SIMPSON
A Norican Technology

Operating Instructions

Hot Distortion Tester

Model 42114

Type:	Hot Distortion Tester
Model:	42114
Part No.:	0042114-A-1A (AFS/120V) 0042114-A-2A (AFS/230V) 0042114-M-1B (Metric/120V) 042114-M-2A (Metric/230V)
Serial Number:	

Name and address of manufacturer:

Simpson Technologies
2135 City Gate Lane Suite 500
Naperville, IL 60563

For other Simpson Technologies offices around the world and for our contact information please visit us on the internet at simpsongroup.com on the Contacts page

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1 Introduction

Congratulations, you have just purchased an extremely reliable sand testing instrument that is backed by the professional technical support and years of proven sand technology experience of Simpson Technologies .

This laboratory equipment is constructed of quality materials and is the result of unsurpassed craftsmanship. The Hot Distortion Tester should be operated only when it is in perfect condition, in accordance with its designed purpose and being aware of possible hazards. Observe the safety instructions in Section 2 and operating instructions in Section 5.

1.1 Application and Designated Use

The Hot Distortion Tester is specifically designed to rapidly heat and measure any corresponding deflections of a standard transverse foundry sand specimen. Readings from the distortion curve can be used to provide an indication of the thermal expansion, hot brittleness, burn out rate and thermo-plasticity. The time required to break the specimen is an indication of the binder's hot strength.

1.2 Organizational Measures

The Operating Instructions should be kept permanently in the vicinity of the operating site of the apparatus! In addition to these Operating Instructions, pay close attention to the common valid, legal, and other binding regulations concerning accident prevention and environmental protection and instruct your staff accordingly.

The personnel operating the machine must have read and understood these Operating Instructions, especially the Safety chapter before commissioning the apparatus.

Wherever safety is concerned, do not modify, add parts to, or rebuild the device without the prior authorization from the manufacturer!

Spare parts must comply with the technical requirements set by the manufacturer. Compliance is always guaranteed when using original Simpson spares.

2 Safety

NOTICE *Before operating and/or performing maintenance or repair on Simpson Technologies designed and/or manufactured equipment, it is required that all personnel have read and understood the entire Operation Maintenance manual. If any questions exist, you must contact your supervisor or Simpson Technologies before taking further action.*

If properly operated and maintained, your Simpson Technologies supplied equipment can provide many years of dependable and safe operation. Please follow all recommended safety, operating, and maintenance instructions. Furthermore, the introduction of any non-Simpson Technologies manufactured and/or approved parts to the equipment may create a hazardous situation. Never alter the equipment without prior consultation with Simpson Technologies .

DO NOT use this machine for purposes other than that for which it was intended. Improper use could result in death or serious injury.

2.1 Safety Signs and Labels

Simpson Technologies has incorporated the ANSI Z535.6 / ISO 3864-1-2 safety symbol only label format on all of its laboratory equipment. For the location of the safety labels on your equipment, refer to the "Location of Safety Decals" drawing in Section 7.

The harmonized ANSI Z535.6 format became an established safety label format since it not only fully meets the current ANSI Z535 standards, but also incorporates ISO 3864-2 symbology and hazard severity panels and thus, can be used for both the U.S. and international markets.

2.1.1 Safety Alert Symbols

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. OBEY all safety messages that follow this symbol to avoid possible injury or death.

***DANGER!** Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.*

The safety alert symbol used without a signal word to call attention to safety messages indicates a potentially hazardous situation which, if not avoided, could or may result in death or minor injury.

NOTICE indicates information used to address practices not related to personal injuries but may result in property damage.

This symbol indicates information containing important instructions concerning the use of the machine or directions for further procedures. Ignoring this information can lead to malfunction of the machine.

2.1.2 Safety Symbol Labels

For proper location of the following Safety Labels on the Simpson Laboratory Core Sand Mixer, see “Location of Safety Decals” in Section 7.

BURN HAZARD – HOT SURFACE
(STC #205307)

This label is located on the left side of the cabinet by the gas burner.

An open flame is present! Do not put your hands in or over the flame. Long hair or loose clothing may ignite and can cause severe burns to body parts. Do not allow any flammable liquids in the room where the Hot Distortion Tester is performing its test. Flammable fumes can abruptly ignite resulting in death or serious injury. Follow Lockout and Tagout procedures before servicing

EXPLOSION/RELEASE OF PRESSURE
(STC #217945)

This label is located on the back of the unit by the pneumatic tubing connections.

With electrical enclosure covers open, electrical terminals are exposed. A hazardous voltage is present, which can cause electric shock or burn, and could result in serious injury. Follow **Lockout** and **Tagout** procedures before servicing.

EXPLOSION / RELEASE OF PRESSURE
(STC #217945)

This label is located on the back of the unit by the pneumatic tubing connections.

With pneumatic pressure present, disconnecting or cutting the pneumatic tubing will release the pressure contained within the tubing. Blown-out air with or without solid particles in the air stream may get into the eyes and may irritate or damage the eye. Follow Lockout and Tagout procedures before servicing.

RISK OF EYE INJURY - EYE PROTECTION REQUIRED
(STC #214075)

This label is located on the bottom left corner on front of the cabinet.

The test specimen consisting of sand and resins may have moisture entrapped that when heated may expand and **burst**, sending flying **debris** to the surrounding area, potentially resulting in eye injury. Follow **Lockout and Tagout** procedures before servicing.

AVOID BURN
(STC #214044)

This label is located on the bottom left corner of front of the cabinet.

Always wear gloves when handling the hot sand specimen which may burn hand and body parts. Follow Lockout and Tagout procedures before servicing.

READ AND UNDERSTAND ALL SERVICE MANUAL INSTRUCTIONS (STC #214081)

This label is located on the mixer base.

Before operating and/or performing any maintenance or repair on Simpson Technologies designed and/or manufactured equipment, it is required that all personnel read and understand the entire Operating Instructions manual. All protective guards shall be installed, and all doors and panels closed before operating the equipment. If any questions exist, you must contact your Supervisor or Simpson Technologies before taking further action. Follow **Lockout and Tagout** procedures before servicing.

2.2 Lockout and Tagout System Procedures

NOTICE

Whenever performing any type of maintenance or repair, whether in the form of cleaning, inspection, adjustment, mechanical or electrical maintenance, the equipment must be rendered into ***Zero Mechanical State (ZMS).***

Prior to any maintenance (routine or otherwise) or repair of equipment, a safety procedure should be established and maintained. This procedure should include training of personnel; identification and labeling of all equipment which is interlocked mechanically, electrically, through hydraulics, pneumatics, levers, gravity or otherwise; and a listing of the established lockout procedures posted on each piece of equipment.

The listing should be permanently attached to the machinery in a prominent area. The form at the end of this section may be used as an example of a listing that might be utilized. This form may be copied; the information filled/completed, and then sealed in a clear plastic laminate before being attached to the equipment.

"Lockout and Tagout" refers to specific practices and procedures to safeguard personnel from the unexpected energizing of machinery and equipment, or the release of hazardous energy during service or maintenance activities. This requires, in part, that a designated individual turns off and disconnects the machinery or equipment from its energy source(s) before performing service or maintenance, and that the authorized employee(s) lock or tag the energy-isolating device(s) to prevent the release of hazardous energy and take steps to verify that the energy has been isolated effectively.

2.2.1 Lockout and Tagout Devices

When attached to an energy-isolating device, both lockout and tagout devices are tools used to help protect personnel from hazardous energy. The lockout device provides protection by holding the energy-isolating device in the safe position, thus preventing the machine or equipment from becoming energized. The tagout device does so by identifying the energy-isolating device as a source of potential danger; it indicates that the energy-isolating device and the equipment being controlled may not be operated until the tagout device is removed.

2.2.2 Glossary:

Authorized Person(s) - Personnel who have been designated by his/her department to perform maintenance or service on a piece(s) of equipment, machinery, or system, and are qualified to perform the work through proper training on the Lockout/Tagout procedures for the equipment, machinery, or system.

Lockout - The placement of a lockout device on an energy isolating device, in accordance with an established procedure, to ensure that the energy isolating device and the equipment being control- led cannot be operated until the lockout device is removed.

Lockout Device - Any device that uses positive methods, such as a lock (either key or combination type), to hold an energy isolating device in a safe position, thereby preventing the energizing of machinery or equipment. When professionally installed, a blank flange or bolted slip blind are considered equivalent to lockout devices.

Tagout - The placement of a tagout device on an energy isolating device, in accordance with an established procedure, to indicate that the energy isolating device and the equipment being control- led may not be operated until the tagout device is removed.

Tagout Device - Any prominent warning device, such as a tag and a means of attachment that can be securely fastened to an energy isolating device in accordance with an established procedure. The tag indicates that the machine or equipment to which it is attached is not to be operated until the tagout device is removed in accordance with the energy control procedure.

Zero Mechanical State - The mechanical potential energy of all portions of the equipment or machine is set so that the opening of pipes, tubes or hoses, and the actuation of any valve, lever, or button, will not produce a movement which could cause injury.

3 Short Description & Specifications

3.1 Usage of the Laboratory Core Sand Mixer

When a mold or a core is suddenly heated by contacting a liquid metal, it distorts. This distortion may cause casting quality problems such as veining, broken molds or cores, mold wall movement and difficulties maintaining critical dimensions. Therefore, it is important to know the performance of these materials during heating. The Hot Distortion Tester is specifically designed to rapidly heat and measure any corresponding deflections of a standard transverse sand specimen. During the heating, the sample first expands and deflects upward. After continued heating, the binding material may soften as measured by either a gradual or steep downward relaxation of the sand specimen. The sand specimen will eventually break when the binder is destroyed. The time required to break the specimen is an indication of the binder's hot strength. Readings from the curve can be used to provide an indication of the thermal expansion, hot brittleness, burn out rate and thermo-plasticity. The deformation is measured during the entire test and is shown on a color monitor. The distortion curve can be printed or stored in the internal memory of the machine. The distortion curve data can also be downloaded into Microsoft® Excel for further statistical evaluation. The instrument also has the capability to accept user defined process control curves entered from the keyboard. The tester uses natural gas to heat the specimen.

3.2 Description

The Hot Distortion Tester measures the expansion and the high temperature plastic performance of chemically bonded sands when suddenly heated by the liquid metal. These properties have a remarkable influence on the shape of the deformation versus time curve measured by the instrument. From a hot distortion curve valuable conclusions may be determined with respect to the thermal expansion of the sand and thermo-plasticity and speed of destruction of the binder.

The test specimen, AFS (American Foundry Society) sand testing standard of 1 x 1/4 x 4-1/2 inches or the metric specimen from the Metric Sand Testing Standard of 115mm x 25mm x 6mm must be prepared by blowing under steady conditions so as to secure dimensional accuracy and compaction grade with no variation.

3.3 Specifications

Specifications	Hot Distortion Tester (Model 42114)
Length	505 mm (19.9 in.)
Width	680 mm (26.8 in.)
Height	365 mm (14.4 in.)
Weight	31.7 kg (70 lbs.)

4 Unpacking and Installation

4.1 Unpacking

NOTICE

Your new Laboratory Equipment has been thoroughly inspected before being shipped to your plant. However, damage can occur in route, so it is wise to inspect all equipment on arrival. Notify both the carrier and Simpson Technologies of any damage at once. Damage should be noted on the shipper's receipt before signing for receipt of the shipment.

The Simpson Hot Distortion Tester is shipped in one piece and is intended to be used as received; no further assembly/disassembly is required. The approximate instrument dimensions are 419mm (16.5 in.) x 635mm (25 in.) x 298mm (11.75 in.) and its weight 47.3 Kg. (104 lb.).

ONLY authorized personnel may unload and install this equipment. Two people are required to unpack this instrument due to the weight and tight fit to the packing crate.

1. Carefully remove apparatus from the packing crate and place it on stable bench.
2. Once removed from the crate, proceed by taking off any protective wrap and unpackage the protective material from the included accessories.
3. The packaging remains the property of the Customer and may be used for returning the apparatus if some repair is required.

4.2 Components

1. A cabinet housing:

» Flame control pack with Flow Meters

» Frame supporting probes and burner

» Deformation measurement unit

» Data acquisition and display system (IBM PC AT compatible)

» Displacement transducer

2. Printer

» Cable with serial connections

» Universal power cord

» PS/2 type keyboard

» CD-ROM printer software disk

» Printer Manual

3. Calibration Kit

» Metallic dummy probe

» 2.5mm thickness calibration gauge

4. Debris Collecting Tray

5. Universal Power Cord

6. Air Regulator/Filter

» Air Gauge

» Quick disconnect fitting

» Adapter fitting

» Pneumatic tubing

7. Two flash drives

» HD-Service (Operating System Back-up)

» HD-Data (export data)

8. Operating and Maintenance Instructions

If any of the above components are missing, contact your local Simpson Technologies office.

The unit requires a standard transverse sand specimen. Preparation of the specimen using the Test Pieces Blower (Model 42109) is highly recommended.

4.3 Installation

The installation of the apparatus is the responsibility of the Client to include procuring and preparing the material required for this purpose.

In order to guarantee effective performance, a solid surface that is free of vibration is recommended.

Place the apparatus on a stable bench. Although it is not required that the machine be perfectly level in order to operate, it should be in a level condition.

The Hot Distortion Tester is intended for operation by one operator. It is recommended for use in a foundry sand laboratory, with its operation display and programming buttons placed at a level for easy use and observation by the operator.

4.4 Electrical Power Connection

To operate the equipment requires natural gas or LPG with pressure regulator, blocking valve and suitable hose to connect the gas line to the apparatus.

Compressed Dry Air, Filtered and Non-Lubricated, regulated at 2 bars (29 psi).

Electrical requirements: 100 -240 Volts, 50 – 60 Hz + Ground (5Ω or less).

Connect the equipment to a grounded electrical outlet.

Before connecting the equipment, verify that the voltage marked on the serial number name plate is the same as the electrical outlet to be used for the machine. Outlet must be properly grounded!

4.5 Airborne Noise Emissions

Regarding airborne noise emission by the Hot Distortion Tester, there is no motor or other noise emitted by this machinery. As such, the equivalent continuous A-weighted sound pressure level at the workstation does not exceed 70db(A).

4.6 Connection Power

1. Install the air supply using a rigid pipe/tubing for a minimum working pressure of 3 bar (43.5 psi) locating the end of the pipe/tubing close to the Hot Distortion Tester (H.D.T.). Locate the air regulator/filter on an accessible area; the air filter must be cleaned periodically. Connect the air regulator/filter to the pipe/tubing and the 4mm ID flexible tubing (supplied) to the H.D.T. (see Photo #1).

When connecting the air regulator/filter, check that the arrow indicating the air flow of the regulator is pointing toward the H.D.T.

2. Install the natural or LP gas line ending with a pressure regulator and shut-off valve close to the air regulator. Using a 6mm ID flexible line suitable for use with natural/LP gas that is in compliance with national and local codes and protective measures, connect the gas shut-off valve to the H.D.T.

3. Install a dual electric female plug at a distance permissible by the national and local codes from the gas supply components. Using the universal power plugs (supplied) with the proper heads, connect the H.D.T. and the printer.

DANGER! Before connecting the electrical power to the Hot Distortion Tester, or to the printer if it is located close by, or before lighting the burner, check the gas connection for LEAKS. Flammable fumes will ignite from electrical spark or an open flame resulting in death or serious injury.

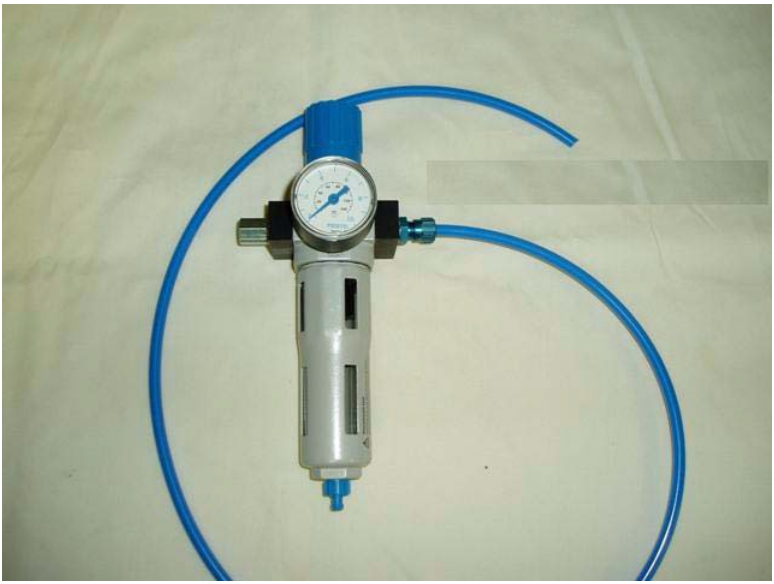

Photo 1: Assembling the Air Regulator/Filter

4. The air regulator/filter is shown in Photo 1 with the airline connected to the tester on the right. The hex adapter shown on the left is only used if 1/8" NPT connection is desired; otherwise, use the 1/8G thread connection supplied with the regulator/filter. When making the connections, make certain that the O-ring between the fittings and the regulator/filter are in place.

This unit is reversible. Reverse the location of the gauge with the plug on the reverse side. Make certain that the air flow direction remains the same (arrows on face plate).

5. Once the Hot Distortion Tester is in its final location and the air and gas lines are connected and checked for leaks, connect the following into the docking panel located on the right side of the cabinet (see Figure 1):

» Connect the keyboard and mouse into their respective mini-DIN ports, and

» the printer into the parallel port.

6. Finally, connect the Universal power cable, with the female plug inserted into the back of the machine (see Figure 3) and the male plug plugged into the wall outlet.

4.7 Airborne Noise Emission

Regarding airborne noise emission by the Hot Distortion Tester, any occurrence of motor or other noise will be lower than 70db. Therefore, the equivalent continuous A-weighted sound pressure level at the workstation does not exceed 70db(A).

5 Operating Instructions

For more information on how to use and care for your Simpson Analytics equipment and accessories visit our Simpson Technologies channel on YouTube and search our library of videos. Subscribe to our channel to keep updated on new releases.

5.1 Principle of Operation

The sand specimen is fastened horizontally by one end as a cantilever beam. Upon the free end, a constant load of 0.3 N is applied. The mounted specimen is submitted to an intense and sudden heat by a flame in the center of its lower face. The flame is standardized in its heating power and in the air-gas ratio.

In the first moments of intense heating, a differential dilatation between the upper and the lower face of the specimen is produced. This differential causes the specimen to bend upward and raise its free end. Later, because the temperature difference between both faces diminishes, the upward curvature decreases and finally cancels out. The temperature causes the resin to become somewhat plastic, and the specimen begins to bend downward.

The shape of the "deformation vs. time" curve depends on all the variables that influence the performance of chemically bonded molds and cores, such as:

» Type of sand (silica, olivine, zircon, chromite, etc.)

» AFS grain fineness number and distribution

» Thermo-plasticity of the resin

» Curing conditions of the resin (curing temperature and time)

» Type and chemistry of binder system

» Amount of binder

» Density of mold or core

Consequently, the results obtained are not only effective for the adjustment of resins and mixture formulations, but also in production shop control of cores and molds:

5.2 Program Operation

The program operation is based on three main objects:

» Title Bar

» Menu Bar

» Working Screen

The **Title Bar** identifies the active function of the program.

The **Menu Bar** displays the actions (Menu Items) that can be taken within a particular function identified by the Title Bar. You can select the desired menu item using the arrow keys and pressing the Enter key. A Menu Item is selected when it is displayed with its colors reversed.

The **Working Screen** is where the commands are executed.

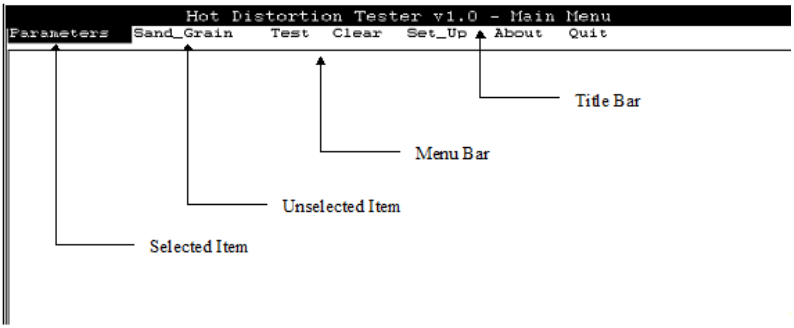

Figure 4

5.3 Main Menu Description

1. When the equipment is turned on, the instrument screen displays a standard P.C. boot sequence and then executes the program.
2. The Title Bar will display the legend:

   Hot Distortion Tester v1.0 - Main Menu

3. The Main Menu items are:

» PARAMETERS

» SAND GRAIN

» TEST

» CLEAR

» SET-UP

» ABOUT

» QUIT

Figure 5

The program operation is based on three main objects:

5.3.1 Parameters

If Parameters is selected from the Main Menu items, then the Title Bar will change to:

Hot Distortion Tester v1.0 - Test Parameters

The items within the Menu Bar are:

- Edit
- Quit
- New
- Help

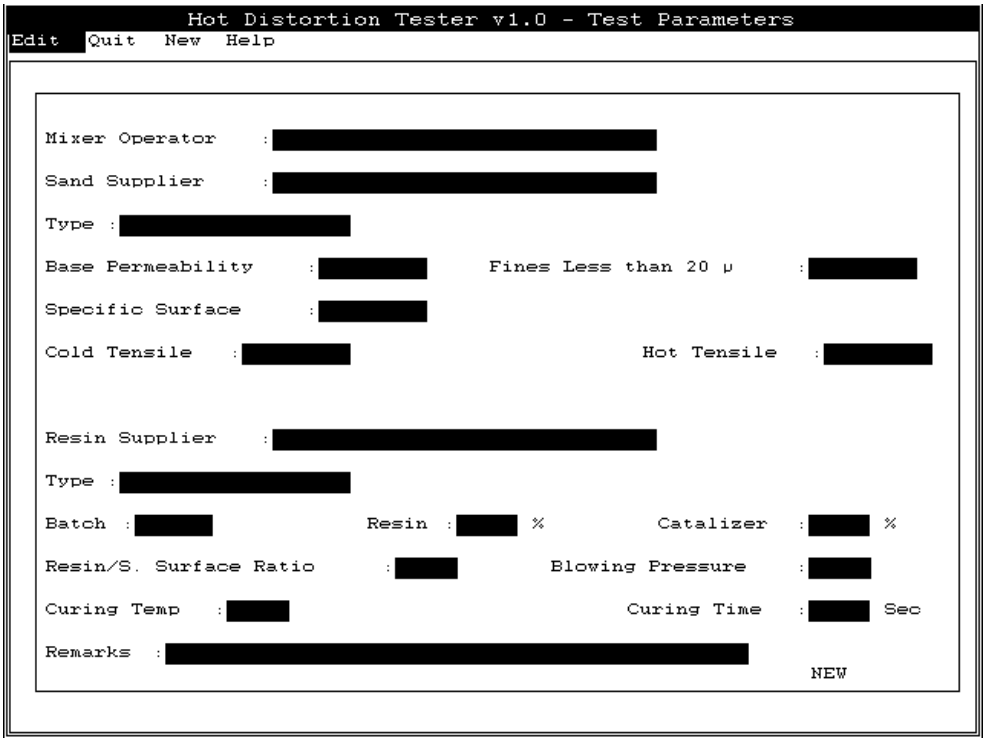

Figure 6

5.3.2 Sand Grain

If Sand Grain is selected from the Main Menu items, then the Title Bar will change to:

Hot Distortion Tester v1.0 - Sand Grain Distribution Analysis

The items within the Menu Bar are:

- Edit
- Quit
- New
- Help

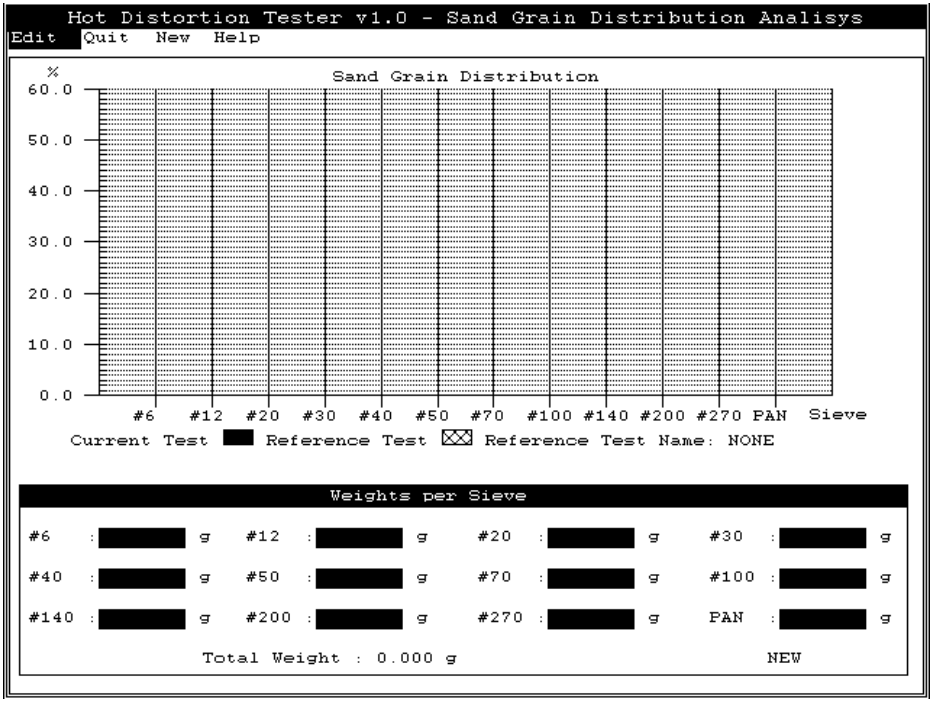

Figure 7

5.3.3 Test

If Test is selected from the Main Menu items, then the Title Bar will change to:

Hot Distortion Tester v1.0 - Test Control Center

The items within the Menu Bar are:

- Start
- Calibrate
- Save
- Get
- Compare
- Report
- Cursor
- Clear
- Limits (not shown on Figure 8 Menu Bar)
- Quit

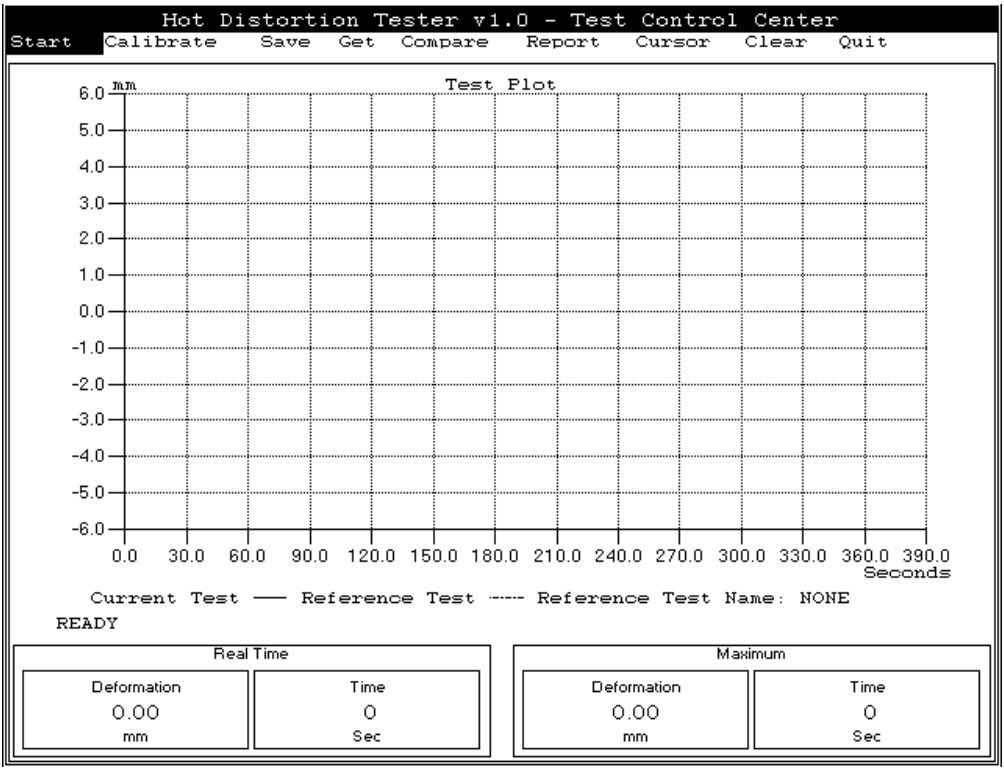
Hot Distortion Tester v1.0 - Test Control Center
Start
Calibrate
Save
Get
Compare
Report
Cursor
Clear
Quit
Test Plot
mm
6.0
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
0.0
30.0
60.0
90.0
120.0
150.0
180.0
210.0
240.0
270.0
300.0
330.0
360.0
390.0
Seconds
Current Test
Reference Test
Reference Test Name: NONE
READY
Real Time
Deformation
0.00
mm
Time
0
Sec
Maximum
Deformation
0.00
mm
Time
0
Sec

Figure 8

5.3.4 Set-up

If Set-Up is selected from the Main Menu items, then the Title Bar will change to:

Hot Distortion Tester v1.0 - Set-Up

The items within the Menu Bar are:

- Printer
- Printer Port
- Paper Type
- Monitor
- Colors
- Report
- Quit

The hot distortion program is configured at the factory and in most of the cases there is no need to make any change in the manufacturer's set-up (see Section 6.4).

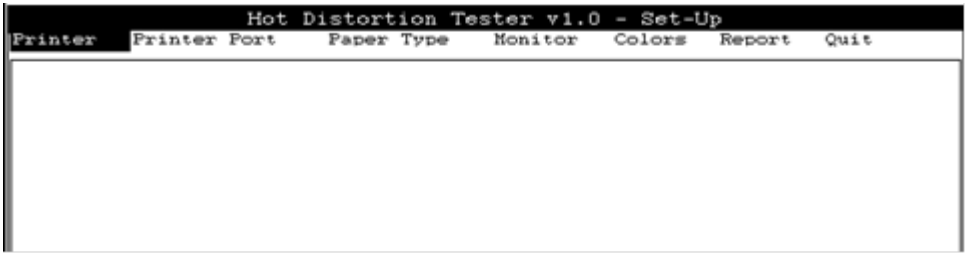

Figure 9

5.3.5 About

If About is selected from the Main Menu items, then a message box will appear giving information about the current software version of the Hot Distortion program.

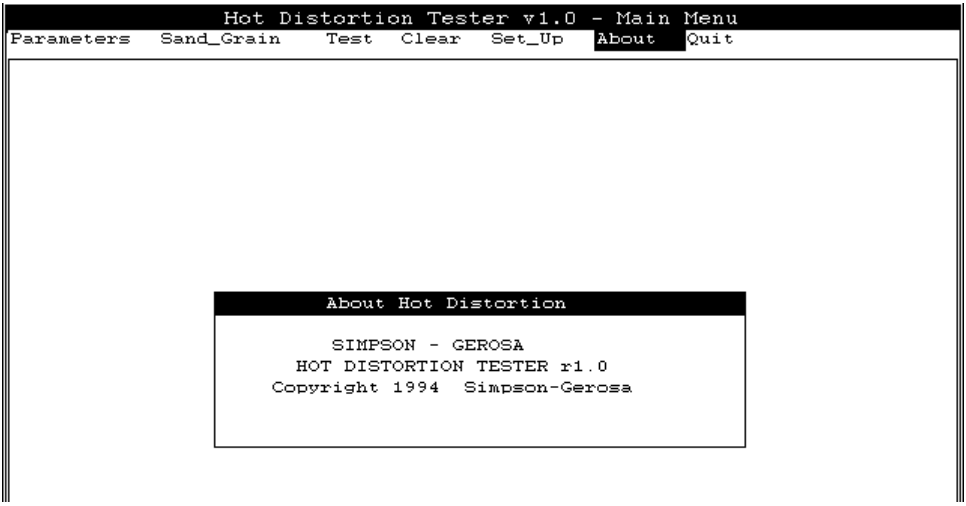

Figure 10

5.3.6 Clear

If Clear is selected from the Main Menu items, then all tests in active memory will be erased.

5.3.7 Quit

If Quit is selected from the Main Menu items, then the program will quit.

5.4 Performing a Test

A typical hot distortion test involves four steps:

- Sample description
- Sand Grain description
- Testing

Evaluation of test results

5.4.1 Sample Description

1. From Main Menu select Parameters from the Menu Bar. The Working Screen will display a fill-in form with the following fields:
    - » Mixer Operator
    - » Sand Supplier
    - » Type (sand type)
    - » Base Permeability
    - » Fines less than 20 micron
    - » Specific Surface
    - » Cold Tensile
    - » Hot Tensile
    - » Resin Supplier
    - » Type (resin type)
    - » Batch
    - » Resin %
    - » Catalyzer %
    - » Resin/Surface Ratio
    - » Blowing Pressure

» Curing Temperature

» Remarks

These fields allow you to identify as **precisely** as possible the material under analysis.

You may decide to ignore this option or use only certain parameters of interest to your particular operation. The Parameters **are not** required to perform a test.

2. Fill in the fields with data considered of value for the test in progress. To place or correct data in a field, simply choose Edit from the Menu Bar and press Enter. A cursor will appear at the left-hand side of the black box located to the right of mixer operator. Using the keyboard, type in the name of the mixer operator and then press Enter. By using the Enter or Arrow key, you are able to move through the fields on the Working Screen.
3. To get back to the Menu Bar from the Working Screen and to validate existing data, press the Enter key twice while the cursor is within the remarks field on the Working Screen. After pressing the Enter key twice, the function display located in the lower right corner of the Working Screen will change from Edit to Ready. If Ready is displayed in the function display of the Working Screen, then the arrow keys will move the cursor within the Menu bar.
4. Selecting New from the Menu Bar will erase all existing data from the Working Screen. Select Quit from the Menu Bar and press Enter to return to the Main Menu Title Bar.
5. There is no action associated with the Help menu item in the current version (version 1.0) of this software.

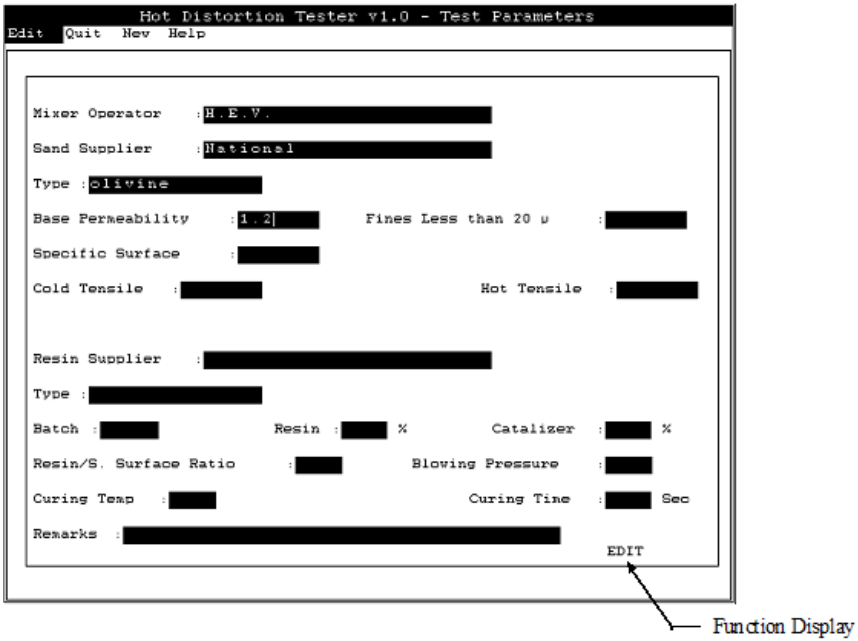

Figure 11

5.4.2 Sand Grain Analysis

1. From the Main Menu Title Bar select the Sand Grain menu item. The working screen will display a fill-in form and a graph frame. The fill-in form will receive the results of the sieve test performed on the sample material. Once all the fields have been completed the program automatically plots the data in a bar graph format on the Working Screen.

2. It is possible, if desired, to compare different bar graphs between a current test and a reference test. When comparing results, the reference test will be superimposed on the Working Screen for a better appreciation of differences.

You may decide to ignore the Sand Grain option in your particular operation. The Sand Grain data is not required to perform a test.

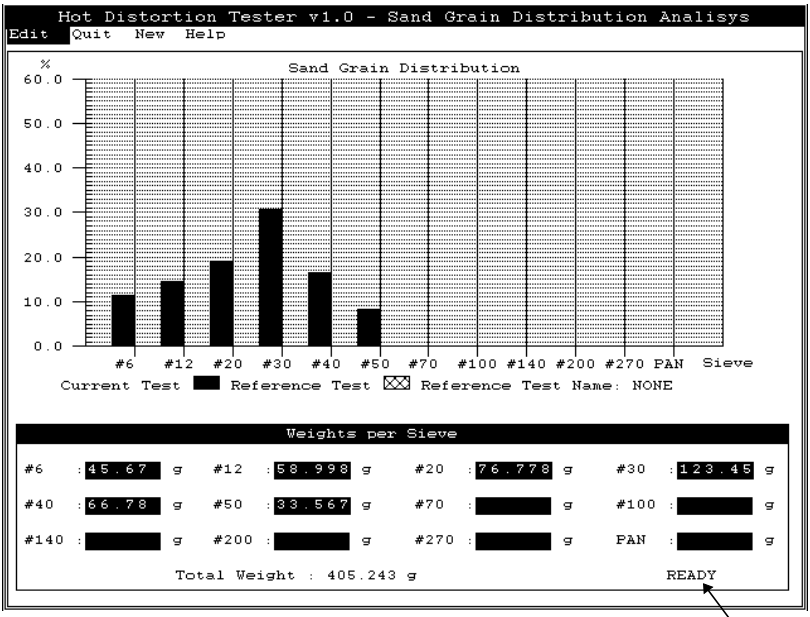

Figure 12

3. Select Edit from the menu bar to enter new data or correct erroneous data.

4. When editing, use the arrow keys to move from field to field on the Working Screen. When the cursor is in the last field (Pan), press the Enter key twice to validate existing data. After pressing the Enter key twice, the function display located in the lower right corner of the Working Screen will change from Edit to Ready. If Ready is displayed in the function display of the Working Screen, then the arrow keys will move the cursor within the Menu Bar.

5. Select Quit from the menu bar to go back to Main Menu screen.

6. Select New from the menu bar to enter new data, erasing all existing data.

7. There is no action associated with the Help menu item in the current software version (version 1.0).

5.4.3 Testing

NOTICE *If you are using the Tester for the first time, please carefully read Section 6 - Tester Calibration.*

1. From the Main Menu select Test item from the Menu Bar. The Title Bar will change to:

   Hot Distortion Tester v1.0 - Test Control Center

   and the Working Screen will display an x-y graph (displacement vs. time), one INFORMATION LINE which identifies the test plots and the reference test name, one STATUS LINE showing the current program step and two digital meters, one (REAL TIME METER) for the data being read while the test is being performed and the other (MAXIMUM METER) for the maximum values obtained from the test being performed.

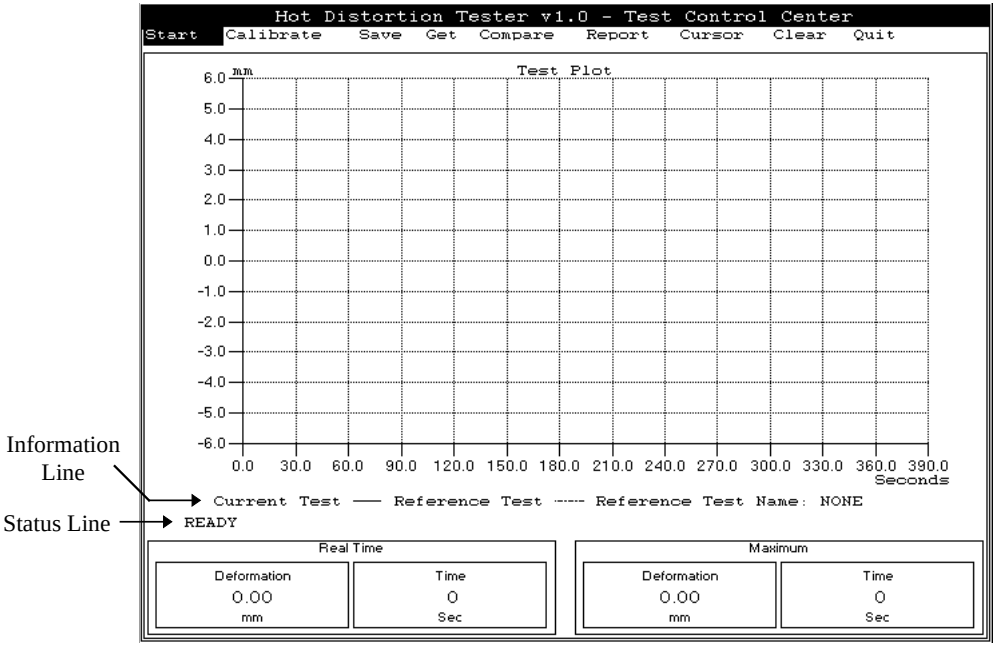

Figure 13

» Select Start from the Menu Bar to begin the test.

» Select Calibrate from the Menu Bar to enter in procedure (see Section 6.2 Calibrating the Tester for a description of the calibration procedures).

» Select Save from the Menu Bar to store the test performed results and description on the machine for future reference.

» Select Get from the Menu Bar to retrieve a test previously stored. After loading, the test is designated as the reference test.

» Select Compare from the Menu Bar to compare hot distortion curves, sand grain distributions or sample descriptions. The tests to be compared are the current test and the test loaded as reference.

» Select Report from the Menu Bar to activate a graphic cursor that can be moved over the curve with the left and right arrow keys. The exact deformation vs. time value pointed to by the cursor is displayed in the REAL TIME METER.

» Select Clear from the Menu Bar to clear the test(s). The reference test or both can be cleared from memory leaving the instrument ready for the next test or to load a new reference test.

» Select Quit from the Menu Bar to go back to the Main Menu.

2. To start a test select Start. The STATUS LINE will display the message.

Place and lock probe under testy and press any key.

» To place the sand specimen in the Hot Distortion Probe (see Figure 21), first adjust the gap between the Clamp Knob (1) and the Specimen Bracket (9) large enough to introduce the Sand Specimen (5).

» Gently lift up the Sensor Feeler (2) and introduce the Sand Specimen between the Specimen Bracket (9) and the Clamp Knob (1) and gently rest the Sensor Feeler (4) on the Sand Specimen.

» While holding the Sand Specimen with one hand gently tighten the Clamp Knob (1) to secure the Sand Specimen between the Specimen Bracket (9) and the Clamp Knob (1).

» The Sand Specimen is now fixed in the Hot Distortion Probe and ready for the test to start.

The distance between the sand specimen and the Retaining Flame Plate (6) top flat surface should be kept at 9mm. The gap is preset at the manufacturer; if adjustment is necessary, refer to calibration instructions in Section 6.2.3.

3. Adjust the Gas Flow Meter to the gas heating value being used in the test. Adjust the Air Flow Meter at the 20.2 division (see Section 6.2.2).

4. Pull open the valve on the air flow meter. Air will pass through the Burner Head (7). After fixing the sand specimen and opening the air valve, press any key and the following message will appear in the STATUS LINE prompting you to light the burner.

Light the Burner…Recording will start after 0.05mm deformation.

***Do not** allow any flammable liquids in the room where the Hot Distortion Tester is performing its test. Flammable fumes can **abruptly ignite** resulting in death or serious injury!*

*After the turn is lit, an open flame is present! **Do not** put your hands in or over the flame. Long hair or loose clothing may ignite and can cause severe burns to body parts.*

5. Once the probe starts deforming, the STATUS LINE will display the message:

   Test in process…Press any key to abort.

A deformation vs. time curve will start to develop in the Working Screen.

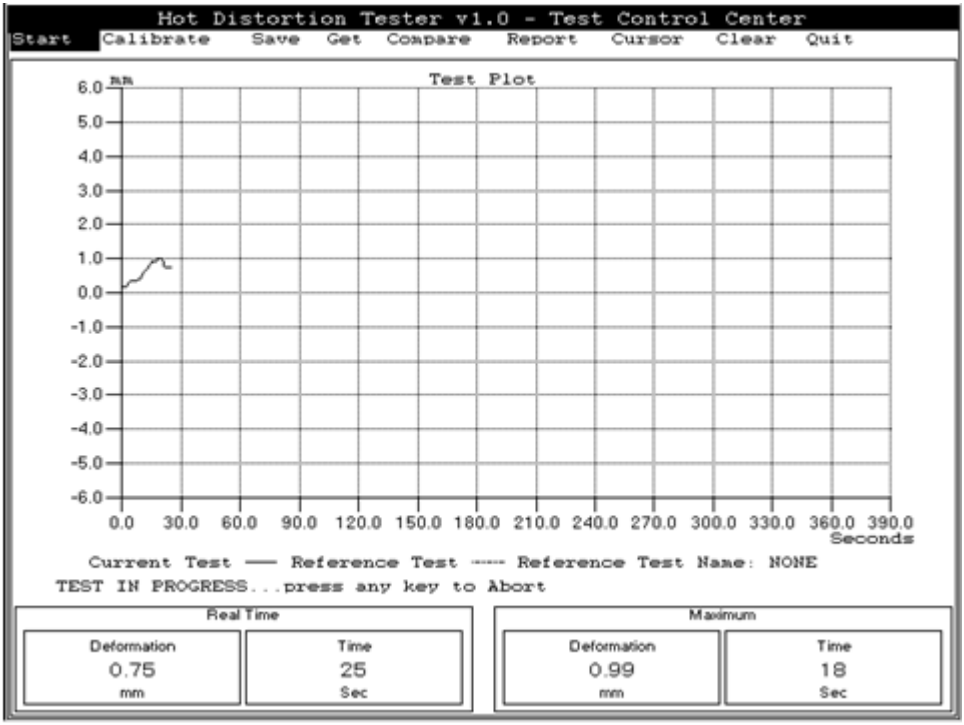

Figure 14

6. If for any reason the test fails, pressing any key during the test will abort the operation. This situation is reflected in the STATUS LINE with the message:

User aborted test, press any key

7. The test will finish automatically when the probe breaks, causing the deformation to exceed the negative range (-6mm). The STATUS LINE will display:

Test complete

8. At this point, turn off the gas flow by pushing the bottom valve closed, but keep the air valve open to help refrigerate the burner. Remove the burned specimen and any small particles of loose burnt sand that might fall through the flame diffuser of the burner.

After each test LEAVE the air valve open to clear the burner of gas residues, to cool it and to keep the burned sand grains from falling through the Retaining Flame Plate. Use gloves to remove the sand specimen from the Hot Distortion Probe.

5.4.4 Evaluation of Test Results

1. After testing, the obtained curve can be stored in the memory of the Tester by selecting Save from the Menu Bar.

2. A box will appear in the Working Screen prompting you to identify the material under study (8 characters maximum) in order to enable retrieval. Instructions are displayed in the box. Files can be saved on the HD-Data flash drive located in the USB port in the docking panel on right side of tester.

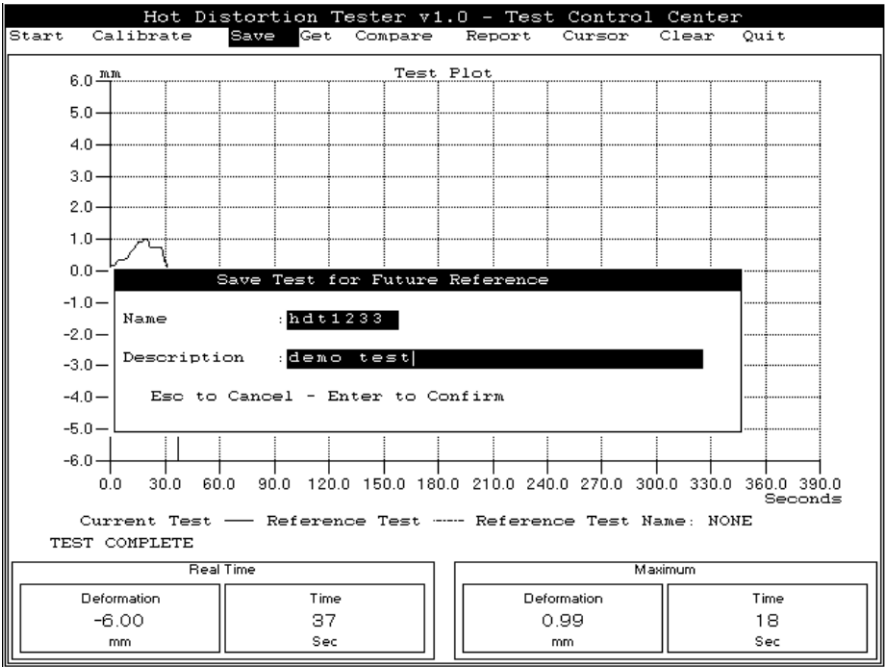

Figure 15

3. Select Get from the Menu Bar to retrieve from the memory data and curves to check them against the current test.

4. A box will appear within the Working Screen with a list of tests stored in memory. Choose the desired reference test with the arrow's keys (if the list is large, then you can scroll using the arrows or the PgUp and PgDn keys).

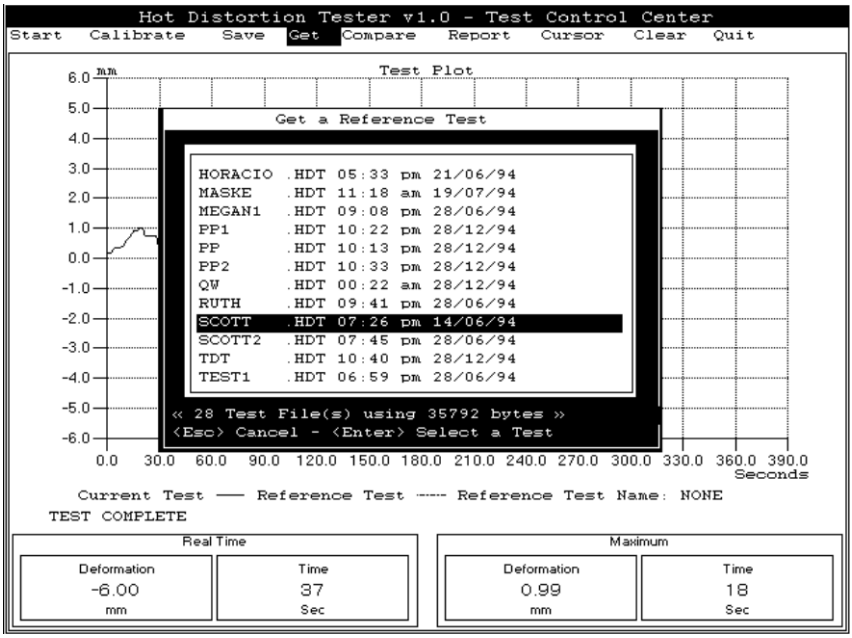

Figure 16

» Select Compare from the Menu Bar to show the current test data collected with one retrieved from the memory.

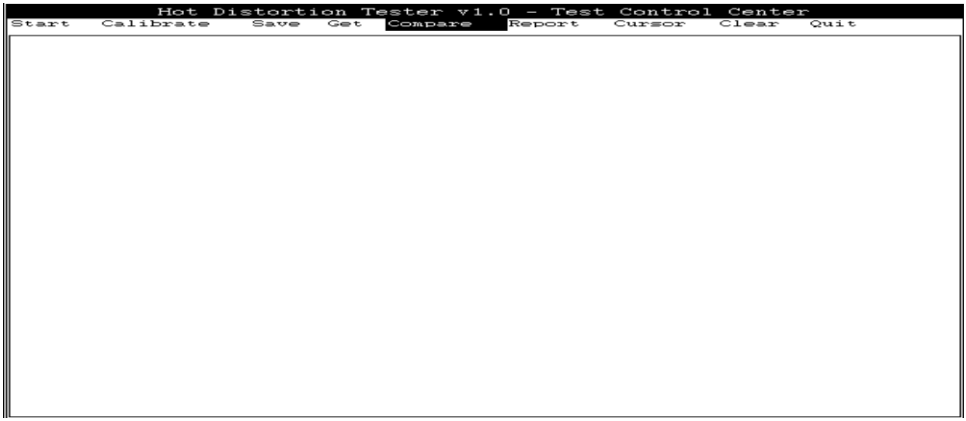

Figure 17

» Select Quit from the Menu Bar and the software will go back to the Main Menu.

» Select Sand Grain from the Main Menu and the Working Screen will display the sand grain distribution curves from the current test and reference test for reference.

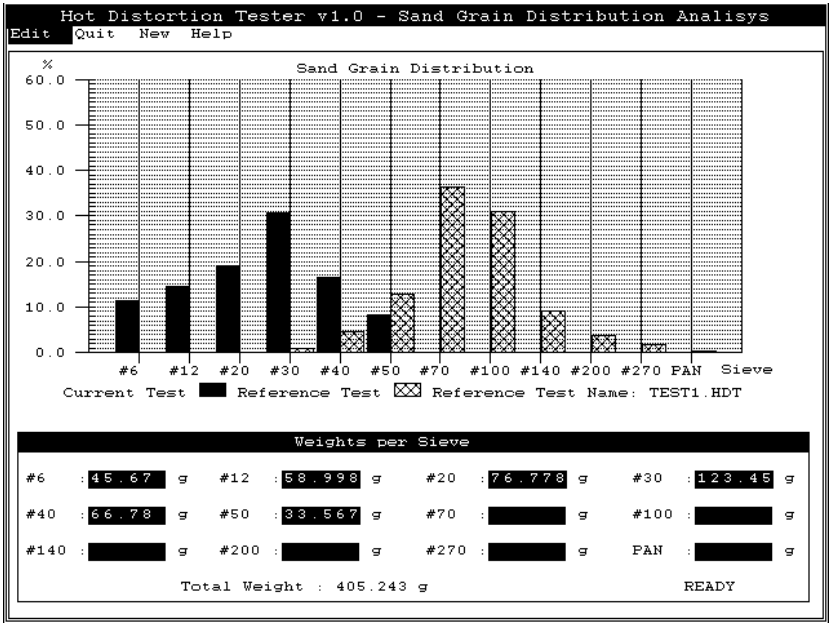
Hot Distortion Tester v1.0 - Sand Grain Distribution Analisys
Edit Quit New Help
%
Sand Grain Distribution
60.0
50.0
40.0
30.0
20.0
10.0
0.0
#6 #12 #20 #30 #40 #50 #70 #100 #140 #200 #270 PAN Sieve
Current Test
Reference Test
Reference Test Name: TEST1.HDT
Weights per Sieve
#6 : 45.67 g
#12 : 58.998 g
#20 : 76.778 g
#30 : 123.45 g
#40 : 66.78 g
#50 : 33.567 g
#70 : g
#100 : g
#140 : g
#200 : g
#270 : g
PAN : g
Total Weight : 405.243 g
READY

Figure 18

5. Within the TEST CONTROL CENTER selecting the Menu Bar item Cursor activates a vertical reference line (called cursor) which makes an exact reading of every point on the curve for a deeper analysis of either the current tests or any reference test. The cursor can be moved along the curve using the arrow keys (right left) for point-to-point motion. By pressing the Ctrl together with the desired arrow, a rapid cursor movement is achieved.

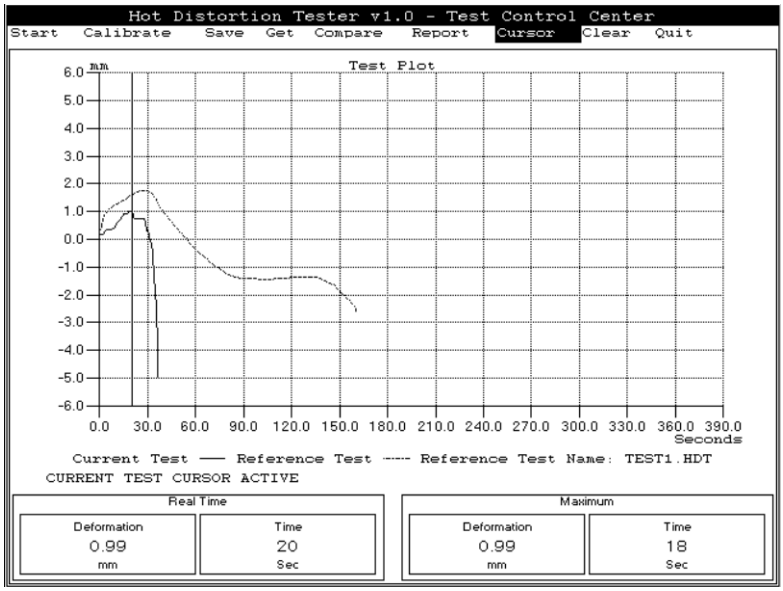

Figure 19

6. To make a hard copy of either the current test or a reference test, select Report from the Menu Bar. A box will appear prompting you to prepare the paper and check that the printer is ONLINE. While printing, the STATUS LINE will display the message:

   Wait…Printing Test Results

7. Once all information from the current test has been evaluated it can be erased. Select Clear from the Menu Bar and a box will

appear asking what test you want to clear. The options are current test only, reference test only, or both.

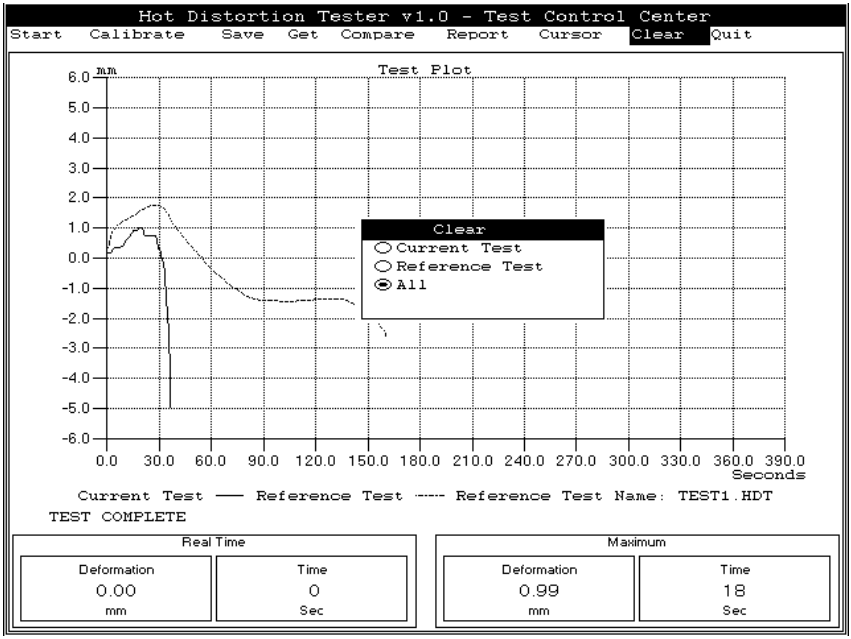

Figure 20

6 Maintenance and Calibration

For more information on how to use and care for your Simpson Analytics equipment and accessories visit our Simpson Technologies channel on YouTube and search our library of videos. Subscribe to our channel to keep updated on new releases.

The HD-Service Flash Drive containing the Hot Distortion Tester Operating System is provided as back-up in the event the system is corrupted. To re-install system, insert the HD-Service flash drive into the USB port located in the docking panel before turning the machine ON. Turn the machine ON and follow the screen instructions.

6.1 Maintenance Guidelines

- Keep the air filter clean.
- Do not allow excessive heating of the burner.
- Change the Top Burner Screen whenever it seems necessary.
- Always keep the burnt sand collecting tray under the burner.
- Clean sand and dust from machine daily.
- Make measuring system calibration checks.

6.2 Calibrating the Tester

Fuses: there are two slow blow 25 Amp (120V) or 16 Amp (230V) - IEC 269-3-1 31.5mm x 8.5mm fuses located in the back of the base of the mixer. These should only be replaced with similar amperage and sized fuses.

6.2.1 Flame Adjustment

1. At the front of the apparatus there are two flow meters, one for the gas and the other for the compressed air (see Figure 2). Below each of the flow meters there is a valve. When the valve is pulled out, it will deliver the respective gas or air.
2. To calibrate the flame, first open the air and then the gas by pulling out (toward the operator) the valve located below the flow meter. With the fine adjusting valves of each flow meter, the gas flows are set according to calorific power, which must be 660 Kcal/hour.

NOTICE *Before attempting any use of the tester, or every time the caloric properties of the gas in use change, the flame must be calibrated.*

DO NOT USE the fine adjusting valves to completely shut off the gas flow**.** To turn on or off the gas flow, pull to open or push to close the valves below the flow meter. Excessive tightening of the Fine Adjusting Valves may **damage** the orifice.

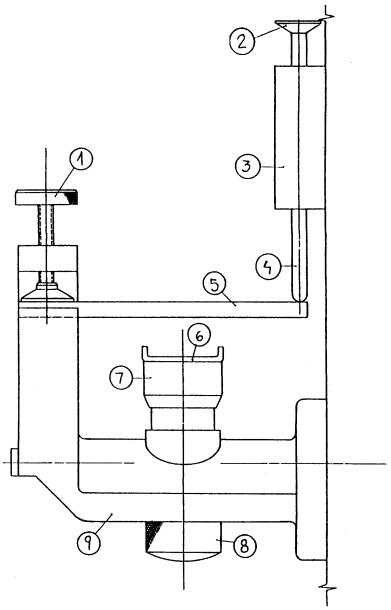

Figure 21: Hot Distortion Probe

Item #	Description
1	Clamp Knob
2	Sensor Feeler
3	Transducer Head
4	Feeler
5	Metallic Dummy or Sand Specimen
6	Retaining Flame Plate
7	Burner Head
8	Cleaning Lid
9	Specimen Bracket

6.2.2 Flow Meter Settings

See the Flow Meter Instruction, SAFETY INFORMATION (Section 10) at the back of this manual for pressure and temperature limitations. Exceeding the manufacturer's recommendation may cause breakage and personal injury.

The burner should have a heat release of 660 Kcal/hour and can use methane gas or low-pressure gas (mixture of propane and butane).

The flow of gas must be regulated according to the heating value of the respective gas. To achieve 660 Kcal/hour, the following settings are required.

1. Methane Gas

METHANE			
	MM WATER COLUMN	**FLOW ML/M**	**FLOWMETER NUMBER**
Nominal Pressure	200	1020.70	54.83
Maximum Pressure	267	1017.47	54.69
Minimum Pressure	170	1022.16	54.88

2. Propane Gas

Propane			
	MM WATER COLUMN	**FLOW ML/M**	**FLOWMETER NUMBER**
Nominal Pressure	200	1020.70	54.83
Maximum Pressure	267	1017.47	54.69
Minimum Pressure	170	1022.16	54.88

3. Butane Gas

Butane			
	MM WATER COLUMN	**FLOW ML/M**	**FLOWMETER NUMBER**
Nominal Pressure	280.00	531.86	34.18
Maximum Pressure	350.00	530.12	34.10
Minimum Pressure	200.00	533.88	34.27

4. Control of Stoichiometric Air Fuel Ratio

Stoichiometric ratio air-methane - 9.47

Flow of air - 1171 ml/min x 9.47 = 11080 ml/min in Flow Meter with tube Nº 54-17 and stainless-steel float, the center of float should be at division 20.2.

After correctly setting the gas flow meter, the air flow meter is adjusted to achieve a light blue flame.

6.2.3 Burner Head Setting (see Figure 21: Hot Distortion Probe)

The distance between the sand specimen (5) and the Retaining Flame Plate (6) top flat surface located above the Burner Head (7) should be kept at 9mm. The gap is preset at the manufacturer. If adjustment is necessary, a 9mm gauge is required. If one is not immediately available, a 9mm Allen wrench will work as a substitute. Use the FLAT area of the wrench as the gauge.

To adjust this distance, place and secure the Metallic Dummy Specimen (5) in the Specimen Bracket (9). Gently slide a 9mm thickness gauge between the flat surface on the Retaining Flame Plate (6) and the Metallic Dummy Specimen. The 9mm thickness gauge should just fit between the Metallic Dummy Specimen and the Retaining Flame Plate. If not, then the Burner Head (7) can be adjusted by loosening the two set screws. After adjusting, then secure the set screws.

6.2.4 Calibrating the Measuring System

1. From the Main Menu select Test from the Menu Bar and press the Enter key. The Title Bar will change to:

   Hot Distortion Tester v1.0 - Test Control Center

2. Next select Calibrate from the Menu Bar and the Status Line, located at the bottom of the Working Screen, will display the message:

   Place dummy probe and press any key to set zero reference

3. The calibration procedure uses the REAL TIME METER, located at the bottom left of the Working Screen, as a display.

4. To place the metallic dummy specimen in the Hot Distortion Probe (see Figure 21), first adjust the gap between the Clamp Knob (1) and the Specimen Bracket (9) large enough to introduce the Metallic Dummy Specimen (5).

5. Gently lift up the Sensor Feeler (2) and introduce the Metallic Dummy Specimen (5) between the Specimen Bracket (9) and the Clamp Knob (1) and gently rest the Sensor Feeler on the Metallic Dummy Specimen. While holding the Metallic Dummy Specimen with one hand, gently tighten the Clamp Knob (1) to secure the Metallic Dummy Specimen between the Specimen Bracket (9) and the Clamp Knob.
6. The Metallic Dummy Specimen is now secure in the Hot Distortion Probe, then press any key. The REAL TIME METER will read 0.00 deformation and Status Bar will now display the message:

   Place now 2.5mm Calibration gauge then press any key
7. Gently place the 2.5mm calibration gauge provided with the equipment, between the Metallic Dummy Specimen and the Feeler (4).
8. Press any key. The Status Line will now display the message:

Calibration Complete

6.3 Configuring the Tester

NOTICE

The Hot Distortion Tester should be calibrated after the tester has been turned on. The unit does not require calibration between tests. The hot distortion program is configured at the factory and in most cases there is no need to make any change in the manufacturer's set-up.

The configuration program allows the change of some operating parameters that describe the hardware installed (monitor type, printer, etc.) and some general parameters such as paper type, colors of screen, etc. In general, this information will not require changes.

1. To start the configuration program, select Set-Up from the Main Menu bar. The Title Bar will display:

Hot Distortion Tester v1.0 - Set-Up

The Menu Bar will display the following items:

» Printer

» Printer Port

» Paper Type

» Monitor

» Colors

» Report

» Quit

2. If Printer is selected from the Menu Bar the options are:

» EPSON LX

» EPSON MX

» EPSON LQ

» EPSON FX

» HP DESKJET SERIES

The EPSON LX option works with almost any printer except some laser or Ink Jet printers.

Figure 22

3. If Printer is selected from the Menu Bar a list with the following items will be displayed:
   - » LPT1
   - » LPT2
   - » COM1
   - » COM2

Figure 23

NOTICE *The hardware installed in all standard versions of the Hot Distortion Tester uses LPT1 as the printer port. Do not change for any reason.*

4. If Paper Type is selected from the Menu Bar, the options are:
   - » 11-inch single sheet
   - » 11-inch continuous form
   - » 12-inch single sheet
   - » 12-inch continuous form
   - » DIN A4

This software version (v1.0) only accepts 11-inch single sheet or 11-inch continuous form. If other options are chosen, the software will automatically choose 11 inch single or continuous form.

Figure 24

5. If Monitor is selected from the Menu Bar, the options are:
   - » Color
   - » Monochrome
   - » LCD1
   - » LCD2

   A color monitor is installed standard on the tester, therefore select the Color option.

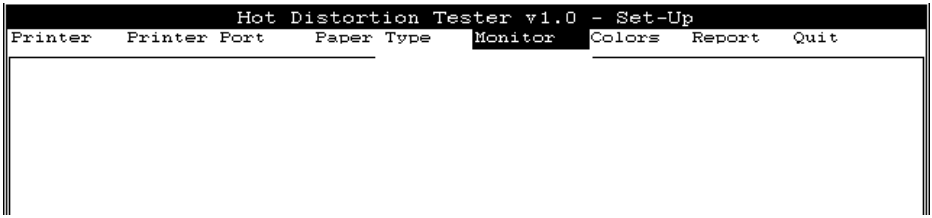

Figure 25

6. If menu item Colors is selected, the following list of the objects whose colors can be changed will appear at the left of the screen:
   - » Title Bar
   - » Title Bar Text
   - » System Window Border
   - » System Menu Text
   - » System Menu Background
   - » Window Background
   - » Window Pen
   - » Window Border
   - » Grids Pen
   - » Current Test Pen
   - » Reference Test Pen
   - » Meters Digits
   - » Meter Display Background
   - » Meters Borders
   - » Meters Faceplate Text
   - » Messages Box Background
   - » Warning Box Text
   - » Warning Box Background

» Status Bar Text

7. Select the desired object and press enter. The current color of the object will appear at the right of the screen. Select the new color and press enter again. This sequence can be repeated to change the color of any object displayed on screen.

The color options are:

- Black
- Blue
- Green
- Cyan
- Red
- Magenta
- Brown
- Light Gray
- Dark Gray
- Light Blue
- Light Green
- Light Cyan
- Light Red
- Light Magenta
- Yellow
- White

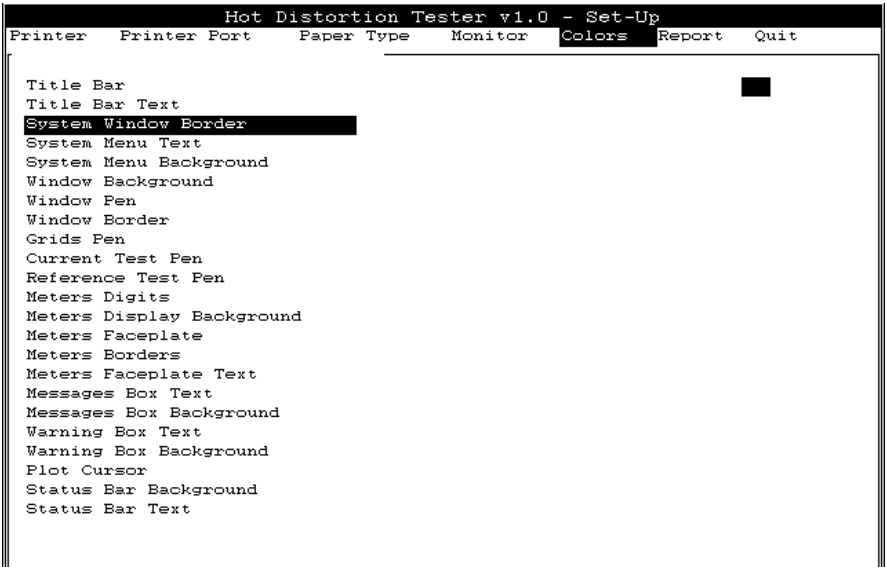

Figure 26

8. When Report is selected from the Menu Bar, a list of report formats will be displayed. Check the box for each item to be included in the printed report. The items that may appear in the report are:
   - » Test Information
   - » Test Plot
   - » Test Statistics
   - » Granulometric Distribution
   - » Sieve Weights

Customizing the printed report on software version 1.0 is not allowed.

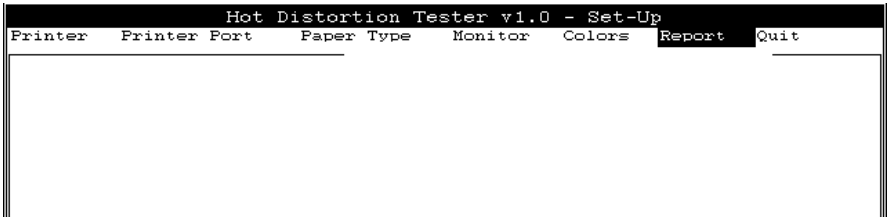

Figure27

9. Select Quit from the Menu Bar to return to the Main Menu, ending the program configuration. All changes made are saved and kept valid until they are changed by the same procedure.

6.4 Upper and Lower Limits

6.4.1 Setting Limits

1. Select TEST on the Main Menu and from the TEST menu bar, select LIMITS and hit Enter. A menu will appear with the following options:
   - » Load Limits
   - » Edit Limits
   - » Save Limits
   - » Clear Limits
   - » Export Limits
2. Go to Edit Limits - hit Enter.
3. Use right arrow key to move line across plot to the right. Note time window.
4. To set Upper Limits, use up arrow key to set millimeter deflection. Note deformation window.
5. Push Enter to set parameter.

6. Repeat 3 through 5 for each setting.
7. When the Upper Limits have been set, push CTL-Enter to set Lower Limits.
8. Repeat Steps 3-6, except use the down arrow key in Step 4 to set millimeters of deflection. When finished, push CTL-Enter.

6.4.2 Saving Limits

1. Go to LIMITS on the TEST Menu, hit Enter.
2. Next go to Save Limits and hit Enter.
3. Fill in blanks in window and hit Enter when finished.

Current Program with Limits is in the directory called [HDT] C:\HDT>.

6.5 Exporting Files

1. To export data, turn OFF the machine and insert the HD-Data flash drive into the USB port in the docking panel on the right side of Tester (see Figure 1). This is necessary for the operating system to recognize the flash drive. Turn ON the machine and follow the screen instructions.
2. Select TEST from the Main Menu and then REPORT from the TEST menu bar. A window will appear with the following information:

Report
o Hard Copy
• Export Test Files

3. Select Export Test Files and hit Enter. A menu will appear with all of the saved test files. Highlight the test you want exported, hit Enter.
4. A menu will appear:

Target
o A:
o C:\Hot
• D:\

5. Select D:\ (USB Port Drive)
6. Test files will be exported to the drive.
7. The data being exported to Excel is divided by commas which are needed by Excel to open the files.

7 Apparatus Layout

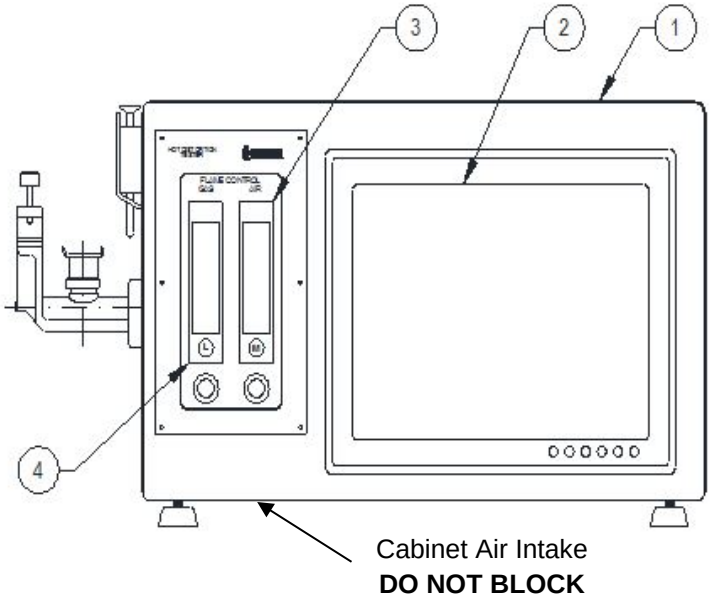

Figure 1: Tester Front View

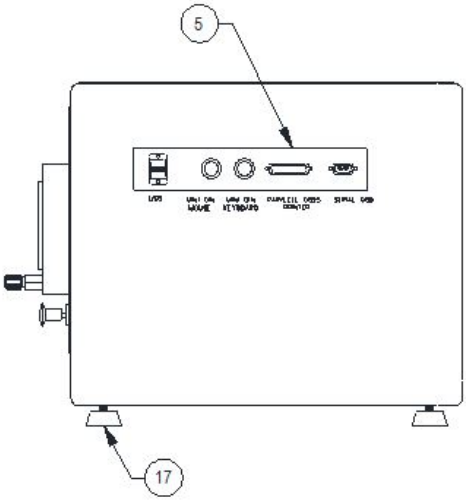

Figure 2: Tester Right Side View

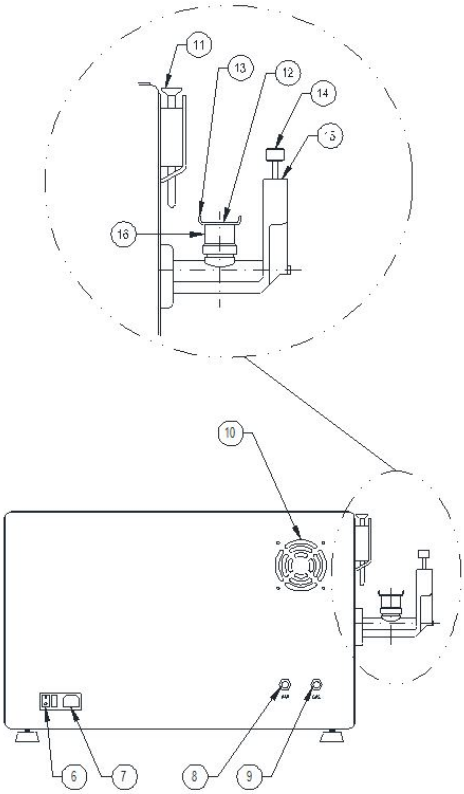

Figure 3: Tester Rear View

Item	Part No.	Description
1		Cabinet
2		Monitor
3		Flowmeter - Air
4		Flowmeter - Gas
5		Docking Panel
6		On-Off Switch
7		Electrical Plug
8		Air Inlet
9		Gas Inlet
10		Cabinet Fan
11	205304	Sensor Feeler
12	205301	Burner Screen
13	205303	Retaining Flame Plate
14		Clamp Knob
15		Specimen Bracket
16		Burner Head
17	0045802	Rubber Foot

8 Parts List / Ordering Parts / Returns

8.1 Parts List

Simpson maintains a large inventory of common spare parts for all current Simpson Analytics products. The following table provides part numbers for common spare parts for this device. Contact Simpson Technologies with the part number and description when ordering.

Part No.	Description
0042150B	Air Filter Regulator
0042150E	Regulator Male Quick Disconnect
0042150D	Regulator 4mm I.D. Polyurethane Tubing
205301	Top Burner Screen
205303	Retaining Flame Plat
205304	Metallic Dummy Specimen
205305	Deflection Measurement Gauge
205301	Keyboard

8.2 Ordering Replacement / Spare Parts

The source of replacement parts for your Simpson Analytics equipment is just as important as the make of the equipment you purchase. ALWAYS order parts for your Simpson Analytics equipment directly from Simpson Technologies. To find the Simpson office closest to you please visit us on the internet at www.simpsongroup.com on the “Contact Us” page.

Parts may be ordered from the sales department via e-mail at parts@simpsongroup.com: When contacting our sales department to obtain a quotation on replacement parts or service please always include the equipment serial number, the description of the part and the part number. Your Simpson Technologies sales team representative will provide you with a quote on the items with current price and delivery times. When ordering, please always refer to the quote number on your order.

To arrange for calibration support or repair assistance please contact our customer service department at service@simpsongroup.com.

8.3 Returned Goods Policy

Simpson Technologies strives to provide their customers with maximum follow-up support and, in order to offer the most practical flexibility, the following conditions apply to returned goods. Adherence to these procedures will ensure the most prompt and efficient service.

RETURNS WILL BE CONSIDERED IN THE FOLLOWING SITUATIONS:

- Products ordered in error by customer (subject to a restocking charge).
- Incorrect or defective products shipped to customer.
- The return of existing products for factory repair or upgrade.
- Products ordered correctly but which are unwanted or unsuitable (subject to a restocking charge).
- A Safety Data Sheet (SDS) must accompany material that is sent to Simpson Technologies for testing purposes. Simpson Technologies will NOT authorize the return of hazardous materials.

RETURN PROCEDURE:

- **The customer must obtain a Return Material Authorization Number (RMA#) from Simpson Technologies prior to returning the goods.**
- To obtain an RMA#, the customer should contact the Customer Service department by phone, fax, e-mail to service@simpsongroup.com. The material being returned must be identified and the reason for its return clearly specified. Once approved for return, Simpson Technologies will issue the customer an RMA form to be included with the shipment and with instructions on where and how to ship the goods.
- All returned goods are to be shipped with transportation charges PREPAID, unless otherwise agreed when the RMA# is assigned. If it has been predetermined that return goods are to be shipped COLLECT, Simpson Technologies will specify the desired routing.
- All returned shipments will be subject to inspection upon arrival at Simpson Technologies.
- Material returned without an RMA# may be refused and returned at customer's expense.

9 Decommissioning

Before doing any work, review the Safety Procedures in Section 2 and **Lockout** and **Tagout** all the power sources to the machine and peripheral equipment.

Failure to follow safety procedures could result in serious injury.

Use qualified personnel and follow safety procedures, applicable local policies, and regulations in decommissioning the Simpson Hot Distortion Tester and peripheral equipment.

Electrical Power: Disconnect the electrical power source and verify there is no power on all components being decommissioned.

WASTE DISPOSAL

The machinery and controls consist of:

- Iron
- Aluminum
- Copper
- Plastic
- Electronic Components and circuit boards

Dispose of the parts in accordance with the applicable regulations.

Oil and Grease: Used oil and grease, which are no longer suitable for their intended use, must be transported to the relative collection point and disposed of in accordance with local regulations.

10 Location of Safety Labels

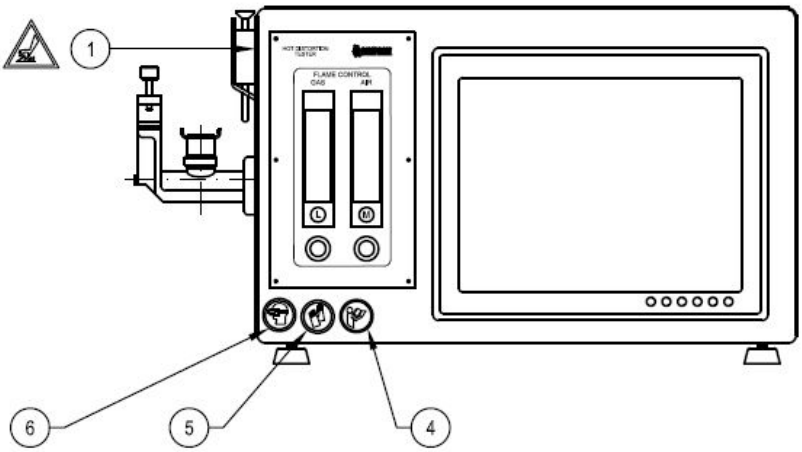

Figure 1: Front View

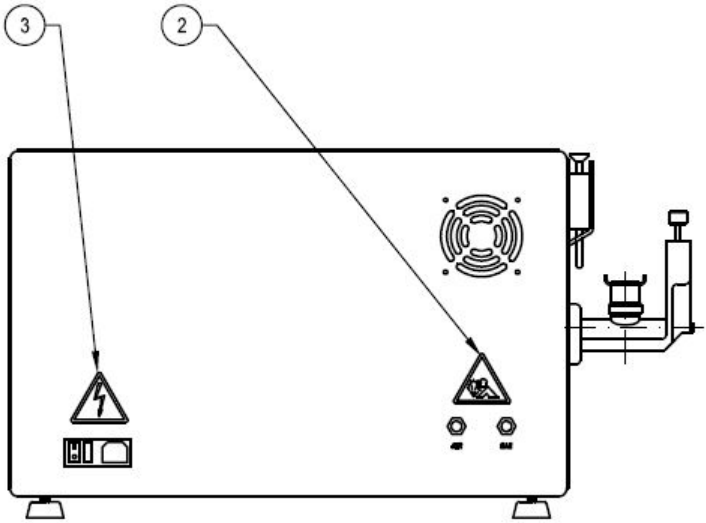

Figure 2: Rear View

Item	Part No.	Quantity
1	205307	1
2	217945	1
3	217958	1
4	214042	1
5	214044	1
6	214075	1

The product user is responsible for maintaining the legibility of all safety signs.

NOTICE *When replacement signs are required, contact Simpson Technologies Parts Department.*

11 Commercial Manuals

11.1 Flow Meter

- Flow Meter Instructions, TCV0102SM
- Flow Data, 014-96, Document No. 577
- Flow Data, 023-92, Document No. 612

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