

Operating Instructions

Wet Tensile Strength Tester

Model 42112



Type:	Wet Tensile Strength Tester
Model Number:	42112
Part Number:	0042112-ASM 0042112-ASM-220 042112-M-ASM-1 042112-M-ASM
Serial Number	

Name and address of manufacturer:

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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 Wet Tensile Strength 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 Wet Tensile Strength Tester, Model 42112, determines tensile strength of the condensation zone that is created in all clay bonded molds during and after pouring.

1.2 Organizational Measures

The operating instructions should be readily available at the place of operation. In addition to the operating instructions, the general legal regulations, or other mandatory rules for prevention of accidents and environmental protection should be made known and be observed!

The personnel instructed to use this apparatus, before beginning work, should have studied and fully understood these Operating Instructions, in particular the "Safety" chapter.

No modifications, extensions, or changes of design of the device that would impact safety requirements should be put into effect without prior consent of the supplier! Spare parts must conform to the technical specifications defined by the manufacturer. This is always guaranteed when using original spares.

2 Safety

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 Nameplate and 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 panel 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



BURN HAZARD - HOT SURFACE (STC #205307)

This label is located on the front panel above the heating plate.

When the Tester is ON, the Heating Plate (Figure 7-2, Item 1) is extremely **hot** and can cause severe **burn** to body parts. Also, the Heat Vent Cover (Figure 7-4, Item 12) can become **hot** and may cause minor **burns** to body parts. Follow **Lockout and Tagout** procedures before servicing.



ELECTRICAL SHOCK / ELECTROCUTION (STC #217958)

This label is located on the back of the tester above the electrical power receptacle.

When the back panel is removed, electrical terminals are exposed. A hazardous voltage is present, can cause electric **shock** or **burn**, and will result in serious injury. Follow **Lockout and Tagout** procedures before servicing.



ELECTRICAL SHOCK / ELECTROCUTION (STC #214043)

This label is located on the front panel below the control panel and on the lower right hand of the panel.

When the front panel or the two-sided panels are removed, electrical terminals are exposed. A hazardous voltage is present, can cause electric **shock** or **burn**, and will result in serious injury. Follow **Lockout and Tagout** procedures before servicing.



EXPLOSION / RELEASE OF PRESSURE (STC #217945)

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

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.



WEAR GLOVES / AVOID BURN
(STC #217975)

This label is located on the front panel below the specimen table.

Always wear gloves when performing any test with the Wet Tensile Strength Tester; its heating plate and specimen tube are extremely **hot** and may **burn** hand and body parts. Follow **Lockout and Tagout** procedures before servicing.



READ AND UNDERSTAND ALL SERVICE MANUAL INSTRUCTIONS
(STC #214042)

This label is located on the front panel below the electronic control panel.

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 labelling of all equipment which is interlocked mechanically, electrically, through hydraulics, pneumatics, levers, gravity or otherwise.

"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 Safety

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 controlled 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 properly 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 controlled 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, which 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 Fundamental Principles

As molten metal enters a green sand mold cavity, the sand develops several distinctive strength zones. A temperature gradient is generated in the mold as heat transfers from the metal into the sand. This temperature gradient develops regions within the mold that have varying temperatures and moisture contents. These changes in temperature and moisture have pronounced effects on sand strength.

During the pouring process, sand on the surface of the mold cavity is heated. The water within this hot layer is vaporized. This water vapor migrates between the sand grains to a cooler region of the mold and condenses. This condensation results in a thin layer of sand that is saturated with water. This condensation zone is known as the wet layer within a green sand mold. Behind this region is a layer of warm sand that contains a normal water percentage. Following this region is the remainder of the mold that has not been influenced by the casting process.

These zones of various temperatures and moisture contents result in non-uniform sand strengths within a mold. At the mold metal interface, the sand surface layer is dry, hot, and strong. Behind this hot zone is a warm layer that is slightly stronger when compared to the condensation zone but weaker than the remainder of the mold, which is still at ambient temperature.

The condensation zone is the lowest strength layer in the cross section of the mold and the source of casting defects. The Wet Tensile Strength Tester, Model 42112, is designed to measure the tensile strength of bentonite bonded molding sand in this condensation zone (wet layer).

3 Short Description & Specifications

3.2 Description

The Wet Tensile Strength Tester, Model 42112, is designed to accurately determine the tensile strength of the condensation zone in a clay/bentonite bonded molding sand. The instrument recreates the casting environment by utilizing a heater to generate a condensation zone in a sand specimen. The wet tensile strength is determined by pulling a detachable ring from a specially designed specimen tube. The specimen tube, with its detachable ring in position on top on the specimen tube, is loaded with molding sand and compacted to a proper specimen height using a sand rammer.

The sand specimen and specimen tube are loaded onto the table of the Wet Tensile Strength Tester. After the start button is pressed, the table raises the specimen tube loaded with the compacted sand specimen against a heating plate. The sample is firmly pressed against the plate. This avoids the loss of the generated steam and forces it into the cooler zones inside the sand sample. Once in contact with the heating plate, the temperature at the surface of the sand specimen increases. Steam is generated at the sand heater interface and a temperature/moisture gradient is developed through the sand specimen. The steam is driven away from the heating plate through the porosity of the sand specimen. The moisture vapor migrates back into the sand specimen to a low temperature zone where it condenses.

After a user-selected time has elapsed, the table together with the specimen tube lowers away from the heating plate. During this descent, the detachable ring of the specimen tube assembly is held by the measuring fork which transmits to the load cell the tensile force being applied to the wet zone of the sand specimen. Since the wet layer is the weakest strength zone, when a load is applied to the specimen, it will always fail in this layer. The force required to break the wet layer is the wet tensile strength. The instrument is fully automatic and displays the wet tensile results in an easy-to-read digital display. The final strength value is displayed on a three-digit display in N/cm².

The testing time, the time in seconds elapsed between the start of elevating the specimen tube and the specimen tube descent, must be chosen according to the specific sand specimen. The timer which controls this time is programmed by a digital keyboard. The heating plate temperature is kept between 300°C and 320°C by means of a digital temperature controller.

3.3 Specifications, Dimensions and Weights (Approximate)

Specifications	Wet Tensile Strength Tester (Model 42112)
Length	455 mm (17.9 in.)
Width	325 mm (12.7 in.)
Height	480 mm (19 in.)
Weight	50 kg (110 lbs.)
Power	100-240V; 50-60Hz
Compressed Air	Filtered and regulated between 3.5 to 4.5 bar (50 to 65 PSI). Pressure regulator and filter are supplied.

4 Unpacking and Installation

4 Unpacking and Installation

4.1 Unpacking

NOTICE

Your new Laboratory Equipment has been closely 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 Wet Tensile Strength Tester, Model 42112, is shipped in one piece and is intended to be used as received; no further assembly/disassembly is required. No special lifting equipment for handling is required. The tester weighs approximately 50 kg. Due to its bulky dimensions and tight-fitting shipping crate, it is recommended that two people remove the equipment from the crate. Whenever positioning or relocating this instrument, two people should be utilized. The approximate instrument dimensions are 455mm x 325mm x 480mm. Its shipping weight (in a box) is 58 kg.

1. Remove any loose accessories/parts within from the shipping crate and place in a location away from any packaging material to assure that these items are not misplaced.
2. Carefully remove the tester from the packing crate and place it on stable bench.
3. Once removed from the crate, proceed by taking off any protective wrap and unpackage the protective material from the included accessories.
4. The packaging remains the property of the Customer and may be used for returning the apparatus if some repair is required.

4.2 Components

Your Wet Tensile Strength Tester is shipped with the following accessories and installation components. Please take a moment and identify that the following items were included.

- Wet Tensile Strength Tester
- Specimen Tube and Detachable Ring
- Specimen Tube Base
- Power Cord
- Pneumatic Regulator/Filter
- Pneumatic Hose and Connectors

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

NOTICE

Do not store the device in the open and unprotected from atmospheric conditions. If this instruction is not followed, claims under guarantee will no longer be considered.

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. Vibration can disrupt the machine's proper operation and give false strength readings. Care should be taken to make certain that the tester is not placed on a surface that also includes instruments such as laboratory sifters or mullers.

Place the apparatus on a stable bench. The machine should be in a level condition. The machine can be leveled by making adjustments to the four adjustable rubber feet located at each bottom corner of the tester.

4 Unpacking and Installation

The Wet Tensile Strength 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 and Pneumatic Power Connection

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



Connect the equipment to a grounded electrical outlet.

Pneumatic Requirements: Compressed air that is filtered and regulated between 3.5 to 4.5 bar (50 to 65 PSI).



Before connecting the equipment, an approved pneumatic safety Lock-Out air valve must be installed in the supply airline. This item is not supplied with the Wet Tensile Strength Tester and is the responsibility of the customer to provide and install.

Verify that the voltage marked on the serial number nameplate (Figure 7-7, item 1) is the same as the electrical outlet to be used for the machine. Outlet must be properly grounded! Failure to follow safety procedures could result in serious injury.



A pressure regulator/filter and length of pneumatic hose required to connect the Wet Tensile Strength Tester to the regulator/filter has been included with the Wet Tensile Strength Tester.

NOTICE

The compressed air should be free of dirt, debris, and condensate. Debris and condensate will cause damage to the Wet Tensile Strength Tester.

4.5 Connecting Power and Set-Up

1. Verify the voltage on the specification plate (Figure 7-7, Item 1) located on the back of the Wet Tensile Strength Tester. Connect the universal power cable supplied with the tester into the power plug receptacle located on the back of the Wet Tensile Strength Tester (Figure 7-3, Item 11).
2. Choose the proper electrical plug from the multiple plugs that are supplied with the universal power cord.



Some areas may require an electrical plug that is not supplied with the universal power cord to properly conform to the specific electrical outlet. These special electrical plugs will need to be purchased separately by the customer.

3. Verify the proper voltage of the electrical outlet before plugging the power cord into the outlet. Connect universal power cord to the AC electrical outlet that is free of disturbances/fluctuation and is properly grounded.

NOTICE

It is highly recommended that a voltage stabilizer/filter (line conditioner) is installed between the electrical outlet and the inlet of the Wet Tensile Strength Tester. This device will help to ensure the proper performance of the Wet Tensile Strength Tester. It will also help to eliminate/reduce potential premature failures of the electric heater used in the Wet Tensile Strength Tester.

4. Assemble the provided pneumatic regulator/filter according to the original equipment manufacturer's instructions supplied with the regulator/filter.

4 Unpacking and Installation

5. Connect the assembled pneumatic regulator/filter to the incoming compressed air line.
6. Connect the Wet Tensile Strength Tester to the pneumatic regulator/filter using the pneumatic air hose and fittings included with the unit. Connect the air hose from the outlet of the regulator/ filter to the air inlet (Figure 7-3, Item 8) located on the back side of the Wet Tensile Strength Tester. Secure the air hose to the air inlet with the provided connector that is attached to the air inlet.
7. Using the supplied air regulator/filter adjust the air pressure to 4.5 bar (65 psi). Refer to the manufacturer's manual for the regulator/filter for instructions on regulating air pressure.

NOTICE

The air fed to the apparatus must be filtered and free of condensate. If water present in the incoming compressed air makes contact with the hydraulic oil within the hydro/pneumatic tanks, it may contaminate oil and affect the load application speed regulation.

4.6 Airborne Noise Emission

Regarding airborne noise emission by the Wet Tensile Strength Tester (Model 42112), there is no motor or other noise emitted by this machinery other than the click of a solenoid valve being operated. As such, the equivalent continuous A-weighted sound pressure level at the workstation does not exceed 70db(A).

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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 Wet Tensile Strength Tester's heating plate is extremely hot when the tester is in operation. Always wear gloves and be cautious when working with or around the tester. **Hot** surfaces can **burn** hands and body parts.*

5.1 Preparing the Sand Specimen

1. Assemble the wet tensile specimen tube assembly:
 - » Place the specimen tube base facing up on a stable bench.
 - » Carefully stack the detachable ring into the specimen tube base.
 - » Gently slide the specimen tube into the detachable ring.
 - » The finished assembly, arranged from top to bottom, consists of the specimen tube, detachable ring, and specimen tube base.
2. Obtain a representative sample to mold sand to be tested.
3. Quickly pass the molding sand through a number 4 sieve (American Foundry Society sand testing standard) or a number 6 sieve (Metric sand testing standard).
4. Carefully weigh the proper amount of molding sand to prepare a sand specimen that is 2 inches in height (American Foundry Society sand testing standard) or 50 mm in height (Metric sand testing standard).
5. Carefully transfer the weighed molding sand sample into the assembled wet tensile specimen tube assembly.

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6. Manufacture a standard (AFS or Metric) sand specimen using a standard sand rammer or pneumatic sand squeezer (Simpson Technologies Model numbers; 42100, 42100-M, 42117, 42117-M, 42160 or 42160-M).



Detailed sand specimen preparation instructions can be found in the operation manual for the sand rammer or squeezer being used. Follow the step-by-step procedures listed in the operation manual to manufacture the standard wet tensile sand specimen using the wet tensile specimen tube assembly.

NOTICE

Failure to use a Simpson Technologies manufactured Sand Rammer or Sand Squeezer may result in damage to the specimen tube base or specimen tube assembly. The rammers and squeezers are specifically designed to accept the Wet Tensile Strength Tester's specimen tube base and assembled specimen tube assembly

Failure to use the proper rammer or squeezer may also result in inaccurate wet tensile results due to premature sample failure during preparation and removal from the rammer or squeezer.

7. After ramming, gently remove the assembled wet tensile specimen tube assembly from the sand rammer or squeezer. At this point, use extreme care when handling the wet tensile specimen tube assembly. Rough handling of the assembly may result in a premature failure of the molding sand specimen).
8. Carefully rotate the wet tensile tube assembly 180 degrees while holding the base against the specimen tube assembly. Gently set the rotating assembly down on a stable bench. After rotation, the specimen tube base is now on top of the specimen tube assembly. Gently lift off the specimen tube base without disturbing the detachable ring. The assembled specimen tube, detachable ring and sand specimen are now ready to be inserted into the Wet Tensile Strength Tester).

5.2 Performing a Wet Tensile Strength Test



BURN HAZARD! *The Wet Tensile Strength Tester's heating plate is extremely hot when the tester is in operation, always wear gloves and be cautious when working with or around the tester. Extreme caution must be observed when loading and unloading the specimen tube assembly onto the table of the Wet Tensile Strength Tester due to the high temperature present at the heating plate. **Hot** surfaces can **burn** hands and body parts.*

1. Turn the Wet Tensile Strength Tester on by switching the rocker switch located on the back of the machine (Figure 7-3, Item 6) to the ON position. All lighted indicators located on the front panel will light for approximately four seconds. During this period, the tester verifies the current condition of the instrument.
2. After the automatic verification of instrument condition (approximately four seconds after turning on the tester), the Wet Tensile Strength Tester should indicate the following:
 - » The digital timer display (Figure 7-2, Item 5) will be blank (no numbers displayed in the LED display).
 - » The digital Wet Tensile Strength load display (Figure 7-1, Item 2) will indicate a zero (000) value or a value very near zero.
 - » The temperature controller SV digital display (Figure 10-1, Item 2) will indicate the set point temperature. The PV display (Figure 10-1, Item 1) will indicate the current actual temperature of the heating plate.
3. Set the Wet Tensile Strength Tester temperature using the up and down arrows on the temperature controller (Figure 10-1, Item 5). When the desired set point temperature is shown in the SV digital display, press the Set button on the temperature controller to enter this value. The set point (SV) temperature should be set at 310°C (590°F).

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For further information regarding the temperature controller, refer to the temperature controller manufacturer's manual in Section 11 of this manual.

4. Allow time for the heating plate on the Wet Tensile Strength Tester to reach the selected operating temperature. The SV (Figure 10-1, Item 2) temperature should equal the PV (Figure 10-1, Item 1) temperature displayed by the temperature controller.
5. Select the sand specimen heating time using the numeric keypad located on the front panel of the Wet Tensile Strength Tester (Figure 7-1, Item 9). The digital time display (Figure 7-1, Item 1) will indicate the selected time in seconds on the digital display.



If an error was performed when entering the heating time, then press the Clear Time button located on the front panel (Figure 7-1, Item 10) of the Wet Tensile Strength Tester. This function will clear the incorrect time value from the time display. After clearing the incorrect value from the time display, repeat Step 6.



For further information regarding how to determine the correct sand specimen heating time, refer to Section 6.2.2 "Determining Proper Heating Time" in the Calibration Section of this manual.

6. Check the value displayed in the load display (Figure 7-1, Item 2) on the front panel of the Wet Tensile Strength Tester. If the value shown on the display is zero, then move to Step 7 of this procedure. If the value does not indicate a zero, then the load display must be set to zero. The load display can be set to zero by pressing the Zero Tensile Display button (Figure 7-1, Item 8) located on the front panel of the Wet Tensile Strength Tester. After resetting the load display to zero, proceed to Step 7 of this procedure.
7. After entering the sand specimen heating time and setting the load display to zero, the Ready to Start indicator light (Figure 7-1, Item 3) will turn on. This light indicates that the Wet Tensile Strength Tester is correctly programmed and ready to accept the prepared sand specimen).

8. Carefully insert the prepared specimen tube assembly containing the compacted molding sand sample onto the table (Figure 7-2, Item 3) of the Wet Tensile Strength Tester. Gently push the specimen tube assembly back on the table until it reaches the hard stop located at the rear of the table. The flange of the detachable ring should be above the top of the fork and below the heating plate during this operation.
9. Press the Start button (Figure 7-1, Item 6) located on the front panel of the Wet Tensile Strength Tester. At this time, the heating time starts which is indicated by the Timer On indicator light (Figure 7-1, Item 4).



An error message "Er.2" will be displayed in the load display after pressing the Start button if all required start-up conditions are not satisfied. Refer to Section 5.3 "Error Messages" for information regarding the cause and corrective actions to clear an error message.

10. When the operator selected sand specimen heating time is complete the Timer On indicator light (Figure 7-1, Item 4) shuts off. The table and specimen tube assembly start moving downward. The table continues moving down to a point where the measuring fork (Figure 7-2, Item 2) of the Wet Tensile Strength Tester makes contact with the flange of the detachable ring of the specimen tube assembly. At this point, the detachable ring will be held by the measuring fork while the specimen tube follows the table descent. This action causes a tensile load on the compacted sand specimen between the detachable ring and specimen tube.
11. The load display (Figure 7-1, Item 2) will begin to display different tensile strength values that are registered by the load cell as the tensile load on the sand specimen increases. This tensile loading process continues on until the sand specimen is broken.
12. The detachable ring and a fraction of the sand specimen will remain on the measuring fork after specimen failure. This load is also detected by the measuring fork, although it takes no part in the tensile load applied to the sand specimen. The

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microprocessor of the Wet Tensile Strength Tester automatically weighs and subtracts this supplementary mass weight from the previously detected value since this weight was not included in the tensile load applied to the sand specimen.

13. When this automatic operation is complete, the wet tensile strength value of the molding and specimen will appear on the load display (Figure 7-1, Item 2). At the same time, the Operation Finished indicator (Figure 7-1, Item 5) turns on, indicating that the wet tensile strength test is complete.



The three-digit unit of measure value displayed in the load display is in $\text{N/cm}^2 \times 10^{-3}$ (example 234 = .234 N/cm^2).

14. When the test is complete, the Wet Tensile Strength Tester will display the following information until a new test sequence is started.
 - » Test time for the test completed (value remains until new test sequence is started).
 - » Wet tensile strength value for the test completed (value remains until a new test sequence is started).
 - » Current heating block temperature (changes with current temperature).
 - » Set temperature (value remains until temperature set point is changed).
 - » Operation finished indicator light indicating operation finished).
15. To perform another tensile test:
 - » Erase the wet tensile strength value by pressing the Clear Tensile Display button (Figure 7-1, Item 7). The Wet Tensile Strength load display (Figure 7-1, Item 2) will change to zero. If this step does not bring the load display to zero, then press the Zero Tensile Display button (Figure 7-1, Item 8) to zero the load display).

- » Erase the heating time, if necessary, by pressing the Clear Time button (Figure 7-1, Item 10).
- » The Ready to Start indicator (Figure 7-1, Item 3) will turn on indicating that the Wet Tensile Strength Tester is ready for another test.

5.3 Error Messages

This information can be used to identify and troubleshoot any error messages that may appear in the load display (Figure 7-1, Item 2) of the Wet Tensile Strength Tester.



If an error message appears in the load display, it is necessary to press the Clear Tensile Display button (Figure 7-1, Item 7) to recover the operating system of the Wet Tensile Strength Tester.

The following list shows all potential error messages that may occur in the load display. The list provides basic definitions and potential causes and solutions for each error message of the Wet Tensile Strength Tester:

- **"Er.1" - Capacity of load display exceeded.** This message appears in the load display if the tensile load required to break the sand specimen is greater than the capacity of the instrument. If this message appears, the current test is automatically and immediately aborted.
- **"Er.2" - Test not ready to start.** This message indicates that all required start-up conditions were not achieved prior to pressing the start button. Check the three possible reasons for this error message:
 - » Sand specimen heating time was not preset.
 - » The local display was not zeroed.
 - » The Ready to Start indicator (Figure 7-1, Item 3) was off.

5 Operating Instructions

Once the reason for the error message is identified, make the required corrections, and press the Start key to restart the test.

- **"Er.4" - Minimum load range exceeded.** This message indicates that negative loads are detected by the electronic load cell. This may indicate that part of the measuring fork (Figure 7-2, Item 2) has been removed or an upward force is or has been exerted on the measuring fork. If the status of the measuring fork appears normal, then this message may indicate a failure in the electronic circuit. Contact Simpson Technologies for additional assistance in resolving this message.
- **"Er.5" - Auto zero out of range.** The message indicates that the zero condition was not met before beginning a test. This condition may occur if the measuring fork is briefly loaded and then unloaded by an outside force during the test sequence. Do not touch the measuring fork or let anything interfere with the measuring system while a test is in progress. If this occurs, then the instrument will display an "Er.5" error message and abort the current test.

This error message may also appear immediately after pressing the Zero Tensile Display button (Figure 7-1, Item 8) if the Wet Tensile Strength Tester detects any load disturbance on the measuring fork or the measuring fork was disturbed and/or mechanically jammed at the time the Zero Tensile Display button was pressed.

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.

6.1 Maintenance



*Before performing any maintenance, turn-off the Lock-Out air supply valve, remove the electrical power cord from the wall receptacle and allow the heating plate to cool off to ambient temperature. The Wet Tensile Strength Tester must be put into **Zero Mechanical State (ZMS)**. Follow **Lockout and Tagout** procedures before servicing!*



*Replace all panels before operating the machine. A hazardous voltage is present, can cause electric **shock** or **burn**, and will result in serious injury*



Always make certain that the back panel of the Wet Tensile Strength Tester is kept in an upright (vertical) position if removed for maintenance. If the panel is not kept vertical, oil can leak from the hydro-pneumatic system which is attached directly to the back panel of the Wet Tensile Strength Machine.

6.1.1 Daily Maintenance

- Drain any condensation from the air filter located under the regulator in the air regulator/filter unit.
- Check air pressure at the regulator/filter and adjust if required.
- Remove and clean any loose sand/dirt from the outside surfaces of the instrument.
- Remove any full or partial sand specimens from the specimen tube and detachable ring. Clean the internal surfaces of the specimen tube with specimen tube swab.

6 Maintenance and Calibration

6.1.2 Replacing Oil in Hydro-pneumatic Oil System

If encountering difficulty in maintaining a constant load application speed, then the oil in the hydro-pneumatic system may require replacement. Before replacing oil make certain to verify that all settings in Section 6.2.1 "Regulating the Load Application Rate" are correctly adjusted. Only replace oil if the problem of maintaining a constant load application still occurs after carefully following all instructions in Section 6.2.1.



Replace oil with a Shell TELUS 20/27 or equivalent type of automatic transmission oil.

1. Turn the Wet Tensile Strength Tester off by switching the rocker switch located on the back of the machine (Figure 7-3, Item 6) to the OFF position.
2. Turn off the Lock-out air supply valve.
3. Remove the electrical universal power cord from the wall receptacle.
4. Allow the heating plate to cool to ambient temperature.
5. Remove the plastic cover caps on both oil drain connectors located on the back side of the machine (Figure 7-3, Item 10).
6. Allow time for oil to drain.
7. Gently place the Wet Tensile Strength Tester onto its left side.
8. Unscrew and remove the plug that is located on the bottom of the cylinder that actuates the table. The bottom cover panel does not need to be removed as there is an access hole to this drain plug.

9. Place a flat container to catch the used oil on the bench next to the Wet Tensile Strength Machine.
10. Carefully return the Wet Tensile Strength Tester to its upright position over a flat container. Allow time for oil to drain from bottom drain hole.
11. After oil has drained from the machine, replace the oil plug and both plastic cover caps.
12. Remove the plastic cover caps on both oil inlet connectors located on the back side of the machine (Figure 7-3, Item 9).
13. Using a syringe equipped with a thick needle, slowly refill the oil back into the hydro-pneumatic system from the oil inlet connectors. Continue to add oil until excessive oil flows out of oil inlet connectors.
14. Replace the plastic cover caps on both oil inlet connectors (Figure 7-3, Item 9) located on the back side of the machine.
15. Plug the Wet Tensile Strength Tester back into the wall receptacle and open-air supply valve.
16. Turn the Wet Tensile Strength Tester on by switching the rocker switch located on the back of the machine to the ON position.
17. Cycle the equipment several times simulating the testing process cycle. During this operation, the machine may make some bubbling noises which indicate air being purged from the oil system. Again, open the two oil inlet connectors and add more oil to fill the system. When the system is full replace both plastic covers on the oil inlet connectors

6.2 Calibration

6.2.1 Regulating the Load Application Rate

The Wet Tensile Test standard establishes a load application rate of .05 Newton's per square centimeter per second (or 0.05 N/cm² /sec.). To verify the load application rate, use a Master Alignment Tube, Model 42112A, from the Calibration Kit, Model 42113.

6 Maintenance and Calibration

1. Note the weight of the alignment tube from the calibration certificate.
2. Gently insert the Master Alignment Tube on the Table (Figure 7-2, Item 3) of the Wet Tensile Strength Tester.



The Master Alignment Tube, Model 42112A, is positioned on the table of the Wet Tensile Strength Tester in the same manner as an assembled specimen tube assembly during a standard test sequence.

3. Set the heating time for one second (see Section 5.2 “Performing a Wet Tensile Strength Test” for detailed procedures on programming heating time).
4. Zero the load display (see Section 5.2 “Performing a Wet Tensile Strength Test” for detailed procedures on how to zero load display)
5. Press the button to begin a test.
6. With a stopwatch, carefully measure the time that elapses from the moment values start to appear in the load display (Figure 7-1, Item 2) until the first steady values appear in the digital display. Note the time required to complete loading. The load application rate is calculated by dividing the indicated wet tensile strength by the measured time in seconds.

Example:

$$\frac{0.435 \text{ N/cm}^2}{8.5 \text{ s}} = 0.051 \text{ N/cm}^2/\text{s}$$

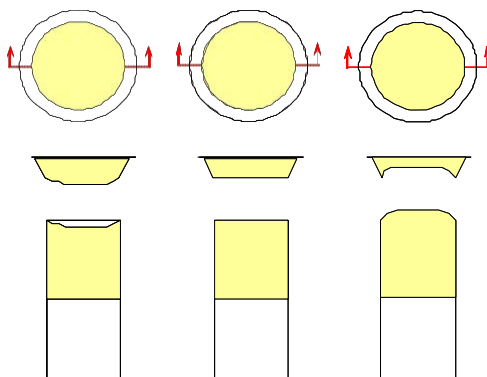
7. If the value obtained is too fast or too slow, then follow the directions:
 - » Verify incoming air pressure meets specifications at the regulator/filter and adjust if required.
 - » With a small screwdriver adjust the table descending speed regulating valve (Figure 7-5, Item 13). Turning the valve clockwise will reduce the load application speed. Turning the valve counterclockwise will increase the load application speed.

6.2.2 Determining Proper Heating Time

The location of the condensation zone in the molding sand test specimen is influenced by the heating time selected by the user. The tensile strength in the condensation zone is the weakest within the sand specimen. The sand sample will typically experience a tensile failure (rupture surface) in the wet layer.

To determine the proper heating time, carefully examine the break area (rupture surface) of the sand specimen after completing a test. The sand sample should fail with an even layer breaking through the wet layer. The wet layer (rupture surface) should be at or just below the top edge of the specimen tube and a complete solid plate of dry molding sand should lift off and remain in the detachable ring of the specimen tube assembly. If the rupture surface is uneven, then repeat the test with less or more heating time.

Graphic 1 shows the effect of selecting different heating times on the same molding sand sample. Position 2 would be considered the correct heating time. Position 1 would be considered an excessive heating time and Position 3 would be considered insufficient heating time. Typically, the proper sand specimen heating time will result in the lowest wet tensile strength.



Graphic 1

6 Maintenance and Calibration

6.2.3 Heating Plate Temperature

The actual temperature of the heating plate should be verified with a surface pyrometer. Make certain that the SV equals the PV temperature on the temperature controller (Figure 10-1, Items 1 & 2) before starting this test.

6.2.4 Load Calibration

1. Turn the Wet Tensile Strength Tester off, wait a few seconds and turn it back on by switching the rocker switch located on the back of the machine (Figure 7-3, Item 6) to the OFF and ON position.
2. Carefully adjust the calibration Zero (Figure 7-1, Item 12) using a small screwdriver through the small access hole in the electronic front panel. Slowly and gently rotate the calibration Zero screw to achieve a 00 reading in the load display (Figure 7-1, Item 2).
3. Note the weight of the Master Calibration Weight from the calibration certificate.
4. Gently place a Master Calibration Weight, Model 42112B, on the measuring fork (Figure 7-2, Item 2). See Photo 1 showing the Master Calibration Weight loaded onto the measuring fork.

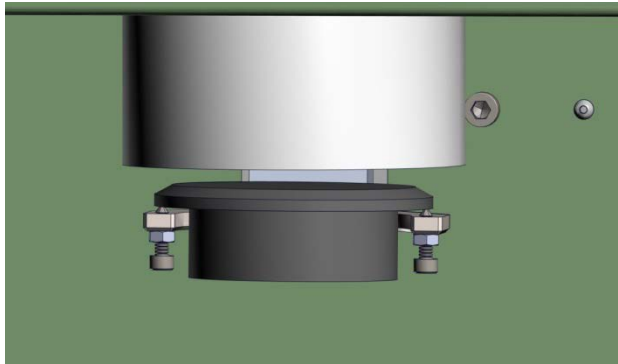
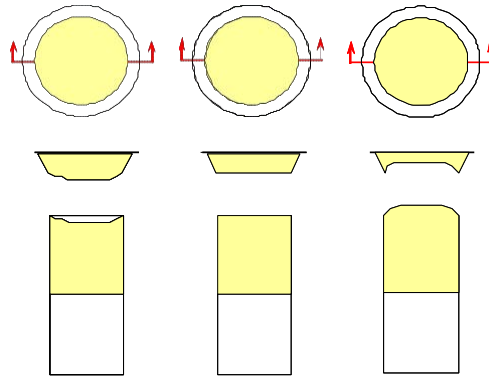


Photo 1

Carefully adjust the calibration span (Figure 7-1, Item 11) using a small screwdriver through the small access hole in the electronic front panel. Slowly and gently rotate the calibration screw while watching the load display (Figure 7-1, Item 2). Adjust screw until the weight of the Master Calibration Weight is shown of the load display.

5. Carefully remove the Master Calibration Weight from the measuring fork.
6. The load display (Figure 7-1, Item 2) should read 00. If not, then repeat Steps 2 through 6 until the load display indicates 00 after

6 Maintenance and Calibration

the Master Calibration Weight is removed from the measuring fork.

6.2.5 Measuring Fork Alignment

It is important to center the supporting pins located on the measuring fork (Figure 7-2, Item 2) to the center of the detachable ring of the specimen tube assembly. To verify the position of the pins, follow the following procedure:

1. Carefully insert the Alignment Master Tube (Model 42112A) on the table (Figure 7-2, Item 3) of the Wet Tensile Strength Tester. Gently push the Alignment Master Tube back on the table until it reaches the hard stop located at the rear of the table.
2. Turn the Wet Tensile Strength Tester on by switching the rocker switch located on the back of the machine (Figure 7-3, Item 6) to the ON position.
3. Using the numeric keypad (Figure 7-1, Item 9), enter a short heating time (2 seconds). See Section 5.2 “Performing a Wet Tensile Strength Test” for detailed procedure on programming heating time.
4. Program the temperature controller to 310C. See Section 5.2 “Performing a Wet Tensile Strength Test” for detailed procedure on programming temperature controller.
5. Press the button (Figure 7-1, Item 6). The table and alignment tube will rise up and contact the heating plate. The table will be held in this position for the program heating time. After this, the table will slowly drop, and the flange of the alignment tube will contact the support pins of the measuring fork.
6. At this point in the sequence, closely observe the alignment tube. If the supporting pins of the measuring fork are properly centered in relation to the gravity center of the alignment tube, the tube will remain hanging on the measurement fork without any lateral movement.

7. If the alignment tube tilts (leans) to the left or right, then carefully adjust the position of the support pins on the measuring fork to correct the alignment.
8. If the alignment tube tilts (leans) backward or forward, then contact Simpson Technologies for support.

7 Apparatus Layout and Location of Safety Symbols

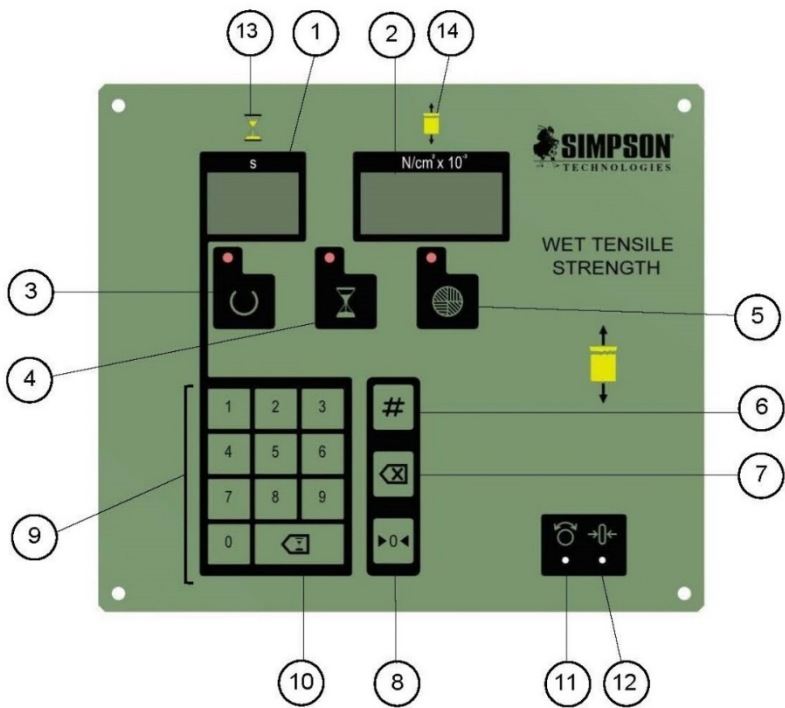


Figure 7-1 - Electronic Panel

Item	Symbol	Apparatus Description
1	-	Time Display
2	-	Tensile Strength Load Display
3		Ready to Start Indicator
4		Timer On Indicator Light
5		Operation Finished Indicator
6		Start Button
7		Clear Tensile Display
8		Zero Tensile Display
9	-	Numeric Keypad
10		Clear Time Button
11		Calibration Span
12		Calibration Zero
13		Time Symbol
14		Tensile Strength Symbol

7 Apparatus Layout and Location of Safety Symbols

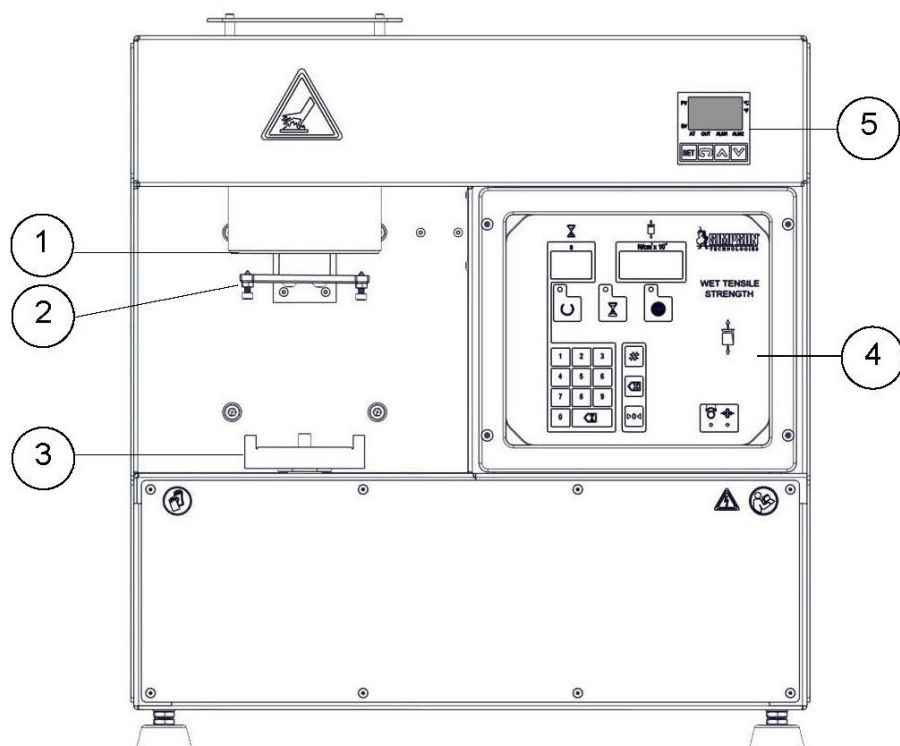


Figure 7-2 - Front View

Item	Apparatus Description
1	Heating Plate
2	Measuring Fork
3	Table
4	Front Control Panel
5	Temperature Controls (See Section 10.1 for operating instructions)

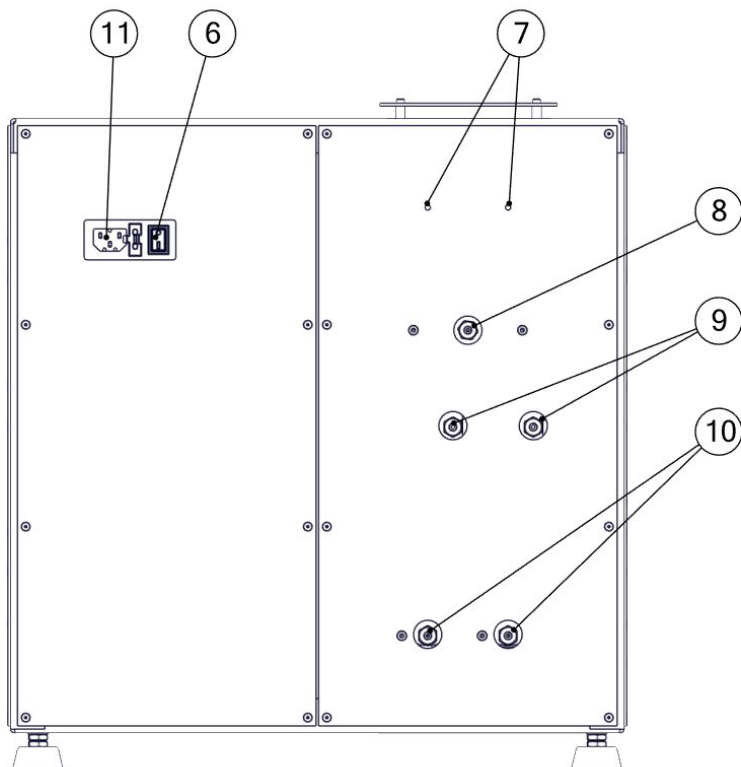


Figure 7-3 - Rear View

Item	Apparatus Description
6	ON/OFF Switch
7	Air Exhaust
8	Compressed Air Inlet
9	Oil Inlet Connector
10	Oil Draining Connector
11	Power Cord Receptacle

7 Apparatus Layout and Location of Safety Symbols

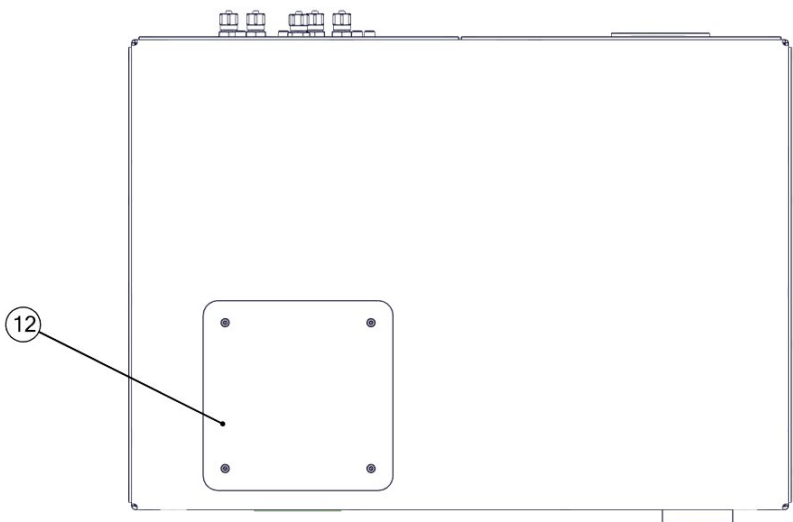


Figure 7-4 - Top View

Item	Apparatus Description
12	Heat Vent Cover

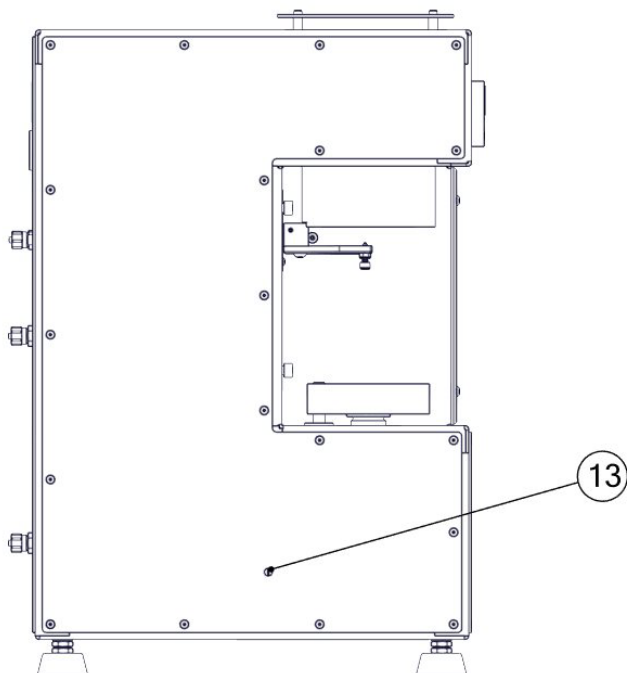


Figure 7-5 - Left Side View

Item	Apparatus Description
13	Table Speed Regulating Valve

7 Apparatus Layout and Location of Safety Symbols

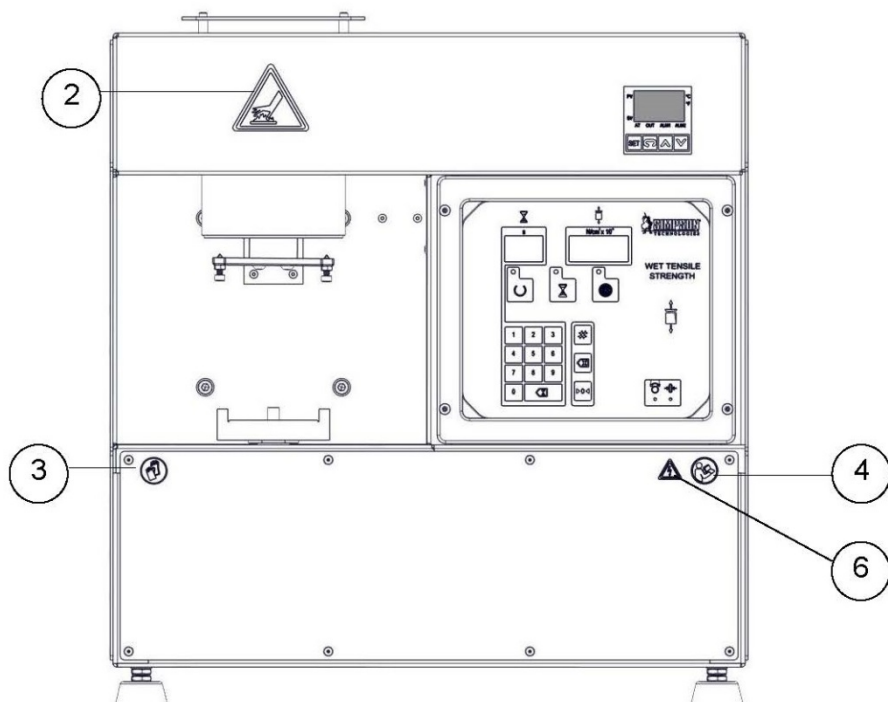


Figure 7-6 - Front View

Item	Safety Symbol Description
2	Burn Hazard - Hot Surface
3	Wear Gloves/Avoid Burn
4	Read and Understand All Service Manual
6	Electrical Shock/Electrocution

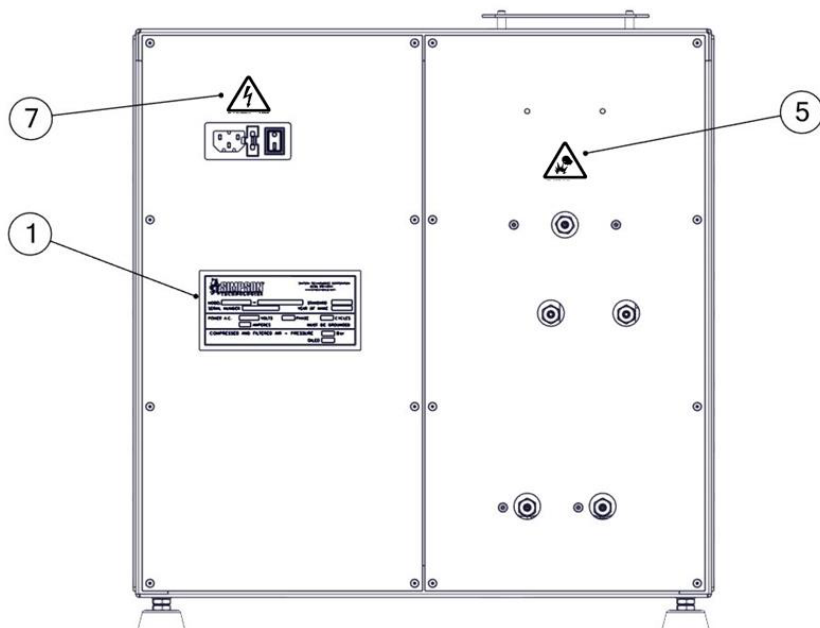


Figure 7-7 - Rear View

Item	Safety Symbol Description
1	Equipment Name Plate (Supplied with Tester)
5	Explosion/Release of Pressure
7	Electrical Shock/Electrocution

8 Parts List / Ordering Parts / Returns

8.1 Spare 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
206514	Ceramic Heating Element
206513	Heating Package Assembly
0013-101	Specimen Tube (AFS)
0013-102	Tube Ring (Detachable) (AFS)
208800	Specimen Tube (Metric)
208801	Tube Ring (Detachable) (Metric)
0013-104	Specimen Tube Base (Universal)
0042112A	Alignment Master Tube
0042112B	Master Calibration Weight

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.simpsonsgroup.com on the “Contact Us” page.

Parts may be ordered from the sales department via e-mail at parts@simpsonsgroup.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@simpsonsgroup.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 Wet Tensile Strength Tester and peripheral equipment.

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

Air Supply: Shut-off all plant airlines supplying air to the pneumatic components and bleed the downstream air lines before dismantling.

WASTE DISPOSAL

The Machinery and Controls Consists of:

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

Dispose of the parts in accordance with the applicable regulations.

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

10 Commercial Manuals

10 Commercial Manuals

10.1 Instruction Delta Temperature Control DTB 4848 – Adjust Temperature

1. Turn on power switch of the equipment.
2. The Temperature Default is in °C.
3. To change the temperature Set Value “SV,” press either UP or DOWN arrow (Figure 10-1, Item 5).
4. The display LEDs for the Set Value “SV” will go from solid to flashing rapidly.
5. Use the UP or DOWN arrows (Figure 10-1, Item 5) to change the number to the desired value (Holding the buttons down continuously will result in rapid change of the value).
6. Once the desired value is established, press the set key (Figure 10-1, Item 3) to save the changes and the numbers will return to normal NON-FLASHING numbers.
7. The unit is now ready to start.

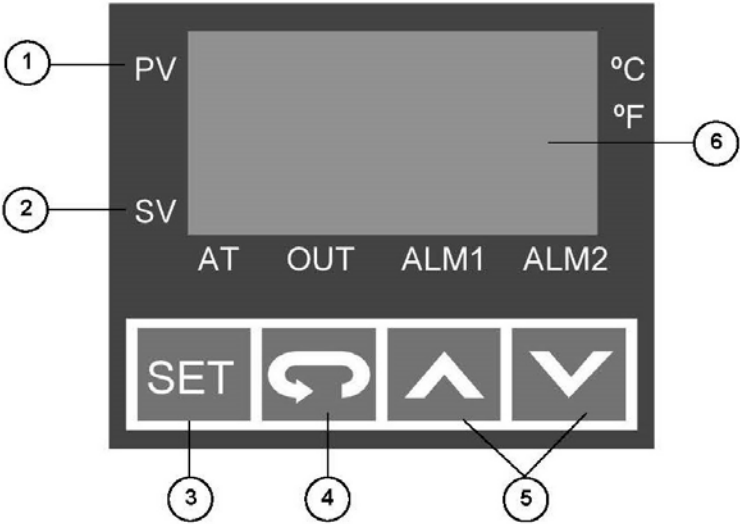


Figure 10-1

Item	Description
1	“PV” Process Value (Actual Temperature)
2	“SV” Set Value (Desired Temperature)
3	“SET” button, Use it to Save the Changes.
4	Select “FUNCTION” Button
5	UP and DOWN Arrow Buttons
6	Display Window (SV & PV)



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