Mechanical Characterization of Sand Cast Samples - LAB 3

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Objective   Investigate the mechanical strength of the sand cast parts.

I. Tension Testing

In the sand casting lab, tension test pure aluminum samples were manufactured according to the ASTM E8M-04. This experiment will characterize their mechanical strength by conducting tension tests.

II. Equipment

Patterns for the sand casting was designed according to the ASTM E8M-04. Table on p3. gives the details of the geometry. Pattern dimensions were selected as *width*= 6 mm, *thickness*= 6mm, *overall length*= 120 mm, *width of grip*= 10 mm, and *radius of fillet*= 20 mm.

You will have two specimens from green sand and resin sand casting methods as shown in Figure 1.

Figure 1. G Green sand casting sample **R** Resin sand casting sample

Experiments will be conducted at MC565 laboratory with Shimadzu AGS-X 50 kN tensile test machine as seen in Figure 2.
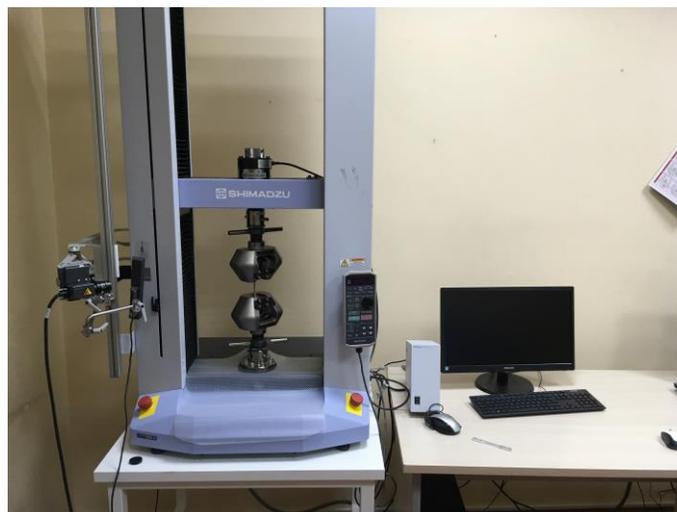

Figure 2. SHIMADZU AGS-X 50 kN set up.

Figure 3 shows the tensile test samples engaged to the grips.
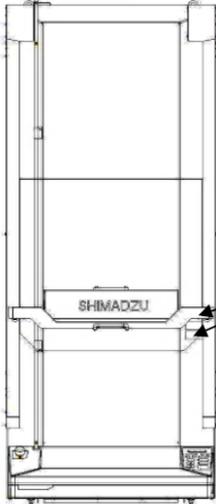

Figure 3. Tensile test grips are pulling the sample.

III. Procedure

Following instructions are for the hardware equipment

⚠ WARNING

Pinch Hazard

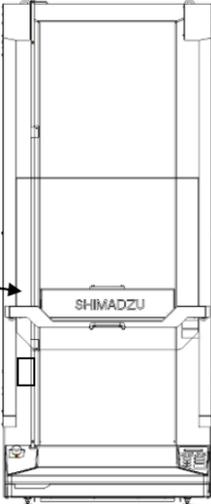Keep hands away from
testing area while
crosshead is in motion.

Warning Label

(Front Side of AGS-X Unit)

Be sure to set the Limiting knob.
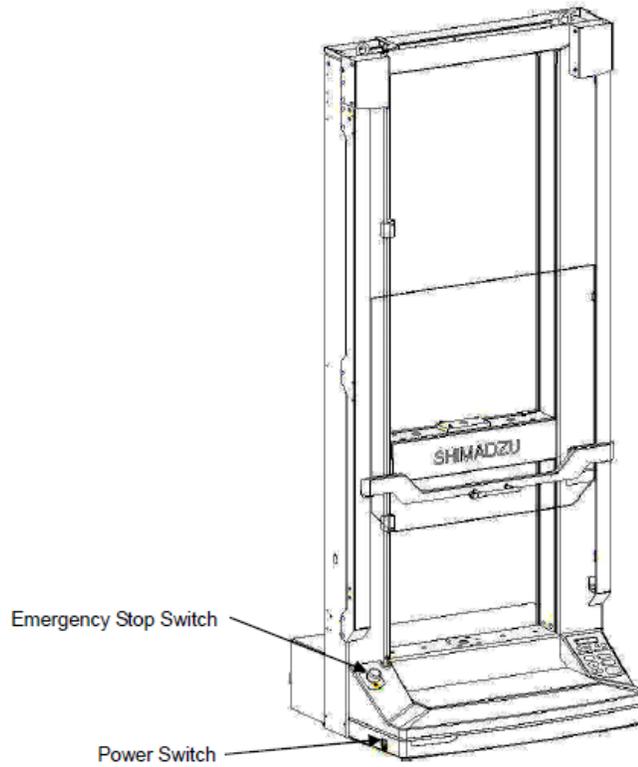
Reconfirm positions of
the limiting knob
before testing.

Warning Label

Shutting OFF the Machine in an Emergency (Power Failure)
1) Press the emergency stop button.
2) Switch the AGS-X power OFF.
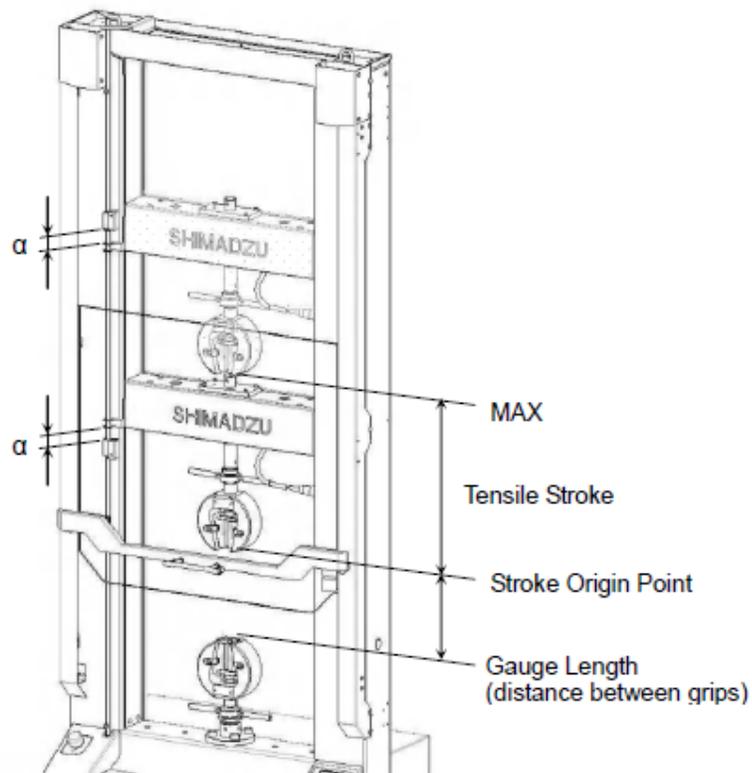3) Disconnect the power cable from the back of the AGS-X unit.

Emergency Stop Switch

SHIMADZU

Power Switch

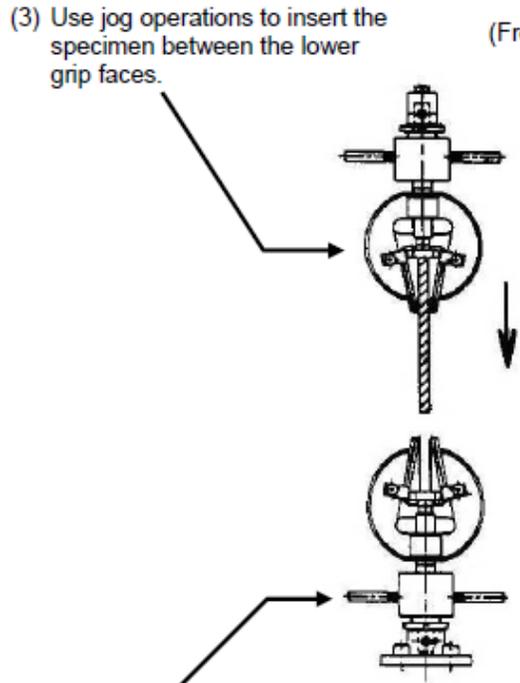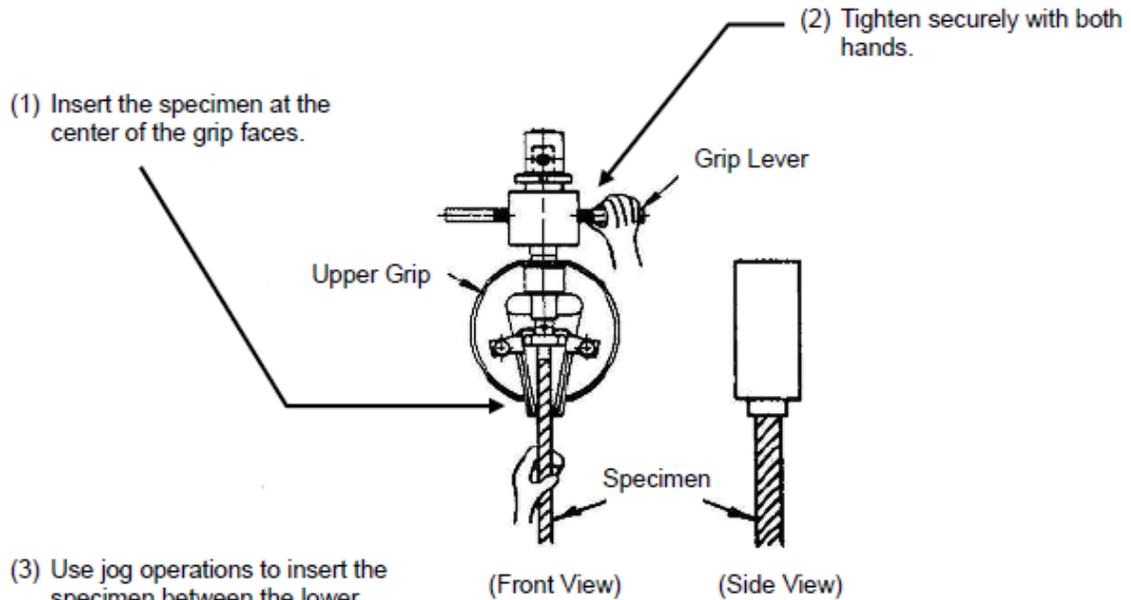**Location of Emergency Stop Switch and Power Switch**

5.3 Setting Crosshead Stroke Limits

To prevent the crosshead (or attached load cells or jigs) from colliding with anything, secure upper and lower limit collars at respective crosshead upper and lower movement limits.
For tensile tests, use the tensile stroke length as a reference to keep any extra cushion to a minimum at both upper and lower limits.

1. Attaching the Specimen

(2) Tighten securely with both hands.

(1) Insert the specimen at the center of the grip faces.

Grip Lever

Upper Grip

Specimen

(Front View)   (Side View)

(3) Use jog operations to insert the specimen between the lower grip faces.

(4) Press [FORCE] to reset the test force to zero.

```
FORCE/◄ 0000.000 kgf/cm²  🖳
STRESS
STROKE◄ 0000.000 mm        00
```

ZERO

REAL
···/···   DISP.   PEAK   FORCE   STROKE
BREAK

TEST   METHOD   FILE   SYSTEM

(5) Tighten securely with both hands.

2. Eliminate Any Initial Test Forces

Eliminate any initial test forces that occurred when the lower grips were tightened.

(1) Use jog operations to remove any initial test forces.

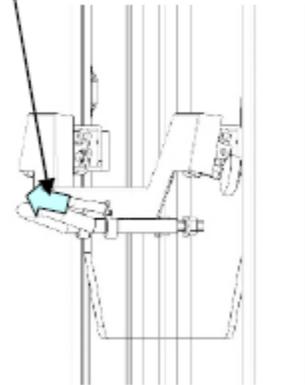(2) Press [STROKE] to zero the crosshead position.
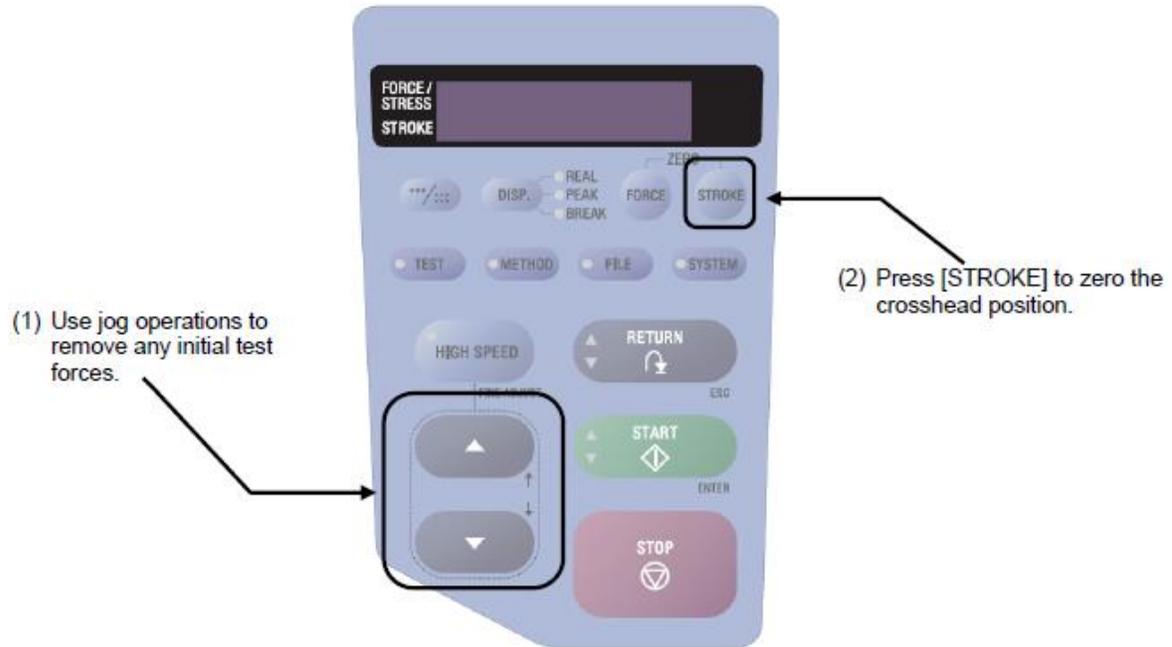
5.6 Starting Tests

1. Pre-Test Confirmation

(1) Reconfirm the positions of limit collars.
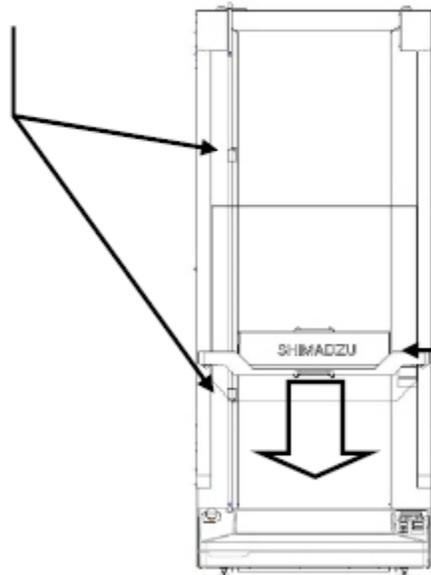
The fragment containment cover can be moved by simultaneously gripping both inner and outer lips.

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(2) Close the fragment containment cover.

Following pages will describe the software control during the experiment.

Chapter 2
Execution of Test

This chapter describes the basic procedure for executing test with TRAPEZIUMX.

Step 1: Turning power ON

Step 2: Preparation for test execution

Step 3: Executing test

Step 4: Saving test result

Operations available during test execution

Restoring data in emergency (Backup function)

Step 1: Turning power ON

First, the operating procedure from power-ON to start of TRAPEZIUMX is described below.

1. Turn ON the testing machine power supply.

2. Turn ON the PC power supply.

3. Double-click on the icon on the desktop to start TRAPEZIUMX.

4. After entry of a user name and password, the [TRAPEZIUMX Home] window appears.

Step 2: Preparation for test execution

The following is the procedure for selecting a desired type of test and displaying the test execution screen after start of TRAPEZIUMX.
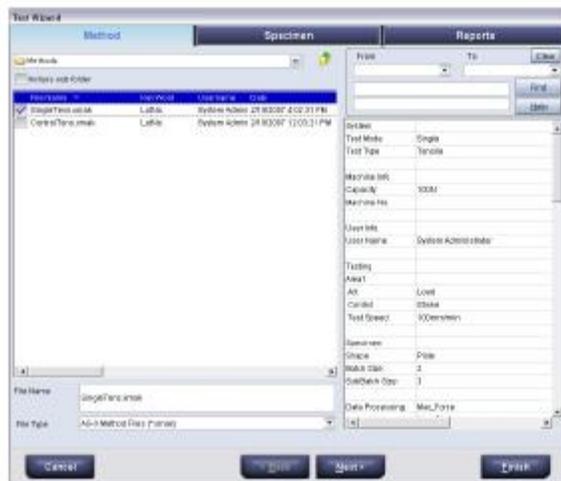
1. Click on [Select a method and test].

* There are other ways for selecting a method. You can use a preferable way to select a method.

Related keyword: "Selecting a method"

2. The [Test] Wizard appears. Select a desired method.

**Related keyword**: "[Test] Wizard"

3. Click on [Finish].

4. The TRAPEZIUMX main window appears.

Step 3: Executing test

After the preparations for test execution are completed, TRAPEZIUMX can execute tests continuously with specimens as many as required.

The test execution procedure is as follows.

1. Prepare a required number of specimens.
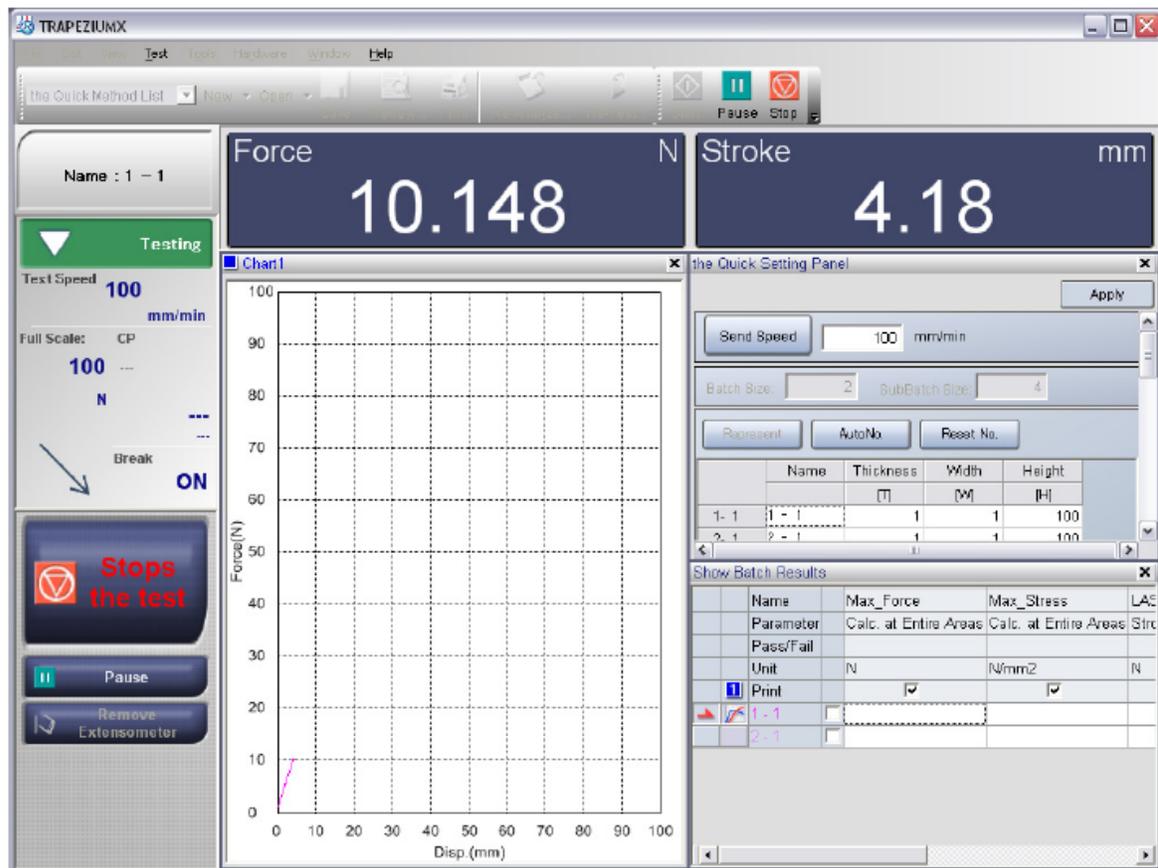
2. Move the testing machine to the specimen mounting position.

Force   N

-0.002
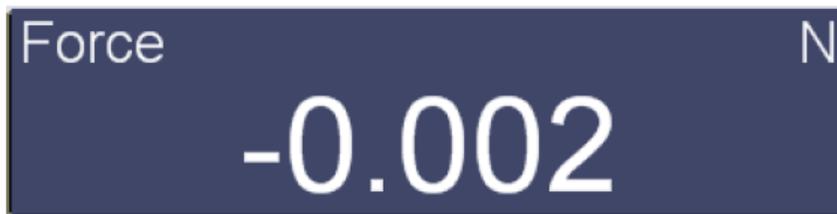
Click the mouse right button in the blue area.

3. Mount the first specimen to the testing machine.

4. Press [Start.] on the testing machine, or in the software.

5. The machine executes test. During execution of test, measured values and charts are displayed.

For operations available during test execution, refer to the following page.

Related keyword : "Operations available during test execution"

Step 4: Saving test result

Test results can be saved in a PC. The saving procedure and subsequent procedures are as follows.

1. Select [File] - [Save as] - [Test].

2. The [Save As Test] dialog box appears.

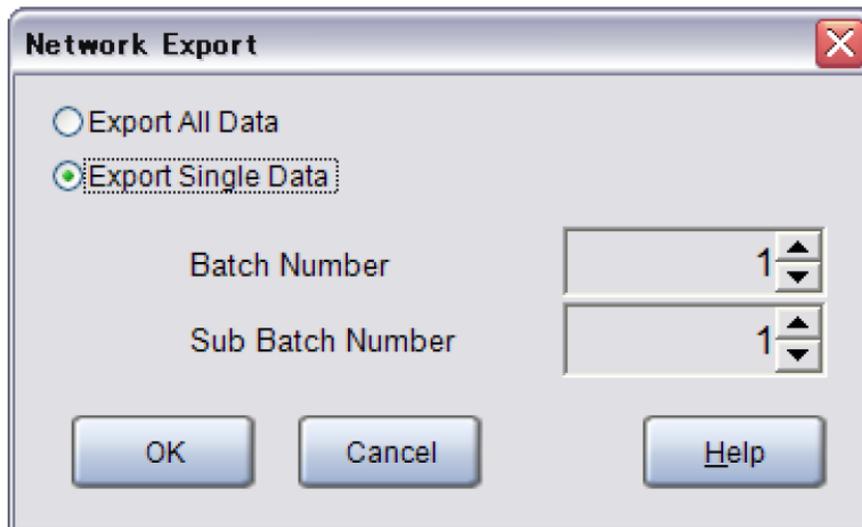*3.* Enter a file name, and click on [Save].

Hint

After completion of tests for all registered specimens, you can continue tests in various ways.

Related keyword: "[Save As Test] dialog box"

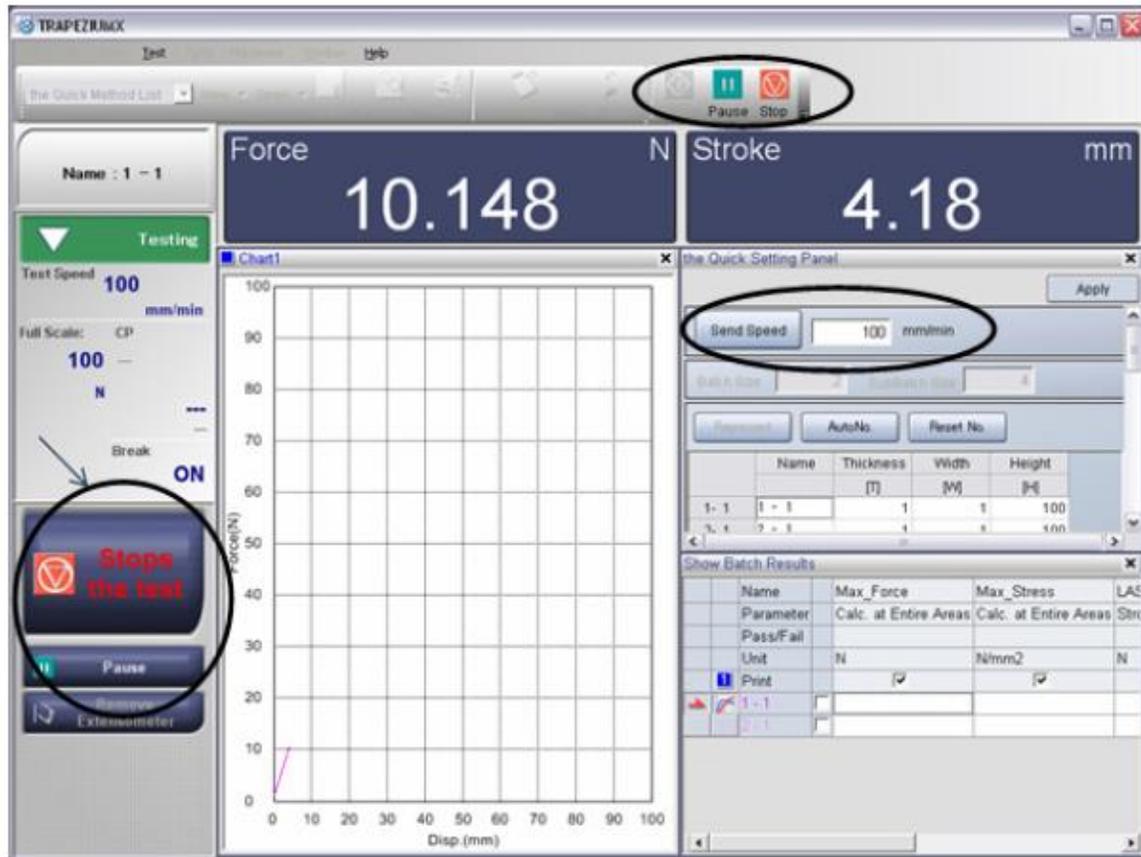Related keyword: "Continuing test after completion of test"

3. Manual export

To send E-mail at an arbitrary timing, select [File] – [Network Export]. Select the export mode ("Send All Data" or "Send Single Data"), and click on [OK].

Network Export

○ Export All Data

⊙ Export Single Data

Batch Number   1

Sub Batch Number   1

OK   Cancel   Help

Operations available during test execution

During execution of test, you cannot execute most operations, because the system executes high-speed communication with the testing machine. However, the following operations are enabled.
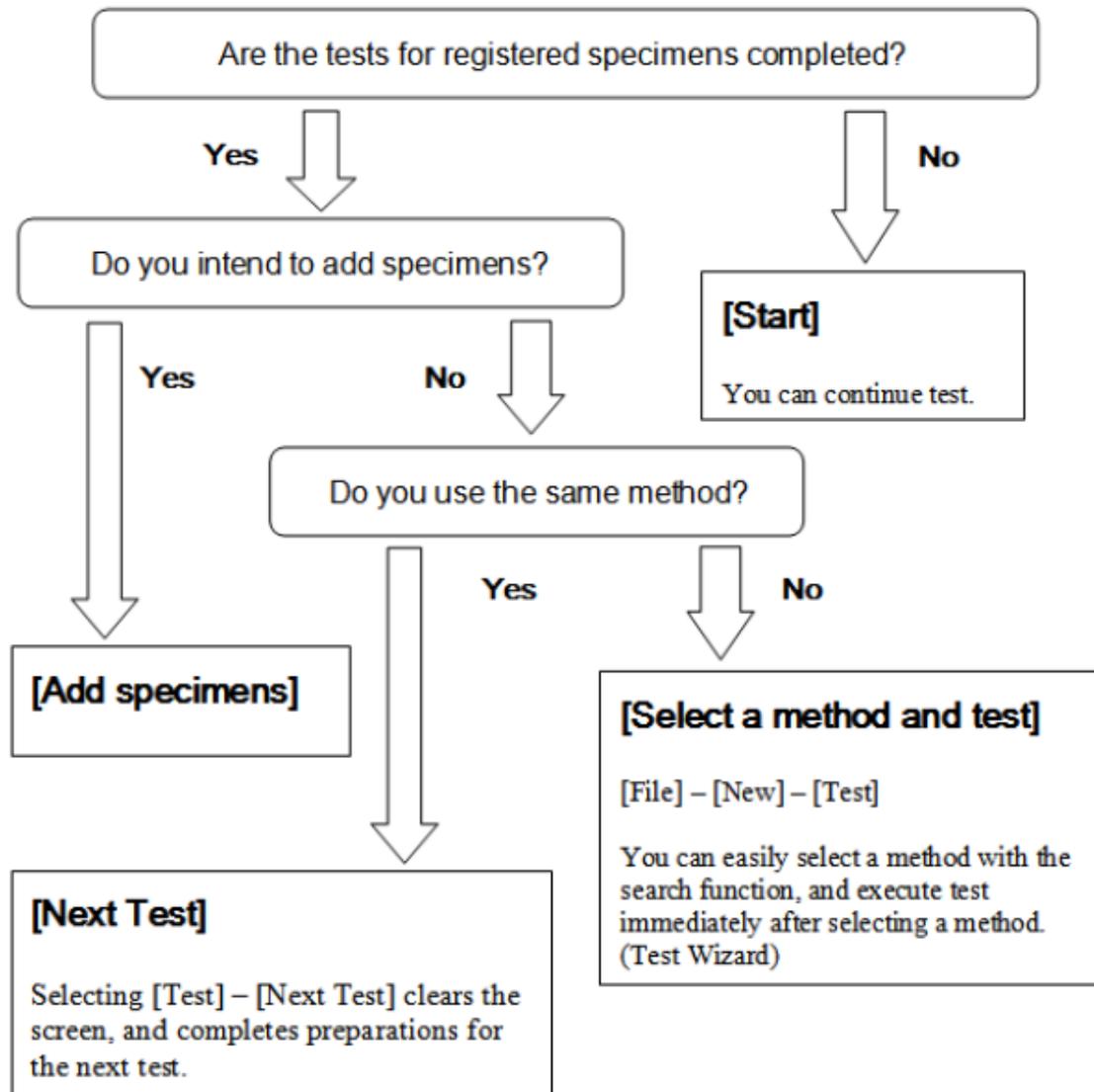

In addition to the above, the following operations are also enabled.

- Removing extensometer

- Starting high-speed sampling from a desired position(for AG-IS and EZGraph only)

Related keyword: "Setting Quick Panel"

Continuing test after completion of test

TRAPEZIUMX provides some ways for effectively continuing several tests. Select a suitable way depending on your purpose from the following flowchart.

Are the tests for registered specimens completed?

Yes   **No**

Do you intend to add specimens?

[Start]

You can continue test.

Yes   **No**

Do you use the same method?

Yes   **No**

[Add specimens]

[Select a method and test]

[File] – [New] – [Test]

You can easily select a method with the search function, and execute test immediately after selecting a method. (Test Wizard)

[Next Test]

Selecting [Test] – [Next Test] clears the screen, and completes preparations for the next test.

IV. Assignments

- Run tension test for both of your sample.
- Export the force vs displacement data.
- Plot strain vs. stress curves for both samples.
- Compare the results
- Is the mechanical strength of the samples as expected? Why/Why not?