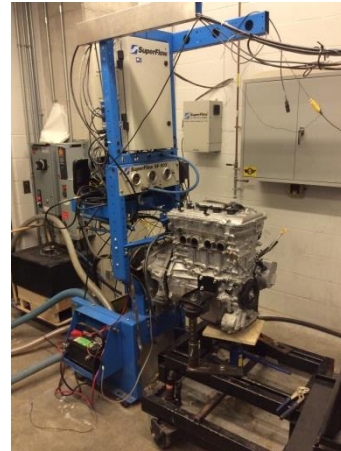
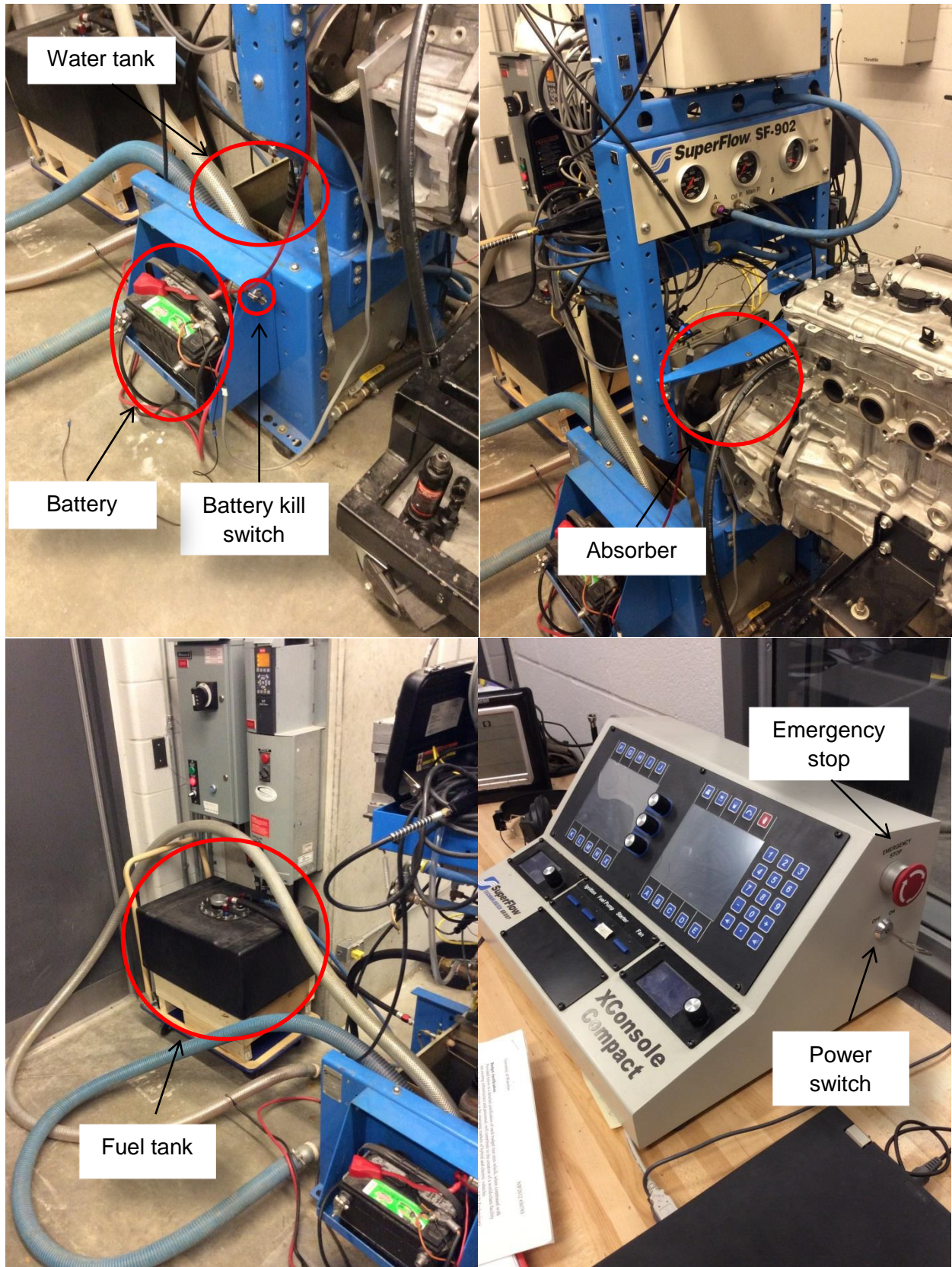


<b>Equipment</b>	SuperFlow SF-902
<b>Description</b>	Instrumentation package designed for complete test control and data acquisition of an engine.
<b>Team</b>	Student Design Center
<b>Location</b>	E5-1106A
<b>SOP created</b>	January 5, 2016
<b>SOP revised</b>	
<b>Manual location</b>	Top shelf to the right of the entrance door
<b>Authorized trainers</b>	Peter Teertstra Yulian Bagnel Stefanie Bruinsma
<b>Support technicians</b>	Yulian Bagnel Stefanie Bruinsma



<b>Significant hazards</b>	<ul style="list-style-type: none"> <li>• Fire</li> <li>• Spinning pieces might break</li> </ul>
<b>Administrative Controls</b>	<ul style="list-style-type: none"> <li>• The equipment is only to be operated in presence of authorized trainer</li> <li>• No one is to enter the dynamometer room while engine is operating</li> </ul>
<b>Engineering Controls</b>	None
<b>PPE Required</b>	None
<b>Relevant MSDS</b>	Gasoline, unleaded
<b>Accident procedures</b>	<ul style="list-style-type: none"> <li>• In case of small fire, shut down the equipment using emergency stop button and use fire extinguisher to extinguish the fire. Shut down the inlet water pump.</li> <li>• In case of large fire, shut down the equipment using emergency stop button, vacate the area, pull fire emergency trigger and call campus police.</li> </ul>
<b>Emergency shutdown procedures</b>	<ul style="list-style-type: none"> <li>• Shut down the equipment using emergency stop button</li> <li>• Shut down the inlet water pump</li> </ul>

### Equipment Diagram



## Operation information

### Pre-start Checklist

1. Verify the engine installation and all connections to the engine.
2. Ensure:
  - That the connection between engine and dynamometer is aligned and secure and that all guards are properly installed
  - No tools are left on the engine or dynamometer
3. Verify:
  - Oil and water levels in the engine and heat exchanger(s)
  - Fuel connections
  - Electrical connections to the engine
  - Battery hook-ups and battery charge condition
  - Throttle connections and adjust throttle end stops
  - That proper sensors are connected as required for the test
4. Ensure no sensor cables, electrical wires, or pressure lines interfere with the engine exhaust system or other hot or rotating parts.
5. Verify that water supply valves are in the test position.
6. Secure all objects that might move due to the ventilation fans.
7. Verify that:
  - The fuel supply is adequate for the test
  - The power is on at the console, sensor box, computer, printer, and any additional control equipment
  - WinDyn on the computer is communicating with the sensor box
8. Make sure that the ventilation system is on and operating.
9. Turn on the battery switch and open fuel supply valves.

**Start-up Procedures**

1. Set the load and throttle control knobs to zero (or close the throttle if manually operated) and select medium controller sensitivity.
2. Activate water pumps to the dynamometer and cooling systems. (Prime the absorber pump by opening the boost valve and letting the outlet reservoir to fill up. Close the valve once the outlet pump got activated)
3. Activate test cell ventilation.
4. Activate engine exhaust evacuation systems.
5. Auto-zero the sensors only if necessary and only with no pressure in any of the lines (engine and fuel pump are off). On the console, press Calibrate, then Zero. Zeroing is required only when pressure and torque channels do not read zero. Zeroing of these channels is normally handled in the calibration process.
6. Switch on the Ignition.
7. Switch on the fuel pumps
8. Verify that there are no fuel leaks at the connectors when fuel pressure has reached operating level
9. Evacuate all personnel from the test area and close the doors.
10. Start the engine.
11. Verify proper throttle response.
12. After the engine has been running for a short period of time, turn the engine off, enter the test cell and inspect for any water, fuel, or oil leaks.

## Operating Procedure

Automated tests are selected and run from the console touch screen display.

1. Press the **K (Test)** button to select the test. There are several tests available. A description of each of the can be found in the manual.
2. Press the **L (Rate)** button to select the acceleration rate for Accel test or the step size for Step tests.
3. Press the **M (Time)** button to select the hold time for Step tests or the cycle time for Break-In tests.
4. Press the **N (Limit Setup)** button to select a Safety Limits file if one is available. Limits files can also be installed directly from WinDyn or by a Test Group. Buttons under the right display screen can be used to turn Limits on and off.
5. Press the **X (Clr MsgLog)** button to clear any messages that may be on the screen.
6. Set the **Upper Speed** to the desired ending rpm for the test. This value is stored in Specification channel #96 once the test is started. Changing this value during the test will have no effect.
7. Set the **Lower Speed** to the desired starting rpm for the test. This value is stored in Specification channel #95 once the test is started. Changing this value during the test will have no effect.
8. Set the **Return Speed** to the desired rpm after the test is complete. Typically this is set to the same value as the Lower speed but can be set higher if desired. This value is stored in Specification channel #99 once the test is started. Changing this value during the test will have no effect.
9. Press the **A (Start Test)** button below the right-hand screen to begin the test. Follow the instructions on the left screen. The test is automatic. Press Pause or Stop only if necessary.
10. Select **Repeat Test** or **Stop Test** as desired after each test. Continue to follow the e instructions on the left screen. **Test Profile execution commands** display while a test is running:
  - **Stop (F key):** Press to stop the autotest currently in progress and return the system to the state it was in when the test was started.
  - **Pause (G key):** Press to pause the autotest in progress ate the current step. The system will hold at that step until the resume button is pressed.
  - **Resume (H key):** Press to restart the test from the point at which it was paused.

## Post Test

Each test can be viewed after it is saved. Current data is stored in memory in the Data Acquisition sensor box. Saved data is on the computer in the location and with the filename specified in the Test Setup screen. Press "Shift+F3" to select and view the saved test data.

## Shutdown Procedure

1. Let the engine cool down as necessary in idle mode
2. Turn off fuel and ignition
3. When the test cell ambient temperature and the engine coolant temperature are normal, shut down the test cell pumps and fans

## Maintenance and Repair

### Oil Requirements:

The oil capacity of the SuperFlow 833 absorber is 2 ounces (60cc). Because of the low oil capacity of an absorber, it is very important to change the oil frequently. SuperFlow recommends changing the oil every 50 hours of operation and using 10w-30 synthetic motor oil.

**SF-902 Maintenance Chart**

Component	Interval	Action	Replace when/if...
Fuels system	Each use	Verify condition and check for leaks	If leaks cannot be stopped
Hydraulic throttle		Check for water leaks	Diaphragm leaks
Absorber oil		Inspect level	If low
System cables		Inspect for wear or damage	If worn or damaged
Pressure hoses & fittings		Inspect for wear or damage	If worn or damaged
Other sensors		Inspect for wear or damage	If worn or damaged
Fuel filters	Every 50 hours of operation	Clean as per manual	Cannot clean
Water filters		Clean as per manual	
Absorber oil		Replace as per manual	
Load cell calibration	Every 3 months	Calibrate as per manual	Cannot calibrate
Servo valve		Inspect for water leaks	Gaskets and seals
Absorber		Inspect for oil and water leaks	Bearing and seal kit
Magnetic pickup		Inspect as per manual	If worn or damaged
Engine cart		Lubricate castors	
Barometric pressure sensor		Calibrate as per manual	Sensor if inoperative
Emergency stop console power supply		Verify proper operation	Switch if inoperative
Sensor box power supply		Verify cooling fans are working	Power supply if inoperative
Console, computer, absorber, stand, and sensor box		Clean	

**Lockout**

1. Disconnect the battery
2. Close the supply and return valves at the water pumps
3. Turn the supply and return water pumps off

**Additional Operating Instructions**

During engine installation, make sure the battery is disconnected while work is being done.

**APPENDIX. Authorized Users**

<b>Name</b>	<b>Trained on</b>	<b>Trained by</b>	<b>Signature (trainer)</b>
Yulian Bagnol			
Stefanie Bruinsma			
Peter Teertstra			