Engine Dynamometer Test Cell Requirements

SuperFlow®

Contents

Notice

It is imperative that you understand dynamometer testing can be hazardous. A properly designed and built test cell is a prerequisite to providing a safe environment for testing engines.

While SuperFlow provides specific test equipment designed to test your engines, we have no control over how you build your test cell. These room recommendations are general and may not specifically be suitable for your particular location or application.

A locally certified engineer or contractor must approve your designs and certify that they conform to local building codes. Your local governing body regulations and insurance company policies will rule over any questions or uncertainties.

SuperFlow, its employees, or agents do not assume any responsibility or liability for suggestions, applications, or mechanical failure outside of the normal warranty or for issues where negligence, ignorance, or mis-applied technologies are present. Ultimately, you are responsible for ensuring your test cell is safe and conforms to all local codes and regulations.

Read this document in its entirety before beginning construction. Contact SuperFlow Sales or Customer Service if you have any questions or need assistance

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Safety

1. Follow all local construction codes.
2. Do not locate water pumps or exhaust fan motors in close proximity where fuel is present.
3. Install a carbon monoxide (CO) detector in the test cell and the console area.
4. Provide fire extinguishers rated for gasoline and oils.
5. Provide adequate lighting in the test cell and at the operator's console.
6. Provide a switch outside the test cell to turn off the ventilation fans and water pumps.
7. Provide a means outside the test cell to shut off the fuel supply.
8. Always use hearing and eye protection when necessary.
9. Regularly inspect the cell for fuel, oil, or liquid spills because flammable vapours can ignite.
10. Keep all personnel, flammable items, and sensitive objects away from any rotating radial plane.

Overview

When deciding to build an engine dynamometer test cell, you must consider many things:

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dynamometer should be installed in a facility with proper lighting and electrical outlets and include a water supply, fuel supply, ventilation, exhaust extraction, and fire control system. Prefabricated rooms are available as an option to building a room. They can be constructed of sound-deadening materials which may be beneficial for sensitive installation locations. They usually also have intake and exhaust ducts built into the design.
The test cell should be large enough to make it easy to install and remove the engine and to work on the engine while it is in place on the dynamometer, yet small enough to take up minimal space in your building.
The dynamometer and engine require a constant supply of cool water from an open or closed recirculating water system. Either type of system will suffice as long as the minimum flow requirements are met. Even though a closed water system initially costs substantially more than only using a local water supply source and draining it into the sewer system (or into the open field next door), the savings in the water bill over several years could pay for the difference.
Fuel must be readily available to supply the engine and last until all testing is completed. Because, of the hazards involved with storing flammable liquids, you must carefully consider how to handle the storage and use of flammable fuels.
Proper airflow through the test cell is critical for engine cooling and room ventilation. Having a larger test cell than needed may make it difficult to control the airflow through the cell, plus the cost increases for expanded wall and floor areas as well as larger air-handling equipment.
The plans on the following pages are SuperFlow's suggestions for this room. These suggestions are only several of many possible solutions for constructing a dynamometer test cell. Even though these plans are designed for a water brake dynamometer, they may also apply to eddy current (EC) systems.

Test Cell Construction

IMPORTANT: These plans are suggestions only. SuperFlow does not certify that the plans are suitable for your location or application. Before beginning construction, have your construction and engineered plans checked for compliance with local building codes and zoning requirements.

See Figure 1, "Engine Test Cell," on page 6 for an overview of a typical test cell.

Dimensions

A recommended minimum length for the test cell is 12 feet *[3.6 m],* and a maximum length is 15 feet *[4.9 m]*. The width should be a minimum of 10 feet *[3 m]* and a maximum of 12 feet *[3.6 m]*. The suggested ceiling height is 10 feet *[3 m]*. (2.7m height is Ideal)

Operator's Console

Locate the operator console outside the test cell; never locate it to the side of the engine. If the engine or dynamometer fails, parts could fly out radially from the engine and injure the operator. SuperFlow recommends that the operator sit in-line with the crankshaft for maximum safety. Several cables and hoses must be routed from the console area to the dynamometer system inside the test cell. These include communication and control cables, hoses for the hydraulic throttle or a Morse throttle cable, and hoses for the mechanical gauges on an SF-902 console. Route these hoses and cables in the test cell along a wall, the ceiling, or in a trench in the floor. Always keep the hoses for the hydraulic throttle as low as possible to prevent air bubbles from forming in the line.

Operator's Viewing Window

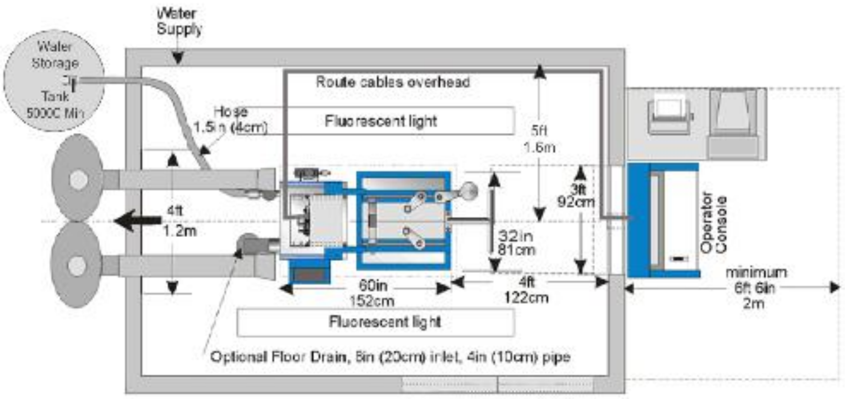
DANGER: The potential exists for projectiles to be thrown from the engine during testing; Such projectiles typically fly toward the side walls of the test cell. If a projectile impacts a Glass window, it could shatter the glass and injure someone. Never install a viewing Window that faces the sides of the engine.

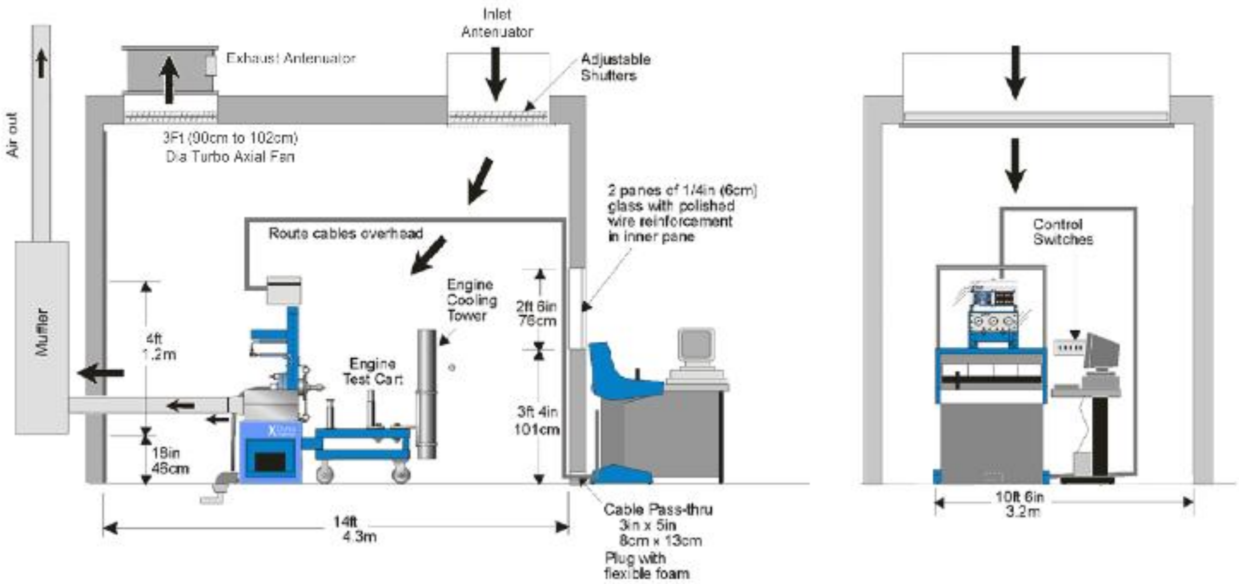
The viewing window should extend from the top of the operator's console to a point high enough that a standing operator can see all of the engine and dynamometer. At a minimum, the window should be 36 inches wide by 30 inches high (101 x 76 cm) and be positioned so the console sits directly in front of the window. The sound isolation provided by the window is much less than the dynamometer test cell walls. If the window is overly large, it may rattle or transmit excessive noise into the operator area.

It is best to use two or three panes of glass in the window. The inner pane should be at least ¼ inch *[6 mm]* thick with polished wire reinforcement in the centre of the pane. The wire reinforcement prevents the glass from shattering in the event of fire and keeps air from entering the room. The second pane should be 1/2 to 1/4 inch thick *[6 to 13 mm]*. If a third pane is added, it is best to centre the pane at an angle so it is not parallel to the other two panes. The angle helps reduce transmitted sound vibrations. The area directly behind the operator should be a dark or unlit area so the operator cannot see strong reflections in the windows when viewing the engine.

***TIP**: Prefabricated sound-deadening windows can be purchased from a reputable sound Enclosure or window manufacturer.*

SF902 Dynamometer Engine Test Cell





Walls and Doors

Using staggered wood studs with gypsum board wall surfaces is the lowest cost construction. For best sound attenuation, use two layers of 1/2 inch *[13 mm]* gypsum on the inside wall and one Layer on the external wall. Special noise-cancelling gypsum board is available in some locations. The wall studs should be narrower than the base plate so they contact only the inner or outer wall At each point. Two-by-four-inch (2" x 4") wall studs on 24-inch centres' on a two-by-six- inch (2" x 6") base plate work well. Preventing contact between the inner and outer wall studs reduces low frequency sound transmission. Fill the empty space between the inner walls with fibreglass, Rockwool, Or sprayed foam insulation.

A second alternative is to use a concrete block wall. When constructing the wall, fill the empty Spaces in the concrete block with concrete, sand, or vermiculite. A third alternative is to use a Poured concrete wall 6 to 8 inches *[15 to 20 cm]* thick.

Paint the room in light colours to reflect additional light around the engine.

Steel door frames and steel sheet metal doors are recommended for fire protection and longer life. If a wood door is used, make sure it is a solid-core exterior door at least 1-3/4 inch *[5 cm]* thick and Complies with your local building codes. It is also possible to use a double door or an intermediate Air space between two exit doors. Prefabricated sound doors can be purchased from a reputable Sound enclosure manufacturer.

Floors

The sub-base of the test cell floor should be concrete. However, it can be covered with stain resistant tile or epoxy paint. Provide a drainage system for water that may escape the dynamometer system or spillage that may occur when disconnecting the engine from the cooling tower.

A drainage trench along the length of the floor that runs underneath the dynamometer stand can Also be used to route water and fuel lines. For systems with hydraulic or Morse cable throttles, the Hoses or cable can be routed in this trench as well. Cover the trench with grated material strong Enough to handle the weight of an engine on a cart.

Lighting and Electrical

IMPORTANT: All electrical installations must adhere to your local codes and regulations. SuperFlow cannot advise as to the proper installation of electrical devices and wiring for your area. The recommendations in this section are suggestions only. Consult a local, certified electrical contractor for assistance with lighting and electrical installation.

Use two or more overhead fluorescent lights of at least 80 watts to reduce shadows. SuperFlow Recommends fluorescent lights with protective covers designed for outside use. In cold climates Where the room air is drawn from outside the building, use fluorescent light ballasts that will Operate at the lowest temperatures expected in the room.

All electrical devices inside the test cell must be properly grounded. Water is present in the test Cell, so use Ground Fault Circuit Interrupt (GFCI) outlets. Use sealed conduit for all wiring if it is Not embedded into the walls. Do not install switches inside the test cell, but instead locate them Next to the operator's console. This includes light switches.

The power outlet for the SuperFlow electronics inside the test cell should be on the same circuit as The console. It is actually best to route a special power cable from the SuperFlow Data Acquisition and Control System (sensor box) to a surge suppressor or Uninterruptible Power Source (UPS) located in the operator's area. Plug the operator's console and the computer into the surge suppressor or UPS as well.

Water System

The dynamometer test system requires water for the absorber and for the engine cooling tower if the engine is water cooled. The water flow requirement is 10 gallons per minute (gpm) for each 100 horsepower (hp) produced by the engine at a minimum pressure of 35 psi while free flowing *[5 lpm per 10 kW at 2.4 bar]*. For air-cooled engines, these flow rates may be reduced by one-half.

Water supply systems are not included in the purchase of a standard SuperFlow dynamometer system. All facility equipment must be purchased separately. Recommendations and suggested equipment are discussed on page 28.

IMPORTANT: Consult a local, certified plumbing contractor for assistance with the dynamometer water system.

The water supply system may be an open system with water supplied from the city water supply or a closed system which recirculates the water through a tank. Either design requires an easily accessed water shutoff for supply and return water in the test cell.
Whether using a city water supply or a recirculating system, you can test the water supply capacity by placing a control valve (ball valve) and a pressure gauge at the end of the supply line. The pressure gauge should be on the supply side of the control valve. To determine the maximum flow rate, fill a container of known capacity with water, then time how long it takes to fill it. Open the control valve until the pressure gauge reading drops to 35 psi *[2.4 bar]* to measure the flow at the minimum required supply pressure. The test results may be inconclusive if the flow capacity is measured above 35 psi pressure (free flow).

Open Systems

For the dynamometer and engine water, water is provided from the local water supply and drained into the building waste system. This type of system is suitable as long as the minimum flow requirements are met. However, typical city water systems for homes only deliver an adequate water supply for engines up to 100 hp *[75 kW]*. Commercial areas are usually somewhat higher. If the test cell is located in a commercial establishment, a water line at least 1-1/2 inches *[4 cm]* in diameter is required for the average 600-hp *[450-kW]* engine.

NOTE: Environmental regulations may apply when discharging water from a dynamometer into a commercial water waste system.

Some local codes restrict the use of city water in test systems of this type without back flow prevention. They may also forbid depositing warm waste water into an open sewage system. Always consult the local authorities before installing an open water system for a dynamometer

Closed Systems

DANGER: Due to the presence of water and fuel in the test cell, both electrocution and explosion hazards may exist. To reduce the possibility of an accident, install all water pump motors outside the test cell. If this is unavoidable, use only explosion-proof pumps and seal all electrical connections in conduit.

NOTE: Explosion-proof pumps are designed and manufactured to prevent introducing an ignition source within an enclosed environment. Sealed electrical connections will help prevent an electrical hazard in the event of a water spill in the test cell.

A closed system recirculates the water from the tank, through the dynamometer, and back to the tank (see Figure 2 on the following page), possibly through a cooling tower.

Suggested models and part numbers for some of the equipment suggested are shown in "Equipment Sources" on page 27.

The storage tank (**1**) should have a minimum capacity of 300 gallons for each gallon of gasoline burned per day *[300 litres of water for each litre of gasoline]*. Typical capacities are 1500 to 5000 gallons *[5500 to 15000 litres]*. SuperFlow recommends a metal or plastic tank located above ground level. Tanks located below ground level cool much more slowly. A tank located directly below the dyno allows the water to gravity drain into the tank, eliminating the need for a return pump.

TIP: Agricultural or farm equipment suppliers typically carry a selection of tanks that are suitable for use on dynamometer water systems.

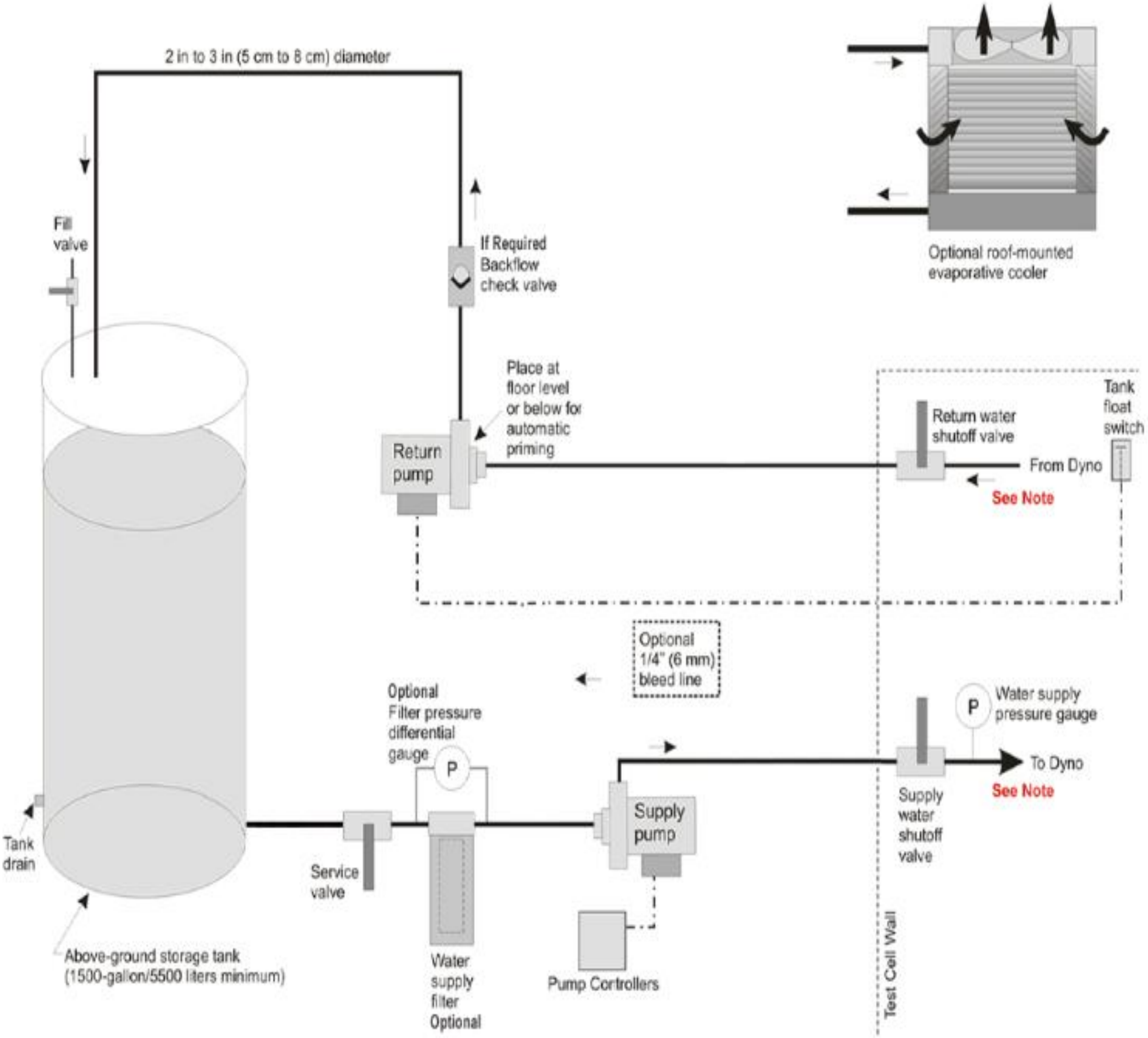
You must provide a way to add water to the tank (**2**). The valve controlling this function can be a manual valve or an automatic level-controlled system. Install the line leading into the tank above the water line to ensure the water does not siphon back into the main facility supply lines. Some local building codes require installing a back flow preventer or check valve on this line. Also provide a method for draining the tank if the need arises (**3**). A manhole access cover may be useful if the tank ever needs cleaning.

In some situations, an auxiliary cooling system (**24**) should be installed to cool the water after it passes through the dynamometer and engine (see "Cooling" on page 12).

In areas that are cold in the winter, be sure to provide adequate protection from freezing for the tank, pumps, and supply lines (see "Freezing" on page 13).

For above-ground tanks with a tap near the bottom (**5**), locate the supply pump (**9**) well below the water level in the tank so it will prime automatically. These tanks do not require a foot valve on the supply line. For below-ground tanks, or when the pickup inlet is installed through the top of the tank, a foot valve (**4**) or check valve is required to maintain prime on the pump. In all cases, install a service valve (**6**) between the tank and the first device in line.

A float valve on the dynamometer sump tank is designed to operate with water supply pressure up to 110 psi [*7.5 bar*]. However, SuperFlow recommends that the pressure to the dynamometer be no more than 65 psi [*4.5 bar*] to make the system more reliable. 35 psi [*2.4 bar*] is the minimum pressure for the system to operate properly. Install a pressure gauge (**14**)(can be connected to sensor box pressure panel) to monitor the water pressure.



NOTE: The water line to the dyno inlet is routed ***to*** the left side of the dynamometer as looking at it from the back of the test cell. The water line ***from*** the dynamometer is routed to the right side.

Filters can be installed on both the supply line (**7**) to the dyno/engine and on the return line (**17**) to the supply tank. This helps prevent contaminants in the water tank from reaching the dyno or engine and keep contaminants from the engine getting into the water supply. The supply filter should be before the pump to protect them from debris. Differential pressure gauges (**8**, **19**) on the filters or gauges on each side of the filter monitor the condition of the filters.

See "Filters and Drains" on page 15 for more information on filters.

Install valves in the supply line (**13**) and return line (**16**) inside the test cell. These valves allow the operator to shut off the water lines when the dynamometer is not in use, preventing water from passing through the system and overflowing the dynamometer sump tank. In some situations the head pressure in the supply tank can cause water to flow through the system or siphon from the top of tank. On systems where the absorber is on a roll-around cart, these valves are necessary so the water lines can be disconnected without losing a large amount of water.

TIP: Installing an electric valve (12) in the supply line that is controlled by the same switch as the pump ensures the water flow to the dynamometer is always shut off when the pump is off.

The standard SuperFlow dynamometer is supplied with a 1-1/2 inch diameter Camlok fitting on the inlet (**15**) to a sump tank underneath the absorber. A matching Camlok fitting with a 1-1/2 inch hose barb is included with the dynamometer for connecting to the water supply line.

SuperFlow recommends using at least 1 foot (*30 mm*) of flexible hose between a rigid water supply line and the dynamometer inlet to minimize complications caused by vibration from the dynamometer.

The 4-inch Camlok fitting on the dynamometer sump tank outlet (**16**) for return water is nonpressurized. A matching Camlok fitting with a 4-inch hose barb is included with the dynamometer for connecting to the water return line or drain. Additional fittings or adapters necessary for connecting to your water or drain system are not provided by SuperFlow.

Locate the self-priming return pump (**21**) as close to the dynamometer stand as practical but still outside the test cell. The pump should be at floor level or below so the dynamometer sump tank will prime it automatically. If that is not possible, you must install a float switch (**16**) in the dynamometer sump tank to turn the pump off and on during operation so the pump will not cavitate and lose its prime.

NOTE: The sump tank has 1/2 Female National Pipe Thread (FNPT) holes in the rear for installing high- and low-level float switches (or a single dual-function switch). Switches are not provided by SuperFlow but are usually found at most plumbing supply stores or in the Grainger® catalog.

Place a check valve in the water line from the dynamometer tank. The check valve prevents water from back flowing into the dynamometer sump tank.

Be sure all water lines feeding into the supply tank do not extend below the water level in the tank (**23**). This prevents water from siphoning back through the lines.

Cooling

NOTE: Do not confuse the engine cooling tower and a dynamometer water supply cooling system. The engine cooling tower essentially replaces the radiator in a vehicle and regulates the engine coolant temperature. A dynamometer water cooling system helps maintain the water temperature of the entire system to an acceptable level. Open systems do not require a dynamometer cooling system unless the temperature of the inlet water is greater than 100°F [38°C].

For the dynamometer system to operate properly, the dynamometer water outlet temperature must stay below 160°F *[70°C]*. If the outlet temperature exceeds this value, the dynamometer control may become erratic, and damage to the absorber my occur. To prevent this, keep the inlet water temperature below 100°F *[40°C]*. ***The dynamometer temperature rises with engine speed***.

TIP: As a rule for open water systems, the typical mean temperature for commercially provided water will stay within a few degrees of the average yearly ambient temperature for the area. Average temperature data is available at www.noaa.gov.

In a typical dynamometer test, the temperature of the water exiting the dynamometer sump tank will increase by 30 to 50 degrees Fahrenheit (*15 to 30 degrees Celsius*) including water from the engine cooling tower. This water then increases the temperature of the water in the supply tank by a proportional amount (based on the total quantity in the tank).

A typical water supply tank will cool down within 24 hours to its initial temperature when following the capacity guidelines for the size of the tank. However, additional cooling may be required if planning continuous testing, a large-capacity tank cannot be supplied, the tank is below ground, or if the dyno is located in a very hot area where the water will not cool properly.

The least expensive cooling system is generally an evaporative cooling tower mounted on the roof of the building. The size depends on the local temperature and humidity. The higher the temperature and humidity, the larger and more expensive the evaporative cooling tower.

Sometimes a large radiator from a diesel tractor or generator works well. If more cooling is needed, add a fan to the radiator.

TIP: Local commercial heating and air conditioning companies can usually supply industrial grade evaporative or chiller cooling systems.

If using a roof-mounted evaporative cooling tower, a larger outlet line than the inlet line is required from the cooling tower to the storage tank so the tower does not overflow. You can use a separate thermostat-controlled pumping system for the tower, or plumb the dynamometer return pump to the cooling tower inlet so an additional circulating pump is not required. If the cooling tower is located directly above the storage tank so the water will gravity drain to the supply tank, an additional return pump is not required. Be sure the drain line from the tower is at least double the size of the inlet line—triple is better.

Separate circulating pumps and fans on the cooling tower should be thermostat controlled so their operation is automatic. Pumps should turn on when the water temperature in the supply tank reaches 100oF (*37oC*). Fans should turn on when the temperature reaches 105oF (*40oC*).

Freezing

In cold climates where all or part of the dynamometer water system is subjected to outside weather, take precautions to prevent freezing. Depending on the climate, most large tanks can typically outlast the temperature change. The larger the mass of water, the longer it takes to freeze.

To prevent a water tank from freezing:

- Always wrap outside pipes with heat tape.
- Perform frequent dyno testing, which keeps the water circulating and warm.
- Locate the tank in a room that can be heated when necessary. The room should be large enough so heat from the tank will dissipate easily in warmer weather. The room only must be heated to slightly above freezing temperature.
- Use antifreeze solutions if desired.

Some antifreeze formulas will foam inside the absorber and cause problems. See “Water Additives” on page 25.

- Keep the water in the tank moving and the temperature above or near freezing temperature. The following are two simple ways to do this and can use thermostatic control for unattended maintenance.
  - Use a small air pump or compressor to blow warm air into the bottom of the tank during cold spells. The warm air will bubble through the tank and induce motion in the water.
  - Add a small pump to circulate water from the bottom of the tank through a heater and back to the top of the tank.

Water Quality

The quality of the water used in a dynamometer affects absorber and water pump operation. Contamination, salt water, or water with a high mineral count can reduce their life and increase maintenance costs. The load control valve and water seals in the absorber can quickly deteriorate with bad water. For optimum results, SuperFlow recommends water with the chemical composition and purity levels listed in Table 1.

Table 1. Suggested Average Properties for Dyno Inlet Water

Property	Units	Open System	Closed System
PH Level	pH	7-9	7-9
Total Hardness	Deg.dH*	<30	<35
Total Salinity	mg/1	<2500	<2500
Nitrates	mg/1	-	<50
Chlorides	mg/1	<150	<150
Sulfate (SO3)	mg/1	-	<150
Manganese	mg/1	<0.15	<0.015
Organic Substances	mg/1	<5	<2
Coarse Solids	mg/1	none	none
Solids in Suspension	mg/1	<5	<2
Free Oxygen	mg/1	<0.05	<0.05
Iron	mg/1	<1	<1
Free Carbon Dioxide	mg/1	<20	<3
Oils	-	none	none
Algae Growth	-	none	none
Silicates	-	none	none

Filters and Drains

Filters

For both open water and recirculating systems, install a optional filter to clean the water before it enters the dynamometer sump tank and engine cooling tower. Install a differential pressure gauge (can be connected to pressure panel in sensor box) across the filter to determine when the filter needs cleaning. The water should be filtered to remove 0.004- inch diameter particles [100 microns]. In recirculating systems, a optional filter installed on the return water line back to the supply tank helps keep particles from the engine and dynamometer sump tank from getting into the supply water system.

Drains

Provide a drainage system in the test cell to remove any water that may escape the dynamometer water system. This frequently happens when disconnecting the engine cooling system from the cooling tower or when the dynamometer sump tank overflows.

On an open water system, install a floor drain at the rear of the dynamometer. Place a right-angle elbow on the water outlet from the dynamometer to exit directly into the drain. Ensure that the water will gravity drain without restriction. If a floor drain cannot be installed, it is essential that the line connecting the dynamometer and the drain be at least 3 inches [8 cm] in diameter so flow losses are very low. Use 4 inches [10cm] for continuous operation above 750 hp [560kW] if using only a gravity drain, or use a sump pump with high-flow float switches in the sump outlet tank. If the drain is not sufficient enough, the water will back up in the dynamometer sump tank and back flow into the dynamometer inlet water side, causing rapid overheating. In extreme circumstances the water will overflow the sump tank and flood the test cell.

NOTE: **Some local laws and ordinances restrict draining contaminated water (including water that passes through an internal combustion engine) directly into the sewer system. Usually they require**
using a filter system or oil separator before discharging the water into the local sewer system. NEVER discharge engine water into an open field or street.

Room Ventilation

DANGER: Poisonous carbon monoxide gas is produced as a result of engine operation and may collect inside the building if proper ventilation is not employed. Always exhaust the air from dynamometer test cells outside and away from other buildings. Always place CO detectors in various locations throughout the building.

Test cell ventilation is one of the most overlooked aspects of engine test cell room design. Proper airflow through the test cell is by far one of the most influential factors when assessing engine power. If the temperature of the air going into an engine rises and falls during a test, or if any exhaust gas recirculates within the room, the test results will vary in an unpredictable manner. **Proper room ventilation makes a considerable difference when assessing engine power**. Fundamentally, air is a critical property of the combustion process. Without clean air it is difficult to create power. Figure 3 is a graph from a 493.9-hp alcohol circle track motor. Combustion air was taken from inside the test cell, and the exhaust was ducted to outside the building. The first test (MIKE3835) was done with the room fans turned off. Notice the 25.6 hp and 14.63 lb.-ft. gain that occurred in the second test (MIKE3836) after providing adequate airflow through the room.

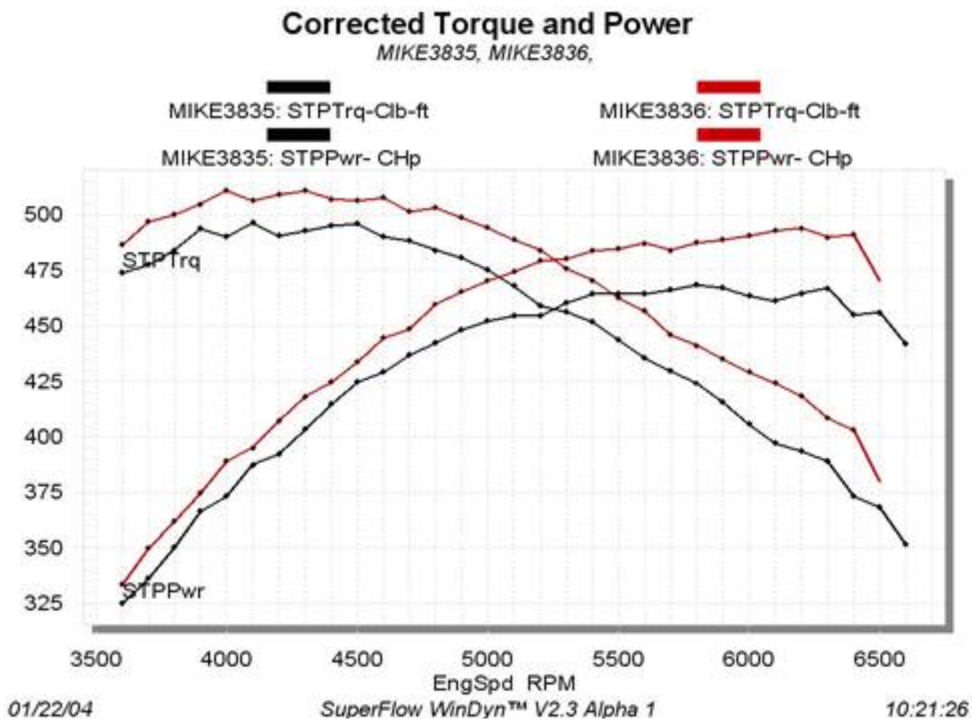


Figure 3. The Effects of Air Ventilation

Proper airflow in a dynamometer test is also important for safety. An engine builder almost lost his life because of the excess alcohol and exhaust fumes he encountered when entering the test cell after only one run. Understandably, test cells can be expensive, but the alternative is inaccurate testing and the risk of injury or death.

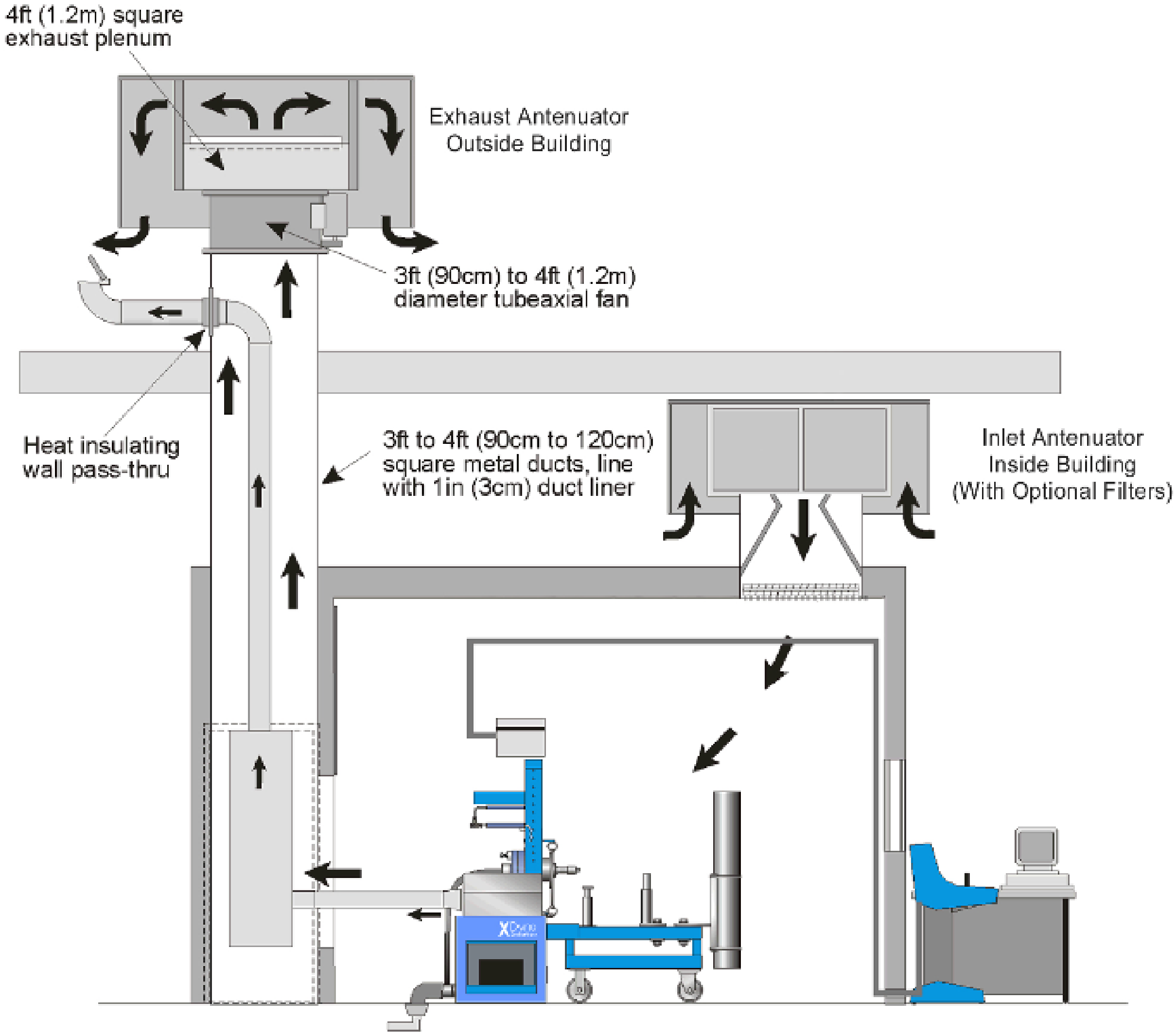
Room Design

The size of the room is critical when choosing the equipment used in the ventilation system. Larger rooms require higher capacity fans. Plus, in larger cells it is typically harder to maintain proper airflow while avoiding turbulence and eddy currents. A cost analysis must be considered when airflow requirements escalate.

The engine itself plays a part in the room ventilation design. When an engine runs, it radiates heat from all of its external surfaces and from its exhaust pipes. The larger the engine, the greater the heat load on the room.

Both the airflow direction and quantity are critical for repeatable test results. Figure 4 illustrates some of the principals utilized when designing the test cell ventilation system.

Air should enter at the front of the cell and flow across the engine to the rear of the cell. The engine exhaust pipes should be directly in the airflow so that any leaking exhaust gases are carried out with the main stream of air and do not recirculate to the engine intake. The airflow should be directed so any smoke or oil vapour does not obstruct the operator’s view of the engine nor coat the window.



The room fans should be positioned so that the air is extracted from the room, even if the operator door is open. If the fan is on the inlet side, it will blow the smoke out into the operator area when the door is open and through any natural leaks. Fans should also be placed at the end of the exhaust duct so contaminated air won't be pushed through leaks or auxiliary ducts into other parts of the building.
If noise is not a problem and the rear of the test cell is on an outside wall, a simpler approach is to mount the fan in the back wall of the dynamometer test cell. The fan will ventilate the room and extract the exhaust. However, SuperFlow recommends always installing mufflers and always directing the engine exhaust out of the test cell
through ducts.

Equipment

Realistically, most heating and ventilation system designers or HVAC contractors do not understand how much air is needed through a dynamometer test cell and will probably underestimate the amount of airflow required. SuperFlow recommends an air exchange rate in the test cell of 8 to 10 times per minute. For example, if the room has a total volume area of 1,000 cubic feet (length x width x height), the ventilation system should move 8,000 to 10,000 cfm of air.

TIP: The airflow through the room should exert enough suction force that an outward opening door to the test cell would be difficult to open when the exhaust fans are on.

Properly connect and ground all electrical items used in the ventilation systems (motors, switches, speed controllers). Explosion-proof devices provide the best safety. Mount the control switch for the fan on or near the operator's console. Where applicable, you must use Ground Fault Circuit Interrupter (GFCI) breakers/outlets.

See "Room Controls" on page 24 for information on using switches on the console to control the ventilation system.

SuperFlow recommends using tube axial or industrial box type fans. Most squirrel-cage type blowers of comparable size do not provide an adequate amount of airflow.

TIP: Variable speed controls can be installed if desired to provide adjustable airflow that allows for slow speeds while an operator is working in the test cell and fast speeds while running an engine test.

Suggested fans are shown in "Ventilation Tube Axial Fans" on page 30.

Ideally, the test cell should have a pressure drop of 0.5 to 1.0 inches of H2O *[120 to 250 mm of water]* pressure. A manometer can be installed between the test cell and the operator's area to measure the pressure drop when the fans are on.
The manometer can also be used to determine the condition of any filters that may be installed in the room air ducts. When the pressure drop doubles from the initial point when the filters were new, it is time to replace the filters or check for an air blockage.
A fan may also be needed on the inlet to overcome the flow losses caused by filters and ducts. On such systems the fans should be balanced to retain approximately a negative 1-inch pressure difference in the room with the door closed to provide good airflow. A completely balanced room may experience little or no effective airflow exchanges through the room.

Shutters

You can install adjustable shutters on the inlets to adjust flow direction as required. SuperFlow also suggests installing close-off shutters on the intake and exhaust so the room may be sealed off to prevent freezing in cold climates and to keep the animals out.

TIP: Electrically operated shutters with automatic controls can aid in fire suppression systems and enhance security for your building.

Any grating installed should have a minimum spacing of 1 inch (2.5 cm) between the bars. If mesh screening is used, the size of the opening should be increased by at least 50% accommodate the added air flow restriction. Install rain hoods when applicable.

Air Conditioning and Filters

For sophisticated systems, it is possible to heat or cool the incoming air to maintain a constant temperature and humidity in the test cell. For high-powered engines, the flow rates and the energy required are very high; therefore, the equipment cost can be much greater than the cost of the rest of the test cell. For most cells, this is not a cost-effective solution.
Filtering the room air to “engine-air-cleaner” quality eliminates the need for an air cleaner on the test engines. Use air filters known as “92% efficiency filters” which are made of engine air cleaner type material and are much more efficient than typical furnace filters. Furnace filters are only effective on air that is recirculated repeatedly through the filter. In a test cell, the air passes through the filter only once.

TIP: If the engine combustion air is routed from outside the test cell by a separate duct, then filters are not required for the room air if it comes from a reasonably clean source.

See “Engine Combustion Air” on page 19.

Airflow Test

After completing the room, check the airflow by attaching a piece of cloth or tissue to a long stick and exploring the airflow direction through the room. The engine intake and engine surfaces should be in the area of high flow. Check for swirls to make sure the air behind the engine is not recirculating into the engine intake after it passes over the exhaust pipes.

Engine Combustion Air

The main purpose of the room air ventilation is to extract any toxic gases and keep the room cool. Normally, the engine uses the same air for combustion. To improve test result repeatability, use a special duct to direct air from outside the test cell but inside the building into the engine intake. Drawing air for the engine from inside the building reduces temperature variations throughout the year. Air for the test cell can then be brought in from, and exhausted to outside the building without filters or conditioning, substantially reducing heating and cooling expenses.

IMPORTANT: The quality of the combustion air in the engine is much more critical than the airflow around the engine. The cleanest air in a room is approximately 5 feet (1.5 meters) off the floor. Route the air ducts so the combustion air is not drawn from near the building ceiling and away from any contamination sources such as solvent tanks or heaters.

The engine airflow rate will be approximately 1.6 cfm per hp *[60 l/m per kW]*. The open area of the ducts should be a minimum of 5 to 10 times the area of the engine air inlet.
A ceiling-mounted air turbine kit assembly is available from SuperFlow (part number 1200A-0954) to help isolate intake or combustion airflow (see Figure 5).
A filter box can be located at the intake of the engine air duct to protect the engine. You can permanently install the engine airflow sensor (air turbine) and air temperature/humidity sensor in the duct. Special air handling equipment can also be installed to regulate the combustion air temperature and humidity.

Figure 5. Ceiling Mount Air Turbine Kit

Use air filters known as “92% efficiency filters” which are made of engine air cleaner type material and are much more efficient than typical furnace filters. A differential pressure gauge across the filter can monitor the condition of the filter. Always include replacing the filters as part of regular maintenance.
Two airflow turbines may be required for high-flow applications. Essentially two ways to accomplish this are:

- Place each turbine directly on the engine intake.
- Build an air box on or above the test cell ceiling with a duct routed to the engine intake.

Place the turbines on the air box. The WinDyn™ software will add the two flow numbers together for a combined airflow.
Sometimes a inlet fan is required to overcome the flow losses caused by filters and ducts. However, this fan should not apply too much air so pressure variances will not effect the test results. In most cases, a pressure difference of 1.5 inches *[3 cm]* of water or less between the engine intake and the outside air will have no significant effect on engine power. If the air intake pressure is greater than this, it can effectively supercharge the engine.

NOTE: The XConsole Data Acquisition System measures the barometric pressure at the sensor box. This is used for correction factor calculations. For greater accuracy in the power corrections, an external pressure transducer can be installed to measure the actual pressure at the carburettor inlet for systems with ducted engine air supplies.

Engine Exhaust System

IMPORTANT: Consult the local authorities before designing an exhaust system to ensure compliance with environmental restrictions concerning emissions.

An engine exhaust system is required in a dynamometer test cell to prevent exhaust gas recirculation and control the cell's sound level.
Table 2 shows the recommended minimum pipe diameters for the power level of the engine connected to each exhaust pipe. If the diameter of the test cell exhaust system pipes is at least twice the diameter of the engine exhaust pipes, the effect of flow restriction on the engine performance is generally negligible. For larger high-powered engines, it is generally best to use two exhaust pipes and two mufflers.

k/W/Exhaust	Pipe Diameter	Hp/Exhaust	Pipe Diameter
7.5	7cm	10	3”
75	10cm	200	4”
150	13cm	300	5”
250	16cm	450	6”
350	20cm	800	8”
500	23cm	1000	9’

An exhaust back pressure of approximately 1 inch of mercury (in/Hg) or *3 kPa* will cause a power loss of approximately 1%. The pipe diameters proposed here usually causes a much lower pressure loss, but the back pressure of the installed exhaust system should be measured at full power to ensure minimal loss.
Use industrial-style mufflers instead of normal vehicle-type mufflers to reduce power loss without increasing the back pressure on the system. If the engine is tested with the standard vehicle exhaust installed, the standard system should be placed between the engine and the larger industrial mufflers because the losses caused by the larger mufflers will be insignificant compared to the losses caused by the typical engine system.

TIP*: *Mufflers used on heavy-duty diesel engines such as for industrial generators work very well for a typical dynamometer system.

By placing the engine exhaust system inside the room air exit ventilation duct, all heat and exhaust gas losses are carried away with the room ventilation air. Use a heat-insulating bulkhead connector where the exhaust pipe exits the air duct. These are standard items designed for furnace exhaust stack roof penetrations.

NOTE: A properly designed room ventilation system will ensure that all exhaust gases are extracted from the test cell.

Engine Fuel System

IMPORTANT: Local zoning codes may prohibit storing large quantities of fuel above ground or inside a building. Check with local authorities to determine any restrictions. Check the system integrity for any leaks before turning on any electrical devices or operating an engine. Avoid creating any spark sources from contacting raw fuel, vapours, or lines.

Some facilities conduct most testing with five-gallon cans where only one can is in the building and connected at a time. The total fuel required for most test sessions is less than that found in the tanks of most automobiles in repair garages.

For fire protection, locate the fuel supply outside of the test cell in a separate enclosure. Depending upon your local building codes, differing amounts of fuel may be kept inside the test cell or in a separate fuel room. If you plan on keeping fuel in the test cell, SuperFlow recommends acquiring an automotive racing-styled fuel cell with supply, return, and vent fittings. Slightly elevating or wall mounting the tank may simplify filling, and the fuel pump for the engine will not work as hard. Keep the fuel tank close to the ground for safety. Make certain the tank is vented outside the building.

IMPORTANT: Always consider the possibility of a fuel spill. Keep a supply of approved material available that will soak up the fuel. Never operate electrical devices when fuel or fuel vapours are subject to ignite. Always dispose of contaminated fuel in proper containers.

Provide a means to shut off the fuel at the fuel container. If the supply tank is outside the test cell, provide a shutoff valve inside the test cell as well for safety purposes. Fuel shutoff valves installed close to the engine can minimize spillage when connecting and disconnecting fuel lines. A low voltage electric valve could be installed on the tank and controlled by a switch on or near the operator’s console. This type of valve could be incorporated into an emergency stop system.

See “Room Controls” on page 24 for information on using switches on the console to control electric valves on the fuel system.

If the system uses the SuperFlow pump with a bypass fuel return, the fuel return must be routed from the dynamometer stand back to the fuel supply container. If no fuel return path is provided, the pump will overheat and become damaged. The fuel supply line should have a minimum diameter of 5/8 inches *[16 mm]* or a –10 AN hose and fitting combination. The return line should have a minimum inside diameter of 1/2 inch *[13 mm]* or –8 AN hose and fitting combination.

If more than one type of fuel will be used in the test cell, SuperFlow recommends completely separate fuel systems. It is very time consuming and oftentimes confusing to mix the fuel delivery through the same lines.

TIP: As today's market changes, fuel-injected engines are increasingly being tested on engine dynamometers. SuperFlow can supply fuel injection canisters for use on these engines to measure flow. Please note that even though SuperFlow’s fuel system is designed to meet a broad market of applications, your particular application may fall outside its capabilities.

IMPORTANT: The SuperFlow fuel system has a filter that requires periodic cleaning/changing and an accumulator that has a drain valve. Consider providing provisions to accommodate the draining of fuel from these devices.

Sound Control

For most test cell installations, sound control is extremely important if tests are run frequently. A properly designed test cell can reduce the sound level by 40 to 50 decibels (dB) between the inside of the cell and the operator position. The guidelines below are general and can be applicable to any facility installation. Wear hearing and eye protection in risk environments.

TIP: Prefabricated sound-deadening enclosures can be purchased from a reputable sound enclosure manufacturer. Check for local code requirements before installing prefabricated rooms.

First, the exhaust system must be tightly sealed to the muffler system so no sound leaks occur. For temporary installations, this is sometimes difficult to do. With the engine running in the room, listen for any obvious exhaust leaks and watch for escaping exhaust gas. If exhaust gas is detected in the room, the exhaust is leaking and the engine power may be affected.

The pumps recommended for closed-circuit water systems are also very noisy. They should be enclosed in a separate room to reduce noise transmission.

If the walls of the room are constructed as described in “Test Cell Construction” on page 5, the room should provide good sound reduction. Most of the sound will exit the room through the door, the window, and any leaks through the walls. Caulk all around the window panes during installation and make sure all joints are filled in the gypsum board surrounding the room. Be sure all electrical boxes are caulked all the way around their penetration through the wall, and even caulk all of the small screw holes in the electrical box. Caulk around any wires where they enter the conduit. Sound travels very well down long tubes.

Use special sound-control insulation on the door and a lowering threshold at the bottom of the door. These devices push down against the floor when the door is closed and are available from building suppliers. Plug any cable pass-through holes between the engine console and the dynamometer with blocks of compressible foam. Caulk all around the external switch plates and holes in the test cell wall.

Most rooms are finished with semi-gloss painted walls so they are easy to clean and reflective for better lighting. It is possible to further reduce the sound level in the room by placing absorptive pads on the walls. These are typically one to two inches *[2 to 5 cm]* thick and covered with perforated metal. They are available from various sound-control companies. It is not necessary to cover all the walls to substantially deaden the room.

Line the inlet and outlet ventilation ducts with a minimum of one-inch thick *[2.5 cm]* duct liner to prevent sound transmission through the ducts. Also line the inside of roof covers. The sound will bounce back and forth across duct liner through several direction changes before exiting at the roof of the building. Make sure the liner is well-adhered to the wall of the duct so it does not blow loose by the high-velocity air. Never use duct liner in an area exposed to exhaust gases. The duct liner will collect oil or unburned fuel and become a fire hazard.

Room Controls

Room controls include fan, pump, and lighting controls. Easy-to-operate controls should be located convenient to the operator's console. An emergency stop feature for these devices is recommended in case of fire or spills with large, easy-access push-button switches. Locate emergency stops in the test cell and near the operator's console for quick response.

The switches on the operator's console can be interfaced with the test cell using two methods:

- The toggle switches can be connected to low-voltage relays that control motor starters or light controllers and is an easy addition to XConsole or SF-902 systems. A kit is available from SuperFlow (part number 1200A-2831).
- A more sophisticated system can include the SuperFlow relay box (part number 1200A-1843-09) which can be controlled with programmed push buttons on the console and WinDyn™ software. This system is ideal for system automation and pre-programmed occurrence functions.

The SuperFlow Data Acquisition system has a built-in Emergency Stop feature that the room controls can be integrated into if using the console toggle switches or a relay box.

Contact SuperFlow Customer Service for more information on this ability.

Computers and Electronics

The SuperFlow dynamometer electronics typically consist of a sensor box, operator's console or controller, and a computer system. Some systems may have additional components such as an electric throttle controller or a relay control box. The sensor box, throttle controller box, and the relay box all are located in the test cell while the operator's console and computer are outside. SF-902, XConsole, and NSCR systems have three 35 foot long, shielded Category 5 (Cat-5) Local Area Network (LAN) cables that connect the sensor box to the console and computer. Racers Pack systems have only one Cat-5 cable from the computer and a cable connected to the SF-1853 remote handheld dyno controller that both go to the sensor box. All of these cables must be routed through the test cell wall in a manner that will protect them. SuperFlow suggests using 1-1/2 or 2-inch conduit or wire way for this purchase.

NOTE: The standard cable for the Racers Pack SF-1853 remote handheld dyno controller is 22 feet long. Make sure the cable distance between the sensor box and the operator's console is short enough to accommodate this. If not, you can request a longer cable when ordering the system, or return the controller to have SuperFlow install a longer cable on it.

If a relay control box is included with the dynamometer system, a cable is required to connect from the back of the console to the bottom of the relay box. This cable should also be routed through a conduit or wire way. However, the connector on the cable is 2-1/4 inches in diameter, so a 3-inch minimum conduit is required. This conduit or wire way can also carry the console and computer cable if feasible. One cable is routed between the sensor box and the relay box.

An electric throttle system does not have any cables that need to be routed to the operator's area unless the SF-1805 throttle controller is located there. In addition to a power cable, one cable is routed between the SF-1805 and the sensor box and another between the SF-1805 and the throttle actuator.

Computer Systems

The operation of SuperFlow dynamometers is enhanced by a computer with WinDyn™ software installed. Space for a table or console should be provided next to the operator's console for the computer and printer. Place the monitor where you can see it, the console controls, and the engine through the viewing window at the same time with minimal body movement.

TIP: Movable monitor stands can be purchased that attach to the wall next to the console or to the side of the console cabinet.

Place the computer keyboard and mouse for operator convenience. The SF-902 console and tables from SuperFlow for the XConsole or Racers Pack systems have space available on them for the keyboard and mouse.

Power Requirements

The SuperFlow electronic components and the computer require 110 V or 220 VAC power. They can all run off a single 15A/8A circuit. SuperFlow recommends routing the power circuit for the sensor box into the operator's console area where it plugs into a surge suppressor along with the console and computer. SuperFlow further recommends replacing the surge suppressor with an Uninterruptible Power Source (UPS) that has a minimum rating of 750 VA. This may protect the electronics from damage in the event of a power surge and keep the engine running if the power goes out.

TIP: Your electrician can wire the electrical circuits in your test cell with outlets for the sensor box, console, and computer wired to a special protected circuit.

You can also plug the relay control box into the surge suppressor or UPS if desired. Do not plug an SF-1805 throttle controller into a surge suppressor or UPS.

Fire Suppression

Engines, fuel, oil, fans, electrical devices, motors, pumps, and all other items inside and outside the test cell can catch fire at any time. When designing your test cell, pay special attention to local fire codes and insurance requirements. This can include sprinkler heads installed inside the test cell (use high-temperature pop-offs due to normal engine heat). Fire extinguishers should conform to local fire codes and be conveniently accessed. If using an automatic fire suppression system, make sure it has safeguards against human contact. Other safeguards such as fire dampers can also be used if allowed in your area.

NOTE: SuperFlow does not make any specific recommendations related to fire protection or insurance.

Water Additives

A water brake dynamometer works best with clean, cold water at the inlet. This applies for the engine cooling system as well as the absorber. For closed water systems, additional water treatment and lubrication may be required to maintain the quality of the water and extend the life of the system.

Test methods and supply water conditions affect the performance and life expectancy of a SuperFlow dynamometer system. Since these methods and conditions vary from place to place, SuperFlow cannot make specific recommendations. This section only provides general observations on additives and their use

The only way to determine what additives are required is to have the water tested and analyzed for content. Expert advice is available from various suppliers listed in the phone book yellow pages under "water treatment." At no time should anyone pour additives into a water system without first knowing why they are required or whether they are actually needed.

Antifreeze

Depending on the winter climate, antifreeze may be required to protect against dyno water supply freeze-up. Some antifreeze formulas will foam inside the absorber. Foaming causes loss of water stability and subsequent loss of dyno control which can be disastrous for a test.

IMPORTANT: **Only use antifreeze with ingredients that reduce foaming in the absorber. Always follow the manufacturer's guidelines on the container. If control issues arise, stop using the antifreeze.**

☞ **See "Freezing" on page 13 for alternatives on freeze prevention**.

Anticorrosives

When considering protection from corrosion, it is best to first get the water analysed. Then have a treatment company recommend the appropriate anticorrosive for the particular materials that need protection. In some cases the use of sacrificial anodes (a piece of readily corrodible metal attached to the metal you wish to protect) of magnesium to control galvanic corrosion would be indicated or possibly other types of safeguards.

The absorber, sump tank, and engine cooling tower on a SuperFlow SF-902 is built of aluminium, copper, aluminium bronze, and stainless steel where water is contacted. Copper lines are used along with brass and nickel-plated steel fittings on the stand. Other types of materials are used where they do not interact with water.

Water filters should be used on both the supply and return to reduce particles in the water supply. The filters must be cleaned or changed regularly.

See "Filters and Drains" on page 15 for more information on filters.

Antifungus

Algae sometimes grows in a dyno supply tank. Although it is unnecessary to maintain the pH quality required for a swimming pool, some algae control should be administered. As with any additive, first test the water to determine if an algae problem exists, and contact a local authority for advice. Sometimes simple algae can be controlled by adding one gallon of chlorine bleach per 1000 gallons of water. Chlorine for swimming pools works well.

Lubricants

The real benefit from water lubricants is in their surfactant properties. Basically, a lubricant reduces the surface tension of the water, allowing it to make better surface contact with the absorber and therefore improving its ability to conduct heat from the metal surface into the liquid. This helps reduce the overall outlet water temperature.

Equipment Sources

Below are listed some of the common equipment sources for items used in a engine test cell.

W. W. Grainger
Pumps, fans, ventilation, valves
+1-800-473-3473
http://www.grainger.com

Mechtronics E/M Products
Mufflers, exhaust pipe components
+1-952-440-9200
http://www.mechtronics.net/catalog

MER Equipment
Exhaust components
http://www.merequipment.com

Riker® Products
Exhaust pipe components
+1-800-292-9744
http://www.rikerprod.com

Nelson Products
Mufflers, Exhaust pipe components
+1-800-223-4483
http://www.nelsondiv.com

GT Exhaust Systems
Mufflers, Exhaust pipe components
+1-800-775-2466
http://www.gtexhaust.com

Air Pro
Exhaust collection hoses/systems
+1-800-967-0288
http://www.airpro.com

Factory Direct
Professional automotive equipment
+1-800-234-7642

American Fan
Room ventilation equipment
+ 1-513-874-2400

Stowe Enterprises - DynoAir
Climate controlled airflow systems
+1-800-315-6751
http://www.stoweenterprises.com

Soundmaster
Prefabricated test cell enclosures
+1-800-472-5952
http://www.dynotestcells.com

Bermad Inc (BIC)
Water valves and level controls
http://www.bermaid.com

A-T Controls, Inc
Automated Water Valves
+1-513-530-5175
http://www.a-tcontrols.com

JEG's
Fuel tanks and fuel cells
+1-800-345-4545
http://www.jegs.com

Summit Racing Equipment
Fuel Tanks and Fuel cells
+ 1-800-230-3030
htp://www.summitracing.com

Onga Pumps (Australia)
180 Serries Heavy Duty Cast Iron Pumps
+61 1800-664-266
http://www.onga.com.au

Equipment Recommendations

The equipment listed in the following sections are suggestions only. Other brands and models may be suitable for the applications as long as the minimum specifications are met.

Call SuperFlow Sales or Customer Service for suggestions and alternatives.

W.W. Grainger part numbers and specifications are from the 2006–2007 catalog #397.
Dyno power is an indication for the maximum power capability of the engine for that part.
All pumps, filters, and valves should have an orifice size equal or greater than the pipe size so as to not create a flow restriction.

Pumps and fan motors may require special controllers or contactors. Consult a local certified electrician to determine the proper equipment for your area.

Water Supply Pumps

These pumps are for supplying water from a storage tank to the dynamometer. Minimum recommended specifications are 10 gpm @ 35psi per 100 hp produced by the engine *[50 l/m @ 240 kPa per 100 kW]*.

NOTE: These pumps are not listed as explosion-proof pumps and therefore should not be located inside the test cell or where fuel or fuel vapours are present. For better protection, request explosion proof pumps

Grainger Part Number	Flow @ 30psi	Dyno Power	Motor	Inlet/Outlet
1N497	107 gpm	1100 hp	3 hp, 1 ph, 240 VAC	2”/1.5”
1N484	170gpm	1700 hp	5 hp, 1 ph, 240VAC	2”/1.5”
1N479	234gpm	2500 hp	7.5 hp, 1 ph, 204VAC	3”/2.5”
1N496	120gpm	1200 hp	3 hp, 3 ph, 240 VAC	2”/1.5”
1N487	170gpm	1700 hp	5 hp, 3 ph, 240VAC	2”/1.5”
1N478	234gpm	2500 hp	7.5 hp, 3 ph, 240VAC	3”/2.5”

Water Return Pumps

These pumps are for returning the water from the absorber sump to the storage tank possibly through a cooling system. It is important to make sure the pump keeps the dynamometer sump tank near empty. Adding high/low float or level switches in the sump tank is optional. These switches turn on the return pump when the level is high and off before the sump is empty so the pump does not lose prime.

NOTE: **These pumps are not listed as explosion-proof pumps and therefore should not be located inside the test cell or where fuel or fuel vapours are present. For better protection, request explosion proof pumps.**

Grainger Part Number	Flow @ 25psi	Dyno Power	Motor	Inlet/Outlet
4UA76	120 gpm	1200 hp	2 hp, 1 ph, 240VAC	2" NPT
4UA77	120gpm	1200 hp	2 hp, 3 ph, 240VAC	2"NPT
4UA78	200 gpm	2500 hp	5 hp, 3 ph, 240VAC	3" NPT
4UA79	265 gpm	2500 hp	5 hp, 3 ph, 240VAC	3"NPT

Foot Valves and Inlet Strainer

Install a check valve in-line to the return tank to prevent the tank from siphoning back to the dynamometer sump tank.

NOTE: The outlet of the pipe returning the water into the tank should not be submerged. This also minimizes flooding if the check valve fails.

Install a foot valve on a supply line when it draws water through the top of the tank. This prevents water from draining back into the tank which can cause the supply pump to lose prime.

Part	Grainger Part Number	Dyno Power	Inlet/Outlet
Check Valve	4RG75	1900 hp	2"/2" NPT
Check Valve	4RK70	2500 hp	3"/3" NPT
Foot Valve	5YM45	1900 hp	1-1/2" FNPT
Foot valve	5YM46	2500 hp	2" FNPT

Water Filters

Water filters on the inlet and outlet of the dynamometer sump tank help keep contaminants from transferring between the water supply tank and the dynamometer or engine. The filters listed below are available from SuperFlow. Comparable filters can be obtained from local plumbing equipment suppliers,

Part	SuperFlow Part Number	Filtration	Inlet/Outlet
Filter, in Line with Poly filter bags	1200A-0983*	150 Microns	1-1/2” NPT
Y –Strainer, in Line , 80 Mesh	4500P-20080	180 Microns	2”

*Includes five extra poly filter bags, SuperFlow Part Number 4500P-4610

Electric Water Valves

An electric valve on the water supply line can be helpful to block the flow of water when the dynamometer is not in use. The operation of this valve can be electrically controlled by the supply pump controller. Always place a filter or strainer ahead of the valve to prevent debris from blocking the operation of the valve.

Part	Grainger Part Number	Inlet/Outlet	Flow	Required Pilot Valve (120v,60hz)
Angle body Piston Valve	3UK38	1-1/2”	493 gpm	3UL95
Angle Body Piston Valve	3UK36	2”	597 gpm	3UL95

Ventilation Tube Axial Fans

An air exchange rate of 8 to 10 times per minute (minimum) through the test cell is recommended. The flow required depends on the room size (see “Room Ventilation” on page 16).

NOTE: **These fan motors are not listed as explosion-proof and therefore should not be located inside the test cell or where fuel or fuel vapours are present. For better protection, request explosion-proof fan motors.**

Consult SuperFlow Sales, Customer Service or a qualified air handler contractor for assistance in selecting the proper size.

Part Numbers	cfm @ 1” H_2O	Dyno Power	Size	Motor*
7F853	14,400	500 hp	34” diameter	5hp , 3 ph, 240VAC

7F872	21,700	750 hp	42” diameter	7.5 hp, 3 ph, 240VAC
7F883	28,500	1000 hp	48” diameter	10 hp, 3 ph, 240VAC

*single-phase motors are also available

Ventilation Air Shutters

When using motorized shutters, SuperFlow highly recommends using a micro switch for fan delay. This ensures the shutters are open before the fan engages.

	Part Number		Inlet Size
Inlet Shutter	Exhaust Shutter	Motorized Shutter	
3C242	3C311	3C235	42” x 42”
3C243	3C312	3C132	48” x 48”

Ventilation Air Filters

Eight or more ventilation air filters are required.

Part Number	Size	Rating Capacity
2W237	20” x 25” x 4”	1740 cfm @ 0.22” H_2O
2W239	24” x 24” x 4”	2000 cfm @ 0.22” H_20

Air Ducts

Engine combustion air can be routed to the engine intake from outside the test cell. Below are some suggested air duct materials for use with systems when engine combustion air is separate from the room air.

Part Number	Size	Rating Capacity
5E290	12”	1 Air Turbine, or 1 Carburetor
2W237	20” x 25” x 4”	Air Filters recommended 2 minimum