SUPERFLOW AUTODYN AD-30 AWD CHASSIS DYNAMOMETER PIT INSTALLATION

SuperFlow
DYNAMOMETERS & FLOWBENCHES
A Division of Power Test, Inc.

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AutoDyn AD-30 AWD Chassis Dynamometer

SuperFlow AutoDyn dynamometers can be installed in a pit so vehicles can drive on and off the rolls for testing. Pit installations have certain advantages over above-ground dynamometers—particularly that it is safer and easier to position the test vehicles on the rolls.

All Wheel Drive (AWD) dynamometer are designed to be installed in a pit because of the required additional supports for the covers in front of and between the dynamometer rolls.

- The pit is normally constructed of poured concrete with provisions for drainage and ventilation. Access for control cables and electrical wiring is also required through conduits or trenches.
- Vehicle tie-downs should be embedded in the concrete around the pit so the vehicle can be secured on the rolls. A minimum of three tie-downs is required at each end of the vehicle. Ideally, tie-down anchors should be spaced around the dynamometer to provide for most any situation. More information on this is provided later in this document.
- Air flow must be provided in both the test room and the dynamometer pit. This is necessary for vehicle cooling, room ventilation, exhaust extraction, and eddy current absorber cooling.

Safety Warnings

To ensure safe operation, this equipment must only be operated according to the instructions in the *SuperFlow Operator Manual*. It is also essential that this equipment is installed, maintained, and operated according to local safety requirements.

Any person instructed to carry out installation, maintenance or repair of the equipment must read and understand the *SuperFlow Operator Manual* and in particular the technical safety instructions. Any users of this equipment must operate only the controls of the equipment. Only qualified personnel should remove exterior panels and service equipment.

1. Follow all local building and fire 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 computer console.
6. Provide a switch outside the test cell to turn off the ventilation fans and water pumps.
7. Always use hearing and eye protection when necessary.
8. Regularly inspect the cell for fuel, oil, or liquid spills because flammable vapors can ignite.
9. Keep all personnel, flammable items, and sensitive objects away from any rotating object that can throw debris radially outward.

Dangers Due to Non-observance of Safety Instructions

- Hearing damage due to high noise level
- Electrical shock
- Exposure to rotating parts

Document Conventions

The following conventions indicate items of interest or concern:

WARNING: Failure to take or avoid a specific action could result in physical harm to the user or the hardware.

CAUTION: Failure to take or avoid a specified action could result in loss of data or equipment.

IMPORTANT: Essential operating information.

NOTE: *Helpful information that may provide insight to the user/operator.*

TIP: *Additional information that may provide convenient workaround or solution.*

Cross-references refer the reader to additional information in the chapter, manual, or other sources (including Web sites).

Test Cell Room Requirements

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 vehicles.

While SuperFlow provides specific test equipment designed to test your vehicles, 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.

Hazards of Dynamometer Testing

Dynamometer testing involves running internal combustion engines. Doing so exposes the operator to rotating parts, fluids under pressure, explosive fuels, high voltages, noise, heat, and exhaust gases. Chassis dynamometer testing has additional risks associated with rotating transmission parts, wheels, and chassis rolls.

These risks are generally associated with the vehicle under test rather than the dynamometer. It is not possible for SuperFlow to protect the operator against all hazards by the design of the dynamometer. Therefore, the dynamometer must be installed in an environment which is specifically designed for this type of testing and provides maximum protection for the operator.

IMPORTANT: Safety equipment required to provide maximum protection for the operator must be readily available for dynamometer testing.

Test Cell Design

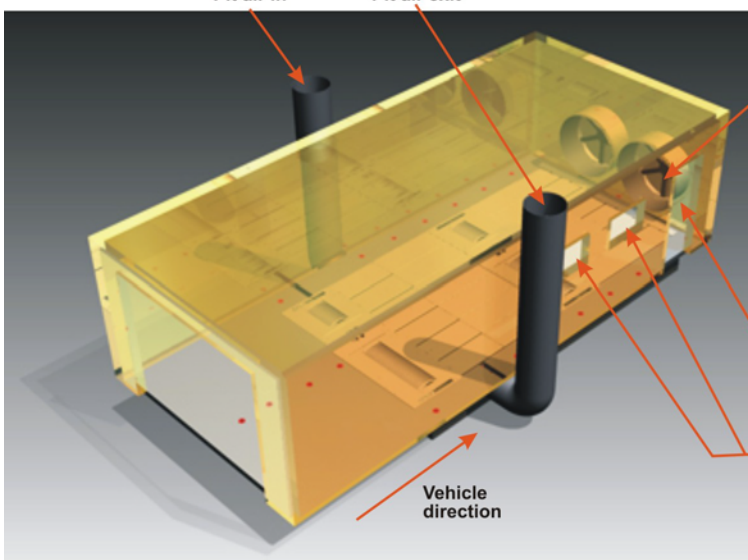


Figure 1. AutoDyn Test Cell

A dynamometer should be installed in a facility with proper lighting, electric power, compressed air, good ventilation, exhaust extraction, and a fire detection system. There must be enough room to easily install and remove the test vehicle. It should allow enough space to work on the vehicle while it is in place on the dynamometer, yet small enough to take up minimal space in your building.

A dedicated, separate room is not actually required for operation of the AutoDyn. However, a properly built test cell provides protection, noise control, exhaust isolation, and directed cooling of the test vehicle.

Figure 1 shows a setup where the vehicle is driven forward onto the dyno. The direction of travel for the vehicle on the dynamometer is purely at the discretion of the system owner or test cell designer. SuperFlow makes no distinction as to which is better—driving forward or driving backward onto the dynamometer.

- Driving forward with the rear of the vehicle toward the access door makes it easier to position the vehicle on the rollset. However, this means the ventilation fans are at the front of the vehicle and will ***blow*** air through the room. This generally requires higher-capacity fans to maintain proper ventilation and keep the room clear of dangerous exhaust gases.
- Backing onto a rollset and getting the vehicle straight can be difficult until the operator gains experience. But having the ventilation fans ***sucking*** air at the back of the vehicle is more efficient for moving air through all areas of the room and extracting errant exhaust fumes, especially if you can produce a slight negative pressure in the room. This design usually requires additional spot fans in front of the vehicle for cooling.
- A drive-through test cell is an ideal setup if the ventilation system can be designed around having access doors at both ends of the room. These test cells generally operate with the rear door closed and ventilation fans pulling air out of the room either through a ceiling vent or through ducts on both sides of the rear door. This concept can also work for a drive-forward design.

Proper airflow through the test cell is critical for engine cooling and room ventilation. Having a larger test cell than necessary makes it difficult to control airflow through the cell and increases the cost because of the need for larger air-handling equipment. A large room also increases heating and cooling costs.

TIP: *Prefabricated rooms are available as an option to building a room.*

The room should be no larger than necessary to ensure high air velocity around the vehicle during tests. The room should be long enough to accommodate a vehicle on the dynamometer and still be able to close the main access door. This helps minimize building heating or cooling loss while not actually testing the vehicle. Typically, the room should be 30 ft. *[9 m]* long, 15 ft. *[4.5 m]* wide with a 10-ft. *[3.0-m]* ceiling.

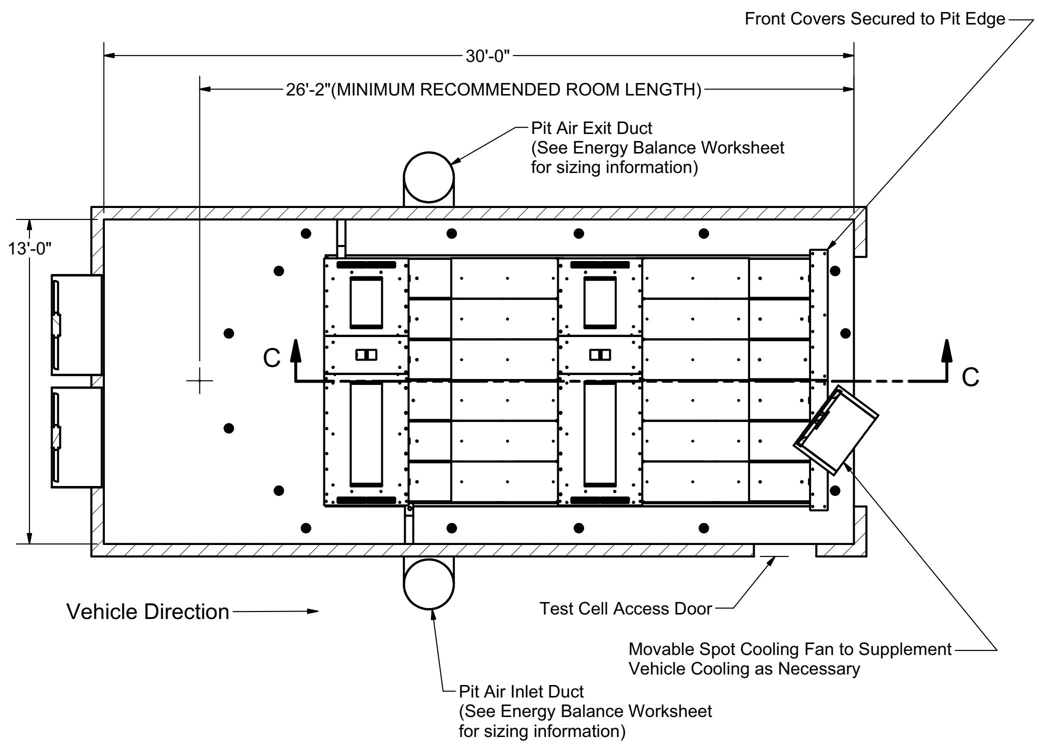


Figure 2. AD-30 AWD Test Room Dimensions

A separate control room or dedicated viewing area overlooking the dynamometer can be part of the test cell design. This room may be used to house the computer and printer, thus providing a convenient and safe viewing area during testing. Avoid positioning the control room where an object thrown from the vehicle may create a hazard.

When building a dynamometer test cell, consider the following:

- Provide viewing windows so observers can watch a test in progress from a safe vantage point. Position the window so it does not align with possible objects thrown by the vehicles. The viewing window can be part of the control room and is more effective if it is located on the driver side of the vehicle.
- The rotating tires may throw rocks or debris, so **do not** locate any storage or equipment in line with the direction of the tire rotation.
- All test room doors should open outward from the room, and all doors should be fitted with appropriate door latches.

Pit Design

See Figures 3 through 6, “AD-30 AWD Pit Layout” on pages 43 through 46.

The pit for a SuperFlow AD30-AWD chassis dynamometer is constructed on site of poured concrete with 6″ minimum (20 cm) thick walls and steel rebar reenforcement. The concrete should have a minimum strength of 4000 psi *[280 kg/cm^2]*.

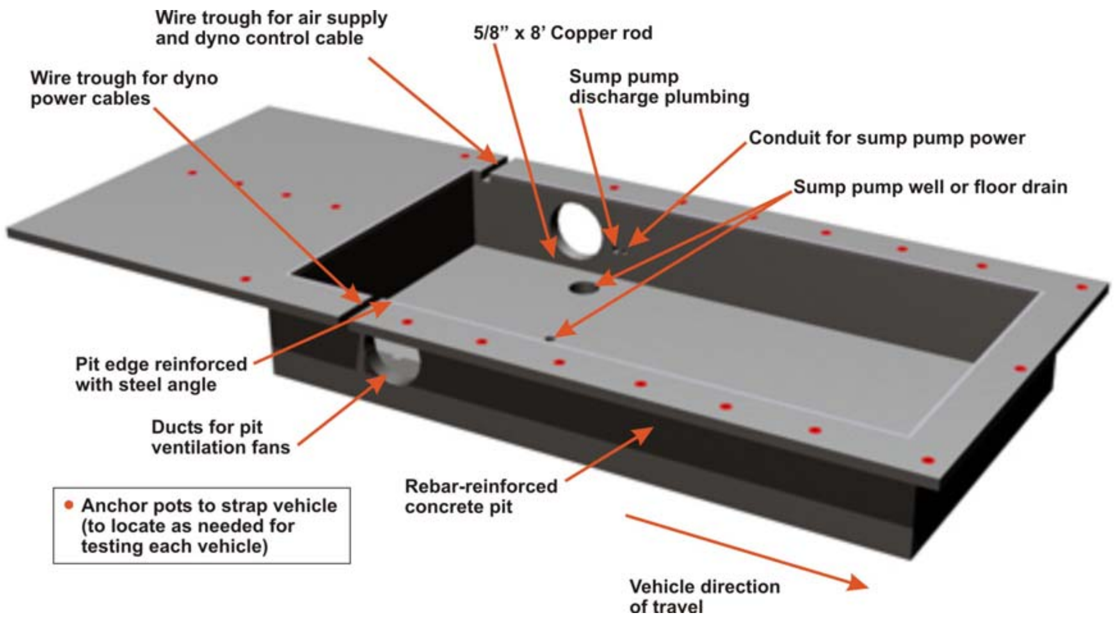


Figure 3. Pit Design – Open View

The 24″ (60 cm) diameter holes on each side of the pit are for a ventilation system that removes the heat generated by the air-cooled eddy current power absorbers and any dangerous gases that may collect in the pit. The ducting for the pit ventilation should extend to the side walls of the test cell or at least far enough to clear a vehicle mounted on the dynamometer (see “Absorber Cooling and Pit Ventilation” on page 12).

Embedded in the pit floor are eight weld plates to carry the main weight of the rear rollset. Additional weld plates are embedded in the pit floor for the front rollset track rail. An angle-iron weldment is cast in the pit top edges to strengthen the pit edges and support the AutoDyn top covers.

Weld plate locations are shown on Figure 6, “AD-30 AWD Pit Layout (page 4 of 4),” on page 46.

Install a 5/8″ x 8 ft. copper rod through the pit floor into the soil below. The rod is used to ground the AutoDyn chassis.

Access into the pit for the electrical wiring, compressed air, and sump pump drain is required. Conduits or a covered trench may be used for the electrical wiring. Typically two electrical cables will extend into the pit: one for the dynamometer control and the other for the dynamometer power (see “Electrical Requirements” on page 14).

Floor anchors are required for securing the vehicle on the dynamometer with tie-down straps or chains (see “Vehicle Restraint Requirements” on page 13). Anchors should be positioned around the pit to provide multiple tie-points for a wide variety of vehicles.

Suggested placement of floor anchors are shown in Figure 5, “AD-30 AWD Pit Layout (page 3 of 4),” on page 45 and Figure 7, “Vehicle Tie-down Points,” on page 47.

Pit Drainage

Water and other fluids can get into the pit from local ground water conditions or spillage from other sources. If the water level gets too high it can cause damage to the AutoDyn. A sump pump or floor drain must be provided in the pit floor to automatically remove any accumulated water.

Suggested pumps are shown in “Equipment Recommendations” on page 17.

- A sump pump should be recessed in the pit floor and have a float-actuated switch to automatically keep the pit empty of any water or other fluids.
- Make sure the electrical wiring conforms to local code requirements for installing an electric motor in a below-floor-level enclosed area.

IMPORTANT: Many sump pumps come with a standard three-prong plug, so the easy solution is to put an electrical outlet in the pit; however, because the outlet is in an enclosed pit, this may not conform to local building codes. Consult a certified electrician to determine the proper installation of a sump pump in this situation.

- Install check valves or a back flow preventer so water will not drain back into the pit.
- Be sure the pump wiring and plumbing do not interfere with the movement of the front rollset.

NOTE: *Local codes may require water pumped or drained from a dynamometer pit to be routed through an oil separator or cleaner.*

You may also wish to install a drain in the test room floor to help wash down the test cell area. This drain may also have to be routed through an oil separator.

Ventilation

IMPORTANT: Electric fans, ventilation ducts, and the location of fans in the ducts must conform to local codes and regulations. Always consult with local authorities when installing a ventilation system.

Chassis dyno test cells require extensive ventilation systems to address five requirements for safe and repeatable dyno testing:

- Provide air to the vehicle for combustion
- Remove heat from the test cell
- Cool the vehicle
- Extract exhaust gas and combustion by-products
- Provide pit ventilation and cool the dynamometer eddy current absorber

Although it is best to address these tasks individually, it is possible to combine some systems to meet two or more requirements.

Place the master control for the ventilation fans inside the room within easy access for the dynamometer operator and an emergency cutoff switch outside the room.

See Figure 13, “AutoDyn Room and Pit Airflow (U.S. Units),” on page 53 or Figure 12, “Energy Balance (Metric Units),” on page 52 for typical AutoDyn airflow requirements.

Suggested fans and other ventilation supplies are shown in “Equipment Recommendations” on page 17.

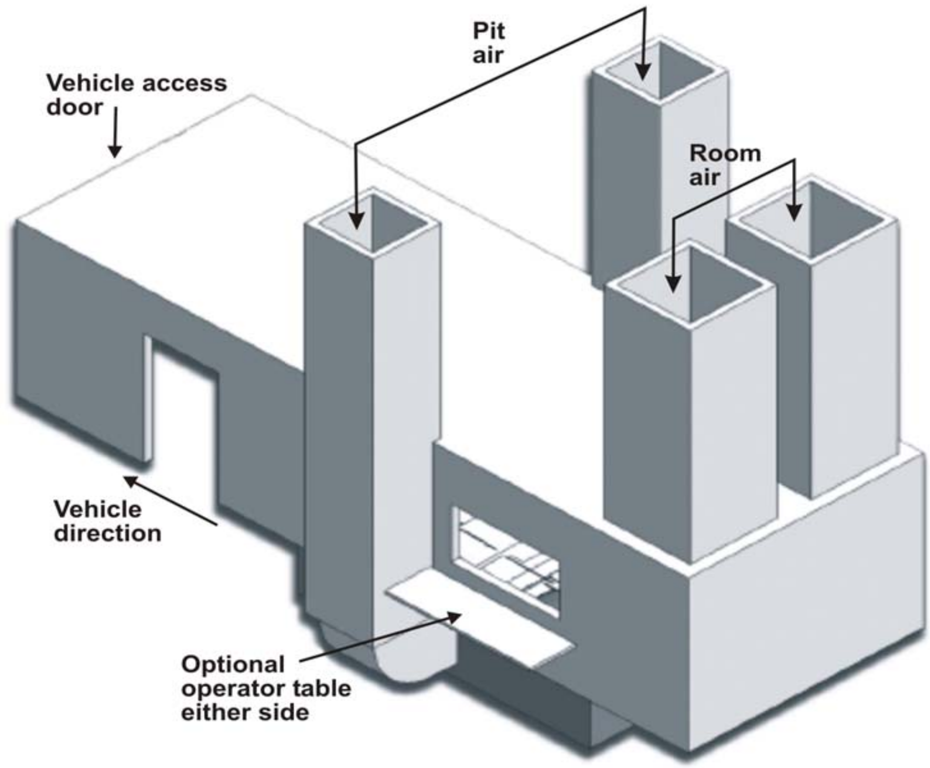


Figure 4. Ventilation Ducts

Combustion Air

Internal combustion engines need clean, cool air to function properly and produce the best performance. Normally, the engine uses the same air for combustion the air in the dynamometer test cell, so the airflow in the room must provide combustion air in addition to extracting any toxic gases and keep the room cool.

If testing the vehicles without filters on the engine, you may be required to filter the air flowing into the room. If required, filters can be installed on the inlet ducts. SuperFlow recommends 92% efficient filters and also recommends installing a pressure gauge to measure the pressure drop across the filter system. When the filters become clogged, the ventilation system may not be able to overcome the pressure drop, and the airflow though the room will rapidly decrease.

TIP: *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.*

Heat Extraction

Chassis dynamometer testing produces a significant amount of heat that is for the most part released to the test room air. Ventilation is required to evacuate this heat from the room. If the room temperature increases during the test or exhaust gas recirculates into the engine inlet, your test results will vary in an unpredictable manner. Both the quantity and direction of airflow are critical for repeatable test results.

In chassis dyno testing, about 40% more energy is released into the air than the engine tested in the vehicle produces. This energy is in the form of heat from the vehicle's engine and exhaust as well as heat from the various drivetrain components and their corresponding drivetrain frictional losses. So for every 100 hp of engine flywheel power, you must assume it releases 140 hp in the form of heat and then size the ventilation system so it is capable of removing the heat. If your system is not capable of removing all of this heat effectively, your testing will suffer as a result of excessive temperatures in the room, or you will be forced to run limited duration tests with a cool-down period between tests.

Generally, for every 1 hp of engine power produced for 1 minute, the temperature of 2,313 cubic feet of air in a room (at sea-level standard conditions of 60°F, 0% relative humidity, and 29.92 inHg barometric pressure) will be heated 1°F.[1] A room ventilation system must be designed with the capability to maintain a temperature at the rear of the vehicle that will not exceed the temperature rating of the extraction system. Without adequate ventilation, on a nice 70°F day the temperature in your test cell will be intolerable within minutes.

Example:

If the test vehicle is rated at 400 hp (at the flywheel) and you want to limit the temperature increase in the room to 25°F, you need a ventilation system that flows more than 50,000 cfm.

$$\frac{(\mathbf{400hp} \times \mathbf{1.4}) \times \mathbf{2313ft^3}}{\mathbf{25^\circ F}} = \mathbf{51811cfm}$$

- 1.4 is 40% increased heat load
- 2313 ft.^{3} is the volume of air affected by a 1° increase in temperature in 1 minute by 1 hp.

In a 30ft. x 12ft. x 8ft. (2,880 ft.^{3}) test cell, 50,000 cfm is almost 17 air exchanges per minute (50,000 divided by 2,880).

If a separate exhaust extraction system is in place, room ventilation airflow can be decreased to a rate equaling 10 to 12 air exchanges per minute. Regardless of the test cell design, the room ventilation fans should be sized to provide enough air to the room to prevent an excessive buildup of heat in the room and remove any dangerous fumes not captured by the exhaust extraction system.

SuperFlow recommends using tube-axial fans for ventilation of any closed-room test cells. The air should enter the room at the front of the vehicle and be directed rearward. Ducting can be used to direct the air at the radiator level of the vehicle. Air can exit out the rear door of the room or through the rear ceiling or rear sidewalls.

Figure 5. Room Ventilation Fan

1. Thermodynamics, J.P. Holman, McGraw-Hill College, 4th edition, ©1988

It is advisable to locate the fans at the rear of the test cell to extract air out of the room and therefore create a slight negative pressure in the room to help prevent fumes and heat from the test cell from entering other areas of your building or collecting in the corners. It is also advisable to locate the fans or use duct work as necessary near floor-level to assist in directing airflow along the path the vehicle will normally experience on the road.

The large fans required to provide the necessary airflow are noisy, so install them in a location where the noise causes minimal disturbances for your employees and neighbors. You may need to take additional protective measures such as enclosing the fans and ducts in sound-dampening material. Self-closing shutters on the air outlets (and inlets if applicable) are advisable so the duct openings can be sealed off when the dynamometer is not in use.

Vehicle Cooling

The main room ventilation system should evacuate heat released by the vehicle cooling system, engine block, transmission, and exhaust. However, in many cases the airflow patterns resulting from the room ventilation system do not adequately cool certain vehicle components. The engine compartment and undercarriage exhaust system are usually the most troublesome areas.

Spot fan

High-capacity fan

Figure 6. Vehicle Cooling

To compensate for this deficiency, SuperFlow recommends spot cooling fans. Although these fans do not increase the overall airflow through the room, they modify the local patterns and speeds of the airflow to accomplish specific goals. High-speed fans are commonly used for these tasks.

Some racing vehicles require air speed through the radiator at near road-speed. Achieving high flows at high speeds requires tremendous power which explains why many high-performance chassis dyno rooms resemble wind tunnels containing fans of several hundred horsepower.

As an example, to blow air at 100 mph *[160 km/h]* through a standard size radiator would require a fan capable of about 50,000 CFM *[90,000 m3/hr]*. The motor required for a fan of this size could exceed 50 HP *[37 kW]*. If your requirements do not quite reach these levels, you should purchase a set of mobile high-speed fans of 5000–10000 cfm *[8500–17000 m3/hr]* which can be positioned in critical areas.

TIP: *SuperFlow data acquisition and control systems are capable of supplying a 0–10VDC control signal based on engine speed to a variable speed fan controller. This allows more realistic test simulations where the vehicle will experience airflow in near-real-world road conditions.*

In some cases you may want to install an under-car ventilation system. These provisions should be made at the time of installation. Perforated in-floor rails or ducts can be installed below floor grade. Incorporating a pressure blower in this system helps you more easily control exhaust and undercarriage temperatures.

Exhaust Extraction

WARNING: A proper exhaust extraction system is critical for the safety of your employees and customers both inside and outside the test room. If the room ventilation is good, a separate engine exhaust collection may not be necessary. However, to ensure the safety of all personnel in your building, exhaust from the vehicle must be completely removed.

Many test cells are built with the idea they will have enough airflow with a room ventilation fan to extract the exhaust without any help from duct work or auxiliary fans. If the cell is small and the airflow is many thousands of cfm (exchanging all air in the room at least 12–15 times per minute), this is possible. However, very few test cells achieve this goal. Sometimes the best solution is to use hoses or flexible metal with a fan on the other end to suck out the exhaust (see Figure 7).

Consider that for every 100 hp of engine power, roughly 17 pounds of exhaust is produced per minute which is equivalent to 223 cfm of airflow. In addition to noxious gases, a significant amount of heat is released through the exhaust system, especially with the engine at wide-open throttle and at full load. The exhaust system must be able to handle both the flow and temperature of the exhaust gas. Most ventilation ducts and fans only handle temperatures up to 250 deg F (110 deg C). Therefore, exhaust ducts, hoses, and fans should be rated for high temperatures. The extraction fan can be rated for a lower temperature if the exhaust is diluted with cooler air prior to reaching the fan.

IMPORTANT: Hoses typically used in service garages are not applicable for dynamometers as they are only rated for slightly above idle temperatures.

It is much easier to build a system with higher flow capacity than one that can handle exhaust-level temperatures. In addition, sealing the exhaust pipe can influence engine performance by increasing the exhaust back pressure. With a high-flow extraction system, exhaust gas can be diluted with ambient air to reduce the overall temperature in the exhaust system. Leave some space between the vehicle exhaust and the duct inlet so the fan pulls room air into the pipe. This will dilute the exhaust gases by about 2 to 1 and help prevent overheating the fan.

Figure 7. Exhaust Extraction

Alternately, connect directly to the exhaust pipes and integrate an air inlet near the pipe entrance to provide dilution air from inside or outside the test cell. Dilution air can even be introduced from outside the building. The piping prior to the dilution point must be rated for high temperatures.

As with spot cooling fans, the exhaust fan is usually a centrifugal type, high-speed fan. Proper temperature-resistant ducting should be installed to capture the exhaust gas close to the vehicle tailpipe.

For an exhaust extraction system, SuperFlow recommends selecting a fan capable of flowing 1,500 cfm for every 100 hp of engine power. Ensure that the duct system is capable of providing the required flow with the fan you plan on using. A system capable of 1,500 cfm per 100 flywheel hp will provide a 7:1 dilution ratio which should keep the temperature of the diluted air in the ducts below 250°F. Due to incomplete mixing at the collection point, it may be desirable to use metal ducting for the first 10 ft. of the collection system.

If relying on the room ventilation to remove the exhaust from the vehicle, you must assume that for every 100 hp of engine power, roughly 140 hp releases as heat into the room. Therefore, the specifications for a ventilation system to handle both room ventilation and exhaust extraction should be increased by 40% over the standard requirements.

For more information on exhaust extraction and system design suggestions, contact SuperFlow Sales or Customer Service and ask for the document “Chassis Dyno Exhaust Extraction” PDF.

Absorber Cooling and Pit Ventilation

Pit ventilation is required for two reasons: to remove heat generated by the absorbers and to evacuate potential explosive gases.

The eddy current Power Absorption Unit (PAU or absorber) in the pit absorbs power generated by the vehicle and converts it to heat. Most tests on the AutoDyn are short and limited first by the vehicle overheating when testing at full power and second by the eddy current absorber overheating. Consequently, tests can be run for a longer period at much higher power levels if the vehicle and absorber are kept cool. The vehicle temperature is maintained by the room air ventilation whereas the absorber temperature is handled by a pit ventilation system.

The heat from the absorber is removed by supplying fresh air to the pit during vehicle operation. SuperFlow recommends two tube-axial fans for pit ventilation: one fan pushes the air into the pit, and one fan extracts air from the pit. One fan alone does not normally have enough pressure capability to overcome the duct flow losses. These fans can be mounted on the roof, an outside wall, or anywhere within the ducts. It is best to install the exhaust fan at the end of the duct to ensure all air (possibly contaminated) is exhausted from the building. SuperFlow recommends a pit ventilation system capable of flowing 1,500 cfm per 100 hp of engine power of vehicle to test. This limits the temperature rise in the dyno pit to 80°F. A system with less flow than this will limit the length of the tests being performed and requires a cool-down period between tests.

For efficiency, airflow should be directed across the absorbers. Therefore, the ventilation ducts should be placed on opposite sides of the pit and in line with the absorber which is about four feet from the back wall of the pit.

- Ducts may be round or rectangular as long as the cross-sectional area is sufficient to manage the airflow.
- Make sure the fans and duct system are compatible in providing the required airflow.
- The pit ventilation ducting should extend to the side walls of the test cell or at least far enough to clear a vehicle mounted on the dynamometer.
- If the fan motors are actually located in the pit, they should be rated as explosion-proof.

- Place the master control for the ventilation fans inside the room within easy access for the dynamometer operator and an emergency cutoff switch outside the room.

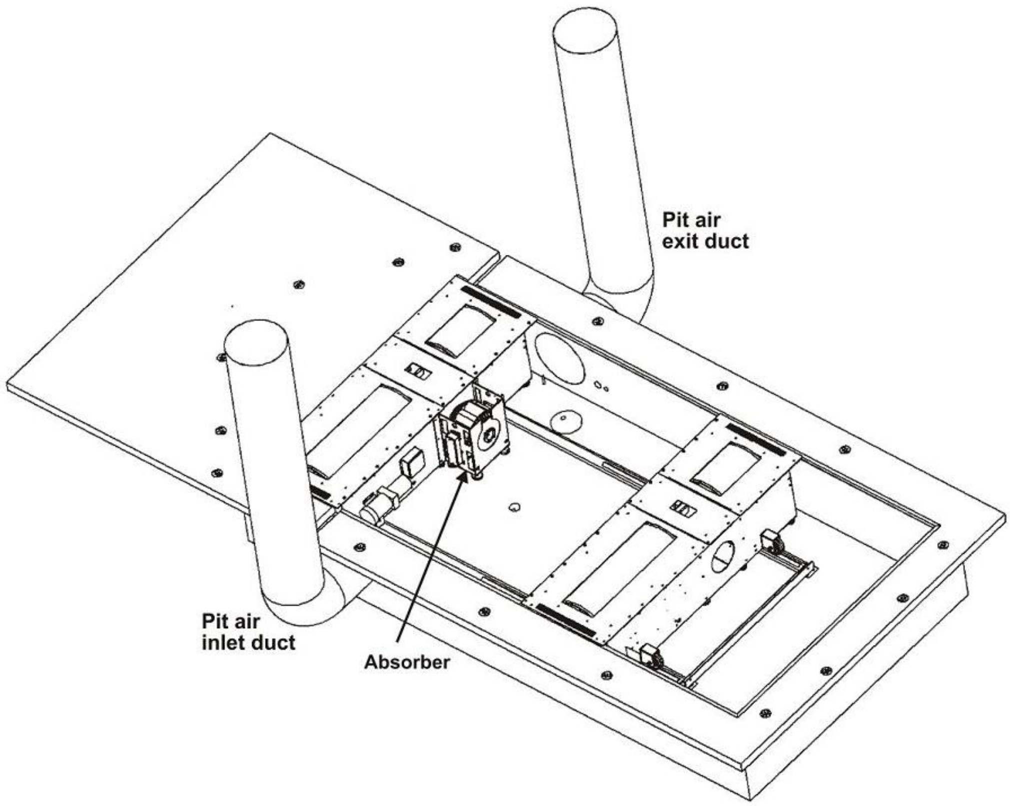


Figure 8. AD30-AWD Pit Ventilation

An option is to replace the pit covers on one side of the absorbers and closest to the pit edge with metal grates so air is drawn from the test room into the pit and out the exit ducts. One fan may suffice with this design. If replacing solid metal covers with grates, make sure the grating is supported sufficiently to support the weight of a vehicle that may possibly drive over the grating.

NOTE: *The fans must deliver the required flow against a pressure of at least 1.25" (3 cm) of water pressure to overcome the duct flow losses. The fans listed in "Equipment Recommendations" on page 17 here meet that requirement. Do not try to substitute a lower velocity fan design.*

TIP: *Placing the AutoDyn next to an external wall makes it easier to route ventilation ducts outside the building.*

Vehicle Restraint Requirements

Vehicles must be carefully and securely restrained when testing on a dynamometer, more so on an all-wheel-drive dynamometer. Because the vehicle is sitting on free-turning rolls, the only restraint comes from straps securing the vehicle to the test cell floor. Three or four restraining straps are required at each end of the vehicle. In some applications, straps are needed along the sides of the vehicle. Front-wheel-drive vehicles are particularly susceptible to sideways movement because the testing primary load is on the steering axle.

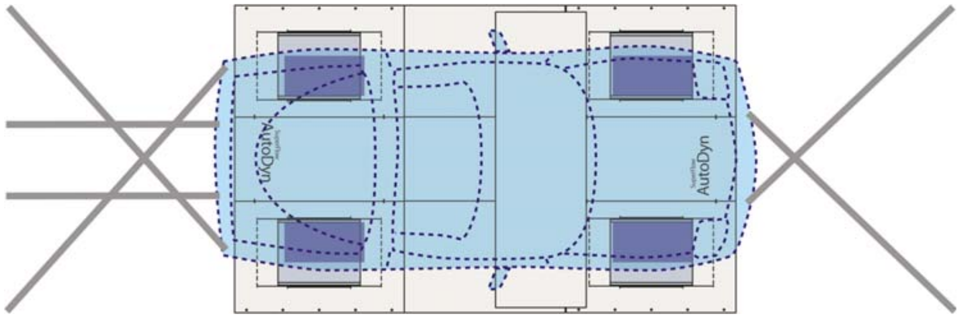


Figure 9. Vehicle Restraint – AWD

The straps are attached to the floor with flush-mounted floor anchors. Floor anchors can be integrated in the room floor when the concrete is poured or special anchor pods are inserted into holes bored into the concrete floor and wedged in place. Chains or load hooks can be attached to the anchor points.

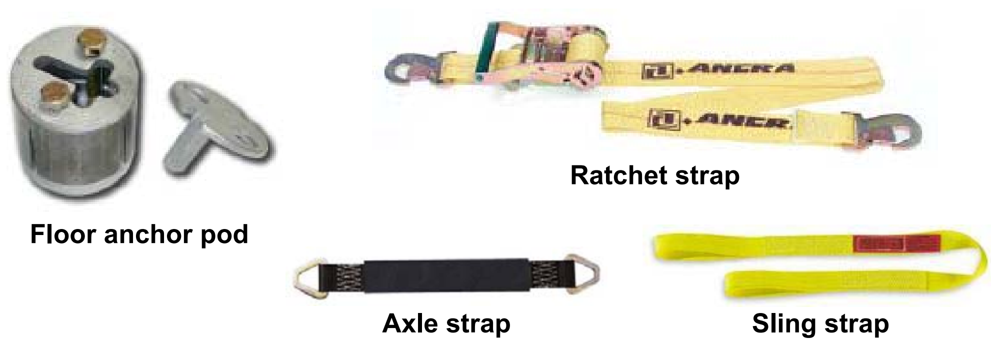


Figure 10. Tie-down Anchor and Straps

Use adjustable-length, ratcheting restraining straps with at least a 5000-lb. (2200-kg) load-working capacity. Straps with ends terminated in J-hooks or eye loops are the most useful. You will need at least four side straps, each at least 8 ft. (2.5 m) long and four front/rear straps, each at least 12 ft. (3.5 m) long.

SuperFlow recommends installing at least 12 tie-down points as shown in Figure 7, "Vehicle Tie-down Points," on page 47. If you are testing specialty vehicles, you may want to add more tie-down points. At least three points must be used at each end during testing. Add wall-mounted hooks for storage when the straps are not in use.

NOTE: *If using the anchor pods purchased from SuperFlow (part number 3420P-1300), install them with the long slot pointed toward the vehicle.*

Electrical Requirements

WARNING: 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.

Dynamometer Chassis

The AutoDyn power absorber requires 25 amps of 208 to 240 VAC power wired from a power distribution box through a 1” (25 mm) diameter conduit in the pit or a trench cut in the side wall to the rollset power junction box on the AutoDyn. The junction box is located on the front side of the rear rollset just to the right (looking forward) of the eddy current absorber (see Figure 32, “Electrical Controls,” on page 35).

This power operates the eddy current absorbers and the hydraulic pump that moves the front rollset. Both devices can be run on the same circuit because both should never be on at same time.

In addition to the power cable, a control cable is routed from the AutoDyn through a trench or conduit to the SuperFlow Data Acquisition System (sensor box). The connection for this cable is an interconnect panel on the left side (looking forward) of the rear rollset.

If the conduit or trench is placed about one foot from the rear wall and about one foot below the top edge of the pit, it will be very close to being in line with the interconnect panel. Otherwise, place it no closer than 4 feet *[1.2 meters]* or farther than 8 feet *[2.4 m]* from the rear wall. This will put the cable and air hose between the rollset frames making access much easier. Conduit should be no less than 18” *[45 cm]* from the pit floor.

- A 3” *[75 mm]* conduit is required for the control cable and air line for easy passage of the large connector on the control cable.
- The power cable and the control cable should not be routed together in the same conduit or trench.
- A a master disconnect switch for the VAC power should be within sight of the rollset.
- Do not combine the dynamometer power with any other devices such as fans or pumps.

Data Acquisition System

The AutoDyn sensor box, computer, and printer requires a 110 VAC, 15-amp or 240 VAC, 8-amp supply using approved GFI plug receptacles. SuperFlow recommends using an Uninterruptible Power Source (UPS) or a good surge suppressor for these devices.

Miscellaneous

Additional power is required for the fans, sump pump, room lights, and any power tools or devices that may be used in the room.

- Use only Ground Fault Interrupter (GFI)-protected power outlets in the test cell.
- Install two-way switches inside and outside the test room for the lights.
- Place the master control for the ventilation fans inside the room within easy access for the dynamometer operator and an emergency cutoff switch outside the room.

Air Requirements

Compressed air at 100 psi (600 kPa), must be supplied to the AutoDyn to operate the AutoDyn roll lock. This line is routed into the pit through a conduit or a trench cut in the side wall of the pit edge. The connection is on the left rear side (looking forward) of the rear rollset chassis next to the control cable panel. The air line can be routed alongside the AutoDyn control cable or the power cable.

- Provide an easily accessible air shutoff valve.
- Install a regulator, filter, and water trap where they can be easily monitored.

- In situations where high concentrations of water may be in the air supply, install an automatic water drain in the pit at the lowest level of the air supply line.

Suggested air supply equipment is shown in “Equipment Recommendations” on page 17.

Static Electricity

An ungrounded vehicle on a chassis dynamometer will create a very high static charge as the tires turn. This charge normally dissipates fairly quickly after the vehicle is stopped if an alternative ground path is not provided.

However, the alternative ground path can be the handheld controller (wired model) or the operator while stepping out of the vehicle. The back plate of the handheld is metal and is connected to earth ground through the sensor box. If the handheld backing plate is laid on a metal part of the vehicle or the operator is in contact with the backing plate and touches a metal part of the vehicle, a static discharge can occur. A discharge can also occur when the operator steps down from the vehicle and contacts the ground. Such a discharge can cause severe damage to the system electronics or give the operator a mild electric shock.

The best way to prevent any static buildup and subsequent discharge is to provide a positive ground path. The easiest and most efficient method is to connect a ground strap from the vehicle frame to a positive earth ground. This strap can be flat metal braid, welding cable, battery jumper cables, or a length a thick, solid copper wire. With one end permanently attached to an earth ground point and a alligator-style clip on the other, it only takes a few seconds to ground the vehicle and prevent damage or injury.

The AutoDyn pit design has a copper grounding rod through the pit floor. A wire or strap is connected from the AutoDyn frame to this rod. Therefore, a vehicle ground strap can be attached to the AutoDyn frame that will provide a discharge path for static electricity.

Convenience Issues

Based on experience gathered while installing and visiting countless test facilities, SuperFlow suggests making these enhancements to your facility:

- Wide-angle mirrors positioned in front of the driver so all parts of the test room are visible during tests.
- A video computer monitor or projector to display WinDyn data screens on the front wall during the tests.
- Wireless two-way communication link between driver and system/computer operator or an intercom between the test room and the control room.
- Digital camera for pictures of the vehicle while tested. The pictures can be downloaded to the test system computer to display and store with the test data files. Additionally, pictures provide a quick method to record the vehicle configuration and cooling blower arrangement for the test, improving test repeatability.
- A microphone in the test room and driving speakers in the control room (and customer viewing room). Because of the test room’s noise insulation, it may be difficult to hear abnormal engine or drive line sounds from the control room.
- A telephone line for communication. A wireless telephone is convenient. When requesting assistance from SuperFlow Customer Service, the dynamometer operator must be near the system.

- Additional test system computer monitor in the customer viewing area, if separate from the control room (for example, the lobby of your facility). It may be a good idea to provide a cable for this purpose when building your facility.

TIP: *A remote computer with WinDyn installed and setup as a slave can display real-time data from the dynamometer system.*

- Closed-circuit video with monitor in the control room (or in the customer viewing area).
- Battery-powered emergency lighting in the test room and control room.
- Heating and air conditioning in the test cell and control room, depending on your climate.
- A secure storage space in the control room for software, manuals, backup disks, and test results
- A closed storage space in the test room for sensors, cables, calibration equipment, and personal protective equipment (such as earmuffs and safety glasses).

SuperFlow also recommends keeping the test room clean at all times. Dirt from the test vehicles tends to accumulate; the powerful room ventilation systems sweeps up and blows around any dirt, rags, papers, etc. Protect your engine, vehicle, and fans by avoiding loose objects. Clean test vehicles before installing them on the dynamometer whenever possible. Install a water faucet with a garden hose to periodically wash down the test room.

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 requirements are achieved.

Contact SuperFlow Sales or Customer Service for suggestions and alternatives.

W.W. Grainger part numbers and specifications are from the online catalog.

You can locate any Grainger parts at **http://www.grainger.com**. Enter the part number in the **Search** text box.

- Dyno power is an indication of 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.

Ventilation Fans

SuperFlow recommends an air exchange rate of 8 to 10 times per minute (minimum) through the test cell. The size of the fan and the flow required depends on the room size and the type of testing you intend to perform.

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

Table 1. Dayton Tube Axial Fan and Belt Drive with Drive Package

Grainger Item/Mfr #	Propeller Diameter	Motor	Dimensions	CFM	Fan Speed (rpm)
7F883	48”	• 10 hp • 3 ph • 208–230/460, 60 Hz	• Height 64-3/4” • Width 51-3/4” • Max depth 36” • Tube dia 48-5/8”	38,100	891
7F862	36”	• 5 hp • 3 ph • 208–230/460, 60 Hz	• Height 52-7/8” • Width 39-3/4” • Max depth 29” • Tube dia 36-5/8”	20,650	1133
7F843	30”	• 5 hp • 3 ph • 208–230/460, 60 Hz	• Height 46-5/8” • Width 33-5/8” • Max depth 24” • Tube dia 30-5/8”	16,000	1551
7F831	24	• 2 hp • 3 ph • 208–230/460, 60 Hz	• Height 37-1/4” • Width 27-7/8” • Max depth 18” • Tube dia 24-7/16”	9,000	1688
4TM85	24	• 1 hp • 3 ph • 208–230/460, 60 Hz	• Height 26-7/8” • Width 26-7/8” • Max depth 18” • Tube dia 24-7/16”	8,000	1160
7F957	18	• 1.5 hp • 1 ph • 115/208–230 Hz	• Height 31” • Width 21” • Max depth 16-1/2” • Tube dia 18-1/2”	5,298	2255

Air Handling

Grainger Item	Manufacturer & Model #	Description	Specifications
6D756 1/4” Filter/ Regulator	Wilkerson B18-02-FL00 	• 1/4” Filter/regulator • Compact 18-series air line • Airflow 88 cfm	• NPT: 1/4” • Maximum Pressure: 250 psi • Bowl Size: 4.09 oz. • Bowl Material): Zinc • Max Temperature: 150°F • Height: 10.0” • Width: 2.36” • CFM: 65
2A147 100-psi Pressure Gauge	US Gauge P500K 	• Pressure gauge • Back connection location • 100 psi range • Case steel • Brass socket and bronze tube material • Glass window	• Dial size: 2” • NPT: 1/4” • Smallest graduation: 2 psi • Accuracy: +/- 3-2-3%
6B251 Pneumatic Auto Drain	Wilkerson GRP-95-973 	• Fits 18, 28, 30, and 38 series air filters	• PSI: 15–250 • NPT: 1/8” • Function: Normally open, float-operated drain automatically discharges liquids from the bowl when liquids reach a predetermined level • Application: Converts manual drain on filter to automatic drain

Water Pumps and Accessories

Grainger Item	Manufacturer & Model #	Description	Specifications
2P547 3/10-hp Pump, Sump	Zoeller M53 	• Sump pump • Cast-iron top • Automatic operation • Single phase • 9-ft. cord	• Type: Sump pump, cast-iron top, automatic operation, single phase, 9-ft. cord • Power Rating: 3/10 hp Current Rating: 9.6 amps Voltage Rating: 115 volts • Maximum Flow: 43 gpm • Off Point: 3-1/4 inches On Point: 8-1/2 inches • Impeller: Glass-filled polypropylene • Water Flow: 15 ft. of head 19 gpm, 5 ft. of head 43 gpm • Shutoff: 19–14 ft. • Speed: 1,550 rpm • Gauge: 18/3 SJTW-A • Maximum Solids: 1/2 inch • Height: 10-1/16 inches
2P843 Valve, Check	Zoeller 30-0192 	• Full flow check valve • PVC construction material • Includes stainless steel clamps and screws and hinges	• Type: Full-flow check valve, PVC construction material • Size: 1-1/4 or 1-1/2 inches

Vehicle Tie-down Accessories

Floor anchors, straps, and slings are necessary for securing the vehicle to the dynamometer. Individual pieces are shown below. Kits are available from SuperFlow Sales or Customer Service.

Part Numbers	Description	Specifications
SuperFlow 3420P-1300	Cored in Floor Anchors 	3.5” in-floor compression Chain receiver 1000 lb rating
Grainger 3LLF7	Ratchet strap, U-hook 	27 ft. x 2 in

Part Numbers	Description	Specifications
Grainger 2RU88	Web sling, eye & eye 	3 ft. x 2 in 3,200 lbs
Grainger 3LLT9	Axle strap w/ wear pad 	36 in
Grainger 4ZV46	Heavy-duty tuff edge web sling, Endless loop 	4 ft x 2”, 6,400 lbs
Ancra 45515-10 R (Ford) T (GM, Chrysler) J (Foreign)	RTJ Cluster Hook 	Breaking strength: • R: 25,000 lbs/11,363 kg. • T: 15,000 lbs/7,272 kg. • J: 12,000 lbs/5.454 kg. Working load limit: • R: 8,333 lbs/3,787 kg. • T: 5.333 lbs/2,424 kg. • J: 4,000 lbs/1,816 kg.

Installation Instructions

WARNING: The AD-30 AutoDyn parts are very heavy. They should only be moved and lifted with forklifts or cranes. A rollset weighs approximately 4500 lbs. (2050kg). The cover frames and plates weigh more than 100 lbs. (45kg).

CAUTION: Do not use electric welding equipment in the vicinity of the dynamometer while the AC power to the dynamometer or to the sensor box is turned on.

Required Tools

- Minimum 5,000-pound forklift or crane
- Pallet jack (for maneuvering the rollsets in the pit)
- Standard mechanics tool kit including:
  - Screwdrivers
  - Pliers
  - SAE wrenches (1/2″ to 1-1/8″)
  - SAE socket set (3/8″ and 1/2″ drive)
  - Allen wrench set
- 3/8″ or 1/2″ impact wrench
- 6-lb. sledgehammer (for coercing stubborn parts)
- 1/2″ hammer drill with steel and masonry drill bits
- Angle grinder (just in case adjustments are needed)
- Carpenter's level
- 25′ tape measure
- Step ladder (for getting into the pit)
- Drift bar (for lining up holes)

Pit Preparation

Refer to Figures 3 through 6, "AD-30 AWD Pit Layout" on pages 43 through 46 for a detailed pit drawing.

Measure the width, length, diagonals, and depth to determine whether significant deviation from the drawing exists. Mark the actual dimensions on the pit drawing for future reference.

If deviations are found, you may need to modify the dynamometer installation to accommodate the differences. Modifications may include alterations on the pit or the rollset frame to make it fit.

See Figure 1, "AD-30 AWD Dimensions," on page 41 for the nominal AutoDyn dimensions.

If the pit is too short or too narrow, it might be very difficult to get the dyno into the pit. If the pit is too long or too wide, additional supports may be required to fill the gap.

The most critical installation dimension is the pit depth. If the pit is too shallow, the AutoDyn frame will extend above the pit edge. The only way to correct this is to raise the floor around the pit. If the pit is too deep, supports can be placed under the AutoDyn frame to raise it.

Rollset Preparation

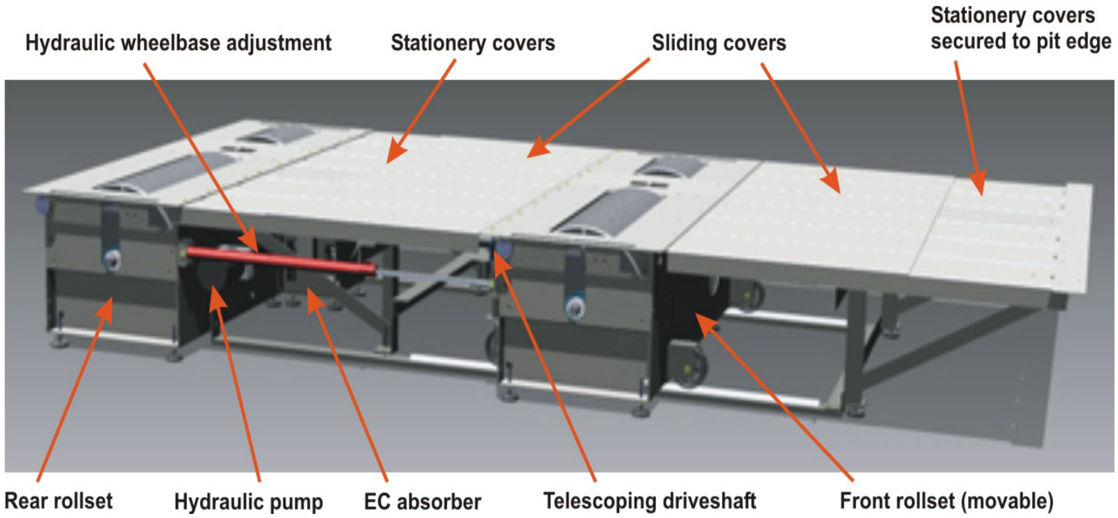


Figure 11. AD-30 AWD AutoDyn

The AWD AutoDyn is installed in four parts: the front rollset, rear rollset with the eddy current power absorber module, the stationary covers, and the sliding covers. The rear rollset, eddy current absorber, and the stationary covers remain in place while the front rollset is moved by a hydraulic system for different wheel-base length vehicles. Bridging covers attached to the front rollset slide over the stationary covers as the front rollset is moved.

1. The designed pit depth is 32.8" (83.3 cm). The depth will vary with location. Measure and record the depths at the location of the support feet on the rear rollset. These measurements are used to pre-set the support feet (Figure 12) on the rollset frame prior to lowering it into the pit. Final adjustments can be done after the frame is in the pit.
2. Ensure that the jam nuts for the leveling feet are on top of the frame supports and not underneath.

__NOTE:__ The leveling feet for the backside of the rollset have a 1/2" [13 mm] square hex head machined at the top of the threaded rod. This allows the shaft and jam nut to be adjusted with the rollset in the pit using a socket on a long extension. Therefore, the jam nuts must be accessible from above the rollset.

Figure 12. Leveling Foot

3. If there is no way to lift the rear rollset with the eddy current absorber attached while it is in the pit, remove the absorber module. This makes moving the rollset in the pit with a single pallet jack much easier. Electrical connections must also be removed.

4. Set the rear rollset on a flat floor and adjust the leveling feet on the corners until the top edge of the rollset frame is at a height equal to 0.06″ or 1/16″ *[1.55 mm]* less than the measured pit depth (Figure 13). This will place the rollset covers at the correct level to the pit edge. The nominal foot extension from the bottom AutoDyn frame surface is 2″ *[49.5 mm]*.

NOTE: *By setting the rollset height to slightly less than the pit edge, the outer covers on the pit edge will carry some of the load and reduce rattling during operation.*

5. Adjust the four inner mounting feet until they touch the floor. The total load must be distributed across all mounting feet. If the pit floor is not level, you may need to lift the rollset off the pit floor and adjust the feet to allow for the differences in pit floor height.
6. Lock the adjusting nuts on the four feet on the rear side. Even though they are accessible with a socket on a long extension, it is easier to place a wrench on the nuts with the rollset out of the pit. You can access the front leveling feet when the rollset is in the pit.

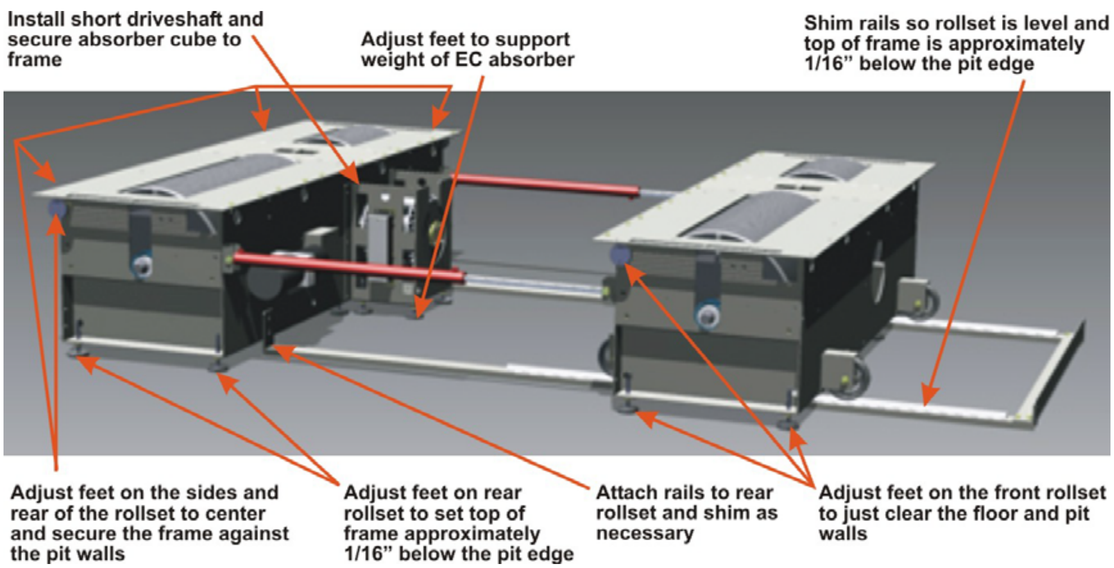


Figure 13. Rollset Height Adjustments

7. Install three adjustable side feet on the back side of the rear rollset and one at each end (Figure 14). These feet will secure the rollset in the pit. First, remove the lock nuts and then screw them all the way in to allow for clearance during the installation. Putting the locking nuts on the inside of the frame will provide a little more clearance on the outside.

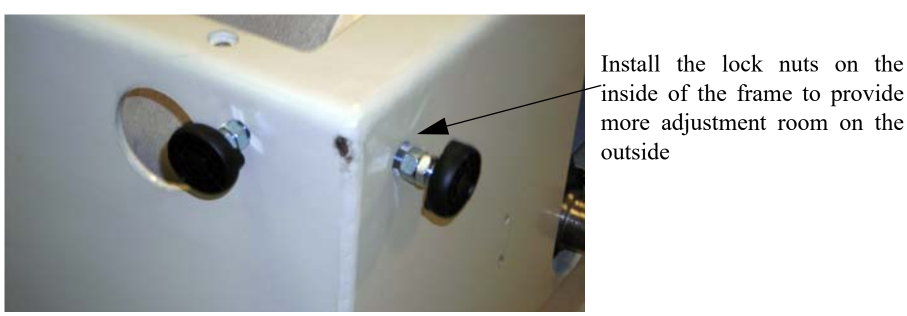


Figure 14. AD30 Side Supports

8. Install the four front rollset wheels if not already done (Figure 15).
   - Remove the V-grooved wheels from the mounting brackets.
   - Attach the brackets to the rollset using two ½-13 x 1½ Hex-Head bolts, flat washers, and lock washers on each bracket.
   - Re-attach the wheels to the brackets.

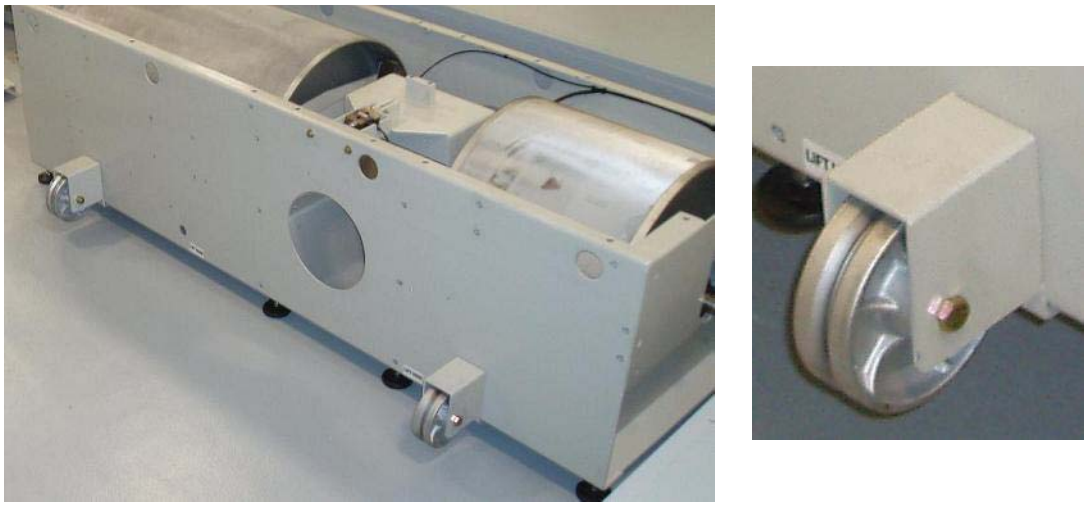


Figure 15. Front Rollset Wheels

9. Set up the front rollset on the V-rails on a flat floor. Ensure the support feet on the bottom do not touch the floor. The height of this rollset is adjusted with shims between the V-rail channel and the pit floor (Figure 16). Do not secure the shims to the rails until they are in the pit. Do not use anything that can interfere with the movement of the rollset. If the pit is too shallow, the V-rail height can be cut down.

Figure 16. V-Rail Shims

The height of the top of the cover plates should be 0.06″ or 1/16″ *[1.5 mm]* higher than the pit depth so the covers do not drag appreciably on the recessed pit edges when the front rollset moves to adjust the wheelbase.

10. Install one 1/2" adjustable foot in each end of the rollset housing, first removing the lock nut, then screwing them all the way in. These side feet will be adjusted to clear the pit wall by about 0.2" *[5 mm]* after the rollset is in final position in the pit. Putting the lock nut on the inside of the frame provides a little more clearance on the outside.

NOTE: *The side feet are safety guides to ensure that the rollset does not move sideways during operation. In normal operation they will not touch the sides of the pit.*

11. Remove all covers from both rollsets prior to lowering into the pit.

Placing the AutoDyn in the Pit

IMPORTANT: The order in which the rollsets are lowered into the pit depends on how the test cell is built and how well the lift vehicle can maneuver in the test cell. In a standard design as shown in Figure 1 on page 4, the rear rollset is at the rear of the pit with no access for a lift vehicle to get behind the pit. This procedure assumes that design so the rear rollset is lowered first. If the test cell is built with the vehicle access door closest to the rear rollset, then put the front rollset in first and move to the front of the pit. If the lift vehicle can reach at least halfway across the length of the pit, install the rear rollset first.

CAUTION: Do not use the cover frame or a rollset in the pit as a support platform when installing the second rollset. Damage may occur from the combined weight of the lift vehicle and rollset.

1. Place the pallet jack in the pit to prepare for moving the rollsets after they are lowered into the pit.

   TIP: *Place the pallet jack in the pit with the handle against the front wall.*

2. Using a strap configuration as shown below, lift the rollset and lower it into the pit. The rollset weighs about 4,500 lbs. *[2050 kg]*. Be very careful to keep the rollset level while lifting it and not let it come down unevenly as the foot supports cannot individually handle the full weight of the rollset.

Figure 17. Lift Straps

NOTE: *The rollsets have 2-inch holes in the front and back sides that can be used for lifting. Be careful not to damage the hydraulic hoses or electrical cables when using these holes. The balance point for the rollset is slightly off center toward the longer roll.*

3. Using the pallet jack or the lift machine, push the rollset against the rear wall of the pit. Align it according to the side dimensions shown in Figure 2, "AD30 AWD Pit Location," on page 42. Note that the rollset is not centered exactly across the width of the pit.

Figure 18. AD-30 Rollset on a Pallet Jack

4. Verify the height and level of the rollset. The top of the frame should be 0.06" *[1.55 mm]* lower than the edge of the pit. Make adjustments as necessary.

   TIP: *Place the rollset covers in place to verify the alignment is correct. Remove when done.*

5. Screw the side support feet out until they are snug against the pit walls. Tighten all locking nuts on the side supports and the leveling feet.
6. Position the V-rails in the pit on the weld plates with the estimated required height shims under each V-rail channel (Figure 19). The rails should be 41.3" *[1048 mm]* center-to-center and centered between the two side pit walls. The end of the rails should be approximately 13.75" *[350 mm]* from the front of the pit.

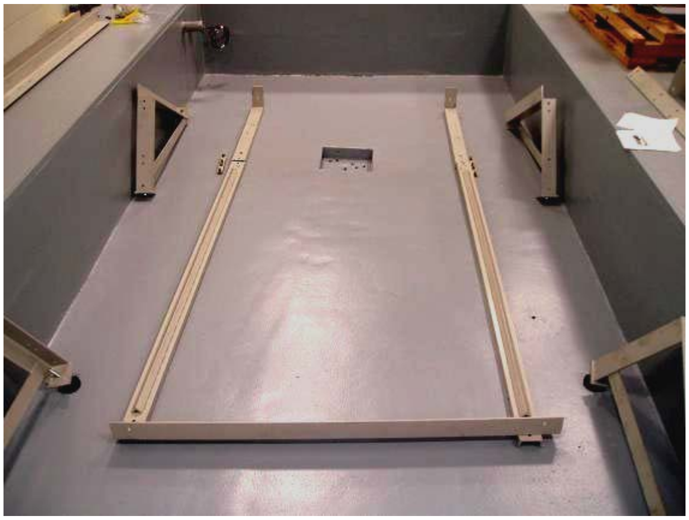


Figure 19. V-Rails in Pit

See Figure 3, “AD-30 AWD Pit Layout (page 1 of 4),” on page 43 for details on the location and positioning of the V-rails.

7. Loosely attach the connecting rails to the V-rails and to the rear rollset.
8. Shim the V-rails as required to reach the desired clearance, allowing for the variations measured in the pit depth. If the weld plates are at different heights, add or remove the appropriate shims to keep the V-rails level.

   Do not secure the rails to the weld plates at this time.
9. Using the strap configuration shown in Figure 17 on page 26, lift the front rollset and lower it into the pit and onto the V-rails. The rollset weighs about 4,500 lbs. *[2050 kg]*. If the front rollset was already in the pit, use the pallet jack to move it onto the rails.
10. Move the front rollset to about the center of the rails. Raise the rollset up off the rails and use blocks under the leveling feet to support it. After securing the rails to the front cover frame, you will lower the rollset back onto the V-rail and align it.
11. Install and secure the front lower cross-member to the V-rails. Do not tighten.

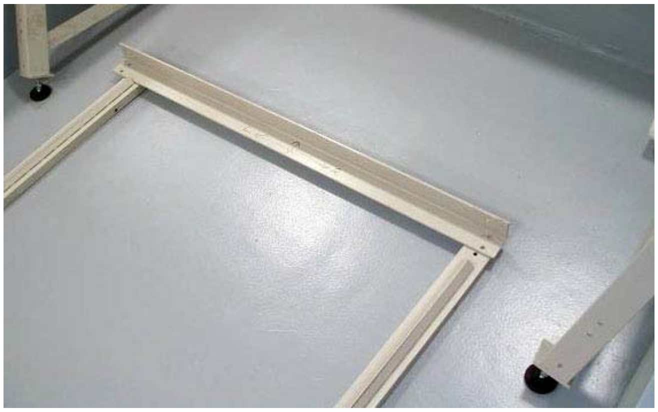


Figure 20. Front Lower Crossmember

12. Install a leveling foot on each of the two front cover supports and set them in the pit. Loosely secure them to the lower cross-member.

Figure 21. Front Cover Supports

Ensure the supports are level. If the supports do not fit level snug between the lower crossmember and the pit wall, the rear rollset can be moved forward to take up the space. If the supports are too long, the pit wall will have to be chiseled out to accommodate the support flange.

IMPORTANT: Do not drill any anchoring holes in the pit wall or edge until all alignments are completed.

13. Position the front pit edge support panels (two pieces) in front of the pit (Figure 22). Do not secure it to the pit wall at this time. Use this as a reference for setting the deck height of the front cover support.
14. Using the adjustable feet, set the height of the front cover supports so the top rail of the cover support is level with the pit edge and 0.06" *[1.5 mm]* below the top of the pit edge support panels.
15. Assemble the front cover support as shown in Figure 23, ensuring the alignment of the rollset on the V-rails to the side walls is maintained per the dimensions in Figure 2, "AD30 AWD Pit Location," on page 42.
16. Lower the rollset onto the V-rails. Push it forward and backward to confirm the rail alignment.
17. Use a straight edge to determine whether the top surface of the rollset (without the covers) is flush with the pit edge where the covers will sit. If not, adjust the shim heights to reach the desired height.
18. Install the two outside rollset covers to make sure they clear the pit edge rails. Push the rollset forward and backward to see if it maintains the correct alignment and height. Make adjustments as required.

Figure 22. Front Pit Edge Support

NOTE: *If the feet of the front rollset are not dragging on the pit floor, you should be able to move the front rollset fore and aft with about 100 lbs. of force. If you cannot, check for possible interference points and remedy as required.*

19. Secure the front cover supports to the pit wall with 1/2" anchor studs.
20. Tighten all connections on the V-rails and front cover supports.
21. Remove the outer covers off the front rollset and set them aside until later.

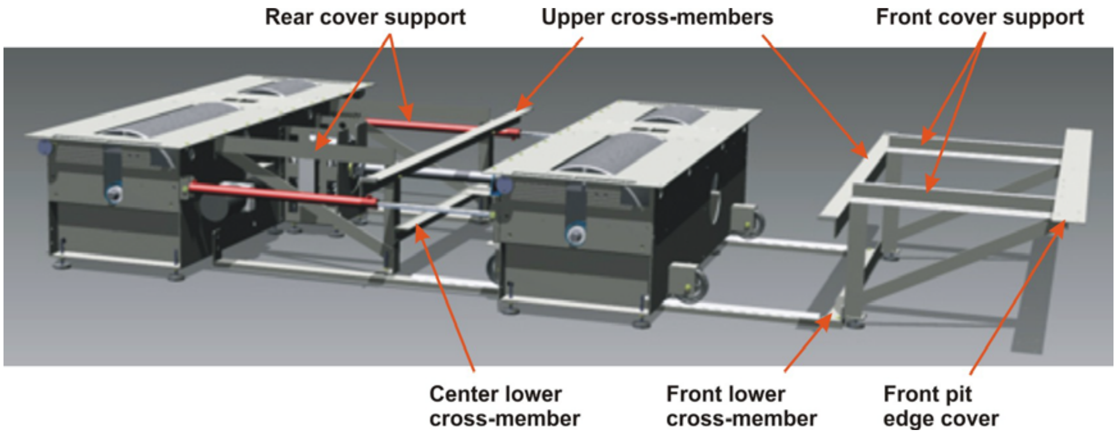


Figure 23. Cross-member Supports

22. Check the side and rear supports on the rear rollset to make sure they are snug against the pit wall. Check all locking nuts on the side supports and leveling feet. Confirm the dimensions between the rollset and pit walls according to Figure 2, "AD30 AWD Pit Location," on page 42.
23. Install the rear rollset outer covers and check for clearance. Adjust if required. Remove the covers when complete.
24. Adjust the leveling feet on the front rollset to 0.12" or 1/8" *[3 mm]* from the pit floor, ensuring clearance as the rollset moves. Adjust the side feet to about 0.20" or 3/16" *[5 mm]* clearance from the pit walls.

NOTE: *The adjustable feet on the front rollset are for safety. They should never contact the pit floor or walls during normal operation.*

25. Assemble the center cover framework as shown in Figure 24.
    - Attach the cover supports to the rear rollset and to the V-rails.
    - Install the lower cross-members between the two vertical support legs.

    Wait until the driveshaft is in place between the front and rear rollsets before installing the upper cross-member.

Figure 24. Center Cover Supports

26. Connect the hydraulic arms from the rear rollset to the front rollset using the bolts that were attached to the arms. From this point on, the front rollset can only be moved by the dynamometer control system.

IMPORTANT: Do not install any covers on the rollsets until the eddy current and driveshaft are installed and plumbing and wiring is done. Wait until the dynamometer is completely installed and checked for proper operation before securing the V-rails to the pit floor.

Eddy Current Absorber Module and Driveshaft

NOTE: *If the eddy current absorber was left attached to the rear rollset and the short driveshaft is correctly installed, skip to step 6.*

1. Locate the eddy current (EC) absorber module.

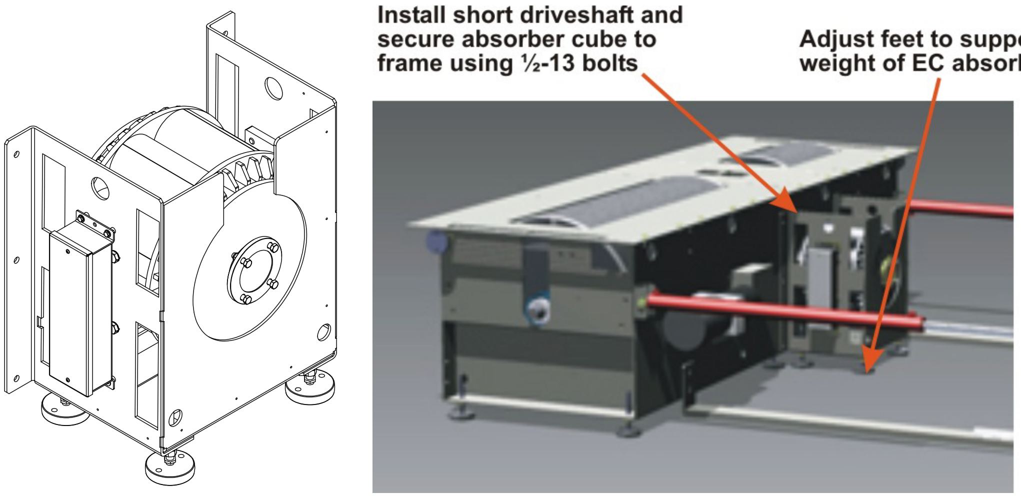


Figure 25. AD-30 Eddy Current

2. Attach a lifting sling to the lift holes, and lower the module into the pit. The module weighs about 700 lbs. (315 kg).
3. Attach the module to the rear rollset with four ½"-20 x 1.25" Hex Head cap screws, lock washers, and flat washers. Do not tighten and leave approximately ½" clearance between the EC absorber module frame and the rear rollset to provide enough room to install the short driveshaft.
4. Verify the "phasing" of the driveshaft U-joints. All driveshafts that utilize U-joint connections should be installed in only one fashion that allows proper alignment or "phase" of the joints. Any other fashion of alignment is not correct and can lead to vibration and joint lubrication problems. Figure 26 shows the proper relationship of one end of the shaft with the other.

Figure 26. Typical AutoDyn Driveshaft with the U-joints Properly Phased

Dana-Spicer® is a good resource for a more in-depth presentation on drivelines and the need for proper phasing, balancing, and mechanical configurations.

5. Position the short U-joint driveshaft on the rear rollset differential and the EC absorber flange studs. Secure with 1/2″ Nylok nuts. Alternatively tighten the driveshaft nuts and the bolts holding the EC housing to the rollset frame.
6. Adjust the support feet under the absorber module to carry some of the vertical load but not put any excessive stress on the bolts holding the module to the rollset frame.
7. Mount the driveshaft center bearing support (Figure 27) onto the lower cross-member using 1/2″ bolts, flat washers, and lock washers. Adjust the height by rotating the base of the support until the base plate is on the pit floor. Do not secure the base to the floor until all alignments are complete.

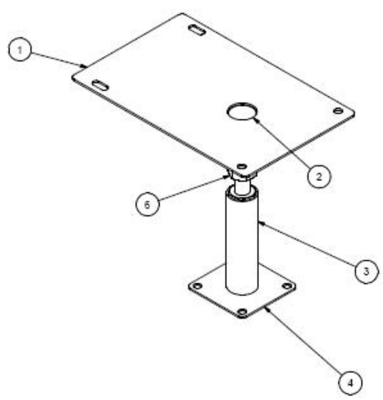


Figure 27. Driveshaft Support

8. Slide the center bearing onto the front rollset driveshaft and set it on the support. Do not secure the bearing to the support until all alignments are completed.
9. Attach the driveshaft to the eddy current absorber front flange and to the front rollset differential flange.
10. Verify that the driveshaft is horizontal and level. The front rollset should move completely forward and backward without the center bearing moving more than 1/8″ vertically. If the driveshaft is not level, check the height alignment of the rollsets.

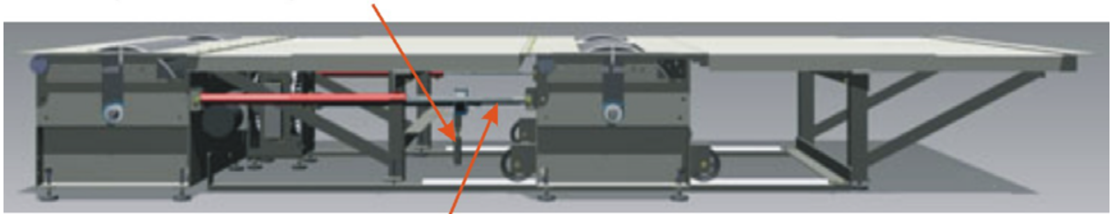


Figure 28. AD-30 AWD AutoDyn Side View

11. Secure the driveshaft bearing to the support plate using 1/2" bolts, flat washers, and lock washers. Do not secure the baseplate to the floor until all alignments are complete.

Plumbing and Wiring

1. Install the pit sump pump and attach the outlet to the drainpipe. Connect the pump electrical wiring to a suitable power source.

NOTE: *Sump pump controls and electrical power are not part of the AutoDyn system and should not be run on the same circuit as the dynamometer or sensor box. See "Pit Drainage" on page 7 for information on sump pumps in the pit.*

Refer to Figure 9, "AWD Electrical Drawing," on page 49 for details on the power, cable, and hose routing.

2. Connect an air line to a 100-psi (600-kPa) filtered air supply. Blow out the air supply piping prior to connecting to the AutoDyn. Route the air to the AutoDyn air inlet on the rear rollset (a 90° elbow may be necessary to clear the pit wall).

See "Air Requirements" on page 15 for information on the AD-30 air requirements.

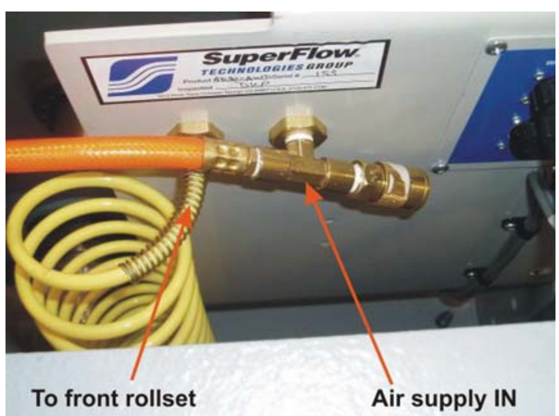


Figure 29. AD-30 Air Line Connection

3. Connect the coiled air hose from the rear rollset air **out** to the front rollset air **in**.

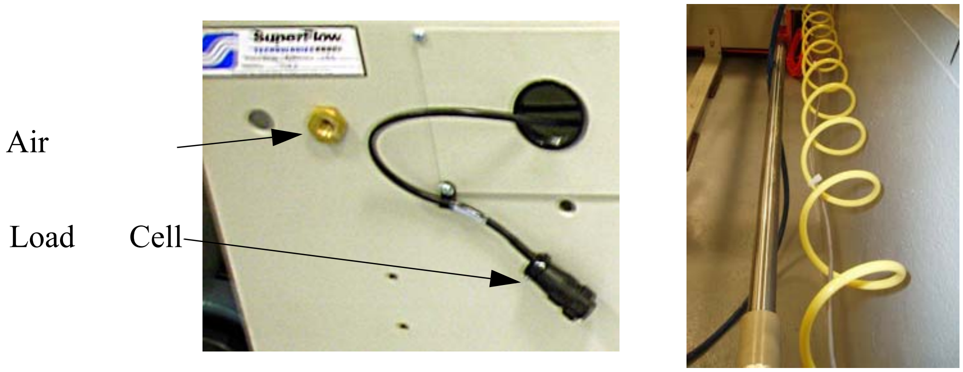


Figure 30. Front rollset cable and air hose

4. Connect the 1200A-2805-AWD cable between the connector labeled **Dyno 2 J2** on the rear rollset interconnect panel and the 1200A-2342-AWD30 load cell cable on the front rollset.

Figure 31. AutoDyn Interconnect Panel

TIP: *It works very well to run the front rollset load cell cable through the coiled air line hose. Zip-tie the cable to the air hose every few feet to protect the cable from damage.*

5. Two cables should be unconnected yet hanging close to the interconnect panel. Connect the 1200A-2374-05 eddy current cable to the connector labeled **Eddy Current J3** and the 1200A-2806-AWD30 FWD/REV cabled to the connector labeled **Wheelbase J1**.

6. Connect a suitable grounding cable between the rollset frame and the copper ground rod embedded in the pit floor. A flat, braided battery cable works well for this purpose.

NOTE: *The rod and cable ensure that the absorber and rollset are properly earth grounded. It also provides protection from static electricity discharges from the vehicle if a grounding cable is connected between the vehicle frame and the rollset frame.*

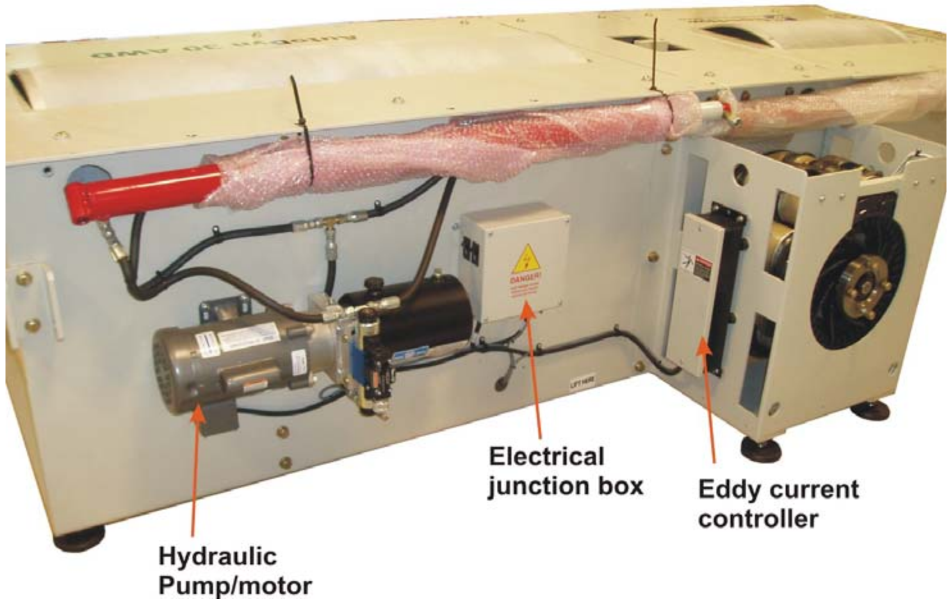


Figure 32. Electrical Controls

7. Referring to Figure 10, “AWD AD-30 Junction Box Assembly,” on page 50, connect the 240VAC or 208VAC 50–60Hz, 50-amp single-phase power line to the junction box on the front side of the rear rollset EC module (shown in Figure 32).
8. If the eddy current controller is not connected, connect the power and control cables as shown in Figure 11, “Eddy Current Assembly Drawing,” on page 51.
9. Locate the AutoDyn control cable supplied with the dynamometer (SuperFlow part number 1200A-2325-03). Note the labels at each end of the cable. Route the end of the cable labeled **AUTODYN** through the 3” conduit or the floor channel and connect it to the connector marked **Sensor Box J4** on the AutoDyn interconnect panel (Figure 31 on page 34). The panel is located on the right side of the rear rollset (looking forward). The other end of the cable connects to the SuperFlow sensor box.
10. Tie all plumbing and wires to the rollset supports so they are protected, but make sure they do not interfere with the movement of the front rollset.
11. Plug the handheld controller into the sensor box.
12. Plug a power cable to the sensor box receptacle on the bottom of the box and to a 115 or 240 VAC power outlet.
13. Turn on the dynamometer 220/240 VAC power
14. Press the white button on the front of the sensor box to turn the power on. Verify the green light in the upper right corner illuminates.
15. On the handheld, press the “A” button (START MENU) to access the operation screen.

NOTE: *If the handheld screen is blank or if the buttons do not respond, contact SuperFlow Technical Support.*

16. Use the handheld controller to test the hydraulic system for moving the front rollset.
    - Press the "C" button (PUMP) to turn on the hydraulic pump
    - Verify that hydraulic fluid is not leaking anywhere in the system
    - Use the "A" (FWD) and "B" (REV) buttons to move the front rollset in both directions to the extreme positions
    - Verify the rollset moves easily with no obstructions
    - Press the "C" button (PUMP) to turn off the hydraulic pump
17. Test the roll lock function:
    - Turn on the air supply to the dynamometer
    - Using the handheld controller, press **RollLock On** - Verify the rolls will not turn.
    - Press **RollLock Off** - Verify the rolls can turn
    - The air supply can be left on or turned off if desired
18. Test the eddy current absorber for proper operation:
    - Press < TEST > < MANUAL TEST> to put the handheld controller in manual control mode.
    - Using the load control positive (+) increment button, apply about 30% load.
    - Listen closely for a "buzzing" sound from the eddy current absorber.
    - Verify that the rolls are very difficult to turn.
    - Return the load control to 0%.

WARNING: Do not leave the dynamometer with load applied when not in use as the absorber coils could overheat and be damaged.

19. The speed sensor can be checked by spinning the rolls manually and watching the **Speed** channel on the handheld. It can take 15 to 20 revolutions for the signal to register at the low speed. Be very careful when doing this as spinning the rolls manually can be dangerous.
20. The torque sensors can be checked by stepping on the load cell mounting blocks located between the rolls and watching the **Trq1** and **Trq2** channels on the handheld, These channels are usually displayed on screen 9 (press the number 9 on the keypad).
21. Press the white button on the sensor box to turn off the power and turn off the AC power to the dynamometer.

Rollset Covers

NOTE: *The cover plates have ½ -13 UNF threaded holes that can be used with eyebolts to aid in lifting the covers with a forklift or engine hoist.*

There are thirty separate pieces that make up the cover plates for the AD-30 AWD dynamometer. Each rollset has three covers. There are twenty-four pieces the cover the pit.

Twelve of the pit covers are stationary and attached either to the rear rollset frame or to the front pit edge. Ten of these have a single lip along the long side on which the adjoining cover sits. The other two are access covers.

The twelve bridging covers are attached to the front rollset and slide over the stationary covers as the front rollset moves. The bridging covers ride on a nylon slide rail that is attached to the lip of each stationary cover.

All of the pit covers will have a lip along the short sides with threaded holes that are use to secure the pit covers to the rollset covers.

Refer to Figure 8, “AWD Cover Plate Locations,” on page 48 for a detailed drawing showing the cover plate locations.

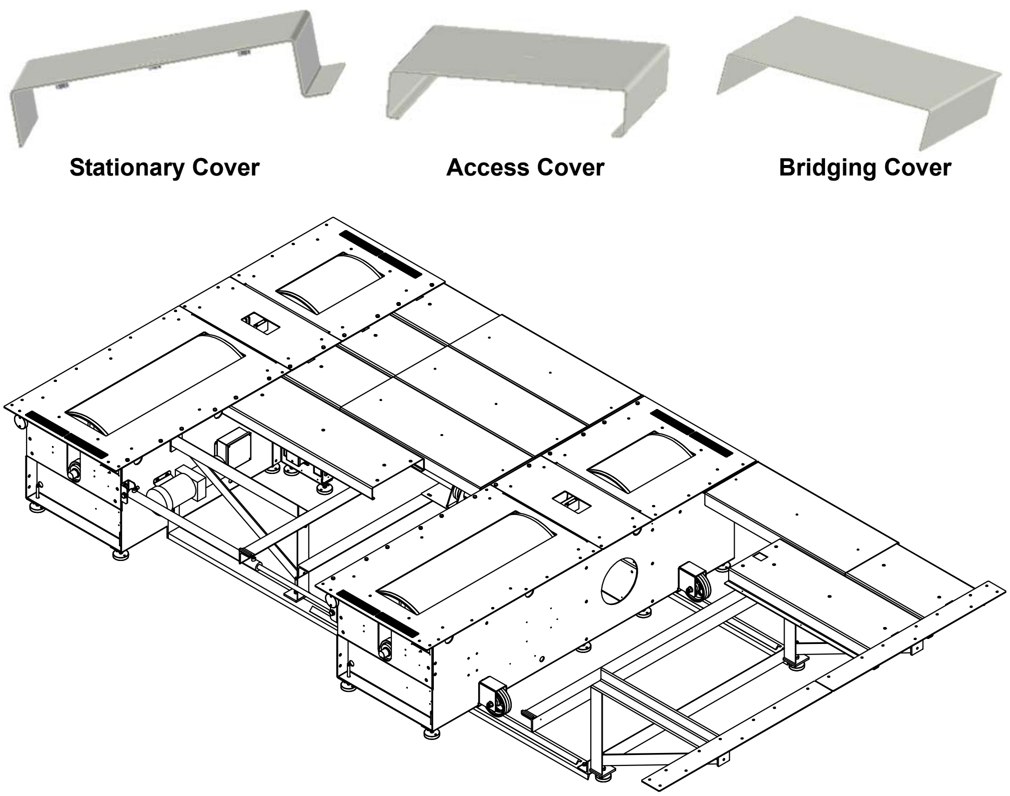


Figure 33. Rollset Covers

1. Install the upper crossmembers on the center cover support and the front cover support if not already done (see Figure 23 on page 30). Tighten all bolts on the cover supports.
2. Install the rear and front rollset covers and secure them with Button Head Allen bolts. Do not secure them to the pit edge until all alignments are completed.
3. Starting with the rear rollset at the long roll side of the pit, install three of the stationary covers (refer to Figure 33 on the preceding page) beginning with the outermost cover. Place the cover so the lip faces toward the center of the rollset. Each adjoining cover will rest on the lip of the first cover. Bolt the covers to the underside of the rear rollset cover using ½ -13 x 1 Button Head Allen bolts. The other end of the cover rests on the center support upper cross-member.

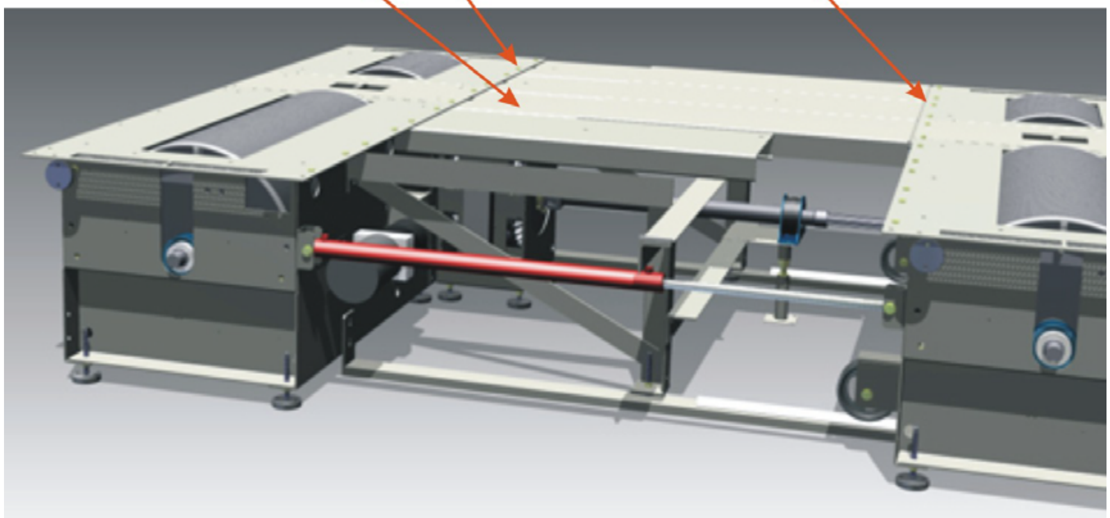


Figure 34. Center Covers

4. Place two stationary covers on the short roll end with the lips toward the center of the rollset. Bolt them to the rear rollset cover.
5. Locate one of the two access covers. Place it in the gap with the edges resting on the lips of the adjoining covers (refer to Figure 34).

NOTE: *SuperFlow recommends locating the access covers adjacent to the dyno driveline to provide access to the dyno electrical, hydraulic, or driveline features.*

---

6. Move the front rollset back far enough so the bridge covers can rest on the stationary covers, making bolting them to the front rollset easier.
7. Place the bridge covers in the grooves between the stationary covers, and bolt them to the underside of the front rollset cover using ½ -13 x 1 Button Head Allen bolts. Make certain the cover edges rest on the nylon slide rails on the stationary covers.
8. Moving the front of the dyno, place the two outside stationary covers on the front cover support frame with the lips toward the center of the rollset. Bolt them to the underside of the pit edge anchor plate (refer to Figure 35). Do not secure the anchor plate to the pit edge until the cover alignment is completed.
9. Move the front rollset as far forward as possible.
10. Set the outside bridge covers in place over the stationary cover. Adjust the alignment of the pit edge anchor plate to allow the proper clearance between the sides of the covers.
11. Set the second two stationary covers in place and bolt them to the pit edge anchor plate. The cover support frame should support these covers.

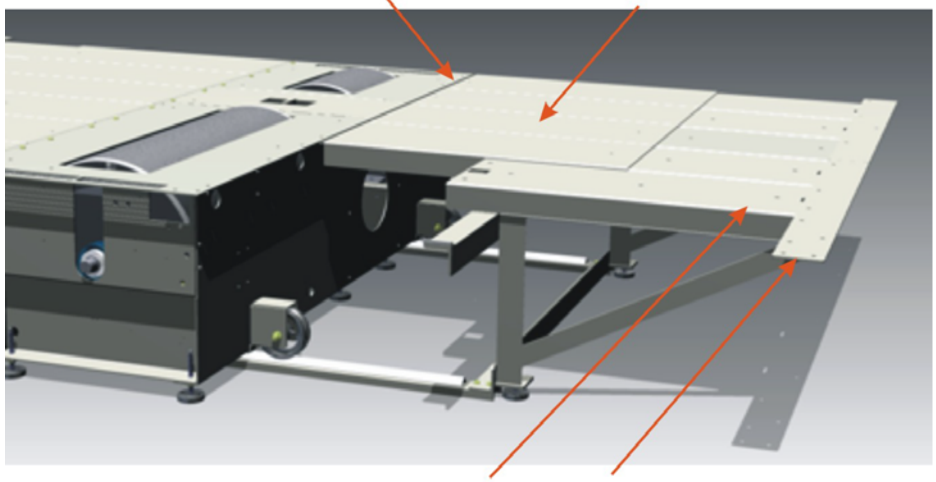


Figure 35. Front Covers

12. Set two more of the bridge covers in place and check the alignment of the pit edge anchor plate. Make sure the front rollset can move all the way forward and back without binding.
13. Secure the pit edge anchor plate to the floor using ½" anchor bolts. Do not use anchor studs because the protruding ends can potentially puncture the tires on a vehicle.
14. Install the remaining covers.
15. Test the dynamometer installation by mounting a vehicle on the rollset and running it at low to medium speeds for about 10 minutes. Remove the vehicle and visually inspect for any signs of movement of the frame or binding of the driveshaft. Move the front rollset through its travel range. Make adjustments as needed.
16. Secure the rear rollset covers to the pit edge. Remove the access covers and secure the V-rail to the pit floor (anchor bolts or welding to the embedded plates). This is not necessary for operation but can prevent the rollset from shifting due to vibration.
17. Secure the driveshaft center support base to the pit floor using ½" anchor studs.

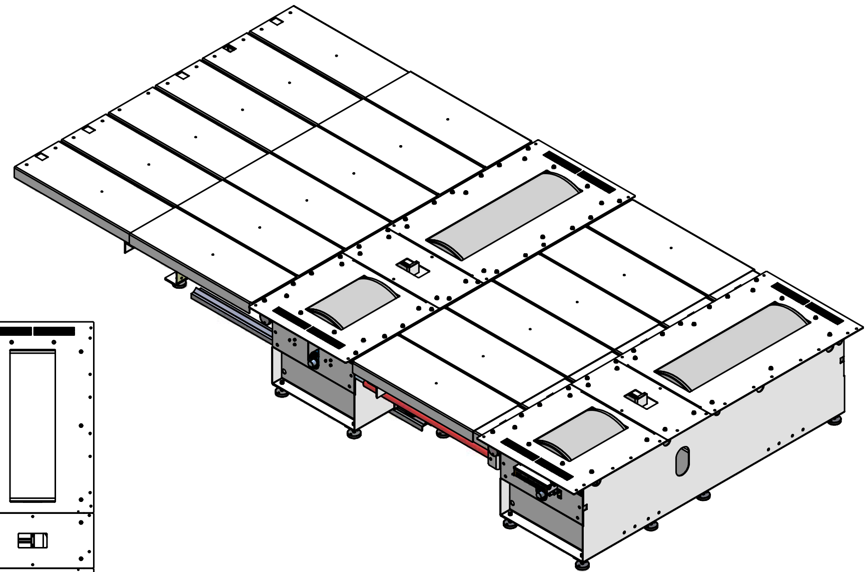
If everything works properly, the AutoDyn is ready for testing.

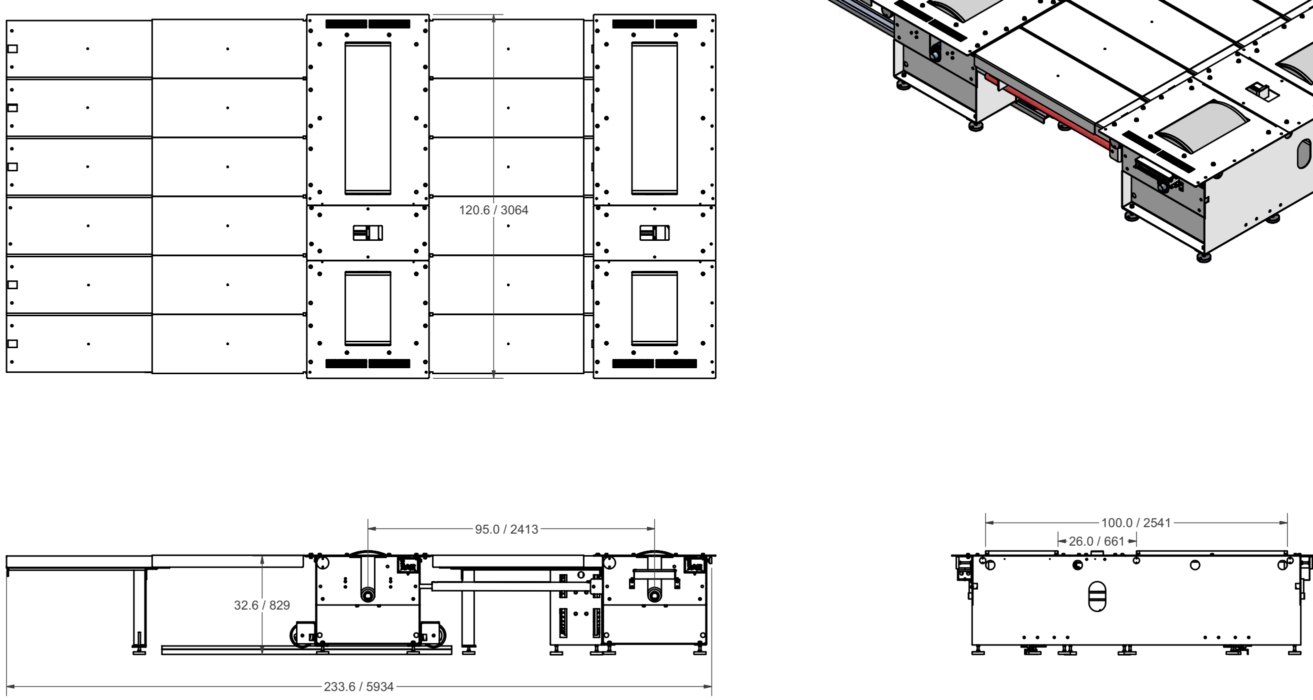
Drawings and Schematics

Drawing 1. AD-30 AWD Dimensions

Parts List

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	Roll Set, 30AWD	Roll Set, 30AWD
2	1	Absorber Assembly 2, AWD	Absorber, Add-on Assembly
3	1	Roll Set, 30AWD- F	Roll Set, 30AWD- F
4	2	2300Z-0366	Rail Track 2
5	4	Wheel, 8x2.5 V groove	Wheel, 8x2.5 V groove
6	4	2300Z-0364	Support, Wheel Assembly 2
7	1	Cover Assembly, AWD Center	Cover Assembly, AWD Center
8	1	Cover Assembly, AWD Front	Cover Assembly, AWD Front
9	2	2300Z-0368	Bracket, Cylinder Mount
10	2	Cylinder Assembly 2.5x48	Cylinder Assembly 2.5x36





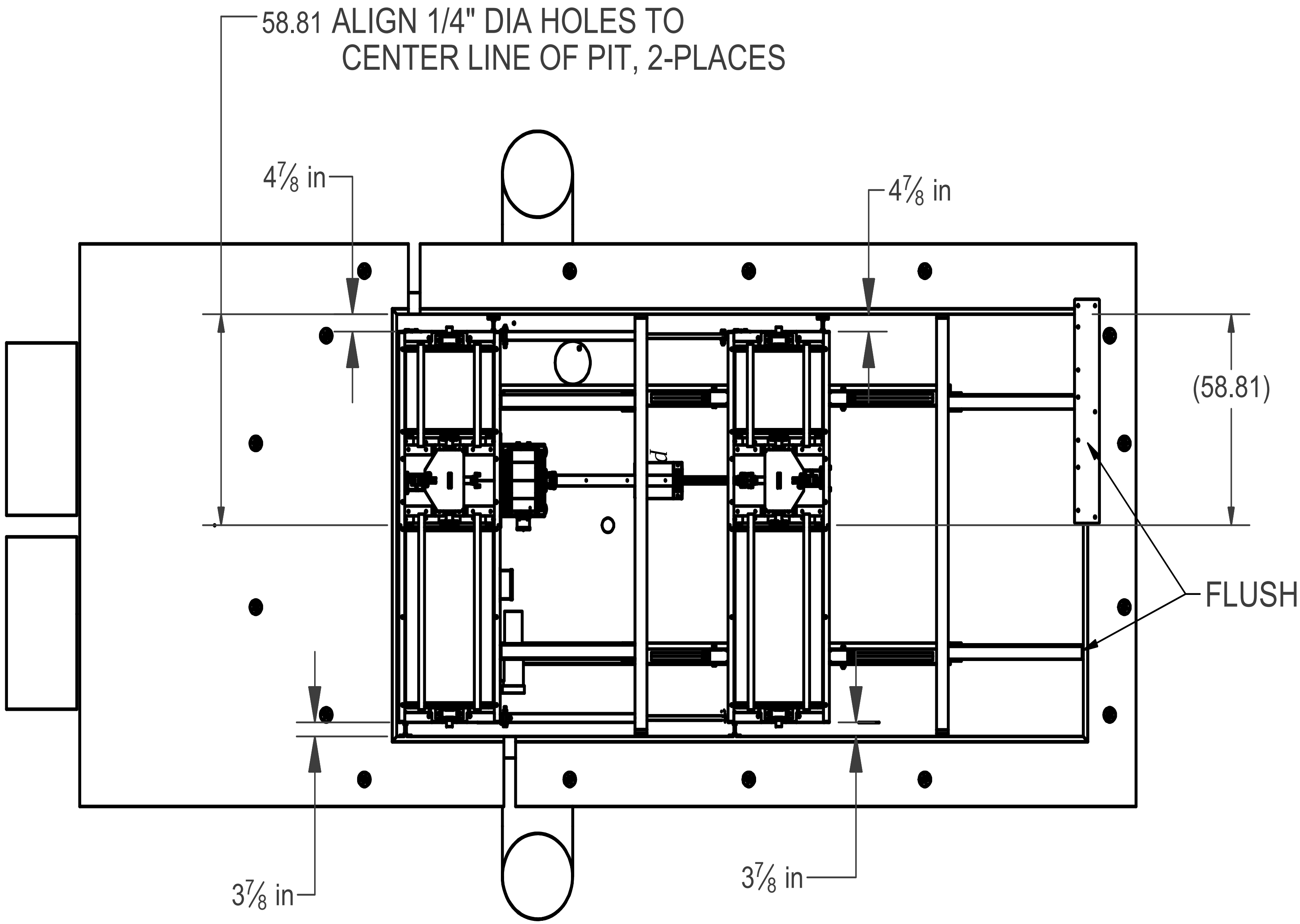
Decimals	+/-
x	.25
x.x	.1
x.xx	.03
x.xxx	.005
Fractions	
Angles	1 deg

All dimensions in inches unless otherwise specified.

Drawn: Neal Williams 1/11/2006
Checked
Approved
Material
Finish
Do not scale drawing

SuperFlow TECHNOLOGIES GROUP
Colorado Springs, Colorado, USA www.superflow.com

Title: **SF30AWD-1**
Part No. SF30AWD-1
Size: C
File Name: SF30AWD-1.iam
Rev: A
Scale
Weight
Sheet 1 of 1

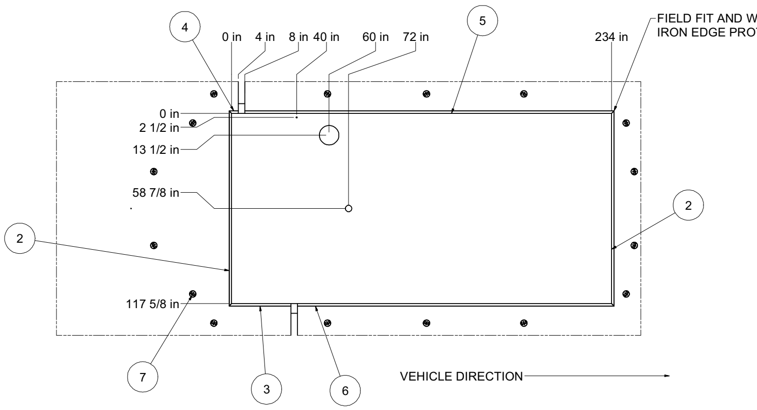


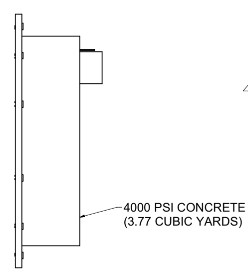
Drawing 2. AD30 AWD Pit Location

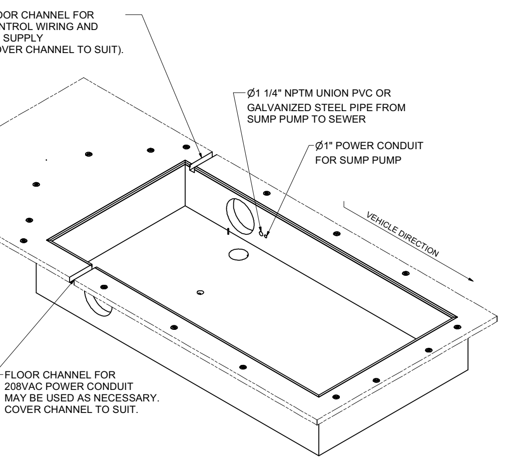
Drawing 3. AD-30 AWD Pit Layout (page 1 of 4)

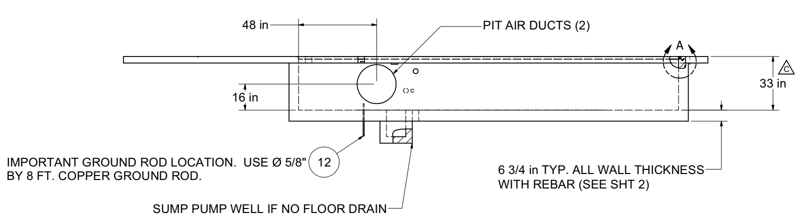
Parts List			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	AD-30 AWD Pit Concrete	4000 PSI CONCREATE
2	2	AD-30 AWD Short Side Pit Edge	3/16 X 1 1/2 X 1 1/2 X 120 5/8" LG. ANGLE IRON
3	1	AD-30 AWD Long Side Pit Edge	3/16 X 1 1/2 X 1 1/2 X 38" LG. ANGLE IRON
4	1	AD-30 AWD Long Side Cut Pit Edge Short	3/16 X 1 1/2 X 1 1/2 X 5.5" LG. ANGLE IRON
5	1	AD-30 AWD Long Side Cut Pit Edge Long	3/16 X 1 1/2 X 1 1/2 X 227.5" LG. ANGLE IRON
6	1	AD-30 AWD Long Side Pit Edge Long2	3/16 X 1 1/2 X 1 1/2 X 195" LG. ANGLE IRON
7	16	Cored Chain Anchor Pot	FLOOR ANCHORE
8	16	Anchor Pot Chain (Not Shown)	3/8" X 6 LINKS LONG
9	20	AD-30 AWD Pit Reinforcement Short	REBAR # 4 X 189 in Lgth
10	11	AD-30 AWD Pit Reinforcement Long	REBAR # 4 X 307 in Lgth.
11	3	REBAR SIDES	REBAR # 4 X 730 in Lgth
12	1	Ground Rod	5/8" X 8 FT. COPPER
13	34	AD-30 AWD Pit Edge Protection Rod	3/8 X 3" "J" BOLT

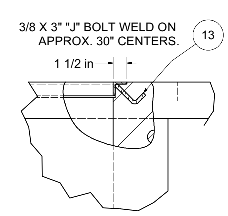
ECO #	REV	REVISION DESCRIPTION	ENG	DATE
	B	REDRAWN IN INVENTOR	FWL	9/16/08
3130	C	33 in was 32 in	FWL	4-9-10











DETAIL A
SCALE 3/16

Notes:

1. The dynamomete pit is a lass 1, Div. II location.
Electrical connections should be made according to local code eq i ements.

2. Install d t fan su h as G ainge P/N 5C516, 72 CFM @ .4" H~2O for adequate ventilation to comply with class 1, Div II eq i ements

3. S mp p mp well or floor drain. Slope pit floor 1/8" / Ft. (1 to 50) to s mp p mp o d ain.

4. Sump p mp G ainger # 3YU67 or equivalent.

Disclaimer:
The ontents of this document are installation suggestions only. All appli able lo al, state, and federal egulations and odes supersede this document. SuperFlow Technologies G oup does not guarantee the ac a y of this do ment and shall in no manner be liable fo any in idental or onsequential damages res lting f om the use or misuse of these installation s ggestions. The e a e no wa anties o liabilities whi h e tend beyond the des ibed s ggestions on the fa e the eof.
For f the details please efer to the Supe Flow Technologies G oup standard limited warrantee.

Decimals	+/-	Drawn cmacwilliam	3/10/2008
x	.25	Checked	
x.x	.1		
x.xx	.03	Approved	
x.xxx	.005		
Fractions		Material	
Angles			
All dimensions in inches unless otherwise specified.		Finish	
		Do not scale drawing	

SuperFlow TECHNOLOGIES GROUP
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www.superflow.com

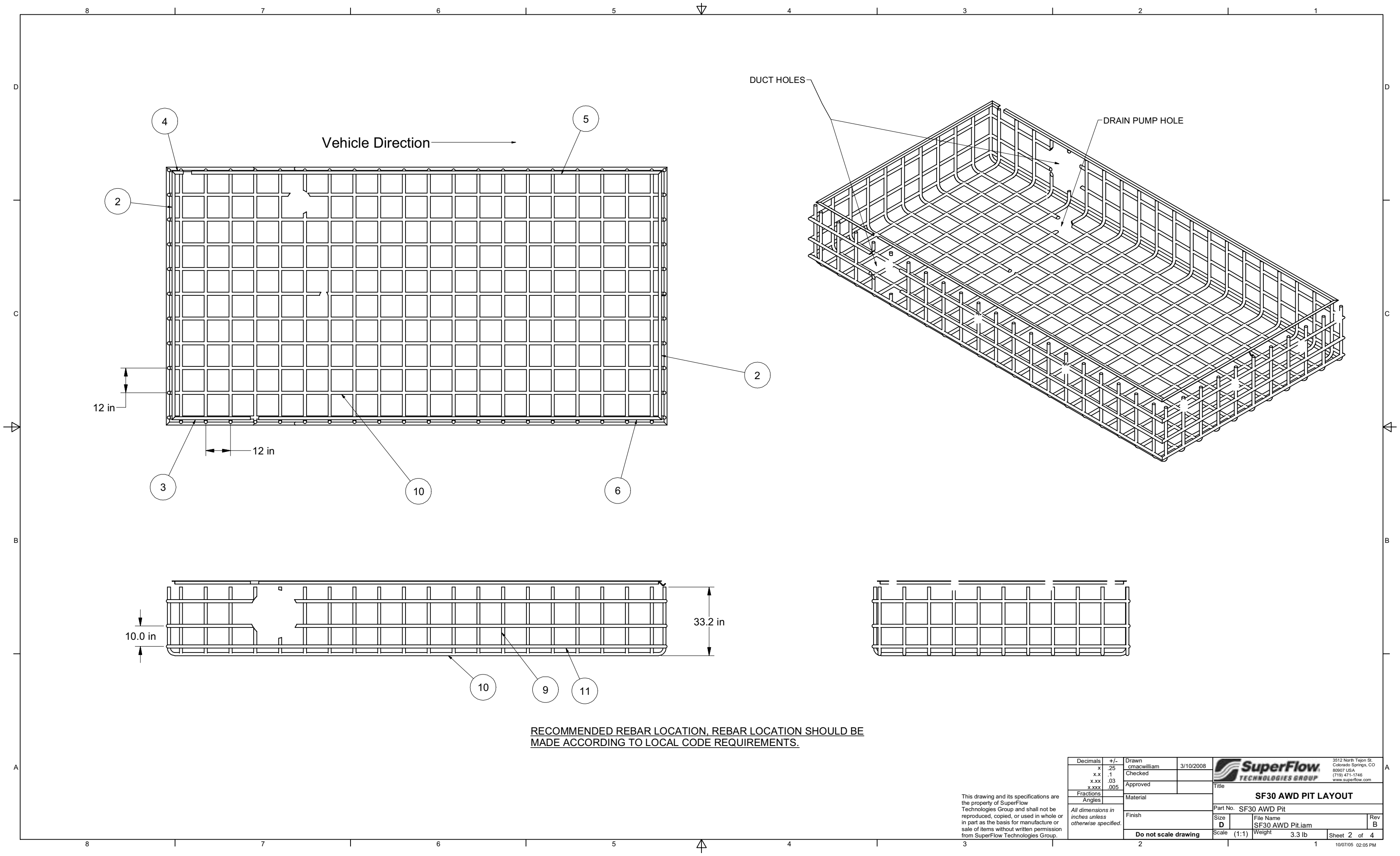
Title: **SF30 AWD PIT LAYOUT**

Part No. SF30 AWD Pit

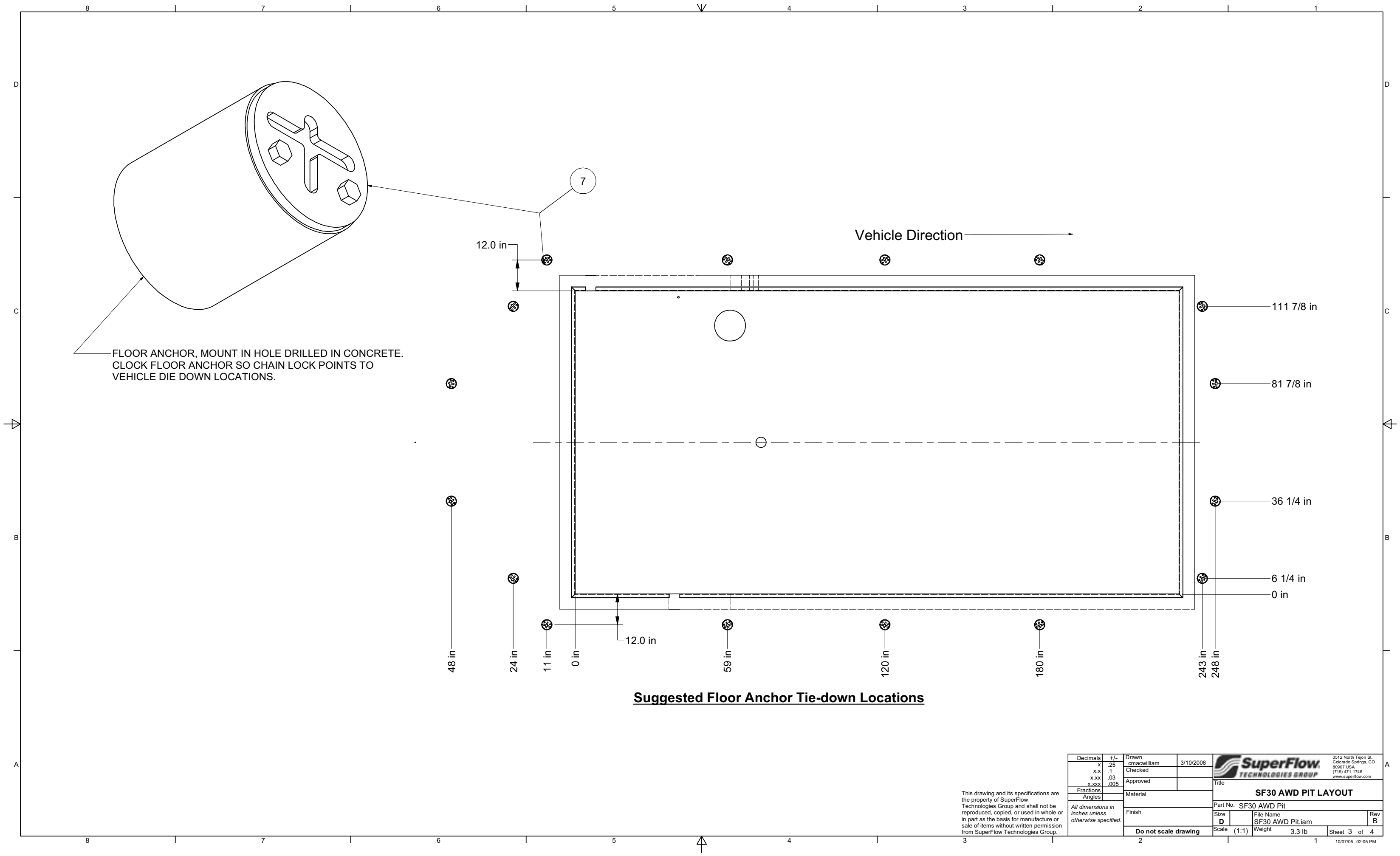
Size	File Name	Rev
D	SF30 AWD Pit.iam	C
Scale (1:1)	Weight 3.3 lb	Sheet 1 of 4

10/07/05 02:05 PM

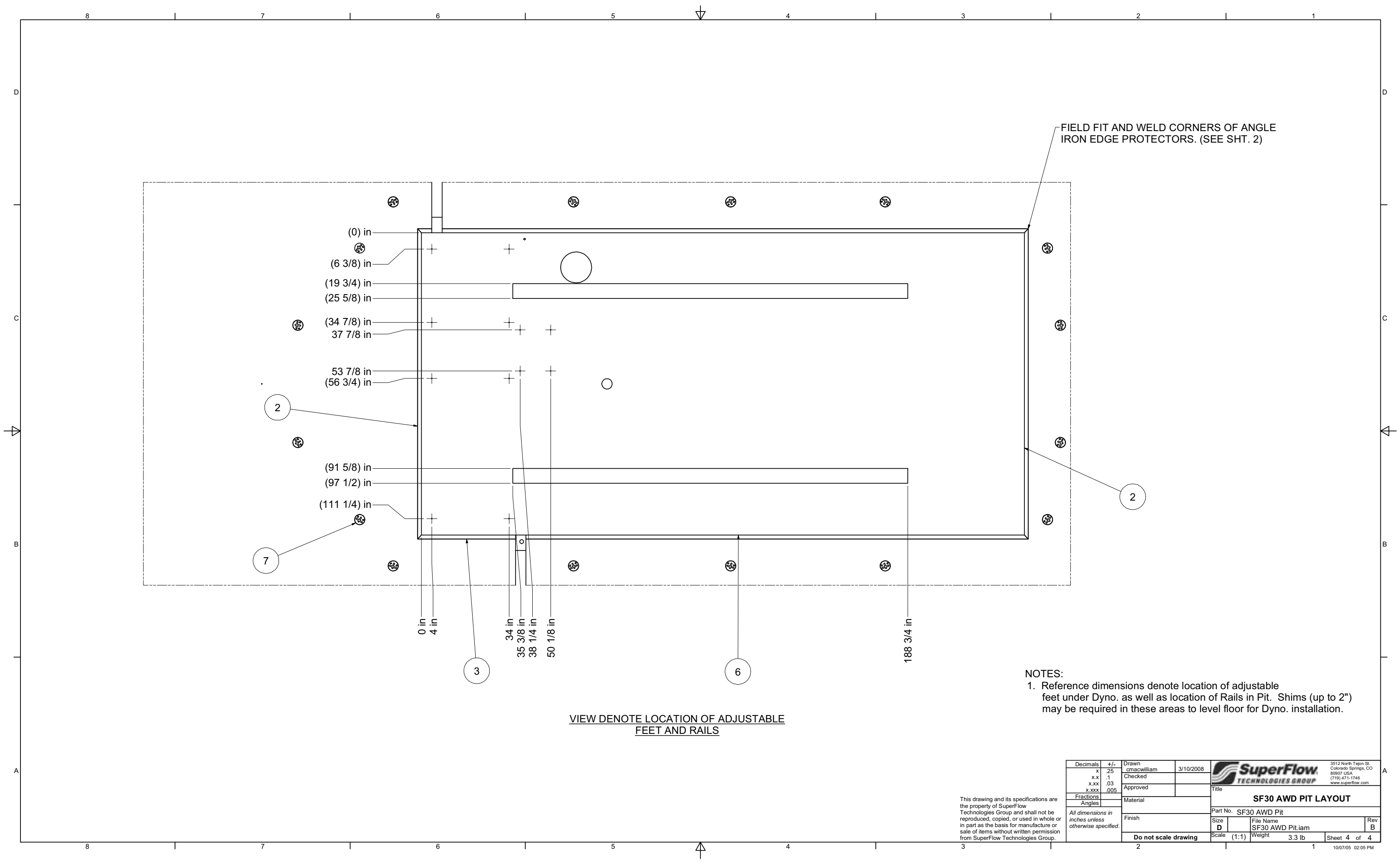
Drawing 4. AD-30 AWD Pit Layout (page 2 of 4)

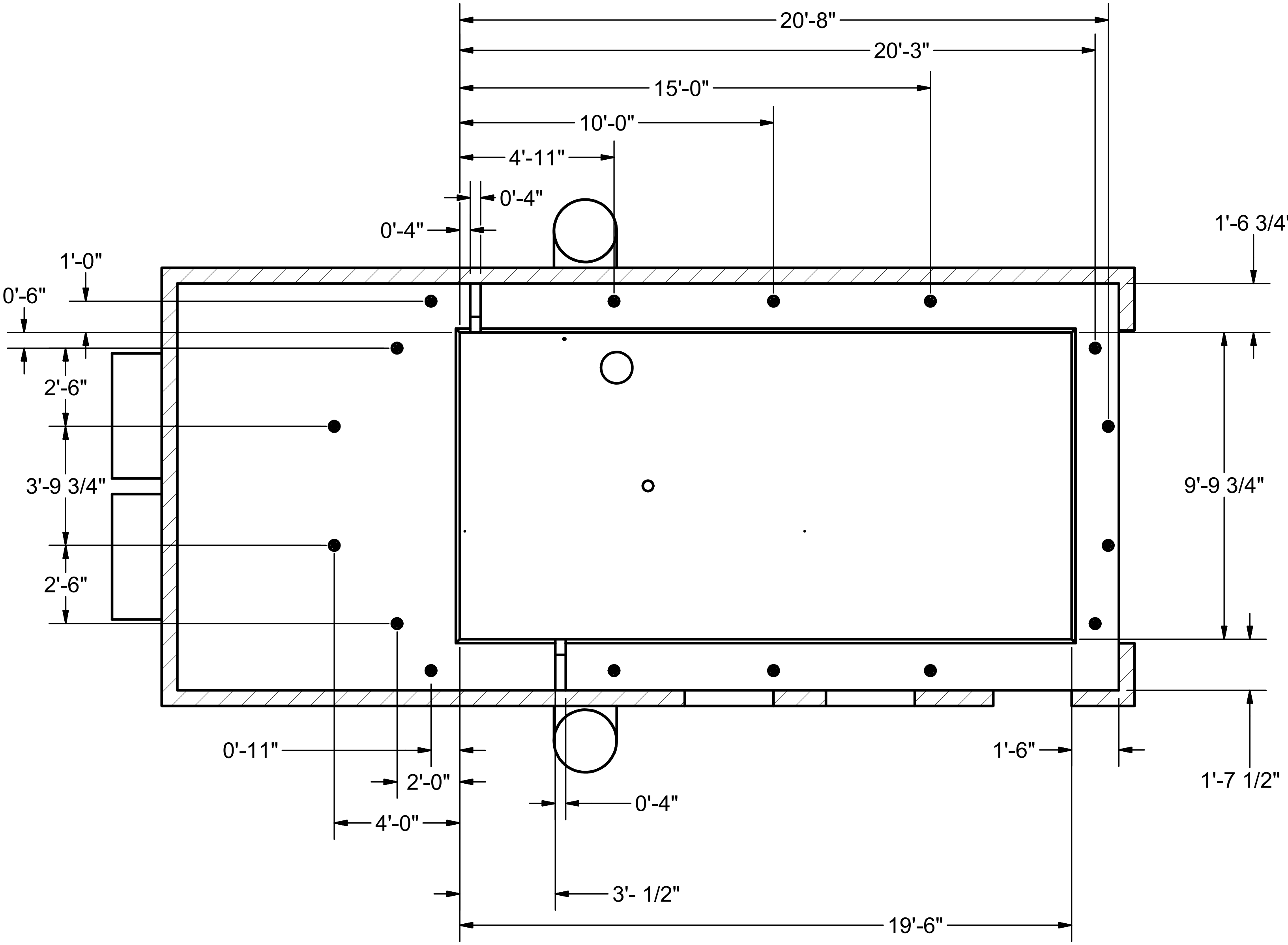


Drawing 5. AD-30 AWD Pit Layout (page 3 of 4)



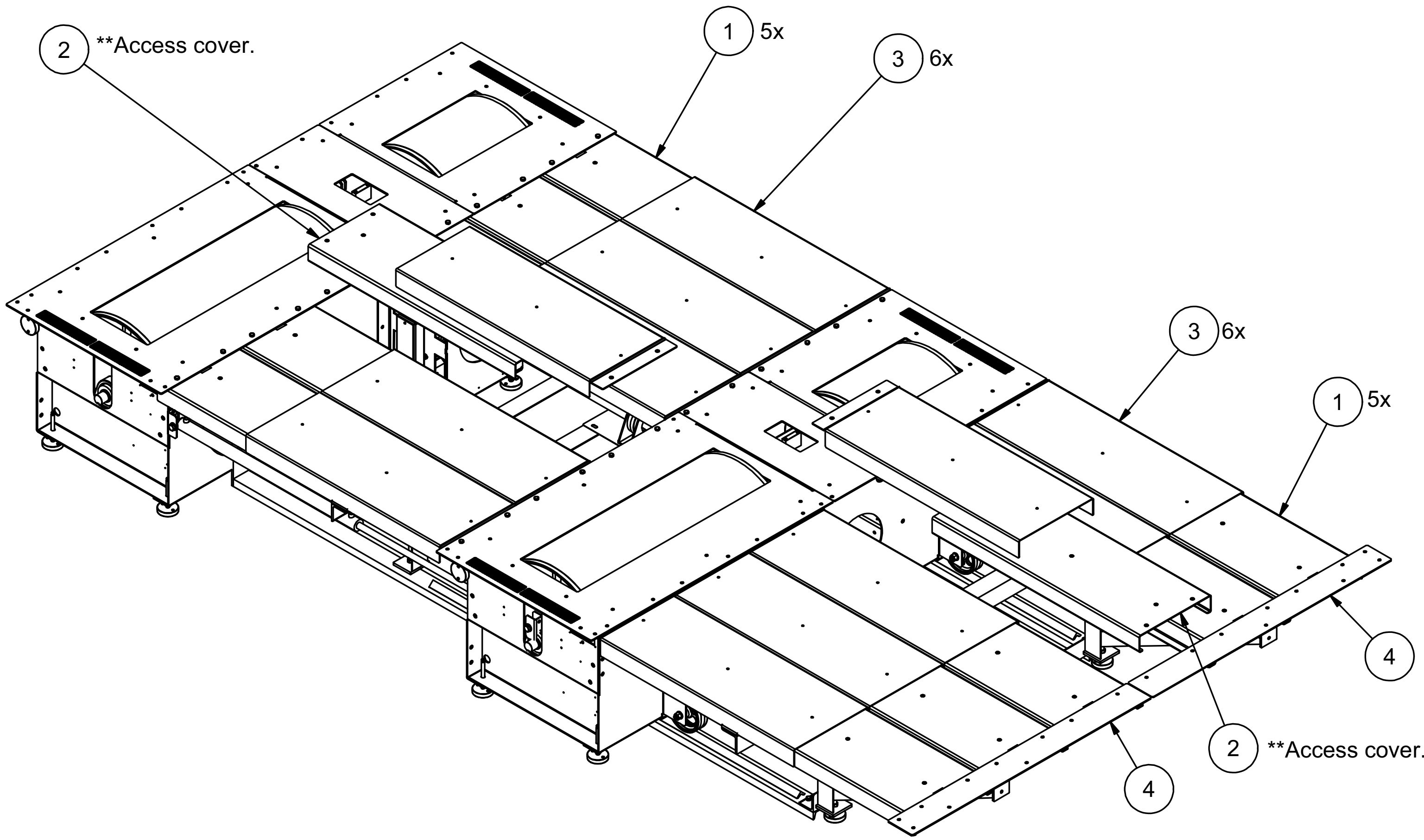
Drawing 6. AD-30 AWD Pit Layout (page 4 of 4)



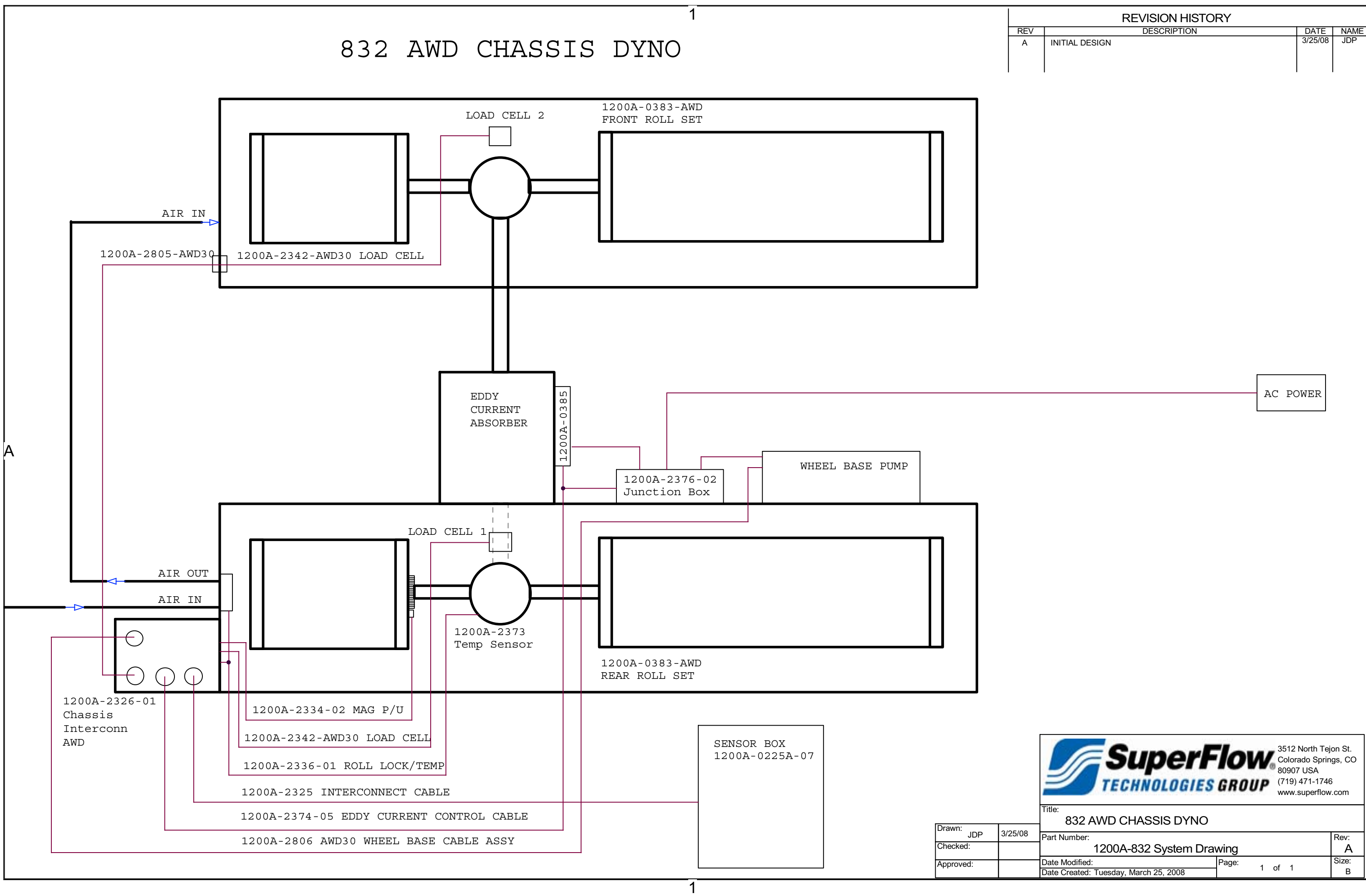


Drawing 7. Vehicle Tie-down Points

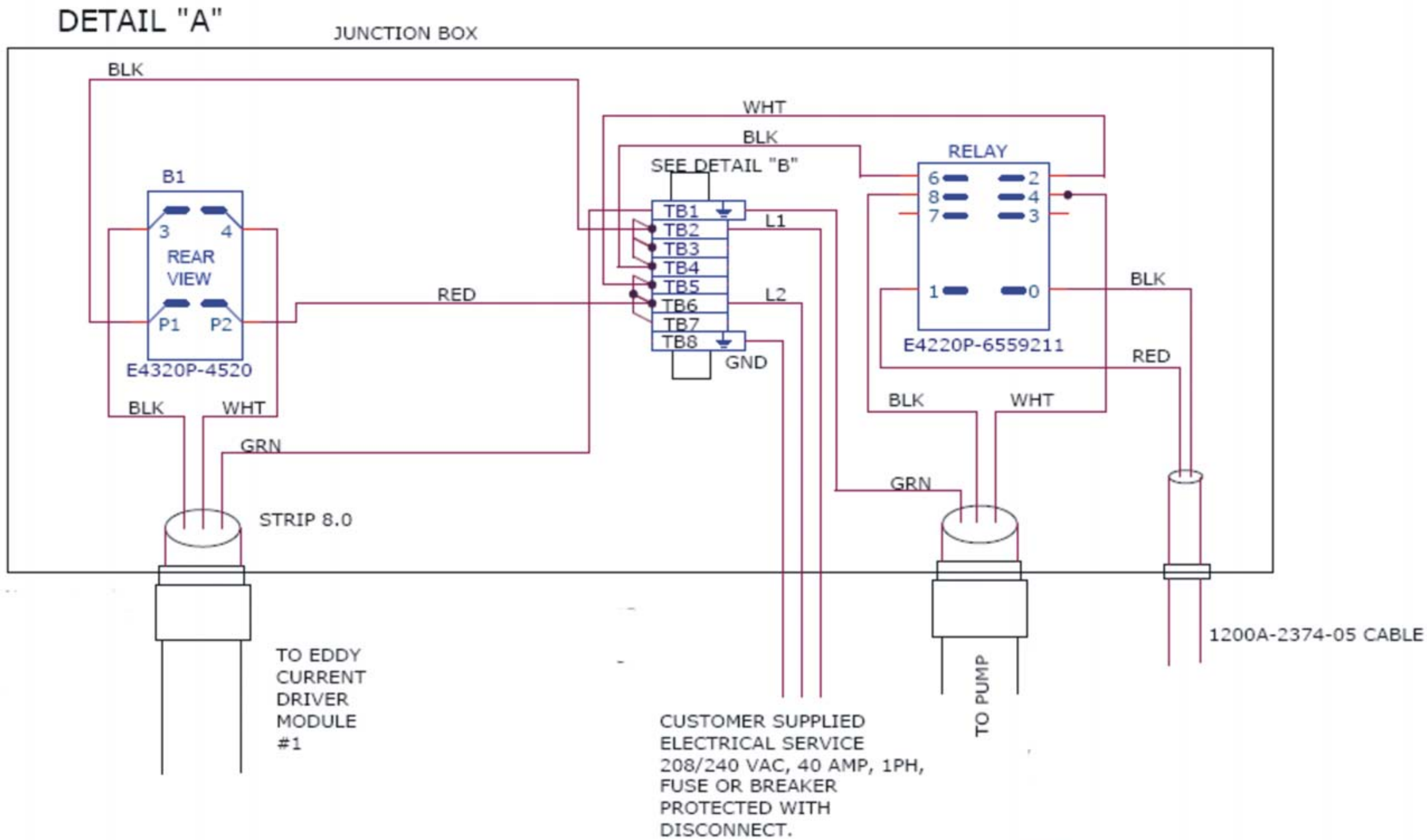
Parts List			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	10	2300Z-0360	Cover, Lower Extension
2	2	2300Z-0365	Cover, Center Lower Extension
3	12	2300Z-0361	Cover, Bridge Gap
4	2	2300Z-0356	Support, Front Edge AWD



Drawing 8. AWD Cover Plate Locations



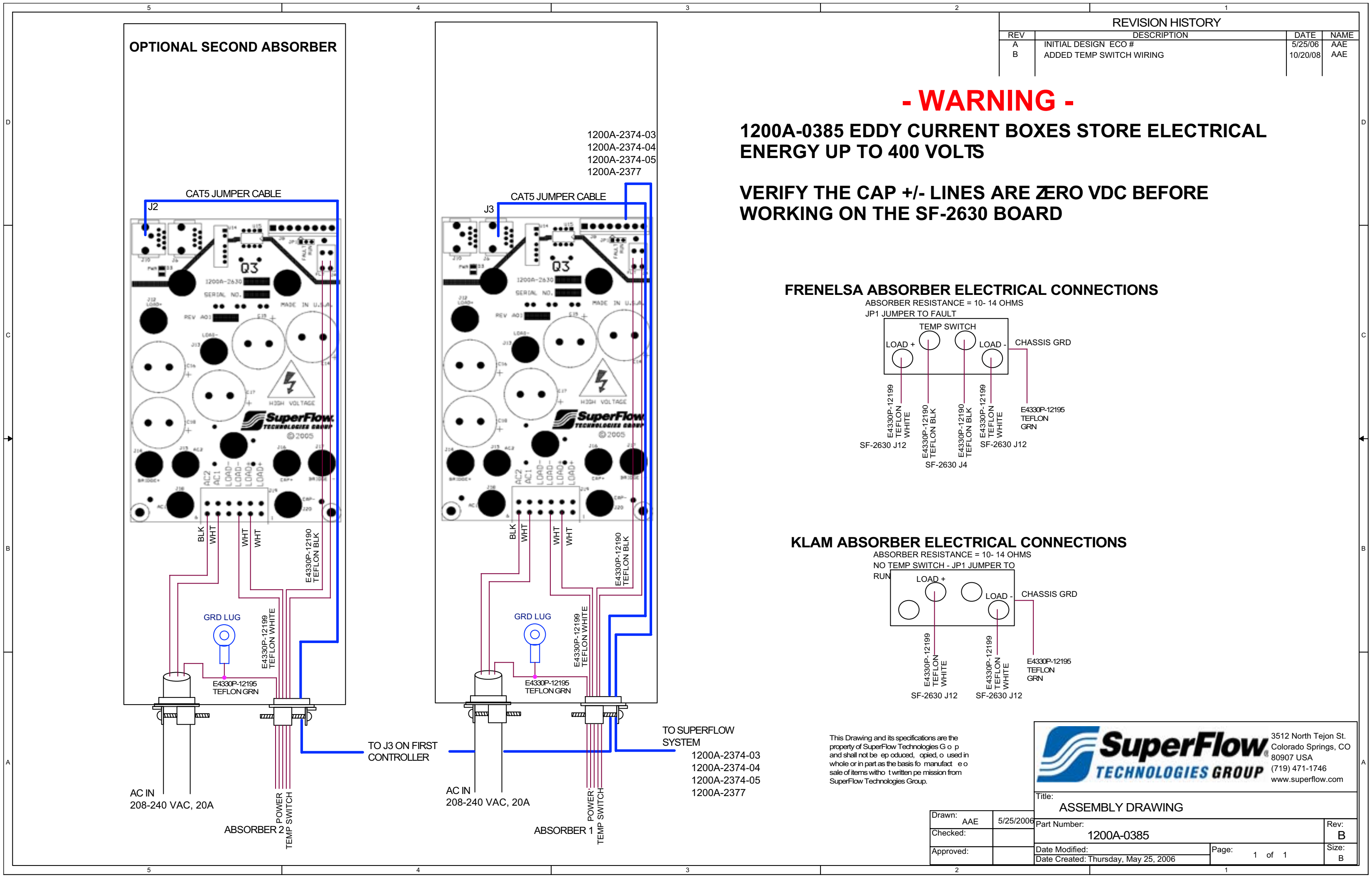
Drawing 9. AWD Electrical Drawing



SuperFlow® TECHNOLOGIES GROUP
3512 North Tejon St.
Colorado Springs, CO
80907 USA
(719) 471-1746
www.superflow.com

		Title: JUNCTION BOX ASSY, AWD30 AUTODYN			
Drawn: AAE	11/25/2007	Part Number: 1200A-2376-02			Rev: B1
Checked:					
Approved:		Date Modified:	Page:	1 of 1	Size: B
		Date Created: Monday, August 24, 1998			

Drawing 10. AWD AD-30 Junction Box Assembly



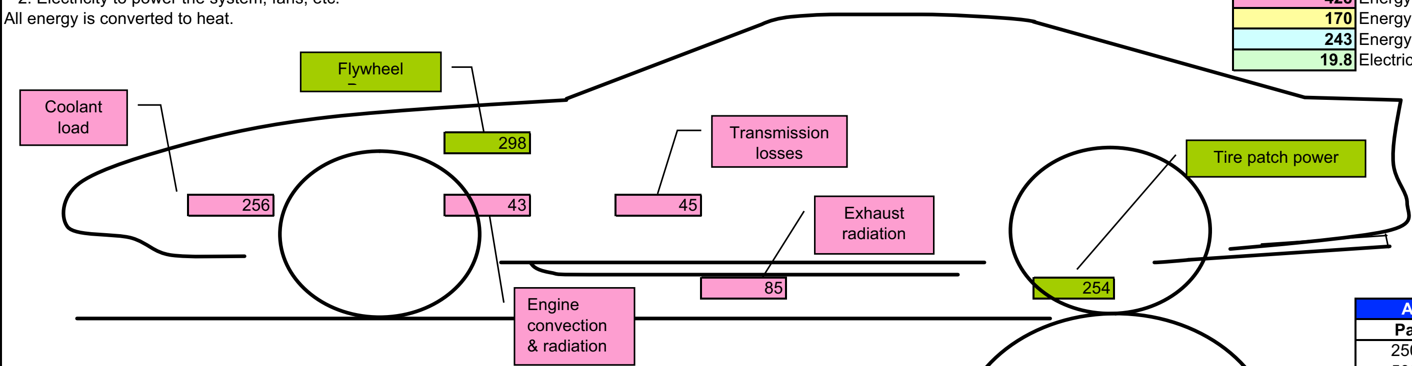
Drawing 11. Eddy Current Assembly Drawing

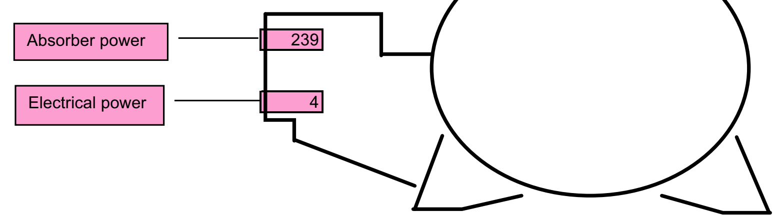
Energy balance on an E/C absorber chassis dynamometer (Metric units)

There are generally two sources of energy flowing into the test room:
1. Fuel.
2. Electricity to power the system, fans, etc.

All energy is converted to heat.

blue	User provided
428	Energy released to test cell air
170	Energy released to exhaust air
243	Energy released to pit
19.8	Electrical power to services





Assumptions

Engine Flywheel Power	298	kW
Transmission Losses	15	%
Dyno losses	15	kW
# of EC absorbers	1	
Services power	4	kW

Total heat load	Room	Pit	Exhaust	
Air	428	257		kW
Exhaust extraction			170	kW
Water	0			kW
Total heat load	428	257	170	kW

Areas

Room width	3.65	m	Vehicle width	1.8	m
Room height	2.44	m	Vehicle height	1.4	m
Room length	9	m	Vehicle cross-section	2.52	m2
Room cross-section	8.906	m2			

Design constants

Mean air velocity in main ducts	20	m/s
Mean air velocity in exhaust duct	22	m/s

Air velocity vs Pressure

Pa	m/s	km/h
250	20	73
500	29	104
750	35	127
1000	41	147
1250	46	164
1500	50	180
1750	54	194
2000	58	208
2250	61	220
2500	65	232
2750	68	244
3000	71	255
3250	74	265
3500	76	275
3750	79	285
4000	82	294
4250	84	303
4500	87	312
4750	89	320
5000	91	329

Cell service requirements

Air	Room	Pit*	
Temperature rise	14	45	degC
Required flow rate	92501	17303	m3/hr
Fan static pressure	250	250	Pa
Duct area	1.28	0.24	m2
Estimated air speed	14	12	km/h
Air changes	19	73	per minute
Fans	2 x 48"	1 x 30"	
Estimated power	14.9	3.7	kW

Total services power 19.8 kW

Exhaust		
A/F ratio	13.5	:1
Exhaust dilution ratio	2	:1
Required flow rate	6304	m3/hr
Estimated temperature	102	degC
Fan static pressure	310	Pa
Duct area	0.080	m2
Fans	1 x 18"	
Estimated power	1.1	kW

Grainger Tubeaxial fans www.grainger.com

Size	m3/h @ 250 Pa	HP	Cost	Part
48"	48,100	10	$ 2,862	7F883
42"	45,300	10	$ 2,462	7F873
36"	25,000	5	$ 1,264	7F862
34"	24,400	5	$ 1,722	7F853
30"	22,300	5	$ 1,485	7F843
24"	13,700	3	$ 1,165	7F832
18"	6,400	1.5	$ 948	7F957
16"	3,200	1	$ 864	7F942
12"	2,900	0.75	$ 730	7F930

These fans produce a sound level of 100-105dB

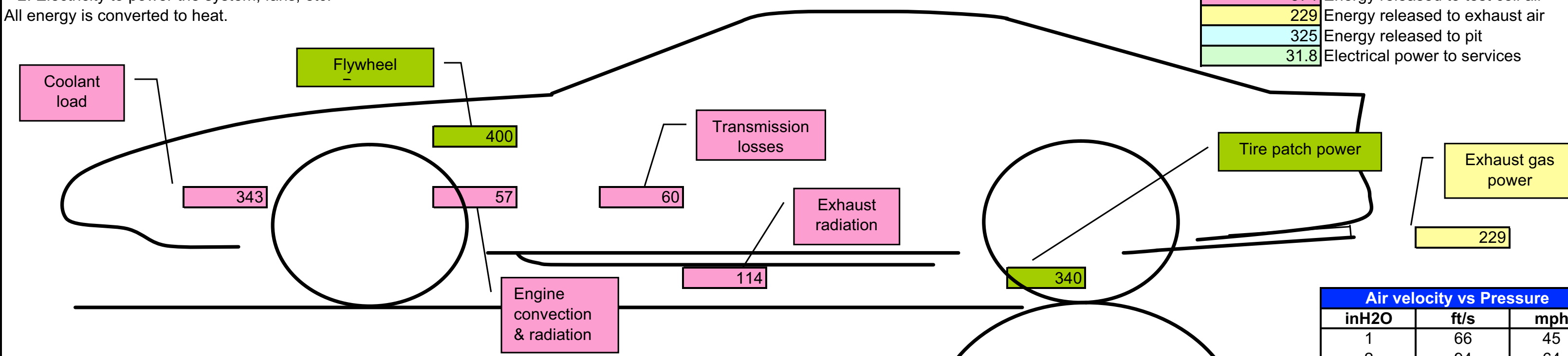
Drawing 12. Energy Balance (Metric Units)

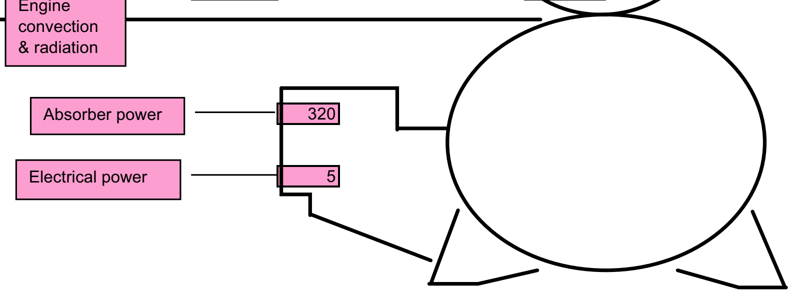
Energy balance on an AWD AD-30 chassis dynamometer (US units)

There are generally two sources of energy flowing into the test room:
1. Fuel.
2. Electricity to power the system, fans, etc.

All energy is converted to heat.

blue	User provided
574	Energy released to test cell air
229	Energy released to exhaust air
325	Energy released to pit
31.8	Electrical power to services





Assumptions

Engine Flywheel Power	400	HP
Drivetrain Losses	15	%
Dyno losses	20	HP
# of EC absorbers	1	
Services power	5	HP

Heat load	Room	Pit	Exhaust	
Air	574	345		HP
Exhaust extraction			229	HP
Water	0			HP
Total heat load	574	345	229	HP

Areas

Room width	12	ft	Vehicle width	6	ft
Room height	8	ft	Vehicle height	4.5	ft
Room length	30	ft	Vehicle cross-section	27	ft2
Room cross-section	96	ft2			

Design constants

Mean air velocity in main ducts	66	ft/s
Mean air velocity in exhaust duct	66	ft/s

Air velocity vs Pressure

inH2O	ft/s	mph
1	66	45
2	94	64
3	115	78
4	132	90
5	148	101
6	162	111
7	175	119
8	187	128
9	199	135
10	209	143
11	220	150
12	229	156
13	239	163
14	248	169
15	256	175
16	265	181
17	273	186
18	281	191
19	289	197
20	296	202

Cell service requirements

Air	Room	Pit	
Temperature rise	25	80	degF
Required flow rate	54821	10301	cfm
Fan static pressure	1	1	in H2O
Duct area	14	3	ft2
Est. room air speed	9	8	mph
Air changes	19	74	per minute
Fans	2 x 48"	1 x 30"	
Estimated power	20.0	5.0	HP

Total services power 31.8 HP

Exhaust		
A/F ratio	13.5	:1
Exhaust dilution ratio	2	:1
Required flow rate	3707	cfm
Estimated temperature	217	degF
Fan static pressure	1.25	in H2O
Duct area	0.9	ft2
Fans	1 x 18"	
Estimated power	1.5	HP

Grainger Tubeaxial fans www.grainger.com

Size	cfm at 1"H2O	HP	Cost	Part
48"	28,550	10	$ 2,862	7F883
42"	26,850	10	$ 2,462	7F873
36"	14,800	5	$ 1,264	7F862
34"	14,445	5	$ 1,722	7F853
30"	13,190	5	$ 1,485	7F843
24"	8,143	3	$ 1,165	7F832
18"	3,803	1.5	$ 948	7F957
16"	1,892	1	$ 864	7F942
12"	1,700	0.75	$ 730	7F930

These fans produce a sound level of 100-105dB

Drawing 13. AutoDyn Room and Pit Airflow (U.S. Units)