Installation MANUAL

PACBRAKE®
ENGINE & EXHAUST BRAKES

DirectMount
EXHAUST BRAKES

APPLICATIONS:

Caterpillar, Cummins, Detroit Diesel, Mack & International

SEE INFORMATION REGARDING PACBRAKE'S AIR COMPRESSOR KIT FOR INSTALLATION ON NON-AIR EQUIPPED VEHICLES. SOME ELECTRONIC ENGINES MAY REQUIRE THE ENGINES ECM TO BE TURNED ON AND DASH SWITCH CONFIGURED FOR EXHAUST BRAKING.

CAUTION: DO NOT EXCEED ENGINE MANUFACTURER'S SPECIFIED BACK PRESSURE.

ENGINE MAKE	ENGINE MODEL	PRESSURE	ENGINE SPEED	SPECIAL INSTRUCTIONS
CATERPILLAR	3116	15	2800	55 PSI for 185-210 HP engines from serial number 2BK30000 and 200-275 HP engines from serial number 2BK25000
	3126	55	2800	
	3126B/E/C7	40	2400	
	3176	30	2100	
	3208T	25	2100	Engines with steel camshaft & roller followers only
	3406/A/B	50	2100	70 PSI with optional exhaust valve springs
	3406E	50	2100	
	C9	60	2500	
	C10	35	2100	
	C11	46	2100	
	C12	35	2100	
	C13	46	2100	
	C15 non-ACERT	50	2100	
	C15 ACERT	64	2100	
	C16 non-ACERT	50	2100	
CUMMINS	855	30	2100	45 PSI with optional exhaust valve springs
	855 Big Cam 400	42	2100	
	N14 Plus	45	2100	
	N14	45	2100	
	B 5.9L	35	3100	60 PSI with optional exhaust valve springs
	ISB (24 valve engine)	60	3100	Dodge pick-up
	ISB (24 valve engine)	60	2900	Medium duty engines built prior to 10/02
	ISB-02 (24 valve engine)	55	2900	Medium duty engines built after 10/02, 230 HP and below, with wastegated turbochargers only
	C 8.3L (12 valve engine)	35	2800	65 PSI with optional exhaust valve springs
	ISC (24 valve engine)	60	2700	With wastegated turbochargers only
	ISL	60	2500	No exhaust brake allowed on 400 HP engines built prior to 10/03
	ISL 03/05	60	2500	With both wastegate and VGT turbochargers
	ISX 99	65	2100	Exhaust brake not permitted on ISX02
	L10/M11/ISM	65	2100	ISM engines - built prior to 10/02 only. Exhaust brake not permitted on ISM02.
	ALL 2007 ISB, ISC, ISL, ISM AND ISX ENGINES HAVE VGT TURBOCHARGERS, EXHAUST BRAKES NOT PERMITTED			
DETROIT DIESEL	Series 40	53		
	Series 50/60	45	2100	
	8.2L	20	2800	Engines built after serial number 8G0150391
FORD	6.6/7.8 Liter	45	2800	Exhaust brake must be mounted more than 42" from turbocharger
	7.3L Powerstroke	32	3400	Same as Navistar T444E
	6.0L Powerstroke	TBA	TBA	Same as Navistar VT365
HINO	J05D-TA	64	3000	4 cylinder
	J08E-TA	57	2600	6 cylinder
ISUZU	6.6L Duramax	55	3400	2004.5+ engines require interface module. See Service Bulletin #170
	7.8L Duramax	59	2700	
MACK	E-7	45	2100	E-7 E-Tech engines limited to 20 PSI
	E-6W, 4 valve	45	2100	
	E-6W, 2 valve	40	2100	Engine must have heavy duty exhaust valve springs
	E-9	45	2100	
	Midliner 200/300	40	2100	
NAVISTAR	DTA 360	38	2800	
	DT 408	56	3000	
	DT/DTA 466	28	2800	52 PSI for engines built after serial number 532980 with upgrade parts available from Navistar
	DT466P	28	2800	Engine Serial #850654 to 925681 52 PSI w/optional exhaust valve spring
	DT466E	28	2800	Engine Serial # 933834 to 966778 52 PSI w/optional exhaust valve spring
	DT466E	52	2800	Engines built after 1/1/04, measured in exhaust manifold
	DT/HT 530/530E	52	2600	
	DT570	52	2800	Measured in exhaust manifold
	HT570	52	2400	Measured in exhaust manifold
	T444E	32	3400	

IMPORTANT CONSIDERATIONS BEFORE STARTING

A. Ensure the exhaust brake unit (DirectMount or downstream) is correct for this application, including the correct engine exhaust valve springs.
CAUTION: Severe engine damage can result from improper application, regarding engine exhaust valve springs. Consult application guide.

B. For downstream mount units, locate brake as close to turbo as possible. Brake unit should be mounted with the main shaft as close to vertical as possible with the air actuating cylinder horizontal.
(Do not exceed 45 degrees) Note: new models may mount in any rotation.

C. For downstream mount units, no flex pipe or clamped joints (other than "V" clamp type) are permitted between brake unit and the turbocharger.

D. If the brake unit is subjected to heavy road spray due to its location, a remote breather for actuating cylinder must be used PN C11020.

E. If the Pacbrake is not preset, a final road test and backpressure adjustment MUST be done to ensure recommended backpressure is not exceeded. This test requires a liquid dampened gauge for accurate setting. Pacbrake Gauge Kit is P/N C10600.

F. For downstream mount units, additional exhaust system support may be required.

G. Ensure the exhaust header pipe is well supported to the engine block. Inadequate exhaust support after the exhaust brake can introduce vibration causing premature wear of exhaust brake components, not covered by warranty.

Allison Automatic Transmissions and your Pacbrake: Trucks and coaches with Allison automatic transmissions will be one of the following Series:

1.) AT Series: Does not have a lock-up torque converter and cannot transmit all of the available retarding to the wheels. Downshifting to raise the RPM will be required to maximize the retarding effect of your Pacbrake. Consult Pacbrake Service Bulletin #124

2.) MT Series: Has lock-up in 3rd and 4th, or 4th and 5th gears, depending on the MT model. Lock-up will provide maximum available retarding to the wheels.

3.) MD Series: Has lock-up in top five (5) gears and when programmed, the MD Series electronic transmission provides preselected downshifting when the Pacbrake is activated. The increased RPM, while in lock-up, provides the best combination for retarding. Programming may be required for the MD Series, please consult the Pacbrake supplement on automatic transmissions or call 1-800-663-0096.

NOTE: This manual covers installation instructions for vehicles with air systems. An auxiliary compressor group is available for non-air equipped vehicles, which has additional instructions for its installation.

Getting Started

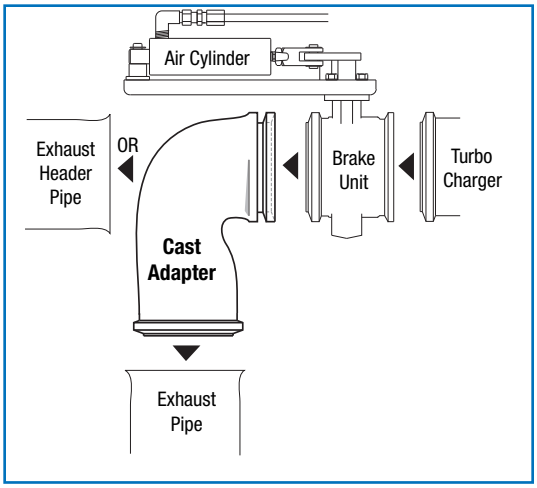
Before starting the installation, please read the installation manual carefully. Make sure you have a good understanding of the requirements and that you have all the necessary parts to complete the installation. If you have any questions, please call 1-800-663-0096.

Important Considerations About Exhaust Brake Mounting

3 types of exhaust brake housing mounting exist.

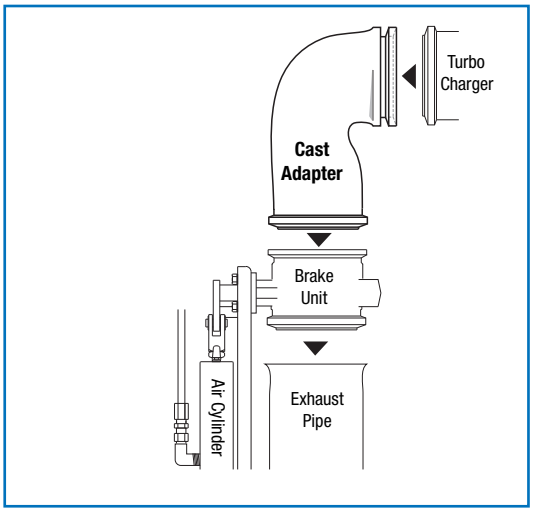
1 **Direct Turbocharger Mounting**

This application is preferred because it has only one connection between the exhaust brake and the turbocharger. The mating surfaces are both machined cast iron, this virtually eliminates any chance of exhaust leaks. This method on some vehicles only requires shortening of the header pipe to maintain an adequate amount of flex pipe. Pacbrake offers replacement header pipes for some model trucks.



2 **Mounting at the end of Pacbrake's "CobraHead"**

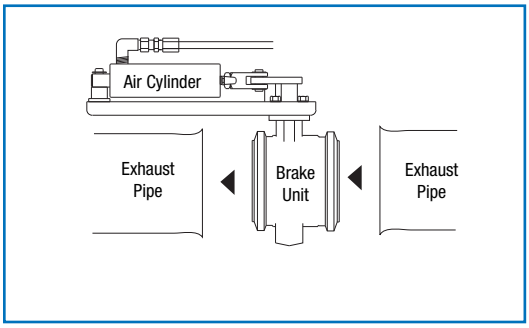
This application is the best option for vehicles with a tight 90° bent header pipe after the turbocharger. The "Cobra Head" is cast iron and has machined mating surfaces virtually eliminating any chance of exhaust leaks.



3 **Inline Mounting**

Some vehicle configurations do not have clearance around the turbocharger to install a direct exhaust brake, these require an inline mount. This model requires a minimum of 7" of straight exhaust pipe which is then cut and exhaust flange adapters installed. This method should be mounted as close to the turbocharger as possible and away from road spray.

NOTE: Clamped Joints that exist between the brake and the engine must be welded to ensure that joint cannot separate or leak under pressure and no flex pipe is allowed between the exhaust brake and the turbocharger.



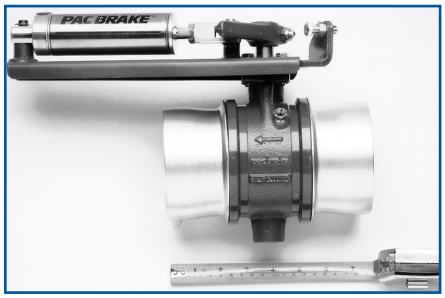
Cobra Head Exhaust Adapter Applications

PART NUMBER	DESCRIPTION	SAMPLE APPLICATIONS
C11969	Caterpillar Direct Mount 4" Full Marmon inlet with 4" OD flex slip on outlet.	Cat 3116/3126/3126B, E/C7 & Cummins ISC/ISL
C11970	Caterpillar Direct Mount 4" Full Marmon inlet with 4" Full Marmon outlet.	Cat 3116/3126/3126B. E/C7 & Cummins ISC/ISL
C11982	Cummins Direct Mount 3.5" Half Marmon inlet with 4" Full Marmon outlet.	Cummins ISC/ISL
C11985	Navistar Direct Mount 3.5" Full Marmon inlet with 3.5" pipe slip in outlet.	Navistar 466/530
C11986	Cummins Direct Mount 3.5" Full Marmon inlet with 4" Full Marmon outlet.	Cummins ISC/ISL

NOTE: If you do not see your application above please call for technical support or instructions on how our engineers can custom design adapters to meet your needs.

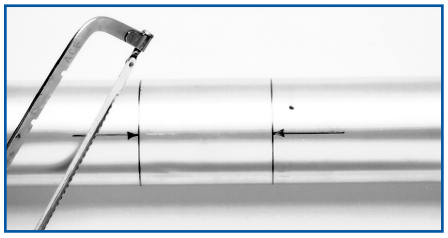
1 Inline Mounting

FOR DIRECT TURBO MOUNT INSTALLATIONS, PROCEED DIRECTLY TO STEP 5.
With the exhaust brake on the bench, loosely attach the exhaust pipe adapters provided, and make a measurement to determine the length of vehicle exhaust pipe to be removed. The adapters are expanded to slide over the existing exhaust pipe—consider this in your measurement.



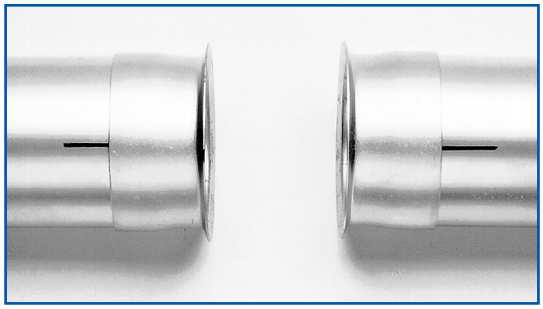
2

The brake location on the vehicle should allow for upright positioning (air cylinder at the top with the main butterfly shaft vertical) and a location away from dirt and road spray. Transfer the brake/adapter measurement to this location and mark the exhaust pipe. Remove the exhaust pipe and cut the pre-marked section.
NOTE: In some cases, the cutting and welding of exhaust systems can be done without removing the pipe sections from the vehicle.

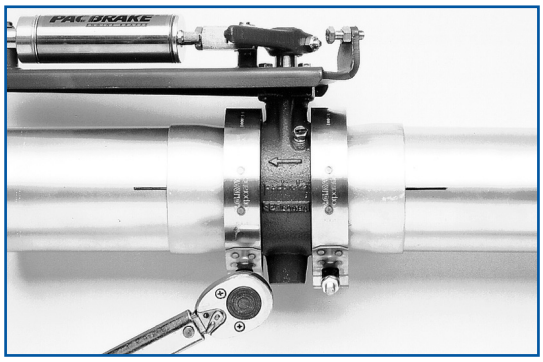


3 Clamp and tack prior to final welding. Weld the adapters to the sections of pipe, being careful to maintain the proper length and angles that exist. Welding can be done on the outside or the inside of the adapter, but it must be leak free.

NOTE: Clamped joints that exist between the brake and the engine must also be welded at this time to ensure the joint cannot separate or leak under pressure.

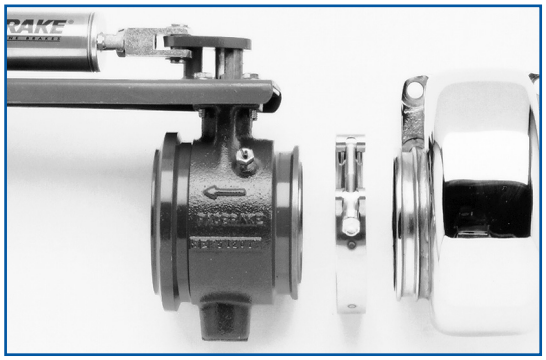


4 Reinstall the front section of pipe on the engine. Torque turbo clamp to engine manufacturers specification. Center brake and tighten clamp on the exhaust brake pressure side. Install the rear section of pipe and loosely clamp. Check alignment of all sections and joints and torque "V" clamps to 10 FT.LBS.



5 ## Direct Turbo Mount

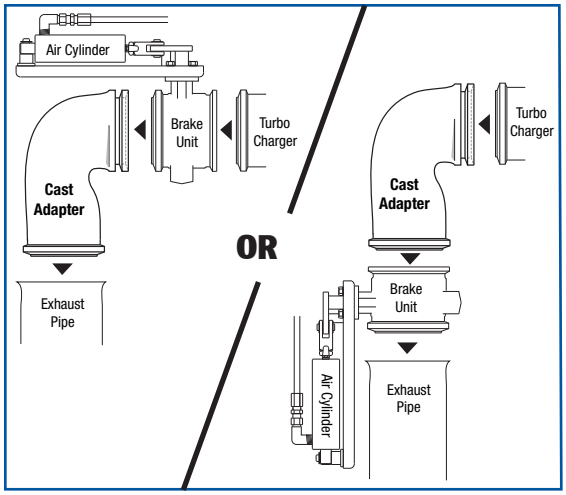
Remove the turbo "V" clamp and the exhaust header pipe from the turbocharger. Inspect the sealing face of the turbo for carbon deposits or other imperfections. If necessary, clean or repair to assure a good seal will be made as no gaskets are used. Using the new "V" clamp supplied, loosely install the exhaust brake to the turbocharger, align the header pipe/exhaust system to the outlet of the exhaust brake. With the exhaust brake and system aligned, torque the "V" clamp to the specifications below, (some applications reuse the existing turbocharger "V" Clamp)



	Turbo Clamp Torque	Header Pipe Torque
All 5" DirectMount® Models	15 ft.lbs.	15 ft.lbs.
Caterpillar 3116/3126	15 ft.lbs.	15 ft.lbs.
Cummins B Series	6 ft.lbs.	15 ft.lbs.
Cummins C Series	12 ft.lbs.	15 ft.lbs.
Navistar	15 ft.lbs.	15 ft.lbs.

6 Direct Turbo Mount Using A Cobra Head

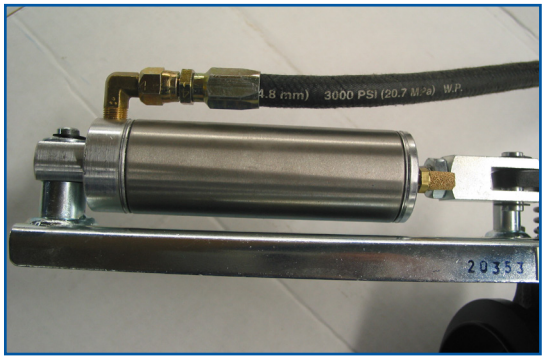
Loosely install either the exhaust brake or the cast adapter to the turbocharger outlet using the "V" clamp supplied. Align the exhaust brake and cast adapter to the exhaust system, then torque to the "V" clamps to the specifications in step 5. The exhaust system must be well supported due to the additional weight of the cast adapter. Cummins "B" series engines may use a spherical ball outlet flange. Torque the two metric cap screws evenly to 25 ft.lbs



Note: For control System Installations using Pacbrake's Auxiliary Air Compressor and Valving Group, refer to instructions contained in that group from this point on.

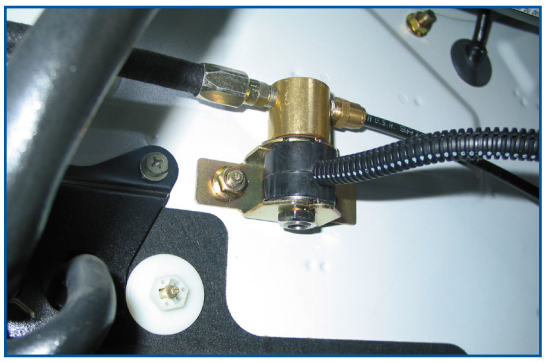
7

Determine the length of wire braid hose required to connect the solenoid valve's "cyl" port to the exhaust brake air cylinder. Install the fittings supplied into the wire braid line, using air pressure blow the line out from each end to remove debris from the line before installing. Once installed, secure away from heat sources and moving objects that could damage the air line.



8

Choose a clean and dry location to mount the solenoid valve, mounting must be with the exhaust port pointing down. Source reservoir air from the vehicles DRY tank. Using the fittings and nylon tube provided, plumb reservoir air to the port marked "IN" of the solenoid.



9 Electrical Installation

Every vehicle has different exhaust brake interface requirements depending on the optional equipment, type of engine, transmission and anti-lock brake systems. It is impossible to provide a wiring schematic for every combination of engine, transmission and anti-lock braking systems available on trucks today. It is also impossible to keep up with the rapid changes to vehicle electrical systems. Some vehicle OEM's require the electronic control module to be turned on, some also require the dash switch be enabled, they do charge to perform the turn on at no preset cost. If you decide to interface with the VOEM wiring, it would be expedient to contact the vehicle manufacturer with the VIN# for their version of the exhaust brake wiring.
Upon request Pacbrake can provide a wiring schematic for most engine and transmission combinations but cannot held responsible for it's compatibility with the VOEM.

The schematics provided in this manual are generic samples to meet the minimum requirements for exhaust brake operation.

Please consider the following requirements for exhaust brake actuation, choose which systems meet the customers needs.

1) The exhaust brake should have a throttle switch or throttle switch relay, in order to prevent the exhaust brake from being applied when the engine is under power.
2) The exhaust brake should have a cruise control relay installed, or means to prevent the exhaust brake from being applied when the engine is under power.
3) The exhaust brake must have an ABS (anti-lock brake) disable relay installed if equipped with ABS, or means to turn the exhaust brake off if wheel skid occurs.
4) If exhaust brake is installed on a vehicle with an Allison electronic transmission it must be interfaced, in order to provide the torque converter unlock feature and automatic downshifting.
5) The exhaust brake to be used as a warm-up feature requires a special dash switch and an additional relay in some cases.

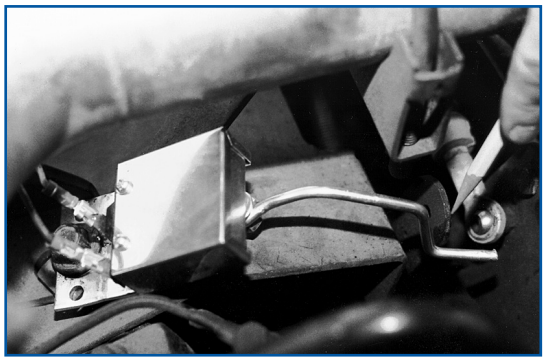
The choice of the electrical actuation system should be discussed with the vehicle owner prior to starting the installation. The VOEM integrated system provides the most seamless interface with the other vehicle features, but is by far the most difficult and costly to install. The basic schematics provided in this manual are simple to install and are the most cost effective to the customer. Pacbrake technical service will assist you in choosing the correct control group for your choice of actuating system should you have difficulty.

Electrical Installation Instructions

10a **THROTTLE SWITCH INSTALLATION (mechanical engines):**

This system requires installing a dash switch in a convenient location for the operator. Mount the throttle switch so the switch actuating arm is contacted by the throttle linkage. Adjust the throttle switch so that the arm is contacted and the switch "clicks" (closes) when the throttle is within 1/4" of its totally closed position.

NOTE: This group contains a dash and throttle switch. See schematic B.
The mounting of this switch varies between engine types. It is permissible to bend the switch arm to achieve proper adjustment.



10b **OPTIONAL FOOT SWITCH GROUP INSTALLATION:**

Mount the electrical foot switch in a convenient location on the floor for actuation by the driver's right or left foot. The foot switch is the only switch in the exhaust brake system required to achieve retarding mode.

See Schematic "A".

Note: This system should have a switch or relay installed to prevent the exhaust brake from being applied when the throttle is depressed.

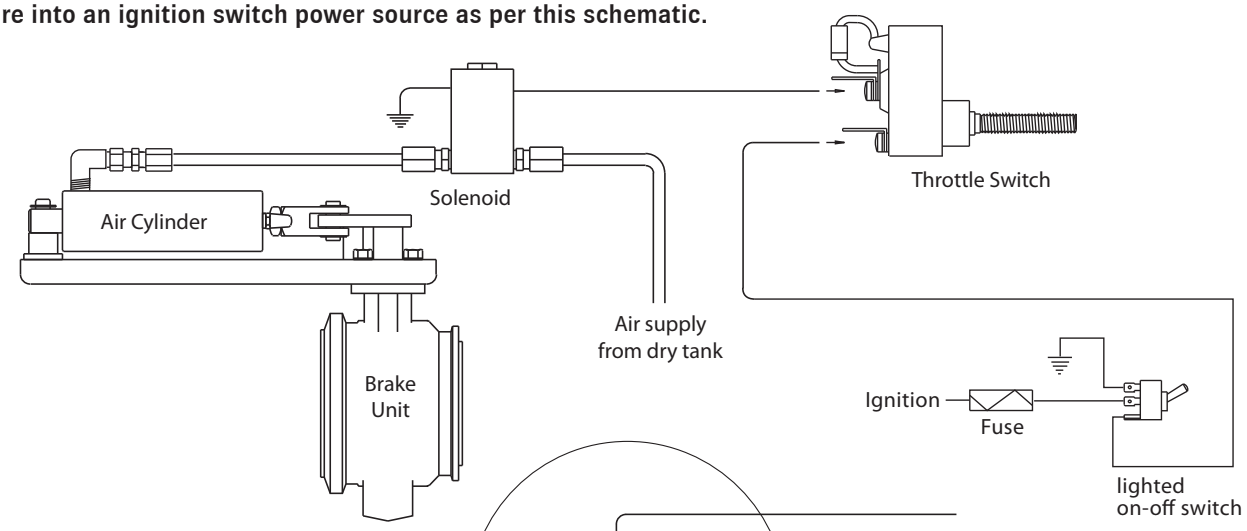
10c **INSTALLATION FOR CATERPILLAR 3116/3126 mechanical engines:**

Install the throttle switch assembly to the firewall with the switch arm horizontal and behind the throttle linkage as shown.

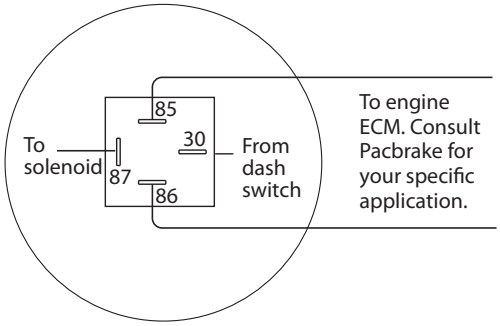
Adjust the switch by loosening the screws and positioning it to "click" as the throttle returns to it's released position. Cycle the throttle and listen for the click each time the throttle returns to idle. Tighten screws when adjustment is complete.

Schematic A - Standard Control Group

This control system utilizes an on-off switch, and a throttle switch. When the dash switch is "on" and the throttle is in the "released" (no fuel) position, the brake is activated. Select the location for the throttle switch. This universal switch must be mounted and adjusted so the switch arm is contacted by the throttle linkage. When the throttle is within1/4" of fully released, the switch should "click", to close the circuit and activate the exhaust brake. Install the fuse and dash switch, and wire into an ignition switch power source as per this schematic.



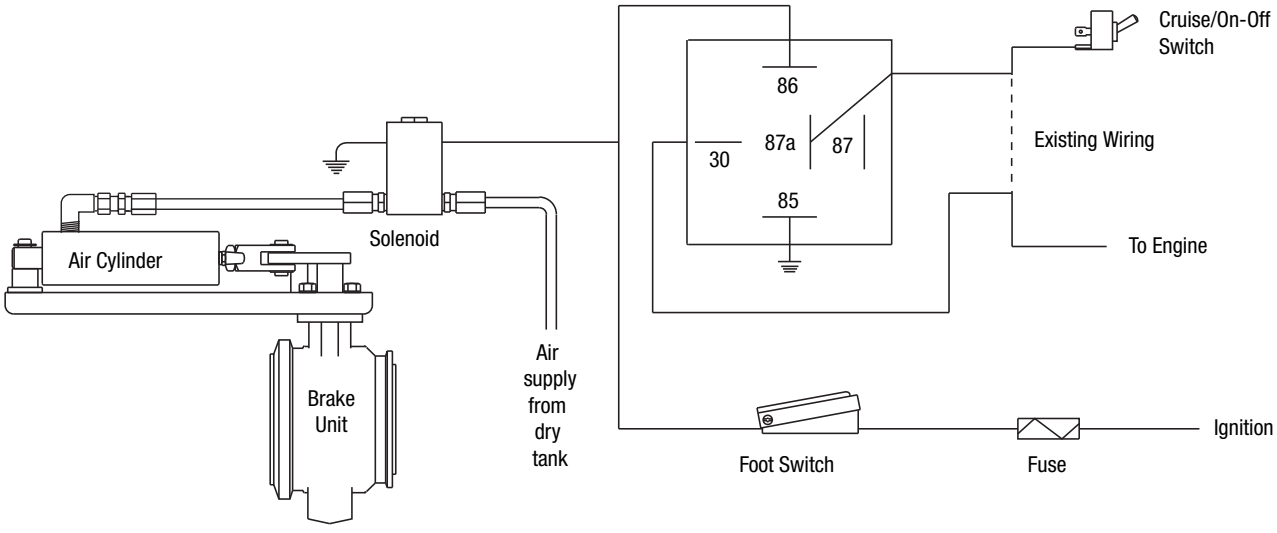
NOTE: If the vehicle is equipped with cruise control, ensure the exhaust brake opens when the cruise accelerates the engine.



Detail option electronic engines

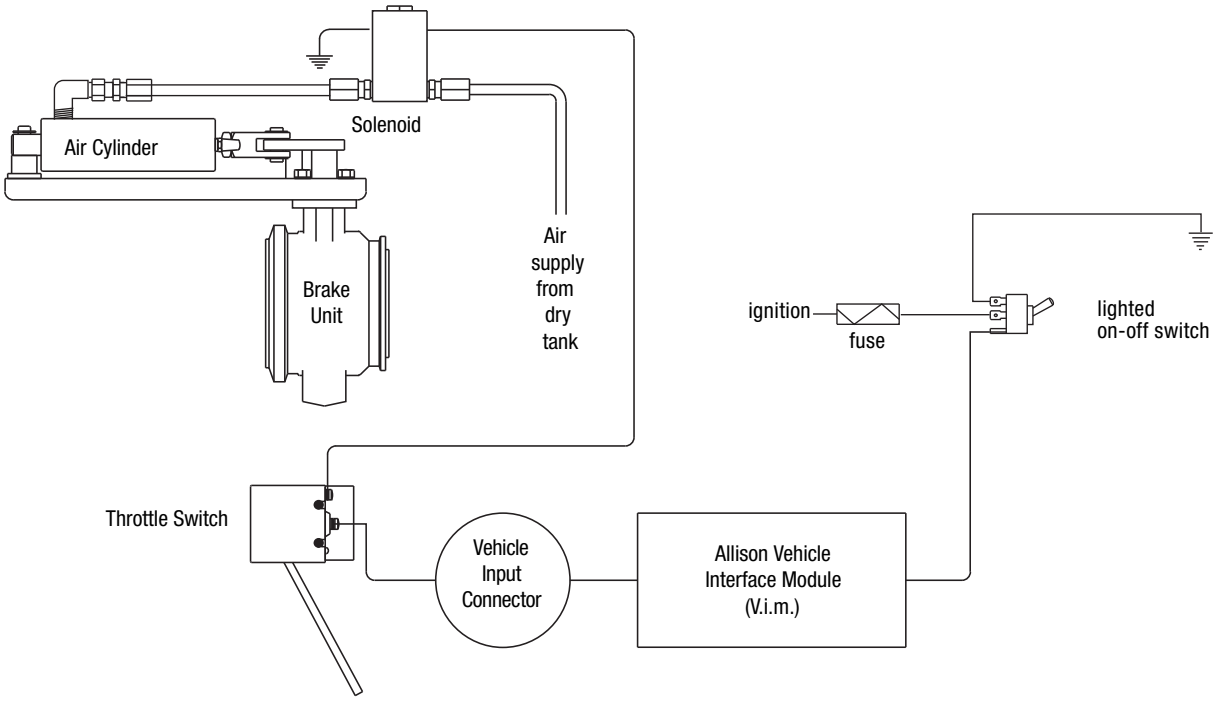
Schematic B - Manual Control Group

This control system utilizes a foot switch which must be mounted on the floor of the vehicle. Using an ignition power source and the fuse provided, route wiring to the foot switch. This group contains a relay to deactivate the cruise control, and must be "wired in" – after the foot switch. Using the schematic, continue the wiring to the solenoid.



Schematic C - Interface Through Allison World Transmission

Allison requires that exhaust brakes be interfaced with the transmission ECU controls to maintain optimum shift quality. This will provide automatic downshifting when the exhaust brake is activated to achieve high RPM to maximize retarding power. Some Allison MD transmission ECU's must be programmed when used with an exhaust brake–which requires the use of a Prolink diagnostic tool. If a Prolink tool is not available, or you need additional information, contact your nearest Allison Transmission recalibration center. There is a service charge for reprogramming service. This schematic provides only general instructions for the wiring interface. For further information, call Pacbrake's hotline at 1-800-663-0096.



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