RV Trailer Brake Systems

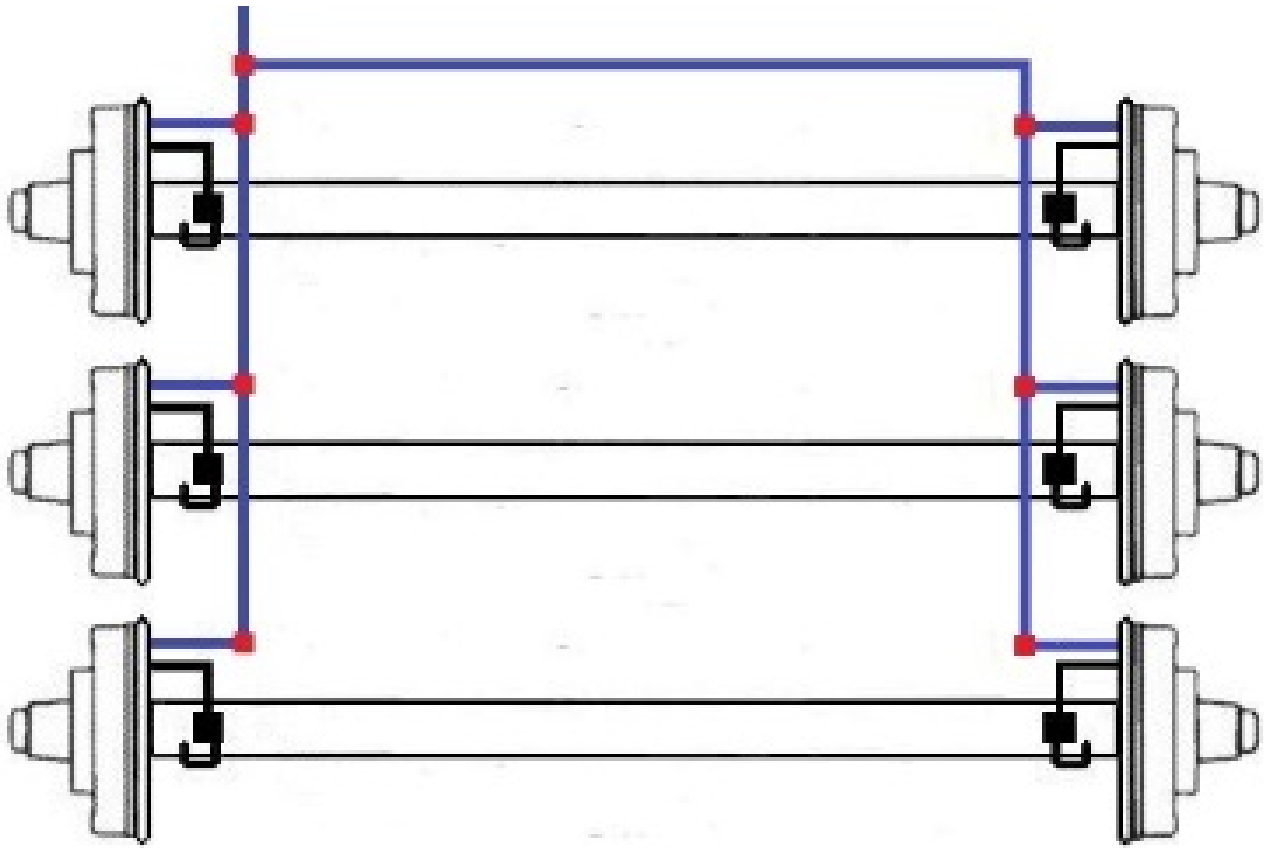
2015 National HDT Rally

Electric Drum Brakes

- Properly Adjusted, electric drum brakes can lock the wheels.
- Just before wheel lockup, is the maximum braking effort that can be generated, limited by tire traction

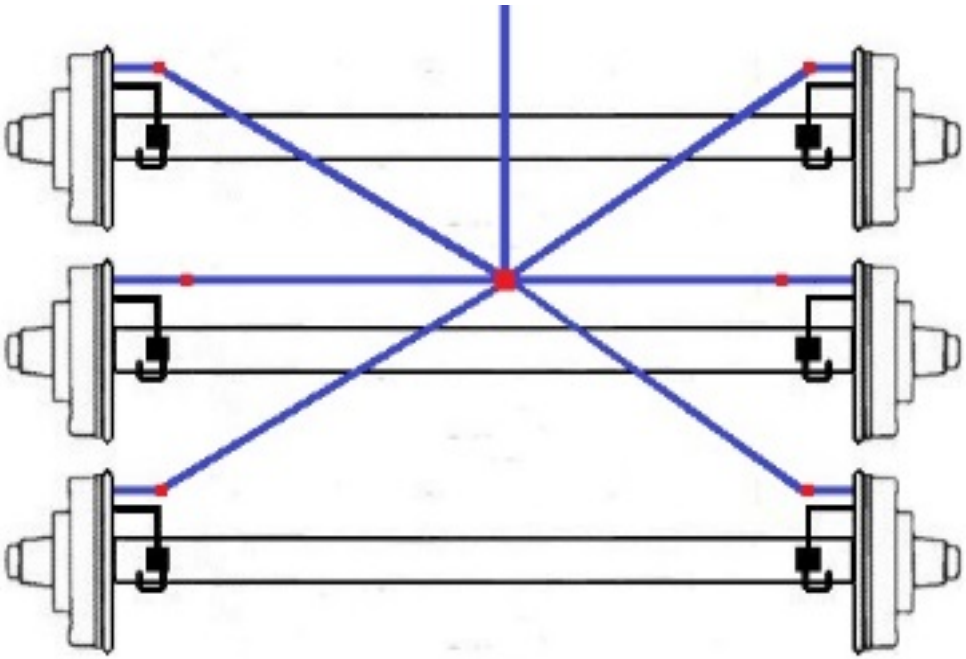
Electric Drum Brakes - Wiring

Typical wiring for electric drum brakes



Electric Drum Brakes - Wiring

Better wiring for electric drum brakes



Use at least #10 gauge wire

Typical Brake Magnet uses up to 2.5 amps

Wire size is important

Electric Drum Brakes - Wiring

Wire Size for Distance 12 Volt Systems (feet)				
Current	Wire Size AWG#			
Amps	12	10	8	6
5	24	38	61	96
10	12	19	30	48
15	8	13	20	32
20	6	10	15	24
30	-	6	10	16
40	-	-	8	12
55	-	-	-	9

Electric Drum Brakes - Wiring

Besides using adequate wire size from the fuse to the controller , to the receptacle, to the brakes, the type of fuse is important.

You should always use a self-resetting type fuse.

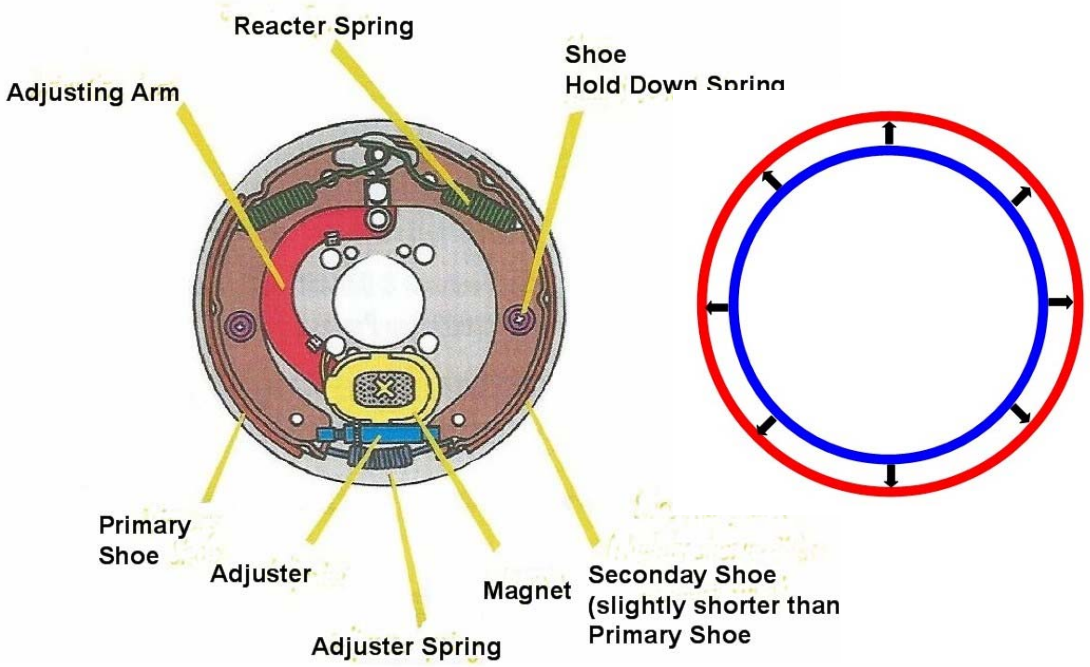
- There is a chance that, whatever cause the overcurrent to flip the fuse, was a transient condition.
- Each time you apply the brakes, even if the fuse flips, you might get a little braking assist.

Hydraulic Disk Brakes

Disk brakes have three advantages over drum brakes

- Centrifugal action will remove water from the rotors while drums will trap water between the drum and the shows.
- When rotors heat up, they expand towards the brake pads while drums will expand away from the shoes
- **There are no adjustments for disk brakes**

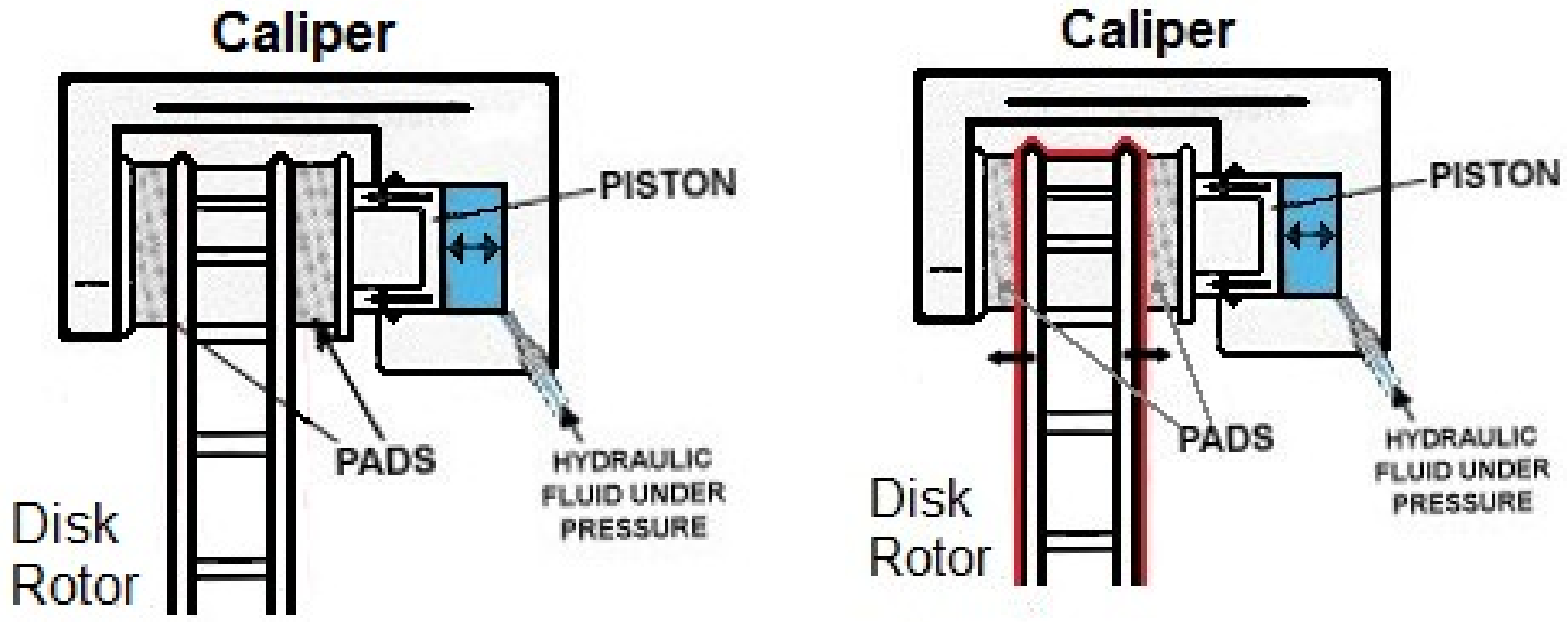
Disk Brakes Benefit - Heat



As the drum heats up, it will expand outward away from the brake shoes.

HDT drums have a lot of mass to avoid the expansion.

Disk Brakes Benefit - Heat



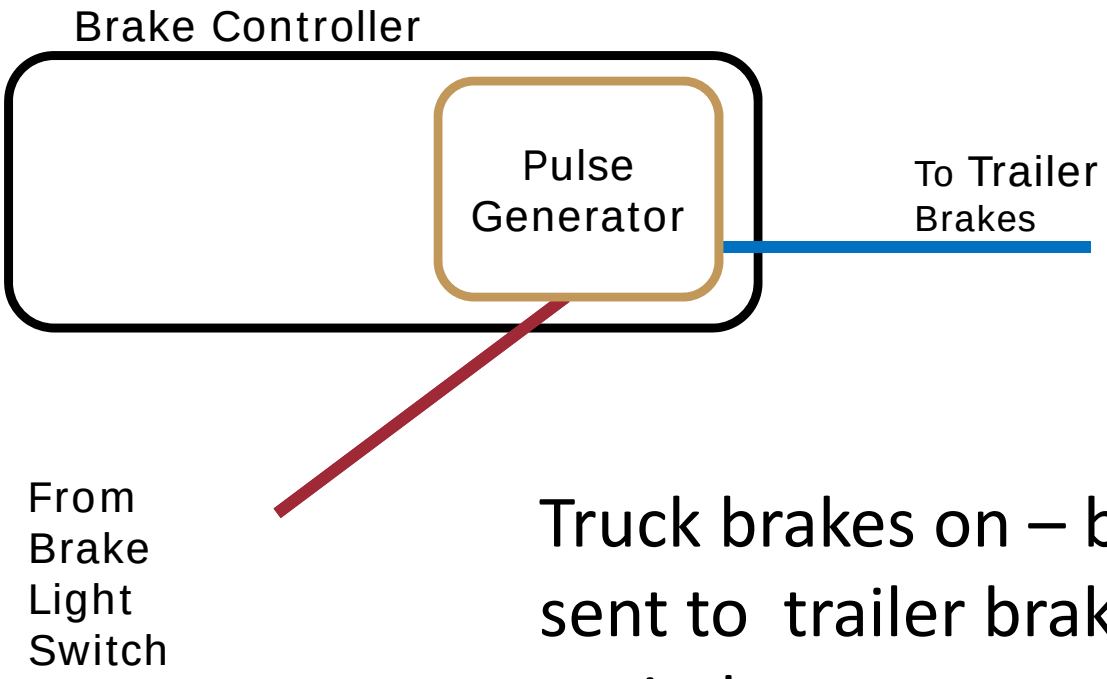
Hot rotors expand towards the pads.

Electric Brake Controllers

Three basic kinds

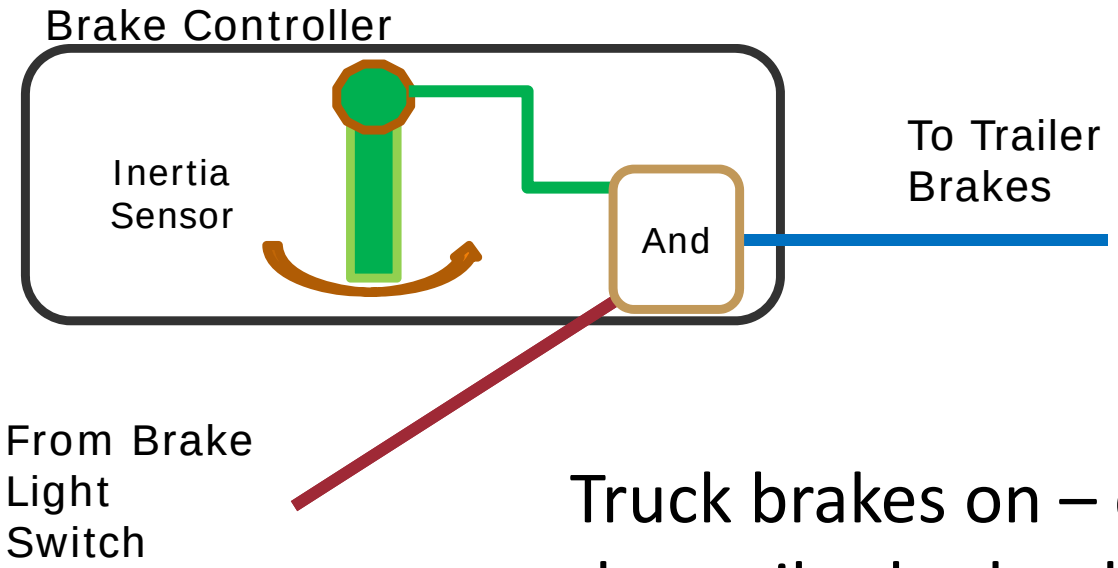
- Time Delayed controller
- Proportional controller
- Direct Action controller

Electric Brake Controller – Time Delayed



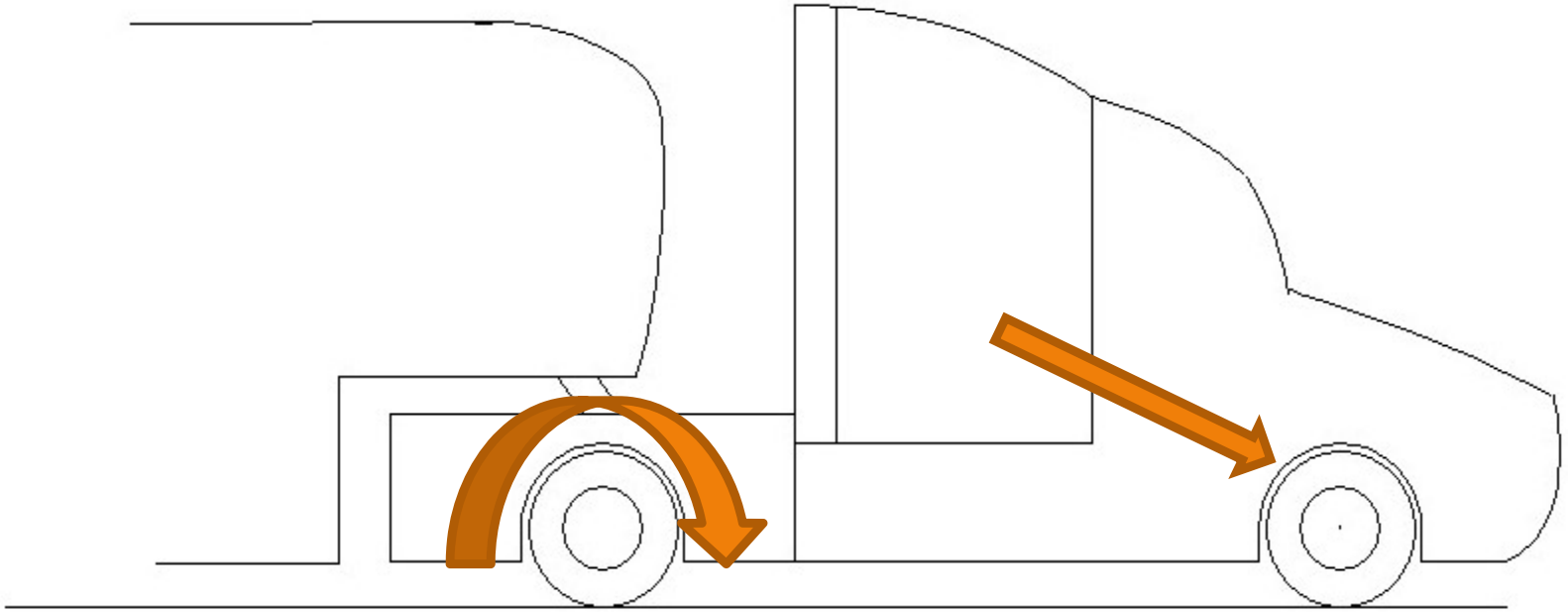
Truck brakes on – brake current sent to trailer brakes for a timed period

Electric Brake Controller - Proportional



Truck brakes on – current is sent to the trailer brakes based upon the sensed deceleration of the truck.

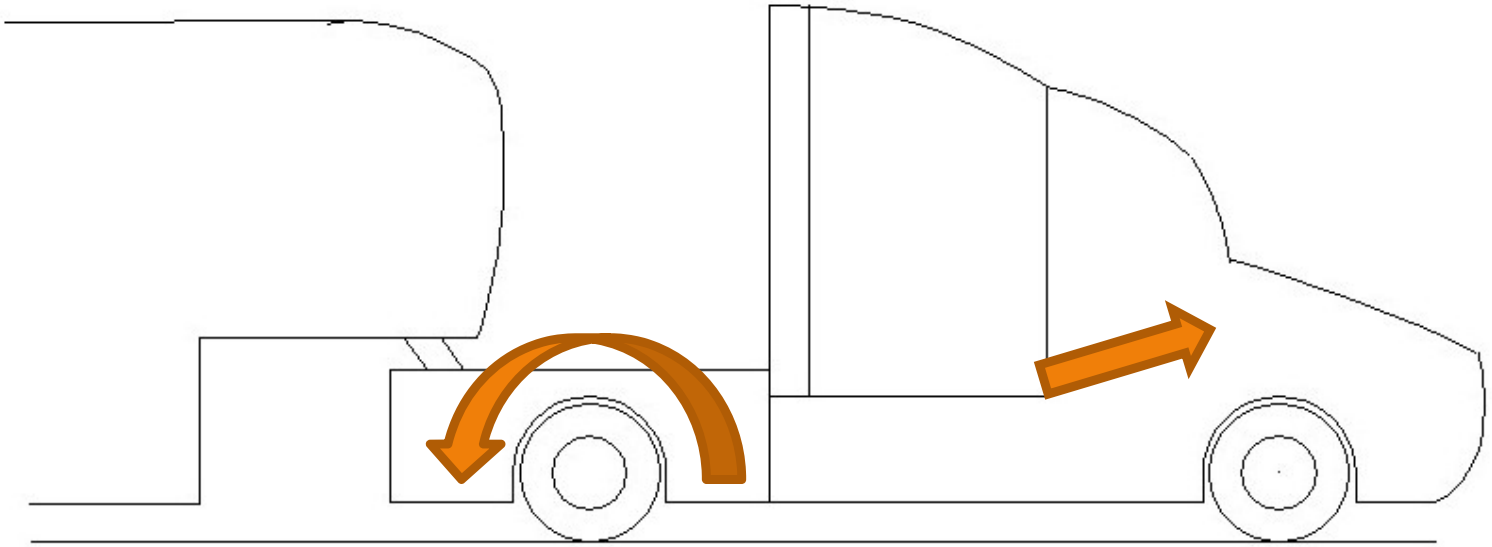
Electric Brake Controller - Proportional



Typical pickup pin location: over axle

During braking, causes a forward rotation of the pin weight amplifying the motion of the truck

Electric Brake Controller - Proportional

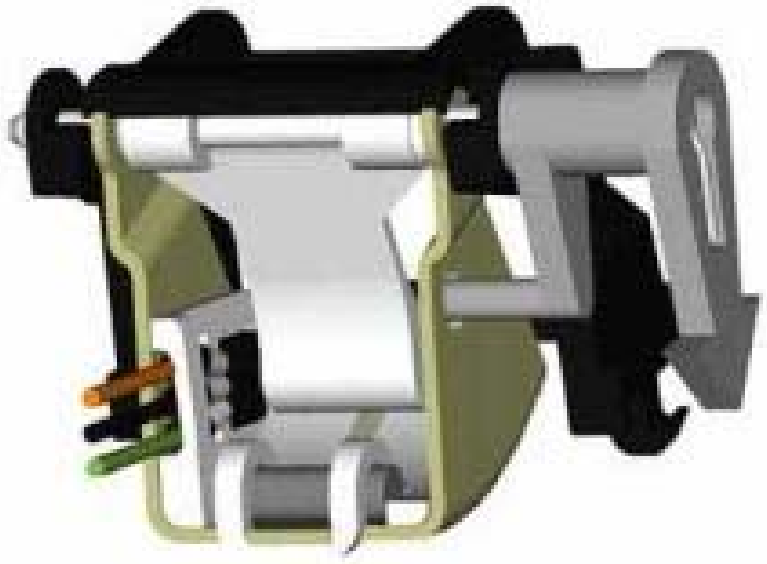


Typical HDT pin location: after the axle
During braking, causes a rotation to the rear of the pin weight reducing the effective truck motion.

Electric Brake Controller - Proportional

Prodigy P2: Uses an inertia sensor that self adjusts for angle. Uses a tilt sensor for speed change detection.

Electric Brake Controller - Proportional

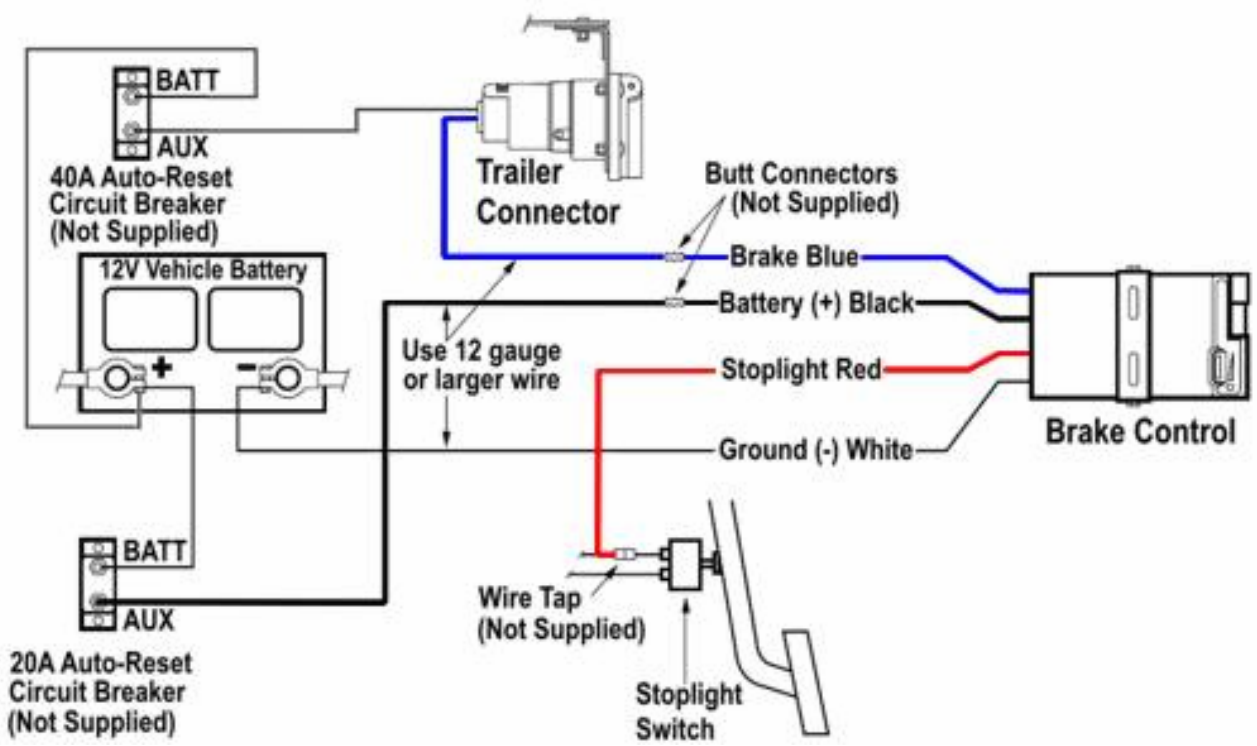


Example of typical
Proportional sensor

Electric Brake Controller - Proportional

Hensley: Uses an inertia sensor like a small gyroscope that is not dependent on tilt for speed change detection.

Electric Brake Controller - Proportional



Typical wiring for a Proportional controller

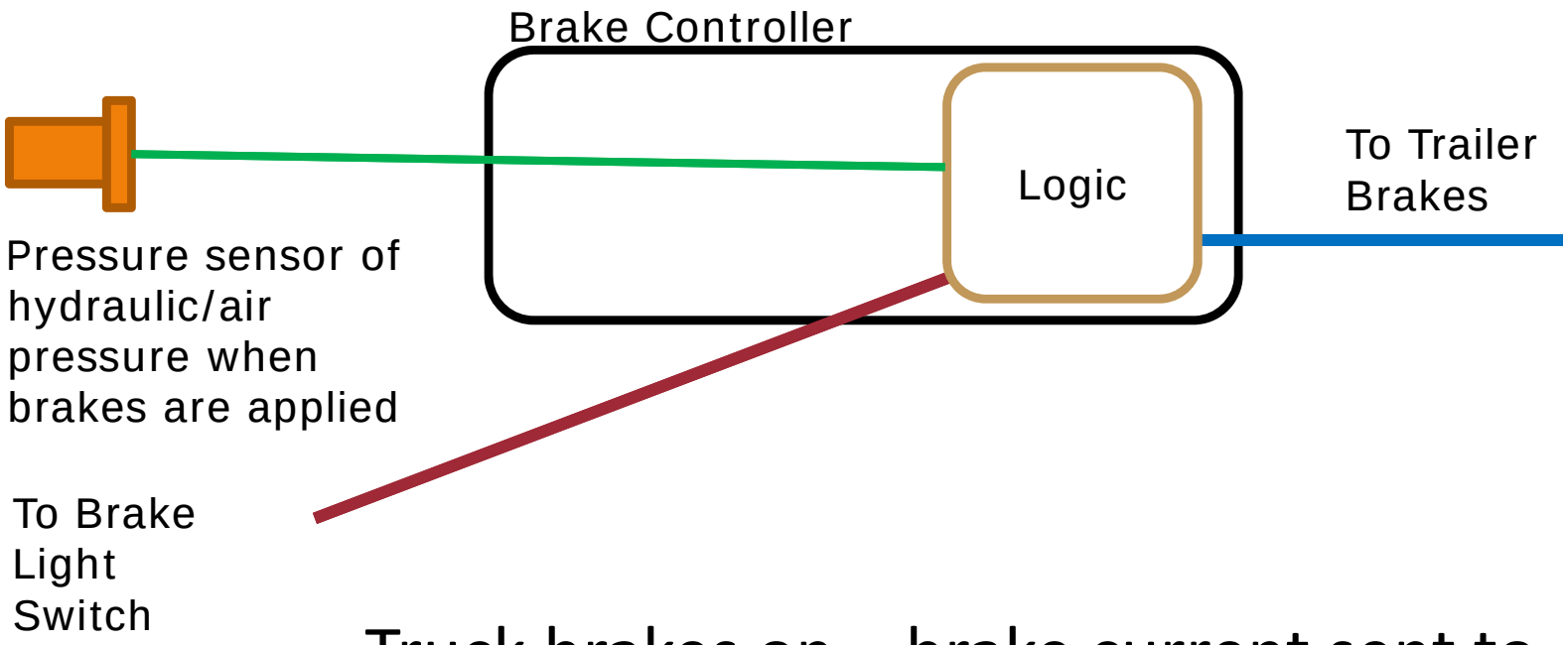
Electric Brake Controller - Direct

A Direct brake controller applies trailer brakes because the truck brakes are being applied.

There is no reliance on inertial change of the truck.

Trailer brakes remain applied as long as the truck brakes are applied.

Electric Brake Controller - Direct



Truck brakes on – brake current sent to trailer brakes

Electric Brake Controller - Direct

Hayes Air Actuated electric brake controller.

Air from the brake line causes a piston to push a rheostat to adjust the amount of current to the trailer brakes.

Very simple, no special provision for electric/hydraulic brake systems. Most electric/hydraulic systems can deal with a current only controller.

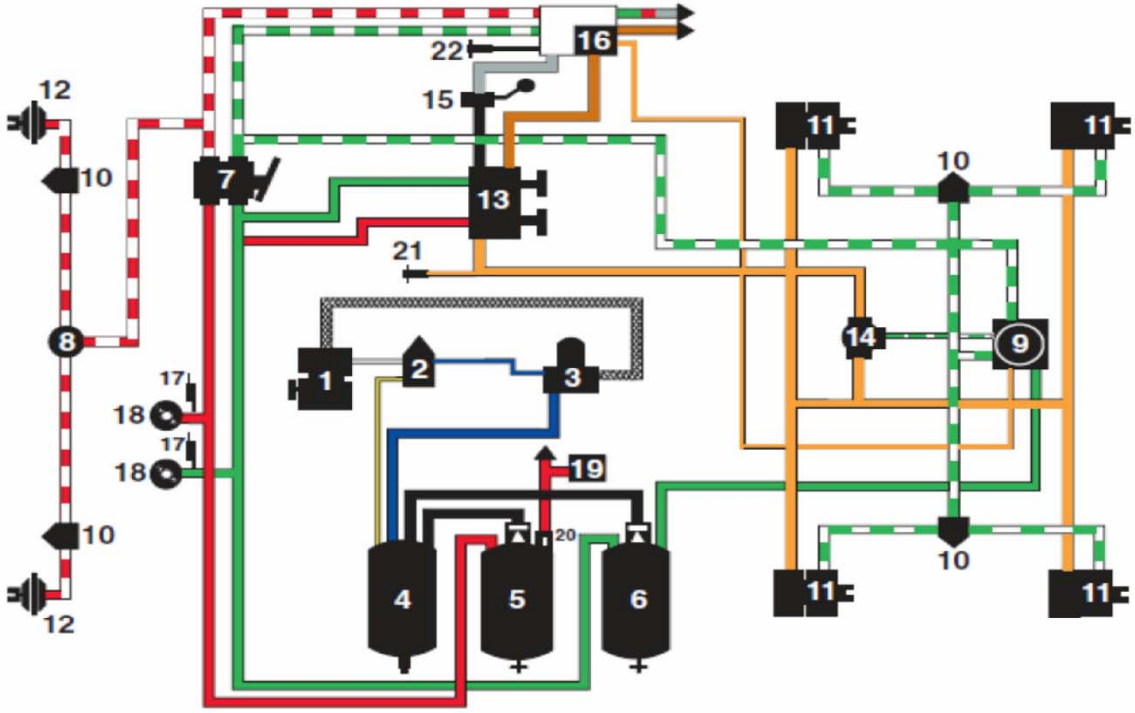
Primary appeal – lower cost

Electric Brake Controller - Direct

This schematic describes the air brake system. All colors are as they appear on the tubing in the vehicle. Components are grouped together so that the left of the schematic represents the front of the vehicle and the right represents the rear of the vehicle. Other locations are not representative of true location in the vehicle.

Use the schematic for troubleshooting and understanding the air brake system function. To separate the supply and operation systems, the operation system is shown with dashed lines. In the vehicle, all tubing is solidly colored.

Colors are to current standard (see list on page 8) and are separated into main groups, as listed:



- Supply System Circuit
- Front Service Brake Circuit
- Rear Service Brake Circuit
- Parking Brake Circuit
- Trailer Supply Circuit
- Trailer Hand Control Circuit

Supply
Operation

1 Compressor
2 Governor
3 Air Dryer
4 Wet Tank
5 B System Tank
6 A System Tank
7 Foot Valve
8 Quick Release Valve
9 Relay Valve
10 ABS Modulator Valve
11 Spring Brake Chamber
12 Front Brake Chamber
13 Manifold Dash Valve
14 Quick Release Valve
15 Trailer Hand Brake Valve
16 Manifold Tractor Protection Valve
17 Low Air Pressure Switch
18 Air Gauge
19 Accessory Manifold
20 Pressure Protection Valve
21 Park/Daytime Running Light Switch
22 Stoplight Switch

V560228

Electric Brake Controller - Direct

MaxBrake hydraulic or air electric brake controller.

A pressure transducer sense increase pressure in the brake line and applies an appropriate current or signal for the trailer brakes. This is important for hydraulic systems where no fluid volume is used.

No longer available

Senses either the presence of brake magnets or electric/hydraulic brakes.

Electric Brake Controller - DirecLink

Tuson DirecLink was designed to connect to the OBD-II data ports of standard pickups.

The DirecLink communicates with the ECM and knows when the truck brakes are being applied and applies the trailer brakes.

Electric Brake Controller - DirecLink

With a Tuson DirecLink NE controller, you can add a Tuson AcuLink electric-hydraulic brake actuator.

The AcuLink actuator is different from traditional electric/hydraulic actuators in that instead of pretending to be a set of brake magnets, the AcuLink uses digital signals over current wiring to the DirecLink NE controller.

The signal connection allows for bidirectional data transfer. This means that the AcuLink can indicate failures like fluid loss to the DirecLink.

Electric Brake Controller - DirecLink

With a Tuson DirecLink controller and AcuLink actuator, you can add a Tuson AcuLink ABS module which provides for Anti-Skid braking.

There are four independent channels to which wheel cylinders are connected providing independent wheel braking.

For triple axle trailers, two axles are paired together.

Electric Hydraulic Brakes

Dexter Electric Hydraulic. Brake Actuator

Senses either current or control signals from the brake controller and turns on the pump that drives hydraulic pressure to the wheel brake cylinders or calipers.

Air/Hydraulic Brakes

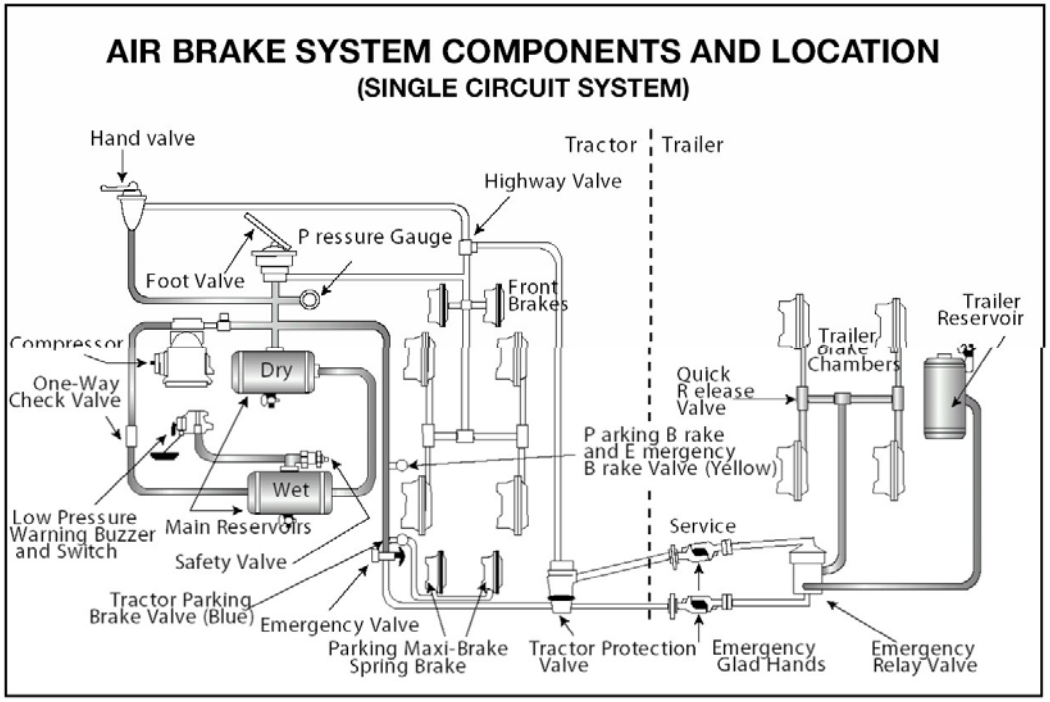
Air Over Hydraulic brake system eliminate the need for a electric brake controller. The action is similar to a Direct brake controller, the trailer brakes are applied when the truck brakes are on as long as the truck brakes are on.

The system is similar to commercial trailer air brakes.

The most popular conversion kit is call BluDot.

Basically the electric hydraulic actuator is replaced with a air hydraulic actuator plus some extra hardware.

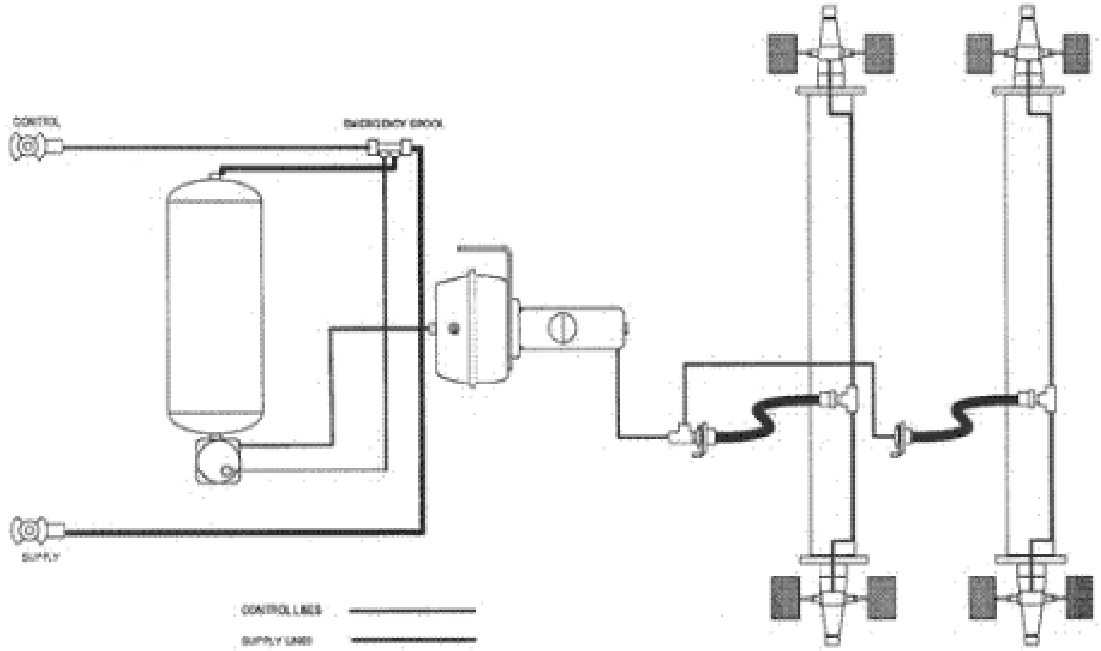
Commercial Air Brake System



The Emergency air hose fills the Trailer reservoir. For brake actuators that have Parking springs, the Emergency air also releases the Parking springs.

The Service air hose applies the braking air to the Brake actuators.

Air/Hydraulic Brake System



The Supply (Emergency) air hose fills the Trailer reservoir.

The Control (Service) air hose tells the Control Valve to apply air pressure from the Trailer reservoir to the hydraulic actuator.

Bludot System - why use it

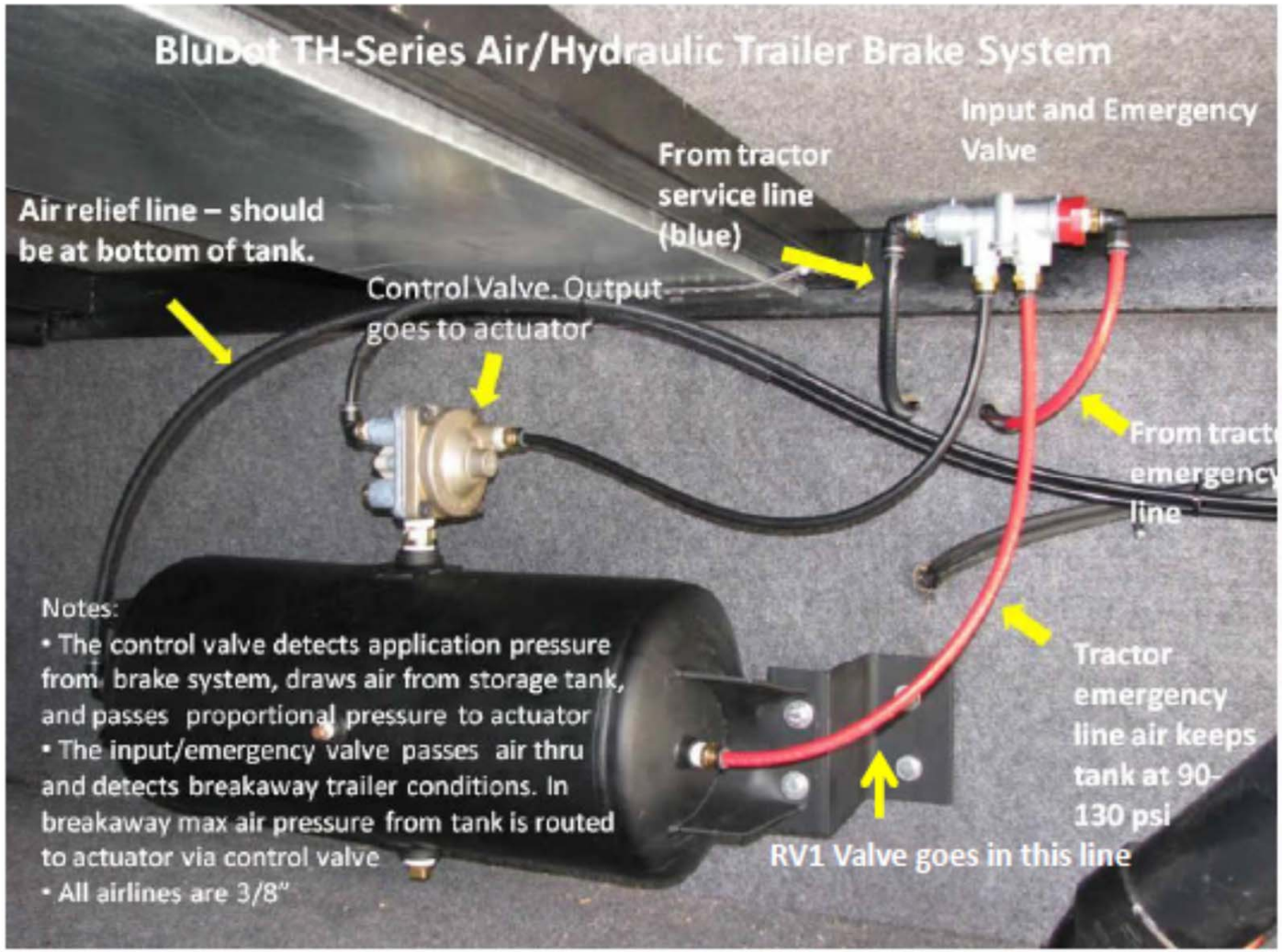
- It is “perfectly” proportional – it is as if there is only ONE unit
- The entire system is simpler, one less step of conversion from air to hydraulic
- It uses DOT-certified components tested over billions of miles in commercial operation
- There is NO brake controller – it uses the tractor air system
- There is no electrical or mechanical pickup to supply brake controller signal
- Your tractor is *designed* around air systems
- There is NO electrical connection or conversion
- There are no plugs to go bad (electrically)
- There is no hydraulic pump to “spool up” before brakes actuate, so less delay

Bludot System - Cons

- You have airlines running between truck/trailer
- You **must have** a vehicle with air brakes tow the trailer
- You truck will not have a conventional controller to tow other trailers (unless you add one)
- Resale of trailer may be affected (requires air)
- Some manufacturers will not install (no skills)
- It ***may*** be more expensive because of installation costs

Bludot System - Components

Bludot System - Components



Bludot System - How does it work

- Service air and emergency air supplied via gladhands to trailer
- Service air is “signal” and provides proportioning
- Emergency air is stored in tank on trailer
- “Proportioning” valve takes air from tank at same level as service air and applies it to a brake can which drives a master cylinder
- Master cylinder mechanically converts air pressure to hydraulic line pressure and “amplifies” the pressure.
- Hydraulic pressure drives the brakes

Bludot System - How does it work

Cont.

There is an emergency “breakaway” capability for air loss or disconnect.

Note – The Emergency brake function should not be used for parking. After the trailer is on its legs, the pressure should be released from the brakes.

Bludot System - Nuances and Improvements

- Dexter brakes work with unmodified BluDot systems (high line pressures permissible)
- Kodiak brakes require lower line pressures – must use a reducing valve on tank (pressure around 90psi, RV1 valve)
- Relief valve/water drain valve must be added
- Recommend a tank pressure gauge
- Gladhand placement is “backward” from commercial operation (gladhands stay with trailer)

Bludot System - Nuances and Improvements

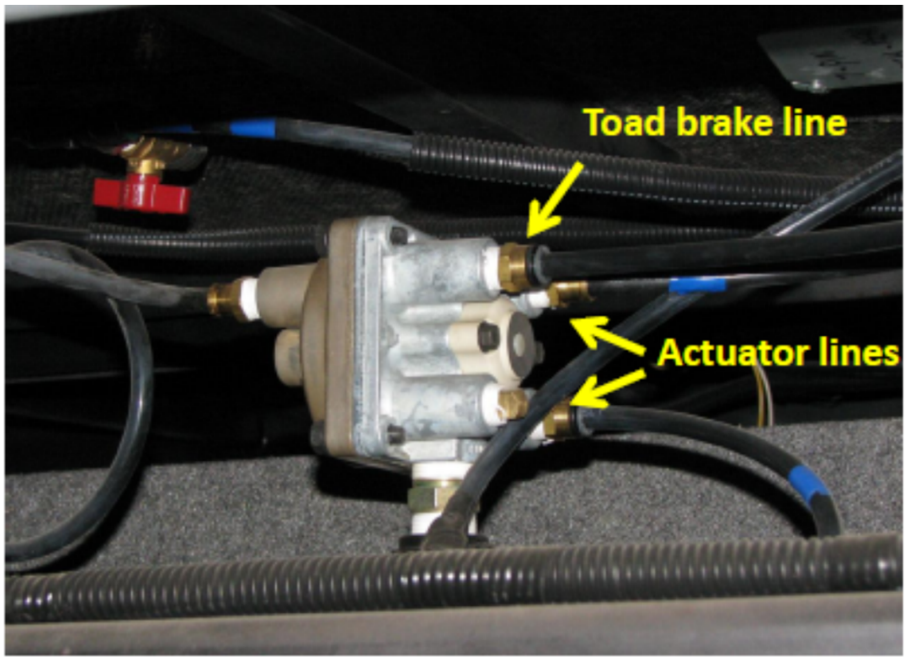
Cont.

- **Installation is sensitive to proper brake bleeding**
- **Recommend DOT 4 brake fluid**
- **Sizing is critical for actuator – there must be enough volume for all the calipers**

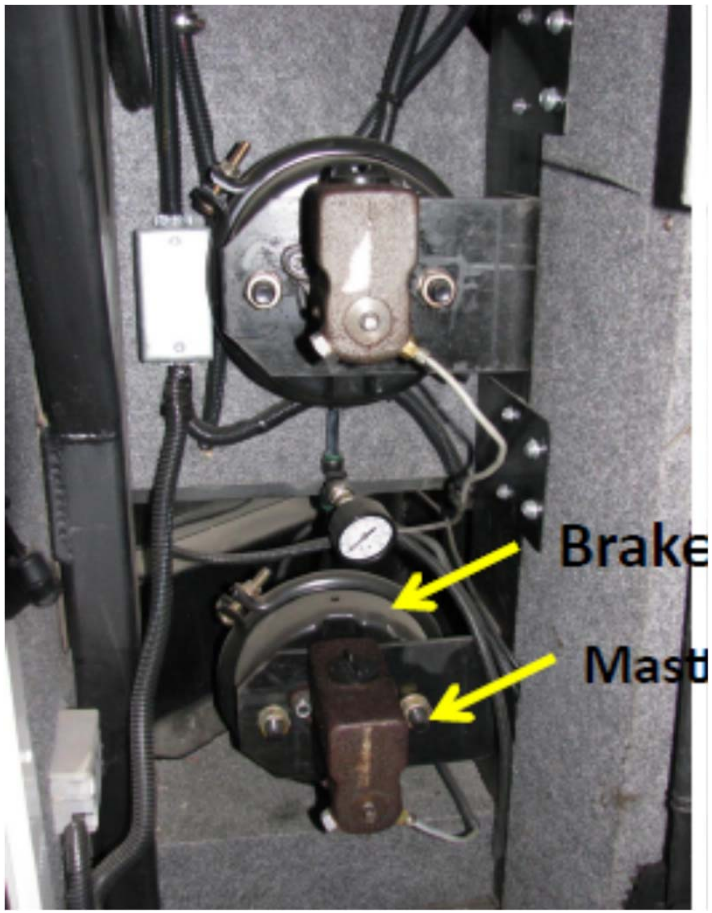
Bludot System - Kodiak Modification Parts

Bludot System - Installation Photos

Bludot System - Installation Photos



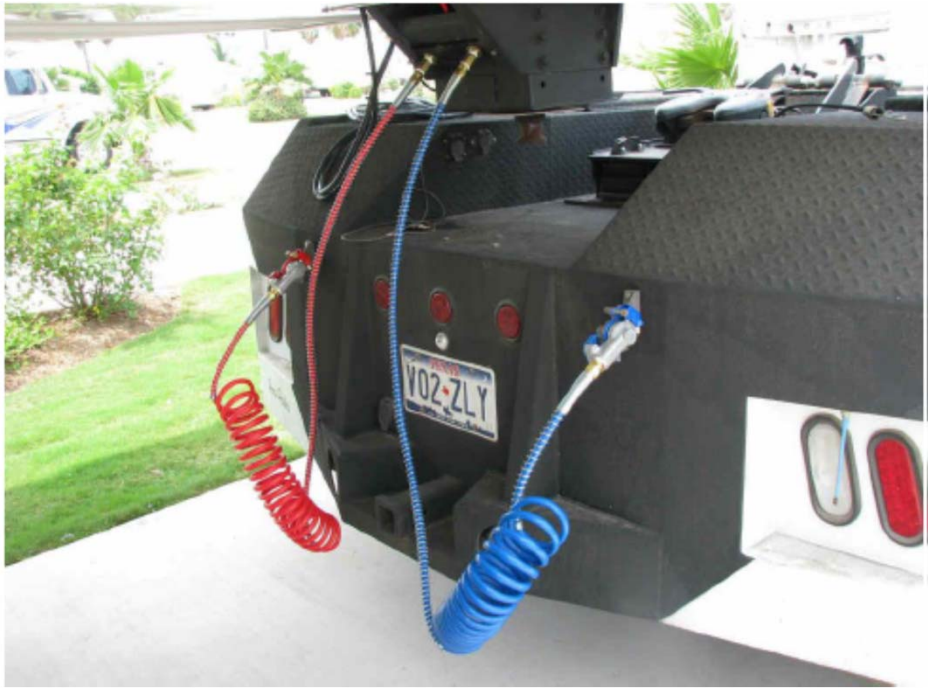
Dual Actuator Installation to gain enough fluid volume.



Bludot System - Gladhands and Coils

- This can be difficult on a retrofit
- Two methods: through gooseneck, or across “gap”
- Coils mount to trailer and “stay with” trailer. This is a cleaner install than commercial method.
- Location of fittings on truck
  - Together or spread
  - Use of angled fittings
- Protection when not connected

Bludot System - Installation Photos



Bludot System - Installation Photos

Bludot System - Installation Photos

Bludot System - Installation Photos

Discussion