Decelostats
— Part II, Today’s E-5 System —

by

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Previously (Sept./Oct. 1995, pp. 17–18), we took a look at the older decelostat systems. This time around we take a close look at the current E-5 decelostat system, appearing on more and more private cars these days.

The E-5 decelostat system consists of a 100-tooth gear, speed sensor, electronic “black box” called the E-5 controller, C-3 decelostat air valve consisting of a pipe bracket, FA-4 magnet valve, release valve (also known as a dump valve), and necessary wiring and plugs.

Parts

On private cars with Timken EE bearings, the 100-tooth gear is cast integral as a part of the bearing end-cap. The speed sensor is added through a threaded hole in the roller bearing journal housing. This hole, located on the lower right side of the housing, is drilled at an angle and the speed sensor tip will always be perpendicular to the gear teeth.

The C-3 decelostat air valve is located between the relay valve and the truck cylinder cut-out cock on the air line that delivers air pressure to the brake cylinders when the brakes are applied. Air pressure from the relay valve flows to one side of the pipe bracket and out the other side to the brake cylinder. The E-5 controller, an electronic marvel, is positioned either inside or outside of the car body, the preferred location being a locker inside the car where the box is free from snow, ice, rocks, and “UFOs.” This box is easily removed by disconnecting two plugs and the four bolts which hold it fast to its bracket.

Operation

When a railroad passenger car is in motion, the speed sensor “reads” the velocity of the axle by counting the speed of the gear teeth as they pass the tip of the sensor. This velocity is recorded and memorized by the E-5 controller. All axle velocities are recorded in this manner. The E-5 controller takes into account the size of the wheels and there is no adjustment necessary if, for example, one of the wheels is approaching scrap limit. If you have wheels on one axle that are smaller than, say, new wheels on another axle, the smaller wheels are going to rotate much faster than the new ones. The controller takes all of these things into account. The controller also allows for differences in velocity at low speed (4 mph and below) and high speed (120 mph and above).

As an axle decelerates very rapidly during a braking application, the controller, alerted by the speed sensor, sends a signal to the affected truck’s decelostat valve. The magnet valve activates and blocks off air pressure from the relay valve. The dump valve acts very quickly and releases brake cylinder air to the truck. When the wheels start to rotate at normal speed once again, the controller senses this, and deactivates the magnet valve and closes the dump valve.

All of this action takes only a second or two. If the wheel-slide condition continues to exist, the decelostat will keep dumping and applying brake cylinder air pressure until normal wheel to rail adhesion is obtained. However, if decelostat equipment should malfunction and the release should extend beyond five seconds, a relay timer is activated and nullifies the wheel-slide protection. This timer will be reset and wheel-slide protection restored when the engineer makes a full brake release.

Possible Problems, Component by Component

Private cars with Timken EE and NFL roller bearings can be outfitted with E-5 decelostat systems. The 100-tooth gear is cast integral as a part of the bearing end cap on these bearings. Since the gear is in plain sight at all times, it is very easy to inspect for damage.

• **100-tooth gear:** this gear will become ineffective when two consecutive teeth are broken off or are very badly damaged. If you notice a groove cut in the middle of the gear teeth and this groove extends around the middle circumference of the gear, the distance between the speed sensor and 100-tooth gear is improperly gapped and the sensor tip is causing this groove by hitting the teeth.

• **Speed sensor:** as you can see from the above example, it is possible for the speed sensor to be improperly gapped. Know the proper gap. When the anti-slide system is installed on your car, ask the technician what the proper gap is and how to gauge it. You can check the gap at any time by using the same feeler gauge used to gap automobile spark plugs. Always remember to cut out the truck before inspecting the gap. Amtrak uses a “go-no go” feeler gauge for this job; perhaps you can pick one up.

Speed sensor wiring must have sufficient slack in it to compensate for vertical truck movement. Remember that trucks have coil springs and speed sensor wiring which is snug or just plain too short is going to snap off. If your speed sensor wiring does break off or if a speed sensor becomes defective, it is poor practice to splice wire. Always use a full-length wire.

After running through a snow or ice storm, always check the speed sensor wiring. Heavy buildup of snow and/or ice can cause a break. Chances of the wire breaking off are magnified in the event the wire is spliced.

• **Release (dump) valve:** this valve seldom malfunctions but in the event you suspect this valve is not functioning properly, remove it from the pipe bracket and check the gasket positioned on the pipe bracket. It just may be that it is reversed, thus stopping the exhaust of brake cylinder air.

• **FA-4 magnet valve:** you will find that this valve is the cause of most problems in the anti-wheel slide protection system. Being an electro-pneumatic devise, it is susceptible to damage from air pressure and from electrical shorts. If the valve is contaminated by oil vapor and moisture from air pressure, the valve will shut out and the decelostat for that truck will not function. The result is
possible wheel damage. Additionally, if the magnet valve shorts out, it will in most cases also damage the E-5 controller and the car’s anti-wheel slide protection will be nullified on all wheels.

- **Pipe bracket**: there is a check valve on this bracket. In rare cases, the check valve can malfunction (more on this later).

- **E-5 controller**: as I mentioned, this is an electronic wonder. Whether your car is on its storage siding or in a train consist, the controller can be tested manually. On the inside of the protective cover is a block diagram showing you what buttons to press and in what sequence. This manual test should point up any problems. Remember, the car must have electrical power and the brakes must be applied in full service or in emergency.

  **Important**: do not allow anyone to tell you that the controller can be tested with the brakes released. Keep in mind that this is a two-step process and when activated the magnet valve must function and brake cylinder pressure must exhaust.

**E-5 + D-22/26-C: Possible Problems**

There are some problem situations which can arise on PVs having D-22 or 26-C brake equipment outfitted with E-5 decelostat systems. I’ll deal with these on a basis of an assumed failure somewhere in the decelostat system.

- **Q**: During a brake test, the car inspector informs you that the air brakes apply on one truck and not on the other. The affected truck is cut in and no piping has been crushed or otherwise damaged. What could cause this?

  **A**: While on a trip, your car’s decelostat system may have actuated during a heavy and/or severe braking period. The FA-4 magnet valve activated and blocked off air pressure to the truck. However, when the controller sent a signal to the magnet valve to deactivate, the magnet valve remained applied in the blocking mode. What happens here is that no air pressure can get through to your brake cylinders. If you have disc brakes, always check to see that the sides of the discs are shiny. If there is discoloration or if the discs become dirty, the brake is not applying on that truck.

  **Solution**: Change out the FA-4 magnet valve.

- **Q**: I changed out the magnet valve but the brake still will not apply. What now?

  **A**: There is a check valve on the pipe bracket. It is a very rare occurrence, but in the event that this check valve breaks down, delivery of air pressure to the truck’s brake cylinders can be blocked. WABCO sells a kit which has replacement parts for the check valve. It may be necessary, however, to also change out the pipe bracket.

  Incidentally, if you have to change out an FA-4 magnet valve, there is no wiring to disconnect. The wiring is in the pipe bracket, and the FA-4 plugs into the contacts on the pipe bracket, just as you would plug in a lamp at home.

- **Q**: I recently performed a manual test on my E-5 controller. I could hear the brake cylinder air release and the brakes apply and release on one end, but there was no movement on the other end? What’s wrong?

  **A**: Have someone stand at the affected end and place a hand underneath the decelostat pipe bracket. There’s an exhaust vent on the bottom. When you activate the E-5 controller for that end of the car, the person working with you may feel a very light exhaust of air at this vent. This is an indication of a defective FA-4 magnet valve. After you’ve removed the valve, you will probably find it is very rusty as a result of moisture and oil vapor.

  Another possibility indicating a malfunction is that one of the leads to the contacts for the magnet valve, situated in the pipe bracket, may have come loose. Reconnect it.

  While you’ve got the magnet valve off, inspect the three metal strainers in the pipe bracket. Check them over and clean them if dirt particles are present. The strainers can be removed with your fingers.

- **Q**: My car is equipped with the E-5 decelostat system, but I notice that all of my car’s wheels have flat spots. What happened?

  **A**: There is always the possibility your car was dragged by a yard switcher. If operating on a train, it could have happened before the brakes were fully released. These situations can happen. Remember that decelostat controllers depend on velocity. If your car is dragged, there is no wheel rotation, hence no velocity, and the E-5 controller receives no velocity signal.

- **Q**: The electronic technician tells me my E-5 controller is defective and applies a new (reconditioned) controller. After making a manual test, he informs me this controller is defective. Whaa, this is getting expensive!

  **A**: Once again, check the magnet valve. Have the technician “meter” it. A defective valve can “blow” a resistor in the controller, and even when the controller is replaced, a defective magnet valve will “blow” the controller. Be alert and try to stop costly and unnecessary maintenance.

**In Conclusion...**

The most likely candidate for E-5 anti-wheel slide protection is a four-wheel truck equipped with bolster and equalizer coil springs and disc brakes. Try to digest everything written about the E-5 decelostat system. If you have the E-5 system, avoid the potential of turning it into a high maintenance system by checking out before every trip. Try to obtain a spare FA-4 magnet valve—cause of most of the trouble in this anti-slide system—to keep on hand. If your car travels a lot freight railroads, you’ll be hard pressed to find any one familiar with decelostats these days.

A final point to always keep in mind when manually testing your car’s E-5 controller: there is a specified sequence of apply and release. For example, it may be A-B-B-A. The A-end releases and applies. Then the B-end releases and applies, etc. Learn the correct sequence when the system is first installed. There’s always the possibility it could be wired wrong. If it is wired incorrectly, sliding trucks are not going to release.

And the old P-3 anti-slide devices? Pick up the March/April issue of PRIVATE VARNISH and read the article by California Zephyr Railcar Charters’ Burt Hermey once again. Hermey brings up a very significant point to keep in mind. There are still a lot of P-3’s around on privately owned cars everywhere, but as you may have noticed somewhere along the route of the Nelson convention last year, the number of E-5 systems appearing on private cars is on the increase, while the old P-3 is becoming proportionately less common (even more so since the Hermey article first appeared).

So, here it is: the future is E-5!