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## Diagnosing Uncommanded Brake Drag

When no pressure is applied to a brake, there should be essentially no torque resulting from the friction material contacting the brake disc. There may be rolling drag from other sources such as tires or bearings (nominal drag or torque) but not from the brake (commanded drag or torque). The first thing to verify when diagnosing a braking problem is whether the problem is hydraulic or mechanical in nature. When the brake is exhibiting higher than nominal drag, open the bleeder valve on the brake. If pressurized oil is released and the drag stops, the problem is hydraulic. If no pressurized fluid is released and the drag continues, the problem is likely mechanical.

If the problem is hydraulic, verify that the reservoir is vented, the vent is open, and the vent is the highest point in the hydraulic system. Verify all of the master cylinder shafts are fully extended. There is a bypass valve in the master cylinder that opens the hydraulic system to the reservoir (and therefore atmosphere) that opens in the last 1/16 inch or so of shaft extension on the master cylinder. The bypass valve allows the hydraulic system to compensate for pad wear and fluid temperature changes. The internal spring in the cylinder provides some excess force for shaft extension but it can be overpowered by excessive drag in the pedal or lever mechanism.

If the issue is mechanical, you need to determine where the interference is coming from. The caliper must be free to float inboard and outboard in the brake plate. When pressure is applied, the caliper is able to move as required and will center on the disc. Even force is applied to both sides of the disc. If the caliper cannot float, the force on both sides will not be even. This can result in loss of torque, uneven wear, and uneven torque on the disc. A rigid line connected to the caliper will restrict the free unloaded positioning of the caliper. A flexible line must be used to be certain the caliper is freely centered and unloaded when pressure is released. **Even a soft aluminum line formed with a coil as a spring will position the caliper rather than allow it to float and is not an adequate**

**substitute for a flexible line connection to the caliper.** Accelerated pad wear can result on the loaded side.

When pressure is released, the brake will relax and pressure on the linings and disc will reduce to essentially zero. The running clearance at the linings and disc will be very small (on the order of 0.010 inch) By virtue of the design of the hydraulic system and free floating caliper, the running clearance will stay in this range during the wear life of the disc and linings. The venting of the hydraulic system will also allow pressure changes from fluid temperature changes (both increasing during brake operation and decreasing during brake cooling) to be eliminated through the vent in the system. If there is mechanical interference with the caliper motion when pressure is applied, the caliper may be forced into the interference and become lodged in position and no longer able to float. Dragging can result that can cause operational problems for the aircraft and damage to the brake from excess heat or distortion. Keep in mind that the caliper housing will move away from the disc with pad wear so there must be adequate clearance behind the housing as well. Free floating of the caliper inboard and outboard in the brake plate when pressure is off must always be maintained.