ACELA Straya 4x4 Driver Controlled Differential Locks (DCDL)

Introduction to DCDL in the Vehicle:

The Driver Controlled Differential Lock (DCDL) is a carrier-mounted traction device manually operated from the vehicle cab.

The purpose of the DCDL is to fully lock the differential and provide maximum vehicle traction when encountering unfavorable operating conditions.

When encountering a poor traction condition, the operator can activate the DCDL to temporarily force each driving wheel to use all the tractive effort available to the axle, and then deactivate as soon as the vehicle is through the area.

A DCDL consists of a shift assembly mounted on the axle carrier.

Actuating the Differential Lock moves a shift fork, connected to a rotating shift collar, along the splines of the axle shaft, toward the differential case. When the splines on the shift collar engage with the splines on the differential case, the shafts and the differential assembly lock together, forcing both wheels to turn at the same speed and with equal torque.

Features and Benefits of DCDL

- A fully locked differential provides superior vehicle traction and control over other traction assist devices.
- Fewer parts compared to other traction control devices which means lower cost, less maintenance; easily serviced.
- No special friction modifying oil additives like some clutch pack traction devices and does not generate wear particles.
- Driver Controlled" means the DCDL is used only when needed, otherwise it operates as a typical differential with all the associated benefits.

Figure 1: Differential case half showing shift collar, shift fork (red), and actuator.

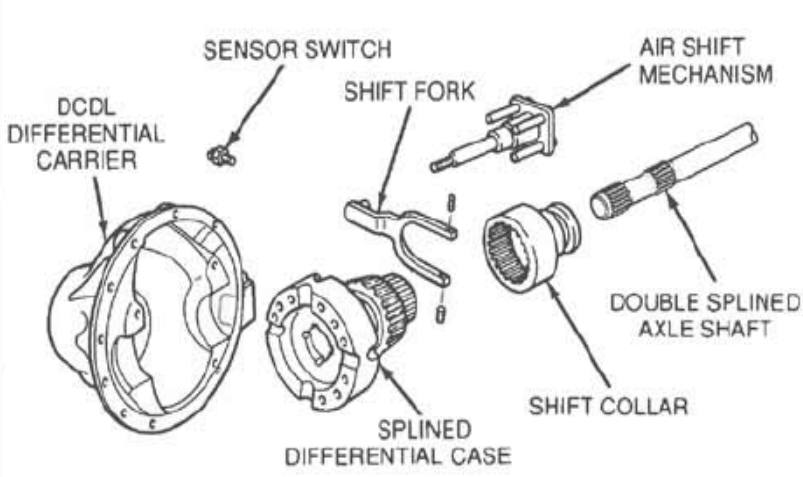

Figure 2: DCDL consists of 7 unique components

DCDL Operation

DCDL is activated by instrument panel switch(es), allowing the driver to activate or deactivate front (if equipped) and rear differential action as poor traction conditions are encountered.

Visual and audible indicators and/or status messages on the instrument panel display DCDL status – messages indicate front (if equipped) and/or rear DCDL activation and confirmation of engagement DCDL clutch collar position from a signal that is provided by a sensor in the DCDL unit itself.

DCDL controls can only be activated only when the vehicle transfer case is in 4LO and the vehicle is at a complete stop. Additionally, the front DCDL (if equipped) can only be activated if the rear DCDL is already activated.

Figure 3: In-cab Differential Lock Switch

This setup, in effect, allows drive torque to be available to at least three of the four wheels. If the vehicle encounters a situation where three wheels are slipping (three wheels on ice), activating a second DCDL would send nearly 100% of available torque to one wheel. It is likely that the design limits of the axle shafts and planetary gearing will be exceeded.

IMPORTANT WARNINGS

1. **The DCDL can only be activated or deactivated when the vehicle is in 4LO and at a complete stop**
2. **NEVER EXCEED 25 MPH (40 kph) when DCDL is activated**
3. **When the front DCDL (if equipped) is activated, the vehicle's turning radius will increase. This condition is called "understeer." The driver must use extreme caution when operating the vehicle with the front DCDL activated.**
4. **Always deactivate the DCDL as soon as the need for maximum traction has passed.**
5. **Tight turns MUST BE AVOIDED while front or rear DCDL are activated.**

Key Operating Tips

It is important that the driver remember to:

- Never activate or use when going downhill or while going around a corner or sharp curve.
- Never activate DCDL while the wheels are in a spinout condition.
- Only DCDL use at low vehicle speed; UNDER 25 MPH (40 kph).

DCDL is intended to be used only in poor traction conditions and unlocked as soon as traction improves.

- Poor surface condition = ground coefficient less than 0.4 typically encountered in mud, snow, or ice.
- Improved surface condition = ground coefficient greater than 0.4; pavement, packed dirt, or packed gravel.

DCDL should NEVER be engaged on improved surfaces due to potentially unexpected changes in vehicle handling characteristics and risk possible driveline damage.

Activating DCDL

Follow these recommended steps when encountering poor operating conditions where maximum traction is needed:

1. Bring the vehicle to a complete stop and ensure transfer case is in 4LO
2. While at a complete stop, activate the rear DCDL by depressing the rear DCDL lock switch - the switch will illuminate and an audible signal will sound
3. When rear DCDL is fully engaged, a signal from the DCDL itself will illuminate an additional indicator light or message
4. If front DCDL (if equipped) is desired, bring the vehicle to a complete stop, ensure rear DCDL is activated and activate the front DCDL by depressing the front DCDL switch - the switch will illuminate
5. When front DCDL is fully engaged, a signal from the DCDL itself will illuminate an additional indicator light or message

Deactivating DCDL

Follow these recommended steps to deactivate the DCDL:

1. Bring the vehicle to a complete stop.
2. While at a complete stop, deactivate the front DCDL (if equipped and activated by depressing the front DCDL switch first - the switch indicator will turn off.
3. When front DCDL is fully disengaged, a signal from the DCDL itself will turn off the visual indicator light and/or message
4. While at a complete stop, deactivate the rear DCDL by depressing the rear DCDL switch - the switch indicator will turn off.
5. When rear DCDL is fully disengaged, a signal from the DCDL itself will turn off the visual indicator light and/or message

DCDL Background Information:

• When used improperly, axle component life can be significantly reduced or lead to driveline damage.

• Because of this damage risk, drivers of DCDL equipped vehicles require a higher level of training on proper use than they would with vehicles equipped with some other traction control devices.

• The damage risk is due to undesirable high torque wrap-up in axle shafts if used improperly. For example, with a front axle DCDL engaged (differential locked) during steering, an axle shaft will wrap to tire slip torque in a very short distance; within a few feet at full steer.

• Planetary Axles are not designed to experience frequent slip torque events on high-traction surfaces. The axle shafts in particular are highly stressed at this torque level. Designing for frequent tire slip would require a significant increase in axle size and weight.

• The vehicle speed at which the DCDL is engaged is not as important to component life as the relative speeds of the tires. A difference in wheel speeds can prevent the DCDL lock collar from fully engaging.

• While not intended for use on improved surfaces, an exception is when one wheel has no load to provide tractive effort for movement (i.e. one wheel off the ground). In this scenario, an attempt at movement by first engaging all drive axles is preferred before using the DCDL. If the DCDL is then required, its use should be only momentary with wheels pointing straight ahead.

• Remember that the DCDL is intended to be used only in poor traction conditions and unlocked as soon as traction improves.