

# Common turbo problems

## REA/SREA failure modes

Rotary Electronic Actuators (REA) or Simple Rotary Electronic Actuators (SREA) are fitted to many variable geometry turbos and control the variable vane movement. This TechTip from Melett explores the benefits of these actuators, and possible causes or symptoms of failure.

### What is variable geometry and why are these systems used?

When a turbocharger is matched to an engine, it is essential to balance the low speed response with high speed efficiency. The nozzle ring assembly is designed to change the exhaust gas inlet area with the engine speed, to closely match the desired boost requirements of the engine. As the engine speed increases, the electronic actuator moves the nozzle ring assembly vanes to the fully open position, to maximise the exhaust gas flow.

REA/SREA electronic actuators are highly complex and intricate. They are not interchangeable with different gearboxes or black caps. The calibration settings are programmed in the software within the black cap and are unique to each turbocharger.

### Benefits of Electronic Actuators

- Rapid response to changes in speed.
- Accuracy of minimum and maximum air flow.
- Feedback loop to the vehicle's ECU - indicates where the actuator position is and learns what boost is required.

### Faulty Electronic Actuator Symptoms

- Complete loss of power, causing the vehicle to go into limp home mode.
- Flashing engine management light.
- Intermittent low pressure, or overboost.

### Common Failure Modes

• **Gearbox Failure** - REA and SREA will fail, as a result of the variable geometry mechanism sticking due to sludging or carbon build up within the turbo. When the variable geometry mechanism sticks, it pulls a higher current through the motor than it is designed to take, causing the motor or the plastic worm gears to fail. This restriction can reduce boost pressure and can result in the vehicle being put into 'limp home mode'. In most failures, the black cap and electronics are unaffected by the gearbox failure and can be reused.

- **Board Connectors** - The wire connectors can expand and contract, eventually breaking and causing failure of the electronic actuator. This fault can often go undetected during repair and workshop testing, as the fault can only be detected once the actuator heats up.
- **Mishandling of the Turbo** - If the turbo connector is knocked or banged, it may break and the whole unit will need replacing.
- **Water Ingress** - The location of a turbo in the engine compartment can mean the electronic actuator is more susceptible to water ingress. The actuator can become rusty and contaminated, giving the wrong signals, before ultimately breaking.
- **Engine Vibration** - Constant vibration from



**Worm gear failure due to restricted VNT mechanism**



**CIPOS gear, worm gear and motor failure. A complete gearbox is required with failures of this nature.**

the vehicle can wear the electronic actuator out, causing it to fail over a period of time.

- **Loss of Power** - If the electronic actuator has failed to open the nozzle ring assembly vanes under acceleration, the turbo will fail to

operate efficiently. If the vanes are set to a closed position, it can cause choking of the engine or overspeeding of the turbine. Alternatively, if the vanes are open more than is required, the turbo will have too much 'lag' and may be slow to respond. If this occurs, it is essential to check if the electronic actuator has failed as a consequence of other failure modes.

### Notes for Repair

- When repairing the electronic actuator, the worm gear and motor must be the correct ratio to avoid immediate failure.
- REA actuators must be calibrated to the turbo after repair. Incorrect calibration of the electronic actuator when assembled on the turbocharger can result in poor performance.
- Soldering to repair broken connections in the gearbox and black cap is not advised. Solder is susceptible to cracking in environments with temperature variance and vibration. For this reason, the motor and motor choke assembly connector must be spot welded.

**For further information on this or other topics, please contact Melett Technical Support.**

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