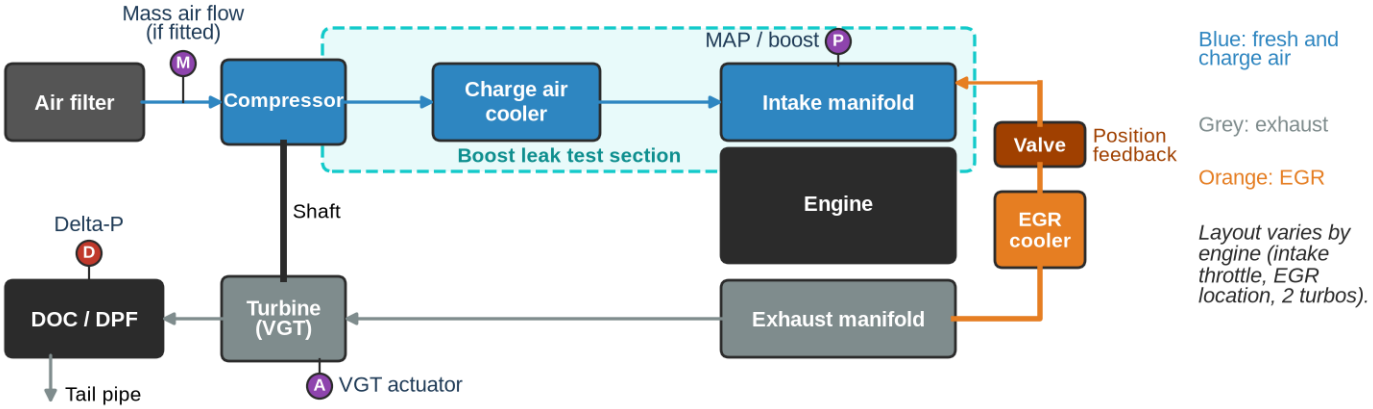
Boost and EGR Cheat Sheet

Low power and smoke: charge air, VGT, EGR and exhaust. Values are typical only; the OEM service information governs.

Intake, charge air, EGR and exhaust path (typical)



Low air or extra exhaust restriction costs power and makes soot. Test the air side before replacing fuel or aftertreatment parts.

Tools needed

- Scan tool with live data, variable geometry turbocharger (VGT) and exhaust gas recirculation (EGR) service tests, data logging
- Charge air test kit (caps, regulator, gauge) or a smoke machine
- Manometer for intake restriction; cooling system pressure tester
- Original equipment manufacturer (OEM) service information: boost, restriction and charge air cooler decay specs

Safety

Never delete, bypass, disable or tamper with EGR, VGT, diesel particulate filter (DPF), selective catalytic reduction (SCR) or their sensors. It is illegal under federal law. Diagnose and repair the fault.

Pressure test caps can blow off. Use regulated air at or below OEM test pressure, clamp the caps, wear eye protection, stand clear.

Do not open a hot, pressurized cooling system. Keep hands and tools out of a running turbo inlet.

Turbos, manifolds and EGR coolers stay very hot after shutdown.

Step-by-step procedure

1. **Verify and scan.** All modules, freeze frame, active derates. Fix air and EGR codes before aftertreatment codes.
2. **Basics.** Air filter restriction (heavy-duty often under about 25 inches of water (inH2O) at full load, per OEM), exhaust leaks before the turbo, loose clamps, split boots.
3. **Key on, engine off plausibility.** Manifold absolute pressure (MAP) or boost reads barometric (or 0 gauge), mass air flow (MAF) near 0, delta-P near 0.
4. **Boost leak test.** Cap the charge air system and pressurize with regulated air or smoke. Listen, soap-test, and run the OEM decay test. Charge air coolers may leak slightly by design.
5. **VGT.** Run the actuator sweep. Actual should follow commanded without sticking. Note how the OEM reports position (% open or % closed).
6. **EGR valve.** Command open and closed: actual position follows, and, if fitted, MAF drops when it opens. Stuck open: low power, black smoke.
7. **EGR cooler.** Coolant loss with no outside leak, white smoke with a sweet smell, a pressurized cooling system or coolant in the intake. Pressure test per OEM; inspect the DPF face after a leak.
8. **Exhaust restriction.** High DPF differential pressure (delta-P) means high backpressure: low power, high exhaust gas temperature (EGT) and poor turbo response. Compare to soot load.
9. **Road test.** Log boost desired vs actual, MAF, VGT and EGR positions under full load. Recheck codes.

Smoke and readings

Symptom or reading	Likely causes
Black smoke	Too little air for the fuel: boost leak, VGT stuck, EGR stuck open, restricted air filter, over-fueling injector. With a DPF fitted, black smoke at the tail pipe points to a cracked or failed DPF
White smoke, fuel smell	Unburned fuel: cold engine, low compression, injector fault
White smoke, sweet smell	Coolant: EGR cooler, head gasket or cracked head
Blue smoke	Oil burning: turbo seals, rings, valve guides, crankcase pressure
Boost below desired	Charge air leak, VGT, exhaust restriction, air filter, sensor
MAP and barometric pressure (BARO) disagree, key off	Sensor or plugged sensor port

- Small amounts of oil in the charge air piping can be normal. Puddles point to turbo seals or crankcase pressure.
- Clean sooted EGR flow sensor tubes and ports before replacing sensors.

Always verify against the OEM wiring diagram and service information for the vehicle.
Learn a structured diagnostic process with Mechanic Mindset training.