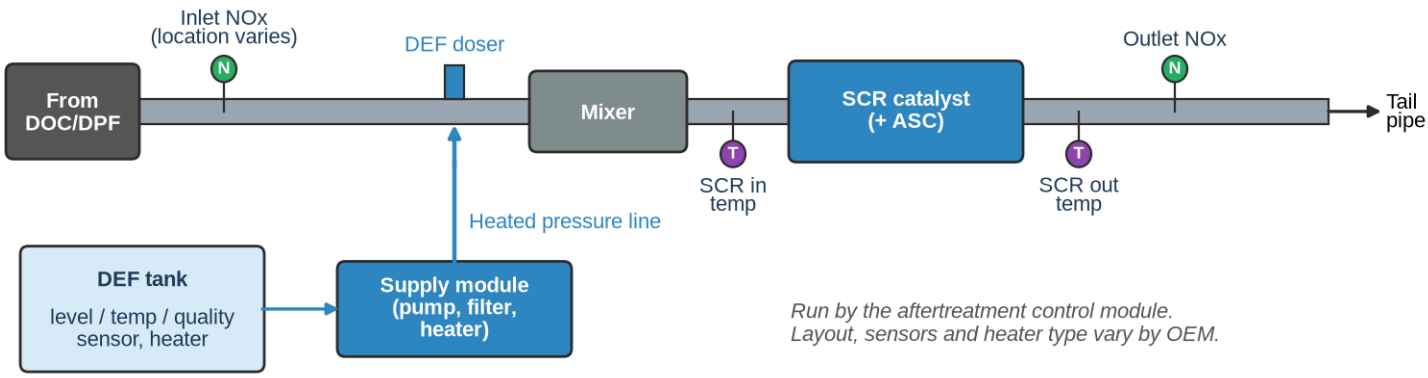
SCR, DEF and NOx Sensor Cheat Sheet

Selective catalytic reduction: DEF quality, dosing, heaters and NOx sensor tests, step-by-step. Values are typical only.

Typical SCR and DEF system



Generic layout. Some systems are air-assisted, some use coolant-heated tanks, and NOx sensor locations vary. Check the service information.

Tools needed

- Scan tool with live NOx data, DEF dosing (quantity) test and resets
- DEF refractometer (urea scale) and contamination test strips
- Graduated container for the dosing test; clean, dedicated DEF containers
- DMM and back probes for heaters, sensors and the doser circuit

Safety

DEF: wear gloves and eye protection; rinse skin and eyes with water. It attacks copper, brass and plain steel, so clean spills and use only DEF-rated tools and containers.

Wait for the purge. Many systems pump DEF back to the tank after key off. Let it finish and relieve pressure before opening lines.

The doser and exhaust are hot after running. Let them cool before removing the doser or sensors.

DEF freezes at about -11 °C (12 °F). Store it out of heat and sun; it degrades.

Step-by-step procedure

1. **Scan, save and check history.** Record codes, freeze frame, inducement status and DEF use. Low DEF use with no codes is a red flag for a dosing problem.
2. **Fix upstream codes first.** Air, EGR, fuel and NOx sensor faults come before blaming the catalyst.
3. **Test the DEF.** Sample from the tank into a clean container. Refractometer target about **32.5%** urea. Use strips for fuel or oil. If it is bad: drain, flush per OEM, refill with fresh DEF, and find where it came from.
4. **Visual.** Exhaust leaks ahead of the NOx sensors or SCR, white crystals at the doser tip, mixer or fittings, damaged heated lines, connectors and sensor wiring.
5. **Dosing (quantity) test.** Run the service routine into a graduated container and compare to the OEM amount. Low: DEF filter, crystals, pump, lines or doser.
6. **Heaters and lines** (cold weather or heater codes). Check tank, line and supply module heaters for power, ground and resistance per OEM.
7. **NOx sensor plausibility.** Engine warm, dosing disabled: inlet and outlet should read close together. Compare to a known-good sensor to find the one that is off. Check sensor power, ground and CAN.
8. **Conversion check.** With dosing on and the SCR warm, outlet NOx should be well below inlet. Run the OEM SCR performance test if one is available.
9. **Repair and verify.** Do the required resets (NOx sensor reset, doser prime). Some OEMs verify with a parked regen. Road test and rescan.

Readings and what they mean

Test	Good	Points to
Refractometer	About 32.5% urea (one OEM tree accepts 31 to 34%)	Low: diluted. High: evaporated. Strips for fuel or oil
Dosing test	Within OEM amount	Filter, crystals, pump, lines, doser
NOx in vs out, dosing off	Close together	One far off: biased sensor
NOx in vs out, dosing on	Outlet well below inlet	Near equal: DEF, dosing, deposits, catalyst
Crystals at doser or mixer	None or light	Leak, overdosing, long idle, bad DEF

Notes

- DEF is 32.5% urea in purified water (ISO 22241). Never add water or additives.
- Many "bad catalyst" calls are bad DEF or a biased NOx sensor. Test the DEF first; it is cheap.
- Common codes: SPN 4364, 3226, 3216, 3364, 4334, 1761; P20EE, P207F, P20B9/P20BA, P2201, P2047.
- **Never disable dosing or use an emulator.** Repair the system.

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