

SECOND WRENCH DIESEL SUPPORT — Tech Response

SAMPLE — example problem with a fictional shop and truck, showing the format subscribers receive

Shop: Sample Truck Repair LLC · **Request #:** 1042 · **Date:** October 21, 2026

Truck: 2020 Freightliner Cascadia — Detroit DD15 · **Unit #:** 214 · **Mileage:** 612,480

Requested by: Shop Foreman · **Category:** Aftertreatment / derate help

1. The problem, in plain words

Truck came in with the check-engine and derate warning lights on and power cut back. Driver says it started losing power gradually over two days, no recent work done to the aftertreatment. Codes read with JPRO: **SPN 4364 FMI 18** (SCR NOx conversion efficiency below normal) and **SPN 3216 FMI 4** (aftertreatment intake NOx sensor circuit, voltage low). Shop has not replaced anything yet — good. Nothing gets replaced until the tests below say so.

2. Most likely causes — in order

- **Bad or biased intake (upstream) NOx sensor.** The SPN 3216 FMI 4 is a circuit code pointing at this sensor or its wiring. If the ACM can't trust the NOx reading coming in, the conversion-efficiency math falls apart — one bad sensor can set both codes.
- **Poor DEF quality or low DEF concentration.** Contaminated or watered-down DEF drops conversion efficiency exactly like this. Cheap to check, commonly skipped.
- **DEF doser valve restricted or crystallized.** Under-dosing starves the SCR of ammonia — same result, same code.
- **SCR catalyst degraded.** Possible at this mileage, but it's the expensive guess — it's last on the list on purpose, after everything cheap is proven good.

3. Diagnosis steps — run them in this order

1. **Check DEF quality first.** Sample from the tank (not the filler neck) with a refractometer. Spec is **32.5%** urea; the acceptable window is **31.8%–33.2%**. Inside that window, the fluid is good — move on. Outside it, or if the sample looks cloudy or smells of diesel, the fluid is the problem: drain, flush, refill with fresh sealed DEF, then go to Step 5.
2. **Inspect the NOx sensor wiring.** Follow the intake NOx sensor harness from the sensor to the aftertreatment control module. Look for chafing, melted insulation near the exhaust, and green corrosion in the connector. Wiggle-test while watching live data — a reading that jumps around found your problem.
3. **Check sensor power and ground — meter in hand, here's exactly what to do.** Unplug the intake NOx sensor. The connector has 4 pins: **pin 1 = power** (from the ACM), **pins 2 and 3 = data (CAN) wires**, **pin 4 = ground**. Key ON, engine off, meter on DC volts: red lead on pin 1 (harness side), black lead on a clean ground. **You must read over 10.5 volts** — on a healthy truck you'll see near battery voltage, about 12 volts or better. **10.5V or less (or zero)** means the power feed is the fault — the sensor is innocent. Trace the pin-1 wire back toward the ACM (it lands on pin 50 of the ACM's 120-pin connector): key OFF, that wire must read **under 5 ohms**

end to end. Over 5 ohms = damaged wire; repair it. Next, ground check: key OFF, meter on ohms, pin 4 to ground must read **under 5 ohms** (that ground runs to pin 51 at the ACM). Over 5 ohms = bad ground wire. Last, data wires: key OFF, measure across pins 2 and 3 — about **60 ohms** is correct (two 120-ohm resistors in parallel). Way off 60 means a data-wire or termination problem. If power, ground, and data all pass and the code stays, the sensor itself has failed — now you've *earned* replacing it.

4. **Compare the two NOx sensors live.** With the engine at operating temp and a parked regen or sustained load running, watch inlet vs. outlet NOx in the scan tool. Rule of thumb: under load the inlet can read several hundred ppm, and a working SCR brings the outlet down to a small fraction of that — well under half, usually far less. If the outlet reads about the same as the inlet, conversion isn't happening. If the *inlet* reads zero, frozen, or nonsense while the outlet behaves, the inlet sensor is lying — replace it, not the SCR.
5. **Run a parked regen and monitor.** Confirm the DOC outlet / DPF inlet temperature climbs into its normal regen working range — typically around **1,000–1,100°F** — and holds there instead of falling away, and that DEF dosing commands on once the SCR is up to temperature. Record the temps — if it comes back, we compare against these.
6. **Verify with the parked SCR efficiency test.** In DiagnosticLink, run a parked regen followed by the **SCR efficiency test** — that's the verification routine for this fault. It passes when the test completes without SPN 4364 resetting and the outlet NOx reads clearly below the inlet. Then road test under load 20–30 minutes. A code that returns at any point means keep going to Section 8 — don't ship it on hope.

4. Specs & torque specs for this job

Item	Spec / expected reading
DEF concentration (refractometer)	32.5% spec — acceptable 31.8%–33.2%; outside = replace fluid
NOx sensor supply voltage — pin 1 to ground, key on	Must be over 10.5V; expect near battery voltage (~12V+)
NOx power wire (ACM pin 50 → sensor pin 1)	Under 5 ohms, key off
NOx ground wire — pin 4 to ground (ACM pin 51)	Under 5 ohms, key off
NOx data wires — across pins 2 and 3	About 60 ohms, key off
Aftertreatment temps during regen	DOC outlet / DPF inlet typically ~1,000–1,100°F, climbing and holding steady
Outlet vs inlet NOx (working SCR)	Outlet clearly lower than inlet at operating temp
TORQUE — NOx sensor (inlet or outlet) into exhaust	50 N·m (37 lb·ft)
TORQUE — DEF dosing unit mounting bolts (3)	10 N·m (7 lb·ft) — new bolts and new gasket every time; both are one-time use. Over-torquing crushes the gasket and causes exhaust leaks.

TORQUE — Sensor box cover bolt (if opened for harness inspection)	10 N·m (7 lb·ft)
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5. If a part proves bad — repair guide (NOx sensor example)

Job time: diagnosis about 1.0–1.5 hours; sensor replacement about 1.0 hour; regen, SCR efficiency test, and road test about 45 minutes. Call it roughly 3 hours of bay time, start to finish — plan the bay accordingly.

- Key off, batteries disconnected. Let the exhaust cool — the sensor lives on a hot pipe.
- Unplug the sensor module connector, remove the sensor from the exhaust pipe with a NOx/O₂ sensor socket. Work it, don't force it — a snapped sensor turns a one-hour job into a pipe job.
- Anti-seize only if the new sensor doesn't come pre-coated (most do — check the box, don't add more).
- Torque the sensor to **50 N·m (37 lb·ft)**, route the harness exactly like the old one, away from the pipe, clips in their holes.
- Reconnect, clear codes, run Step 6's verification (regen + SCR efficiency test + road test) before the truck leaves.
- **Get the truck's power back — do not skip this.** This truck came in in derate. When the SCR efficiency test passes, the fault clears and the inducement/derate resets with it. If the derate warning is still showing after a passed test, complete the derate reset through DiagnosticLink's service routines before you release the truck, and confirm full power on the road test. A truck that leaves still derated is a comeback with your name on it.

6. Parts & tools

- **NOx sensor** — in a real response, the exact part number is confirmed by the truck's VIN/engine serial before you order. Inlet and outlet sensors are **not** interchangeable, and ordering by year and make alone gets the wrong one on the counter.
- DEF refractometer (borrow one if you don't own one — every shop should)
- Digital multimeter; back-probe pins
- NOx/O₂ sensor socket set
- Scan tool with Detroit aftertreatment data (DiagnosticLink or equivalent) — JPRO reads codes fine, but live NOx data and regens want the Detroit tool
- Fresh sealed DEF — only if Step 1 fails the fluid

7. Safety — read this first

Exhaust and aftertreatment components stay burn-you hot long after shutdown. DEF in the eyes is no joke — glasses on when sampling or draining. Chock the wheels and set the brakes for the road test route, and no regen indoors without exhaust extraction — a parked regen makes real heat and real fumes.

8. If that doesn't fix it

If DEF tests good, wiring and power are clean, and both NOx sensors read believably — but 4364 comes back — the next branch is the DEF doser: pull it, inspect for crystallization, and run a doser quantity test in DiagnosticLink (the tool displays the expected delivery for the test — your measured amount has to match it). If dosing is on spec too, send us the regen temperature recordings from Step 5 and we'll work the SCR catalyst branch with you. Follow-ups on this same problem are part of this same request — reply to the email this came on with your test results.

9. Close

Most likely outcome on this truck: one NOx sensor and an hour of testing — not the SCR box the parts counter wants to sell you. Run the steps in order and send back what you find. Need to talk it through? Book a call here: [\[BOOKING LINK\]](#) — calls are by appointment so you get a mechanic's full attention, start to finish.

— Second Wrench Diesel Support · Sample document — example only, not guidance for a specific vehicle