N54 Engine Diagnostic Fault Tree Version 12_03_09

*TC-Authorization is needed for replacements of all parts listed below
- EKP
- EKPM
- Low Pressure Fuel Sensor
- Rail Pressure Fuel Sensor
- High Pressure Fuel Pump
- Fuel Injector
- Ignition Coil
- O2 Sensor
- Knock Sensor

First Steps
- ISTA short test (use v2.16 or higher)
- PMP questionnaire
- Car service history → **Possible buy-back situation?**
- Come back more than 2 times?
- **Has RTE been contacted?**

Check for Powertrain Aftermarket Devices /Modifications,
e.g. turbo boost controllers, complete exhaust or induction systems, blow off valves, etc. (see SIB121008/122008);
IF YES: contact customer and advise that vehicle has to be brought back to STOCK CONDITION prior to continuing diagnosis;
Contact Area-Team to flag the vehicle in the warranty system!!

Symptom is „**white smoke upon start up**“ or „**strong fuel smell**“
- Yes → „TC N54 Drivability“ → Follow **Leaking Injector** Diagnostic Fault Tree (see page 2 of 6)
- No

If customer complaint is „**long crank**“ **or** fuel system fault codes? (**29DC, 29E2, 29F1, 29F2, 2FBC, 2FBE, 2FBF**)
- Yes → „TC N54 Fuel“ → Follow **Fuel System** Diagnostic Fault Tree (see page 3 of 6)
- No

Check Fault Memory

Turbocharger or **VANOS** fault codes stored
- Yes → „TC N54 Engine“ → Submit a **TC-Engine Case**
- No

IGNITION fault codes stored
- Yes → Follow according ISTA test module
- No

INJECTOR fault codes stored
- Yes → Follow according ISTA test module
- No

other fault codes stored
- Yes → Follow according ISTA test module
- No

Check I-Level (DME)

MSD80 before 03/2008

MSD81 since 03/2008

vehicle type E60 or E61?
- No → DME OK
- Yes

I-Level =Exxx-08-xx-xxx
- No → DME OK
- Yes

I-Level <E060-09-03-500
- No → DME OK
- Yes

I-Level Update to newest version

IMPORTANT:
Readaptation of the DME → Test Drive is needed!
- Car must be at operating temperature / warm
- Drive vehicle 50-60mph with 2000-2500rpm for about 3min (use manual shift, if needed)
- Let vehicle idle for about 5min
- If possible: let vehicle sit over night and cold start the next morning (let it idle for 5min)

Symptom is „**mixture adaptation fault**“ (e.g. 29E0, 29E1)
- Yes → „TC N54 Drivability“ → Follow **Mixture Adaptation Fault** Diagnostic Fault Tree (see page 4 of 6)
- No

Symptom is „**rough running at cold start**“
- Yes → „TC N54 Drivability“ → Follow **Rough Running @ cold** Diagnostic Fault Tree (see page 5 of 6)
- No

Symptom is „**rough running at warm engine**“
- Yes → „TC N54 Drivability“ → Follow **Rough Running @ warm** Diagnostic Fault Tree (see page 6 of 6)

DFT – Leaking Injector

Check Symptom

Is this really the symptom described?

Is **white smoke** visible at the tailpipe or does the exhaust **strongly smell of fuel**?

No → Return to Page 1

Yes

Any misfire faults stored?

No → Contact TC

Yes → **Swap ignition coil and spark plug** of misfiring cyl. with OK cylinders;

Does misfire follow the ignition coil?

No

***Submit TC case for injector replacement on the cylinders affected by misfire**

Note:

- If only one misfire occurs per bank → Replace just one injector
- If more than one misfire occurs in the same bank → Replace all 3 injectors of that bank;
- If more than three cylinders misfire → Replace all 6 injectors
- If the injector part numbers are **7 537 317** → Replace **ALL** injectors

DC_LEAK

Yes

***Submit TC case for ignition coil replacement** and spark plug accordingly

DC_COIL

Injector Part Number

When replacing injectors, make sure that:

- Injector calibration is done (follow SIB 12 26 08)
- Clear all DME adaptations
- Include replaced injector part number (see picture at the left) in PUMA case

In case of this **leaking injector symptom**, make sure that:

- Catalyst inside (Honeycomb) is visually checked (borescope if available), whether they are mechanically deteriorated; please attach pictures to TC case; also check for fault codes 29F4, 29F5 „catalyst conversion“ in the fault memory;
- Oil change is performed
- Current DME I-Level is programmed
- Extended test drive is performed! It needs elevated temperatures and high engine loads to evaporate/burn fuel in exhaust system

Exit

Create and submit TC-Case, where applicable

Recheck fault memory after test drive; If clear, return car to customer

DFT – Fuel System

Entry
Check Fault Memory

EKP Module

Any fault entries in the EKP module?

Yes → Information: CCC message „fuel pump defective“ or engine does not run at all → EKP function check according to ISTA EKP test modules; *submit TC case for EKP replacement if necessary → **DC_EKPM**

No

DME Low Pressure (LP) System

0x29F3 „fuel pressure sensor electrical“ **or 0x2A2D** „fuel LP system, fuel pressure“ **or 0x2AAF** „Fuel pump plausibility“

Yes → Check for open electrical circuit between LP sensor and DME;; replace components if necessary → **DC_EKP_LINE**

OK → Check LP sensor (except E89); follow ISTA test module; *submit TC case for LP sensor replacement if necessary; default value appears as 6.5bar, when sensor defective/ open circuit **Check low pressure sensor line: if mounting bracket is welded onto pipe, replace with part number 7 545 725** → **DC_LPS**

OK → EKP function check; follow ISTA test module; *submit TC case for EKP replacement if necessary → **DC_EKP**

Proceed with High Pressure System Check

No

DME High Pressure (HP) System

0x29E2 „fuel injection rail, pressure sensor signal (HP system)“

Yes → Check for open electrical circuit between rail sensor and DME; *submit TC case for rail sensor replacement if necessary; Note: default value appears as 265bar, when sensor deffective / open circuit → **DC_HPS_29E2** → Have components been replaced? Yes

No

0x29F1 „fuel pressure plausibility“

Yes → Check HP sensor; make sure car was sitting more then 15min; follow diagnostic request to compare LP to HP sensor values; the values must not differ more the +/-3 bar; replace HP sensor if necessary **Important note**: in case the HP sensor value is higher then 9bar, release the pressure by slightly loosening the connection between the injector and the rail and repeat the above check again; in case of repeated failure *submit TC case for HP sensor replacement → **DC_HPS_29F1**

No

No

0x2FBC „fuel control valve, signal“

Yes → Check for open electrical circuit between HDP and DME; replace components if necessary → **DC_HDP_HARNESS**

0x2FBE fuel high pressure after engine stop, pressure too high

Yes → *Submit TC case for HDP replacement → **DC_HDP_VCV**

0x29F2 „fuel HP system, fuel pressure“ **or 0x29DC** „cylinder injection switch-off, pressure too low in the HP system“

Yes → **E89 only**: Check EKP function; follow EKP test module; *submit TC case for EKP replacement if necessary; → **DC_HDP_E89_EKP** → EKP repaired

OK → For E9x/E8x/E6x/E71 Follow ISTA test module B1214 DI6KHDR; follow DCS message on 10/7/2009 (ISTA D2.16.9 – N54 HDP test plan) **Information! Shows up to 170bars during cold start (catalyst heating); Between 40bar and 210 bar is OK. Note value at idle.** → *Submit TC case for HDP replacement

SIB 12 55 06 Situation 2

Yes

No

0x2FBF fuel high pressure on release of injection, pressure too low **AND** customer complaint is “long crank”

Follow instructions in SIB 12 55 06 Situation 1

Yes → **Let engine cool down below 40°C / 100°F**
Disconnect low pressure side from high pressure side
Check EKP function / LP System with gauge:
- p_fuel(LP) > 4.75bar while EKP is running; if not: follow B1214_DI6KNDR
- residual pres. of >3.75bar 10min after EKP was deactivated; if not: *replace components as per SIB 125506
- Note Values and add them to the PUMA case!

If EKP check (LP system) okay → **Connect low pres. side and high pres. side**
- Check residual pressure in HP system with B 1214_DI6KHDR (Subtest 2 „Check Rail Pressure Sensor“)

Is the residual pressure of HP sys. >2bar after 10min

No → Check for leaks in the rail/ conectors; Replace defective parts

No leaks found → **Continue with page 2,** following DFT – leaking injector

Leaks eliminated → Enter HDP Production and Serial No. (see picture above) PUMA case; Make sure PMP questions are answered as thorough and accurate as possible

Yes → *Submit TC case for HDP replacement (when ISTAP 2.36.0 is available & car has MSD81, then update DME) → **DC_HDP_2FBF**

No

only „long crank“ complaint without 2FBF

Check battery voltage; check starter; check crank shaft and camshaft sensors; repair if needed → **DC_OTHER_LC**

No trouble found

Repair was needed at battery, starter, crankshaft or camshaft sensors

Create and Submit TC-Case where applicable
Recheck fault memory after test drive (for recommended procedure see page 1); If clear, return car to customer

For Your Information

Definition of the „long crank“ complaint:
the engine is cranking up to about 3-4 seconds, before it starts quickly

LP = Low Pressure System
HP = High Pressure System

Where to find the HDP’s **Production and Serial Number**

DFT – Mixture Adaptation Fault

Check Symptom

Is this really the symptom described?

Is **29E0, 29E1** fault code stored?

No → Return to Page 1

Yes

Check environmental conditions of fault code: Is it too **Rich** or too **Lean**?

Too Rich

Check for possible rich conditions

- Visually check monoliths (borescope if available), whether they are mechanically deteriorated; check fault memory for 29F4, 29F5 „catalyst conversion“
- Continue following DFT – Leaking Injector on Page 2

DC_MIX_RICH

Too Lean

Check exhaust side on that bank

- Smoke the exhaust system; search for cracks/leakages and replace part if needed
- Are O2 sensors torqued correctly; *Submit TC case for replacement, if needed

DC_MIX_EXH

Check Fuel Quality

- Check alcohol content following SIB 13 04 06; In case >12% → check fuel lines and connections for corrosion
- Refuel the car with **known good gas**
- Clear DME adaptations (doublecheck with short test GT1)

DC_MIX_FUEL

Readaptation of the DME
→ Test Drive is needed!

- Car must be at operating temperature / warm
- Drive vehicle 50-60mph with 2000-2500rpm for at least 3min (use manual shift, if needed)
- Perform at least 2-3 drive cycles if possible
- Let vehicle idle for about 5min
- Recheck mixture adaptation values (short test GT1)

Problem fixed? Check FASTA data!

No

Check Fuel Supply

- Check crankcase ventilation pressure
- Check fault memory (history) for any indications of lean conditions, 29F2, 29DC, 29F1, etc.
- Inspect the fuel tank for contamination like sand, grit, cloudy fuel, etc.; if yes drain the fuel system and *Submit TC case for replacement, if needed

DC_MIX_SUP

Problem not fixed

Contact TC

Yes

Exit

Create and submit TC-Case, where applicable

Recheck fault memory after test drive; If clear, return car to customer

DFT – Rough Running @ Cold Start

Check Symptom

Is this really the symptom described?

Is the vehicle **running rough ONLY at cold start**? Does it run smooth @ warm?

No → **Continue with page 6,** following DFT – rough running @ warm engine

Yes

Are **misfire faults** set in DME?

Yes → Check environmental conditions of misfire faults: Is there a misfire fault with **engine temperature >50°C**?

Yes → Continue with page 6, following DFT – rough running @ warm engine

No

No

In case of **rough running @ cold** make sure to:

- Check for upper end taping noises from HVAs (valve lifters)
- Check **crankcase ventilation** pressure following SIB 11 03 08; crankcase ventilation pressure should be 9mbar (+/- 1mbar)
- Check **spark plugs;** are they wet or excessively sooted?
- Check **injector calibration** values; follow SIB 12 26 08
- **Update DME** to latest I-Level

- **Swap injectors** from misfiring cylinders to okay cylinders
- **Recalibrate injector** values according to swap; follow SIB 12 26 08
- If swaping injectors fixes the car, make sure to replace Teflon seal

DC_RRC_SWAP

Readaptation of the DME → Test Drive is needed!

- Car must be at operating temperature / warm
- Drive vehicle 50-60mph with 2000-2500rpm for about 3min (use manual shift, if needed)
- Perform at least 2-3 drive cycles if possible
- Let vehicle idle for about 5min
- **Let car sit over night and start the car cold!!**

Problem fixed?

No → **Contact TC**

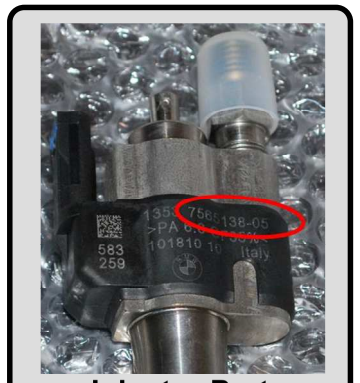
Yes

Exit

Create and submit TC-Case, where applicable

Recheck Fault Memory after cold start; If clear, return car to customer

DFT – Rough Running @ Warm Engine



Injector Part Number

Check Symptom

Is this really the symptom described?

Is the vehicle **running rough with warm engine**?
- Yes → Are **fault codes 29E0 or 29E1** set in DME?
  - Yes → **Continue with page 4,** following DFT – mixture adaptation fault
  - No → Are **misfire faults** set in DME?
    - Yes → Check environmental conditions of misfire faults: Are **engine temperature <50°C for ALL misfire faults**?
      - Yes → **Continue with page 5,** following DFT – rough running @ cold start
      - No → (continue below)
    - No → (continue below)
- No → Is the **SES light on?**
  - Yes → (continue below)
  - No → Return to Page 1

First Check:

- **Recheck DME fault code**; are there any other fault codes; if yes follow ISTA test plans
- Recheck DME I-Level (look at page1), update if needed
- Check **crankcase ventilation** pressure following SIB 11 03 08; crankcase ventilation pressure should be 9mbar (+/- 1mbar)
- Check **cylinder compression / cylinder leak down at engine operating temperature with open throttle;** follow RA 11 00 039 and SIB 11 13 06; nominal values 14...16 bar, deviation between cylinders not more than 2bar (29psi); leak down exceeding 8% indicates problem; further determine whether it's caused by the intake, exhaust valves or piston rings
- Check **spark plugs**
- Check vacuum lines, waste-gate solenoid valves of the turbochargers, etc.

Are there **misfire codes on multiple cylinders?**

- No → **Misfire on single cylinder**
  - **Clear all DME adaptations via service function path!** Perform a short test using GT1
  - **Update DME I-Level** (compare with instructions on page 1)
- Yes → **Misfire on multiple cylinders**
  - **Swap ignition coil and spark plug** of misfiring cyl. with OK cylinders; visually check the coils and plugs for burn marks
  - Does misfire follow the ignition coil?
    - Yes → ***Submit TC case for ignition coil replacement** and spark plug accordingly
    - No → ***Submit TC case for injector replacement on the cylinders affected by misfire**
      Note:
      - If only one misfire occurs per bank → Replace just one injector
      - If more than one misfire occurs in the same bank → Replace all 3 injectors of that bank;
      - If more than three cylinders misfire →Replace all 6 injectors
      - If the injector part numbers are **7 537 317** → Replace **ALL** injectors

      When replacing injectors, make sure that:
      - Injector calibration is done (follow SIB 12 26 08)
      - Include replaced injector part number (see picture at the left) in PUMA case
      - Clear all DME adaptations

IMPORTANT:
Test Drive is needed!
- Engine must be warm
- Drive vehicle at different loads and speeds!

Readaptation of the DME → Test Drive is needed!
- Car must be at operating temperature / warm
- Drive vehicle 50-60mph with 2000-2500rpm for about 3min (use manual shift, if needed)
- Perform at least 2-3 drive cycles if possible
- Let vehicle idle for about 5min

Problem fixed?
- No → **Contact TC**
- Yes → **Exit**
  Create and submit TC-Case, where applicable
  Recheck Fault Memory after test drive;
  If clear, return car to customer