STAR ONLINE PUBLICATION

Case Number: S2418000010

Release Date: August 2024

Symptom/Vehicle Issue: MIL On/Check Engine Lamp On, Engine May Run Rough

Customer Complaint/Technician Observation: The customer's complaint may include the MIL on/ check engine lamp on. The condition may or may not include the engine missing or running rough. Upon further investigation, the following DTC(s) may be set in the Powertrain Control Module (PCM):

P0300-Multiple Cylinder Misfire
P0301-Cyl 1 Misfire
P0302-Cyl 2 Misfire
P0303-Cyl 3 Misfire
P0304-Cyl 4 Misfire
P0305-Cyl 5 Misfire
P0306-Cyl 6 Misfire

Discussion: This STAR On-Line is meant to pinpoint the diagnostic steps needed for different types of misfires. If there are any other DTCs (P- codes) setting along with the misfire DTCs, complete diagnostic checks on those **FIRST** in accordance with Service Library procedure(s) **before proceeding with the misfire DTCs**. **Failure to do so could result in wasted diagnostic time and not fixing the problem.**

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IF there are no other DTCs (P- codes) setting alongside the misfire DTCs, proceed with the following:

BEFORE COMPLETING ANY WORK, COLLECT A FREEZE FRAME REPORT. IF YOU ALREADY CLEARED THE DTCs, ATTEMPT TO DUPLICATE THE CONDITION FIRST, THEN COLLECT FREEZE FRAME REPORT. THIS IS A CRITICAL STEP!

Reviewing and understanding the data in the freeze frame data will provide important information on what the conditions were when the DTC(s) were setting.

If misfire DTC(s) cannot be duplicated, please refer to the information below for diagnostic direction:

Diagnostic Direction

Misfire Diagnostic Category	Applicable DTC	DTC Condition	DTC Status	Diagnostic Step
Single Cylinder	P0301, P0302, P0303, P0304, P0305, P0306	ONLY 1 misfire code present (not P0300)	ACTIVE, STORED or PENDING	Skip to Step 1.
Single Bank 1	P0300, P0301, P0302, P0303	Any combination of those 4 only	ACTIVE, STORED or PENDING	Skip to Step 2.
Single Bank 2	P0300, P0304, P0305, P0306	Any combination of those 4 only	ACTIVE, STORED or PENDING	Skip to Step 2.
All-Cylinder (across banks)	P0300, P0301, P0302, P0303, P0304, P0305, P0306	All 6 individual cyl misfire codes must be present (plus P0300)	ACTIVE, STORED or PENDING	Skip to Step 3.
Multi-Cylinder (across banks)	P0300, P0301, P0302, P0303, P0304, P0305, P0306	-More than 1 misfire code (not P0300) -Cannot be classified as single bank	ACTIVE, STORED or PENDING	Skip to Step 4.

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After recording the above information, follow the procedure below for 3.0L **SO** (EFH):

1) **For a single cylinder misfire:** Follow the Service Library procedure fully **in specified order** of diagnostic checks. Suggested to submit DIDI with evidence of diagnostic checks to confirm warranty claim.
2) **For a single bank 1/2 misfire:**
   a) Clear codes
   b) Start vehicle
   c) If codes return, remove **downstream** O2 sensor of associated misfire bank. (Fig. 1 shows location of upstream and downstream o2 sensors.)

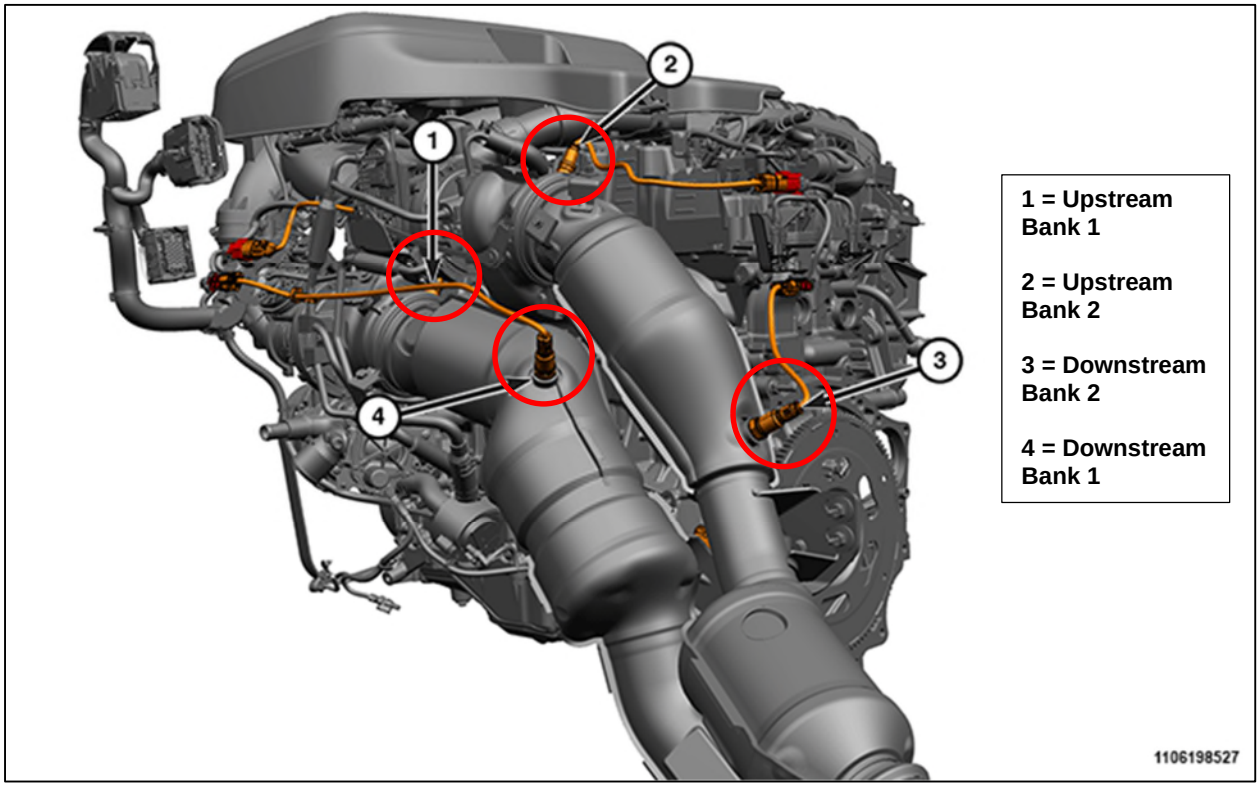

Fig. 1 O2 Sensor Locations

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d) Inspect catalytic converter internally through the **upstream and downstream O2 sensor holes** with borescope. Compare to pictures below to determine if it was damaged. Images outlined in GREEN frames are OK (Figs. 2-4). Images in RED frames are NOT OK (Figs 5-7).

Figs. 2-4 Good Catalyst Examples

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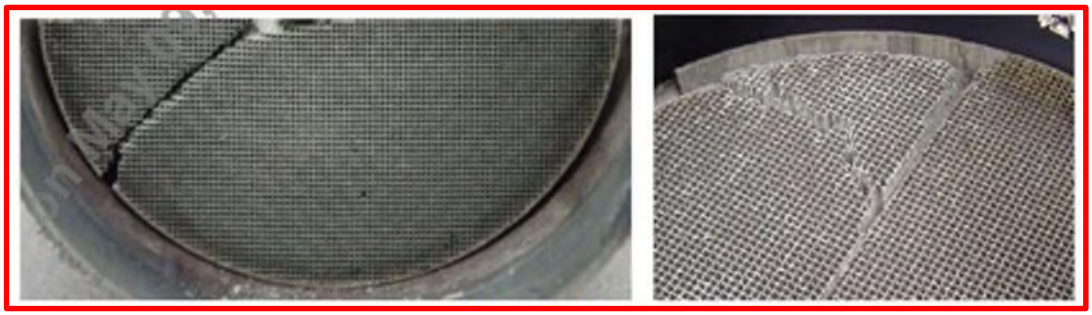

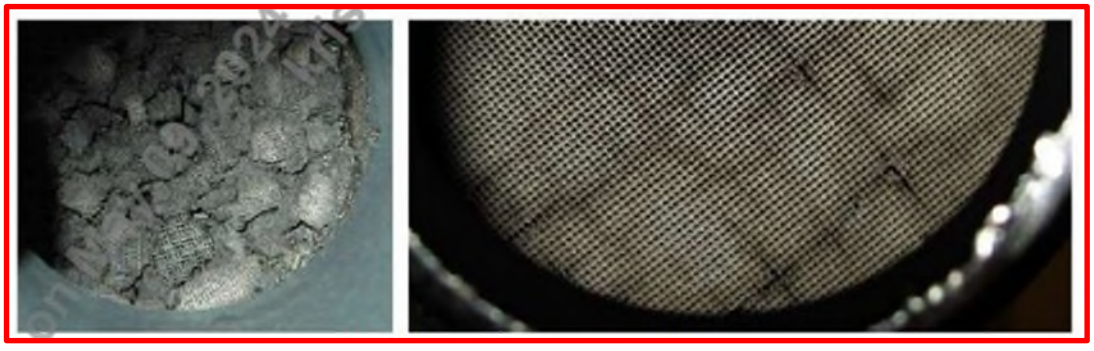

Figs. 5-7 Bad Catalyst Examples

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i) If no damage is found in catalytic converter, swap **upstream** O2 sensors **(Fig. 1 – Sensors labeled 1 & 2)**. Clear codes. Start vehicle. Record Vehicle Scan Report. If misfire DTCs return but switch banks, replace the **upstream** O2 sensor that was originally in the bank associated with the original misfire DTC in accordance with Service Library procedure. Suggest submitting DIDI with evidence of diagnostic checks to confirm warranty claim.

ii) If damage is present in catalytic converter, replace part in accordance with Service Library procedure. Suggest submitting DIDI with evidence of diagnostic checks to confirm warranty claim.

NOTE: It is possible that a misfire can damage multiple components. After the catalytic converter has been replaced, if misfire DTCs return or you have O2 sensor related DTCs, also replace the associated O2 sensor in accordance with Service Library procedure. Suggest submitting DIDI with evidence of diagnostic checks to confirm warranty claim.

3) **For all cylinder misfire (across banks):**

a) Check battery voltage in accordance with the Service Library procedure.

i) If voltage results are below **10.5 V**, follow the service procedure to diagnose and repair the condition. Suggest submitting DIDI with evidence of diagnostic checks to confirm warranty claim.

ii) If battery diagnostics are OK, proceed to next step 3b.

b) Follow SOL S2418000005 to inspect the **air box, air filter,** and **air box lid for proper assembly**. The vehicle may have been recently serviced. If the airbox assembly is not re-assembled correctly after an air filter check, it will disturb the airflow across the Mass Airflow sensor (MAF) and cause varying levels of symptoms.

i) If the air filter or air box lid is found not correctly assembled, follow the SOL above to ensure proper installation. Make sure the repair has resolved the condition.

ii) If those parts are found to be properly assembled, proceed to step 3c.

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c) Check supply side fuel pressure in accordance with Service Library procedure.
   i) If an issue is found with supply side fuel pressure, follow the published repair procedure in Service Library to resolve it. Suggest submitting DIDI with evidence of diagnostic checks to confirm warranty claim.
   ii) If no issues are found with supply side fuel pressure, proceed to step 3d.

d) Check for engine wiring harness for a rub-through or pinched wiring condition. Pay close attention to the section of wiring that falls below or behind AIS Y-Pipe near the lift stud (see Fig. 8 below).

Fig. 8 AIS Y-Pipe near the lift stud

   i) If a wiring defect condition is found, replace or repair wiring harness in accordance with Service Library procedure. Suggest submitting DIDI with evidence of diagnostic checks to confirm warranty claim.
   ii) If no wiring defect is found, proceed to next step 3e.

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e) Check the CAC Cold duct for proper connections/missing or damaged gaskets (locations shown by red circles in Fig. 9).

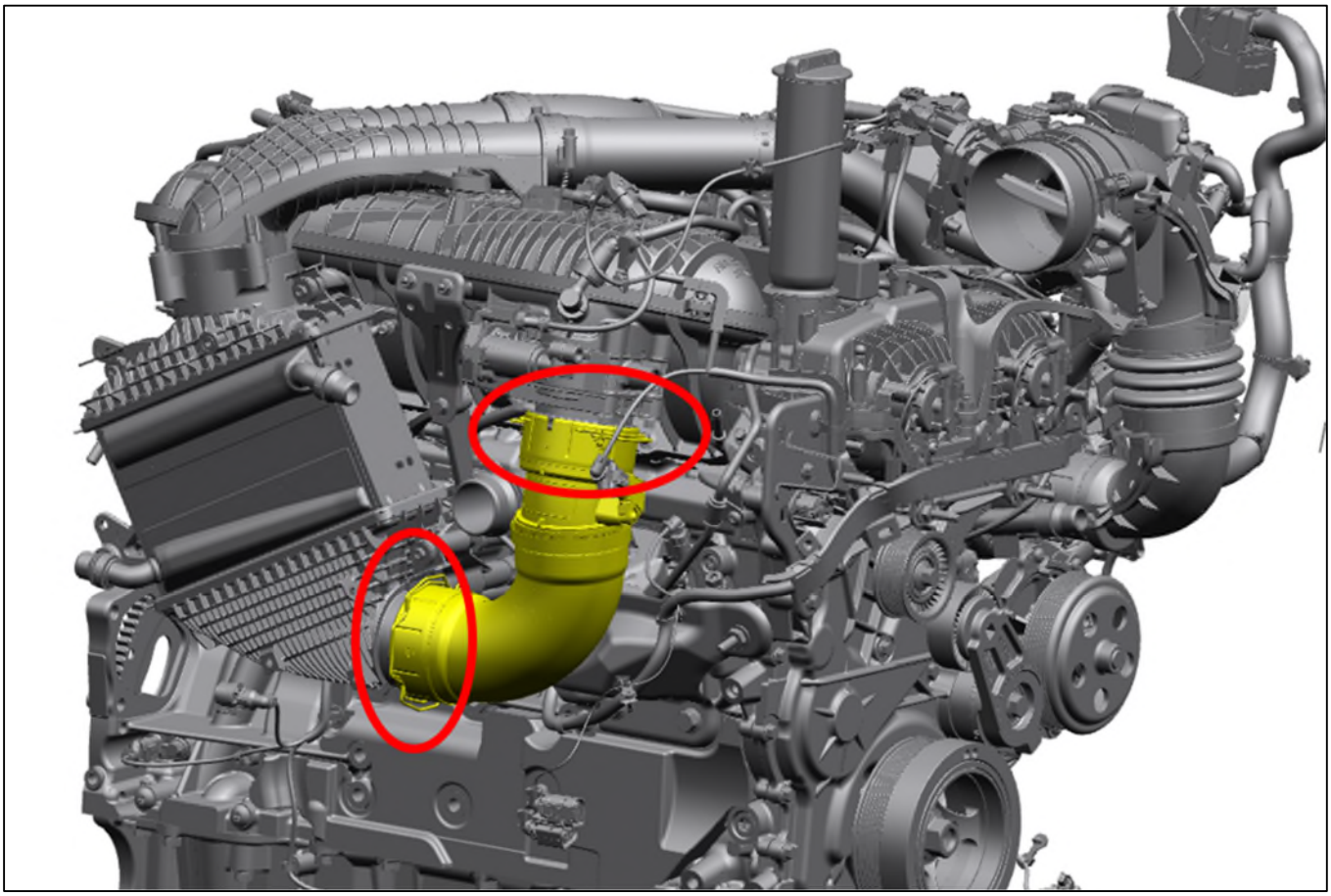

Fig. 9 CAC Cold Duct Location on Engine Assembly

f) Check the Charge Air Cooler Duct connections proper connections/missing or damaged gaskets (Figs. 10-11).

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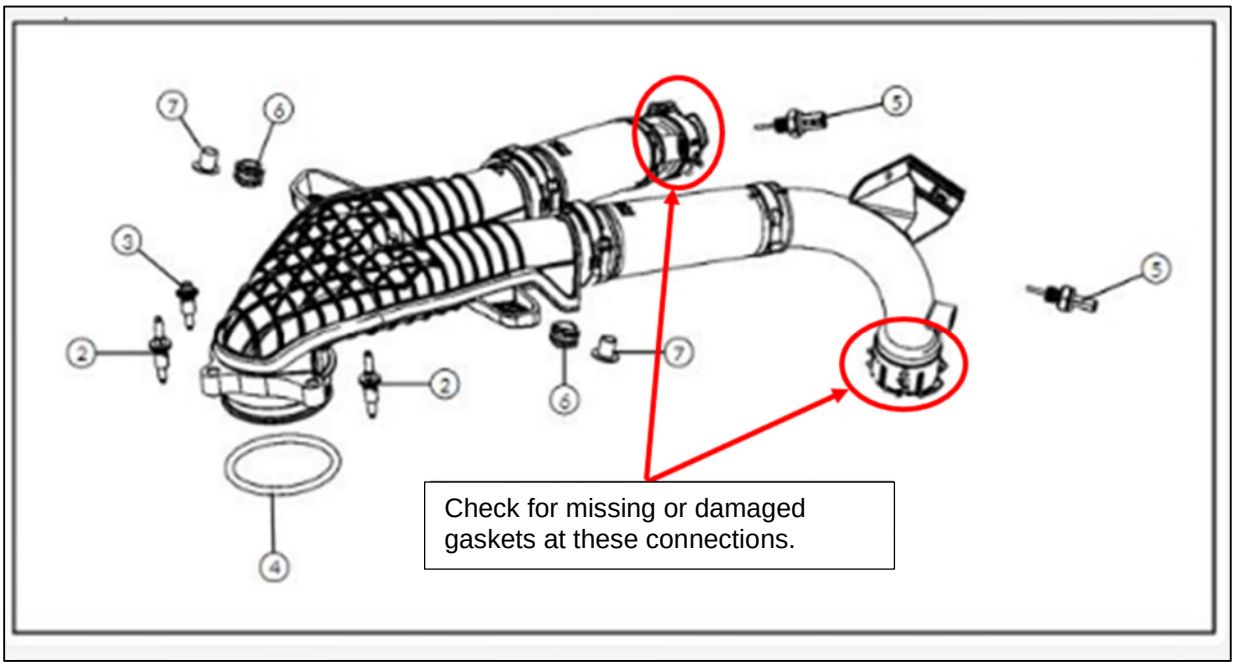

Fig. 10 Charge Air Cooler Duct connections

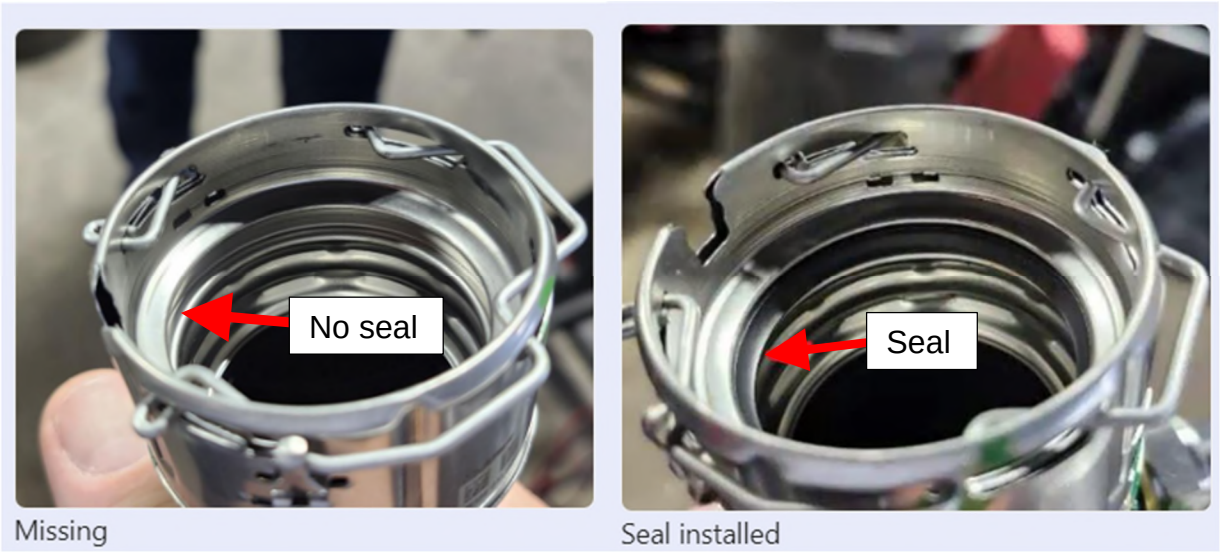

Fig. 11 Missing Seal/Installed Seal

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i) If missing gasket condition is found, repair condition in accordance with Service Library procedure. Suggest submitting DIDI with evidence of diagnostic checks to confirm warranty claim.
ii) If gasket is present, end diagnostic step.

4) **For multi-cylinder misfire (mixed banks)**
   a) Determine if issue exists as Cold Start Multiple Cylinder Misfire Vs. Multiple Cylinder Misfire under Other Conditions by reviewing freeze frame data.
      i) Review the following freeze frame data parameters. If the values fall within the given ranges, the issue is considered as Cold Start Misfire.
         (1) **Time To Start: Less than 60 seconds**
         (2) **Engine Speed: 1200 – 1700 RPM**
         (3) **Engine Coolant Temperature: Less than 125 F degrees**
         (4) **Vehicle Speed: Less than 2 MPH**
      ii) If after reviewing freeze frame data, the conditions are found NOT to fall under Cold Start Misfire as described above, follow normal diagnostic service procedures as published in Service Library for the relevant misfire DTCs.
      iii) If after reviewing freeze frame data, the conditions do fall under Cold Start Misfire as described above, continue with the steps outlined below.
   b) **Cold soak** the vehicle by letting it sit overnight for 8+ hours.
   c) **DO NOT START VEHICLE UNTIL THE FOLLOWING STEPS HAVE BEEN COMPLETED. READ PROCEDURE TO THE END BEFORE PROCEEDING.**
   d) Following instructions found in the wiTECH Knowledge Base, set up a MicroPOD (with trigger) to data record the vehicle. Use data recording template "T6 Cold Start Misfire Template" that can be found under the "Flight Recordings" tab in wiTECH.
   e) Install the POD to the under dash OBD2 diagnostic port.
   f) Make sure before starting the vehicle, the LED on the POD is in a green/steady-on state. If it is not, press the button on the trigger once. This will wake up the POD and get it ready to record but will not trigger the recording yet. IF THE POD LED IS ALREADY IN A GREEN/STEADY- ON STATE, DO NOT PRESS THE TRIGGER BUTTON, THE POD IS ALREADY READY TO GO.

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g) When starting the vehicle, pay attention to whether you can feel the misfire happening, or not, record details of your experience.
h) Start engine.
i) Wait 10 seconds after start-up then trigger flight recording.
j) Allow the vehicle to idle for 5 minutes without disturbing it.
k) After 5 minutes, depress the button on the POD trigger again to trigger a second recording. Do not disturb the vehicle again for 5 minutes.
l) Attempt to get the answer to the following questions from the customer. We understand some data may not be available, but please ask. The more data that is available to review, the faster we can resolve the issue.
   - Did the issue occur during a remote start?
   - What were the conditions when the MIL came on (idle, driving)?
   - What was the fuel level?
   - What grade of fuel was used (Regular/Premium)?
   - How long had the vehicle been sitting (minutes, hours, overnight)?
   - Was the vehicle on an incline during start?
   - Was the vehicle inside or outside?
   - If outside, what was the weather?
   - Please include all data in the STAR case (see step m)
m) Open a STAR case and attach flight recording files and any other recorded data to STAR case (including details of symptoms experienced during diagnosis) and await further instructions.

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