Hard Start/Non Start Condition – AJ26 Engines – Diagnostic Flowcharts

MODEL	
	1997-98 MY XK Range
	1998 MY V8 XJ Series
VIN	1998-99 XJR
	001001-031302
	812256-878717

Issue:

This bulletin provides diagnostic information organized by symptom.

Action:

Before using the guide, check the Symptom Matrix on the next page for the diagnostic flowchart sequence. For example, if the **engine does not crank**, work through flow charts P6, P2, P10, P11 etc… Following the flowcharts in the sequence identified will help rectify any concerns while optimizing the utilization of workshop time.

> ⚠ **Caution:** When working on any vehicle ensure that exposed paintwork is protected with the appropriate fender protection covers.

ADDITIONAL INFORMATION

Relay codes and date stamps

Relay date codes come in two forms:

- Relays prior to December 1998 have the format: Letter – Number – Letter i.e. R6 K1
- Relays post December 1998 have the format: Number – Letter – Letter i.e. 2AB

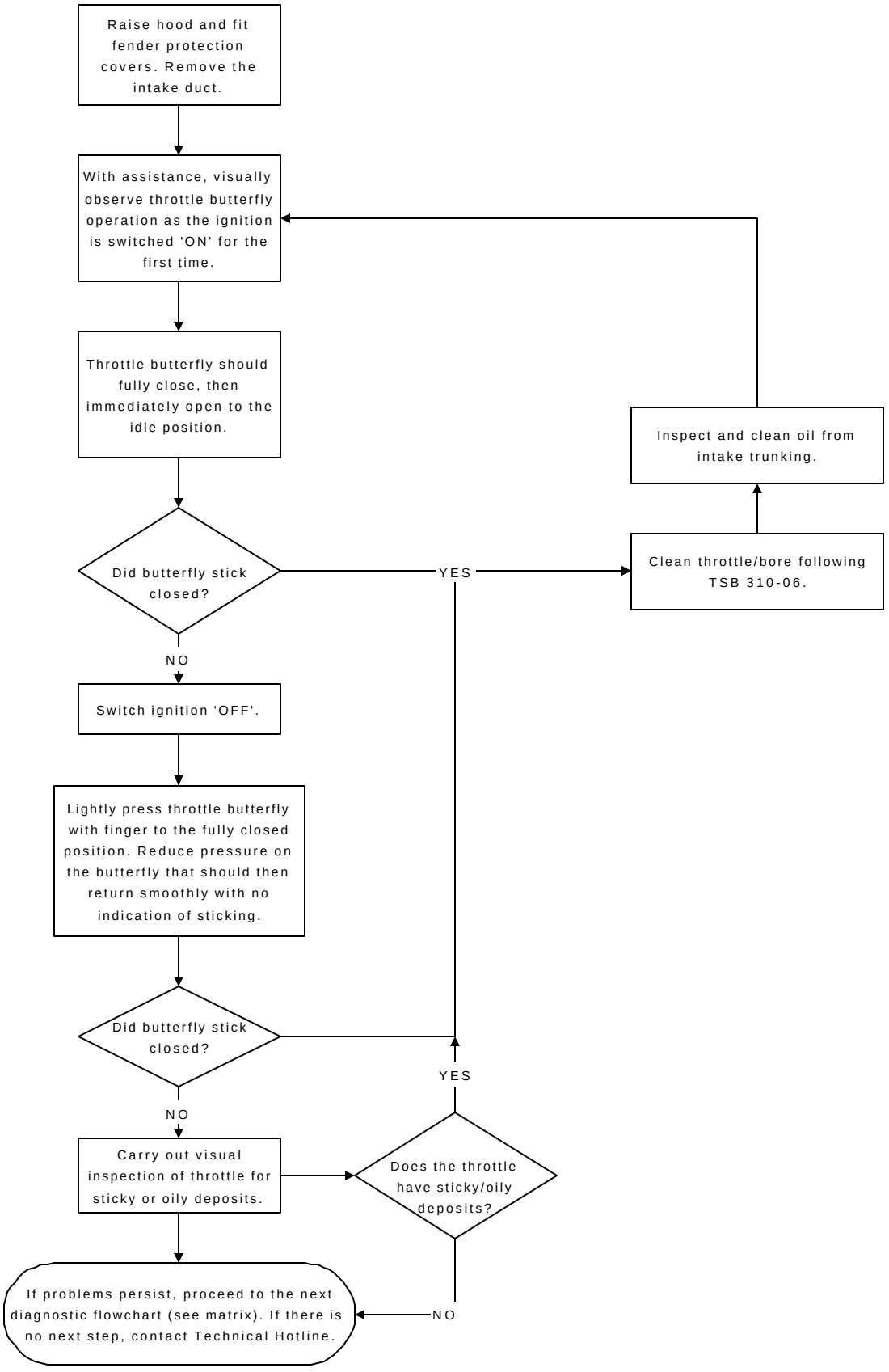
All date codes are printed in white on the top face of the relay, adjacent to the part number.

> ⚠ **Fuel Systems Warning:** Working on the fuel system can result in fuel vapor being emitted into the atmosphere. Fuel vapor is extremely flammable; hence great care should be taken when working on the fuel system.
> Do not smoke in the working area and ensure that there is a CO2 fire extinguisher close by. The working area must be well ventilated and extraction equipment used when appropriate. When emptying fuel, use suitable fireproof equipment and an authorized explosion-proof container.

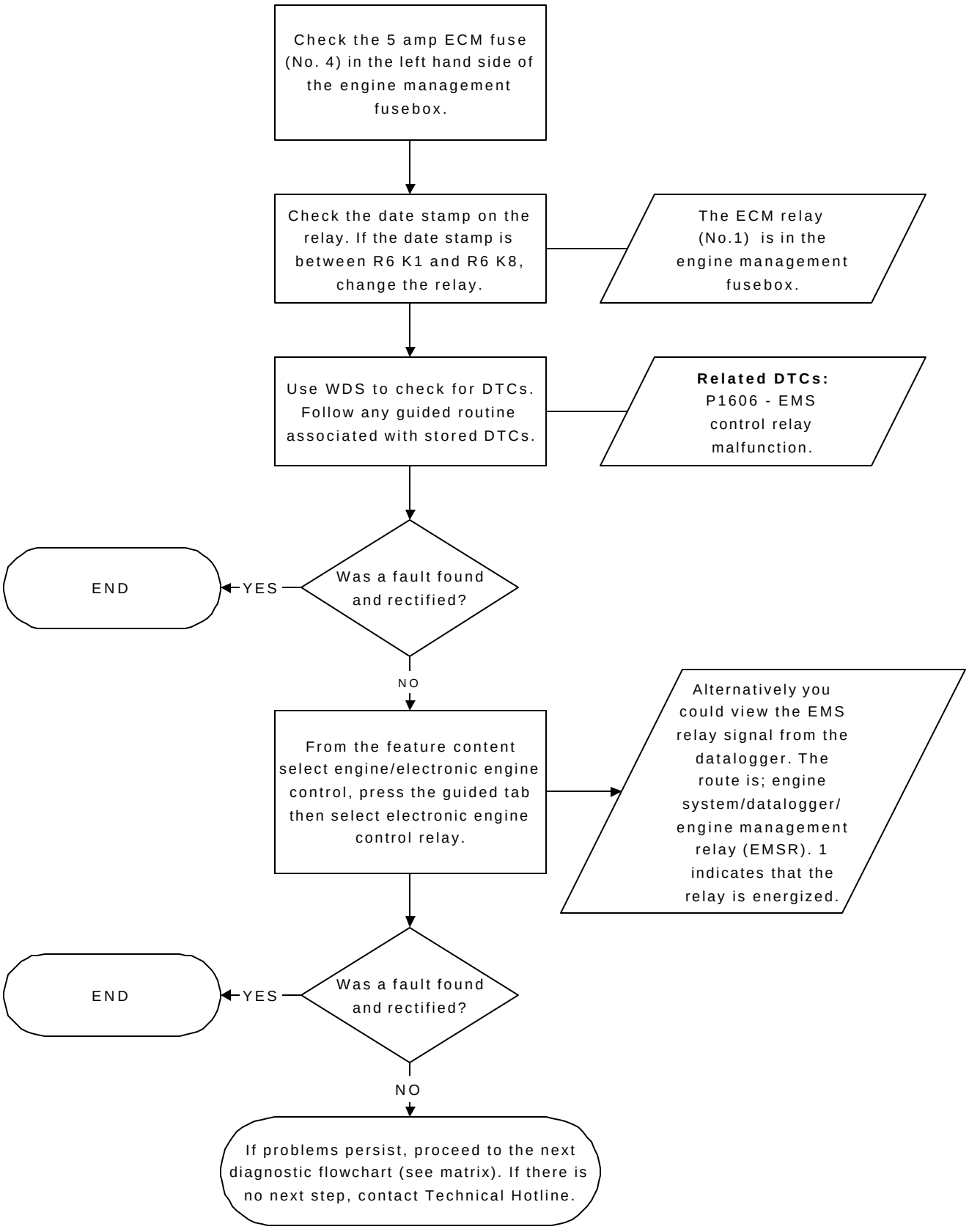
Symptom Matrix

Difficult to Start			Does not Start					
Difficult to start after hot soak	Difficult to start hot	Difficult to start cold	Engine cranks too fast/too slow	No complete combustion	No combustion	Engine does not crank	Symptom / Suspect Area	See Chart
2	3	3		2	2		Throttle (contaminated)	P1
						2	ECM Relay	P2
				1	4		Fuel pump relay	P3
					1	7	Immobilizer	P4a
							DTC 'P1336'	P5
			2			1	Starter relay	P6
1	1	1					Rochester valve	P7
7	7						Injector leak	P8
		7	4	8			Cylinder compression	P9
		2	1			3	Battery	P10
						4	Park/Neutral switch	P11
3	2	6		3			Purge valve	P12
			3			5	Starter motor	P13
					3	6	Harness	P14
				7			Ignition coil	P16
4	4	4		4	5		Fuel pump	P17
5	5	5		5			Coolant sensor	P18
							Fuel pressure regulator	P20
							Fuel lines	P21
				6			Spark plugs	P26
6	6	8					Blocked part-load breather	P29

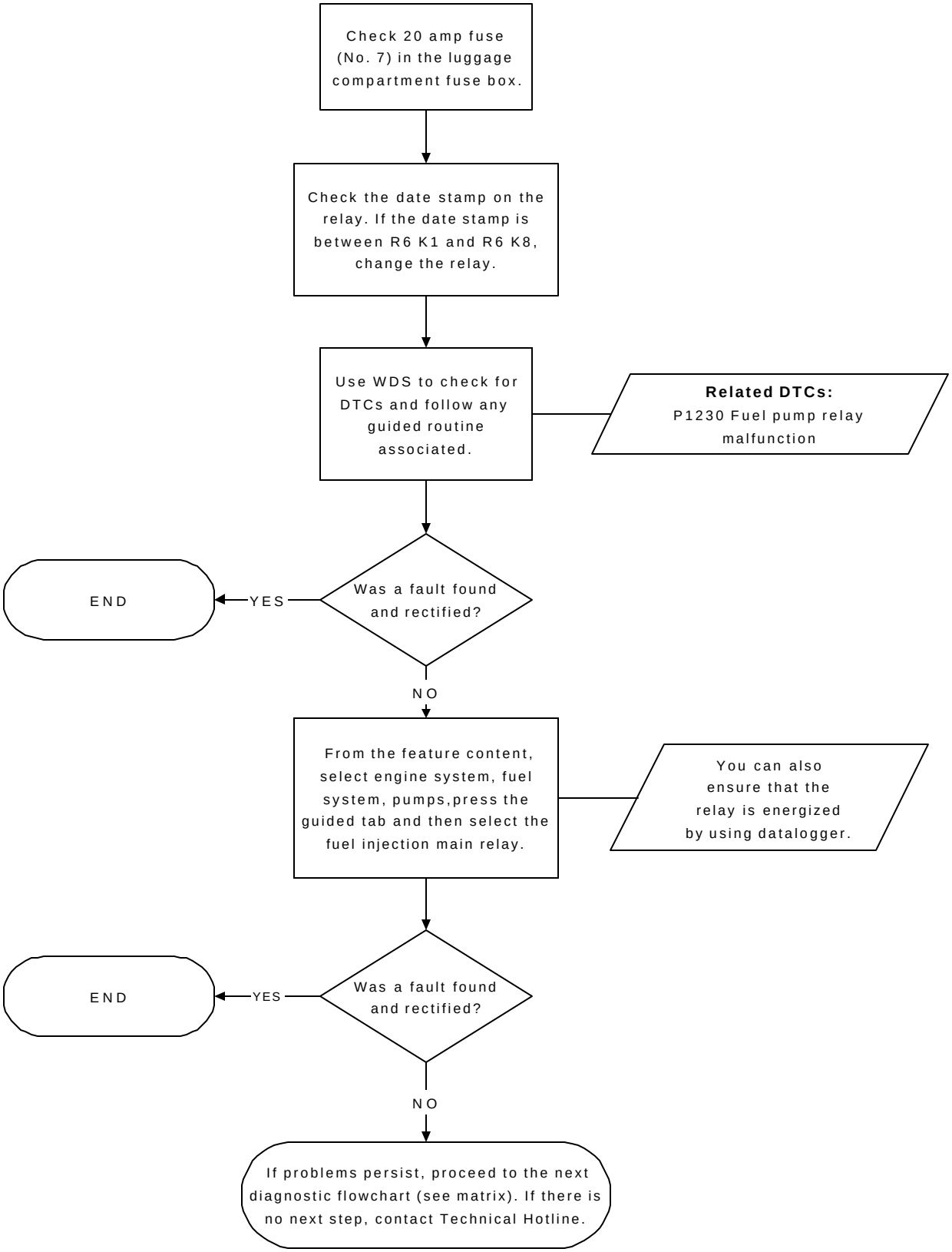
P1 - Contaminated Throttle Diagnostic Flowchart



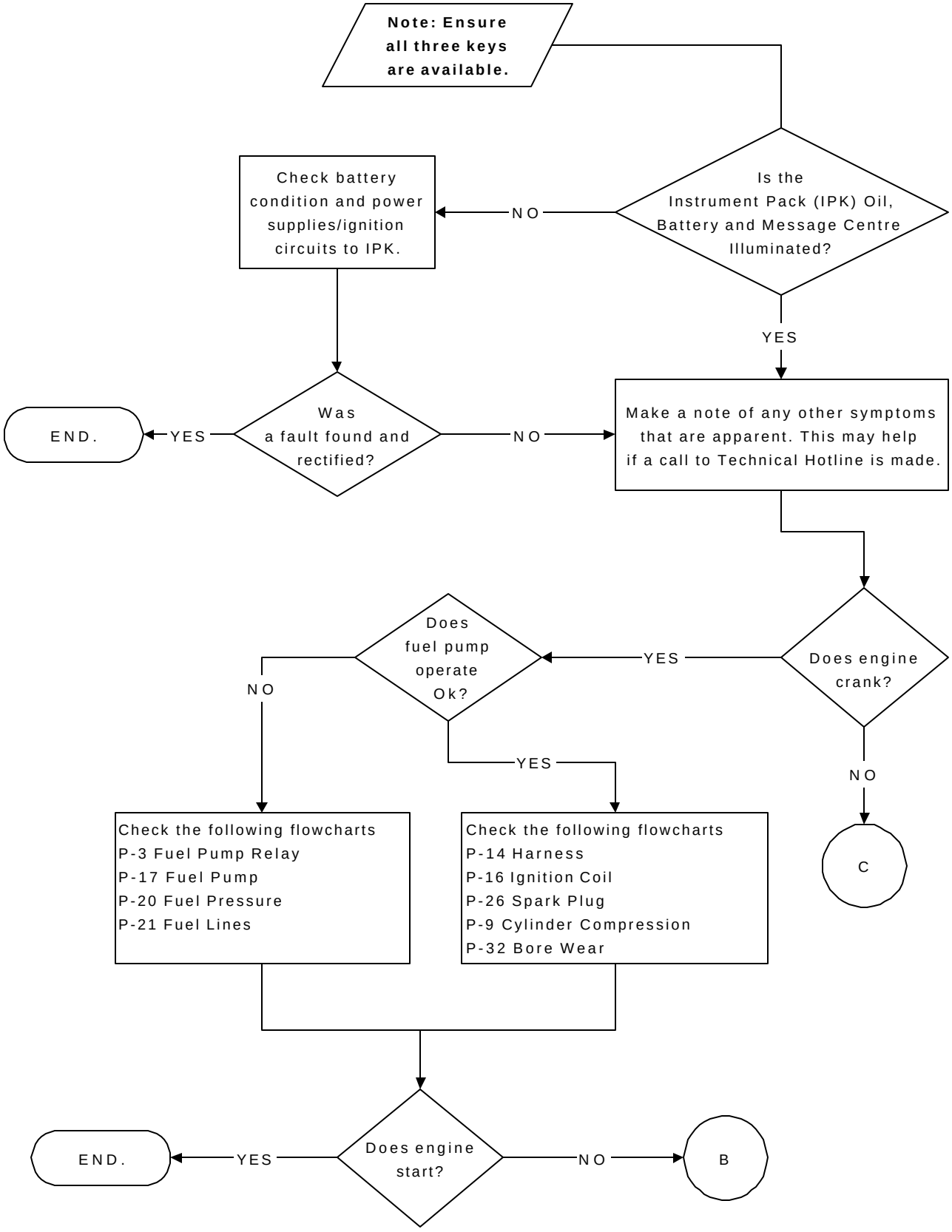
P2 - ECM Relay Diagnostic Flowcharts



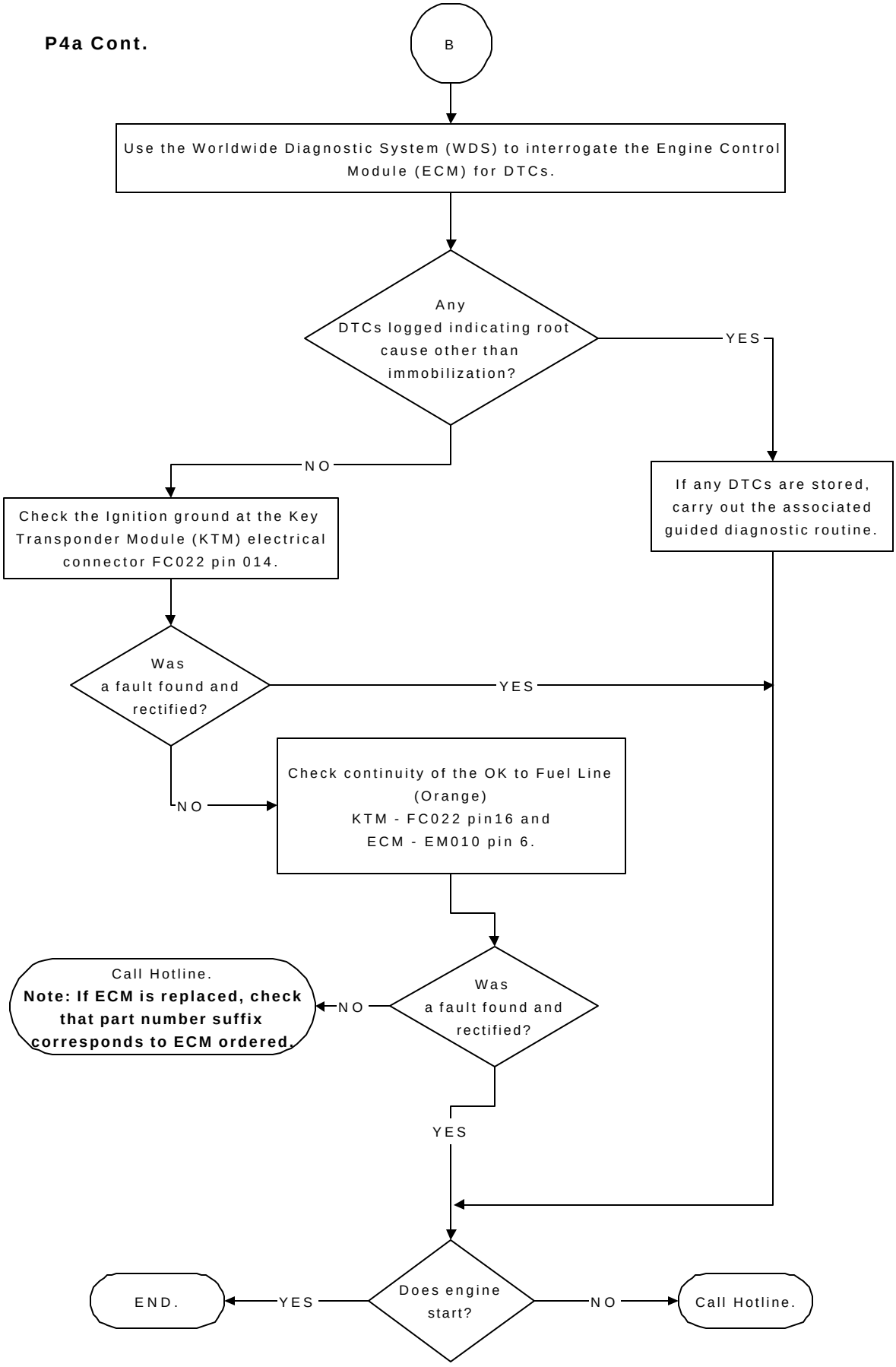
P3 - Fuel Pump Relay Test Diagnostic Flowchart



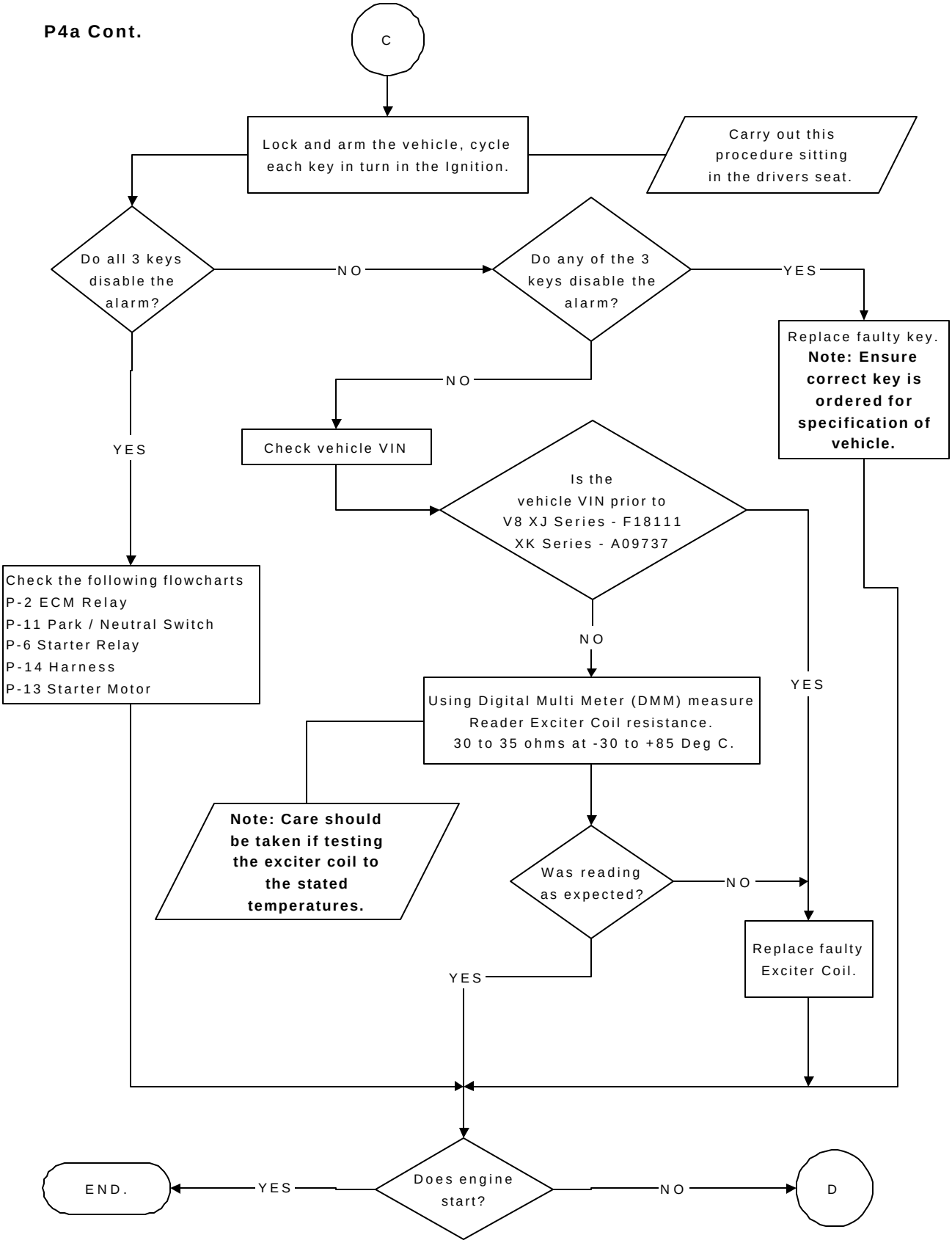
P4a- Immobilization Non Start Diagnostic Flowchart



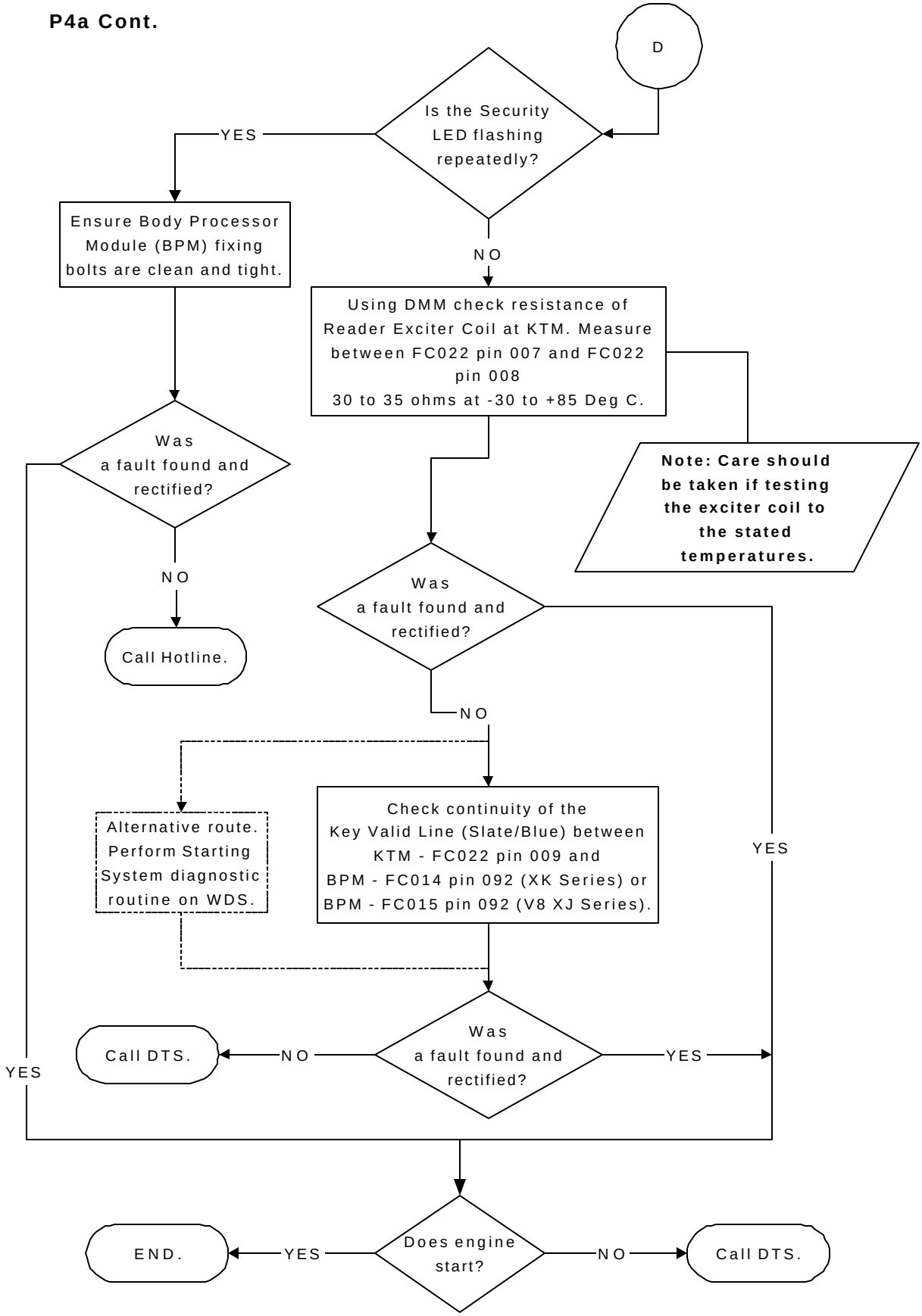
P4a Cont.


B
Use the Worldwide Diagnostic System (WDS) to interrogate the Engine Control Module (ECM) for DTCs.
Any DTCs logged indicating root cause other than immobilization?
YES
NO
If any DTCs are stored, carry out the associated guided diagnostic routine.
Check the Ignition ground at the Key Transponder Module (KTM) electrical connector FC022 pin 014.
Was a fault found and rectified?
YES
NO
Check continuity of the OK to Fuel Line (Orange)
KTM - FC022 pin16 and
ECM - EM010 pin 6.
Was a fault found and rectified?
NO
Call Hotline.
Note: If ECM is replaced, check that part number suffix corresponds to ECM ordered.
YES
Does engine start?
YES
END.
NO
Call Hotline.

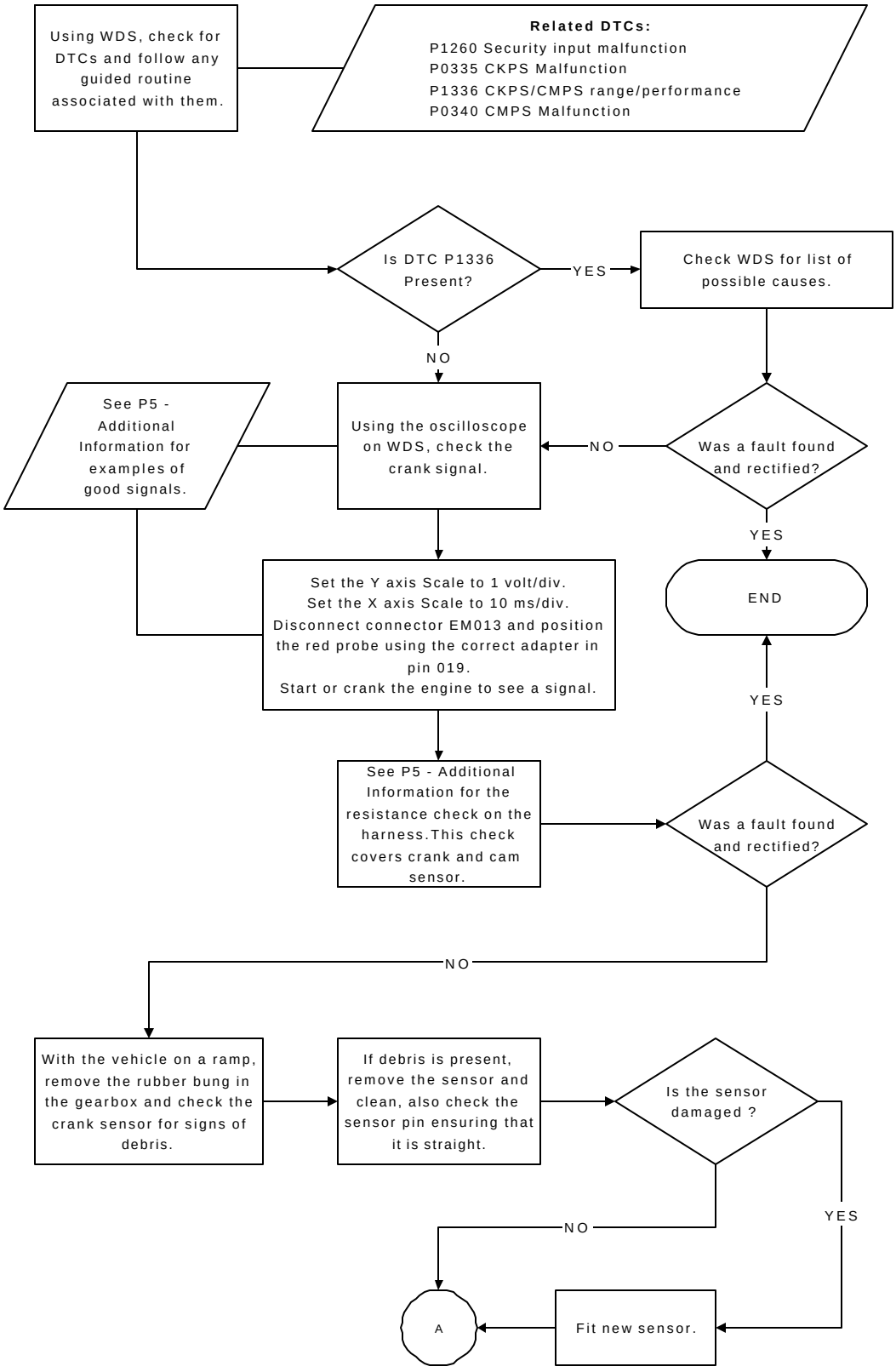
P4a Cont.


C
Lock and arm the vehicle, cycle each key in turn in the Ignition.
Carry out this procedure sitting in the drivers seat.
Do all 3 keys disable the alarm?
NO
Do any of the 3 keys disable the alarm?
YES
Replace faulty key. Note: Ensure correct key is ordered for specification of vehicle.
YES
NO
Check vehicle VIN
Is the vehicle VIN prior to V8 XJ Series - F18111 XK Series - A09737
Check the following flowcharts
P-2 ECM Relay
P-11 Park / Neutral Switch
P-6 Starter Relay
P-14 Harness
P-13 Starter Motor
NO
YES
Using Digital Multi Meter (DMM) measure Reader Exciter Coil resistance. 30 to 35 ohms at -30 to +85 Deg C.
Note: Care should be taken if testing the exciter coil to the stated temperatures.
Was reading as expected?
NO
Replace faulty Exciter Coil.
YES
END.
YES
Does engine start?
NO
D

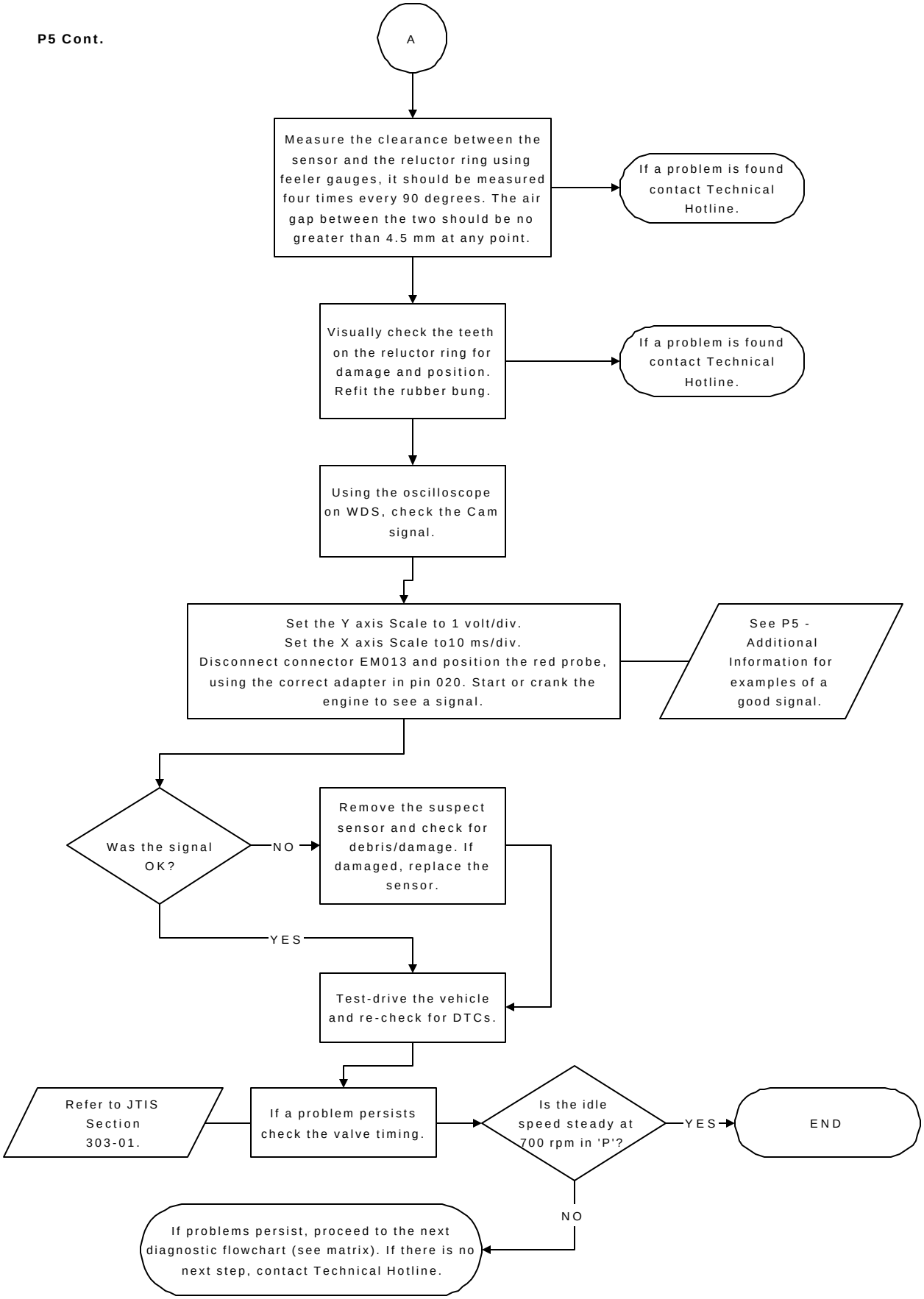
P4a Cont.


D
Is the Security LED flashing repeatedly?
YES
NO
Ensure Body Processor Module (BPM) fixing bolts are clean and tight.
Using DMM check resistance of Reader Exciter Coil at KTM. Measure between FC022 pin 007 and FC022 pin 008
30 to 35 ohms at -30 to +85 Deg C.
Note: Care should be taken if testing the exciter coil to the stated temperatures.
Was a fault found and rectified?
NO
Call Hotline.
Was a fault found and rectified?
NO
YES
Alternative route. Perform Starting System diagnostic routine on WDS.
Check continuity of the Key Valid Line (Slate/Blue) between KTM - FC022 pin 009 and BPM - FC014 pin 092 (XK Series) or BPM - FC015 pin 092 (V8 XJ Series).
Was a fault found and rectified?
NO
Call DTS.
YES
YES
Does engine start?
YES
END.
NO
Call DTS.

P5 - DTC P1336 Crankshaft and Camshaft Sensor Diagnostic Flowchart



P5 Cont.


A
Measure the clearance between the sensor and the reluctor ring using feeler gauges, it should be measured four times every 90 degrees. The air gap between the two should be no greater than 4.5 mm at any point.
If a problem is found contact Technical Hotline.
Visually check the teeth on the reluctor ring for damage and position. Refit the rubber bung.
If a problem is found contact Technical Hotline.
Using the oscilloscope on WDS, check the Cam signal.
Set the Y axis Scale to 1 volt/div.
Set the X axis Scale to10 ms/div.
Disconnect connector EM013 and position the red probe, using the correct adapter in pin 020. Start or crank the engine to see a signal.
See P5 - Additional Information for examples of a good signal.
Was the signal OK?
NO
Remove the suspect sensor and check for debris/damage. If damaged, replace the sensor.
YES
Test-drive the vehicle and re-check for DTCs.
Refer to JTIS Section 303-01.
If a problem persists check the valve timing.
Is the idle speed steady at 700 rpm in 'P'?
YES
END
NO
If problems persist, proceed to the next diagnostic flowchart (see matrix). If there is no next step, contact Technical Hotline.

P5 - Additional Information

Harness resistance check crank/cam sensor

Component	Part Number	+20°C	+10°C ~ +50°C	+50°C ~ +100°C
Crank sensor	LCA 1640AE	950 – 1250 Ohms	835 – 1400 Ohms	1060 – 1645 Ohms
Cam sensor	LCA 1646AD	1850 – 2450 Ohms	1630 – 2740 Ohms	2065 – 3225 Ohms

Resistance is measured in Ohms at the engine management connector EM013:

1 Disconnect the engine management connector EM013.
2 Check the resistance between pin 019 and pin 028 (sensor ground crankshaft position sensor).
3 You should get a reading between the parameters (see table) for the relative temperature.

Resistance is measured in Ohms at the engine management connector EM013:

1 Disconnect the engine management connector EM013.
2 Check the resistance between pin 020 and pin 029 (sensor ground camshaft position sensor).
3 You should get a reading between the parameters (see table) for the relative temperature.

Crank and Cam Sensor signals are displayed on WDS:

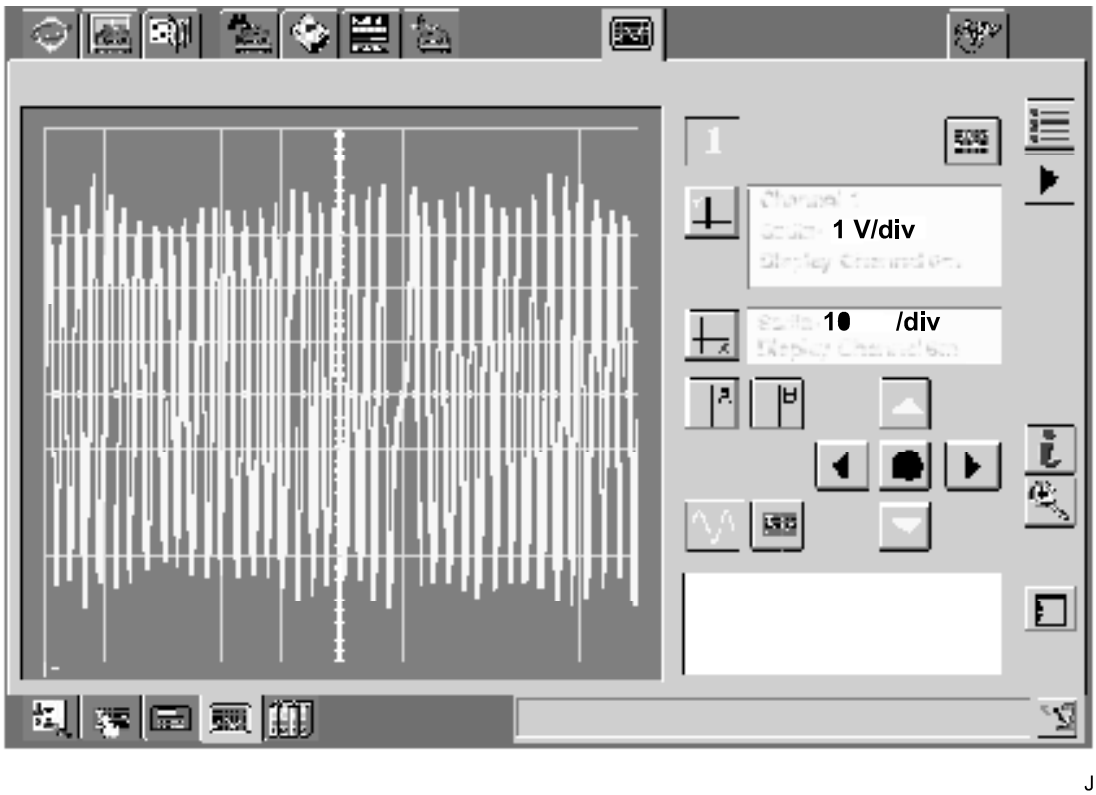


Illustration 1

See Illustration 1 for an example of a good crank signal as seen on the WDS oscilloscope.
Note: The oscilloscope was set to 1 volt/div and 10 ms/div. The gap in the waveform represents the missing tooth on the flywheel.

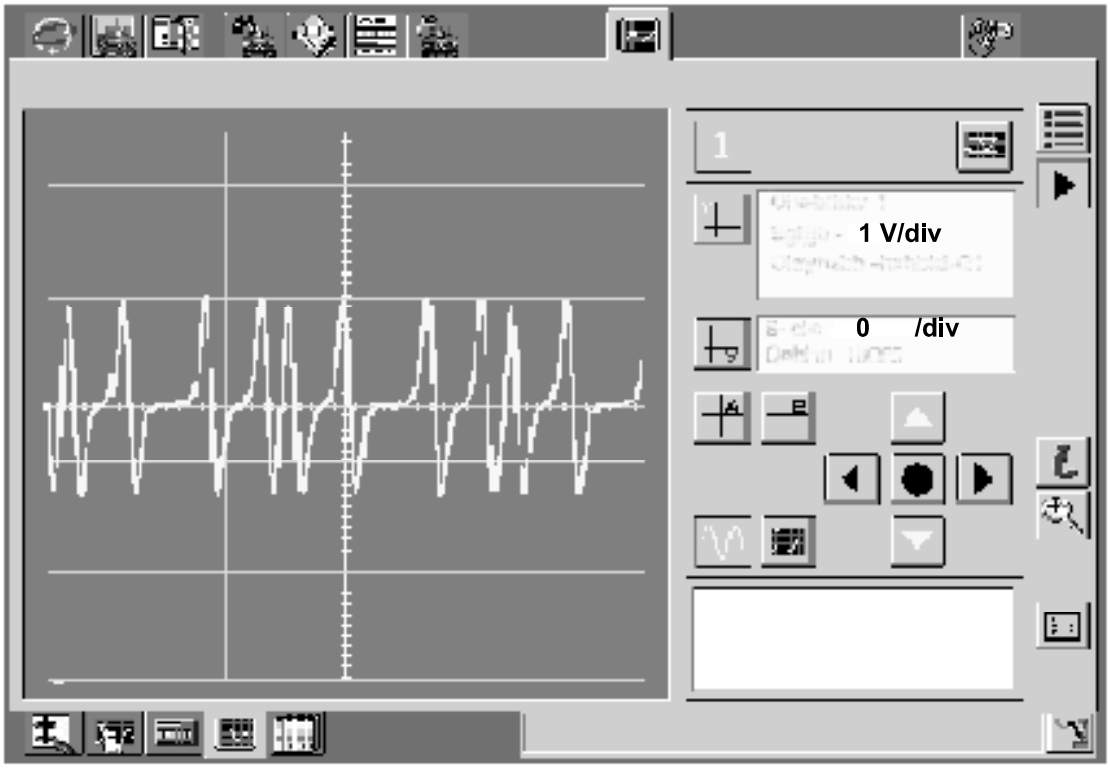
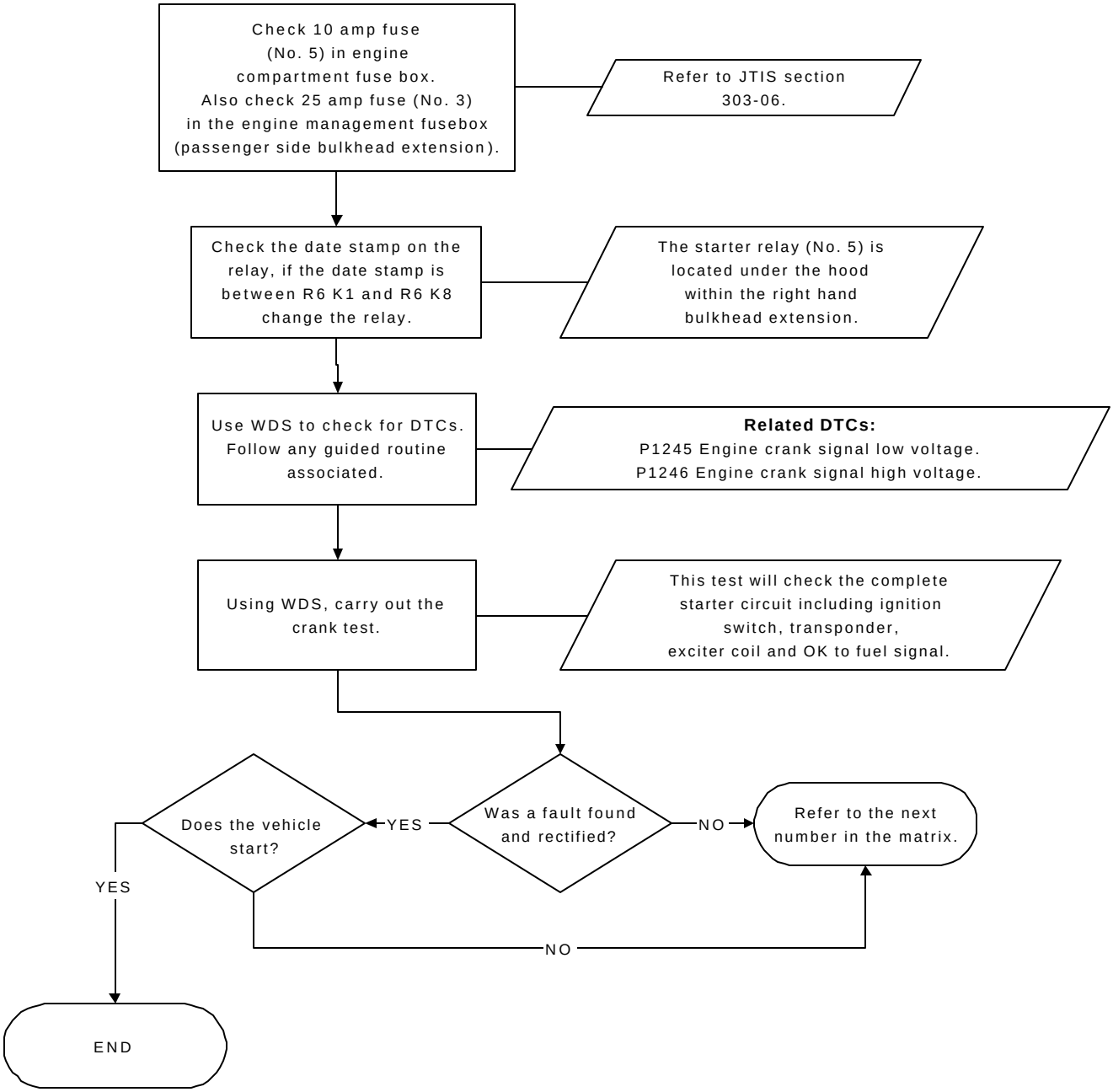


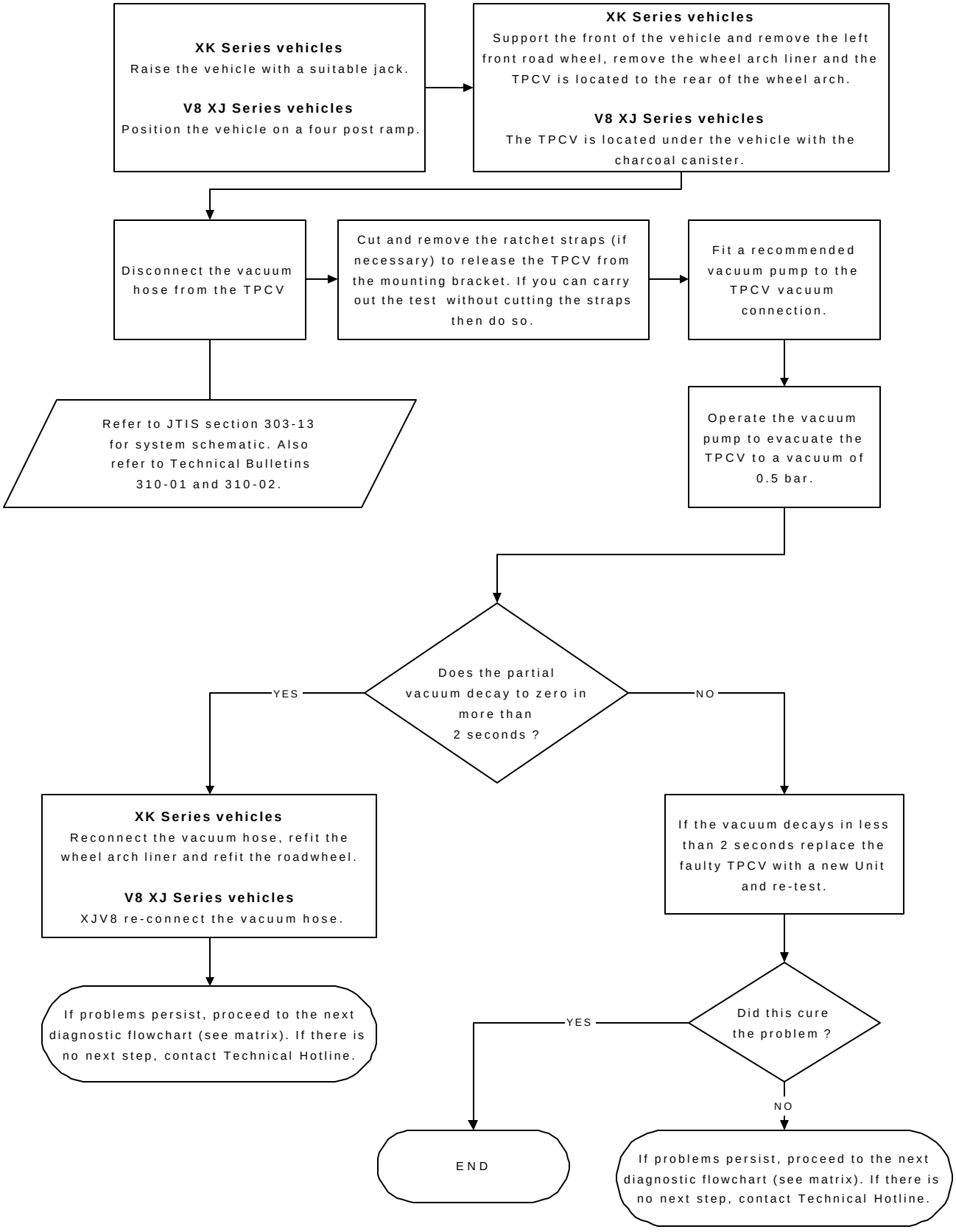
Illustration 2

See Illustration 2 for an example of a good cam signal as seen on the WDS oscilloscope.
Note: The oscilloscope was set to 1 volt/div and 50 ms/div.

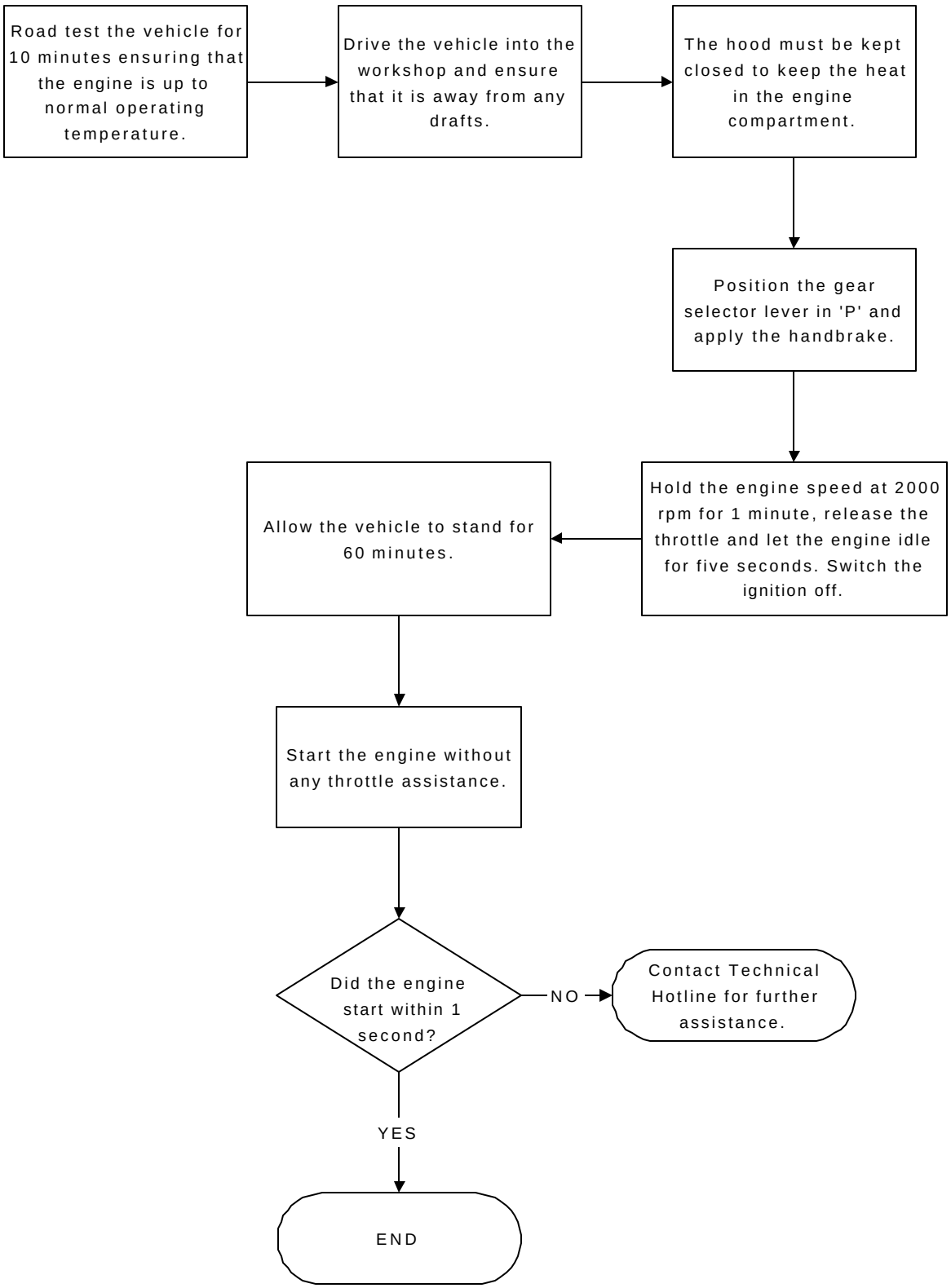
P6 - Starter Relay Diagnostic Flowchart



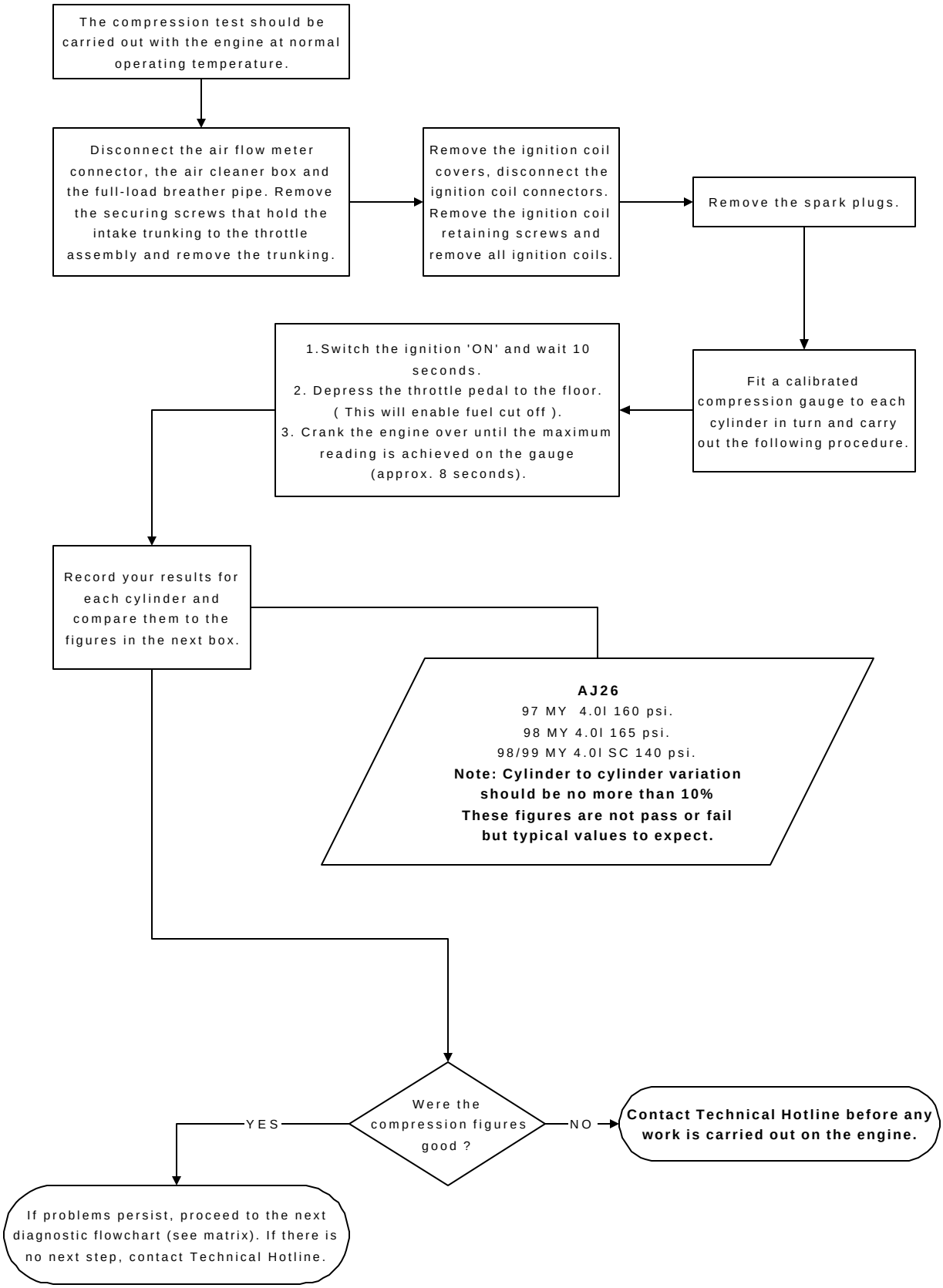
P7 - TPCV Rochester valve Diagnostic Flowchart



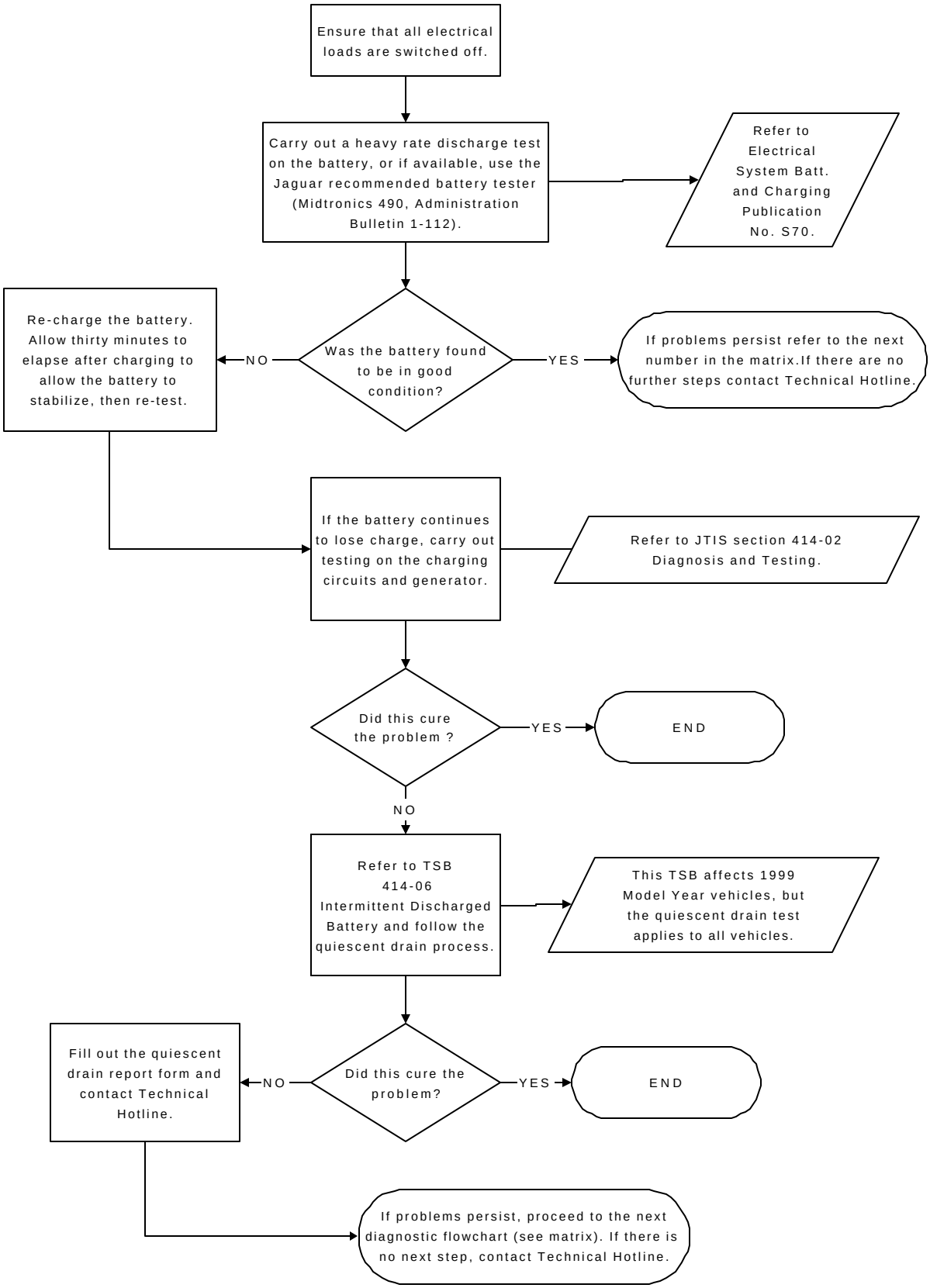
P8 - Injector Leak Diagnostic Flowchart



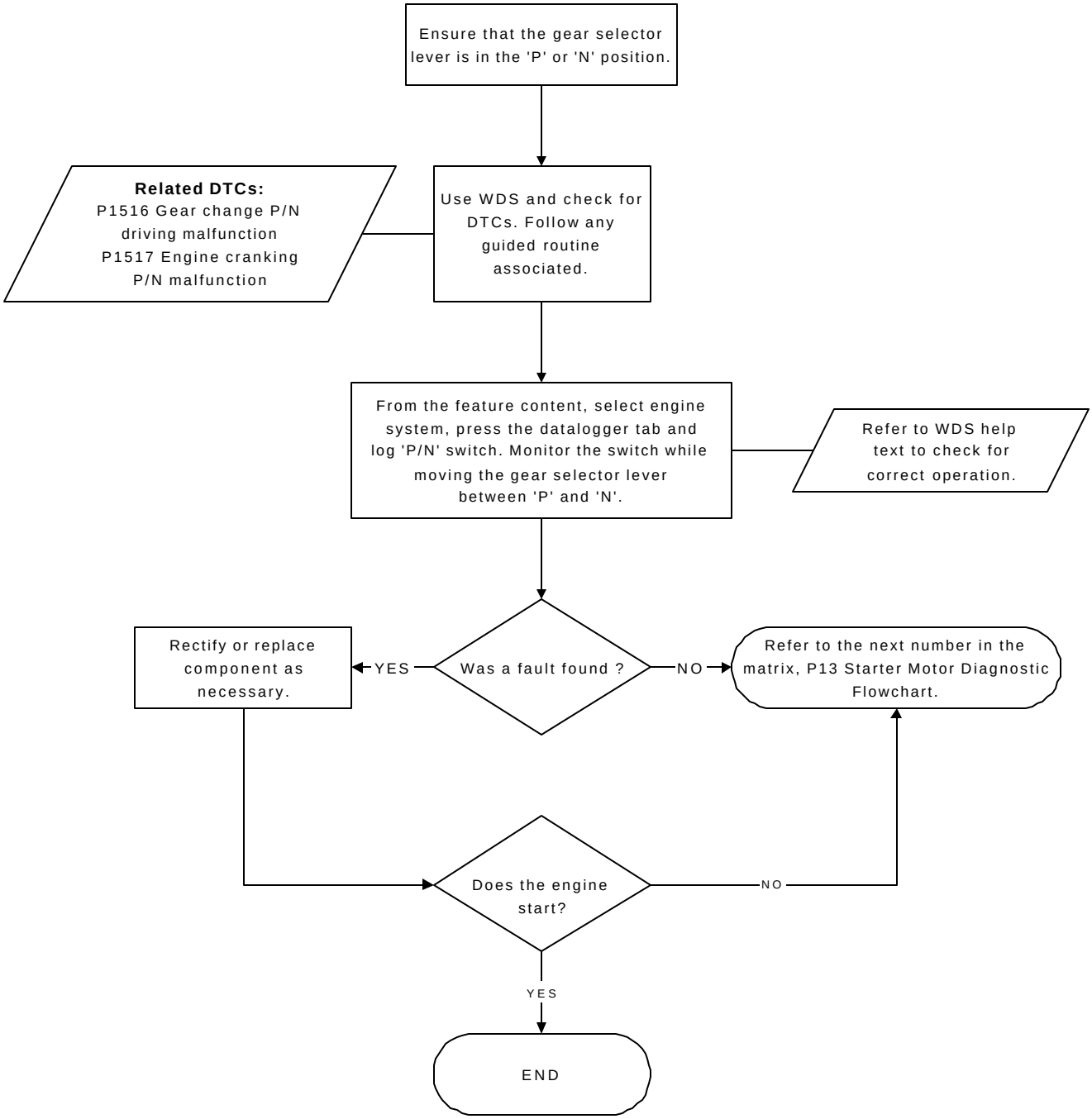
P9 - Cylinder Compression Diagnostic Flowchart



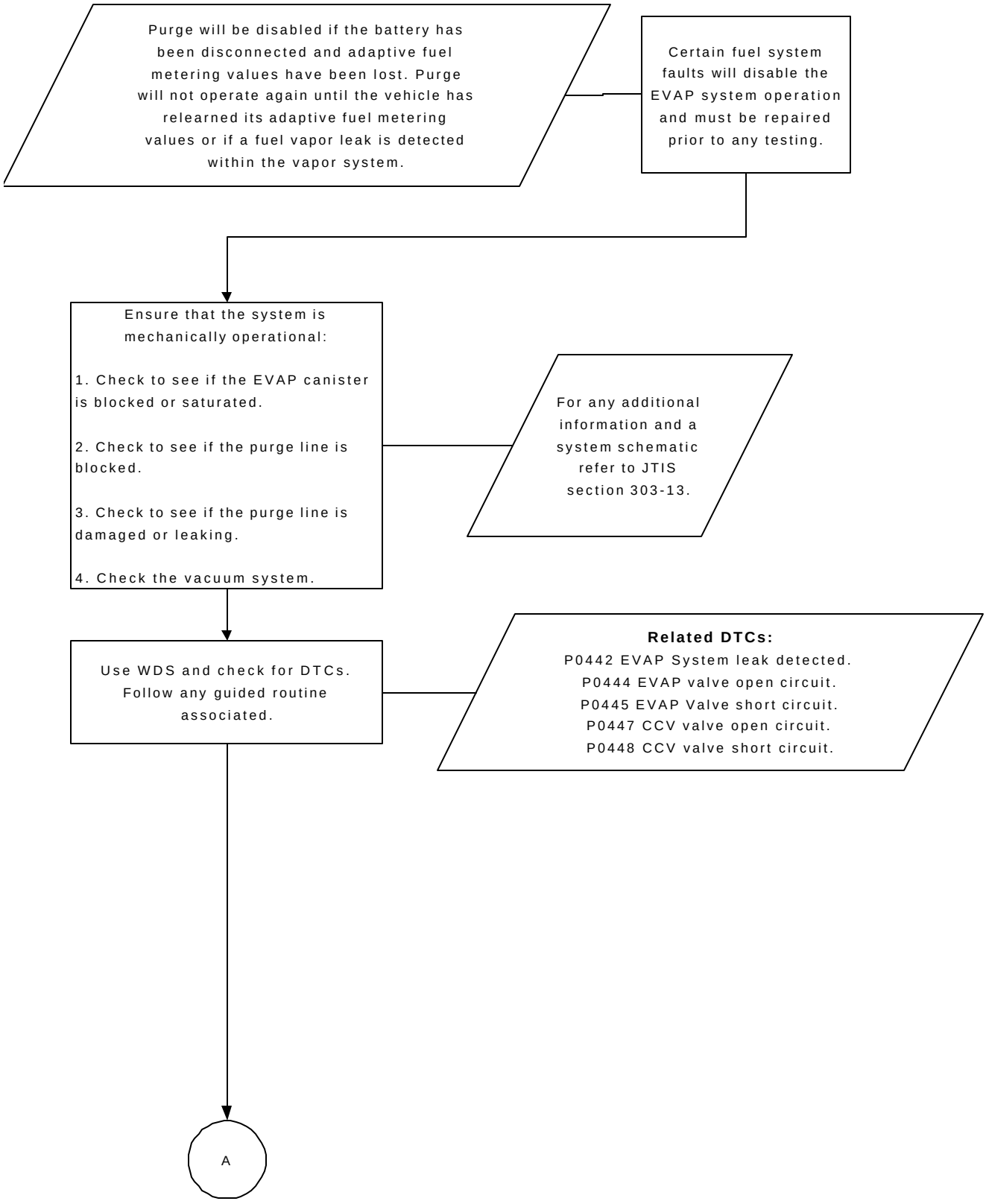
P10 - Battery Diagnostic Procedure



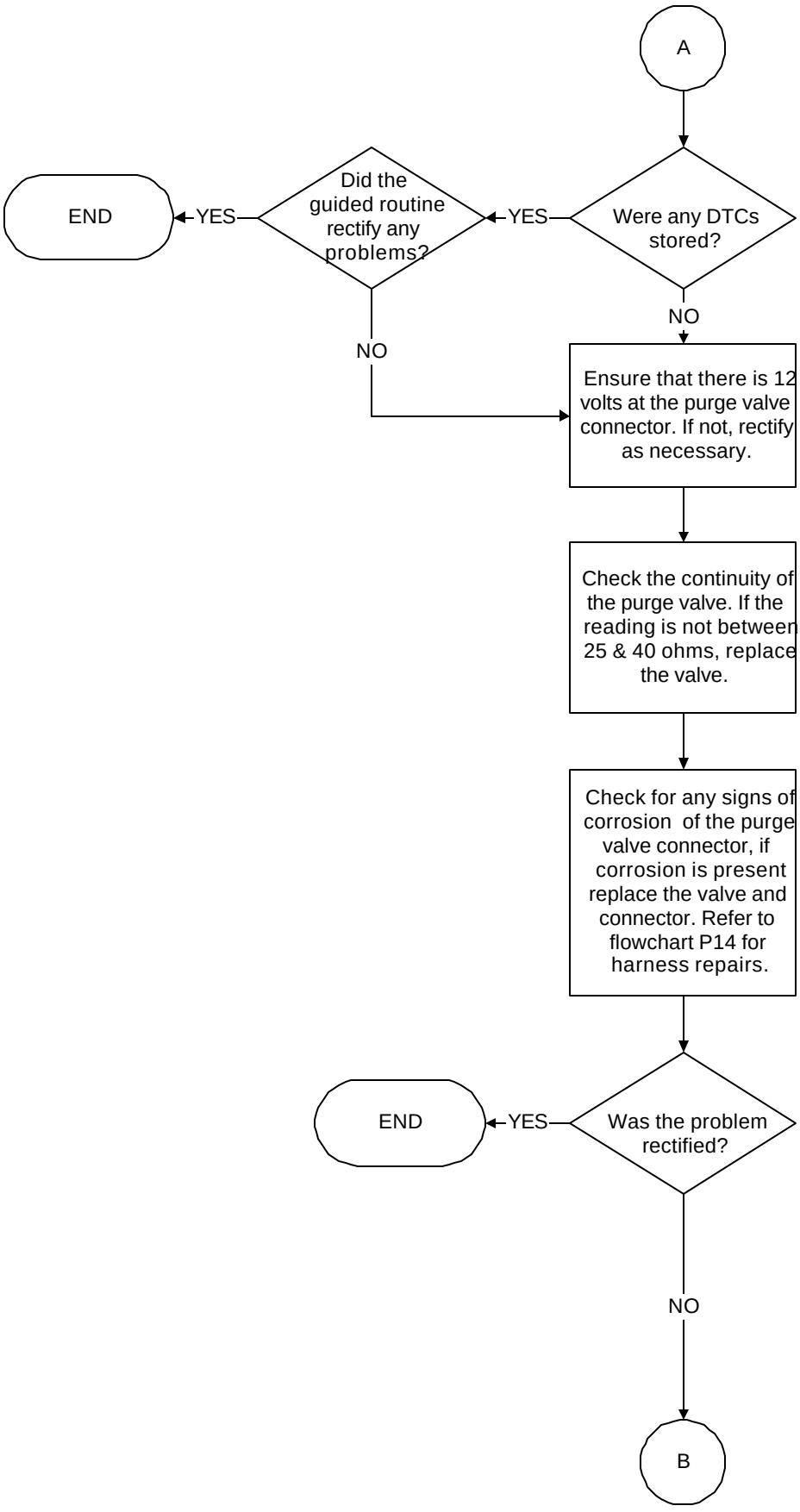
P11 - Park/Neutral Switch Diagnostic Flowchart



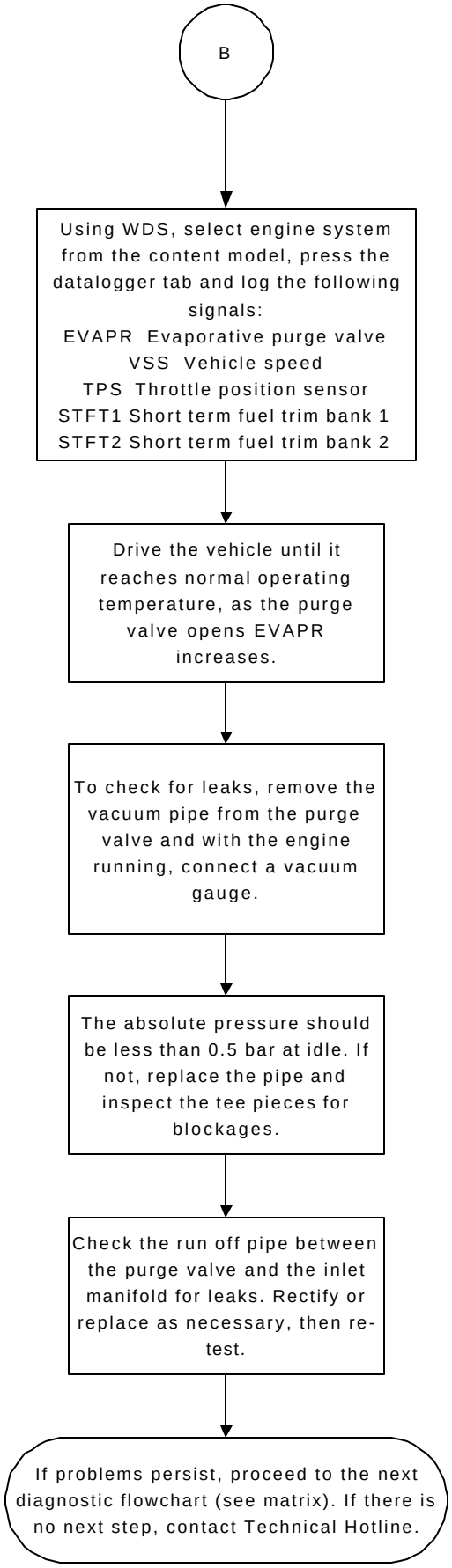
P12 - Purge Valve Mechanical Checks Diagnostic Flowchart



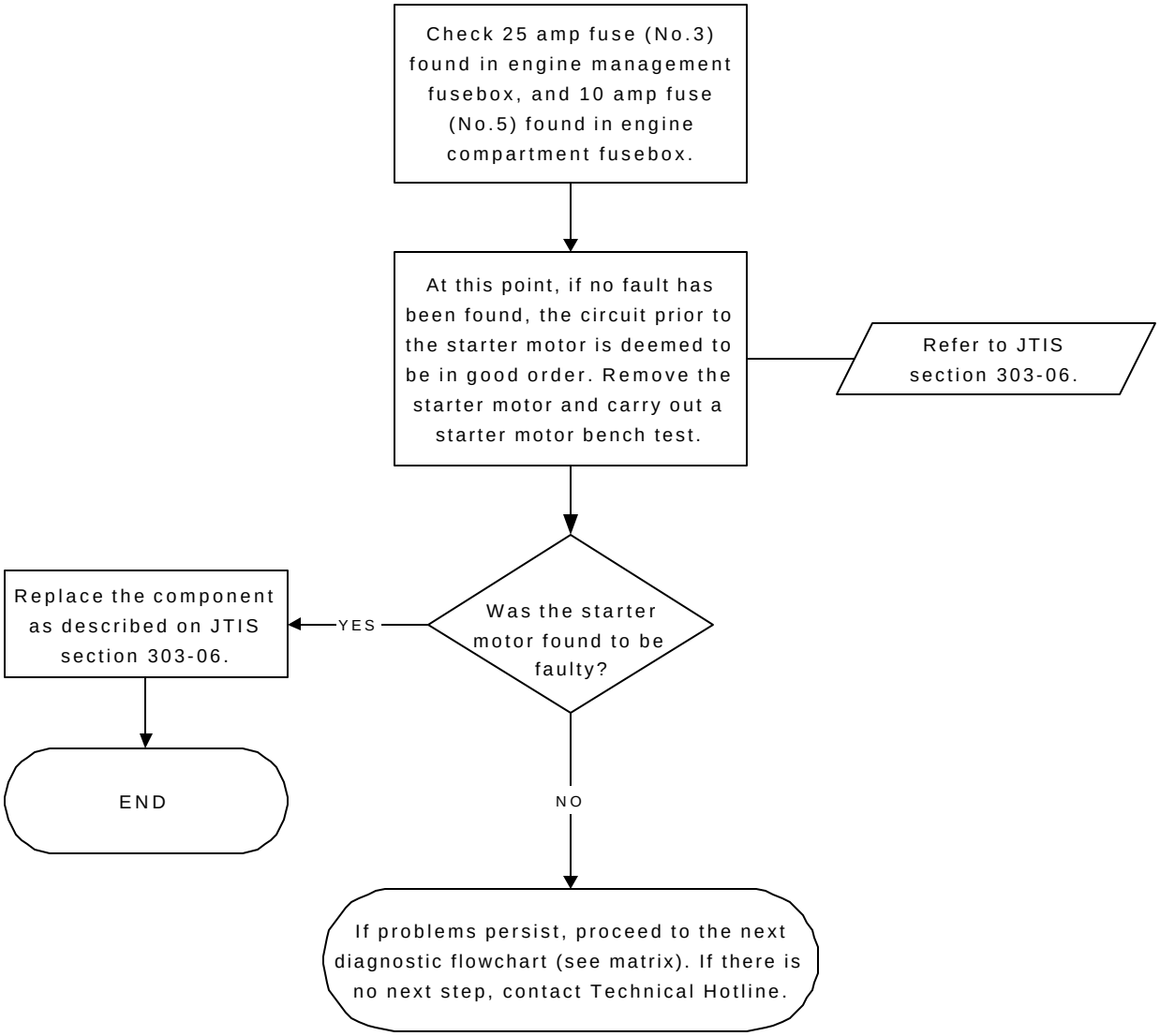
P12 Cont.


A
Were any DTCs stored?
YES
Did the guided routine rectify any problems?
YES
END
NO
NO
Ensure that there is 12 volts at the purge valve connector. If not, rectify as necessary.
Check the continuity of the purge valve. If the reading is not between 25 & 40 ohms, replace the valve.
Check for any signs of corrosion of the purge valve connector, if corrosion is present replace the valve and connector. Refer to flowchart P14 for harness repairs.
Was the problem rectified?
YES
END
NO
B

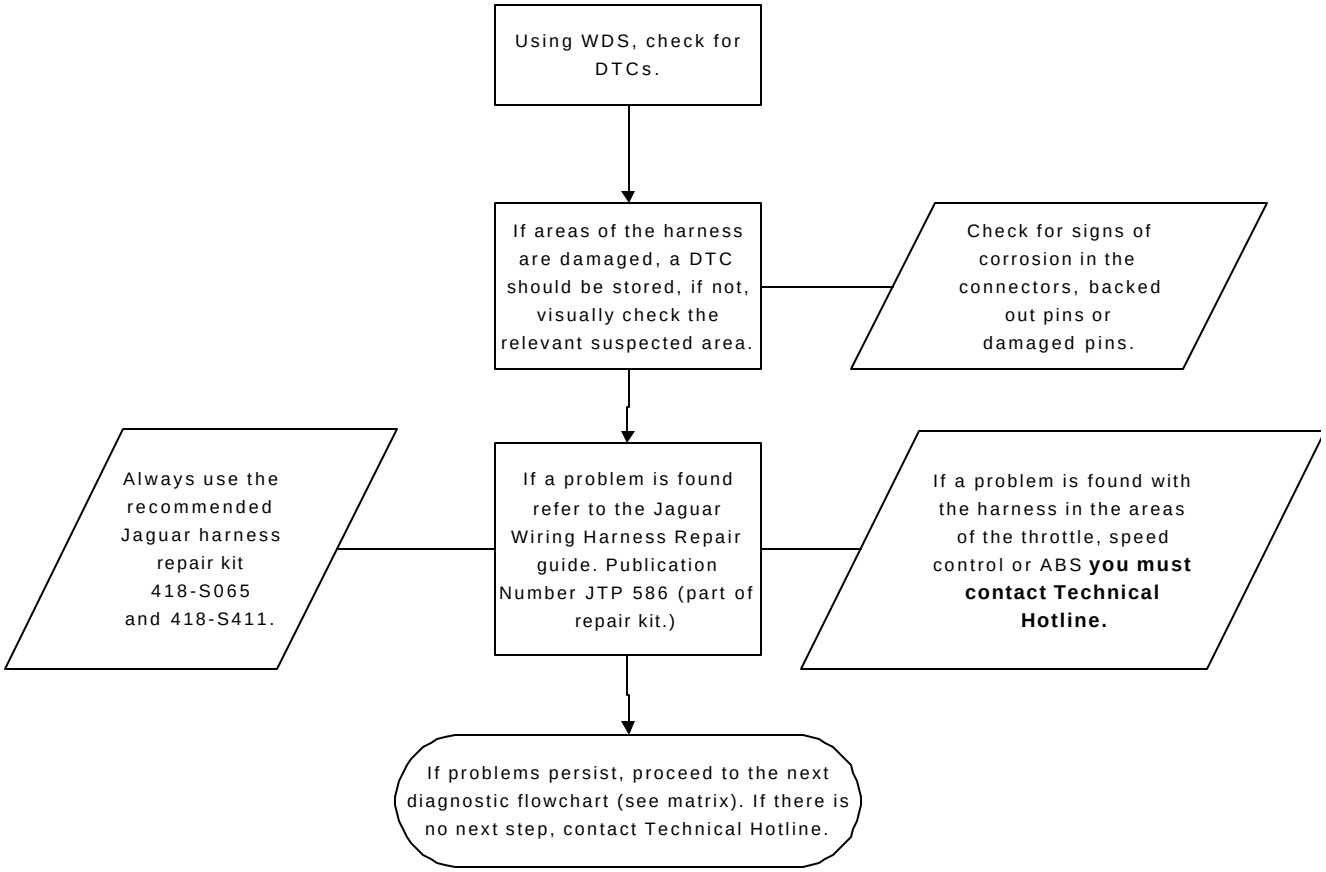
P12 Cont.


B
Using WDS, select engine system from the content model, press the datalogger tab and log the following signals:
EVAPR Evaporative purge valve
VSS Vehicle speed
TPS Throttle position sensor
STFT1 Short term fuel trim bank 1
STFT2 Short term fuel trim bank 2
Drive the vehicle until it reaches normal operating temperature, as the purge valve opens EVAPR increases.
To check for leaks, remove the vacuum pipe from the purge valve and with the engine running, connect a vacuum gauge.
The absolute pressure should be less than 0.5 bar at idle. If not, replace the pipe and inspect the tee pieces for blockages.
Check the run off pipe between the purge valve and the inlet manifold for leaks. Rectify or replace as necessary, then re-test.
If problems persist, proceed to the next diagnostic flowchart (see matrix). If there is no next step, contact Technical Hotline.

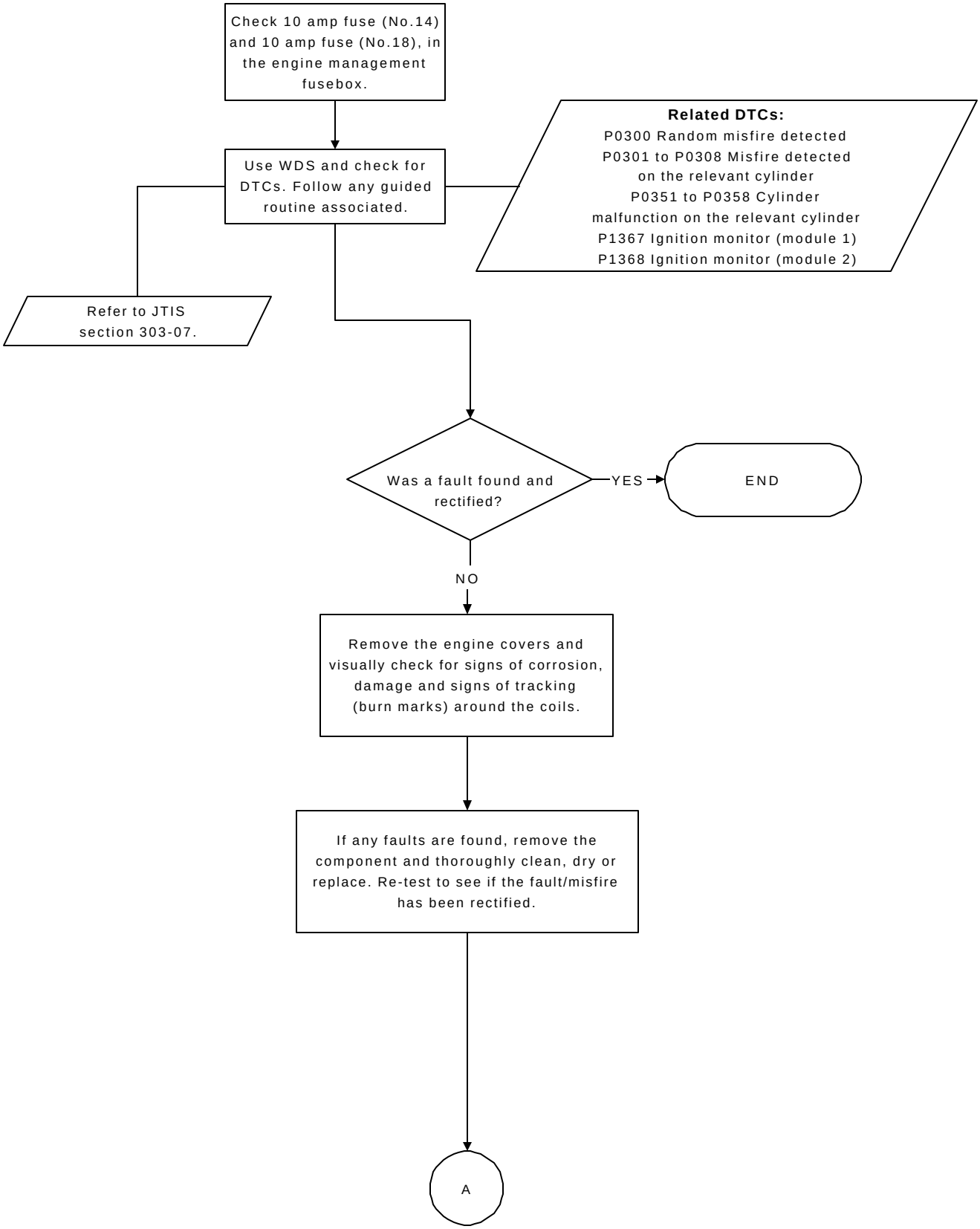
P13 - Starter Motor Diagnostic Flowchart



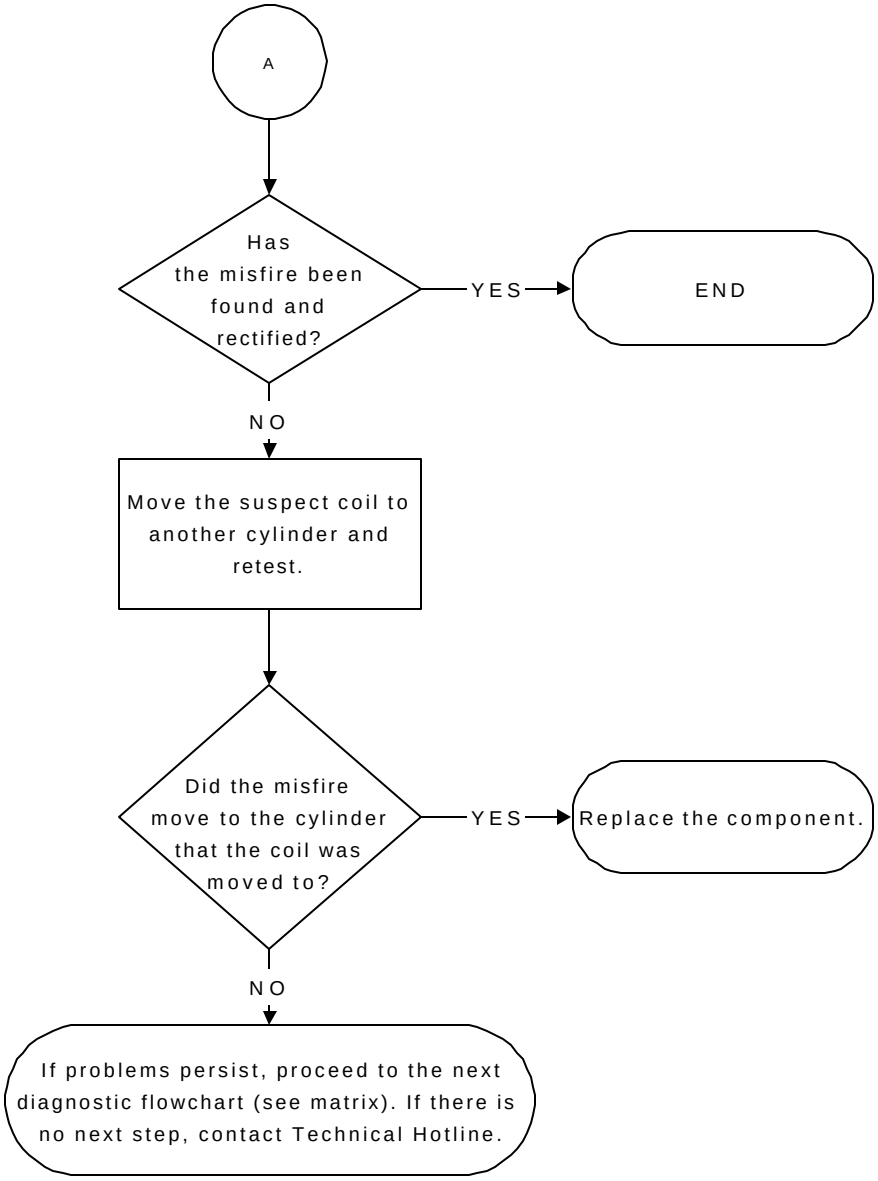
P 14 - Engine Harness Diagnostic Flowchart



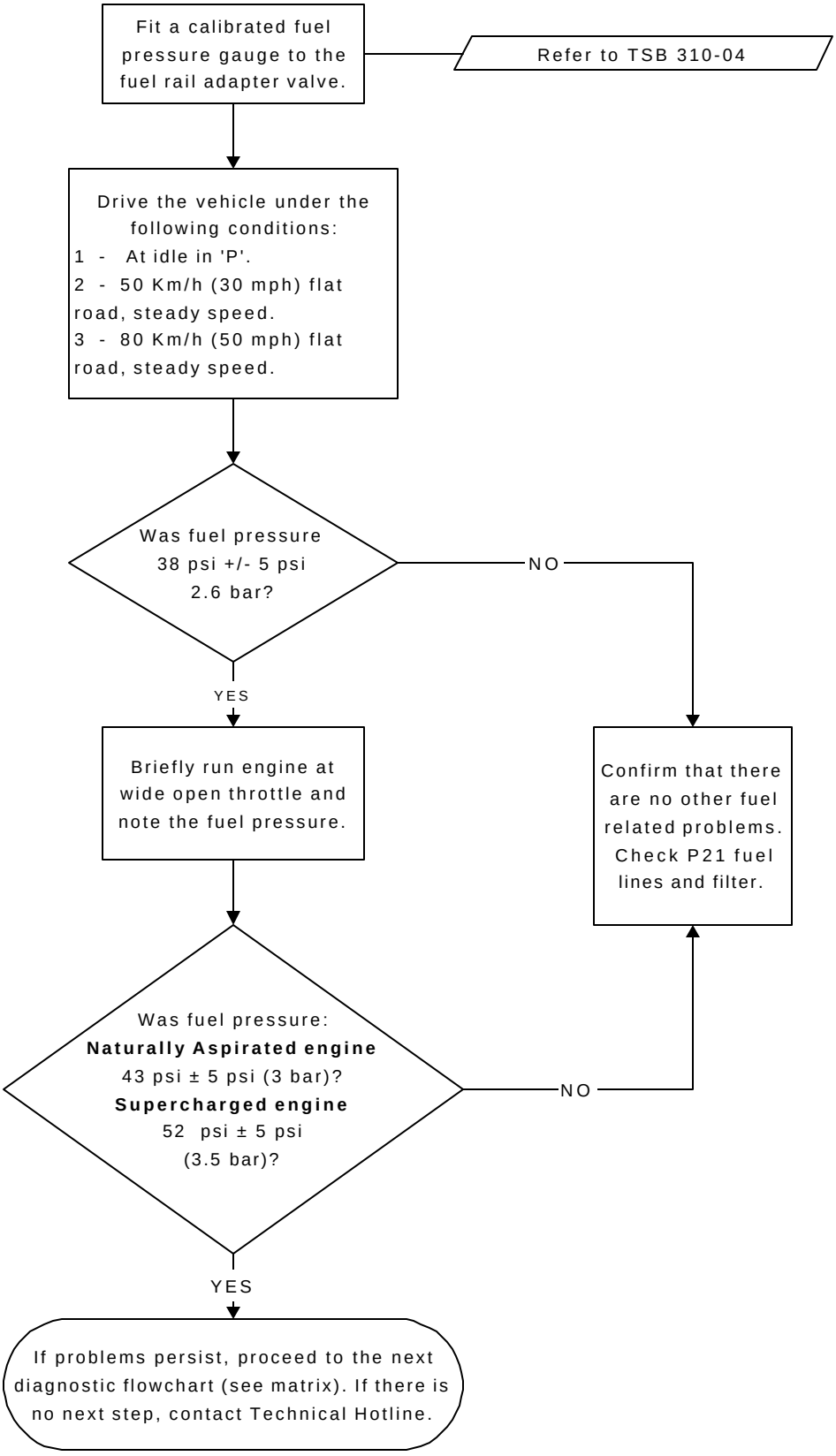
P16 - Ignition Coils Diagnostic Flowchart



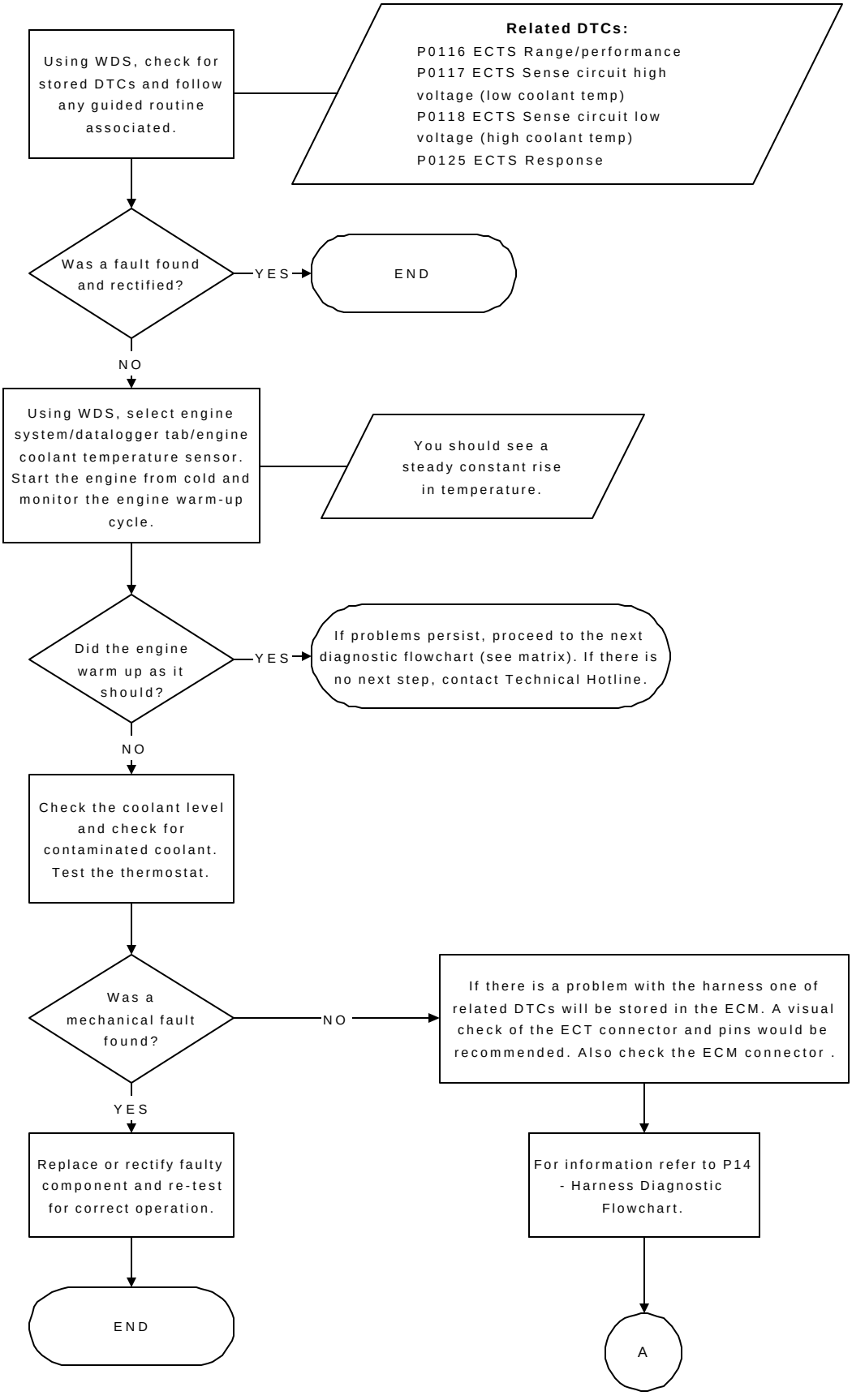
P16 Cont.


A
Has the misfire been found and rectified?
YES
END
NO
Move the suspect coil to another cylinder and retest.
Did the misfire move to the cylinder that the coil was moved to?
YES
Replace the component.
NO
If problems persist, proceed to the next diagnostic flowchart (see matrix). If there is no next step, contact Technical Hotline.

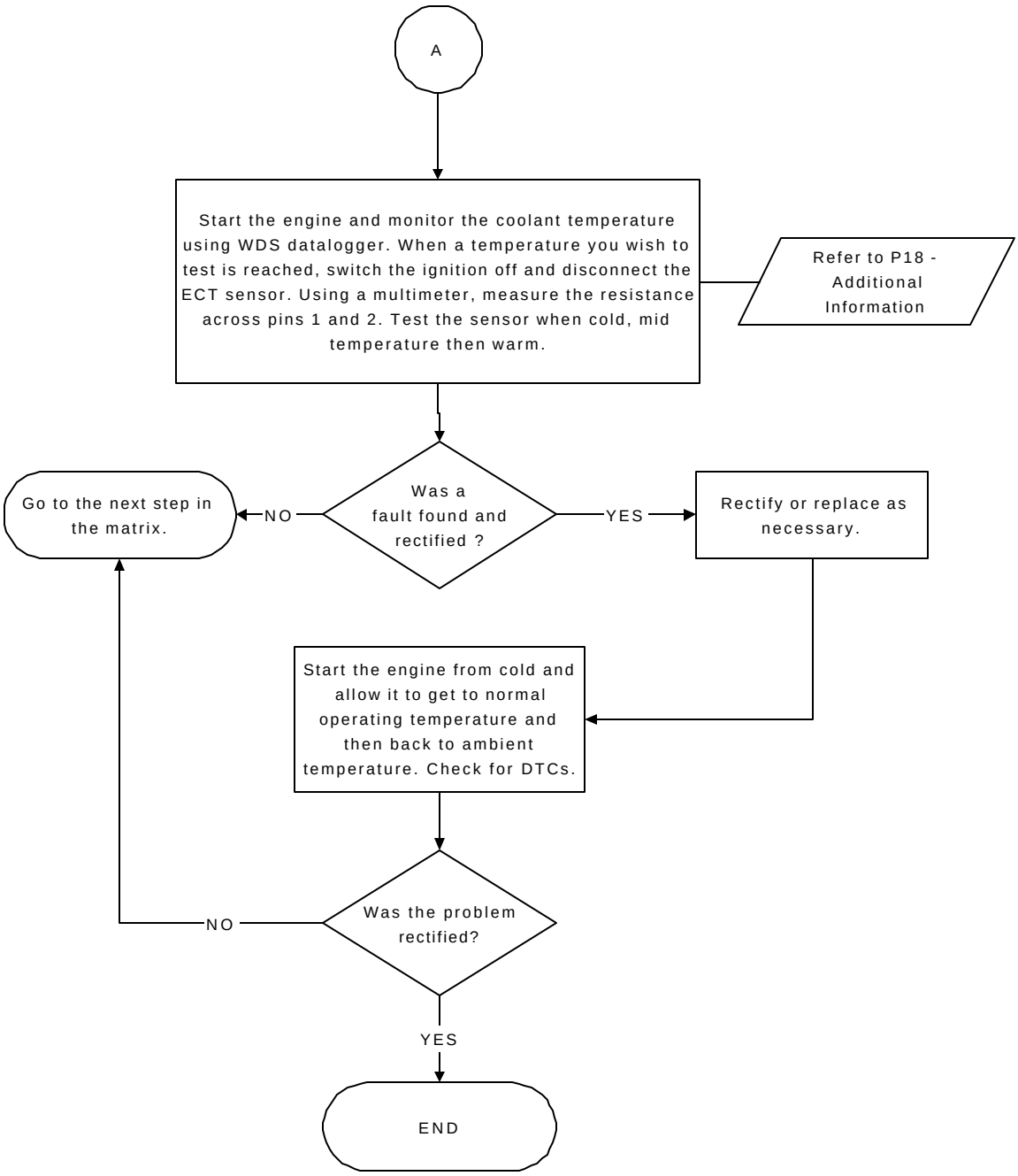
P17 - Fuel Pump Diagnostic Flowchart



P18 - ECT Sensor Diagnostic Flowchart



P18 Cont.

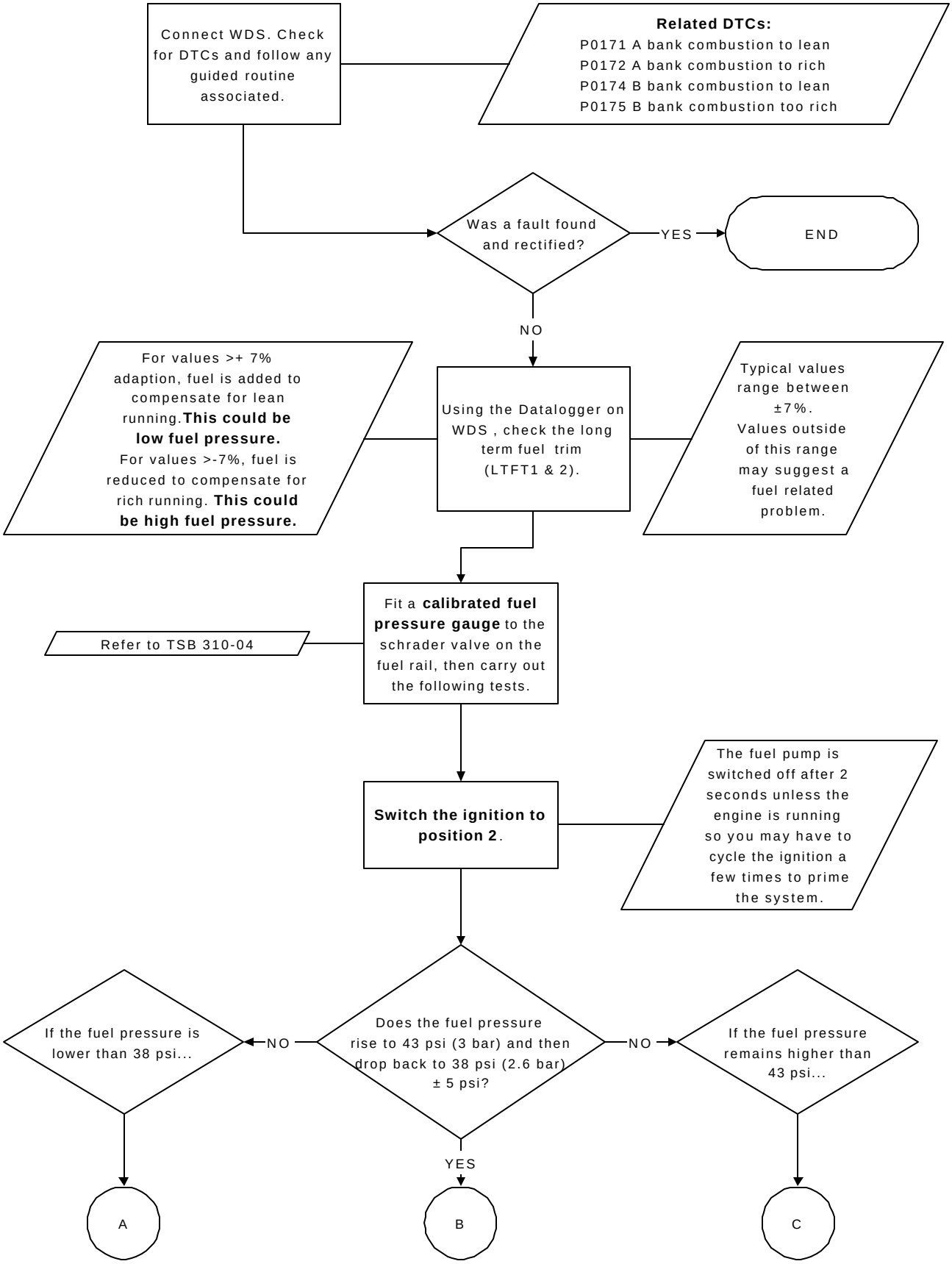

A
Start the engine and monitor the coolant temperature using WDS datalogger. When a temperature you wish to test is reached, switch the ignition off and disconnect the ECT sensor. Using a multimeter, measure the resistance across pins 1 and 2. Test the sensor when cold, mid temperature then warm.
Refer to P18 - Additional Information
Was a fault found and rectified ?
NO
Go to the next step in the matrix.
YES
Rectify or replace as necessary.
Start the engine from cold and allow it to get to normal operating temperature and then back to ambient temperature. Check for DTCs.
Was the problem rectified?
NO
YES
END

P18 – Additional Information

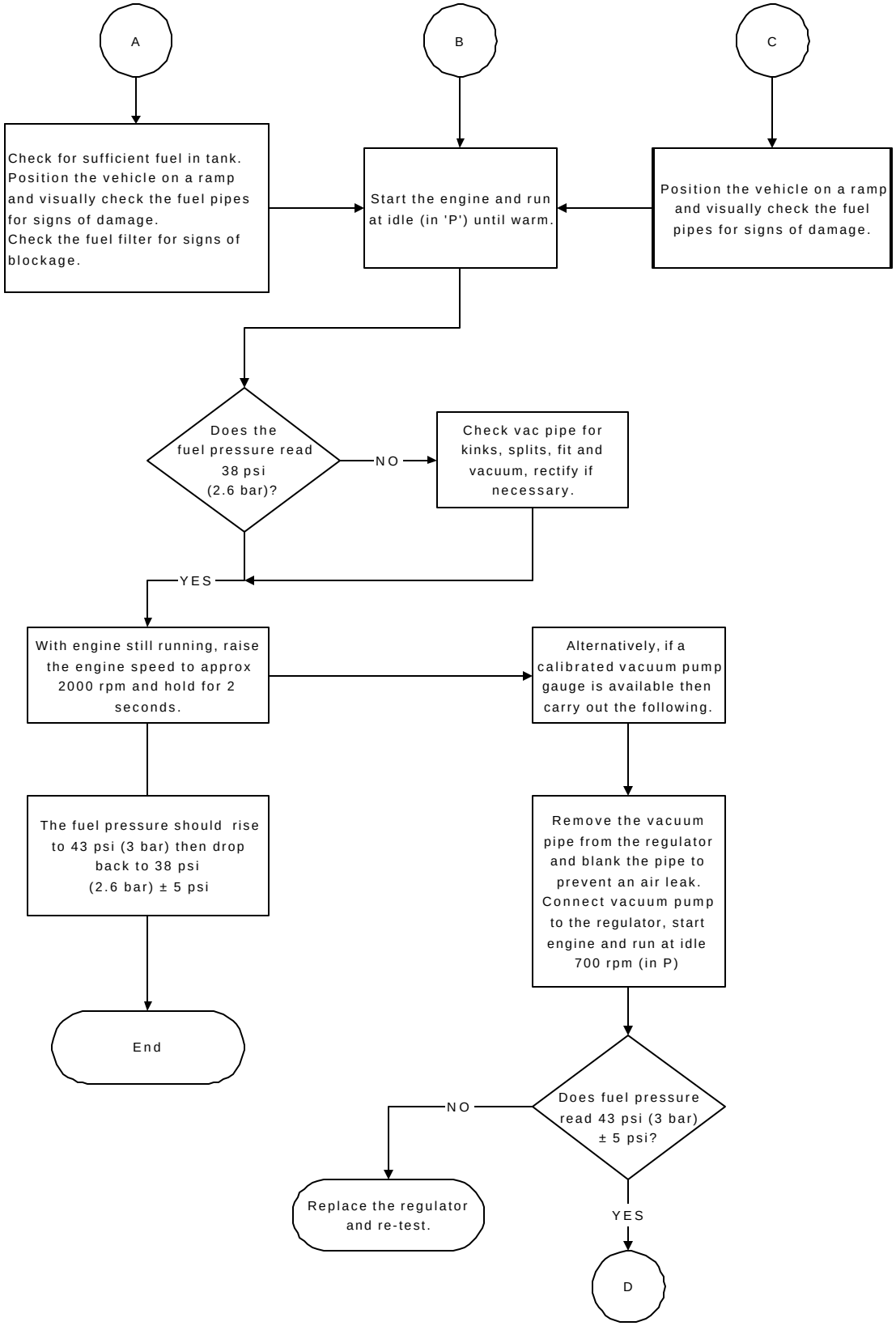
Engine coolant temperature sensor/resistance relationship

Engine coolant temperature °C	Resistance K ohms	Voltage V
-10	9.20	4.05
0	5.90	3.64
10	3.70	2.89
20	2.50	2.42
30	1.70	2.20
40	1.18	1.78
50	0.84	1.44
60	0.60	1.17
70	0.435	0.95
80	0.325	0.78
90	0.25	0.65
100	0.19	0.55

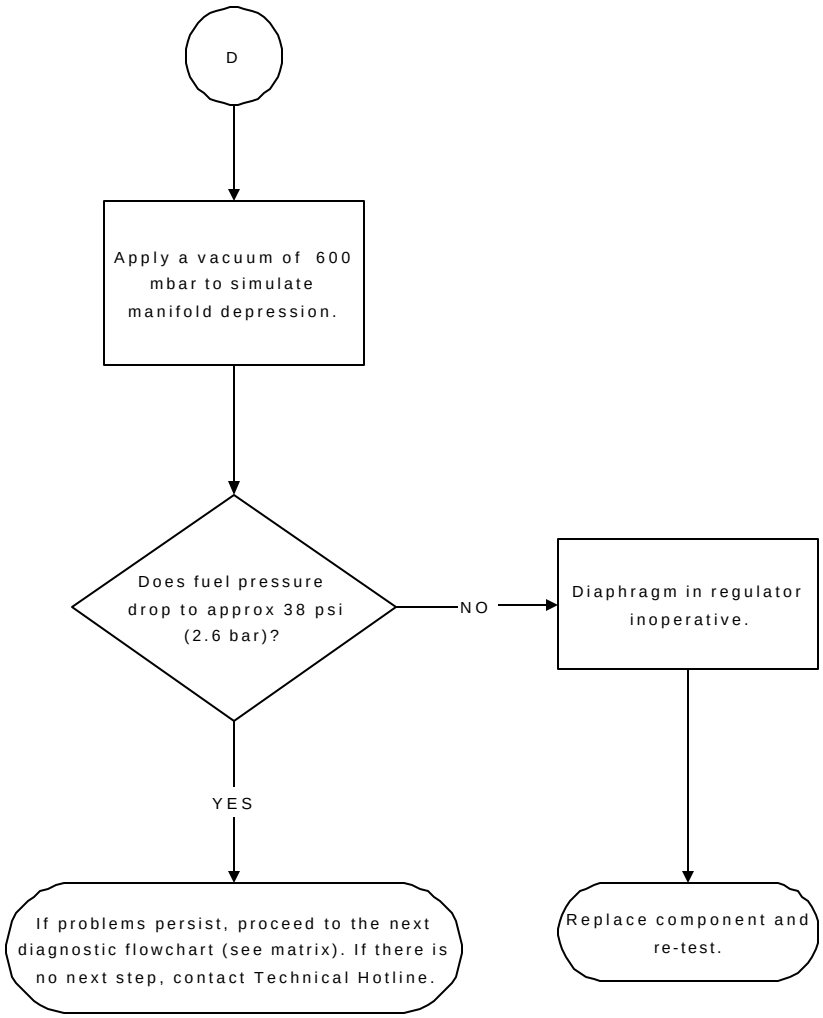
P20 - Fuel Pressure Regulator Diagnostic Flowchart



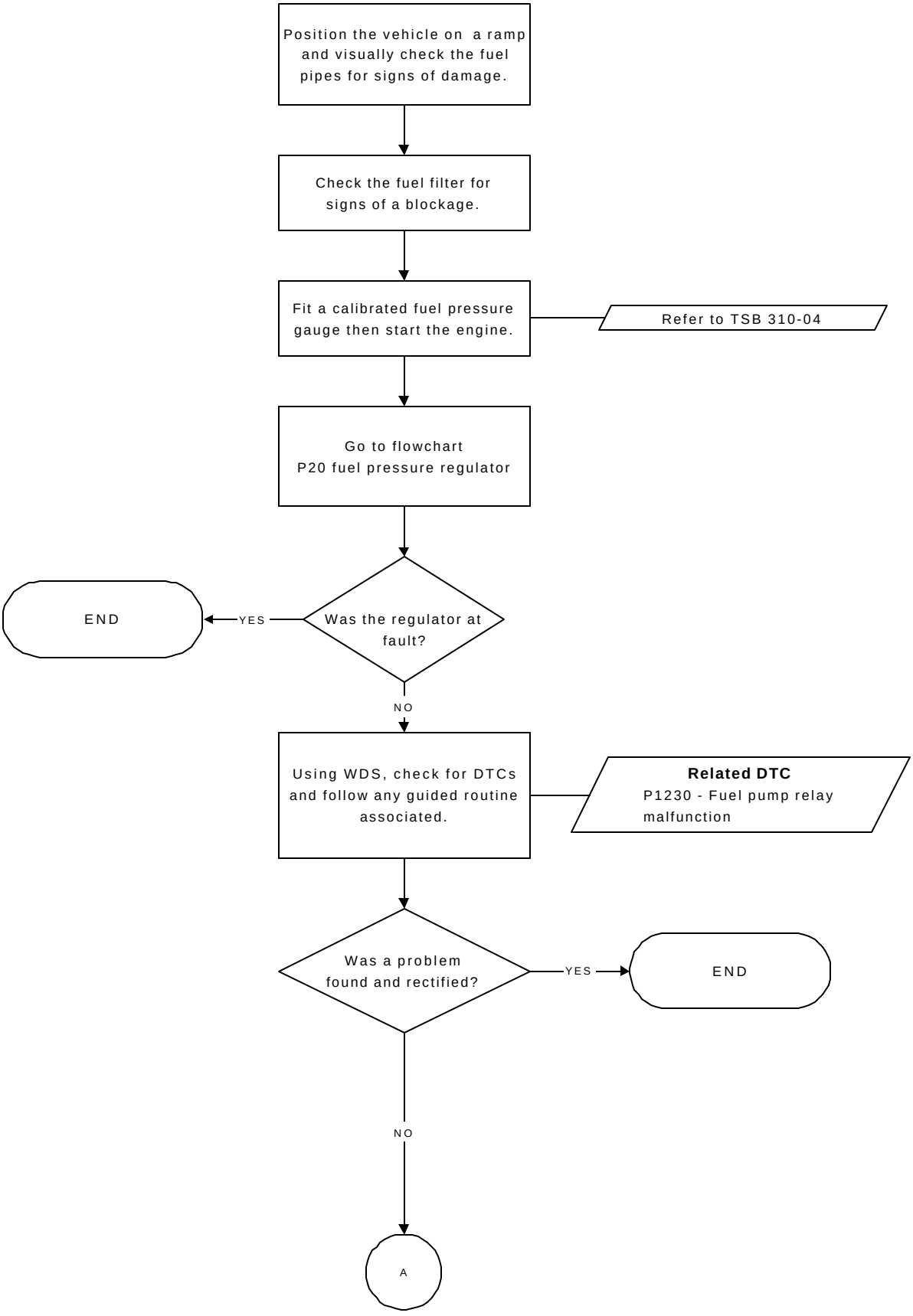
P20 Cont.


A
B
C
Check for sufficient fuel in tank. Position the vehicle on a ramp and visually check the fuel pipes for signs of damage. Check the fuel filter for signs of blockage.
Start the engine and run at idle (in 'P') until warm.
Position the vehicle on a ramp and visually check the fuel pipes for signs of damage.
Does the fuel pressure read 38 psi (2.6 bar)?
NO
Check vac pipe for kinks, splits, fit and vacuum, rectify if necessary.
YES
With engine still running, raise the engine speed to approx 2000 rpm and hold for 2 seconds.
Alternatively, if a calibrated vacuum pump gauge is available then carry out the following.
The fuel pressure should rise to 43 psi (3 bar) then drop back to 38 psi (2.6 bar) ± 5 psi
Remove the vacuum pipe from the regulator and blank the pipe to prevent an air leak. Connect vacuum pump to the regulator, start engine and run at idle 700 rpm (in P)
End
Does fuel pressure read 43 psi (3 bar) ± 5 psi?
NO
Replace the regulator and re-test.
YES
D

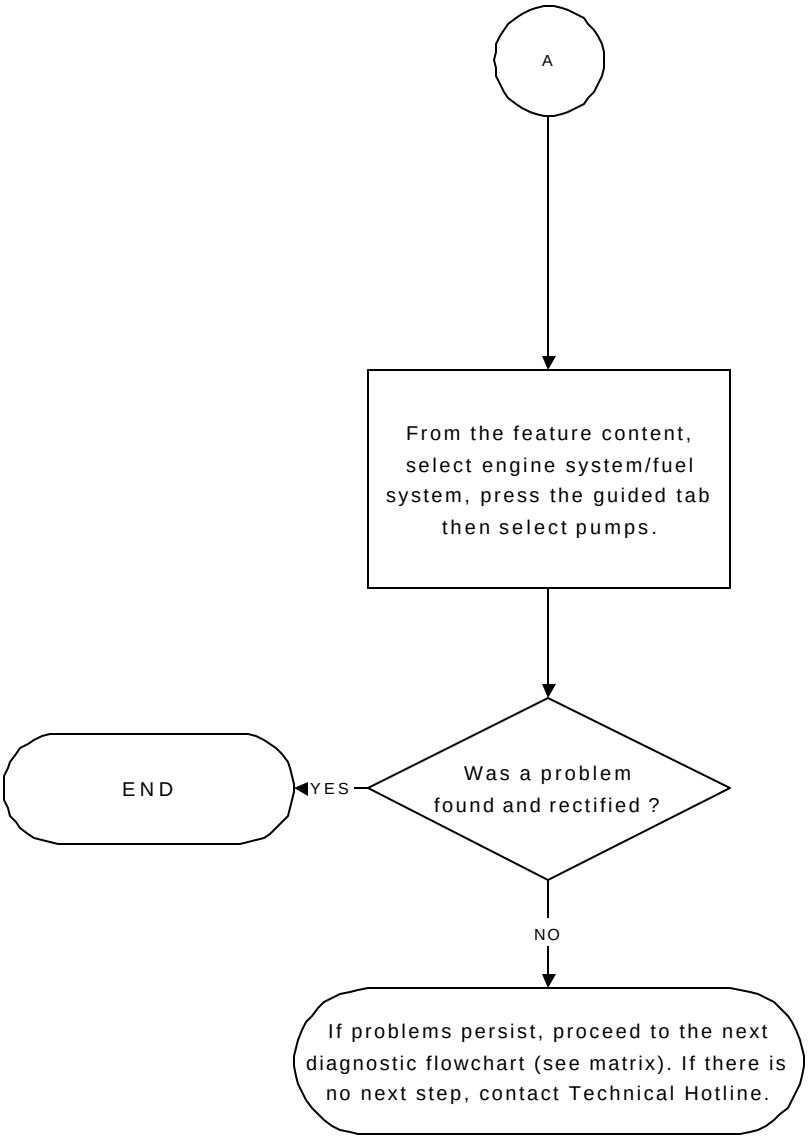
P20 Cont.


D
Apply a vacuum of 600 mbar to simulate manifold depression.
Does fuel pressure drop to approx 38 psi (2.6 bar)?
NO
Diaphragm in regulator inoperative.
YES
If problems persist, proceed to the next diagnostic flowchart (see matrix). If there is no next step, contact Technical Hotline.
Replace component and re-test.

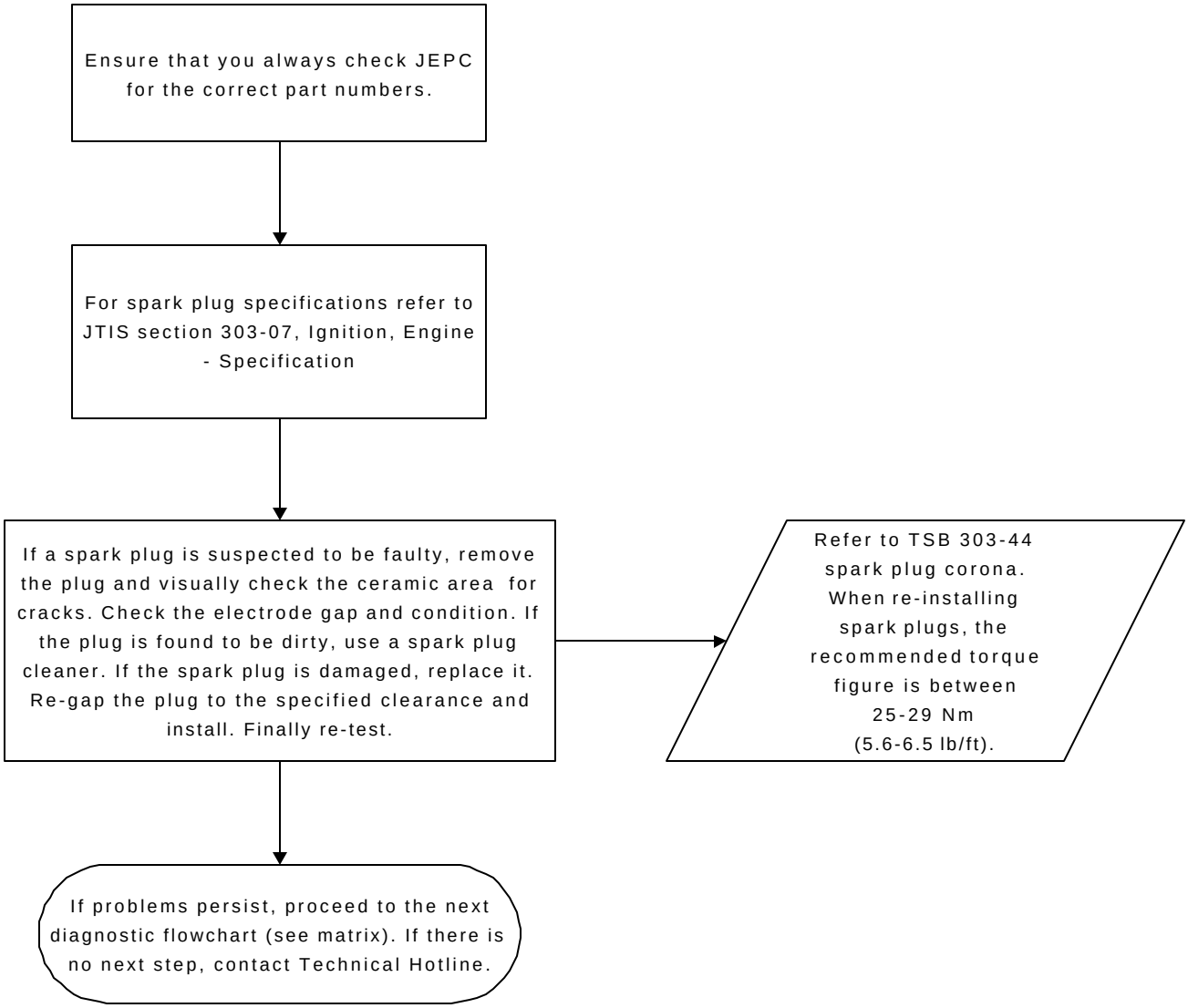
P21 - Fuel Lines Diagnostic Flowchart



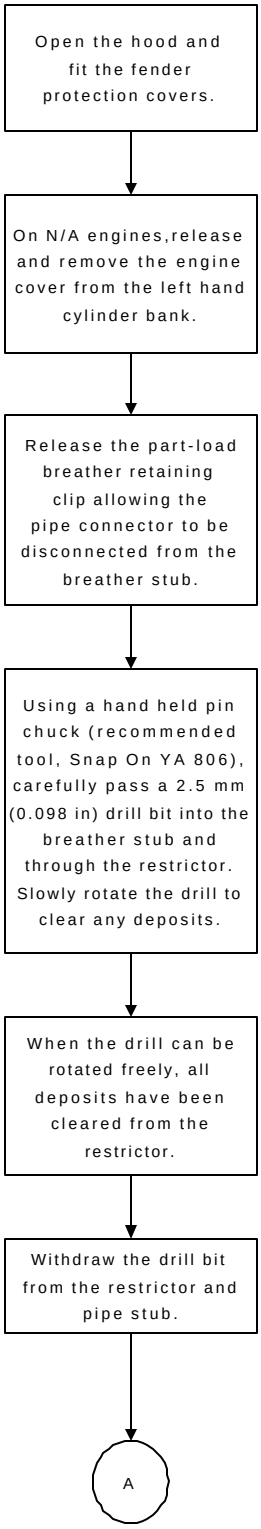
P21 Cont.


A
From the feature content, select engine system/fuel system, press the guided tab then select pumps.
Was a problem found and rectified ?
YES
END
NO
If problems persist, proceed to the next diagnostic flowchart (see matrix). If there is no next step, contact Technical Hotline.

P26 - Spark Plugs Diagnostic Flowchart

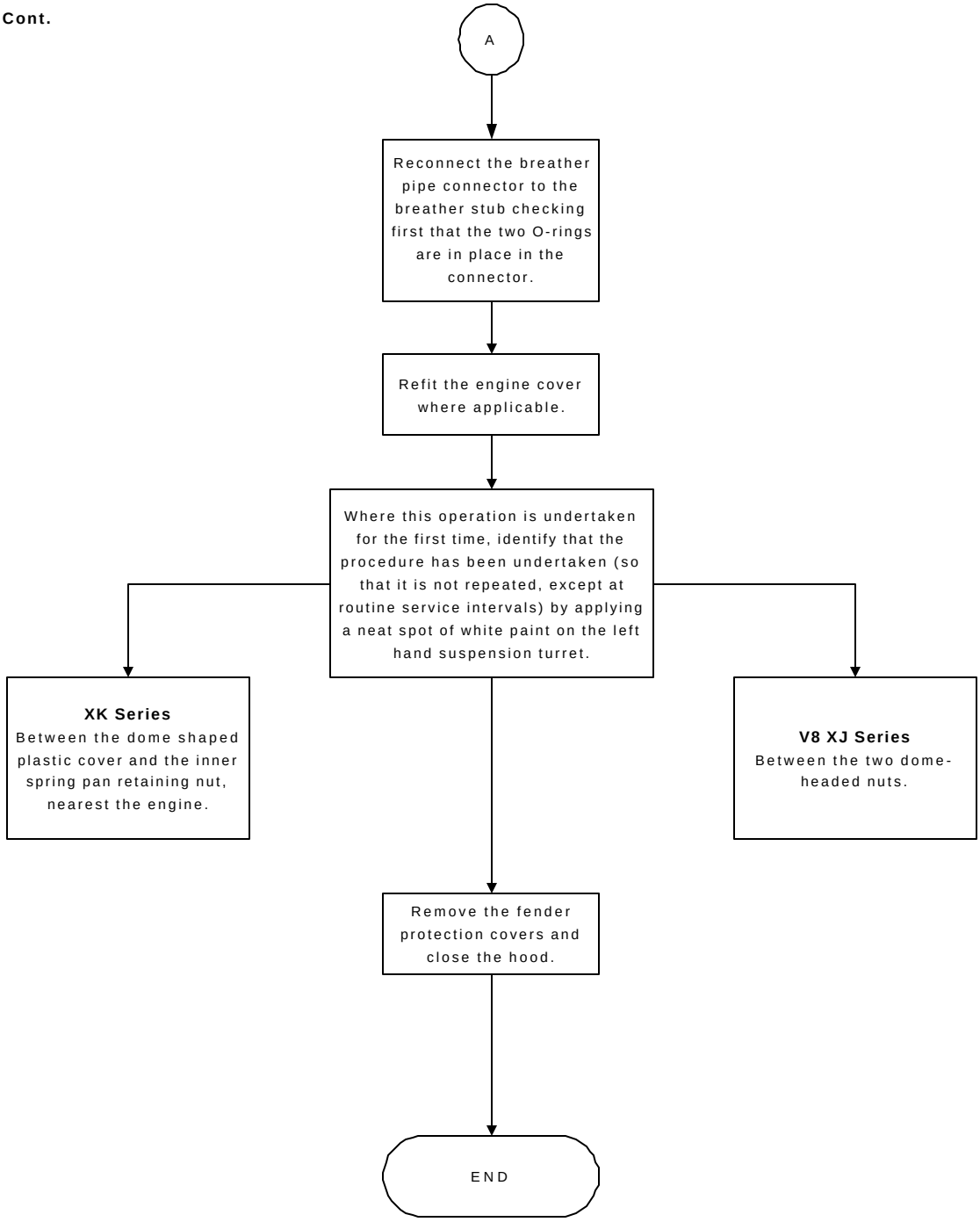


P29 - Blocked Part-Load Breather Diagnostic Flowchart



Note: In no circumstances must a power drill be used, it should always be rotated by hand. The drill bit should never exceed 2.5 mm (0.098 in)

P29 Cont.



Note: The information in this flowchart has been taken from Service Action S474.
Use the chart in conjunction with Service Action S474 Technical Bulletin 600-03.