# Hesitation, Surging, Detonation, Poor Throttle Response/Acceleration – Diagnostic Flowcharts – AJ 26 Engines

MODEL
1997-98 MY XK8 Range
1998 MY V8 XJ Series
VIN 1998-99 MY XJR

### Issue:

This Technical Bulletin provides diagnostic information relating to various engine drivability concerns such as hesitation, backfiring, surging, knocking, poor throttle response, and cruise control inhibited. The diagnosis is organized by the symptoms that the customer experiences.

### Action:

Before using the guide, check the Symptom Matrix (next page) for the diagnostic flowchart sequence. For example, if the **cruise control is inhibited or disabled**, work through flowcharts P28, P30 and P27.

Following the flowcharts in the sequence identified will help rectify any concerns while optimizing the utilization of workshop time.

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

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 after 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.

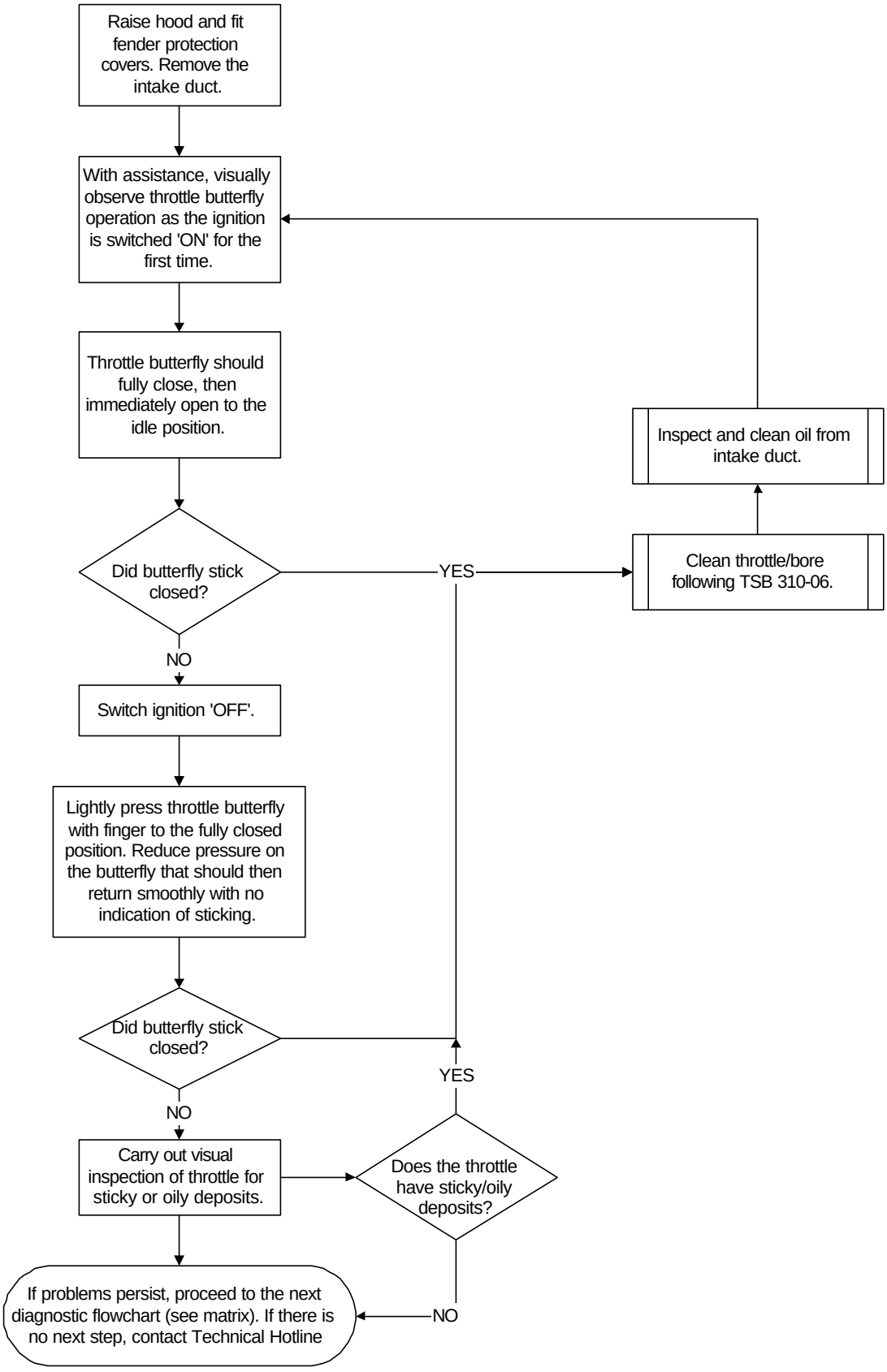
> ⚠ **Warning:** Working on the fuel system can result in fuel vapor being emitted into the atmosphere. Fuel vapor is extremely flammable; hence great care should be taken when working on the fuel system.
> Do not smoke in the working area and ensure that there is a CO2 fire extinguisher close by. The 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

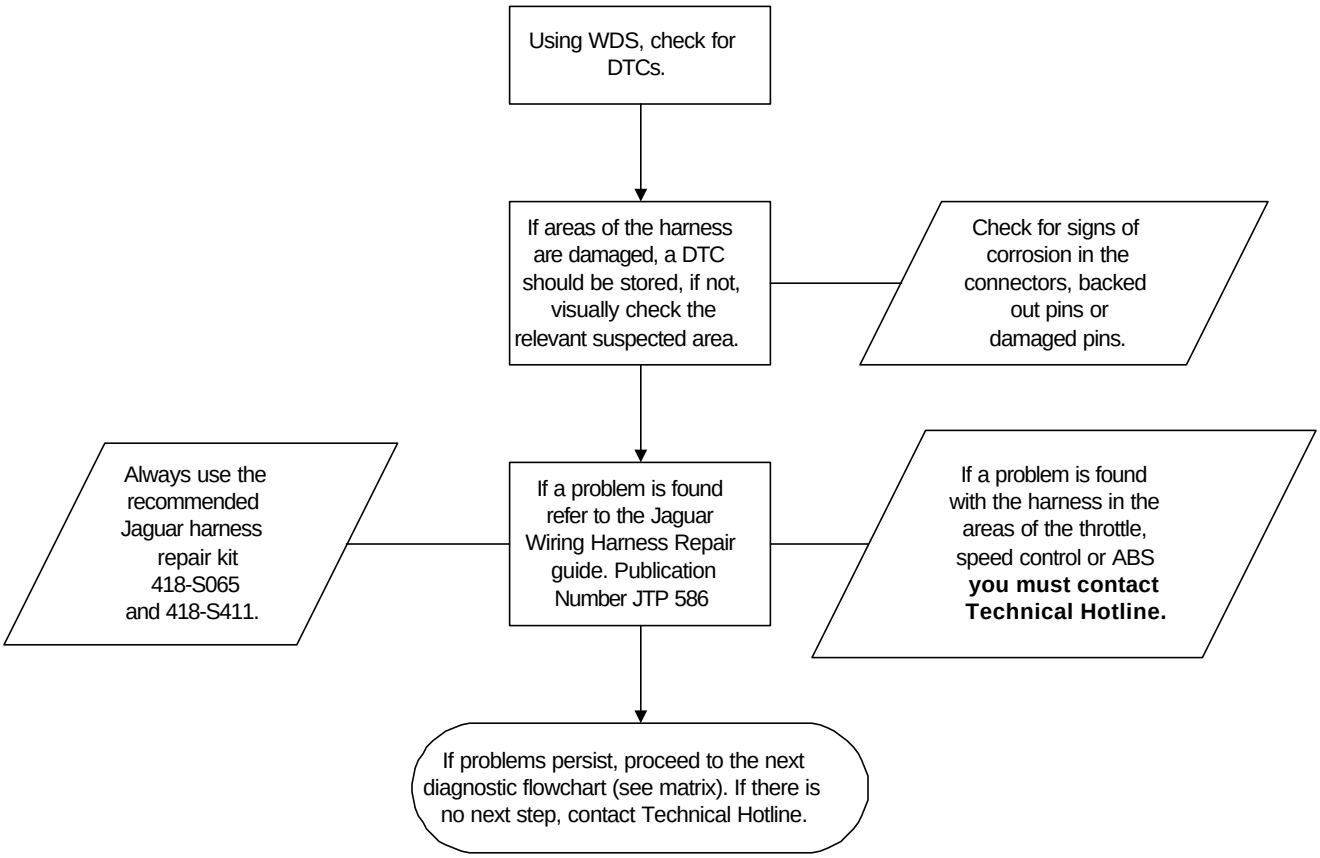
| Poor Drivability | | | | | | Symptom / Suspect Area | See Chart |
|---|---|---|---|---|---|---|---|
| Cruise control inhibited or disabled | No throttle response | Engine detonates/knocks | Engine surges | Engine backfires | Engine hesitates/poor acceleration | | |
| | | | | | | Throttle (contaminated) | P1 |
| | | | 5 | | | Harness | P14 |
| | | | 9 | | 7 | ECM | P15 |
| | | 1 | 2 | 1 | 1 | Fuel pump | P17 |
| | | 5 | 4 | 3 | | Mass air flow meter | P19 |
| | | | | | | Fuel pressure regulator | P20 |
| | | | | | | Fuel lines | P21 |
| | | 2 | | 4 | | Oxygen sensors | P22 |
| | | 3 | 1 | 2 | 2 | Air leakage | P23 |
| | 1 | | 6 | | 4 | Throttle sensors | P24 |
| | 2 | | 7 | | 5 | Throttle motor | P25 |
| | | | 8 | 5 | 6 | Spark plugs | P26 |
| 3 | | | 3 | | 3 | Stop lamp switch | P27 |
| 1 | | | | | | Cruise control switch | P28 |
| | | 4 | | | | Blocked part-load breather | P29 |
| 2 | | | | | | Mechanical guard, VSVs | P30 |
| | | | | | 1***** | EGR | P31 |

*** If the vehicle is to a North American specification, flowchart P31 must be carried out first.**

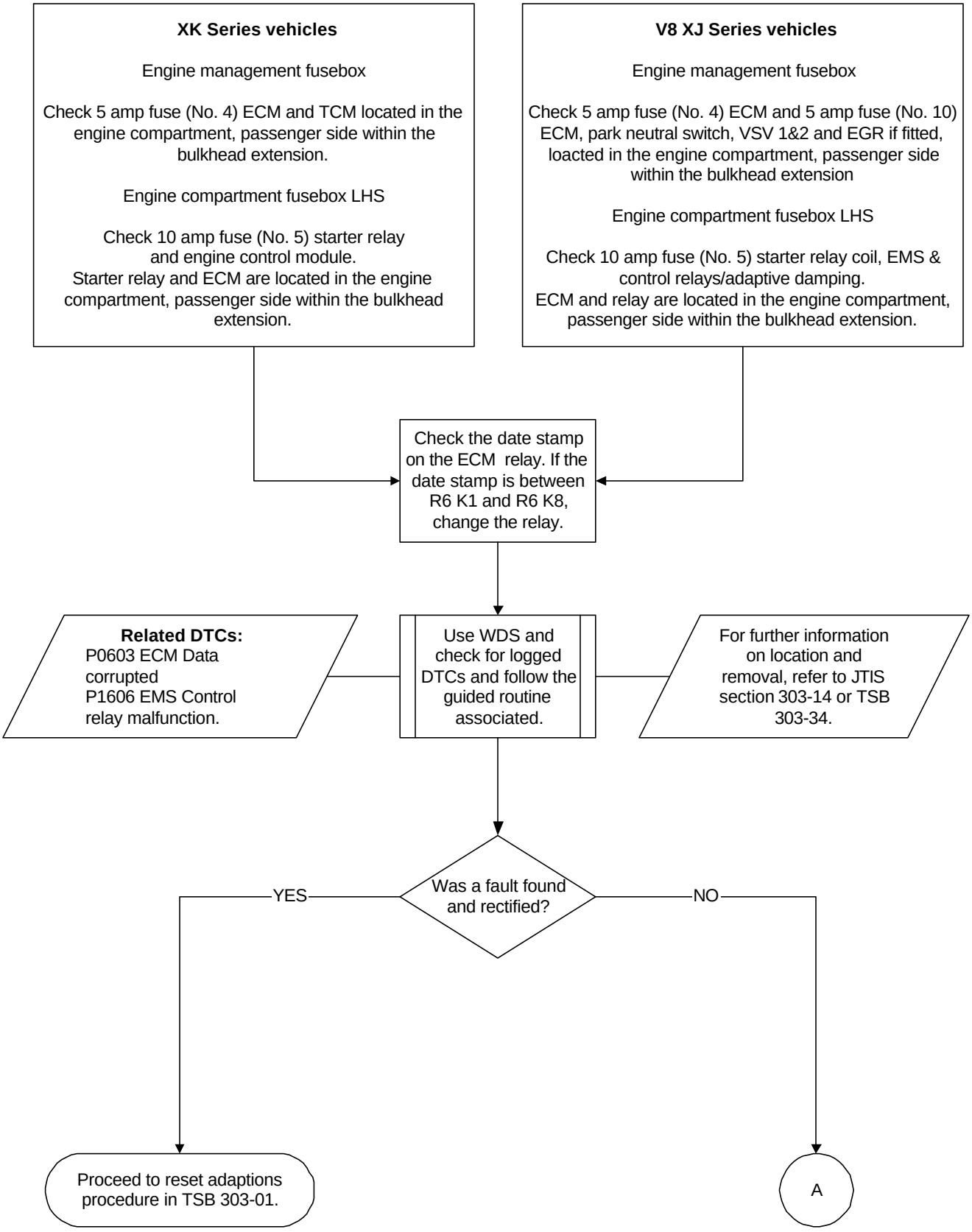
## P1 Contaminated Throttle Diagnostic Flowchart



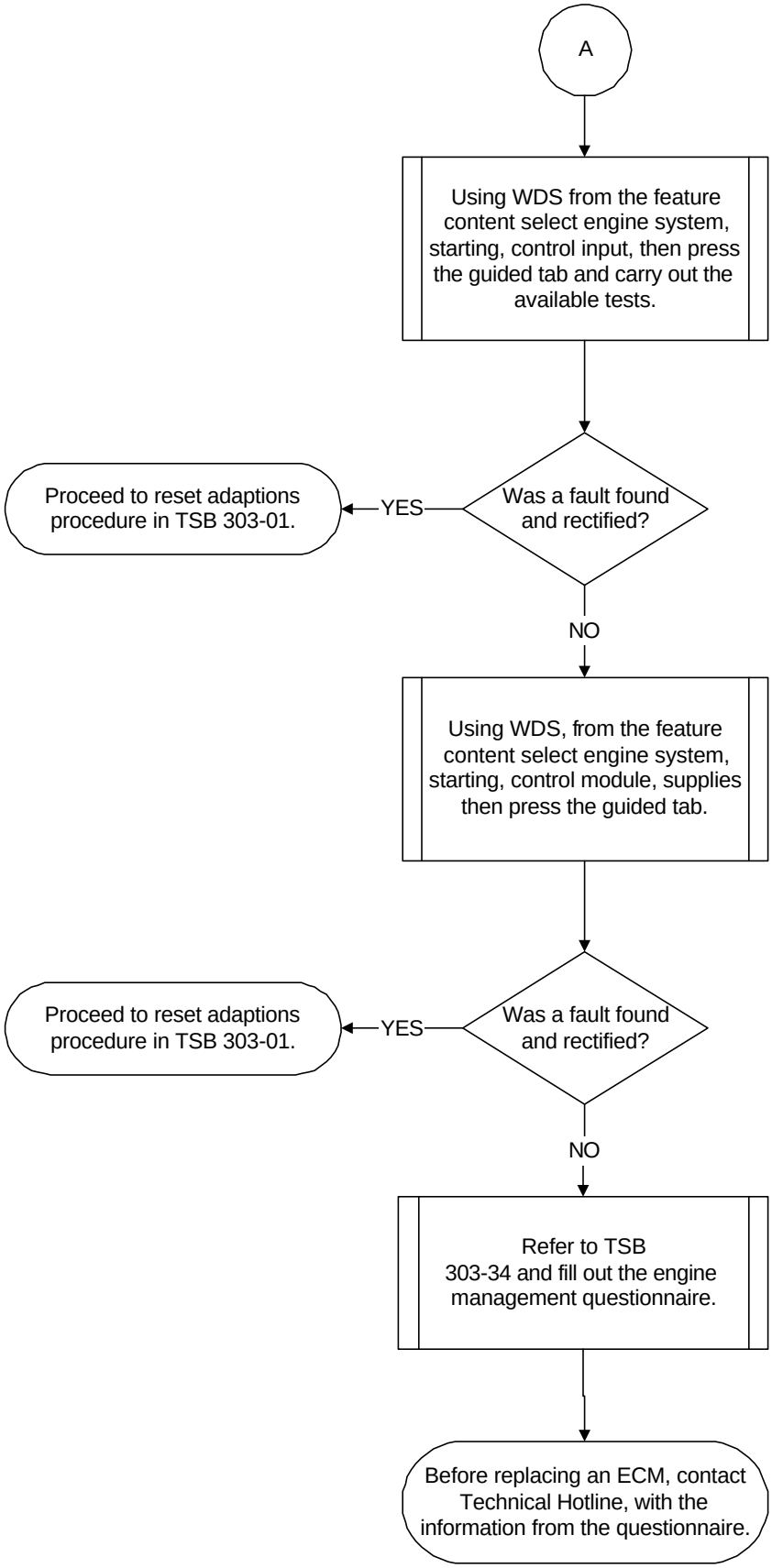
## P 14 Engine Harness



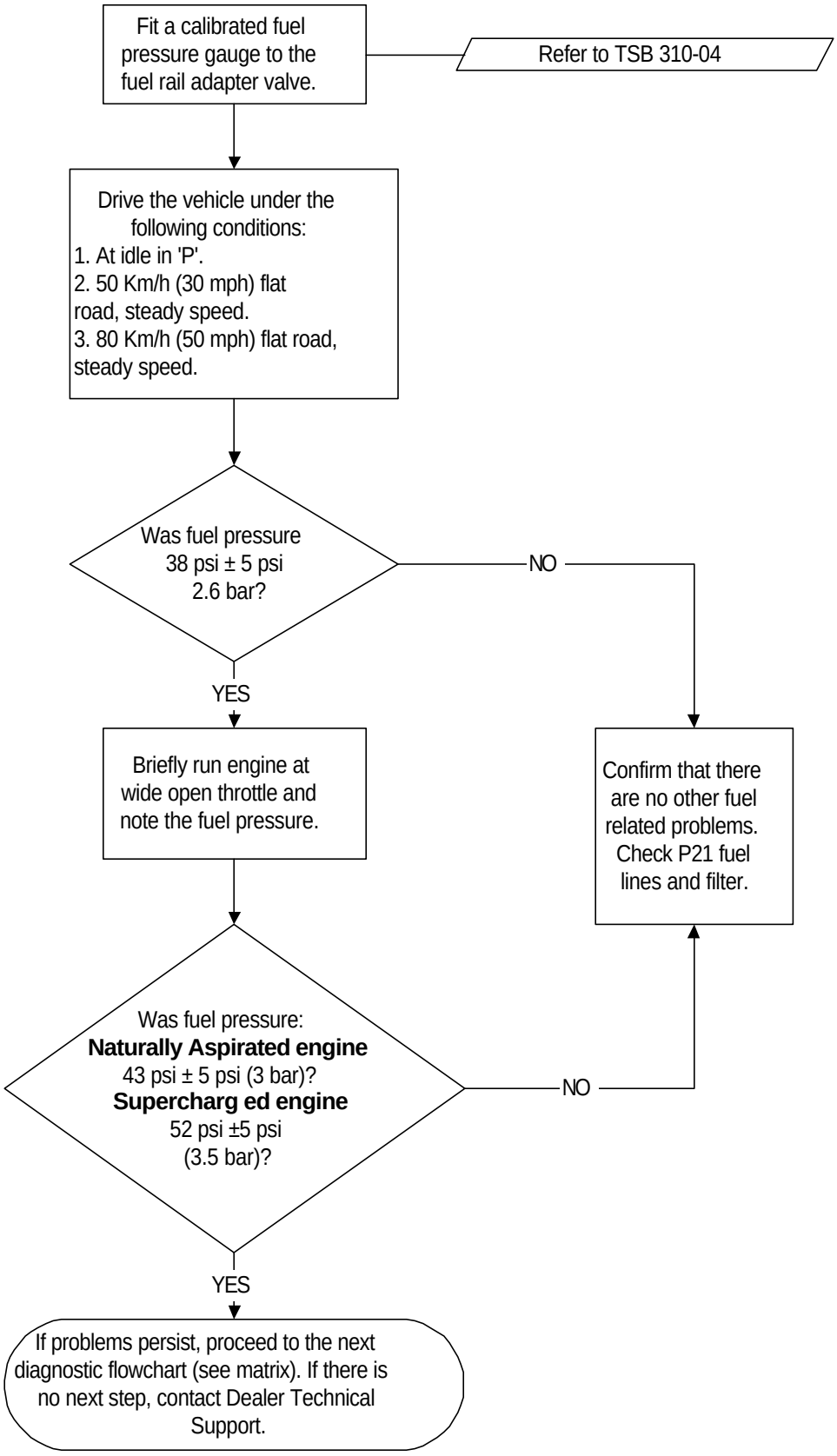
## P15 ECM


XK Series vehicles
Engine management fusebox
Check 5 amp fuse (No. 4) ECM and TCM located in the engine compartment, passenger side within the bulkhead extension.
Engine compartment fusebox LHS
Check 10 amp fuse (No. 5) starter relay and engine control module.
Starter relay and ECM are located in the engine compartment, passenger side within the bulkhead extension.
V8 XJ Series vehicles
Engine management fusebox
Check 5 amp fuse (No. 4) ECM and 5 amp fuse (No. 10) ECM, park neutral switch, VSV 1&2 and EGR if fitted, loacted in the engine compartment, passenger side within the bulkhead extension
Engine compartment fusebox LHS
Check 10 amp fuse (No. 5) starter relay coil, EMS & control relays/adaptive damping.
ECM and relay are located in the engine compartment, passenger side within the bulkhead extension.
Check the date stamp on the ECM relay. If the date stamp is between R6 K1 and R6 K8, change the relay.
Related DTCs:
P0603 ECM Data corrupted
P1606 EMS Control relay malfunction.
Use WDS and check for logged DTCs and follow the guided routine associated.
For further information on location and removal, refer to JTIS section 303-14 or TSB 303-34.
Was a fault found and rectified?
YES
NO
Proceed to reset adaptions procedure in TSB 303-01.
A

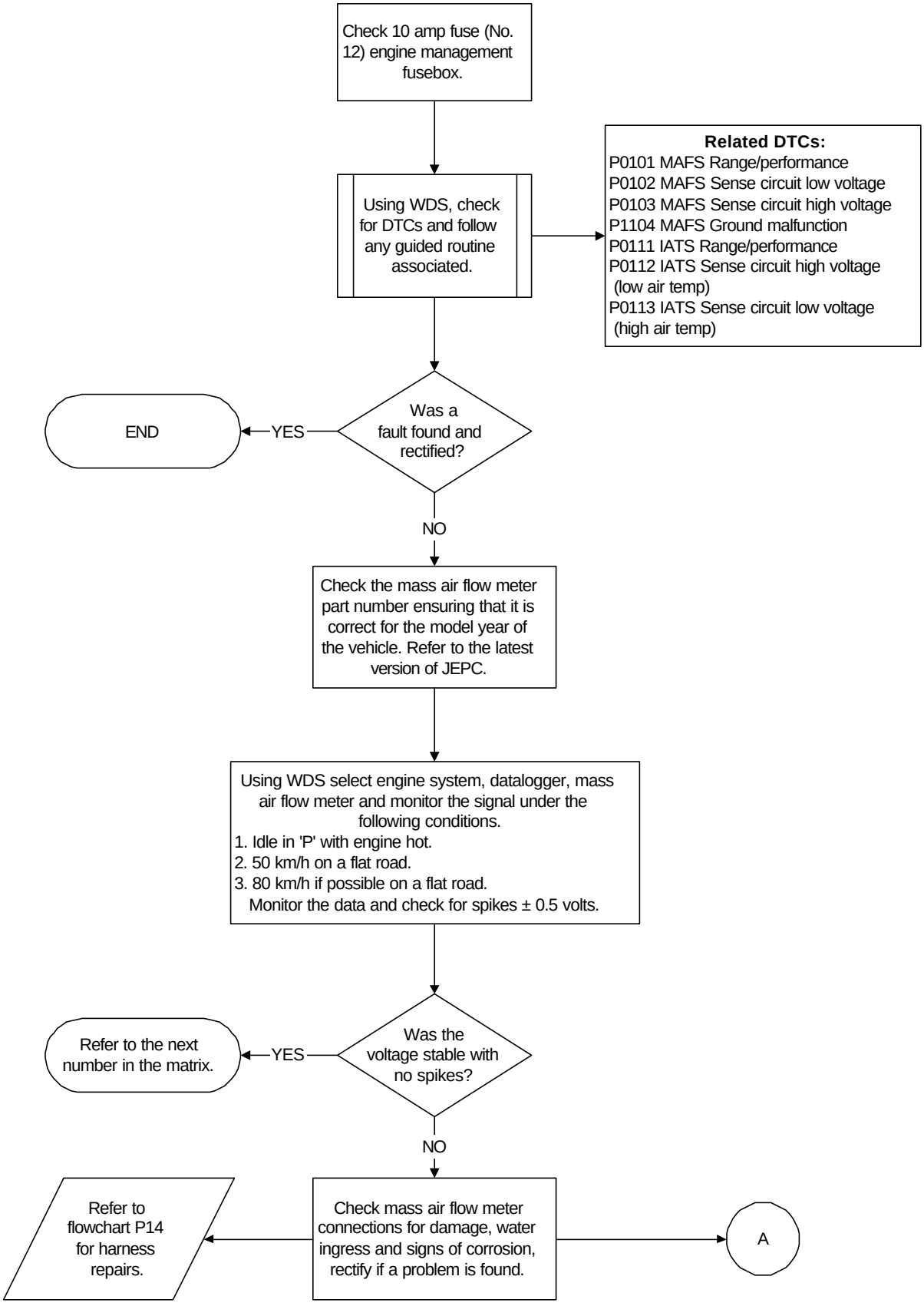
**P15 Cont.**


A
Using WDS from the feature content select engine system, starting, control input, then press the guided tab and carry out the available tests.
Was a fault found and rectified?
YES
Proceed to reset adaptions procedure in TSB 303-01.
NO
Using WDS, from the feature content select engine system, starting, control module, supplies then press the guided tab.
Was a fault found and rectified?
YES
Proceed to reset adaptions procedure in TSB 303-01.
NO
Refer to TSB 303-34 and fill out the engine management questionnaire.
Before replacing an ECM, contact Technical Hotline, with the information from the questionnaire.

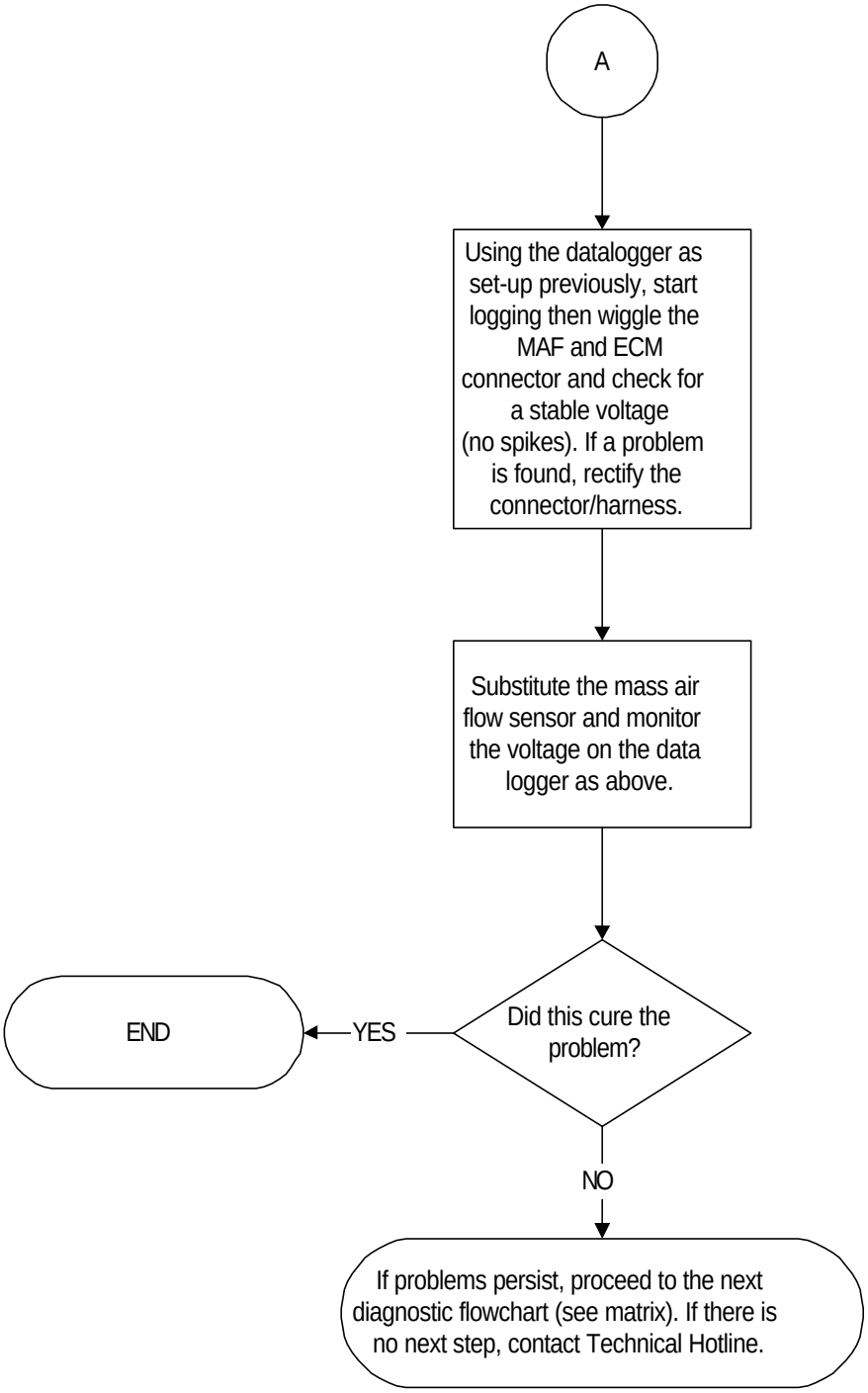
## P17 Fuel Pump



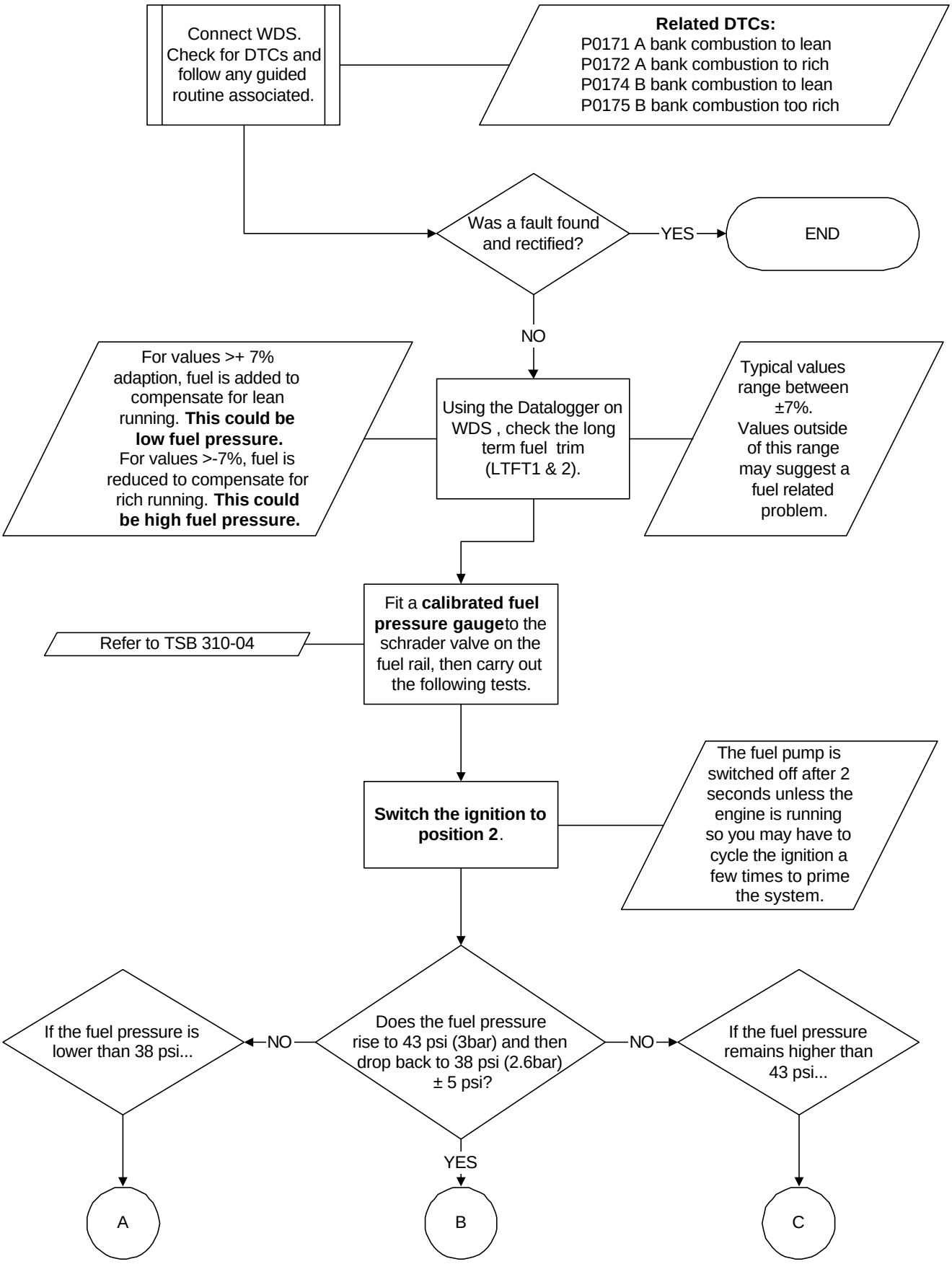
## P19 Mass Air Flow Meter



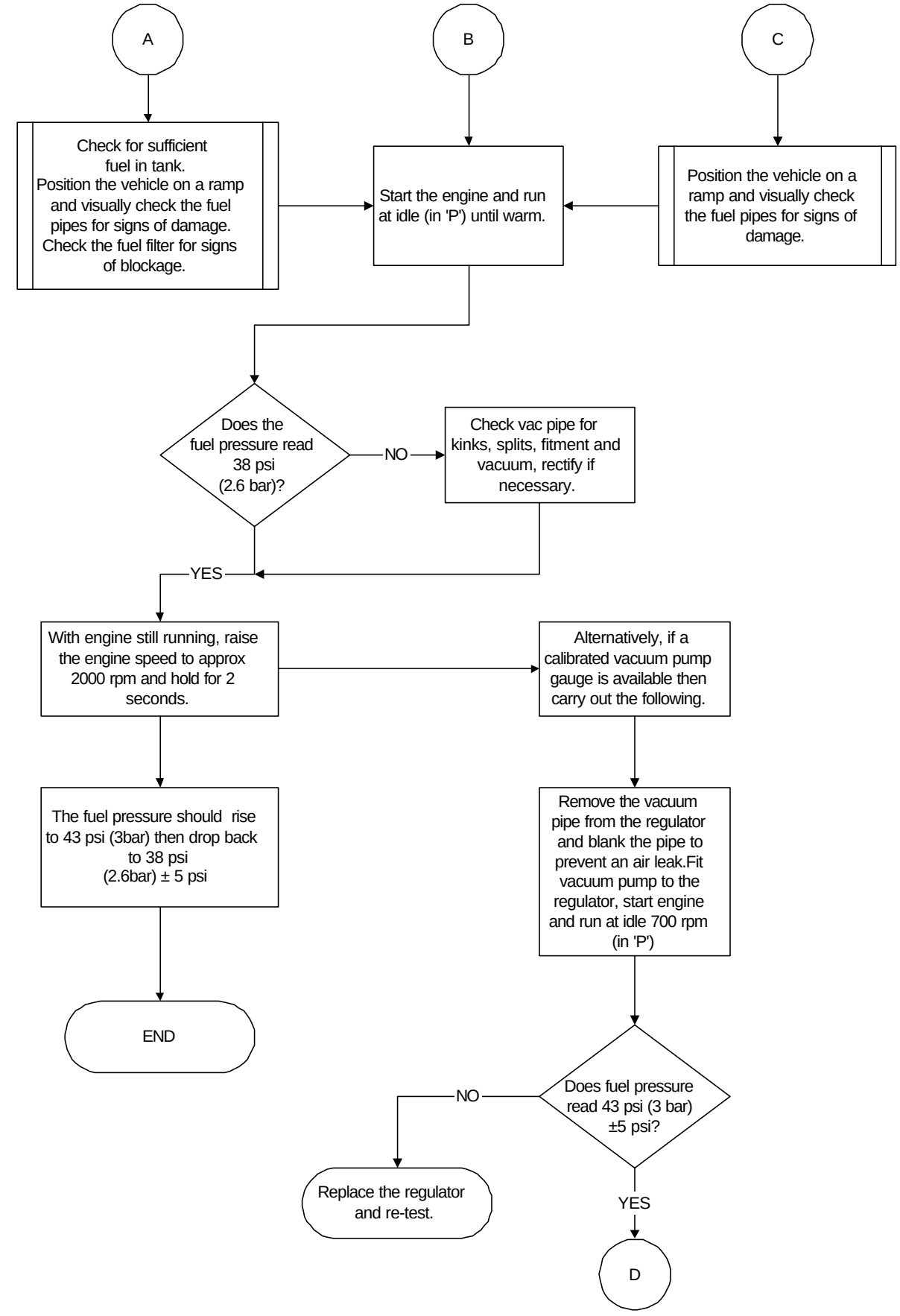
**P19 Cont.**


A
Using the datalogger as set-up previously, start logging then wiggle the MAF and ECM connector and check for a stable voltage (no spikes). If a problem is found, rectify the connector/harness.
Substitute the mass air flow sensor and monitor the voltage on the data logger as above.
Did this cure the problem?
YES
END
NO
If problems persist, proceed to the next diagnostic flowchart (see matrix). If there is no next step, contact Technical Hotline.

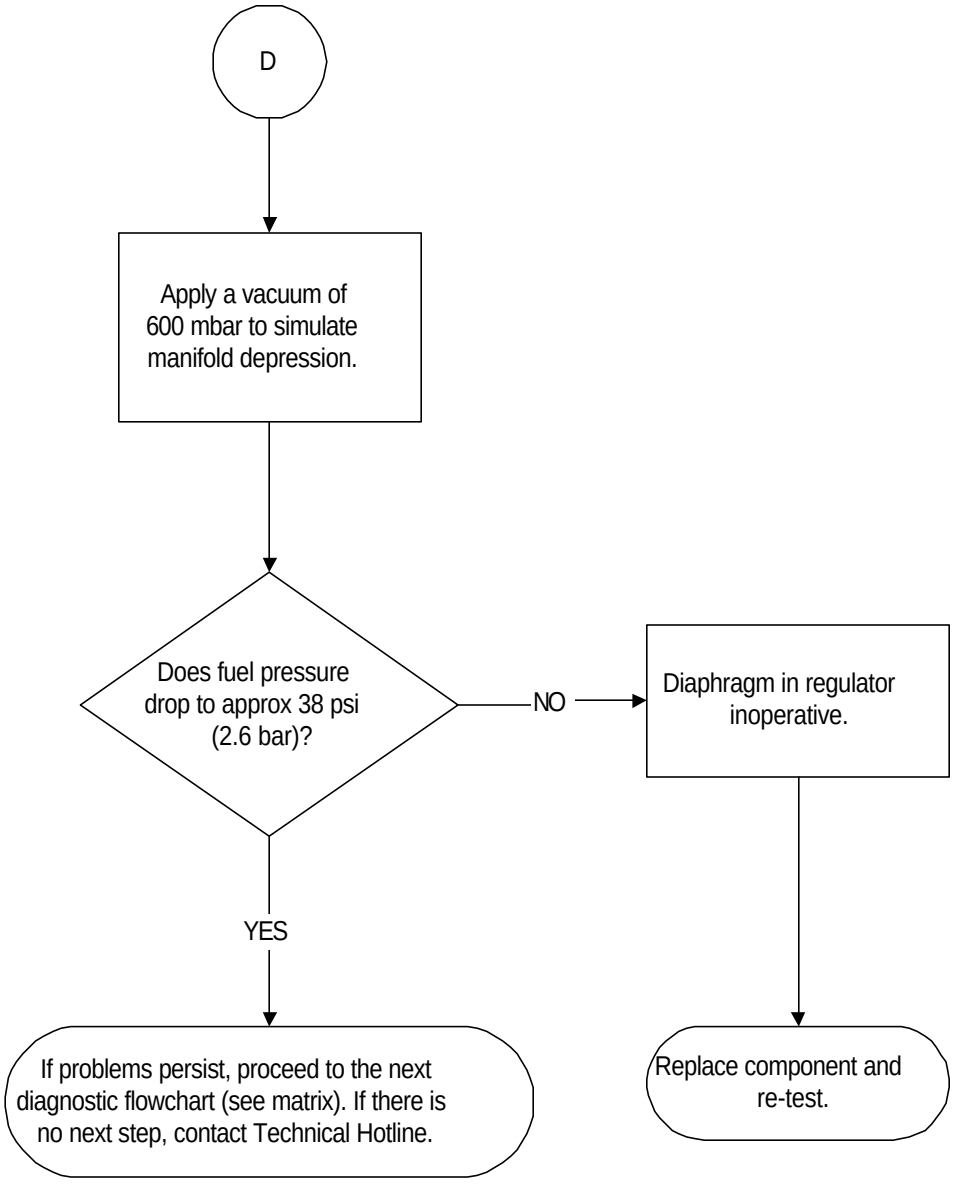
## P20 Fuel Pressure Regulator



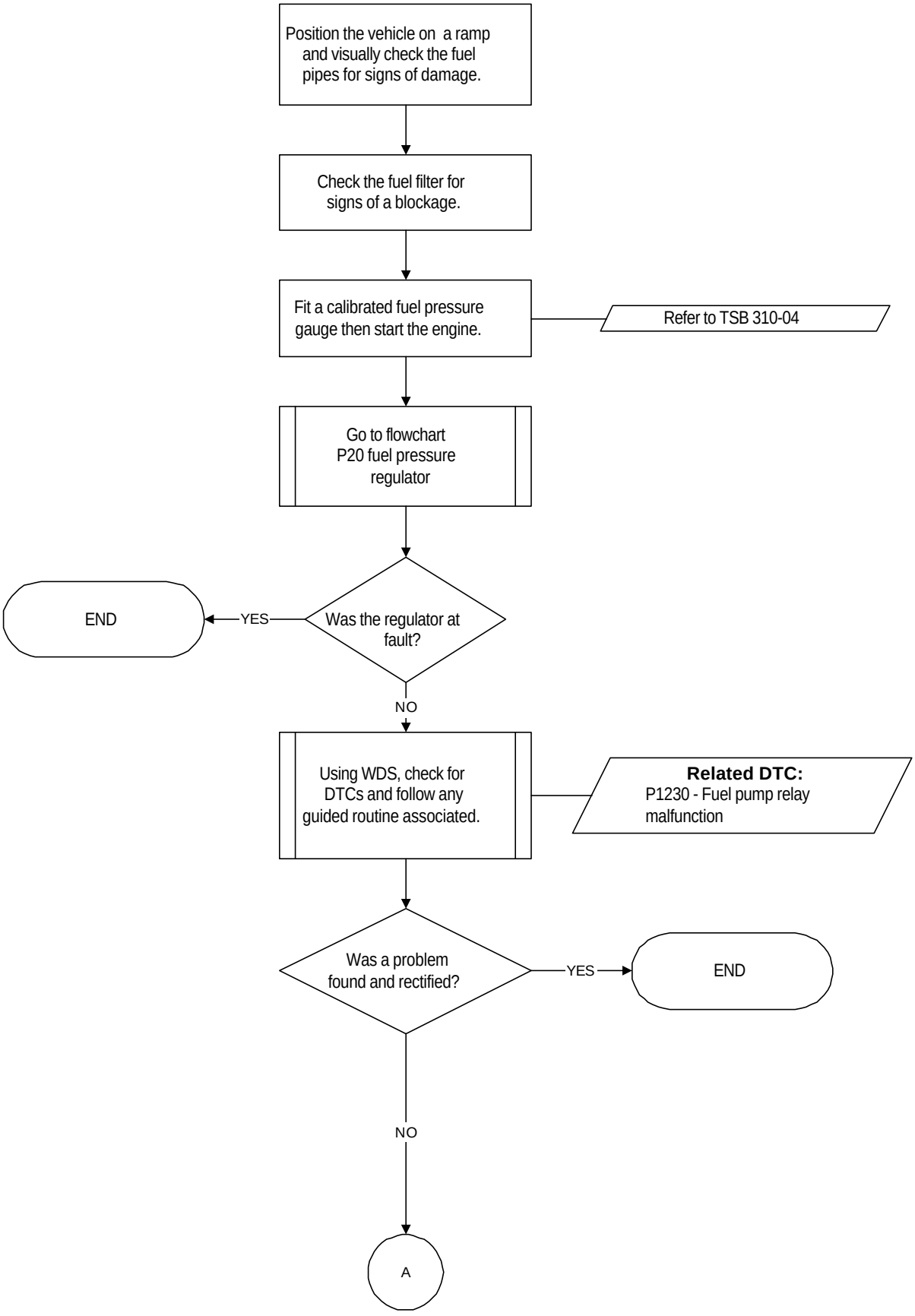
**P20 Cont.**


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, fitment 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 (3bar) then drop back to 38 psi (2.6bar) ± 5 psi
Remove the vacuum pipe from the regulator and blank the pipe to prevent an air leak.Fit 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

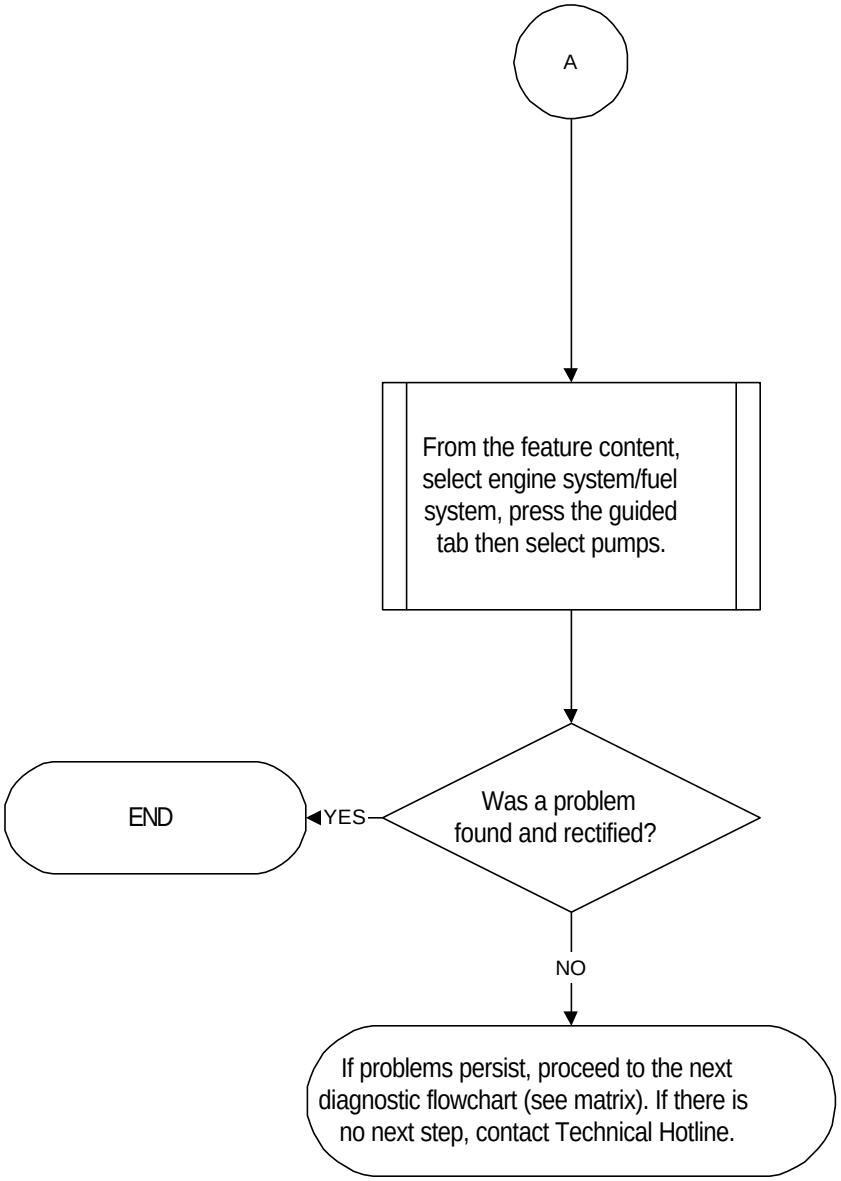
**P20 Cont.**


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.

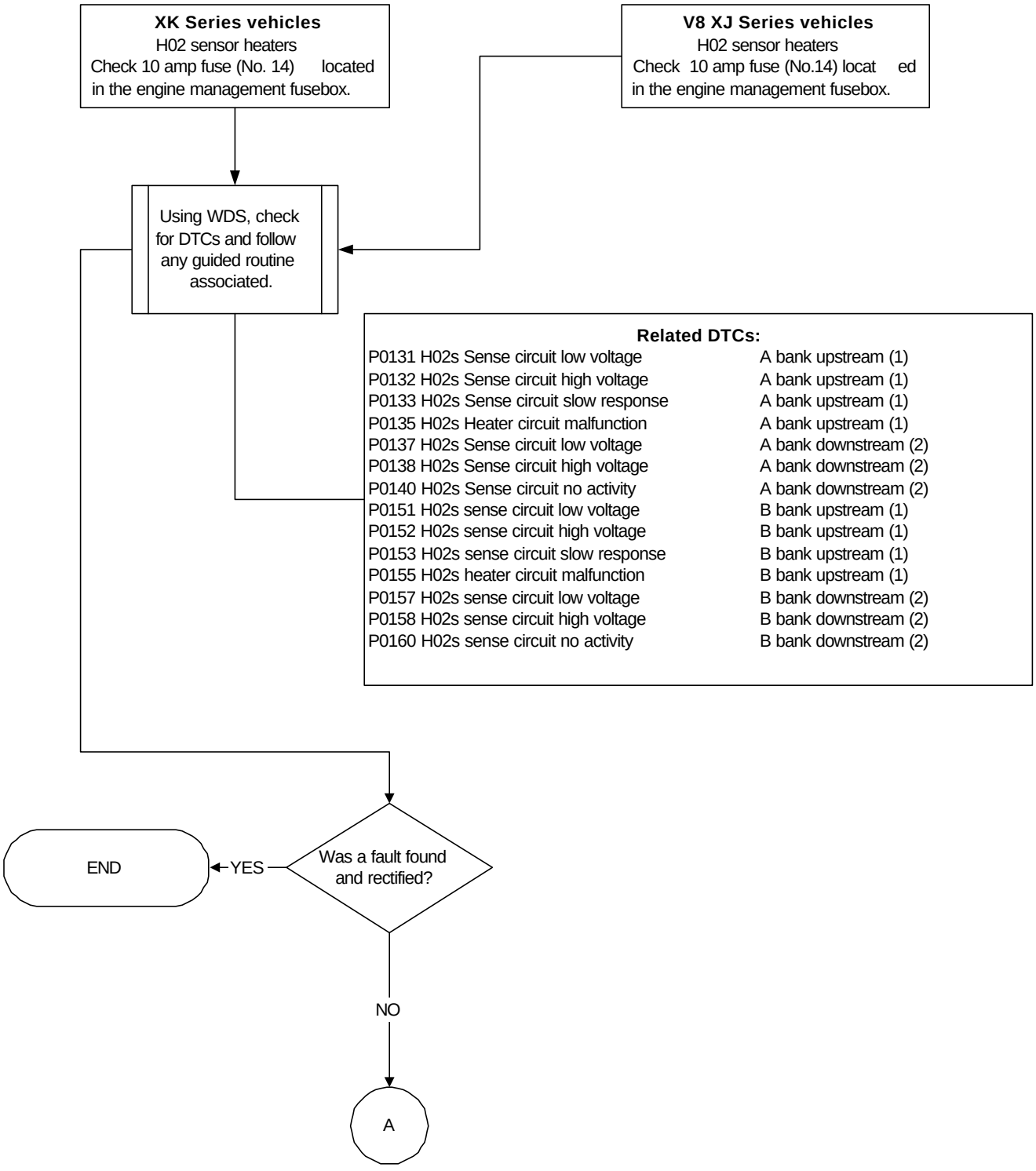
## P21 Fuel Lines



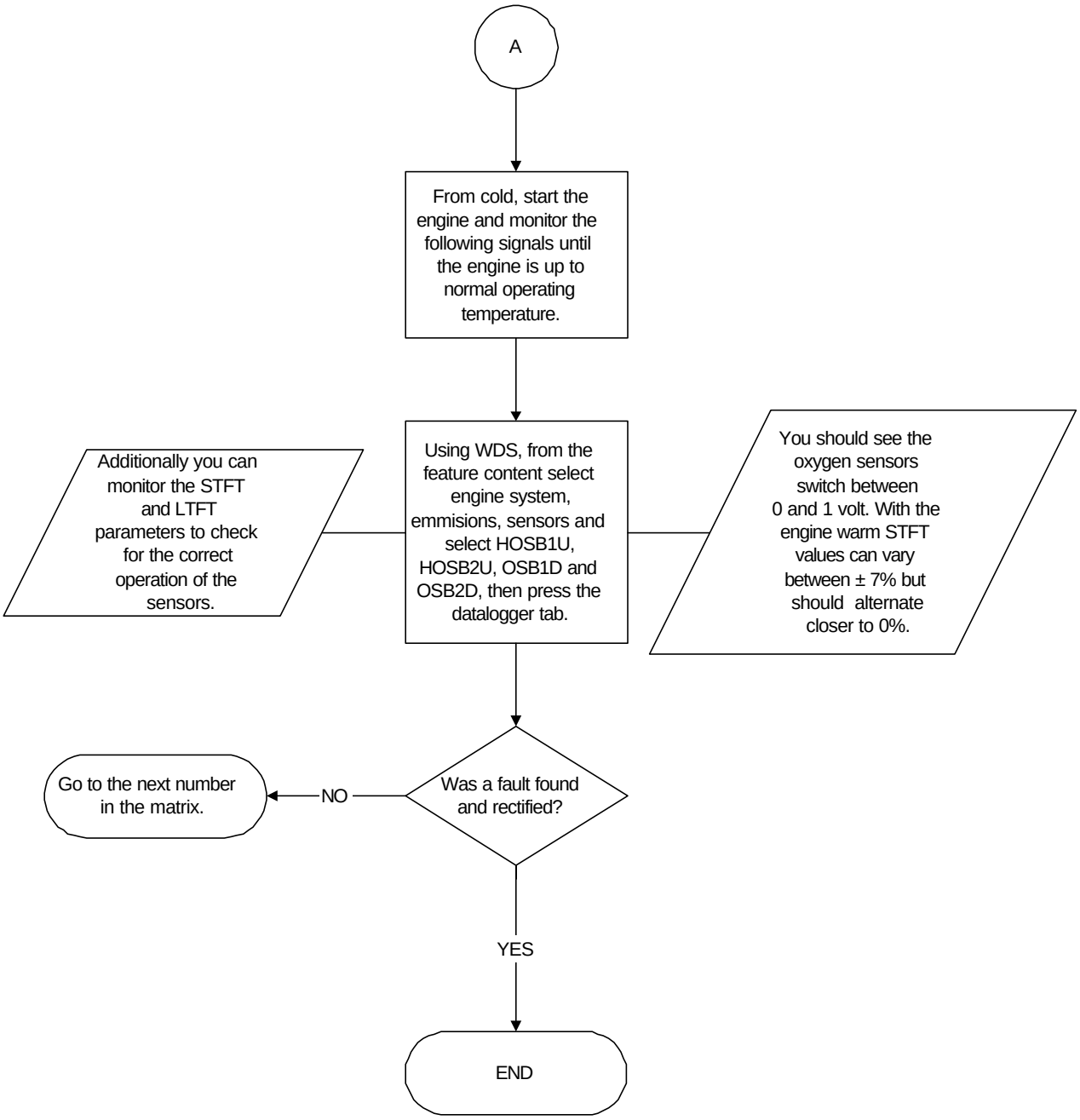
**P21 Cont.**


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.

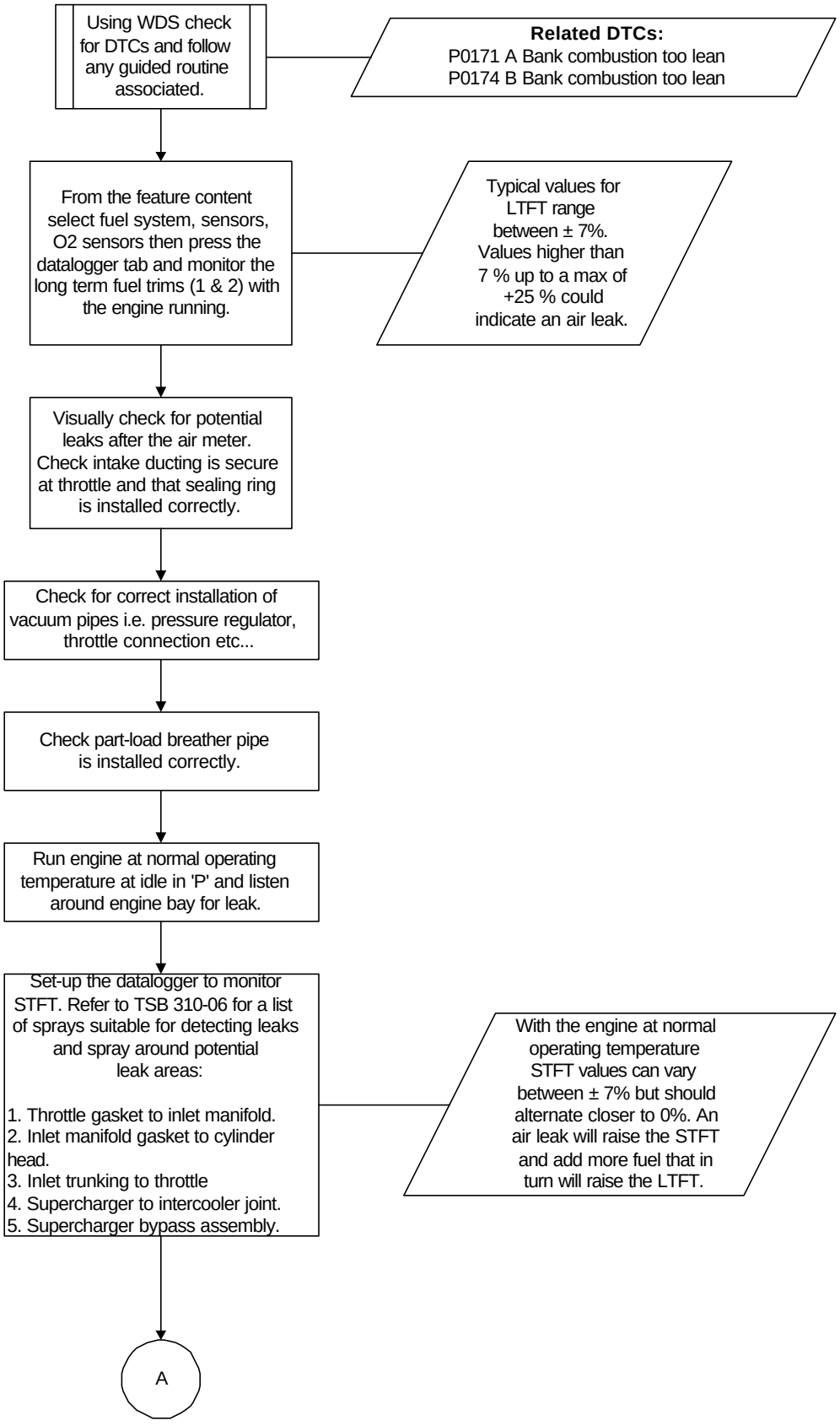
## P22 Oxygen Sensors



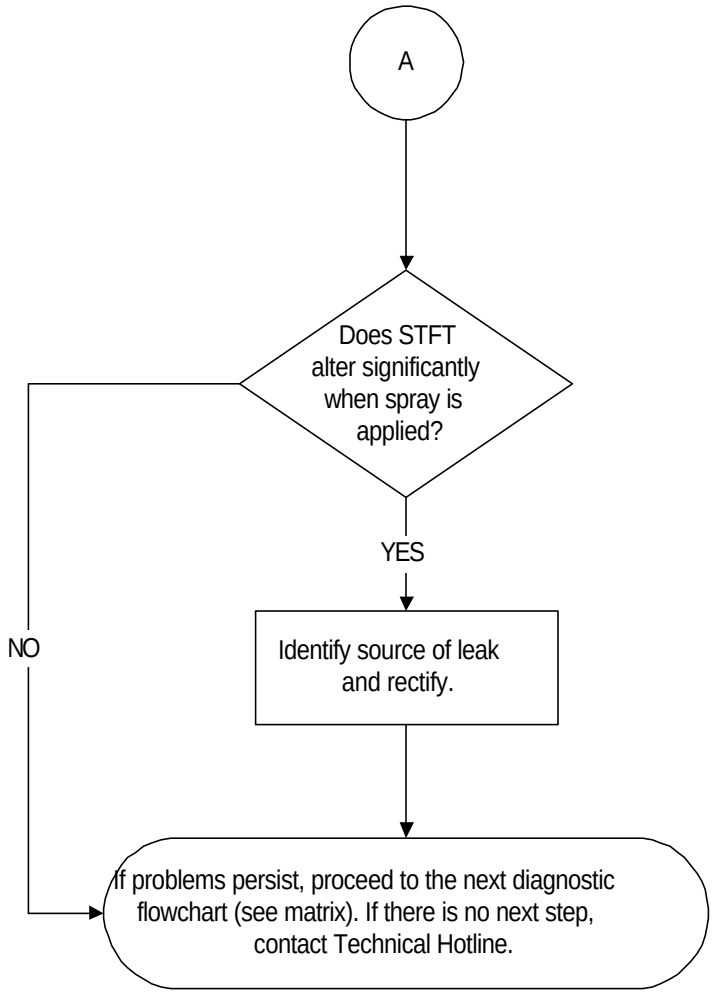
**P22 Cont.**


A
From cold, start the engine and monitor the following signals until the engine is up to normal operating temperature.
Using WDS, from the feature content select engine system, emmisions, sensors and select HOSB1U, HOSB2U, OSB1D and OSB2D, then press the datalogger tab.
Additionally you can monitor the STFT and LTFT parameters to check for the correct operation of the sensors.
You should see the oxygen sensors switch between 0 and 1 volt. With the engine warm STFT values can vary between ± 7% but should alternate closer to 0%.
Was a fault found and rectified?
NO
Go to the next number in the matrix.
YES
END

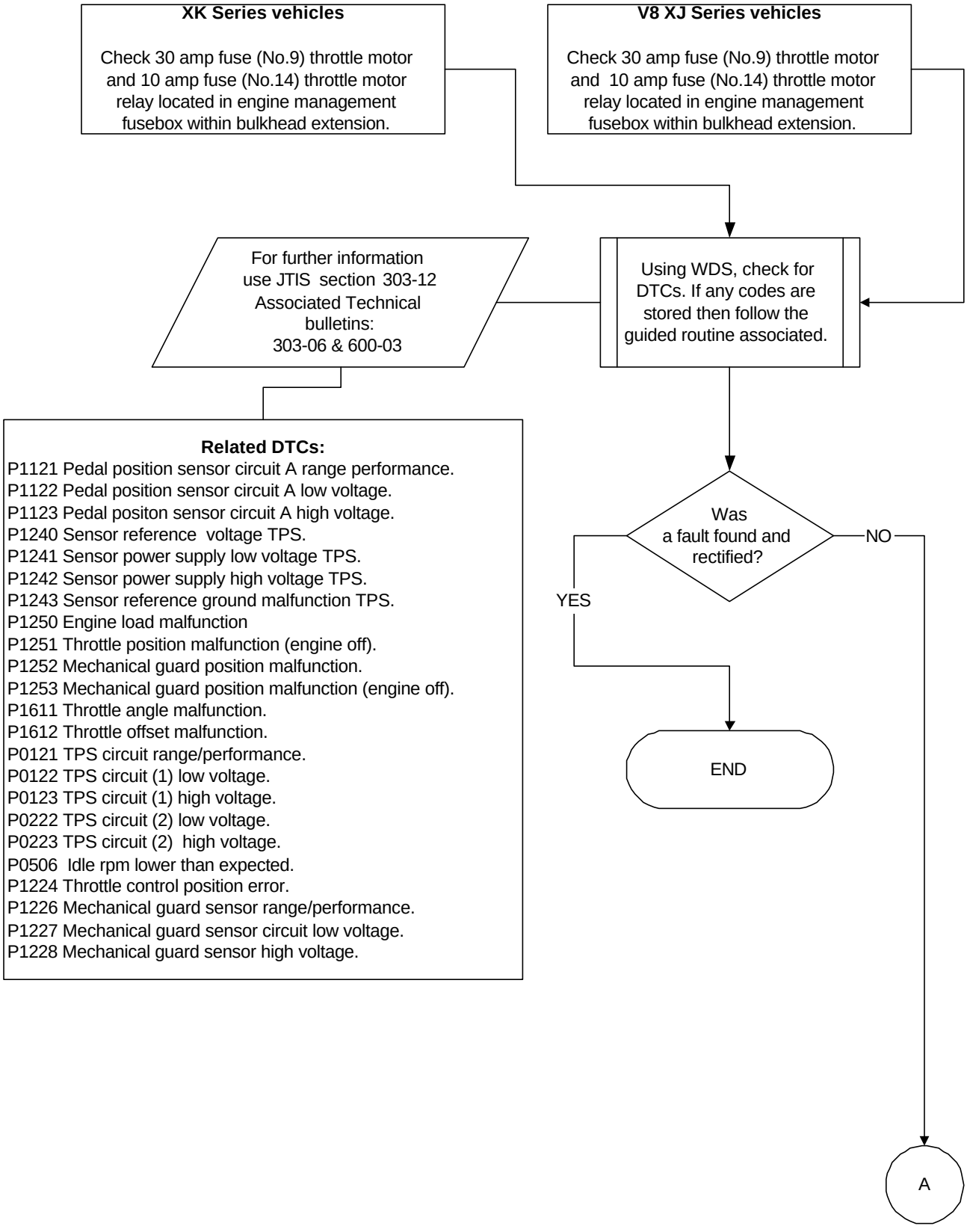
## P23 Air Leakage



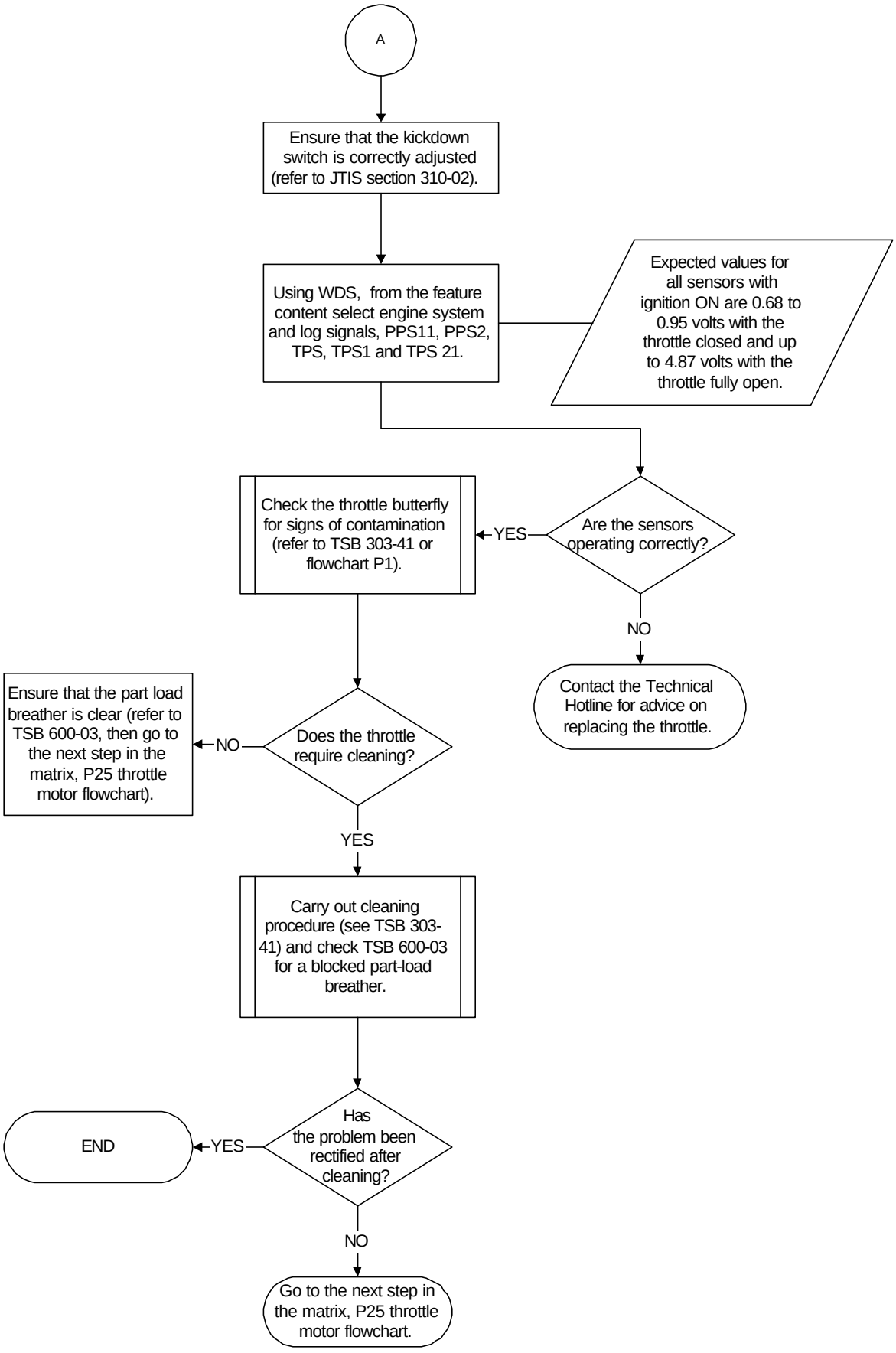
**P23 Cont.**


A
Does STFT alter significantly when spray is applied?
YES
NO
Identify source of leak and rectify.
If problems persist, proceed to the next diagnostic flowchart (see matrix). If there is no next step, contact Technical Hotline.

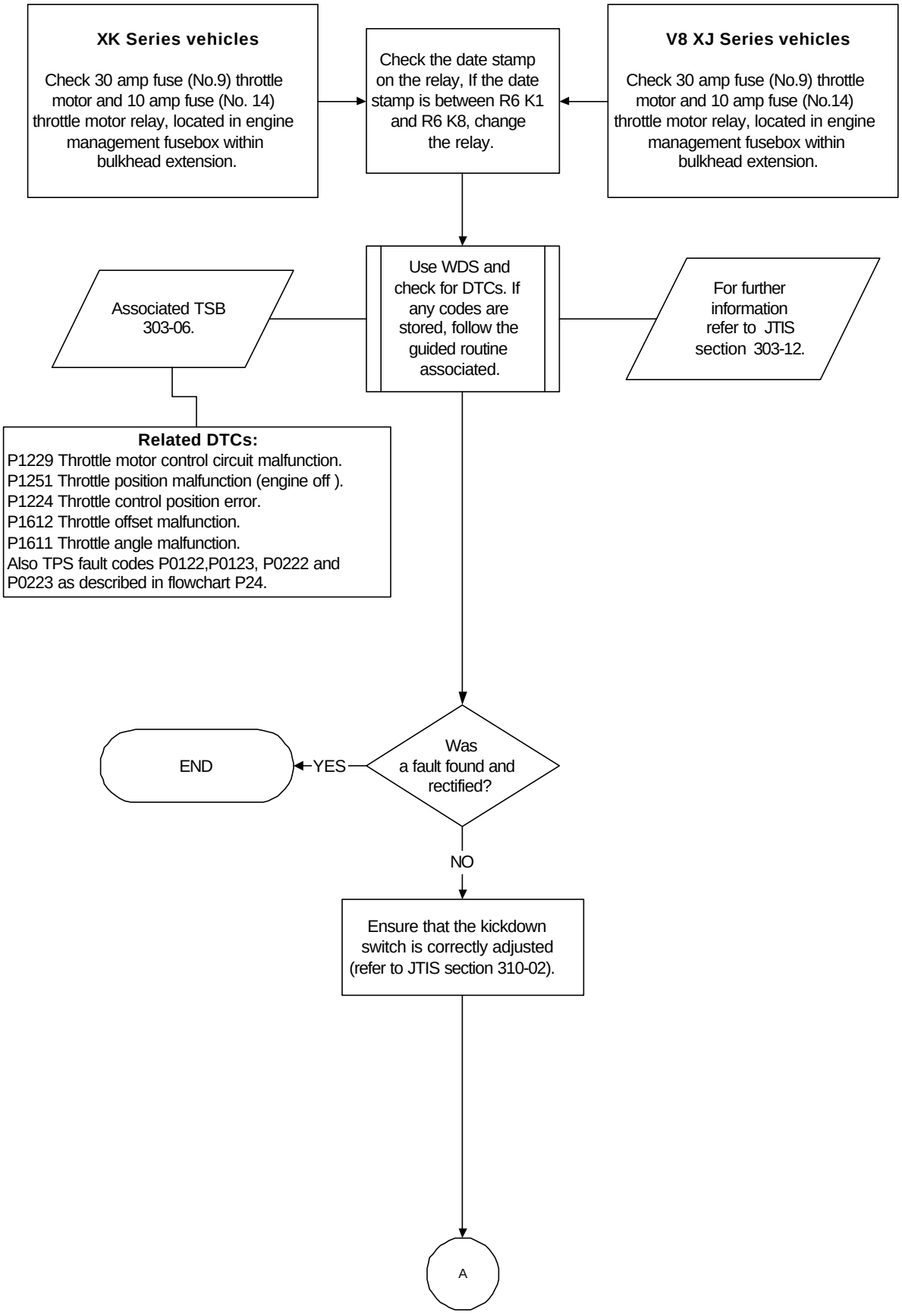
## P24 Throttle Sensors



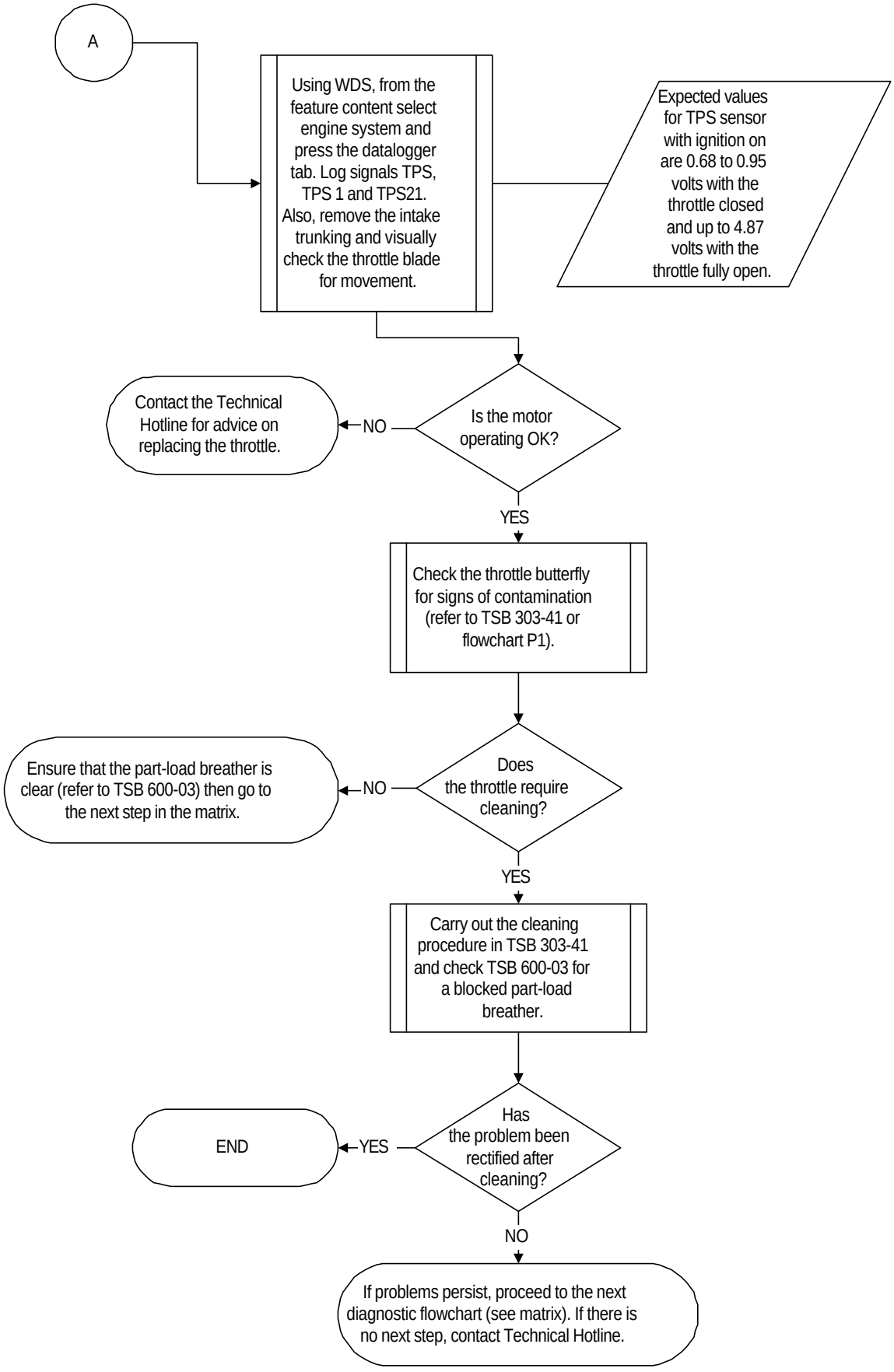
**P24 Cont.**


A
Ensure that the kickdown switch is correctly adjusted (refer to JTIS section 310-02).
Using WDS, from the feature content select engine system and log signals, PPS11, PPS2, TPS, TPS1 and TPS 21.
Expected values for all sensors with ignition ON are 0.68 to 0.95 volts with the throttle closed and up to 4.87 volts with the throttle fully open.
Are the sensors operating correctly?
YES
Check the throttle butterfly for signs of contamination (refer to TSB 303-41 or flowchart P1).
NO
Contact the Technical Hotline for advice on replacing the throttle.
Does the throttle require cleaning?
NO
Ensure that the part load breather is clear (refer to TSB 600-03, then go to the next step in the matrix, P25 throttle motor flowchart).
YES
Carry out cleaning procedure (see TSB 303-41) and check TSB 600-03 for a blocked part-load breather.
Has the problem been rectified after cleaning?
YES
END
NO
Go to the next step in the matrix, P25 throttle motor flowchart.

## P25 Throttle Motor



**P25 Cont.**


A
Using WDS, from the feature content select engine system and press the datalogger tab. Log signals TPS, TPS 1 and TPS21. Also, remove the intake trunking and visually check the throttle blade for movement.
Expected values for TPS sensor with ignition on are 0.68 to 0.95 volts with the throttle closed and up to 4.87 volts with the throttle fully open.
Is the motor operating OK?
NO
Contact the Technical Hotline for advice on replacing the throttle.
YES
Check the throttle butterfly for signs of contamination (refer to TSB 303-41 or flowchart P1).
Does the throttle require cleaning?
NO
Ensure that the part-load breather is clear (refer to TSB 600-03) then go to the next step in the matrix.
YES
Carry out the cleaning procedure in TSB 303-41 and check TSB 600-03 for a blocked part-load breather.
Has the problem been rectified after cleaning?
YES
END
NO
If problems persist, proceed to the next diagnostic flowchart (see matrix). If there is no next step, contact Technical Hotline.

## P24 and P25 Additional information

### Throttle system failure modes

| Fault | DTCs | Warning Light Color | Default Mode | Effect | Message Center |
|---|---|---|---|---|---|
| Throttle position sensor 1 | P0123<br>P0121<br>P1224 | Red | Mechanical guard and fuel intervention | Fuel intervention, idles between 950 rpm and 1150 rpm, cruise control inhibited | Failsafe engine mode |
| Throttle position sensor 2 | P0121<br>P0222<br>P0223<br>P1224 | Red | Mechanical guard and fuel intervention | Fuel intervention, idles between 950 rpm and 1150 rpm, cruise control inhibited | Failsafe engine mode |
| Throttle sensor 2 different to sensor 1 | P0121<br>P1229<br>P1122<br>P1121<br>P0506 | Red | Mechanical guard and fuel intervention | Fuel intervention, idles between 950 rpm and 1150 rpm, cruise control inhibited | Failsafe engine mode |
| Pedal sensor 1 | P1122<br>P1121 | Amber | Redundancy | Runs normally, cruise active | Failsafe engine mode |
| Pedal sensor 2 | P1122<br>P1121 | Amber | Redundancy | Runs normally, cruise active | Failsafe engine mode |
| Mechanical guard sensor | P1226<br>P1227<br>P1228 | Red | Full authority and cruise inhibited | Runs normally | Restricted performance |
| Pedal sensor 1 different to Mechanical guard sensor | P1226<br>P1222<br>P1221 | Red (Intermittent) | Full authority (Intermittent) | Poor pedal response | Restricted performance |
| Mechanical guard or actuator stuck open | P1226<br>P1252 | Red | Full authority and cruise inhibited | Runs normally | Restricted performance |
| Mechanical guard or actuator stuck closed | P1235 | Amber | Cruise inhibited | Runs normally | Failsafe engine mode |
| Throttle motor fault | P1224 | Red | Mechanical guard and fuel intervention | Fuel intervention, idles between 950 rpm and 1150 rpm, cruise control inhibited | Failsafe engine mode |
| Throttle motor high resistance (engine idling) | P0507 | Amber | Redundancy (on second trip) | Idle speed increase, poor throttle response | Failsafe engine mode |
| Throttle motor | P1229 | Red | Mechanical | Fuel intervention, | Failsafe |

| | | | | | |
|---|---|---|---|---|---|
| high resistance (driving) | P1612 | | guard and fuel intervention | idles between 950 rpm and 1150 rpm, cruise control inhibited | engine mode |
| VSV1 Fault | P1235<br>P1236 | Amber | Cruise inhibited | Runs normally | Failsafe engine mode |
| VSV2 Fault | P1235<br>P1237<br>P1252 | Amber | Cruise inhibited | Runs normally | Failsafe engine mode |
| VSV3 Fault | P1235<br>P1238 | Amber | Cruise inhibited | Runs normally | Failsafe engine mode |
| Vac pipe leak | P1235 | Amber | Cruise inhibited | Runs normally | Failsafe engine mode |
| Throttle motor relay stuck closed | P1251 | Amber | Redundancy | Runs normally cruise active | Failsafe engine mode |
| Throttle motor relay stuck open | P1224 | Red | Mechanical guard and fuel intervention | Fuel intervention, idles between 950 rpm and 1150 rpm, cruise control inhibited | Failsafe engine mode |
| Throttle motor relay open circuit | P1224 | Red | Mechanical guard and fuel intervention | Fuel intervention, idles between 950 rpm and 1150 rpm, cruise control inhibited | Failsafe engine mode |

**Throttle Control Modes:**

1 Normal
2 Cruise
3 Mechanical guard
4 Fixed idle
5 Redundancy
6 Full authority
7 Engine shut down

**Normal mode** occurs when the ECM uses the mechanical and monitoring arrangement of the throttle valve to control throttle opening. The ECM does not permit driver demand to be exceeded but it can be restricted to allow for such features as stability, traction control or engine power limitation. The ECM determines engine idle speed by controlling the throttle valve motor to vary the blade angle between the non-adjustable preset limits of the mechanical guard and the throttle valve motor.

**Cruise mode** is engaged as a result of the ECM calculating and controlling the required throttle valve. The vacuum system controls the mechanical guard. When the driver releases the throttle pedal the input shaft disengages from the mechanical guard or the vacuum actuator pulls the guard away from the throttle valve. The throttle pedal will feel light should it be pushed again to accelerate (pressing the pedal further will re-engage the input shaft with the mechanical guard and restore normal feel). The ECM utilizes sensors to monitor the relative positions of the mechanical guard and throttle valve and adjusts them to maintain the set cruise speed.

**Mechanical guard mode** permits full mechanical operation of the throttle if the ECM detects that a problem has been encountered with the throttle valve position sensor, DC motor, associated harness, connectors or the ECM.

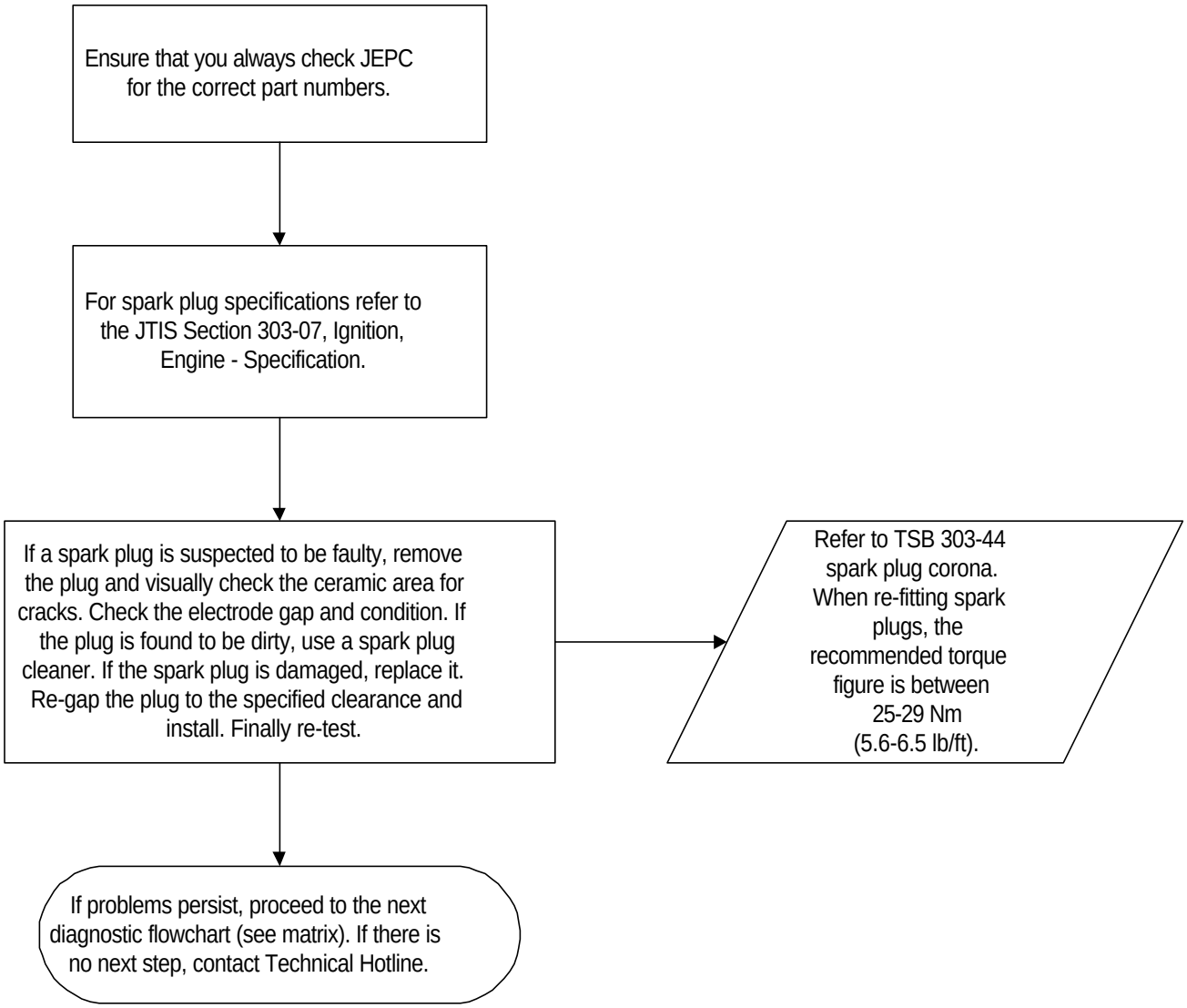
**Fixed idle mode** occurs when any two of the three sensors (two input shaft sensors and the mechanical guard sensor) fail. The ECM will assume values, which represent a blade angle of approximately 2.5 degrees and 1200 rpm (unloaded) maximum engine speed.

**Redundancy mode** occurs when any one of the three sensors (two input shaft sensors and the mechanical guard sensor) fails. The operational pair will be deemed to be safe to continue without intervention, but cruise will be inhibited.

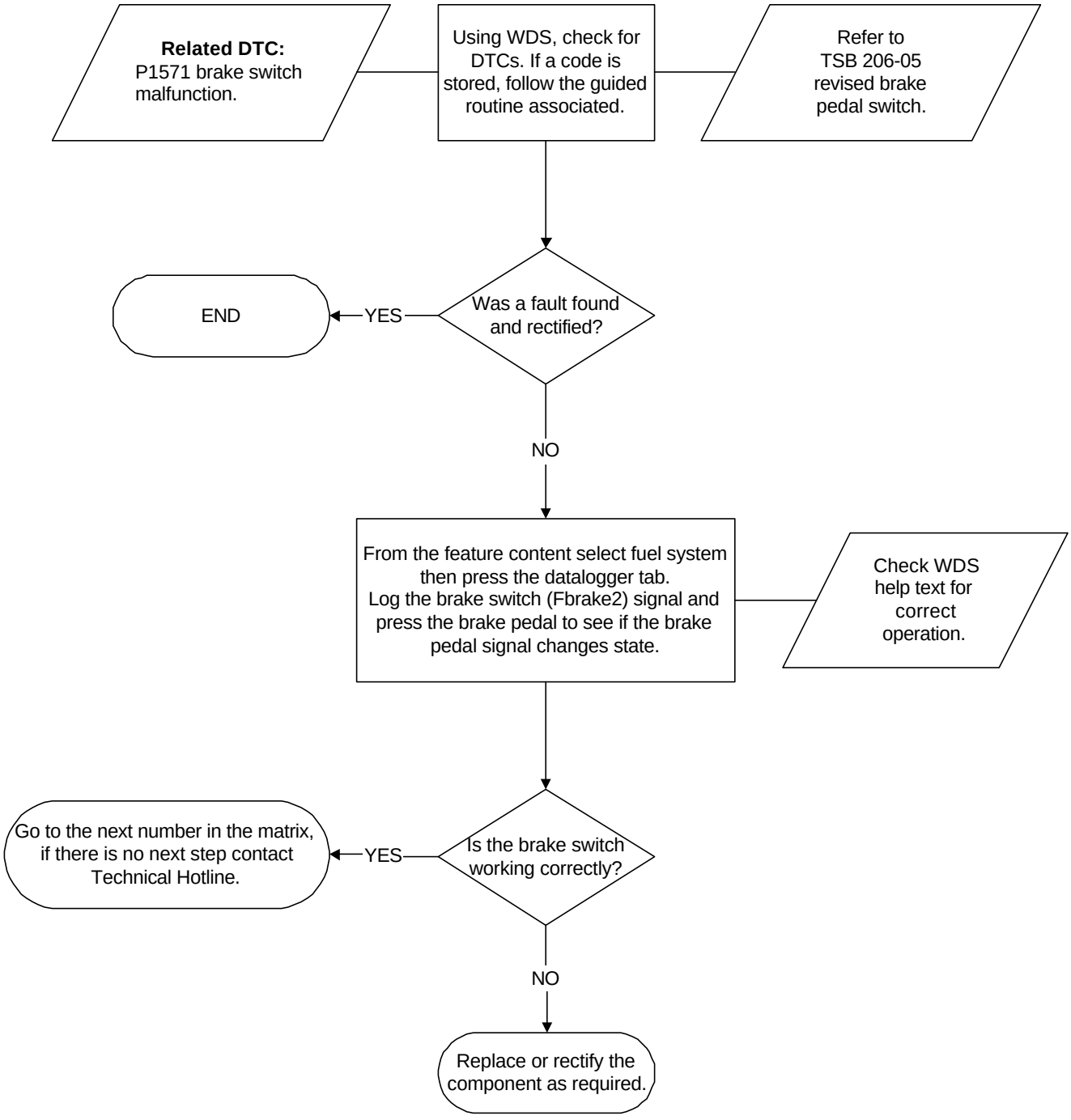
**Full authority mode** is invoked when a mechanical guard failure occurs which indicates that the guard is stuck fully open. The red warning lamp will be lit and road speed will be limited to 120 km/h (75 mph).

**Engine shutdown mode (engine stops)** will occur following multiple failures, such as mechanical guard mode following full authority mode (or vice versa) or the throttle blade sticks.

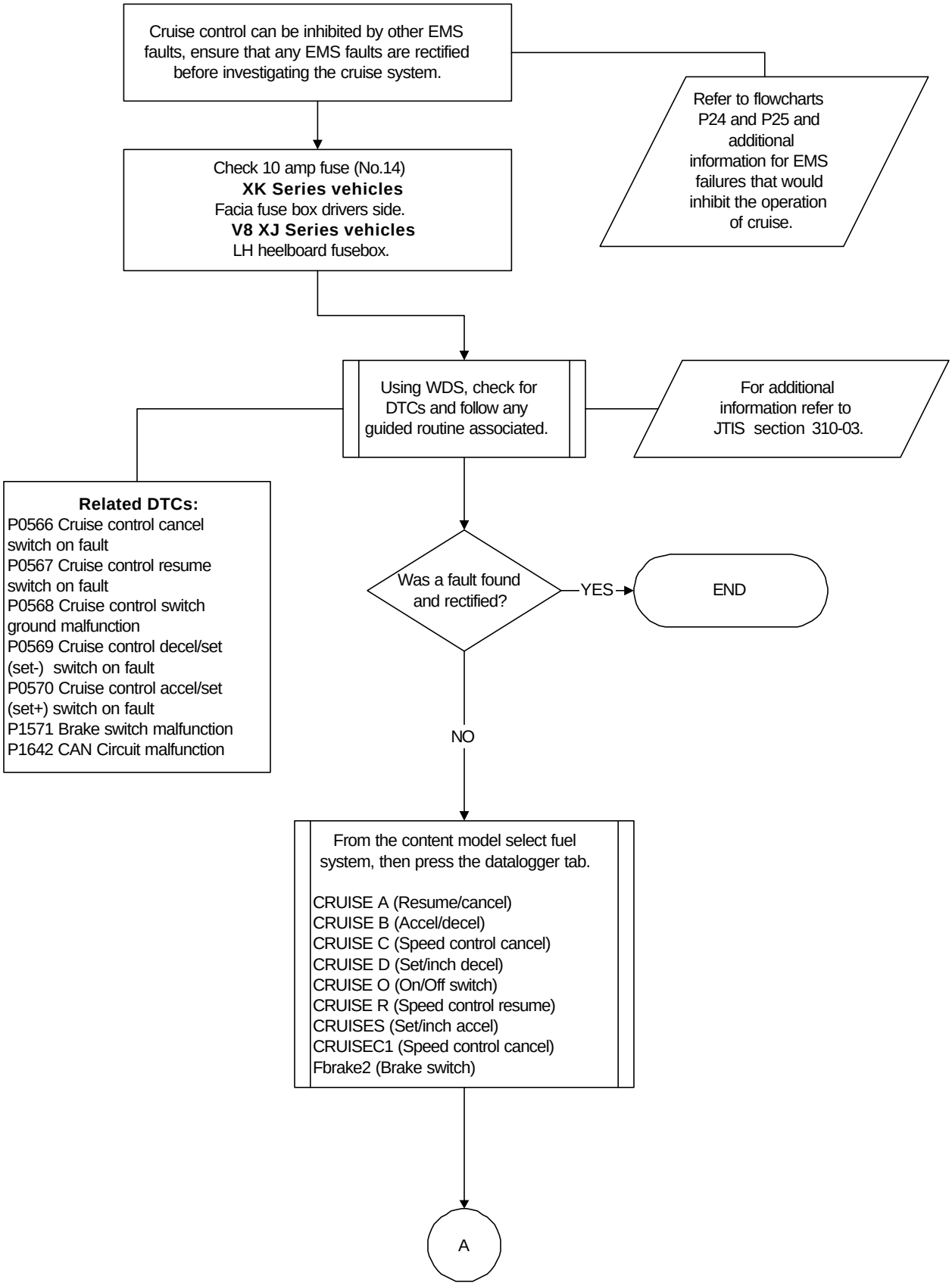
## P26 Spark Plugs



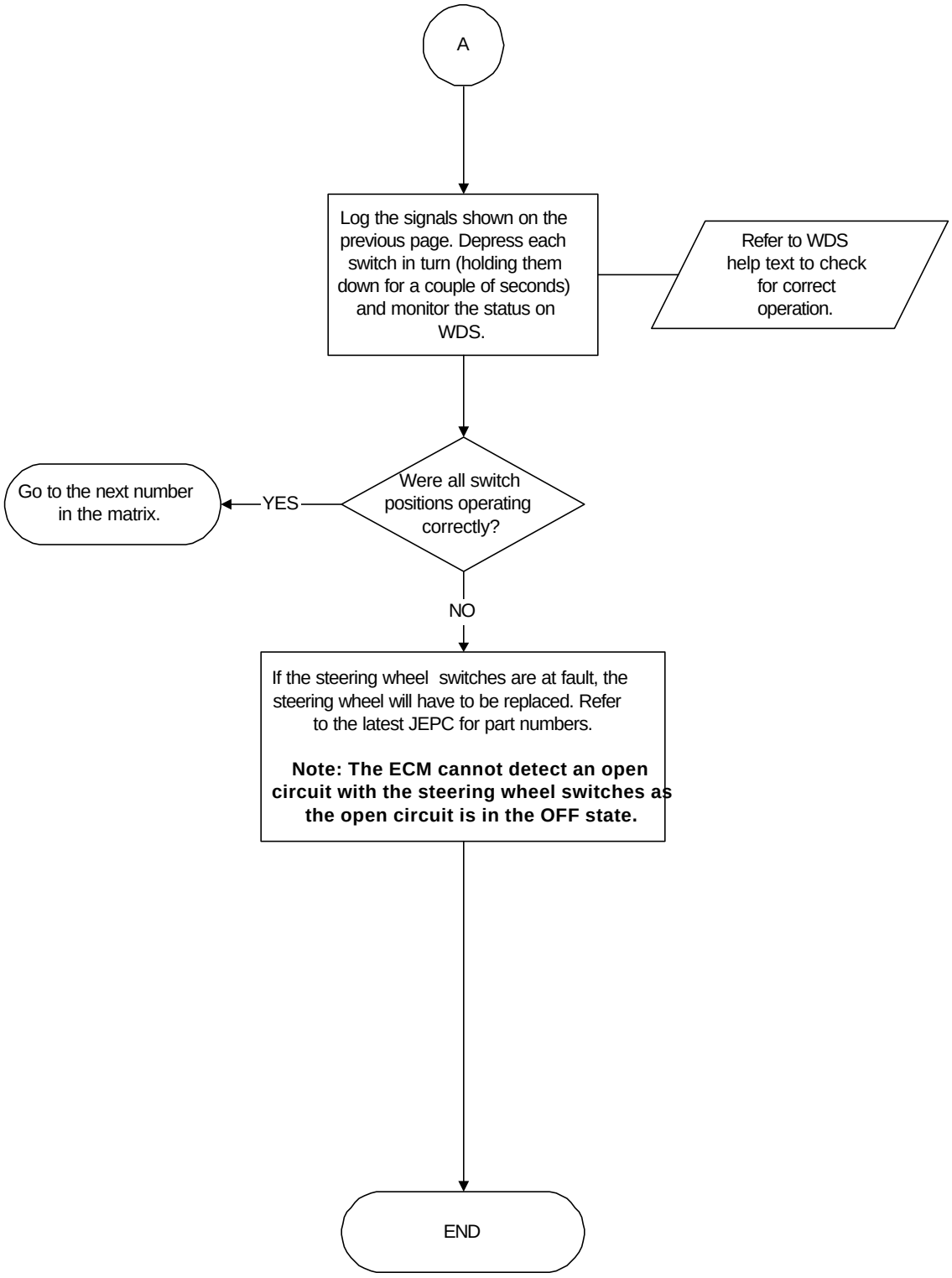
## P27 Stop Lamp Switch



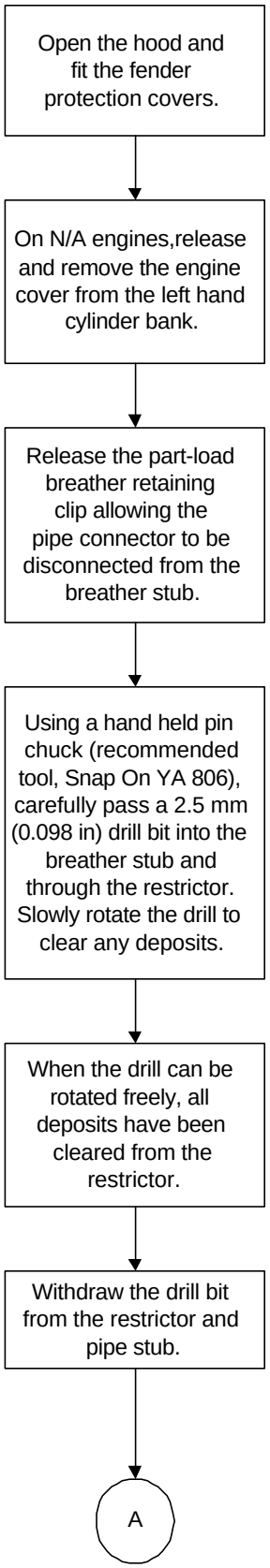
## P28 Cruise Control Switches



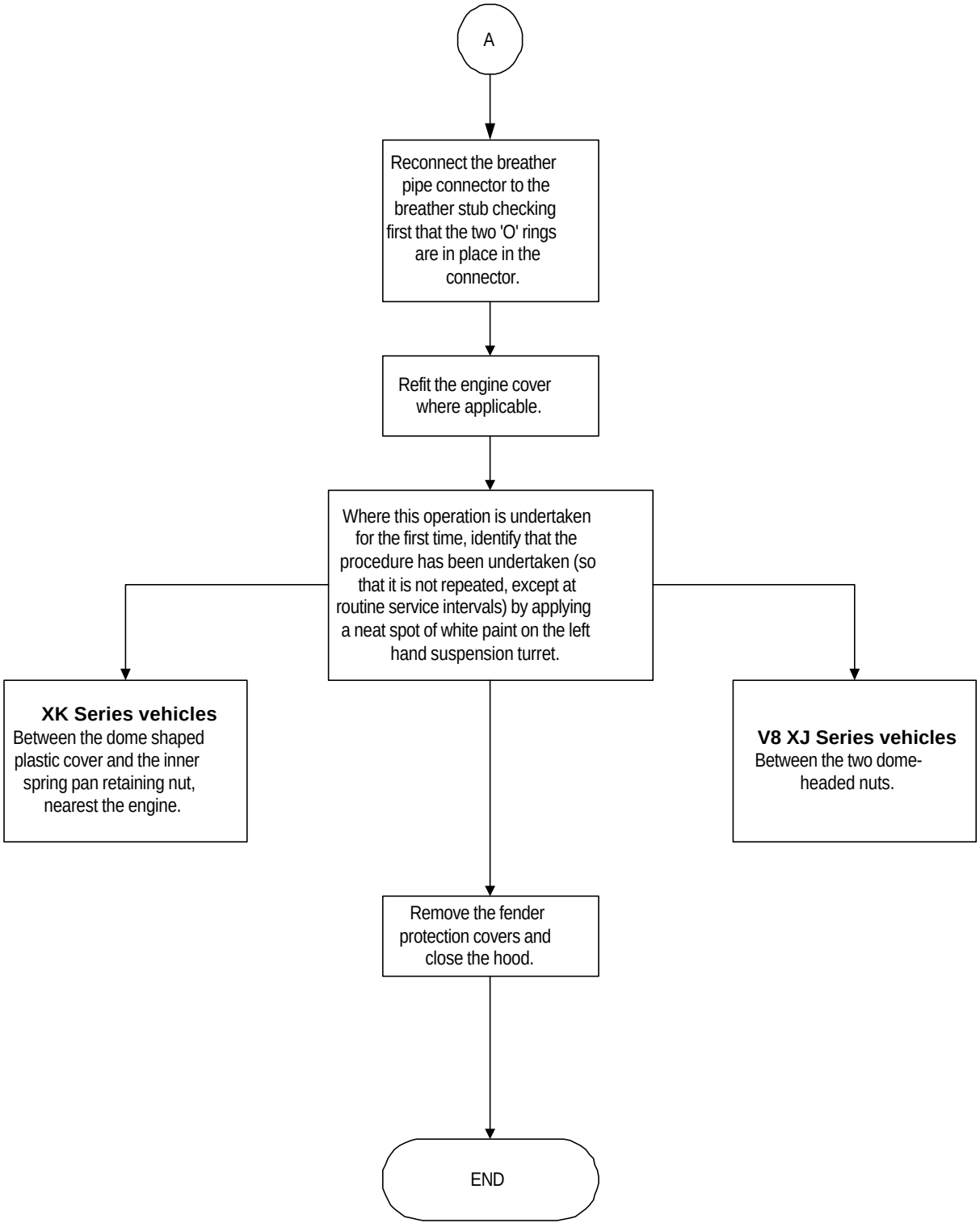
**P28 Cont.**


A
Log the signals shown on the previous page. Depress each switch in turn (holding them down for a couple of seconds) and monitor the status on WDS.
Refer to WDS help text to check for correct operation.
Were all switch positions operating correctly?
YES
Go to the next number in the matrix.
NO
If the steering wheel switches are at fault, the steering wheel will have to be replaced. Refer to the latest JEPC for part numbers.
Note: The ECM cannot detect an open circuit with the steering wheel switches as the open circuit is in the OFF state.
END

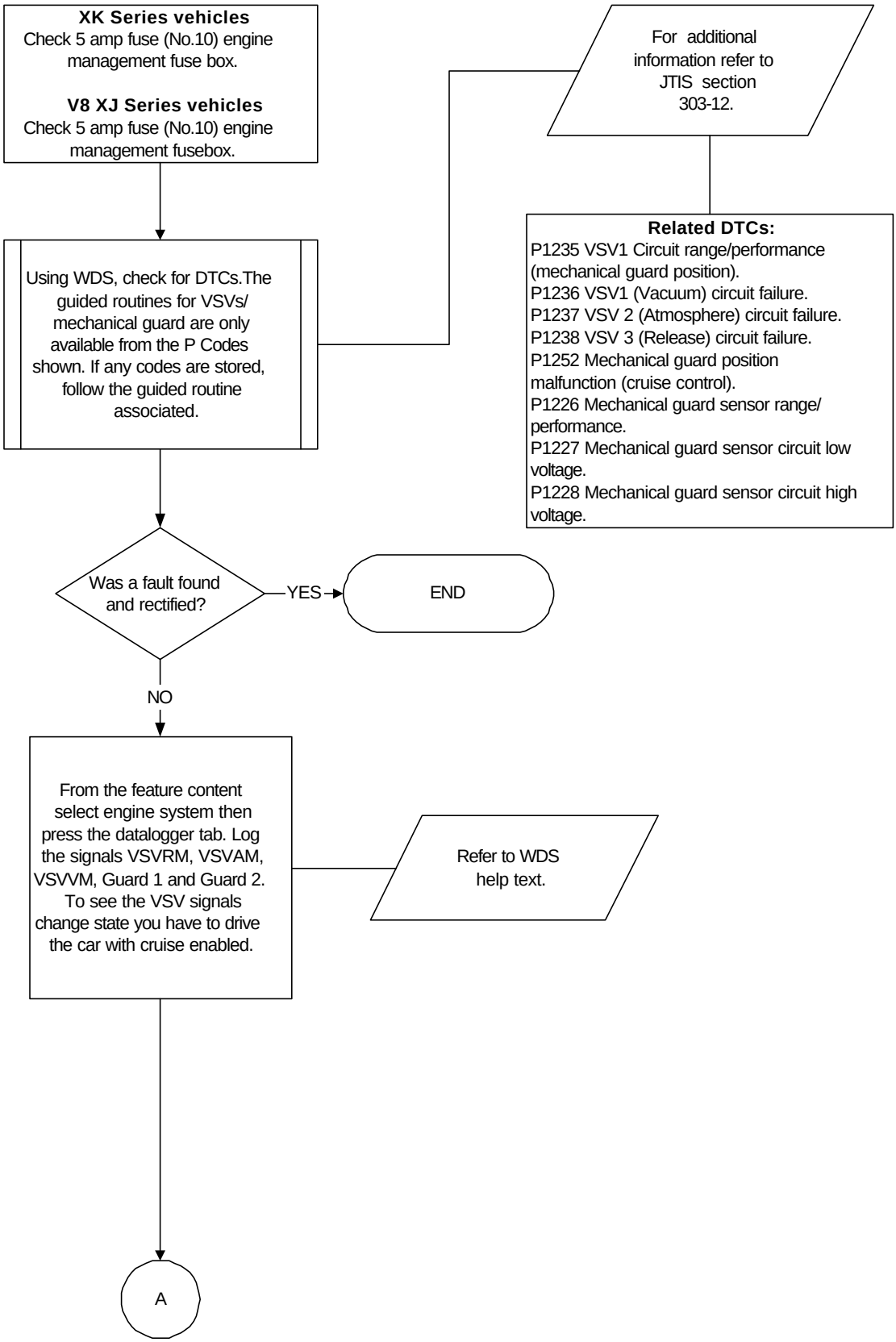
## P29 Blocked Part-Load Breather



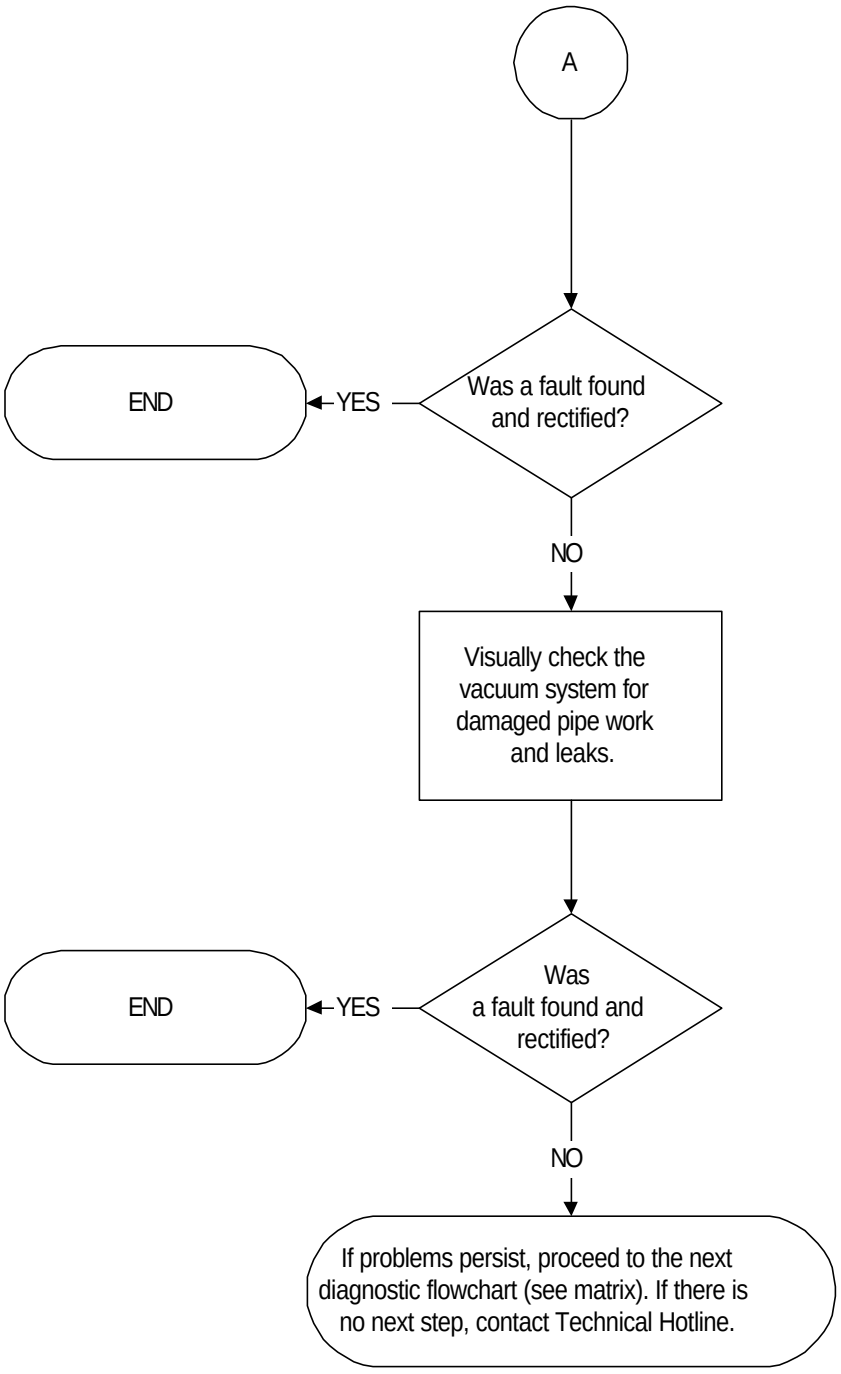
**P29 Cont.**


A
Reconnect the breather pipe connector to the breather stub checking first that the two 'O' rings are in place in the connector.
Refit the engine cover where applicable.
Where this operation is undertaken for the first time, identify that the procedure has been undertaken (so that it is not repeated, except at routine service intervals) by applying a neat spot of white paint on the left hand suspension turret.
XK Series vehicles
Between the dome shaped plastic cover and the inner spring pan retaining nut, nearest the engine.
V8 XJ Series vehicles
Between the two dome-headed nuts.
Remove the fender protection covers and close the hood.
END

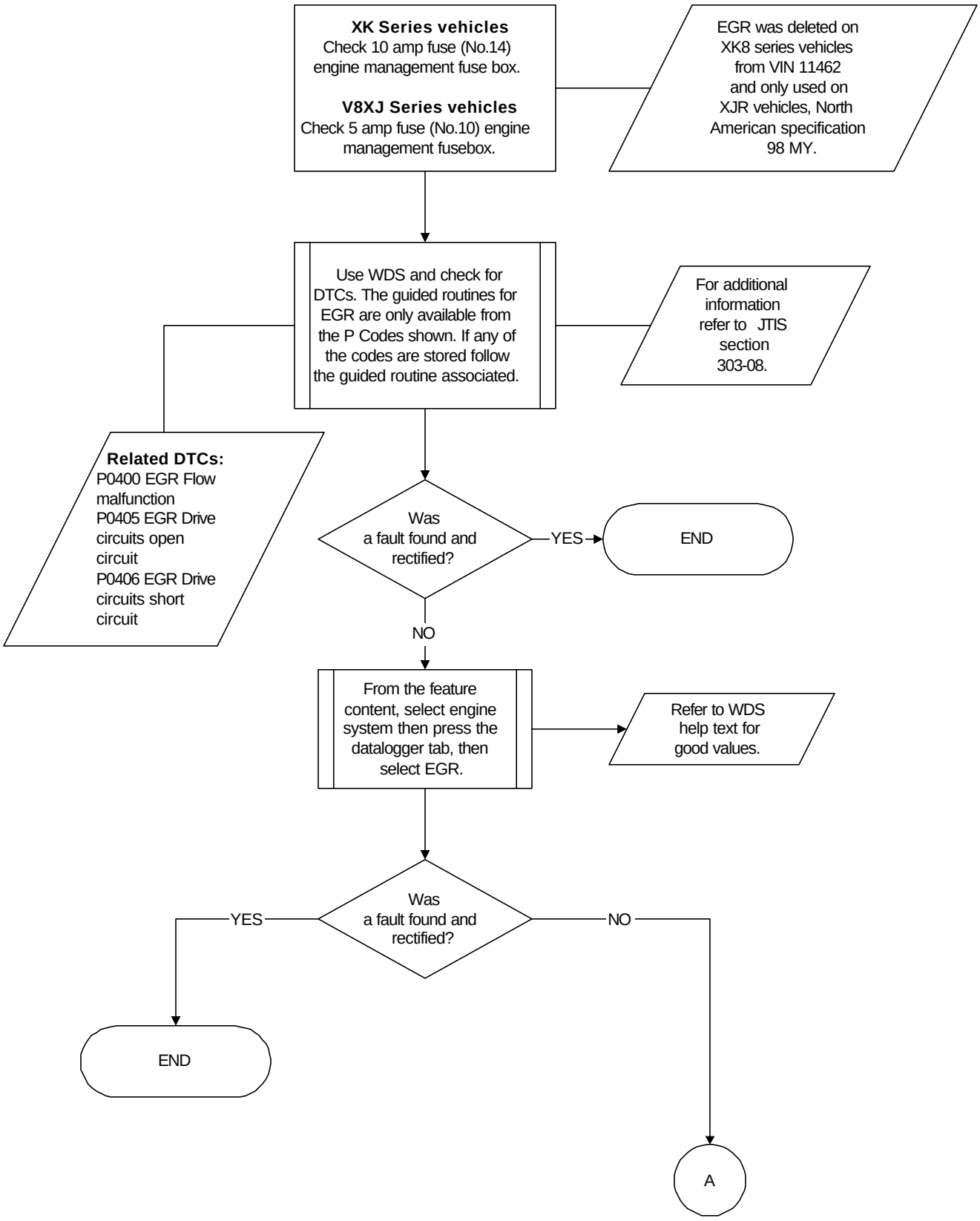
## P30 Mechanical Guard and VSVs



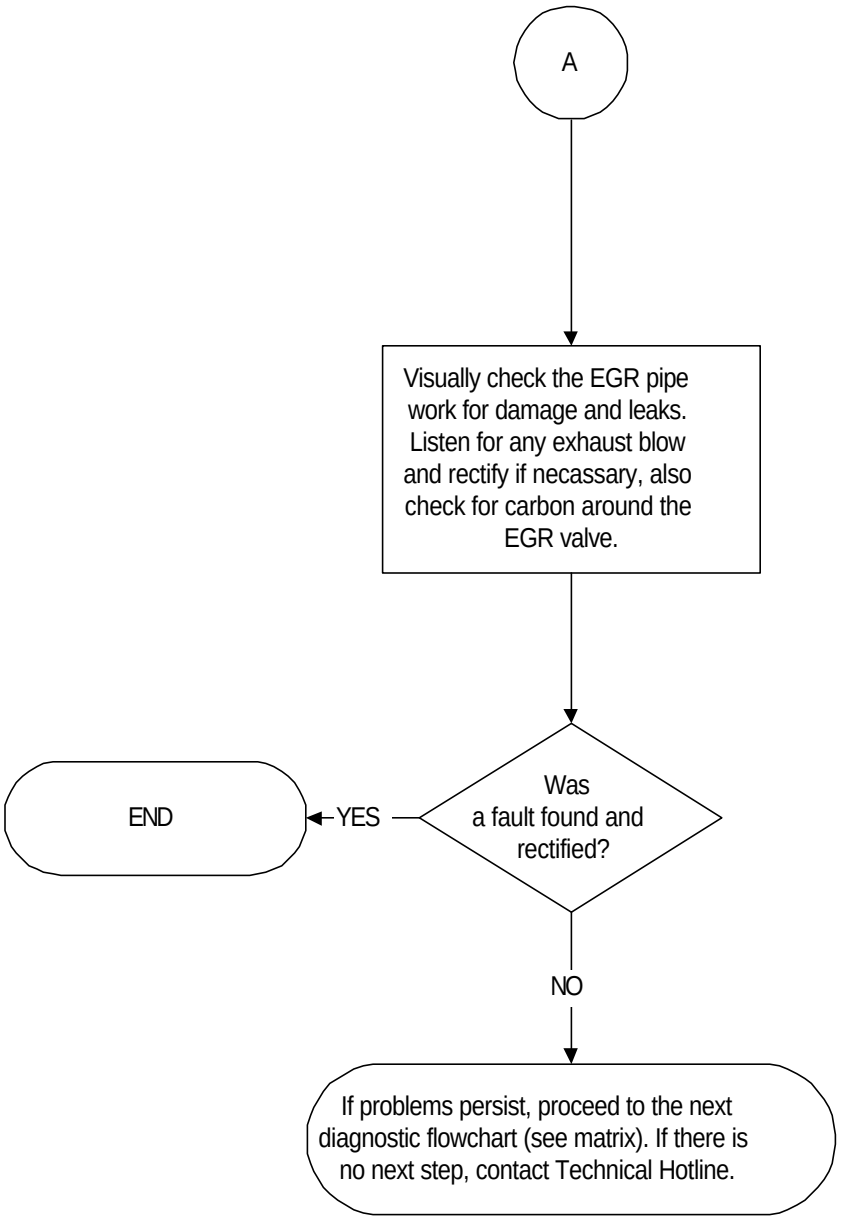
**P30 Cont.**


A
Was a fault found and rectified?
YES
END
NO
Visually check the vacuum system for damaged pipe work and leaks.
Was a fault 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.

## P31 EGR


XK Series vehicles
Check 10 amp fuse (No.14) engine management fuse box.
V8XJ Series vehicles
Check 5 amp fuse (No.10) engine management fusebox.
EGR was deleted on XK8 series vehicles from VIN 11462 and only used on XJR vehicles, North American specification 98 MY.
Use WDS and check for DTCs. The guided routines for EGR are only available from the P Codes shown. If any of the codes are stored follow the guided routine associated.
For additional information refer to JTIS section 303-08.
Related DTCs:
P0400 EGR Flow malfunction
P0405 EGR Drive circuits open circuit
P0406 EGR Drive circuits short circuit
Was a fault found and rectified?
YES
END
NO
From the feature content, select engine system then press the datalogger tab, then select EGR.
Refer to WDS help text for good values.
Was a fault found and rectified?
YES
NO
END
A

**P31 Cont.**


A
Visually check the EGR pipe work for damage and leaks. Listen for any exhaust blow and rectify if necassary, also check for carbon around the EGR valve.
Was a fault 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.