Hard Starting/Poor Idle/Restricted Performance – Engine Management Diagnosis – Flowcharts

MODEL 2002 MY-ON X-TYPE

VIN C00001-ON

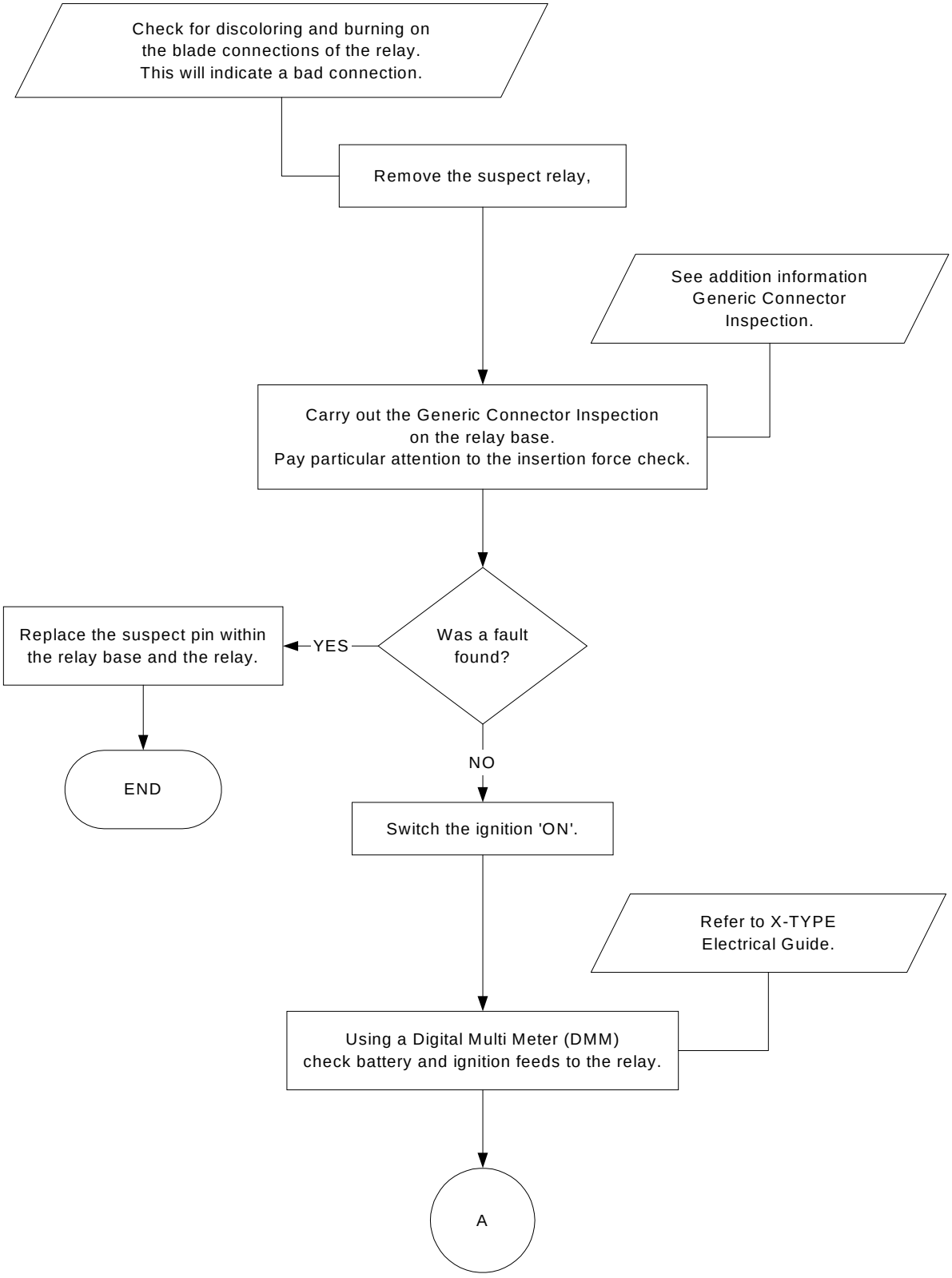
Issue:

This bulletin provides diagnosis procedures for various components of the engine management system.

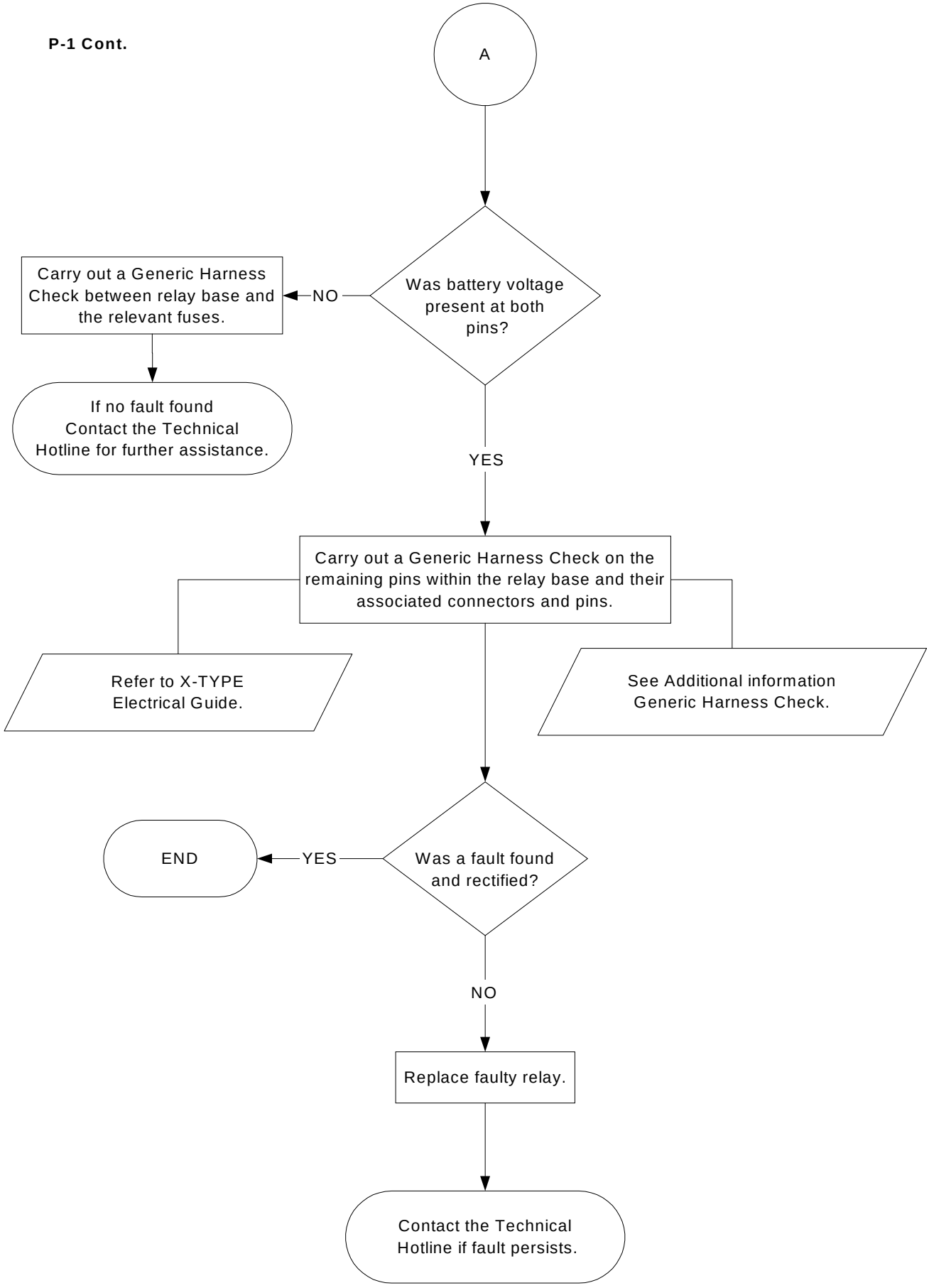
ENGINE MANAGEMENT SYSTEM FLOWCHARTS – TABLE OF CONTENTS

Engine Management System Flowcharts – Fault Matrix			
Flowchart	**Component/area**	**ECM noticeable default action**	**Possible symptoms**
P-1	Engine Management Relays	None	Non-start. No crank.
P-2	Camshaft Position Sensors	None	Prolonged crank. Stall (A bank fault only). Reduced performance
P-3	Ignition Coils	Restricted performance (max engine speed 3000 rpm). Amber warning lamp illuminated.	Non-start. Poor start. Poor idle. Reduced/restricted performance. Misfire. Stall.
P-4	Upstream and Downstream Oxygen Sensors	Open loop fuel metering upstream oxygen sensors only.	Poor idle. Hesitation. Stall.
P-5	Throttle Position Sensor	Throttle motor and throttle relay disabled. Red warning lamp illuminated. Limp home mode.	Limited throttle response.
P-6	Throttle Motor	Throttle motor and throttle relay disabled. Red warning lamp illuminated. Limp home mode.	Limited throttle response.
P-7	Accelerator Pedal Position Sensor	Red warning lamp illuminated. Limp home mode.	Fixed engine speed (approximately 1200 rpm). No throttle response.
P-8	Variable Valve Timing	None	Prolonged crank. Poor start. Poor idle. Reduced performance. Stall.
P-9	Intake Air Temperature	None	Prolonged detonation.
P-10	Mass Air Flow Meter	Restricted performance (max engine speed 3000 rpm). Amber warning lamp illuminated.	Poor start. Reduced/restricted performance. Start then stall.
P-11	Engine Fuel Temperature Sensor	None	Prolonged crank. Poor start.
P-12	Crankshaft Position Sensor	Restricted performance (max engine speed 3000 rpm). Amber warning lamp illuminated.	Prolonged crank. Poor start. Reduced/restricted performance.
P-13	Air Leakage	Restricted performance (max engine speed 3000 rpm). Amber warning lamp illuminated.	Poor start. Poor idle. Hesitation. Reduced/restricted performance. Start then stall.
P-14	Park Neutral Switch	None	No crank.
P-15	Injection Pressure Sensor	None	Prolonged crank. Poor start. Poor idle. Reduced performance. Hesitation.
P-16	Knock Sensor	Restricted performance (max engine speed 3000 rpm). Amber warning lamp illuminated.	Reduced/restricted performance.
P-17	Clutch Pedal Safety Switch	None	No crank.
P-18	Engine Coolant Temperature Sensor	Restricted performance (max engine speed 3000 rpm). Amber warning lamp illuminated.	Poor start. Poor idle. Hesitation. Reduced/restricted performance. Start then stall.

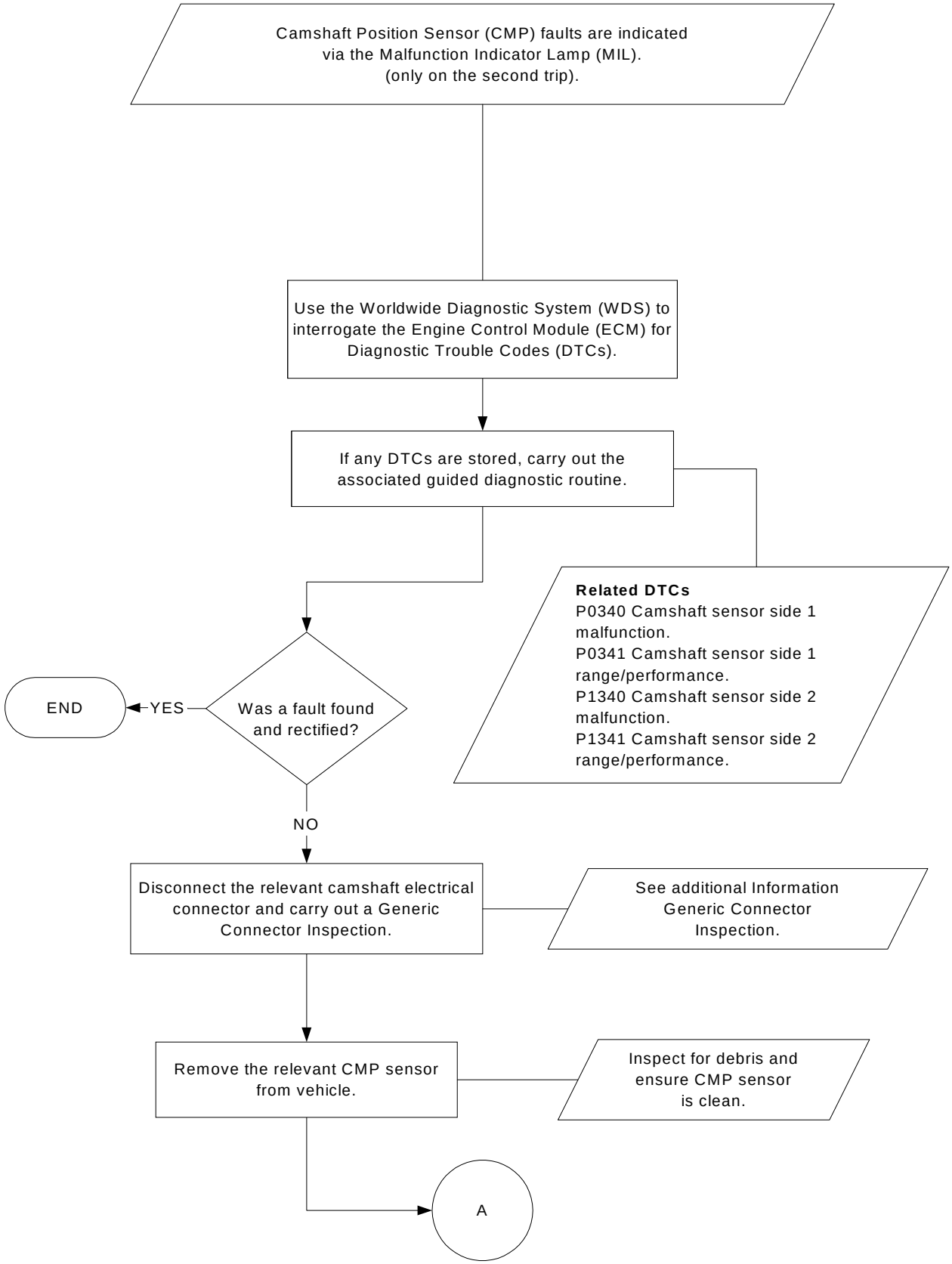
Engine Management Relays
Flowchart P- 1



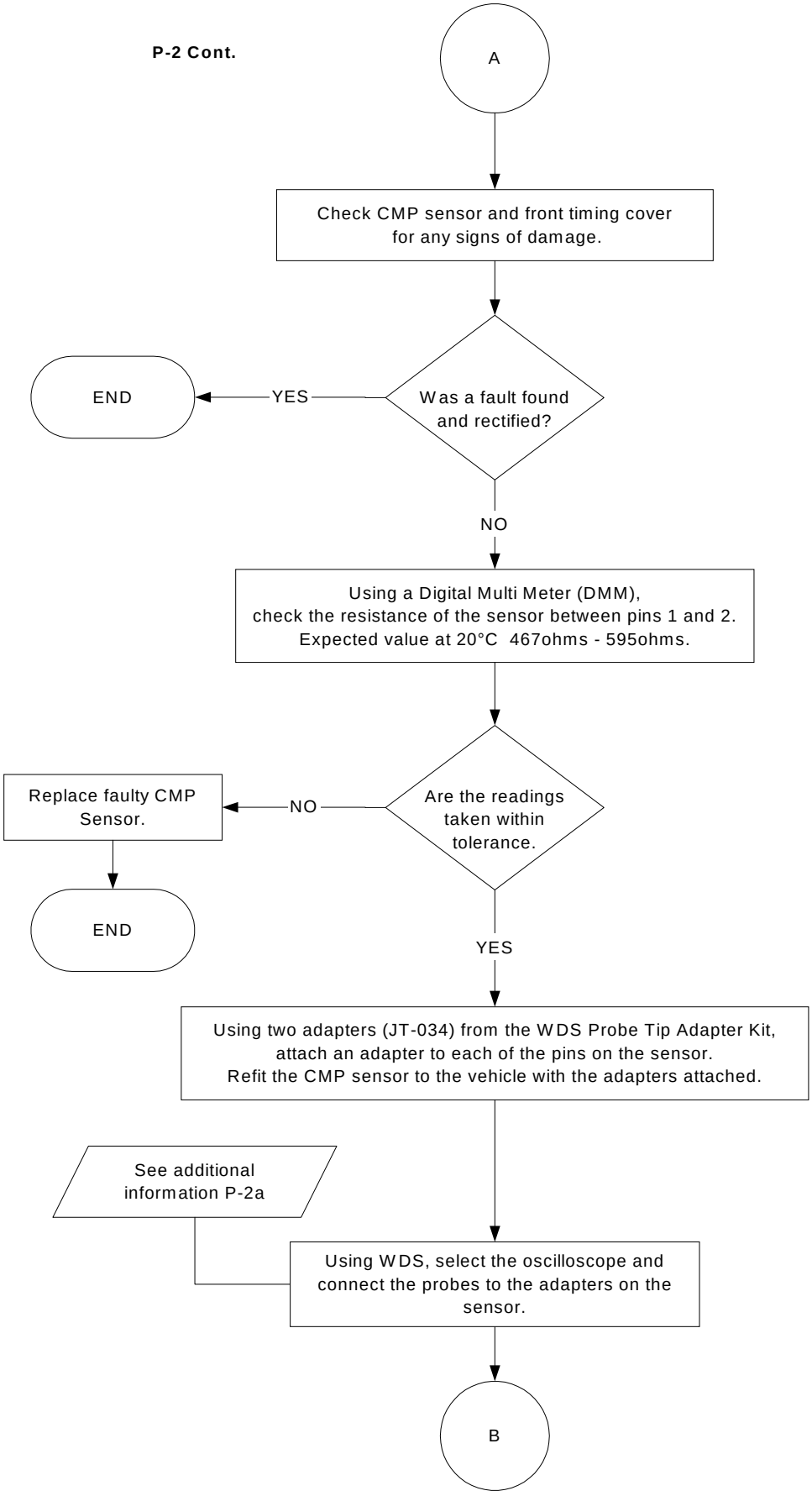
P-1 Cont.


A
Was battery voltage present at both pins?
NO
Carry out a Generic Harness Check between relay base and the relevant fuses.
If no fault found Contact the Technical Hotline for further assistance.
YES
Carry out a Generic Harness Check on the remaining pins within the relay base and their associated connectors and pins.
Refer to X-TYPE Electrical Guide.
See Additional information Generic Harness Check.
Was a fault found and rectified?
YES
END
NO
Replace faulty relay.
Contact the Technical Hotline if fault persists.

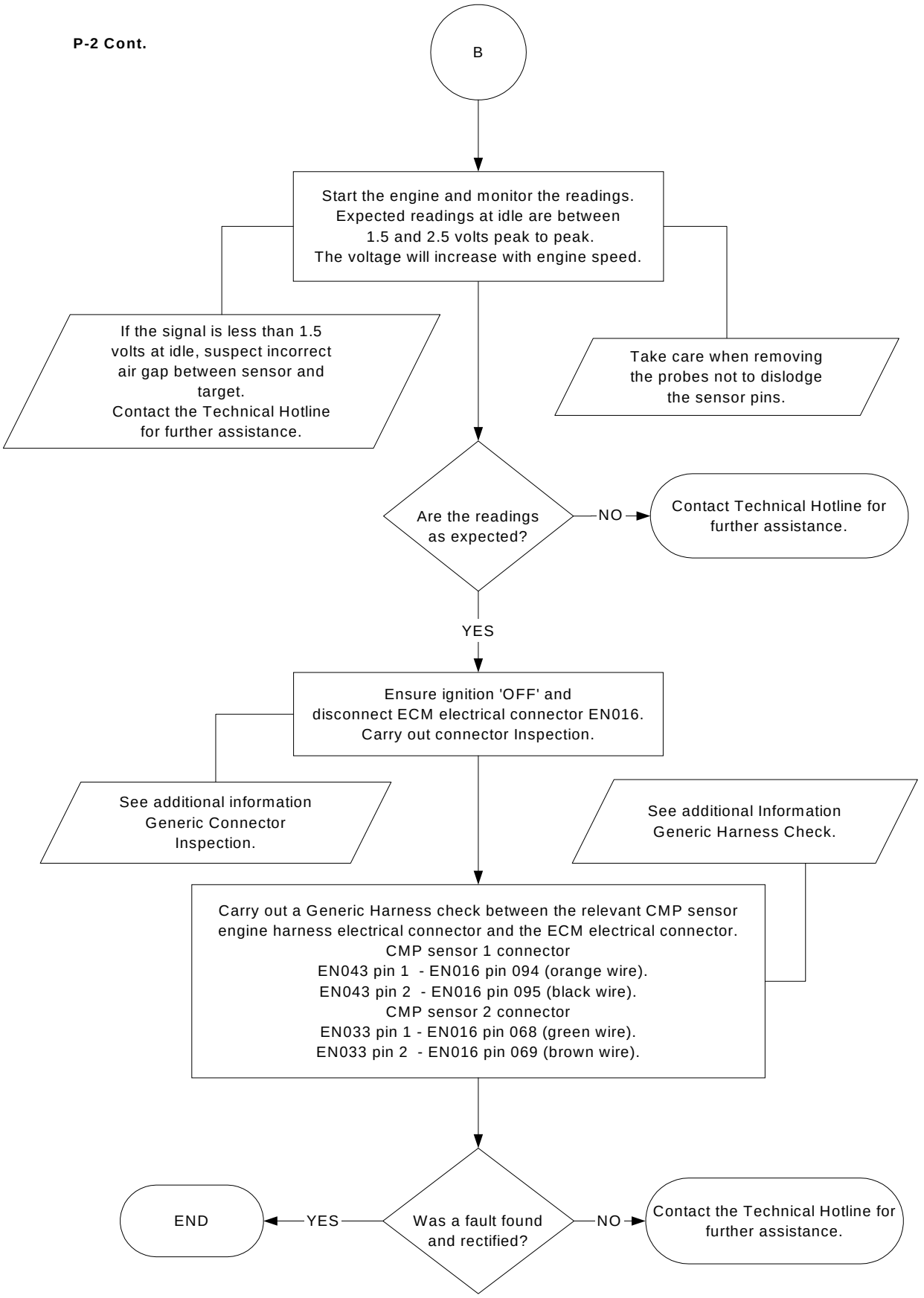
Camshaft Position Sensor
Flowchart P- 2



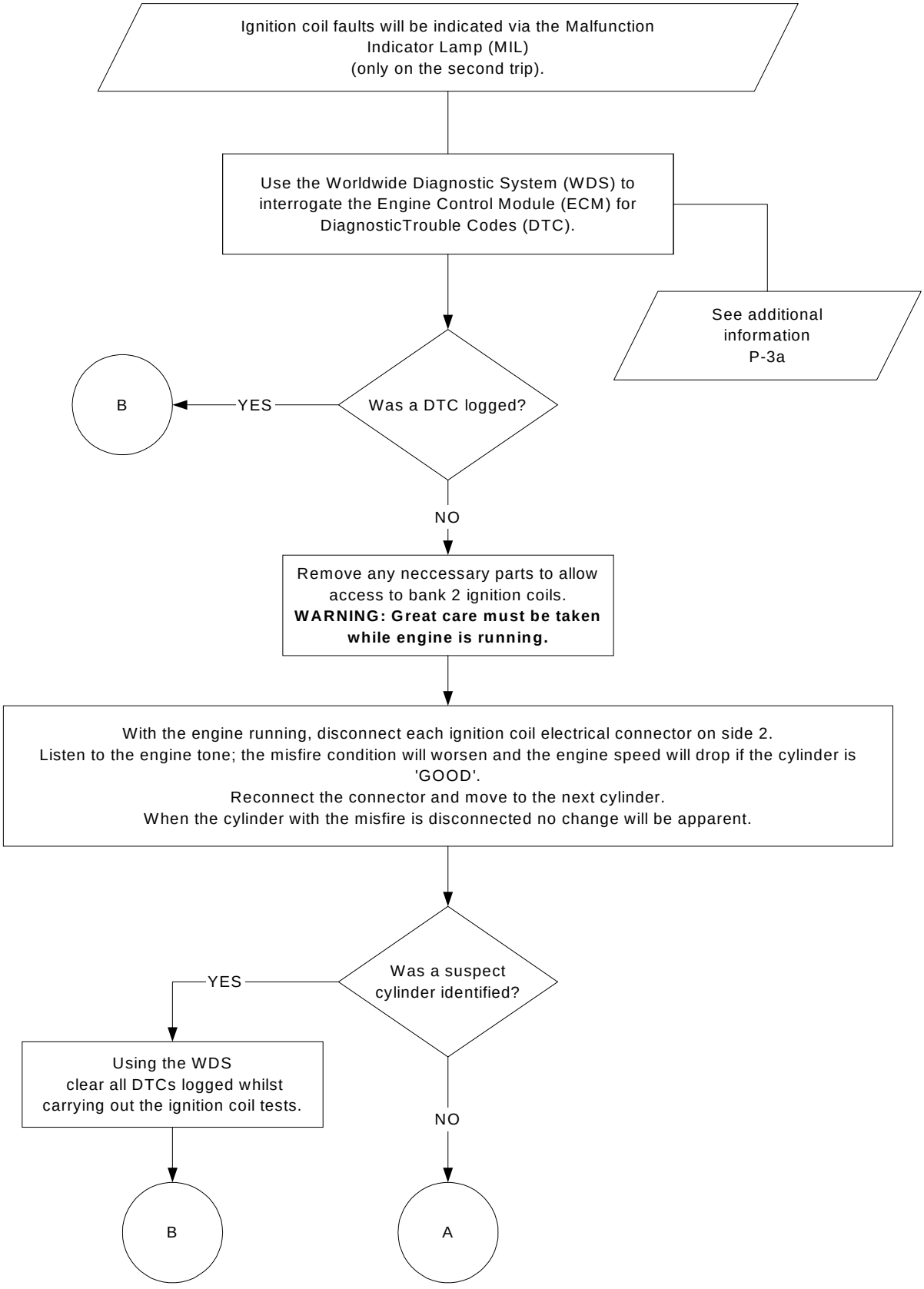
P-2 Cont.


A
Check CMP sensor and front timing cover for any signs of damage.
Was a fault found and rectified?
YES
END
NO
Using a Digital Multi Meter (DMM), check the resistance of the sensor between pins 1 and 2. Expected value at 20°C 467ohms - 595ohms.
Are the readings taken within tolerance.
NO
Replace faulty CMP Sensor.
END
YES
Using two adapters (JT-034) from the WDS Probe Tip Adapter Kit, attach an adapter to each of the pins on the sensor. Refit the CMP sensor to the vehicle with the adapters attached.
See additional information P-2a
Using WDS, select the oscilloscope and connect the probes to the adapters on the sensor.
B

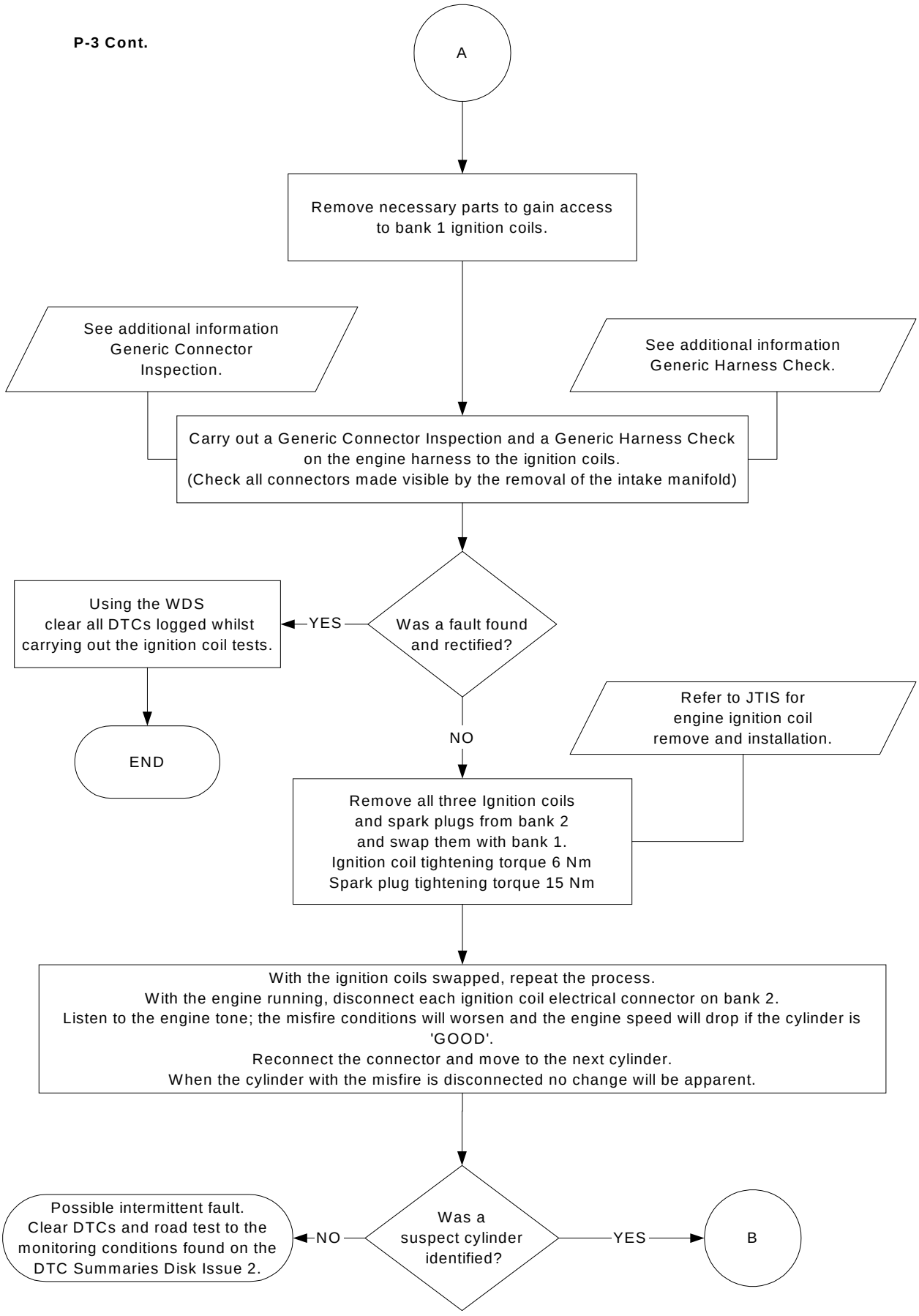
P-2 Cont.


B
Start the engine and monitor the readings.
Expected readings at idle are between
1.5 and 2.5 volts peak to peak.
The voltage will increase with engine speed.
If the signal is less than 1.5 volts at idle, suspect incorrect air gap between sensor and target.
Contact the Technical Hotline for further assistance.
Take care when removing the probes not to dislodge the sensor pins.
Are the readings as expected?
NO
Contact Technical Hotline for further assistance.
YES
Ensure ignition 'OFF' and disconnect ECM electrical connector EN016.
Carry out connector Inspection.
See additional information Generic Connector Inspection.
See additional Information Generic Harness Check.
Carry out a Generic Harness check between the relevant CMP sensor engine harness electrical connector and the ECM electrical connector.
CMP sensor 1 connector
EN043 pin 1 - EN016 pin 094 (orange wire).
EN043 pin 2 - EN016 pin 095 (black wire).
CMP sensor 2 connector
EN033 pin 1 - EN016 pin 068 (green wire).
EN033 pin 2 - EN016 pin 069 (brown wire).
Was a fault found and rectified?
YES
END
NO
Contact the Technical Hotline for further assistance.

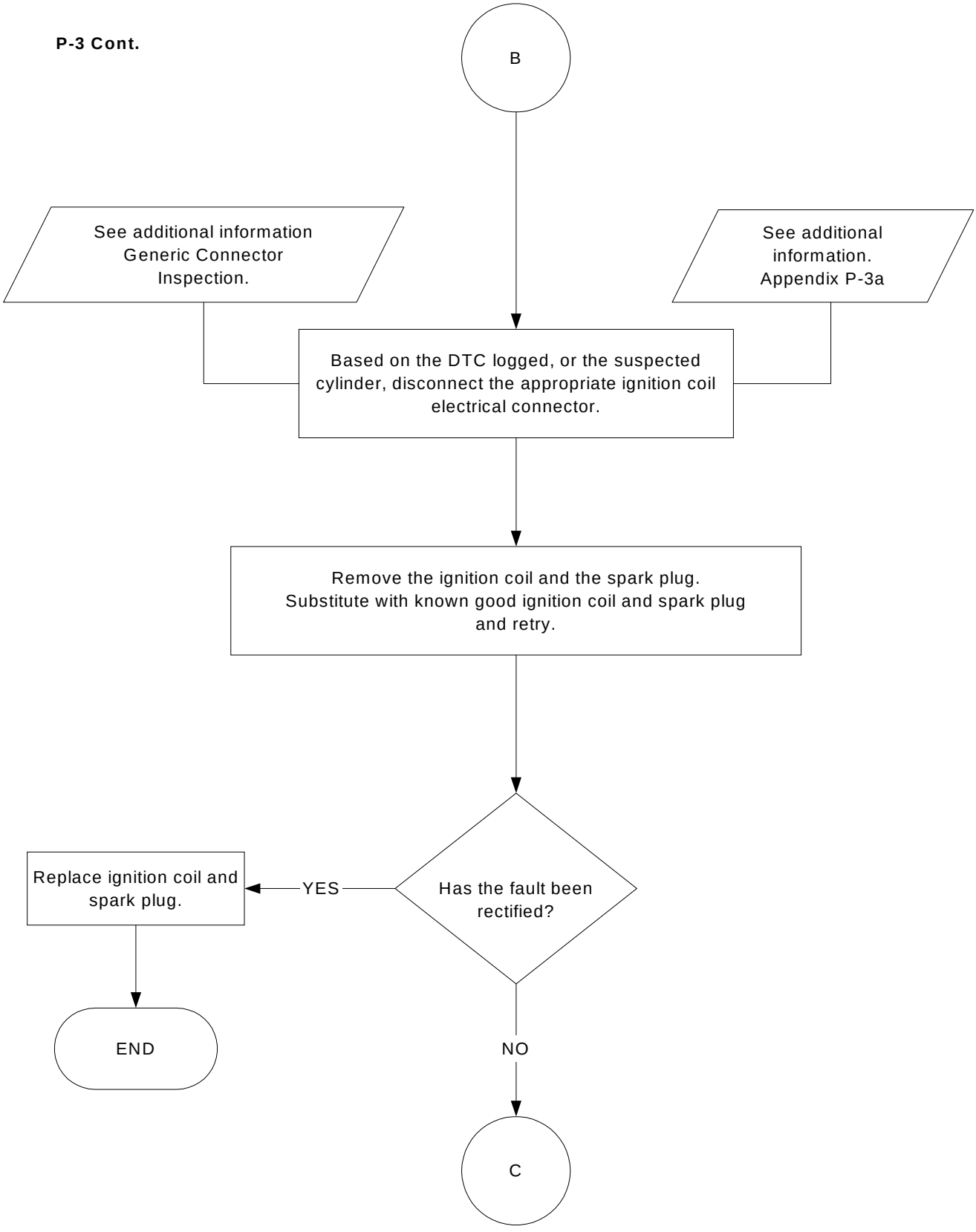
Ignition Coil
Flowchart P- 3



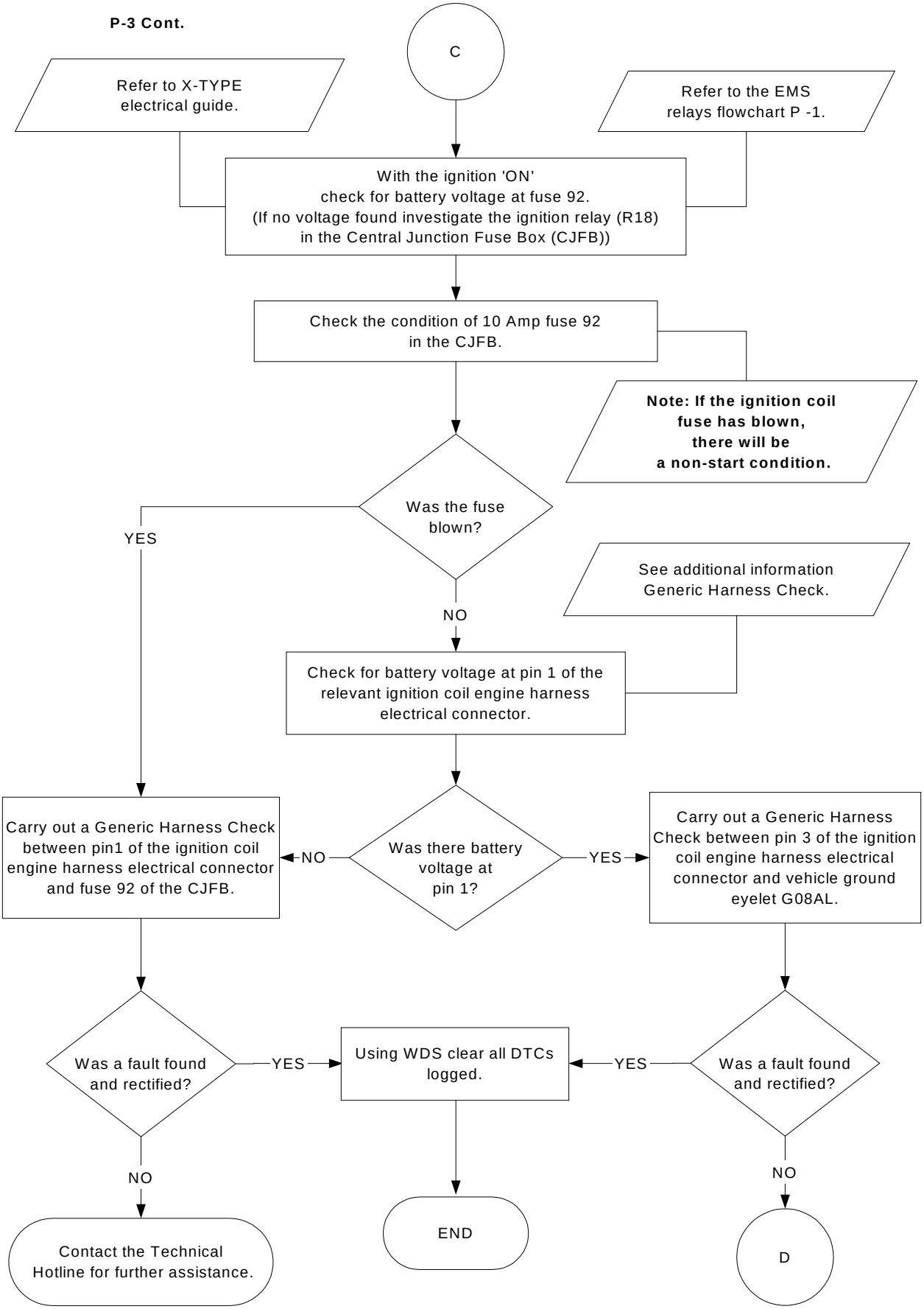
P-3 Cont.


A
Remove necessary parts to gain access to bank 1 ignition coils.
See additional information Generic Connector Inspection.
See additional information Generic Harness Check.
Carry out a Generic Connector Inspection and a Generic Harness Check on the engine harness to the ignition coils.
(Check all connectors made visible by the removal of the intake manifold)
Was a fault found and rectified?
YES
Using the WDS clear all DTCs logged whilst carrying out the ignition coil tests.
END
NO
Refer to JTIS for engine ignition coil remove and installation.
Remove all three Ignition coils and spark plugs from bank 2 and swap them with bank 1.
Ignition coil tightening torque 6 Nm
Spark plug tightening torque 15 Nm
With the ignition coils swapped, repeat the process.
With the engine running, disconnect each ignition coil electrical connector on bank 2.
Listen to the engine tone; the misfire conditions will worsen and the engine speed will drop if the cylinder is 'GOOD'.
Reconnect the connector and move to the next cylinder.
When the cylinder with the misfire is disconnected no change will be apparent.
Was a suspect cylinder identified?
NO
Possible intermittent fault.
Clear DTCs and road test to the monitoring conditions found on the DTC Summaries Disk Issue 2.
YES
B

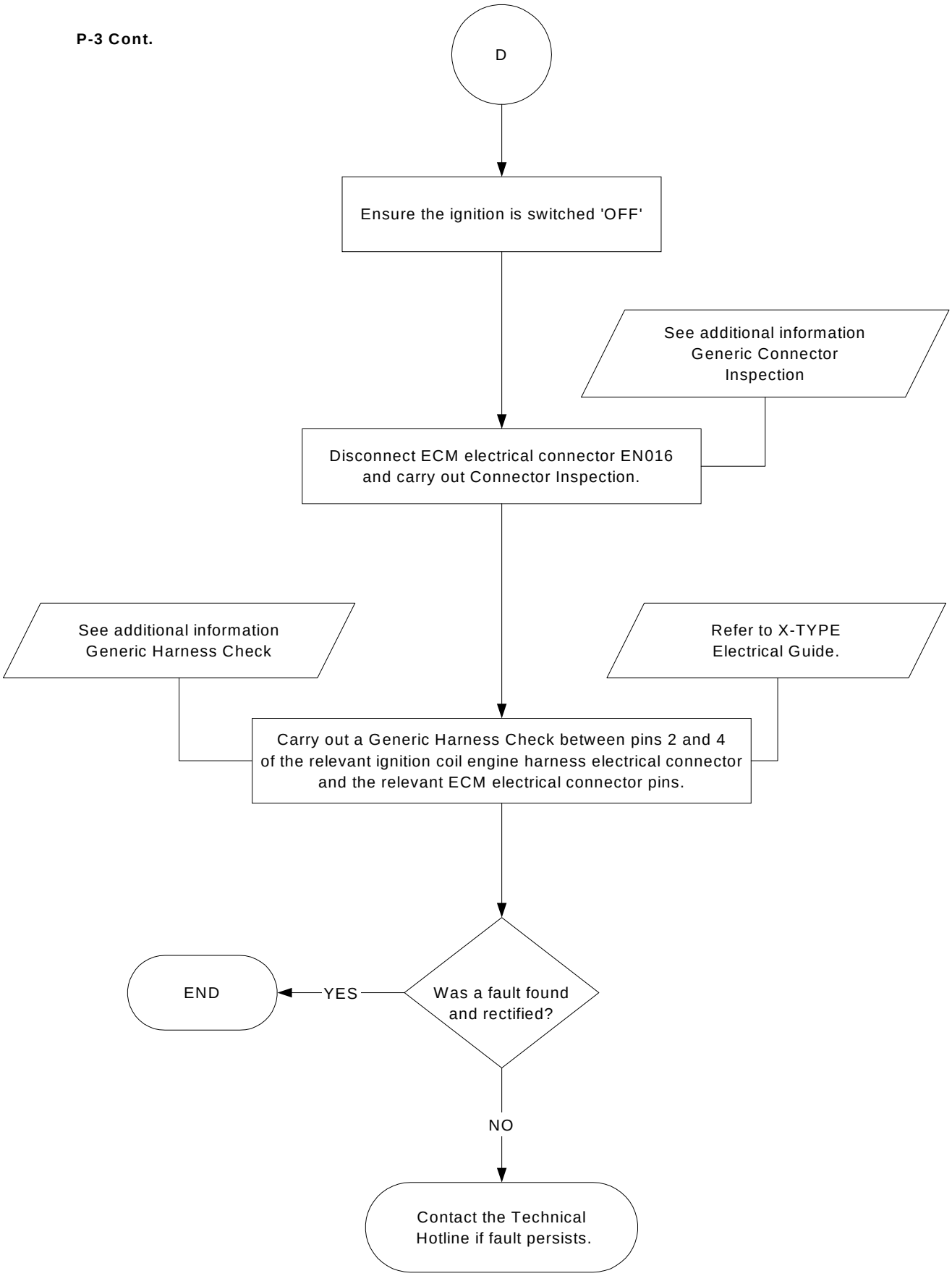
P-3 Cont.


B
See additional information Generic Connector Inspection.
See additional information. Appendix P-3a
Based on the DTC logged, or the suspected cylinder, disconnect the appropriate ignition coil electrical connector.
Remove the ignition coil and the spark plug. Substitute with known good ignition coil and spark plug and retry.
Has the fault been rectified?
YES
Replace ignition coil and spark plug.
END
NO
C

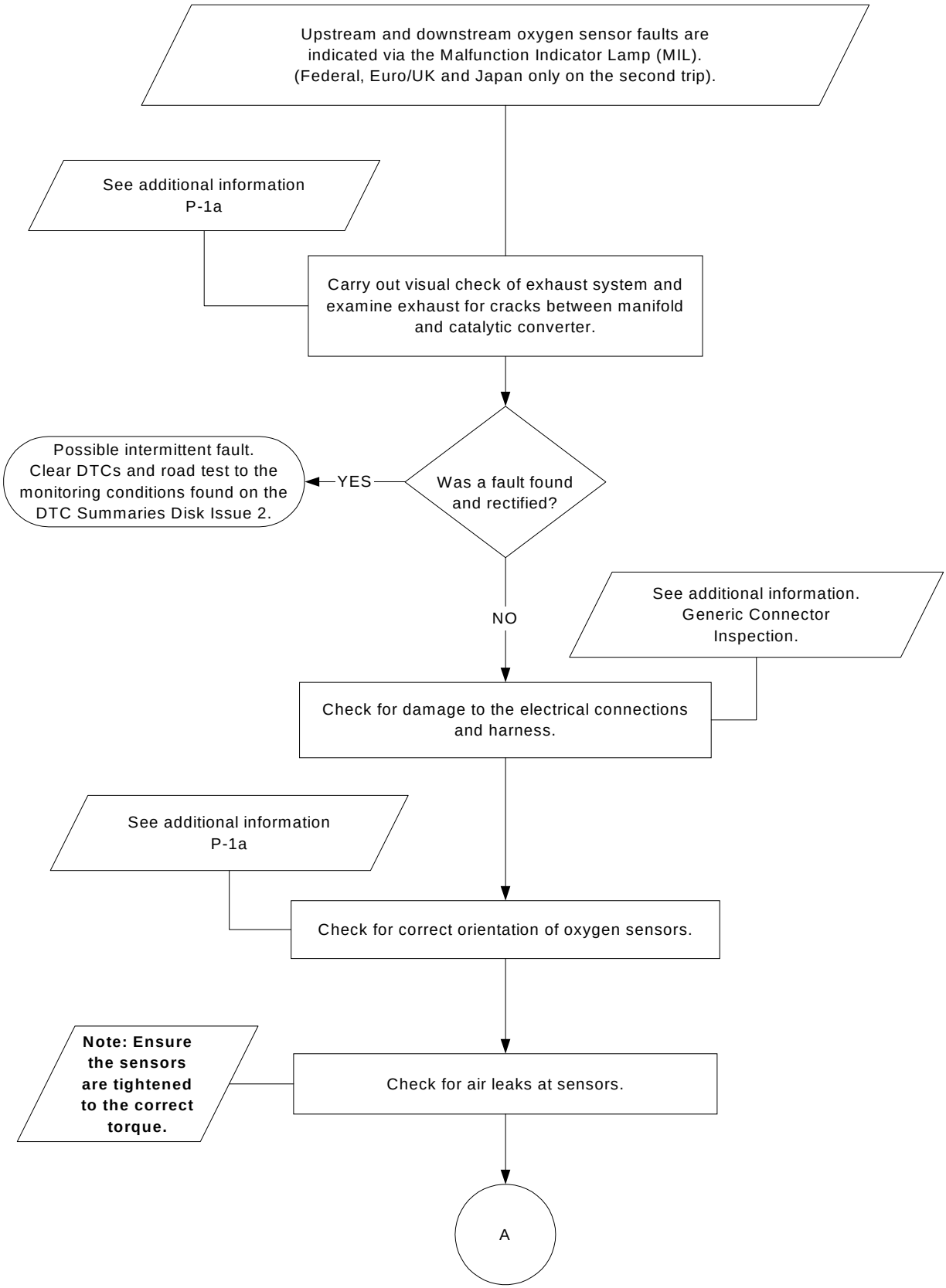
P-3 Cont.


C
Refer to X-TYPE electrical guide.
Refer to the EMS relays flowchart P -1.
With the ignition 'ON' check for battery voltage at fuse 92. (If no voltage found investigate the ignition relay (R18) in the Central Junction Fuse Box (CJFB))
Check the condition of 10 Amp fuse 92 in the CJFB.
Note: If the ignition coil fuse has blown, there will be a non-start condition.
Was the fuse blown?
YES
NO
See additional information Generic Harness Check.
Check for battery voltage at pin 1 of the relevant ignition coil engine harness electrical connector.
Was there battery voltage at pin 1?
NO
YES
Carry out a Generic Harness Check between pin1 of the ignition coil engine harness electrical connector and fuse 92 of the CJFB.
Carry out a Generic Harness Check between pin 3 of the ignition coil engine harness electrical connector and vehicle ground eyelet G08AL.
Was a fault found and rectified?
YES
Using WDS clear all DTCs logged.
YES
Was a fault found and rectified?
NO
NO
Contact the Technical Hotline for further assistance.
END
D

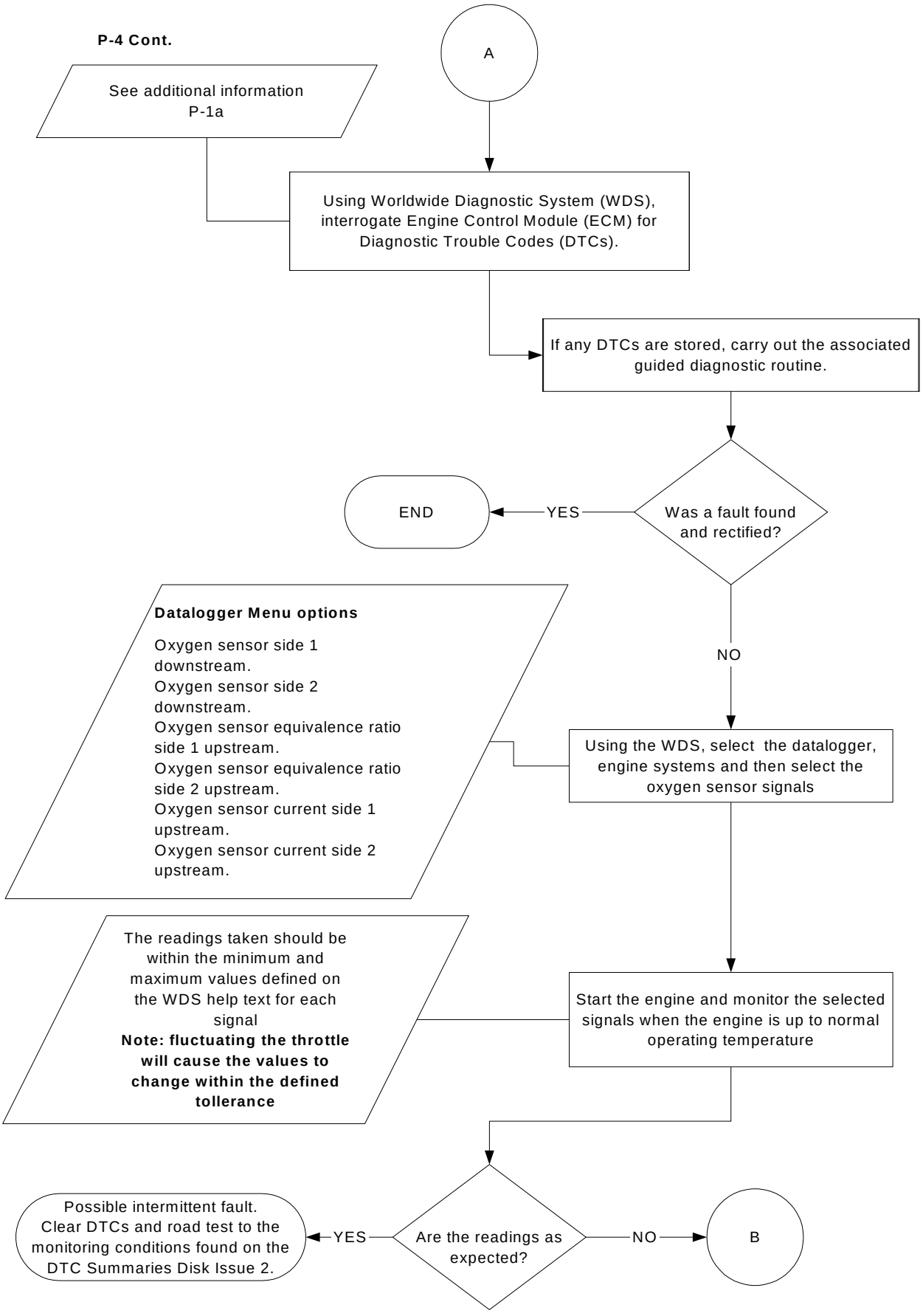
P-3 Cont.


D
Ensure the ignition is switched 'OFF'
See additional information
Generic Connector
Inspection
Disconnect ECM electrical connector EN016
and carry out Connector Inspection.
See additional information
Generic Harness Check
Refer to X-TYPE
Electrical Guide.
Carry out a Generic Harness Check between pins 2 and 4
of the relevant ignition coil engine harness electrical connector
and the relevant ECM electrical connector pins.
Was a fault found
and rectified?
YES
END
NO
Contact the Technical
Hotline if fault persists.

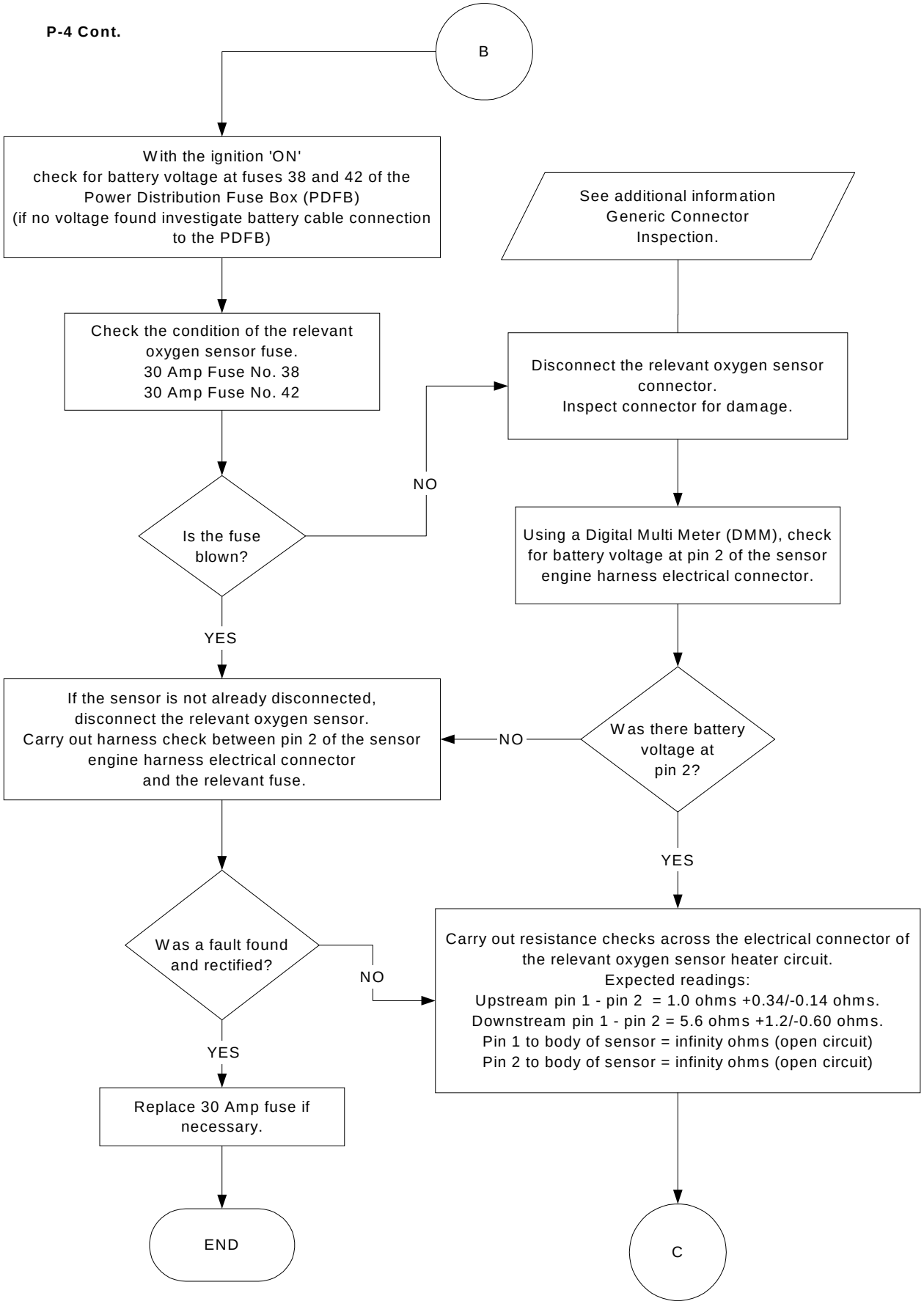
Upstream and Downstream Oxygen Sensors
Flowchart P- 4



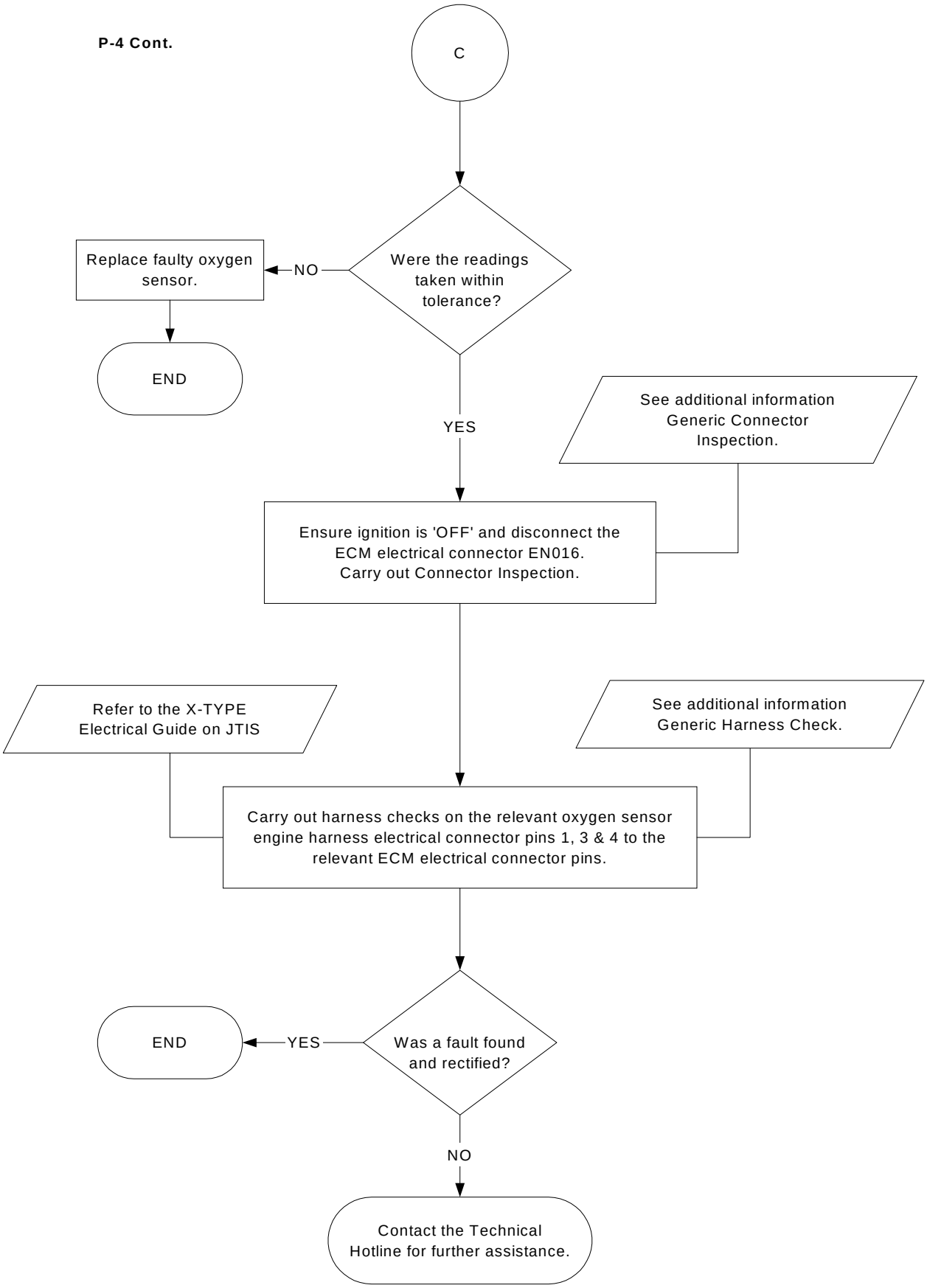
P-4 Cont.


A
See additional information P-1a
Using Worldwide Diagnostic System (WDS), interrogate Engine Control Module (ECM) for Diagnostic Trouble Codes (DTCs).
If any DTCs are stored, carry out the associated guided diagnostic routine.
Was a fault found and rectified?
YES
END
NO
Datalogger Menu options
Oxygen sensor side 1 downstream.
Oxygen sensor side 2 downstream.
Oxygen sensor equivalence ratio side 1 upstream.
Oxygen sensor equivalence ratio side 2 upstream.
Oxygen sensor current side 1 upstream.
Oxygen sensor current side 2 upstream.
Using the WDS, select the datalogger, engine systems and then select the oxygen sensor signals
The readings taken should be within the minimum and maximum values defined on the WDS help text for each signal
Note: fluctuating the throttle will cause the values to change within the defined tollerance
Start the engine and monitor the selected signals when the engine is up to normal operating temperature
Are the readings as expected?
YES
Possible intermittent fault. Clear DTCs and road test to the monitoring conditions found on the DTC Summaries Disk Issue 2.
NO
B

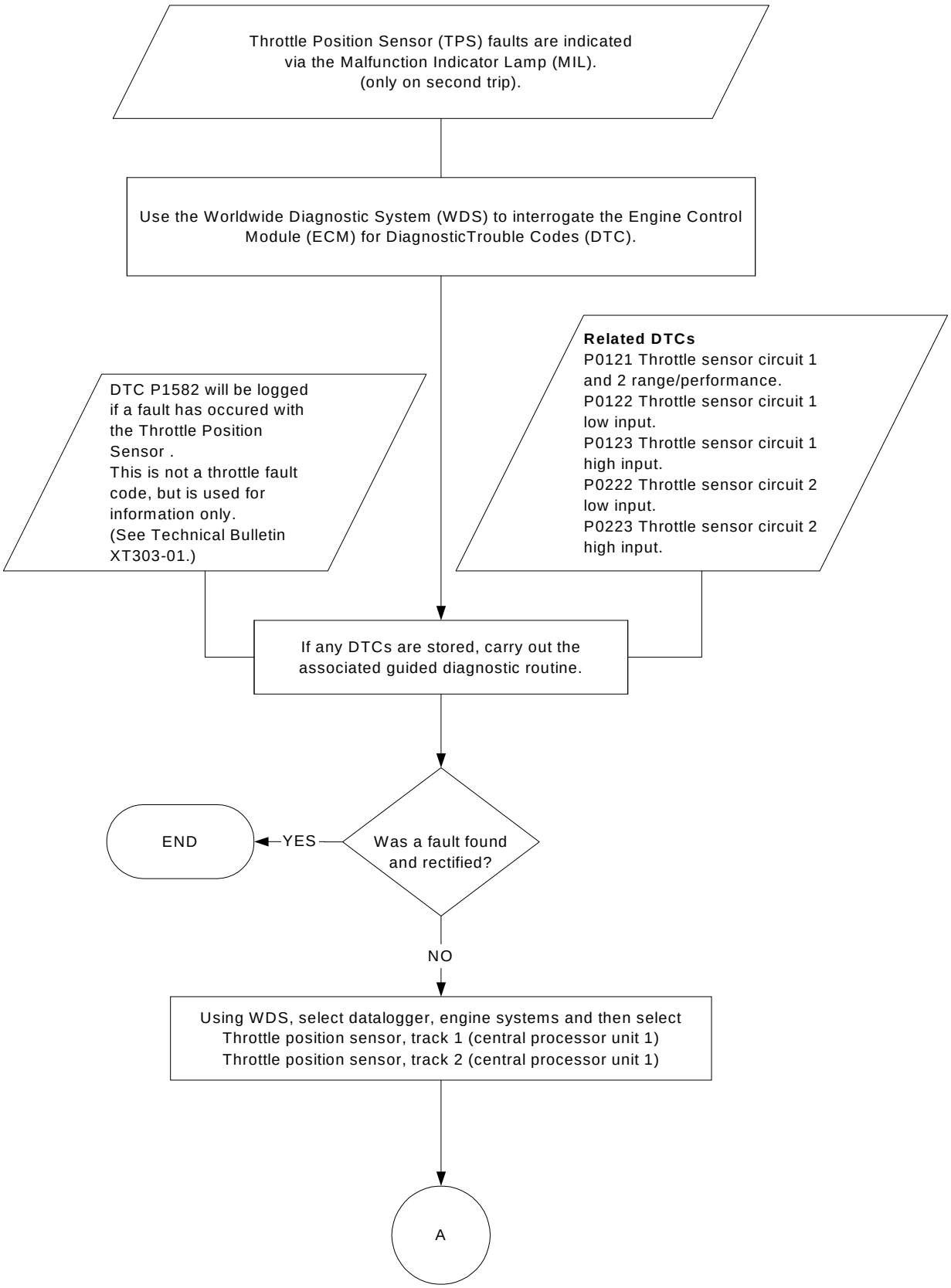
P-4 Cont.


B
With the ignition 'ON'
check for battery voltage at fuses 38 and 42 of the
Power Distribution Fuse Box (PDFB)
(if no voltage found investigate battery cable connection
to the PDFB)
See additional information
Generic Connector
Inspection.
Check the condition of the relevant
oxygen sensor fuse.
30 Amp Fuse No. 38
30 Amp Fuse No. 42
Disconnect the relevant oxygen sensor
connector.
Inspect connector for damage.
NO
Is the fuse
blown?
Using a Digital Multi Meter (DMM), check
for battery voltage at pin 2 of the sensor
engine harness electrical connector.
YES
If the sensor is not already disconnected,
disconnect the relevant oxygen sensor.
Carry out harness check between pin 2 of the sensor
engine harness electrical connector
and the relevant fuse.
NO
Was there battery
voltage at
pin 2?
YES
Was a fault found
and rectified?
NO
Carry out resistance checks across the electrical connector of
the relevant oxygen sensor heater circuit.
Expected readings:
Upstream pin 1 - pin 2 = 1.0 ohms +0.34/-0.14 ohms.
Downstream pin 1 - pin 2 = 5.6 ohms +1.2/-0.60 ohms.
Pin 1 to body of sensor = infinity ohms (open circuit)
Pin 2 to body of sensor = infinity ohms (open circuit)
YES
Replace 30 Amp fuse if
necessary.
END
C

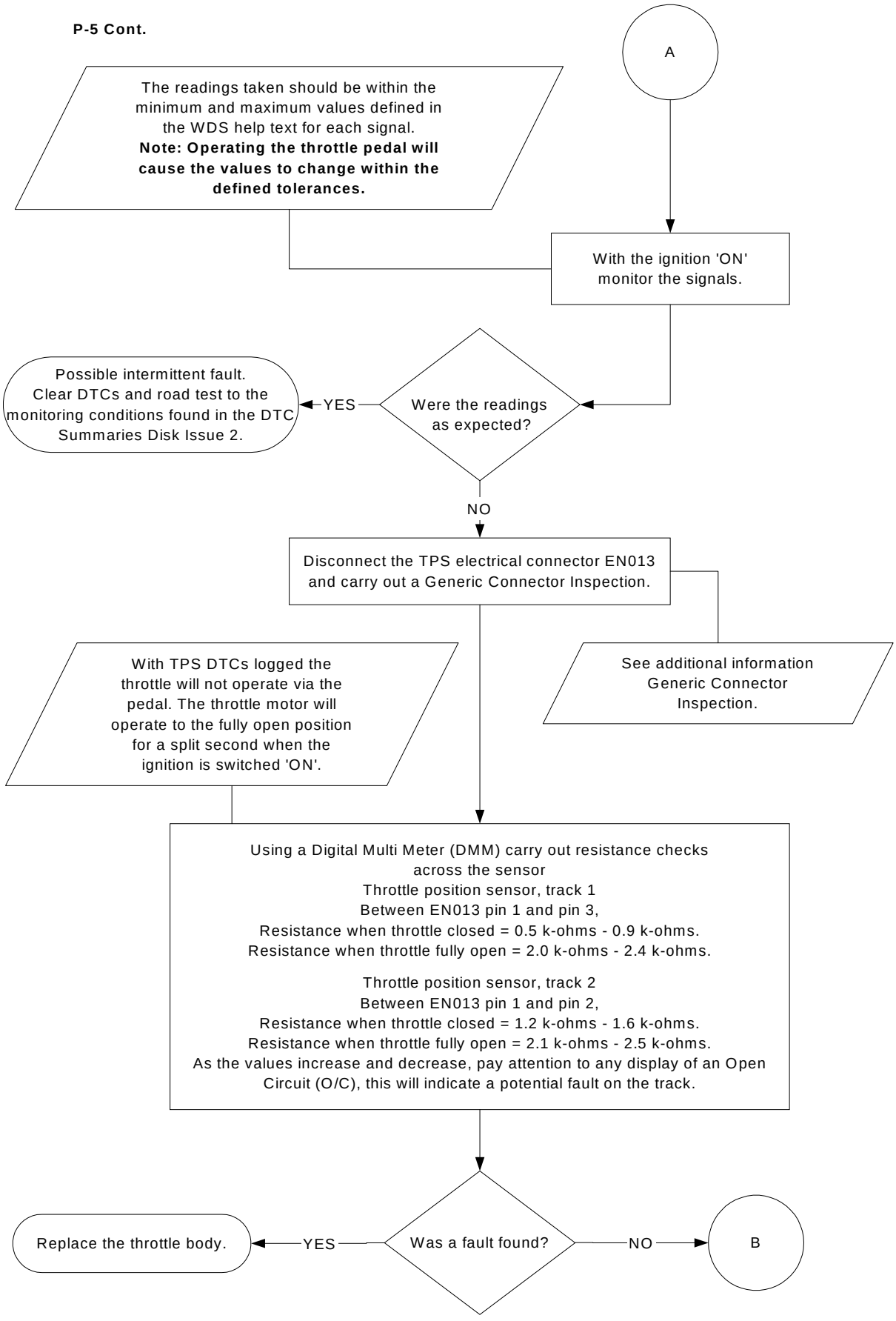
P-4 Cont.


C
Were the readings taken within tolerance?
NO
Replace faulty oxygen sensor.
END
YES
See additional information Generic Connector Inspection.
Ensure ignition is 'OFF' and disconnect the ECM electrical connector EN016. Carry out Connector Inspection.
Refer to the X-TYPE Electrical Guide on JTIS
See additional information Generic Harness Check.
Carry out harness checks on the relevant oxygen sensor engine harness electrical connector pins 1, 3 & 4 to the relevant ECM electrical connector pins.
Was a fault found and rectified?
YES
END
NO
Contact the Technical Hotline for further assistance.

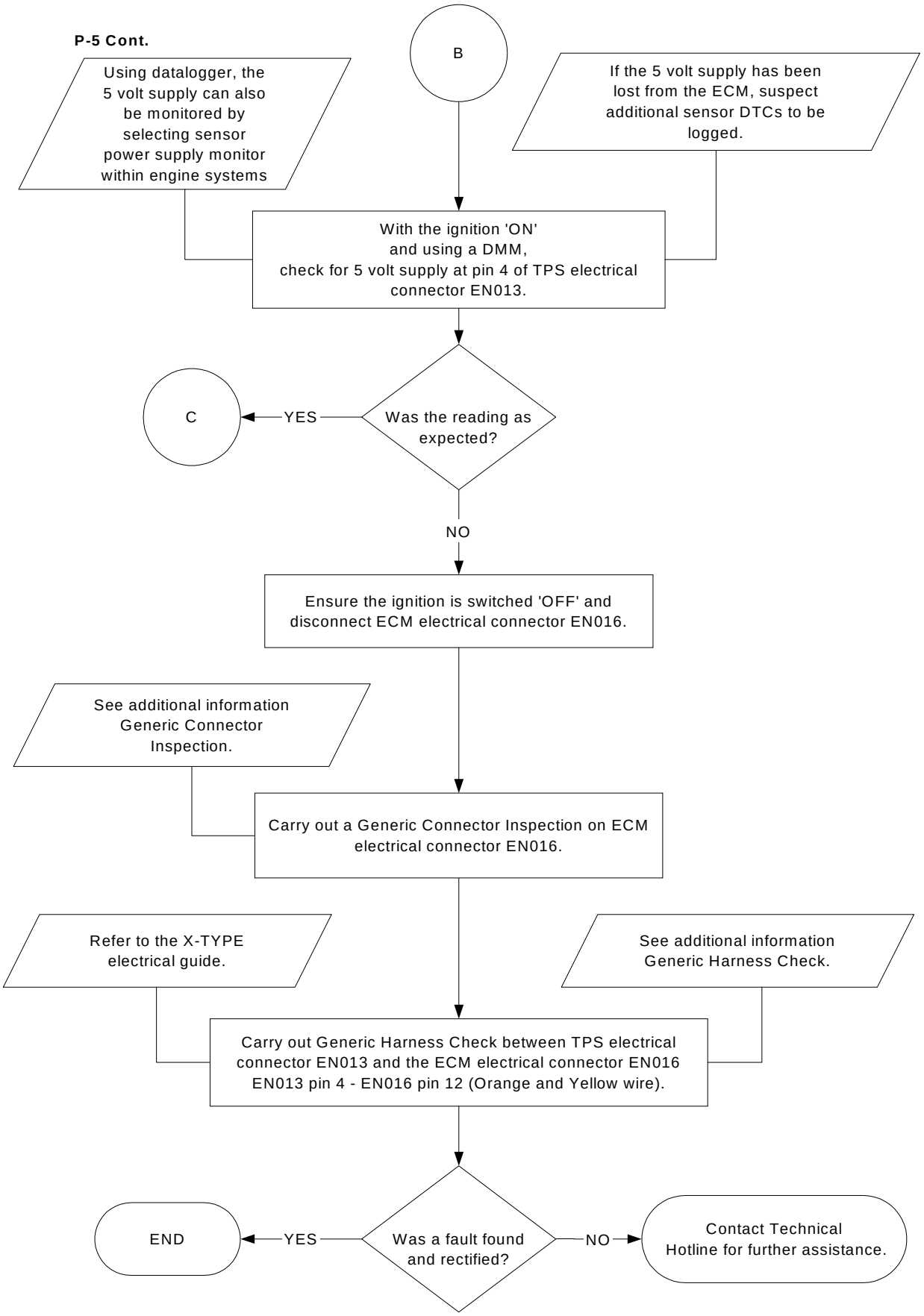
Throttle Position Sensor
Flowchart P- 5



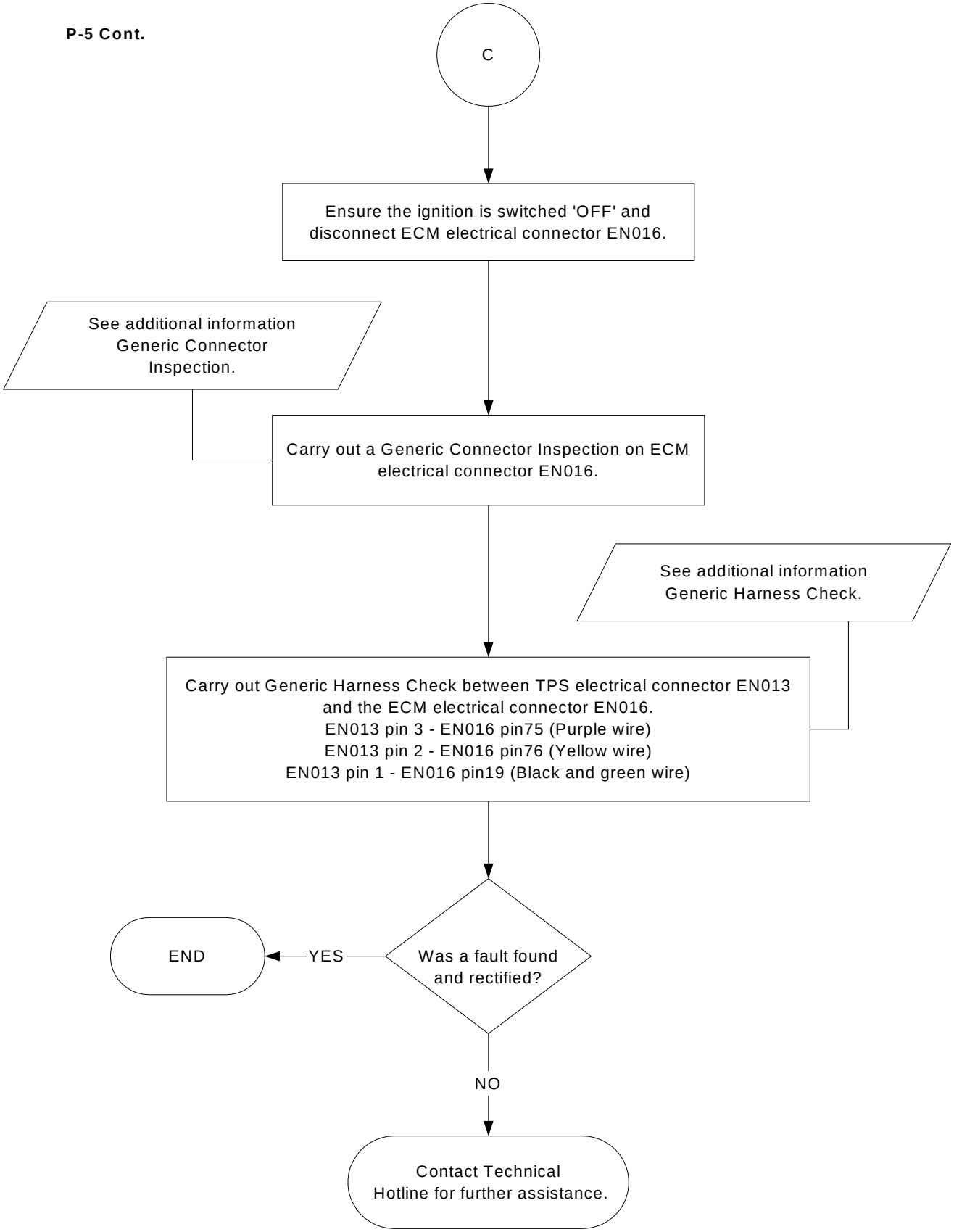
P-5 Cont.


A
The readings taken should be within the minimum and maximum values defined in the WDS help text for each signal.
Note: Operating the throttle pedal will cause the values to change within the defined tolerances.
With the ignition 'ON' monitor the signals.
Were the readings as expected?
YES
Possible intermittent fault. Clear DTCs and road test to the monitoring conditions found in the DTC Summaries Disk Issue 2.
NO
Disconnect the TPS electrical connector EN013 and carry out a Generic Connector Inspection.
See additional information Generic Connector Inspection.
With TPS DTCs logged the throttle will not operate via the pedal. The throttle motor will operate to the fully open position for a split second when the ignition is switched 'ON'.
Using a Digital Multi Meter (DMM) carry out resistance checks across the sensor
Throttle position sensor, track 1
Between EN013 pin 1 and pin 3,
Resistance when throttle closed = 0.5 k-ohms - 0.9 k-ohms.
Resistance when throttle fully open = 2.0 k-ohms - 2.4 k-ohms.
Throttle position sensor, track 2
Between EN013 pin 1 and pin 2,
Resistance when throttle closed = 1.2 k-ohms - 1.6 k-ohms.
Resistance when throttle fully open = 2.1 k-ohms - 2.5 k-ohms.
As the values increase and decrease, pay attention to any display of an Open Circuit (O/C), this will indicate a potential fault on the track.
Was a fault found?
YES
Replace the throttle body.
NO
B

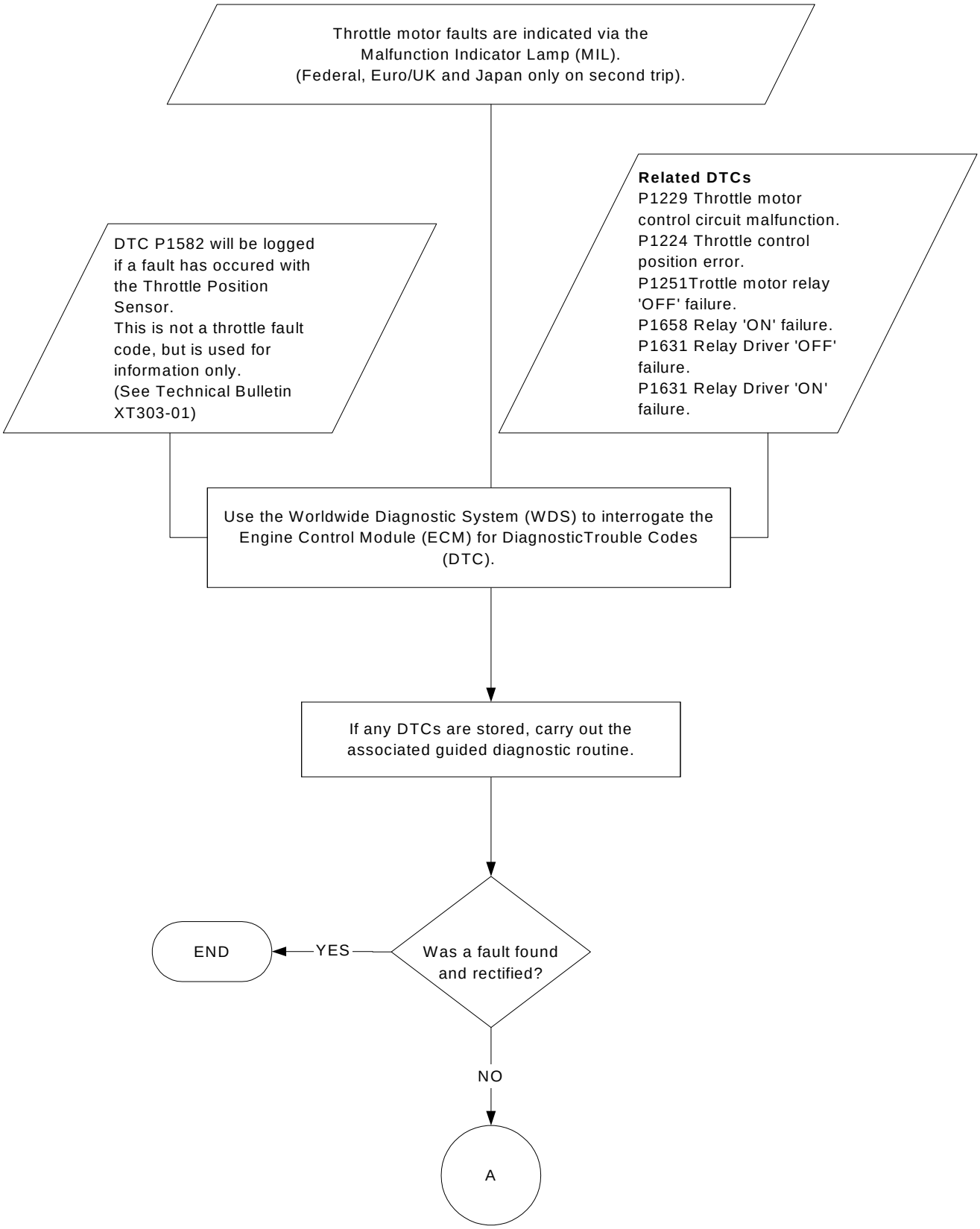
P-5 Cont.


B
Using datalogger, the 5 volt supply can also be monitored by selecting sensor power supply monitor within engine systems
If the 5 volt supply has been lost from the ECM, suspect additional sensor DTCs to be logged.
With the ignition 'ON' and using a DMM, check for 5 volt supply at pin 4 of TPS electrical connector EN013.
Was the reading as expected?
YES
C
NO
Ensure the ignition is switched 'OFF' and disconnect ECM electrical connector EN016.
See additional information Generic Connector Inspection.
Carry out a Generic Connector Inspection on ECM electrical connector EN016.
Refer to the X-TYPE electrical guide.
See additional information Generic Harness Check.
Carry out Generic Harness Check between TPS electrical connector EN013 and the ECM electrical connector EN016 EN013 pin 4 - EN016 pin 12 (Orange and Yellow wire).
Was a fault found and rectified?
YES
END
NO
Contact Technical Hotline for further assistance.

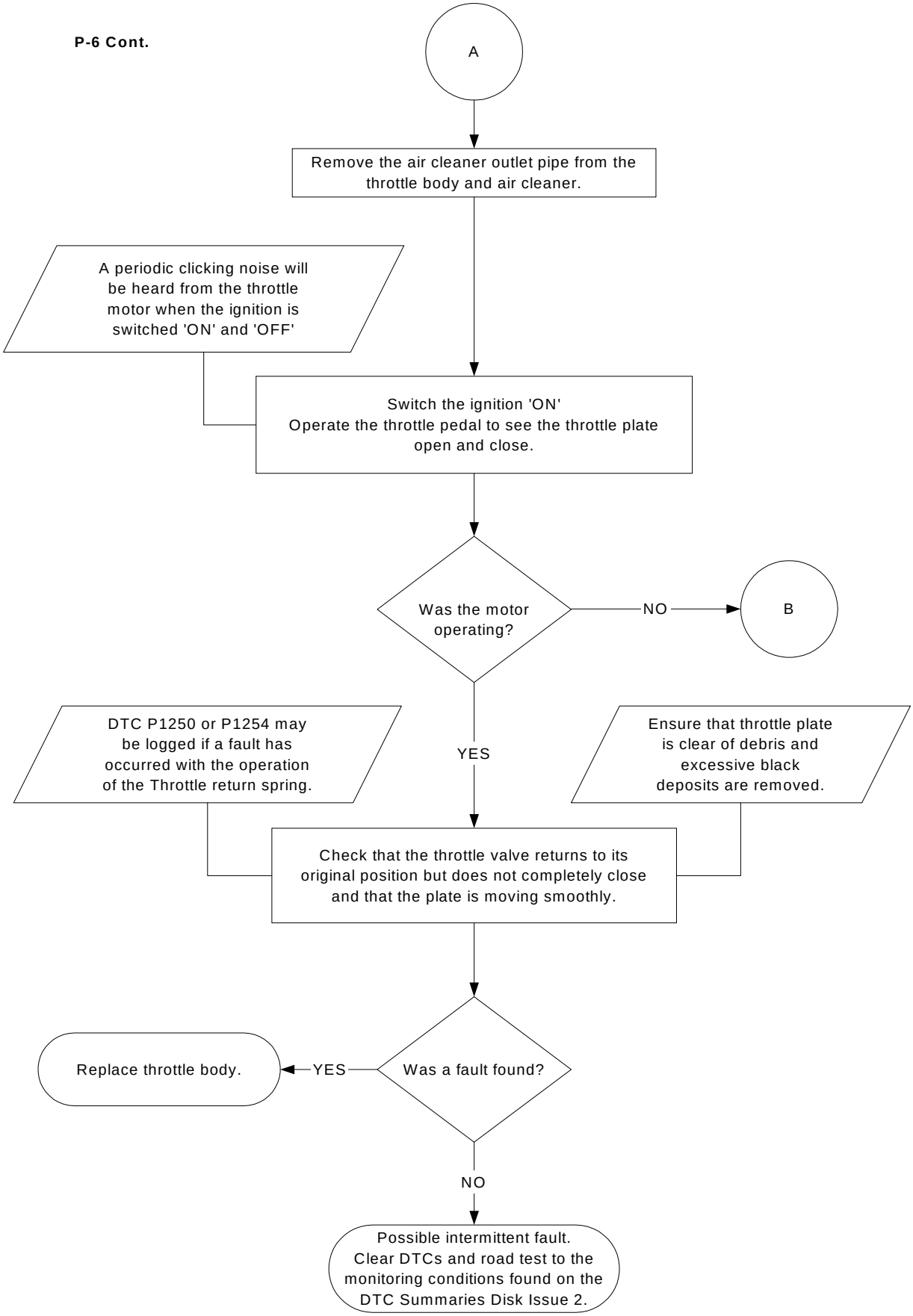
P-5 Cont.


C
Ensure the ignition is switched 'OFF' and disconnect ECM electrical connector EN016.
See additional information Generic Connector Inspection.
Carry out a Generic Connector Inspection on ECM electrical connector EN016.
See additional information Generic Harness Check.
Carry out Generic Harness Check between TPS electrical connector EN013 and the ECM electrical connector EN016.
EN013 pin 3 - EN016 pin75 (Purple wire)
EN013 pin 2 - EN016 pin76 (Yellow wire)
EN013 pin 1 - EN016 pin19 (Black and green wire)
Was a fault found and rectified?
YES
END
NO
Contact Technical Hotline for further assistance.

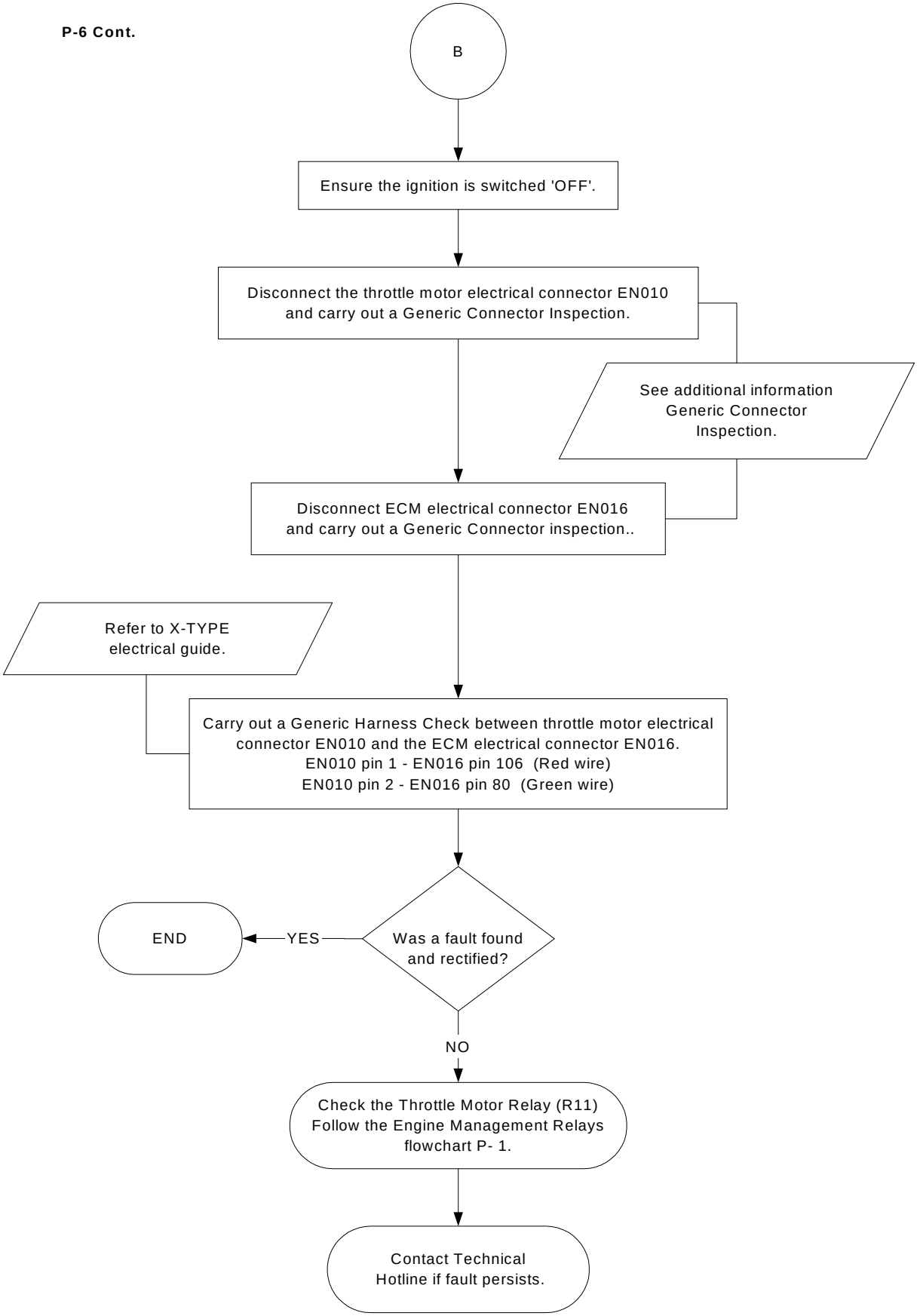
Throttle Motor
Flowchart P-6



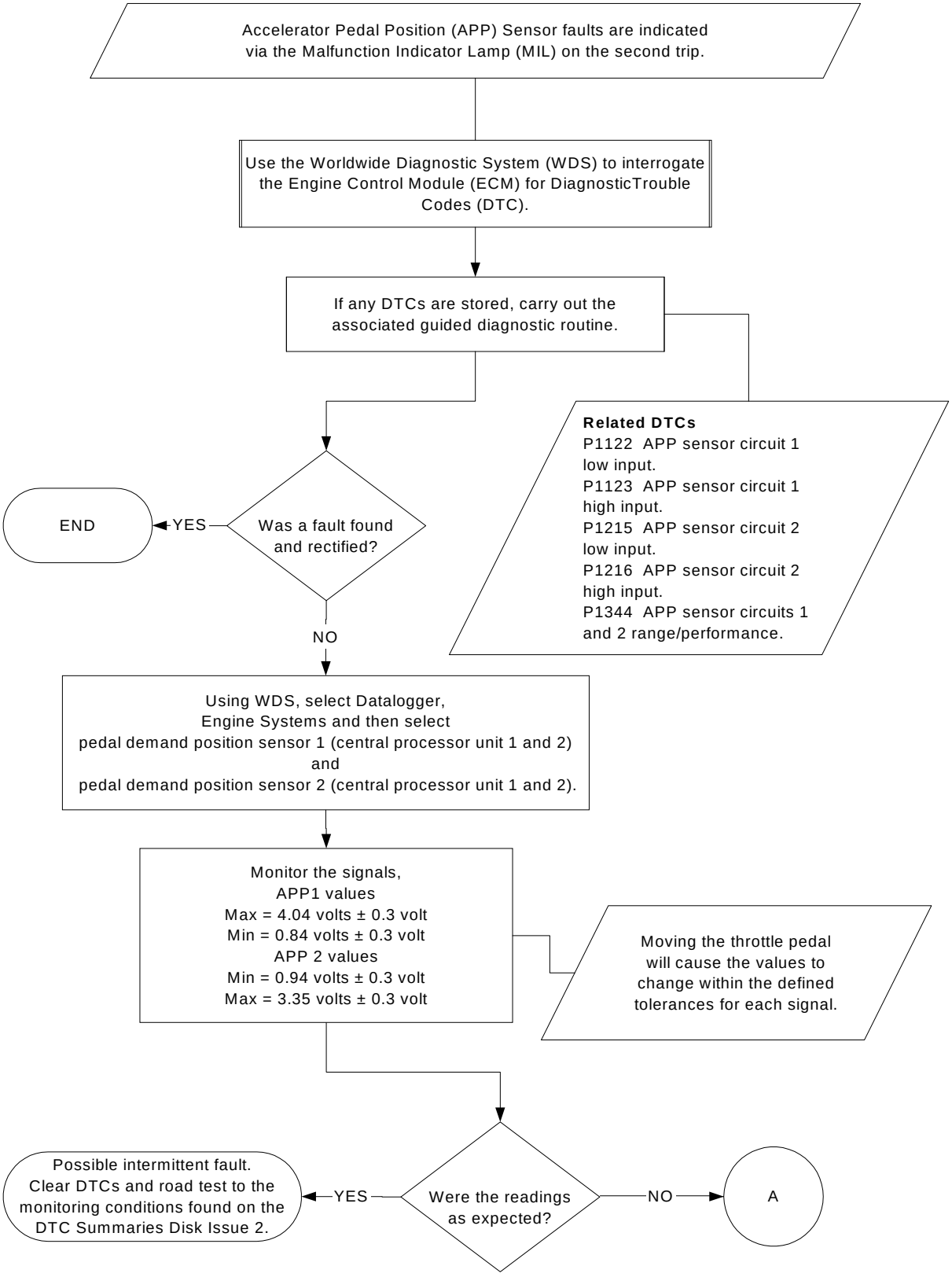
P-6 Cont.


A
Remove the air cleaner outlet pipe from the throttle body and air cleaner.
A periodic clicking noise will be heard from the throttle motor when the ignition is switched 'ON' and 'OFF'
Switch the ignition 'ON'
Operate the throttle pedal to see the throttle plate open and close.
Was the motor operating?
NO
B
YES
DTC P1250 or P1254 may be logged if a fault has occurred with the operation of the Throttle return spring.
Ensure that throttle plate is clear of debris and excessive black deposits are removed.
Check that the throttle valve returns to its original position but does not completely close and that the plate is moving smoothly.
Was a fault found?
YES
Replace throttle body.
NO
Possible intermittent fault.
Clear DTCs and road test to the monitoring conditions found on the DTC Summaries Disk Issue 2.

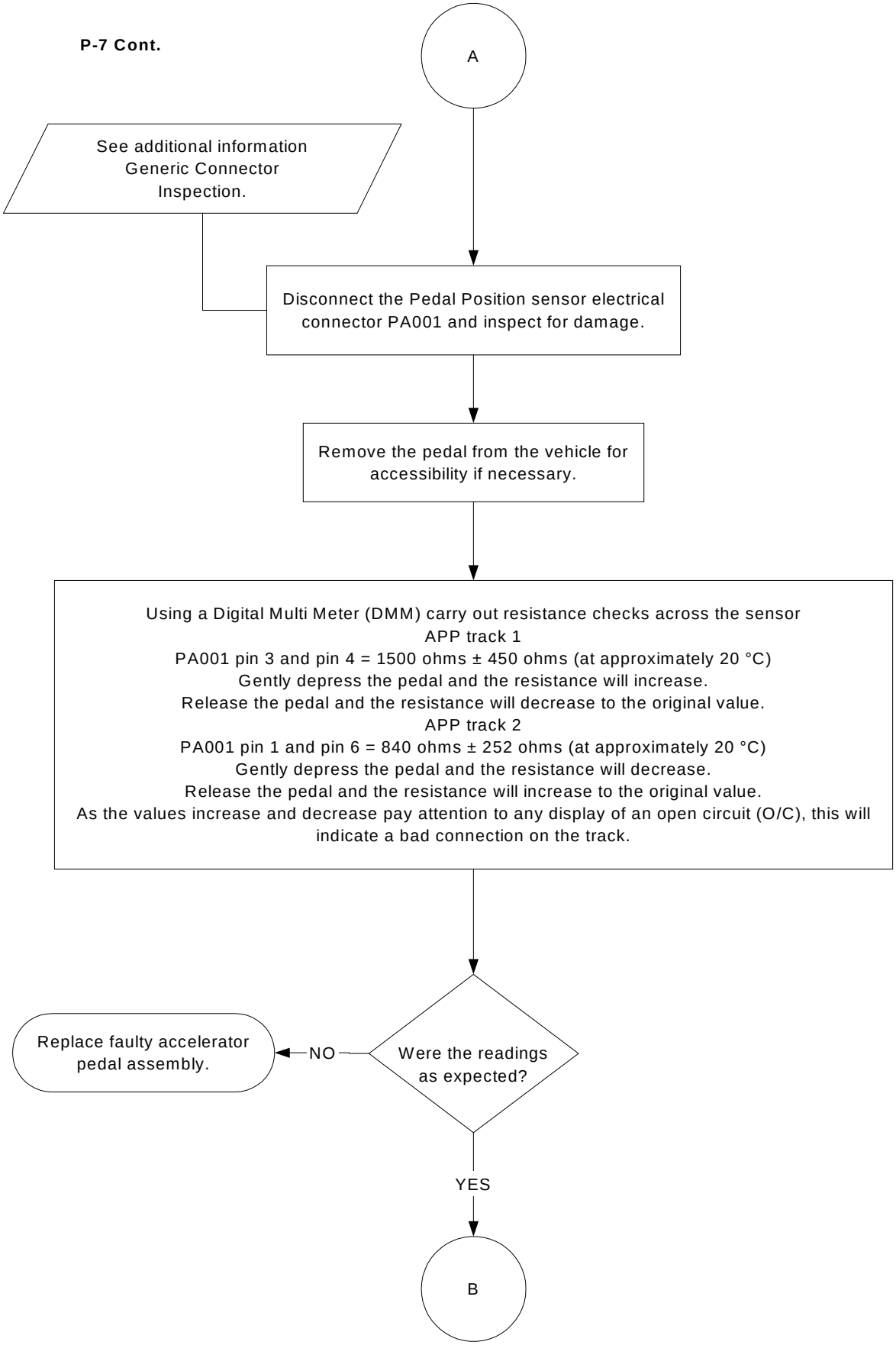
P-6 Cont.


B
Ensure the ignition is switched 'OFF'.
Disconnect the throttle motor electrical connector EN010 and carry out a Generic Connector Inspection.
See additional information Generic Connector Inspection.
Disconnect ECM electrical connector EN016 and carry out a Generic Connector inspection..
Refer to X-TYPE electrical guide.
Carry out a Generic Harness Check between throttle motor electrical connector EN010 and the ECM electrical connector EN016.
EN010 pin 1 - EN016 pin 106 (Red wire)
EN010 pin 2 - EN016 pin 80 (Green wire)
Was a fault found and rectified?
YES
END
NO
Check the Throttle Motor Relay (R11) Follow the Engine Management Relays flowchart P- 1.
Contact Technical Hotline if fault persists.

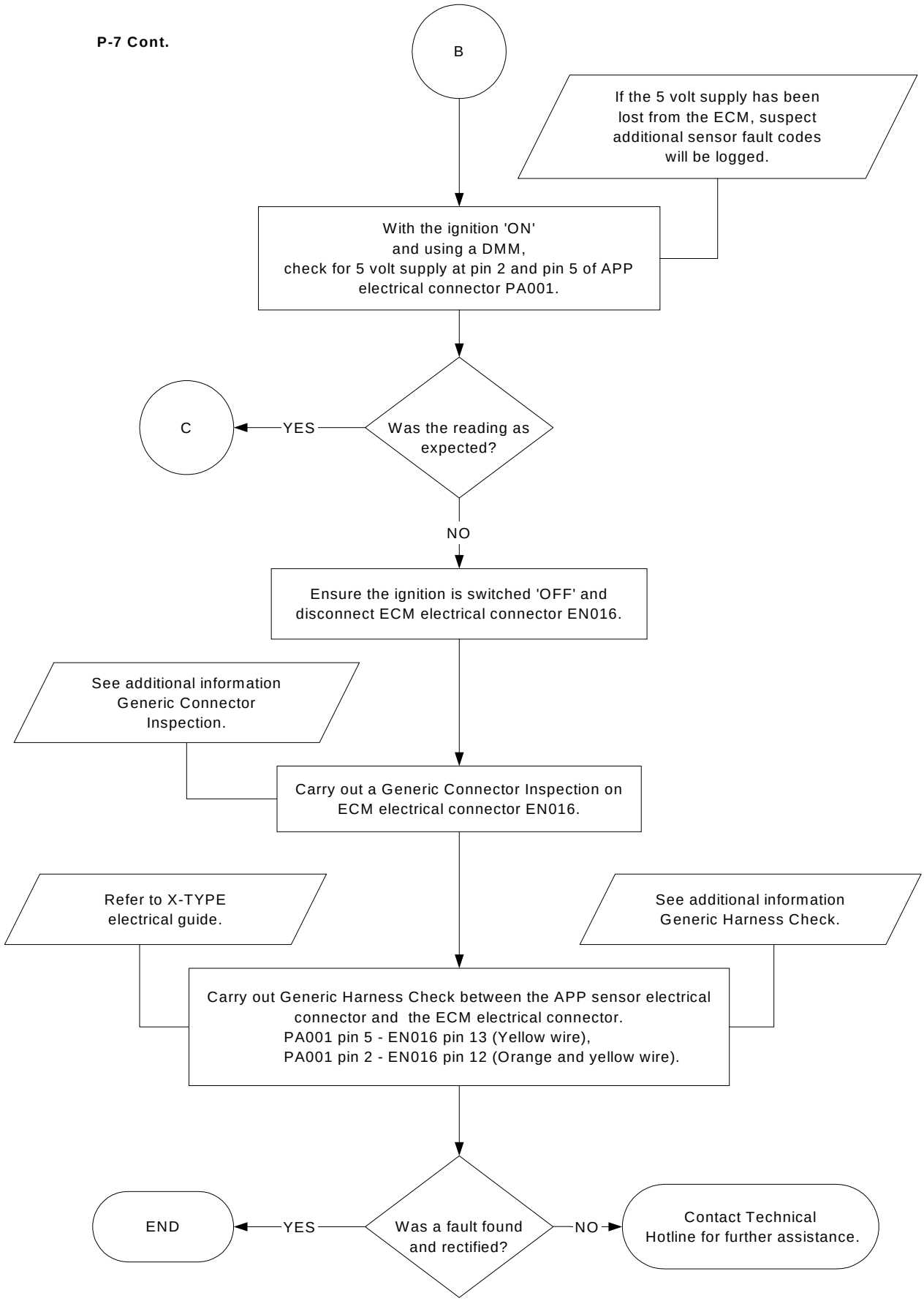
Accelerator Pedal Position Sensor
Flowchart P- 7



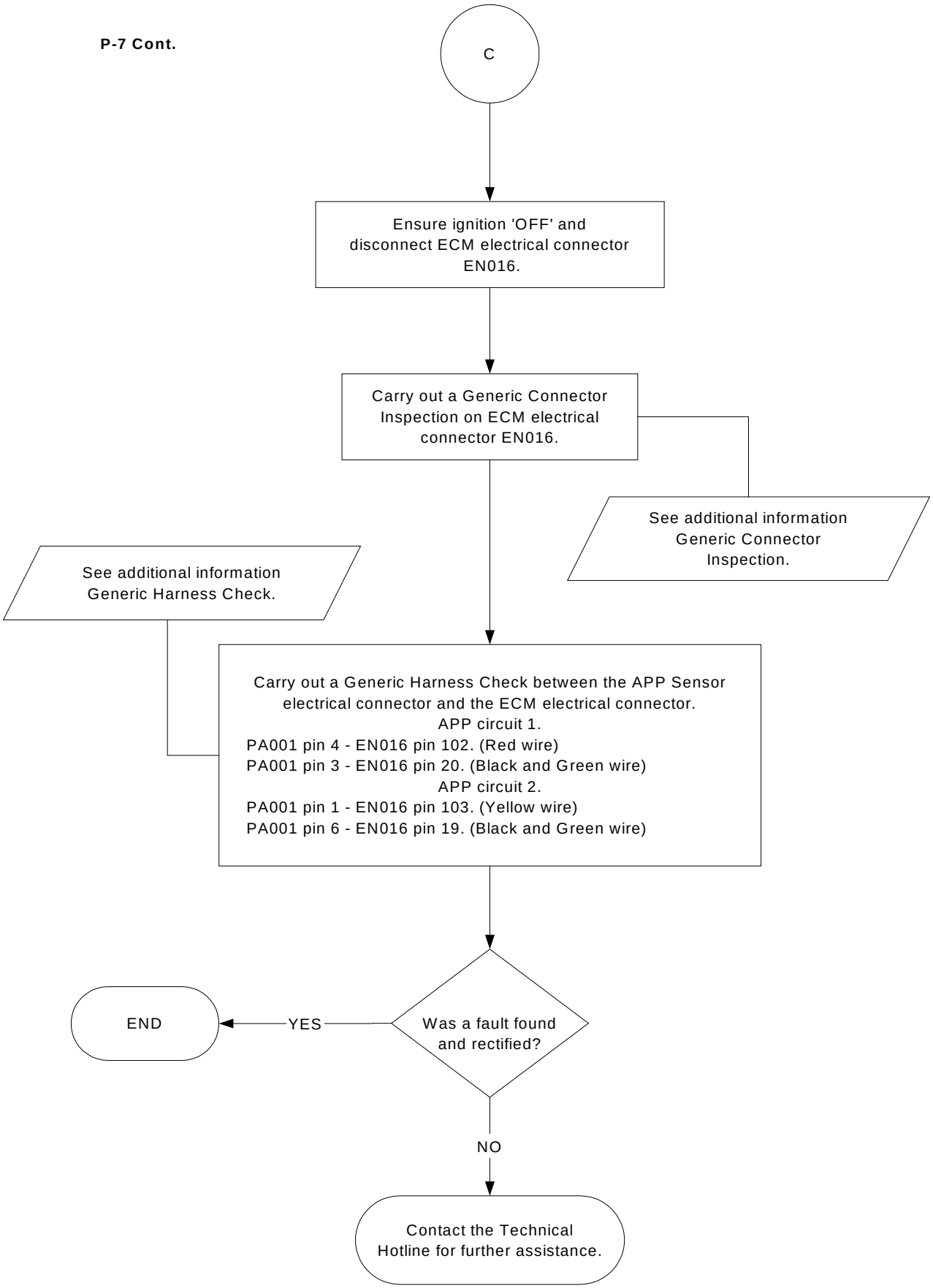
P-7 Cont.


A
See additional information Generic Connector Inspection.
Disconnect the Pedal Position sensor electrical connector PA001 and inspect for damage.
Remove the pedal from the vehicle for accessibility if necessary.
Using a Digital Multi Meter (DMM) carry out resistance checks across the sensor
APP track 1
PA001 pin 3 and pin 4 = 1500 ohms ± 450 ohms (at approximately 20 °C)
Gently depress the pedal and the resistance will increase.
Release the pedal and the resistance will decrease to the original value.
APP track 2
PA001 pin 1 and pin 6 = 840 ohms ± 252 ohms (at approximately 20 °C)
Gently depress the pedal and the resistance will decrease.
Release the pedal and the resistance will increase to the original value.
As the values increase and decrease pay attention to any display of an open circuit (O/C), this will indicate a bad connection on the track.
Were the readings as expected?
NO
Replace faulty accelerator pedal assembly.
YES
B

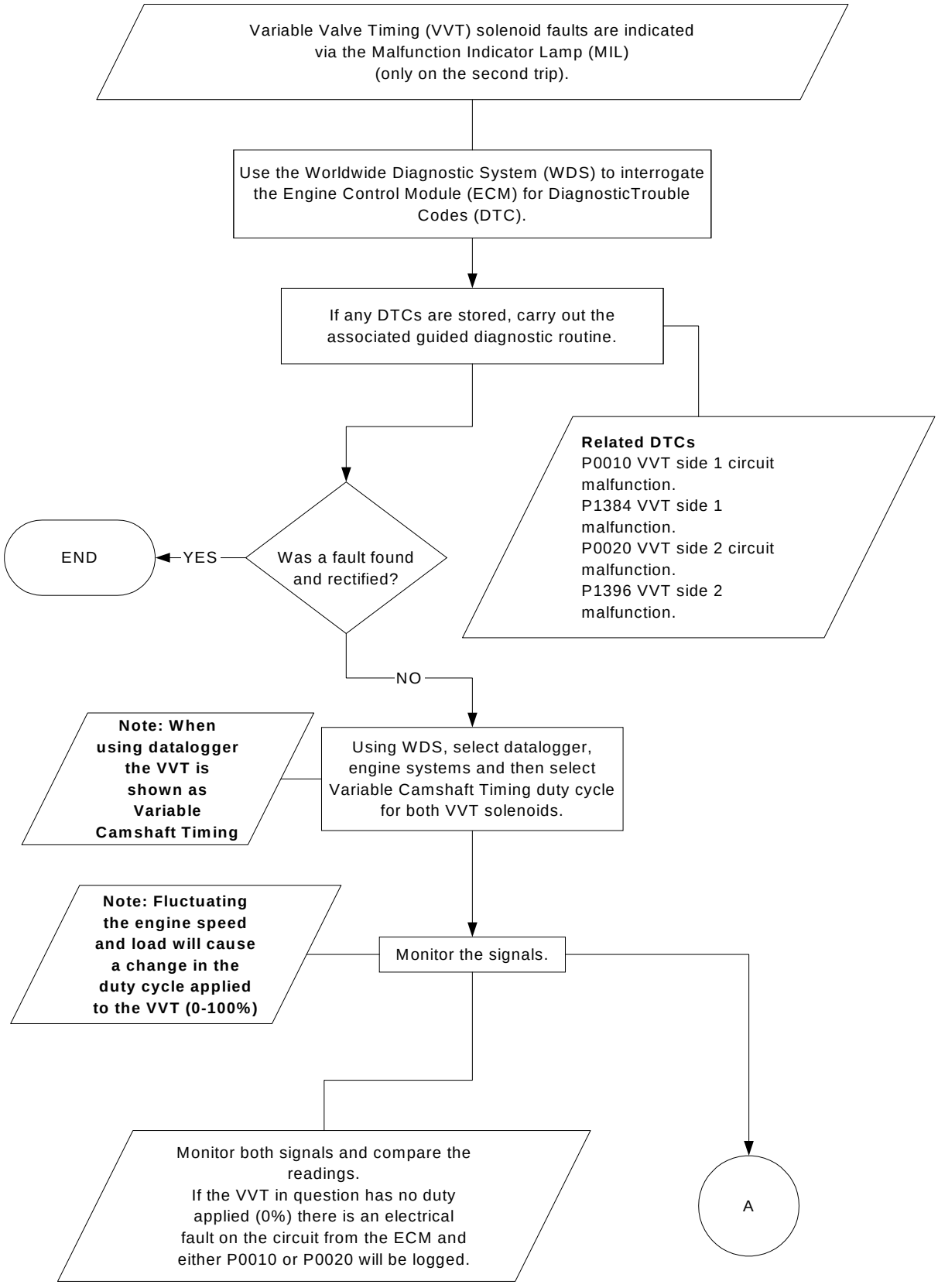
P-7 Cont.


B
If the 5 volt supply has been lost from the ECM, suspect additional sensor fault codes will be logged.
With the ignition 'ON' and using a DMM, check for 5 volt supply at pin 2 and pin 5 of APP electrical connector PA001.
Was the reading as expected?
YES
C
NO
Ensure the ignition is switched 'OFF' and disconnect ECM electrical connector EN016.
See additional information Generic Connector Inspection.
Carry out a Generic Connector Inspection on ECM electrical connector EN016.
Refer to X-TYPE electrical guide.
See additional information Generic Harness Check.
Carry out Generic Harness Check between the APP sensor electrical connector and the ECM electrical connector.
PA001 pin 5 - EN016 pin 13 (Yellow wire),
PA001 pin 2 - EN016 pin 12 (Orange and yellow wire).
Was a fault found and rectified?
YES
END
NO
Contact Technical Hotline for further assistance.

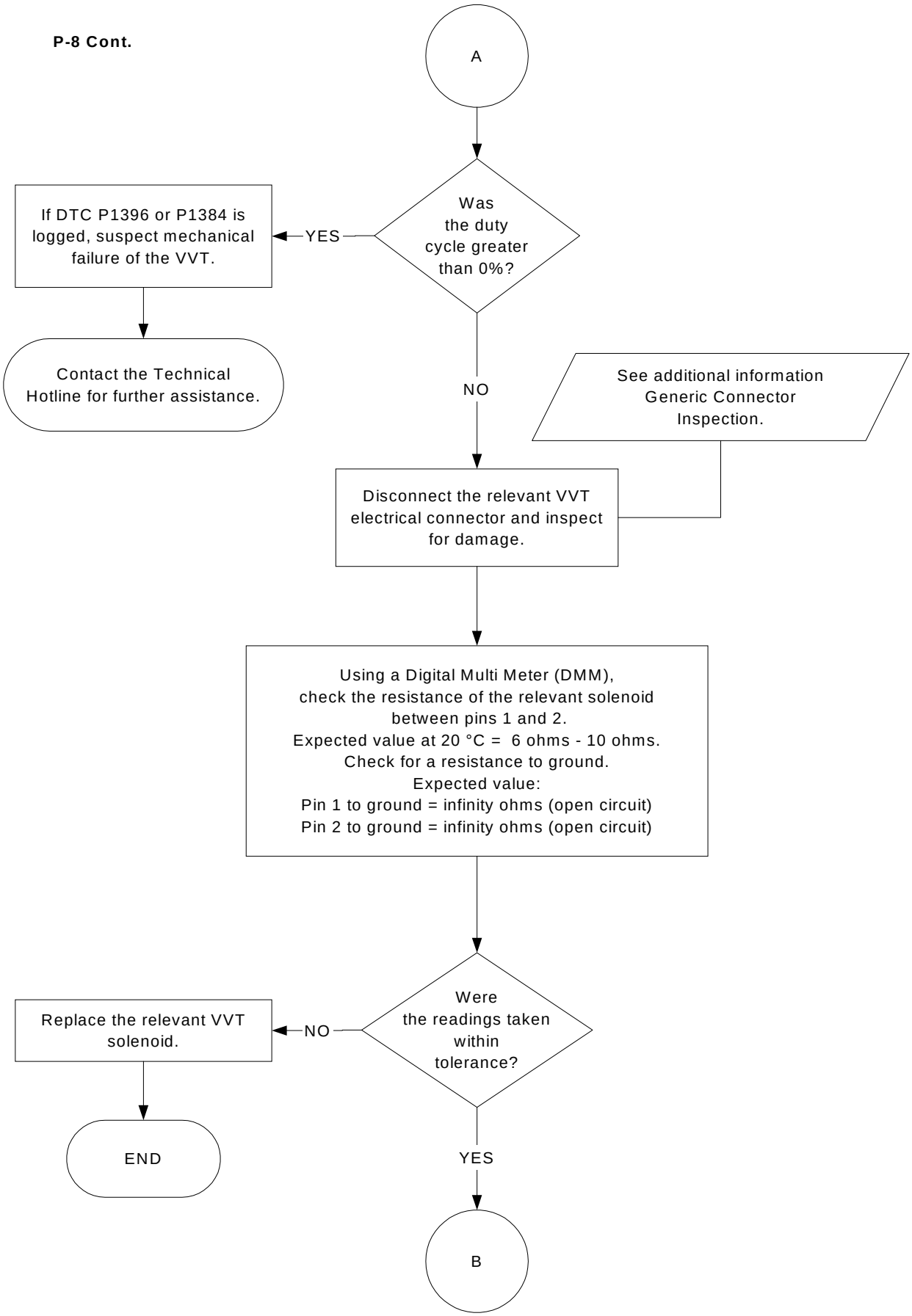
P-7 Cont.


C
Ensure ignition 'OFF' and disconnect ECM electrical connector EN016.
Carry out a Generic Connector Inspection on ECM electrical connector EN016.
See additional information Generic Connector Inspection.
See additional information Generic Harness Check.
Carry out a Generic Harness Check between the APP Sensor electrical connector and the ECM electrical connector.
APP circuit 1.
PA001 pin 4 - EN016 pin 102. (Red wire)
PA001 pin 3 - EN016 pin 20. (Black and Green wire)
APP circuit 2.
PA001 pin 1 - EN016 pin 103. (Yellow wire)
PA001 pin 6 - EN016 pin 19. (Black and Green wire)
Was a fault found and rectified?
YES
END
NO
Contact the Technical Hotline for further assistance.

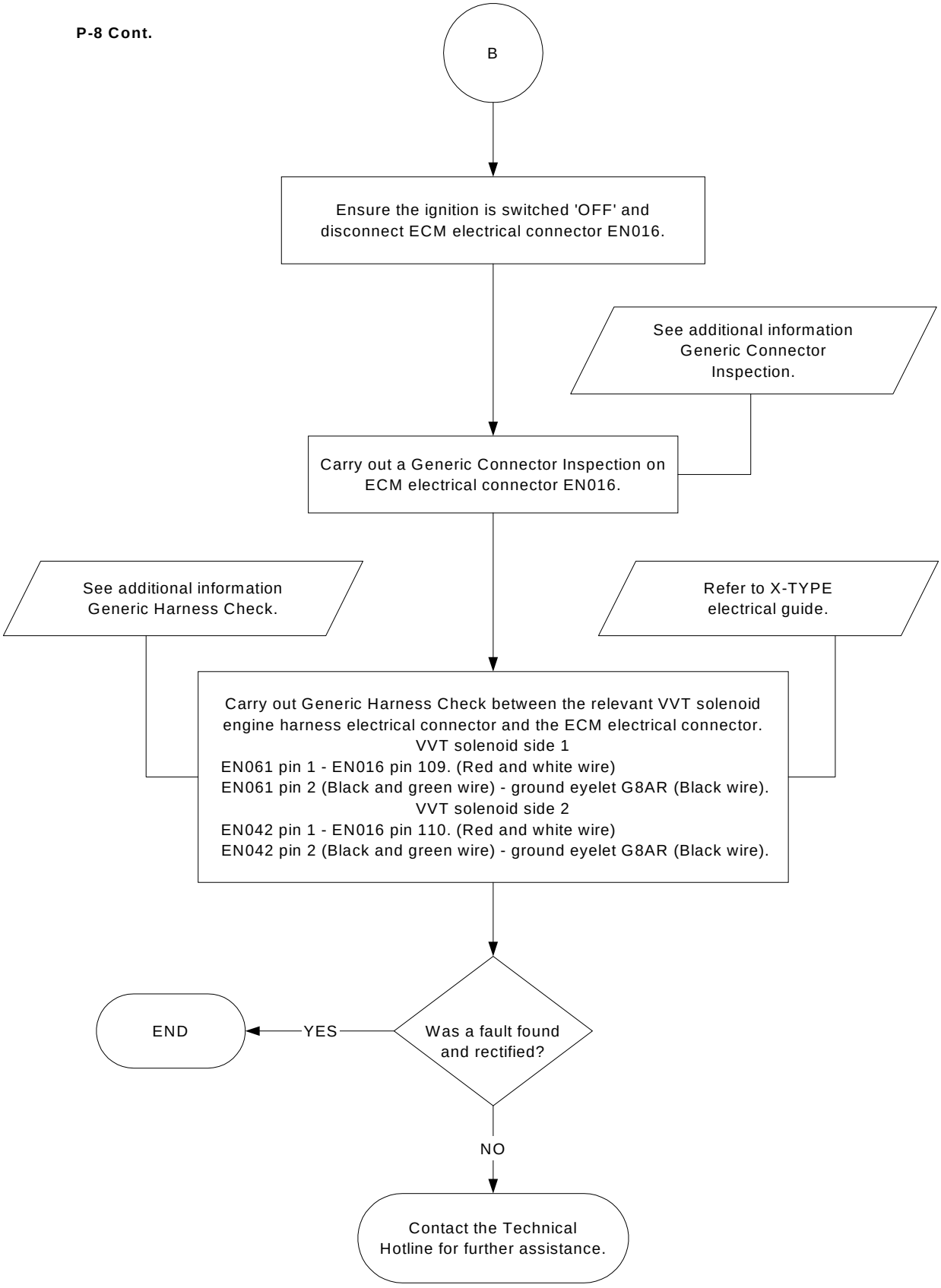
Variable Valve Timing
Flowchart P- 8



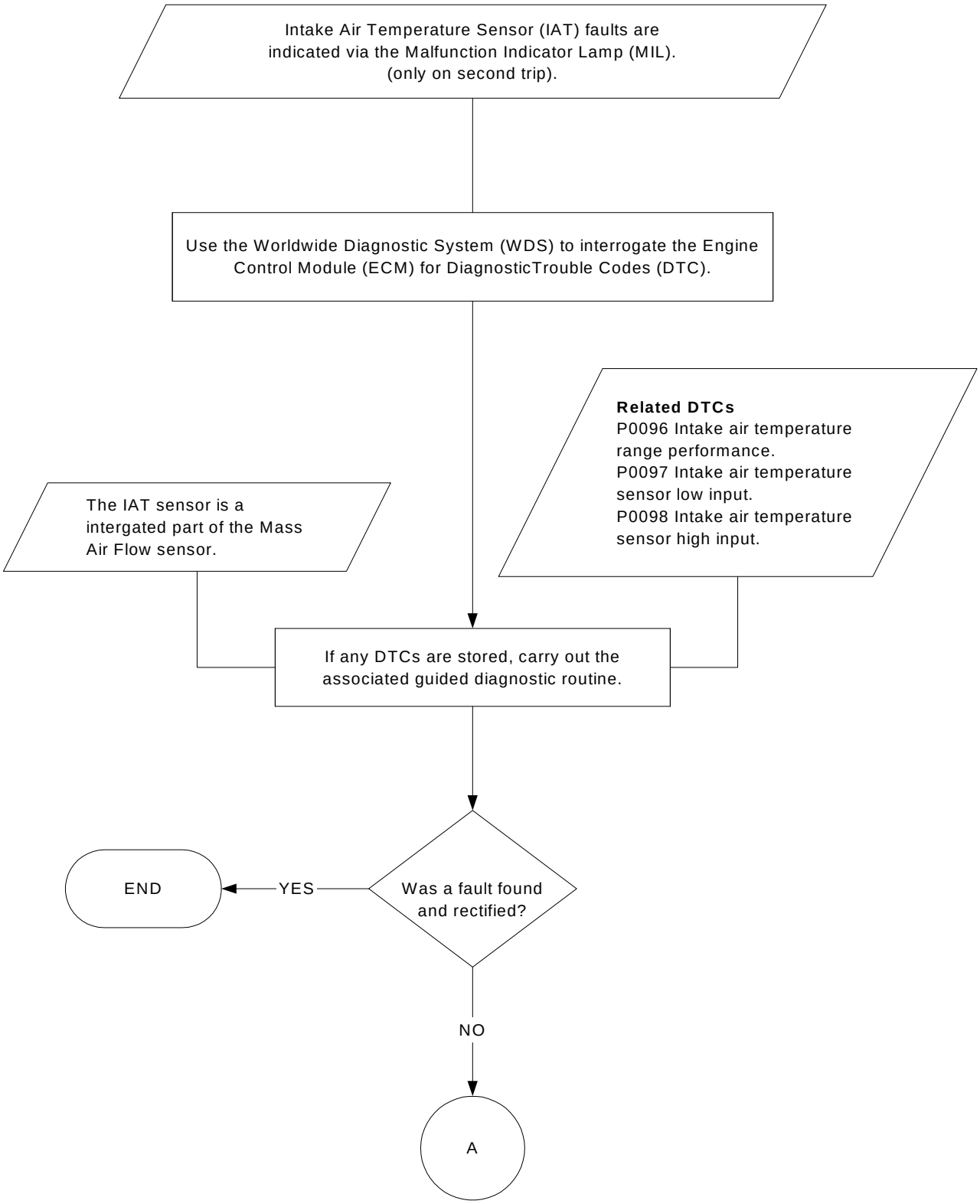
P-8 Cont.


A
Was the duty cycle greater than 0%?
YES
If DTC P1396 or P1384 is logged, suspect mechanical failure of the VVT.
Contact the Technical Hotline for further assistance.
NO
See additional information Generic Connector Inspection.
Disconnect the relevant VVT electrical connector and inspect for damage.
Using a Digital Multi Meter (DMM), check the resistance of the relevant solenoid between pins 1 and 2.
Expected value at 20 °C = 6 ohms - 10 ohms.
Check for a resistance to ground.
Expected value:
Pin 1 to ground = infinity ohms (open circuit)
Pin 2 to ground = infinity ohms (open circuit)
Were the readings taken within tolerance?
NO
Replace the relevant VVT solenoid.
END
YES
B

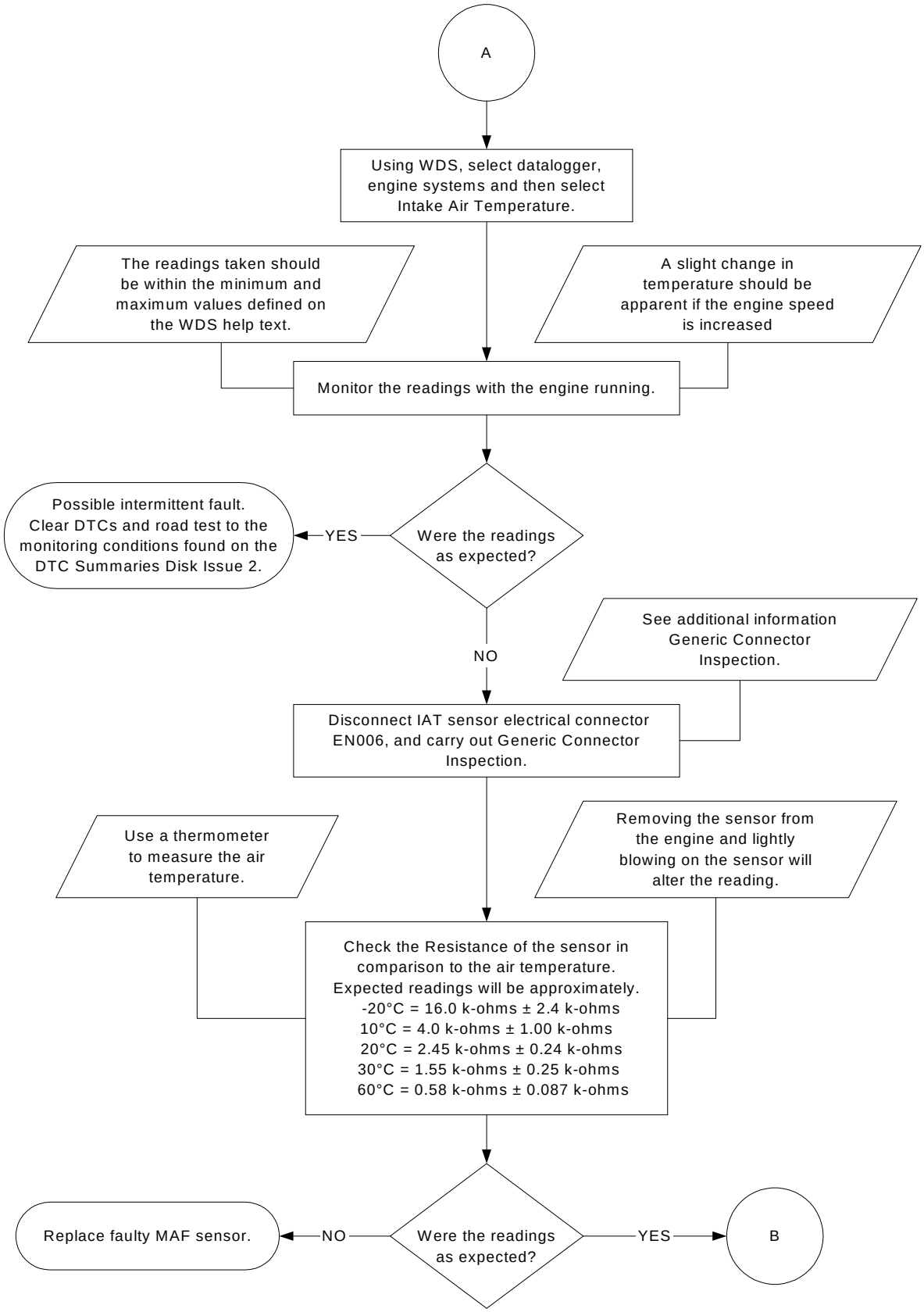
P-8 Cont.


B
Ensure the ignition is switched 'OFF' and disconnect ECM electrical connector EN016.
See additional information Generic Connector Inspection.
Carry out a Generic Connector Inspection on ECM electrical connector EN016.
See additional information Generic Harness Check.
Refer to X-TYPE electrical guide.
Carry out Generic Harness Check between the relevant VVT solenoid engine harness electrical connector and the ECM electrical connector.
VVT solenoid side 1
EN061 pin 1 - EN016 pin 109. (Red and white wire)
EN061 pin 2 (Black and green wire) - ground eyelet G8AR (Black wire).
VVT solenoid side 2
EN042 pin 1 - EN016 pin 110. (Red and white wire)
EN042 pin 2 (Black and green wire) - ground eyelet G8AR (Black wire).
Was a fault found and rectified?
YES
END
NO
Contact the Technical Hotline for further assistance.

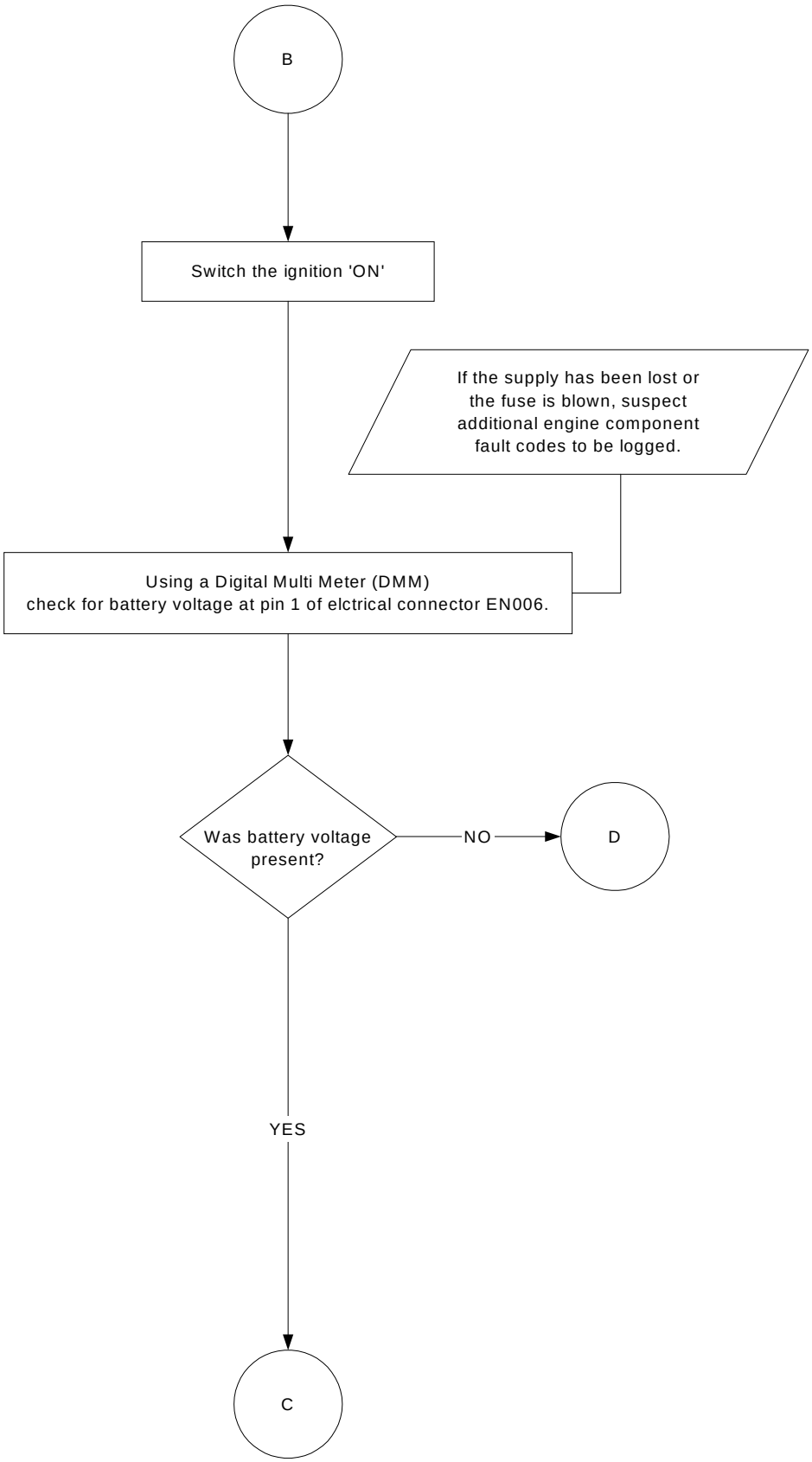
Intake Air Temperature Sensor
Flowchart P- 9



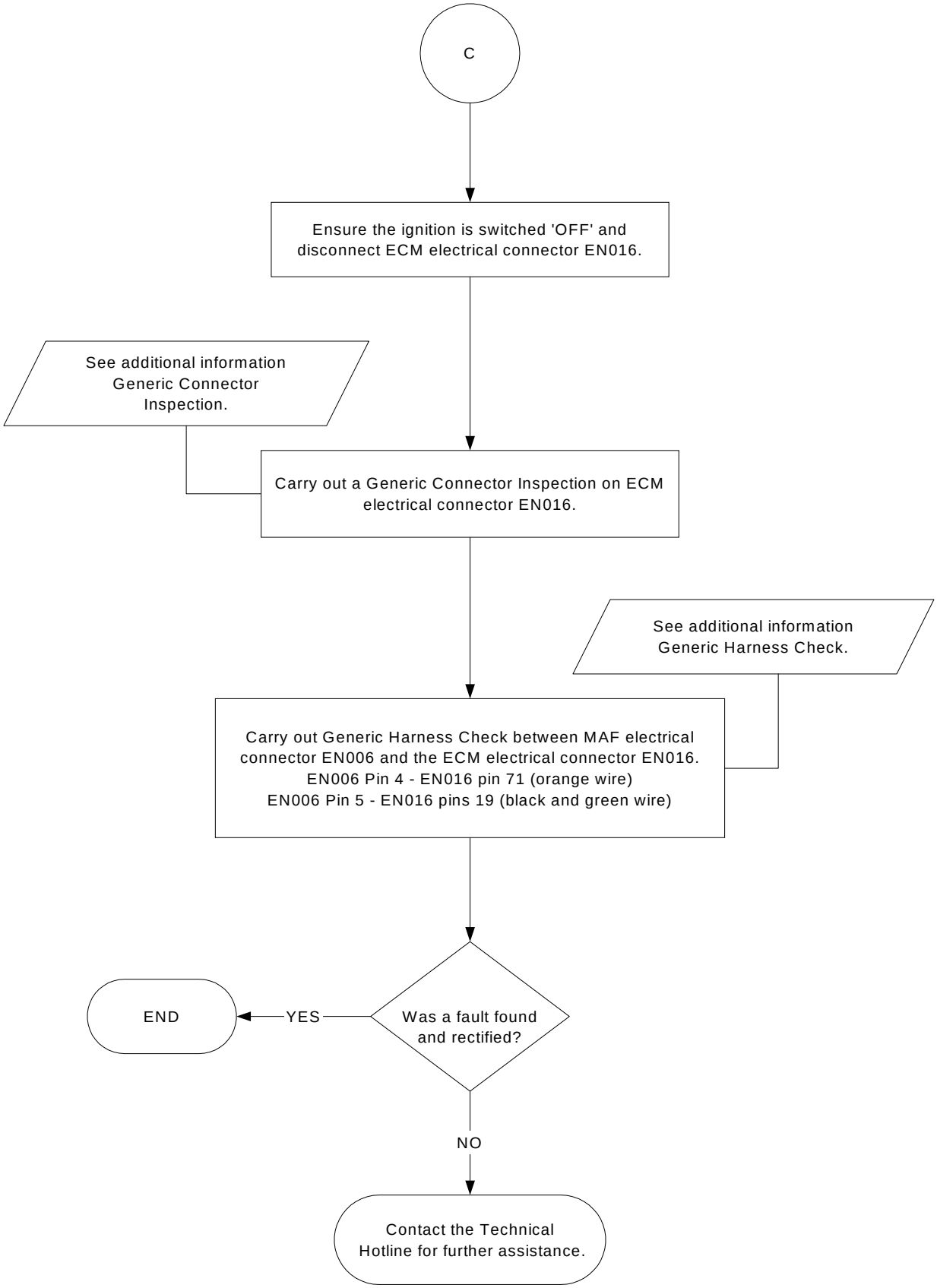
P-9 Cont.


A
Using WDS, select datalogger, engine systems and then select Intake Air Temperature.
The readings taken should be within the minimum and maximum values defined on the WDS help text.
A slight change in temperature should be apparent if the engine speed is increased
Monitor the readings with the engine running.
Were the readings as expected?
YES
Possible intermittent fault. Clear DTCs and road test to the monitoring conditions found on the DTC Summaries Disk Issue 2.
NO
See additional information Generic Connector Inspection.
Disconnect IAT sensor electrical connector EN006, and carry out Generic Connector Inspection.
Use a thermometer to measure the air temperature.
Removing the sensor from the engine and lightly blowing on the sensor will alter the reading.
Check the Resistance of the sensor in comparison to the air temperature.
Expected readings will be approximately.
-20°C = 16.0 k-ohms ± 2.4 k-ohms
10°C = 4.0 k-ohms ± 1.00 k-ohms
20°C = 2.45 k-ohms ± 0.24 k-ohms
30°C = 1.55 k-ohms ± 0.25 k-ohms
60°C = 0.58 k-ohms ± 0.087 k-ohms
Were the readings as expected?
NO
Replace faulty MAF sensor.
YES
B

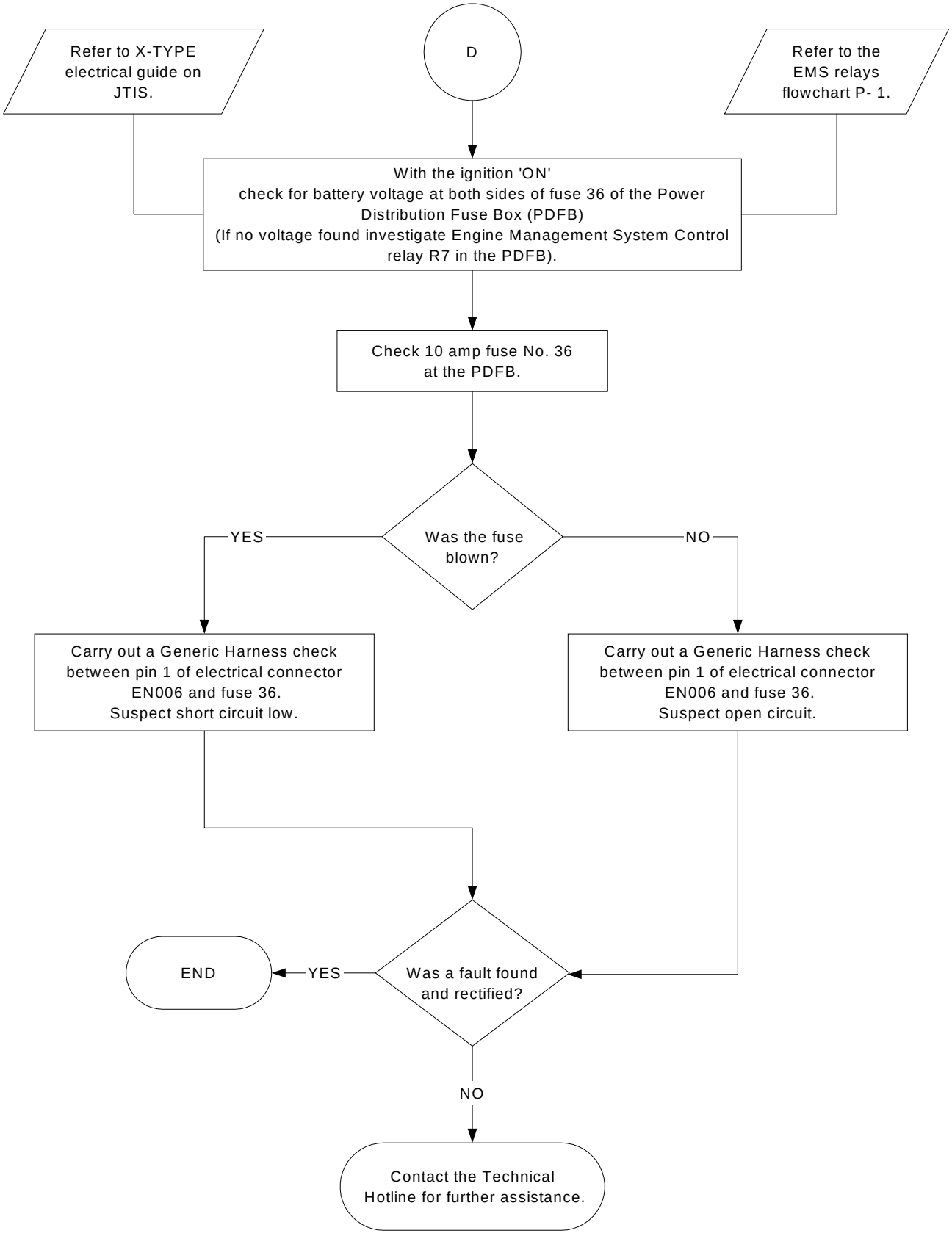
P-9 Cont.


B
Switch the ignition 'ON'
If the supply has been lost or the fuse is blown, suspect additional engine component fault codes to be logged.
Using a Digital Multi Meter (DMM) check for battery voltage at pin 1 of elctrical connector EN006.
Was battery voltage present?
NO
D
YES
C

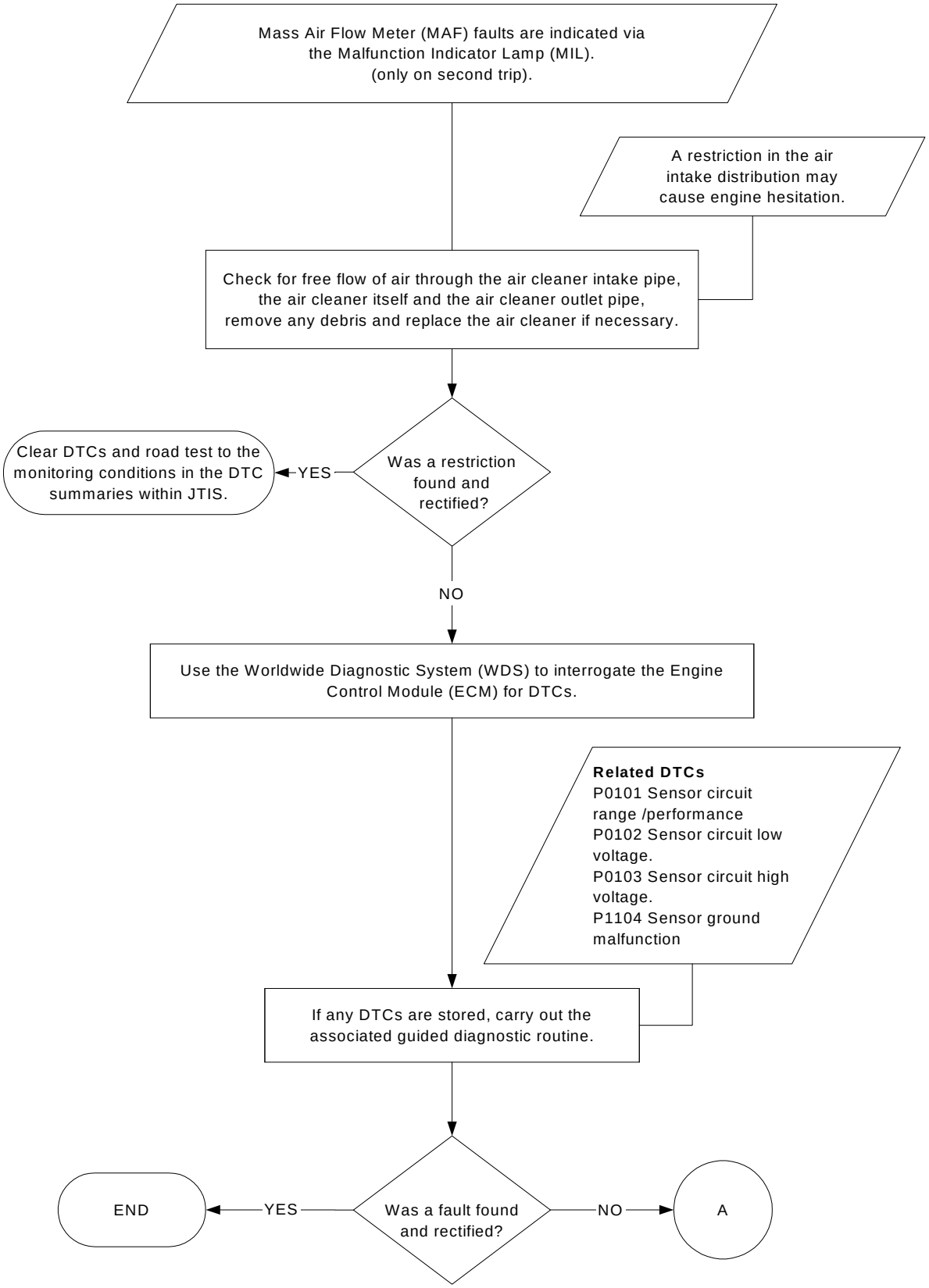
P-9 Cont.


C
Ensure the ignition is switched 'OFF' and disconnect ECM electrical connector EN016.
See additional information Generic Connector Inspection.
Carry out a Generic Connector Inspection on ECM electrical connector EN016.
See additional information Generic Harness Check.
Carry out Generic Harness Check between MAF electrical connector EN006 and the ECM electrical connector EN016.
EN006 Pin 4 - EN016 pin 71 (orange wire)
EN006 Pin 5 - EN016 pins 19 (black and green wire)
Was a fault found and rectified?
YES
END
NO
Contact the Technical Hotline for further assistance.

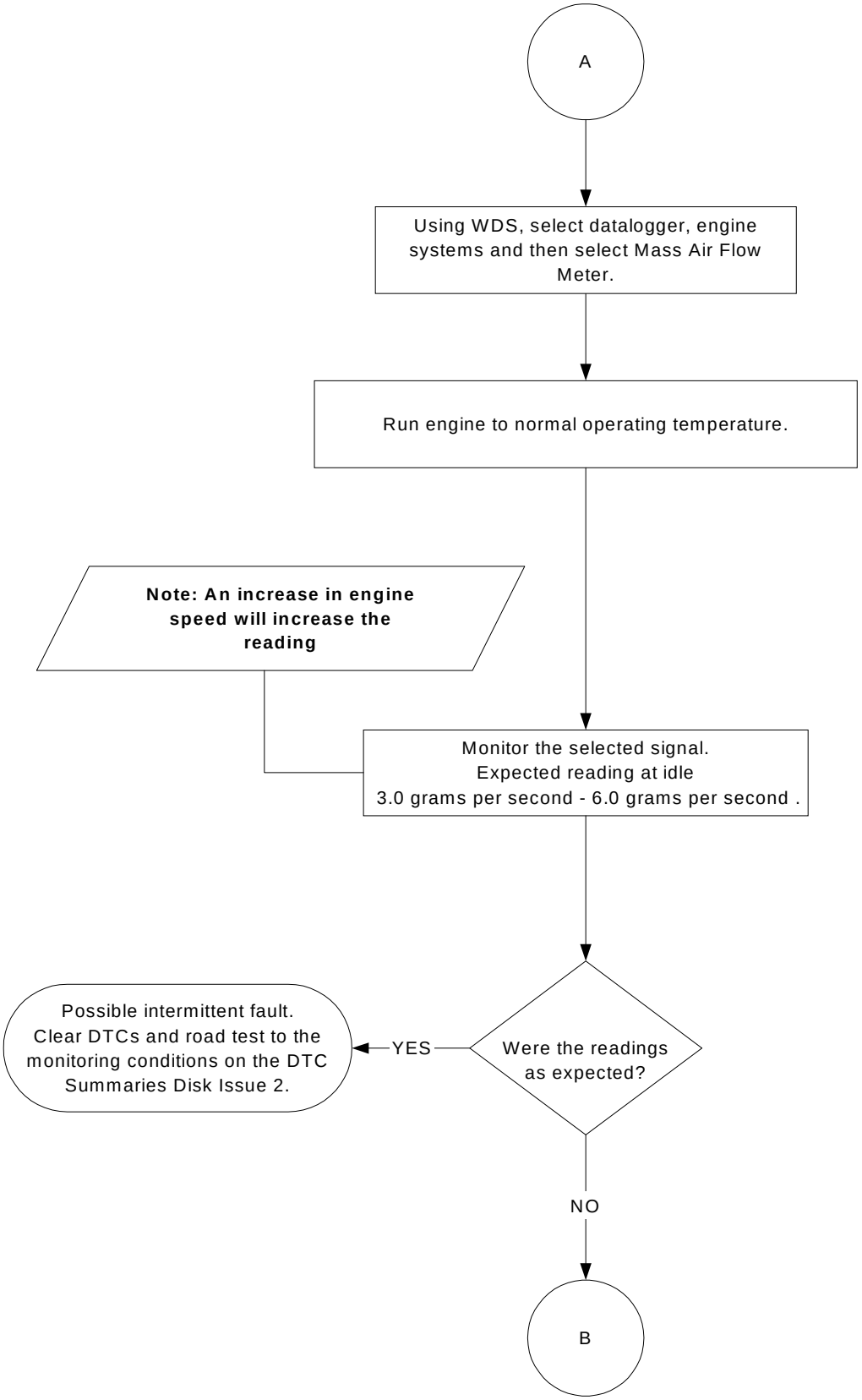
P-9 Cont.


Refer to X-TYPE electrical guide on JTIS.
D
Refer to the EMS relays flowchart P- 1.
With the ignition 'ON' check for battery voltage at both sides of fuse 36 of the Power Distribution Fuse Box (PDFB) (If no voltage found investigate Engine Management System Control relay R7 in the PDFB).
Check 10 amp fuse No. 36 at the PDFB.
Was the fuse blown?
YES
NO
Carry out a Generic Harness check between pin 1 of electrical connector EN006 and fuse 36. Suspect short circuit low.
Carry out a Generic Harness check between pin 1 of electrical connector EN006 and fuse 36. Suspect open circuit.
Was a fault found and rectified?
YES
END
NO
Contact the Technical Hotline for further assistance.

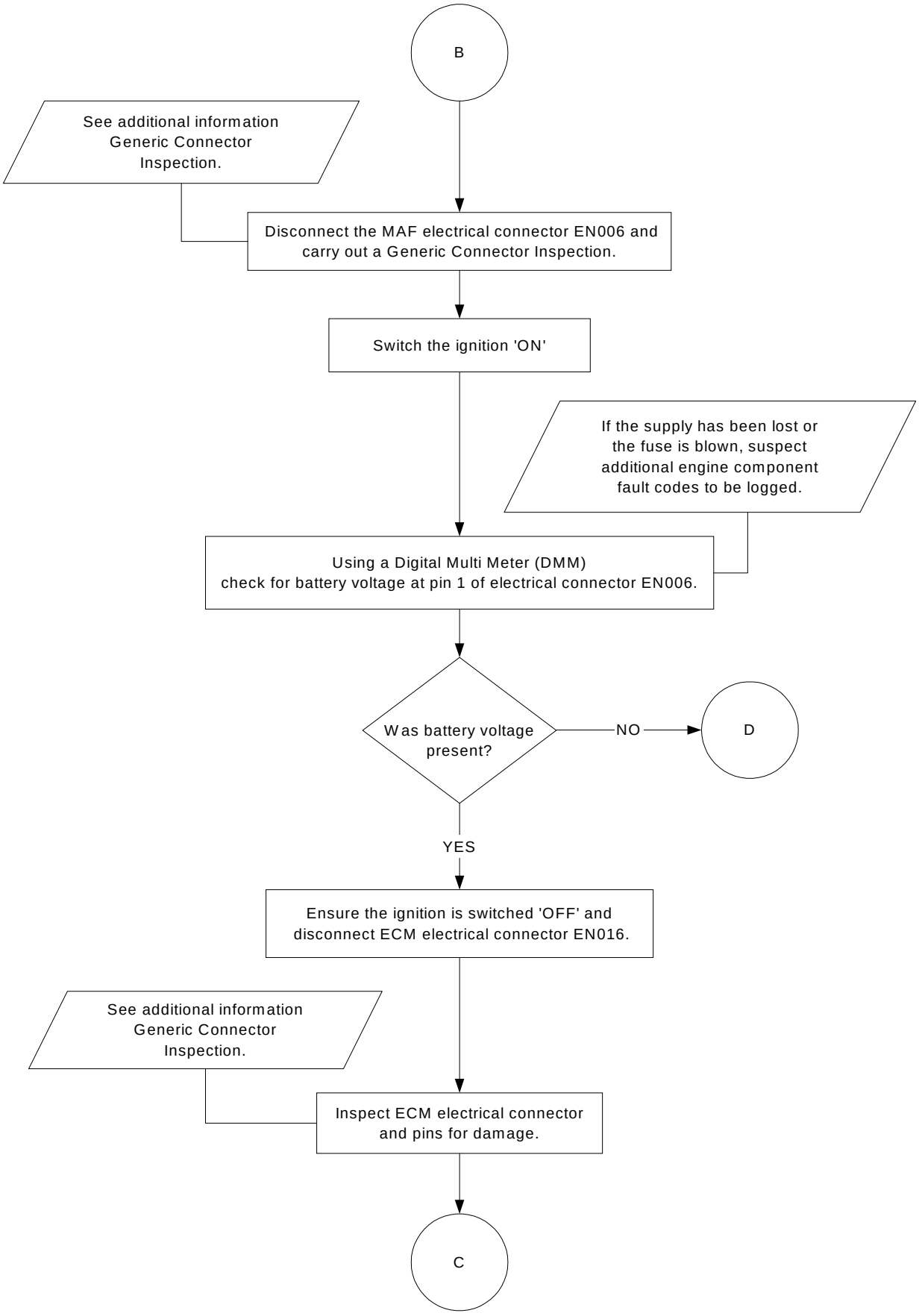
Mass Air Flow Meter
Flowchart P- 10



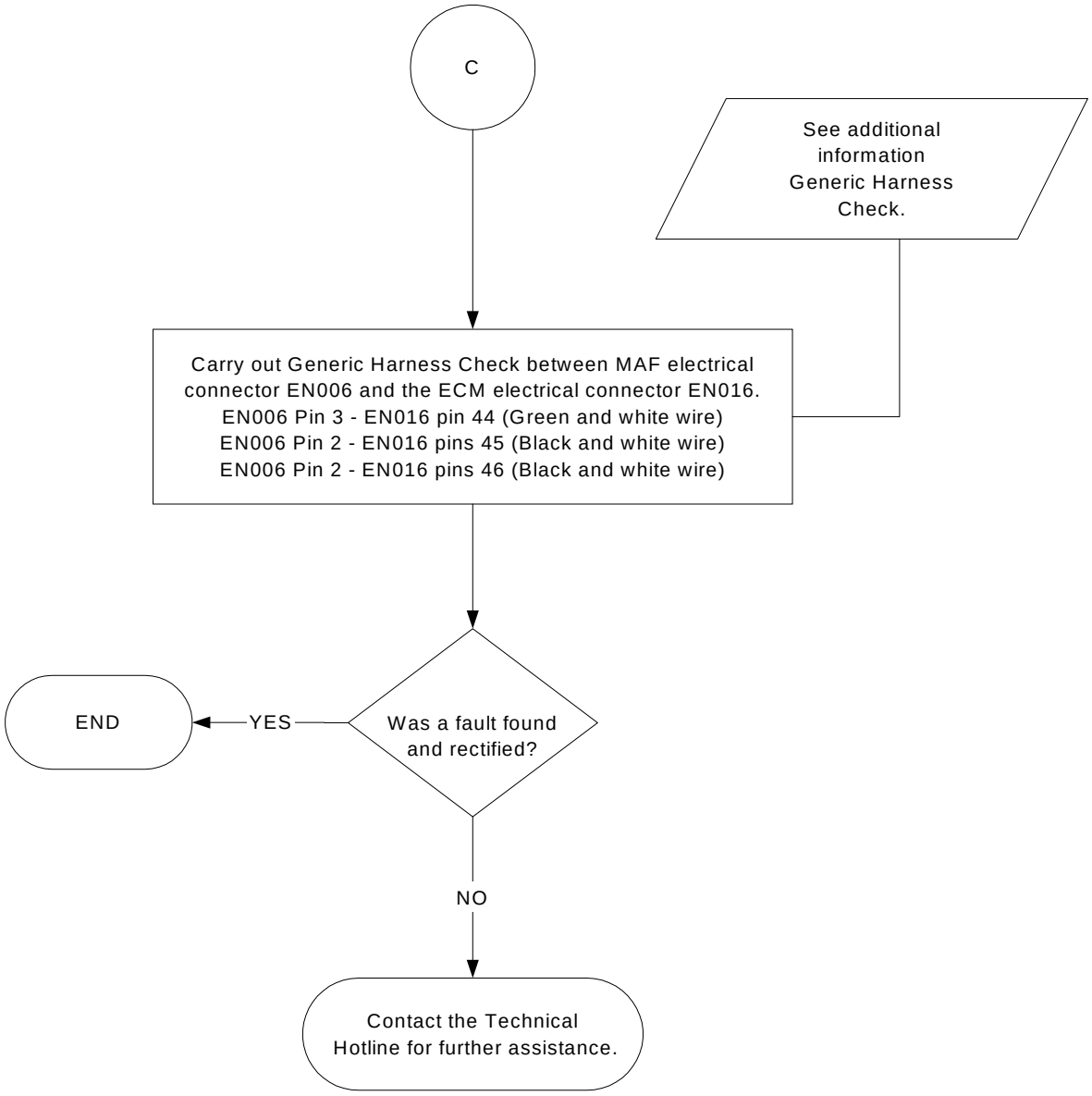
P-10 Cont.


A
Using WDS, select datalogger, engine systems and then select Mass Air Flow Meter.
Run engine to normal operating temperature.
Note: An increase in engine speed will increase the reading
Monitor the selected signal.
Expected reading at idle
3.0 grams per second - 6.0 grams per second .
Were the readings as expected?
YES
Possible intermittent fault.
Clear DTCs and road test to the monitoring conditions on the DTC Summaries Disk Issue 2.
NO
B

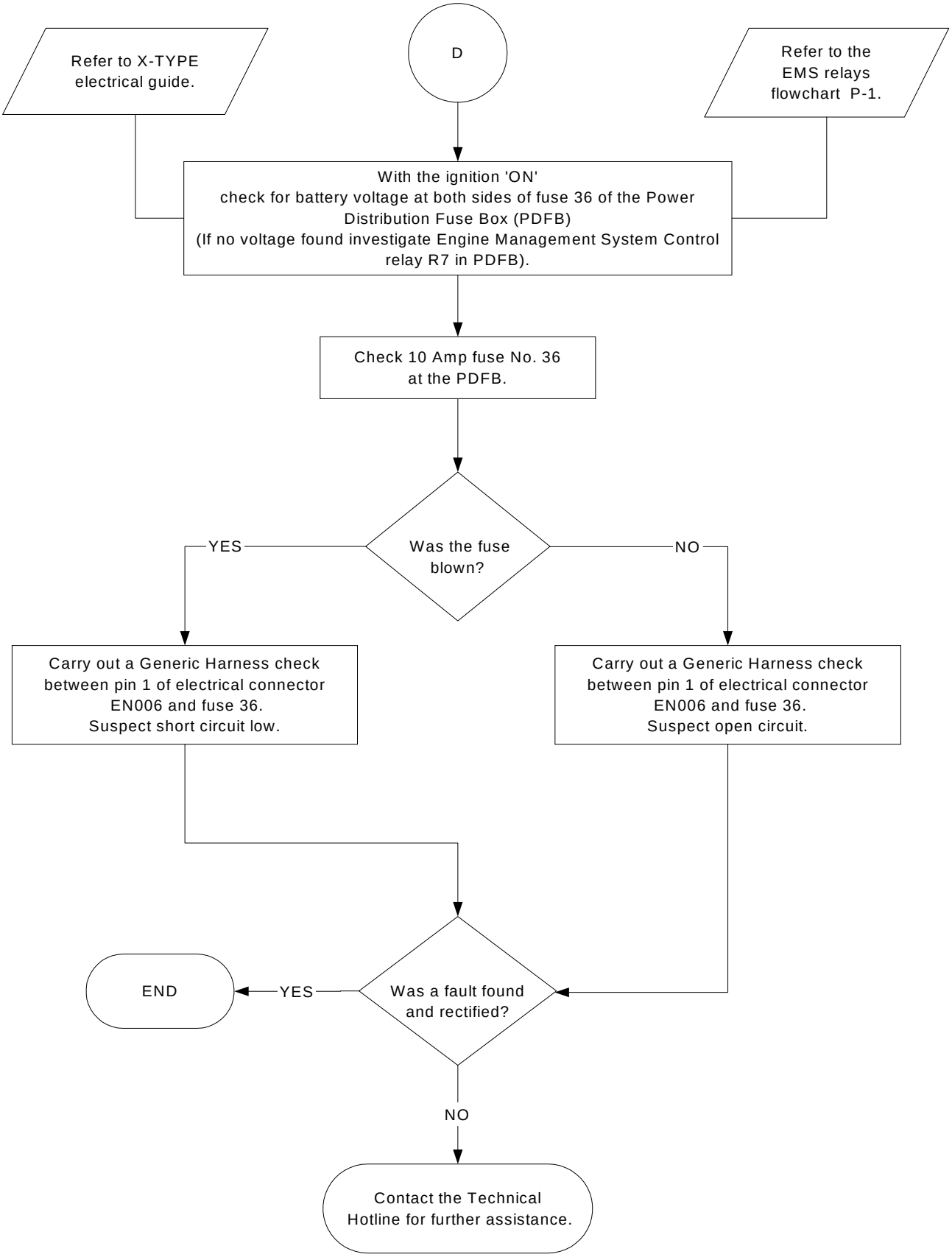
P-10 Cont.


B
See additional information Generic Connector Inspection.
Disconnect the MAF electrical connector EN006 and carry out a Generic Connector Inspection.
Switch the ignition 'ON'
If the supply has been lost or the fuse is blown, suspect additional engine component fault codes to be logged.
Using a Digital Multi Meter (DMM) check for battery voltage at pin 1 of electrical connector EN006.
Was battery voltage present?
NO
D
YES
Ensure the ignition is switched 'OFF' and disconnect ECM electrical connector EN016.
See additional information Generic Connector Inspection.
Inspect ECM electrical connector and pins for damage.
C

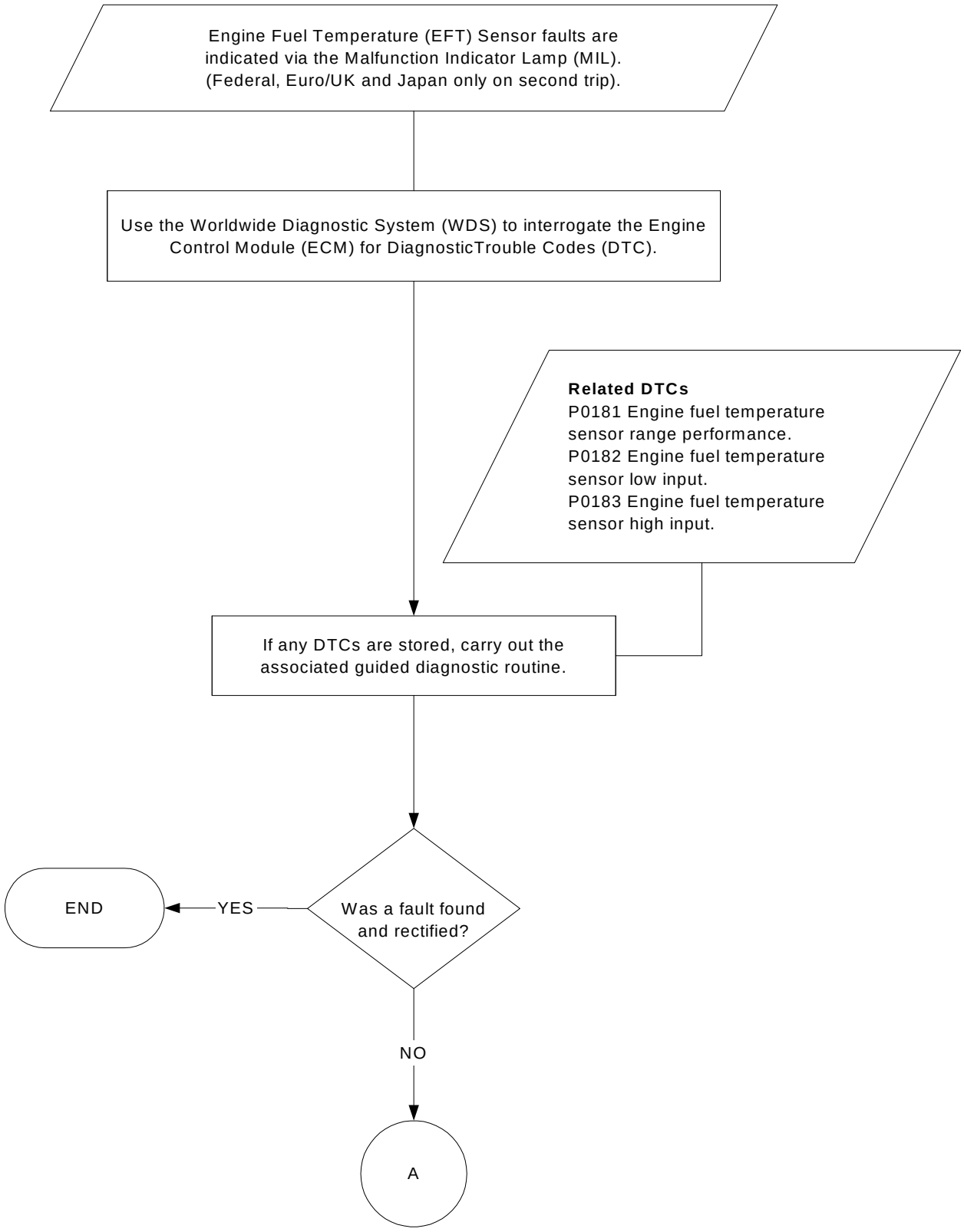
P-10 Cont.


C
See additional information Generic Harness Check.
Carry out Generic Harness Check between MAF electrical connector EN006 and the ECM electrical connector EN016.
EN006 Pin 3 - EN016 pin 44 (Green and white wire)
EN006 Pin 2 - EN016 pins 45 (Black and white wire)
EN006 Pin 2 - EN016 pins 46 (Black and white wire)
Was a fault found and rectified?
YES
END
NO
Contact the Technical Hotline for further assistance.

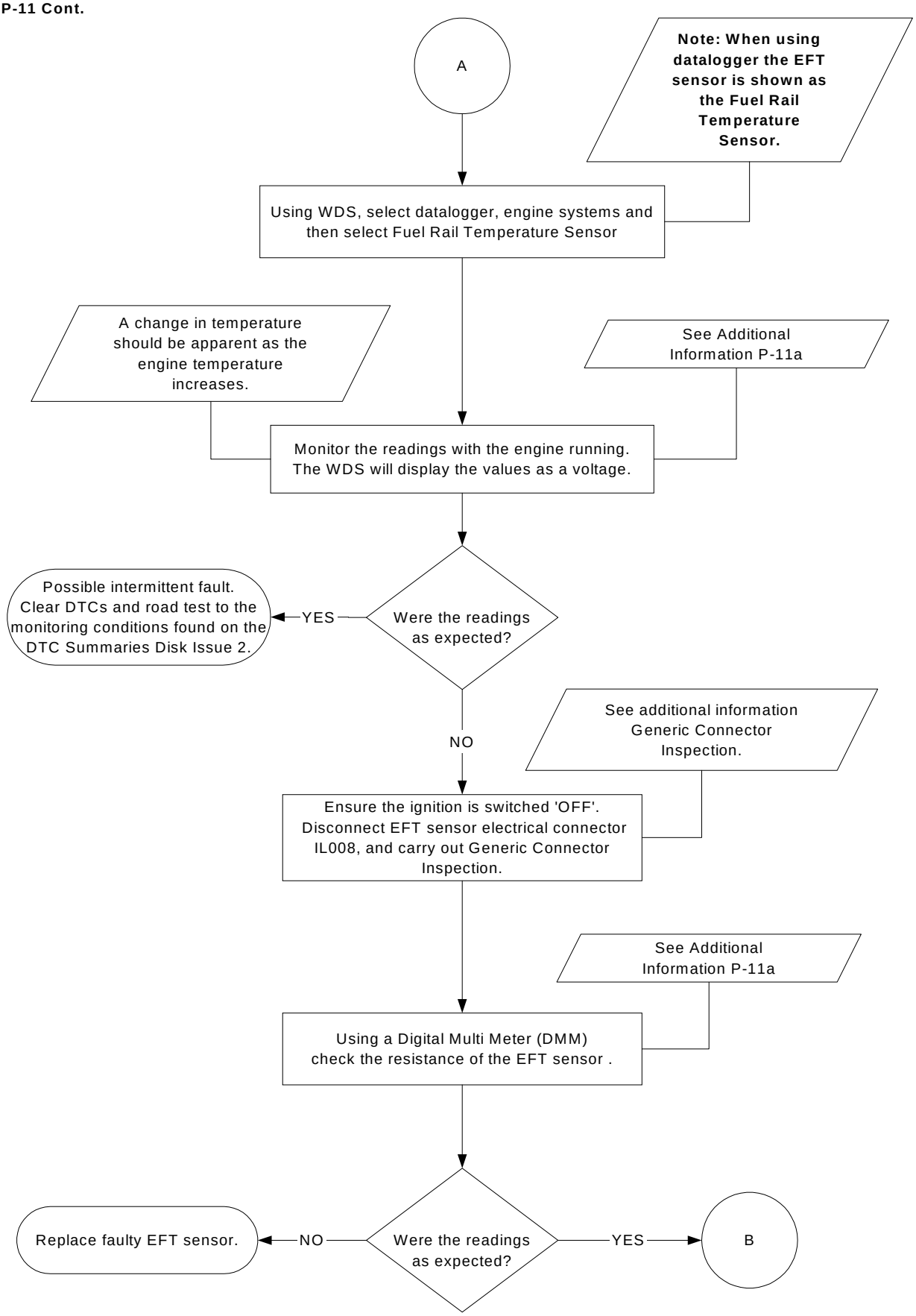
P-10 Cont.


Refer to X-TYPE electrical guide.
D
Refer to the EMS relays flowchart P-1.
With the ignition 'ON' check for battery voltage at both sides of fuse 36 of the Power Distribution Fuse Box (PDFB) (If no voltage found investigate Engine Management System Control relay R7 in PDFB).
Check 10 Amp fuse No. 36 at the PDFB.
Was the fuse blown?
YES
NO
Carry out a Generic Harness check between pin 1 of electrical connector EN006 and fuse 36. Suspect short circuit low.
Carry out a Generic Harness check between pin 1 of electrical connector EN006 and fuse 36. Suspect open circuit.
Was a fault found and rectified?
YES
END
NO
Contact the Technical Hotline for further assistance.

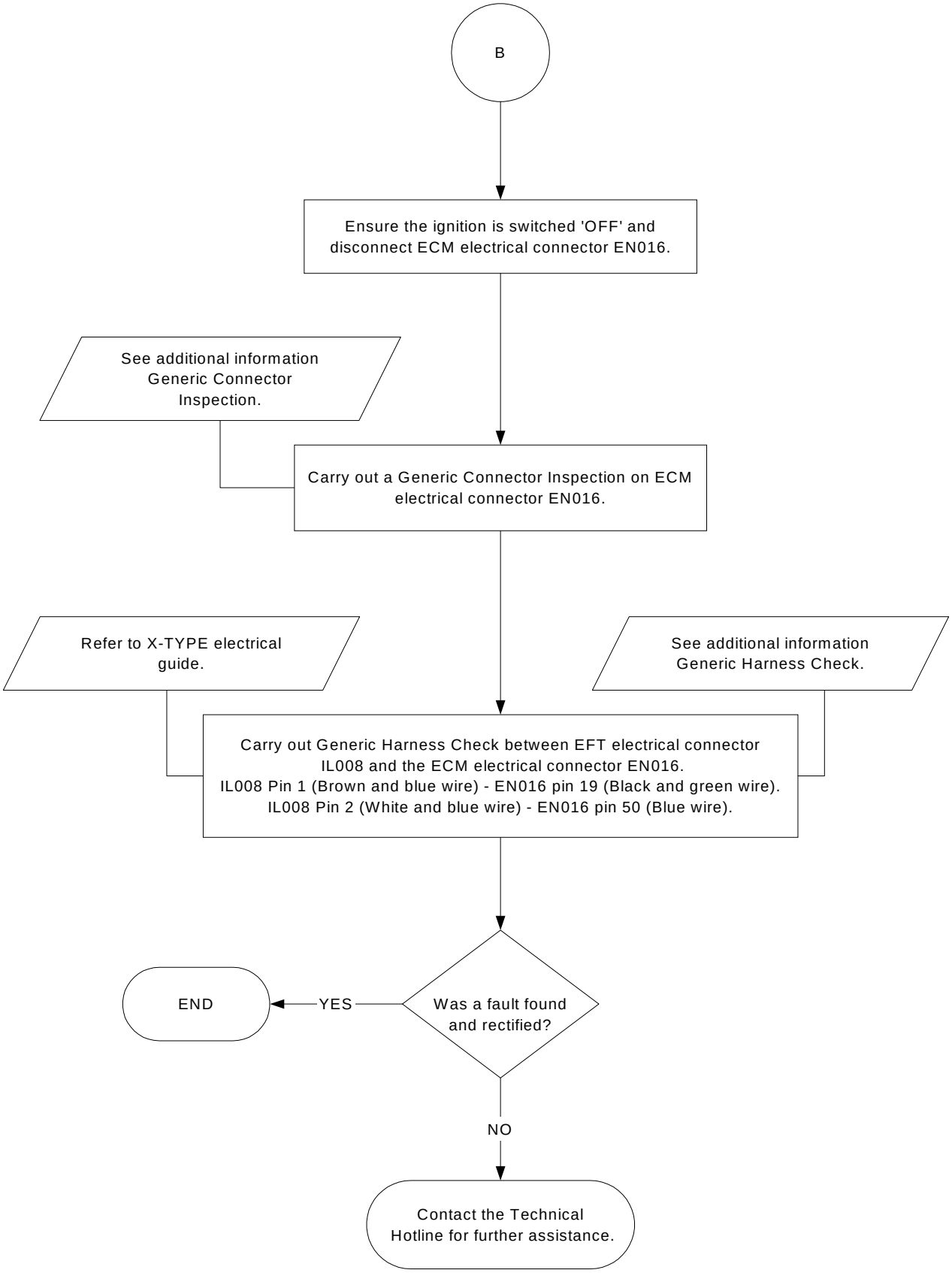
Engine Fuel Temperature Sensor
Flowchart P-11



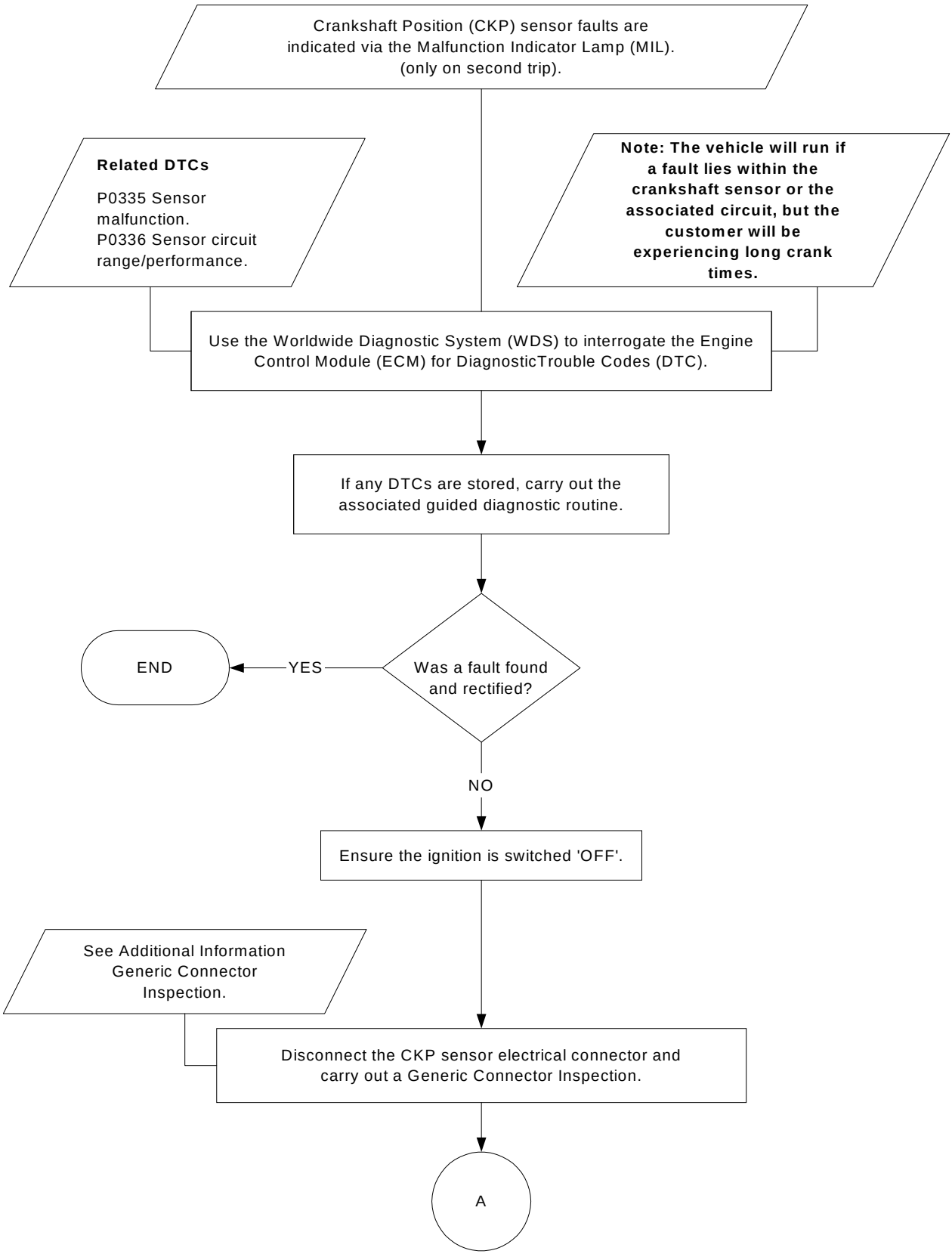
P-11 Cont.


A
Note: When using datalogger the EFT sensor is shown as the Fuel Rail Temperature Sensor.
Using WDS, select datalogger, engine systems and then select Fuel Rail Temperature Sensor
A change in temperature should be apparent as the engine temperature increases.
See Additional Information P-11a
Monitor the readings with the engine running. The WDS will display the values as a voltage.
Were the readings as expected?
YES
Possible intermittent fault. Clear DTCs and road test to the monitoring conditions found on the DTC Summaries Disk Issue 2.
NO
See additional information Generic Connector Inspection.
Ensure the ignition is switched 'OFF'. Disconnect EFT sensor electrical connector IL008, and carry out Generic Connector Inspection.
See Additional Information P-11a
Using a Digital Multi Meter (DMM) check the resistance of the EFT sensor .
Were the readings as expected?
NO
Replace faulty EFT sensor.
YES
B

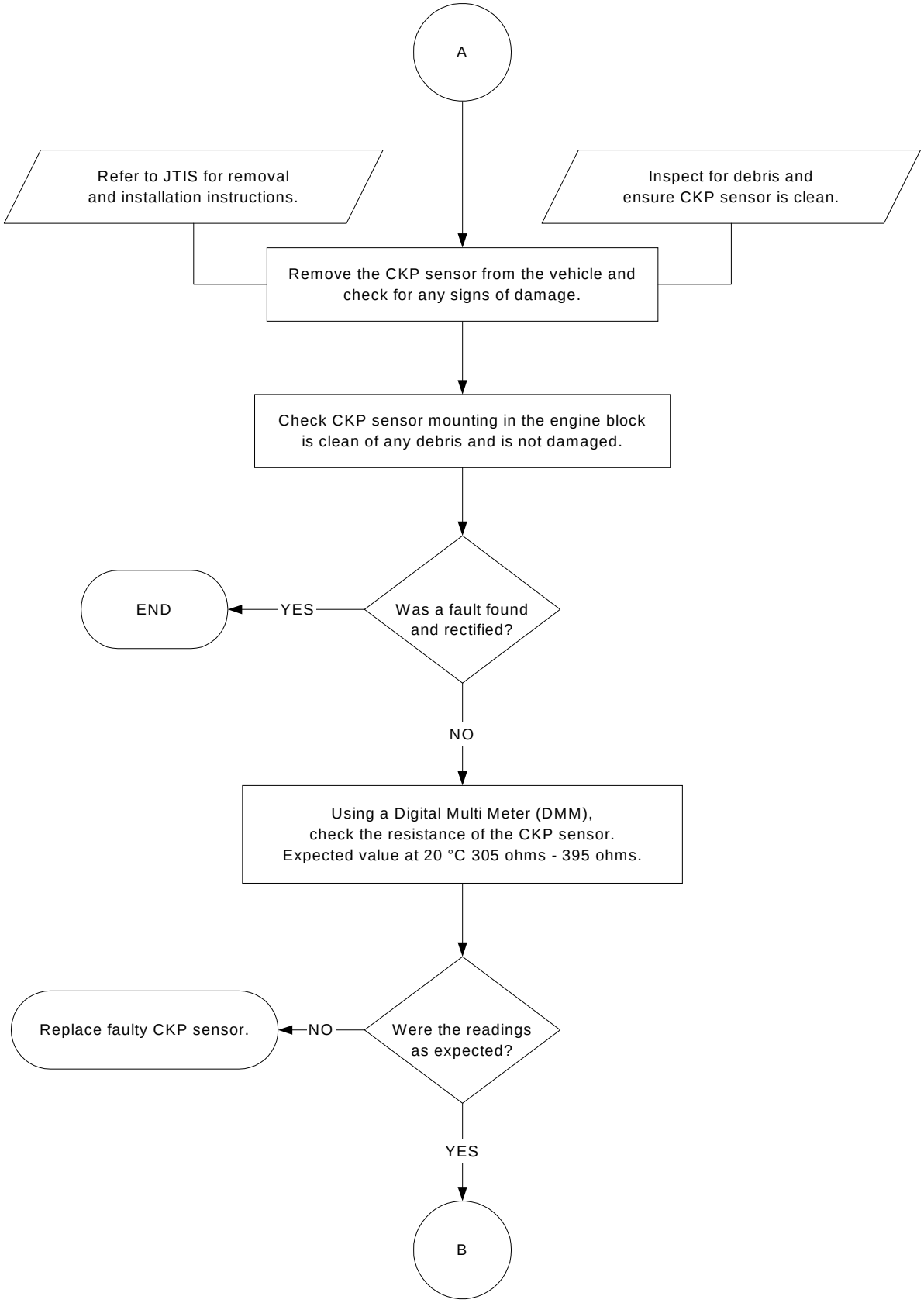
P-11 Cont.


B
Ensure the ignition is switched 'OFF' and disconnect ECM electrical connector EN016.
See additional information Generic Connector Inspection.
Carry out a Generic Connector Inspection on ECM electrical connector EN016.
Refer to X-TYPE electrical guide.
See additional information Generic Harness Check.
Carry out Generic Harness Check between EFT electrical connector IL008 and the ECM electrical connector EN016.
IL008 Pin 1 (Brown and blue wire) - EN016 pin 19 (Black and green wire).
IL008 Pin 2 (White and blue wire) - EN016 pin 50 (Blue wire).
Was a fault found and rectified?
YES
END
NO
Contact the Technical Hotline for further assistance.

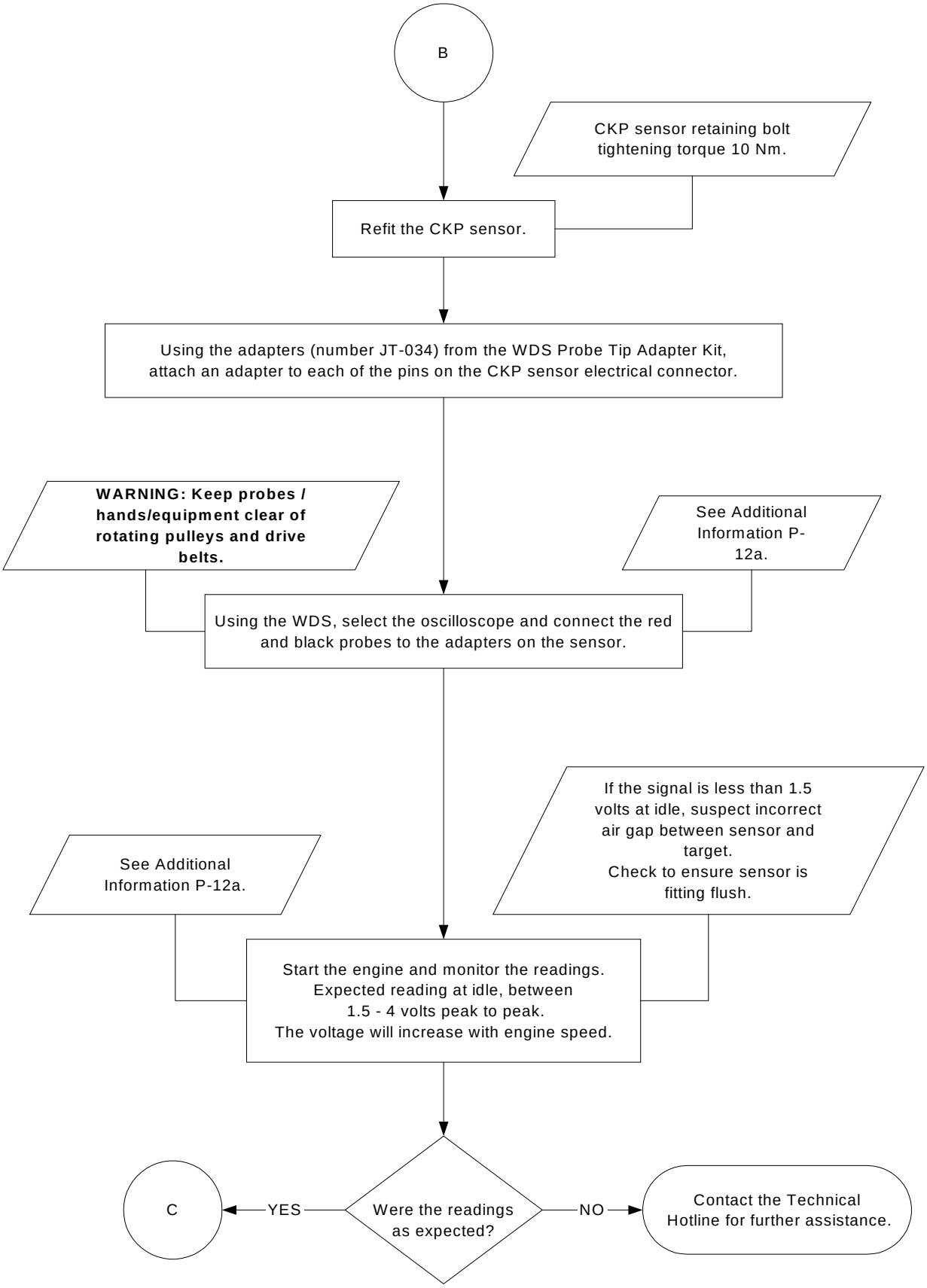
Crankshaft Position Sensor
Flowchart P-12



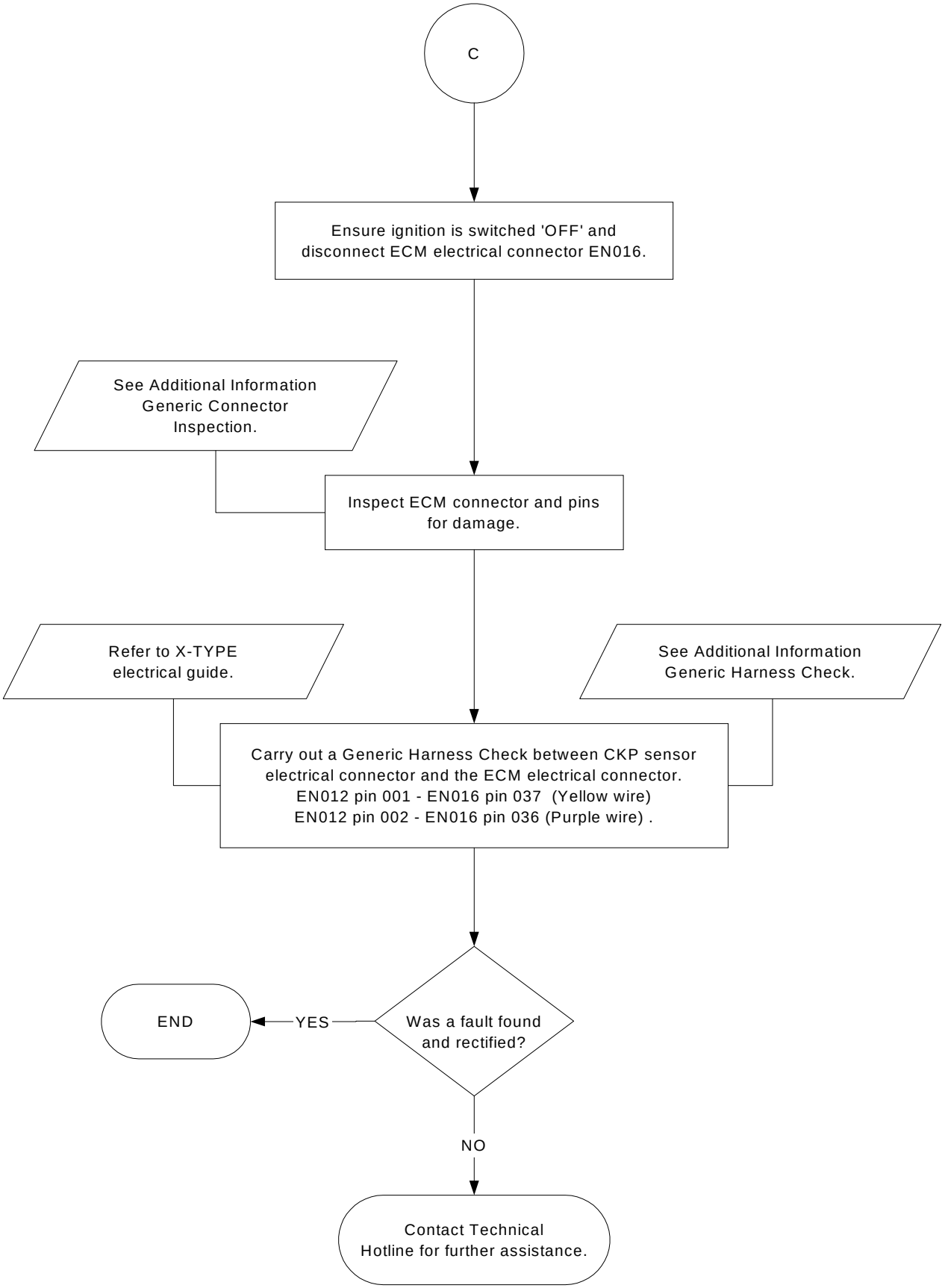
P-12 Cont.


A
Refer to JTIS for removal and installation instructions.
Inspect for debris and ensure CKP sensor is clean.
Remove the CKP sensor from the vehicle and check for any signs of damage.
Check CKP sensor mounting in the engine block is clean of any debris and is not damaged.
Was a fault found and rectified?
YES
END
NO
Using a Digital Multi Meter (DMM), check the resistance of the CKP sensor. Expected value at 20 °C 305 ohms - 395 ohms.
Were the readings as expected?
NO
Replace faulty CKP sensor.
YES
B

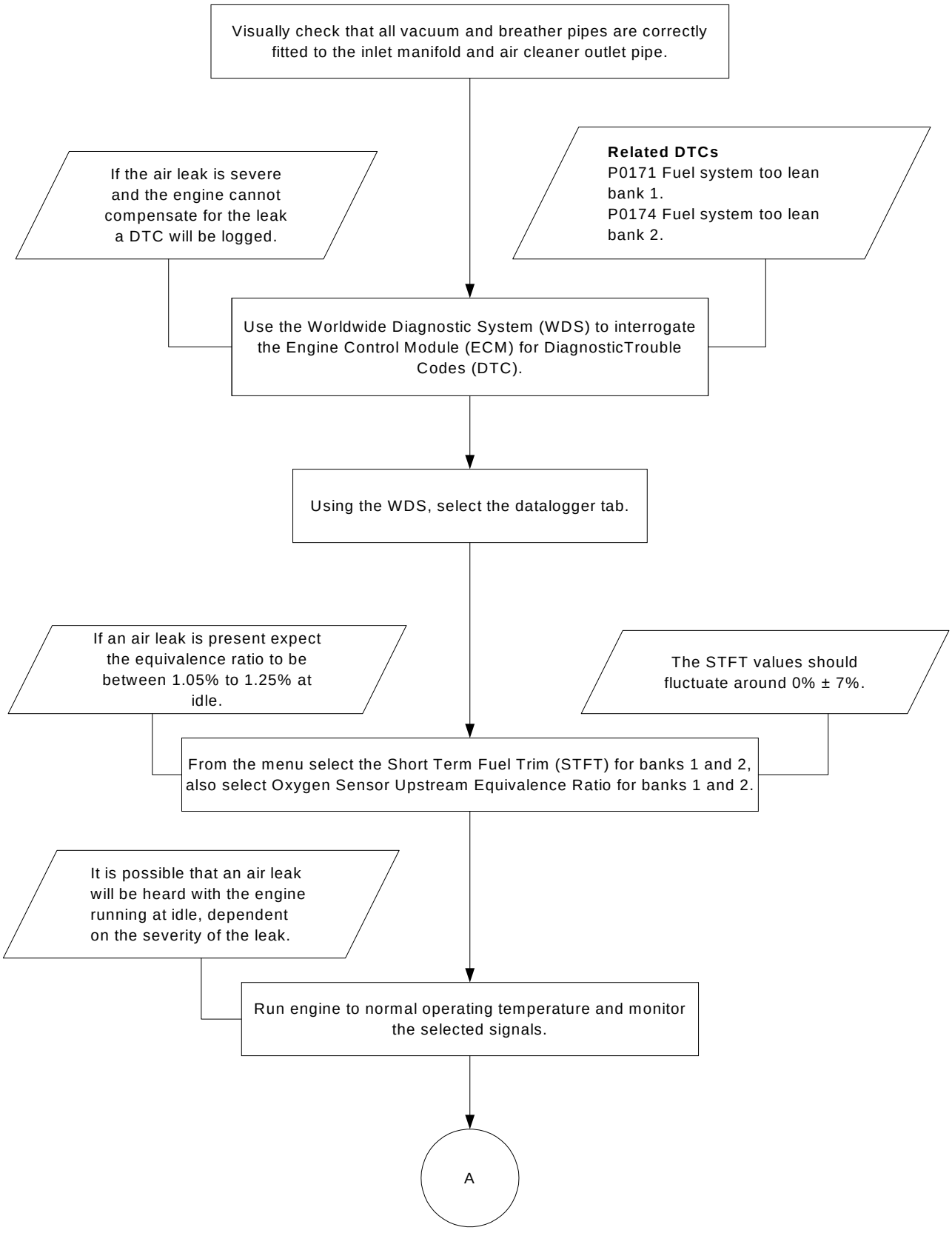
P-12 Cont.


B
CKP sensor retaining bolt tightening torque 10 Nm.
Refit the CKP sensor.
Using the adapters (number JT-034) from the WDS Probe Tip Adapter Kit, attach an adapter to each of the pins on the CKP sensor electrical connector.
WARNING: Keep probes / hands/equipment clear of rotating pulleys and drive belts.
See Additional Information P-12a.
Using the WDS, select the oscilloscope and connect the red and black probes to the adapters on the sensor.
If the signal is less than 1.5 volts at idle, suspect incorrect air gap between sensor and target.
Check to ensure sensor is fitting flush.
See Additional Information P-12a.
Start the engine and monitor the readings.
Expected reading at idle, between 1.5 - 4 volts peak to peak.
The voltage will increase with engine speed.
Were the readings as expected?
YES
C
NO
Contact the Technical Hotline for further assistance.

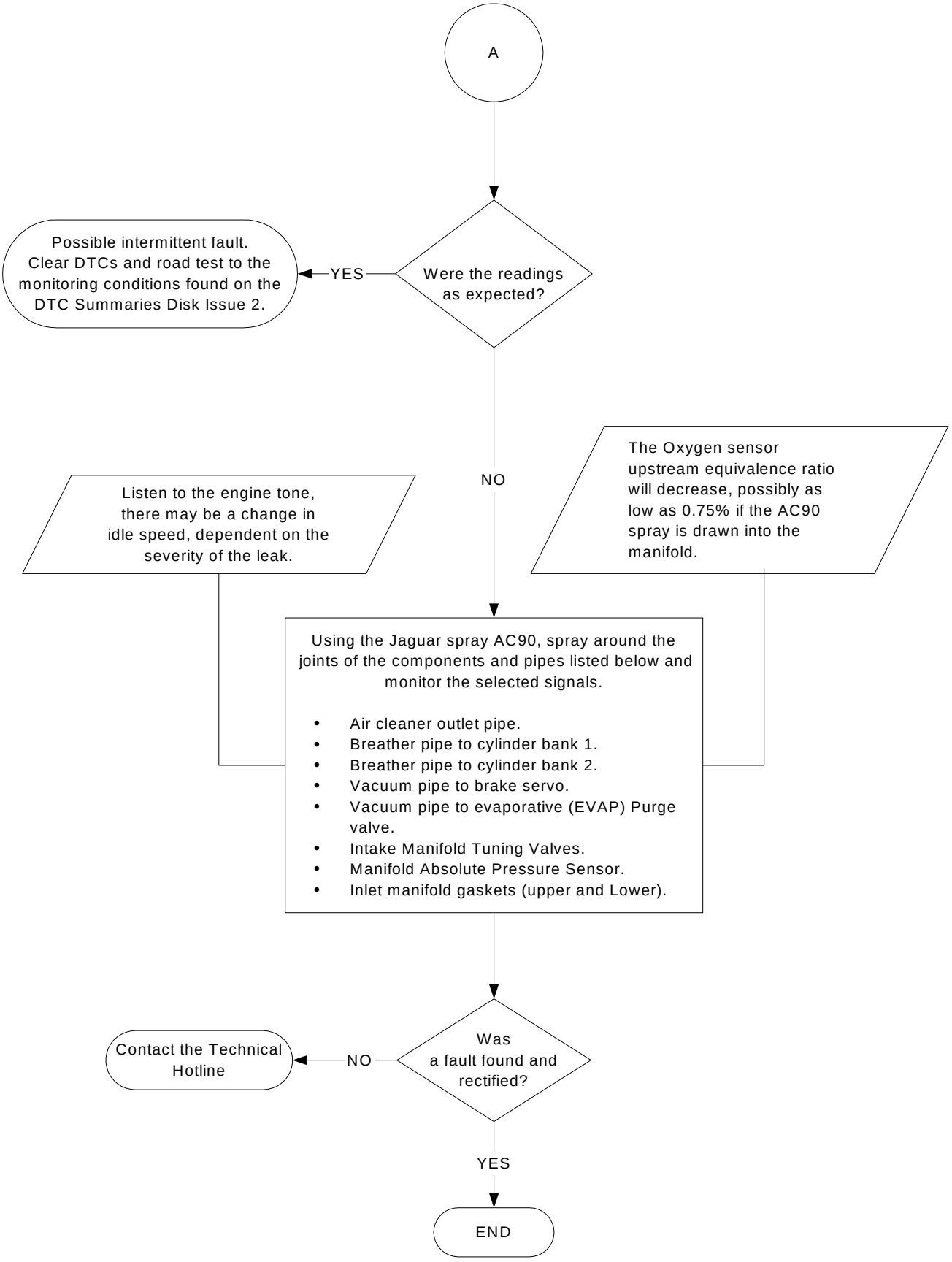
P-12 Cont.


C
Ensure ignition is switched 'OFF' and disconnect ECM electrical connector EN016.
See Additional Information Generic Connector Inspection.
Inspect ECM connector and pins for damage.
Refer to X-TYPE electrical guide.
See Additional Information Generic Harness Check.
Carry out a Generic Harness Check between CKP sensor electrical connector and the ECM electrical connector.
EN012 pin 001 - EN016 pin 037 (Yellow wire)
EN012 pin 002 - EN016 pin 036 (Purple wire) .
Was a fault found and rectified?
YES
END
NO
Contact Technical Hotline for further assistance.

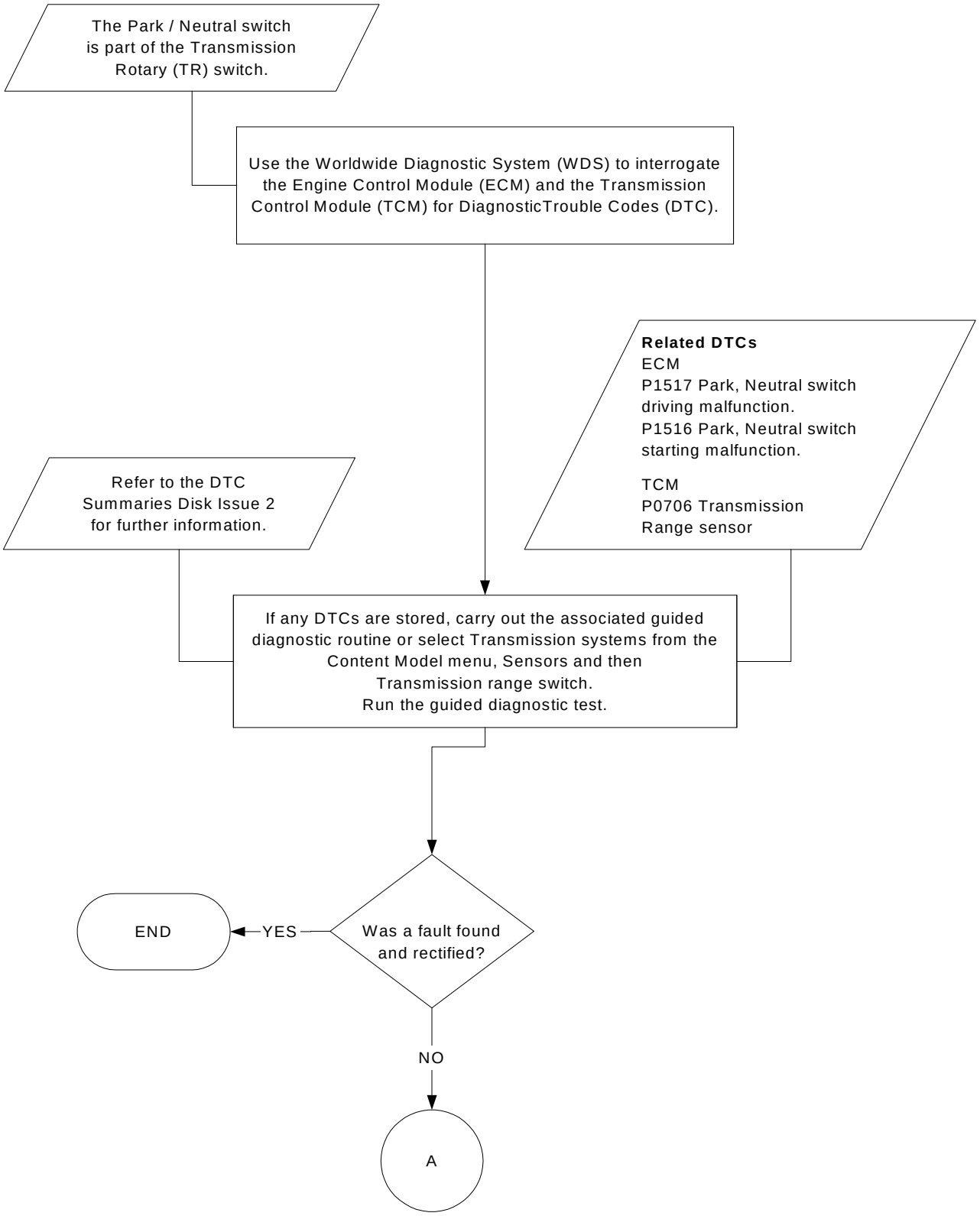
Air Leakage
Flowchart P-13



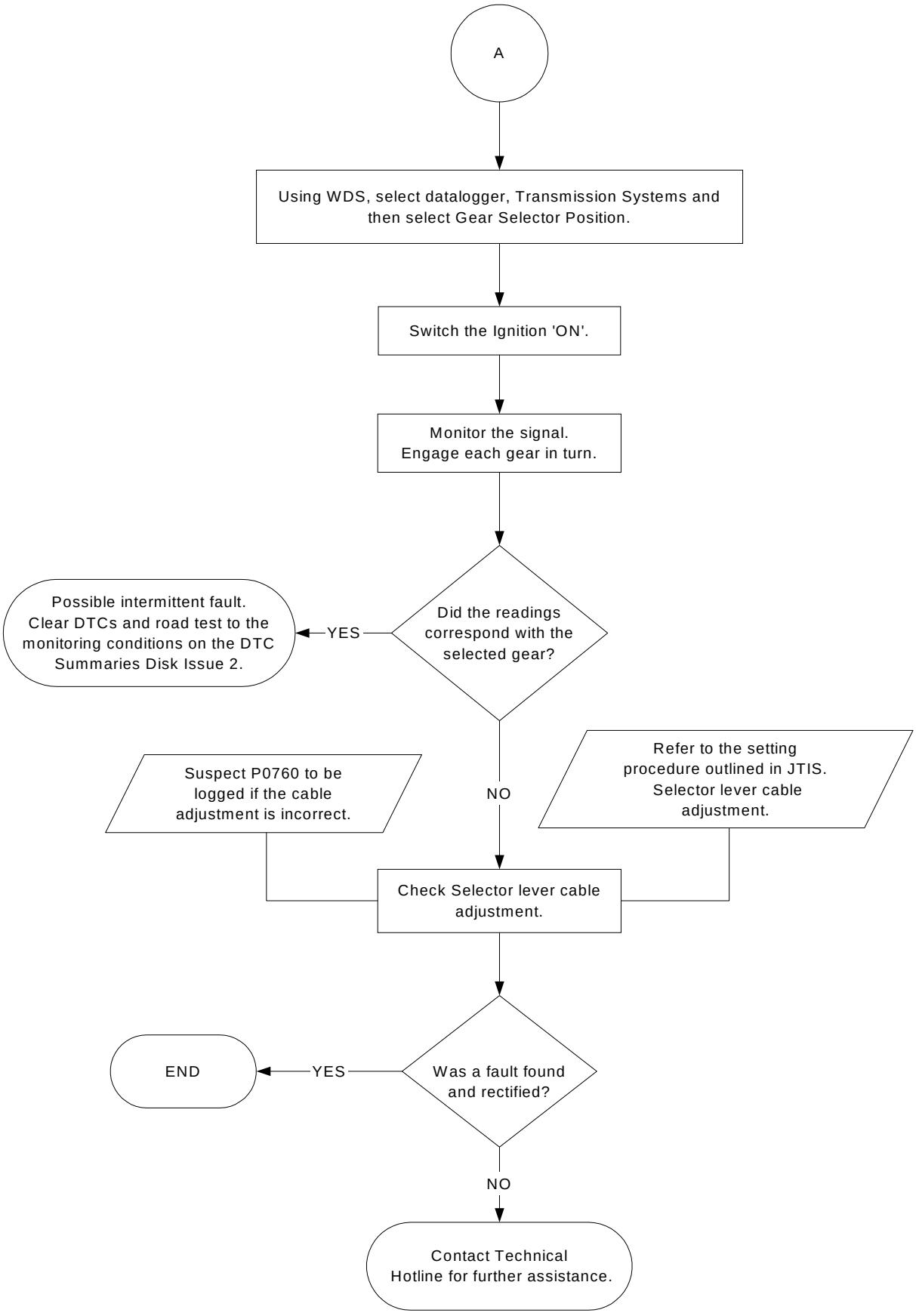
P-13 Cont.


A
Were the readings as expected?
YES
Possible intermittent fault. Clear DTCs and road test to the monitoring conditions found on the DTC Summaries Disk Issue 2.
NO
Listen to the engine tone, there may be a change in idle speed, dependent on the severity of the leak.
The Oxygen sensor upstream equivalence ratio will decrease, possibly as low as 0.75% if the AC90 spray is drawn into the manifold.
Using the Jaguar spray AC90, spray around the joints of the components and pipes listed below and monitor the selected signals.
• Air cleaner outlet pipe.
• Breather pipe to cylinder bank 1.
• Breather pipe to cylinder bank 2.
• Vacuum pipe to brake servo.
• Vacuum pipe to evaporative (EVAP) Purge valve.
• Intake Manifold Tuning Valves.
• Manifold Absolute Pressure Sensor.
• Inlet manifold gaskets (upper and Lower).
Was a fault found and rectified?
NO
Contact the Technical Hotline
YES
END

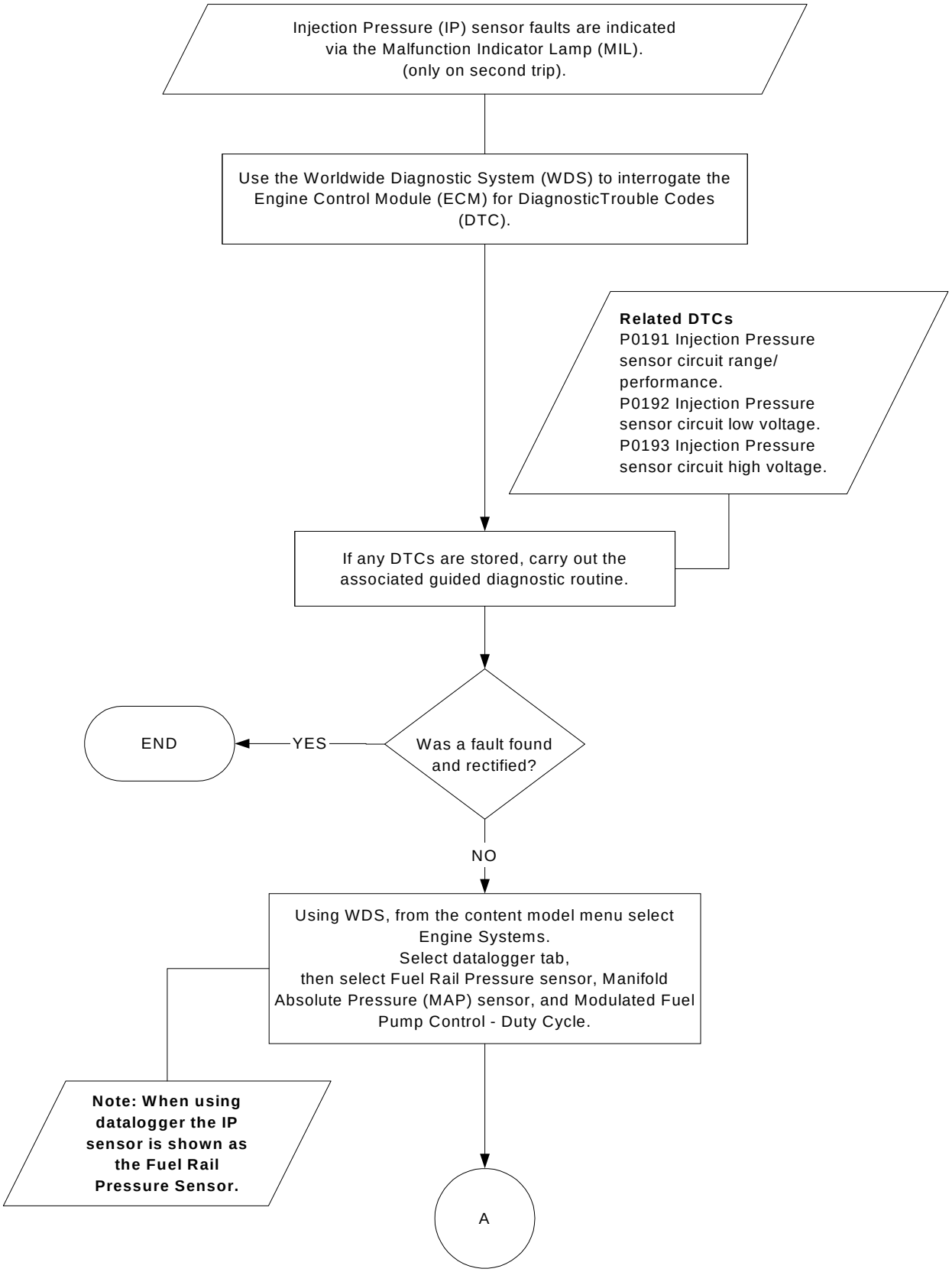
Park Neutral Switch
Flowchart P-14



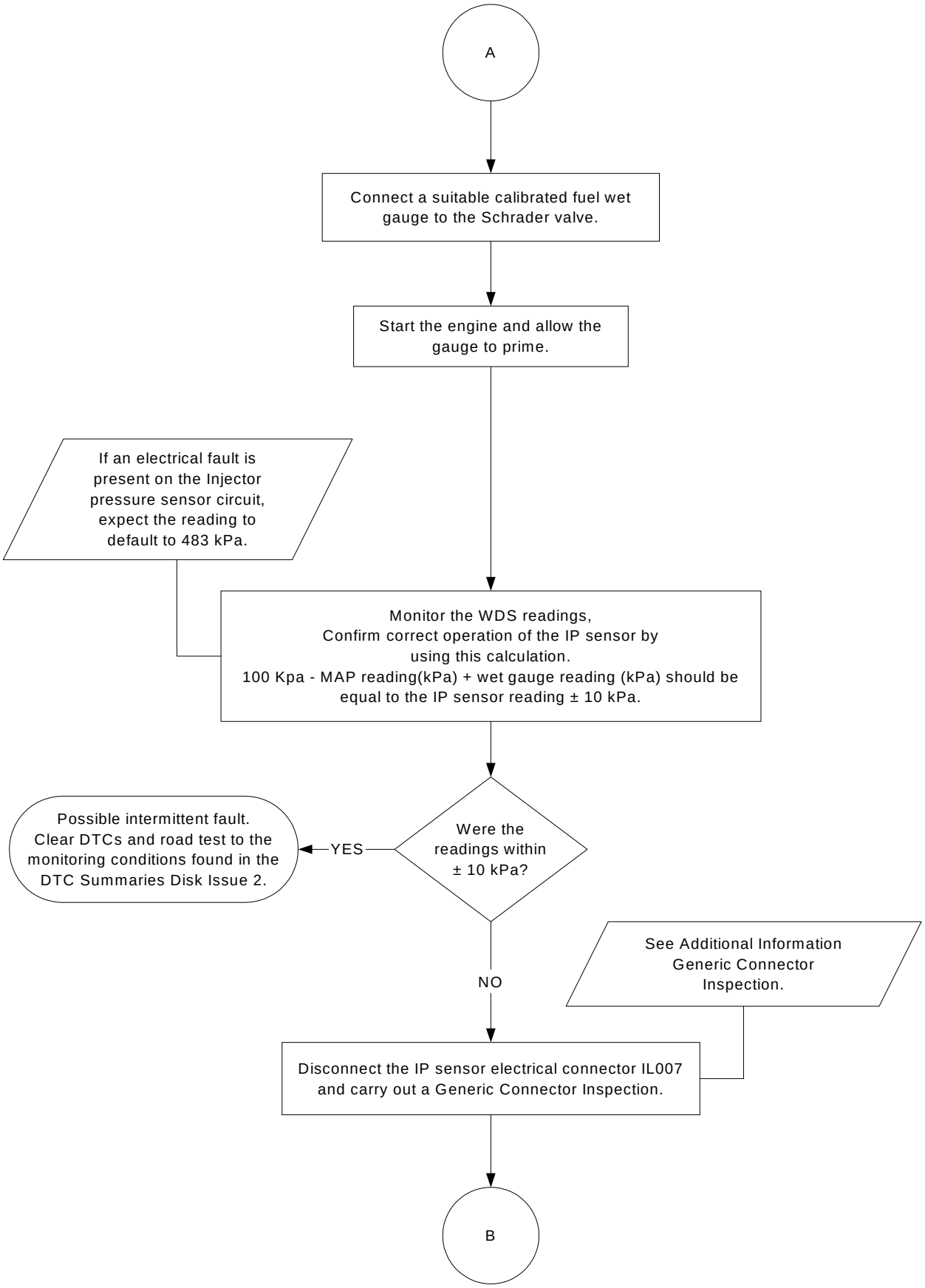
P-14 Cont.


A
Using WDS, select datalogger, Transmission Systems and then select Gear Selector Position.
Switch the Ignition 'ON'.
Monitor the signal. Engage each gear in turn.
Did the readings correspond with the selected gear?
YES
Possible intermittent fault. Clear DTCs and road test to the monitoring conditions on the DTC Summaries Disk Issue 2.
NO
Suspect P0760 to be logged if the cable adjustment is incorrect.
Refer to the setting procedure outlined in JTIS. Selector lever cable adjustment.
Check Selector lever cable adjustment.
Was a fault found and rectified?
YES
END
NO
Contact Technical Hotline for further assistance.

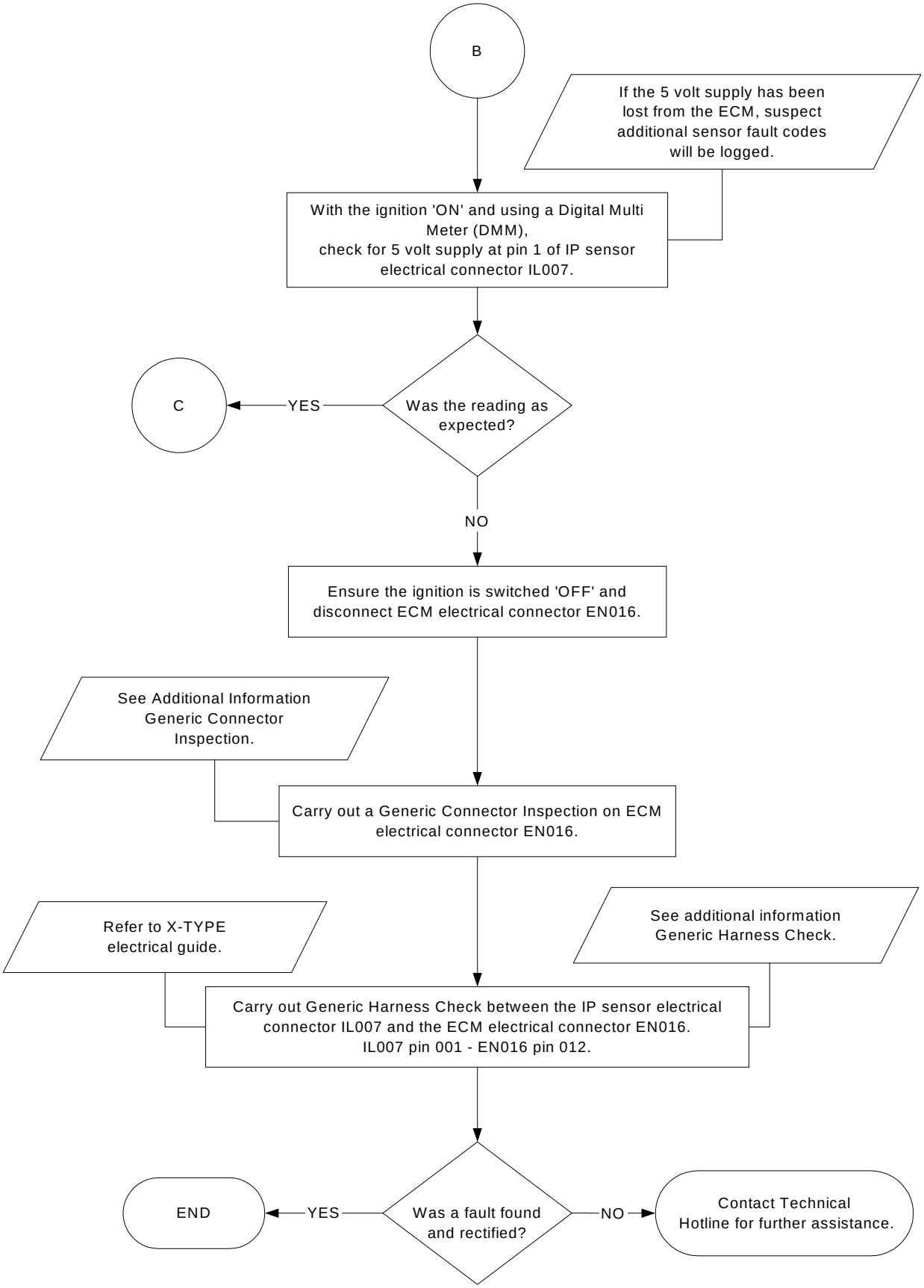
Injection Pressure Sensor
Flowchart P-15



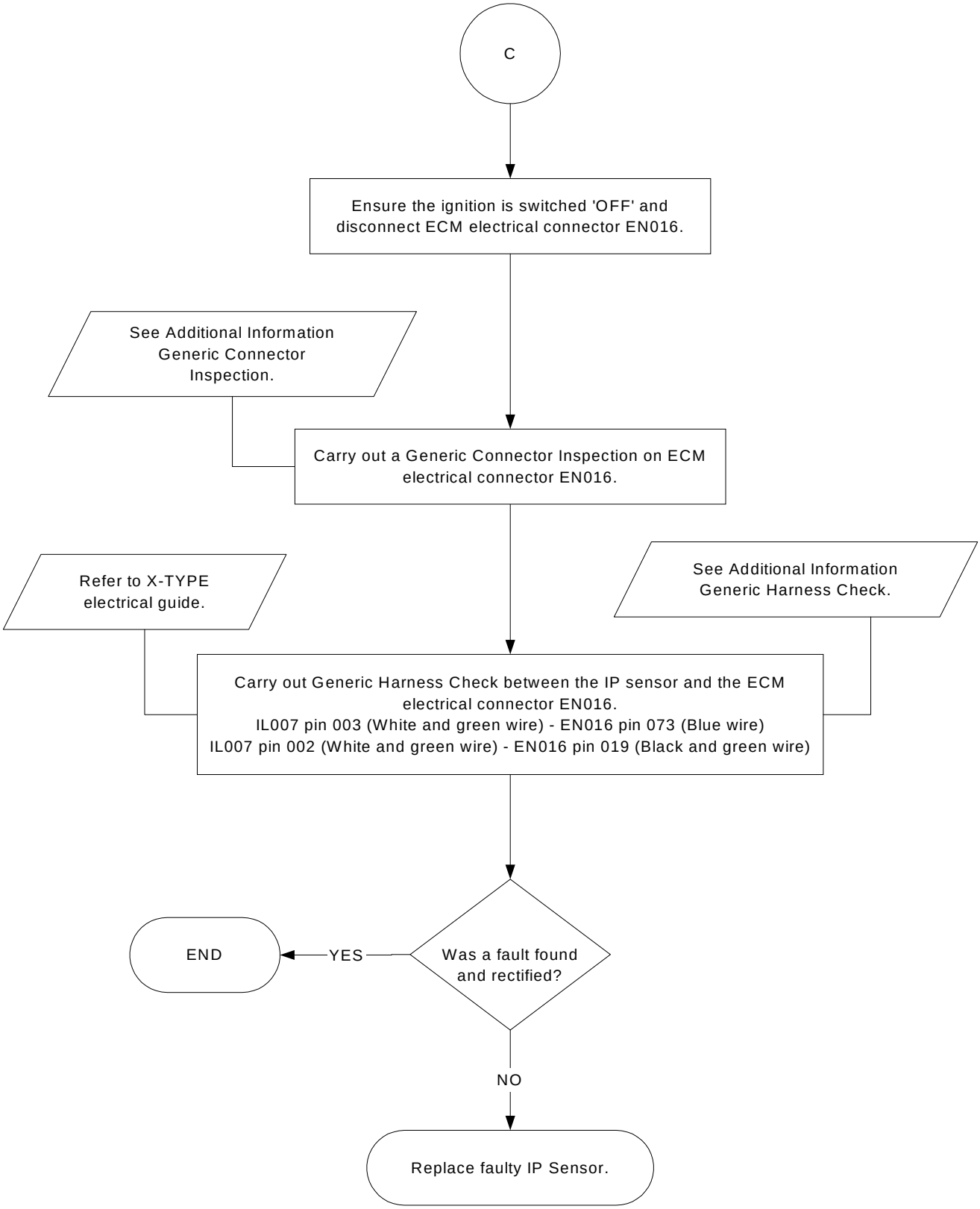
P-15 Cont.


A
Connect a suitable calibrated fuel wet gauge to the Schrader valve.
Start the engine and allow the gauge to prime.
If an electrical fault is present on the Injector pressure sensor circuit, expect the reading to default to 483 kPa.
Monitor the WDS readings,
Confirm correct operation of the IP sensor by using this calculation.
100 Kpa - MAP reading(kPa) + wet gauge reading (kPa) should be equal to the IP sensor reading ± 10 kPa.
Were the readings within ± 10 kPa?
YES
Possible intermittent fault.
Clear DTCs and road test to the monitoring conditions found in the DTC Summaries Disk Issue 2.
NO
See Additional Information Generic Connector Inspection.
Disconnect the IP sensor electrical connector IL007 and carry out a Generic Connector Inspection.
B

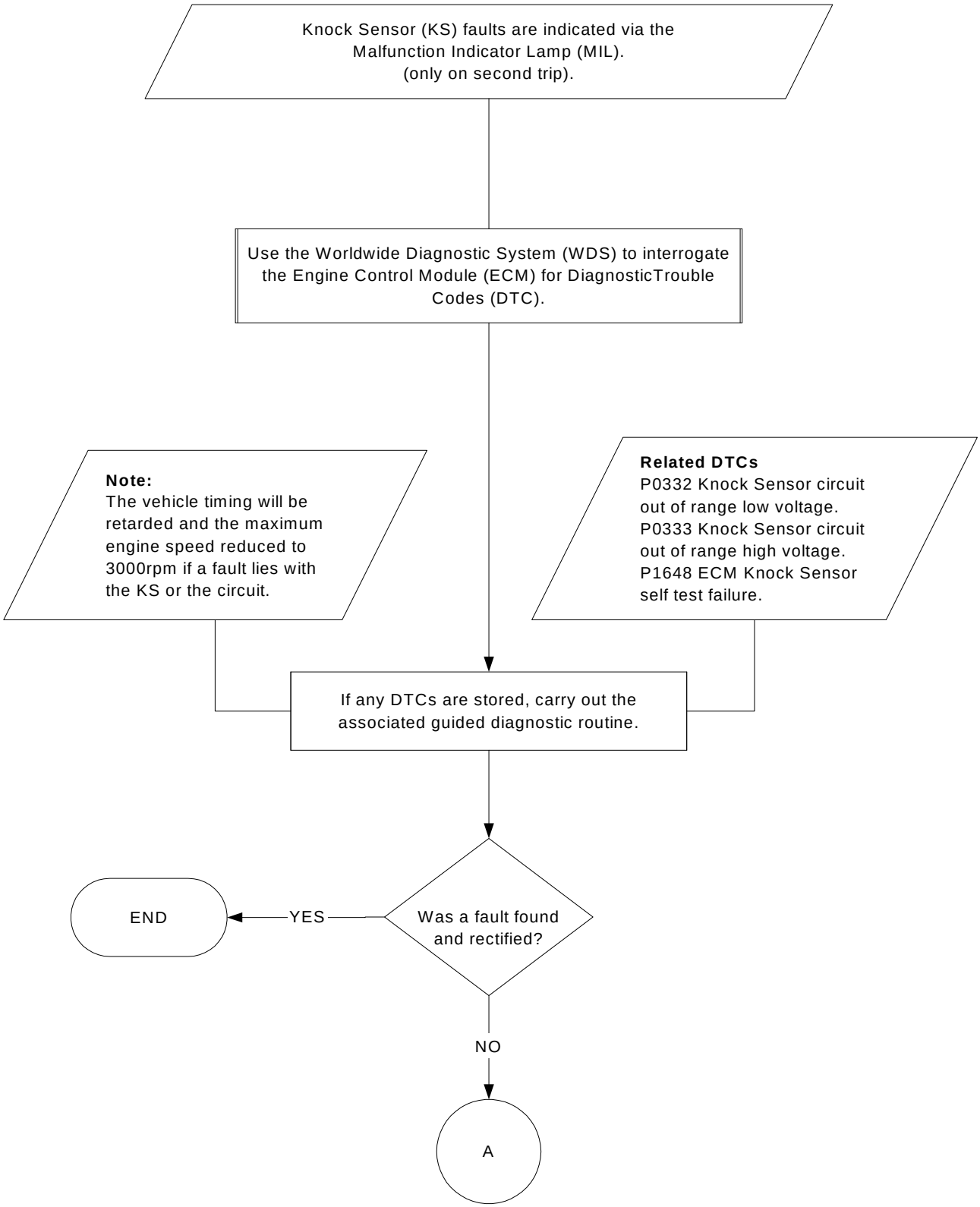
P-15 Cont.


B
If the 5 volt supply has been lost from the ECM, suspect additional sensor fault codes will be logged.
With the ignition 'ON' and using a Digital Multi Meter (DMM), check for 5 volt supply at pin 1 of IP sensor electrical connector IL007.
Was the reading as expected?
YES
C
NO
Ensure the ignition is switched 'OFF' and disconnect ECM electrical connector EN016.
See Additional Information Generic Connector Inspection.
Carry out a Generic Connector Inspection on ECM electrical connector EN016.
Refer to X-TYPE electrical guide.
See additional information Generic Harness Check.
Carry out Generic Harness Check between the IP sensor electrical connector IL007 and the ECM electrical connector EN016.
IL007 pin 001 - EN016 pin 012.
Was a fault found and rectified?
YES
END
NO
Contact Technical Hotline for further assistance.

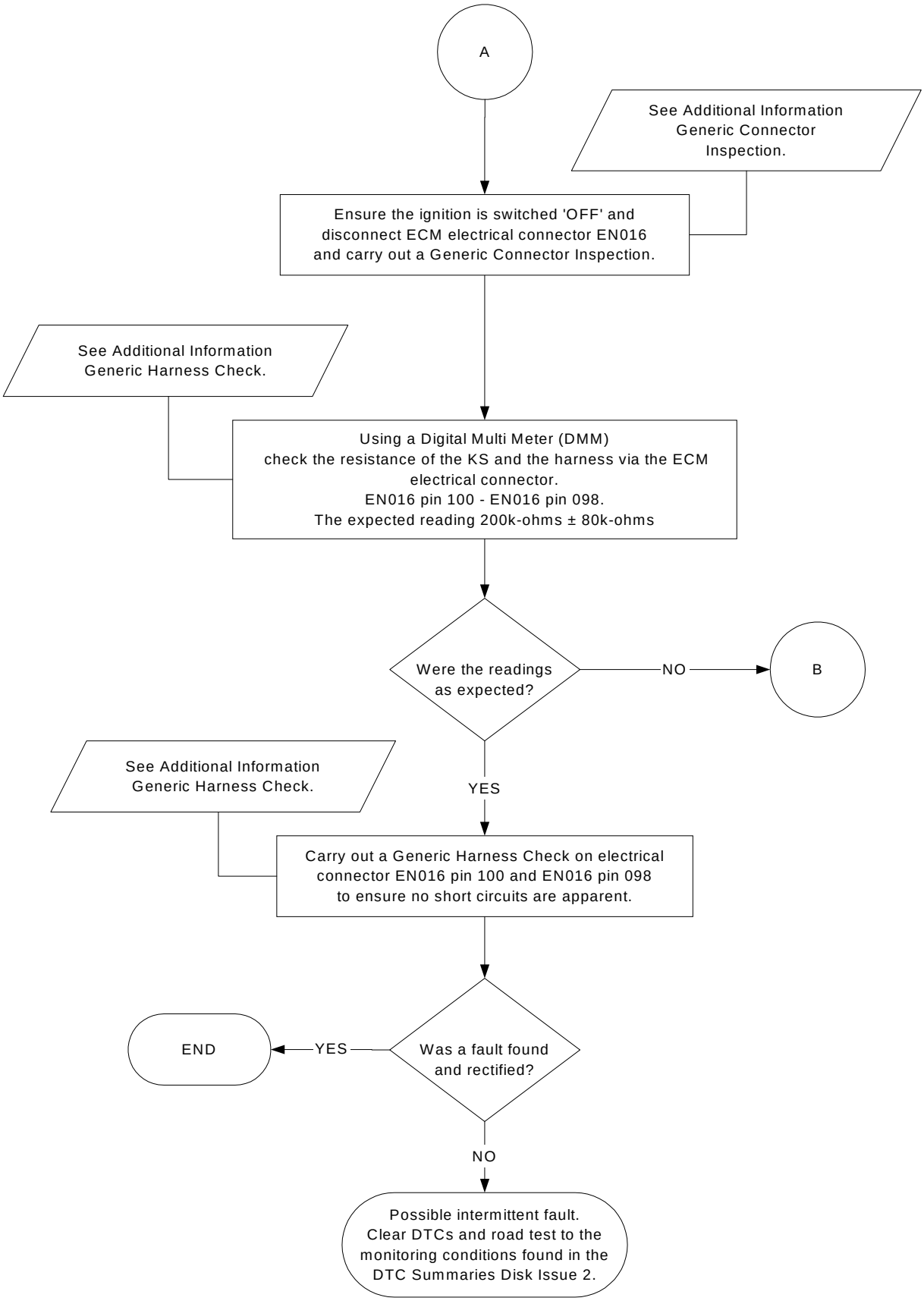
P-15 Cont.


C
Ensure the ignition is switched 'OFF' and disconnect ECM electrical connector EN016.
See Additional Information Generic Connector Inspection.
Carry out a Generic Connector Inspection on ECM electrical connector EN016.
Refer to X-TYPE electrical guide.
See Additional Information Generic Harness Check.
Carry out Generic Harness Check between the IP sensor and the ECM electrical connector EN016.
IL007 pin 003 (White and green wire) - EN016 pin 073 (Blue wire)
IL007 pin 002 (White and green wire) - EN016 pin 019 (Black and green wire)
Was a fault found and rectified?
YES
END
NO
Replace faulty IP Sensor.

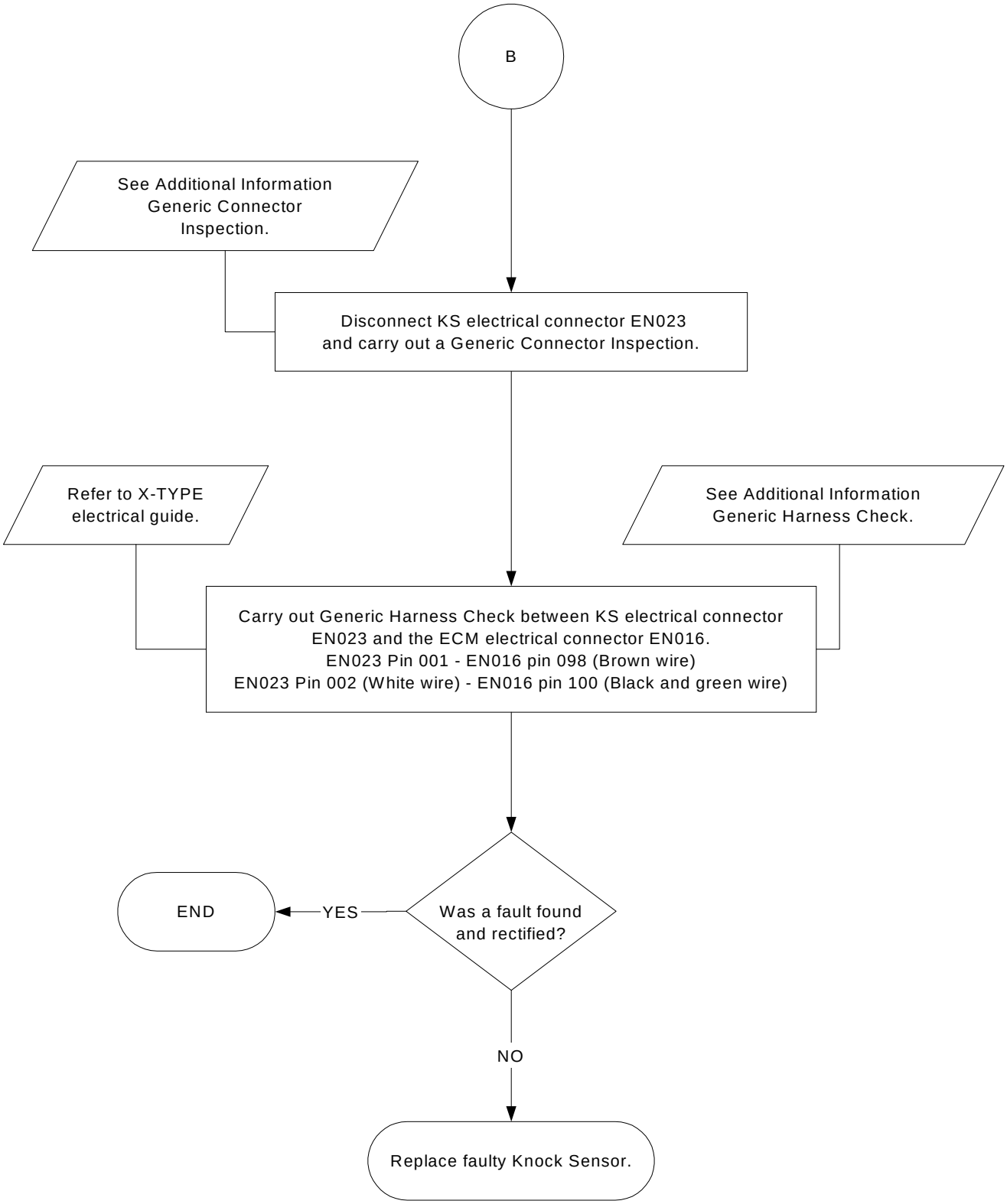
Knock Sensor
Flowchart P-16



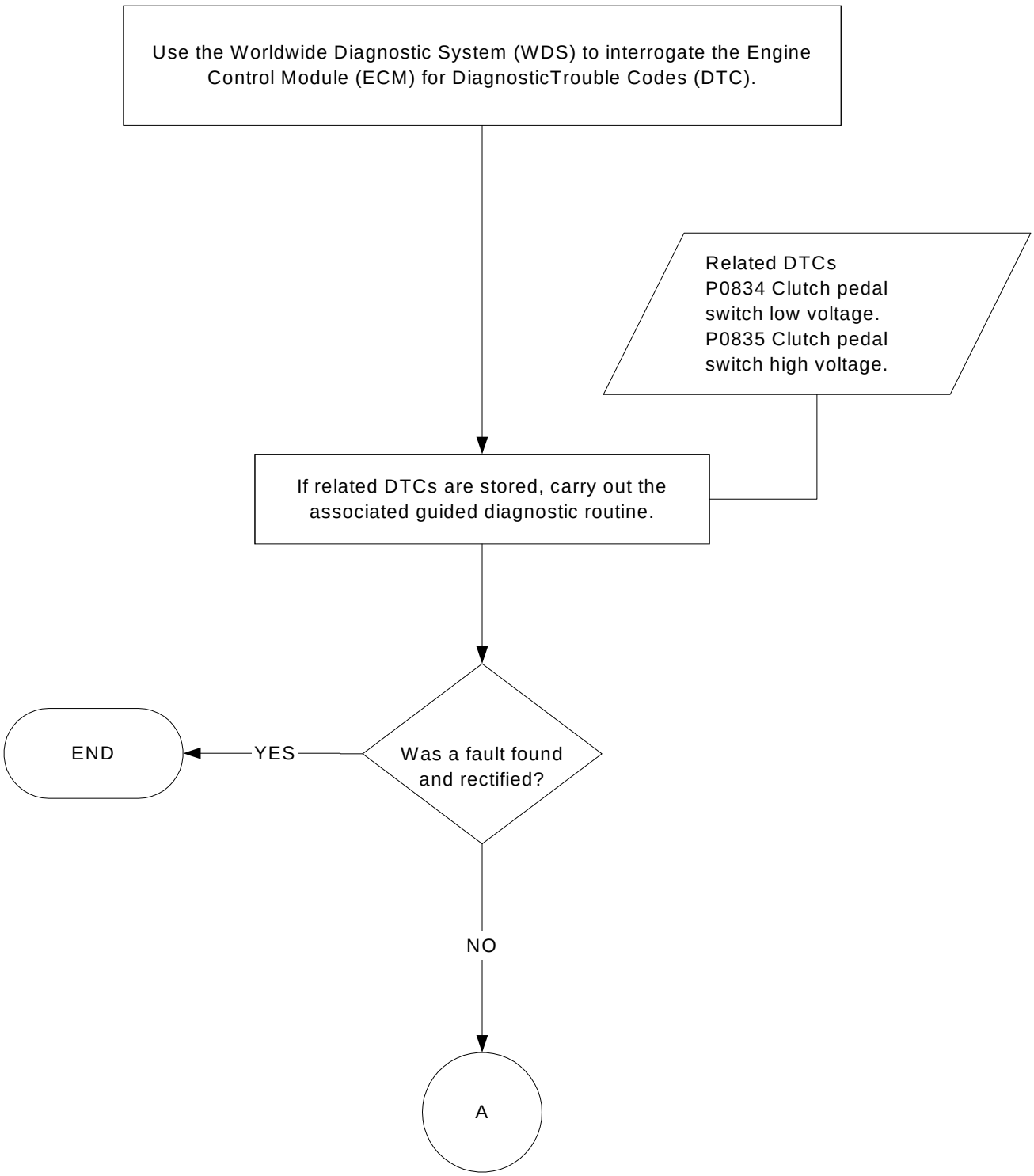
P-16 Cont.


A
See Additional Information
Generic Connector
Inspection.
Ensure the ignition is switched 'OFF' and
disconnect ECM electrical connector EN016
and carry out a Generic Connector Inspection.
See Additional Information
Generic Harness Check.
Using a Digital Multi Meter (DMM)
check the resistance of the KS and the harness via the ECM
electrical connector.
EN016 pin 100 - EN016 pin 098.
The expected reading 200k-ohms ± 80k-ohms
Were the readings
as expected?
NO
B
YES
See Additional Information
Generic Harness Check.
Carry out a Generic Harness Check on electrical
connector EN016 pin 100 and EN016 pin 098
to ensure no short circuits are apparent.
Was a fault found
and rectified?
YES
END
NO
Possible intermittent fault.
Clear DTCs and road test to the
monitoring conditions found in the
DTC Summaries Disk Issue 2.

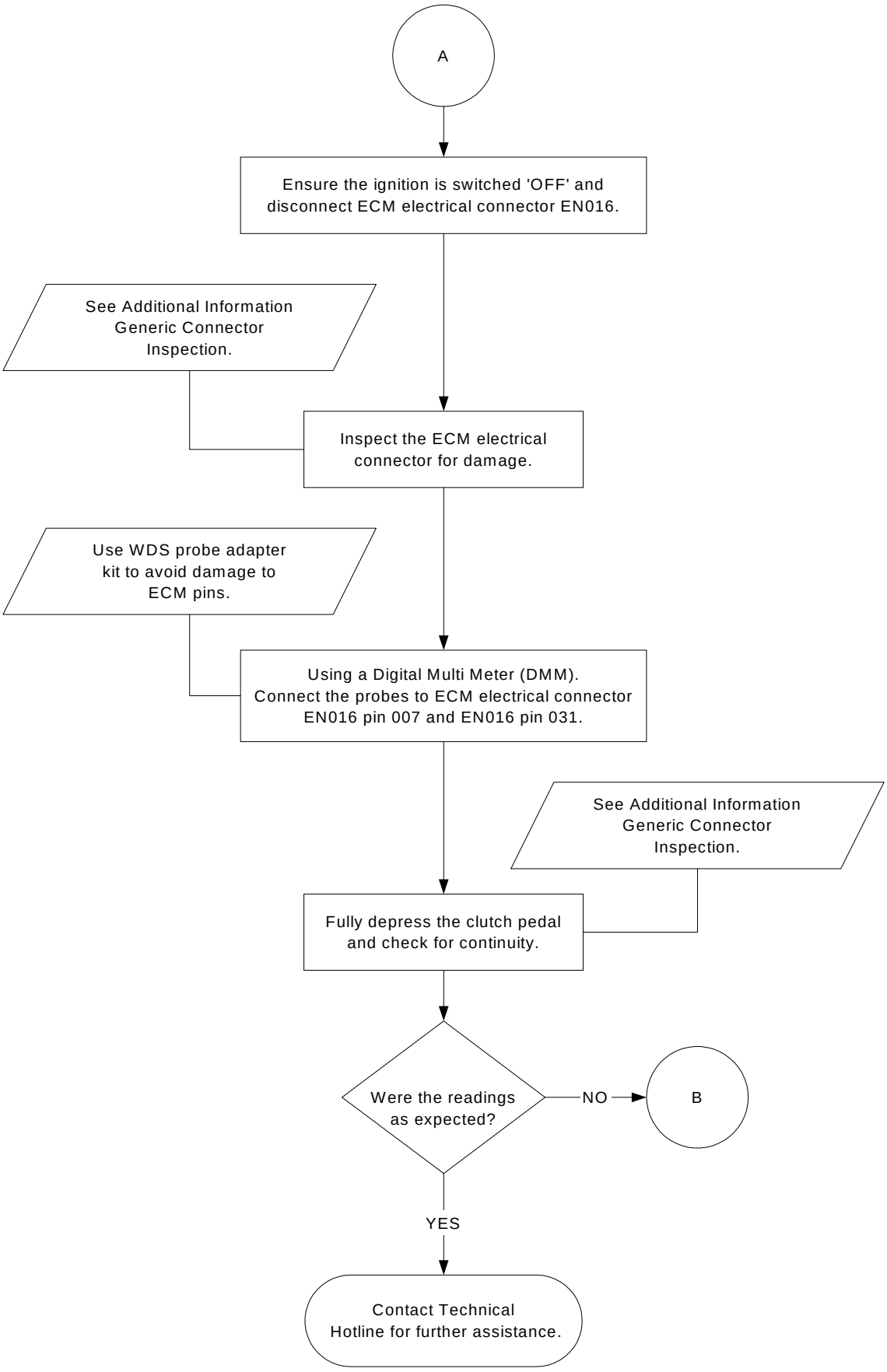
P-16 Cont.


B
See Additional Information
Generic Connector
Inspection.
Disconnect KS electrical connector EN023
and carry out a Generic Connector Inspection.
Refer to X-TYPE
electrical guide.
See Additional Information
Generic Harness Check.
Carry out Generic Harness Check between KS electrical connector
EN023 and the ECM electrical connector EN016.
EN023 Pin 001 - EN016 pin 098 (Brown wire)
EN023 Pin 002 (White wire) - EN016 pin 100 (Black and green wire)
Was a fault found
and rectified?
YES
END
NO
Replace faulty Knock Sensor.

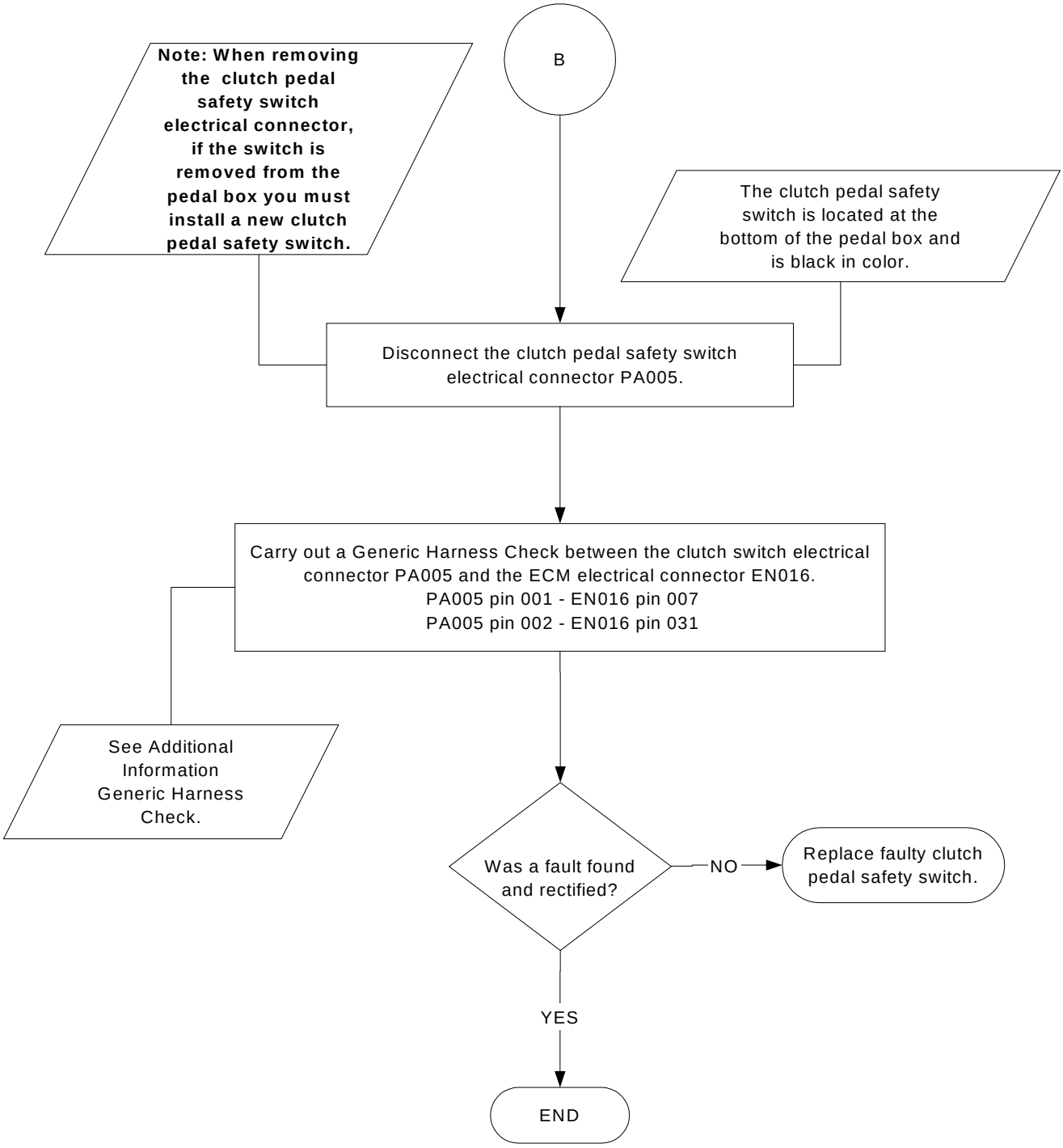
Clutch Pedal Safety Switch
Flowchart P-17



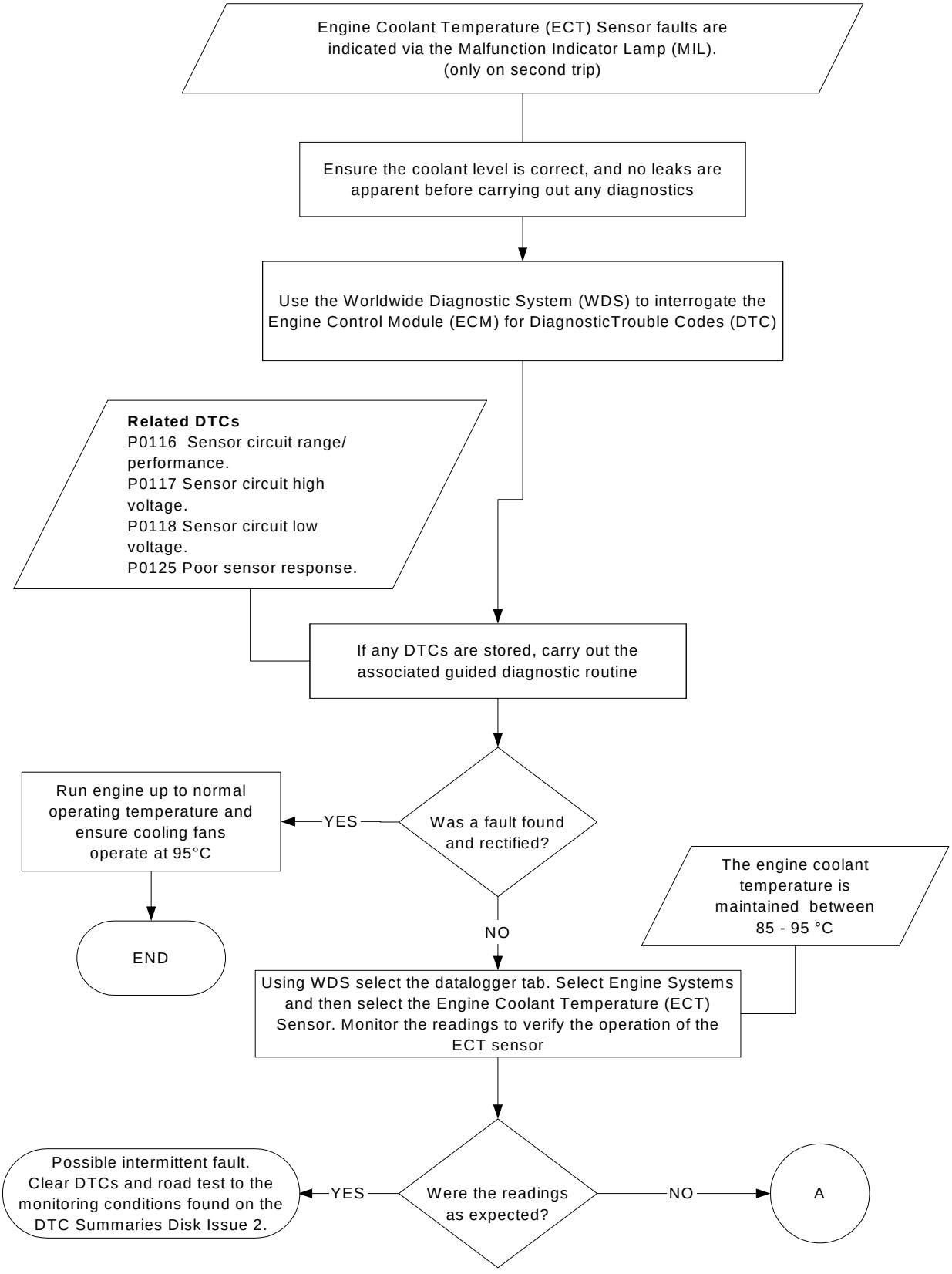
P-17 Cont.


A
Ensure the ignition is switched 'OFF' and disconnect ECM electrical connector EN016.
See Additional Information Generic Connector Inspection.
Inspect the ECM electrical connector for damage.
Use WDS probe adapter kit to avoid damage to ECM pins.
Using a Digital Multi Meter (DMM). Connect the probes to ECM electrical connector EN016 pin 007 and EN016 pin 031.
See Additional Information Generic Connector Inspection.
Fully depress the clutch pedal and check for continuity.
Were the readings as expected?
NO
B
YES
Contact Technical Hotline for further assistance.

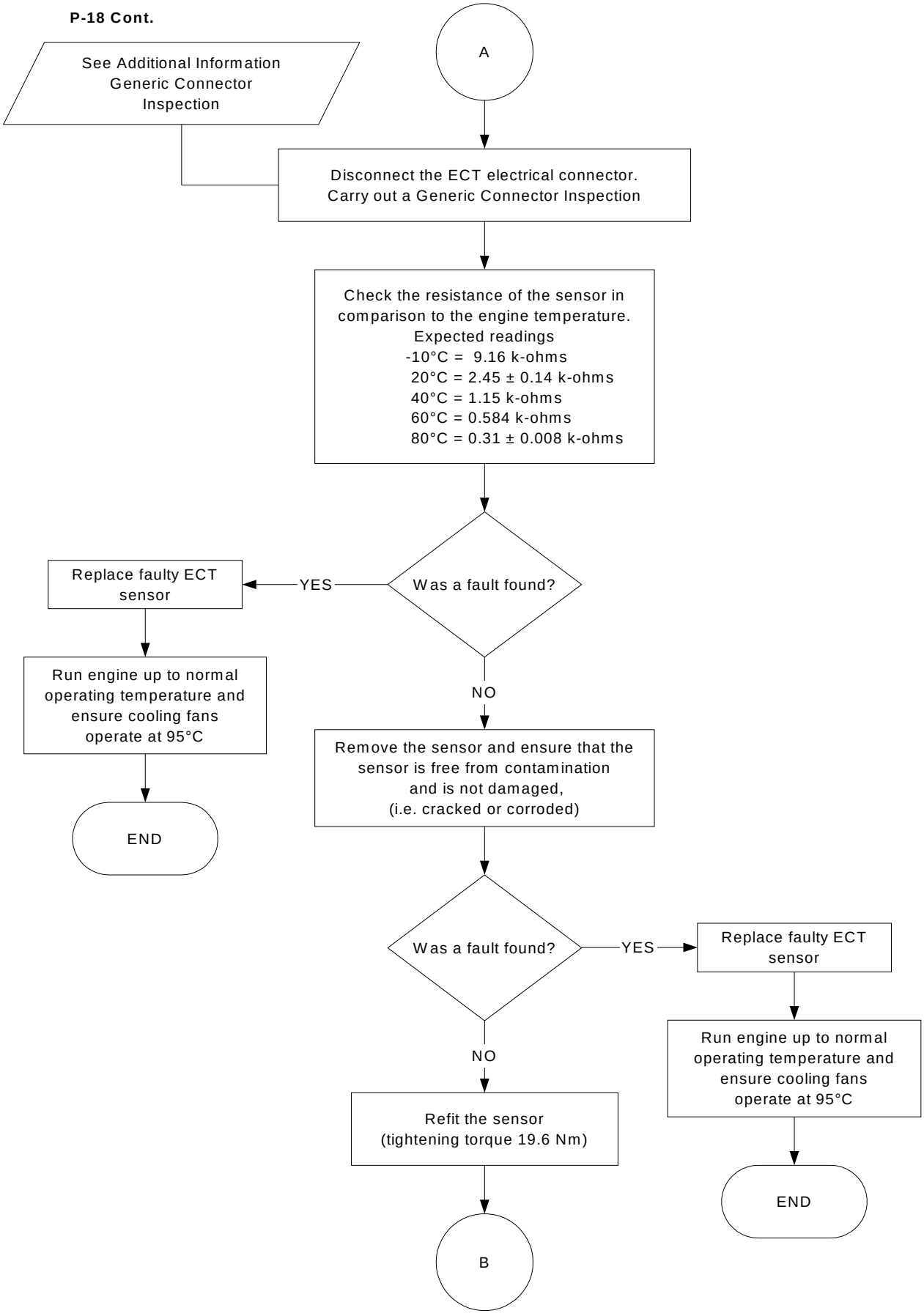
P-17 Cont.


B
Note: When removing the clutch pedal safety switch electrical connector, if the switch is removed from the pedal box you must install a new clutch pedal safety switch.
The clutch pedal safety switch is located at the bottom of the pedal box and is black in color.
Disconnect the clutch pedal safety switch electrical connector PA005.
Carry out a Generic Harness Check between the clutch switch electrical connector PA005 and the ECM electrical connector EN016.
PA005 pin 001 - EN016 pin 007
PA005 pin 002 - EN016 pin 031
See Additional Information Generic Harness Check.
Was a fault found and rectified?
NO
Replace faulty clutch pedal safety switch.
YES
END

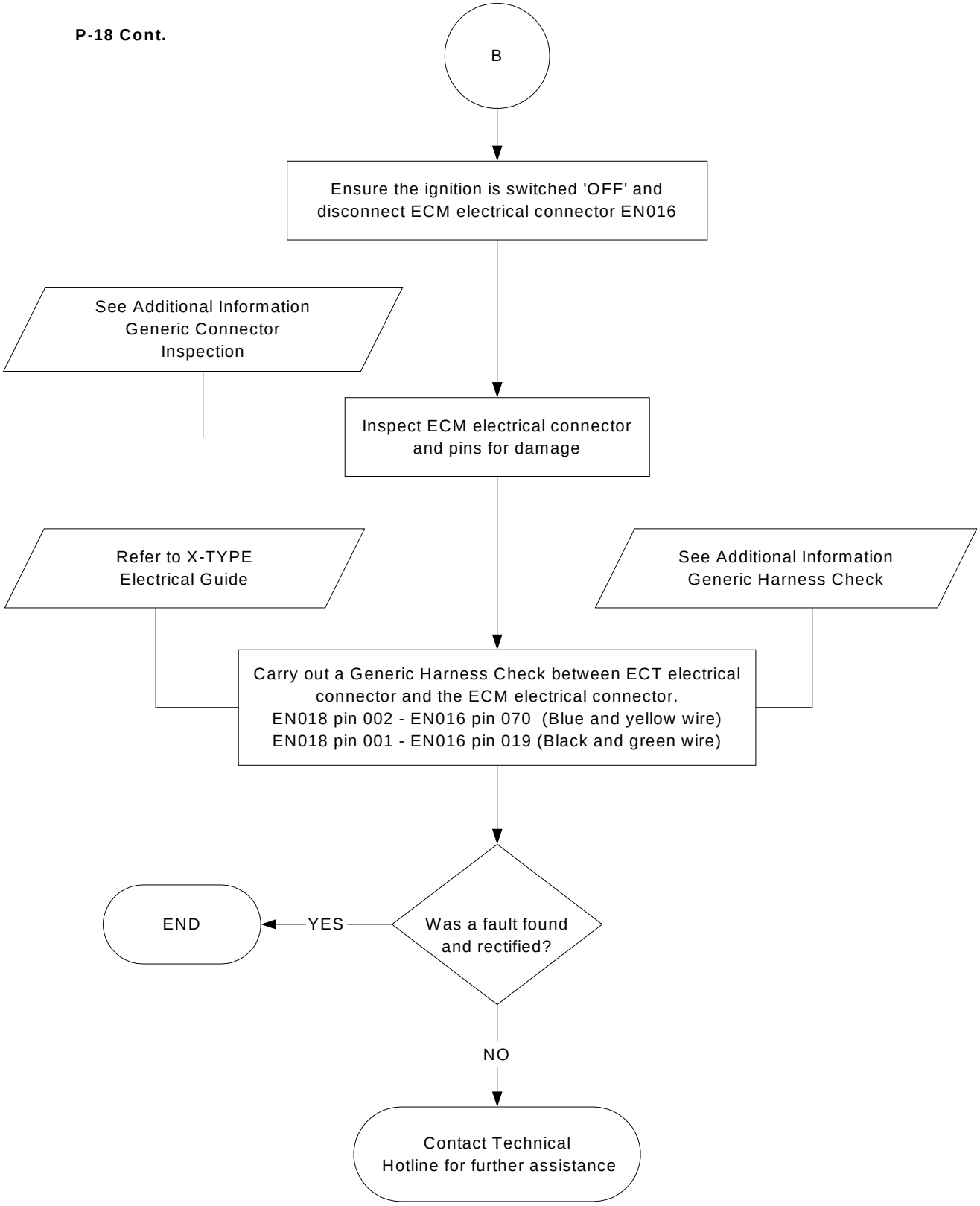
Engine Coolant Temperature Sensor
Flowchart P-18



P-18 Cont.


See Additional Information
Generic Connector
Inspection
A
Disconnect the ECT electrical connector.
Carry out a Generic Connector Inspection
Check the resistance of the sensor in comparison to the engine temperature.
Expected readings
-10°C = 9.16 k-ohms
20°C = 2.45 ± 0.14 k-ohms
40°C = 1.15 k-ohms
60°C = 0.584 k-ohms
80°C = 0.31 ± 0.008 k-ohms
Was a fault found?
YES
Replace faulty ECT sensor
Run engine up to normal operating temperature and ensure cooling fans operate at 95°C
END
NO
Remove the sensor and ensure that the sensor is free from contamination and is not damaged,
(i.e. cracked or corroded)
Was a fault found?
YES
Replace faulty ECT sensor
Run engine up to normal operating temperature and ensure cooling fans operate at 95°C
END
NO
Refit the sensor
(tightening torque 19.6 Nm)
B

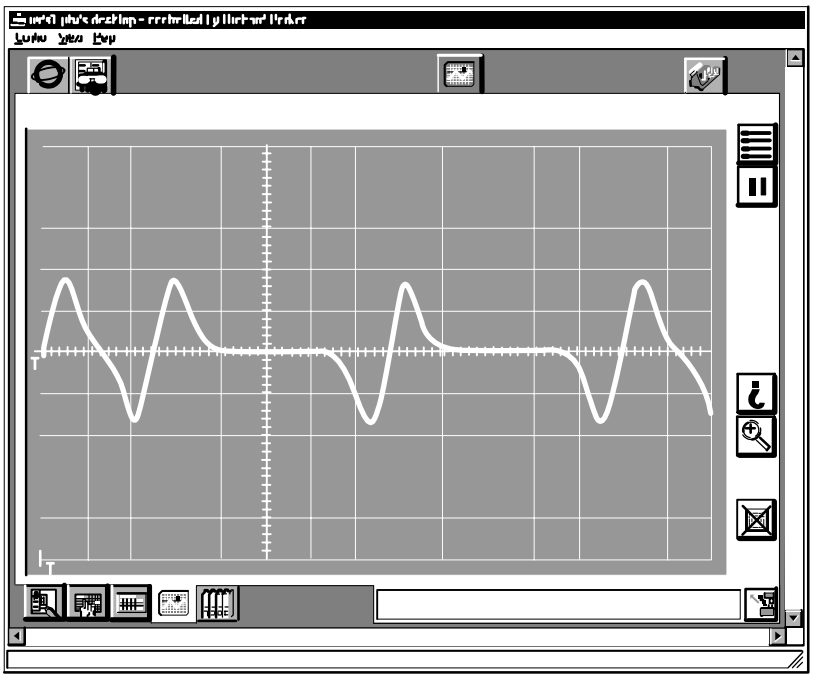
P-18 Cont.


B
Ensure the ignition is switched 'OFF' and disconnect ECM electrical connector EN016
See Additional Information Generic Connector Inspection
Inspect ECM electrical connector and pins for damage
Refer to X-TYPE Electrical Guide
See Additional Information Generic Harness Check
Carry out a Generic Harness Check between ECT electrical connector and the ECM electrical connector.
EN018 pin 002 - EN016 pin 070 (Blue and yellow wire)
EN018 pin 001 - EN016 pin 019 (Black and green wire)
Was a fault found and rectified?
YES
END
NO
Contact Technical Hotline for further assistance

Additional Information P-2a

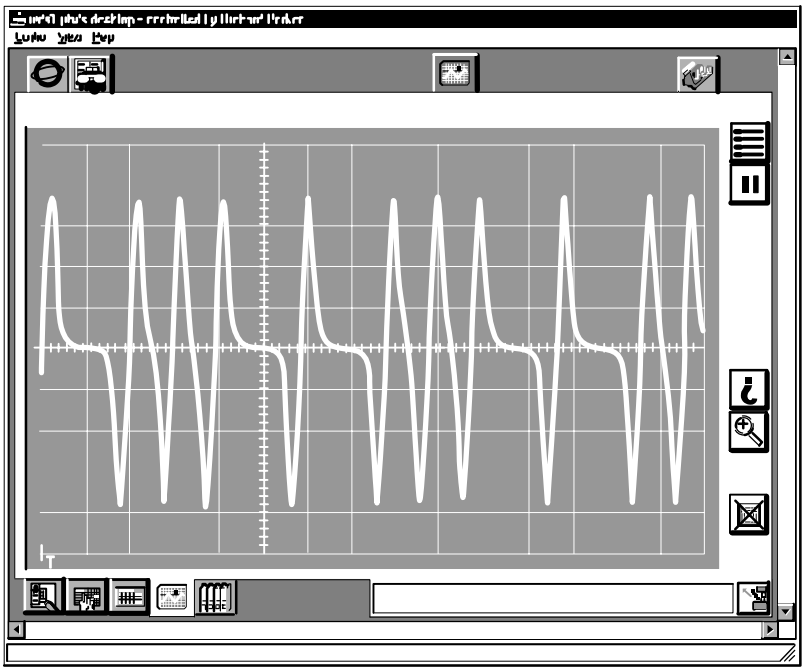
Oscilloscope set up.

1. Configuration sub tab.
   Channel 1
   Select: Red probe and black probe-Differential.
2. Channel calculation sub tab.
   Select: Maximum voltage.
3. Main oscilloscope display sub tab.
   Y-axis select: Scale set to 1 volt/div.
   X-axis select: Scale set to 10 ms/div.
4. Select: Full screen.



J.100.223

Illustration 1 Trace of the cam sensor at idle



J.100.224

Illustration 2 Trace of cam sensor at 2000 rpm

Additional Information P-3a	
Related Diagnostic Trouble Codes.	**Criteria.**
P1367 Ignition amplifier group 1 malfunction	All side 1 coils malfunction
P1368 Ignition amplifier group 2 malfunction	All side 2 coils malfunction
P0351to P0356 Ignition amplifier malfunction at the associated cylinder number 1 to 6	Ignition coil open/short circuit/damaged harness on the associated cylinder
P0300 Misfire random/multiple cylinders	Random misfire detected or misfires on 1 or more cylinders
P0301 to P0306 Misfire at the associated cylinder number 1 to 6	Misfire detected on the associated cylinder

For further information refer to DTC Summaries Disk Issue 2

Side 1 of engine as indicated at 7, Illustration 3
Side 2 of engine as indicated at 8, Illustration 3
Front of engine as indicated at 9, Illustration 3

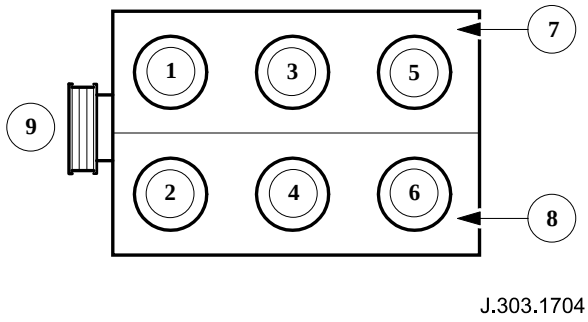


Illustration 3

Always refer to the Technical Hotline if problems are encountered.

Additional information P-4a

Subject- Upstream and Downstream Oxygen Sensors.

Checks

- The upstream sensor is also identified as the UHEGO and has a grey connector.
- The downstream sensor is also identified as the HEGO and has a black connector.
- To ensure that the sensors are fitted correctly, the upstream sensor is situated directly above the catalytic converter (Pre-catalytic), and the downstream sensor is at the center of the catalytic converter.
- If the sensor positions are reversed this will cause catalytic converter monitor diagnostic trouble codes P0420 and P0430 to be logged.
- If the catalyst monitor DTCs are logged (P0420/P0430) and the orientation of the sensors is correct then suspect catalytic converter failure. Removing the catalytic converter and visually checking the honeycomb layout can check this.
- Air leaks are possible at the connection of the sensor to the exhaust. Ensure the sensors are tightened to the correct torque.
- Problems may occur due to air leaks within the exhaust system.
- Carry out visual checks for cracks and leaks from the manifold down to the catalytic converter.
- Listen for the exhaust gas escaping when cold, as it may not be noticeable as the exhaust warms and expands.

Cautions

Removal. (Always refer to JTIS)

Ensure the connector on the flylead is disconnected before removal.
Failure to do this may cause the wires to twist and damage or pull out of the sensor.

Installing. (Always refer to JTIS)

Over tightening may cause damage to the element within the sensor.
Ensure the correct tightening torque is used when installing the sensor.
(Torque setting for both sensors 40 Nm +/- 7.2 Nm.)
Ensure the flylead is routed correctly and is not taut, as this may cause damage with engine movement.

Additional information P-4a cont.			
Upstream Oxygen Sensor Diagnostic Trouble Codes		Downstream Oxygen Sensor Diagnostic Trouble Codes	
DTC	Description	DTC	Description
P0031	Heater control circuit low A	P0037	Heater control circuit low A
P0032	Heater control circuit high A	P0057	Heater control circuit low B
P0051	Heater control circuit low B	P0038	Heater control circuit high A
P0052	Heater control circuit high B	P0058	Heater control circuit high B
P0131	Circuit low voltage A	P0137	Circuit low voltage A
P0132	Circuit high voltage A	P0157	Circuit low voltage B
P0133	Circuit slow response 1A	P0138	Circuit high voltage A
P0151	Circuit low voltage B	P0158	Circuit high voltage B
P0152	Circuit high voltage B	P0140	Circuit no activity A
P0153	Circuit slow response 1B	P0160	Circuit no activity B
P1646	Control module open/shorted A		
P1647	Control module open/shorted B		
For further information, refer to DTC Summaries Disk Issue 2			

Additional Information P-11a Engine Fuel Temperature Sensor Characteristics.		
Temperature.	Nominal resistance Using DMM.	WDS Datalogger voltage display.
-10°C (14°F)	160.3 k-ohms ± 8.3 k-ohms	4.15 volts ± 0.04 v
10°C (50° F)	58.9 k-ohms ± 2.9 k-ohms	3.52 volts ± 0.06 v
20°C (68° F)	37.3 k-ohms ± 2.1 k-ohms	3.09 volts ± 0.07 v
30°C (86° F)	24.2 k-ohms ± 1.4 k-ohms	2.62 volts ± 0.07 v
40°C (104° F)	16.1 k-ohms ± 0.9 k-ohms	2.15 volts ± 0.08 v

Abbreviations:
WDS - Worldwide Diagnostic System.
DMM - Digital Multi Meter.

Note:
When testing the Engine Fuel Temperature sensor, if the vehicle is cold (approximately workshop temperature 20°C) it is possible to invoke a temperature change by rubbing the rail where the sensor is situated, this will increase the temperature and decrease the resistance.

WARNING: PARTS MAY BE HOT.

Additional Information P-12a

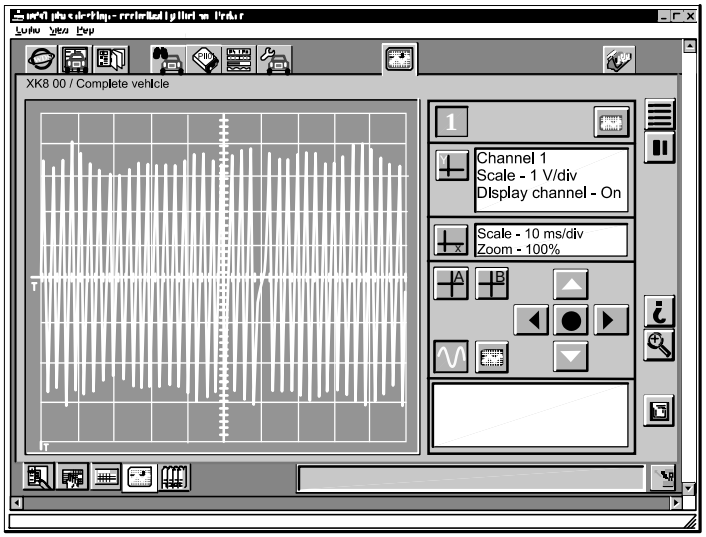
Oscilloscope set up.

1 Configuration sub tab.
Channel 1
Select: Red probe and black probe - Differential.

2 Channel calculation sub tab.
Select: Maximum voltage.

3 Main oscilloscope display sub tab.
Y-axis select: Scale set to 1 V/div.
X-axis select: Scale set to 10 ms/div.

4 Select: Full screen.



J.100.225

Fig. 4 Trace of the crankshaft sensor at idle

Generic Connector Inspection

Electrical failures can be caused by problems with the connectors and their pins. Below are a number of points that may aid in investigation.

Backed-out Pins

Inspection of the connector; look for signs that the pin has backed-out. If a seal is fitted to the pin it may be protruding further out the back of the connector. If a pin has backed-out of the cavity in the connector, there is a possibility that it has been forced out when the connector was mated. Make sure that the pins are in line when the two halves of the connector are mated.

Bent Pins

Disconnect the two halves of the connector and visually inspect the pins. If a pin is bent over there is a possibility of a short from pin to pin. Pins can easily be bent over when the connector is mated. Check to ensure the pins within the connector are not knocked out of alignment before the two halves of the connector are mated.

Water ingress/fluid ingress

Disconnect the connector and inspect for signs of water ingress, corrosion may have occurred. If water or any other fluid is visible this may cause a bad connection or even short circuit to the other pins within the connector. Examine the connector seals for any damage and to ensure that the seals are fitted correctly. Ensure that the two halves of the connector latch together securely.

Probing

Ensure when probing a pin that the correct probe is used and excessive force is not used as this may weaken the locating clip and allow the pin to work loose. Care must be taken when probing female pins as the pin can easily be splayed if probed with the incorrect adaptor or the wrong tool. This would then have the potential to cause a bad connection between the two mating halves. Always use the Worldwide Diagnostic System probe kit when probing pins within a connector. (Jaguar probe adaptor kit part number. 3548-1358-00.)

Insertion force

Insertion force is imperative to ensure a good connection is made between the two mating pins. If the female pin is splayed, the connection will be poor. To check the insertion force of the female connector, identify the correct male pin within WDS probe adaptor kit. Gently insert the adaptor into the female pin and then repeat with the other pins within the connector. If the pin in question feels loose in comparison replace both male and female pins.

Chafing

Inspect the harness when in close contact to other objects (i.e. sharp steel brackets). Engine vibration will cause the outer protection to quickly chafe through if the harness is not routed correctly. When performing a repair, ensure that heat resistant tape is used where relevant. Before repairing or replacing any harness, always refer to the electrical wiring harness repair guide, reference publication number JTP 586. When repairing a harness ensure the Jaguar harness repair kit is used. (Part number. 418-S065 and 418-S411.)

Always refer to Technical Hotline if problems are encountered.

Generic Harness Check

- When carrying out any of the tests in the generic harness check, it is imperative that any other sources that share the harness are taken into consideration when a measurement is taken.
- The X-TYPE electrical guide (publication part number – JJM 10 38 20/20) will show all other sources sharing that harness i.e. splices and sensors. This electrical guide is in JTIS.
- Always ensure the digital voltmeter is operating correctly before proceeding.
- Always use the WDS probe kit when probing pins within a connector.

Note: Do not insert the Digital Multi Meter (DMM) leads into the connector pins. (Probe adaptor kit part number: 3548-1358-00.)

Continuity test

Using a DMM, connect the DMM to the pins at both ends of the circuit that you are testing. Ensure you connect to the correct pin when a large number of pins are used in a connector. (Use WDS Probe adapter kit).

Set the DMM to the resistance test or the continuity beeper. The resistance should be between 0 – 10 ohms. If a high resistance or open circuit is found investigate harness for damage.

Short circuit high fault

The DMM can be connected to any ground source on the vehicle, but it is preferable to use the battery negative pole.
Set the DMM to Volts DC; connect the DMM red probe to the suspect pin of the circuit and the DMM black probe to the battery negative pole. No voltage should be seen, if 4 – 13 volts is seen suspect short circuit high and investigate harness for damage.

Always test the circuit with the ignition 'ON' and 'OFF' when trying to identify this fault condition.

Short circuit low fault (to ground)

The DMM can be connected to any ground source on the vehicle, but it is preferable to use the battery negative pole.
Set the DMM to the resistance test; connect the DMM to the suspect pin of the circuit and the battery negative pole, an infinity reading/open circuit (O/C) should be seen.

If a resistance is seen, suspect short circuit low and investigate harness for damage.

Always refer to the Technical Hotline if problems are encountered.