If you encounter difficulties while operating the ME-engine, this guide can be useful in solving the problems.

The information in this chapter will help you with:

1. Cylinder Components, Tests and Evaluation
2. Test for Earth Failure in the ECS System.

1. Cylinder Components, Tests and Evaluation

This document describes the usage of troubleshooting diagrams and procedures. The procedures only focus on cylinder components (excluding cylinder lubricating components).

Cylinder Fault Diagram

The Cylinder Fault Diagram (CFD – pages 2 and 3 this section) describes the correlation between system failures and symptoms (alarms and other known symptoms).
The crosses in the diagram indicate the symptoms that **can** be generated from a certain failure/cause.

Cylinder Loop Test (flowchart)

The Cylinder Loop Test (CLT – pages 4 and 5 this section) is a description of a test procedure. The CLT can isolate failures on cylinders where it is known that there is an error.

The test categorises failures in: FIVA valve, FIVA sensor, cabling, MPC, exhaust valve system, exhaust valve sensor, fuel plunger system, fuel plunger sensor and hydraulics.

This makes reference to the below mentioned tests.

Please note that there are separate tests for different FIVA valve types.

Amplifier Test (flowchart)

The Amplifier Test (AT – page 6 this section) is a description of a test procedure. The AT should be used to isolate failures in the amplifier loop if it is known that there is an error.

The test categorises failures in: amplifier, power cabling, cabling to amplifier, FIVA and MPC.

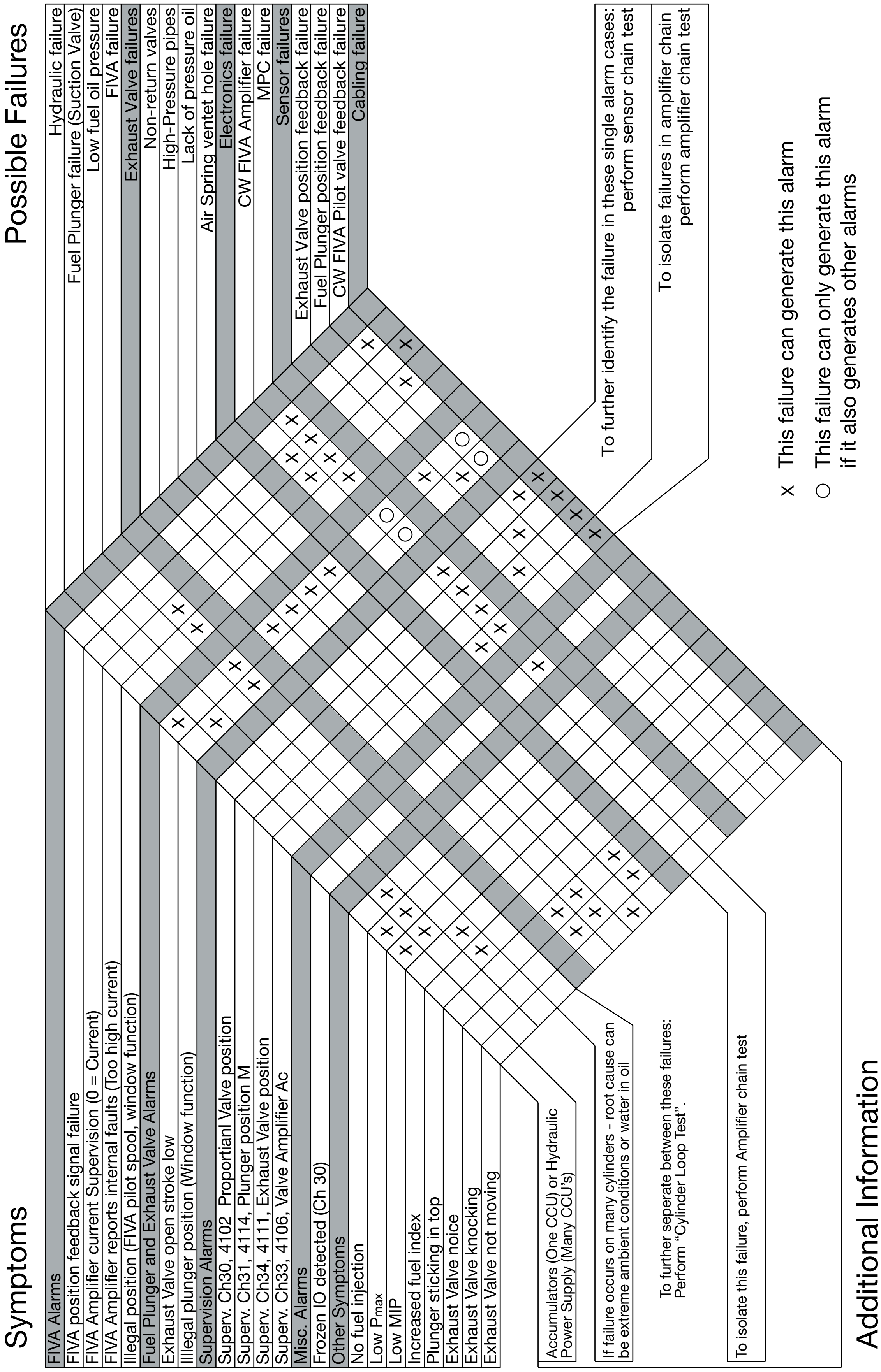
The test is only applicable on systems with Curtiss Wright FIVA valves.

Sensor Chain Test (flowchart)

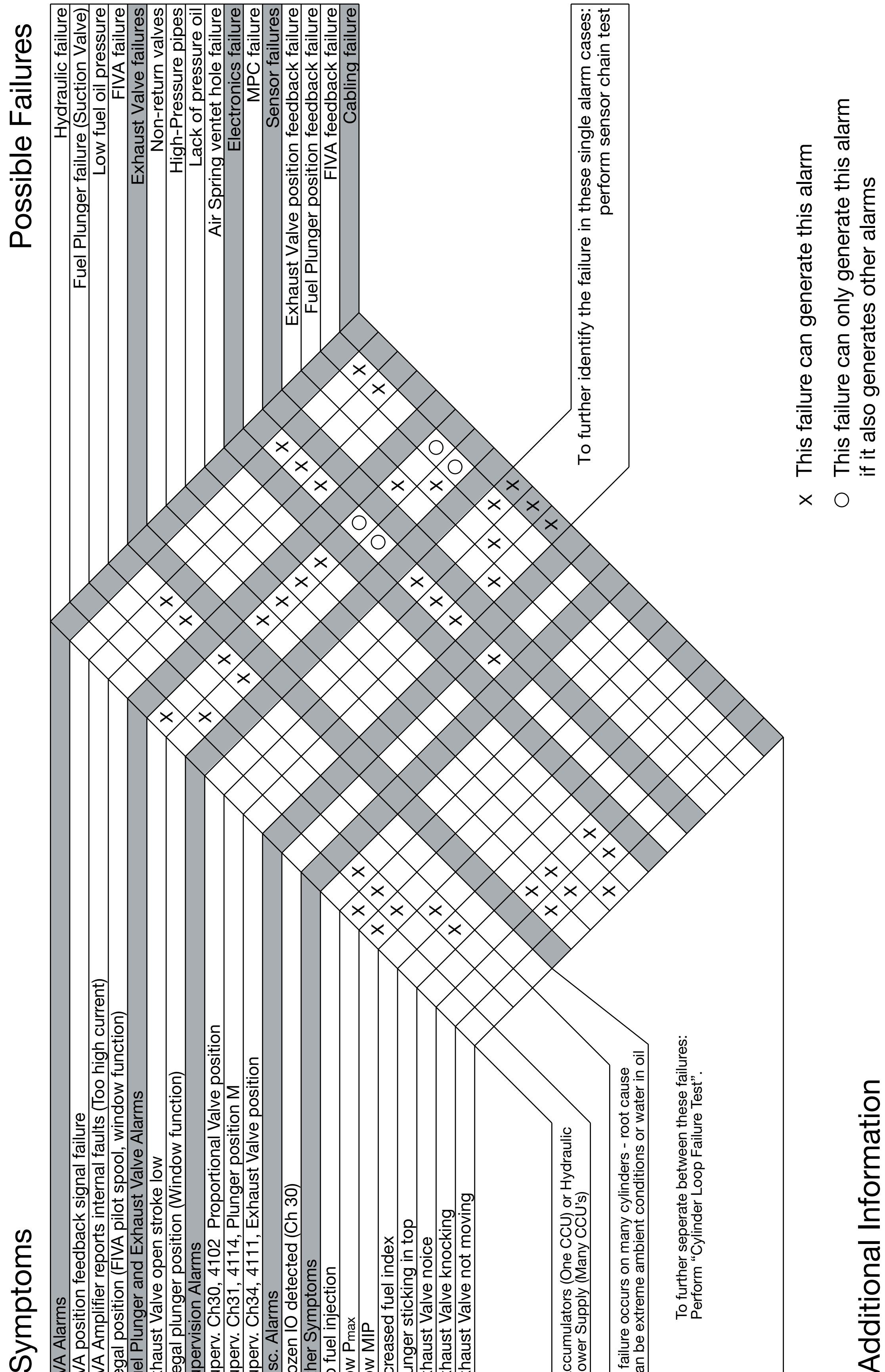
The Sensor Chain Test (SCT - page 7 this section) is a description of a test procedure. The SCT should be used to isolate failures in sensor chains where there is a supervision alarm or another error.

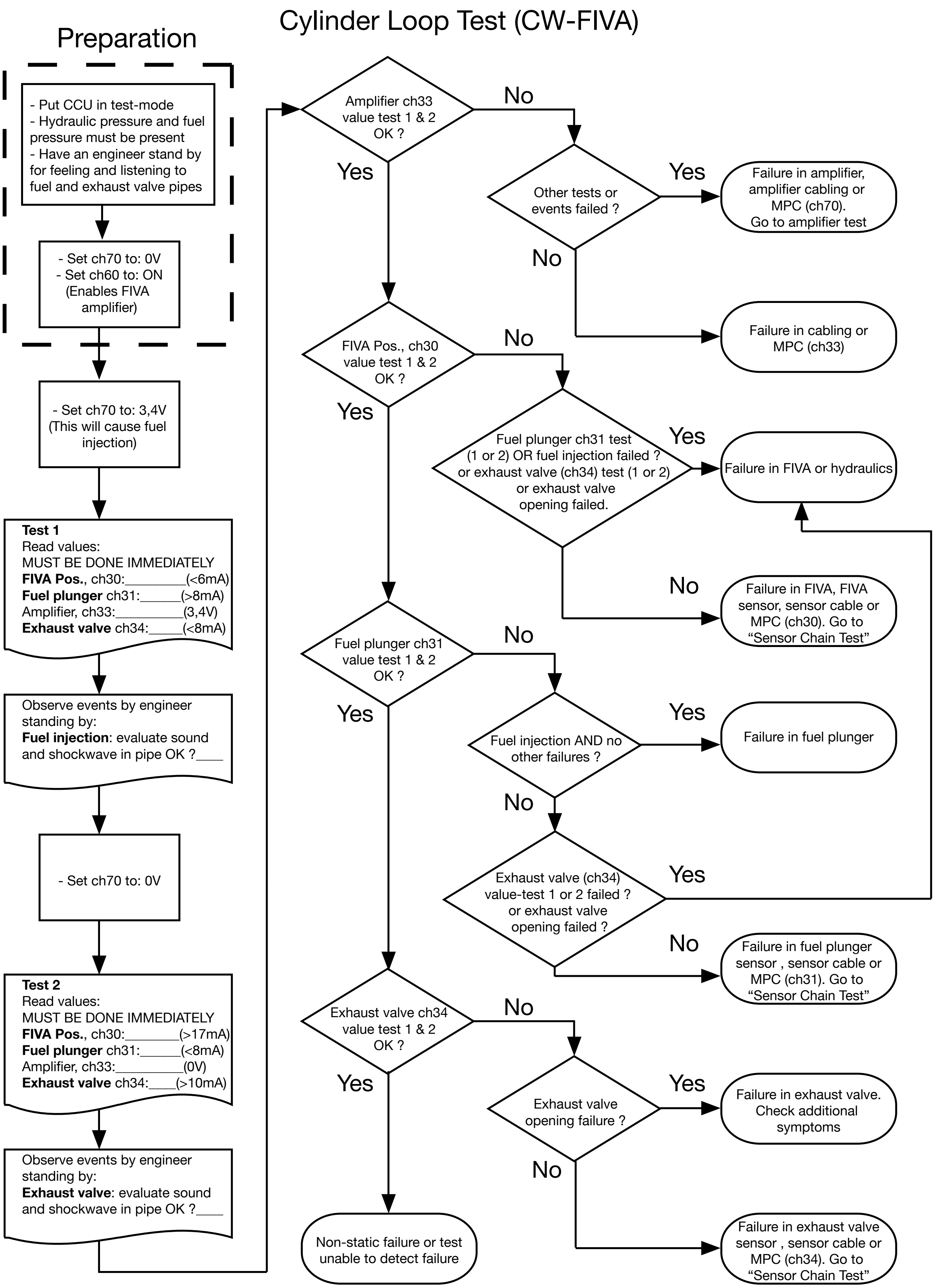
The test categorises failures in: sensor, cabling, MPC.

Cylinder Components Failure Tree (CFD – Curtiss Wright FIVA)

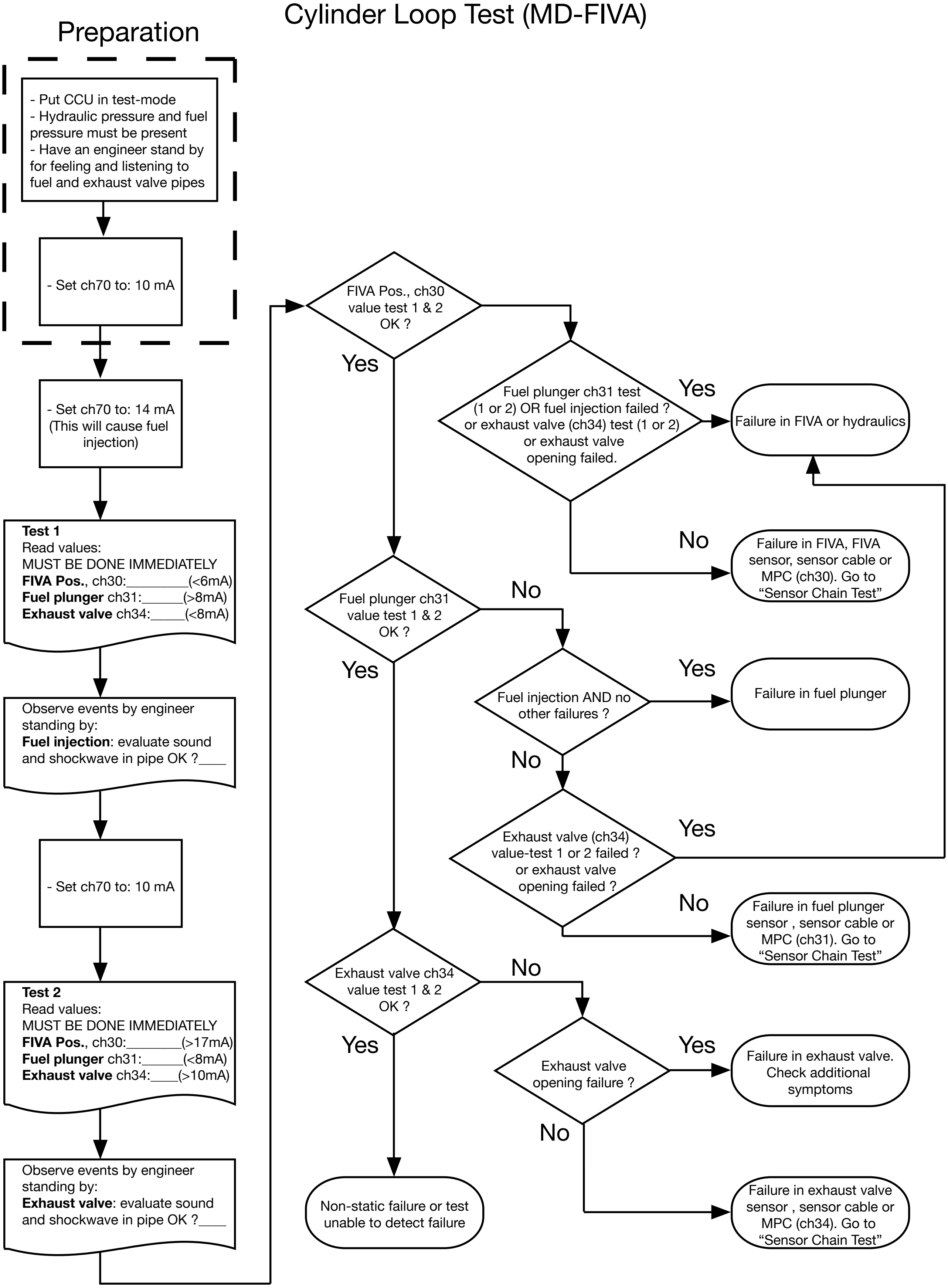


Cylinder Components Failure Tree (CFD – MBD Parker FIVA)

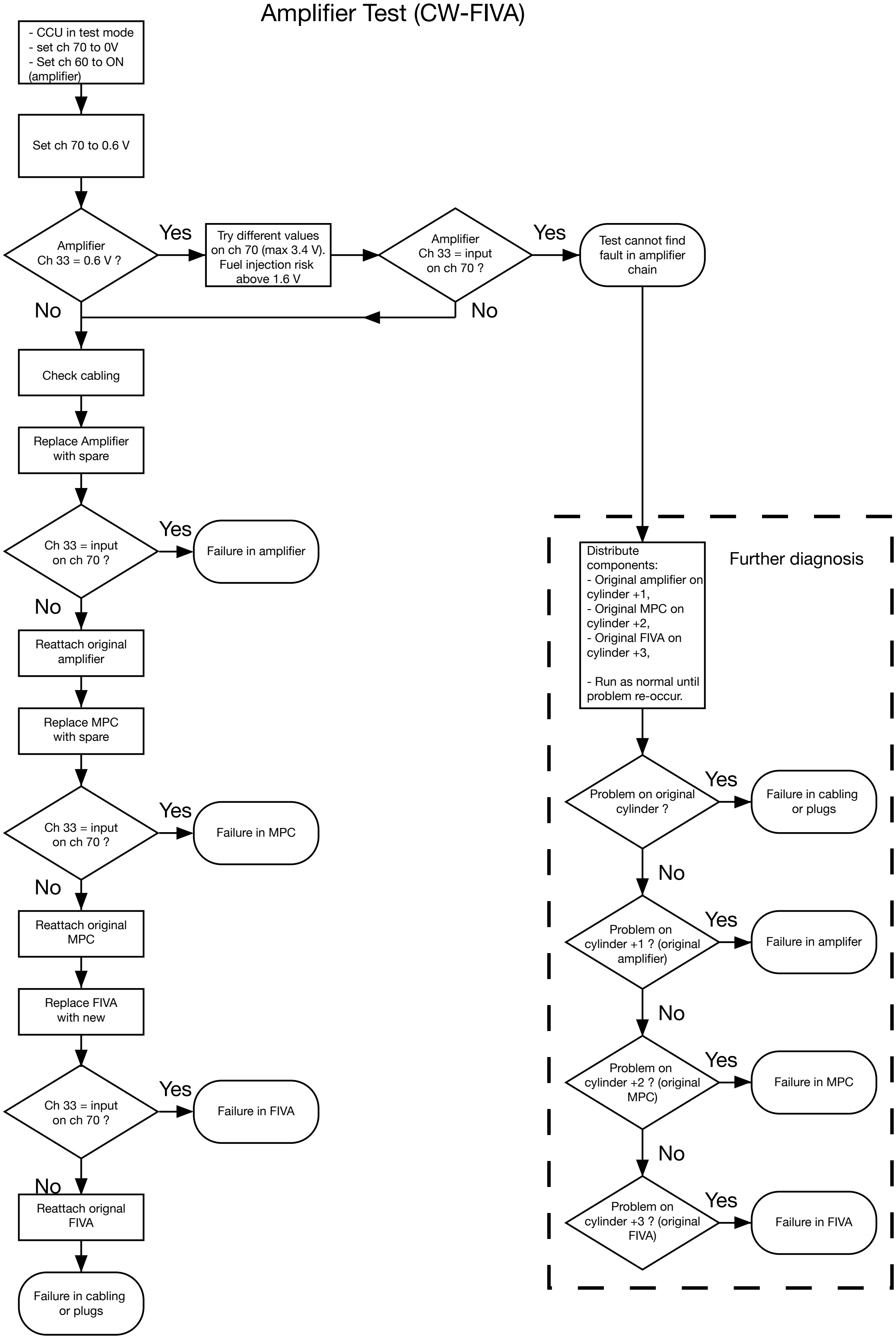


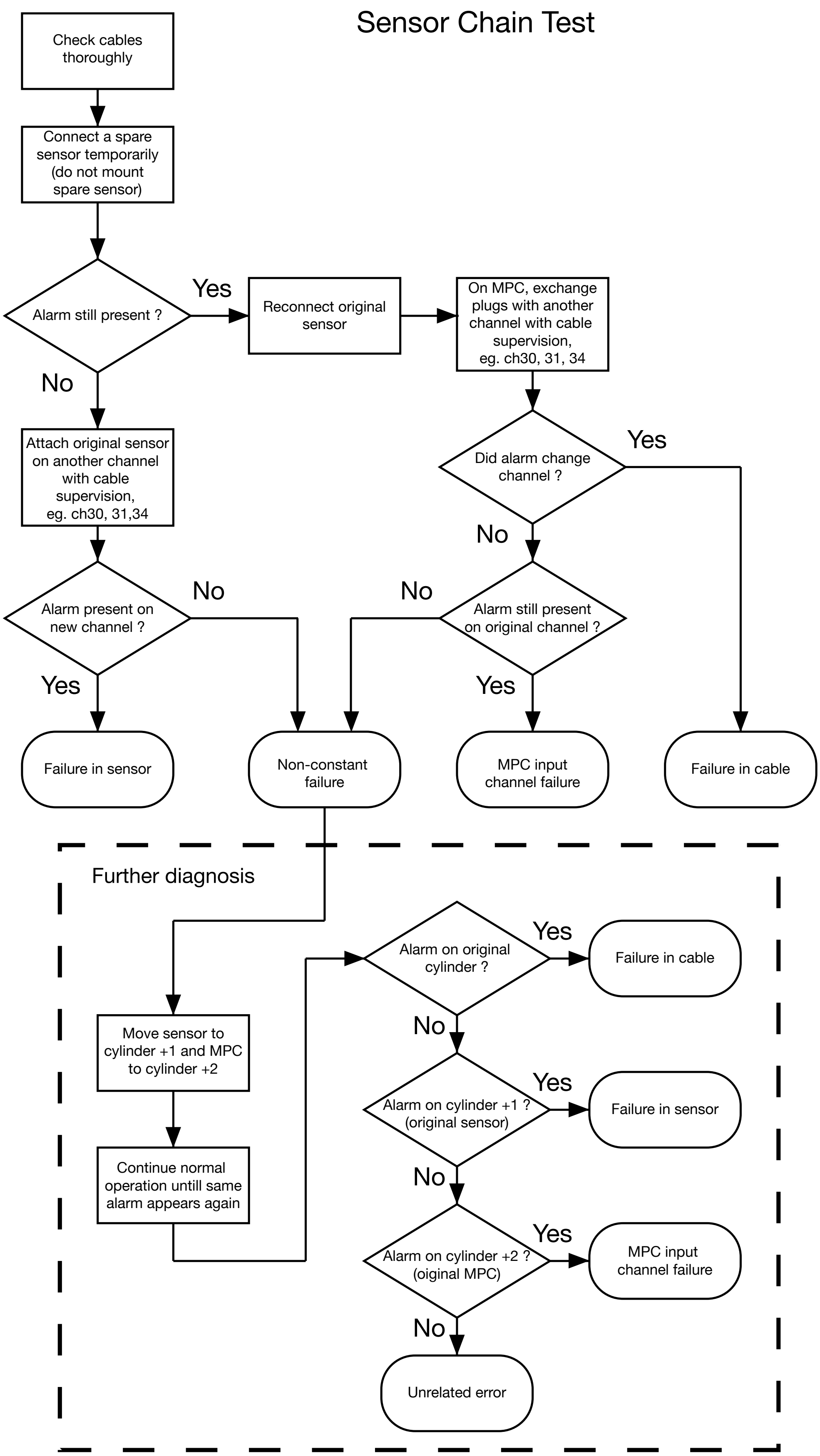

Cylinder Loop Test (CW-FIVA)
Preparation
- Put CCU in test-mode
- Hydraulic pressure and fuel pressure must be present
- Have an engineer stand by for feeling and listening to fuel and exhaust valve pipes
- Set ch70 to: 0V
- Set ch60 to: ON (Enables FIVA amplifier)
- Set ch70 to: 3,4V (This will cause fuel injection)
Test 1
Read values:
MUST BE DONE IMMEDIATELY
FIVA Pos., ch30:________(<6mA)
Fuel plunger ch31:______(>8mA)
Amplifier, ch33:__________(3,4V)
Exhaust valve ch34:_____(<8mA)
Observe events by engineer standing by:
Fuel injection: evaluate sound and shockwave in pipe OK ?____
- Set ch70 to: 0V
Test 2
Read values:
MUST BE DONE IMMEDIATELY
FIVA Pos., ch30:________(>17mA)
Fuel plunger ch31:______(<8mA)
Amplifier, ch33:__________(0V)
Exhaust valve ch34:____(>10mA)
Observe events by engineer standing by:
Exhaust valve: evaluate sound and shockwave in pipe OK ?____
Amplifier ch33 value test 1 & 2 OK ?
No
Yes
Other tests or events failed ?
Failure in amplifier, amplifier cabling or MPC (ch70). Go to amplifier test
Failure in cabling or MPC (ch33)
FIVA Pos., ch30 value test 1 & 2 OK ?
Fuel plunger ch31 test (1 or 2) OR fuel injection failed ? or exhaust valve (ch34) test (1 or 2) or exhaust valve opening failed.
Failure in FIVA or hydraulics
Failure in FIVA, FIVA sensor, sensor cable or MPC (ch30). Go to "Sensor Chain Test"
Fuel plunger ch31 value test 1 & 2 OK ?
Fuel injection AND no other failures ?
Failure in fuel plunger
Exhaust valve (ch34) value-test 1 or 2 failed ? or exhaust valve opening failed ?
Failure in fuel plunger sensor , sensor cable or MPC (ch31). Go to "Sensor Chain Test"
Exhaust valve ch34 value test 1 & 2 OK ?
Exhaust valve opening failure ?
Failure in exhaust valve. Check additional symptoms
Non-static failure or test unable to detect failure
Failure in exhaust valve sensor , sensor cable or MPC (ch34). Go to "Sensor Chain Test"

Cylinder Loop Test (MD-FIVA)



Amplifier Test (CW-FIVA)




Sensor Chain Test
Check cables thoroughly
Connect a spare sensor temporarily (do not mount spare sensor)
Alarm still present ?
Yes
Reconnect original sensor
On MPC, exchange plugs with another channel with cable supervision, eg. ch30, 31, 34
No
Attach original sensor on another channel with cable supervision, eg. ch30, 31,34
Did alarm change channel ?
Yes
No
Alarm present on new channel ?
No
No
Alarm still present on original channel ?
Yes
Yes
Failure in sensor
Non-constant failure
MPC input channel failure
Failure in cable
Further diagnosis
Alarm on original cylinder ?
Yes
Failure in cable
No
Move sensor to cylinder +1 and MPC to cylinder +2
Alarm on cylinder +1 ? (original sensor)
Yes
Failure in sensor
No
Continue normal operation untill same alarm appears again
Alarm on cylinder +2 ? (oiginal MPC)
Yes
MPC input channel failure
No
Unrelated error

2. Test for Earth Failure in the ECS System

Method 1.

Fault isolation of an earth ground failure

A certain and fast method (compared to method 2 below).

Precondition: The engine must be stopped and in FWE.

1. Disconnect the isolation monitor unit (e.g. Bender xxx) from the power supply.
2. Measure the current between ground (a non-isolated point of the engine or ship steal structure) and 0 Volt, and ground and 24 Volt, respectively, by means of an ampere meter (a multimeter in current mode) in serial with a 2 kOhm resistor. The measurement can practically be done either in the power supply of the ECS or in the power distribution box on the engine. If any of the currents are higher than 0.2 mA, the isolation to ground is too low. In a properly isolated system, the current will be lower than 0.2 mA.
3. Disconnect the power plugs (J1) (which disconnects both 0 Volt and 24 Volt) for one MPC at a time until the MPC containing the isolation fault is found, i.e. when the current drops below 0.2 mA.
4. The power plug to the MPC causing the isolation failure is connected again, and the connectors for sensors and external signals are disconnected one at a time, until either a sensor is found that causes the isolation failure, or all connectors have been disconnected. Ground current must be checked as described in Item 2 between 0 Volt and 24 Volt, respectively, while each connector is disconnected.
5. If the isolation failure is located to a sensor, its cabling must be checked and perhaps the sensor must be exchanged.
6. If the isolation failure is still present after all connectors to external signals are disconnected, while the power connector is still connected to the MPC, the failure is probably in the MPC, which must then be exchanged.

When the problem has been rectified, all connectors and plugs are reinstalled, and the isolation monitor is reconnected. Check that the isolation monitor no longer initiates an alarm (note that failures might be present in more than one unit (MPC) at a time).

Method 2

A certain but slow method.

Precondition: The engine must be stopped and in FWE.

1. Disconnect the power plug (J1) (which disconnects both 0 Volt and 24 Volt) in one of the MPCs .

2. Wait one minute - check the isolation value on the isolation monitor (e.g. Bender xxxx) in power supply A.
   If the isolation value is still lower than 24 kOhm (the alarm level), then repeat point 1 in the next MPC. In a properly isolated system the isolation is higher than 100 kOhm.

3. Repeat point 1 and 2 for each MPC until the MPC containing the isolation fault is found, i.e. when the isolation comes above 100 kOhm.

4. The power plug to the MPC causing the isolation failure is connected again.

5. One of the connectors (J2 - J85) for the sensors and external signals is disconnected.

6. Wait one minute - check the isolation value on the isolation monitor as in point 2.

7. Repeat point 5 and 6 for each of the connectors for external signals until either a sensor is found that causes the isolation failure (the isolation comes above 100 kOhm), or all connectors have been disconnected.

8. As method 1 point 5 or point 6.

When the problem has been rectified, all connectors and plugs are reinstalled. Check that the isolation monitor no longer initiates and alarm (note that failures might be present in more than one unit (MPC) at a time).

Method 3

A faster, but uncertain method.

Precondition: The engine must be stopped and in FWE.

1. Disconnect the isolation monitor unit (e.g. Bender xxxx) from the power supply.

2. Connect a voltmeter between the 0 Volt and ground (a non-isolated point of the engine or ship steel structure) and, if possible, another voltmeter between 24 Volt and ground. Alternatively one voltmeter must be connected alternately between 0 Volt and 24 Volt.
   The measurement can practically be done either in the power supply of the ECS or in the power distribution box on the engine.
   When using this method both measured values should be within 10 - 16 V (+ or -) if the system has normal isolation to ground, while an isolation failure normally causes one of the measurement to be below 5 V and the other above 20 V.

3. The further procedure is similar to method 1 above, except that pin pointing of the isolation fault is based on the voltage measurements being in the isolation fault or normal range as specified in previous point 2.

When the problem has been rectified, all connectors and plugs are reinstalled, and the isolation monitor is reconnected. Check that the isolation monitor no longer initiates an alarm (note that failures might be present in more than one unit (MPC) at a time).