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Short Title	Cooling Circuit Pressure and Leak Test Procedure
Full Title	Cooling Circuit Pressure and Leak Test Procedure
Abstract	This document describes the background, criteria and specifies the test procedure for validating cooling circuits are leak free and can withstand normal operating pressure.

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Revision Record

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Abrevassion	Meaning
FCwave	FCwave 200kW Marine Fuel Cell Module

1.0 Objectives and background

The objective with this test procedure is to generalise how cooling circuits are leak free and pressure tested.

2.0 References

Document	Titel

3.0 Equipment list

Equipment	Purpose
Pressure gauge	Monitor pressure

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4.0 Test Procedure

The main purpose of this test procedure is to ensure that the cooling circuit is leak free and can handle maximum system pressure. Furthermore, it is structured in a way to minimize the chance of having big leaks or lose clamps or fittings.

WARNING: The stress test is with elevated pressure, potentially turning plugs or loose fittings into projectiles.

Minimum safety precautions:

- Hose clamps and fittings
- Wear safety goggles
- When dealing with glycol wear gloves
- Check service manual for maximum system pressure.

4.1 Pre-conditioning

- Check and make sure valves in the cooling circuit are in the correct position.
- For pressure testing with coolant in the cooling circuit, make sure the system is fully bleed. Air in the system can act as a spring and can obscure results.
- To achieve stable temperature let system soak for 12 hours. Alternative watch data from temperature sensors in the full system to ensure stable temperature conditions.

4.2 Leak test with air

- Maximum system pressure on Megablock is 1.5barg.
- No temperature pre-conditioning needed; this is not a sign off test.
- Find compressor and leak test kit.
- Adjust pressure reduction valve to minimum (no pressure after reduction valve)
- Attach leak test kit to cooling circuit (not applying pressure to circuit)
- Open valve from compressed air
- Slowly increase pressure from reduction valve to 20% of maximum system pressure (0.3barg)
- Close valve from compressed air
    - If pressure is not maintained
        - Open valve from compressed air again and look for leaks (where surface material is suitable soapy water spray can be used for leak detection)
        - Fix leak and repeat step.
    - If pressure is maintained
        - Continue to next step.
- Open valve from compressed air
- Slowly increase pressure from reduction valve to 80% of maximum system pressure (1.2barg)
- Close valve from compressed air
    - If pressure is not maintained
        - Open valve from compressed air again and look for leaks (where surface material is suitable soapy water spray can be used for leak detection)
        - Fix leak and repeat step.
    - If pressure is maintained
        - Continue to next step.
- Open valve from compressed air
- Slowly increase pressure from reduction valve to 100% of maximum system pressure (1.5barg)
- Close valve from compressed air
    - If pressure is not maintained
        - Open valve from compressed air again and look for leaks (where surface material is suitable soapy water spray can be used for leak detection)
        - Fix leak and repeat step.
    - If pressure is maintained – test completed and passed.

4.3 Leak test with air setup

Compressor and adaptor hose to be connected. Close valve to expansion tank so that pressure can build in cooling circuit. Find test setup image in appendix.

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4.4 Pressure decay test with coolant

- Maximum system pressure on Megablock is 1.5 barg.
- Make sure cooling circuit have been filled and bled before starting this test.
- Make sure pre-conditioning have been done.
- Find coolant pressure test kit.
- Attach test kit to cooling circuit (not applying pressure to circuit)
- Slowly increase pressure 50% of maximum system pressure (0.75barg)
- Close valve from test kit.
    - Quick inspection of cooling circuit for any coolant leaks.
    - If pressure is not maintained
        - Further inspection of test setup and cooling circuit
            - If there is still air in the system if can cause spring effect and drop in pressure
        - Found and fixed issue, repeat step.
    - If pressure is maintained
        - Continue to next step.
- Open valve from test kit
- Slowly increase pressure to 100% of maximum system pressure (1.5barg)
- Close valve from test kit
    - Quick inspection of cooling circuit for any coolant leaks.
    - If pressure is not maintained
        - Further inspection of test setup and cooling circuit
            - If there is still air in the system if can cause spring effect and drop in pressure
        - Found and fixed issue, repeat step.
    - If pressure is maintained
        - Continue to next step.
- Wait 30 minutes if pressure have dropped re-apply pressure to reach 100% system pressure again.
- Wait 2 hours and check pressure again.
    - If pressure have dropped more than 0.1bar
        - Repeat test
    - If pressure have dropped less than 0.1bar after 2 hours – test completed and passed.

4.5 Pressure decay test with coolant setup

Pressure pump and adaptor hose to be connected. Close valve to expansion tank so that pressure can build in cooling circuit. Find test setup image in appendix.

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5.0 Results and discussion

6.0 Appendix

6.1 Cooling leakage HT1 (Suggested section for FAT or SAT document)

6.1.1 Test

Follow designated test procedure for inspection and verification of a leak-free HT1 coolant circuit.

6.1.2 Relevant Standard / document

- SPC ID 0103 Cooling Circuit Pressure and Leak Test Procedure

6.1.3 Brief Test Plan

- Follow test procedure.

6.1.4 Pass/Fail criteria.

- Allow system to maintain pressure, after 2 hours pressure must not drop more than 0,1 bar.

6.1.5 Test Result

Table 1: Cooling leakage HT1 - Test Result

Date tested	Item	Result	Pass/Fail	Notes
	HT 1			

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6.2 Pressure decay test with coolant

Pressure pump and adaptor hose to connect and pressurise.



6.3 Leak test with air

Compressor and pressure test adaptor hose.

