

## Design Verification Test Procedures

Procedure Number: E2-5

Revision Date: 04/20/00

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Purpose:	To establish a review procedure of required Design Verification Test Procedures. <b>See work instructions E2-1 and E2-18.</b>
References:	<ol style="list-style-type: none"><li>a. Title 46 CFR Titles 58, 61 and 62</li><li>b. Title 46 CFR Parts 111 and 112</li><li>c. Navigation and Inspection Circular (NVIC) 2-89, "Guide for Electrical Installations on Merchant Vessels and Mobile Offshore Drilling Units"</li><li>d. American Bureau of Shipping (ABS), "Rules for Building and Classing Vessels under 90 Meters in Length", 1996</li><li>e. Safety Of Life at Sea (SOLAS), Consolidated Editions, 1997, Chapter II-1, Part D</li><li>f. E2-1 and E2-18, MSC Work Instructions</li></ol>
Responsibilities:	<p>The submitter shall include this document as part of the automation plan submittal package, through a single point of contact or the prime contractor of the project. The submission shall be made in triplicate.</p> <p>The MSC branch chief shall assign the level of review to be conducted.</p>
Applicability:	<ul style="list-style-type: none"><li>• Applicable to self-propelled vessels of 500 gross tons and over that are certificated under subchapters D, I, and U, and to self-propelled vessels of 100 gross tons and over that are certificated under subchapter H.</li><li>• The Design Verification Test Procedure (DVTP) document is required to be "<b>Approved</b>" and retained aboard the vessel. Using the DVTP document, design verification testing is required to be performed immediately after the installation of the automated equipment or before the issuance of the initial Certificate of Inspection. Final approval of the DVTP document is contingent upon satisfactory completion of onboard design verification tests in the presence of the Coast Guard. See 46 CFR 61.40-1(c), and 62.30-10(a).</li></ul>

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## Design Verification Test Procedures (cont'd)

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- Design verification testing is used to verify the automated vital system installations are designed, constructed and operate in accordance with the applicable requirements in 46 CFR Part 62. See 46 CFR 61.40-3.
  - The design verification test procedures may be incorporated with the qualitative failure analysis (QFA). See E2-18 Work Instruction.
  - The DVTP document is a separate document from the Periodic Safety Test Procedure (PSTP) document. Both documents are required to be approved and retained aboard the vessel. See 46 CFR 61.40-1(c).
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Level 1  
Review:

- The DVTP document, if submitted separately with the OFA document, must include the following QFA document information:
  - a. Component Failure Considered
  - b. Failure Effects
  - c. Failure Detection
  - d. Alternatives or Control Alternatives Available to the Crew

See Attachments 1 through 3 for sample DVTP formats.

- Examine the test instructions to insure that they closely or realistically simulate the failure of only the failed component of each of the failures considered in the failure analysis. For example: A PLC power supply module failure may be tested by removing the fuse to the power supply module, but a CPU failure (served by the same power supply module), should not be tested using the same power supply fuse, as it is desired the power supply to remain in operation, with just the CPU failing.
- Test instructions should be prepared as if the vessel is underway, in pilothouse automatic pilothouse control, various machinery automation in normal underway mode of operation, and the engineroom manned to the manning level design of the machinery plant.

## Design Verification Test Procedures (cont'd)

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- Design verification testing using the failures considered in the QFA, the vital system automation installation, although supplied by various manufacturers, should function as an integrated system, i.e., various automated systems, although supplied by separate manufacturers, may be used to monitor the operational integrity of other systems and provide failure alarms.
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Level 2  
Review:

- Programmable control or alarm system logic must not be altered after satisfactory completion of Design Verification Tests without the approval of the cognizant Officer in Charge, Marine Inspection. This comment should be included in the approval letter of the DVTP document to insure the cognizant OCMI and the ship's owner are aware of the requirements. See 46 CFR 62.25-25(a). This means that the DVTP document is only used during the initial issuance of the vessel's certificate of inspection or immediately after the installation of the automated equipment, and when the installed automated equipment is upgraded or altered. For the PSTP document, periodic safety testing is conducted at periodic intervals specified by the Coast Guard.

Note: There is no Level 3 review for this instruction.

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Attachments:

1. Sample A, DVTP Format
2. Sample B, DVTP Format

## Design Verification Test Procedures (cont'd)

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### 1.4 6032-610 Digital Input Board Failure

- Effect on the system  
Input channels for failed board are no longer updated (32 channels).
- Failure detection  
Audible alarm and I/O board failure LEDs on the 6032-610 board and on the communication processor are illuminated. Diagnostic alarm message 6032 board position XX failure appears on local operator panels and on graphic workstations. XX indicates the position of the card in the computer rack.
- Failure recovery  
Replace failed 6032-610 board.
- Failure simulation  
Withdraw 6032-610 from rack.

### 1.5 6001-610 Communication Processor Board Failure

- Effect on the system.  
Graphic work stations and local operator panels are no longer updated. Alarm conditions are still indicated on the front panel of the system in the engine control room..
- Failure detection  
Audible alarm and processor board failure LED on 6001-610 board is illuminated. Diagnostic alarm message "CAM XX disconnected" appears on the graphic workstations. Green "system on" LEDs on local operator panels are no longer illuminated.
- Failure recovery  
Replace failed 6001-610 board.
- Failure simulation  
Withdraw 6001-610 from rack..

### 1.6 Duty Selection Unit Failure

- Effect on the system  
No longer possible to select a duty engineer or to create a general engineers alarm..
- Failure detection  
Diagnostic alarm message "duty selection unit failure" appears on the local operator panels and on the graphic workstations. Green "system on" LED on duty selection unit is no longer illuminated.
- Failure recovery  
Check the power fuse on the back of the unit and if the field wires are properly connected. Replace failed duty selection unit.
- Failure simulation  
Remove power fuse from the duty selection unit.

### **Sample A, DVTP Format**

## Design Verification Test Procedures (cont'd)

### 1B1 Loss of Control Interface Slave Module

Testing the failure effects on the starboard boiler combustion control process.

WARNING: Removal of the IMC-IS02 in Step 1 below will cause the starboard boiler to go to low fire due to the fuel oil control valve failing.

STEP	COMPONENT	ACTION	RESULT	ALTERNATE ACTION/CONTROL	ALARM	VERIFIED
1	IMC-IS02 PCU 1 Module 2 Slave 1	In PCU Cabinet #1, remove the IMCIS02 module with the address Module 2 Slave 1.	Analog inputs to the INFI 90 System from this module show last known value as bad quality. Analog outputs from the module go to 0 mA.		System alarm Bad Quality indicated for inputs to this module	_____
			The starboard boiler goes to low fire due to the fuel oil control valve failing to minimum due to loss of control signal.	If the starboard boiler must be operated, manual control can be maintained from the IISAC in the bypass mode. Also manually control the valve via the valve hand wheel.	Starboard Boiler Trip Alarm	_____
			The starboard boiler steam flow signal is lost. The steam drum level should not be controlled in automatic without the signal.	If the starboard boiler must be operated, drum level must be controlled by the IISAC in the bypass mode.		_____
			The starboard superheat temperature control valve falls open due to loss of control signal.	If the starboard boiler is operated, the superheater control valve must be operated by the IISAC in the bypass mode or in Local Manual Control.		_____
2	IMC-IS02	In PCU #1 insert the IMCIS02 module which was removed in Step 1 above with address Module 2 Slave 1.	Functions and control lost in Step 1 above are restored. System is normal.			_____

### Sample B, DVTP Format