Appendix D to
"A Method for Developing Mariner Assessments"

MARINER ASSESSMENT PROCEDURES FOR LOCATING COMMON FAULTS AND PREVENTING DAMAGE TO GENERATORS

This appendix contains example procedures for assessing a mariner's ability to locate common faults and prevent damage to generators. The assessment package consists of the following: assessor instructions, candidate instructions, three assessment worksheets, and an assessment control sheet for documenting the final results of the assessment.

This report may be downloaded from the U.S. Coast Guard Research and Development Center web site at http://www.rdc.uscg.mil.

TABLE OF CONTENTS

ASSESSOR INSTRUCTIONS

Introduction

The following procedures are designed to evaluate a candidate's ability to determine common faults during the operation of a ship service generator, including faults that occur during the start and the operations. The candidate must identify the fault and take corrective action to maintain operations or reduce the risk of damage to the generator and the electrical system.

This assessment was specifically developed for an electrical generation system that includes at least two diesel generators. The specific system used in the generation is part of a Norcontrol simulator of a slow-speed diesel plant. However, this assessment may be applicable to any electrical generation plant that has more than one diesel generator. The method of dealing with faults is specifically designed for a simulator and may not be directly applicable to shipboard installations.

The assessment materials include *Assessor Instructions*, *Candidate Instructions*, an *Assessment Control Sheet*, and three separate assessment modules (*Assessment Worksheets I-III*). The *Assessor Instructions* describe the assessment objectives, method, performance measures, and performance standards. The *Assessor Instructions* also list the responsibilities of the assessor during each phase of the assessment process. The *Candidate Instructions* explain the assessment process from the candidate's perspective and define the responsibilities of the candidate.

The *Assessment Control Sheet* provides a record of the names of the candidate, assessor, and qualified instructor who certified that the candidate met the training prerequisites for assessment. The control sheet also includes the date and location of the assessment and the STCW reference information for the competency area being assessed. Section 3 of the *Assessment Control Sheet* provides space for the assessor to record the candidate's score on each assessment objective. Finally, section 4 of the control sheet summarizes the assessment objectives and the actions comprising each objective.

As the assessor, you will evaluate the candidate's ability to complete the assessment objectives correctly. Using the scoring procedures described below, you will provide the candidate with a separate score for each assessment objective and compile these scores into a final score for the entire assessment. The scores for each assessment objective and the candidate's overall score for the entire assessment are to be recorded on the *Assessment Control Sheet*.

The rest of this section briefly describes the various components of this assessment. *Assessment Worksheets I* through *V* provide additional information about the assessment objectives, method, conditions, performance measures, performance standards, and scoring procedures.

Assessment Objectives

The candidate should evaluate the performance of the generator and its prime mover, identify faults and take action to correct the fault or minimize the potential damage. You should assess the candidate's ability to:

1. Identify and correct faults that occur during engine start.

2. Identify and correct operational faults.
3. Restore power after generator failure.

Assessment Method

These objectives should be assessed in an engine room simulator so that conditions can be varied without affecting the safety of a vessel, its crew, or equipment. The simulator can be either diesel or steam.

Assessment Conditions

The assessment should begin at the local control station. The candidate then should work throughout the engine room simulator. As the assessor, you should set the appropriate faults into the simulator controls and observe the candidate's actions. The candidate should not receive any assistance from others during the assessment.

Performance Measures and Standards

Identifying and correcting faults for the electrical generators involves approximately 17 actions. These actions include a number of steps that must be completed in sequence for a successful correction of the problem. The performance assessment will be based on demonstrating how to analyze the problem and complete each step, not on the memorizing the exact order of all the actions.

Use pass/fail scoring:

- **Pass** – Performance demonstrates an ability to successfully identify the fault and carry out actions to correct the fault or prevent damage to the equipment.
- **Fail** – The candidate either did not identify the fault, or when identified, did not take proper corrective action.

Note that the faults in assessment objective 1 are generally not as critical as faults in objective 2, because the potential for damage is not as great. In objective 3, if the candidate doesn't perform an action properly, he or she will not restore the power. Therefore, most of the items in objective 3 are required items – that is, if the candidate fails these items, he or she fails the entire assessment.

Individual measures and standards for each assessment objective are specified on *Assessment Worksheets I* through *III*. The range of scores acceptable for a "Pass" grade is indicated at the bottom of each worksheet.

Assessment Checklist

The following checklist summarizes the tasks and responsibilities of the assessor at each phase of the assessment process.

Preparing for the Assessment

- Start the simulator and set it in the configuration required for the assessment.
- Set desired faults in the simulator. These faults are in the objective column of the attached scoring form. One fault should be entered for each of the objectives. If there is more than one possible cause of the fault, the assessor may set any one of the possible faults. (The flexibility of the simulator may determine which faults can be set.) There are no faults to be set for the third task, restoring power after generator failure. The assessor must set up the simulator for generator failure.

Briefing the Candidate before the Assessment

- Provide the candidate with a copy of the *Candidate Instructions* and *Assessment Control Sheet*.
- Review the assessment procedures with the candidate and answer any questions.
- Explain the assessment performance measures and standards.
- Discuss the desired outcome(s) and consequences of failing to perform part of all of the assessment.
- Explain that the assessment will be terminated if the candidate does not correctly perform all of the "required" actions (i.e., those with an italicized note in the "standards" column of each Assessment Worksheet).
- Remind the candidate that it is permissible to ask questions during the assessment, especially if he or she has a safety concern.
- Discuss the candidate's willingness to be assessed under the circumstances presented.

Observing the Candidate's Performance

- If a safety violation occurs, terminate the assessment immediately.
- Continuously observe the candidate during the assessment. Require that standard procedures or company policy be adhered to except when assessment procedures require demonstration of knowledge or skill different from a convention adopted by the company or facility.
- Ensure realistic assessment conditions consistent with a normal working environment for a marine engineer. Ensure the candidate can concentrate on the task at hand.
- Avoid giving the candidate unsolicited assistance, but respond to appropriate questions and provide appropriate equipment when required.
- Remain objective and maintain positive control of the operation at all times.

Determining Assessment Outcome

- Record performance on the appropriate assessment worksheets.
- Apply the scoring procedure.

- Remember that if the candidate has incorrectly performed any of the "required" actions, he or she automatically fails the entire assessment (required actions are noted in italics in the "standard" column of each assessment worksheet).
- Determine and document the outcome of the assessment, then transfer the final results to the *Assessment Control Sheet*.

Debriefing the Candidate

- Debrief the candidate as soon as possible after the assessment.
- Provide the candidate with a copy of the *Assessment Control Sheet.*
- Restate the assessment objectives.
- Focus on positive accomplishments first.
- Identify areas needing improvement.
- If the candidate failed to demonstrate proficiency, jointly develop an improvement plan to prepare for reassessment.

CANDIDATE INSTRUCTIONS

In this assessment, you will be evaluated on your ability to successfully locate common faults and prevent damage to generators. Table 1 shows the 1995 *STCW Code* specification for operating generators and control systems.

Table 1. *STCW Code* specification for operating generators and control systems.

STCW Requirement	1995 *STCW Code*, Section A-III/1 (p. 76): Mandatory minimum requirements for certification of ratings for officers in charge of an engineering watch in a manned engine room or designated duty engineers in a periodically unmanned engine room.
STCW Function	Electrical, electronic and control engineering at the operational level.
STCW Competence	Operate alternators, generators and control systems.
STCW Proficiency	*Generating plant* - Location of common faults and action to prevent damage.

Assessment Objectives and Methods

A qualified assessor will assess you on your ability to meet the three assessment objectives in the first column of Table 2. Note that each assessment objective has a corresponding set of assessment methods. Performance assessed by "practical skill demonstration" means your assessor will ask you to demonstrate your ability to perform the actions required in the objective. Your practical skill demonstration will occur in an engine room simulator. Performance assessed by "oral test questions" means your assessor will ask you to respond to one or more questions and then assess your ability to respond correctly to each question.

Table 2. Assessment objectives and methods for locating common faults and preventing damage to generators.

Assessment Objective	Assessment Method
1. Identify and correct faults that occur during engine start.	Practical skill demonstration in an engine room simulator / Oral test questions
2. Identify and correct operational faults.	Practical skill demonstration in an engine room simulator / Oral test questions
3. Restore power after generator failure.	Practical skill demonstration in an engine room simulator / Oral test questions

Refer to the *Assessment Control Sheet* for a list of the specific actions required for each objective (you should receive a copy of this document from the assessor during your pre-assessment briefing). Below are some general guidelines for what you should expect during the assessment process.

Pre-Assessment Briefing with Assessor

This briefing should occur approximately a week in advance of the scheduled assessment, if possible. This will help you and the assessor to be well prepared for the assessment when it actually occurs. During this briefing, you should:

- Discuss your prior experience, training, and/or company policy with the assessor. On the basis of these qualifications, discuss whether you are qualified to undertake this assessment. If you both agree you are qualified, then continue with the assessment process. If not, arrange for additional on-the-job or simulator training, and set a date for another review of your qualifications.
- Obtain a copy of the *Assessment Control Sheet* from your assessor. Review this document and discuss the scope and depth of knowledge covered by this assessment. Ask questions about any part of the assessment that is unclear.
- Review the assessment performance measures and standards, and ask any questions you have about them.
- Discuss the desired outcome(s) and the consequences of failing to perform any part of the assessment.
- Discuss the general assessment procedures. Your assessor will inform you of how much time is allowed, when the assessment begins, and under what circumstances he or she will terminate the assessment.
- Discuss any non-standard procedures that are expected of you during the assessment.
- Consider whether you are willing to be assessed under the circumstances presented and advise the assessor of your willingness to undertake the assessment.

Participation in the Assessment

Your assessment will begin at the local engineering control station. During the assessment you will be working throughout the simulator.

The assessor will suspend the assessment if abnormal conditions develop with any equipment or if the safety of personnel or equipment is endangered. He or she will also suspend the assessment if you fail to correctly perform one of the required actions for this assessment.

Your assessor will continuously observe you during the assessment. You are expected to adhere to standard procedures or company policy unless the assessor briefs you on a requirement to perform a non-standard procedure. During the assessment, remember to:

- Use appropriate marine terminology and nomenclature at all times.
- Listen to an entire question before responding or acting. Remember that you may not use reference material of any kind during the assessment.
- Ask questions if you have a safety concern. The assessor will provide you with appropriate responses to your questions. If a safety violation occurs, the assessor will terminate the assessment immediately.

Your assessor will ensure realistic assessment conditions consistent with the normal working environment for an engineer.

The Outcome of Your Assessment

The assessor will record your performance on a series of *Assessment Worksheets.* He or she will score each assessment objective on a "Pass/Fail" basis. Acceptable performance (a "Pass" score) will be based on your ability to correctly respond to test questions. It will also be based on your ability to perform assigned tasks safely in a manner that demonstrates:

- The required level of skill, knowledge, and ability.
- Sound and professional judgment.

Unacceptable performance (a "Fail" score) will be based on your failure to perform a critical phase of the assessment exercise proficiently. When this occurs, your assessment will be suspended and postponed until you receive further instruction and training.

Note that the following events will terminate an assessment immediately:

- An action, or lack of action, by you which required corrective action or intervention by the assessor to prevent injury, damage, or the development of a hazardous condition.
- Your failure to use proper procedures, including appropriate communication procedures, during the assessment.
- Your failure to take prompt corrective action when required.

The assessor will strictly adhere to pre-determined scoring procedures, and will document the outcome of the assessment. He or she will transfer the final results of your assessment to the *Assessment Control Sheet*.

Assessment Debriefing

You and the assessor should discuss the assessment results as soon as possible after the assessment. During the debriefing:

- The assessor should provide you with a copy of the *Assessment Control Sheet* describing the results of your assessment.
- The assessor should restate the assessment objective(s) and identify those that you successfully demonstrated.
- If appropriate, you and the assessor should discuss the areas in which you need improvement, and then develop an improvement plan based on the assessment outcome.

ASSESSMENT CONTROL SHEET

Section 1. Assessment Reference Information

1. Name of Candidate	2. Name of Designated Assessor	3. Signature of Qualified Instructor[1]
4. Date of Assessment	5. Assessment Location[2]	

Section 2. STCW Reference Information

Assessment Area	*Locating common faults and preventing damage to generators*.
Assessment Method	Simulator assessment and oral test questions.
STCW Requirement	*STCW Code*, Section A-III/1, p. 76 – Mandatory minimum requirements for certification of ratings for officers in charge of an engineering watch in a manned engine room or designated duty engineers in a periodically unmanned engine room.
STCW Function	Electrical, electronic and control engineering at the operational level.
STCW Competence	Operate alternators, generators and control systems.
STCW Proficiency	*Generating plant* - Location of common faults and action to prevent damage.

Section 3. Assessment Objectives, Methods, and Scores

Assessment Objective	Assessment Method	Score
1. Identify and correct faults that occur during engine start.	Practical skill demonstration in an engine room simulator/ Oral test questions	❑ Pass ❑ Fail
2. Identify and correct operational faults.	Practical skill demonstration in an engine room simulator/ Oral test questions	❑ Pass ❑ Fail
3. Restore power after generator failure.	Practical skill demonstration in an engine room simulator/ Oral test questions	❑ Pass ❑ Fail
COMMENTS:	**FINAL SCORE**	❑ Pass ❑ Fail

[1] The qualified instructor certifies that the candidate has met the training prerequisites.

[2] Write the name of the simulator or vessel used during the assessment (e.g., Massachusetts Maritime Academy training simulator, *ARCO California*, etc.).

Section 4. Assessment Worksheet Summary

Assessment Worksheet	Assessment Objective	Action
I	1. Identify and correct faults that occur during engine start.	1.1 Identify and correct fault of lack of pump oil pump pressure. 1.2 Identify and correct lack of starting air. 1.3 Identify and correct lack of fuel oil pressure. 1.4 Identify and correct failure to start due to overspeed trip. 1.5 Identify and correct failure of prime mover to come up to speed. 1.6 Identify and correct failure of generator to synchronize with the bus.
II	2. Identify and correct operational faults.	2.1 Identify and correct loss of lube oil pressure. 2.2 Identify and correct overheating generator. 2.3 Identify and correct overheating of prime mover. 2.4 Identify and correct overload of prime mover. 2.5 Identify and correct loss of fuel oil pressure. 2.6 Identify and correct low cycles. 2.7 Identify and correct for overspeed.
III	3. Restore power after generator failure	3.1 Ensure non-operational engine is not connected to bus. 3.2 Start idle engine and generator. 3.3 Connect generator to bus. 3.4 Secure emergency generator.

ASSESSMENT WORKSHEET I

Section 1. Assessment Conditions

Assessment Objective	*1. Identify and correct faults that occur during engine start.*
Assessment Method	Engine room simulator assessment and oral test questions.
Candidate Orientation	The candidate should have a strong familiarization with the equipment involved and the operations of the simulator. The assessor will be either observing the candidate directly or from the simulator control station. The candidate should attempt to start the generator. The candidate should then identify and correct the faults the assessor has programmed. The assessor will set the faults into the simulator and tell the candidate when to start. The assessor will then check to be sure that the task is properly completed.
Required Equipment, Apparatus, and/or Tools	The candidate should begin the assessment at the engineer's local operating console in the simulator.
Initial Conditions	The auxiliary generator and its prime mover are secured but operational and available for use. All the support systems are lined up and operational. The area is clear and the assessor can observe activities. The assessor should create the following faults; however, he or she can change the order in which they occur: ❑ Prime mover fails to start due to: • Lack of lube oil pump of pressure. • Lack of starting air pressure. • Lack of fuel oil pressure. • Failure to reset the overspeed trip. ❑ Prime mover will not come up to speed. ❑ Generator will not synchronize with electrical bus.

Section 2. Actions, Performance Measures, Standards, and Scores

Action	Performance Measure	Performance Standard	Score
1.1 Identify and correct fault of lack of oil pump pressure.	Checks and corrects lube oil level Starts lube oil pump	Correctly checks and corrects lube oil level Correctly starts lube oil pump	❑ Pass ❑ Fail
1.2 Identify and correct lack of starting air.	Checks and corrects starting air valve Checks and corrects starting air compressor Answers questions: *What are the potential causes of the fault?* *How should the equipment respond to your actions?*	Correctly checks and corrects: ❑ Air valve. ❑ Air compressor. Correctly responds to both questions	❑ Pass ❑ Fail

Section 2. Actions, Performance Measures, Standards, and Scores (continued)

1.3 Identify and correct lack of fuel oil pressure.	Checks and corrects fuel oil line up Checks and corrects dirty fuel oil filters/strainers Answers questions: *What are the potential causes of the fault?* *How should the equipment respond to your actions?*	Correctly checks and corrects: ❑ Fuel oil line up. ❑ Dirty fuel oil filters/strainers. Correctly responds to both questions	❑ Pass ❑ Fail
1.4 Identify and correct failure to start due to overspeed trip.	Check and reset overspeed trip Answers questions: *What are the potential causes of the fault?* *How should the equipment respond to your actions?*	Correctly checks and resets overspeed trip Correctly responds to both questions	❑ Pass ❑ Fail
1.5 Identify and correct failure of prime mover to come up to speed	Checks and corrects low fuel oil pressure Answers questions: *What are the potential causes of the fault?* *How should the equipment respond to your actions?*	Correctly checks and corrects low fuel oil pressure Correctly responds to both questions	❑ Pass ❑ Fail
1.6 Identify and correct failure of generator to synchronize with the bus	Checks and corrects low voltage Checks and corrects low cycles Answers questions: *What are the potential causes of the fault?* *How should the equipment respond to your actions?*	Correctly checks and corrects: ❑ Low voltage. ❑ Low cycles. Correctly responds to both questions	❑ Pass ❑ Fail
SCORING PROCEDURE Total the number of "Pass" scores you indicated above. **Pass:** Score of 5-6 **Fail:** Score of 0-4 Transfer the final score at right to the *Assessment Control Sheet*.		**FINAL SCORE**	❑ Pass ❑ Fail

ASSESSMENT WORKSHEET II

Section 1. Assessment Conditions

Assessment Objectives	*2. Identify and correct operational faults.*
Assessment Method	Engine room simulator assessment and oral test questions.
Candidate Orientation	The assessor briefs the candidate on assessment methods, conditions, and standards and then either observes the candidate directly or from the simulator control station. The candidate should demonstrate the ability to identify and correct faults that occur on an operating generator. This demonstration of knowledge will be verified by observing the candidate reacting to the faults the assessor has programmed.
Required Equipment, Apparatus, and/or Tools	The candidate should begin this assessment from the electrical control station. During the assessment, the candidate may need to return to the engineer's local operating stations in the simulator.
Initial Conditions	The prime mover and generator should be operating properly and should be connected to the electrical bus. It may be necessary for the candidate to operate a second generator to correct the faults. To create faults, the assessor should vary the following items. He or she may vary the order in which these faults occur: ❑ Loss of lube oil pressure. ❑ Overheating of the generator. ❑ Overheating of the prime mover. ❑ Overload of the prime mover. ❑ Loss of fuel oil pressure for the prime mover. ❑ Generator cycles below operating level. ❑ Overspeed of prime mover.

Section 2. Actions, Performance Measures, Standards, and Scores

Action	Performance Measure	Performance Standard	Score
2.3 Identify and correct loss of lube oil pressure.	Checks engine for lube oil leaks Stops engine, if required Starts engine, if required	Correctly checks engine for lube oil leaks Correctly starts or stops engine, as required	❑ Pass ❑ Fail
2.2 Identify and correct overheating generator.	Checks load on generator Reduces load on generator Checks fresh water cooling Checks ventilation level	Correctly checks and reduces load on generator Correctly checks: ❑ Fresh water cooling. ❑ Ventilation level.	❑ Pass ❑ Fail

Section 2. Actions, Performance Measures, Standards, and Scores (continued)

2.3 Identify and correct overheating of prime mover.	Checks fresh water-cooling to engine Checks ventilation in engine room Answers questions: *What are the potential causes of the fault?* *How should the equipment respond to your actions?*	Correctly checks: ❑ Fresh water-cooling to engine. ❑ Ventilation in engine room. Correctly responds to both questions	❑ Pass ❑ Fail
2.4 Identify and correct overload of prime mover.	Checks electrical load Reduces load as required	Correctly checks electrical load of prime mover Correctly reduces electrical load of prime mover	❑ Pass ❑ Fail
2.5 Identify and correct loss of fuel oil pressure.	Checks filters/strainers Checks fuel oil pump	Correctly checks: ❑ Filters/strainers. ❑ Fuel oil pump.	❑ Pass ❑ Fail
2.6 Identify and correct low cycles.	Checks for overload Checks engine speed	Correctly checks: ❑ For overload. ❑ Engine speed.	❑ Pass ❑ Fail
2.7 Identify and correct for overspeed.	Starts idle engine and places online Checks engine for cause of overspeed	Correctly starts engine and places it online Correctly checks engine for cause of overspeed	❑ Pass ❑ Fail
SCORING PROCEDURE Total the number of "Pass" scores you indicated above. **Pass:** Score of 6-7 **Fail:** Score of 0-5 Transfer the final score at right to the *Assessment Control Sheet*.		**FINAL SCORE**	❑ Pass ❑ Fail

ASSESSMENT WORKSHEET III

Section 1. Assessment Conditions

Assessment Objective	*3. Restore power after generator fails.*
Assessment Method	Engine room simulator assessment and oral test questions.
Candidate Orientation	The assessor briefs the candidate on assessment methods, conditions, and standards. The candidate should demonstrate the ability to start the idle engine and generator. To successfully meet this objective, the candidate must complete the following assessment objectives, which must be completed in the proper order.
Required Equipment, Apparatus, and/or Tools	The candidate should begin the assessment at the engineer's local control station.
Initial Condition	The assessor should ensure that the emergency generator is operating. One prime mover and generator should have no faults and should be ready to start. The generator supplying the electrical bus fails and the emergency generator starts. One generator and its prime mover are ready to start. There is one candidate starting the idle engine.

Section 2. Actions, Performance Measures, Standards, and Scores

Action	Performance Measure	Performance Standard	Score
3.1 Ensure non-operational engine is not connected to bus.	Checks the bus is non-operational	Correctly checks the bus	❑ Pass ❑ Fail
3.2 Start idle engine and generator.	Starts idle engine and generator	Correctly carries out start procedures	❑ Pass ❑ Fail
3.3 Connect generator to bus.	Connects generator to bus	Correctly carries out procedures for connecting generator to bus	❑ Pass ❑ Fail
3.4 Secure emergency generator.	Ensures generator is operating properly Secures emergency generator Answers question: *What electrical loads does the emergency generator carry?*	Correctly ensures generator is operating Correctly secures emergency generator Correctly answers question	❑ Pass ❑ Fail

SCORING PROCEDURE **FINAL SCORE** ❑ Pass ❑ Fail

Total the number of 'Pass' scores you indicated above.

Pass: Score of 3-4 **Fail:** Score of 0-2

Transfer the final score at right to the *Assessment Control Sheet*.

REFERENCES

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