

# *The Training Methods Research on Emergency Recovery of Marine Electrical Equipment*

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**Abstract**—For the practical application and popularization of ship electrical equipment emergency recovery technique, the training mission and training requirements of ship electrical equipment emergency recovery technique was analyzed. The Models and approaches of Ship's emergency recovery training were studied. The contents and organization methods of emergency recovery training were studied. The inspection way of emergency recovery training was designed. The training and organization methods of electrical equipment emergency recovery technique which were put forward were comprehensive and practical and can effectively promote the Marine electrical equipment emergency recovery technique application.

**Keywords**—Training; Organization method; Emergency recovery; Electrical equipment; The ship

## I. INTRODUCTION

Modern ships in the implementation of the task and the operation of the process is facing severe challenges, the big waves, pirates, and even hostile forces are likely to put the ship in a very dangerous situation[1-3]. In the critical environment, if the ship security forces can quickly apply critical environment in emergency recovery technology to implement efficient recovery work, directly related to the effectiveness of equipment timely recovery and maintain ability, and also related to the ship's survival and the mission success[4-6]. Practice and research show that the implementation of emergency recovery technology is an effective means to improve and maintain the integrity of the ship and to improve the ability of continuous operation[7-8]. However, the current ship equipment emergency recovery technology has not been very good promotion and application, the mainly reason is that the staff working in the ship did not master the equipment emergency recovery technology. Therefore, the training and organization of marine equipment emergency recovery technology become the urgent problem which needs to solve.

In this paper, marine electrical equipment management personnel as the object, the training mission of emergency recovery technology of ship electrical equipment is analyzed, and the ship emergency recovery training requirements also is analyzed, models and methods of ship electrical equipment emergency recovery training is studied, and the content and organization method of marine electrical equipment emergency recovery training is studied, the evaluation

methods of the ship electrical equipment emergency recovery training is designed. It provides support for the promotion and application of ship electrical equipment emergency recovery technology.

## II. ANALYSIS ON TRAINING TASK OF EMERGENCY RECOVERY TECHNOLOGY FOR MARINE ELECTRICAL EQUIPMENT

To clear the basic task of emergency recovery training of the ship electrical equipment is the starting point and the basis of the electrical equipment recovery training in the ship emergency environment and the final standard for the test of training achievement. Generally speaking, the basic task of developing marine electrical equipment emergency recovery training is to improve the emergency recovery skills of the ship commander, operation personnel and maintenance personnel, and emergency recovery ability of the whole ship<sup>[9]</sup>. Mainly include the following aspects:

### A. Learn and master the basic knowledge of electrical equipment emergency recovery technology, research and develop emergency recovery training of marine electrical equipment

Marine electrical equipment emergency recovery training should be divided into joint training, professional training and task training. According to the different levels of the training object, the focus on the joint training, professional training and task training is different. It needs to distinguish between levels and content. Specific to the study and master the knowledge of electrical equipment emergency recovery should mainly include:

- Basic concepts of electrical equipment emergency recovery;
- At home and abroad, research and development status and training situation of electrical equipment emergency recovery;
- Basic analysis method for electrical equipment emergency recovery;
- Importance of the development of electrical equipment emergency recovery for ships;
- Basic characteristics of electrical equipment emergency recovery for ships;

- Basic process of electrical equipment emergency recovery for ships;
- Ship emergency recovery method and skills;
- The development and use of the recovery tool kit;
- The preparation and use of the repair manual.

*B. To use the existing crew level maintenance training results, focus on strengthening assessment method and recovery skill training of the emergency environmental damage, training crew to carry out effective emergency recovery ability in the limited conditions.*

To carry out ship electrical equipment emergency recovery training, it needs to deal with the environmental crisis demand for traction, set approximate the actual environmental crisis emergency recovery environment and repair project, in accordance with the actual requirements of the emergency response to the crisis, organize recovery training of various forms, strict requirements at all levels of crew's basic theory, basic skills and special skills training. In the training, take training crew emergency recovery consciousness and repair skills as the focus, the training of various repair methods as the thread, study various forms of damage which may occur on the ship in emergency environment, and what kind of methods used, how long will it take, how many persons, what spare parts and tools needed, and evaluate the equipment after recovery.

Formulate various conditions of the repair plan, and continue to exercise, in order to test and improve the repair plan. At the same time, make all kinds of personnel familiar with the repair plan, so that in emergency conditions, without temporary training, carry out and complete all kinds of ship repair tasks according to repair plan, which is very important to improve the crew's response to the crisis emergency rescue ability.

The full use of modern means and methods of training, especially the use of computer virtual training system, the implementation and operation of virtual combination, which makes the training more feasible, more realistic, more close to the actual crisis environment, more conducive to the exercise of the staff recovery awareness and skills to improve their overall recovery capability. At the same time, the training cost will not significantly increase. Be sure to pay attention to an idea, that is, emergency recovery training is based on the usual training, running through all aspects of daily training.

*C. Change the traditional concept, train and enhance the crew's awareness of emergency recovery*

Ship emergency recovery training is mainly for the crew to carry out training. For this purpose, we must firstly develop the concept of fighting and emergency recovery of the crew. In particular, the ship's commander and the department commander should have a strong sense of emergency response, and consider how to do if there is a crisis in the environment. Carry out carefully ship emergency recovery training and organization, and constantly sum up experience in practice, improve the decision-making speed and decisive decision-making ability of the ship commander in the critical

environment, finally, improve the emergency recovery consciousness.

### III. ANALYSIS ON THE REQUIREMENTS OF THE SHIP EMERGENCY RECOVERY TRAINING

(1) To carry out ship emergency recovery training, must project the integration of technology and command, focus on emergency recovery methods and pay attention to the principle of training effectiveness. Training background and the setting of critical environmental conditions should meet the actual situation. The content of the training and emergency repair methods should meet the actual situation on board. The evaluation of training effect should conform to the actual crisis to meet the environmental requirements. This is also a bottleneck restricting the crew to carry out emergency recovery training.

(2) Follow the training regulations and improve the training methods. Ship emergency recovery training should adhere to the training according to the program, according to the law, so that to achieve integration training. On the one hand, actively participate in training which organize by the higher level and the training department in order to respond to the actual crisis training to promote emergency recovery training. At the same time, when necessary, in the premise of ensuring safety, it can also be in emergency recovery training to organize emergency recovery training in the actual crisis environment, in order to improve the repair crew practical ability training. In addition, to improve the training method, make full use of computer technology to carry out a full range of efficient training, try to reduce the concentration of personnel, make them be trained on their post. Strengthen the comprehensive support of the training work, in particularly, materials, equipment, venues and a variety of necessary material support. Carry out training and assessment according to the assessment outline.

### IV. STUDY ON THE MODE AND METHOD OF SHIP EMERGENCY RECOVERY TRAINING

#### A. Organization mode

The training organization mode of ship emergency recovery is the form and way of organization training. It mainly includes:

##### 1) Assemble for training

According to the need of ship emergency recovery and crew current work system, the short-term assembling for training can be taken in order to learn basic theory knowledge in the limited time. In order to ensure the training effect, the preparation should be careful before the training, the implementation of training should carefully organize, and there should be a summary after training, so that the training objectives can be ensured. The training can be implemented by the unified organization of the ship management department, and the training time should be limited within two weeks.

##### 2) Lecture

The issues of emphases, difficult point and hot point about ship emergency recovery work can be learnt by the

organization form of lecture. The trainees can understand the frontier and the professional knowledge, master the latest research achievements in this field, so as to promote the development of ship emergency recovery training. Organizing the lecture, select the lecture topics, and invite the authority in this area as speaker. In order to improve the quality of lectures the modern teaching methods should be used, and the training range should be expanded. The lecture should be organized by the units themselves.

### 3) Unit training

The unit training is the basic training method. Under this training mode, the trainers and trainees are in the same unit, and then the system level and the relationship are clear. It is convenient to organize, coordinate and manage. The unit training can be distinguished as two types of respective training and whole training, which should be carried out by different ways according to the unified plan, different stages.

The respective training is the primary stage of unit training. The respective training of ship emergency recovery training is divided into two main types. One is the individual training, such as single crew skills, a single kind of equipment maintenance. The other is a professional training, divided mainly by different profession, including hull repair training, electrical training, mechanical maintenance training, etc. The organizer should focus on the characteristics of respective training and give play to the advantage of respective training, organize carefully, and implement training strictly, in order to improve the quality of training.

Whole training is the advanced stage of unit training. It mainly includes: The first is the basic whole training, that is, whole training for the content of the joint training part in accordance with the requirements of the training outline. The second is professional whole training, that is, after the completion of professional departments respective training, according to a whole process of repair, there will be a whole training for the various professional departments, so that the various departments form the overall ability to repair. The third is the subject whole training, that is, the whole training is carried out according to the unified plan of the subject.

Simulation training is the use of computer and simulation equipment to imitate the emergency recovery situation, It is vivid, and has more realistic effect. It is not only an effective way to improve the training efficiency, but also the direction of the development of modern training. There are two situations: Firstly, the commander explores the command of the simulation exercises of ship emergency recovery under different tactical background. Secondly, it is the simulation training for recovery technology, which uses computer technology to simulate the situation of the ship and sets the damaged parts and conditions to explore the specific implementation methods and repair technical measures of emergency environmental damage assessment. For organizing simulation training, the top-level design of the training must be strengthened. Firstly, clear purpose of training. Secondly, select training topics according to the training objectives. Thirdly, set up the training content and the plot well. Fourthly, well organize and use simulation equipment to maximize the effectiveness of equipment. Fifthly, well organized simulation

training summary can find out the existing problems and countermeasures.

Network training is the training which is carried out relying on the computer network and related facilities and software. It can be used for personal study, classroom teaching, imagining practice, online exercise and examination. With the function of the common theoretical study, it also can provide the detailed equipment, training regulations, standards, training content, the principle and operation of the technical method.

Network training system is still in the initial stage, especially the development of emergency recovery training network system is not yet started.

### B. Recovery training method

The correct training method can get twice the result with half the effort, and has the important function to improve the training quality. Methods to carry out ship emergency recovery training mainly can be used: lectures, demonstrating, practice exercises, examination contest.

Lecture here means that the teacher explains the basic theory and the basic method process of ship emergency recovery. The purpose is to help trainees understand the content, inspire ideas, learn and master the basic knowledge, basic methods and basic skills of ship emergency recovery, improve the theoretical level and innovative ability.

Operation demonstration is a vivid teaching methods with the teacher showing material objects and doing the demonstration action for the crew. Operation demonstration is one of the most intuitive methods of teaching and training, after the theoretical knowledge study, the operation demonstration must be carried out.

The practice training is basic training methods to promote the implementation of the crew to put the theoretical knowledge into individual ability. In order to effectively train crew skills, the authenticity and the amount of practice training must increase.

Practice training is the method to use theory to solve practical problems. Before practice training, there needs a lot of preparation, including supplying practice equipment, straightening out the practice method, simulating ship emergency environmental damage, providing repair tools and practice manual. Practice training is one of the most basic works of ship emergency recovery training, and it is also the most important link to improve the emergency recovery skills of the crew.

## V. RESEARCH ON THE CONTENT AND ORGANIZATION OF SHIP EMERGENCY RECOVERY TRAINING

### A. Ship emergency recovery training content

- (1) Characteristics and rules of ship emergency recovery
- (2) Method and principle of ship emergency recovery;
- (3) Duties and regulations of the ship emergency recovery

(4) Relevant professional knowledge and professional skills training for ships emergency recovery training

(5) The training for the use and maintenance, technical state detection and monitoring, troubleshooting, repair and other aspects of ship equipment

#### *B. Ship emergency recovery training organization*

(1) Make the training plan for the ship emergency recovery, Clear the guiding ideology, methods, steps, content and specific plans of training.

(2) Clear the methods and approaches of implementing ship emergency recovery training for all levels, according to the different situation of the training object, choose the right method and approach to achieve.

(3) Plan the ship emergency recovery training assessment, clear the object of the assessment, the content of the assessment and the method of assessment, give mark according to the assessment criteria.

In order to organize the ship emergency recovery training, it needs to pay attention to distinguish the level of the ship emergency recovery training, pay attention to clear division of the various stages of the ship emergency recovery training, and grasp the different requirements of various stages, project the key point of various stages of training, increase the skill training of ship emergency recovery training. The skill training must be organized carefully, because it is the root of ship emergency recovery training. The assessment for skill training must be closely linked with daily ship maintenance and repair skill training, the professional skill can be promoted.

#### *C. Implementation of ships emergency recovery training*

The implementation of ships emergency recovery training is professional and operational. In the implementation of ship emergency recovery training, it is necessary to fully grasp the professional basic knowledge of ship emergency recovery, but also to master the practical operation skills. Therefore, according to the characteristics and rules of the implementation of the ship emergency recovery training, from the implementation of the individual training, and then carry out whole training of the overall repair capacity.

##### *1) Theory Course*

The ship emergency recovery related professional have their own professional theory. The implementation of theory course should be in small class training form, in order to improve the repair pertinence training implementation. In the training, according to the different situation, the large units can respectively organize annual theory training in different profession. Especially for the training of new equipment and new profession, the theory whole training can be carried out in case that the theory training cannot be carried on because of little person. According to the characteristics of strong professional, various teaching methods especially multimedia teaching means should be comprehensive used to improve the training effect.

##### *2) Operating course*

The implementation of the operation course is the main way of the ship emergency recovery training. In the operation course, the trainees master the skills of emergency recovery with learning by doing. The operation course should project the meaning of operation. Firstly, do a good job in the decomposition of action training, first master local skills, and then master the overall skills. Secondly, pay attention to grasp the essentials of the operation, only the essentials are grasped, then the degree of mastery can be ensured. Thirdly, highlight the practical operation, only after repeated operation, the purpose of Practice makes perfect can be achieved. Fourthly, control the rhythm of the operation class. Fifthly, do a good job in training summary of the operation course, constantly sum up experience in practice, in order to guide the actual operation.

##### *3) Exercise course*

In the ship emergency recovery training, the training intensity of exercise course should be strengthened. Operate repeatedly in the exercise course to improve repair skills proficiency. Do a good job in the implementation of the repair training class, firstly, determine the amount of exercise according to the outline, different persons and different subjects. Secondly, project the key point of training, exercise repeatedly on the important skill. Thirdly, enhance the guidance of training, especially pay attention to grasp the operation essentials. Fourthly, guide students to self-summary in training. fifthly, establish and promote the function of typical role in training.

## VI. SUMMARY

In this paper, the ship electrical equipment is taken as the object, the ship electrical equipment emergency recovery technology training tasks and requirement are analyzed. The mode and method of ship emergency recovery training are studied, and the assessment method of ship emergency recovery training is designed. Training and organization method of emergency recovery technology for marine electrical equipment can provide effective support and useful reference for the promotion and application of equipment emergency recovery technology.

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