

CECW-OM

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Project Operations
HYDROELECTRIC POWER OPERATIONS AND MAINTENANCE
GUIDANCE AND PROCEDURES

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CHAPTER 1 - INTRODUCTION

1-1. Purpose. This pamphlet establishes the guidance for the operation and maintenance (O&M) of USACE hydroelectric power generation facilities and related structures at civil works water resource projects and supplements Engineer Regulation (ER) 1130-2-510.

1-2. Applicability. This guidance applies to all USACE commands having responsibility for civil works functions and hydroelectric power generation.

1-3. References.

- a. PL 85-507, The Government Employees Training Act, 7 July 1958.
- b. PL 95-91, Section 302, 95th Congress, Department of Energy Organization Act, 4 August 1977 (91 Stat. 565).
- c. PL 99-662, Section 937, Reports on Hydropower Statistics, Water Resources Development Act of 1986.
- d. PL 104-303, Section 216, Water Resources Development Act of 1996.
- e. PL 534, Section 5, 78th Congress, Flood Control Act of 1944, 22 December 1944, (58 Stat. 889).
- d. AR 690-400, Employee Performance and Utilization, Chapters 410, 430 and 432.
- e. USACE Supplement 1 to AR 690-400, 410 and 430, Employment Performance and Utilization Training.
- f. ER 385-1-31, Safety Clearance Procedures
- g. ER 1105-2-100, Guidance for Conducting Civil Works Planning Studies.
- h. ER 1110-2-109, Hydroelectric Design Center.
- i. ER 1110-2-1200, Plans and Specifications.
- j. ER 1130-2-500, Partners in Support (Work Management Policies).
- k. ER 1130-2-510, Hydroelectric Power Operations and Maintenance Policies.
- l. REMR Condition Rating Procedures/Condition Indicator For Hydropower Equipment.

1-4. Glossary.

a. Allocated Power Investment Cost. That portion of total project investment cost which is allocated to generation of power based on firm cost allocation of multipurpose projects with power.

b. Available Hours. The hours during which a unit is available. Available Hours (AH) is equal to the sum of Service Hours (SH) plus Reserve Standby Hours (RSH).

c. Balance of Total Investment Cost. The cumulative unpaid federal investment in power facilities. The cost includes the additional federal investments subsequent to the initial placement of generating units in service and the credits for the revenues transferred to the project.

d. Delayed Forced Outage Hours (DFOH). The hours for any malfunction that results in removal of a generating unit from connection to the transmission system for maintenance or repair at a later time, so as to allow an outage to be scheduled after the trouble develops.

e. Equipment Failures and Generation Interruptions. For the purpose of this guidance, equipment failures and generation interruptions are defined as those affecting the project's major power plant equipment which are necessary for generation of hydroelectric power. Such equipment may consist of turbines, generators, transformers, switching equipment, station service system, etc. Also included in this definition is loss of power generation due to project operating procedures and errors, improper or faulty maintenance or work practices. Interruptions due to lightning strikes, outages of non-USACE facilities, and those where impact to service, equipment, cost, etc. is insignificant are excluded.

f. Forced Outage Hours (FOH). The hours for any failure, misoperation, or malfunction that results in the immediate automatic or manual removal of a generating unit from connection to the transmission system, or that prevents such connection from being accomplished when desired.

g. Generator Forced Outage (GFO). Any generating unit forced outage caused by a misoperation, failure or malfunction of a turbine, water passage, governor, or generator, including related auxiliaries or controls. These items are considered to represent a generating unit.

h. Generator Scheduled Outage (GSO). A scheduled outage for a generating unit. (See 1-4.g. above and Note 1 below.)

i. Hours. Hours will be recorded to the nearest hundredth.

j. In-Service Date. The in-service time and date reported in compliance with ER 1130-2-510, Chapter 2, Reports on Hydroelectric Power Generation Statistics.

k. Non-Generator Forced Outage (NGFO). A forced outage caused by misoperation, failure or malfunction of equipment or facilities beyond the load side of the generator terminals.

l. Non-Generator Scheduled Outage (NGSO). A scheduled outage for equipment other than a generating unit. (See 4-4.l. above and Note 1 below.)

m. Period Hours (PH). The number of hours in the year for existing units. For new units, the hours since the unit was first synchronized until the end of the year.

n. Planned Modification Hours (PMH). Scheduled outage for installation of new equipment, switchyard rearrangements or to correct design or construction deficiencies.

Replacement of existing equipment due to failure or normal deterioration is not included. (See Note 1 below.)

o. Reserve Standby Hours (RSH). The hours during which a generating unit is not in service, but is available for use if required.

p. Service Hours (SH). The hours during which a generating unit is connected to the transmission system either supplying power or condensing; i.e., the time during which the generator main power circuit breaker is closed.

q. Scheduled Outage Hours (SOH). The hours for routine repetitive maintenance and repair that have been programmed into the power schedule.

NOTE 1: When a variety of work is performed on both generating unit and non-generating equipment, the primary reason for the outage will determine to which category the outage hours will be charged. Outages due to reservoir conditions, high tailwaters, flood control operations, loss of transmission lines, or short outages for trash removal are not to be considered unavailable time.

CHAPTER 2 - REPORTS ON HYDROELECTRIC POWER GENERATION STATISTICS

2-1. Purpose. This chapter establishes guidance for reporting USACE hydroelectric power statistics, including the availability, failure and usage rates of generating equipment; power generating equipment failures and generation interruptions; monthly power plant generation; and in-service data at multiple-purpose projects having hydroelectric power.

2-2. Background.

a. This pamphlet provides guidance for implementing the following hydropower statistical and informational reporting requirements to Congress and other designated recipients, as defined in ER 1130-2-510, Chapter 2, Reports on Hydroelectric Power Generation Statistics, and for coordinating the operation of the Corps of Engineers hydroelectric generating facilities with the power marketing agencies. Reporting requirements include:

- (1) general hydroelectric power generation equipment operational and cost data;
- (2) the availability, failure and usage rates of generating equipment at multiple-purpose projects having hydroelectric power;
- (3) power generating equipment failures and generation interruptions; and
- (4) the in-service dates for hydroelectric generating units and reporting the monthly power plant generation on the Department of Energy Form EIA-759.

b. Section 5 of the Act of December 22, 1944 (PL 534, 78th Congress) provides that electric power and energy generated at reservoir projects under the control of the Department of the Army and in the opinion of the Secretary of the Army not required in the operation of such projects shall be delivered to the Secretary of Interior for transmittal and disposal in a manner to encourage the most widespread use thereof at the lowest possible rates to consumers consistent with sound business principles.

c. Section 302 of the Department of Energy Organization Act (PL 95-91) transfer all functions of the Secretary of Interior under Section 5 of the 1944 Act to the Secretary of Energy together with all other functions of the Secretary of Interior, and officers and components of the Department of the Interior, with respect to Southeastern Power Administration; the Southwestern Power Administration; the Alaska Power Administration; the Bonneville Power Administration; Western Area Power Administration; and the power marketing functions of the Bureau of Reclamation.

2-3. Guidance.

a. Congressional Reports. Section 937, Reports on Hydropower Statistics, PL 99-662, Water Resources Development Act of 1986, states that the Secretary of the Army shall provide to the Committee on Public Works and Transportation of the House of Representatives and the Committee on Environment and Public Works of the Senate, a statistical report on each water resources project constructed by the Army Corps of Engineers which generates electricity. (See Appendix A.)

(1) The report shall specify:

- (a) Amount of electricity generated;
- (b) Revenues received by the United States from the sale of electricity;
- (c) Costs of construction, operation, and maintenance allocated to power; and
- (d) Balance owed to the US Treasury by the Power Marketing Administration.

(2) Submission Dates. The report is due to the Congress by the 15th of January each year. The field operating activities will submit to CECW-OM their data by 15 December each year.

b. Service Rates for Generating Equipment.

(1) Each year, on a fiscal year basis, districts having multi-purpose projects with hydropower will determine and report the rates listed below for each hydroelectric project. These rates will be composite for each project, based on the total main unit hours in each category for all units at the project, and computed as indicated in Appendix B.

- In-service operating rate.
- Standby rate.
- Availability rate.
- Generator forced outage rate.
- Non-generator forced outage rate.
- Generator delayed forced outage rate.
- Generator scheduled outage rate.
- Non-generator scheduled outage rate.
- Planned modification outage rate.
- Non-generator delayed forced outage rate.

(2) Service Rate Reports.

(a) Each MSC shall furnish annual reports to HQUSACE (CECW-OM) by 15 February (RCS CECW-0-34) for the previous fiscal year utilizing the Lotus 1-2-3 format provided as ENG Form 4338-E (AUG 89), illustrated in Appendix C. The reports shall be submitted using a diskette or electronic mail.

(b) The additional information shown in Appendix D shall be furnished as a MSC summary report along with an individual summary report for each district having hydroelectric power facilities.

c. Equipment Failure and Generation Interruption Reports.

(1) Project Managers shall report all power generating equipment failures and generation interruptions anticipated to cost in excess of \$50,000, or require more than five working days to return equipment to service, to CECW-OM immediately by telephone, facsimile machine (FAX),

or electronic mail (E-mail) and then also in writing. Reports shall be made as soon as possible; however, reports must be furnished before the end of the next regular business day. A sample of the required information is provided as Appendix E.

(2) When requested by CECW-OM, a detailed narrative report shall be prepared and forwarded to CECW-OM as soon as all pertinent information and data on the failure or interruption are available. The report shall present the information and data in such a manner as to facilitate review and evaluation by CECW-OM and other elements of the HQUSACE. These reports are required for review and evaluation for determining what changes are needed in guide specifications, operating and maintenance procedures, or personnel training, to reduce power production interruptions.

(3) Written Report. When requested, a detailed narrative report will be prepared and forwarded to CECW-OM as soon as all pertinent information and data on the failure or interruption are available. The report will include, but not be limited to, the following information as applicable: Name of the project; actual time of day and date of occurrence; identity of equipment or procedure causing the interruption; unit(s) involved; megawatts of project generation shutdown; megawatts of load passing through the project switchyard before interruption; megawatts of switchyard load interrupted; actual or estimated length of time required to return the failed equipment to service; the actual cause of failure or interruption; and any deficiencies found in design, construction, operation or maintenance. The report will also include a description of all actions, interim and final, needed to restore equipment to service, and recommendations for changes in design, construction, protective equipment, operational and maintenance practices and procedures that will reduce the possibility of recurrence. Supporting data, such as single line diagrams, sketches, schematic wiring diagrams, and photographs will be included when such information will clarify the cause of the interruption and assist in determining the best corrective action. The report will present the information and data in such a manner as to facilitate review and evaluation by CECW-OM and other elements of the HQUSACE.

d. Monthly Power Plant (DOE FORM EIA-759) and In-Service Data Reports for Hydroelectric Generating Units.

(1) The Commander, U.S. Army Corps of Engineers (USACE) is required to keep the Chairman, Federal Energy Regulatory Commission, informed of the current installed hydroelectric generating capacity at USACE projects.

(a) This includes installation of new generators and changes in the existing generating capacity due to rewinding of the generator stator, or any other reason. Within five business day after occurrence of the in-service date, the Commander, USACE, will be notified, Attention: CECW-OM, of the name of the project and the nameplate rating in kilowatts of each unit as it is placed in service. The information may be transmitted by telecopy, electronic mail or any other suitable method. The in-service date of a unit is defined as the date when the generator is first brought to rated terminal voltage and synchronized to the transmission system.

(b) For new generators, the date when the generator is initially placed in service, as defined above. For existing generators, the date is when the generator is again placed in operation after a change in capacity. Units declared in service, which subsequently develop trouble requiring modifications that may delay normal generation, will continue to be considered in service, unless otherwise specifically approved by the Commander, USACE. The in-service

date information will agree with the date reported to the Power Marketing Administration and Federal Energy Regulatory Commission.

(c) In service data, for stator rewinds, turbine replacements, or similar work that does not change the nameplate rating of the unit, will be reported only to CECW-OM.

(2) Monthly power Plant Report - Form EIA-759 (OMB No. 1905-0129 and RCS FERC-1001). Each month Energy Information Administration (EIA) of the Department of Energy furnishes USACE field offices with copies of Form EIA-759 for the monthly generation report. This form shall be completed and submitted directly to EIA by the tenth of the following month. In determining net generation, the power used for operation of locks, fishways, flood control, or functions other than power will be included. Power for the operation of the powerhouse and generating equipment only will be deducted from gross generation in computing net generation. A copy of completed Form EIA-759 will be forwarded to CECW-OM for information concurrent with sending the original to the Energy Information Administration. A sample copy of this form is provided as Appendix F.

e. Reports for Power Marketing Agencies.

(1) The Corps is responsible for operating the hydroelectric projects and providing information affecting cost and availability of power to the Power Marketing Agencies. Marketing the power declared excess to the need of the projects and recovering Federal investment are the responsibilities of the Power Marketing Agencies.

(2) Specific Requirements.

(a) Continuing. Prompt written notification will be provided to the appropriate power marketing agency each time a change in power operation or condition which could substantially affect costs or power availability is anticipated.

(b) Annually, when no changes in power operations or costs are expected for the succeeding 12 month period, the marketing agency will be notified of that fact in writing.

(3) MSC Responsibility. The MSCs directly responsible for communicating with the marketing agency will develop reporting procedures in coordination with that agency. This responsibility may be delegated to the District Commander.

CHAPTER 3 - COORDINATION OF HYDROELECTRIC POWER OPERATIONS WITH POWER
MARKETING AGENCIES

Reserved.

CHAPTER 4 - PROJECT EMPLOYEE REFRESHER OPERATIONAL EXERCISES FOR
EMERGENCY STATIONS, MULTIPLE-PURPOSE PROJECTS WITH POWER

Reserved.

CHAPTER 5 - HYDROELECTRIC POWER PLANT TRAINEES

5-1. Purpose. This chapter establishes the procedures for the Corps of Engineers apprenticeship training program for hydropower trainees for advancement to journeyman status as power plant operators, mechanics, electricians, or electronic mechanics. Guidance for establishing training beyond the apprenticeship program is also included.

5-2. Rationale. Hydroelectric power plants are complex electrical and mechanical installations which need trained personnel for operation and maintenance. The trend towards automation and optimization further emphasizes the importance of a well trained staff to ensure continuity and reliability of power generation. Sufficient number of qualified personnel are not available from the industry to meet the Corps requirements and this necessitates a training program to develop trainees to perform well at journeyman level.

5-3. Selection of Trainees. The vacancies will be filled from any appropriate source, e.g., OPM register, merit promotion action, reassignments, change to lower grade, Veterans' Readjustment Act, Handicap authority, etc. Single-Agency Qualification Standard for Hydroelectric Power Plant Trainee (Army) has been issued by the U.S. Civil Service Commission. Physical requirements are included in the above standard. All candidates, including current Federal employees, must meet these standards. Human Resources will prepare a list of eligible candidates for selection by the MSC Commander or his/her designate.

5-4. Employment Provisions.

a. Trainee Agreement. Each trainee will enter into a written agreement with the local appointing authority. The agreement will specify, but not be limited to:

- (1) Local arrangements about tools and supplies.
- (2) Trainee's employment and training in an occupation, under standards adequate to produce a qualified skilled worker.
- (3) Conditions for advancement and retention, removal from the program, and performance in a full performance position.
- (4) Mobility during and after training for Division-wide placement.
- (5) Mandatory service for four years after graduating from the program, otherwise the trainee must reimburse Government expenses on pro-rate basis.

b. Probationary Period. The probationary period for a trainee is one year. However, unacceptable performance during the program period will be a cause to remove him from the training program under 5 USC 4303.

c. Pay During Training. Pay rates for trainee levels are established by the Department of Defense Wage Fixing Authority and are shown on current authorized wage schedules. Current Federal employees who enter the training program will have their pay set in accordance with the OPM regulations.

5-5. Training Responsibilities.

a. Headquarters, U.S. Army Corps of Engineers. The Headquarters (CECW-OM) shall be responsible for overview of the training program and keeping the ER current to meet the changing requirements. Any deviations from the program will require approval from CECW-OM.

b. Major Subordinate Command. The MSC Commander is responsible for the overall implementation and management of the program. At his/her discretion, the MSC Commander may delegate all or part of his/her duties to the district commanders as appropriate.

c. District. The District Commander, when so delegated, is responsible for the implementation of the training program. The Chief, Operations Division will see that the training is imparted as stipulated in this EP. He/she will also be an advisor to the District Commander on matters pertaining to the training program.

d. Training Board. A training board shall be established at the MSC or District level, as determined by the MSC Commander. The Board shall consist of a minimum of three members. The Chairman and each Board member shall be directly involved in, and knowledgeable of, operation and maintenance of Corps hydroelectric power plants. The Board shall be responsible for:

(1) Reviewing trainees' requests for reduction in training time and forwarding them to the MSC Commander or his delegatee for approval or denial.

(2) Reviewing and approving course instructions and on-the-job training for trainees granted a reduction in training time.

(3) Evaluating progress of classroom instructions and on-the-job performance of each trainee at the end of each training phase.

(4) Recommending to the MSC commander the hydroelectric power plants to be used as training sites.

(5) Other training related duties as assigned.

e. Training Facility.

(1) Training Coordinator. The Chief, Operations Division, in each district with hydropower training site(s) shall appoint a training coordinator at each training site. The training coordinator will be responsible for scheduling classroom and on-the-job training for all assigned trainees. He/she will also provide assistance and guidance to instructors, as needed, and be responsible for maintaining training records.

(2) Senior Craft-person. The senior craft-person to whom the trainee is assigned for on-the-job training will be responsible to over-see the trainee's work assignments. The senior will make every effort to ensure that the trainee receives the best possible training, and will guide, monitor and evaluate the trainee's work and progress on a daily basis. The senior will also provide to the training coordinator a formal evaluation of the trainee at the completion of trainee's rotational assignment with the senior's crew.

(3) Instructors. The instructors, or project personnel acting in this capacity, will be responsible for providing classroom instructions to the trainees. They should have the demonstrated capability to teach the class and have been at least a senior level craft-person. The instructors are responsible for keeping the training coordinator apprised of the trainee's performance, and for keeping trainees informed of their progress in the classroom.

(4) Trainees. The trainees are responsible for meeting and maintaining standards of Federal employment in their class-room and on-the-job performance and personal work conduct. They are responsible for learning the study material and be able to do the work required in the trade without hazard to themselves or other workers.

5-6. Training Sites. The MSC Commander will select the hydroelectric power projects to be used as training sites. They should be chosen from the larger and more complex projects in the MSC. If feasible, trainees should be transferred between projects while in the training program to broaden their experience.

5-7. Program Details. The training program will consist of a combination of academic, plant equipment study, and on-the-job training. The academic training will be imparted by enrolling in a correspondence school for academic subjects and class room (or equivalent) instructions for plant equipment. On-the-job training will be achieved by orderly progression through practical assignments closely related to correspondence school subjects and plant equipment instructions.

a. Training Period. A four-year training and development program will be required for all entrants who do not have previous hands on experience, and academic or vocational education beyond the entry level requirements.

b. Reduced Training Period. Reductions in time required to complete the training program may be granted by the MSC Commander for the prior experience or training, provided that the trainee applies for such reduction before completing the first year of the standard program. The trainee will be responsible for providing the satisfactory proof of experience or training he or she cites as creditable for a reduction in training time. Acceptable proof will be academic transcripts and course descriptions from accredited vocational schools, colleges or community colleges, and statements from former supervisors outlining previous work experiences, level of responsibility, and performance appraisal. Only one reduction will be granted. If the MSC Commander grants a trainee a reduction in time of the training period, the training coordinator shall prepare a training schedule which will insure that the trainee has an opportunity to develop the same skills and knowledge by the end of the reduced training period as a full four year program trainee would have. This training schedule must be approved by the training board. Trainees granted a reduction in training time will have their progress evaluated in the same manner as a full 4-year term trainee.

c. Craft Selection. The first one year of the training program will be identical for all crafts. Specialization will begin in the second year. Each trainee will be asked to express a preference for the craft specialty desired. Depending on the needs of power plants and trainee's aptitude and talents, the training board will assign a craft specialty, subject to the approval by the MSC commander, to each trainee before the beginning of the specialization phase. The training board will document the basis on which assignment was based.

d. Deviation from the Standard Program. Any deviation from the standard four year program as stated herein, or material changes in classroom subjects, shall be submitted to

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HQUSACE, ATTN.: CECW-OM for approval. No such changes shall be incorporated without prior approval of HQUSACE.

5-8. Training Program Schedule.

a. General. The first year of the training program consists of approximately 60% on-the-job training at a Corps hydroelectric power project, and 40% training in trade theory and closely related academic subjects. The next three years of the program consists of approximately 80% on-the-job training at a Corps hydroelectric power plant, and 20% training in trade theory and closely related academic subjects.

b. Academic Instructions. Craft persons are required to know the basic physical principles of the equipment they use. They are also required to read and understand reasonably complex written instructions, and be able to write legible, meaningful reports. Instructions in academic subjects should preferably be provided by professional teachers. This could be accomplished through a local school system if it is located nearby and is easily accessible. If professional classroom training is not practical because of geographic distance, then correspondence courses (Appendix G) or other delivery methods covering the same general subjects should be provided to the trainees.

c. Plant Equipment Study. The plant equipment study is designed to provide a trainee with the theory and operation of the hydroelectric plant equipment. Appendix G lists the topics for formal instructions. The theory portion of the instructions may be obtained through correspondence school courses subject to the approval of the training board. However, a qualified trade theory instructor must be provided to the trainees to insure that the trainees are receiving the best quality instructions and counseling.

d. On-the-Job Training. This portion of training is critical. Work habits, methods, and techniques developed in this phase of training can make the trainee an efficient and effective craft person. The training coordinator, in consultation with power plant superintendent, will prepare an on-the-job schedule for each trainee. The trainee should work on as many jobs as practicable, keeping in mind the desirability of completing a task from start to finish. Also, the trainee will be assigned to work with craft persons who have a special capability for the assigned task.

5-9. Training Evaluation. Each trainee's progress will be evaluated periodically and at the end of each phase as described below.

a. Periodic Evaluation. Each trainee's academic and on-the-job progress will be continually monitored by the instructors and craft seniors. The purpose of the evaluation is to assess the trainee's progress and the effectiveness of the instructional process. These evaluations are necessary so that any incipient problems can be exposed at the earliest possible time. The training coordinator should also consider evaluations from the trainee's instructors, crafts seniors and correspondence school.

b. Phase Evaluation. At the end of each training phase (approximately six months), every trainee will be evaluated by the training board. The evaluation will have a written portion, an oral portion and a demonstration of practical skills, and will cover both academic and on-the-job portions of the program. These evaluations will be used as a part of the procedure to assess a trainee's progress for determining fitness to remain in the program, and as an input to the trainee's

performance appraisal. The minimum requirement for passing a phase evaluation is a score of 70% overall and 70% on each correspondence school instruction unit or classroom course. Upon satisfactory completion of the phase evaluation and other performance requirements, the trainee will be advanced to the next training phase.

5-10. Failure to Maintain Satisfactory Progress. Each trainee is responsible for maintaining satisfactory progress in academic studies and on-the-job training. The evaluations will determine the trainee's progress. Non-satisfactory evaluations will be handled as below:

a. Failing Periodic Evaluations. If the results of a periodic evaluation are unsatisfactory, the appropriate supervisor will discuss the results with the trainee, determine reasons for unacceptable progress, counsel the trainee on improvements needed, provide an appropriate improvement period as prescribed by the Office of Personnel Management (OPM) regulations, provide the trainee with appropriate assistance, and give the trainee a make-up performance test at the end of improvement period. If the trainee's performance is unsatisfactory in two consecutive makeup evaluations, a recommendation shall be made to the training board to remove that trainee from the training program. The training coordinator or appropriate supervisor shall ensure that any trainee who is having a problem with satisfactory performance is placed with at least one other craft person before beginning of the remedial period leading to probable removal from the training program.

b. Failing Phase Evaluations. If the result of a phase (6-month) evaluation is unsatisfactory, the training board will inform the appropriate supervisor. The supervisor will notify the trainee in writing of unsatisfactory performance, inform the trainee of the specific deficiencies, what the trainee must do to overcome the deficiencies, provide an appropriate improvement period, and provide the trainee with appropriate assistance. At the end of the improvement period, the training board will re-administer the phase evaluation. Failure at two consecutive phase evaluations or three non-consecutive phase evaluations any time during the training period shall require removal of the trainee from the training program in accordance with the OPM regulations.

5-11. Training Accomplishments. After successful completion of four years of training, as prescribed in this EP, a trainee will be eligible to advance to journeyman status and should have the academic knowledge and practical skills for his respective trade as described in Appendix H.

5-12. Training Records. Complete training and performance evaluation records will be maintained for each trainee. A set of obsolete forms are enclosed in Appendix I to illustrate the types of records needed for each phase of the program.

5-13. Certificate of Completion. Each trainee who successfully completes the training program will be presented with a Certificate of Training on DA Form 87, included as Appendix J.

5-14. Training at the Journeyman Level. {FUTURE}

CHAPTER 6 - REWIND OF HYDROELECTRIC GENERATORS AND GENERATOR MOTORS

6-1. Purpose. This chapter establishes guidance on replacement of generator stator windings, generators, or other comparable large scale electro-mechanical components of a USACE hydroelectric power generating facility.

6-2. Background.

a. This guidance is designed to assist hydropower managers in providing higher authority with a uniform and consistent rationale for replacing a generator or generator/motor winding. It also provides the framework for justifying the replacement of a generator stator winding as part of a major rehabilitation program.

b. The goal of this rewind procedure is to develop a decision document that justifies a generator winding replacement before a catastrophic failure. That decision depends on adequately describing the condition of the winding and displaying the economic justification to support the decision.

6-3. Guidance.

a. Replacement of generator stator windings shall be based upon the factors found in Appendixes K, L and M. Each unit will be considered on its individual merits. Brief reports shall be prepared that contain this evaluation. Consideration shall be given to uprating the unit, whenever replacement of the winding is contemplated. Appendix N is a partial listing of technical standards.

b. The factors identified in subparagraphs (1) and (2) shall be addressed in the report as a basis to support the need for a generator rewind. The additional factors in subparagraph 3 shall be addressed to support generator uprating, if recommended, and shall be included in the report. If generator uprating is not recommended, the report shall address the factor or factors which makes an uprating not feasible. In accordance with ER 1110-2-109, Hydroelectric Design Center will prepare the engineering and design features of the reports and other engineering documentation.

(1) Background Information. Provide a tabulation of pertinent data for the existing generator, turbine, transformer and other associated equipment. See Appendix K.

(2) Rewind Evaluation. Provide an analysis of the need for any proposed rewind that considers the condition of the existing winding and the impact of forced rewind if a scheduled rewind is not accomplished. The analysis should be developed around Appendixes L and M.

(3) Potential for Uprating. If uprating is recommended, an analysis shall be prepared to demonstrate that an uprating is justified based on the following factors:

(a) Compatibility of new winding with existing generator circuit breaker, excitation equipment, transformer, buswork, structural, etc.

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(b) Hydrology (turbines, water availability): Additional mechanical power capability to increased generation.

(c) Marketability of the increased capacity and/or energy, see Section 103(c)(1), Public Law 99-662, (WRDA 86).

(d) Environmental impacts, see Section 216, Public Law 104-303, (WRDA 96).

(e) Economic justification.

FOR THE COMMANDER:

14 APPENDIXES
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