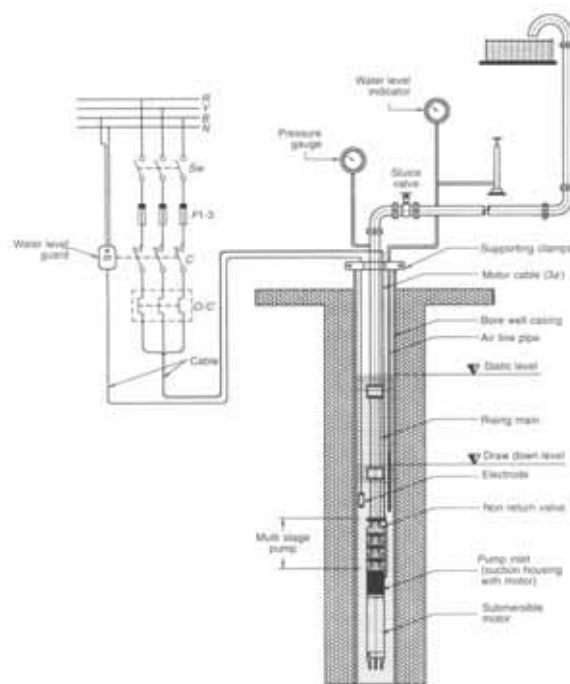


9th Training Course
in
Electrical Equipment Maintenance Technology
Course Guide



Addis Ababa
July 31/2007

Ethiopian Water Technology Center

Ministry of Water Resources
&
Japan International Cooperation Agency

Preface

The Ministry of Water Resources (MoWR) and Japan International Cooperation Agency (JICA) welcome the 9th batch of Electrical equipment maintenance Technology participants. This course is conducted under Ethiopian Water Technology Center.

We hope that you will successfully complete the training program.

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Introduction

Electrical equipment Maintenance Technology

To improve the access and rate of safe water to every part of the country is painstaking task. To achieve this task trained man power is vital. Obviously there is a shortage of man power in different area of water sector of the country .Our training center here established by the ministry of water resources and Japan International Cooperation Agency (JICA) to eradicate and minimize this problem. One of the courses offered at this center is the Electric equipment Maintenance Technology course. In this section trainees are expected to learn theoretical and practical lessons that are helpful for operating and maintenance of electrical systems of water well facilities.

Course Duration: July 31/2007-September 7/2007

Course Description:

This –six week technical course includes a detailed study of fundamentals of electricity, diesel engine, generators, pumps and voltage regulators. The course also provides a solid understanding of control circuit for motorized pumps. Good working knowledge Basic electricity is recommended as a prerequisite; however, a refresher of the important fundamentals is presented at the beginning of the course.

Who Should Attend:

This course is recommended for maintenance technicians, and operators who are required to work with water well plant.

Course Objectives:

This course is designed to enable participants to:

- Upgrade the concepts of basic electricity.

- Measure the resistance, current and voltage on electrical circuit correctly and utilize measuring equipment for maintenance activity.
- Conduct the periodical maintenance and overhauling on submersible and centrifugal pumps according to the instruction manuals, thus they can extend the life span of equipment by using this method.
- Install, maintain and repair electrical control systems such as switch board and panel board by using their ability to identify the circuit drawing.
- The trainee will be able to understand the working principles of the diesel engine, point out the failure, and repair it correctly.
- The trainee will be able to maintain the diesel engine generating set in good condition by conducting preventive maintenance on both aspects of mechanical part and electrical part.
- Identify the peak and effective AC voltage values on a waveform
- Describe the fundamental operations of a generator

Training method

The trainers will

- ✧ Explain safety precautions in handling on electrical appliances.
- ✧ Lecture on the definition of different terms of electrical symbols.
- ✧ Lecture on fundamental laws of electricity.
- ✧ Lecture on several kind of electrical measuring equipment such as analog meter, digital meter, clamp meter, megger and phase detector.
- ✧ Demonstrate electrical measuring equipment mentioned above.
- ✧ Lecture on the principles and construction of submersible and centrifugal pump.
- ✧ Provide and demonstrate on trouble shooting and overhauling of submersible and centrifugal pumps using real materials and cut models.
- ✧ Lecture on the basic concepts of logic systems of the electrical circuit.
- ✧ Provide practical training on sequence control with several kinds of electrical drawings.
- ✧ Arrange visit the field to show the system of rural water scheme.

- ✧ Lecture on basic concepts of internal combustion and explain difference between 2 stroke and 4 stroke engines.
- ✧ Lecture on vital functions of diesel engine such as firing order, valve timing, injection pump, cooling system, fuel system and lubricating system.
- ✧ Demonstrate vital functions of diesel engine mentioned above.
- ✧ Provide and demonstrate on trouble shooting and periodical maintenance of diesel engine using real materials and cut models.
- ✧ Lecture on maintenance points of electrical devices of automobile such as battery, charging system and starter motor.
- ✧ Demonstrate on maintenance points of electrical devices of automobile mentioned above.
- ✧ Evaluate by conducting the quiz twice in the course.
- ✧ Summarize the lesson.

Course Outline:

Fundamentals of Electricity and Measurements

- .1. Fundamentals of electricity
 - 1.1 Safety precautions
 - 1.2 Electrical symbols
 - 1.3 Nature of electricity
 - 1.4 Alternating current theory
2. Electrical measuring instruments and measuring
 - 2.1 Construction of electrical measuring instruments
 - 2.2 Usages of electrical measuring instruments

Submersible pump

1. Introduction
 - 1.1 General information
 - 1.2 The head of the pump and its measurement
 - 1.3 Pumping theory
2. Pump classification
 - 2.1 Pump performance
 - 2.2 Dismantling and assembling Submersible pump & Electrical motor
 - 2.3 Submersible pumps installation

- 2.4 Polyphase motors
- 2.5 Three phase system
- 3. Cables
 - 3.1 Cables
 - 3.2 Soldering
 - 3.3 Selecting Cable

Sequence Control

- 1. Electrical devices and Logic
 - 1.1 Control and Protective devices
 - 1.2 Relay logic
 - 1.3 Digital logic
- 2. Circuit design, development and analysis
- 3. Basic circuit diagram for machine, tools and machinery

Diesel engines

- 1. Course introduction
- 2. General safety guide lines
- 3. How diesel engine works
- 4. Engine components
- 5. Starting system
- 6. Air intake/Exhaust system and tests
- 7. Lubricant system and tests
- 8. Cooling system and tests
- 9. Fuel system and test
- 10. Managing fluids and filters
- 11. Gathering data

Electrical Devices on Diesel Engines

- 1. Direct current (DC) & Alternating current (AC)
- 2. Battery
- 3. Starting system
- 4. Charging system
- 5. Introduction of a tester

Ethiopian Water Technology center
Schedule
Electrical equipment maintenance Technology course

July 31/2007- September 7/2007

	European	Day Ethiopian		Instructor	Subject	Module	Hou r	A m pm
1st week								
	31/7/07	Hamle 24	Tuesday	Endris	Opening ceremony		1	am
	31/7/07	Hamle 24	Tuesday	Melaku	Safety Precaution, useful definitions and electrical symbols	1	2	Pm
	1/8/07	Hamle 25	Wednesday	Beneberu	Nature of Electricity	1	2	am
	1/8/07	Hamle 25	Wednesday	Beneberu	Ohms law and resistance	1	2	pm
	2/8/07	Hamle 26	Thursday	Beneberu	Electrical measuring instruments	1	4	W
	3/8/07	Hamle 27	Friday	Beneberu	Electrical measuring instruments	1	4	W
	4/8/07	Hamle 28	Saturday					
	5/8/07	Hamle 29	Sunday					

	European	Day Ethiopian		Instructor	Subject	Module	Hou r	A m pm
2nd week	6/8/07	Hamle 30	Monday	Beneberu	Digital Logic circuits	1	4	W
	7/8/07	Nehase 1	Tuesday	Mr X	Generator	3	4	W
	7/8/07	Nehase 1	Tuesday	Mr X	Generators	3	4	W
	8/8/07	Nehase 2	Wednesday	Mr X	Motors	3	4	W
	9/8/07	Nehase 3	Thursday	Mr X	Motors	3	4	W
	10/8/07	Nehase 4	Friday	Mr X	Motors	3	4	W
	11/8/07	Nehase 5	Saturday					
	12/8/07	Nehase 6	Sunday					

	European	Day Ethiopian		Instructor	Subject	Module	Hou r	A m p m
3rd week	13/8/07	Nehase 7	Monday	Abebe	Engine	3	2	am
	14/8/07	Nehase 8	Tuesday	Abebe	Engine	3	2	
	14/8/07	Nehase 8	Tuesday	Abebe	Engine	3	2	
	15/8/07	Nehase 9	Wednesday	Abebe	Engine	3	2	
	15/8/07	Nehase 9	Wednesday	Abebe	Engine	3	2	
	16/8/07	Nehase 10	Thursday	Abebe	Engine	3	2	
	16/8/07	Nehase 10	Thursday	Abebe	Engine	3	2	
	17/8/07	Nehase 11	Friday	Melaku	Cables and wires		2	am
	17/8/07	Nehase 11	Friday	Melaku	Introduction to different types of Pump	2	4	Pm
	18/8/07	Nehase 12	Saturday					
19/8/07	Nehase 13	Sunday						

	European	Day Ethiopian		Instructor	Subject	Module	Hou r	A m pm
4th week	20/8/07	Nehase 14	Monday	Melaku	Construction of centrifugal pumps	2	4	am
	20/8/07	Nehase 14	Monday	Melaku	Pump selection & installation of centrifugal pumps Pump Exam	2	4	Pm
	21/8/07	Nehase 15	Tuesday	BISELEX Wubshet	Assembling and disassembling of pumps	2	4	am
	22/8/07	Nehase 16	Wednesday	Shumet	Pump Test	2	2	W
	22/8/07	Nehase 16	Wednesday	Shumet	Pump Test	2	2	
	23/8/07	Nehase 17	Thursday	Beneberu	Electrical circuit drawing and design analysis	4	4	W
	24/8/07	Nehase 18	Friday	Beneberu Melaku	Basic controlling circuit	4	4	W
	25/8/07	Nehase 19	Saturday					
	26/8/07	Nehase 20	Sunday					

	European	Day Ethiopian		Instructor	Subject	Module	Hou r	A m p m
5th week	27/8/07	Nehase 21	Monday	Beneberu Melaku	Various controlling circuit	4	4	
	28/8/07	Nehase 22	Tuesday	Beneberu Melaku	Various controlling circuit	4	4	
	29/8/07	Nehase 23	Wednesday	Beneberu Melaku	Various controlling circuit	4	4	
	30/8/07	Nehase 24	Thursday	Beneberu Melaku	Field Trip			
	31/8/07	Nehase 25	Friday	Beneberu Melaku	Field Trip			
	1/9/07	Nehase 26	Saturday	Beneberu Melaku	Field Trip			
	2/9/07	Nehase 27	Sunday	Beneberu Melaku	Field Trip			

	European	Day Ethiopian		Instructor	Subject	Module	Hou r	A m pm
	3/9/07	Nehase 28	Monday	Getachew	Fundamental Knowledge of Auto Electricity	3	4	
	4/9/07	Nehase 29	Tuesday	Getachew	Maintenance points on starting system	3	4	W
	5/9/07	Nehase 30	Wednesday	Getachew	Maintenance points on charging system	3	2	W
	6/9/07	Pagumen 1	Thursday	Getachew	Maintenance points on batteries and Exam on auto electricity	3	2	
	7/9/07	Pagumen 2	Friday	Endris	Closing Ceremony		1	
	8/9/07	Pagumen 3	Saturday					
	9/9/07	Pagumen 4	Sunday					

Material and Equipments for the training

- ✧ Submersible pumps
- ✧ Control panel for submersible pump
- ✧ Generating set
 - 1) NIPPON SHYARYO MODEL DG – 10Z
 10 kW 380V 50 Hz
 - 2) HOKUETSU INDUSTRES SDG35S – 3A2
 35 kW 380V 50 HzIncluding old generators
- ✧ Cut models
 - 1) Submersible pump
 EBARA MODEL Z BH4J
 1.5 kW 3 phase
 - 2) Starter motor
 - 3) Alternator
- ✧ Measuring instruments
 - 1) Circuit tester
 - 2) Insulation tester
 - 3) Clamp meter
 - 4) Phase detector
- ✧ Practical board for sequence control

Staff Members of the Project

Project Director
Project Manager
Head of Training Center
Trainee Affairs

Ato Abera Mekonin
Ato Getachew Abdi
Ato Markos Tefera
Ato Sultan Kemal

Advisors from JICA

Chief Advisor
Coordinator

Dr. Akira Kamata
Mr. Masahiko Ikemoto

Course Coordinators:

Ground Water Investigations
Drilling Technology
Drilling Machinery Maintenance
Electrical Maintenance

Ato Shumet Kebede
Ato Mulugeta Kinfu
Ato Endris Mohammad
Ato Beneberu Demisse

Instructors:

Ground Water Investigations
Electrical Maintenance
Drilling Machinery Maintenance
Drilling Machinery Maintenance

Ato Shumet Kebede
Ato Melaku Nasibu
Ato Getachew W/Michael
Ato Abebe Mekonin

Associate Staff:

Mechanic
Technical Assistant

Ato Feleke Temkete
Ato Mekonen Aweke

Administrative Staff:

Secretary
Secretary for Chief adviser
Store Keeper

W/ro Zelalem Girma
W/t Kidist Niguse
W/ro Yiregdu Asfaw

Clinic

Sister Tadellech Yusuf
Ato Ketema Teshome

Librarian

W/t Sara G/Silase

Instructors for the course

Staff member of the Training Center (Ministry of Water Resources)

Ato Beneberu Demise
Ato Abebe Mekonin
Ato Getachew W/Michael
Ato Melaku Nasibu

Other Information

Duration

July 31/2007- September 7 /2007

Course Time Table

Monday to Friday		
Morning Session	1st Lecture	09:30 to 10:30
	Coffee break	
	2nd Lecture	11:00 to 12:00
Lunch Break		12:00 to 13:50
Afternoon Session	3rd Lecture	14:00 to 15:00
	Refreshments	
	4th Lecture	15:30 to 16:30

Language

English shall be the main language of the training.

Accommodation

Dormitory
Canteen

Premises of the training center

Kality Training Center
Phone: 251 443 11 25
Fax: 251 443 11 28
Ministry of Water Resources
Fax: 611700
P.O. Box: 5744 Addis Ababa