higher education & training
Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MOTHEO TVET COLLEGE

Specifications of Equipment and Training Required

A. Training Laboratory Equipment:

1. Photoelectric converters x 50

2. Energy saving technologies.

Study of photoelectric energy converter – solar panel X 5

3. Energy saving technologies.

Solar power generator with flat-plate collectors x 5

4. Energy saving technologies.

Solar power generator with tube collector X 5

5. Energy saving technologies.

Wind turbine studies x 5

6. Projector Screen x 5

7. Data Projector x 5

8. Software and methodological support with a detailed description of the sequence of experiments included.

1. Specs for Photoelectric converters x 50

Description:

The training laboratory system must be able to carry out practical works on studying the processes of photoelectric energy conversion.

Will be used as a teaching facility for practical and laboratory classes on:

- studying the processes of solar radiation to electricity conversion,
- determining KPI and characteristics of converters in higher and secondary technical institutions.

The following equipment should be located on the front panel of the bench:

- 4 solar cells 6W/40mA;
- accumulator battery;
- fan DC 12V;
- LED point-light 12V;
- active variable load;
- independent voltage source 12V.

The training system must be supplied with a set of methodical and technical documentation for teaching staff.

Experiments to be provided:

1. Familiarization with solar cells operation principle.
2. The study of solar cell characteristics.
3. The method of solar cells termination in groups
4. Solar battery operation while shading separate modules.
5. Electrical specifications of solar batteries.
6. The characteristics of solar batteries depending on radiation intensity, beam incidence angle and temperature.
7. Solar accumulator battery.

2. Specs for Study of photoelectric energy converter – solar panel X 5

Description:

The training laboratory system should be designed as an educational equipment for studying photoelectric energy conversion.

The construction of the bench consists of a control unit, two solar modules (with single-crystal and multi-crystal solar panels) and a lighthead.

The control unit consists of a housing with the following equipment installed:

· power supply units, electronic circuit boards, load resistors, front panel and an integrated desktop tabletop.

The schemes of the solar panel, load connection and measurement means are depicted on the control unit front panel.

The following equipment should also be located on the front panel:

- mains switch;
- functional switches;
- lighters with halogen lamps (4 pcs.);
- digital indicators;

The solar modules should be movable frames made of steel section. Each unit has two solar panels mounted on it. The angulation of the panels could be adjusted from 0 to 90 degrees at fixed 5 degree intervals. The temperature of each panel is controlled by a digital thermometer.

The lighthead is a movable frame made of steel section with 8 (2 groups of 4 pieces) halogen lamps, each 0.5 W power. Each group has it's own power switch.

The laboratory system set should include software and methodical guidelines.

Experiments to be provided:

1. The study of the laboratory bench.
2. The study of the construction and operation principle of photoelectric converters.
3. The study of the characteristics of the solar panels of different types.
4. Parallel connection of solar panels.
5. Series connection of solar panels, bypass diodes.
6. The characteristics of solar panels depending on radiation intensity, incidence angle and temperature.

3. Specs for Solar power generator with flat-plate collectors x 5

Description:

The training laboratory system should be designed as an educational equipment for practical laboratory tests.

The training system should consists of:

- laboratory unit mounted on a platform;
- solar collector mounted on a platform;

- storage water heater mounted on a platform.

The following equipment to be installed on the mobile platform:

- pumping unit;
- pipeline accessories;
- expansion tank;
- water meters;
- pulse flow meters;
- temperature-sensing points (Pt500).

The panels of: thermal energy flow meters (heat meters), thermometers with remote sensors, solar energy unit digital controller must be mounted at the front of the frame.

The measuring system should include digital thermometers with 4 remote sensors, digital and analog flow meters and water meters (4), 2 heat meters, 4 mounted water temperature-sensing points (Pt500), 3 multifunction meters of electric power parameters.

The laboratory bench must be completely ready for operation, it's possible to connect external heating devices and additional modules.

The laboratory bench set should also include the following software and methodological support: a set of methodological and technical documentation for teaching staff.

Experiments to be provided:

1. The study of the solar power unit;

2. Solar collectors. General characteristics;

3. Mounting and working with the equipment;

4. The study of the solar collector operation;

5. Solar power unit controller.

4. Specs for Solar power generator with tube collector X 5

Description:

The laboratory training system should be designed to be used as a teaching facility for practical laboratory tests.

The training system should consists of:

- laboratory unit mounted on a platform;
- solar collector mounted on a platform;
- storage water heated mounted on a platform.

The solar collector devices must be mounted on the laboratory unit. The elements of the system are fixed on an aluminium profile frame (mobile mounting platform).

The following equipment should be installed on the mobile platform:

- pumping unit;
- pipeline accessories;
- expansion tank;
- water meters;
- pulse flow meters;
- temperature-sensing points (Pt500).

The panels of: thermal energy flow meters (heat meters), thermometers with remote sensors, solar energy unit digital controller should be mounted at the front of the frame.

The measuring system must include digital thermometers with 4 remote sensors, digital and analog flow meters and water meters (4), 2 heat meters, 4 mounted water temperature-sensing points (Pt500), 3 multifunction meters of electric power parameters.

The laboratory system should be completely ready for operation, it’s possible to connect external heating devices and additional modules.

The laboratory system set should also include the following software and methodological support: a set of methodological and technical documentation for teaching staff.

Experiments to be provided:

1. The study of the solar power unit;
2. Solar collectors. General characteristics;
3. Mounting and working with the equipment;

4. The study of the solar collector operation;
5. Solar power unit controller.

5. Wind turbine studies x 5

Description:

The training laboratory system should be designed to study different types of wind turbines and their operating modes.

Structurally, the training system should consists of:

• testing facility;

• control and measurement unit.

The control unit must consists of a housing with the following equipment installed: power source, electronic boards, load resistors, front panel and tabletop of integrated desktop.

On the front panel there should be an electric scheme of the wind turbine, load connection and measurement devices.

The following equipment should also be located on the front panel:

- power switch;
- functional switches;
- load lights unit (2 lamps);
- digital indicators;
- power cord for testing facility connection.

The testing facility must be a movable frame with the following equipment installed on it:

- centrifugal blower;
- air channel (aerodynamic tunnel) for creating and routing air flow from the blower;
- rack with synchronous generator mounted;
- inverter for blower speed regulation;
- electrical commutation unit.

The air stream from the blower passes through the air case to the impeller of the wind turbine, thus rotates it. The impeller is changeable, the kit includes at least 4 types of impellers. Impeller blades type 1…3 are adjustable by slope angle. Maximum air flow speed at the blades is 20 m/s. Maximum generator power is 5 W. The commutation of the electrical schemes at the panel is performed using unified jumpers.

The laboratory system set must include software and methodical guidelines.

Experiments to be provided:

1. Studying the laboratory bench;
2. Determination of air stream speed and blower rotation speed;
3. Studying wind turbine speed properties depending on impeller type and blade slope angle;
4. Wind turbine power dependence on wind speed.
5. Wind turbine performance at a constant wind speed.
6. Synchronous generator performance.

B. Training programmes required for Train-the-Trainer Course: 5 Trainees

- Energy-saving technologies. Wind turbine studies:
- Experimental test of wind turbine speed characteristics dependence on wind speed.
- Experimental test wind turbine speed characteristics dependence on the type of impeller.
- Experimental test wind turbine power dependence on wind speed.
- Experimental test of wind turbine characteristics at a constant wind speed and changeable load.
- Experimental test of the electrical characteristics of synchronous generator.

Wind turbine:

- Experimental demonstration of wind energy to electricity conversion.
- Experimental test of wind turbine speed characteristics dependence on wind speed.
- Experimental test of wind turbine speed characteristics dependence on the type of impeller.

- Experimental test of wind turbine speed characteristics dependence on the impeller pitch angle.

Energy saving technologies. Study of photoelectric energy converter – solar panel:

- Experimental test of single monocrystalline and polycrystalline solar panel characteristics.
- Experimental test of series-connected solar panels characteristics.
- Experimental demonstration of bypass diode operation.
- Experimental test of solar panels characteristics while changing radiation intensity.
- Experimental test of solar panels characteristics while changing sunrays incidence angle.

Photoelectric converters:

- Experimental test of single solar panel characteristics.
- Experimental test of series connected solar panels characteristics.
- Experimental test of parallel connected solar panels characteristics.
- Experimental test of series-parallel (combined) connected solar panels characteristics.
- Experimental demonstration of bypass diode operation.
- Experimental demonstration of the conversion of solar energy into electricity for electric power supply.
- Experimental test of solar panels characteristics while changing radiation intensity.
- Experimental test of solar panels characteristics while changing sunrays incidence angle.
- Experimental demonstration of solar system operation modes with accumulator battery.

Energy saving technologies. Solar power generator with tube collector:

- Practical work on operating solar power generator with collector.
- Experimental test of tube collector characteristics.
- Practical work for the study of electronic controller of operating solar power generator with collector.

Energy saving technologies. Solar power generator with flat-plate collector:

- Practical work on operating solar power generator with collector.
- Experimental test of flat-plate collector characteristics.
- Practical work for the study of electronic controller of operating solar power generator with collector.

PRICING SCHEDULE

DESCRIPTION	UNITS	PRICE (INCL VAT)
Photoelectric converters	**50**	**R**
Energy saving technologies. Study of photoelectric energy converter – solar panel	**5**	**R**
Energy saving technologies. Solar power generator with flat-plate collectors	**5**	**R**
Energy saving technologies. Solar power generator with tube collector	**5**	**R**
Energy saving technologies. Wind turbine studies	**5**	**R**
Projector Screen	**5**	**R**
Data Projector	**5**	**R**
Software and methodological support with a detailed description of the sequence of experiments included.	**1**	**R**
Training programmes required for Train-the-Trainer Course	**5 Trainees**	**R**
	DELIVERY	**R**
	TOTAL PRICE (INCL VAT)	**R**