

**46967** Electrical Workstation offers an excellent approach to the teaching of Electrical Machines principles by introducing a unique modular designed control unit. It provides flexibility for the students to carry out experiments over AC and DC Machines using a large selection of Industry standard inbuilt components.

Electrical Machines is one of the most important area of study as it helps users to understand the operational characteristics and working of AC and DC Machines. 46967 enables user to put their theory knowledge into practice with ease. There is an additional facility to make wireless connection on workstation with computer and to monitor real time electrical parameters using computer interfacing software. Users can also observe a real time graph between any of the AC and DC electrical parameters on computer.



Workstation comprises of separate AC and DC measuring sections equipped with all the necessary instruments such as digital meters, facility to connect AC and DC Supplies along with protection devices such as Fuses, MCB's, Supply Indicators, etc. There are multiple buses provided on the Workstation to make external connections while performing AC and DC Machines Experiments.

The design of the control unit ensures to get the highest quality practical experience to user. All the necessary protective measures are taken to avoid fault or danger.

**Note: All AC & DC Machines along with supporting accessories are available optionally**

### Features

- Compatible for Machines upto 2HP
- Equipped with Measurement Facilities for Experimentation on AC Machines, DC Machines and Transformers
- Separate AC and DC Measuring Sections
- Diagrammatic representation of AC and DC Machines for better understanding
- Rust Free Powder Coating Paint
- Standard BS-10 terminals, patch cords for safety purpose
- Terminals provided to obtain Three Phase Fixed as well as Variable AC and DC Supplies with suitable protection
- High Quality Digital Tachometer for RPM Measurement
- Motors provided with standard Mechanical Loading Arrangement Facility
- Motors with "aluminum" casted Brake-Drum/Pulley with heat suppression facility
- Machines with Class "B" Insulation
- Flexible shaft coupling arrangement (Lovejoy) for Motor Generator (MG) Sets
- Machines provided with Heavy Duty Base/Channel with suitable interconnection
- Machines provided with suitable protections such as MCB's, Fuses, Motor Generator (MG) Sets provided with coupling protective cover
- Generator with Electrical Loading Arrangement Facility
- Durable good quality spring balance
- Designed by considering all the safety measures

Note: Specifications are subject to change.

**Technical Specifications****Electrical Measuring Instruments****AC Ammeter (4 Nos.)**

Type : Digital  
Range : 10A

**AC Voltmeter (4 Nos.)**

Type : Digital  
Range : 450Vrms

**DC Ammeter (4 Nos.)**

Type : Digital  
Range : 20A

**DC Voltmeter (4 Nos.)**

Type : Digital  
Range : 300V

**Single Phase Wattmeter (2 Nos.)**

Type : Digital  
Range : 4kW

**DC Supply (for excitation purpose only)**

Voltage : 300V  $\pm$  10%  
Current : 2Amp

**DC Power Supply**

DC Output Voltage (Fixed) : 220V  $\pm$  10%, 2A  
DC Output Voltage (Variable) : 220V  $\pm$  10%, 15A

**Protective Devices**

Three Phase MCB (TPN) : 2 Nos.  
Interconnections : 4mm BS-10 Safety Terminals

**Object****DC Machines (optional)****DC Shunt Wound Motor**

01. Study of Operational Working and Principle of DC Shunt Motor
02. Study of running and reversing phenomenon of DC Shunt Motor
03. Study of No Load Characteristic of DC Shunt Motor
04. Study of Load Characteristic of DC Shunt Motor
05. Study of speed control of DC Shunt Motor using armature voltage control and flux field control method
06. Study and Determine the losses of DC Machine and correspondingly calculate the efficiency of DC Machine by Swinburn's Test Method

**DC Series Wound Motor**

07. Study of Operational Working and Principle of DC Series Motor
08. Study of running and reversing phenomenon of DC Series Motor
09. Study of Load Characteristic of DC Series Motor
10. Study of speed control of DC Series Motor using armature voltage control and flux field control methods

**DC Compound Wound Motor**

11. Study of Operational Working and Principle of DC Compound Motor
12. Study of running and reversing phenomenon of DC Compound Motor
13. Study of Load Characteristic of DC Cumulative-Compound Wound Motor
14. Study of Load Characteristic of DC Differential-Compound Wound Motor

**DC Shunt Wound Generator**

15. Study of Operational Working and Principle of DC Shunt Generator
16. Study and measurement of Open Circuit Characteristic of DC Shunt Generator
17. Study and measurement of External Characteristic of DC Shunt Generator
18. Study and measurement of Internal Characteristic of DC Shunt Generator

**DC Series Wound Generator**

19. Study of Operational Working and Principle of DC Series Wound Generator
20. Study and measurement of Open Circuit Characteristic of DC Series Generator
21. Study and measurement of Load Characteristic of DC Series Generator
22. Study and verify the Field Test of DC Series Machine and correspondingly determine the efficiency of DC Series Motor and Generator at any desire load

**DC Compound Wound Generator**

23. Study of Operational Working and Principle of DC Compound Wound Generator

Note: Specifications are subject to change.

24. Study and verify the Load Characteristics of Long Shunt Cumulatively Compound Generator
25. Study and verify the Load Characteristics of Short Shunt Cumulatively Compound Generator
26. Study and verify the Load Characteristics of Long Shunt Differentially Compound Generator
27. Study and verify the Load Characteristics of Short Shunt Differentially Compound Generator

### AC Machines (optional)

#### Single Phase Capacitor Start Induction Motor

- Study of Operational Working and Principle of Single Phase Induction Motor
- Study of Running and Reversing of Single Phase Induction Motor
- Study of the No-Load Test in a Single Phase Induction Motor
- Study of the Blocked Rotor Test in a Single Phase Induction Motor
- Study of Load Test in a Single Phase Induction Motor

#### Three-phase Squirrel Cage Induction Motor

- Study of Operational Working and Principle of Three Phase Squirrel Cage Induction Motor
- Study of Running and Reversing of Three Phase Induction Motor
- Study of No Load Test performed in a Three Phase Induction Motor
- Study of Block Rotor Test performed in a Three Phase Induction Motor
- Measurement of Slip in a Three Phase Induction Motor
- Study of Speed-Torque characteristics in a Three Phase Induction Motor

#### Three Phase Salient Pole Synchronous Motor

- Study of Operational Working and Principle of Three Phase Synchronous Motor
- Study of V curve of Three Phase Synchronous Motor
- Study of Inverse V curve of the Three Phase Synchronous Motor

#### Three Phase Salient Pole Synchronous Generator

- Study of Operational Working Principle of Three Phase Synchronous Generator
- Study and Measurement of Positive Sequence Impedance of Three Phase Synchronous Generator
- Study and Measurement of Negative Sequence Impedance of Three Phase Synchronous Generator
- Study and Measurement of Zero Sequence Impedance of Three Phase Synchronous Generator
- Study of short circuit characteristics (SCC) of three Phase Synchronous Generator
- Study of open circuit characteristics (OCC) of three Phase Synchronous Generator
- Study and measure of voltage regulation of Three Phase Synchronous Generator using EMF Method

#### Single Phase Transformer:

- Study of Single-Phase Isolation Transformer
- Study of Single-Phase Step Up Transformer
- Study of Single-Phase Step Down Transformer
- Study of Subtractive Polarity of Single Phase Transformer
- Study of Additive Polarity of Single-Phase Transformer
- Study of Open Circuit test of Single-Phase Transformer
- Study of Short Circuit Test of Single-Phase Transformer

To determine the Efficiency and Voltage Regulation of a Single-Phase Transformer by direct loading at different loading condition.

#### Three Phase Transformer:

- Study of Open Circuit test of Three-Phase Transformer
- Study of Short Circuit Test of Three-Phase Transformer
- Study of Three Phase Configurations in Three Phase Transformer

**\*\*More than 70 Experiments can be performed in 46967**

**\*\*Also suitable for performing experiments on basic Electrical Measurements**

### Technical Specifications of Optional Machines

#### DC Motors (optional)

##### Machine Specification Type - Shunt

Power Rating	:	Available with 1/2HP, 1HP& 2HP
Voltage Rating	:	220V DC $\pm$ 5%
Rated Speed	:	1500RPM $\pm$ 7.5%
Insulation	:	Class 'B'
Loading arrangement	:	Mechanical
Spring Balance	:	2Nos. (Tubular Type)
Brake Drum/Pulley	:	Aluminum casted with heat suppression facility
Machine Base	:	"C" Channel

Note: Specifications are subject to change.

Protection	:	Fuses (mounted at the terminal box of the Machines)
<b>Machine Specification Type - Series</b>		
Power Rating	:	Available with 1HP&2HP
Voltage Rating	:	220V DC $\pm$ 5%
Rated Speed	:	1500RPM $\pm$ 7.5%
Insulation	:	Class 'B'
Loading arrangement	:	Mechanical
Spring Balance	:	2Nos. (Tubular Type)
Brake Drum/Pulley	:	Aluminum casted with heat suppression facility
Machine Base	:	"C" Channel
Protection of the Machines)	:	Fuses (mounted at the terminal box

**Machine Specification Type - Compound**

Power Rating	:	Available with 1HP & 2HP
Voltage Rating	:	220V DC $\pm$ 5%
Rated Speed	:	1500RPM $\pm$ 7.5%
Insulation	:	Class 'B'
Loading arrangement	:	Mechanical
Spring Balance	:	2Nos. (Tubular Type)
Brake Drum/Pulley	:	Aluminum casted with heat suppression facility
Machine Base	:	"C" Channel
Protection	:	Fuses (mounted at the terminal box of the Machines)

**AC Motors (optional)**

**Machine Specification - Single Phase Induction Motor**

Type	:	Single phase Capacitor Start Induction Motor
Power Rating	:	Available with 1HP
Voltage Rating	:	230V AC $\pm$ 5%, 50Hz
Rated Speed	:	1440RPM $\pm$ 7.5%
Insulation	:	Class 'B'
Loading arrangement	:	Mechanical
Spring Balance	:	2 Nos. (Tubular Type)
Brake Drum/Pulley	:	Aluminum casted with heat suppression facility
Machine Base	:	"C" Channel
Protection	:	Fuses (mounted at the terminal box of the Machines)

**Machine Specification - Three Phase Squirrel Cage Induction Motor**

Type	:	Three Phase Squirrel Cage Induction Motor
Power Rating	:	Available with 1HP & 2HP
Voltage Rating	:	415V AC $\pm$ 5%, 50Hz
Rated Speed	:	1440RPM $\pm$ 7.5%
Insulation	:	Class 'B'
Loading arrangement	:	Mechanical
Spring Balance	:	2 Nos. (Tubular Type)
Brake Drum/Pulley	:	Aluminum casted with heat suppression Facility
Machine Base	:	"C" Channel
Protection	:	Fuses (mounted at the terminal box of the Machines)

**Single Phase Transformer (optional)**

**Transformer Specifications**

Mains Supply	:	Single Phase, 230V AC $\pm$ 10%, 50Hz
Rating	:	1kVA
Primary Voltage	:	0-125V, 0-125V
Secondary Voltage	:	0-125V, 0-125V
Rated Current	:	5A

**Three Phase Transformer (optional)**

**Transformer Specifications.**

Mains Supply	:	415V $\pm$ 10%, 50Hz
Type	:	Three Phase

Note: Specifications are subject to change.



Power Rating	:	1kVA
Primary Voltage	:	415V
Secondary Voltage	:	230V
Rated Current	:	4A

**DC Generators (optional)**

**Machine Specification**

Both the Machines are flexibly coupled and Mounted on a Single 'C' Channel Base DC Machine (acts as prime mover)

Type	:	Shunt
Voltage Rating	:	220V DC $\pm$ 5%
Rated Speed	:	1500RPM $\pm$ 7.5%
Insulation	:	Class 'B'

**DC Machine (acts as generator)**

Type	:	Shunt
Power Rating	:	Available with 0.5HP, 1HP & 2HP
Rated Speed	:	1500RPM $\pm$ 7.5%
Insulation	:	Class 'B'
Shaft extension	:	Single Sided
Loading Arrangement	:	Electrical
Type of Coupling	:	Flexible "Lovejoy" Coupling
Machine Base	:	"C" Channel
Protection	:	Fuses (mounted at the terminal box of the Machines)

**Machine Specification**

Both the Machines are flexibly coupled and Mounted on a Single 'C' Channel Base DC Machine (acts as prime mover)

Type	:	Shunt
Voltage Rating	:	220V DC $\pm$ 5%
Rated Speed	:	1500RPM $\pm$ 7.5%
Insulation	:	Class 'B'

**DC Machine (acts as generator)**

Type	:	Series
Power Rating	:	Available with 1HP & 2HP
Rated Speed	:	1500RPM $\pm$ 7.5%
Insulation	:	Class 'B'
Shaft extension	:	Single Sided
Loading Arrangement	:	Electrical
Type of Coupling	:	Flexible "Lovejoy" Coupling
Machine Base	:	"C" Channel
Protection	:	Fuses (mounted at the terminal box of the Machines)

**Machine Specification**

Both the Machines are flexibly coupled and Mounted on a Single 'C' Channel Base

**DC Machine (acts as prime mover)**

Type	:	Compound
Voltage Rating	:	220V DC $\pm$ 5%
Rated Speed	:	1500RPM $\pm$ 7.5%
Insulation	:	Class 'B'

**DC Machine (acts as generator)**

Type	:	Compound
Power Rating	:	Available with 1HP & 2HP
Rated Speed	:	1500RPM $\pm$ 7.5%
Insulation	:	Class 'B'
Shaft extension	:	Single Sided
Loading Arrangement	:	Electrical
Type of Coupling	:	Flexible "Lovejoy" Coupling
Machine Base	:	"C" Channel
Protection	:	Fuses (mounted at the terminal box of the Machines)

Note: Specifications are subject to change.



**AC Generators (optional)**

**Machine Specification**

Both the Machines are flexibly coupled and Mounted on a Single 'C' Channel Base

**Three Phase Synchronous Machine**

Type	:	Salient Type
Power Rating	:	3 HP
Voltage Rating	:	415V AC $\pm$ 10%, 50Hz
Configuration	:	"Delta" Connected
Rated Speed	:	1500RPM $\pm$ 5%
Insulation	:	Class 'B'
Excitation Voltage	:	180Vdc $\pm$ 10%

**DC Machine (acts as generator)**

Type	:	Shunt
Power Rating	:	2HP
Rated Speed	:	1500RPM $\pm$ 7.5%
Insulation	:	Class 'B'
Loading Arrangement	:	Electrical
Type of Coupling	:	Flexible "Lovejoy" Coupling
Machine Base	:	"C" Channel
Protection	:	Fuses (mounted at the terminal box of the Machines)

**Machine Specification**

Both the Machines are flexibly coupled and Mounted on a Single 'C' Channel Base

**DC Machine**

Type	:	Shunt
Power Rating	:	2HP
Voltage Rating	:	220V DC $\pm$ 5%
Rated Speed	:	1500RPM $\pm$ 5%
Insulation	:	Class 'B'

**Three Phase Synchronous Machine**

Type	:	Salient Type
Configuration	:	"Star" Connected
Power Rating	:	3HP
Voltage Rating	:	415V AC $\pm$ 5%, 50Hz
Rated Speed	:	1500RPM $\pm$ 7.5%
Insulation	:	Class 'B'
Excitation Voltage	:	180Vdc $\pm$ 10%
Loading Arrangement	:	Electrical
Type of Coupling	:	Flexible "Lovejoy" Coupling
Machine Base	:	"C" Channel
Protection	:	Fuses (mounted at the terminal box of the Machines)

**Other Supporting Optional Items**

**Single and Three Phase Resistive Load**

**Single Phase Operation**

Voltage	:	240V AC $\pm$ 10%, 50Hz
Current	:	15A
Power	:	3.5kW
Loading steps	:	15

**Three Phase Star Operation**

Voltage	:	415V AC $\pm$ 10%, 50Hz
Current	:	5A (per Phase)
Power	:	3.5kW
Loading steps	:	5 (per Phase)

**Three Phase Delta Operation**

Voltage	:	415V AC $\pm$ 10%, 50Hz
Current	:	15A (per Phase)
Power	:	10.5kW
Loading steps	:	5 (per Phase)
Switching Technique	:	Star/Delta Switch, 415V, 25A
Mains MCB	:	16A (TPN)

Note: Specifications are subject to change.



**Three Phase Inductive Load**

Three Phase Star Operation

Voltage : 415V AC  $\pm$ 10%, 50Hz  
Current : 10A (per Phase)

**Single and Three Phase Capacitive Load**

**Single Phase Operation**

Voltage : 230V AC  $\pm$ 10%, 50Hz  
Current : 14A (Approx.)  
Loading steps : 30

**Three Phase Star Operation**

Voltage : 415V AC  $\pm$ 10%, 50Hz  
Current : 4.6A (per Phase)  
Loading steps : 10 (per Phase)

**Three Phase Delta Operation**

Voltage : 415V AC  $\pm$ 10%, 50Hz  
Current : 13A (per Phase)  
Loading steps : 10 (per Phase)  
Switching Technique : Star/Delta Switch, 415V, 25A  
Mains MCB : 16A (TPN) 10A (One Pole) 30 Nos.

**Thyristorized DC Regulated Power Supply**

Input Mains : 415VAC  $\pm$  10%, 50Hz  
Rated Output Voltage : 220VDC (Fixed)  $\pm$  5%,  
Rated Output Current : 50ADC  
Regulation : Less than 3% at full load condition.

**Measuring Instruments**

AC Voltmeter : 1 No. (with voltage selector switch)  
DC Ammeter : 1 No.  
DC Voltmeter : 1 No.

**Protection with its indicators**

Overload Protection  
Short Circuit Protection  
Phase Sequence Indicator

**Single Phase Variac**

Type : Close Type  
Operating Rating : 230V AC  $\pm$ 10%, 50Hz  
Output Voltage : 0 - 270V AC  $\pm$ 10%, 50Hz  
Current : 10A (Also available in different Current Ratings)

**Three Phase Variac**

Type : Close Type  
Operating Rating : 415V AC  $\pm$ 10%, 50Hz  
Output Voltage : 0 - 470V AC  $\pm$ 10%, 50Hz  
Current : 10A (Also available in different Current Ratings)

- Rheostats
- AC Starters
- DC Starters



Single and Three Phase  
Capacitive Load



Three Phase Inductive Load



Single and Three Phase  
Resistive Load

Note: Specifications are subject to change.