

## Powerframes Dissectible Machines



### Features

- Fully functional, multi-part constructional machines kit
- Creates a practical and realistic machines tutor
- Over 50 types of machine may be assembled
- From vocational to graduate engineer level
- Inherently safe
- Fully developed course curriculum

The Powerframes Dissectible Machines System components form a complete trainer that covers a wide range of generators and motors - dc, Single and Three Phase ac and Stepper. The trainer is built around the unique Feedback Dissectible Machine, which is designed to introduce students to the principles of electrical motors and generators.

The trainer includes power supplies, drives and control equipment, loading and instrumentation modules that are all provided in the form of panels. These panels can easily be slotted in and out of a purpose-designed, bench-standing frame. The frame is constructed from an advanced, fibre-loaded, rigid plastic material which is electrically insulated for safety.

The trainer provides a dynamic approach to understanding electrical machines principles and construction covering a wide range of student levels from vocational to graduate Engineer. The Dissectible Machine has been designed so that the characteristics of the machines that can be assembled closely represent those of their industrial equivalents.

The trainer is supplied with a printed manual also on CD, which provide a wide range of step-by-step theory, courseware and experiment assignments, using the versatile and extensive dissectible machine.

The components in the system that make up the trainer are available separately, enabling customers to configure a trainer that suits their needs.

### System Benefits

- Covers dc and ac single and 3-phase motors and generators
- Allows machine construction to be examined
- High level of electrical and mechanical safety built-in
- Low cost installation - suitable for bench-top use
- Portable machine and system components
- Modular concept provides flexibility for individual requirements
- Choice of conventional or virtual instruments
- Provided with in-depth teaching manual

## The Dissectible Machine 62-100

### Curriculum Coverage

The unique Dissectible Machine System enables students to construct and investigate many different machine assemblies.

The System may be used to study a wide range of topics, from the principles of magnetic circuits and electrical machine theory through to Three-phase synchronous machines.

Students are able to see clearly the component parts of the machine and how they are interconnected, both electrically and mechanically. They may assemble machines from these component parts and then investigate the operation and characteristics of each machine.



### Curriculum Coverage

- Identification of constituent parts of an Electrical Machine
- Electromagnetic principles
- Elementary machine principles
- dc Motors and Generators
- Series, shunt and compound motor types
- ac single and three phase motor and generators
- Series, universal, single phase capacitor, split phase and repulsion motor
- Synchronous motors and generators - single and three phase
- Split field, shaded pole and stepper motors
- Electrical Machine faults

The focus of this system is a fully dissectible experimental machines kit. It enables a considerable number of machine assemblies to be built covering a wide range of ac and dc, Single and 3-Phase motor and generator assemblies. The machines that may be assembled use low voltages, have protected rotating parts and operate at relatively low power levels, minimising the risk of accidents. Nominal operating voltages are 50V dc and 125V ac.

The separate field poles, interpoles, armature poles, hub, 12-slot stator and squirrel cage rotor are made from electrical steel laminations riveted together. The coils are wound from synthetic enamel-covered copper wire and wrapped with a strong cloth-base tape. Each has 'coil finish' and identification bands.

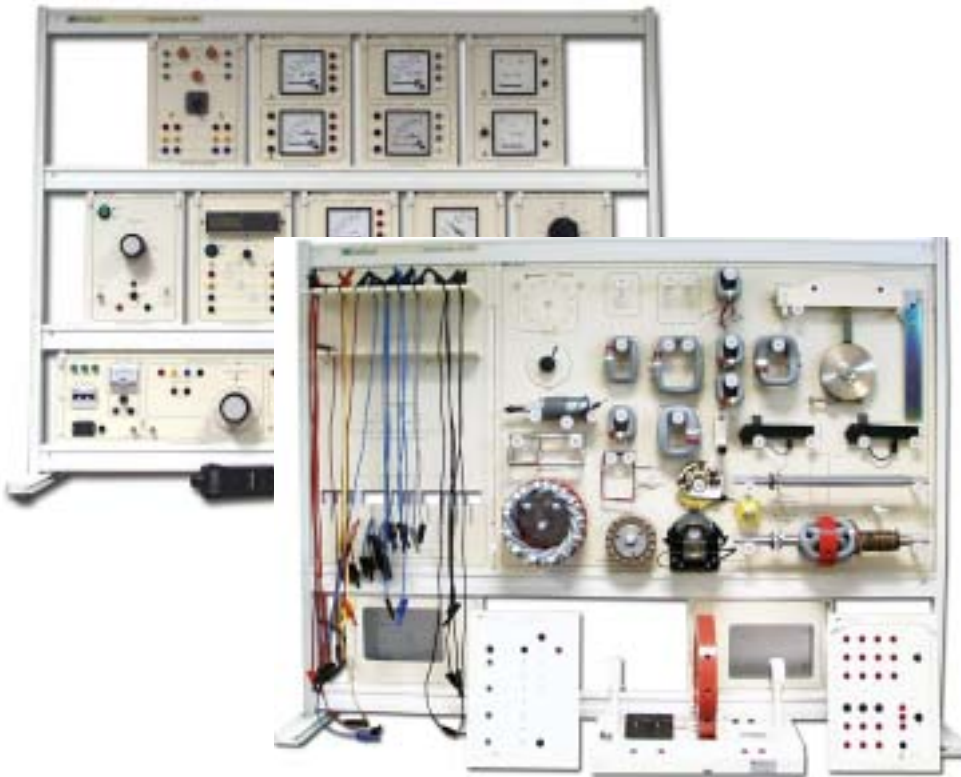
A stainless steel shaft of high corrosion resistance is supported by plain and self-aligning ball race bearings. These are held in aluminium alloy housings fixed to a cast aluminium baseplate. The shaft speed can range from very low values up to 3,600 rev/min (ac machines), or 5,000 rev/min (dc machines) according to the application. The commutator, slip rings and brush gear are of simple design to facilitate armature assembly and give good accessibility.

A sturdy component storage panel is provided for easy inventory control.

The following studies and machine assemblies may be investigated:

- |   |  |
|---|--|
| ■ Introduction to electromagnetism                                  | ■ 3-phase ac induction motor, squirrel cage, 2 pole and 4 pole |
| ■ Machine operating principles                                      | ■ 3-phase ac synchronous motor, 2 pole                         |
| ■ Elementary ac and dc generators                                   | ■ 3-phase ac synchronous generator, 2 pole                     |
| <b>Machines with and without interpoles:</b>                        | ■ ac brushless generator                                       |
| ■ dc series motor   | ■ Stepper motors   |
| ■ dc shunt motor  | ■ Shaded pole induction motor                                  |
| ■ dc series generator   | ■ Split field series motor                                     |
| ■ dc compound motor   | ■ Dynamic braking of a dc motor                                |
| ■ dc shunt generator  | ■ Power factor correction of ac motors                         |
| ■ dc compound generator   | ■ Synchronisation  |
| ■ dc separately excited generator                                   | ■ Synchronous motor characteristics                            |
| ■ Single phase ac induction motor, squirrel cage, 2 pole and 4 pole | ■ Pole-changing induction motor                                |
| ■ Single phase ac series universal motor                            | ■ dc shunt motor faults  |
| ■ Single phase ac repulsion motor                                   | ■ 4 pole induction motor faults                                |
| ■ Single phase ac synchronous motor/generator, 2 pole and 4 pole    |  |
| ■ Single phase ac generator, rotating field                         |  |
| ■ Single phase ac generator, rotating armature                      |  |

## Complete Dissectible Machines System 62-005



The complete Dissectible Machines trainer 62-005 provides all the components to perform the full range of student assignments.

The bench-top, free-standing frames divide the equipment into two distinct areas. One frame specifically holds all the component parts of the Dissectible Machine on an inventory control panel that includes connecting lead storage, component storage for couplings and nuts and bolts etc.

The second frame houses the workstation. It consists of a wide range of ac and dc meters, resistive and capacitive loads and power supplies. Fixed and variable ac and dc supplies are provided and require a three phase supply input of 400-415V ac from a five wire system. Total power requirement is 6kVA.

### Variable Speed Drive 63-501

A dc Variable Speed Drive is provided. It consists of a 250W motor mounted on a base unit and an electronic motor drive providing the motor supply. The shaft speed range is from zero to 4,000 rev/min and all controls and fuses are accessible externally. It has current limiting, electronic control for good regulation & soft-start.

### Measuring Equipment

A combination of electronic and more conventional analogue metering is provided to enable a full range of dc and ac parameters to be measured.

The Electronic Single and Three Phase Measurements panel gives a digital read-out of such parameters as voltage, current, power, kVA, kVAR, kWh, etc. Large scale analogue voltmeters and ammeters are provided for ac and dc readings together with a frequency meter and synchronising lamps. A hand-held tachometer allows machine speed to be determined. Torque is measured by a Friction brake mounted on the machine base. Both are supplied in the package.

### Loading Equipment

Both electrical and mechanical loading devices are provided in the system. The electrical loading is carried out with variable resistance loads and a resistor/capacitor unit for ac single phase and three phase machines. The mechanical loading is by a friction (Prony) brake, which is calibrated for quantitative measurement.

### Features

- Complete training system
- Comprehensive students manual that covers:
  - Magnetic principles to Three phase machines
  - Conventional instrumentation pointer type and digital meters
  - dc, single phase and three phase motors and generators
- Machines construction from component parts
- Protected supplies, meters and connecting leads
- Safety cover for Dissectible Machine and couplings
- Safety earthing system

### System components

- Baseplate
- Frame Ring
- Shaft
- Coupling
- Fixed and removable bearing housings
- Wound Stator
- Squirrel Cage Rotor
- Hand Crank
- Centrifugal Switch
- Brush Holders and Brushes
- Commutator/Slip Rings
- Interpoles
- Armature Poles and Hub
- Field Poles
- Armature, Field and Interpole coils
- Compound Field Coils
- Tools and Hardware

## **Complete Dissectible Machines System 62-005**

The full system comprises:

Universal Power Supply	60-105
Variable ac/dc Supply 5A	60-121
Dissectible Machines Components - 62-100 Dissectible Machines Tutor, 65-130 Control Switches and 67-190 Resistor Capacitor Load Unit	62-110
Variable Speed Drive	63-501
Variable Resistance 200Ω 3A	67-113
Friction (Prony) Brake	67-470
Electronic Single and Three Phase Measurements	68-100
dc Voltmeter and Ammeter x2	68-110
dc Milliammeter Centre Zero	68-113
Rectifier Voltmeter/Ammeter	68-117
Synchronising Lamps	68-120
ac Voltmeter and Frequency Meter	68-121
Digital Optical/Contact Tachometer	68-470
Patch Leads	68-800
Dissectible Machines Storage System	91-100
System Frame	91-200

### **Optional Equipment for 62-005**

Multi-channel I/O unit (includes Virtual Instrumentation pack and PC interface)	68-500
Oscilloscope/Computer Housing	91-210
Storage Bin	91-240
Earth Leakage Breaker Three Phase (recommended where earth leakage protection is not part of the laboratory supplies installation)	60-140-1

### **Ordering Information**

Please quote the following product names and numbers when ordering:

Dissectible Machines System (230/400V operation)	62-005
Dissectible Machines System (120/208V operation)	62-035

### **Individual Dissectible Machines items**

Dissectible Machines Storage Panel	62-101
Rotatable Brush Gear	62-102
Friction (Prony) Brake	67-470
Optical/Contact Tachometer	68-470
Standard set of patch leads	68-800
Oscilloscope / Computer Housing	91-210
Storage bin	91-240
System Frame	91-200
Lead Storage panel	91-245
Dissectible Machines Tutor	62-100
Control Switches	65-130
Resistor/Capacitor unit	67-190

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