BTEC HIGHER NATIONALS IN ENGINEERING: A PRACTICAL GUIDE
ENGINEERING EXCELLENCE IN EDUCATION
Since 1958, TecQuipment has been dedicated to developing products that inspire students at universities, colleges, schools and training centres in over 100 countries.

The quality of our teaching equipment is central throughout our design and production processes. We manufacture all of our products in our own factory in the UK under a ‘World Class’ quality system accredited to ISO9001. We therefore have full control and confidence in the quality of our products that we can deliver to you.

TecQuipment retains the reputation of market leader in this industry by attention to detail and business excellence.

Our five-year warranty is reinforced by our dedicated team of specialists at TecQuipment with life-time support when you purchase our products.

Our products help students understand key concepts in many fields of engineering and science, including Aerodynamics, Fluid Mechanics, Thermodynamics, Materials Testing, plus many more.

TecQuipment’s products include detailed manuals and instructional material that are specifically designed to aid instructors to provide students with the facilities to grasp the key concepts covered by the systems.

Through intuitive design and thorough safety features, students are able to get hands-on with complex systems that will spark a passion for engineering and knowledge of the relevant topics.

INSPIRING OUR FUTURE ENGINEERS
**INTRODUCTION**

In setting assignments and working within the structures of the BTEC Higher Nationals Course 2017 this interactive document provides the course leader and student with an enhanced reference for the key learning outcomes. Follow the live links by hovering over the required equipment and discover the detailed product overview and video demonstrations.

The TecQuipment resource guides you through the essential criteria to teaching within a stimulating and engaging academic environment. With practical demonstrations of fundamental engineering principles, students can analyse data and information, make sense of this and reach evaluative judgements. This is also supported through both the practical application and our Versatile Data Acquisition System (VDAS®). Practical demonstrations provide engaging and stimulating learning, and our products support you in delivering motivating and inspirational learning that is active, flexible and progressive, securing students’ overall learning outcomes.

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**UNIT 2**

**ENGINEERING MATHS**

**LEARNING OUTCOME:** LO3  
**DISTINCTION:** D2

**SIMPLE MECHANISMS KIT (ES14)**  
Shows how three popular mechanisms convert motion.

**CAM, CRANK AND TOGGLE KIT (ES12)**  
Shows the characteristics of a mechanical toggle, crank motion and the most popular shaped cams.

**FREE VIBRATIONS OF A MASS-SPRING SYSTEM (TM164)**  
Uses simple harmonic motion theory to show how to calculate the frequency of oscillation in simple mass-spring systems.

**FREE VIBRATION OF A BEAM AND SPRING (TM167)**  
An experimental apparatus that allows students to investigate the oscillatory motion of a rigid beam, pivoted at one end and suspended by a spring at the other.

**FREE VIBRATIONS OF A CANTILEVER (TM166)**  
An experimental apparatus that allows students to use fundamental theory and Rayleigh’s approximation to calculate the frequency of oscillation of a cantilever.

**FREE TORSIONAL VIBRATIONS (TM165)**  
An experimental apparatus that allows students to investigate the oscillatory motion of a disc attached to a slender rod.
UNIT 3
ENGINEERING SCIENCE

LEARNING OUTCOME: L02
PASS: P3

EQUILIBRIUM OF A BEAM (STF5)
Demonstrates the forces, moments and reactions of a rigid beam.

CONTINUOUS AND INDETERMINATE BEAMS (STR13)
An experimental apparatus to allow students to investigate the properties of statically indeterminate and continuous beams.

BEAM APPARATUS (SM1004)
A bench mounted beam apparatus to allow students to investigate the deflections and reactions in simply supported and cantilevered beams.

SIMPLE AND COMPOUND PENDULUMS (TM161)
An experimental apparatus that allows students to study simple harmonic motion and the factors that affect the period of oscillation of pendulums.

LEARNING OUTCOME: L02
DISTINCTION: D2

HEAT TRANSFER EXPERIMENTS (TD1002)
A base unit and four optional experiments that demonstrate heat transfer.

HEAT EXCHANGER EXPERIMENTS (TD300)
A base unit and four optional experiments that examine and compare small-scale heat exchangers to help students understand how they work.

WATER TO AIR HEAT EXCHANGERS (TD1007)
An experimental unit to show how cross-flow water to air heat exchangers work.

LEARNING OUTCOME: L03
PASS: P6
MERIT: M3
DISTINCTION: D2

TORSION TESTING MACHINE (30 NM) (SM1001)
A bench mounted machine to allow students to do torsion tests on different materials.

BENCH TOP TENSILE TESTING MACHINE (SM1002)
A laboratory-scale hand driven bench top tensile testing machine, 20kN capacity.

UNIVERSAL TESTING MACHINE (SM1000)
A versatile test machine, that with optional ancillaries, allows a range of destructive and non destructive material tests to be completed.

HARDNESS TESTERS (SM1015-17)
Bench-top industrial-standard testers for accurate measurements of Rockwell and Vickers hardness.
# UNIT 8
## MECHANICAL PRINCIPLES

<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>PASS:</th>
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<tr>
<td>LO1</td>
<td>P1</td>
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### BENDING MOMENTS IN A BEAM (STR2)
A simply supported beam apparatus to demonstrate and investigate the bending moments and forces within a structure.

### SHEAR FORCE IN A BEAM (STR3)
A simply supported beam apparatus to demonstrate and investigate the shear forces within a structure by use of a loaded beam designed to move in shear only.

### BENDING STRESS IN A BEAM (STR5)
An experimental apparatus to allow students to investigate the stresses and strains within a structure in relation to bending loads.

### TORSION OF CIRCULAR SECTIONS (STR6)
An experimental apparatus to allow students to investigate the relationship between torque and deflection in the elastic region of solid sections in various materials and a single tubular section.

### BENDING STRESS IN A BEAM (STR13)
An experimental apparatus to allow students to investigate the stresses and strains within a structure in relation to bending loads.

### BEAM APPARATUS (SM1004)
A bench mounted beam apparatus to allow students to investigate the deflections and reactions in simply supported and cantilevered beams.

### GYROSCOPE (TM1004)
Demonstrates the relationship between gyroscopic couple and the velocities of the rotor and precession.

### GEAR TRAINS KIT (ES13)
Demonstrates the characteristics of the most popular gear sets.

### GEARED SYSTEMS (TM1018)
An experimental unit to allow students to find the dynamic efficiency of various drive types. The unit comes complete with a gear drive unit which can be configured as a simple or compound drive.

### ROTATIONAL FRICTION KIT (ES17)
Demonstrates how rotational friction affects the efficiency of popular machine elements.

### DRIVE SYSTEMS KIT (ES11)
Demonstrates the advantages and disadvantages of three popular drive systems - belt, chain and a universal coupling.
**Learning Outcome: LO3**
**Merit:** M3

**Potential and Kinetic Energy Kit (ES9)**
Shows the difference between potential and kinetic energy and how it can change from one to the other.

**Learning Outcome: LO4**
**Distinction:** D4

**Learning Outcome: LO4**
**Pass:** P9
**Merit:** M4

**Free Vibrations of a Mass-Spring System (TM164)**
Uses simple harmonic motion theory to show how to calculate the frequency of oscillation in simple mass-spring systems.

**Learning Outcome: LO4**
**Pass:** P9
**Merit:** M4

**Free and Forced Vibrations (TM016)**
Allows students to investigate the free and forced vibration of a rigid beam and spring, and a simply supported beam.

**Whirling of Shafts and Critical Speed (TM1001)**
A compact bench top mounting experiment to demonstrate the phenomena of whirling shafts.
UNIT 9
MATERIALS, PROPERTIES AND TESTING

**LEARNING OUTCOME:** LO3
**DISTINCTION:** D3

**TORSION TESTING MACHINE** (30 NM) (SM1001)
A bench mounted machine to allow students to do torsion tests on different materials.

**BENCH TOP TENSILE TESTING MACHINE** (SM1002)
A laboratory-scale hand driven bench top tensile testing machine, 20kN capacity.

**UNIVERSAL TESTING MACHINE** (SM1000)
A versatile test machine, that with optional ancillaries, allows a range of destructive and non-destructive material tests to be completed.

**HARDNESS TESTERS** (SM1015-17)
Bench-top industrial-standard testers for accurate measurements of Rockwell and Vickers hardness.

**LEARNING OUTCOME:** LO4
**DISTINCTION:** D4

**CREEP TESTING MACHINE** (SM1006)
A bench-mounted machine that demonstrates the phenomenon of creep under different conditions and in different materials.

**ROTATING FATIGUE MACHINE** (SM1090)
Demonstrates the failure of materials when subjected to an alternating stress.

**CREEP TESTING MACHINE** (SM1006)
A bench-mounted machine that demonstrates the phenomenon of creep under different conditions and in different materials.

**ROTATING FATIGUE MACHINE** (SM1090)
Demonstrates the failure of materials when subjected to an alternating stress.
# Unit II: Fluid Mechanics

## Learning Outcome: LO1
**Pass:** P1, P2
**Merit:** M1

### Centre of Pressure (H11)
A pivoted clear plastic assembly which students use to find the centre of pressure of a totally or partially submerged plane surface. Compact, self-contained and excellent for classroom demonstrations.

## Learning Outcome: LO3
**Pass:** P5
**Merit:** M3

### Bernoulli’s Theorem (H5)
An educational Venturi tube that allows students to study the Venturi meter and Bernoulli’s Theorem and to make direct comparisons between the results obtained by experimentation and those predicted by theory.

### Positive Displacement Pump Module (MFP103)
Allows students to study and perform tests on a range of optional Positive Displacement Pumps to understand how they work and calculate their performance.

## Learning Outcome: LO3
**Distinction:** D3

### Centre of Pressure (MFP101)
A pivoted clear plastic assembly which students use to find the centre of pressure of a totally or partially submerged plane surface. Compact, self-contained and excellent for classroom demonstrations.

## Learning Outcome: LO4
**Pass:** P7, P8
**Merit:** M4

### Flow Measurement Methods (H10)
Investigates different ways of measuring flow including a Venturi meter, an orifice plate and a rotameter. At the same time shows applications of the steady flow energy equation (Bernoulli’s equation).

### Modular Air-Flow Bench (AF10)
A fully mobile bench to provide basic airflow facilities to enable a wide range of practical airflow investigations. Suitable for demonstration, laboratory and project work at a basic level.

### Modular Air-Flow Bench (AF18)
A fully mobile bench to provide basic airflow facilities to enable a wide range of practical airflow investigations. Suitable for demonstration, laboratory and project work at a basic level.

### Centre of Pressure (H408)
A pivoted clear plastic assembly which students use to find the centre of pressure of a totally or partially submerged plane surface. Compact, self-contained and excellent for classroom demonstrations.

### Pressure Measurement Bench (H30)
A bench-mounting apparatus to enable practical demonstrations and investigations into pressure and vacuum measurement techniques using manometers and Bourdon type gauges.

### Osborne-Reynolds Apparatus (H215)
A self-contained bench-mounting apparatus that uses water to allow students to investigate laminar and turbulent flow and the conditions at the transition.

### Modular Air-Flow Bench (AF10) + Aerofoil With Tappings (AF18)
UNIT 13
FUNDAMENTALS OF THERMODYNAMICS AND HEAT ENGINES

LEARNING OUTCOME: LO1
PASS: P3

IDEAL GASES - BOYLE’S LAW (TD1000)
Shows the relationship between pressure and volume of an ideal gas at a fixed temperature.

IDEAL GASES - GAY-LUSSAC’S LAW (TD1001)
Demonstrates the relationship between pressure and temperatures of a fixed volume of ideal gas.

EXPANSION OF A PERFECT GAS (TD1004)
Bench-top apparatus to demonstrate the behaviour and expansion processes of a perfect gas.

LEARNING OUTCOME: LO3
PASS: P7
DISTINCTION: D3

HEAT EXCHANGER EXPERIMENTS (TD360)
A base unit and four optional experiments that examine and compare small-scale heat exchangers to help students understand how they work.

LEARNING OUTCOME: LO4
PASS: P8, P9
MERIT: M4
DISTINCTION: D4

SMALL ENGINE TEST SET (TD200)
A versatile engine test bed with instrumentation to provide the facilities to investigate the operating characteristics of single-cylinder and four-stroke internal combustion engines.

REGENERATIVE ENGINE TEST SET (TD300)
A versatile engine test bed with instrumentation to provide the facilities to investigate the operating characteristics of compatible and interchangeable single-cylinder internal combustion engines.
UNIT 15

AUTOMATION, ROBOTICS AND PROGRAMMABLE LOGIC CONTROLLERS (PLCS)

LEARNING OUTCOME: LO1
DISTINCTION: D1

PLC TRAINER (CE123)

Uses an industry standard PLC to control the PLC Process using ladder logic programming running on a PC. For use with the PLC Process (CE111).

PLC PROCESS (CE111)

Provides a physical system on which students can gain experience in the programming of programmable logic controllers (PLCs). The process is a model of a two-tank system typical of a chemical process in which liquids are measured before being mixed. The task for the student is to control liquid level and flow. For use with the PLC Trainer (CE123).

UNIT 16

INSTRUMENTATION AND CONTROL SYSTEMS

LEARNING OUTCOME: LO1
MERIT: M1, M2

TEMPERATURE, MEASUREMENT AND CALIBRATION (TD400)

Studies the accuracy, linearity and important characteristics of popular temperature measuring devices.

LEARNING OUTCOME: LO1
DISTINCTION: D1

PROCESS CONTROL TRAINING SYSTEMS (TE3300 SERIES)

Four separate training systems for a wide range of practical experiments in pressure, flow, level and temperature control.

LEARNING OUTCOME: LO2, LO3, LO4
PASS: P5, P8, P9
MERIT: M3
DISTINCTION: D2, D3

PROCESS TRAINER (CE117)

A fully integrated and self-contained bench top process control apparatus containing valves, pumps, power supplies and ancillaries to allow flow, level, temperature and pressure control strategies to be investigated individually and in combinations.
UNIT 30

OPERATIONS AND PLANT MANAGEMENT

**LEARNING OUTCOME: LO1**
*PASS:* P1, P2, P3
*MERIT:* M1
*DISTINCTION:* D1

IDEAL GASES - BOYLE’S LAW (TD1000)
Shows the relationship between pressure and volume of an ideal gas at a fixed temperature.

IDEAL GASES - GAY-LUSSAC’S LAW (TD1001)
Demonstrates the relationship between pressure and temperatures of a fixed volume of ideal gas.

EXPANSION OF A PERFECT GAS (TD1004)
Bench-top apparatus to demonstrate the behaviour and expansion processes of a perfect gas.

**LEARNING OUTCOME: LO2**
*PASS:* P4, P6

DRIVE SYSTEMS KIT (ES11)
Demonstrates the advantages and disadvantages of three popular drive systems - belt, chain and a universal coupling.

GEAR TRAINS KIT (ES13)
Demonstrates the characteristics of the most popular gear sets.

**LEARNING OUTCOME: LO3**
*PASS:* P7

FRICITION LOSS IN A PIPE (H7)
A bench-mounting apparatus to allow students to investigate friction losses in a small-bore horizontal pipe under laminar and turbulent flow conditions.

PIPEWORK ENERGY LOSSES (H34)
A simple single pipeline apparatus to demonstrate energy losses around typical bends and fittings.

LOSSES IN PIPING SYSTEMS (H16)
An apparatus to allow students to investigate the friction losses in piping systems. The large open format of the apparatus makes it ideal for students working in small or large groups.

FLUID FRICTION APPARATUS (H408)
A floor standing apparatus to allow students to investigate the phenomena of laminar, transitional and turbulent flows in pipe systems.
LEARNING OUTCOME: LO3

Merit: M3

Learning outcome: LO3

Learning outcome: LO3

Friction Loss in a Pipe (H7)

A bench-mounting apparatus to allow students to investigate friction losses in a small-bore horizontal pipe under laminar and turbulent flow conditions.

Osborne-Reynolds Apparatus (H215)

A self-contained bench-mounting apparatus that uses water to allow students to investigate laminar and turbulent flow and the conditions at the transition.

Pressure Measurement Bench (H30)

A bench-mounting apparatus to enable practical demonstrations and investigations into pressure and vacuum measurement techniques using manometers and Bourdon type gauges.

Flow Meter Calibration (H40)

A compact unit that compares and shows the accuracy, losses and use of fundamental flow meters. Includes a nozzle flow meter as standard.

LEARNING OUTCOME: LO4

Pass: P11

Distinction: D4

Heat Exchanger Experiments (TD360)

A base unit and four optional experiments that examine and compare small-scale heat exchangers to help students understand how they work.

UNIT 31

ELECTRICAL SYSTEMS AND FAULT FINDING

LEARNING OUTCOME: LO1

Distinction: D1

Distribution Trainer (PSL40)

Shows how electricity is distributed and protected. Investigates distribution through transformers, radial and ring-main circuits, efficiency and regulation.
UNIT 36
ADVANCED MECHANICAL PRINCIPLES

LEARNING OUTCOME: LO1
DISTINCTION: D1

UNSYMmetrical BENDING AND SHEAR CENTRE (STR7)
An experimental apparatus to allow students to investigate deflection and stability within a structure in relation to beams with unsymmetrical sections.

LEARNING OUTCOME: LO2
PASS: P5

THIN CYLINDER (SM1007)
A bench mounting apparatus to allow the stresses and strains of a pressurised thin walled cylinder to be investigated and analysed.

LEARNING OUTCOME: LO2
PASS: P4

THICK CYLINDER (SM1011)
A self-contained bench mounting experimental apparatus to enable students to investigate the distribution of radial and hoop stresses and strains throughout the wall of a thick cylinder and to compare the practical results with those predicted by theory.

LEARNING OUTCOME: LO3
PASS: P6

DRIVE SYSTEMS KIT (ES11)
Demonstrates the advantages and disadvantages of three popular drive systems – belt, chain and a universal coupling.

LEARNING OUTCOME: LO4
PASS: P9
DISTINCTION: D4

CAM, CRANK AND TOGGLE KIT (ES12)
Shows the characteristics of a mechanical toggle, crank motion and the most popular shaped cams.

LEARNING OUTCOME: LO2
MERIT: M2
DISTINCTION: D2

BENDING STRESS IN A BEAM (STR13)
An experimental apparatus to allow students to investigate the stresses and strains within a structure in relation to bending loads.

LEARNING OUTCOME: LO2
PASS: P4

BENDING STRESS IN A BEAM (STR5)
An experimental apparatus to allow students to investigate the stresses and strains within a structure in relation to bending loads.

LEARNING OUTCOME: LO4
PASS: P9

CAM ANALYSIS MACHINE (TM1021)
A machine to allow students to study the dynamic behaviour of different cams and followers and their “bounce” speed.
**UNIT 38**

**FURTHER THERMODYNAMICS**

**LEARNING OUTCOME: LO4**

**PASS:** P10

**GOVERNORS (TM1027)**

Three interchangeable governors (Hartnell, Porter and Proell) show the effects of speed, mass and geometry on governor behaviour.

**LEARNING OUTCOME: LO4**

**PASS:** P11

**BALANCE OF RECIPROCATING MASSES (TM1022)**

A model four cylinder engine that shows the primary and secondary forces and moments when balancing reciprocating masses.

**LEARNING OUTCOME: LO2**

**PASS:** P3, P5

**MERIT:** M3

**DISTINCTION:** D2

**REFRIGERATION CYCLE (EC1500)**

Bench-top unit that allows students to investigate the stages of refrigeration.

**LEARNING OUTCOME: LO1**

**MERIT:** M2

**PASS:** P8, P9

**MERIT:** M5

**DISTINCTION:** D4

**RECIPROCATING COMPRESSOR MODULE (MFP104)**

Allows students to study and perform tests on a reciprocating compressor to understand how it works and calculate its performance.

**CENTRIFUGAL COMPRESSOR MODULE (MFP105)**

Allows students to study and perform tests on a centrifugal compressor (blower) to understand how it works and calculate its performance.

**LEARNING OUTCOME: LO3**

**DISTINCTION:** D3

**SUPERHEATED STEAM PLANT PERFORMANCE (TD1050)**

A laboratory-scale steam plant that shows fundamental thermodynamic principles of energy conversion, and mechanical power measurement.

**LEARNING OUTCOME: LO4**

**PASS:** P10

**MERIT:** M5

**DISTINCTION:** D4

**TURBOJET TRAINER (GT100)**

A self-contained single-shaft gas turbine thrust jet that uses kerosene as the working fuel.

**TURBOJET TRAINER WITH REHEAT (GT100RS)**

Based on the Turbo Jet (GT100) this product has a reheat (afterburner) section for in-depth examination of a working gas turbine.
UNIT 41
DISTRIBUTED CONTROL SYSTEMS

Learning Outcome: LO1, LO2
Pass: P2, P4

Process Control Training Systems (TE3300 Series)
Four separate training systems for a wide range of practical experiments in pressure, flow, level and temperature control.

UNIT 42
FURTHER PROGRAMMABLE LOGIC CONTROLLERS (PLCS)

Learning Outcome: LOI
Pass: P1
Merit: M1

PLC Trainer (CE123)
Uses an industry standard PLC to control the PLC Process using ladder logic programming running on a PC. For use with the PLC Process (CE111).

PLC Process (CE111)
Provides a physical system on which students can gain experience in the programming of programmable logic controllers (PLCs). The process is a model of a two-tank system typical of a chemical process in which liquids are measured before being mixed. The task for the student is to control liquid level and flow. For use with the PLC Trainer (CE123).

UNIT 53
UTILISATION OF ELECTRICAL POWER

Learning Outcome: LO2
Pass: P2

Power System Trainer (PSS1)
A self-contained Power System Trainer that allows engineers, technicians and control room operatives to gain knowledge-based learning and skills-based training in all aspects of electrical power systems.

Second Generator for PSS1 (PSS3)
A self-contained console comprising a motor/generator machine set, instrumentation and protection. Nominally rated at 2 kVA to operate as a second generator with the PSS1 Power System Trainer.
UNIT 54
FURTHER CONTROL ENGINEERING SYSTEMS

LEARNING OUTCOME: LO3
PASS: P6, P9
DISTINCTION: D3

THERMAL CONTROL PROCESS APPARATUS (CE103)
A compact self-contained bench mounting temperature control apparatus designed to allow students at all academic levels to investigate the basic and advanced principles of control.

COUPLED TANKS APPARATUS (CE105)
A self-contained, bench-mounting apparatus designed to allow students at all academic levels to investigate basic and advanced principles of open and closed-loop control of flow rate and liquid level in single and dual tank systems.

BALL AND BEAM APPARATUS (CE106)
A compact self-contained bench mounting apparatus designed to allow students at all academic levels to investigate basic and advanced principles of control including control of naturally unstable systems.

ENGINE SPEED CONTROL APPARATUS (CE107)
A compact self-contained bench mounting apparatus designed to allow students at all academic levels to investigate basic and advanced principles of control including control of non-linear systems and inner-loop feedback techniques.

COUPLED TANKS APPARATUS (CE108)
A compact, bench-mounting apparatus designed to allow students at all academic levels to investigate basic and advanced principles of control including control of multi-variable systems.

BALL AND HOOP APPARATUS (CE109)
A compact self-contained bench mounting apparatus designed to allow students at all academic levels to investigate basic and advanced principles of control including systems that are naturally oscillatory.

SERVO TRAINER (CE110)
A compact self-contained bench mounting d.c. servo apparatus designed to allow students at all academic levels to investigate basic and advanced principles of control. In particular the CE110 deals with control issues relating to position and speed control in servo systems.

HELICOPTER MODEL (CE150)
A multi-dimensional naturally unstable model helicopter system with three manipulated inputs and two measured outputs to be controlled from within a MATLAB/Simulink environment.

BALL AND PLATE APPARATUS (CE151)
A two-dimensional bench mounting system to allow controller design and real-time control from within a MATLAB/Simulink environment. Requires MATLAB and Simulink and other MathWorks products.

MAGNETIC LEVITATION MODEL (CE152)
A compact one dimensional strongly non-linear unstable magnetic levitation system to be controlled from within a MATLAB/Simulink environment.
**Learning Outcome:** LO4
**Pass:** P7, P8
**Merit:** M5
**Distinction:** D4

**Process Trainer (CE117)**
A fully integrated and self-contained bench top process control apparatus containing valves, pumps, power supplies and ancillaries to allow flow, level, temperature and pressure control strategies to be investigated individually and in combinations.

**Process Control Training Systems (TE3300 Series)**
Four separate training systems for a wide range of practical experiments in pressure, flow, level and temperature control.

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**Unit 62**

**Heating, Ventilation and Air Conditioning (HVAC)**

**Learning Outcome:** LO1
**Distinction:** D1

**Air Conditioning Trainer (EC1501)**
Bench-top trainer, allows students to investigate the fundamental principles of air conditioning.
UNIT 63

INDUSTRIAL SERVICES

LEARNING OUTCOME: LO2
PASS: P4, P6

RECIPROCATING COMPRESSOR MODULE (MFP104)

Allows students to study and perform tests on a reciprocating compressor: to understand how it works and calculate its performance.

CENTRIFUGAL COMPRESSOR MODULE (MFP105)

Allows students to study and perform tests on a centrifugal compressor (blower) to understand how it works and calculate its performance.
UNIT 64

THERMO FLUIDS

LEARNING OUTCOME: LO1
MERIT: M1

IDEAL GASES - BOYLE’S LAW (TD1000)
Shows the relationship between pressure and volume of an ideal gas at a fixed temperature.

IDEAL GASES - GAY-LUSSAC’S LAW (TD1001)
Demonstrates the relationship between pressure and temperatures of a fixed volume of ideal gas.

EXPANSION OF A PERFECT GAS (TD1004)
Bench-top apparatus to demonstrate the behaviour and expansion processes of a perfect gas.

LEARNING OUTCOME: LO2
MERIT: M2

SUPERHEATED STEAM PLANT PERFORMANCE (TD1050)
A laboratory-scale steam plant that shows fundamental thermodynamic principles of energy conversion, and mechanical power measurement.

LEARNING OUTCOME: LO4
PASS: P9

LOSSES IN PIPING SYSTEMS (H16)
An apparatus to allow students to investigate the friction losses in piping systems. The large open format of the apparatus makes it ideal for students working in small or large groups.

FLUID FRICTION APPARATUS (H408)
A floor standing apparatus to allow students to investigate the phenomena of laminar, transitional and turbulent flows in pipe systems.

LEARNING OUTCOME: LO4
PASS: P10

MODULAR FLUID POWER RANGE (MFP)
A range seven fluid power modules (MFP101–MFP107) comprising pumps, fans and compressors.