Item No	Description	QTY	UOM	Unit Price	Total Price
	(A) - MECHANICS OF MACHINES AND VIBRATION LABORATORY				
001	GYROSCOPE • Shows the relationship between gyroscopic couple, and the velocities of rotor and precession • Portable, self-contained bench-top unit, suitable for classroom demonstrations and use by small groups of students • Interlocked, transparent dome allows students to see the gyroscope spinning in safety • Works in both clockwise and anticlockwise directions for a full range of tests • Unique multifunction controls for coarse and fine adjustment of velocity and direction • Direct measurement of gyroscopic tilting force, couple and velocities (speeds) shown on digital displays NOTE REQUIRES VDAS-B TO MAKE FULL USE OF THIS EQUIPMENT	1	Each	3,987,900.00	3,987,900.00
002	GOVERNORS Three interchangeable governors (Hartnell Porter and Proell) show the effects of speed mass and geometry on governor behaviour.	1	Each	3,616,620.00	3,616,620.00
002.01	VDAS (BENCH MOUNTED VERSION) Recommended Ancillary: A bench mounting versatile data acquisition system (VDAS) to allow computer-based data capture for a wide range of TecQuipment products.	1	Each	632,574.00	632,574.00
003	FREE VIBRATIONS TEST FRAME A sturdy frame for use with Free Vibrations Experiments. (Essential Base Unit for the TM161, TM164, TM163, TM165, TM166 and TM167)	1	Each	470,400.00	470,400.00
003.01	SIMPLE AND COMPOUND PENDULUMS An experimental apparatus that allows students to study simple harmonic motion and the factors that effect the period of oscillation of pendulums.	1	Each	811,650.00	811,650.00
003.02	FREE VIBRATION OF A MASS-SPRING SYSTEM An experimental apparatus that shows students the oscillatory motion of mass-spring system in terms of both displacement and acceleration.	1	Each	1,787,100.00	1,787,100.00
003.03	DAMPER KIT FOR TM164 MASS/SPRING Damper pot, connecting rod and disc for use with the TM164 Free Vibrations of a Mass Spring System.	1	Each	195,300.00	195,300.00
003.04	VDAS (BENCH MOUNTED VERSION) Recommended Ancillary: A bench mounting versatile data acquisition system (VDAS) to allow computer-based data capture for a wide range of TecQuipment products.	1	Each	632,574.00	632,574.00
003.05	CENTRE OF PERCUSSION An experimental apparatus that shows students how to calculate and find the centre of percussion of a compound pendulum.	1	Each	719,250.00	719,250.00
003.06	FREE TORSIONAL VIBRATIONS An experimental apparatus that allows students to investigate the oscillatory motion of a disc attached to a slender rod.	1	Each	1,594,950.00	1,594,950.00
003.07	FREE VIBRATIONS OF A CANTILEVER An experimental apparatus that allows students to use fundamental theory and Raleigh's approximation to calculate the frequency of oscillation of a cantilever.	1	Each	1,541,400.00	1,541,400.00
003.08	FREE VIBRATIONS OF A BEAM & SPRING 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.	1	Each	1,472,100.00	1,472,100.00
003.09	DAMPER KIT FOR TM167 BEAM/SPRING Damper pot, connecting rod and disc, plus mounting bracket for use with the TM167 Free Vibrations of a Rigid Beam and Spring System.	1	Each	298,200.00	298,200.00
004	FREE AND FORCED VIBRATIONS Allows students to investigate the free and forced vibration of a rigid beam and spring and a simply supported beam.	1	Each	9,587,550.00	9,587,550.00
004.01	VDAS (BENCH MOUNTED VERSION) Recommended Ancillary: A bench mounting versatile data acquisition system (VDAS) to allow computer-based data capture for a wide range of TecQuipment products.	1	Each	632,574.00	632,574.00

005	JOURNAL BEARING DEMONSTRATION A self-contained floor standing apparatus to fully investigate the effects of speed viscosity and load on the pressure distribution in a journal bearing.	1	Each	8,997,504.00	8,997,504.00
005.01	STROBOSCOPE A portable stroboscope providing 60 to 7 500 flashes per minute (FPM) in one continuous range.	1	Each	1,031,478.00	1,031,478.00
006	WHIRLING OF SHAFTS (TM1001) • Self-contained bench mounting unit for experiments that predict and show 'whirling' in different length and diameter shafts with different end conditions • Very visual apparatus - ideal for demonstrations to groups of students • Shows first and second mode whirl speeds and how to predict them • Extra bearings and weights (included) give a choice of free-free, fixed-free and fixed-fixed end conditions and experiments with loaded shafts and eccentric loading • Includes all tools needed for easy experiment setup • Supplied with different shafts to study how length and diameter affects whirling • Fully guarded and interlocked for safety • Optional stroboscope to 'freeze' the image of the shaft to see its shape clearly	1	Each	4,654,650.00	4,654,650.00
006.01	STROBOSCOPE A portable stroboscope providing 60 to 7 500 flashes per minute (FPM) in one continuous range.	1	Each	1,031,478.00	1,031,478.00
007	CAM ANALYSIS MACHINE A machine to allow students to study the dynamic behaviour of different cams and followers and their "Bounce" speed.	1	Each	9,029,088.00	9,029,088.00
007.01	VDAS (BENCH MOUNTED VERSION) Recommended Ancillary: A bench mounting versatile data acquisition system (VDAS) to allow computer-based data capture for a wide range of TecQuipment products.	1	Each	632,574.00	632,574.00
008	GEARED SYSTEMS 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.	1	Each	9,981,300.00	9,981,300.00
008.01	ACCELERATION & STATIC TEST STAND An ancillary unit to the TM1018 for performing acceleration tests on a simple flywheel (included) and the TM1018 Gear Drive Unit. It also provides a facility for static friction tests on the TM 1018 Gear Drive Unit.	1	Each	2,572,500.00	2,572,500.00
008.02	TOOTHED BELT DRIVE UNIT A toothed belt drive unit for TM1018 Geared Systems	1	Each	1,283,100.00	1,283,100.00
008.03	ROUND BELT DRIVE UNIT A round belt drive unit for use with the TM1018 Geared System	1	Each	1,224,300.00	1,224,300.00
008.04	ROLLER CHAIN DRIVE UNIT For use with TM1018	1	Each	1,252,650.00	1,252,650.00
008.05	VDAS (BENCH MOUNTED VERSION) Recommended Ancillary: A bench mounting versatile data acquisition system (VDAS) to allow computer-based data capture for a wide range of TecQuipment products.	1	Each	632,574.00	632,574.00
009	AIR BEARING APPARATUS A self-contained air bearing apparatus to demonstrate the performance of self-acting gas lubricated journal bearings including the phenomenon of half-speed whirl.	1	Each	14,091,000.00	14,091,000.00
009.1	VDAS (FRAME MOUNTED VERSION) (VDAS-F) A frame mounting versatile data acquisition system (VDAS) to allow computer-based data capture for a wide range of TecQuipment products.	1	Each	816,156.00	816,156.00
			Sub Total Mechanics of Machines		85,210,494.00

	(B) - STRENGHT OF MATERIALS LABORATORY				
001	UNIVERSAL TESTING MACHINE A versatile test machine, that with optional ancillaries, allows a range of destructive and non-destructive material tests. Students can use the Universal Testing Machine to test many materials, engineering parts and structures, but TecQuipment also offers optional parts for the machine. These allow students to do Brinell hardness tests on materials, and tests on coil springs, leaf springs and beams. Included with the Universal Testing Machine is a set of different grade steel tensile test specimens. These allow students to compare the tensile qualities of steel in its 'as drawn' state and 'normalised' steel. You can order extra specimens, and the user guide includes a diagram to help you create your own tensile test specimens from suitable materials. For quick and reliable tests, TecQuipment can supply the optional Versatile Data Acquisition System (VDAS®). This gives accurate real-time data capture, monitoring and display, calculation and charting of all important readings on a	1	Each	6,867,000.00	6,867,000.00
001.01	VDAS (BENCH MOUNTED VERSION) Recommended Ancillary: A bench mounting versatile data acquisition system (VDAS) to allow computer-based data capture for a wide range of TecQuipment products.	1	Each	632,574.00	632,574.00
001.01	SUPPORTING TABLE AND CUPBOARD (SM1000A) Optional supporting table and cupboard specifically tailored for use with TecQuipment's SM1000 Universal Test Machine	1	Each	1,153,596.00	1,153,596.00
001.02	BRINELL INDENTER (SM1000E) Brinell indenter and magnifier with Graticule. Allows hardness tests to be completed on TecQuipment's SM1000 Universal Test Machine.	1	Each	233,310.00	233,310.00
001.03	COIL SPRING (SM1000F) Test Coil Spring and attachments to allow tests to prove Hookes' Law and other spring properties using TecQuipment's SM1000 Universal Test machine.	1	Each	162,864.00	162,864.00
001.04	BEAM AND LEAF SPRING (SM1000G) Test leaf Spring, knife edges and attachments to allow leaf spring and beam bending tests with TecQuipment's SM1000 Universal Test Machine.	1	Each	1,153,596.00	1,153,596.00
001.05	VDAS (BENCH MOUNTED VERSION) Recommended Ancillary: A bench mounting versatile data acquisition system (VDAS) to allow computer-based data capture for a wide range of TecQuipment products.	1	Each	632,574.00	632,574.00

002	Beam Apparatus A bench mounted beam apparatus to allow students to investigate the deflections and reactions in simply supported and cantilevered beams. Features: • Ideal for student use and classroom demonstrations, • Includes textbook with full theory, • Self-contained – needs no other parts, • Made for maximum flexibility and ease of use for extensive range of experiments, • Simply supported and cantilever beam tests with up to four supports with any loading • Three load cells with digital indicators measure reaction forces or act as rigid sinking supports, • Precision digital indicators for accurate deflection measurements, • Weights and hangers supplied to apply point loads, • Supplied with five different test beams. Bench space needed: 2000 mm x 600 mm. Operating Conditions Operating environment: Laboratory, Storage temperature range: –25°C to +55°C (when packed for transport), Operating temperature range: +5°C to +40°C, Operating relative humidity range: 80% at temperatures < 31°C decreasing linearly to 50% at 40°C. Sound Levels: Less than 70 dB(A). Deflection indicators: Digital Indicators with sockets for connection to VDAS® Load cell supports: Fitted with digital indicators with sockets for connection to VDAS®. Five test beams supplied: • 3 steel: 3.2 mm, 4.8 mm and 6.4 mm thick (nominal), • 1 brass: 6.4 mm thick (nominal),	1	Each	3,733,440.00	3,733,440.00
002.01	Additional Specimen Beams Ten test beams supplied: • 4 steel (1 tapered), • 1 brass, • 1 steel and brass compound, • 2 aluminium (1 with channel cross-section), • 1 hardwood, • 1 aluminium and wood compound. All beams are of different dimensions and cross section	1	Set	389,118.00	389,118.00
002.02	VDAS (BENCH MOUNTED VERSION) Recommended Ancillary: A bench mounting versatile data acquisition system (VDAS) to allow computer-based data capture for a wide range of TecQuipment products.	1	Each	632,574.00	632,574.00
003	TORSION TESTING MACHINE (30 Nm) A bench mounted machine to allow students to do torsion tests on different materials.	1	Each	4,242,000.00	4,242,000.00
003.01	TORSIOMETER For use with SM1001 Torsion Testing Machine	1	Each	857,946.00	857,946.00
003.02	VDAS (BENCH MOUNTED VERSION) Recommended Ancillary: A bench mounting versatile data acquisition system (VDAS) to allow computer-based data capture for a wide range of TecQuipment products.	1	Each	632,574.00	632,574.00
004	STATIC AND DYNAMIC BALANCING For experiments in balancing a rotating mass system, statically and dynamically	1	Each	2,270,100.00	2,270,100.00
005	THIN CYLINDER A bench mounting apparatus to allow the stresses and strains of a pressurised thin walled cylinder to be investigated and analysed.	1	Each	3,445,704.00	3,445,704.00
005.01	VDAS (BENCH MOUNTED VERSION) Recommended Ancillary: A bench mounting versatile data acquisition system (VDAS) to allow computer-based data capture for a wide range of TecQuipment products.	1	Each	632,574.00	632,574.00

006	THICK CYLINDER 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.	1	Each	4,619,076.00	4,619,076.00
006.01	VDAS (BENCH MOUNTED VERSION) Recommended Ancillary: A bench mounting versatile data acquisition system (VDAS) to allow computer-based data capture for a wide range of TecQuipment products.	1	Each	632,574.00	632,574.00
007	BALANCE OF RECIPROCATING MASSES A model four cylinder engine that shows the primary and secondary forces and moments when balancing reciprocating masses.	1	Each	9,843,750.00	9,843,750.00
007.01	OSCILLOSCOPE Essential Ancillary: Single channel 10 MHz analogue oscilloscope.	1	Each	214,146.00	214,146.00
008	STATICS WORK PANEL A vertical work panel printed with a magnetic grid. For use with the STF range of experiments.	1	Each	320,250.00	320,250.00
008.01	SUSPENSION CABLE DEMONSTRATION A demonstration to show the shape and tensions of suspension cables.	1	Each	540,750.00	540,750.00
008.02	EQUILIBRIUM OF A RIGID BODY Practical demonstration of the equilibrium of a ladder.	1	Each	525,000.00	525,000.00
008.04	EQUILIBRIUM OF FORCES Demonstrates concurrent and non-concurrent coplanar forces. Shows students to construct force polygons and understand conditions of equilibrium.	1	Each	462,000.00	462,000.00
008.05	EQUILIBRIUM OF A BEAM Demonstrates the forces, moments and reactions of a rigid beam.	1	Each	262,500.00	262,500.00
				Sub Total Strength of Materials Lab	45,091,590.00

	(C) - THERMODYNAMICS LABORATORY				
001	REGENERATIVE ENGINE TEST SET 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 rated up to 10 kW.	1	Set	22,594,716.00	22,594,716.00
001.01	4 STROKE PETROL ENGINE A four-stoke single-cylinder petrol engine with modified cylinder head and crank for use with TecQuipment's TD300 Regenerative Engine Test Bed.	1	Each	3,045,000.00	3,045,000.00
001.02	4 STROKE DIESEL ENGINE A four-stoke single-cylinder diesel engine with modified cylinder head and crank for use with TQ's TD300 Regenerative Engine Test Bed.	1	Each	3,301,812.00	3,301,812.00
001.03	MANUAL VOLUMETRIC FUEL GAUGE A manual volumetric fuel gauge for use with TD200 and TD300 engine test sets.	1	Each	493,644.00	493,644.00
001.04	AUTO VOLUMETRIC FUEL GAUGE (DVF1) An automatic volumetric fuel gauge with an instrumentation unit for use with TD200 and TD300 engine test sets	1	Each	2,292,918.00	2,292,918.00
001.05	CALORIMETER (For TD300) A fully instrumented exhaust gas calorimeter for use with the TD300 Regenerative Engine Test Bed to measure the heat content of engine exhaust gasses to determine the energy lost to exhaust in the energy balance for engines of various types operating at different loads and speeds.	1	Each	5,931,354.00	5,931,354.00
001.06	ECA100 BUNDLE SET (ECA100S) A bundled set of the Engine Cycle Analyser (ECA100), a Pressure Transducer (ECA101) and a Crank Angle Encoder (ECA102).	1	Set	5,586,000.00	5,586,000.00
001.07	VDAS (FRAME MOUNTED VERSION) (VDAS-F) A frame mounting versatile data acquisition system (VDAS) to allow computer-based data capture for a wide range of TecQuipment products.	1	Each	816,156.00	816,156.00
002	STEAM MOTOR AND ENERGY CONVERSION A laboratory-scale steam plant that shows fundamental thermodynamic principles of energy conversion, and mechanical power measurement.	1	Each	19,421,850.00	19,421,850.00
002.01	VDAS (FRAME MOUNTED VERSION) (VDAS-F) A frame mounting versatile data acquisition system (VDAS) to allow computer-based data capture for a wide range of TecQuipment products.	1	Each	816,156.00	816,156.00

003	THERMOELECTRIC DEVICE DEMONSTRATOR A benchtop unit to examine the performance of a thermoelectric device for Peltier or Seebeck tests as a heat pump or generator	1	Each	5,401,200.00	5,401,200.00
003.01	VDAS (BENCH MOUNTED VERSION) Recommended Ancillary: A bench mounting versatile data acquisition system (VDAS) to allow computer-based data capture for a wide range of TecQuipment products.	1	Each	632,574.00	632,574.00
004	TEMP. MEASUREMENT AND CALIBRATION Studies the accuracy, linearity and important characteristics of popular temperature measuring devices	1	Each	3,430,350.00	3,430,350.00
004.01	VDAS (BENCH MOUNTED VERSION) Recommended Ancillary: A bench mounting versatile data acquisition system (VDAS) to allow computer-based data capture for a wide range of TecQuipment products.	1	Each	632,574.00	632,574.00
005	HUMIDITY MEASUREMENT BENCH (TE6) A self-contained humidity measurement bench to demonstrate the principles of humidity measurement and to compare the relative performance and accuracies of different types of humidity measurement systems.	1	Each	5,398,008.00	5,398,008.00
006	HEAT EXCHANGER SERVICE MODULE Service module for a range of bench-top educational heat exchanger demonstration units. • A bench-top service module with optional small-scale demonstration heat exchangers – designed for teaching • Optional heat exchangers include the most common types used in industry (tubular, plate, shell and tube, and a jacketed vessel with coil and stirrer) • Simple and safe to use – foolproof fittings allow students to change and connect the optional heat exchangers quickly and easily – needs no tools • Clear digital displays of all readings – you do not need a computer to work it or take readings	1	Each	4,170,600.00	4,170,600.00
006.01	TUBULAR HEAT EXCHANGER Small scale educational tubular heat exchanger	1	Each	718,410.00	718,410.00
006.02	PLATE HEAT EXCHANGER Small scale educational plate heat exchanger	1	Each	948,252.00	948,252.00
006.03	SHELL AND TUBE HEAT EXCHANGER Small scale educational shell and tube heat exchanger	1	Each	1,161,930.00	1,161,930.00
006.04	JACKETED VESSEL AND COIL Small scale educational jacketed vessel and coil heat exchanger	1	Each	2,092,650.00	2,092,650.00
006.05	VDAS (FRAME MOUNTED VERSION) (VDAS-F) A frame mounting versatile data acquisition system (VDAS) to allow computer-based data capture for a wide range of TecQuipment products.	1	Each	816,156.00	816,156.00
007	HEAT TRANSFER EXPERIMENTS BASE UNIT Self-contained bench-top Base Unit with (4) optional experiments (not included) which can be easily interchanged without need for tools. Clear digital displays of all readings. Experiments all have clear schematic diagrams showing connections and measuring points. Available with Versatile Data Acquisition System as option (VDAS) The Base Unit is the core module for providing cold water and heater power to the optional experiments in the range. Connects to any suitable cold water supply and drain, includes hand-operated valve for adjustable water flow. RECOMMENDED ANCILLARIES: - VDAS-F (frame mounted version of the Versatile Data Acquisition System) AVAILABLE EXPERIMENT MODULES (not included) - Linear Heat Conduction Experiment - Radial Heat Conduction Experiment - Extended Surface Heat Transfer Experiment - Conductivity of Liquids and Gasses Experiment REQUIRED SERVICES: - Bench Space needed: 650 x 480 mm - Clean water supply and drain (waste) - Electrical supply: 240 VAC, 1Ph, 5A	1	Set	2,493,750.00	2,493,750.00

007.01	LINEAR HEAT CONDUCTION EXPERIMENT Introduces students to the principles of linear heat conduction and thermal conductivity. This experiment has a solid brass bar of circular cross-section, made in two sections with an interchangeable middle section, it mounts on a base plate with clear schematic of the experiment layout. The first brass section includes three thermocouples and the electric heater (heat source). The second brass section includes a small water-cooled chamber (heat sink) and three more thermocouples. Also supplied are interchangeable middle sections of different metals: - Brass - so the bar becomes one length of brass EXPERIMENTS: - Demonstration and calculations of linear heat conduction - Calculation of the thermal conductivity (k value) - Demonstration of the effectiveness of thermal paste - Demonstration and calculations of thermal resistances (R value) in series - Demonstration of @thermal lag@ Essential Services: Requires Heat Transfer Base Unit - Aluminium - Stainless Steel - Copper	1	Each	1,706,250.00	1,706,250.00
007.02	RADIAL HEAT CONDUCTION EXPERIMENT (TD1002B) An experimental module to introduce students to the principles of radial heat conduction, and to allow the conductivity of the test disk to be measured	1	Each	1,181,250.00	1,181,250.00
007.03	EXTENDED SURFACE HEAT TRANSFER (TD1002C) An experimental module to show the temperature gradient of a long thin horizontal member that is free to loose heat by natural convection and radiation.	1	Each	1,155,000.00	1,155,000.00
007.04	CONDUCTIVITY OF LIQUIDS & GASSES (TD1002D) An experimental module to show the thermal conductivity of various compatible liquids and gasses.	1	Each	1,401,750.00	1,401,750.00
007.05	VDAS (FRAME MOUNTED VERSION) (VDAS-F) A frame mounting versatile data acquisition system (VDAS) to allow computer-based data capture for a wide range of TecQuipment products.	1	Each	816,156.00	816,156.00
010	FREE AND FORCED CONVECTION EXP. An experimental apparatus to examine free and forced convection from a flat plate, a plate with fins and a plate with rods.	1	Each	4,200,000.00	4,200,000.00
010.01	VDAS (BENCH MOUNTED VERSION) Recommended Ancillary: A bench mounting versatile data acquisition system (VDAS) to allow computer-based data capture for a wide range of TecQuipment products.	1	Each	632,574.00	632,574.00
			Sub Total Thermodynamics Lab		103,289,040.00

	(D) - MATERIAL SCIENCE / ENGINEERING SCIENCE / METROLOGY LABORATORY				
002	ENGINEERING SCIENCE FULL SET A mobile trolley with a complete set of TecQuipment's Engineering Science kits and three Work Panels	1	Set	6,791,664.00	6,791,664.00
			Sub Total Mat/Eng/Met Science		**6,791,664.00**

	(E) - FLUID MECHANICS LABORATORY				
001	CENTRIFUGAL PUMP MODULE Description - Pump Module For use with and driven by the Universal Dynamometer, the Centrifugal Pump Module is part of the Modular Fluid Power range. The Centrifugal Pump Module is ideal for student experiments, demonstrations and projects. Centrifugal pumps are common machines used to move water and other fluids in many applications. These can be domestic water systems, agriculture, sanitation and many industrial applications. The module includes a centrifugal pump, a Venturi flowmeter, valves, a reservoir and instrumentation; all mounted on a robust, mobile trolley for ease of use. The separate Universal Dynamometer measures and displays the speed and torque of the pump to calculate and display mechanical (shaft) power. Electronic pressure transducers measure the pump inlet and delivery pressures and the Venturi differential pressure (flow rate). Speed is fully variable up to the maximum allowable for the pump. The centrifugal pump is also the power source for the optional turbines: a Pelton wheel, a Francis turbine and Kaplan turbine (all available separately). The turbines fit on the separate Turbine Dynamometer. You can only test one turbine at a time. The Turbine Dynamometer fits onto the Centrifugal Pump Module. The centrifugal pump delivery pipe then connects to the turbine. A pressure transducer on the Centrifugal Pump Module measures the turbine inlet pressure. The turbines and	1	Each	5,792,442.00	5,792,442.00
001.01	TURBINE DYNAMOMETER AND INSTRUMENTATION Turbine dynamometer for use with the Centrifugal Pump Test Set and optional turbines ANCILLARY TO ITEM 1	1	Each	2,202,858.00	2,202,858.00
001.02	PELTON WHEEL MODULE Pelton Wheel (turbine) for use with the Centrifugal Pump Module.	1	Each	2,326,896.00	2,326,896.00
001.03	PROPELLER TURBINE (MFP101C) PROPELLER Turbine for use with the Centrifugal Pump Module.	1	Each	3,360,000.00	3,360,000.00
001.04	FRANCIS TURBINE Francis Turbine for use with the Centrifugal Pump Module.	1	Each	2,880,096.00	2,880,096.00
001.05	STROBOSCOPE A portable stroboscope providing 60 to 7 500 flashes per minute (FPM) in one continuous range.	1	Each	1,031,478.00	1,031,478.00
001.2	AXIAL FLOW PUMP MODULE Axial flow pump, mounted in a mobile frame with full instrumentation, including a digital pressure display • Self-contained, has its own water reservoir and needs no external water supply • Part of Modular Fluid Power range which connects with the Universal Dynamometer (MFP100) as a common motive-power source for a cost-effective solution • Allows students to study and test a common type of rotodynamic pump, safely and at a realistic scale • Connection plate with schematic diagram shows the water flow circuit and how parts of the module connect to each other • Fully variable speed and flow, for range of tests	1	Each	10,485,930.00	10,485,930.00

001.3	POSITIVE DISPLACEMENT PUMP MODULE Description For use with and driven by the Universal Dynamometer (available separately), the Positive Displacement Pump Module is part of the Modular Fluid Power range. When used with one of the optional pumps, the Positive Displacement Pump Support Module is ideal for student experiments, demonstrations and projects. Positive displacement pumps are common machines, used to move fluids in many applications, and usually at high pressures. They can be rotary pumps or reciprocating pumps and work by moving a fixed volume of fluid from their inlet to their outlet. These pumps are used in lubrication systems, hydraulic systems, automobiles, agriculture, medical equipment, sanitation and many industrial applications. The module consists of a mobile frame with an oil reservoir, a flow meter, valves and instruments to measure pump performance. The flow meter is a positivedisplacement unit, so that it still works correctly at any oil viscosity. Any of the optional pumps fit to the module. Two flexible, high-pressure pipes with quick-release, selfsealing connections connect the pump to the oil circuit. The separate Universal Dynamometer also fixes to the module to drive the pump. The Universal Dynamometer measures and displays the speed and torque of the pump to calculate and display mechanical (shaft) power. Electronic pressure transducers measure the pump inlet and delivery pressures and the fluid flow	1	Each	6,774,798.00	6,774,798.00
001.31	PISTON PUMP A piston pump for use with the Positive Displacement Pump Support Module.	1	Each	1,044,384.00	1,044,384.00
001.32	GEAR PUMP A gear pump for use with the Positive Displacement Pump Support Module.	1	Each	1,664,556.00	1,664,556.00
001.33	VANE PUMP A vane pump for use with the Positive Displacement Pump Support Module.	1	Each	1,317,258.00	1,317,258.00
001.34	SWASH PLATE PUMP A swash plate pump for use with the Positive Displacement Pump Support Module.	1	Each	3,028,932.00	3,028,932.00
001.4	RECIPROCATING COMPRESSOR MODULE Allows students to study and perform tests on a reciprocating compressor: to understand how it works and calculate its performance. Description For use with and driven by the Universal Dynamometer (available separately), the Reciprocating Compressor Module is part of The Modular Fluid Power range. It is ideal for student experiments, demonstrations and projects. Reciprocating compressors are common machines that provide compressed air for machines and tools. These can be air tools (saws, sanders and screwdrivers), paint spray equipment, pneumatic actuators and control systems. The module includes a small compressor with an air receiver and instrumentation, all mounted on a robust, mobile trolley for ease of use. The separate Universal Dynamometer measures the speed, torque and power absorbed by the compressor. Speed is fully variable up to the maximum allowable for the compressor. Air enters the compressor, which then delivers it under pressure to the receiver. A valve releases pressure from the receiver to atmosphere through an orifice. The valve sets the pressure in the receiver and hence the flow rate; the orifice allows an accurate measurement of the mass flow rate of the outlet air. These values help students to discover how the compressor flow rate relates to the pressure delivered by the compressor. Thermocouples measure temperatures at the inlet and delivery of the compressor, and upstream of the orifice.	1	Each	7,757,160.00	7,757,160.00

	Standard Features * Supplied with comprehensive user guide * Two-year warranty * Made in accordance with the latest European Union directives Experiments * Energy balance for a compressor * Variation of compressor performance with pressure * Variation of compressor performance with speed * Mechanical, volumetric and isothermal efficiencies * Thermodynamics of a compressor Essential Ancillaries				
001.5	Centrifugal Compressor Module For use with the Universal Dynamometer. The Centrifugal Compressor Module is ideal for student experiments, demonstrations and projects.Centrifugal compressors are common machines, used for forced ventilation in applications that need a good volume of air at a reasonable pressure - for example: forced ventilation and cooling systems. The module consists of a compressor and instrumentation, all mounted on a robust, mobile trolley for ease of use. The Universal Dynamometer measures the speed, torque and power absorbed by the compressor. Speed is fully variable up to the maximum allowable for the compressor. Air enters the compressor through a shaped nozzle, used to measure the airflow rate. The air then moves past a hand operated delivery valve and out to atmosphere. The delivery valve controls the airflow rate (and therefore delivery pressure). Electronic transducers measure the inlet pressure, delivery pressure, nozzle differential pressure (flow rate) and the atmospheric (barometric) pressure. Thermocouples measure inlet, outlet and ambient temperatures. Digital displays show all the readings.	1	Each	7,593,420.00	7,593,420.00
001.6	Centrifugal Fan Module For use with the Universal Dynamometer. This unit examines and explains fluid power machines. The Centrifugal Fan Module is ideal for student experiments, demonstrations and projects. Centrifugal fans are common machines, used for ventilation or any application that needs a good volume of air at a reasonable pressure. The module consists of a fan and instrumentation, all mounted on a robust, mobile trolley for ease of use. The Universal Dynamometer measures the speed, torque and power absorbed by the fan. Speed is fully variable up to the maximum allowable for the fan. Air enters the fan through a shaped nozzle, used to measure the airflow rate. The air then moves past a slide-valve and out to atmosphere. The slide-valve controls the airflow rate (and therefore delivery pressure). The fan impeller (moving part) is interchangeable. Supplied with the fan are three different impellers for more tests on fan performance. The fan housing has an interlock so themotor cannot run unless the user assembles the fan correctly. This allows the user to safely change fan impellers. Electronic transducers measure the inlet pressure, delivery pressure, nozzle differential pressure (flow rate) and the atmospheric (barometric) pressure. Digital displays show all the readings.	1	Each	7,109,688.00	7,109,688.00
001.61	PIPE FLOW AND NOZZLE KIT Nozzle and pipe flow kit, for fitting to the MFP106 fan test set.	1	Kit	7,350,000.00	7,350,000.00

001.7	Axial Fan Module For use with and driven by the Universal Dynamometer. The Axial Fan Module is ideal for student experiments, demonstrations and projects. Axial fans move air in a wide range of applications from ventilation in domestic and commercial buildings to mines and agriculture. For these reasons it is important for engineers to be able to study and understand the characteristics of axial fans. The module has an axial fan mounted in a cylindrical steel duct. Air enters the duct through an inlet nozzle. The pressure at a set of tappings just downstream of the nozzle allows calculation of the inlet air flow rate. A slide-valve (downstream of the fan) controls flow rate and delivery pressure. Air exits the duct through a silencer to reduce noise in the laboratory. Universal Dynamometer measures the speed, torque and power of the axial fan. Two more sets of pressure tapping points measure the pressure difference across the fan. Each tapping point has three tappings arranged at 120-degree separation around the duct to give a good average value at that location. A traversing Pitot tube with a calibrated scale allows students to find the velocity distribution across the duct. The Pitot tube fits to a choice of two positions, to allow students to	1	Each	7,757,160.00	7,757,160.00
001.71	PITOT STATIC TRAVERSE (450mm) (MFP107A) A traversing pitot static tube with electronic position measurement. For use with TecQuipment's MFP107 Axial fan Module, to establish velocity distributions.	1	Each	1,966,776.00	1,966,776.00
001.8	Universal Dynamometer It has two parts: the electric dynamometer, and a motor drive and display unit. The dynamometer is an induction motor, trunnion-mounted to allow it to move freely against a strain gauge load cell. An inductive sensor measures the shaft speed. The load cell measures the shaft torque. A precision-machined base plate holds the motor and its sensors. The base plate has location points to give accurate and repeatable alignment onto each Fluid Power module. The coupling between the Universal Dynamometer and all Fluid Power machines is a jaw-type coupling with a rubber element. The Universal Dynamometer directly drives the Fluid Power machines. This means that the user has no need to fit or adjust the tension of belts and pulleys.The motor drive and display unit contains a variable-speed a.c. inverter drive and includes signal conditioning. It digitally displays speed, torque and shaft power. The unit fits on the instrument frame fitted to all the Fluid Power modules. The front of the motor drive and display unit has motor stop, start and speed controls. Outlets on the back of the unit give power for instruments supplied with the Fluid Power modules.	1	Each	3,360,000.00	3,360,000.00
001.9	VDAS (FRAME MOUNTED VERSION) (VDAS-F) A frame mounting versatile data acquisition system (VDAS) to allow computer-based data capture for a wide range of TecQuipment products.	1	Each	816,156.00	816,156.00
002	MODULAR AIR FLOW BENCH 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.	1	Each	5,262,960.00	5,262,960.00
002.01	MULTI TUBE MANOMETER A 14-tube multi-range water manometer for use with the AF10 Airflow Bench (not included).	1	Each	1,251,204.00	1,251,204.00
002.02	BERNOULLI'S EQUATION APPARATUS An experimental module for use with the Air Flow Bench (not included) to provide experiments that investigate and support Bernoulli's equation.	1	Each	741,888.00	741,888.00
002.03	DRAG FORCE An experimental module for use with the AF10 Air Flow Bench (not included) to provide experiments that measure and compare the effects of drag force on objects mounted in an airstream that have the same projected frontal area but different shape. Facilities to compare drag force measurement methods are included	1	Each	1,258,176.00	1,258,176.00

002.04	ROUND TURBULENT JET An experimental module for use with the AF10 Air Flow Bench (not included) for the analysis of an emerging jet-stream and its break-up as it moves away from the outlet. Also allows velocity distribution and momentum flux to be evaluated.	1	Each	1,295,388.00	1,295,388.00
002.05	FLOW ROUND A BEND An experimental module for use with the AF10 Air Flow Bench (not included) to investigate the radial pressure distribution around a bend and the pressure distribution along the curved inner and outer walls of the bend.	1	Each	839,556.00	839,556.00
002.06	JET ATTACHMENT An experimental module for use with the AF10 Air Flow Bench (not included) to investigate the effect of a jet attaching to an adjacent wall examining the Coanda effect evaluation of attachment & separation and demonstration of a fluidic switch/flip-flop (fluidics)	1	Each	1,827,966.00	1,827,966.00
002.07	FLOW VISUALISATION An experimental module for use with the AF10 Air Flow Bench (not included) to provide facilities for flow visualisation experiments.	1	Each	5,956,008.00	5,956,008.00
002.08	AEROFOIL WITH TAPPINGS An experimental module for use with the AF10 Air Flow Bench (not included) to provide the facilities for investigating the pressure distribution around an aerofoil.	1	Each	1,216,320.00	1,216,320.00
003	Two-Stage (Series and Parallel) Pumps A compact, mobile and fully self-contained centrifugal pump test set, that allows students to find the characteristics of centrifugal pumps working alone or in series or parallel. It also allows students to see (and hear) cavitation and understand the use of a Venturi meter and differential pressure measurement to find flow rate. Two bearing-mounted motors drive each pump independently. The pumps draw water from the integral reservoir. The water travels through strainers and a series of valves to be delivered to a Venturi meter. The water then returns to the reservoir for re-use, keeping water use to a minimum. The pumps each have a transparent 'window' so students can see the impeller turning and how the water vapour bubbles form in the pump at cavitation. Instrument and control modules fit into a frame above and behind the pumps. Each pump has an electronic Motor Drive to control its speed, a load cell to measure torque and a sensor to measure pump speed. A display on each Motor Drive shows speed and torque and automatically calculates and displays true 'shaft' power.The	1	Each	11,320,104.00	11,320,104.00
003.01	VDAS (FRAME MOUNTED VERSION) (VDAS-F) A frame mounting versatile data acquisition system (VDAS) to allow computer-based data capture for a wide range of TecQuipment products.	1	Each	816,156.00	816,156.00
003.02	STROBOSCOPE A portable stroboscope providing 60 to 7 500 flashes per minute (FPM) in one continuous range.	1	Each	1,031,478.00	1,031,478.00
003.03	ANALOGUE PRESSURE DISPLAY An analogue pressure display module for use with compatible TecQuipment products	1	Each	974,904.00	974,904.00
004	SUBSONIC WIND TUNNEL An open circuit suction subsonic wind tunnel with a working section of 300 mm by 300 mm and 600 mm long.	1	Each	11,132,100.00	11,132,100.00
004.01	CYLINDER MODEL A cylinder model with a single pressure tapping point for use with the AF100 Subsonic Wind Tunnel.	1	Each	343,824.00	343,824.00
004.02	NACA 0012 AEROFOIL WITH TAPPINGS A 150 mm chord 300 mm span NACA0012 aerofoil with pressure tappings for use with the AF100 Subsonic Wind Tunnel.	1	Each	1,442,280.00	1,442,280.00
004.03	NACA 2412 AEROFOIL WITH FLAP A 150 mm chord NACA2412 unsymmetrical section aerofoil with 300 mm span and adjustable flap for use with the AF100 Subsonic Wind Tunnel.	1	Each	1,078,362.00	1,078,362.00
004.04	SET OF (2) NACA 0012 AEROFOILS A set of two aerofoils both of NACA0012 profile and 150 mm chord for use with the AF100 Subsonic Wind Tunnel	1	Set	645,228.00	645,228.00
004.05	FLAT PLATE DRAG MODEL A 100 mm diameter flat plate for use with the AF100 Subsonic Wind Tunnel.	1	Each	370,608.00	370,608.00

004.06	BOUNDARY LAYER MODEL A flat boundary layer model to illustrate the phenomena of boundary layer development and separation. For use with the AF100 Subsonic Wind Tunnel.	1	Each	2,929,218.00	2,929,218.00
004.07	AIRCRAFT MODEL LOW WING A model aircraft with low wing configuration for use with AF100 Wind tunnel	1	Each	867,300.00	867,300.00
004.08	AIRCRAFT MODEL HIGH WING A model aircraft with low wing configuration for use in TecQuipment's AF100 Wind tunnel	1	Each	867,300.00	867,300.00
004.09	THREE DIMENSIONAL DRAG MODELS Five drag investigation models for use with the TecQuipment AF100 wind tunnel - a streamlined shape, a sphere, hemisphere, "dimpled" sphere, and a flat plate. All the models have a 50mm frontal area for easy comparison.	1	Set	1,125,276.00	1,125,276.00
004.10	MULTI-TUBE MANOMETER A tilting 36-tube manometer for use with the AF100 Series Subsonic Wind Tunnel, or as a general purpose instrument.	1	Each	2,991,720.00	2,991,720.00
004.11	BASIC LIFT AND DRAG BALANCE A single component balance to measure the lift and drag forces on models mounted in an AF100 Subsonic Wind Tunnel.	1	Each	2,429,112.00	2,429,112.00
004.12	THREE_COMPONENT BALANCE A three-component balance designed for use with the AF100 Subsonic Wind Tunnel.	1	Each	5,992,392.00	5,992,392.00
004.13	BALANCE ANGLE FEEDBACK UNIT The AFA4 Angle Feedback Unit is an optional ancillary for use with an AFA3 Three-Component Balance to measure the angular position of models mounted on the balance in an AF100 Subsonic Wind Tunnel.	1	Each	1,234,644.00	1,234,644.00
004.14	DIFFERENTIAL PRESSURE UNIT The AFA5 Differential Pressure Transducer is an optional ancillary for TecQuipment's AF100 Subsonic Wind Tunnel to measure and display pressures with respect to the atmosphere or differential pressures.	1	Each	1,156,488.00	1,156,488.00
004.15	32-WAY PRESSURE DISPLY UNIT The AFA6 32-Way Pressure Display Unit is an optional ancillary to the AF100 Subsonic Wind Tunnel that measures and displays up to 32 different pressures from models Pitot-static tubes and other measuring instruments fitted to a wind tunnel.	1	Each	3,201,600.00	3,201,600.00
004.16	PITOT STATIC TRAVERSE (300mm) A traversing pitot static tube with electronic position measurement. For use with TecQuipment's AF100 wind tunnel.	1	Each	1,406,556.00	1,406,556.00
004.17	SMOKE GENERATOR This smoke generator and probe is an optional ancillary to TecQuipment's AF100 Subsonic Wind Tunnel & AF41 Flight Demonstration Wind Tunnel to allow the observation of airflow in subsonic wind tunnels and other airflow situations.	1	Each	2,885,676.00	2,885,676.00
004.18	VDAS (FRAME MOUNTED VERSION) (VDAS-F) A frame mounting versatile data acquisition system (VDAS) to allow computer-based data capture for a wide range of TecQuipment products.	1	Each	816,156.00	816,156.00
005	SUPRSONIC WIND TUNNEL The AF300 is an intermittent operation induction type supersonic wind tunnel that allows investigations into the flow around 2-dimensional models at supersonic airspeeds.	1	Each	31,447,500.00	31,447,500.00
005.01	AIR COMPRESSOR & RECEIVER The AF300B is a complete air service package suitable for use with the AF300 Intermittent Supersonic Wind Tunnel.	1	Each	13,300,002.00	13,300,002.00
005.02	VDAS (FRAME MOUNTED VERSION) (VDAS-F) A frame mounting versatile data acquisition system (VDAS) to allow computer-based data capture for a wide range of TecQuipment products.	1	Each	816,156.00	816,156.00
005.03	SCHLIEREN APPARATUS FOR AF300 A monochrome Schlieren apparatus for use with the AF300 Intermittent Supersonic Wind Tunnel.	1	Each	9,229,698.00	9,229,698.00
				Sub Total Fluid Mechanics Lab	**217,121,292.00**
				Total Price	**457,504,080.00**