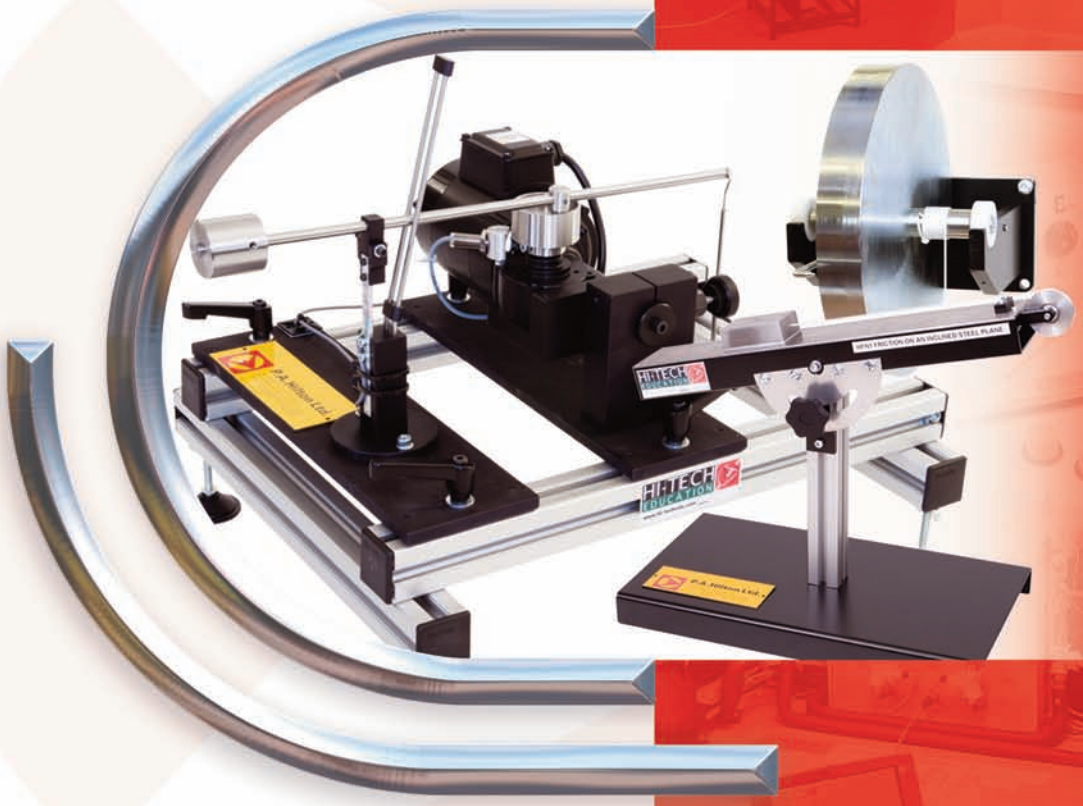
P·A·Hilton Ltd

HI-TECH EDUCATION



FRICTION

HI-TECH Education is a market leader in the manufacture and provision of teaching equipment for Universities and Technical Colleges worldwide for both degree and vocational level.

It has been designing and manufacturing “hands-on” Engineering teaching equipment for almost 50 years and has a wealth of knowledge and experience within the educational and training industry. Its worldwide network of agents guarantees a fast and professional response to all enquiries.

The FRICTION range of HI-TECH Education equipment enables clear and comprehensive learning of FRICTION and TRIBOLOGY covering a variety of theories and topics. An understanding of the way in which Friction acts is fundamental when studying the application of loads on a variety of surfaces. The FRICTION range forms a comprehensive set of equipment, from simple inclined planes to complete Tribology Trainers suitable for demonstration and experimental work.

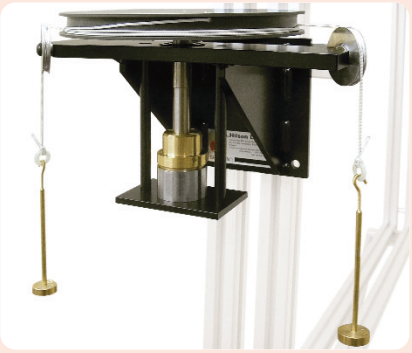
2 Two Year Warranty

HFN1 Friction on an Inclined Plane

The compact bench top unit has a sturdy base plate, non-slip feet and central vertical pillar. Pivoting on the pillar is a ground steel plane which can be locked in any angular position between ±45°, indicated on a semi-circular protractor scale. Two composite slider trays are supplied in Aluminium/Steel and Nylon/Brass pairings. Each tray in turn is attached to a load hanger and weights are added until the tray just begins to slide. The slider trays also allow additional weight to be added. The hanger cord pulls the tray up the sloping plane whilst passing over a pulley and bearing. The experiment may also be used as an exercise in equilibrium of forces, determining the force required to move the tray along the plane giving the coefficient of friction.

HFN3 Clutch Plate Friction

The wall mounted apparatus comprises a lower stationary plate attached to a sturdy wall mounting bracket. On top of this stationary plate sits an upper plate whose shaft rotates in ball bearings. Sandwiched between the lower and upper plates are three interchangeable friction discs of different diameters. Each one sits onto location pins in the lower plate. The minimum force on the friction disc is the self weight of the upper plate, but the contact pressure can be increased by adding weights to the upper plate. Pure torque is applied to the upper plate through two loaded cords and pulleys. The cords wrap around a groove in the upper plate. A set of calibrated weights and load hangers are supplied which enable the loading force to be varied and applied torque to be adjusted also.



HFN4 Pivot Friction

The wall mounted apparatus consists of a rotating circular table on a vertical shaft at the bottom of which a variety of end pivots can be attached. The table rotates on an interchangeable seating selected to match the conical angle of the pivot. Pure torsion is applied to the table by a pair of cords diametrically opposite on its periphery and passing over pulleys to load hangers. The standard apparatus is supplied with four sets of pivots with vertex angles of 60° 90° 120°and 180° (flat). The seating is in mild steel and the pivot is in brass. In addition a ball thrust bearing is included to show the difference in performance. Students can study the effect of the conical angle of a pivot bearing and obtain the coefficients of friction for bearings of different design. All load hangers and calibrated weights are supplied.

HFN5 Journal Friction

This apparatus is designed to determine the friction torque in a plain journal bearing under varying conditions of load, speed and lubrication. The ground steel journal shaft is driven by a variable speed electric motor. The journal housing has a thermometer pocket, a lubricator and a removable end cover. Friction due to end face contact is very much reduced by the use of a "floating" sleeve. Friction torque is measured by adding weights to a load hanger suspended from the damped torque arm. Weights added to the lower hanger apply a steady load to the journal bearing. A set of journal sleeves are supplied as standard. A tachometer is provided for measurement of the journal shaft speed, which can be controlled. An oil drip tray is provided to ensure all oil passing through the journal bearing is captured. A full set of weights, hangers and tools is provided.

HFN6 Bearing Friction

This experiment provides an opportunity to study the efficiency of journal bearing friction over a range of commonly used materials. The wall mounted apparatus consists of a flywheel on a horizontal shaft carried in a pair of similar bearings, the flywheel being used to even out small variations in friction. The shaft is of mild steel, and interchangeable bearings in a range of materials are provided. For comparison a ball or roller bearing is available to demonstrate the advantages of rolling rather than sliding contact. Torque is applied by a loaded cord wrapped round the flywheel shaft. A set of calibrated weights and load hanger is supplied for loading the flywheel.

HFN9 Friction of Belts

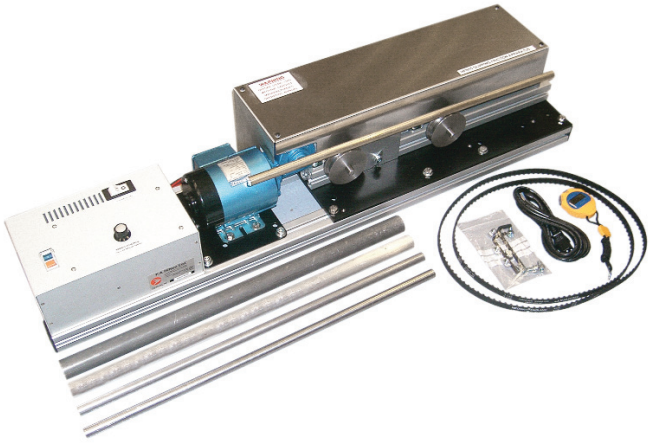
The apparatus consists of a wall mounted pulley with a loaded belt. The pulley is made of aluminium and has two machined grooves to suit a flat and a vee belt. Each belt fits into its respective groove during testing. For a given belt tension and angle of lap, a turning moment can be applied by adding weights to the pulley drive hanger. The student determines the torque which just causes the pulley to turn, and so find the ratio of the belt tensions. This enables the belt tension equation to be verified and the coefficient of friction to be determined. The angle of lap can be easily varied by placing one end of each belt at different angular positions on the wall bracket. A removable pin and bar are used to enable the various angular positions to be achieved. A set of calibrated weights and hangers is supplied to achieve the loadings desired.

HFN11 Brake Drum Friction

Students can compare the braking effect of a leading and trailing shoe with this apparatus. In addition the coefficient of friction for the brake lining on the drum can be evaluated. At one end of a baseplate is a pair of bearing brackets carrying an aluminum alloy brake drum on a shaft. The bracket on the open side of the drum provides the bottom pivot for a brake shoe and another for a 1 : 1 lever actuator at the top of the shoe. A cord from this lever passes over a pulley at the other end of the baseplate and then down to a load hanger. This creates a braking load to the system. A groove on the outside of the brake drum has an attached cord which may be wound round in either direction, thus providing a rotational torque. The cord passes over a second pulley at the far end and then down to another load hanger. To simulate a trailing shoe the cord comes from the top of the drum; for a leading shoe it comes from the underneath.

HFN15 Slipping Friction

With this apparatus students can verify the expression for periodic time of an oscillatory motion by determining a number of parameters. This apparatus continuously subjects two surfaces to a condition of slipping friction. The apparatus involves a clever application of simple harmonic motion as a test rod supported on two contra-rotating grooved wheels oscillates longitudinally. A variable speed electric motor drives the grooved wheels. A removable belt guard covers the drive mechanism. A set of test specimens is supplied in different materials, diameters and solid or hollow section. The main variables are the coefficient of friction, the size and the weight of the specimens. The whole apparatus is built on a heavy base. A speed controller and all necessary tools are provided.



HFN20 Tribology Trainer Base Unit

The system allows full investigations into sliding and rolling friction using a number of individual modules that attach to a common base unit (HFN20). The system can undertake experiments on stick/slip, pin on disc, elastrohydrodynamics, journal bearings and more. The HFN20 base unit consists of an aluminium profiled frame, with integral grooves for attaching the individual modules, making for quick and easy attachment. The integral motor has couplings for attaching the individual modules and is speed controlled from the speed control unit supplied. Fine tuning of the motor speed is accomplished through the potentiometer on the front of the unit. The speed control unit also has a digital display for the motor speed and force generated from the strain gauging technology incorporated into the relevant modules. All the modules must be used with the HFN20 base unit.

Optional Modules: HFN20a, HFN20b, HFN20c, HFN20d, HFN20e, HFN20f, HFN20g

HFN20b Pin on disc Friction module

The HFN20b Pin on Disc Friction module is one of a range of modules which allows the study of sliding and rolling friction. It must be operated with the HFN20 Tribology Trainer Base unit (sold separately).
When connected to the HFN20 the ground steel disc is speed controlled. A variety of pins, manufactured from different materials can be attached to a lever arm. The pins rest onto the surface of the disc. As the disc is rotated the lever arm is forced in the direction of rotation, and against a load cell which then monitors the friction force. A load hanger is suspended from one end of the lever arm such that the contact pressure between the pin and disc can be varied. A set of calibrated weights is supplied. The disc runs inside a surround which enables lubrication to be added without spillage. This varies the experimental parameters and results obtained.

HFN20c Elastohydrodynamic Module

The HFN20c Elastohydrodynamic Module is one of a range of modules which allows the study of the behaviour of a film of lubricant between a sphere and disc. It must be operated with the HFN20 Tribology Trainer Base Unit (sold separately). When connected to the HFN20 the ground steel ball is pressed underneath a rotating precision glass disc. A thin film of lubricant runs between the sphere and disc. The disc is speed controlled from the HFN20. An integral microscope passes light through the glass disc and the film of lubricant at the point of contact. The light is then reflected from the surface of the sphere. The interference rings produced allows the film thickness to be assessed. The microscope position can be adjusted. A lever arm and screw jack mechanism allows the sphere to be pressed accurately into the glass disc. A load cell, with strain gauging technology, monitors the contact force being applied which is then fed into the HFN20 for displaying.

OTHER EXPERIMENTS AVAILABLE *(Refer to our Website for details)*

HFN2	Mitchell Pad
HFN7	Hertzian contact
HFN8	Rope Belt Friction
HFN16	Journal Bearing
HFN20a	Stick-Slip Friction Vibration Module
HFN20d	Journal Bearing Pressure distribution Module
HFN20e	Block on ring Module
HFN20f	Rolling/Sliding Module
HFN20g	Cross Cylinder Module
HFN21	Hydrodynamic Bearing
HFN22	Friction Force Measurement
HFN23	Precision Friction Force Measurement

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