

# DEVELOPMENT FACILITIES

**S&C**  
TRACTION

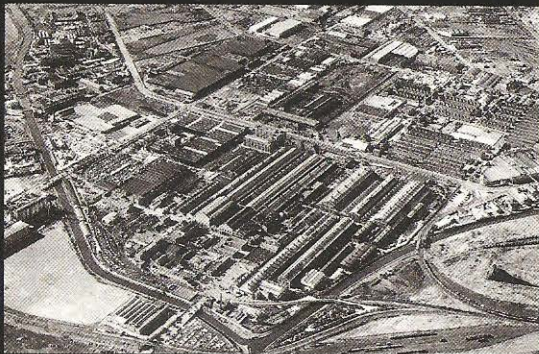
The General Electric Company is Britain's largest electrical and electronics company with over 178,000 employees, an annual turnover exceeding £5½ billion and over 130 specialist companies.

The Transportation group of GEC includes a number of separate companies who concentrate on particular aspects of rail and road transportation. GEC Traction engages solely in the development, design and manufacture of electrical propulsion equipment. It is probably the largest company in the world totally devoted to this specialist field. It employs some 2,500 people at its two principal factories (at Manchester and Preston) as well as having licencees and sub-contractors overseas.

GEC Traction has been in the electric traction business since 1883. During that period it has pioneered numerous developments both as regards equipment and systems. It is the Company's policy always to be at the fore-front of traction technology and to help achieve this aim it has invested heavily in development facilities.



Preston



Manchester

*Cover photo: The vibration laboratory at Preston is equipped to handle the largest components which the Company manufactures.*



# GEC Traction's development facilities

The development of "Conventional" control schemes has taken place over many years and has been a gradual process involving the development of individual items of equipment for inclusion in established schemes.

The advent of control electronics and power electronics has promoted a greater need for the development of the complete system. The complexity of the circuits, and the fact that a complete theoretical analysis may be impossible through lack of data, make development test bed analysis essential.

GEC Traction's facilities are split between its two manufacturing sites:-

## at Trafford Park

- electronics workshops and laboratory
- microprocessor development
- environmental testing
- development workshop for control gear
- development laboratories for equipments and systems.

## at Preston

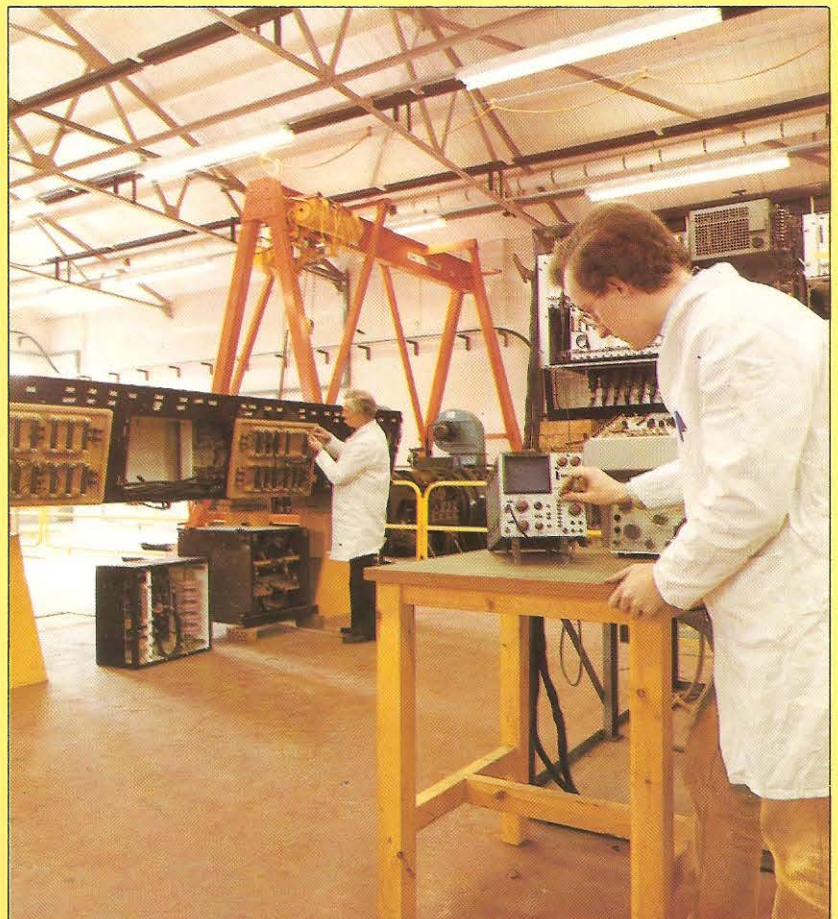
- materials analysis laboratory
- vibration laboratory
- insulation testing laboratory
- combined testing of motors and control gear in simulated service conditions.

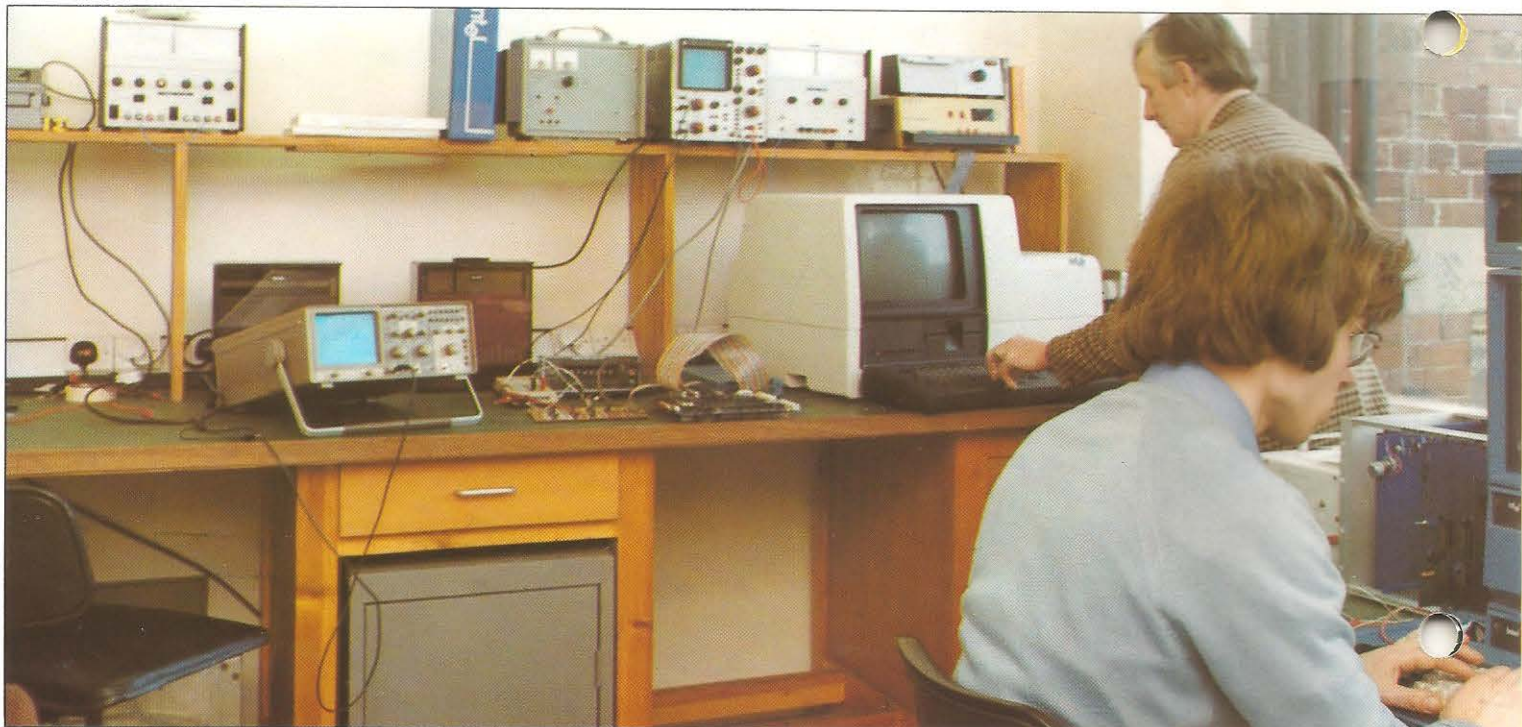
The emphasis is on realism under conditions as near as possible to those to be found in service. Accordingly many of the tests are carried out at full power and full voltage. The Trafford Park control laboratory, for example, has a total installed capacity of nearly 6MVA (2MW at either 1000V or 2000V or 3000V dc., plus 3.5MVA at 25kV plus several smaller loads). At Preston the combined test facility can simulate service conditions in real time at a rating of 3MW including the ability to reproduce regenerative braking.

Less spectacularly, but equally important, is the work carried out in the vibration rigs, in climatic chambers and on laboratory benches with projects varying from new microprocessor systems to artificial ageing of insulation materials.

This brochure describes some of the facilities which are available.

Experiments in progress in the Power Systems laboratory.





# Electronics and microprocessor laboratories



The fully equipped laboratory for the development and testing of low power electronic hardware (above) and its associated workshop (centre) for the manufacture of prototypes.



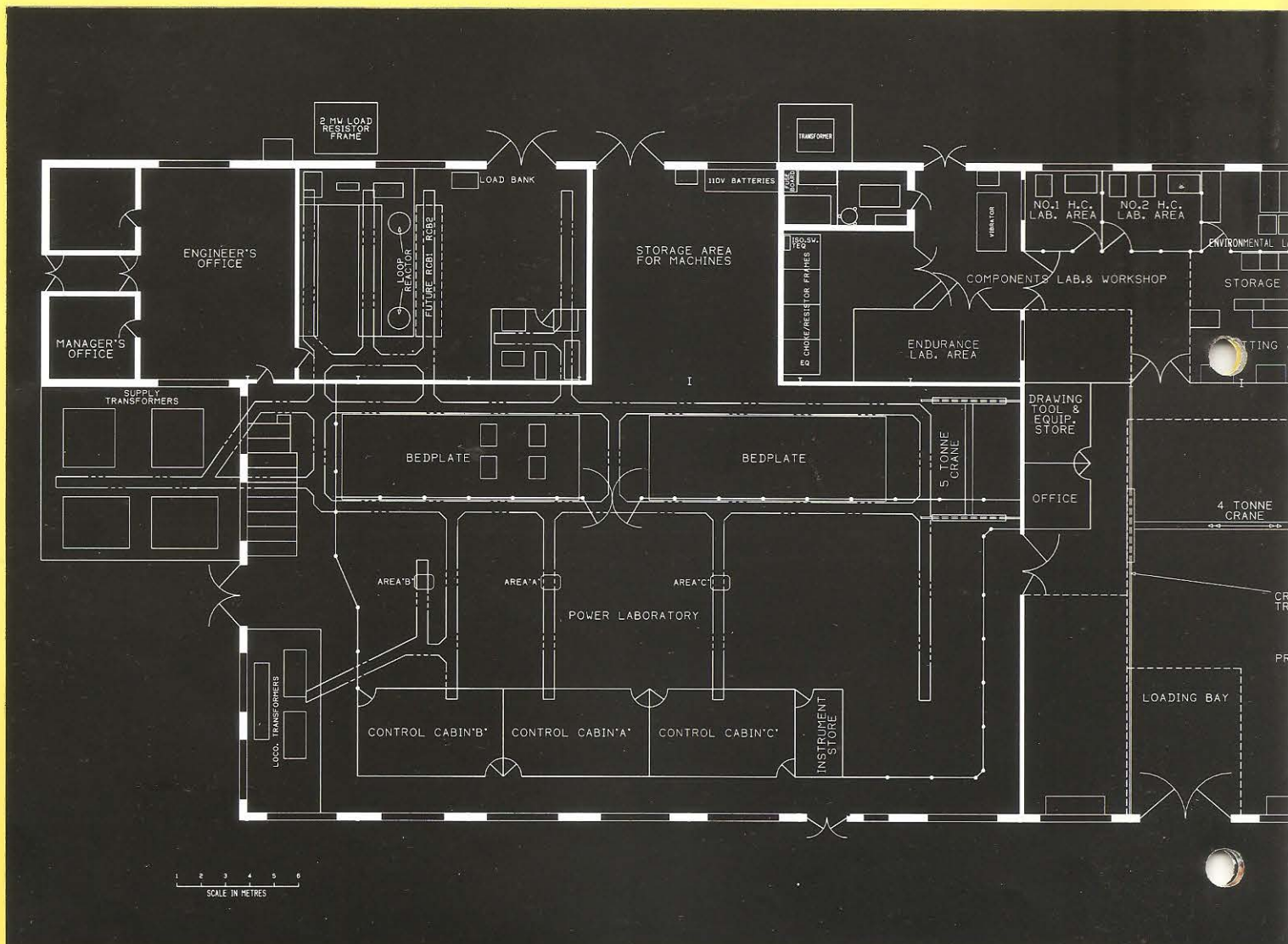
The microprocessor facility is equipped with both Intel Series 3 and Intel Series 4 systems for the development of both software and hardware. These have a large storage capacity (10 megabytes) and are on line to the Company's VAX engineering computer. Microprocessor development is concentrated on the INTEL 8086 16-bit microprocessor.

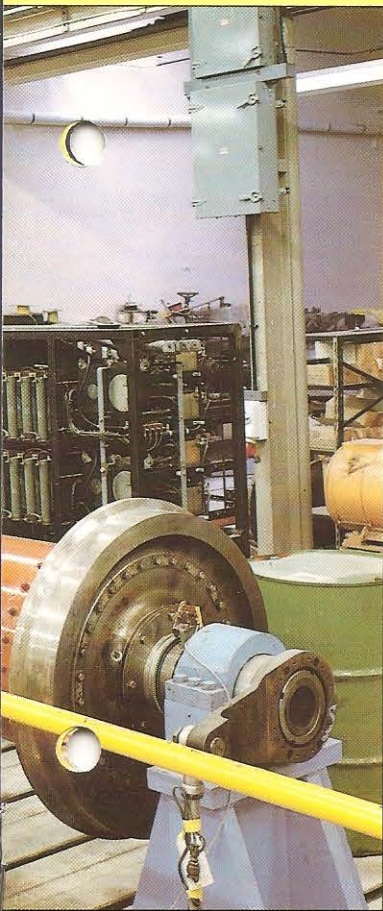


# Prototype workshop and power laboratory



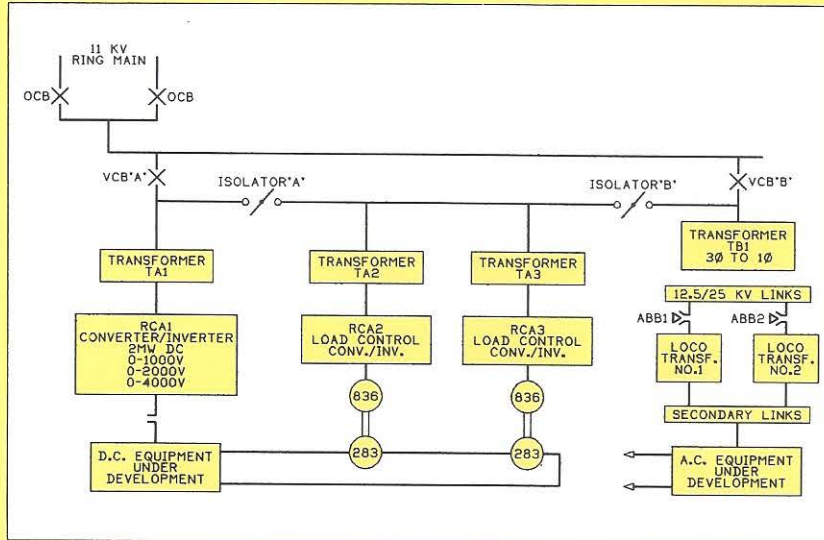
The prototype workshop and the associated components and power systems laboratories at Trafford Park cover 1700m<sup>2</sup> of floor space.





A TAIM motor (tubular axle induction motor) is seen in the foreground with the laboratory's 3kV load machines behind and the 5 tonne crane in the background.

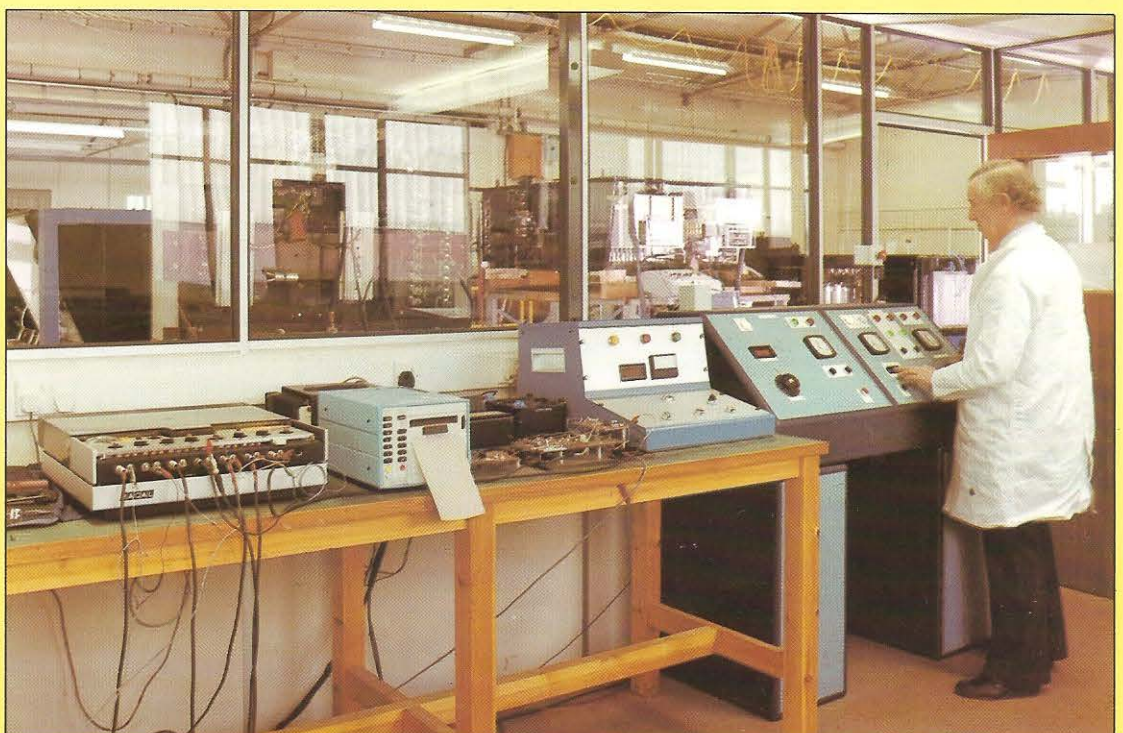
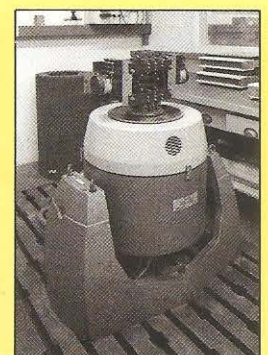
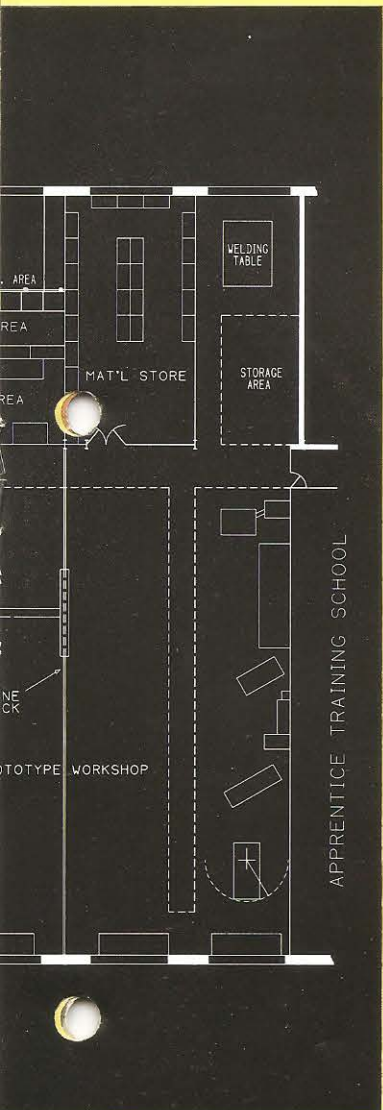
(Below) Simplified power scheme for the power systems laboratory.



(Centre) The prototype workshop is used to assemble control components and complete equipment cases. It has its own limited machining facility and is adjacent to the apprentice training school (whose own machining capacity is readily available).

(Below) The vibration rig can accommodate components weighing up to 200kg. The 3kVA control unit provides sinusoidal or random frequencies up to 3.7kHz with accelerations of 784m/s<sup>2</sup> (80g).

(Bottom) The engineer is at the desk of the 2MW control desk behind which can be seen a PWM (pulse width modulated) inverter for multiple unit service. To the left of the picture is the GTO (gate turn off) chopper test rig.



# Power supplies

## Power systems laboratory

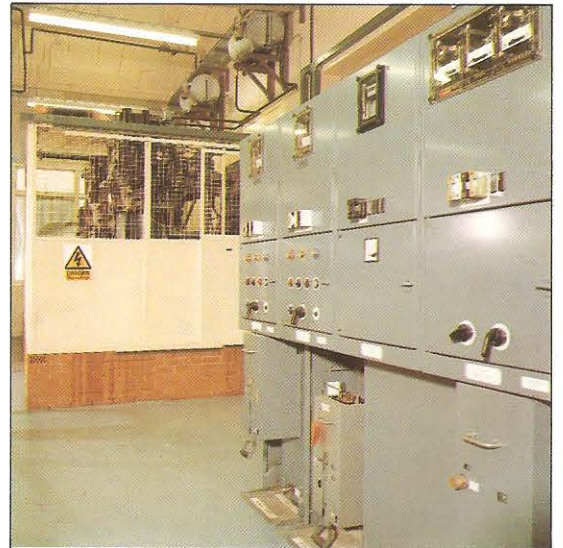
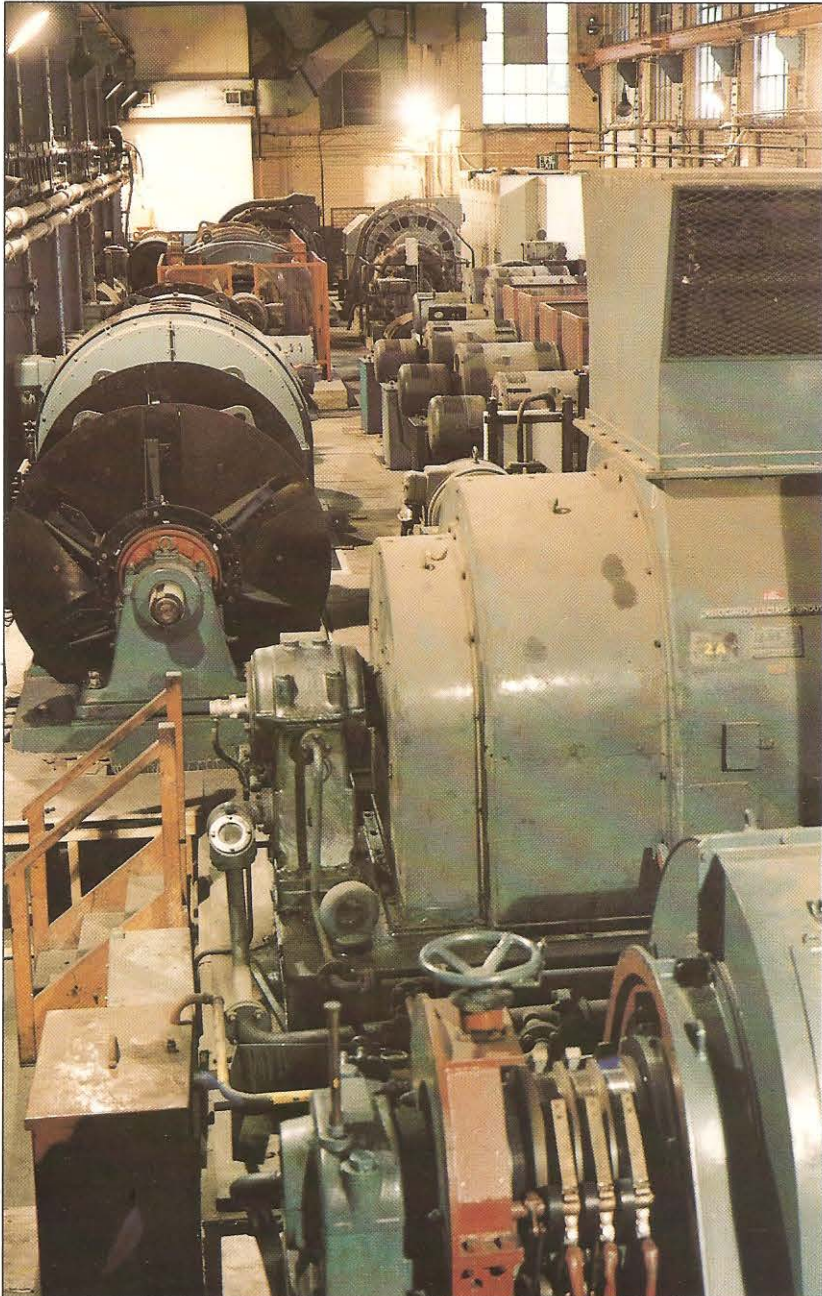
(Below) The 2MW, 3kV load resistor unit under construction.  
(Below right) The 100kVA dc supply set which can provide 600V

1500V and 3000V power to the power systems laboratory.

(Centre) 11kV switchgear in the foreground with the two 25kV locomotive transformers behind.

## Preston

The power house at Preston supplies the test beds which can test any of the Company's equipment on full load. There are 98 machines in the power house rated between 10kW and 3MW



(Above) The 6MVA supply transformers.



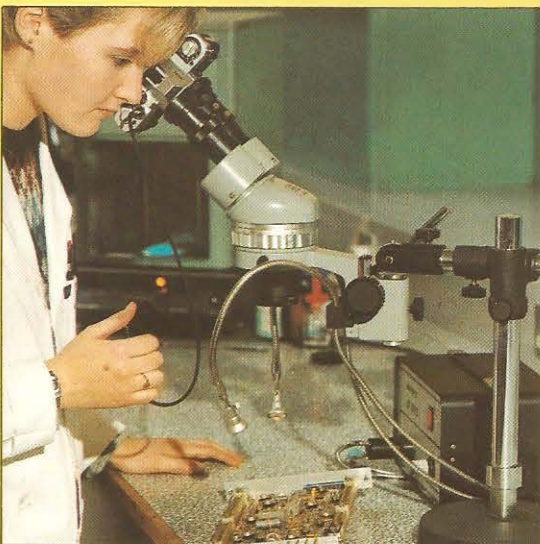
# Engineering Laboratories



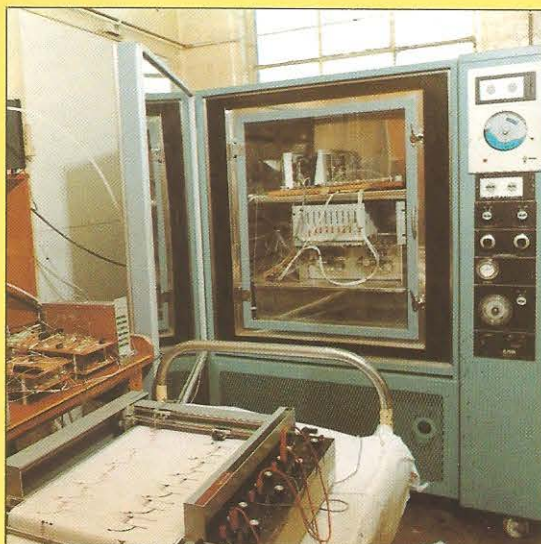
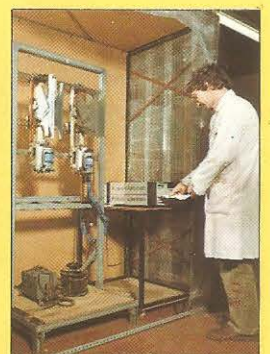
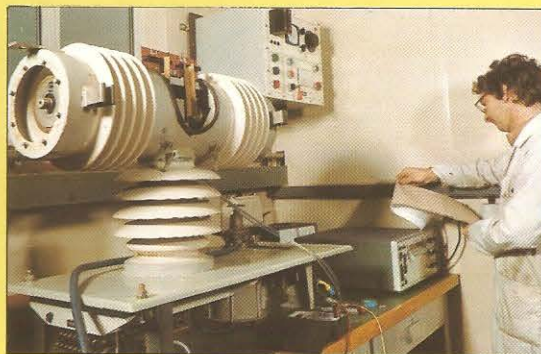
**The vibration test facility** at Preston is equipped to subject components and major assemblies to the vibration levels they are likely to encounter in service.

## Components Laboratory

(Below) Heat run on 3000V electro-pneumatic contactors. (Below left) Checking timings and contact travel on a second generation 25kV vacuum circuit breaker.



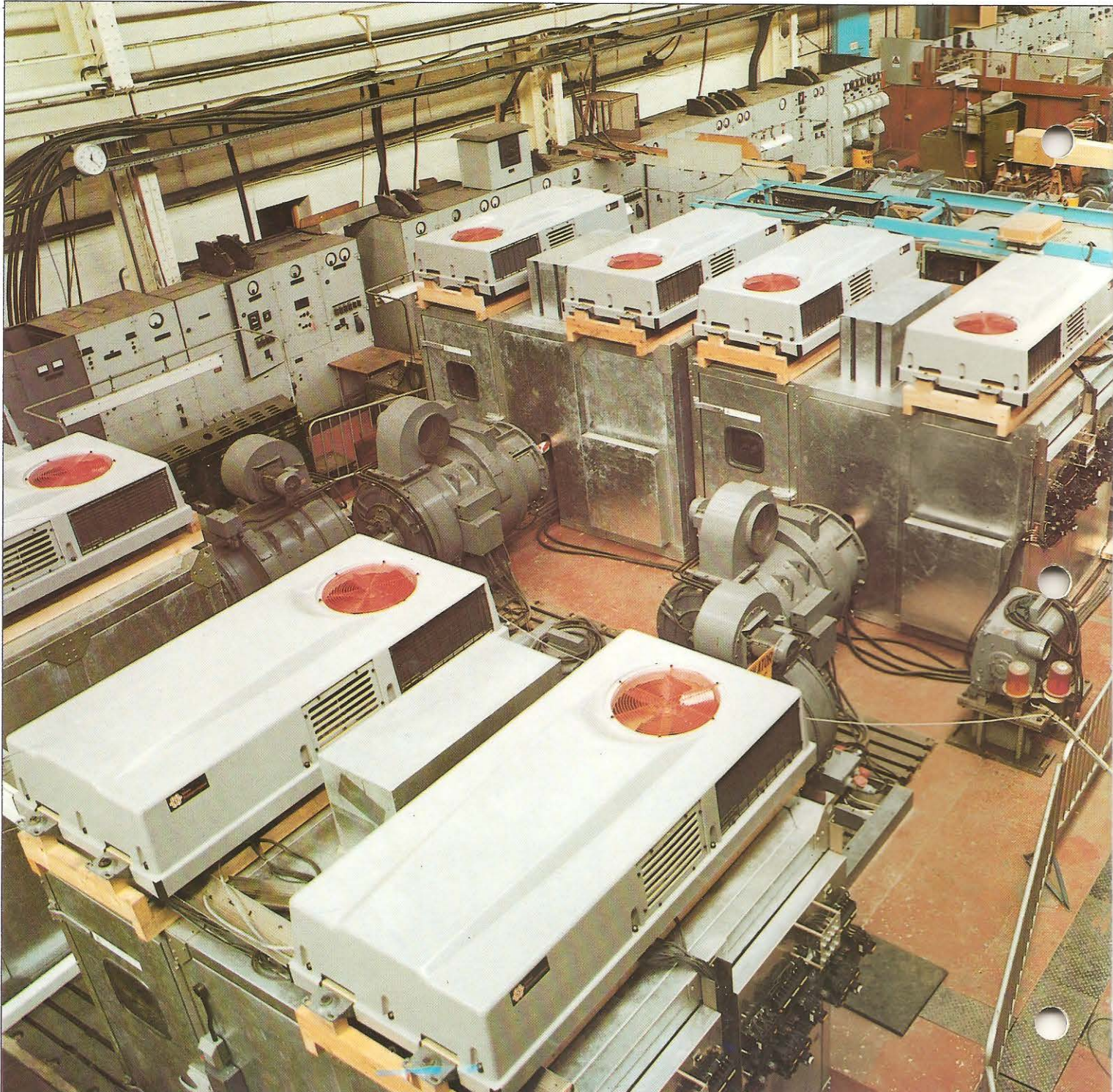
**The materials laboratory** is equipped to carry out detail testing on both control gear and machines. The microscope shown here has a camera fitted to one lense to record the results - in the background is a precision balance which can weigh down to 1 milligram.



**The environmental testing chamber** can carry out tests, *on load*, between  $-50^{\circ}\text{C}$  and  $+100^{\circ}\text{C}$  at humidities varying between zero and 100% plus (fully saturated). The photograph shows a 24 hour simulated test on electronic equipment for an emu train with the chart recorders showing field and armature currents.

# Combined testing

The combined testing facility enables us to simulate full-load service running over actual routes in real-time.



# Test track

## INERTIA SIMULATION CONTROL PROGRAM

17:08 07-OCT-82 Options:- BC Contract:- DUBL

TRAIN SPEED (km/h).....	0.00
SPEED LIMIT (km/h).....	100.00
DISTANCE (km).....	0.00
GRADIENT (%).....	-0.18
TRACTIVE EFFORT (kN)...	0.73
AIR BRAKE (kN).....	0.00
TRAIN MASS (tonnes)....	81.75

TIME FROM START

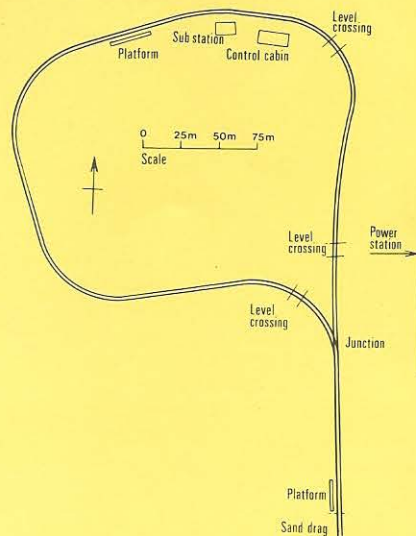
LAST STATION  
BRAY



(Left) An 8-motor twin chopper equipment for a transit train is seen on the test bed together with its associated air conditioning units, air brake equipment and auxiliary supply set.

(Top Left) The control room.

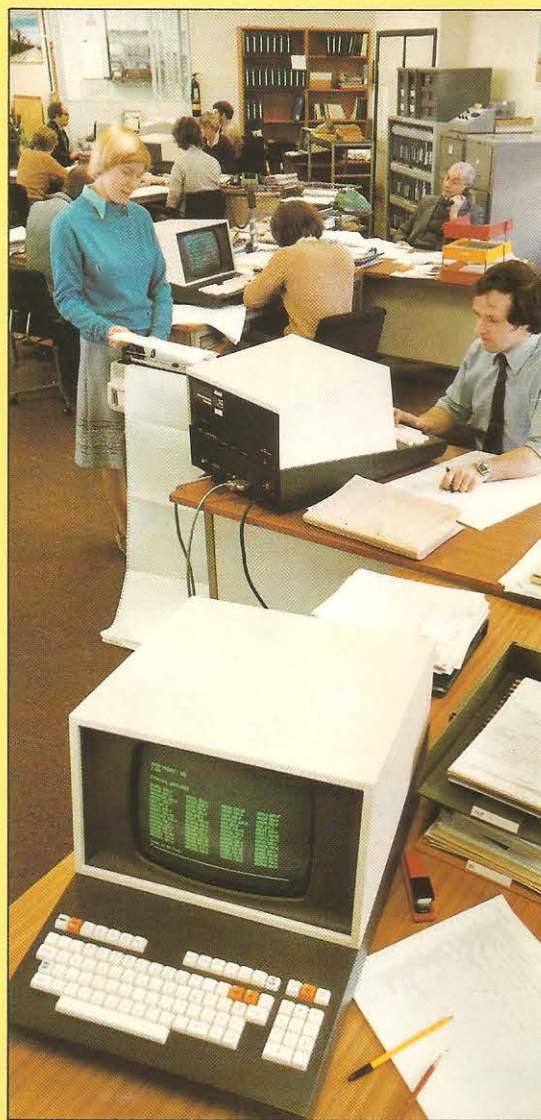
(Above) A typical information display when a simulation is in progress.



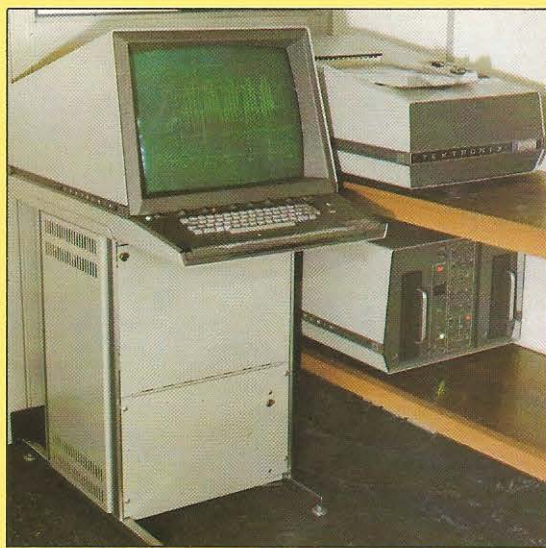
The illustration shows a tram equipped with off-vehicle control on the company's test track at Kearsley in 1983. A layout of the 1km route is shown (left).

# Computing

The company's own VAX 11/780 computer provides direct on-line links to the micro-processor development facility at Trafford Park, to the combined test bed facility at Preston and to more than 60 terminals in engineering departments throughout the company. The main memory has a capacity of 2½ megabytes (soon to be increased to 6 megabytes) with a storage capacity at present of 476 megabytes (to be increased by 900 megabytes).



Some of the on-line terminals.  
Part of the graphics facility.



## **GEC Traction Limited**

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