



CRYPTON



660 Brake Tester

Operating Instructions

✓ TES 829/4
May 1989



WARNING:

Do not attempt to operate this equipment unless you have read and understood these instructions

*How
copy have*

The reliability of this equipment is fully supported by Transervice with repair workshops and field service engineers to provide a full range of after-sales care, including installation, contract maintenance, factory overhaul and emergency repairs on site. Please see the special Service Page at the end of this manual.

IMPORTANT

SAFETY PRECAUTIONS FOR CAR & LIGHT COMMERCIAL VEHICLE BRAKE TESTERS

1. It is preferable to site the equipment in an area designated and clearly marked:

BRAKE TESTING AREA - FOR USE BY AUTHORISED PERSONNEL ONLY

2. When it is impossible to exclude members of the public from the test area, a notice should be prominently displayed to warn of the danger of feet slipping between the rollers.
3. When the brake tester is not in use:-
 - a) A vehicle should NEVER be left standing on the rollers as this will enable the rollers to be started.
 - b) The hinged roller cover plates should always be placed over the rollers.
4. When the brake tester is in use, NO ONE SHOULD EVER:
 - (a) Stand near the rollers.
 - (b) Allow onlookers to stand near the rollers.
 - (c) Attempt to examine or work on the wheels or the underside of the vehicle for any reason.
5. As an additional precaution against accident, the sides of the roller assemblies should be protected by guard rails where this is practicable.
6. The brake tester should not be left switched on while unattended and it is recommended that the mains switchfuse is of a type that can be fitted with a key-operated lock so that the supply can be locked OFF for safety purposes.
7. THE BRAKE TESTER IS NOT SUITABLE FOR OUTSIDE INSTALLATION. If the brake tester is so installed, the warranty will be invalidated.
8. The use of wheel chocks (E23), as described in this manual, is strongly recommended.
9. Where the test area is confined, provision should be made to extract the exhaust gases.

PETROLEUM REGULATIONS - UK INSTALLATION WHERE APPLICABLE

The motors and control gear of the standard 660 are NOT FLAMEPROOF and it is the responsibility of the user to ensure that the proposed site and all aspects of the installation comply with the Petroleum Regulations and that they satisfy the local Petroleum Officer's requirements. Overseas users must consult their own national Petroleum Authority, where applicable.

IMPORTANT -

It is the customer's responsibility, prior to commissioning, to complete the two pits, provide and connect mains switchfuse and wiring (to include connection to the motor in each pit unit) and to install the pit units into the pits. The Crypton 660 Site Preparation publication (Ref. TES 883) is available for this purpose. The customer must also ensure that the installation, where it is to be used in the U.K. for testing vehicles under any of the Dept. of Transport compulsory Testing Schemes, complies in every detail with D.Tp. requirements.

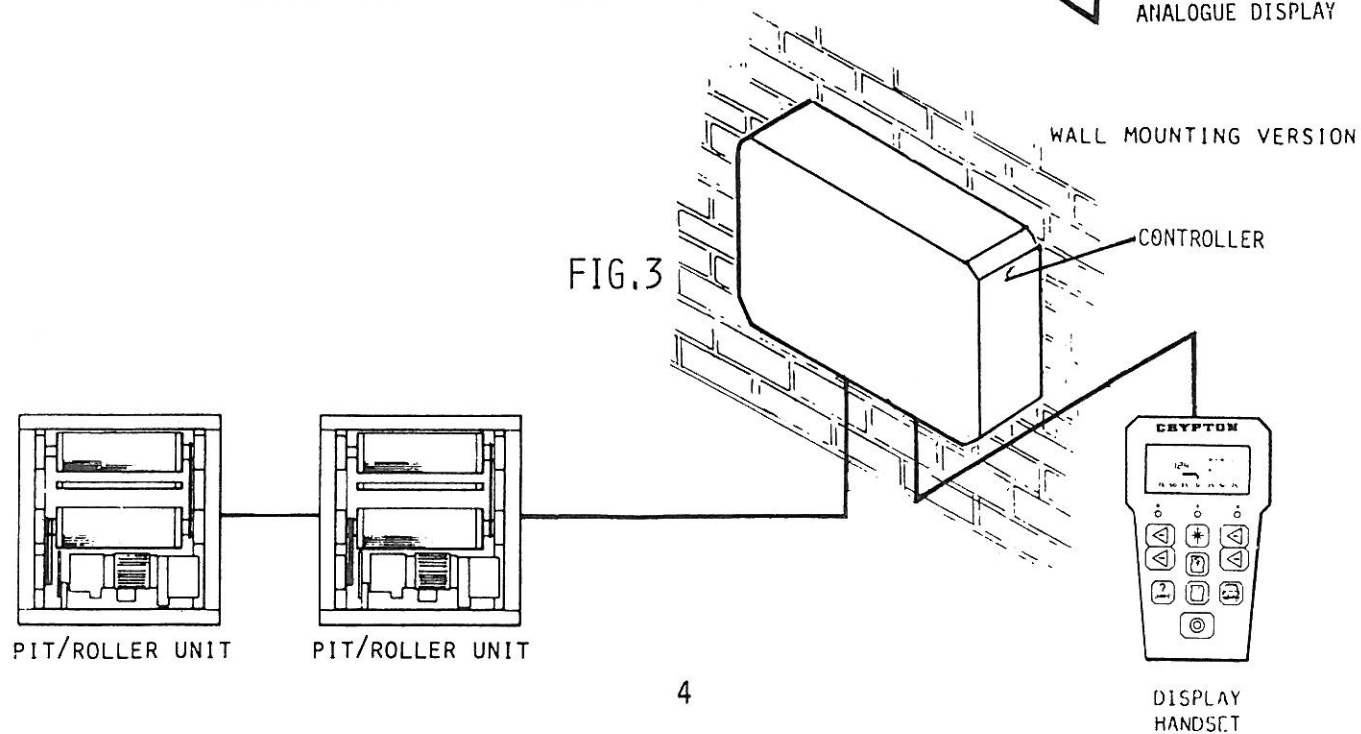
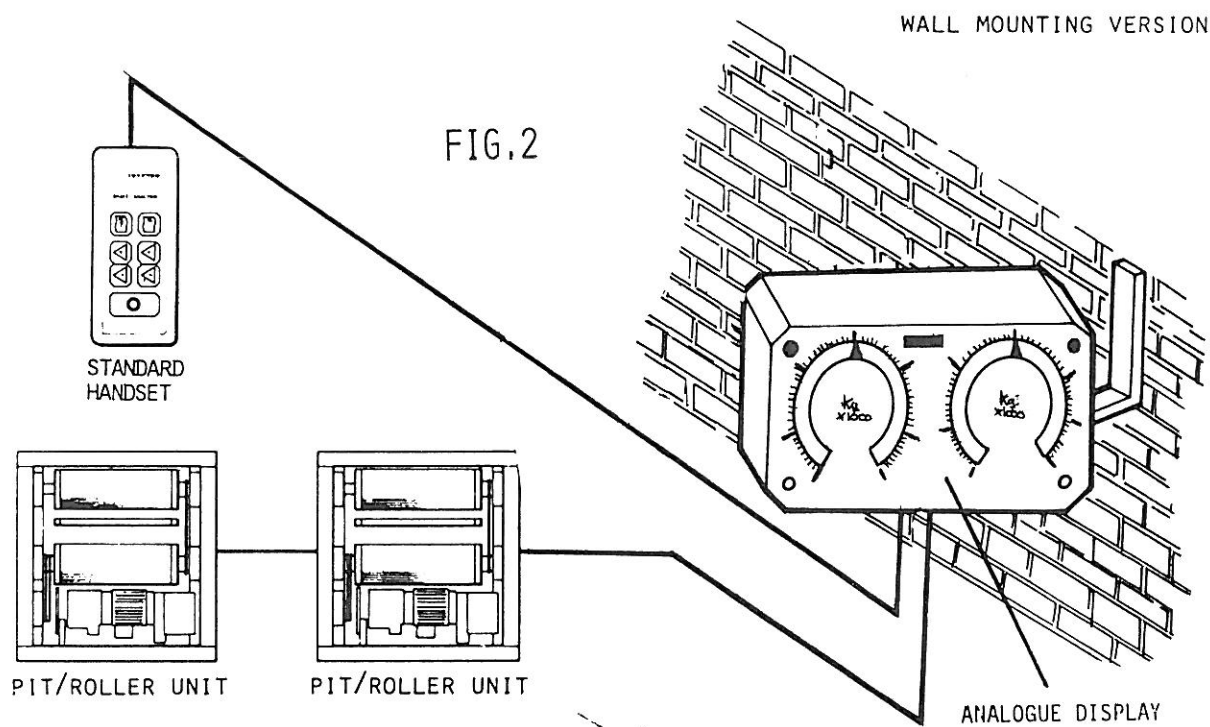
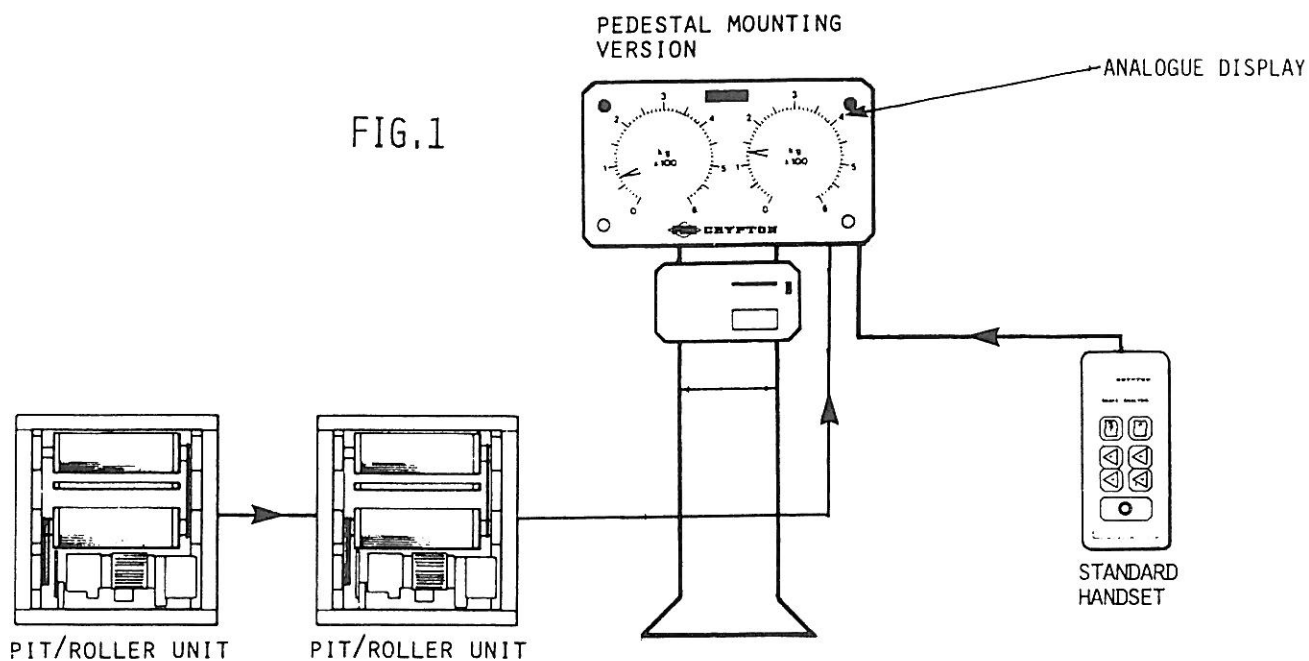
- NOTE:
1. This manual applies to machines calibrated in kilograms.
 2. Where controls identified by symbols are mentioned in the Text, the appropriate symbols will appear in the right hand margin.

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INTRODUCTION

The Crypton 660 Brake Tester is a sophisticated micro-processor controlled machine for measuring and recording the efficiency of vehicle braking systems. It is capable of measuring up to 600kg Braking Effort per wheel on axles supporting up to 3000kg. The rollers run at an equivalent road speed of 5.5 km/hour (3.4 mph).

Its modular design enables the system to be tailored to match precisely the customer's requirements.

OPERATING PRINCIPLE

Two independent pit mounted roller units drive the wheels on one axle of the vehicle under test. Each unit consists of an integral motorised gear box and two driving rollers. As the brakes are applied the resulting torque experienced by the rollers is transmitted to the motor gear box unit. This torque is transmitted to a load cell attached to the gear box casing. The load cell output is detected and processed by the controller and displayed in either analogue (dial) or digital form.

The Braking Effort is increased until the wheel starts to slip on the rollers. The difference in speed between the wheel and rollers is detected by a third spring loaded 'idler' roller driven by the wheel. The rollers are then stopped before the tyre can be damaged.

The results at the end of a test are displayed on the Analogue Display or on the Display Handset. A permanent record can be produced by the optional Printer/Plotter unit.

SYSTEM ARRANGEMENTS

There are three 'minimum' systems to which can be added Printer/Plotter units, a 'Pressometer' (brake pedal force) and additional Analogue Displays etc.

ALTERNATIVE HANDSETS

1. Model 660AP - Analogue Display/
(see Fig.1) Controller
Pedestal
Pit Units
Standard Handset
2. Model 660AW - Analogue Display/
(see Fig.2) Controller
Wall Bracket
Pit Units
Standard Handset
3. Model 660DW - Controller (Wall Mounted)
(see Fig.3) Pit Units
Display Handset

OPTIONS AND ALTERNATIVES

1. The measured Braking Efforts and other data can be displayed on an Analogue Display (wall or pedestal mounted) or on a Display Handset with integral L.C.D. If an Analogue version is specified, a Standard Handset will be supplied.
2. One or more Printer/Plotter units may be connected (optional).
3. A 'Pressometer' unit measures the brake pedal force (optional).
4. A display handset can replace the standard handset on analogue versions.

MODULE REFERENCES

- 681 Twin Pit Units
- 682 Digital Display Controller
- 683 Control Handset - Standard Model
- 684 Control Handset - Digital Display
- 685 Analogue Display and Controller Unit
- 686 Universal Printer/Plotter
- 687 Diagnostic Unit 686 + 695
- 689 Calibration Equipment
- 692 Pedestal for Analogue Display
- 693 Wall Bracket for Analogue Display
- 695 Pedal Pressure Sensor

DESCRIPTION OF MODULES

CONTROLLER

(References are to Fig.4)

The Controller unit is mounted either on a wall or on a pedestal. The Controller side panel holds the 'mains' on/off indicator and the master status indicator.

REMOVABLE

REVIEWS

A panel situated on the side of the Controller holds the calibration controls, operating mode controls and status indicators (see page 35).

The Controller contains a computer, programmed to monitor and control the operation, calibration and self-checking procedures of the system.

The unit is electrically connected to all other modules.

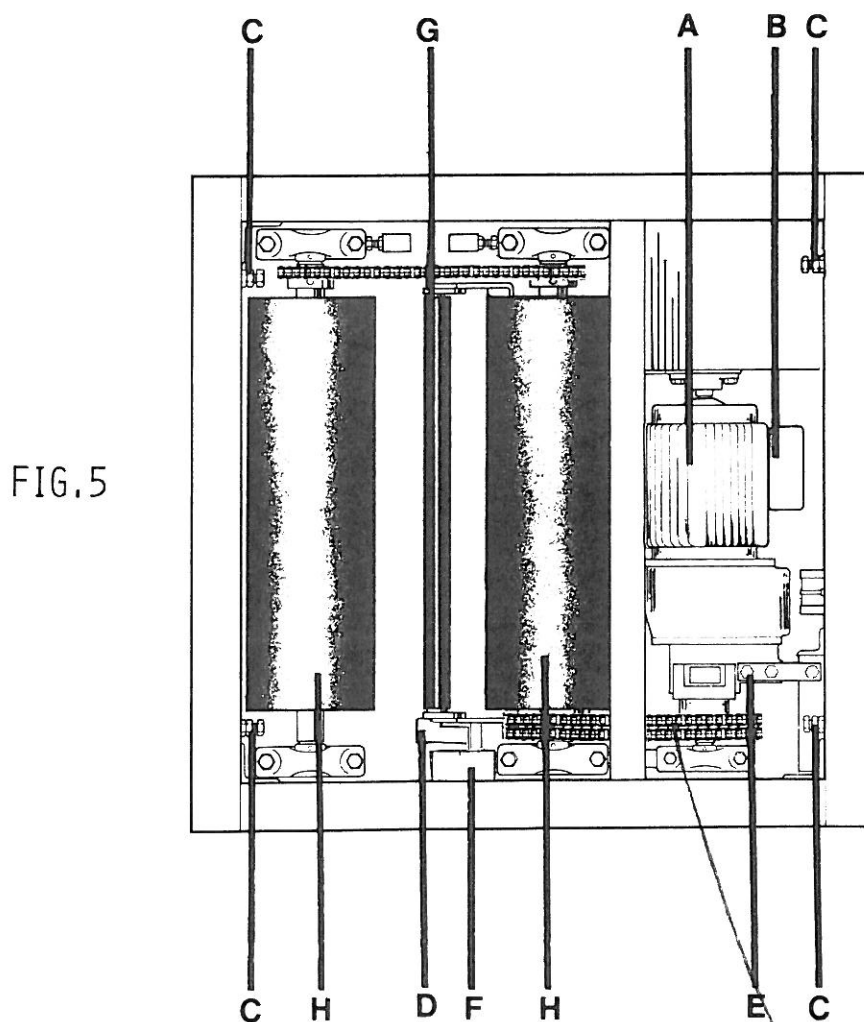
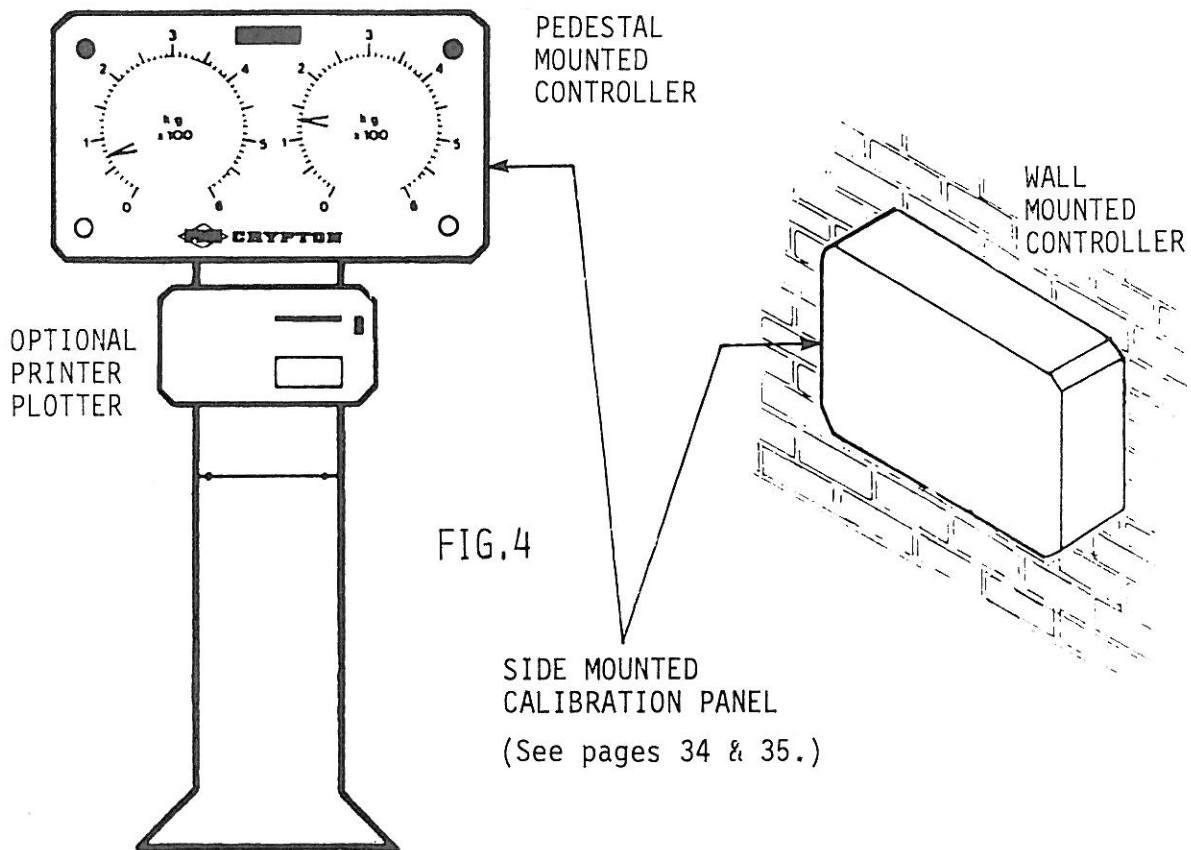
PIT/ROLLER UNITS

Each assembly consists of an integral motorised gear box unit and three rollers (see Fig. 5). The two large rollers are driven by the electric motor. The third roller is driven by the vehicle wheel. It's speed (and thus the speed of the wheel) is electronically measured and compared with the speed of the rollers. Any slip between wheel and main roller can, therefore, be detected. When this slip reaches a predetermined level of either 20% or 40% (selected by a switch on the Controller calibration panel) the rollers will stop. The small roller also operates a depression switch to ensure that the rollers only revolve when a vehicle is in position. This safety feature is disabled when the machine is in any calibration mode.

As the vehicle brakes are progressively applied the torque reaction experienced by each motorised gearbox unit is sensed by a load cell whose output is processed by the controller unit. This gives an extremely accurate measurement of the Braking Effort.

References are to Fig.5

- A - Motorised gearbox unit
- B - Motor terminal box
- C - Frame location adjusting bolts
- D - Speed detector; senses wheel speed for wheel slip detection
- E - Load cell
- F - Depression switch; senses vehicle in position
- G - 'Idler' roller; revolves at wheel speed and drives speed indicator unit
- H - Calcined bauxite coated rollers



THIS IS NOW A SINGLE
WIDE CHIN

ANALOGUE DISPLAY

This large pedestal or wall mounted display consists of left and right hand dials to show left and right hand Braking Effort. Various indicator lights give the status of each pit/roller unit. See Fig.6.

- Lamp No.1 (Green) - Lights when L.H. roller is running and the machine is ready for test.
Flashes when L.H. analogue display is in Calibration mode.
- Lamp No.2 (Green) - Lights when R.H. roller is running and the machine is ready for test.
Flashes when R.H. analogue display is in Calibration mode.
- Lamp No.3 (Yellow) - Lights when R.H. rollers have slipped. Motors will be stopped automatically.
Flashes when system is in a Calibration mode.
- Lamp No.4 (Yellow) - Lights when L.H. rollers have slipped. Motors will be stopped automatically.
Flashes when system is in a Calibration mode.
- Gauges 5 & 6 - Show continuously varying L.H. & R.H. Braking Efforts during a test. When the motors have stopped because of a detected slip or manual stop, the pointers will show the maximum reading achieved during the test. This reading will be retained until the corresponding motor is re-started.

The Analogue Display may be mounted on an adjustable wall bracket or a pedestal.

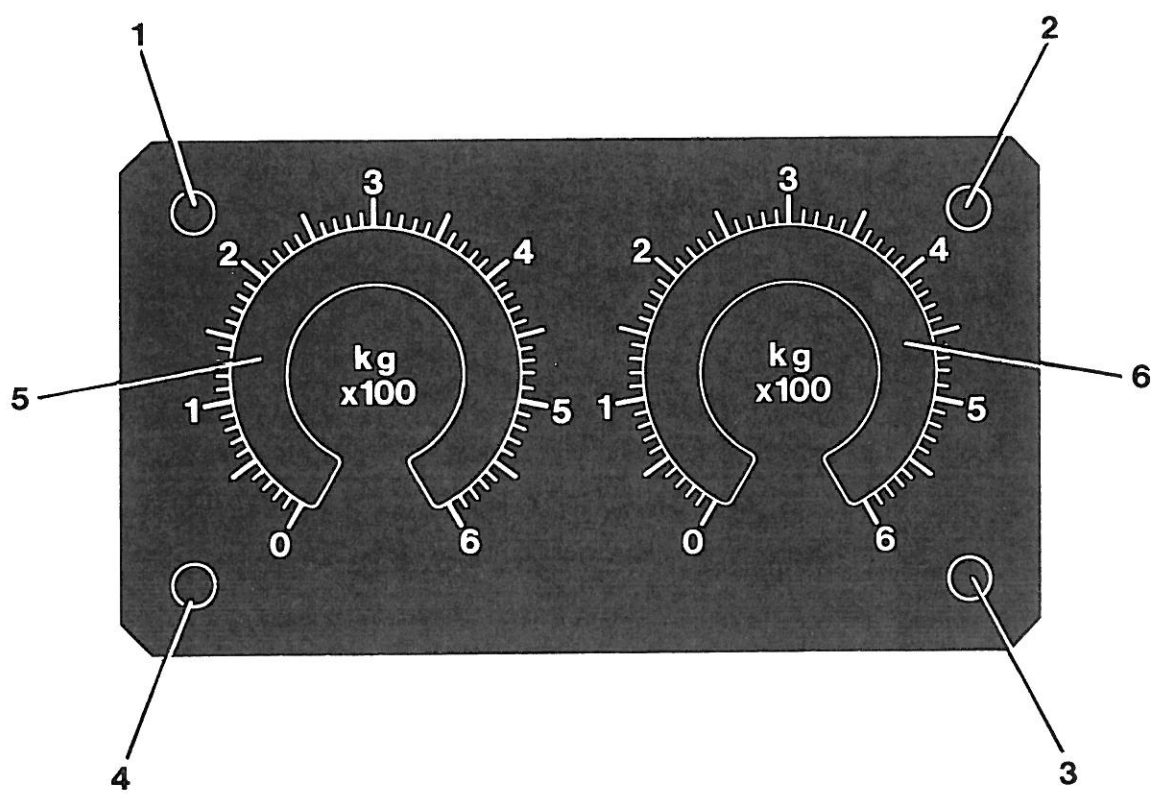


FIG.6

STANDARD HANDSET

(References are to Fig.7.)

The Standard Handset may be used if the system includes the Analogue Display, otherwise the Display Handset must be used.

- Button Nos.1 & 2 - Start left and right hand rollers respectively. (Note: the lower half of each button showing the symbol for reverse roller direction is only applicable when the handset is fitted to other models of brake tester. For the 660, both upper and lower halves operate the same switch. 
- Button No.3 * - Actuates the Printer/Plotter to provide a copy of the test results without the graph. Text only. 
- Button No.4 * - Actuates the Printer/Plotter to provide a copy of both the numerical test results and graph. 
- Button No.5 - Stops the Pit/Roller units. 

DISPLAY HANDSET

(References are to Fig.8)

- Button Nos.1 & 2 - Start left and right hand rollers respectively. (Note: the lower half of each button showing the symbol for reverse roller direction is only applicable when the handset is fitted to other models of brake tester. For the 660, both upper and lower halves operate the same switch. 
- Button No.3 * - Actuates the Printer/Plotter to provide a copy of the test results without the graph. Text only. 
- Button No.4 * - Actuates the Printer/Plotter to provide a copy of both the numerical test results and graph. 
- Button No.5 - Stops the Pit/Roller units. 
- Digital Display 6 - This three digit display gives a continuous **average** reading of either L.H. Braking Effort, R.H. Braking Effort, Imbalance or Brake Pedal Force (optional 'Pressometer' unit). The display will automatically show the Braking Effort for the side for which the rollers were last started, however the display can be changed to show any of the other variables by operating the 'Step' button. (Button No. 8).

At the end of a test the peak value of Imbalance or either Braking Effort is automatically displayed.

If the display is set to show a reading for which no valid data is available, a line of dashes will be displayed, e.g. when flag points to 'Imbalance' symbol and only one side is tested or the 'pedal' symbol when no 'Pressometer' is connected.

- Flag 14 - This flag points to a symbol showing which variable is being displayed. The flag is moved and the variable displayed is changed by operating the 'step button'. The flag is static when a 'live' reading is being displayed and flashes when showing a peak value. 

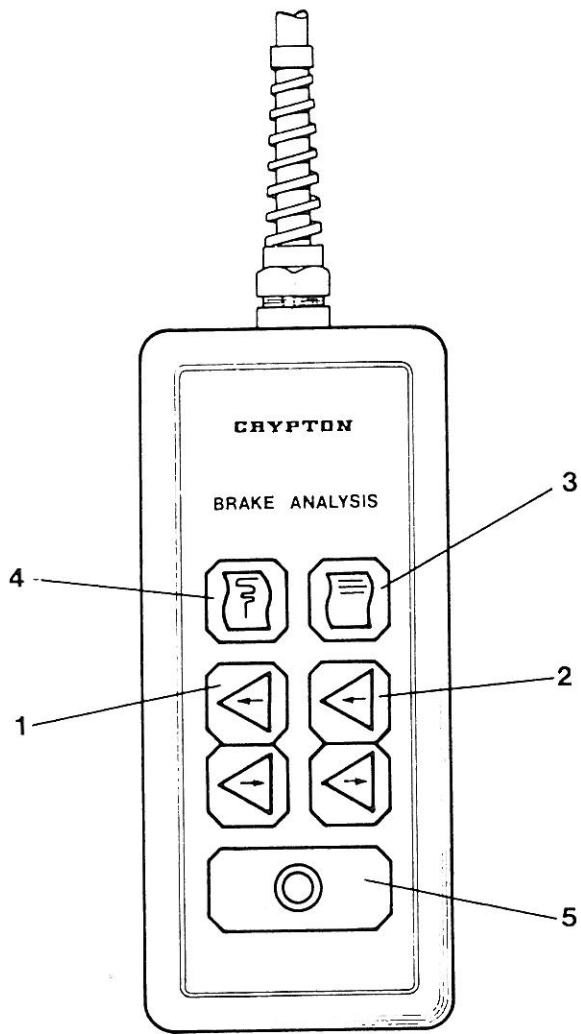


FIG. 7

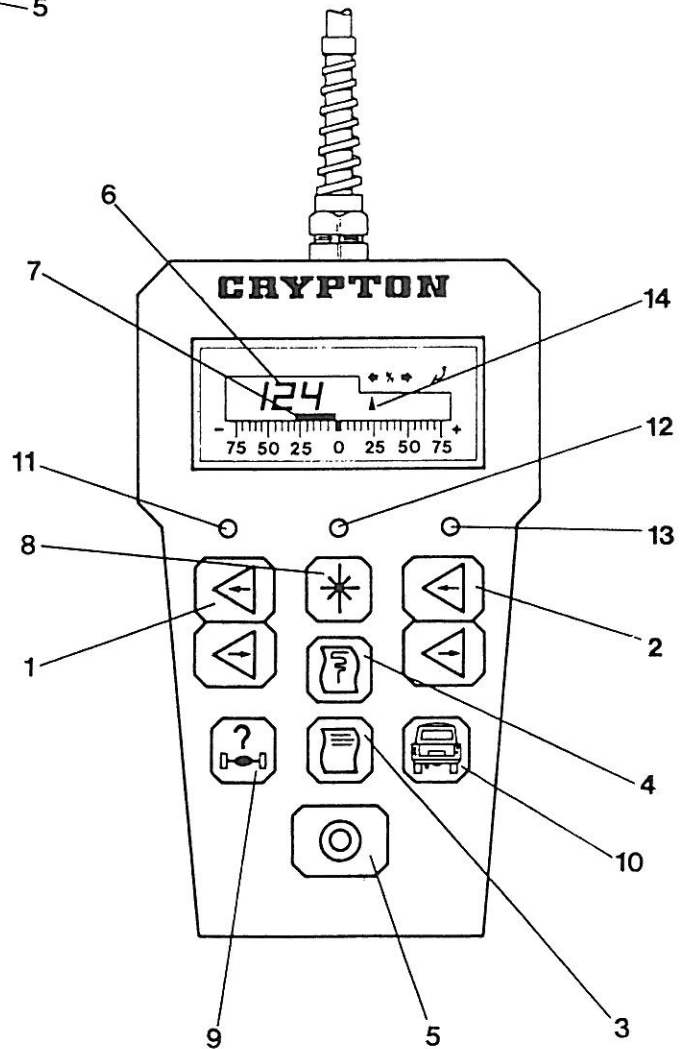


FIG. 8

Bar Graph 7

- Below the 3 digit display, a bar graph gives a continuous indication of any instantaneous change (+ve or -ve) in the variable currently being shown by the digital display. For Brake Effort readings the bar graph reads in steps of 5kg.

When the display is set to read 'percentage imbalance', the extreme left or right hand segment will flash to indicate which side currently has the higher effort.

Button No.8

- A 'Step' button which changes the variable displayed from L.H. Braking Effort to percentage Imbalance to R.H. Braking Effort to Pedal Pressure and back to the start of the sequence. The 'Step' button also moves the flag (14) to the appropriate symbol.



- * If the 'Axle Number' button has been depressed, the 'Step' button will increment the Axle Number (up to 8) allotted to the test.

(When the machine is in the Calibration mode, this button has the same function as the 'Accept' button on the calibration panel - see page 40).

Button No.9 *

- The 'Axle Number' button displays the axle number associated with the test in progress e.g. (A-3) and enables it to be incremented by the 'Step' button, (8). Exit from this mode by pressing again.



Button No.10 *

- The 'New Test' button resets the stored axle number to '1'. The axle number is displayed momentarily.



Lamp No.11 (Red)

- Lights when L.H. motor is running.

Lamp No.12 (Amber)

- Lights when Printer/Plotter is operating.

Lamp No.13 (Red)

- Lights when R.H. motor is running

NOTES:

1. * These functions do not operate unless a Printer/Plotter is 'on line'.

PRINTER/PLOTTER

The Printer/Plotter unit produces a permanent four colour record of the test results and graphs of the Brake Efforts, Imbalance and Pedal Force (Pressometer option) against time.

The unit may be pedestal or desk mounted.

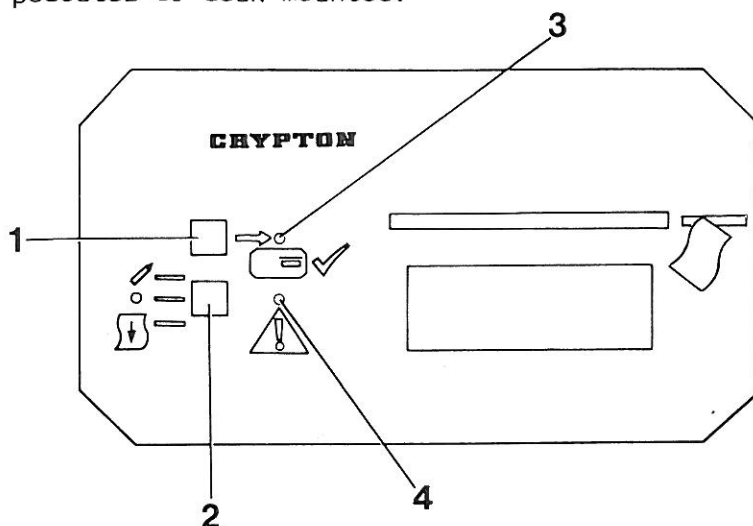


FIG.9

The ON/OFF switch is mounted on the back of the unit.

- IMPORTANT:**
1. DO NOT tear the paper off when the printer is running (i.e. when the red lamp is on).
 2. Only tear the paper in a DOWNWARDS direction.

Controls to command the unit to print and plot the results of a test are incorporated in the handset. Additional controls on the Printer/Plotter are as follows:

(References are to Fig.9)

- Button No.1 (Red) - Press to put the unit 'on line'. Press again to come 'off line'.
- Switch No.2 (Yellow) - Push up to change the coloured pens. Push down to feed the paper through.
- Lamp No.3 (Amber) - Lights when unit is 'on line'.
- Lamp No.4 (Red) - Lights when a print-out is in progress and flashes when paper is exhausted or when the batteries require replacing.

NOTE: The printer should always be 'off line' if its 'mains' power is to be switched off. (Otherwise the Controller will see this as a 'fault'.)

SETTING UP THE CLOCK/CALENDAR

1. Ensure that the Printer/Plotter is 'off line' i.e. the amber lamp (3) is out; press the red button (1) if necessary.
2. Switch off 'mains' power to the unit (rocker switch on rear of unit).
3. Rotate the two fasteners located in the top corners of the front panel. Open panel.
4. Ensure that neither the paper roll nor the pens are exhausted.
5. Locate the two rotary switches and push button on the bottom left hand side of the printer chassis. These are used to enter the data as required.
6. Push the black button to the immediate right of the two red switches and while keeping it depressed, switch the unit 'ON'. The unit will print 'CLOCK SETTING SELECTED'. Release the button.

The unit will instruct the user by printing the required settings, in the order month, date, hour, minute and year. The button is used to enter each setting.

The clock operates in the 24 Hour format.

When the last setting has been made, the unit will print 'CLOCK SETTING COMPLETE' and will follow this with the current time and date e.g.

```
'DATE:- 12-09-87
  TIME:- 15.45'
```

If any part of this printed date and time needs to be altered, the whole procedure must be repeated (steps 2 to 6).

7. Feed the loose end of the paper through the slot in the front panel.
8. Insert the hinge on the front panel into the slot at the bottom of the case and re-fit the front panel.
9. Pull the loose end of the paper protruding through the front panel to ensure that the paper has not been folded when the front panel was fitted.

NOTES ON OPERATION OF THE PRINTER/PLOTTER

- a) The Printer/Plotter stores internally 20 seconds of brake test. This is normally adequate for a standard test. If a test exceeds this time, only the last 20 seconds are retained. A warning to the operator will be printed in this event.
- b) The Printer/Plotter will produce a graph or text print on demand only when a test has been completed (motors stopped).
- c) The Printer/Plotter can print a test and simultaneously store the results of a subsequent test. The print-out of the subsequent test will be available on demand when i) the first print-out is complete, and ii) the subsequent test is complete.
- d) It is not necessary to print every test, the Printer/Plotter will automatically update with the last test completed.
- e) Providing i) no subsequent tests are performed, or ii) the unit is taken 'off line' prior to starting a test, re-prints of a test are available on demand until the Printer/Plotter is switched off.
- f) The Printer/Plotter will only go 'off line' providing it is not printing and no test is in progress. At other times, if the red button is pressed, the yellow lamp will flash. This can be cancelled by pressing again, or left flashing, when the printer will go 'off line' at the first opportunity.
- g) The full 'Header' information will not be printed for axle numbers set to 2 or greater.
- h) The simple text print-out is intended for record keeping and does not automatically feed out of the Printer/Plotter. If it is required to extract the print-out, use the yellow switch. The full graphical plot will automatically feed out.
- i) The Printer/Plotter uses a plain paper roll and draws scales automatically to produce the largest graph.

BRAKING MEASUREMENT - UNITED KINGDOM MOT REQUIREMENTS

The Department of Transport in the U.K. stipulates that braking systems shall meet certain standards of efficiency and balance.

1. **Efficiency** - the ratio between the retarding force produced by the brakes and the weight of the vehicle on which they act. This is usually expressed as a percentage. The D.Tp. requirements for footbrake testing are that the wheels of each axle shall be tested individually. The total retarding force so produced, when divided by the vehicle unladen weight plus approx. 140kg (300 lb), must give an efficiency of at least 50%. For the handbrake, the efficiency must be at least 25% for vehicles having a 'single circuit' footbrake system or at least 16% for vehicles with a 'split/dual' circuit footbrake system.

NOTE: The vehicle weight should be obtained from a data chart.

The brake efficiency/balance calculator provides a simple method of determining the efficiency.

Example: Weight of vehicle = 2240 lb

 Total Retarding force = 1680 lb

 (% efficiency = $\frac{1680}{2240} \times 100 = 75\%$)

Set weight of vehicle on outer disc against brake effort on inner disc. Take the reading indicated by the pointer in the window of the inner disc, in this example 75%.

2. **Brake Balance** - this is the relationship of the retarding forces of two independently braked wheels on the same axle. For D.Tp. test purposes the two steered wheels on the same axle must produce a retarding force where the lower brake effort is not less than 75% of the higher brake effort.

ANALOGUE DISPLAY ONLY

The brake efficiency/balance calculator provides a simple method of determining this requirement.

Example: Offside wheel 440 lb

 Nearside wheel 550 lb

 (Balance ratio = $\frac{440}{550} = 0.8$)

Set the greater reading on the inner disc of the calculator against the smaller reading on the outer disc. Take the reading indicated by the pointer in the window of the inner disc, in this example 0.8 (i.e. the offside wheel's reading is 80% that of the nearside wheel).

DIGITAL DISPLAYS

Where a digital display of the imbalance is available (Display Handset 684) a direct reading is given of the difference between the brake efforts as a percentage of the greater. This should not exceed 25%.

NOTE: This meets the Department of Transport requirements as defined above.

BRAKING MEASUREMENT - NON-U.K. REQUIREMENTS

Certain other means of expressing braking performance may be required in some overseas areas as follows:

1. Parking brake effort required to keep a vehicle stationary on a gradient.

For a gradient of 1 in x

x = horizontal distance

$$\text{Then } y^2 = x^2 + 1^2 \text{ or } y = \sqrt{x^2 + 1}$$

1 = vertical distance

y = sloping distance

$$\text{Also } BE = \frac{W}{y}$$

BE = brake effort

W = laden weight of vehicle

$$\text{Hence } BE = \frac{W}{\sqrt{x^2 + 1}}$$

Example:

Find brake effort required to hold a vehicle on a gradient of 1 in 8.

$$BE = \frac{W}{\sqrt{8^2 + 1}} = \frac{W}{\sqrt{65}} = \frac{W}{8.062} = 0.124W$$

i.e. The brake effort must be greater than 12.4% of the laden vehicle weight or the braking efficiency must be greater than 12.4%.

2. Brake effort necessary to produce a given deceleration

$$BE = \frac{a}{g} \cdot W$$

BE = brake effort

a = deceleration

W = weight of vehicle

g = acceleration due to gravity
= 32.2ft/sec² or 9.81 m/s²

NOTE: 'a' and 'g' must both be in the same units
i.e. both in ft/sec² or both in m/s²

Example:

Find brake effort necessary to produce a minimum deceleration of 1.9 m/s²

$$BE = \frac{1.9}{9.81} W = 0.1937 W$$

i.e. The brake effort must be greater than 19.37% of the laden vehicle weight or the braking efficiency must be greater than 19.37%.

3. Stopping distance from a given speed with a given deceleration

$$s = \frac{v^2}{2a}$$

s = stopping distance in metres

v = initial speed in metres/second

a = deceleration in metres/second²

NOTE: Where 'v' is given in km/hour and 'a' in m/s²,

the formula becomes $s = 0.0772 \cdot \frac{v^2}{2a}$ metres

Also, where 'v' is given in m.p.h. and 'a' in ft/sec²,
the formula becomes $s = 2.151 \cdot \frac{v^2}{2a}$ feet.

Example:

Find stopping distance from 35 km/hour with a deceleration of 1.9 m/s²

$$s = 0.0772 \cdot \frac{35^2}{2 \times 1.9} = 24.87 \text{ metres}$$

i.e. The stopping distance is 25 metres, nearly.

4. Brake effort necessary to stop in a given distance from a given speed

As before $BE = \frac{a}{g} \cdot W$ and $a = \frac{v^2}{2s}$

BE = brake effort

a = deceleration in m/s²

v = initial speed in m/s

s = stopping distance in metres

g = 9.81 m/s²

W = laden weight of vehicle

$$BE = \frac{v^2}{2gs} \cdot W$$

NOTE: Where 'v' is given in km/hour, 'g' in m/s² and 's' in metres,

the formula becomes $BE = 0.0772 \cdot \frac{v^2}{2gs} \cdot W$

Also, where 'v' is given in mph, 'g' in ft/sec² and 's' in feet,

the formula becomes $BE = 2.151 \cdot \frac{v^2}{2gs} \cdot W$

Example:

Find the brake effort necessary to stop in 13 metres minimum from 35km/hour

$$BE = 0.0772 \cdot \frac{35^2}{2 \times 9.81 \times 13} \cdot W = 0.371W$$

i.e. The brake effort must be greater than 37.1% of the laden vehicle weight
or the braking efficiency must be greater than 37.1%.

IMPORTANT INFORMATION FOR BRAKE TESTER OPERATORS

Vehicle brake testing on the road cannot be compared with the roller method of testing. Both methods have advantages and disadvantages but roller testing is now widely accepted as giving repeatable results under controlled conditions with a high degree of safety.

A slip-sensing circuit is incorporated in the Crypton 660 brake tester which stops the rollers from turning immediately a tyre starts to slip on the main rollers. This is an extremely reliable arrangement having separate circuits for each set of rollers, but in the rare event of a system failure operators **MUST ALWAYS** be ready to lift their feet from the brake pedal or release the handbrake should the rollers continue to turn for more than a few seconds after wheel slip has been reached.

IMPORTANT:

1. EVERY OPERATOR OF A BRAKE TESTER SHOULD APPRECIATE THAT HE IS IN CHARGE OF A POWERFUL MACHINE WHICH MUST BE USED WITH CARE.
2. WHEN THE DRIVEN WHEELS ARE ON THE BRAKE TESTER ROLLERS, ALWAYS START THE ROLLER UNITS BEFORE ATTEMPTING TO MOVE THE VEHICLE.

Brake tests should always be carried out with tyres inflated to the correct pressures and, where practicable, having dry surfaces. Wheel chocks should be used when checking the rear brakes of the majority of cars, or the front brakes of rear-engined cars, i.e. when checking brakes on the more lightly loaded axle.

The manufacturer will not accept claims from users of brake testers for tyres damaged during any kind of roller brake test. Always make sure that tyres are in good condition before starting the brake testing sequence.

NOTE: Always centralise the vehicle before a test by running both rollers without applying the foot or hand brake.

INFORMATION REGARDING SPECIFIC VEHICLE TYPES

The following notes include some requirements and advice covered by D.Tp. Special Notices. However, they apply to roller brake testing generally and not to the MOT test specifically.

1. DAF-VOLVO VEHICLES

- a) All DAF models with the exception of the DAF 66.

Testing the rear wheels of these vehicles on a roller brake tester may result in incorrect braking figures, damage to the drive belts and damage to the transmission units.

For these models all brake performance tests must, therefore, be done with a decelerometer.

- b) DAF 66, Volvo 66 and Volvo 343.

These models incorporate a differential action in the transmission and the rear wheels may, therefore, be tested on a roller brake tester without a risk of damage. However, the transmission may cause more drag than is usual for other vehicles and allowance should be made for this.

2. TRANSMISSION HANDBRAKES

Where a transmission handbrake is to be checked, the procedure should be modified as follows:

- a) Run both left and right hand sets of rollers simultaneously.
- b) Apply the brake slowly and progressively, releasing it fully as soon as there is any sign of transmission snatch.

If transmission snatch has been experienced, the test must be repeated when the drum or band has cooled down.

3. VEHICLES WITH INDEPENDENT FRONT SUSPENSIONS HAVING SWINGING LEADING ARMS E.G. CITROEN 2CV, AMI, DYANE AND DERIVATIVES

Vehicles with this type of front suspension have a tendency to steer to full lock if both front wheels are tested together. This may cause tyre damage. Front wheel brake testing should, therefore, be modified as follows:

- a) Hold the steering wheel in the straight ahead position and resist any tendency for the front wheels to steer to either side.
- b) Apply and release the foot brake slowly and carefully while observing the brake effort readings.
- c) The above comments apply to the handbrake test also.

4. FOUR WHEEL DRIVE VEHICLES (PERMANENTLY ENGAGED TYPE)

In vehicles with a permanently engaged four wheel drive, the engine torque is split between front and rear wheels. This arrangement makes these vehicles unsuitable for roller brake testing. The brake performance test must, therefore, be carried out using a decelerometer.

5. FOUR WHEEL DRIVE VEHICLES (WITH FACILITY FOR UNLOCKING)

When vehicles are presented for test with a four wheel drive system that can be unlocked, testing can be performed as normal, although higher drag readings may be obtained.

6. FOUR WHEEL DRIVE VEHICLES (WITH FLUID COUPLING)

Vehicles with a fluid coupling between the front and rear wheels should be tested with caution. Consult the vehicle manufacturer or agent, as some vehicles are subject to time or speed restrictions in this type of brake test.

7. FRONT WHEEL DRIVE VEHICLES

- a) Some difficulty may be found in achieving an adequate performance with the hand brake on front wheel drive vehicles where this operates on the rear wheels. Where this low maximum brake effort reading is caused by loss of tyre adhesion, it can usually be improved by loading the rear of the vehicle.
- b) When testing the front wheels of vehicles with trailing arm rear suspension there may be a tendency for the vehicle to pivot forward; that is to say, the rear will lift relative to the front. This may pull the front wheels backwards and cause them to slip on the rollers prematurely. This effect can be reduced by testing the wheels individually.
- c) Where a limiting valve is fitted in the rear brake system, unsatisfactory readings will be obtained from the front wheels because the rear wheels will not lock sufficiently to hold the vehicle steady; e.g. Renault 4L. Where a vehicle uses this system it is essential to chock the rear wheels.
- d) The limiting valve in the rear brake system also results in a change in the front to rear braking effort balance. When the pressure reaches a predetermined level, the valve will close and any further pressure applied to the brake system is transferred to the front brakes.

Thus the maximum readings achieved for the rear wheels will be significantly less than those obtained for the front. The brake efficiency, however, should be calculated in the usual way.

8. THREE WHEELED VEHICLES

The pit units of the 660 have individual wheel sensing. The single wheel to be tested can be driven into either pit unit as convenient - only that pit unit will start.

9. SPECIAL LIGHT WEIGHT OR SPACE SAVING TYRES

Some vehicles are supplied with special spare wheels and tyres intended to save space. The tyres are of a different size and type compared with those on the normal road wheels. These wheels are only intended for use in an emergency and should NOT be fitted during a brake test.

CARRYING OUT BRAKE TESTING

POWER UP PROCEDURE

1. Ensure that the auto and calibration switches on the calibration panel (Page 34, Fig.10, items 1 & 4) are in the normal running positions, (Symbol ).
2. Move the mains switchfuse to 'ON'.
3. The master status lamp on the Controller will light and should go out after five seconds. (If it fails to extinguish, see page 36.)
4. Check that after a few seconds the displays show zero. The flag on the Display Handset will point to the L.H. Braking Effort (Symbol ).
5. If any of the lamps on the Analogue Display are flashing, check that step 1 above has been correctly followed.
- 6.* Press the red button on the front of the Printer/Plotter unit (if fitted).

- NOTES:**
1. When the brake tester is first switched on, it should be allowed to warm up for ten minutes before any tests are carried out.
 2. The machine can be left switched on during working hours, provided that the safety precautions itemised on page 1 are observed.

TEST PROCEDURE (In accordance with MOT testing requirements)

A. FOR USE WITH AN ANALOGUE DISPLAY

1. Ensure that the 'auto' and 'calibration' switches on the calibration panel (Fig. 10, items 1 & 4) are in the normal running positions (Symbol ).
2. Examine the tyres to check that they are inflated correctly and in good condition.
3. Determine whether the vehicle has a split (dual) braking system; (minimum handbraking efficiency requirements depend on this).
4. Open the hinged roller cover plates. Align the vehicle at right angles to the rollers and then drive the front wheels onto them, selecting neutral gear when the wheels are in position.
5. Without applying either the foot brake or the handbrake, start both sets of rollers to centralise the vehicle. Ensure that the tyres are not rubbing against any of the cover plates. Do not attempt to 'steer' the vehicle. 
6. Stop the rollers. 
7. Place chocks behind the rear wheels.

NOTES: a) The rollers and the floor adjacent to them must be kept free of grease, oil and water to ensure that the tyres have adequate grip.

b) The vehicle engine should be kept running during all the tests if the brakes are servo-assisted.

* c) Ensure that the exhaust extractor/ventilation system is switched on.

* Items marked with an asterisk are not part of the MOT test procedure.

9. SPECIAL LIGHT WEIGHT OR SPACE SAVING TYRES

Some vehicles are supplied with special spare wheels and tyres intended to save space. The tyres are of a different size and type compared with those on the normal road wheels. These wheels are only intended for use in an emergency and should NOT be fitted during a brake test.

CARRYING OUT BRAKE TESTING

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3. The master status lamp on the Controller will light and should go out after five seconds. (If it fails to extinguish, see page 36.)
4. Check that after a few seconds the displays show zero. The flag on the Display Handset will point to the L.H. Braking Effort (Symbol ).
5. If any of the lamps on the Analogue Display are flashing, check that step 1 above has been correctly followed.
- 6.* Press the red button on the front of the Printer/Plotter unit (if fitted).

- NOTES:**
1. When the brake tester is first switched on, it should be allowed to warm up for ten minutes before any tests are carried out.
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A. FOR USE WITH AN ANALOGUE DISPLAY

1. Ensure that the 'auto' and 'calibration' switches on the calibration panel (Fig. 10, items 1 & 4) are in the normal running positions (Symbol ).
2. Examine the tyres to check that they are inflated correctly and in good condition.
3. Determine whether the vehicle has a split (dual) braking system; (minimum handbraking efficiency requirements depend on this).
4. Open the hinged roller cover plates. Align the vehicle at right angles to the rollers and then drive the front wheels onto them, selecting neutral gear when the wheels are in position.
5. Without applying either the foot brake or the handbrake, start both sets of rollers to centralise the vehicle. Ensure that the tyres are not rubbing against any of the cover plates. Do not attempt to 'steer' the vehicle. 
6. Stop the rollers. 
7. Place chocks behind the rear wheels.

NOTES: a) The rollers and the floor adjacent to them must be kept free of grease, oil and water to ensure that the tyres have adequate grip.

b) The vehicle engine should be kept running during all the tests if the brakes are servo-assisted.

* c) Ensure that the exhaust extractor/ventilation system is switched on.

* Items marked with an asterisk are not part of the MOT test procedure.

8. Start the left hand roller unit and apply light pressure to the foot brake to remove moisture from the brake linings etc. During this period observe the left hand dial for any unusual brake behaviour (see page 30 onwards). 
 9. Gradually increase the pressure on the foot brake until a slip condition is reached when the rollers will automatically stop. If the slip condition cannot be reached, press the 'Stop' button. Note the maximum braking effort shown on the left hand Analogue Display. 
 - 10.* Press either of the 'print' buttons if required. (If Printer/Plotter option fitted).  
 11. Repeat steps 8, 9 and 10 for the right hand roller unit
 12. Start both sets of rollers.  
 13. Gradually depress the foot brake and watch the way in which the braking effort at each wheel builds up. Increase the pressure so that the braking effort reaches about 80% of the maximum reached when the wheels were tested individually but not enough to cause 'slip'. Gradually release the pressure and watch the way in which the braking effort at each wheel reduces.
 14. Press the 'Stop' button and note the retained readings of both dials and hence the out-of-balance. 
 - 15.* Press either of the 'Print' buttons if appropriate.  
 16. If the vehicle has a parking brake which operates on the front wheels start the left hand set of rollers and apply the parking brake, keeping the 'hold-on' button or trigger depressed. Increase the force on the parking brake to achieve a maximum braking effort. Stop the rollers and note the maximum braking effort shown by the left hand dial. Release the parking brake.  
 17. Repeat the procedure of step 16 for the right hand wheel.
 18. Drive the vehicle forward so that the rear wheels drop onto the rollers.
IMPORTANT: The rollers must be started before moving if the vehicle has front wheel drive.
 19. Select neutral and start both sets of rollers to centralise the vehicle.  
NOTE: Where the vehicle has unequal wheelbase measurements on either side e.g. Renault, the rear wheels should be driven onto the rollers at a slight angle to the left or right according to which side has the shorter wheelbase.
 20. Stop the rollers. 
 21. Place chocks behind both front wheels.
 22. Carry out the procedure described in steps 8 to 15.
 23. If the vehicle has a parking brake which operates on the rear wheels, repeat the procedure described in steps 16 and 17.
 24. Remove the chocks. Drive the vehicle off the rollers, stop the rollers and close the hinged covers. 
- IMPORTANT:** The rollers must be started before moving if the vehicle has rear wheel drive.

* Items marked with an asterisk are not part of the MOT test procedure.

B. FOR USE WITH A DISPLAY HANDSET

1. Ensure that the 'auto' and 'calibrate' switches on the calibration panel (Fig.10, items 1 & 4) are in the normal running positions (Symbol ).
 2. Examine the tyres to check that they are inflated correctly and in good condition.
 3. Determine whether the vehicle has a split (dual) braking system; (minimum handbrake efficiency requirement depends on this).
 4. Open the hinged roller cover plates. Align the vehicle at right angles to the rollers and then drive the front wheels onto them, selecting neutral gear when the wheels are in position.
 5. Without applying either the foot brake or the hand brake, start both sets of rollers to centralise the vehicle. Ensure that the tyres are not rubbing against any of the cover plates. Do not attempt to 'steer' the vehicle. 
 6. Stop the rollers. 
 7. Place the chocks behind the rear wheels.
- NOTES:**
- a) The rollers and the floor adjacent to them must be kept free of grease, oil and water to ensure that the tyres have adequate grip.
 - b) The vehicle engine should be kept running during all the tests if the brakes are servo-assisted.
 - * c) Ensure that the exhaust extractor/ventilation system is switched on.
- 8.* Press the 'New Test' button (if the optional Printer/Plotter unit is fitted and 'on line'). 
 9. Start the left hand roller unit and apply light pressure to the foot brake to remove moisture from the brake linings etc. During this period, observe the LCD bar graph on the handset for any unusual brake behaviour (see page 30 onwards). 
 10. Gradually increase the pressure on the footbrake until a slip condition is reached when the rollers will automatically stop. If the slip condition cannot be reached, press the 'Stop' button. Note the maximum braking effort displayed  on the handset.

* Items marked with an asterisk are not part of the MOT test procedure.

- 11.* Press either of the 'Print' buttons if appropriate. 
 12. Repeat steps 9, 10 & 11 for the right hand roller unit.
 13. Start both sets of rollers, firstly the R.H. and then the L.H. side. 
 14. The handset will display the braking effort for the L.H. set of rollers.
 15. Gradually depress the foot brake and watch the way in which the braking effort builds up. Increase the pressure so that the braking effort reaches about 80% of the maximum reached when the wheels were tested individually, but not enough to cause slip. Gradually release the pressure and watch the way in which the braking effort reduces.
- NOTE:** If a skid/slip condition occurs, start again from step 13.
16. Press the 'Step' button twice so that the display shows the braking effort for the R.H. wheel (the flag to the right of the numerical display will point to the appropriate Symbol, ). 
 17. Repeat step 15 for the other front wheel.
 18. Press the 'Step' button three times so that the display shows the percentage imbalance between the wheels (the flag will point to the Symbol %). 
 19. Gradually depress and then gradually release the foot brake, as described in step 15, whilst observing the way in which the imbalance changes as indicated by the display and the bar graph.
 20. Press the 'Stop' button and note the maximum percentage imbalance displayed. 
 - 21.* Press either of the 'Print' buttons if appropriate. 
 22. If the vehicle has a parking brake which operates on the front wheels, start the left hand set of rollers and apply the parking brake, keeping the 'hold-on' button or trigger depressed. Increase the force on the parking brake to achieve a maximum braking effort. Stop the rollers and note the displayed maximum braking effort. Release the parking brake. 

 23. Repeat the procedure of step 22 for the right hand side.
 24. Drive the vehicle forward so that the rear wheels drop onto the rollers.
- IMPORTANT:** The rollers must be started if the vehicle has front wheel drive,
25. Select neutral and start both sets of rollers to centralise the vehicle. 
- NOTE:** Where the vehicle has unequal wheelbase measurements on either side e.g. Renault, the rear wheels should be driven onto the rollers at a slight angle to left or right according to which side has the shorter wheelbase.

* Items marked with an asterisk are not part of the MOT test requirements.

26. Stop the rollers.

27. Place chocks behind both front wheels.

28.* Press the 'Axle Number', 'Step' and 'Axle Number' buttons in that sequence if the optional Printer/Plotter unit is fitted.

29. Carry out the procedure described in steps 9 to ~~17~~ 19

30. STOP THE ROLLERS

31. If the vehicle has a parking brake which operates on the rear wheels, repeat the procedure described in steps 22 & 23.

32. Remove the chocks. Drive the vehicle off the rollers, stop the rollers and close the hinged covers.

IMPORTANT: The rollers must be started before moving if the vehicle has rear wheel drive.

* Items marked with an asterisk are not part of the MOT test procedure.

THIS COMPLETES THE MOT TEST PROCEDURE (see page 17 for methods of calculation).

USE OF PRESSOMETER UNIT - (Optional with Printer/Plotter Unit) - 687

The 'Pressometer' measures the brake pedal force. Typical pedal forces necessary to produce the full braking effort are as follows:

	FRONT WHEELS	REAR WHEELS
Manual System	20 - 30kg	30 - 50kg
Servo System	10 - 20kg	30 - 50kg

These figures must only be used as a guide. Use the vehicle manufacturer's specification for exact figures.

The Pressometer, which is worn over the foot when operating the brake pedal, displays a continuous reading on the Display Handset. It facilitates the diagnosis of braking system faults (see page 30).

NOTE: The 'Step' button on the handset must be operated to move the flashing flag to the 'pedal' symbol (extreme R.H. position) to display the pedal force.

The pedal force reading will always reflect the force being applied to the pedal at the moment in question i.e. peak readings are not 'held'.

BRAKING SYSTEM FAULT ANALYSIS

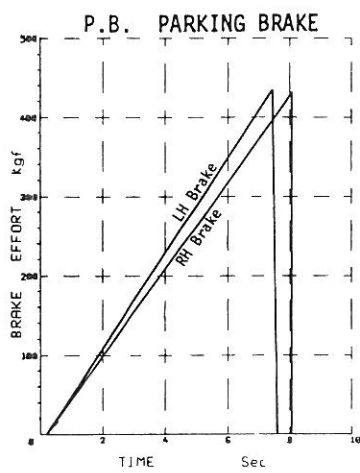
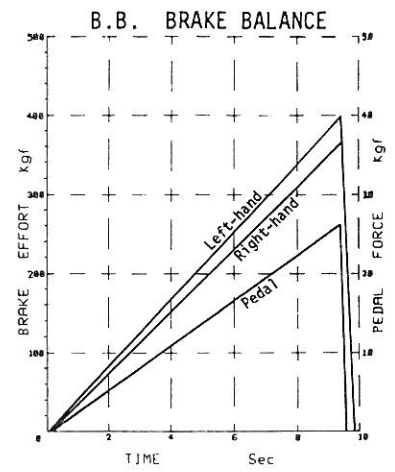
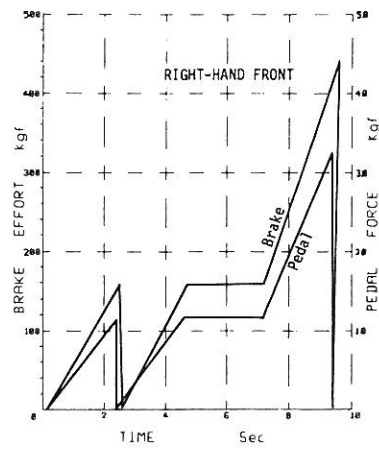
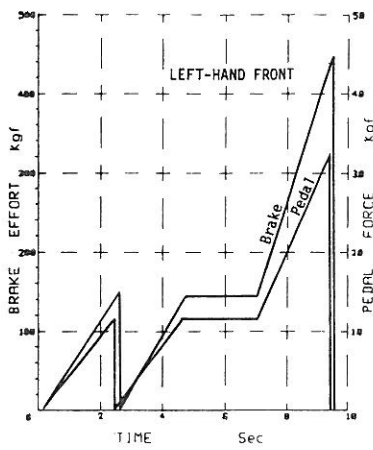
Quite apart from the roller brake tester's main task of measuring brake efficiency, it has a very important secondary role as a fault finding tool.

Although the peak braking effort reading is required to ensure that the vehicle meets the legal requirements, the shape of the Braking Effort graph can provide evidence which will point to the problem area.

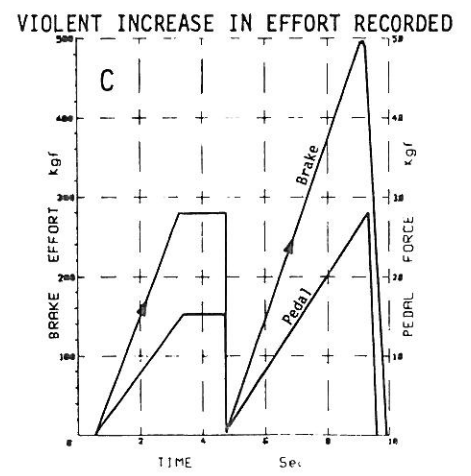
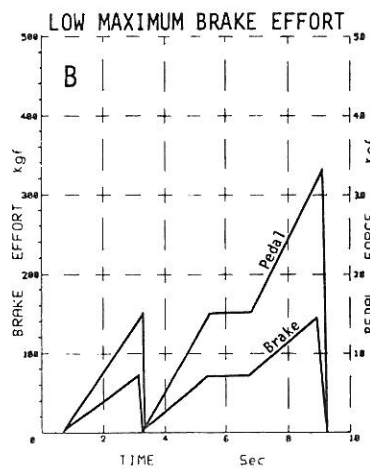
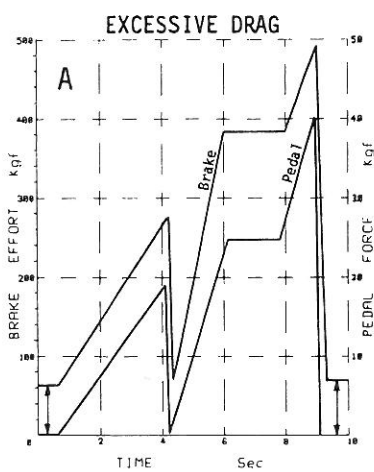
The following illustrates typical system faults:

Indication	Fault
A. Excessive drag reading with no pedal effort.	Over-adjustment of the brake, resulting in a high rate of brake wear and excessive fuel consumption. A binding brake, overtight or broken wheel bearing, lack of lubrication or excessively worn differential (if driving wheel).
B. Very low reading which cannot be improved even with increased foot pressure.	Brakes are not mechanically effective or they are oil or water soaked. Check oilseals if oil soaked.
C. Reading leaps up violently.	Grease or tacky oil on linings.

STANDARD TRACES

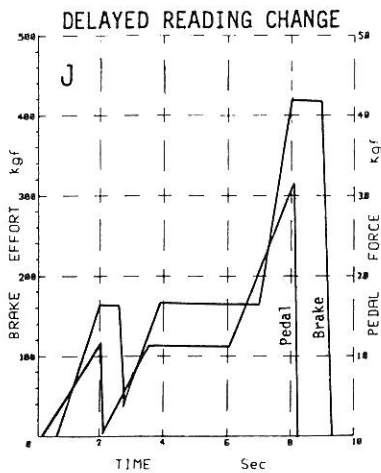
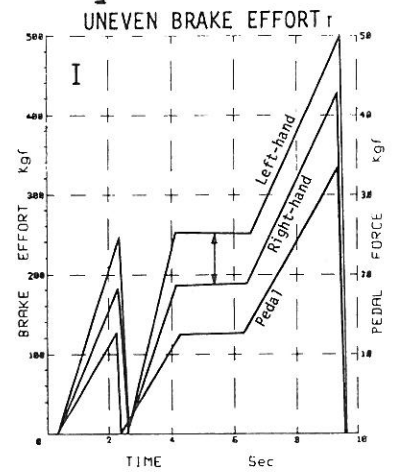
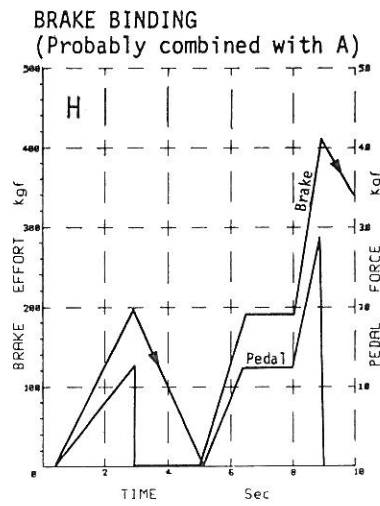
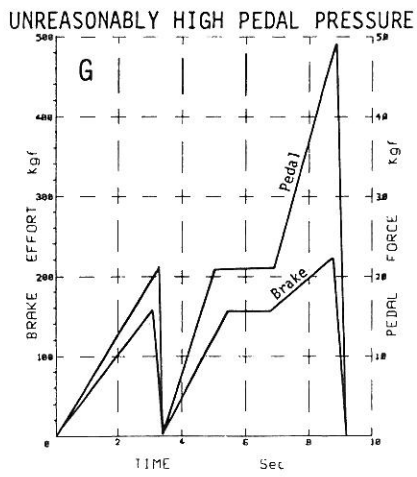
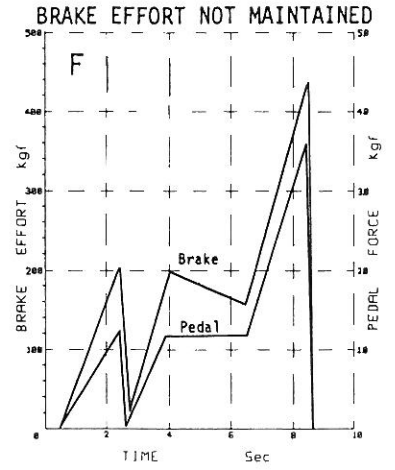
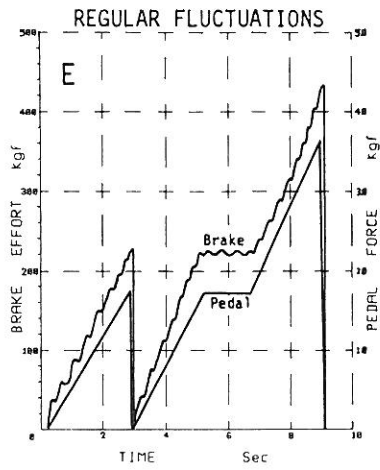
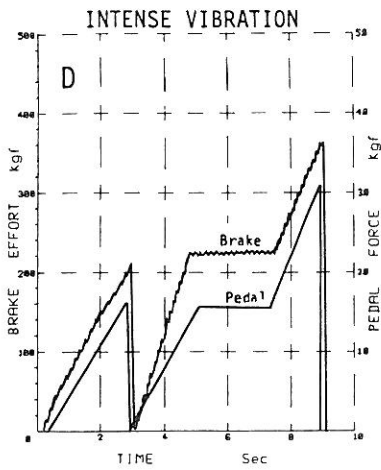


FAULT PATTERNS



- | | |
|---|---|
| D. Intense vibration of needle which is hard to read. | This effect is usually caused by glazed or baked linings. |
| E. Extensive regular fluctuation of reading with each half revolution of the wheel. | Oval or eccentric brake drums. Warped discs. |
| F. Reading starts to drop; foot pressure fails to hold. | Leak in air supply, hydraulic supply or master cylinder. |
| G. Unreasonably high pedal pressure needed to obtain average efficiency readings. | <p>Sticking master cylinder, wheel cylinder or inefficient brakes. When brakes have servo assistance, examine servo mechanism.</p> <p>If one plunger is seized in a wheel cylinder or pad caliper, only one brake shoe will be actuated. This fault is shown by the reading on the meter, which will be approximately 50% of the braking effort indicated for the other wheel on the same axle.</p> |
| H. Reading will not return to zero. | Brake binding, excessive mechanical friction, brake cylinder/caliper sticking or faulty adjusters. |
| I. Uneven braking effort of wheels on the same axle. | Seized brake mechanism inside or outside of brake drum, on one side of axle. Oil seal defective in one drum, etc. Worn linings or pads. |
| J. Delayed reading change after depressing or releasing pedal. | <p>Mechanical defect in braking system. Brake shoe action should be checked.</p> <p>Alternatively, sluggish action of servo mechanism. Sticking piston.</p> |
| K. Matched brake readings on rollers produces skid effect on road. | Mechanical fault - probably loose 'U' bolts allowing axle to move. (Fault not apparent from graphs.) |

FAULT PATTERNS (CONT)



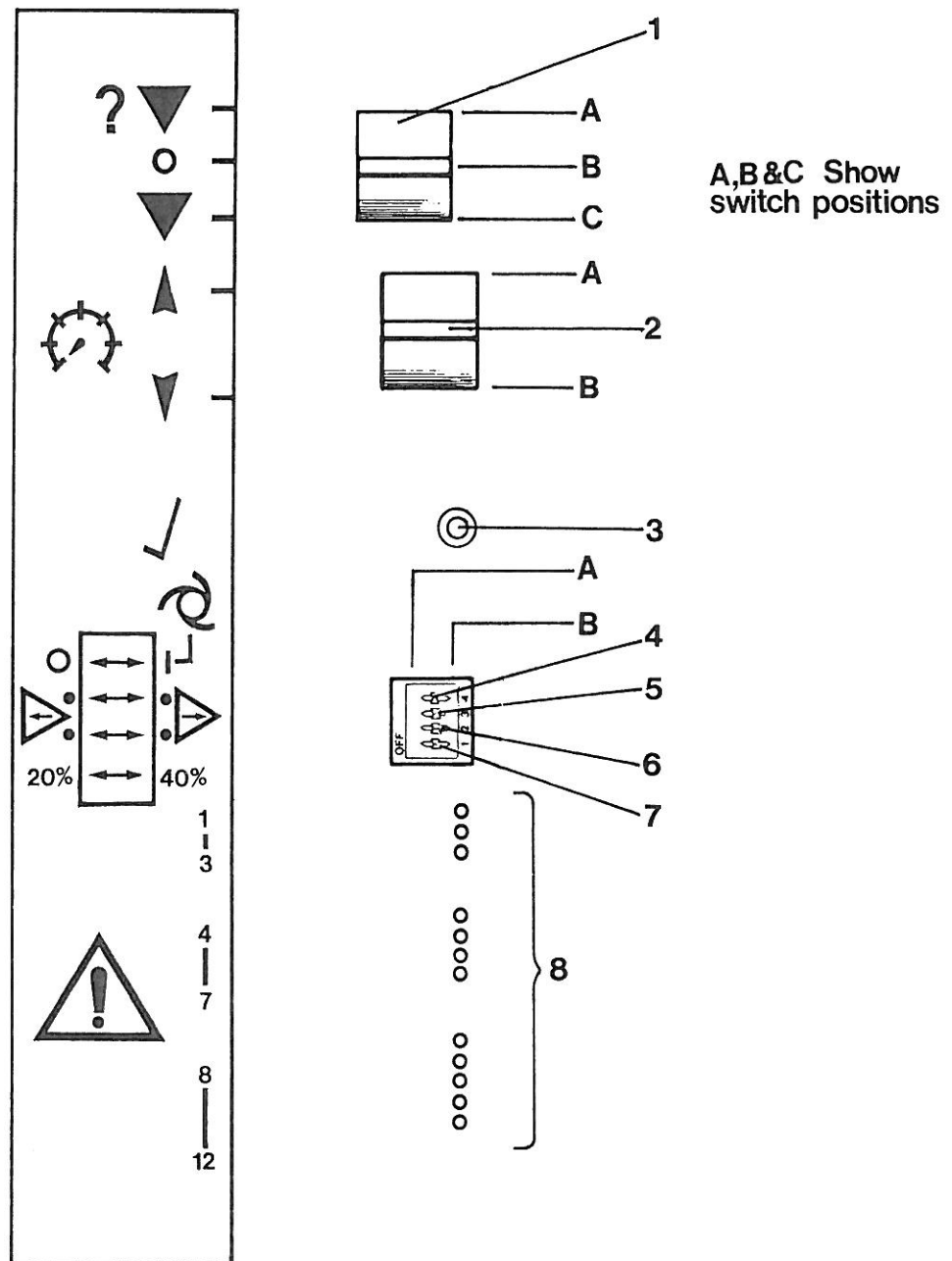


FIG.10

CALIBRATION PANEL

(References are to Fig.10)

This panel (located behind a cover on the side of the controller unit) includes controls used when the system is in the calibration, auto-start and manual modes. In addition, there is a switch to change the degree of slip at which the motors stop and twelve LED lamps which indicate system status.

The control functions are as follows:

<u>Item</u>	<u>Position</u>		
Switch No.1	A	'Calibration Check' - roller motors will start without a vehicle in position on the rollers.	▼ ?
	B	'Normal Running' - normal vehicle testing mode.	○
	C	'Calibration Mode' - system steps through programmed calibration sequence; roller motors will start without a vehicle in position on the rollers.	▼
Switch No.2	A	Increases analogue display reading during analogue phase of calibration sequence.	▲
	B	Decreases analogue display reading during analogue phase of calibration sequence.	▼
Button No.3		'Accept'; reads the calibrated setting into the system memory and advances the 'prompted' setting to the next step in the calibration sequence.	✓
Switch No.4	A	'Normal' - normal vehicle testing.	○
	B	'Auto-Start' - roller motors set to start when vehicle drives into position. Suitable for flow line testing.	⤿
Switch No.5	)	Not used in 660 Brake Tester - Forward/Reverse Selection.	
	)		
Switch No.6	)		
Switch No.7	A	Rollers set to stop at 20% slip rate (i.e. wheel rotating at 80% of roller speed).	20%
	B	Rollers set to stop at 40% slip rate (i.e. wheel rotating at 60% of roller speed).	40%

<u>Item</u>	<u>Position</u>
-------------	-----------------

Status Indicator
Lamps, No.8

The column of status LEDs on the lower part of the calibration panel are numbered from 1 to 12 down the column.

LEDs No.1 to 7 are yellow and No.8 to 12 are red. The LEDs can either glow continuously or flash to indicate the status of various circuits.

The master status indicator lamp on the front panel will alert the operator that a problem has been detected by either flashing or glowing continuously (mimicking the LED fault indicators).

OPERATOR ACTION WHEN MASTER STATUS LAMP LIGHTS

When the master status lamp lights (flashing or continuous) the indication may be cleared by pressing the 'Accept' button on the calibration panel. ✓
If this fails to extinguish the lamp proceed as follows:

1. Status lamp on continuously (Ref. Table 1)

The lit LED(s) on the calibration panel will indicate the area of the problem. See Table 1. The mains switch should be turned 'Off' and the following action taken:

- | | | |
|--------------------|---|---|
| Red LED No.12 | - | Examine pit roller motors for signs and causes of overheating. |
| Red LED No.10 | - | Re-calibrate the machine; see page 40. |
| Red LED No.9 | - | Handset either not connected or handset connections loose. Ensure the connected handset is firmly into the Controller unit and that there is no obvious damage to the handset or cable. |
| Yellow LED Nos.1-7 | - | Ensure that the appropriate device is firmly connected into the Controller unit and that there is no obvious damage to the unit. |

If the lamps remains on after taking the appropriate action, the numbers (1 - 12) of the lit LEDs should be noted and conveyed to the customer service organization (see back of handbook).

2. Status lamp flashing

The numbers (1 - 12) of the lit LEDs should be noted and conveyed to the customer service organization (see back of handbook).

Table 1

Status indicator LEDs 'on' continuously.

o LED 'off'

X LED 'on'

LED Nos.											
Yellow							Red				
1	2	3	4	5	6	7	8	9	10	11	12
o	o	o	o	o	o	o	o	o	o	o	X
o	o	o	o	o	o	o	o	o	X	o	o
o	o	o	o	o	o	o	o	X	o	o	o
X	o	o	o	o	o	o	o	o	o	o	o
o	X	o	o	o	o	o	o	o	o	o	o
o	o	X	o	o	o	o	o	o	o	o	o
o	o	o	X	o	o	o	o	o	o	o	o
o	o	o	o	X	o	o	o	o	o	o	o
o	o	o	o	o	X	o	o	o	o	o	o
o	o	o	o	o	o	X	o	o	o	o	o

Roller motor overheating.
Device not been calibrated (!)
No handset sensed.
Display handset fault.
Analogue display fault.
Printer/plotter fault.
Device at address 4 fault. ()*

Device at address 5 fault. ()*

Device at address 6 fault. ()*

Device at address 7 fault. ()*

N.B. More than one LED may be 'on' at the same time, i.e. more than one item detected.

The machine will continue to run while displaying some of the items (!) indicated in Table 1, however the handset 'Stop' should be pressed and the situation investigated as described above.



* Specific devices at these addresses to be filled in by the installation engineer.

CALIBRATION PROCEDURE

In the UK the Department of Transport stipulates that brake testers used under the D.Tp. testing scheme shall be calibrated at 6 monthly intervals by the user owning and using an approved calibration rig (model 669) or by entering into a contract agreement. Transervice operate such a scheme in the U.K. (see Service page at the back of this manual).
(References are to Fig.10)

WARNING: During this procedure the depression switch, operated by the small roller, is disabled and the rollers can be started even though no vehicle is standing on the machine. This can occur if switch No.1 (see Fig.10) is in the 'Calibrate' position 'C' or 'Cal. Check' position 'A'. The rollers must be protected by the hinged covers under these conditions.

NOTE: That part of the drive system will be exposed and extreme caution should be exercised.

The machine will have been calibrated by the installation engineers when the system was commissioned. The calibration should, therefore, be checked first to find out if re-calibration is necessary.

CALIBRATION CHECK

(See Fig.10)

- | | | |
|------|--|--------|
| CC1 | Remove any vehicle standing on the rollers. | |
| CC2 | Close the hinged cover plates over the rollers. | |
| CC3 | Open the hinged cover protecting the calibration panel on the side of the controller. Remove the motor cover plates on the pit units. | |
| CC4 | Move switch No.1 on the calibration panel to the 'Calibration Check' position 'A'. If a Display Handset is in use, it will display 'CAL'. If the Pressometer is CONNECTED, the Display Handset will read pedal force (preceded by a small "c"). | ▼? |
| CC5 | Press the L.H. roller start button on the handset (Figs.7 or 8). The L.H. analogue dial should read approx. zero. The Display Handset (if in use) should also read approximately zero. Note the precise reading. Stop the roller. | ◀
◎ |
| CC6 | Bolt the 'L' shaped part of the calibration rig onto the locating block mounted on the motor flange. Ensure that the rectangular locating spigot fits into the rig properly. Fit the horizontal arm extension and tighten the two pinch bolts to secure it (see Fig.11). | ◀ |
| CC7 | Press the L.H. roller start button on the handset. The L.H. displays should read approximately 100. Note the precise reading. | |
| CC8 | Slide the 25kg weight onto the calibration rig and position it at the notch marked 200. The L.H. displays should read approximately 200. Note the precise reading. | |
| CC9 | Repeat step CC8 for positions marked 300, 400, 500 & 600. | |
| CC10 | Press the stop button. | ◎ |
| CC11 | Repeat steps CC5 to CC10 for the R.H. roller unit. | |

If any of the displayed readings have differed from the applied load by more than $\pm 3\%$ then the machine must be re-calibrated.

Example: If when the weight is positioned on the rig at the notch marked 400 the display reads less than 388 or more than 412, then re-calibration is required.

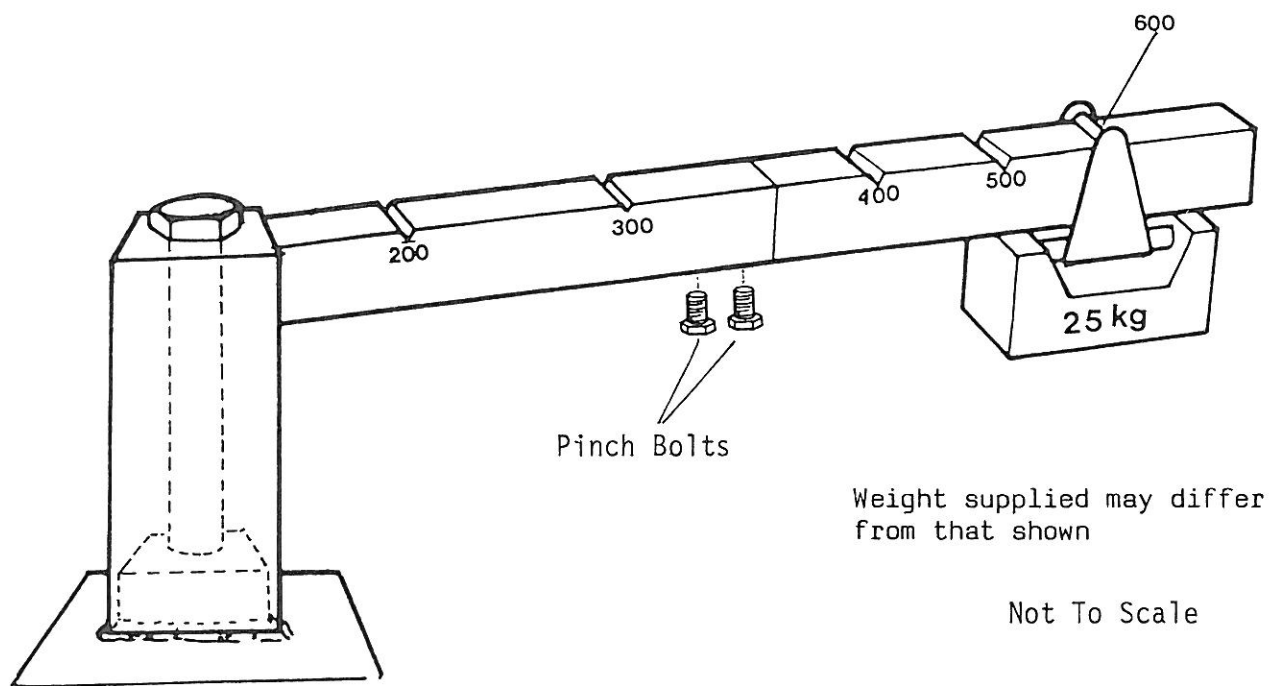


FIG.11

FONT CHANGES

RE-CALIBRATION (See Fig.10)

The calibration procedure is computer controlled and thus the operator will be led through the sequence by displayed 'prompts'.

The controller will lead the operator through the full calibration sequence in the following order:

- Stage 1 - Calibration of Pedal Force Pressure (Pressometer).
- Stage 2 - Calibration of Analogue Displays.
- Stage 3 - Calibration of Load Cells (Brake Effort).

NOTE: When the Controller is in stage 3, a calibration check on the Brake Effort inputs or the Pedal Force input can be performed by switching the calibrate switch to position 'A'.



If the system being calibrated does not include either the Pressometer or the Analogue Display options, the controller will automatically skip that part of the sequence.

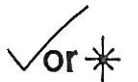
NOTE: Similarly, the operator may, at any time, bypass any of the three phases of the calibration by moving the top switch on the calibration panel (Fig.10 item 1) from position 'C' to position 'A' and back to 'C'.



Assuming that both Pressometer and Analogue Display options are connected and that the operator does not, as described above, override any part of the calibration, the full calibration sequence will be as follows:-

STAGE 1 - PRESSOMETER

- P1 Move the No.1 switch on the calibration panel to position 'C'.
The master status lamp on the Controller will light for a few seconds and then go out.
- P2 The display handset will display '0' (preceded by a small "c") and the flag will be on the pedal symbol. The Printer/Plotter will print '0' if it is 'on line'.
- P3 Ensure nothing is pressing on the transducer and press the 'Accept' button on the calibration panel or 'Step' button on the display handset. The display will then read 100kq.
- P4 Load the Transducer with a 100 kg weight.
- P5 Press the 'Accept' or 'Step' button. The display will go on to show a sequence of readings (all of which are listed below) with each operation of 'Accept' or 'Step'.



- 0kg - no force on transducer - see step P3 above
- 100kg - weight of 100kg - see step P4 above
- 0kg - no force on transducer
- 25kg - 25kg weight
- 50kg - 50kg weight
- 75kg - 75kg weight
- 100kg - 100kg weight

- P6 When the 'Accept' (or 'Step') button has been pressed to accept the last 100kg setting, the display will show 'CAL'. The printer will print "PEDAL FORCE CALIBRATION COMPLETE".



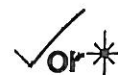
STAGE 2 - ANALOGUE DISPLAY

- A1 The controller will now have entered the Analogue Display calibration phase. This will be confirmed by the L.H. green lamp on the Analogue Display flashing. The amber lamps will continue to flash.
- N.B. Throughout this phase (Analogue Display) of the calibration, the digital displays on the Display Handset (if fitted) will show the setting to which the analogue displays must be set.
- A2 The first setting required is zero. Operate switch No.2 on the calibration panel up or down to position the L.H. pointer precisely on the zero mark. ▲ or ▼
- A3 Press the 'Accept' button (Fig.10 item 3) on the calibration panel or the 'Step' button on the Display Handset if fitted. The L.H. digital display and the handset display will increment to 100kg and the pointer will move towards the 1 mark. ✓ or *
- A4 Operate switch No.2 up or down to position the L.H. pointer precisely on the 1 mark. Press the 'Accept' button or the 'Step' button. ▲ or ▼
✓ or *
- A5 Repeat this procedure for each calibrated point up to 600kg. When the 'Accept' (or 'Step') button has been pressed for this maximum load, the R.H. green lamp on the Analogue Display will start to flash. This denotes that the R.H. analogue display must now be calibrated.
- A6 Repeat the above procedure for the R.H. analogue display.
- A7 Repeat the above procedure for any other Analogue Displays. Where more than one Analogue Display is fitted to the system, the Controller will call for their consecutive calibrations in a sequence determined by the way they are connected to the Controller (see Note 3).

STAGE 3 - LOAD CELLS

- L1 When the 'Accept' (or 'Step') button has been pressed to read the maximum load (600kg) for the last Analogue Display the Controller will enter the load cell calibration phase. This changeover will be confirmed by the two amber lamps on the Analogue Display continuing to flash and by ALL green lamps going out.
- NOTE: During the load cell phase of the calibration, the sequence may be re-started at step L2, the beginning of this phase, by operating the handset 'Stop' button and then re-starting the rollers. ◎ ◀
- N.B. During this phase the displays will show the equivalent braking effort which should be applied via the calibration rig.
- L2 Remove the calibration rig if fitted.
- L3 Press the L.H. roller start button. The displays will show zero. The appropriate 'rollers running' lamps will light. ◀
- L4 Press the 'Accept' (or 'Step') button. The displays will then read 600kg. ✓ or *
- L5 Fit the calibration rig (see Fig.11 & step CC6 on page 38) to the L.H. roller assembly and hang the 25kg weight on the horizontal arm of the rig at the '600' mark.

L6 Press the 'Accept' (or 'Step') button. The displays will go on to show a sequence of readings (listed below) with each operation of 'Accept' (or 'Step') button. The rig should be loaded to apply the equivalent load in each case.



- 0kg - rig not fitted (per step L2)
- 600kg - weight hung at '600' mark on rig (per step L5)
- 0kg - rig not fitted
- 100kg - rig fitted without weight.
- 200kg - rig fitted with weight at '200' mark
- 300kg - rig fitted with weight at '300' mark
- 400kg - rig fitted with weight at '400' mark
- 500kg - rig fitted with weight at '500' mark
- 600kg - rig fitted with weight at '600' mark

L7 When the 'Accept' (or 'Step') button has been pressed to accept the final 600kg setting, the L.H. rollers will stop. (The 'Calibration Check' procedure can be carried out at this point; see page 38).

L8 Press the R.H. roller start button and carry out the procedure for the R.H. load cell.



- NOTES:
1. The calibration arm and weight should be steadied before pressing the 'Accept' button.
 2. It is recommended that the calibration check procedure be carried out after any re-calibration.
 3. Where more than one Analogue Display is connected to the system, the Controller will calibrate them in numerical order of the addresses allotted to them (see page 37). However, if the operator wishes to skip the calibration of the remaining displays the top switch on the calibration panel should be moved from position 'C' to 'A' and back to 'C'.

VERY IMPORTANT:

Always return the calibration switch to the normal operating position (0) when any calibration check or re-calibration has been completed. The main fault lamp will light for a few seconds and then go out.

ROUTINE MAINTENANCE

PERIODIC MAINTENANCE SCHEDULE

Isolate the machine from the mains supply before any maintenance work is carried out.

WEEKLY

- (a) Check pit condition. Remove any rubbish from pit and pit drain. Check operation of pump if fitted.
- (b) Check the roller surfaces and remove any mud, grease, etc. likely to lessen the adhesion between roller and tyre. The cover plates should also be kept clean. After a considerable period of use the coated surface of the rollers will deteriorate. When this occurs, a Transervice engineer or authorised agent (overseas users) should be called to repair the surface.
- (c) Check the main roller bearing bolts for tightness.
- (d) Check the drive chains for correct tension.

3-MONTHLY

Lubricate the drive chains sparingly with Molybdenum Disulphide ('Moly') grease.

2-YEARLY

Lubricate the motor bearings with Shell 'Alvania RA' grease or the equivalent.

CALIBRATION - MOT TESTING REQUIREMENTS

The Crypton 660 Brake Tester, when used for MOT testing of cars and light commercial or small public service vehicles, must be calibrated in accordance with D.Tp. Special Notice No. 3/80 as follows:

- a) Calibration must be checked out at least once every six months.
- b) Calibration must be carried out using equipment owned (not hired) by the Test Station or by contracted outside agency.
- c) The date and result of the check must be recorded in a suitable record book or placed in a folder reserved for calibration evidence.

Refer to page 38 of this manual for details of the calibration procedure.

PRINTER/PLOTTER UNIT MAINTENANCE

PAPER REPLACEMENT

To fit a new roll of paper:- (the unit must be switched 'ON')

1. Ensure that the printer is 'off line'; lamp (3) should be off. Press button (1) if necessary.
2. Rotate the two fasteners located in the top corners of the front panel. Open the panel.
3. Remove the exhausted spool and spindle. Remove the front paper guide.
4. Free the start of the new roll of paper. To facilitate feeding the paper, cut the end to a point with a pair of scissors.
5. Slide the free end of the paper behind the first paper guide. Ensure that the paper is located between the jaws of the switch mounted on the left of the paper carriage (lamp (4) should stop flashing at this stage).
6. Gently push the paper into the paper slot at the top of the printer mechanism.
7. Push the yellow switch (2) down to feed the paper. Release the switch when the paper is just past the second paper guide position (nearest the front of the case).
8. Push the paper behind and re-fit the second guide.
9. Feed a further 100mm (4 inches) of paper through.
10. Insert the spindle into the new paper roll and gently fit the roll into place.
11. Feed the loose end of the paper through the slot in the front panel.
12. Insert the hinge on the front panel into the slot at the bottom of the case and refit the front panel.
13. Pull the loose end of the paper protruding through the front panel to ensure that the paper has not been folded when the front panel was fitted.

PEN REPLACEMENT

To fit new coloured pens:- (the unit must be switched 'ON')

1. Repeat steps 1 & 2 above.
2. Push the yellow switch upwards. The four pen holder will move to the right hand side of the carriage.
3. Press the spring loaded catch beneath the pen holder on the right hand side of the carriage. The old pen should eject.
4. Remove the protective cap from the new pen and insert the pen into the empty slot in the carriage, making sure that the pen colour matches the colour marked on the carriage. First position the point of the pen in the small hole in the pen return spring. Then press the rear of the pen into the carriage. When in position, the pen should be free to revolve within the carriage.