



# REPLACEMENT BRAKE LININGS

## TECHNICAL GUIDANCE

**Vehicle Certification Agency  
1, The Eastgate Centre  
Eastgate Road  
Bristol BS5 6XX**

Telephone: 0117 951 5151  
e-mail: [enquiries@vca.gov.uk](mailto:enquiries@vca.gov.uk)  
website: [www.vca.gov.uk](http://www.vca.gov.uk)

## REPLACEMENT BRAKE LININGS

### Technical Guidance

#### ECE REGULATION 90.01

**Scope:** All categories: motorcycles L1, L2, L3, L4, L5; passenger vehicles M1, M2, M3; goods vehicles N1, N2, N3; trailers O1, O2, O3, O4.

#### EC DIRECTIVE 71/320 AS AMENDED BY 2002/78/EC (ANNEX XV)

**Scope:** M1<3.5t, M2<3.5t, N1, O1, O2.

Approval to either Regulation or Directive became **mandatory** after 31/03/2001 for replacements to fit vehicles having ECWVTA (M1). Member states could require approval for replacement parts and other categories before this date. (UK did not).

#### MOTORCYCLES (Reg 90 only, Annex 7).

Test on representative vehicle required, **no** option to use inertia dynamometer.

Test equipment requirements as Reg 78. (Speed, stopping distance, lever effort front and rear, brake wetting equipment, accuracy 1%)

Test from ECE Reg 78 (as motorcycle brakes vehicle approval):

- Type O test laden engine disconnected.
- Type O test unladen engine connected 30% to 80% Vmax, (L3, L4, L5).
- Type O test wet brakes unladen (disc brakes only).
- Type I fade test laden, (L3, L4, L5).

Additional Reg 90 Annex 7 tests:

- Cold performance:
- Type O tests laden, over a range of control pressures to compare OE and replacement lining assembly performance.
- Limit: replacement within +/-15% of OE.

Speed sensitivity (L3, L4, L5):

Three type O laden stops for each speed, same control force for each: 40 km/h, 80km/h, 120 km/h (120 km/h if Vmax >130km/h). Average of deceleration for high-speed stops within 15% of average deceleration at 40km/h.

#### PASSENGER CARS AND LIGHT GOODS (M1 <3.5t, M2<3.5t, N1).

Reg 90 Annex 3 and Directive 2002/78EC Annex XV.

Test from ECE Reg 13 or 71/320/EEC (as vehicle brakes approval):

Vehicle tests:

- Type O test laden engine disconnected.
- Type O test laden and unladen engine connected 80% Vmax.

- Type I fade test.
- Type O laden Secondary.
- Parking brake tests, dynamic and hill hold if park linings.

Additional Reg 90 Annex 7 and 98/12/EC Annex XV tests:

- Cold performance:
- Type O tests laden over a range of control pressures to compare OE and replacement lining performance. Limit, replacement within +/-15% of OE.70km/h for front axle, 45km/h rear axle. (Note only test axle braked for this test).

Speed sensitivity:

Three type O laden stops for each speed, same control force for each: 65 km/h, 100km/h, 135 km/h (if  $V_{max} > 150\text{km/h}$ ) front axle; 45km/h, 65km/h, 90km/h (if  $V_{max} > 150\text{km/h}$ ) rear axle. Average of deceleration for high-speed stops within 15% of average deceleration at slowest speed. (Note only test axle braked for this test).

Inertia dynamometer:

Cold performance and speed sensitivity can be tested by mounting a single brake on a dynamometer as an alternative to testing them on the vehicle. However the type O and type I tests must still be done on the vehicle.

Test equipment requirements as for Reg13. Note if cold performance and speed sensitivity are tested on the vehicle: thermocouples are essential to ensure consistent brake temperatures throughout the test, and valves are required to enable the axle not being tested to be isolated.

All vehicle categories must also comply with the mechanical characteristics, packaging and marking requirements:

Mechanical characteristics:

- Shear strength according to ISO 6312 (1981) limit  $250 \text{ N/cm}^2$
- Compressibility according to ISO 6310 (1981) limit disc pads: 2% at ambient and 5% at  $400 \text{ }^\circ\text{C}$ , limit shoes for drum brakes 2% at ambient and 4% at  $200 \text{ }^\circ\text{C}$ .
- VCA's usual policy on these tests is to check the manufacturers facilities, and witness a test occasionally, but in general we accept a test report from the manufacturer for Shear Strength and Compressibility.

Packaging and Marking requirements:

- Packed in axle sets, sealed to show previous opening.
- Pack marked with manufacturers name or trademark, make and type of linings, vehicles/axles/brakes components are for, approval mark (E11 or e11 mark).
- Each shall have fitting instructions.
- Actual parts to be marked with Approval mark, date of manufacture, make and type of lining material.



## **WORST CASING**

Worst casing for tests carried out on a dynamometer is fairly straightforward. Heaviest vehicle, largest rolling radius tyre, smallest disc/drum diameter, solid disc before vented disc.

The selection of a Representative vehicle is more difficult as the same replacement brake lining assembly may be used for a range of vehicles, for example a disc pad may be used on a small solid disc on a light car and on a much larger vented disc on a large car. In this case the very worst case may not exist so the worst real vehicle has to be used.

Each replacement brake lining ASSEMBLY has to be tested even though the same brake lining MATERIAL may have already been tested and approved. However we do accept small differences in brake lining assemblies can be covered one test for example with and without wear indicators.

## **CONFORMITY OF PRODUCTION (COP).**

2002/78/EC Annex XV paras 8 & Appendix 4

ECE Reg 90 paras 8 & 9

There are specific COP requirements for replacement brake linings:

A constant speed Dynamometer is needed (this is also called a Kraus Machine) it is used to measure friction value for a sample of the brake lining material.

Friction level of the material is measured and declared when the assembly is approved, the subsequent COP tests on the material then have to fall within a tolerance of this declared value.

Other categories:

ECE Reg 90 Annex 4 covers M3, N2, N3 Whole test can be carried out on either a representative vehicle or an inertia dynamometer.

ECE Reg 90 Annex 5 covers O1 and O2 trailers. Whole test can be carried out on an inertia dynamometer.

ECE Reg 90 Annex 6 covers O3 and O4 trailers. Whole test can be carried out on either a representative vehicle or an inertia dynamometer.

## **ASBESTOS:**

All replacement brake linings must be asbestos free:

Reg 90.01 5.1d, 98/12/EC Annex I 2.1.1.3

## **CONTACT DETAILS**

In the UK, contact Dave Picker VCA Midlands Centre (go to <http://www.vca.gov.uk/contact.asp> for further details).



## **ADDITIONAL NOTES ON ECE R90 REPLACEMENT BRAKE LININGS WORST CASING**

Brake lining materials are not approved. Only brake lining assemblies which is the back plate and the lining can be approved.

Worst casing and grandfathering:

A vehicle brakes approval may have more than one OE lining, the replacement lining only has to be compared to one of these, which the replacement manufacturer can select.

This same replacement lining may fit several different vehicles, maybe from different manufacturers (i.e. they all use the same calliper). In this case there will not usually be any one OE which is common to all the vehicles, so several OEs must be tested such that a comparison is made to at least one OE pad from each vehicle that the replacement lining is to be approved for fitment to.

In the case above it is most convenient to do the cold performance (using several OEs) and the speed sensitivity on the inertia dyno, using the worst case inertia's, disc sizes and tyre sizes. We would then select the worst case vehicle from the fit list to use for the vehicle tests (type O and type I fade). Sometimes when the fit list is quite large or varied we select two vehicles for test i.e. a large heavy one and a lighter faster one.

The use of the dyno reduces the number of vehicles which have to be obtained and instrumented for test, as this is usually the most difficult part of R90 testing.

It would also be possible to use one vehicle fitted with OE pads from several vehicles but only if the vehicle chosen was worst case of the fit list. This can be difficult as the heaviest vehicle does not usually have the smallest discs and may not have the largest tyre radius. This vehicle method usually only works for a vehicle manufacturer who may use essentially the same brake system on several of their vehicles. (For example: Rover 200, 400 and Hondas).