

HARMONISED METHODS FOR BRAKE TESTING ON HEAVY COMMERCIAL VEHICLES

Development Engineer 1983, Halmstad University, Sweden. Currently director of Technical Affairs at SA, the Swedish Association of Road Haulage Companies in Stockholm. Chairman of the Nordic Road Forum, NVF Vehicles and Transports and vice president of the IRU International Commission on Technical Affairs and member of the board of the International Forum for Road Transport Technology, IFRTT



Mårten JOHANSSON

Swedish Association of Road Haulage Companies, Sweden

Abstract

A large proportion of heavy vehicles' brakes fail to pass the yearly vehicle tests. The vehicle testing methods used in periodic technical inspections should be improved in order to make tests more repeatable and improve assessment of the technical condition of brakes. In order to protect legal rights, the method must be designed so that no vehicles fail the test on incorrect grounds. Operators in the road transport sector, haulage contractors, suppliers, garages, testing bodies and authorities must cooperate and adopt measures to improve the technical condition of heavy vehicles' brakes. Legal rules and requirements should prioritise checks on the operation of components and systems that are important for road safety and where an associated cost benefit can be clearly demonstrated.

Keywords: Heavy vehicles, Brakes, Maintenance, Inspections.

1. Operation of brakes and adjustment of brakes between vehicle units

The Swedish Association of Road Haulage Companies has submitted the report “Improved Brakes on Heavy Commercial Vehicles”, SÅ Rapport 2005:2. Some of the conclusions were that brakes should be adjusted for heavy vehicles according to the Swedish standard SS 3658, later transformed into the international standard ISO 20918:2007. By adjusting the brakes according to the standard trucks and trailers will be able to be connected and satisfactory brake operations will be maintained, with all wheels starting to brake at the same time and braking their proportion of the vehicle’s weight. This aim can be achieved by a brake test carried out and comprising of threshold pressure, which in the trailer brake control pipe (duo-matic) must be between 0.5 – 0.8 bar and max 0.7 bar in the brake cylinders.

The threshold pressure in the control pipe for the trailer and brake cylinders and the guaranteed operating pressure should be tested to allow better diagnosis of the condition of braking systems.

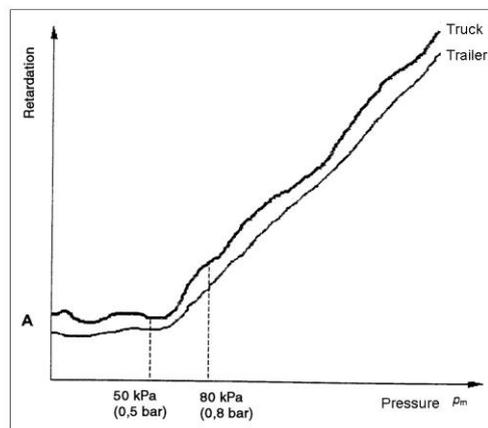


Figure 1 - Threshold pressure for braking effect for both truck and trailer should be in the interval 50kPA till 80kPA, measured in the control pipe.

2. Handling of vehicles and brakes

Most drivers normally apply the brakes gently and therefore do not notice any gradual deterioration. Unfortunately, most modern vehicles require the brakes to be applied sharply every so often in order to maintain optimum performance. Some vehicle instruction books encourage drivers to brake occasionally in wet conditions to keep brakes heated in order for them to working efficiently.

For safety reasons there should be no such need to use the brakes to keep them working efficiently. Brakes should perform within satisfactory margins in all driving conditions.

3. Testing of brakes on new vehicles prior to delivery to clients

New vehicles’ brakes are approved and a certificate is issued stating that the legal requirements have been met. Unfortunately, it is not mandatory that the operating controls of brakes need to be tested on a roller brake tester prior to delivery of a new vehicle to the customer.

The report 2005:2 suggests the introduction of requirements for testing operating controls of brakes before or during registration inspections. These tests should be carried out by garages, suppliers or vehicle inspection companies using a roller brake test. Manufacturers should verify that braking systems meet legal requirements for periodic technical inspection before delivering new vehicles.

4. Testing and inspection methods

Testing methods are currently being developed by the inspection bodies, but this also imposes requirements for organisation and harmonisation between countries to ensure the observance of the legal rights of vehicles in roadside checks. Increased harmonisation in testing and inspection methods is necessary since, according to the Nordic Road Forum, NVF Vehicles and Transport there are still great differences among Scandinavian countries and probably also compared with other EU states. The reason for change is that measurements and checks of important valves and mechanical components in braking systems are carried out in different ways. Measured braking force results are calculated and treated in different ways. This has negative consequences for traffic safety, the legal rights of drivers and vehicle owners and competition in the transport industry.

Table 1 - Calculated brake retardation for the same measured braking force varies to an unacceptable degree in Nordic countries (NVF 2/2004).

	Denmark	Faroe Islands	Finland	Sweden	Iceland	Norway
Truck	0.51	0.43	0.68	0.58	0.55	0.49
Trailer	0.44	0,44	0.50	0.53	0.50	0.45

The limit for approved brake retardation for vehicle testing or roadside inspections for heavy trucks was 0.45 (braking force/vehicle weight), and for trailer and semi-trailer 0,43 in all Nordic countries, except Denmark. When theoretical brake retardation is calculated in different countries (table 1) for the same measured braking force, results vary from a non-approved retardation of 0.43 in the Faroe Islands to an approved retardation of 0.58 in Sweden. The reason for different results depends on different calculation formulas, different maximum pressure in the control line, different starting pressure and correction factors. These are unacceptable results that threaten the legal rights of vehicle owners and road haulage companies. This means that a vehicle with approved brakes in Sweden in the morning can have a driving ban imposed at a roadside inspection in the afternoon in Norway.

Work on Nordic harmonisation is being carried out by the NVF Vehicles and Transport. The NVF Vehicles and Transport suggests development and setting of:

- Nordic technical inspection regulations and measuring practices
- Specification of requirements for roller brake testers
- Qualification requirements for inspection personnel

Formulas for calculating brake performance need to be revised to achieve satisfactory repeatability in brake checks. New calculation formulas and start pressure assessments have been suggested for future testing programmes where values for adjustment of load-sensitive valves must also be checked. Sweden has already implemented improved calculation formulas (1) and (2) for deceleration in which factors such rolling resistance and threshold pressures are included.

$$\text{Retardation} = \frac{\sum F_{\text{ext}}}{M} \quad (1)$$

$$F_{\text{ext}} = \frac{(F - F_{\text{rm}})(P_{\text{gar}} - 0,03)}{(P_{\text{cyl}} - 0,03)} + F_{\text{rm}} \quad (2)$$

The maximum discrepancy in braking force between the left and right wheels for all axles was previously 50 per cent and is now 30 per cent. 30 per cent is considered to be unnecessarily strict and therefore a higher value, e.g. 40 per cent, should be considered. It is most important for this requirement to be applied to front steering axles, but it should also be applied to all axles for the sake of simplicity. A study should be carried out to verify whether a level higher than 30 per cent would be accepted for the uneven braking requirement (2005:2).

All Nordic countries test heavy vehicle brakes in accordance with Directive 96/96/EC, recently replaced by 2009/40/EC and refer to ISO 21069-1, where different formulas for calculation of retardation are listed including the method using reference brake forces.

A future target is for heavy vehicle checks carried out in one country to be accepted beyond its borders.

5. New Provisions for Roadworthiness Tests for Motor Vehicles and their Trailers

In a recent decision taken by a DG TREN Committee in the EU, even old vehicles must fulfil the same criteria and functions as new vehicles. The deceleration limit for heavy trucks was increased from 4,5 to 5.0 m/s², and the calculation formulas for deceleration are still not harmonised.

The IRU and the Swedish Association of Road Haulage Companies seeks rejection of the decision taken on 5 October 2009 by the Technical Adaptation Committee of Directive 2009/40/EC on the approximation of the laws of the Member States relating to roadworthiness tests for motor vehicles and their trailers.

Justification

For most of the functions and components in the vehicles, Directive 2009/40/EC applies a reasonable standard, taking into account some wear and tear during the operation of the vehicle.

However, the logic of the decision taken by the DG TREN Committee, stating that even old vehicles must fulfil the same criteria and functions as a new vehicle is against the principle of roadworthiness that allows for a certain degree of wear and tear of the components and systems, without compromising vehicle safety.

If we compare the existing provisions with the proposed amendments to Directive 2009/40/EC, the failure rate will increase, resulting in additional costs for the European road transport companies, the end customers and society as a whole.

According to the minutes of the meeting held on 5 October 2009, the Commission is confusing COP (Conformity of Production) in type-approval standards with PTI (Periodic Technical Inspections) related to roadworthiness. Type-approval already contains COP checks

and those are not comparable with PTI checks. Furthermore, the statement of the Commission explaining that “*maintaining the braking system is usually done by replacing deteriorating parts by new parts which will give the same possibility as for a new vehicle*” is incorrect as not all parts are changed at the same time in order to comply with the type approval levels.

Vehicles brakes are approved to either EC Directive 71/320/EEC or to the equivalent UNECE Regulation 13. The deceleration limit is 5.0 m/s² for a truck of category N3 according to the Type 0 test. Type 0 test is performed under very strict test conditions, with a complete stop manoeuvre performed by fully-laden vehicles on test tracks (at stipulated speeds and temperatures). This is, however, only one part of a complete approval; there are other important tests that must also be considered. This very strict test can never be repeated during a PTI or a roadside inspection, regardless of a roller bench or a road test. Therefore, the minimum braking efficiency values of the existing Directive should remain valid.

Furthermore, the proposed amendments on braking efficiency will create difficulties for the harmonisation of brake efficiency testing in Europe, if reference braking forces are not introduced in the draft “*Reasons for failure*” of Directive 2009/40/EC (Annex II).

In order to find a standardised method of checking brakes, CITA (International Motor Vehicle Inspection Committee) and ISO (International Standard Organisation) have been working for some years to find such a suitable procedure. This is one reason why Reference Brake Forces were introduced in Regulation 13 in Supplement 7 to Regulation 13-09 in 2003. Reference brake forces can therefore be applied as criteria in 2009/40/EC. In the previous Directive 96/96/EC, this provision was mentioned, but has disappeared in the new draft version 2009/40/EC. Under item 1.2.2 “*Efficiency*”, reference is made to ISO 21069 and its methods, such as in section 5.3.3.1. “*Reference braking forces methods*”, but criteria for rejection has been deleted. This is a serious amendment, as the best option for checking brake function is by reference values, which has been supported strongly by Member States.

Our request on braking force reference methods is in line with items 8 and 9 of the preambles of Directive 2009/40/EC. Reference Brake Forces could be used for old vehicles as well.

To conclude, the IRU and the Swedish Association of Road Haulage Companies recommends staying with the present provisions for evaluation of the brake performance for road vehicles and have asked for the EU Commission’s support in reviewing the points raised above to revoke the decision taken by the Committee.

6. References

- Johansson Mårten, Galvarro Jorge Soria, Carlhäll Lars, Hedbom Kent (2005), Bättre Bromsfunktion på Tunga Fordon (Improved Brakes on Heavy Commercial Vehicles), SÅ Rapport 2005:2
- Andreas Roost, Kalevi Lintula, Bengt Arnalid, , Jorge Soria Galvarro, Lars Carlhäll, Jakup Jacobsen, Karl Ragnars, Erik Graarud, Agnar Dahl, Sigbjörn Eggebö, Bård Öien, Anders Damgaard Andersen, Petteri Hietala, Mauri Haataja, Per Yngve Knudsen, Terje Moen. Kontroll av Bremser på Tunge Körtöj i Norden, NVF Rapport 2/2004.

- ISO 20918:2007, Road vehicles – Braking threshold pressures for heavy commercial vehicle combinations with fully pneumatic braking systems – Test with roller brake tester.