BM TEST EQUIPMENT
- the safe choice

BM25 *SMART*TEST
- for EBS Testing

- Practical on-road brake matching between towing vehicle and trailer.
- Practical on-road measurement of the vehicle's EBS function on each axle.

Testing Electronic Brake Systems, EBS

For decades testing of brakes has been successfully conducted using roller brake testers. Modern roller brake testers include features, that allows for inspection of the brake system performance against authority regulation. Roller brake testers also provide advanced diagnostics the air pressure system and brake matching between axles, as well as between the powered vehicles and trailers.

Since the introduction of Electronic Brake Systems, EBS, the repair industry has increasingly experienced the problem that vehicles (and vehicle combinations), that perform perfectly on a roller brake tester, show unsatisfactory brake performance when being used in practice on the road.

Examples of this are drivers complaining of poor brake matching and brake components on certain axles wearing out much sooner than expected. The result of this is excessive repair costs and unacceptable downtime of the vehicle(s). In short, the problem caused by EBS, seems to be that a perfect repair of the brake system does not necessarily mean that the vehicle (and vehicle combinations) performs perfectly when being used.

Trade experts have suggested that one important reason for this paradox can be related to how the EBS controls and regulates the air pressure between the individual axles. The problem is that this EBS control cannot be tested on a roller brake tester, as the EBS control and regulation only takes place when the vehicle is driving.

What is BM25 *Smart*Test?

BM25 *Smart*Test can measure air pressure simultaneously at up to eight (8) individual points, while the vehicle (and vehicle combination) is driving. At the same time, the true horizontal brake efficiency (deceleration) of the vehicle (and vehicle combination) is also measured using advanced gyro based technology, which compensates for direction differences of the cabin and the vehicle.

The BM25 *Smart*Test presents the vehicle brake efficiency together with air pressure values from individual axles so the operator can conduct a detailed analysis of the EBS control and regulation. This allows the operator to analyse the actual vehicle brake performance, when being used in a real situation on the road.

The technology of the BM25 *Smart*Test features other important diagnostic possibilities, which have the potential to increase the return on investment of the equipment.

BM25 *Smart*Test features:

- On-road EBS testing by analysing the individual axle air pressure control versus vehicle deceleration.
- On-road analysis of EBS regulation of dynamic brake matching between the towing vehicle and the trailer.
- On-road verification of CEE corridor compliance.
- Test for leaks in the air pressure system.
- Determination of the air pressure time lag between axles.
- On-road and static diagnosis of the overall air pressure system performance of the vehicle.

BM25 *Smart*Test for EBS Testing

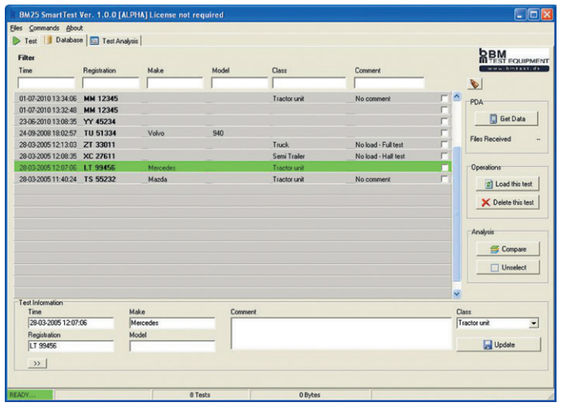
The BM25 *Smart*Test consists of a radio receiver box, which measures the deceleration and receives data from the radio air pressure transducers. The receiver box can easily be placed anywhere in the cabin, as the gyro based technology will ensure a correct measurement of the deceleration.

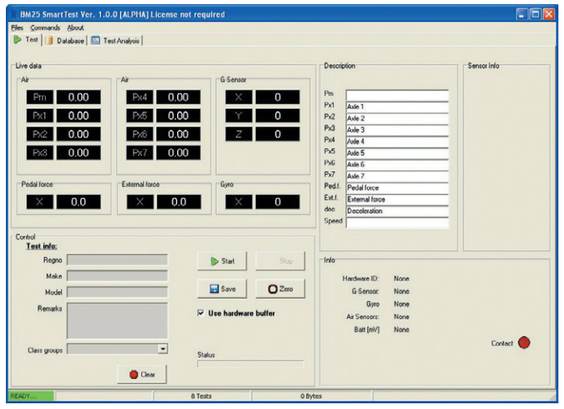
The BM25 *Smart*Test is additionally supplied with a Microsoft Windows program, which is installed on a notebook PC. The notebook PC is also placed in the cabin and presents real time stamped air pressure and deceleration data from the receiver box wirelessly in real time.

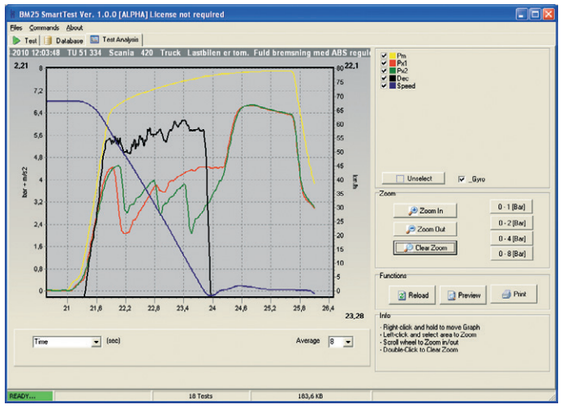
The BM25 *Smart*Test can be supplied with up to 8 radio air pressure transducers, which can be connected to various air pressure measuring points on the vehicle or vehicle combination. Each radio air pressure sensor is supplied with a 1.5 metre hose and a powerful magnet, which ensures an easy placement of the unit on the vehicle.

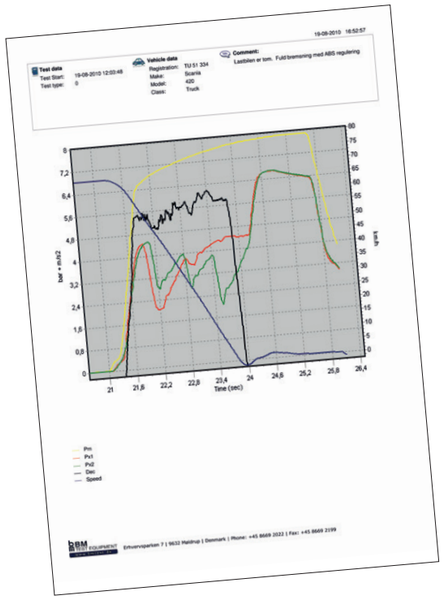
The BM25 *Smart*Test Windows Program

The BM25 *Smart*Test Windows program has a very simple, user friendly menu structure, which ensures that the program is easy and efficient to use. The program features registration of the operator, vehicle(s) together with operator comments explaining the test in more detail. All data is saved in a database with support for numerous search functions.









The sampled data are presented graphically together with selected key vehicle information. A number of graphical tools including zoom, axis settings and selection of data to be presented are available to the operator, so the graphical presentation can be customised to suit specific purposes.

The operator can send the graphical presentation to a printer or save it as a PDF file.

Operated by Only One Person

After the air pressure sensors have been mounted on the vehicle, the operator brings the battery powered BM25 *Smart*Test receiver and notebook PC with BM25 *Smart*Test Windows program into the vehicle cabin.

Due to the gyro based technology of the deceleration measurement and the wireless communication between the BM25 *Smart*Test receiver box and the notebook, there is little restriction to the placement of these two components in the vehicle cabin. The operator can therefore easily and quickly place them on the passenger seat, cabin floor or any other convenient location in the vehicle cabin.

The operator can manually press the "start button" on the BM25 *Smart*Test Windows program and then start driving the vehicle and conduct brake applications. Alternatively, the BM25 *Smart*Test can be set to automatically commence data collection, where air pressure or deceleration measurement is used for automatically starting and stopping the data sampling.

The operator can select between several types of tests including a high resolution 8 minutes test or

a low resolution test of up to 10 hours. Regardless, the data will be continuously sampled and stored by the BM25 *Smart*Test Windows program in the database for later analysis.

When the on-road test is completed, the operator can use the BM25 *Smart*Test Windows program to select the brake test from the database, which will be presented graphically. The operator can zoom, select and deselect measurements to be presented in this graphic, add CEE corridor, make comments and print to either a printer or save to PDF files.

Roller Brake Tester vs. BM25 *Smart*Test

Traditionally, vehicle brakes are considered as a 2-level brake system, air pressure system and mechanical system:

1. The air pressure system, consisting of compressor, valves and hoses creating the brake cylinder air pressure being the input to the mechanical system.
2. The mechanical system, consisting of the mechanical brake components around the individual wheel i.e. slack adjuster, brake springs, brake lining and brake drum or brake disk.

In combination, these two systems can be described as the foundation of the vehicle brake system.

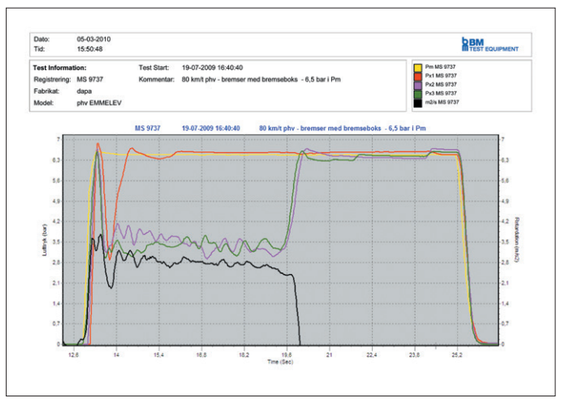
Today we see the brake system as a 3-level brake system, where the 3rd system is:

3. The EBS control, consisting of ECU, actuators and sensors. The BM25 *Smart*Test in combination with advanced roller brake testers, such as models BM14200, BM17200, and BM20200 make up a superior tool for testing brakes on heavy vehicles and vehicle combinations.

The EBS system can only be expected to perform in an optimal manner if the foundation of the brake system works. The operator will, therefore, use the advanced roller brake tester to conduct static brake test, diagnosing and repairing the foundation of the vehicle brake system.

With a correct performance of the foundation of the vehicle brake system, the operator will use the BM25 *Smart*Test to check the EBS control and the actual overall on-road performance of the brake system.

Practical Example no. 1

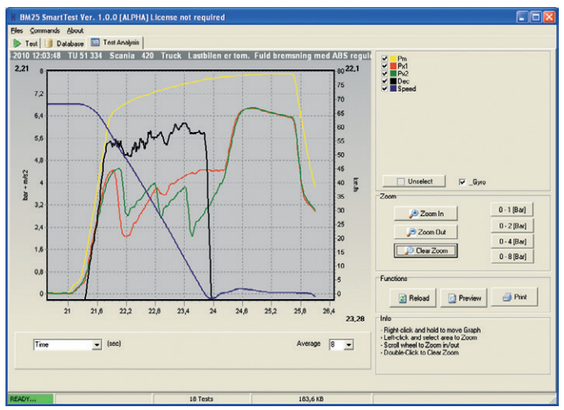


Analysis of EBS performance on a tri-axle drawbar trailer

Key findings from a practical measurement on a tri-axle drawbar trailer with BM25 *Smart*Test:

1. At T=12.8 sec. the brake pedal is applied and main pressure (yellow) as well as axle 1, 2, and 3 air pressure increases. Deceleration (black) follows.
2. At T=13 sec. the EBS detects a close-to-wheel lock situation on axle 1, 2, and 3 and the EBS reduces air pressure on all three axles. The deceleration is accordingly reduced.
3. At T=13.8 sec. the air pressure on axle 1 is increased to maximum and remains high – probably due to load transfer from axle 2 and 3.
4. At the same T=13.8 sec. the EBS increases the air pressure on axle 2 and 3, but far less than on axle 1. From T=13.8 sec. the EBS keeps the air pressure on axle 2 and 3 lower with significant regulation caused by load transfer (i.e. significant less load on axle 2 and 3) which makes axle 2 and 3 very sensitive to wheel lock.
5. At T=20 sec. the vehicle has come to a complete stop and the EBS, therefore, increases the air pressure on axle 2 and 3 to maximum.
6. At T=25 sec. the operator releases the brake pedal and all air pressures go to zero.

Practical Example no. 2

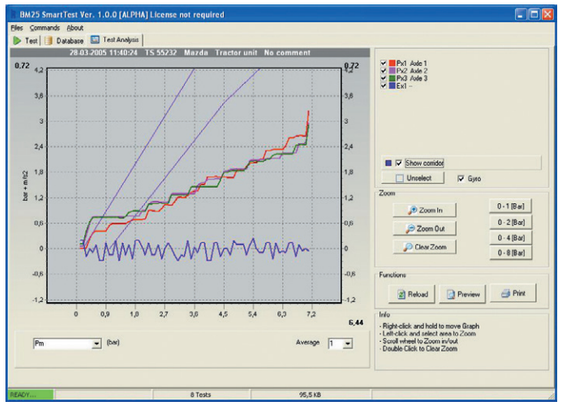


Analysis of EBS performance on a two-axle tractor

Key findings from a practical measurement on a two-axle tractor with BM25 *Smart*Test:

1. At T=21.2 sec. the brake pedal is applied and main pressure (yellow) and axle 1 and 2 air pressures increase. Deceleration (black) increases and speed (blue) decreases.
2. Shortly after, the EBS detects a close-to-wheel lock situation on both axles and reduces air pressure on axle 1 and 2. When the lock risk is removed, the EBS increases air pressure again on axle 1 and 2.
3. At T=22.8 sec. the EBS detects again a close-to-wheel lock and reduces axle 1 and 2 air pressures. The EBS reduces the air pressure less on axle 1 than on axle 2 i.e. the lock risk on axle 1 is less dramatic – probably due to load transfer.
4. At T=23.4 sec. the EBS once again detects a close-to-wheel lock, but only on axle 2, which probably is due to the development of load transfer between the two axles.
5. Shortly after, the lock risk is removed from axle 2 and the EBS increases air pressure on axle 2 again.
6. At T=24 sec. the vehicle has come to a complete stop and the EBS, therefore, increases the air pressure on axle 1 and 2 to maximum.
7. The deceleration of the vehicle (black) seems better than the authority requirement.

Practical Example no. 3



Practical verification of compliance with CEE corridor

BM25 *Smart*Test can be used for conducting a practical verification of the vehicle's compliance with CEE corridor. It is therefore not necessary to conduct a special test to show the status of compliance. With a normal set of data measured with BM25 *Smart*Test, the operator can simply change the graphic settings directly from the Windows program:

1. Choose Deceleration vs. Pm (service line air pressure).
2. Select the CEE corridor of the vehicle.

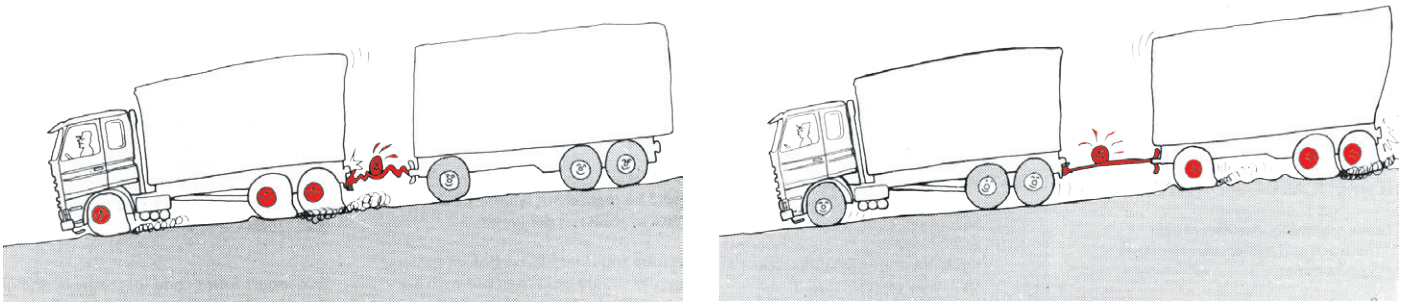
Brake Matching with BM25 *Smart*Test

Excessive wear of the brake system is a major contribution to the overall maintenance cost of a vehicle involving component and labour cost, and loss of revenue from the vehicle being out of service.

One of the main reasons for excessive brake wear is often poor brake matching between the towing vehicle and the trailer. BM25 SmartTest is the perfect tool for examining the real life (on-road) brake matching of vehicle combinations.

With the **Brake Match** tool of the BM25 SmartTest, the operator selects the separate deceleration measurements of a towing vehicle and a trailer, which are then presented in the same graphic for direct comparison.

Research suggests that up to 90% of all brake wear is done with main pressure values at less than 1.5 bar. In below illustration one of the vehicles will perform the vast majority of all the brake effort of the vehicle combination. The braking vehicle will suffer excessive brake wear due to the high temperatures in the brake components and the mechanical coupling will be severely and unnecessarily burdened. The brakes in the other vehicle will, however, not be used and are therefore likely to develop glazed brakes and, effectively, not be able to perform in case of an emergency braking situation.



The safety - and excessive cost consequences - of incorrect brake matching are obvious.

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