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Technical Report

No. EB 135.0E

This Technical Report serves as a working document for the officially authorised expert or examiner of the accredited testing laboratory in the assessment of trailers according to §§ 20 and 21 StVZO or Directive 71/320/EEC in the version of 15 July 1991 (91/422/EEC) and ECE Regulation No. 13/09 (Supplement 5).

1. Identification

1.1 Manufacturer: WABCO Fahrzeugbremsen
Am Lindener Hafen 21
D - 30453 Hannover

1.2 Applicant: see 1.1

1.3 System: **Trailer EBS with TCE**

1.3.1 System function: **Loading ramp approach assistance**

2 Scope of application

Trailers of the classes O_3 and O_4 according to the Framework Directive 70/156/EEC and according to annex 7 of the "Consolidated Resolution on the Construction of Vehicles (R.E.3)" respectively.

3 Technical Data

3.1 General functional description:

The loading ramp approach assistance assists the driver when reversing towards loading ramps. The trailer is automatically braked for a short time before it reaches the load ramp in order to avoid damage to the vehicle and the loading ramp. The brake demand pressure is determined by the TCE as a function of the vehicle speed and the distance to the loading ramp as measured by ultrasonic sensors. If the speed remains below the relevant permitted speed, the brake is only activated to finally stop the vehicle before it reaches the loading ramp. To prevent any damage caused by movements of the vehicle in relation to the loading ramp during loading, a certain distance is maintained between the trailer and the loading ramp.

3.1.1 Functional sequence:

The loading ramp approach assistance is only activated at a vehicle speed of ≤ 2.5 km/h if the reversing lights in the trailer are switched on by engagement of the motor vehicle's reverse gear (pin 8 with ISO 12098 plug connector and pin 3 with ISO 3731 plug connector).

Control operation: When reversing and with the loading ramp approach assistance activated, the distance to any obstacle in the sensing range of the two ultrasonic sensors is measured. The desired brake pressure is determined as a function of the vehicle speed and the distance measured and the trailer is braked. The respective relationship between vehicle speed, distance to obstacle and brake pressure set as given in charts 1 and 2 in Annex 1.

If the vehicle comes to a standstill in front of the loading ramp, the brake is released after a certain time has elapsed (approx. 3 s.). This allows the driver if required to move the vehicle closer to the loading ramp or, where relevant, to pass a weather guard. In the latter case a new control cycle will be initiated, provided the distance measured to the obstacle or loading ramp is greater than 0.4 metres.

The driver has the possibility at all times during the control cycle to override the service brake system (in the direction of greater pressure).

3.1.2 Activation display:

The activation of the loading ramp approach assistance is indicated to the driver by the flashing of the tracking lights located at the rear end of the two longitudinal sides of the trailer. These lights are visible from the driver's cabin. According to the distance of the obstacle, the flashing frequency increases on approach and automatically turns into a continuous light when the vehicle is automatically braked. The tracking lights go out on completion of the control cycle.

In the case of trailers with the WABCO Trailer EBS with TCE the power supply of the lighting is centrally controlled by the TCE. The TCE is able to control the tracking lights individually.

3.1.3 Deactivation:

For reasons of safety the loading ramp approach assistance is deactivated at a vehicle speed of > 12.5 km/h (e.g. faulty reversing headlamp signal from motor vehicle). The loading ramp approach assistance is also deactivated when the reversing headlamp signal of the motor vehicle is switched off and when a fault is detected.

3.1.4 Warning:

Only the faults in the braking system are indicated by the specified warning devices (red and yellow warning signal respectively).

Where faults are detected in the hardware components of the loading ramp approach assistance, the latter and the control of the tracking lights are deactivated.

Annex 2 lists the relevant faults.

3.1.4 Functional monitoring:

The speed limits (2.5 km/h and 12.5 km/h respectively) and all parameters relevant to the brakes (brake pressures, supply voltage etc.) are monitored by the trailer modulator. The sensing of the reversing light signal and the calculation of the desired brake pressure is done by the TCE.

3.2 Components

3.2.1 Trailer modulator

WABCO No. 480 102 ... 0

3.2.2 TCE

WABCO No. 446 122 ... 0

3.3 Electrical plug connectors to trailer::

Trailer EBS:

Through the plug connector according to ISO 7638-1997 (7-pin) Part 1 (24 V) **or** according to ISO 7638-1985 (5-pin) (24 V)

Lighting for trailer:

Through the plug connector according to ISO ISO12098 (15-pin) or ISO 1185 (7-pin) and ISO 3731 (7-pin) respectively.

For the loading ramp approach assistance to function it is necessary to have a power supply for the trailer through the electrical plug connectors listed above.

3.4 Tests:

The proper functioning of the loading ramp approach assistance was tested on a 3-axle semi-trailer. The system reaction to faults in the loading ramp approach assistance was also tested (see also "Failure Matrix" in Annex 2, e.g. failure of an ultrasonic sensor, cable breaks), as was the actual brake pressure as a function of the distance to the obstacle and vehicle speed (see also Annex 1).

3.5 Safety assessment:

The safety assessment of the trailer EBS was conducted within the framework of the RWTÜV Technical Report EB 124.0E.
If there is a malfunction in the loading ramp approach assistance this will not affect the action of the braking system.

Annex 2 "Failure Matrix" shows the reaction of the loading ramp approach assistance in the case of malfunctions.

3.6 Electromagnetic compatibility (EMC):

To fulfil the statutory requirements regarding EMC the electronics itemised in paragraph 3.2. have been tested to the EU Council Directive 72/245/EEC as amended by Directive 95/54/EC and approved under the approval marks

- e1-72/245/*95/54*1206*00 (trailer modulator)
- e1-72/245/*95/54*1665*00 (TCE).

3.7 Test documents:

The following were submitted for the test:

- TCE system description (shortened)
- system FMEAs (for examination)

4. Statutory Regulations

4.1 FKT catalogue of requirements: In accordance with the discussions within the FKT special Committee on "Braking Systems" (SA-BA) and within the Experts' Committee for Automotive Engineering (FKT, Chairmanship: Federal Ministry of Transport - Department S 33), the following requirements must be met when the service braking system is activated automatically during reversing (see minutes SA-BA I/94 - Item 8 and I/93 - Item 7 or 139. FKT - Item III/14):

- The device may not have any adverse effect on the specified braking systems. In particular there must not be any deterioration in the response behaviour in the case of compressed air braking systems.
- Automatic braking may only be triggered with the reverse gear engaged.
- It must only be possible to activate the system when the vehicle is reversing.
- The automatic braking must be triggered before the vehicle comes into contact with the obstacle.
- Electromagnetic compatibility must be verified.
- The device is to be regarded as an auxiliary equipment of the braking systems.
- A warning device must indicate when the system is switched on.
- The system must be overridden by the service braking system at all times (only in the direction of greater pressure).

All these requirements are satisfied by the loading ramp approach assistance (see in particular the details given above in section 3). The tracking lights flash ("warning device") to indicate when the system is switched on.

4.3 Par. 5.1.3.6 of ECE-R13: The loading ramp approach assistance (running gear function) is supplied with electricity through the plug-type connection according to ISO 7638. There is no data transmission to the loading ramp approach assistance through this plug-type connection.

4.4 Par. 5.2.1.21 of ECE-R13:

In the ECE Regulation No. 13 (Supplement 4 to the 09 series of amendments) and the Directive 98/12/EC (see Annex I, Par. 2.2.1.24) it is required that, for a vehicle approved for towing a trailer of the class O_3 or O_4, the service braking system of the trailer may only be operated in conjunction with the service, secondary or parking braking system of the towing vehicle. This is intended to ensure that there is no danger of the trailer brakes' overheating when travelling on public roads and also that the compatibility requirements are fulfilled (see ECE-R13, Annex 10).

The loading ramp approach assistance is not affected by these requirements because, as a supplementary device (auxiliary equipment), it only functions as a manoeuvring aid in a quasi-stationary case.

In Supplement 5 to the 09 series of amendments of ECE Regulation No. 13 actuation of the trailer brakes alone (without actuation of the towing vehicle's braking systems) is even permitted at high speeds, if this is used to stabilise the vehicle combination.

The loading ramp approach assistance is regarded as an accessory to the braking system. In a similar way to other approved additional devices (see, for example, halt brakes in buses, ACC systems, supplementary parking brakes in trailers etc.), it uses parts of the braking system, but does not impair the specified functions of the trailer braking system.

The loading ramp approach assistance is overridden at all times by the service brake of the trailer. Malfunctions in the loading ramp approach assistance do not therefore exert any negative influence.

4.5 Par. 5.2.2.18 of ECE-R13:

The inputs and outputs of the "Trailer EBS with TCE" are protected against short circuits and overload.

Faults in special components of the loading ramp approach assistance which do not belong to the braking system (e.g. ultrasonic sensor) have no influence on the performance of the service braking system (see section 3.5 above)

A short circuit created in the power supply of an ultrasonic sensor demonstrated that the action of the service braking system (brake cylinder pressure applied) was unaffected.

4.6 GGVS*: Comments drawn up by the Physikalisch-Technische Bundesanstalt (PTB) wit respect to the suitability of the ultrasonic sensor for GGVS* vehicles are shown in Annex 3

* Gefahrgutverordnung Straße (Regulation governing Road Transport of Hazardous Goods)

5. Annexes

1. Charts 1 and 2 (actual brake pressures as a function of the distance to the obstacle and vehicle speed)
2. Failure matrix (A & B)
3. Comments of the PTB with respect to the suitability of the ultrasonic sensor for GGVS vehicles

6. Summary

The loading ramp approach assistance was assessed as an auxiliary equipment of the service braking system. The requirements of Directive 98/12/EC and the ECE Regulation No. 13 regarding auxiliary equipment where these affect the braking systems are satisfied.

The loading ramp approach assistance is not an “obstacle detection device” in the meaning of DIN standard 75031 [1995]. It does not release the driver of his obligation to exercise due care and receive instruction when reversing.

Date of German test report version EB135.0
Essen, 08 March 2001
Order No. 204 390 30

Date of English test report version EB135.0E
Essen, 22 May 2001

Institute for Vehicle Technology

Technical Service for Braking Systems

RWTÜV KBA P-00009-95 0/5041 Labor für Fahrzeugtechnik

W. Gaupp

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Diagram 1

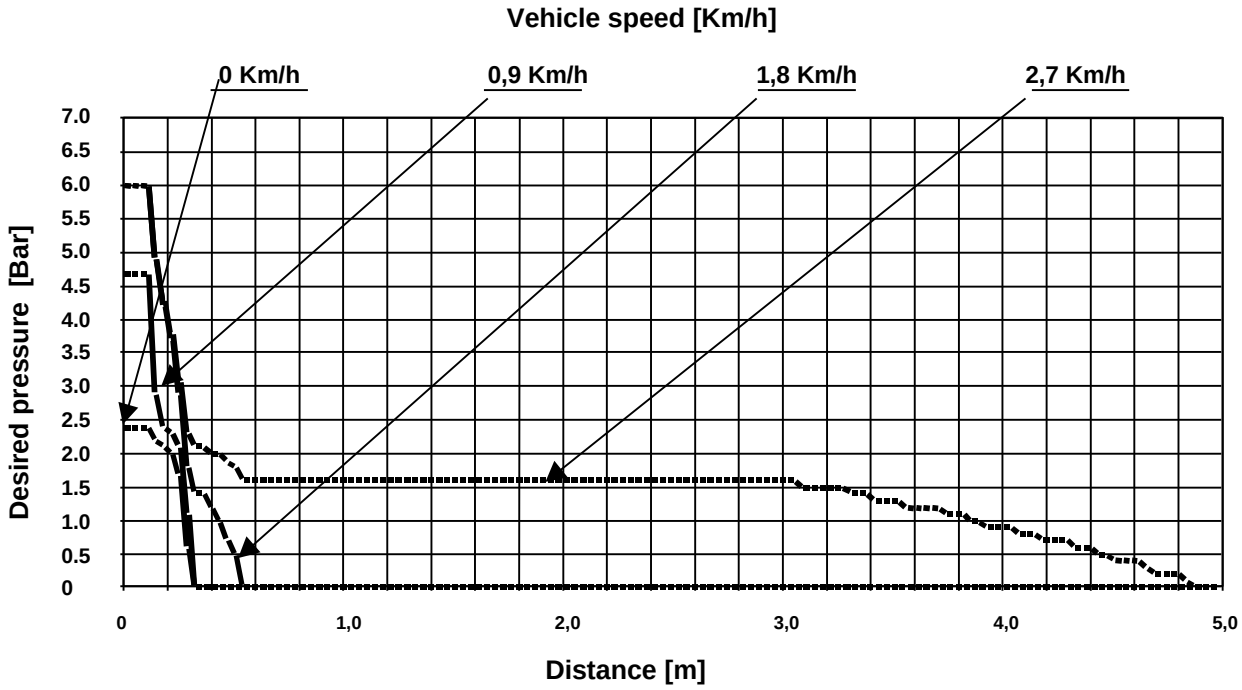
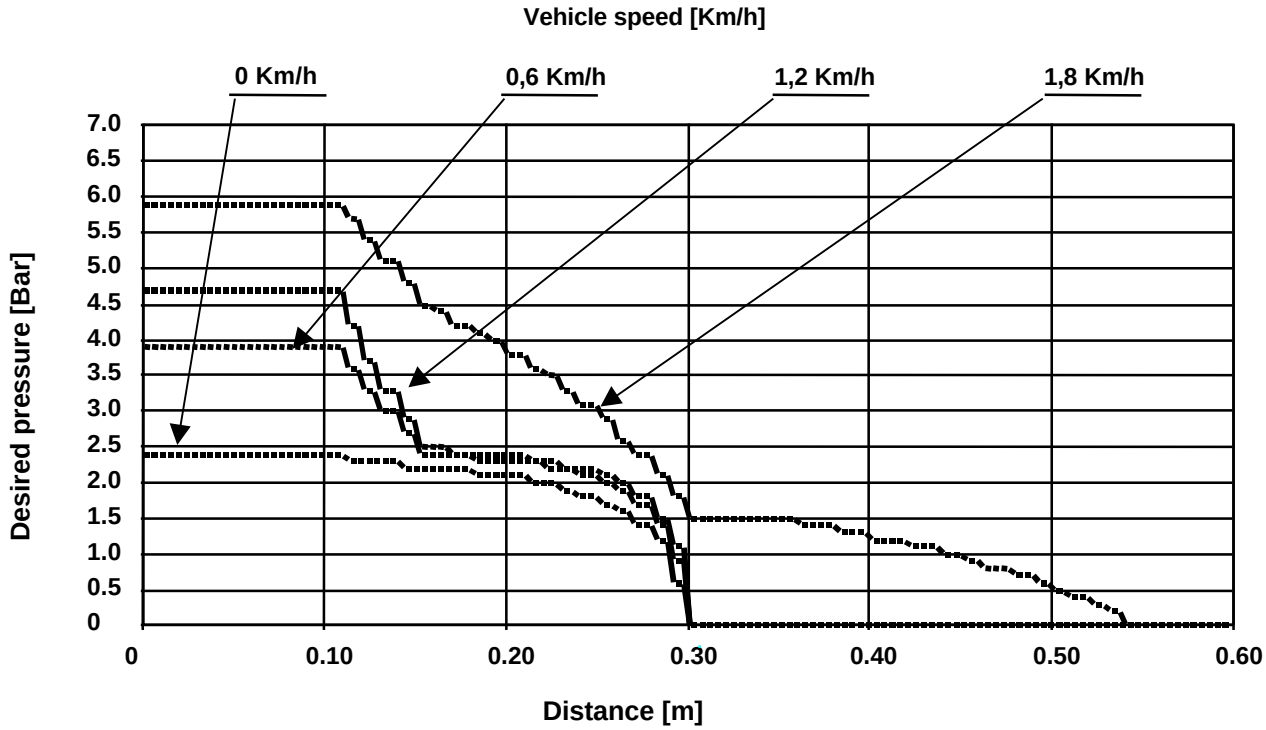


Diagram 2



Failure matrix A

Failure behaviour loading ramp approach assistance

Failure type	Vehicle speed	System reaction of the loading ramp approach assistance			
		a) during reverse loading ramp approach (reverse gear engaged, loading ramp approach assistance activated)			
		Foreign object with high sound-absorption ratio (no echo) within or in front of the sensor. Measured value = 500cm 1)	tell tale lamp status 2)	Foreign object with standard sound reflection within or in front of the sensor (minimum distance = 12cm). Measured value = 12cm 1)	tell tale lamp status 2)
Ultrasonic sensor blocked on one side	v <= 2,5 km/h	Control with unblocked sensor, respectively based on shortest distance.	activated	On error full braking, afterwards control with unblocked sensor.	activated
	2,5 km/h < v <= 12,5 km/h				
	v > 12,5 km/h	Loading ramp approach assistance deactivated.	deactivated	Loading ramp approach assistance deactivated.	deactivated
Ultrasonic sensor blocked on both sides	v <= 2,5 km/h	No distance measurement possible, error not detectable.	flashing frequency 1Hz	On error full braking, afterwards loading ramp approach assistance deactivated.	activated, after full braking: deactivated.
	2,5 km/h < v <= 12,5 km/h				
	v > 12,5 km/h	Loading ramp approach assistance deactivated.	deactivated	Loading ramp approach assistance deactivated.	deactivated
Connection TCE-Ultrasonic sensor interrupted on one side	v <= 2,5 km/h	Defect in sensor is detected, single loading ramp approach, control with other sensor, afterwards deactivation of the loading ramp approach assistance.			activated, after vehicle stop: deactivated.
	2,5 km/h < v <= 12,5 km/h				
	v > 12,5 km/h	Loading ramp approach assistance deactivated.			deactivated
Connection TCE-Ultrasonic sensor interrupted on both sides	v <= 2,5 km/h	On error full braking, afterwards loading ramp approach assistance deactivated.			activated, after vehicle stop: deactivated
	2,5 km/h < v <= 12,5 km/h				
	v > 12,5 km/h	Loading ramp approach assistance deactivated.			deactivated
Communication TCE-EBS interrupted	----------	On error deactivation of loading ramp approach assistance.			before error: activated, afterwards deactivated.
Connection width indicator lamp interrupted on one side	----------	No influence on the loading ramp approach assistance.			No indication on one side.
Connection width indicator lamp interrupted on both sides.	----------	No influence on the loading ramp approach assistance.			No indication on one both sides.
signal reverse lamp faulty, interruption or short to ground	v <= 2,5 km/h	On error loading ramp approach assistance deactivated.			before error: activated, afterwards deactivated.
	2,5 km/h < v <= 12,5 km/h				
	v > 12,5 km/h				
reverse lamp signal faulty, short to power supply	v <= 2,5 km/h	Loading ramp approach assistance remains active.			activated
	2,5 km/h < v <= 12,5 km/h				
	v > 12,5 km/h	Loading ramp approach assistance deactivated.			deactivated
no signal axle load	----------	No influence on the loading ramp approach assistance.			activated
ISO7638 5-pin (no connection to Tractor)	----------				

tell-tale lamp status

designation	*Indicator*	*Explanation*
activated	flashing frequency 1 Hz	distance to foreign object > 3 m
	flashing frequency 2 Hz	distance to foreign object 1 - 3 m
	flashing frequency 4 Hz	distance to foreign object < 1 m
	permanent light	full braking/ normal braking in front of the obstacle
deactivated	switched off	loading ramp approach assistance deactivated.
	(control)	

1) measured value means the evaluated distance of the ECU.

2) the tell-tale lamp status is independent from the normal lighting system status

Failure matrix B

Failure behaviour loading ramp approach

Failure type	Vehicle speed	System reaction of the loading ramp approach assistance			
		b) before reverse loading ramp approach (before gear engaged, loading ramp approach assistance deactivated)			
		Foreign object with high sound-absorption ratio (no echo) within or in front of the sensor. Measured value = 500cm 1)	tell tale lamp status 2)	Foreign object with standard sound reflection within or in front of the sensor (minimum distance = 12cm). Measured value = 12cm 1)	tell tale lamp status 2)
Ultrasonic sensor blocked on one side	v <= 2,5 km/h	Control with unblocked sensor, respectively based on shortest distance.	activated	Loading ramp approach assistance remains deactivated.	deactivated
	2,5 km/h < v <= 12,5 km/h	No activation of the loading ramp approach assistance for v > 2,5 km/h.	deactivated	No activation of the loading ramp approach assistance for v > 2,5 km/h.	deactivated
	v > 12,5 km/h				
Ultrasonic sensor blocked on both sides	v <= 2,5 km/h	No distance measurement possible, error not detectable.	flashing frequency 1Hz	No activation of the loading ramp approach assistance.	deactivated
	2,5 km/h < v <= 12,5 km/h	No activation of the loading ramp approach assistance for v > 2,5 km/h.			deactivated
	v > 12,5 km/h				
Connection TCE-Ultrasonic sensor interrupted on one side	v <= 2,5 km/h	Defect in sensor is detected, single loading ramp approach, control with other sensor, afterwards deactivation of the loading ramp approach assistance.			activated, after vehicle stop: deactivated.
	2,5 km/h < v <= 12,5 km/h	No activation of the loading ramp approach assistance for v > 2,5 km/h.			deactivated
	v > 12,5 km/h				
Connection TCE-Ultrasonic sensor interrupted on both sides	v <= 2,5 km/h	No activation of the loading ramp approach assistance.			deactivated
	2,5 km/h < v <= 12,5 km/h	No activation of the loading ramp approach assistance for v > 2,5 km/h.			deactivated
	v > 12,5 km/h				
Communication TCE-EBS interrupted	----------	No activation of the loading ramp approach assistance.			deactivated
Connection width indicator lamp interrupted on one side	----------	No influence on the loading ramp approach assistance.			No indication on one side.
Connection width indicator lamp interrupted on both sides.	----------	No influence on the loading ramp approach assistance.			No indication on both sides.
signal reverse lamp faulty, interruption or short to ground	v <= 2,5 km/h	No activation of the loading ramp approach assistance.			deactivated
	2,5 km/h < v <= 12,5 km/h				
	v > 12,5 km/h				
reverse lamp signal faulty, short to power supply	v <= 2,5 km/h	Loading ramp approach assistance gets active.			activated
	2,5 km/h < v <= 12,5 km/h	No activation of the loading ramp approach assistance for v > 2,5 km/h.			deactivated
	v > 12,5 km/h				
no signal axle load	----------	No influence on the loading ramp approach assistance.			deactivated
ISO7638 5-pin (no connection to Tractor)	----------				

tell-tale lamp status

Designation	*Indicator*	*Explanation*
activated	flashing frequency 1 Hz	distance to foreign object > 3 m
	flashing frequency 2 Hz	distance to foreign object 1 - 3 m
	flashing frequency 4 Hz	distance to foreign object < 1 m
	permanent light	full braking/ normal braking in front of the obstacle
deactivated	switched off	loading ramp approach assistance deactivated.
	(control)	

1) measured value means the evaluated distance of the ECU.

2) the tell-tale lamp status is independent from the normal lighting system status

Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

PTB

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Betreff: Stellungnahme, ob von einem Ultraschallsensor, Typ „microsonic", als Abstandssensor zur Rangierhilfe bei GGVS-Fahrzeugen und GGVS-Anhängern Zündgefahren durch den ausgestrahlten Ultraschall ausgehen.

Sehr geehrte Damen und Herren,
zu Ihrer Anfrage vom 16.11.2000 nehmen wir wie folgt Stellung:

Für die Beurteilung des Ultraschallsensors Wabco 4461224000 (Betriebsspannung 8 V ±1 V DC, Stromaufnahme 30 mA, Schutzart IP 6k9k, 40 kHz Sendefrequenz, Schalldruck 113 dB in 5 cm Messabstand, entsprechend einer akustischen Leistung von 0,002 W, Membrandurchmesser 10,4 mm, 2800 pF Kapazität) zum Einsatz als Rückfahrhilfe von GGVS-Fahrzeugen ist die Einbindung des Bauteils in den elektrischen Stromkreis von Bedeutung:

Fall 1: Der Sensor ist so geschaltet, dass er mittels eines Batterietrennschalters beim Befüllen und Entleeren vom Bordnetz des Fahrzeugs automatisch abgetrennt wird. In diesem Fall ist nicht mit dem Auftreten von explosionsfähiger Atmosphäre im Bereich des Sensors zu rechnen, während dieser betrieben wird. Er kann somit nicht als Zündquelle wirksam werden.

Fall 2: Selbst wenn der Sensor beim Befüllen und Entleeren betrieben wird, was einer Anordnung in Zone 1 entsprechen würde, bestehen keine Bedenken bezüglich seines Einsatzes anlässlich seiner Ultraschallabgabe, da die übertragene Schallleistung für eine Zündung viel zu gering ist. Hier sind andere Zündquellen wie heiße Oberflächen an Abgasanlagen und Personenaufladung beim Aussteigen aus dem Fahrzeug wahrscheinlicher.

Die Ausführungen betreffen ausschließlich die Zündquelle „Ultraschall". Aussagen zur elektrischen Sicherheit des Bauteils werden nicht gemacht. Wir hoffen, Ihnen mit diesen Ausführungen gedient zu haben und stehen für eine Rücksprache und weitere Dienstleistungen gerne zu Ihrer Verfügung.

Mit freundlichen Grüßen
im Auftrag
von Pidoll

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