INFORMATION DOCUMENT

Directive 71/ 320 – Annex XIV
ECE Regulation 13/10

Trailer Anti-Lock Braking System
Information Document
ID_EB123_8

Electronically controlled Brake System (EBS) for trailers

Trailer EBS E
Trailer EBS E with TCE

2S/ 2M - 4S/ 3M

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			APPR. LEV.	DATE	NAME		
			COMPILER	15.01.2007	A. Stender	Trailer EBS E	
			2	15.01.2007	N. Witte		
			3				
			4				
			TRI	PRODUCT IDENTIFICATION NO.		DOC.NAME	SHEET
Name	REVISION	DATE		400 200 220 0		id_eb123_8.doc	1/43

Introduction

Information document for Trailer EBS

This information document is produced in accordance to Annex XIV of Directive 71/320/EEC and Annex 19 of ECE R13. The information contained in this document is used for the type approval of the prescribed braking system.

1 General

1.1 Name of manufacturer

WABCO GmbH & CO. OHG
Vehicle Control Systems
An American Standard Company

WABCO Fahrzeugbremsen
Am Lindener Hafen 21
D-30453 Hannover

1.2 System name/model: Trailer EBS

1.3 System variant: E

Versions:

Trailer EBS E

Trailer EBS E with TCE*

* TCE: Trailer Central Electronic

Note: Regarding the description of the above mentioned different versions see paragraph 2.1.3 of ID_EBS.

1.4 System configurations

2S/2M, 2 sensors and one trailer modulator for 1- to 3-axle semi- and centre-axle trailer with air suspension or mechanical suspension.

2S/2M+SLV, 2 sensors, one trailer modulator and one select low valve for 2- to 3-axle semi- and centre-axle trailer with air suspension or mechanical suspension and one self-steering axle.

4S/2M, 4 sensors and one trailer modulator for 2- and 3-axle semi-and centre-axle trailer with air suspension or mechanical suspension.

4S/2M + 1M, 4 sensors, one trailer modulator and one ABS-relay valve for 3- to 4-axle semi-trailers and 3-axle centre-axle trailers with air suspension or mechanical suspension.

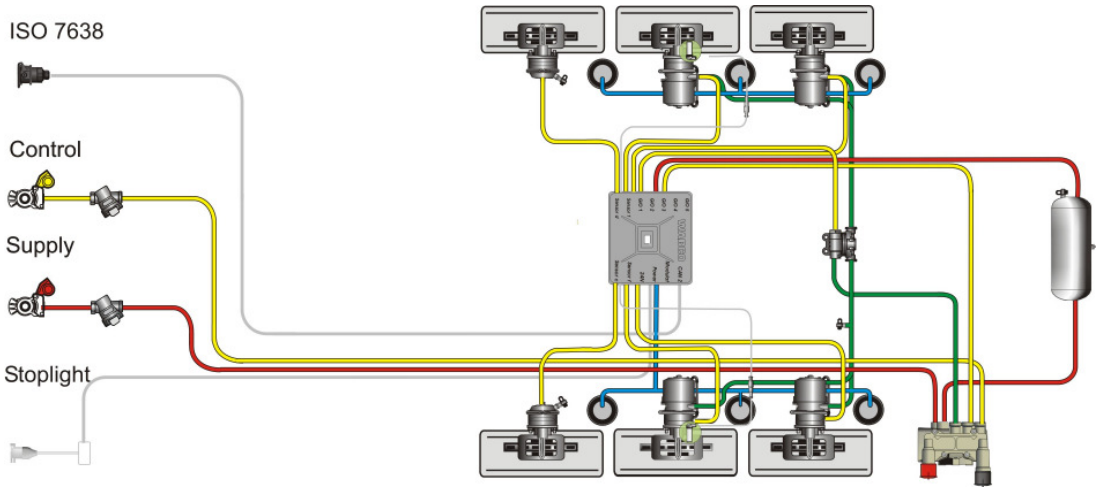
4S/3M, 4 sensors, one trailer modulator and one EBS-relay valve for 2- to 3-axle full trailers and 2- to 3-axle semi-trailer and 2- and 3-axle centre-axle trailer with air suspension or mechanical suspension.

1.5 Explanation of the basic functions and philosophy of the system

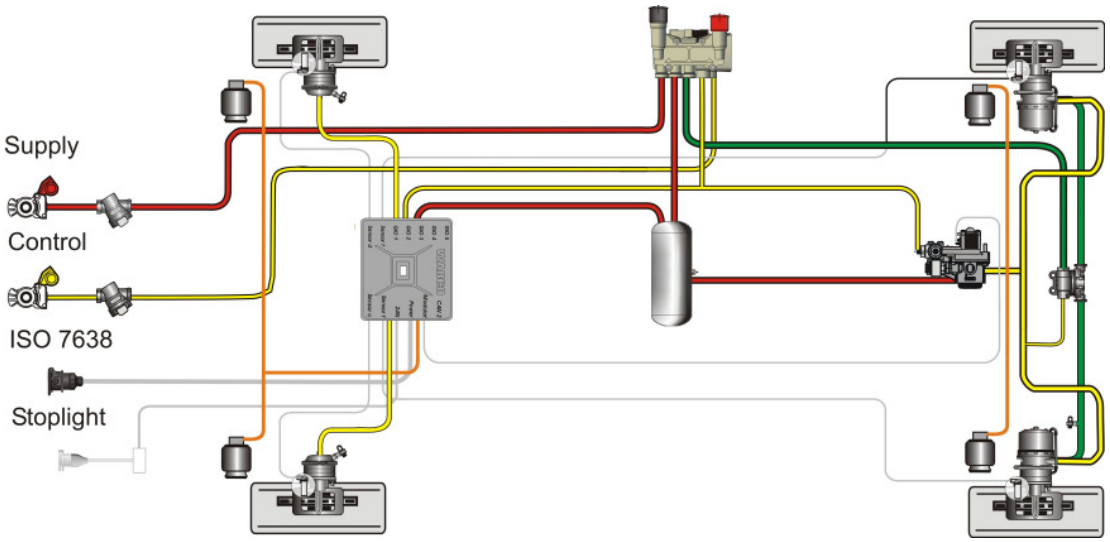
Electronically controlled braking system with load-dependent brake pressure regulation and automatic anti-lock device.

1.5.1 System structure

The standard EBS system for a three-axle semi-trailer is shown in the following figure. Itcontrols the brake pressures electronically on each side. The system is made up of a dual-circuit trailer modulator (**2**) with digital data interface according to ISO 11992 to the EBS towing vehicle, an EBS relay emergency valve or Park Release Emergency Valve (PREV) (**1**), and the ABS sensors.



When used in full trailers or semi-trailers, with a steering axle, a system with an additional EBS relay valve (**7**) on the steering axles is used.



Trailers with this brake system are compatible with conventional and EBS-braked towing vehicles. They can be braked with pneumatic redundancy in the case of an EBS failure on the trailer. This results in three possible modes of operation:

a) Operation behind towing vehicles with EBS and extended (7 pin) ISO 7638 plug-type connection with CAN interface according to ISO 11992.

All EBS functions can be utilised. The driver's braking demand (set value) is transmitted via the data interface to the trailer vehicle.

b) Operation behind conventional towing vehicles with ISO 7638 plug-type connection, without CAN interface

All EBS functions can be used except for transmission of the demand value via the CAN interface. The demand value is specified by the pressure sensor in the relay emergency valve. This pressure sensor measures the trailer control line pressure.

c) Redundancy operation

1. without ISO 1185 or ISO 12098-powering

If the electrical power supply fails or is not plugged in the braking is controlled pneumatically, although **without load-dependent brake force control** and **without ABS function**.

2. with ISO 1185 or ISO 12098-powering as a safety function

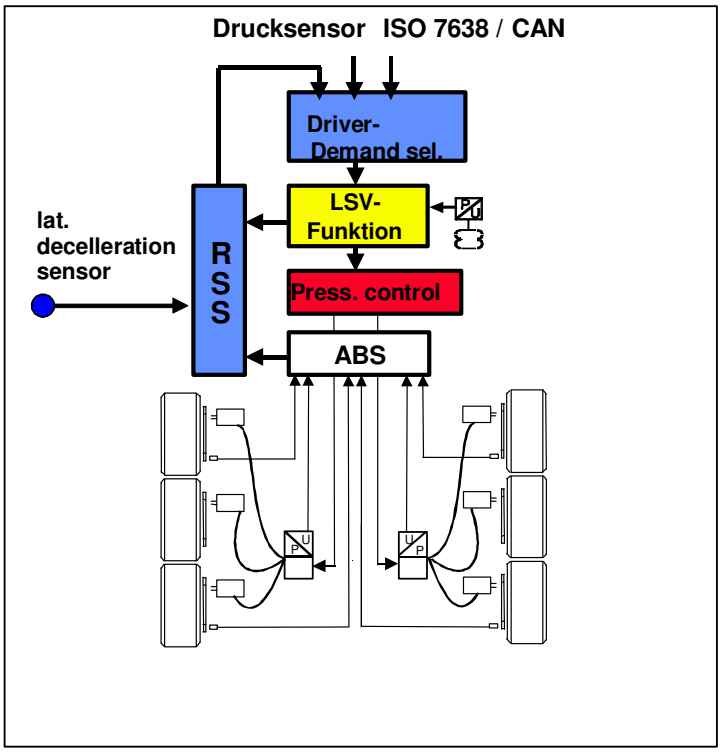
It is not allowed to use the trailer without the ISO 7638 connector. If the electrical power supply via ISO 7638 fails and the system is fitted by an ISO 1185 or ISO 12098-cable (optional feature), the system can be supplied by this optional connection (stoplight-powering). In this case only ABS and the load-dependent brake force control are in function with reduced performance.

1.5.1.1 Description of the EBS-functional blocks

The Trailer EBS mode of functioning can be described in terms of various sub-functions.

1.5.1.1.1 Selection of demand value

The demand value is the driver's braking request. When operated behind an EBS towing vehicle the trailer modulator obtains the demand value via the trailer interface from the EBS towing vehicle. If no demand value is available via the trailer interface, e.g. when operating the trailer behind a conventionally braked towing vehicle or if the trailer interface in the case of EBS combination is interrupted, a demand value is generated by measuring the control pressure. As a matter of priority, control is always the demand value via CAN.

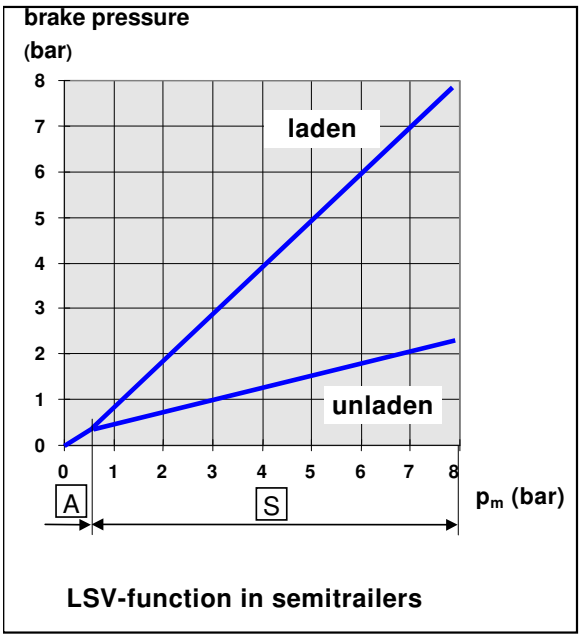


1.5.1.1.2 LSV- function

The Trailer EBS contains the **load-dependent brake force control**, a distinction being drawn between semi-trailers or centre-axle trailers and full trailers.

The current loading state is determined by sensing the air-suspension bellows pressure.

In case of semi-trailers, as at present, a static linear control function is used. The transmission function of brake pressure (p_{Cyl}) to coupling head pressure (p_m) is broken down into two ranges:

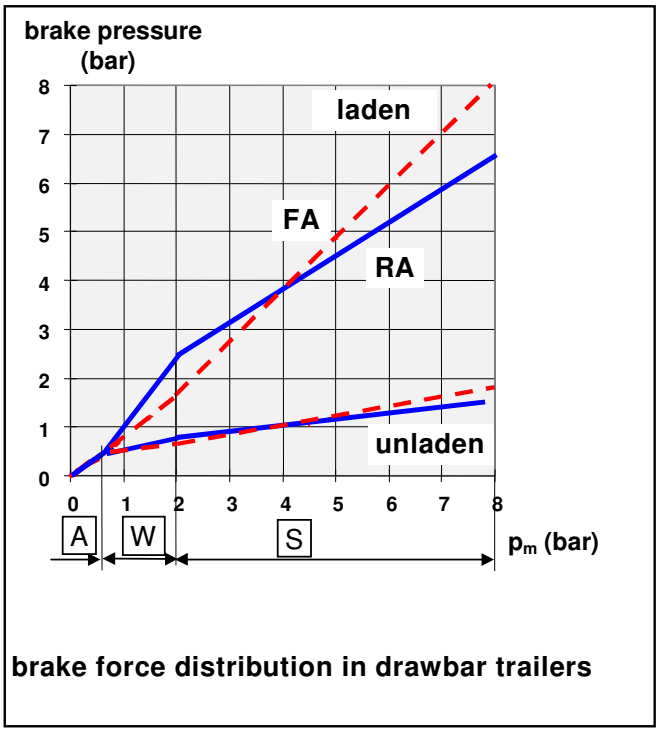


LSV-function in semitrailers

- [A] • Application range
- [S] • Stability range

In the example the brake cylinder pressure in the application range (p_m = 0 bar to p_m = 0.8 bar) rises from 0 to 0.4 bar. At p_m = 0.8 bar the threshold pressure of the wheel brake is reached, and the vehicle can start to generate brake force. The parameters for this point, in other words the response pressure of the whole trailer brake, can be set within the framework of the EEC bands.
Subsequently the brake pressure with laden vehicle follows the straight line which passes through the calculated value at p_m = 6.5 bar. With the unladen vehicle the response pressure is also modulated from p_m = 0.8 bar, and the brake pressure reduced in accordance with the load.

With a full trailer the brake force distribution, achieved on a software basis, replaces the two LSV valves, the adaptor valve on the front axle and the pressure limiting valve on the rear axle which are commonly used at present.



brake force distribution in drawbar trailers

Here the transmission function is broken down into three ranges:

- A application range
- W wear range
- S stability range

At the end of the application range, the response pressures of the brakes are adjusted again, and these pressures may of course differ from axle to axle.

In the partial braking range the pressures are adjusted so as to optimise wear. For a full trailer with, for example, type 24 cylinders on the front axle and type 20 cylinders on the rear axle the pressure to the front axle is reduced in accordance with the design and raised on the rear axle. This ensures uniform loading of all wheel brakes more precisely than can be achieved with the adaptor valve currently used.

In the stability range, the pressures corresponding to equal utilisation of adhesion are adjusted as a function of the axle load.

The rear axle load is determined from the air-suspension bellows pressure. The front axle load is determined, without an axle load sensor, from the slip difference between the speed-sensed wheels.

The parameters are calculated using the WABCO brake calculation program. The parameters are stored in the trailer modulator with the corresponding brake calculation number. The system checks the proper function of the axle load sensor.

1.5.1.1.3 Pressure control

The pressure control circuits convert the set pressure specified by the LSV function into cylinder pressures.

The control unit compares the actual pressures measured at the output of the relay valves with the set pressure specified. If a deviation arises, this is corrected by actuating the supply or exhaust solenoids.

1.5.1.1.4 Anti-lock function (ABS)

The control logic recognises, from the speed behaviour of the wheels, whether one or more wheels display a "locking tendency" and decides if the related brake pressure is to be lowered, maintained or raised.

Each wheel is controlled in its optimum range following this concept (**M**odified **A**xle **C**ontrol (MAR), **M**odified **S**ide **C**ontrol (MSR), **I**ndividual **C**ontrol (IR)).

1.5.1.1.5 Standstill function

With the vehicle at a standstill ($v \leq 1.8$ km/h) **and** when the control pressure (pneumatic and electric) is constant for 3 s, there is a switch from electro-pneumatic to pneumatic pressure adjustment. This function serves to prevent unnecessary power consumption when the vehicle is stands still e.g.. at a traffic light or if the handbrake is applied and ignition is on. This function is deactivated when the vehicle moves.

1.5.1.1.6 Emergency braking function

In order to apply the maximum possible brake force there is an emergency braking function. If the driver's braking command corresponds to more than 90% of the pressure available on the trailer, in other words panic braking is applied, the brake pressures are increased in a ramp fashion up to the characteristic of the vehicle in laden condition.

This function is also effective if the bellows of the air suspension system bursts.

1.5.1.1.7 Monitoring of brake air pressure

The supply pressure in the trailer vehicle is monitored by the EBS.
If the supply pressure falls below 4.5 bar the driver is warned by a warning light which illuminates. When the braking system is filling the warning light only goes out when the supply pressure in the trailer vehicle rises above 4.5 bar.

1.5.1.1.8 Lifting axle control

In conjunction with a WABCO lift axle control valve the EBS controls the lifting axle automatically as a function of the current axle load.

1.5.1.1.9 Integrated speed switch

This output can be used, for example, to lock a self-steering axle at higher speed.

1.5.1.1.10 Lining wear sensing

The system can read in max. 6 lining wear sensors or wear indicators. The driver will be warned when the wear limit is reached.

1.5.1.1.11 Roll stability support

The system is equipped with a system to prevent roll over of the trailer when exceeding the possible lateral acceleration.

1.5.1.1.12 Electronically controlled air suspension

As an option the system can control the air suspension of a trailer by an integrated control algorithm.

1.5.1.1.13 Parameter Setting

Variable parameters: The following parameters must be set in the production by the trailer manufacturer.

Vehicle type	semi-trailer or full trailer
Number of axles	for semi-trailers are allowed a max. of 3 axles and for full trailers 3 axles
ABS-system	installed ABS-system and position of sensors
Lift axle control	1 or 2 lift axles controlled
Integrated speed switch	to control self-steering axles or air suspension
Roll stability support (RSS)	for semi-trailers and centre-axle trailers
Lining wear sensors	to choose the type of wear sensors
Warning lamp sequence	on, after 2 s off or on – off - on- at 7 km/h off
Tyre diameter and pole wheel teeth number	to calibrate the wheel speeds for ABS and odometer
Service interval	The driver will be informed after a specified distance
Axles load unladen and laden	to adjust the load sensing function
Air bellow pressure unladen and laden	to adjust the load sensing function
Brake pressure unladen and laden	to adjust the load sensing function
Special functions	special functions like traction help or telematic support can be choosen
Electronically controlled air suspension	to control the level in trailers with air suspension
GIO- functions	special functions like lift axle control, speed switch, traction help or telematic support can be chosen

2. Applications

2.1 List of trailer types and ABS configurations

Single or multi-axle semi-trailer, centre- axle trailers or full trailers of categories O3 and O4 according to Directive 71/320/EEC, with air suspension or mechanical suspension, disc or drum brakes.

	Semi trailer			Centre-axle trailer			Full trailer	
Number of axles ⇒ ABS configuration	1	2	3	1	2	3	2	3
2S/2M	x	x	x	x	x	x		
2S/2M+SLV		x	x		x	x		
4S/2M		x	x		x	x		
4S/2M + 1 M		x	x		x	x		
4S/3M		x	x		x	x	x	x

For sample diagrams see 3.5.

2.2. Schematic diagrams of the system configurations

Appendix 1 shows possible configurations of sensors and modulators for the different trailers defined in item 2.1.
For possible length and diameters of tube/pipe length see 3.5.

2.3 Relationship of tyre circumference to the resolution of the exciter

The ratio between tyre circumference [mm] and pole wheel teeth number must be between 22 and 40.
The actual tyre circumference and pole wheel teeth numbers are stored in the trailer modulator.

2.4 Tolerance on tyre circumference between one axle and another fitted with the same exciter

The inter wheel variations of rolling circumference must not exceed a value of 6,5 %. Otherwise, the rolling circumference must be adjusted by setting parameter in the trailer modulator.

2.5 Scope of application with respect to suspension type

The Trailer EBS is applicable to trailers with air suspension or mechanical suspension. Appendix 2 defines the specific suspension types by manufacturer for use.

2.6 Recommendations on differential brake input torque in relation to the ABS configuration and trailer bogie

For multiple-axle applications an almost identical utilization of friction of these axles is required. If all of the wheels are not fitted with sensors, the axle(s) which usually lock(s) first must be equipped with sensors.

Multiple-axle applications having only static axle load proportioning must be equipped in that way that the wheels of all axles reach their locking point simultaneously and that one wheel directly controlled

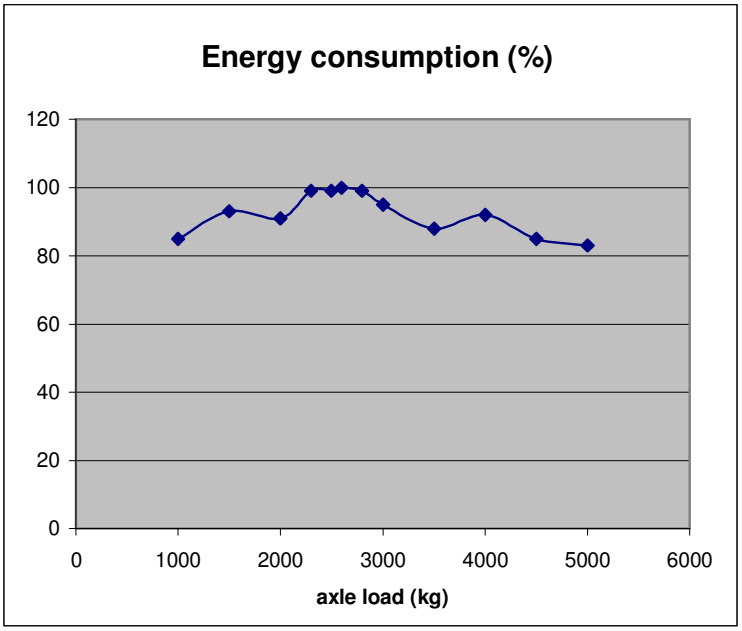
- does not control more than two other wheels
  or
- in the case of central axle trailers does not indirectly control more than one wheel or one axle

Differentials on brake input torque are admissible for all anti-lock configurations within a range of 20 %.

2.7 Test data of energy consumption

The energy consumption has been tested according to paragraph 6.1 of annex 10 of 98/12/EG and annex 13 of ECE R 13, respectively. To determine the worst case a variation of axle load has been made. Within a range of ±10,000 N of the worst case, the energy consumption for different ABS configurations has been determined.

During all energy consumption tests the load-sensing valve was in a fully laden position. The following diagram represents the data from the energy consumption tests. It gives the supply pressure after ABS control of 15 sec and five additional brake applications. The worst case axle load is 2600 kg.



2.8 Additional information to the application of the anti-lock braking system

When the vehicle is first put into service the parameters must be set and the system checked in accordance with the vehicle equipment using the WABCO Trailer- EBS PC diagnostic program. If this sign-off procedure is not followed, the warning light will not go out during operation, even if the system is fault-free. The parameters for the load-dependent brake pressure control and tyre circumference are determined by means of the WABCO brake calculation

3 Component description

3.1 Sensors and exciters

3.1.1 Wheel speed sensors

The sensors transmit the information from the rotating toothed wheels to the trailer modulator. Based on this information the ECU calculates the wheel and vehicle speeds. Special care must be taken to ensure accurate speed information.

Identification:

Wheel speed sensors: WABCO part number	441 032 ... 0 441 035 … 0

Sensors are mounted in clamp bushings, WABCO part number 899 760 510 4, 899 759 815 4 or 899 759 882 4

3.1.2 Exciters

Exciters according WABCO specification 895 905 000 4

3.1.3 Pressure sensor

The sensor can be used optional as an external driver demand sensor in long vehicles or as an external axle load sensor.

Identification:

Pressure sensor: WABCO No.	441 040 007 0 to 441 040 015 0 441 044 0010 and 441 044 002 0

3.1.4 Levelling sensor

The sensor can be used in systems with integrated electronically controlled air suspension (Premium variant) and in trailers with mechanical suspension to measure the axle load.

Identification:

levelling sensor WABCO No.	441 050 1.. 0 .

3.2 Controllers

3.2.1 Trailer modulator

The trailer modulator (TM) serves to control and monitor the electro-pneumatic braking system. The TM is installed in the braking system between the reservoir, relay emergency valve and the brake cylinders. It controls the brake cylinder pressure on both sides of one, two or three axles.
The TM communicates directly or via TCE (Trailer Central Electronic see 3.2.2) using the extended ISO 7638 connector with the motor vehicle via the electric trailer interface according ISO 11992. The TM has two pneumatically independent pressure control circuits, each with a supply and exhaust valve, redundancy valve, pressure sensor and common control electronics. The required deceleration of the vehicle is determined from the pressure signal received from the CAN demand value. The TM has an integrated axle load sensor. If necessary an external demand sensor and axle load sensor can be connected. The TM has also a connector for lining wear sensor(s). The brake force is modified as a function of the vehicle load (brake force distribution function). In addition the wheel speeds are registered and analysed via up to four rotary speed sensors. If there is a locking tendency the braking pressure specified for the brake cylinder is controlled by the ABS control circuit. The TM has an electrical connection for the ABS or EBS relay valve. With this connection, it is possible to control the brake pressure of an axle separately. In the TM the reservoir pressure is sensed so that the driver can be warned if there is any pressure loss.

There two variants available. The Standard variant covers only 2S/2M applications, whereas the Premium variant covers all applications and in addition includes the electronically controlled air suspension.

Identification:

Trailer modulator: WABCO No. Standard variant: 480 102 030 0 – 480 102 058 0
Premium variant: 480 102 060 0 – 480 102 088 0

Failure modes:

The TM monitors itself. In the event of a fault, any parts found to be defective (ECU, sensors, modulator(s)) are selectively switched off, and the warning system is actuated. Even in the event of the whole system being switched off the back-up braking function is maintained **but without load-dependent brake force contro**l and **without ABS function**. In the case of stoplight-powering only ABS and the load-dependent brake force control are in function with reduced performance.
Correct electrical/electronic function of the EBS is indicated by warning device in the driver's cab of towing vehicle according to the provisions of the ECE R13
Section 5.2.1.29.

Additional features:
- integrated speed switch
- diagnostic interface according to ISO 14230 (KWP 2000)
- automatic lift-axle control
- integrated load proportioning function
- Roll stability control
- Lining wear sensing
- Integrated electronically controlled air suspension

3.2.2 Trailer Central Electronic

The Trailer Central Electronic (TCE) integrates a communication gateway and power distribution facilities for brake and running gear equipment as well as for equipment other than brake and running.

Electronically controlled power supply for brake and running gear equipment is provided via the connector according to ISO7638 with the highest priority given to the power supply of the TM. For equipment other than brake and running gear power supply is provided via the connector according to ISO12098.

For brake and running gear equipment the tractor-trailer CAN data link in the connector according to ISO7638 is used. For equipment other than brake and running the tractor-trailer CAN data link in the connector according to ISO12098 is used.

The TM and other trailer systems are connected to the TCE via a trailer CAN high speed data bus according to ISO11898 with separate physical CAN links. One CAN link is specially assigned for the connection of the TM. In case of a physical CAN link failure the respective link can be switched of individually to maintain communication via the other physical CAN links.

Identification:

Trailer Central Electronic: WABCO part number 446 122 ... 0

Failure detection and handling

The TCE is a self-monitoring system. In case of a malfunction, the power supplies and CAN data links of externally connected systems and components can be individually switched of. Detected failures are stored in a non-volatile memory and can be read out by a diagnostic tool via the central diagnostic connector.

Additional features:

- Loading ramp approach assistance
- Levelling control and lift axle control
- Brake lining wear sensing
- Vehicle lights control

3.3 Modulators

3.3.1 EBS relay emergency valve

Trailer brake valve with emergency brake function without predominance - with demand sensor to measure the towing vehicle control pressure.

Identification:

EBS relay emergency valve WABCO part numbers: 971 002 ... 0
400 600 ... 0

3.3.2 ABS Relay Valve

The ABS relay valve serves the purpose of holding or venting the pressure in the brake chambers, this is being done independently of the pressure that is transmitted by the brake valve of the trailer. Only relay valves without check valve between port 4 and the control chamber of the relay valve are permissible.

Electrically controlled relay valve with two solenoids to hold and vent the brake pressure during ABS-braking of one axle in 4S/2M+1M systems.

Identification:

ABS Relay Valve WABCO part numbers: 472 195 037 0

3.3.3 EBS Relay Valve

Electrically controlled relay valve with pressure sensor and redundancy valve (secondary safety circuit) to control the brake pressure during normal braking and ABS-braking of one axle in 4S/3M systems.

Identification:

EBS relay valve: WABCO No. 480 207 ... 0

3.3.4. Park Relay Emergency Valve (PREV)

Trailer brake valve with emergency brake function and integrated release and park valve.

Identification:

Park Release Emergency Valve WABCO part numbers: 971 002 9.. 0

3.3.5. Select Low Valve (SLV)

Double Cut Off Valve or Relay valve to control self-steering axles in 2S/2M+SLV systems.

Identification:

Select Low Valve WABCO part numbers: 434 500 00. 0

Relay valve WABCO part numbers: 973 001 ... 0
973 011 ... 0

3.4 Electrical equipment

The circuit diagrams in appendix 4 shows the connection of all external components (power supply, sensors and modulators). All components are connected via external connectors, which are moulded and coded to avoid mismatching. The cables and connectors fulfil GGVSE resp. ADR requirements (Test report TÜV Nord No. 1203/04).

Powering methods

Permanent power supply via the connector according to ISO 7638-1997 (7-pin) Part 1 (24 V) **or** to ISO 7638-1985 (5-pin) (24 V).

In the event of ISO 7638 power supply failure to maintain trailer stability during braking: Intermittent power supply via the connector according to ISO 1185 or ISO 12098. In this case only ABS and the load- dependent brake force control are in function with reduced performance.

Warning lamp sequence

The system can output two different warning lamp sequences. The sequences are according to the provisions of the ECE R13 Section 5.2.1.29 and can be changed by parameter setting.

1. Option

When vehicle is stationary:

- Warning light comes on when ignition is switched on.
- Warning light goes off after approx. 2 s if no fault is detected.
- If a fault has been detected e.g. sensor fault, the warning light will stay on.
- If a sensor fault was recorded during the previous journey but is no longer current, the warning light will go off at $v \geq 7$ km/h.

When vehicle is travelling at $v \geq 7$ km/h:

- Warning light comes on, or stays on, if a current error is detected.

2. Option

- Warning light comes on when ignition is switched on
- If no current defect has been detected, warning light goes out after about 2 s, lights up again after a further 2 s, and goes out at $v \geq 7$ km/h.
- If a current defect is detected, e.g. sensor broken off, the warning light stays on.

ISO 1185 (ISO 12098) powering failure warning:

The provision of powering the trailer braking system from the ISO1185 or ISO 12098 connector is to provide a backup in the event of failure of the power supplied via the ISO 7638 connector and therefore there is no failure warning requirement.

Non-specified faults

Non-specified faults are monitored by a flashing warning lamp. After energising the Trailer EBS the flashing of the yellow signal starts after the normal warning signal sequence was completed. When the vehicle speed increases over 10 km/h the flashing warning signal is terminated.
When a specified failure is present the flashing warning lamp signal is replaced by a non-flashing warning lamp signal.

3.5 Pneumatic circuits

Sample brake diagrams for different trailers with standard air brakes are represented in Appendix 4 (page 1 to 8):

Page 1: semi-trailer with 2S/2M and 4S/2M
Page 2: semi-trailer with 2S/2M and 4S/2M with PREV
Page 3: semi-trailer with 2S/2M +SLV
Page 4: semi-trailer with 4S/2M+1M
Page 5: semi-trailer with 4S/3M
Page 6: full trailers with 4S/3M
Page 7: full trailers with 2S/2M and TCE
Page 8: emi-trailer with 4S/2M+1M and mechanical suspension

Limitations on pipe/tube sizes and associated lengths:

The length of the hoses between actuator and brake chambers should be as short as possible.

tube and hoses	**min. diameter**	**max. length**
reservoir – trailer modulator	12 mm (see note)	see note
reservoir – EBS (ABS) relay valve	9 mm (see note)	see note
trailer modulator – brake chamber directly controlled wheels indirectly controlled wheels	 9 mm 9 mm	 6 m 6 m
EBS (ABS) relay valve – brake chamber	9 mm	6 m

Note: energy supply lines between air reservoir and modulator(s): response time according to Annex III of Directive 71/320/EEC or Annex 6 of ECE R13/9 has to be fulfilled.

3.6 Electromagnetic Compatibility (EMC)

3.6.1 Documentation

The system has been proofed to confirm compliance with Council Directive 72/245/EEC relating to the radio interference (electromagnetic compatibility) of vehicles as last amended by Directive 2006/28/EC.and has been given the following approval marks:

Approval mark e1 *72/245*2006/28*4868*00

Approval mark e1 *72/245*2006/28*1665*01

A copy of the EMC type approval certificates for Trailer EBS-E and TCE are attached as Appendix 5 (3 pages) and 6 (3 pages).

Appendix 1 (page 1/3)

System Configurations

ABS-Configurations for Semitrailer, Centre Axle Trailer and Drawbar Trailer

Lift axles

System 2S/2M: Lift axles shall not be sensed

All other systems: Lift axles can be sensed with ABS-sensors e and f.

Steering axles

Positively steered axles have to be handled like rigid axles.

WABCO recommends that trailers with self steering axles shall be used with 4S/3M, 4S/2M+1M or 2S/2M+SLV configuration.

If 2S/2M or 4S/2M EBS- Systems are used, checks should be carried at the time of type approval of a trailer to ensure that no undue vibration or course deviation is observed. It is not possible to evaluate the reaction of all available steering axles in the case of anti-lock braking control.

In the case of requirement to provide additional stability to a self-steering axle during anti-lock operation the output-signal of the ISS may be connected to a solenoid valve which locks the self steering function at higher speed.

LEGEND: Mounting Instructions for axle boogie types:

= driving direction


= trailer modulator


= two way valve (SHV)


= select low valve (SLV)


= EBS-relay valve


= ABS-relay valve

Arrangement of control channels:
(acc. to wiring diagram
841 801 620 to 841 801 622 0)

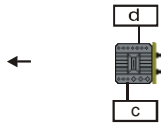
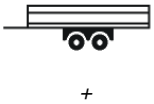
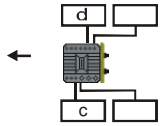
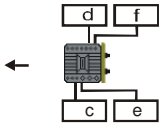
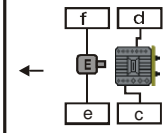
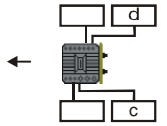
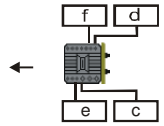
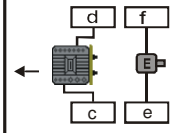
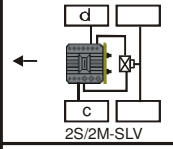
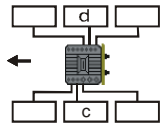
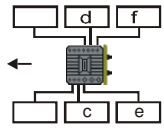
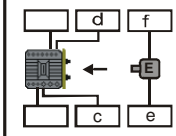
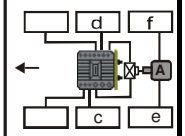
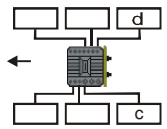
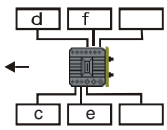
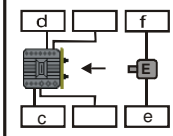
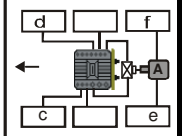
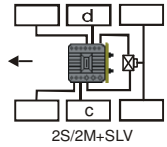
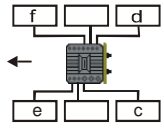
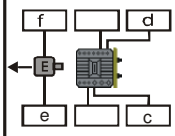
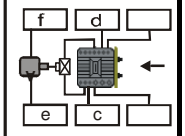
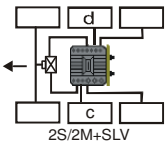
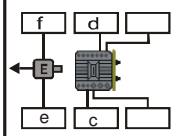
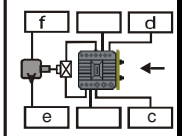
d = sensed (directly controlled)

not sensed (indirectly controlled)

Modulator	Sensors	System axle:	control logic:
M	c , d	main axle (not liftable)	IR / MSR
A/E	e , f	steering axle (liftable)	MAR
Z	e , f	addition axle (liftable)	MSR

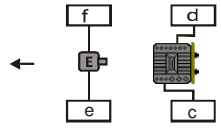
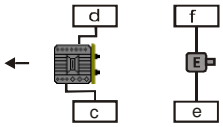
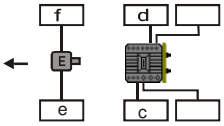
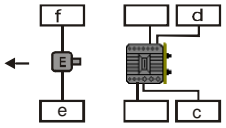
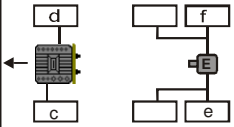
Appendix 1 (page 2/3)

Semi-trailer and Centre-axle Trailer

	Vehicle Type	2S / 1M	2S / 2M	4S / 2M	4S / 3M	*4S / 2M+ 1M*
Centre axle trailer + Semitrailer						
	 + 					
						
			 2S/2M-SLV			
	 					
						
			 2S/2M+SLV			
			 2S/2M+SLV			

Appendix 1 (page 3/3) **System Configurations**

Full Trailer

	VEHICLE TYPE	2S / 2M	4S / 2M	4S / 3M	*4S / 2M + 1M*
Drawbar Trailer					
					
					
					
					

Appendix 2 (page 1/3) Scope of suspension types

Manufacturer	Model	Type
BPW	SLO, SLM, SLU ALO, ALM, ALMT, ALMN, ALU, DLU, O, OM, OT	Air suspension, balanced
	VB, GW, BW, W	Mechanical
Cardi	PR, PR	Air suspension, balanced
	MR	Mechanical
Cometto	SP1, SP2	Air suspension, balanced
	MA3 + G1	Mechanical
Daimler Chrysler	DCA	Air suspension, balanced
Fruehauf	FA	Mechanical
Gigant / SAE	LG, TLG, LR, TLR, NLR,TO, NLRM 50, NTLRO 50, TLRM 72, NKLRT 50, NKLRM 50, NLRT 50, TKLRO 50	Air suspension, balanced
	LK	Mechanical
Granning	PTS, PTL	Air suspension, balanced
Hendrikson	HTE, HT 250, HDB	Air suspension, balanced
	HST	Mechanical
Kaiser	RK, RKV2	Air suspension, balanced
Lecitrailer	ALN	Air suspension, balanced
	411	Mechanical
Mecanización	SN	Air suspension, balanced
Meritor	Flexair, Indair, Flexlite, FL, FM, FP, XL	Air suspension, balanced
	SMT	Mechanical
Montenegro	Tipo estandar, Tipo C, Tipo 70	Air suspension, balanced
	Tipo parabólica, Tipo multihoja	Mechanical
Piazenza	U2, N2, P1, R2, S2,V1, V2	Air suspension, balanced
	R2, N2, S2	Mechanical

Appendix 2 (page 2/3) Scope of suspension types

Manufacturer	Model	Type
Rolfo	7T, 10T, 16T	Air suspension, balanced
SAF	Intraax, Intradisk, Intradisk plus, Intradisk plus II, Intradisk plus II integral, IWST, Modular, R421, AR313/413, AR 321/421, U, M, O, EO, HU, EU, XU/XO, PU/PO, IU/IO, SK RS 9042	Air suspension, balanced
SAF	XU,XO,PU,PO,IU,IO,VU,VO AR U, M, O BM, BO HU	Air suspension, balanced
	VA	Mechanical, balanced
	VR, VER, W	Mechanical
Schmitz	MRH, AC	Air suspension, balanced
SMB	NA, SA, ZA	Air suspension, balanced
	FA, M2 Cantilever	Mechanical
		Mechanical
Trouillet	9T12, 9T13, 11T ;SP912 ; SP913 ; SP1113 ; Monosam ; Bisam 5235 ; Bisam 5222 ; Monolame; Mecanosoude ; Mecanosude a composant Samro	Air suspension, balanced
Tridec	225120 HV-V 226606 HV-A 226935 HV-A	Air suspension, balanced
Weweler	Euro, Heavy Duty, Mega Lite, Specials, Ultra Lite, DLS, Premium Lite, Tipper, Heavy duty +	Air suspension, balanced
Viberti – Acerbi	A.V. Pn molla 70	Air suspension, balanced
Zorzi	B4P, R4P, R6P, R10P, S6P, S10P, S12P	Air suspension, balanced
	S6M, S10M, R10M	Mechanical

Appendix 2 (page 3/3) Scope of suspension types

Manufacturer	Model	Type
Castera	SR01.E1… SR01.E2… SR01.E3… SR02.E1… SR02.E2… SR02.E3… SR03.E1… SR03.E2… SR03.E3… SUSP.R09.00 SUSP.R15.00 SUSP.R19.00 SUSP.TPCB15.00	Mechanical
	SP05… SP06… SH01	Air suspension
Trailona	TG 933250000, TG921450000, TDPIHO01020, TG974651000 TG933451000, TG981351000, TG966151000	Air suspension, balanced
	GTL-nx116, TL-nx116, GTL-nX136, TL-nx136, GTL-nx152, TL-nx152	Mechanical
Fruehauf	FA, JA	Mechanical
Leciñena	ALN-01.X, ALN-02.X, ALN-03.X ALN-04.X, ALN-05.X, ALN-08.X, ALN-09.X, ALN-10.X, ALN-23.X, ALN-25.X, ALN-27.X, ALN-28.X	Air suspension, balanced
	120025100001, 411052, 120025100029, 411039, 120025100030, 411015, 120025100031, 411021,	Mechanical
	120025100063, 411011	

Appendix 3 (page 1/2) Failure-Deactivation Matrix

	WABCO Failure Deactivation Matrix	Semitrailer 4S/3M	Semitrailer 4S/2M + 1M	Semitrailer 2S/2M	Semitrailer 4S/2M	Trailer 4S/3M with 2 axle load sensors	Trailer 4S/3M with one axle load sensor	ABS-Axle e,f deativation (1)	ABS function Modulator side d,f deactivation (1)	ABS function Modulator side c,e deactivation (1)	EBS pressure contol deactivation	loadpropor.trail..set laden	Solenoid valve ABS/ EBS relay-valve currentless	back-up valve modulator currentless (2)	Solenoid valve ABS/ EBS relay-valve currentless	Solenoid valve ABS/ EBS relay-valve currentless	back-up valve modulator currentless (2)	solenoid valve trailmod .currentless	RSS Deactivation	Waning lamp status
A_1	**Sensors**																			
A_1_1	**Wheel speed sensors**																			
A_1_1_1	failure of wheel speed sensor c, d, e or f	X	X	X	X	X			■	■									■	1
	failure of wheel speed sensor c, d, e or f						X	■	■	■		■							■	1
A_1_1_3	Chattering of wheel c, d, e or f	X	X	X	X	X	X	■	■	■									■	0
A_1_1_5	Memorybit wheel c, d, e or f	X	X	X	X	X	X													0
A_1_2	**Brake pressure sensors**																			
A_1_2_1	failure of a pressure sensor in the EBS relay-valve	X				X	X				■			■					■	1
A_1_2_2	failure of a brake pressure sensor side d,f in the trailer- modulator	X	X	X	X	X	X				■						■		■	1
A_1_2_3	failure of a brake pressure sensor side c,d in the trailer- modulator	X	X	X	X	X	X				■						■		■	1
A_1_2_4	failure of a both brake pressure sensors in the trailer- modulator	X	X	X	X	X	X				■						■		■	1
A_1_3	**Driver demand**																			
A_1_3_1	failure of the driver demand sensor	X	X	X	X	X	X												■	1
A_1_3_2	Signal of demand sensor too low	X	X	X	X	X	X												■	1
A_1_3_3	failure of the driver demand sensor and CAN-communication	X	X	X	X	X	X				■			■			■		■	1
A_1_4	**Axle load sensor**																			
A_1_4_1	failure of the axle load sensor	X	X	X	X	X	X					■							■	1
A_1_5	**Supply pressure sensor**																			1
A_1_5_1	failure of the supply pressure sensor	X	X	X	X	X	X	■	■	■	■	■	■	■	■	■	■	■	■	2
A_2	**Solenoid valves**																			
A_2_1	**EBS/ABS)- relay valve**																			1
A_2_1_1	failure of solenoid valves in the EBS(ABS) relay-valve	X		X		X	X	■			■		■	■					■	1
A_2_2	**Trailer modulator**																			
A_2_2_1	failure of solenoid valves in the trailer-modulator side e,f	X	X	X	X	X	X		■		■				■		■		■	1
A_2_2_2	failure of solenoid valves in the trailer-modulator side c,e	X	X	X	X	X	X			■	■					■	■		■	1
A_2_2_3	failure of solenoid valves in the trailer-modulator side c,e and e,f	X	X	X	X	X	X		■	■	■				■	■	■		■	1
A_2_3	**Back-up valve**																			
A_2_3_1	back-up valve failure EBS relay-valve	X				X	X							■					■	1
A_2_3_2	back-up valve failure trailer-modulator	X	X	X	X	X	X										■		■	1
A_3	**ECU**																			
A_3_1	Trailer modulator																			
A_3_1_1	Internal failure	X	X	X	X	X	X	■	■	■	■	■	■	■	■	■	■	■	■	2
A_3_1_2	CPU-failure	X	X	X	X	X	X	■	■	■	■	■	■	■	■	■	■	■	■	2

Appendix 3 (page 2/2) Failure-Deactivation Matrix

	WABCO Failure Deactivation Matrix	Semitrailer 4S/3M	Semitrailer 4S/2M + 1M	Semitrailer 2S/2M	Semitrailer 4S/2M	Trailer 4S/3M with 2 axle load sensors	Trailer 4S/3M with one axle load sensor	ABS-Liftaxle function deactivation (1)	ABS function Modulator side d,f deactivation (1)	ABS function Modulator side c,e deactivation (1)	EBS pressure control deactivation (2)	loadproport.trail..set laden	Solenoid valve ABS/ EBS relay-valve currentless	back-up valve modulator currentless (2)	Solenoid valve ABS/ EBS relay-valve currentless	Solenoid valve ABS/ EBS relay-valve currentless	back-up valve modulator currentless (2)	solenoid valve trailmod .currentless	RSS Deactivation	Waning lamp status
A_3_1_3	EEPROM failure	X	X	X	X	X	X	■	■	■	■	■	■	■	■	■	■	■	■	2
A_3_1_4	Wrong parameter setting	X	X	X	X	X	X	■	■	■	■	■	■	■	■	■	■	■	■	2
A_3_1_5	GIO Main- Powerstage defect	X	X	X	X	X	X				■	■							■	2
A_3_1_7	EOL test at customer not passed	X	X	X	X	X	X												■	2
A_3_1_8	failure of aq-sensor	X	X	X	X	X	X												■	1
A_4	**CAN-Communication**																			
A_4_1	partial failure of CAN-Communication/ one-wire-operation	X	X	X	X	X	X													0
A_4_2	failure of CAN-communication	X	X	X	X	X	X													0
A_5	**Voltage Supply**																			
A_5_3	high voltage at Kl. 30 oder Kl. 15	X	X	X	X	X	X	■	■	■	■	■	■	■	■	■	■	■	■	2
A_5_7	low voltage	X	X	X	X	X	X	■	■	■	■	■	■	■	■	■	■	■	■	2
A_5_9	massproblem (Kl. 15)	X	X	X	X	X	X													1
A_5_11	Warning undervoltage Kl. 30	X	X	X	X	X	X													0
A_5_13	failure in ECAS-communication	X	X	X	X	X	X													0
A_6	**Pneumatic**																			
A_6_1	service line not connected (only with ISO 7638 extended)	X	X	X	X	X	X													1
A_6_2	supply pressure low	X	X	X	X	X	X													2
A_7	**Miscellaneous**																			
A_7_1_1	failure in GIO-output	X	X	X	X	X	X													3/4
A_7_1_1	failure in internal ECAS function	X	X	X	X	X	X													3
A_7_1_2	failure of liftaxle or ISS	X	X	X	X	X	X													1
A_7_2_1	failure of lining wear sensor	X	X	X	X	X	X													3

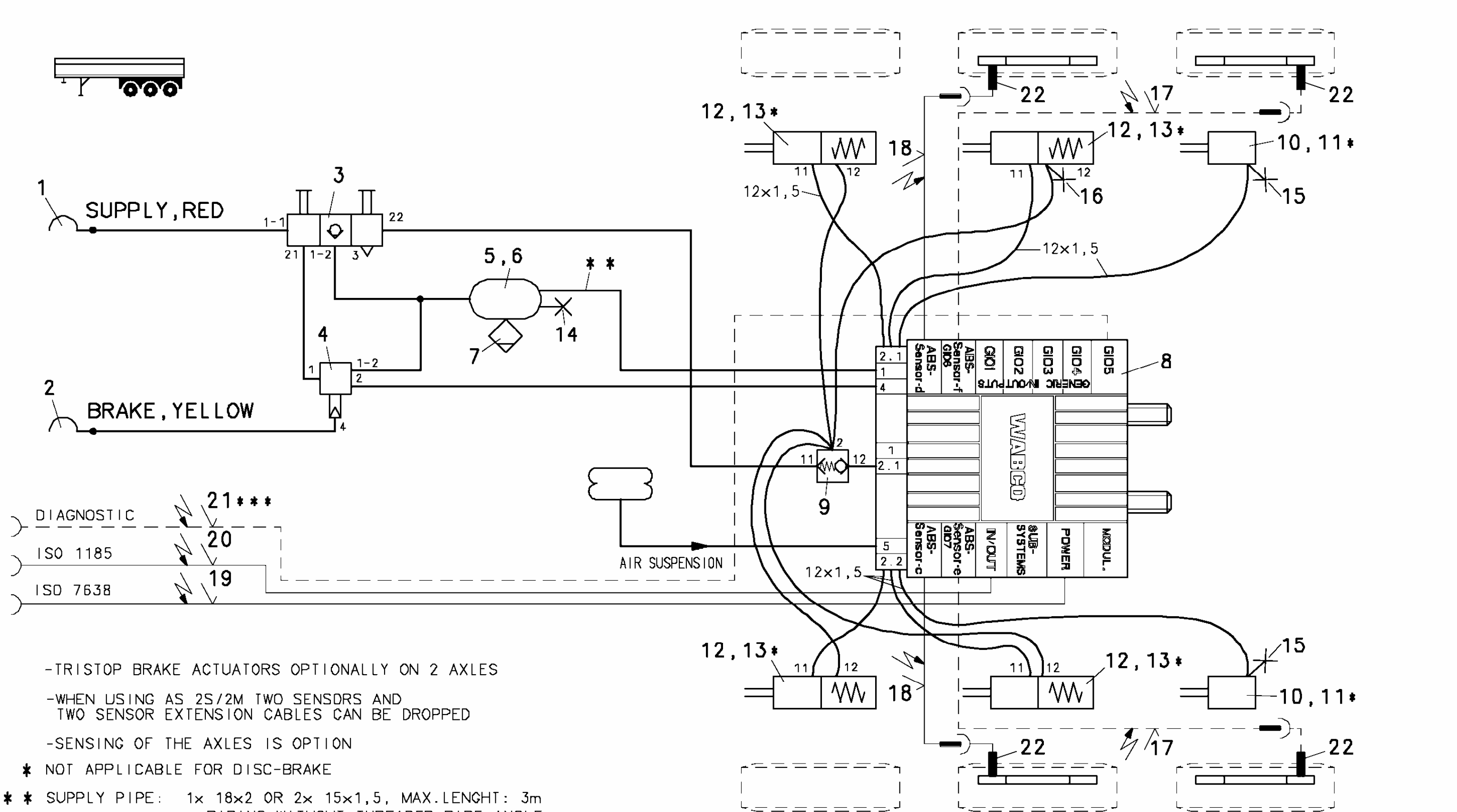
Meaning of failure status

0 = yellow warning lamp during the failure	(ECE R13 para. 5.2.1.29.1.2)
1 = yellow warning lamp until reset	(ECE R13 para. 5.2.1.29.1.2)
2 = yellow and red warning lamp until reset	(ECE R13 para. 5.2.1.29.1.1)
3 = yellow warning lamp flashing after ignition "ON"	(ECE R13 para. 5.2.1.29.6)
4 = no warning lamp	

Remarks:

(1) ABS selective deactivated	(2) braking with pneumatic service line
■ = Function deactivated	

Appendix 4 (page 1/8) Braking schematic 2S/2M and 4S/2M for Semi-trailer



-TRISTOP BRAKE ACTUATORS OPTIONALLY ON 2 AXLES

-WHEN USING AS 2S/2M TWO SENSORS AND TWO SENSOR EXTENSION CABLES CAN BE DROPPED

-SENSING OF THE AXLES IS OPTION

* NOT APPLICABLE FOR DISC-BRAKE

** SUPPLY PIPE: 1× 18×2 OR 2× 15×1,5, MAX.LENGHT: 3m PIPING WITHOUT THREADED PIPE ANGLE

*** OPTIONALLY (ONLY POSSIBLE FOR PREMIUM ECU)

POS.	PCS.	DENOMINATION		PRODUCT IDENTIFICATION NO.	POS.	PCS.	DENOMINATION		PRODUCT IDENTIFICATION NO.
13	4	KIT	*	423 903 532 2					
12	4	TRISTOP BRAKE ACT.		925 0					
11	2	KIT	*	423 000 ... 2					
10	2	BRAKE CHAMBER		423 10. ... 0					
9	1	TWO WAY-VALVE		434 208 055 0	22	4	ABS-SENSOR		441 032 8.. 0
8	1	TRAILER-MODULATOR		480 102 ... 0	21	1	DIAGNOSTIC CABLE	***	449 611 000 0
7	1	DRAIN VALVE		934 300 001 0	20	1	24N-CABLE		449 349 000 0
6	2	HOSE CLAMP		451 999 ... 0	19	1	SUPPLY(POWER)-CABLE		449 173 000 0
5	1	AIR RESERVOIR		950 0	18	2	EXTENSION CABLE	FOR SENSOR	449 723 000 0
4	1	TRAIL.-BRAKE VALVE		971 002 301 0	17	2	EXTENSION CABLE	FOR SENSOR	449 723 000 0
3	1	DOUBLE RELEASE VALVE		963 001 05. 0	16	1	TEST CONNECTION		463 703 036 0
2	1	COUPLING HEAD W.INT.	LINE FILTER	952 201 ... 0	15	2	TEST CONNECTION		463 703 120 0
•1	1	COUPLING HEAD W.INT.	LINE FILTER	952 201 ... 0	14	1	TEST CONNECTION		463 703 115 0

DCN-NO.	REV.	DATE
111301	A	06-10-24

CADAM-DRAWING COPYRIGHT

DATE	SIGNATURE
DRAWN	
06-10-11	APITHY
CHECKED	
06-10-11	GROSSK.
STANDARDIZATION	

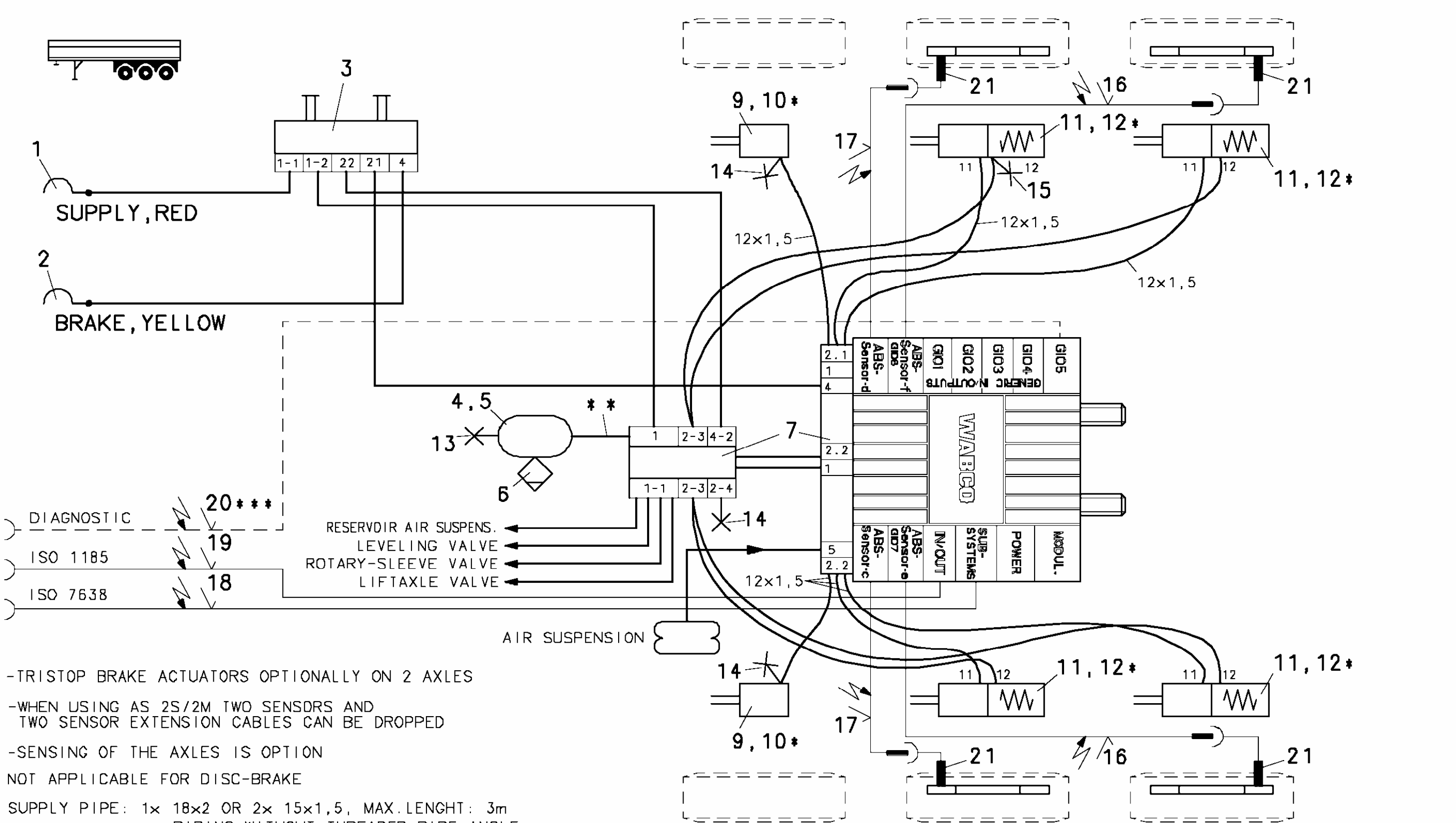
WABCO

TRAILER - EBS E
FOR 3-AXLES-SEMITRAILER
4S/2M OR 2S/2M
WITH TRAIL.-BRAKE VALVE

I.R.I.	PRODUCT IDENTIFICATION NO.	CODE FOR DOCUMENT	SHEET
171	841 701 100 0	402	01
SIZE A 3	CODE FOR FUNCTION 3124	CODE FOR SHAPE	REPLACEMENT FOR

100mm

Appendix 4 (page 2/8) Braking schematic 2S/2M and 4S/2M for Semi-trailer with PREV



-TRISTOP BRAKE ACTUATORS OPTIONALLY ON 2 AXLES

-WHEN USING AS 2S/2M TWO SENSORS AND TWO SENSOR EXTENSION CABLES CAN BE DROPPED

-SENSING OF THE AXLES IS OPTION

* NOT APPLICABLE FOR DISC-BRAKE

* * SUPPLY PIPE: 1x 18x2 OR 2x 15x1,5, MAX. LENGHT: 3m
PIPING WITHOUT THREADED PIPE ANGLE

* * * OPTIONALLY

POS.	PCS.	DENOMINATION		PRODUCT IDENTIFICATION NO.	POS.	PCS.	DENOMINATION		PRODUCT IDENTIFICATION NO.
13	1	TEST CONNECTION		463 703 115 0					
12	4	KIT	*	423 903 532 2					
11	4	TRISTOP BRAKE ACT.		925 0					
10	2	KIT	*	423 000 ... 2					
9	2	BRAKE CHAMBER		423 10. ... 0					
8	.	.			21	4	ABS-SENSOR		441 032 8.. 0
7	1	TRAIL.-MODULATOR W.	EXTENSION MOD.	480 102 ... 0	20	1	DIAGNOSTIC CABLE	* * *	449 611 000 0
6	1	DRAIN VALVE		934 300 001 0	19	1	24N-CABLE		449 349 000 0
5	2	HOSE CLAMP		451 999 ... 2	18	1	SUPPLY(POWER)-CABLE		449 173 000 0
4	1	AIR RESERVOIR		950 0	17	2	EXTENSION CABLE	FOR SENSOR	449 723 000 0
3	1	PARK-RELEASE-EMERG.-	VALVE (PREV)	971 002 9.. 0	16	2	EXTENSION CABLE	FOR SENSOR	449 723 000 0
2	1	COUPLING HEAD W. INT.	LINE FILTER	952 201 001 0	15	1	TEST CONNECTION		463 703 036 0
-1	1	COUPLING HEAD W. INT.	LINE FILTER	952 201 002 0	14	3	TEST CONNECTION		463 703 120 0

DCN-NO. | REV. | DATE

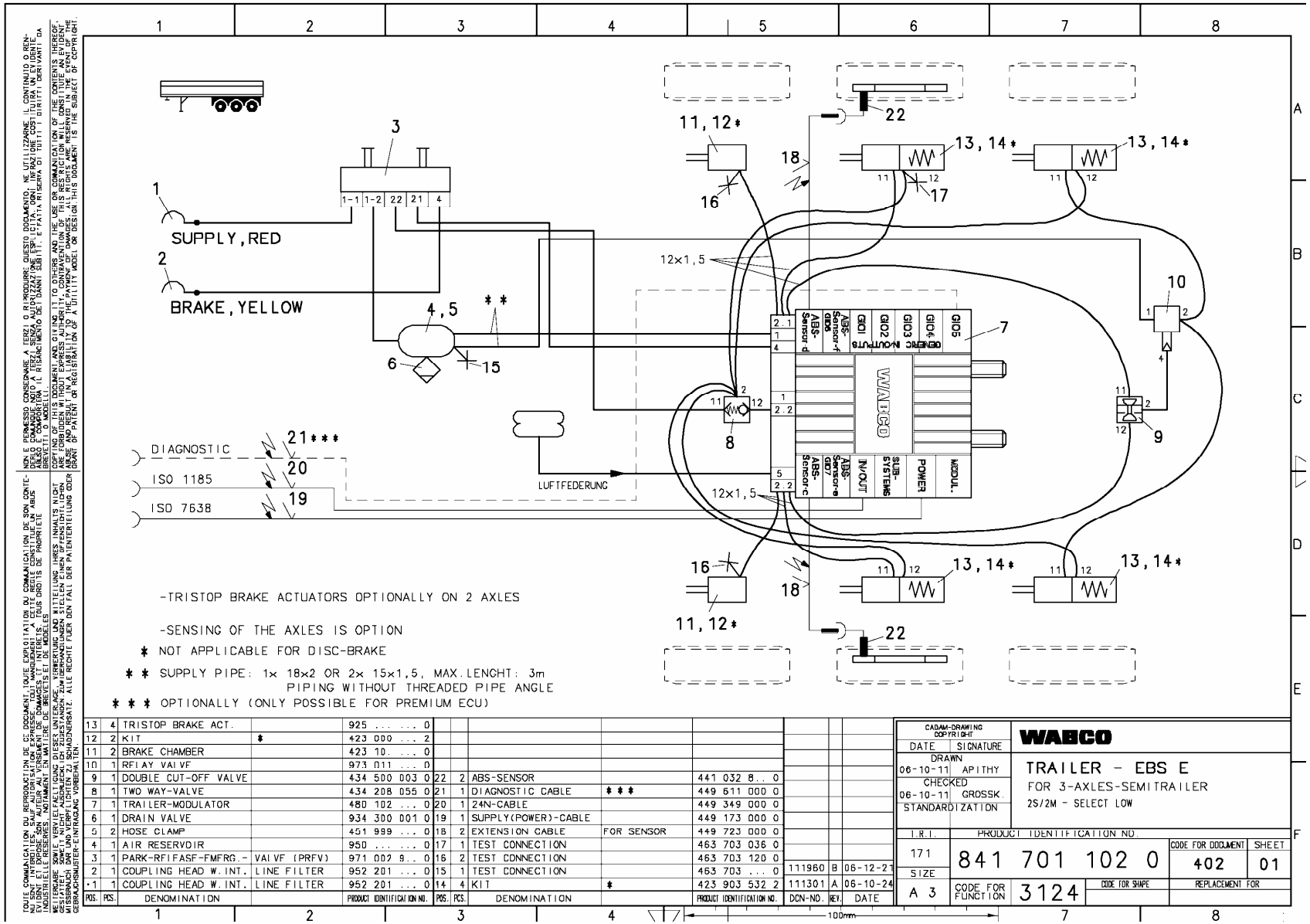
CADAM-DRAWING COPYRIGHT
WABCO

DATE	SIGNATURE
DRAWN	
06-12-04	APITHY
CHECKED	
06-12-04	GROSSK.
STANDARDIZATION	

TRAILER - EBS E
FOR 3-AXLES-SEMITRAILER
2S/2M
-WITH EXTENSION MODUL-

I.R.I.	PRODUCT IDENTIFICATION NO.	CODE FOR DOCUMENT	SHEET
171	841 701 110 0	402	01
SIZE A 3	CODE FOR FUNCTION 3124	CODE FOR SHAPE	REPLACEMENT FOR

Appendix 4 (page 3/8) Braking schematic 2S/2M+SLV for Semi-trailer with steering axle



POS.	PCS.	DENOMINATION		PRODUCT IDENTIFICATION NO.	POS.	PCS.	DENOMINATION		PRODUCT IDENTIFICATION NO.
13	4	TRISTOP BRAKE ACT.		925 0					
12	2	KIT	*	423 000 ... 2					
11	2	BRAKE CHAMBER		423 10. ... 0					
10	1	RELAY VALVE		973 011 ... 0					
9	1	DOUBLE CUT-OFF VALVE		434 500 003 0	22	2	ABS-SENSOR		441 032 8.. 0
8	1	TWO WAY-VALVE		434 208 055 0	21	1	DIAGNOSTIC CABLE	***	449 611 000 0
7	1	TRAILER-MODULATOR		480 102 ... 0	20	1	24N-CABLE		449 349 000 0
6	1	DRAIN VALVE		934 300 001 0	19	1	SUPPLY(POWER)-CABLE		449 173 000 0
5	2	HOSE CLAMP		451 999 ... 0	18	2	EXTENSION CABLE	FOR SENSOR	449 723 000 0
4	1	AIR RESERVOIR		950 0	17	1	TEST CONNECTION		463 703 036 0
3	1	PARK-RELEASE-FMVRG.-	VALVE (PREV)	971 002 9.. 0	16	2	TEST CONNECTION		463 703 120 0
2	1	COUPLING HEAD W.INT.	LINE FILTER	952 201 ... 0	15	1	TEST CONNECTION		463 703 ... 0
•1	1	COUPLING HEAD W.INT.	LINE FILTER	952 201 ... 0	14	4	KIT	*	423 903 532 2

DCN-NO.	REV.	DATE
111960	B	06-12-21
111301	A	06-10-24

CADAM-DRAWING COPYRIGHT

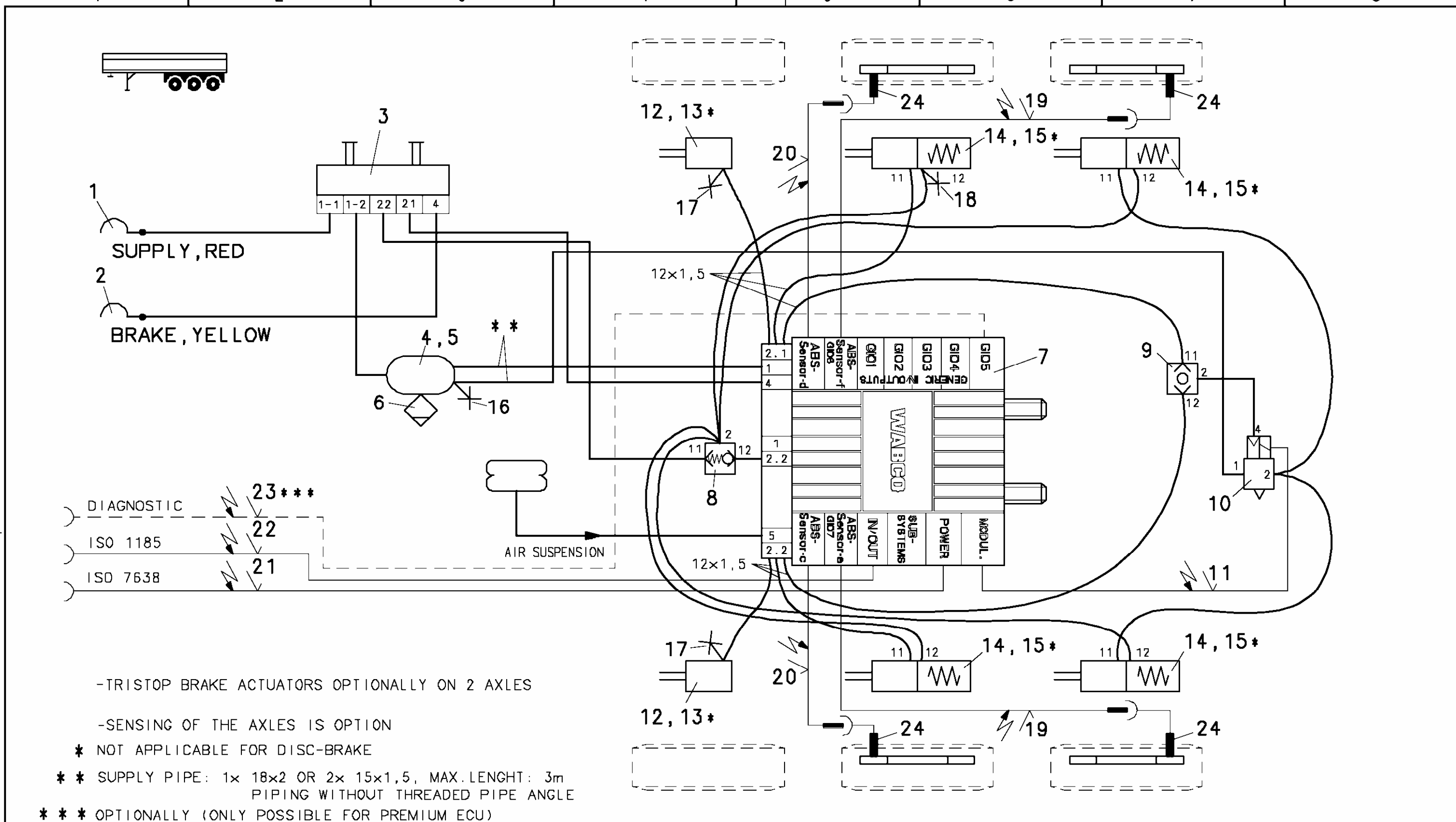
DATE	SIGNATURE
DRAWN 06-10-11	APITHY
CHECKED 06-10-11	GROSSK.
STANDARDIZATION	

WABCO

TRAILER - EBS E
FOR 3-AXLES-SEMITRAILER
2S/2M - SELECT LOW

I.R.I.	PRODUCT IDENTIFICATION NO.	CODE FOR DOCUMENT	SHEET
171	841 701 102 0	402	01
SIZE A 3	CODE FOR FUNCTION 3124	CODE FOR SHAPE	REPLACEMENT FOR

Appendix 4 (page 4/8) Braking schematic 4S/2M + 1M for Semi-trailer



POS.	PCS.	DENOMINATION		PRODUCT IDENTIFICATION NO.	POS.	PCS.	DENOMINATION		PRODUCT IDENTIFICATION NO.
13	2	KIT	*	423 000 ... 2					
12	2	BRAKE CHAMBER		423 10. ... 0					
11	1	CABLE TO ABS-RV		449 436 000 0	24	4	ABS-SENSOR		441 032 8.. 0
10	1	ABS-RELAY VALVE		472 195 037 0	23	1	DIAGNOSTIC CABLE	***	449 611 000 0
9	1	TWO WAY-VALVE		434 208 0.. 0	22	1	24N-CABLE		449 349 000 0
8	1	TWO WAY-VALVE		434 208 055 0	21	1	SUPPLY(POWER)-CABLE		449 173 000 0
7	1	TRAILER-MODULATOR		480 102 ... 0	20	2	EXTENSION CABLE	FOR SENSOR	449 723 000 0
6	1	DRAIN VALVE		934 300 001 0	19	2	EXTENSION CABLE	FOR SENSOR	449 723 000 0
5	2	HOSE CLAMP		451 999 ... 0	18	1	TEST CONNECTION		463 703 036 0
4	1	AIR RESERVOIR		950 0	17	2	TEST CONNECTION		463 703 120 0
3	1	PARK-RELEASE-EMERG.-	VALVE (PREV)	971 002 9.. 0	16	1	TEST CONNECTION		463 703 ... 0
2	1	COUPLING HEAD W.INT.	LINE FILTER	952 201 ... 0	15	4	KIT	*	423 903 532 2
-1	1	COUPLING HEAD W.INT.	LINE FILTER	952 201 ... 0	14	4	TRISTOP BRAKE ACT.		925 0

DCN-NO.	REV.	DATE
111960	B	06-12-21
111301	A	06-10-24

CADAM-DRAWING COPYRIGHT

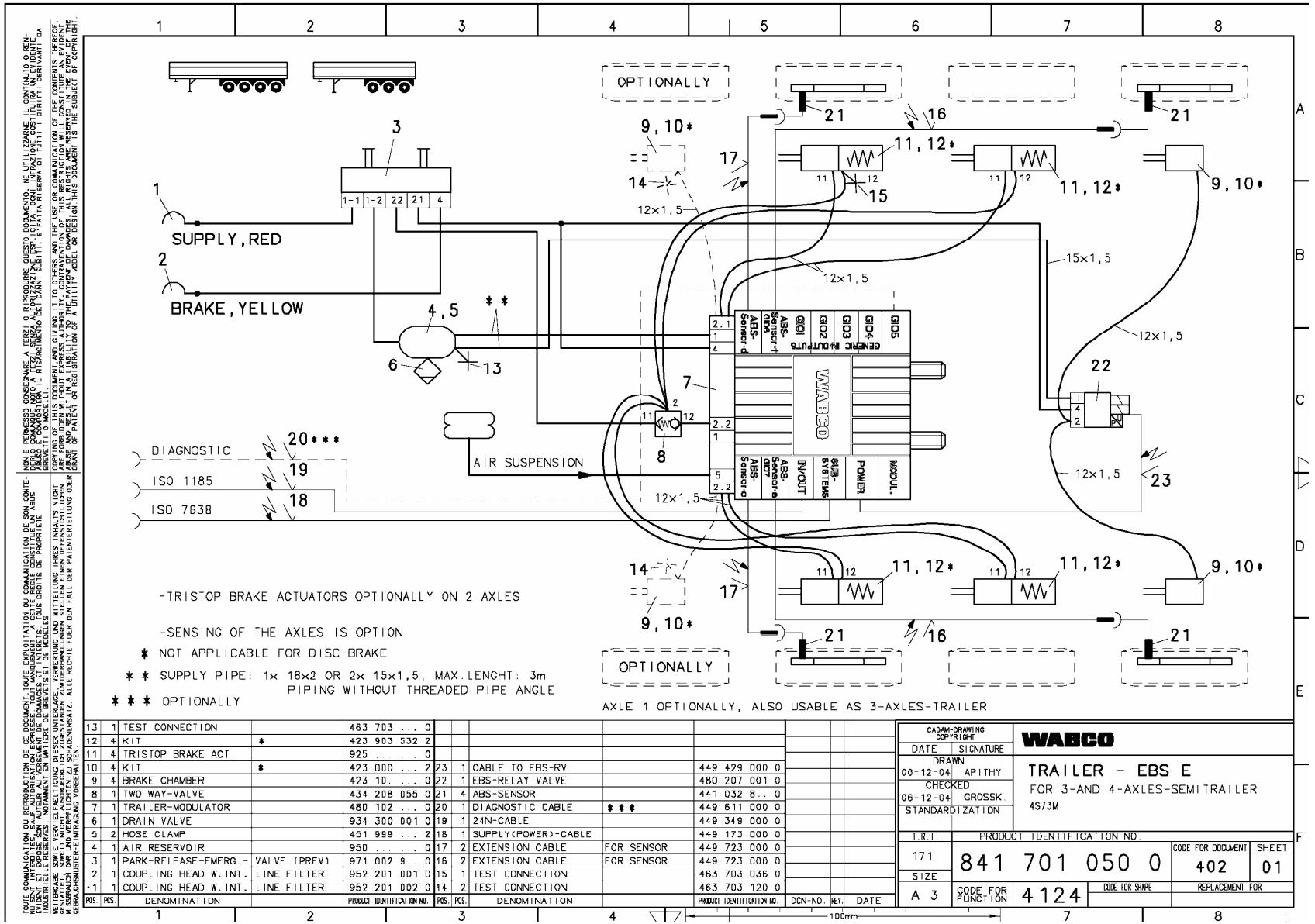
DATE	SIGNATURE
DRAWN	
06-10-11	APITHY
CHECKED	
06-10-11	GROSSK.
STANDARDIZATION	

WABCO

TRAILER - EBS E
FOR 3-AXLES-SEMITRAILER
4S/2M + 1M, AIR SUSPENSION
PREMIUM-ECU

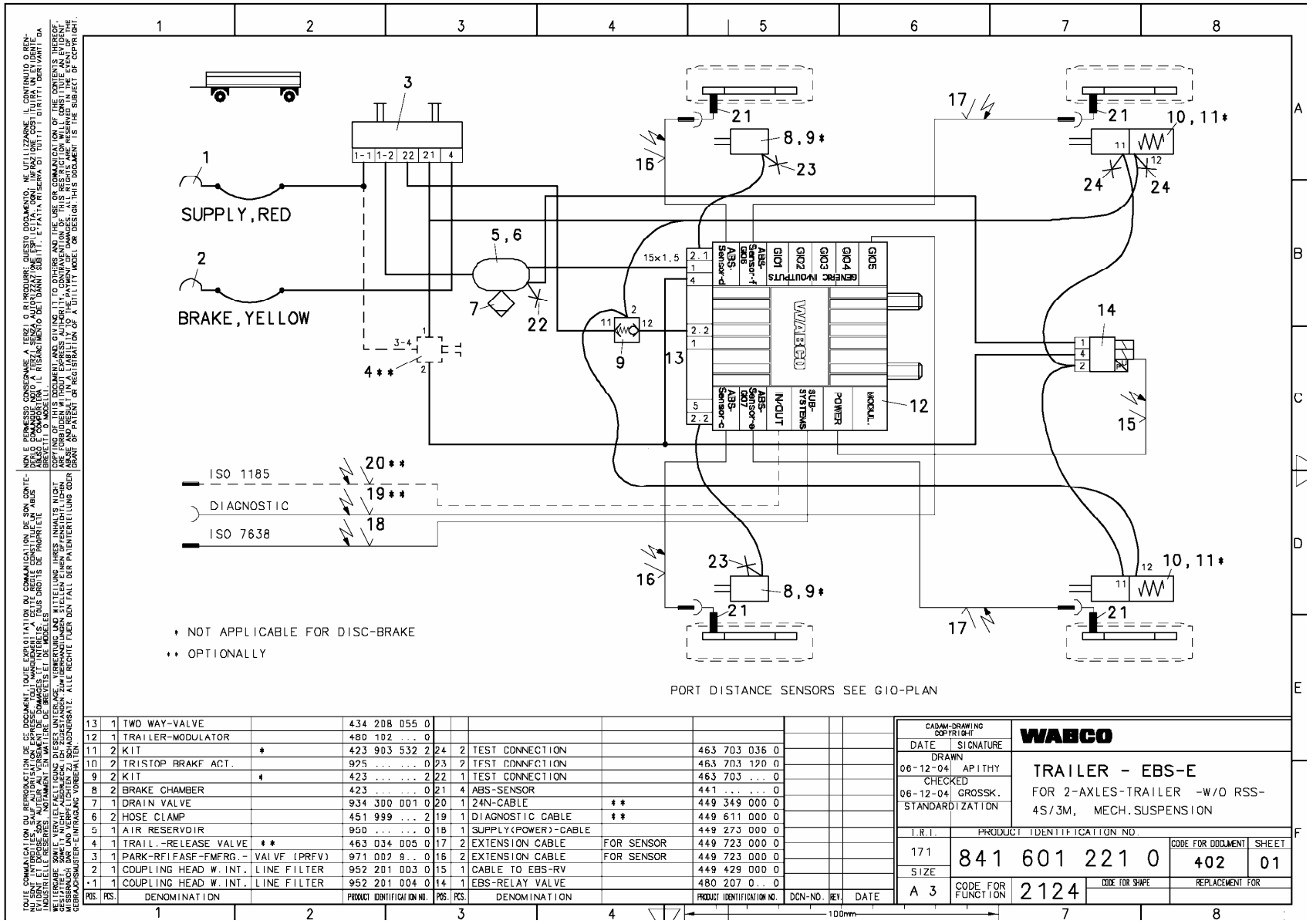
I.R.I.	PRODUCT IDENTIFICATION NO.	CODE FOR DOCUMENT	SHEET
171	841 701 103 0	402	01
SIZE A 3	CODE FOR FUNCTION 3124	CODE FOR SHAPE	REPLACEMENT FOR

Appendix 4 (page 5/8) Braking schematic 4S/3M for Semi-trailer



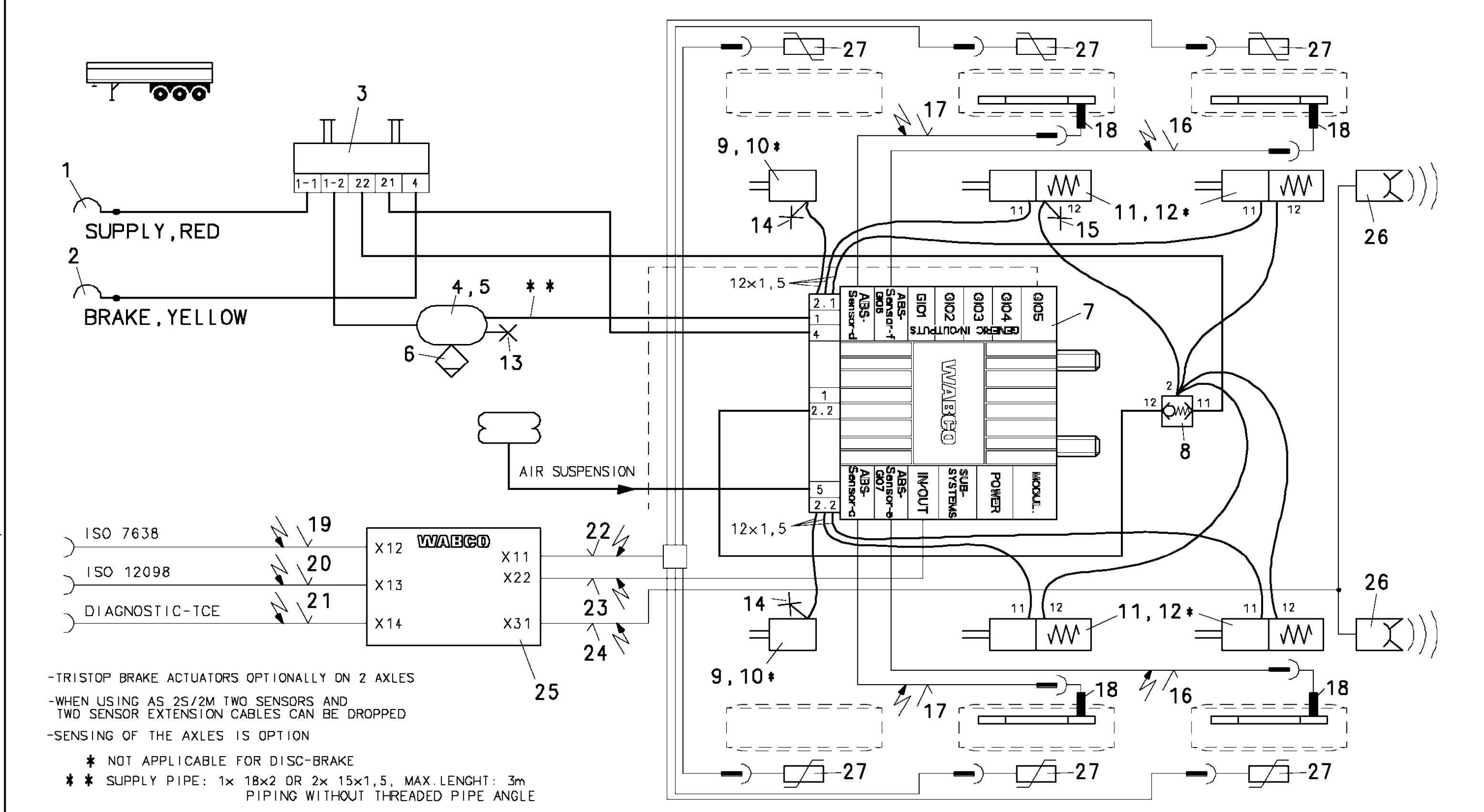
POS.	PCS.	DENOMINATION		PRODUCT IDENTIFICATION NO.	POS.	PCS.	DENOMINATION		PRODUCT IDENTIFICATION NO.
13	1	TEST CONNECTION		463 703 ... 0					
12	4	KIT	*	423 903 532 2					
11	4	TRISTOP BRAKE ACT.		925 0					
10	4	KIT	*	423 000 ... 2	23	1	CABLE TO EBS-RV		449 429 000 0
9	4	BRAKE CHAMBER		423 10. ... 0	22	1	EBS-RELAY VALVE		480 207 001 0
8	1	TWO WAY-VALVE		434 208 055 0	21	4	ABS-SENSOR		441 032 8.. 0
7	1	TRAILER-MODULATOR		480 102 ... 0	20	1	DIAGNOSTIC CABLE	***	449 611 000 0
6	1	DRAIN VALVE		934 300 001 0	19	1	24N-CABLE		449 349 000 0
5	2	HOSE CLAMP		451 999 ... 2	18	1	SUPPLY(POWER)-CABLE		449 173 000 0
4	1	AIR RESERVOIR		950 0	17	2	EXTENSION CABLE	FOR SENSOR	449 723 000 0
3	1	PARK-RELEASE-VALVE	(PRV)	971 002 9.. 0	16	2	EXTENSION CABLE	FOR SENSOR	449 723 000 0
2	1	COUPLING HEAD W. INT.	LINE FILTER	952 201 001 0	15	1	TEST CONNECTION		463 703 036 0
1	1	COUPLING HEAD W. INT.	LINE FILTER	952 201 002 0	14	2	TEST CONNECTION		463 703 120 0

Appendix 4 (page 6/8) Braking schematics 4S/3M for Drawbar-Trailer



POS.	RQ.	DENOMINATION		PRODUCT IDENTIFICATION NO.	POS.	RQ.	DENOMINATION		PRODUCT IDENTIFICATION NO.
13	1	TWO WAY-VALVE		434 208 055 0					
12	1	TRAILER-MODULATOR		480 102 ... 0					
11	2	KIT	*	423 903 532 2	24	2	TEST CONNECTION		463 703 036 0
10	2	TRISTOP BRAKE ACT.		925 0	23	2	TEST CONNECTION		463 703 120 0
9	2	KIT	*	423 2	22	1	TEST CONNECTION		463 703 ... 0
8	2	BRAKE CHAMBER		423 0	21	4	ABS-SENSOR		441 0
7	1	DRAIN VALVE		934 300 001 0	20	1	24N-CABLE	**	449 349 000 0
6	2	HOSE CLAMP		451 999 ... 2	19	1	DIAGNOSTIC CABLE	**	449 611 000 0
5	1	AIR RESERVOIR		950 0	18	1	SUPPLY(POWER)-CABLE		449 273 000 0
4	1	TRAIL.-RELEASE VALVE	**	463 034 005 0	17	2	EXTENSION CABLE	FOR SENSOR	449 723 000 0
3	1	PARK-RELEASE-FMFRG.-	VALVE (PRFV)	971 002 9.. 0	16	2	EXTENSION CABLE	FOR SENSOR	449 723 000 0
2	1	COUPLING HEAD W.INT.	LINE FILTER	952 201 003 0	15	1	CABLE TO EBS-RV		449 429 000 0
1	1	COUPLING HEAD W.INT.	LINE FILTER	952 201 004 0	14	1	EBS-RELAY VALVE		480 207 0.. 0

Appendix 4 (page 7/8) Braking schematics 2S/2M and 4S/2M for Semi-trailer with TCE



-TRISTOP BRAKE ACTUATORS OPTIONALLY ON 2 AXLES

-WHEN USING AS 2S/2M TWO SENSORS AND TWO SENSOR EXTENSION CABLES CAN BE DROPPED

-SENSING OF THE AXLES IS OPTION

* NOT APPLICABLE FOR DISC-BRAKE

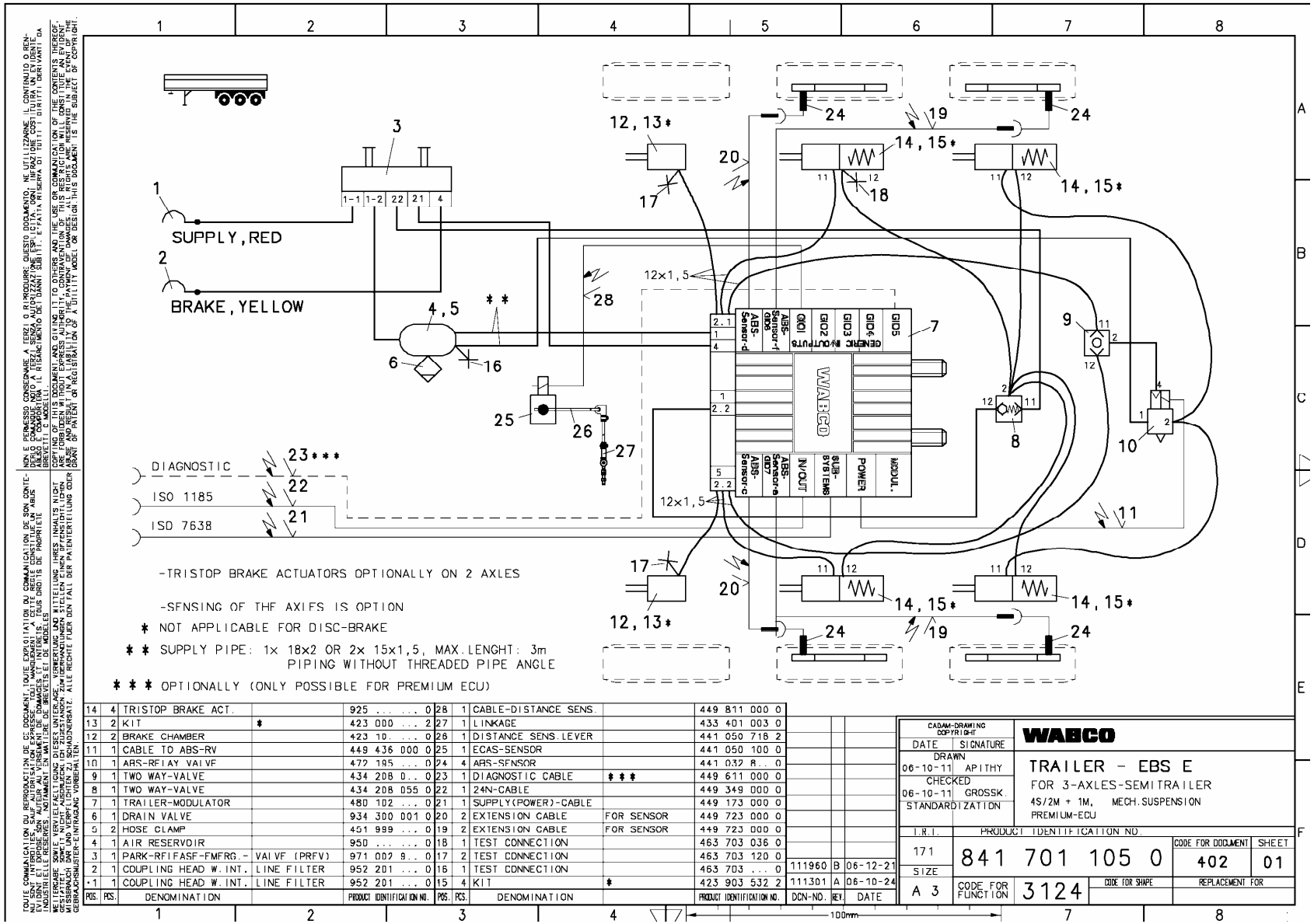
** SUPPLY PIPE: 1x 18x2 OR 2x 15x1,5, MAX.LENGHT: 3m PIPING WITHOUT THREADED PIPE ANGLE

POS.	PCS.	DENOMINATION		PRODUCT IDENTIFICATION NO.	POS.	PCS.	DENOMINATION			PRODUCT IDENTIFICATION NO.
14	2	TEST CONNECTION		463 703 120 0						
13	1	TEST CONNECTION		463 703 115 0	27	6	LINING WEAR-SENSOR		WABCO	MANNHEIM
12	4	KIT	*	423 903 532 2	26	2	ULTRASONIC-SENSOR			466 122 400 0
11	4	TRISTOP BRAKE ACT.		925 0	25	1	TCE-ECU			446 122 001 0
10	2	KIT	*	423 000 ... 2	24	1	CABLE F.ULTRASONIC-	SENSOR		449 704 ... 0
9	2	BRAKE CHAMBER		423 10. ... 0	23	1	POWER CABLE-EBS			449 348 000 0
8	1	TWO WAY-VALVE		434 208 055 0	22	1	CABLE F.LINING WEAR-	SENSOR		449 894 ... 0
7	1	TRAILER-MODULATOR		480 102 ... 0	21	1	DIAGNOSTIC CABLE-TCE			449 672 ... 0
6	1	DRAIN VALVE		934 300 001 0	20	1	POWER CABLE	ISO 12098		449 113 ... 0
5	2	HOSE CLAMP		451 999 ... 2	19	1	SUPPLY(POWER)-CABLE	ISO 7638		449 172 ... 0
4	1	AIR RESERVOIR		950 0	18	4	ABS-SENSOR			441 032 8.. 0
3	1	PARK-RELEASE-EMERG.-	VALVE (PREV)	971 002 9.. 0	17	2	EXTENSION CABLE	FOR SENSOR		449 723 000 0
2	1	COUPLING HEAD W.INT.	LINE FILTER	952 201 ... 0	16	2	EXTENSION CABLE	FOR SENSOR		449 723 000 0
-1	1	COUPLING HEAD W.INT.	LINE FILTER	952 201 ... 0	15	1	TEST CONNECTION			463 703 036 0

DCN-NO.	REV.	DATE
111960	B	06-12-21
111301	A	06-10-24

CADAM-DRAWING COPYRIGHT	WABCO
DATE / SIGNATURE	TRAILER - EBS E WITH TCE
DRAWN 06-10-11 APITHY	FOR 3-AXLES-SEMITRAILER
CHECKED 06-10-11 GROSSK.	4S/2M OR 2S/2M
STANDARDIZATION	WITH ULTRASONIC SENSOR
T.R.I. 171	PRODUCT IDENTIFICATION NO. 841 701 104 0
SIZE A 3	CODE FOR DOCUMENT 402 — SHEET 01
CODE FOR FUNCTION 3124	CODE FOR SHAPE — REPLACEMENT FOR

Appendix 4 (page 8/8) Braking schematics 4S/2M+1M for Semi-trailer with mechanical suspension



POS.	PCS.	DENOMINATION		PRODUCT IDENTIFICATION NO.	POS.	PCS.	DENOMINATION		PRODUCT IDENTIFICATION NO.
14	4	TRISTOP BRAKE ACT.		925 0	28	1	CABLE-DISTANCE SENS.		449 811 000 0
13	2	KIT	*	423 000 ... 2	27	1	LINKAGE		433 401 003 0
12	2	BRAKE CHAMBER		423 10. ... 0	26	1	DISTANCE SENS. LEVER		441 050 718 2
11	1	CABLE TO ABS-RV		449 436 000 0	25	1	ECAS-SENSOR		441 050 100 0
10	1	ABS-RELAY VALVE		472 195 ... 0	24	4	ABS-SENSOR		441 032 8.. 0
9	1	TWO WAY-VALVE		434 208 0.. 0	23	1	DIAGNOSTIC CABLE	***	449 611 000 0
8	1	TWO WAY-VALVE		434 208 055 0	22	1	24N-CABLE		449 349 000 0
7	1	TRAILER-MODULATOR		480 102 ... 0	21	1	SUPPLY(POWER)-CABLE		449 173 000 0
6	1	DRAIN VALVE		934 300 001 0	20	2	EXTENSION CABLE	FOR SENSOR	449 723 000 0
5	2	HOSE CLAMP		451 999 ... 0	19	2	EXTENSION CABLE	FOR SENSOR	449 723 000 0
4	1	AIR RESERVOIR		950 0	18	1	TEST CONNECTION		463 703 036 0
3	1	PARK-RELEASE-EMERG.-	VALVE (PREV)	971 002 9.. 0	17	2	TEST CONNECTION		463 703 120 0
2	1	COUPLING HEAD W.INT.	LINE FILTER	952 201 ... 0	16	1	TEST CONNECTION		463 703 ... 0
*1	1	COUPLING HEAD W.INT.	LINE FILTER	952 201 ... 0	15	4	KIT	*	423 903 532 2

DCN-NO.	REV.	DATE
111960	B	06-12-21
111301	A	06-10-24

CADAM-DRAWING COPYRIGHT

DATE	SIGNATURE
DRAWN 06-10-11	APITHY
CHECKED 06-10-11	GROSSK.
STANDARDIZATION	

WABCO

TRAILER - EBS E
FOR 3-AXLES-SEMITRAILER
4S/2M + 1M, MECH.SUSPENSION
PREMIUM-ECU

I.R.I.	PRODUCT IDENTIFICATION NO.	CODE FOR DOCUMENT	SHEET
171	841 701 105 0	402	01
SIZE A 3	CODE FOR FUNCTION 3124	CODE FOR SHAPE	REPLACEMENT FOR

Kraftfahrt-Bundesamt

DE-24932 Flensburg

E G - T Y P G E N E H M I G U N G S B O G E N
EC TYPE-APPROVAL CERTIFICATE

Benachrichtigung über

- die Erweiterung der Typgenehmigung

eines Bauteiltyps gemäß der Richtlinie 72/245/EWG, zuletzt geändert durch die Richtlinie 2006/28/EG

Communication concerning the

- extension of type-approval

of a type of component with regard to Directive 72/245/EEC, as last amended by Directive 2006/28/EC

Typgenehmigungsnummer: **e1*72/245*2006/28*4868*01**
Type-approval No.:

Grund für die Erweiterung:
Reason for extension:
Erweiterung des Nummernkreises zur Typidentifizierung
extension of numbers for identification of type

An der EUB anzubringendes EG-Typgenehmigungszeichen:
EC type-approval mark to be affixed on ESA:

e1

03 4868

ABSCHNITT I
SECTION I

0.1. Fabrikmarke (Firmenname des Herstellers):
Make (trade name of manufacturer):
WABCO

0.2. Typ:
Type:
EBS Trailer Modulator

Kraftfahrt-Bundesamt

DE-24932 Flensburg

2

Nummer der Genehmigung: e1*72/245*2006/28*4868*01
Approval No.:

0.3. Merkmale zur Typidentifizierung, sofern am Bauteil vorhanden:
Means of identification of type, if marked on the component:
480 102 030 0 bis/up to 480 102 058 0
480 102 060 0 bis/up to 480 102 088 0

0.3.1. Anbringungsstelle dieser Merkmale:
Location of that marking:
auf dem Gehäuse
on the housing

0.5. Name und Anschrift des Herstellers:
Name and address of manufacturer:
WABCO GmbH
DE-30453 Hannover

0.7. Bei Bauteilen und selbständigen technischen Einheiten, Lage und Anbringungsart des EG-Genehmigungszeichens:
In the case of components and separate technical units, location and method of affixing of the EC approval-mark:
Erhebung auf dem Gehäuse
cast relief on the housing

0.8. Anschrift(en) der Fertigungsstätte(n):
Address(es) of assembly plant(s):
WABCO GmbH
DE-30453 Hannover

WABCO Polska Sp.z.o.o.
PL-53-238 Wroclaw

ABSCHNITT II
SECTION II

1. Zusätzliche Angaben (erforderlichenfalls):
Additional information (where applicable):
siehe Anlage
see appendix

2. Für die Durchführung der Prüfungen zuständiger technischer Dienst:
Technical service responsible for carrying out the tests:
WABCO EMV-Prüflabor
DE-30432 Hannover

Kraftfahrt-Bundesamt

DE-24932 Flensburg

3

Nummer der Genehmigung: e1*72/245*2006/28*4868*01
Approval No.:

3. Datum des Prüfprotokolls:
Date of test report:
entfällt
not applicable

4. Nummer des Prüfprotokolls:
Number of test report:
entfällt
not applicable

5. Gegebenenfalls Bemerkungen:
Remarks (if any):
siehe Anlage
see appendix

6. Ort: **DE-24932 Flensburg**
Place:

7. Datum: **11.01.2007**
Date:

8. Unterschrift: **Im Auftrag**
Signature:

KRAFTFAHRT-BUNDESAMT 448

Detlef Hansen

Kraftfahrt-Bundesamt

DE-24932 Flensburg

E G - T Y P G E N E H M I G U N G S B O G E N
EC TYPE-APPROVAL CERTIFICATE

Benachrichtigung über

- die Erweiterung der Typgenehmigung

eines Bauteiltyps gemäß der Richtlinie 72/245/EWG, zuletzt geändert durch die Richtlinie 2006/28/EG

Communication concerning the

- extension of type-approval

of a type of component with regard to Directive 72/245/EEC, as last amended by Directive 2006/28/EC

Typgenehmigungsnummer: **e1*72/245*2006/28*1665*01**
Type-approval No.:

Grund für die Erweiterung:
Reason for extension:
Anpassung an die Fassung 2006/28/EG der Richtlinie
adaptation to the version 2006/28/EC of the directive
technische Änderungen
technical modification

An der EUB anzubringendes EG-Typgenehmigungszeichen:
EC type-approval mark to be affixed on ESA:

e1

03 1665

ABSCHNITT I
SECTION I

0.1. Fabrikmarke (Firmenname des Herstellers):
Make (trade name of manufacturer):
WABCO

Kraftfahrt-Bundesamt

DE-24932 Flensburg

2

Nummer der Genehmigung: e1*72/245*2006/28*1665*01
Approval No.:

0.2. Typ:
Type:
Trailer Central Electronik (TCE)

0.3. Merkmale zur Typidentifizierung, sofern am Bauteil vorhanden:
Means of identification of type, if marked on the component:
446 122 000 0 bis / up to 446 122 015 0

0.3.1. Anbringungsstelle dieser Merkmale:
Location of that marking:
auf dem Typenschild auf dem Gehäuse
on the type label on the housing

0.5. Name und Anschrift des Herstellers:
Name and address of manufacturer:
WABCO GmbH & Co.OHG
DE-30453 Hannover

0.7. Bei Bauteilen und selbständigen technischen Einheiten, Lage und Anbringungsart des EG-Genehmigungszeichens:
In the case of components and separate technical units, location and method of affixing of the EC approval-mark:
Typenschild auf dem Gehäuse oder
als metallisiertes Klebeschild auf dem Elektronikgehäuse geklebt
type label on the housing or
metalized label on the housing of the electronic

0.8. Anschrift(en) der Fertigungsstätte(n):
Address(es) of assembly plant(s):
WABCO GmbH & Co.OHG
DE-30453 Hannover

ABSCHNITT II
SECTION II

1. Zusätzliche Angaben (erforderlichenfalls):
Additional information (where applicable):
siehe Anlage
see appendix

2. Für die Durchführung der Prüfungen zuständiger technischer Dienst:
Technical service responsible for carrying out the tests:
WABCO EMV-Prüflabor
DE-30432 Hannover

Kraftfahrt-Bundesamt

DE-24932 Flensburg

3

Nummer der Genehmigung: e1*72/245*2006/28*1665*01
Approval No.:

3. Datum des Prüfprotokolls:
Date of test report:
15.09.2006

4. Nummer des Prüfprotokolls:
Number of test report:
29_01

5. Gegebenenfalls Bemerkungen:
Remarks (if any):
siehe Anlage
see appendix

6. Ort: **DE-24932 Flensburg**
Place:

7. Datum: **26.09.2006**
Date:

8. Unterschrift: **Im Auftrag**
Signature:

KRAFTFAHRT-BUNDESAMT 448

Detlef Hansen

This side is for technical reasons free