

Regulation (EU) 2015/68 Braking System for Agricultural Vehicles



a **WORLD** of
DIFFERENCE

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Agenda

(EU) 2015/68

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(EU) 2015/68 overview

Towing Vehicles

OVERVIEW (EU) 2015/68



- **Most important issues for tractors:**
- Higher deceleration values:
 - 3,55 m/s² tractors < 30 km/h
 - 5 m/s² tractors > 30 km/h
- **ABS**
 - From 2016/18 for tractors > 60 km/h
 - From [2020/21] for tractors > 40 km/h, technology check in 2016
- Secondary brake of tractor with speed > 40 km/h shall activate the trailer brake. Effect shall be graduable.
- Breakaway function
- Brake force distribution between axles and between tractor and trailer
 - New diagram for tractors > 30 km/h
 - Friction curves for tractors > 40 km/h



OVERVIEW (EU) 2015/68



- **Most important requirements for tractors:**
- Split brake pedals to be automatically connected > 40 km/h or speed limiter at 40 km/h
- Automatic activation of trailer brakes > 12 km/h
- Vehicle stabilization through automatic trailer brake actuation permissible
- Automatic slack adjusters for tractor $v > 40$ km/h
- All wheels shall be braked for tractor $v > 30$ km/h
Lock of longitudinal differential permissible
- Parking brake system 18 %
- Safety level of hydraulic trailer brakes will be increased
 - 2 line system including automatic braking if a line is broken
- Requirements regarding functional safety of complex electronic systems



(EU) 2015/68 overview

Towed Vehicles



OVERVIEW (EU) 2015/68

- Most important issues for trailers:
- Deceleration values:
 - 30 % for trailers > 1,5 t and $v < 30$ km/h
 - 50 % for trailers > 1,5 t and $v > 30$ km/h
- Trailers > 3,5 t shall have a continuous or semi-continuous brake system
- Trailers 0,75 – 3,5 t and $v > 40$ km/h shall be equipped at least with an inertia (overrun) brake system
- Trailers $v > 40$ km/h brakes shall work on all wheels including load depending brake force distribution
- Trailers $v > 40$ km/h and > 3,5 t and trailers > 21 t shall be equipped with automatic slack adjusters, manual adjusters for all other trailers





OVERVIEW (EU) 2015/68





- ABS for trailers $> 3,5$ t and $v > 60$ km/h
- Park brake system 18 %
- Safety level of hydraulic trailer brakes will be increased
 - 2 line system incl automatic braking 13,5% if a line is broken
 - 1 line systems will be repealed with a transitional period of 10 years
- Requirements regarding functional safety of complex electronic systems

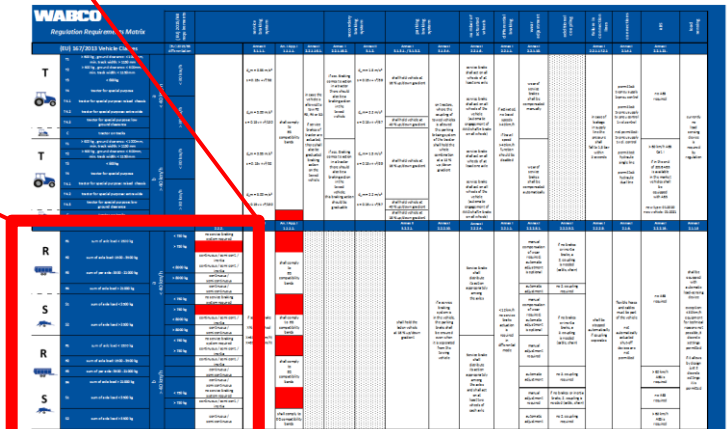


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Permissible Braking Systems R + S

Permitted Braking Systems for R+S

				Annex I 2.2.2.	
R 	R1	sum of axle load < 1500 kg	a < 40 km/h	< 750 kg	no service braking system required
				> 750 kg	
	R2	sum of axle load: 1500 - 3500 kg			continuous / semi cont. / inertia
	R3	sum of per axle: 3500 - 21000 kg		< 8000 kg	continuous / semi cont. / inertia
		> 8000 kg		continuous / semi continuous	
R4	sum of axle load > 21000 kg			continuous / semi continuous	
S 	S1	sum of axle load < 3500 kg		< 750 kg	no service braking system required
				> 750 kg	
R 	R1	sum of axle load < 1500 kg	b > 40 km/h	< 750 kg	no service braking system required
				> 750 kg	continuous / semi cont. / inertia
	R2	sum of axle load: 1500 - 3500 kg			continuous / semi cont. / inertia
	R3	sum of per axle: 3500 - 21000 kg			continuous / semi continuous
				continuous / semi continuous	
R4	sum of axle load > 21000 kg			continuous / semi continuous	
S 	S1	sum of axle load < 3500 kg		< 750 kg	no service braking system required
				> 750 kg	continuous / semi cont. / inertia
	S2	sum of axle load > 3500 kg		continuous / semi continuous	



The image shows the full WABCO RVBR Matrix table. A red box highlights the section corresponding to the summary table on the left, showing the mapping between vehicle types (R and S), axle load conditions, and permitted braking systems (continuous, semi-continuous, or inertia) for different speed ranges (< 40 km/h and > 40 km/h).

Permitted Braking Systems for R+S



Annex I 2.2.2.

Both types are permitted for all tractor trailer combinations (if a service brake on the trailer is required)

Tractor	Type	Trailer
Hydraulic	Continuous	Hydraulic
Hydraulic	Semi-Continuous	Pneumatic
Pneumatic	Semi-Continuous	Hydraulic
Pneumatic	Continuous	Pneumatic

Permitted Braking Systems for R+S

Single Line

Dual Line

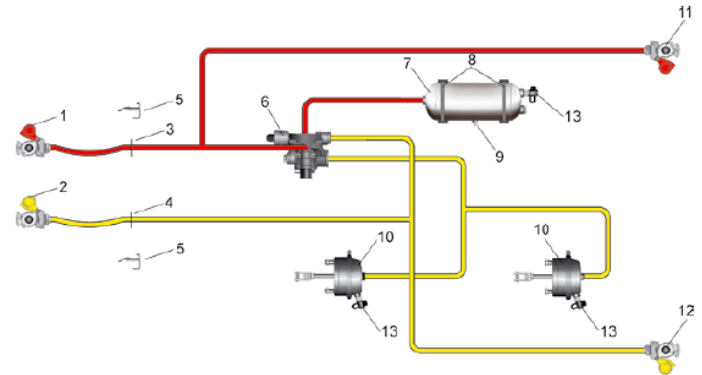
Hydraulic

Not permitted after
2019/2020

CURRENTLY
NO IMAGE
AVAILABLE

Pneumatic

Not permitted



Single and Dual Line

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Most important issues for trailer

Most important issues for trailer

30 % for trailers > 1.5 t and $v < 30$ km/h

50 % for trailers > 1.5 t and $v > 30$ km/h

(deceleration measurement between 0.8 and 0.1 v_{max})

➤ **Explicit claimed deceleration values**

Old values (StVZO): **35 %** for trailers $v < 25$ km/h

50 % for trailers $v > 25$ km/h

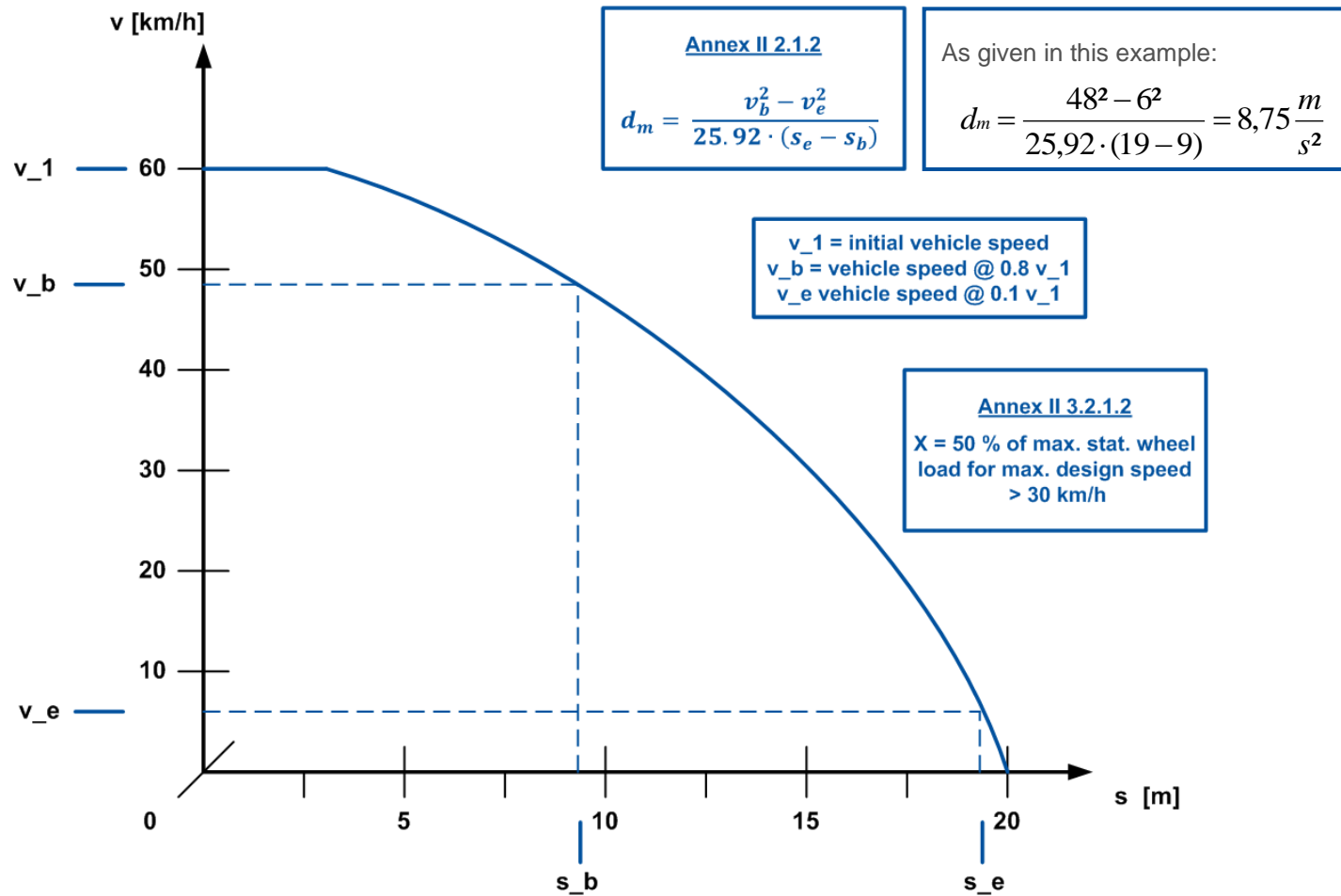
➤ **Explicit claimed deceleration values, but:**

values for mean fully deceleration!

a) according to ECE-R13 (same values as 2015/68)

b) calculation based on stopping distance and v_{max}

Most important issues for trailer (and tractor)



Most important issues for trailer

Test Conditions

- Surface with good adhesion ($\mu = 0.8$)
- Laden and unladen with largest diameter
- Cold brake ($t < 100^{\circ}\text{C}$)
- The road shall be level
- $p_m = 6,5 \text{ bar (pneu)} / 115 \text{ bar (hyd)}$
- 60 km/h or max. design speed

Test Procedure

- Standard: decelerate vehicle by only braking the trailer
- Following formula shall be applied: $z_R = (z_{R+M} - R) \cdot \frac{F_M + F_R}{F_R} + R$

To fulfill test, requirements for MFDD and stopping distance have to be fulfilled!

Most important issues for trailer

For trailers R1, R2, S1, R3a, R4a, S2a and R3b, R4b, S2b with GVW < 10 t

- Heating up of the brakes by continuous activation of the brakes on a 7% slope of 1700 m length at a speed of 40 km/h (alternative values possible)
- May be done on horizontal road pulling the trailer while activating the trailer brakes

Hot brakes need to fulfill:

- 60 % of deceleration value measured during type 0 test
- 36 % of static wheel loads trailers > 30 km/h
- 26 % of static wheel loads trailers < 30 km/h



Alternatively test reports according to Annex VII may be used, that are provided by axle manufacturers.

Most important issues for trailer

For trailers R3b, R4b and S2b with GVW > 10 t

- After adjusting the brakes
- 20 brake applications of 3 m/s² at speed 60 km/h, duration of 1 cycle 60 sec

Hot brakes need to fulfill:

- 60 % of deceleration value measured during type 0 test
- 40 % of static wheel loads trailers > 30 km/h

Alternatively test reports according to Annex VII may be used, that are provided by axle manufacturers.

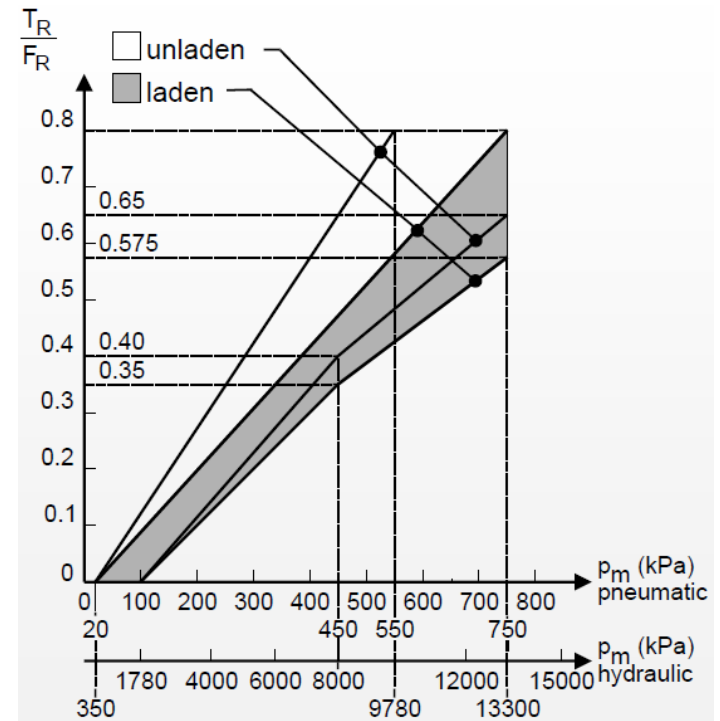
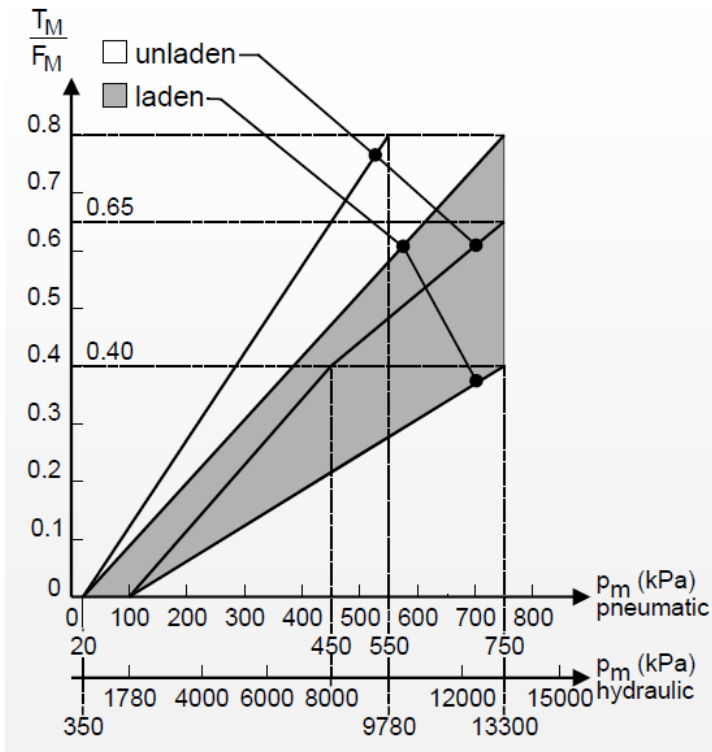
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Tractor – Trailer - Synchronization

Tractor – Trailer - Synchronization

Tractor: $3.55 \text{ m/s}^2 \ v < 30 \text{ km/h}$
 $5.00 \text{ m/s}^2 \ v > 30 \text{ km/h}$

Trailer: $30 \% \ v < 30 \text{ km/h}$
 $50 \% \ v > 30 \text{ km/h}$



Compatibility between towing and towed vehicle

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Tractor – Trailer - Synchronization

2.2.2.4. The service braking system:

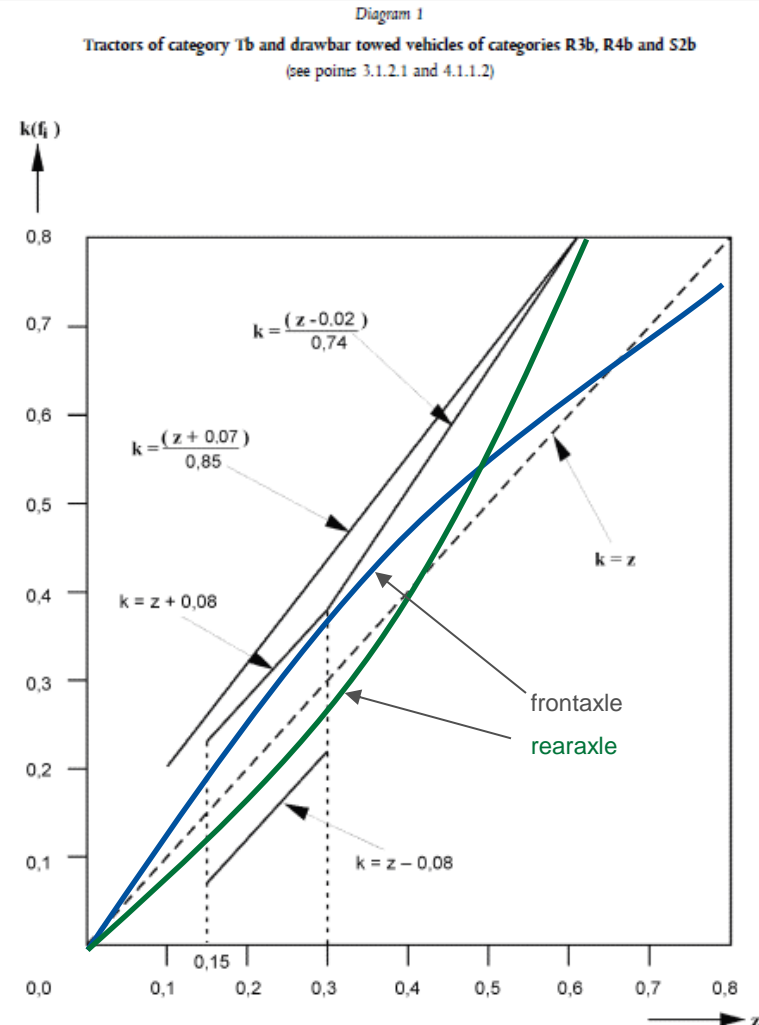
2.2.2.4.1. shall act at least on two wheels of each axle in the case of towed vehicle of categories Rb and Sb;

2.2.2.4.2. shall distribute its action **appropriately** among the axles;

When is the distribution appropriately?

Annex II, App. 1, 4.1.1. requires to fulfill:

- $z = 0,2 \dots 0,8$: rear and front axle below basic line $k = (z+0,07)/0,85$
- $z = 0,15 \dots 0,3$: rear below front axle and between the two border lines
- $z > 0,3$: rear axle below $k = (z-0,02)/0,74$



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Miscellaneous Requirements

Load Sensing Devices

2.1.1.5. A towed vehicle shall be equipped with an automatic load sensing device, with the **exception of the following cases**:

2.1.1.5.1. If a towed vehicle with a maximum design speed not exceeding 30 km/h cannot be equipped for **technical reasons** with an automatic load sensing device, it may be equipped with a device having **at least three discrete settings** for the control of the braking forces.

2.1.1.5.2. In the special case that a towed vehicle **allows by design** that only two discrete loading conditions 'unladen' and 'laden' can be realised then the vehicle **may have only two discrete settings** for the control of the braking forces.

What are technical reasons?

What are design reasons?

Who decides whether it is one of these cases?

Response Time Measurement

Annex III, 4. + 5.

- Towed vehicles response time shall be measured w/o towing vehicle
- Replacement of tractor shall be done with a prescribed simulator
- For **pneumatic** braking systems:
 - pressure increase **0 – 75% of max pressure in 0.4 s**
- For **hydraulic** braking systems:
 - pressure increase **0 – 75% of max pressure in 0.6 s**

Annex III, 1.3.

- Response time shall be rounded to the **nearest tenth of second**
- If the figure representing the hundredth units is **5 or more**, the response time is **rounded to the upper tenth**

If specified value is 0.4 s, the permitted maximum is 0.449 s

Trailer Control

Annex I, 2.1.2.2: Graduable Secondary Braking System

„...it shall be possible to graduate this braking action...”

Annex I, 2.2.1.17.1 + 2.2.1.17.3: Breakaway Protection Connecting Lines

„In the event of a failure (e.g. breakage) in one of the pneumatic connecting lines....it shall be possible...to actuate the brakes...”

„...shall automatically ensure the braking performance...”

Annex I, 2.1.2.3: Control Position for Parking Brake System

„...provided that the driver is able to check, at any time, that the parking braking system performance of the vehicle combination, obtained by the purely mechanical action of the parking braking system, is sufficient.”

„Streckbremse“ vs. Automatic Brake

2.2.1.19. In the case of a tractor authorised to tow a vehicle of categories R3, R4 or S2, the service braking system of the towed vehicle **may only be operated in conjunction with the service, secondary or parking braking system of the tractor**. However, **automatic application** of the towed vehicle brakes alone is **permitted** where the operation of the towed vehicle brakes is **initiated automatically by the tractor** for the sole purpose of vehicle stabilisation.

2.2.1.19.1. By way of derogation from point 2.2.1.19, in order to improve the driving behaviour of the vehicle combination by modifying the coupling force between the tractor and towed vehicle, it is permissible that towed vehicle brakes are applied **automatically up to a time of 5 s** without the operation of the service, secondary or parking braking system of the tractor.



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