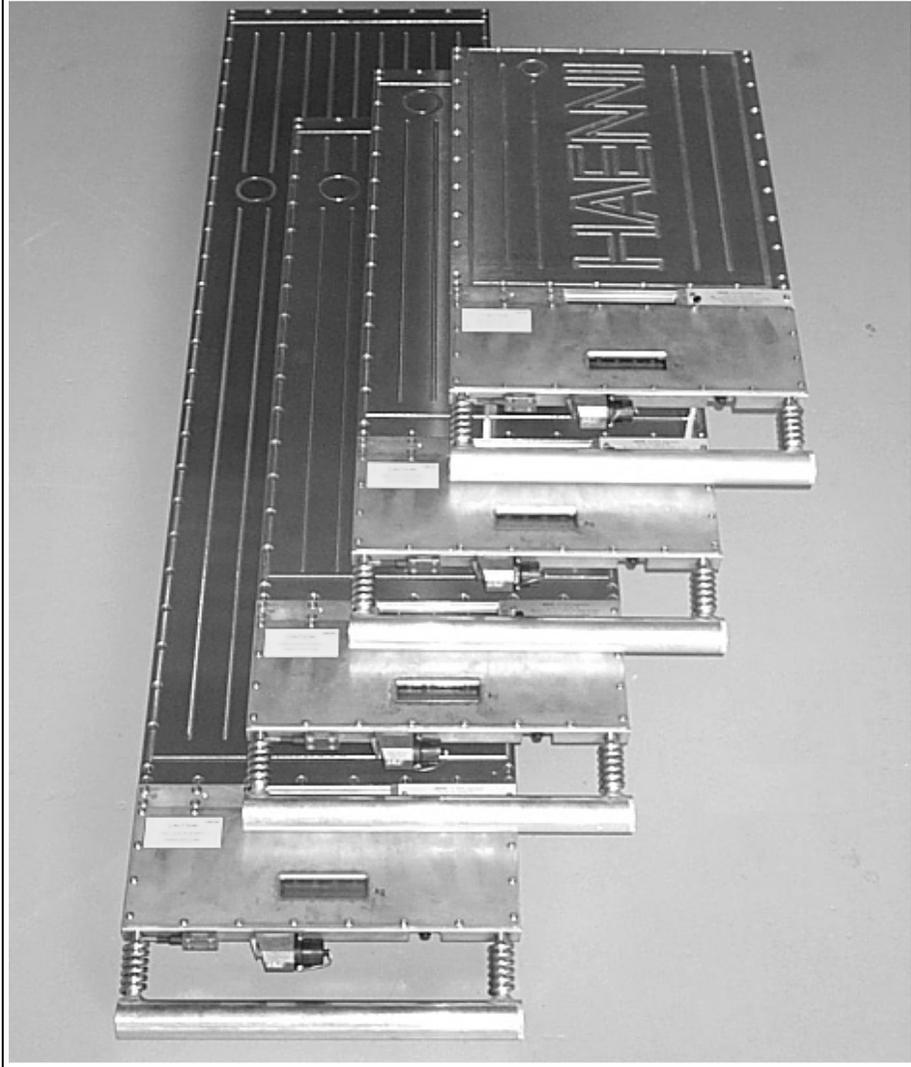


## Wheel Load Scale WL 103

### Operating Instruction



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## 1. Technical Details

Data for standard size. For more information refer to the data sheet.

Ranges		0-2t	0-10t	0-15t
Division		5kg/10kg	20kg/50kg	50kg
Accuracy		OIML No. 76 Class 4		
Tolerances		Acceptance	In Service	
Division: 5kg:	± 2.5kg	(0-200kg)	± 5kg	(0-200kg)
	± 5kg	(200-1000kg)	± 10kg	(200-1000kg)
	± 7.5kg	(1000-2000kg)	± 15kg	(1000-2000kg)
Division: 10kg:	± 5kg	(0-500kg)	± 10kg	(0-500kg)
	± 10kg	(500-2000kg)	± 20kg	(500-2000kg)
Division: 20kg:	± 10kg	(0-1000kg)	± 20kg	(0-1000kg)
	± 20kg	(1000-4000kg)	± 40kg	(1000-4000kg)
	± 30kg	(4000-10000kg)	± 60kg	(4000-10000kg)
Division: 50kg:	± 25kg	(0-2500kg)	± 50kg	(0-2500kg)
	± 50kg	(2500-10000kg)	± 100kg	(2500-10000kg)
	± 75kg	(10000-15000kg)	± 150kg	(10000-15000kg)
Temperature range		-20°C to +60°C (2t/Div. 5kg: 0°C to 40°C)		
Dim.	height of platform	19mm	17mm	17mm
	length of platform	498mm	724mm	724mm
	width of platform	393mm	393mm	393mm
Active surface	length	485mm	660mm	660mm
	width	345mm	380mm	380mm
Max. loading per area		6kg/cm <sup>2</sup>	12kg/cm <sup>2</sup>	15kg/cm <sup>2</sup>
Weight		14kg	17kg	17kg
Construction		Aluminium, watertight IP 65		
Auto Shut Off		after 10 minutes without load		

## 2. Construction and function

The WL103 Wheel Load Scale is a portable low profile instrument designed for the fast and accurate measurement of wheel, axle and total load of vehicles with pneumatically filled tires.

It comprises of a flat weighing platform with a laterally connected indicating device.

The sensing system is a measuring element in the form of a grid of flat oval tubes mounted between the base and platform. All tubes are connected together and to a sensor located in the indicator. The sensing system is filled with a non freezing liquid and is hermetically sealed. The elastic tubes are compressed between the moving cover plate and the massive ground plate when the platform is loaded. The liquid expressed is measured by the sensor, which produces a electrical signal proportional to the applied load.

For compensation of all kinds of temperature effects, a temperature sensor in the form of a long nickel wire in a polyethylene tube is located between the measuring tubes.

The signals of the volume and the temperature sensor are digitised in the electronic circuit and processed by the micro computer to a weight value, which is indicated at the display.

When the scale is powered up, a test routine is activated and the indication is set to zero. In service the indication is automatically kept at zero when the scale is not loaded.

If desired, two scales may be connected together to indicate an axle load. Each scale will indicate the sum of both units and an "A" is displayed in the first digit. Another possibility is to connect up to 12 scales serially to a processing unit or a personal computer. The signals are compatible to RS 232C.

The charging circuit for the built in Ni-Cd accumulators avoids an overcharge. A total discharge is not possible because of the auto shut-down of the scale, when the lower limit of the battery voltage is reached. The result is a long lifetime of the batteries.

The construction of the platform is specially designed for measuring the weight of vehicles with pneumatically filled tires. Hard rubber tires and rigid items as containers and so on, are not suitable, because the load will be distributed on a too small surface area.

### 3. Operating Instructions

#### 3.1 Requirements for weighing site selection

3.1.1 The weighing site must be even. For determinations of total weight, the maximum gradient in any direction may not exceed 5%. For axle load determinations the site must be horizontal (max. 0.5%), in the lengthwise direction, while a maximum gradient of 5% is permissible in the crosswise direction. For wheel load determinations the site must be horizontal in all directions.

3.1.2 The base of the scale must be evenly supported by the road surface. Hard surfaces with protruding stones and roads with ruts are unsuitable. The space between the base of the scale and the road surface may not exceed 10 mm at any location.

#### 3.2 Switch on and zero adjustment

The scale has to be switched on in horizontal position. As a function check the display shows all segments for a few seconds and then displays the battery voltage. Fully charged batteries will show little more than 8V. After a short time of use, the voltage falls to the normal value of 7.7V and remains there for the next 40 to 60 hours of operation. When the voltage falls below 7.5V the remaining operating time is only a few hours and the batteries should be recharged. The scale is operational when the display shows 00. Before every weighing procedure the zero point should be checked. If not at zero, the scale has to be restarted by pushing the on/off switch 2 times.

#### 3.3 Recharge of the built in NiCd-batteries

To charge the batteries, connect the HAENNI charger to the scale and to a suitable AC power source. Also, other 12V DC sources are suitable provided that the voltage is within the range of 10.8 to 16V at an minimum of 400mA. Suitable connectors are Amphenol Series C 16-1 6+PE or Binder Series 693 6+PE. Connect so that pin #4 is(-) and pin #5 is(+). The charging is complete after a minimum of 14 hours. A longer charging period will not harm the batteries.

### 3.4 Process of weighing

#### 3.4.1 General directions

**⚠ Warning:** When weighing a driving axle the scale may be catapulted by the wheel due to too rapid operation of the clutch!

The scale should be placed directly in front of the wheel to be weighed in accordance with the site selection instructions in section 3.1. Slowly move the vehicle with the wheels straight forward, so that the tire rests completely within the marked active weighing area of the scale. Levelling mats or additional scales must be treated analogous. After stopping the vehicle the proper position of the wheels must be checked. The brakes must be released completely before taking the reading. In order to prevent the vehicle from rolling away the first gear must be engaged with stopped engine or the brake must be activated again. Alternatively a immobilising wedge can be used. .

In normal operation the scale displays the individual wheel weight. The axle load is determined by addition of the two corresponding wheel loads, the total weight by addition of the axle loads or all wheel loads.

By connecting two scales together with the specially designed cable, both scales will display the axle load. This is distinguished by the letter "A" in the first digit of the display.

Two or more scales may be connected serially to a separate processing unit by means of specially designed cables and connecting boxes. The processing unit may be a specially designed HAENNI type or a personal computer with WINDOWS operating system and RS 232C interface. For the use of a personal computer HAENNI provides a processing program, which makes sure, that the data from the scales are interpreted correctly.

#### 3.4.2 Measurement of the wheel load

The wheel to be controlled must be driven correctly onto the scale. The overall height of the scale of 17 respectively 19 mm may cause a falsification of the result depending on the type of vehicle (more than 2 axles) and the character of the load (see paragraph 4.1.6 and Appendix). This error can be avoided by using levelling mats (or any type of backings of 17 respectively 19 mm thickness) or additional scales for the other wheels of an axle group or by placing the scales into a recess in the pavement of 17 respectively 19 mm.

### 3.4.3 Measurement of the axle load

#### 3.4.3.1 Measurement of the axle load with one scale:

The axle load of a vehicle can be determined by doing the process of weighing once each wheel according to paragraph 3.4.2.

#### 3.4.3.2 Measurement of the axle load with two scales:

The wheels of the axle which are to be measured must be driven against two correctly mounted scales at the same time. The overall height of the scale of 17 respectively 19 mm may cause a falsification of the result depending on the type of vehicle (more than 2 axles) and the character of the load (see paragraph 4.1.6 and Appendix). This error can be avoided by using levelling mats (or any type of backings of 17 respectively 19 mm thickness) or additional scales for the other wheels of an axle group or by placing the scales into a recess in the pavement of 17 respectively 19 mm.

#### 3.4.3.3 Measurement of the axle load of double or triple axle systems:

The measurement must be made analogous to paragraph 3.4.3.2 at which the non-weighed wheels of the multiple-axle system must be underlaid with backings.

### 3.4.4 Measurement of hard-rubber and metal wheels and supports of two-wheel trailers

A intermediate plate must be put between the scale and the wheel or the support, to ensure that the load per area does not exceed the permissible value according to the specification.

## 4. Sources of Errors

### 4.1 Wrong application and operation.

4.1.1 The weighing site is not clean or uneven. The scale sags too much.

4.1.2 The gradient of the weighing site is too big. The weight does not lie right-angledly on the scale. The result is an underregistration.

Additionally a load shift may occur due to the dislocation of the centre of gravity .

4.1.3 The scale was not at zero prior to loading the platform.

4.1.4 The wheel is not completely within the marked active weighing area. The result is an underregistration.

4.1.5 The surface pressure is too high, when measuring a hard rubber wheel. The result is an underregistration.

4.1.6 The non-weighed wheels are not or not correctly underlaid. The result is an overregistration depending on the construction of the vehicle.

Both wheels of an axle and all wheels of an axle group must be on the same level while weighing. All consecutive axles with a spacing less than 3 m are considered as an axle group.

The above requirement is fulfilled for most vehicles if there are levelling means 3 m before and after the scales. A positive error of up to 3% may occur in the case that this arrangement can not fulfil the above requirement.

In the case of weighing a tank truck, the liquid load flows away from the lifted axle. The result is an underregistration.

4.1.7 The brakes were not released fully. Additional forces and load shift may occur. .

4.1.8 The immobilizing wedge was applied at different parts of a vehicle composition. Load shift may occur on sites with a slope above 0.5% in driving direction .

4.2 Static friction in the suspension of the vehicle. A small weighing error may arise because of the static friction especially when weighing multiple-axle systems.

4.3 The scale shows clearable errors:

E01 : The battery voltage is too low. Recharge with the HAENNI charger.

**⚠ Warning:** Never connect the scale directly to the mains! In case of no success, replace the batteries. Dispose of used batteries properly.

E02 : The temperature is beyond the limits.

E03 : Transmission error. Check cable connectors.

E04 : Initial zero setting error. Check if the scale has been turned on loaded. In this case unload and restart.

E05 : Zero point error. May occur when the scale was exposed to great temperature changes in a short time period. Wait a few minutes and restart the scale.

OL : The load is beyond the capacity of the scale.

If the listed remedial measures show no success, the scale is defective.

#### 4.4 The scale is defective.

All error messages not listed in paragraph 4.2. indicate malfunctions which under normal conditions are not clearable on site. Nevertheless in some cases it is possible that the error occurs only temporarily e.g. due to electromagnetic disturbances. Therefore it is advised to restart the scale. If this does not clear the problem, the scale is in need of service. The transmission errors E19 and E25 can only occur when two or more scales are connected together. The scales will still work properly when disconnected and used as individual units. If there is any doubt about the correct working or accuracy of the scale despite the absence of error messages, a controlled test of the scale according to paragraph 5 is required.

## 5. Test Instructions

### 5.1 Test measurement in use

#### 5.1.1 Swapping the scales:

The approximate precision of the scale can be determined by weighing a single axle with two scales. After the first measurement is made, swap the scales left to right and repeat the process. The individual wheel as well as axle weights should agree from the first to the second measurement.

The instructions in chapter 3 must be followed strictly.

#### 5.1.2 Testing on a platform scale:

Place the wheel load scale to be tested onto a verified platform scale. Prior to testing both the wheel load scale and the platform scale must be zeroed. Load both scales with identical load by placing one wheel only of a truck on the wheel load scale. All other wheels of the vehicle must be located outside of the platform of the weigh bridge. The error of the wheel load scale is its indication minus the indication of the platform scale. Different loads may be applied by repeating the test with other wheels and by using different vehicles and different loading conditions.

### 5.2 Test measurement on the test bench

An exact control of the specified tolerance is only possible on the test equipment. The way of control must strictly be followed. The following conditions must be fulfilled:

The weight force must act equally distributed on the active area of the platform, without exceeding the maximum admissible loading per area specified.

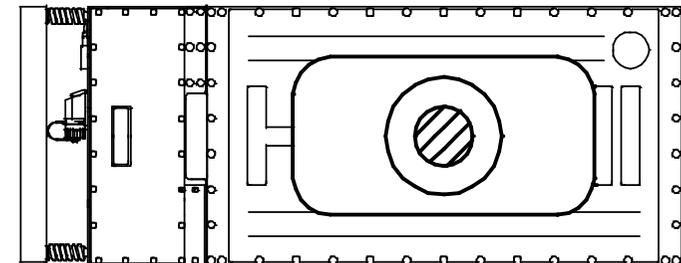
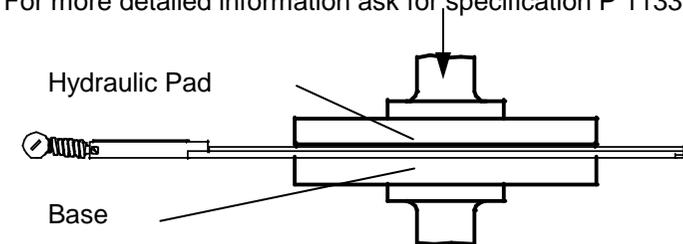
The base (HAENNI W12509) is a 40 mm (1.5 in) plain steel plate.

The force plate HAENNI W 12497 (for 10t, 15t and 20000lb), as well as the HAENNI W 14836 (for 2t and 5000lb) are specially designed to fulfil all above listed specifications.

We do not recommend any other test equipment as e.g. the use of a rubber intermediate layer as it exists the danger of a local overload. The consequence would be a underregistration in the upper indicating range.

With a correct zero adjustment the scale must keep the specified tolerance OIML No. 76, class. 4 or NIST H44, class. 4.

For more detailed information ask for specification P 1133.

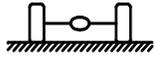
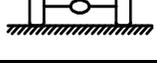


## Appendix

How to weigh correctly with the Wheel Load Scale Type WL 103

### A Error sources at the weighing site

#### A1 Weighing site gradient

Weighing		Total weight	Axle weight	Wheel weight
Gradient				
	longitudinal 0%	correct	correct	correct
	transversal 0%			
	longitudinal 0%	correct	correct	incorrect <sup>1)2)</sup>
	transversal 5%			
	longitudinal 5%	correct	incorrect <sup>1)3)</sup>	incorrect <sup>1)3)</sup>
	transversal 0%			
	Total 5%	correcte	incorrect <sup>1)4)</sup>	incorrect <sup>1)5)</sup>
				
	Total >5%	incorrect <sup>6)</sup>	incorrect <sup>6)</sup>	incorrect <sup>6)</sup>
				

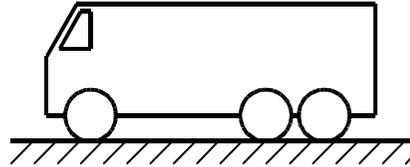
- 1) The load of the axle and wheels in the lower position is greater than that in the horizontal position, that of the higher axle or wheels correspondingly less. Even though the scale is working perfectly, this will result in weighing errors that may range from small to large depending on the type of vehicle. In the case of vehicles carrying liquid payloads, the error is compounded by shifting of the load onto lower-lying axle or wheels.
- 2) When an unfavourable vehicle <sup>7)</sup> is being checked, the reading error is  $\pm 7\%$  in the case of the more heavily loaded wheel of an axle (closer to centre of gravity) and  $\pm 9\%$  for the axle's less heavily loaded wheel. (First sign: centre of gravity shifted towards the higher wheel; second sign: towards the lower wheel.)
- 3) When an unfavourable vehicle <sup>7)</sup> is being checked, the reading error is  $\pm 4.3\%$  for the rear axle or wheels and,  $\pm 12.5\%$  for the front axle or wheels. (First sign: upgrade; second sign: downgrade.)
- 4) As described in 3) for axle loads.
- 5) The reading errors described in 2) and 3) for wheel load are cumulative.
- 6) In the case of gradients steeper than 5%: same is true as for 5%, but the differences become proportionally greater. Furthermore, the total weight indicated will be perceptibly smaller (more than  $-0.12\%$ ), because the scale registers only the weight component perpendicular to the platform. If the 5% limit is badly exceeded, the scale may malfunction as well.
- 7) Assumption: The vehicle being checked has a wheel base of 4 m, an average track width of 1.6 m and its centre of gravity 1 m ahead of the rear axle, 0.2 m off the lengthwise centreline and 2.5 m above the road surface. The % errors stated are in relation to the respective axle and wheel loads. For gradients less than 5% the errors are proportionally smaller.

A2

### Uneven place of weighing

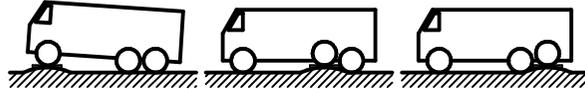
#### Even place of weighing

Correct weighing



#### Crown

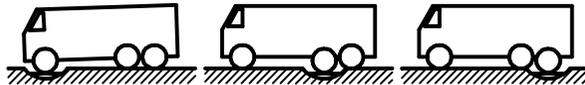
Incorrect weighing



The indicated total weight is higher than on a flat surface.

#### Hollow

Incorrect weighing



The indicated total weight is lower than on a flat surface.

### Even place of weighing

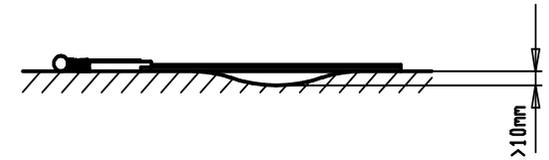
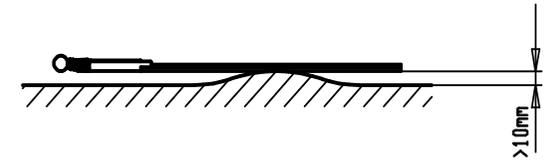
Correct weighing



The scale is correctly placed. The clearance between the scale and the ground is not more than 10 mm.

### Uneven place of weighing

Incorrect weighing

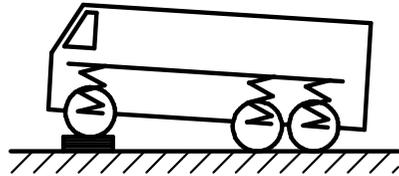


The clearance between the scale and the ground is more than 10 mm. The scale is deformed too much

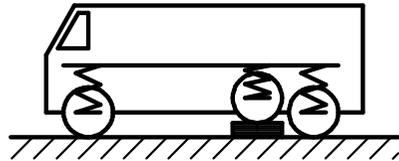
**B Sources of errors through the suspension of the vehicles**

**B1 Influence of the suspension on the weighing**

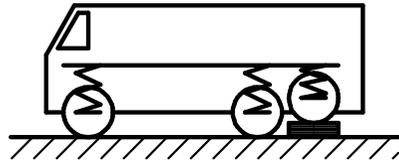
Front axle correctly weighed



incorrect: the indication is too high



incorrect: the indication is too high



Result: total weight too high.

The error can be avoided if both rear axles are weighed at the same time with two additional scales or if the axle not being weighed, is supported with a dummy with the same thickness as the scale.

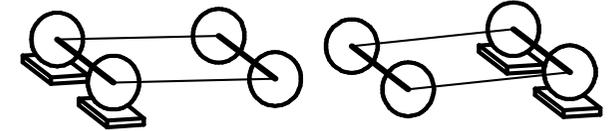
**B2 Examples**

**B2.1 General**

The rectangular plates under the wheels represent the wheel load scale type WL 103 respectively the levellers of 17 respectively 19 mm thickness. Aside from exceptional cases always two or more scales should be used. The required number of scales and backings can be seen from the maximum plates per sketch (e.g. vehicle with three axles, see B 2.3.1.: at least four scales and levellers.

**B2.2 Vehicles with 2 axes**

Correct weighing

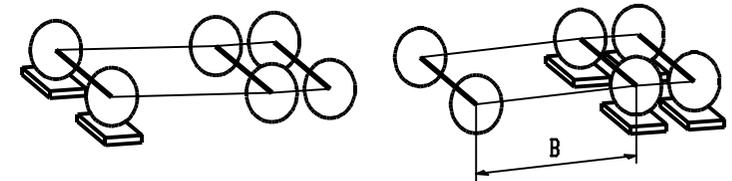


Incorrect weighing

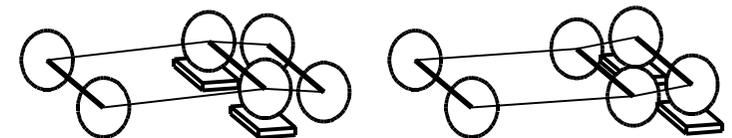


**B2.3. Vehicles with 3 axes**

**B2.3.1 Vehicles with long wheel base (B greater than 3 m)**



Correct weighing

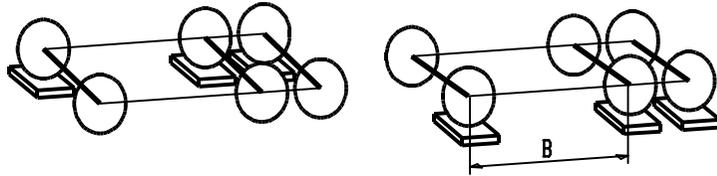


Incorrect weighing

The indicated weight too high.

**B2.3.2 Vehicles with short wheel base**  
(B smaller than 3 m)

Correct weighing



The indicated weight is approximately 1% too low  
The error might be more important when measuring vehicles with liquid payload.

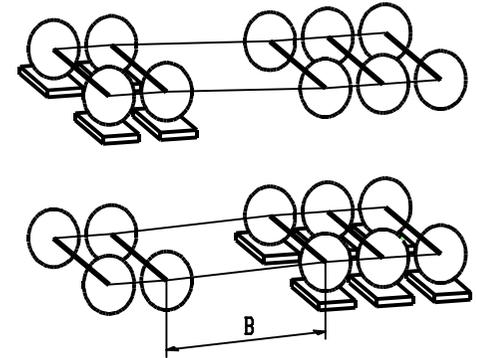
**B2.4 Vehicles with 4 axles**

The same remarks apply as for vehicles with 3 or 5 axles.

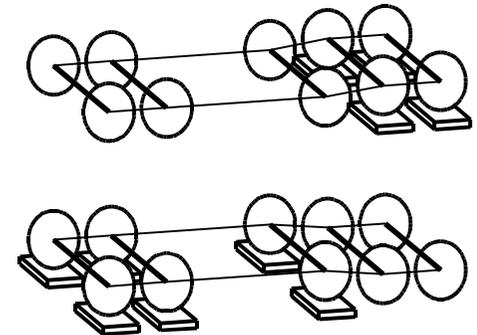
**B2.5 Vehicles with 5 axles**

**B2.5.1 Vehicles with long wheel base**  
(B greater than 3 m)

Correct weighing



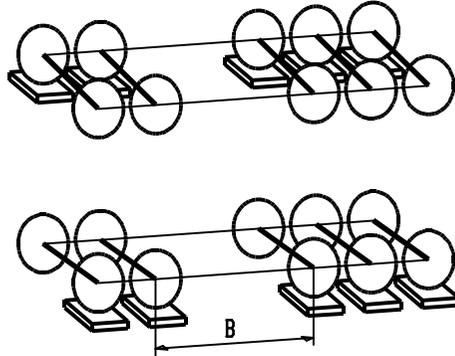
Incorrect weighing



The indicated weight too high.

B2.5.2 **Vehicles with small wheel base**  
(B smaller than 3 m)

Correct weighing



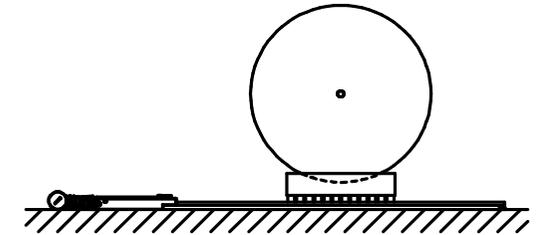
The indicated weight is approximately 1% too low.  
The error might be more important when measuring vehicles with liquid payload.

**C Errors because of „hard“ wheels**

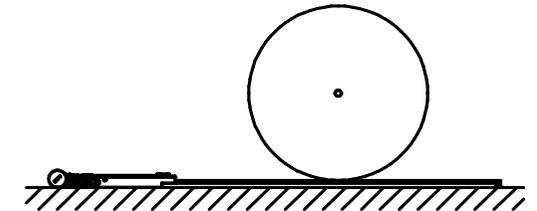
Solid rubber and steel wheels need special precautions. For such wheels the pad D 12590 must be used between the scale and the wheel to ensure that the load per area doesn't exceed the value specified in chapter 1 „Technical Details“.

Correct weighing

Pad D 12590 with deepening for proper centring of the load.



Incorrect weighing



The indicated weight may be far too low due to local overload.



**the portable scale for all type of vehicles with rubber tires**

**protects against overloading as well as insufficient loading**

**assures the exact observance of the permissible total weights and axle loads**

**can always and at any time be used without connections or ramps**

**can easily be transported and put to use by one person alone**

**is robust, does not require any maintenance, is practically unaffected by ambient temperature and is accurate**



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