




<b>POLICY: Legal Metrology</b>		 <b>NRCS</b> national regulator for compulsory specifications	
Policy Number	LM-P-030-03-14_Ver 5	Version No:	4
Effective Date	Ver5: 01 March 2018	File name:	LM-P-030-03-14_Ver 5 SANS689:2013-Verification
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## 1. Background

The SANS689: 2013-Automatic rail-weighbridges (ARW) standard came into effect on 01 January 2014 after the amendment of Regulation 61 was published in Government Gazette No 36974.

SANS689: 2013, Clause AA.1.1 allows instrument which was type approved before this standard was made compulsory to comply in design and construction with their type approval documentation, be marked accordingly and it need not necessarily meet all the requirements of the standard. They shall however be subjected to the accuracy tests prescribed in Annex AA, with the maximum permissible error being the error permitted for an ARW of accuracy class1.

## 2. Scope

This policy prescribes;

- a) the procedure to be followed when the maximum capacity for a test wagon cannot be achieved;
- b) the Legal Metrology interpretation on the number of wagons in a test train and the number of runs (weighing's) to be done during verifications and
- c) the interpretation of the tolerances to be applied.

## 3. Reference documents

SANS689: 2013-Automatic rail-weighbridges.

## 4. Clarifications:

### 4.1 Capacity

The anomaly that was created is that instruments that was originally installed and tested as an example on the ore lines was tested (old Reg 61) with wagons which was loaded to capacity or close to capacity (120 t), the instrument was then type approved for that capacity as a result.

If the type approved instrument is then installed at a site where that capacity of wagons was not available the instrument was then tested with wagons that was available although the wagon capacity was not even 0,5 Max, e.g. 40 t.

Regulation 61 did allow for this.

*"(11) (a) (i) The mass of 11 trucks of the various types, the mass of which the system is required to measure, with as far as practicable one or two trucks empty and not less than two or more..."*

The new SANS689:2013, Clause AA.5.3.5 b) and c) requires the wagons to be loaded between half max and max of the type approved maximum mass,

*"...reference wagon loaded as close as is practicable to the approved maximum mass, and the other reference wagons with masses evenly spread in between half the approved maximum mass and the approved maximum mass..."*

which means that for the verification tests, "loaded as close as is practicable to the approved maximum mass", the wagons on certain ARW sites will not be able to comply with this requirement as the capacity of the heaviest wagons normally used for the site is less than half the type approved capacity of the automatic rail-weighbridges (ARW).



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**“AA.5.3.6 Ensure that a test series consists of several passes of the test train of coupled wagons over the ARW until at least 60 reference wagons have been weighed or the equivalent in total train mass has been reached. Test each mode of operation as follows:**

**a) For the range of operating speeds, carry out one test series (at least 60 weighings). Pass the train over the ARW at or near minimum speed, at or near maximum speed, and the rest of the passes of the train in the series at various speeds in between the maximum and minimum speeds.**

**NOTE Depending on the number of reference wagons in the train, more than 60 weighings might be necessary.”**

It means the whole speed range shall be covered within the test series (60 readings).

Example:

Wagons test train	in	Number of runs	Number readings	of	Number of runs at:		
					Min speed	Max speed	In between Max & Min speed
5		12	60		3	3	6
6		10	60		3	3	4
7		9	63		3	3	3
8		8	64		3	3	2
9		7	63		3	3	1
10		6	60		2	2	2
11		6	66		2	2	2
12		5	60		2	2	1
13		5	65		2	2	1
14		5	70		2	2	1
15		4	60		1	1	2
20		3	60		1	1	1
25		3	75		1	1	1
30		2	60		1	1	

**“b) Where both directions of weighing are used, carry out one of the test series in (a) in each direction.**

**c) Where both pushing and pulling are used, carry out one of the test series in (a) with reference wagons that are pushed and one series with reference wagons that are pulled.”**

For b) and c): The example in a) shall be applied in both directions of use of the ARW. One direction (one series) for pushing and the opposite direction (one series) for pulling the wagons.

If, for example, only pulling is used in both directions then one series, (60 weighing’s) of pulling the wagons in one direction and then one series, (60 weighing’s) of pulling the wagons in the opposite direction will apply.

Evidence, in the form of a questionnaire to determine the number of wagons, capacities of wagons, ARW installation address etc shall be kept by the verification laboratory indicating interaction with user (signature and date of user) of the instrument at the time of verification.

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**4.3 MPE for wagon weighing (individual coupled or uncoupled wagon masses indicated) (6.2.1.2)**

*The biggest value of the MPEs described in a), b) or c) for each test wagon will always be chosen and used each time the test wagon is passed over the ARW so it does not matter when you check for compliance, i.e. after each run or after a series of runs.*

The maximum permissible error for uncoupled or coupled wagon weighing shall be one of the following values, whichever is the greater:

**a) the value calculated according to the accuracy class in table 1, rounded to the nearest scale interval;**

**Table 1 — Maximum permissible errors for in-motion weighing**

1	2	3
Accuracy class	Percentage of the mass of a single wagon or a train in the case of train weighing %	
	Verification	In-service inspection
0,2	± 0,10	± 0,20
0,5	± 0,25	± 0,50
1	± 0,50	± 1,00
2	± 1,00	± 2,00

*This MPE is a variable and depends on the mass of each test wagon and will have the greatest value of the three options for heavier test wagons as described below. Clauses b) and c) are fixed values and would be the same MPE for all test wagons irrespective of their mass.*

*Example of interpretation of clause a):*

*Markings on ARW (see Clause 7.12, SANS 689):*

*Accuracy Class: 1*

*d= 20 kg*

Wagon Mass	MPE (± 0,5%) as per table 1 for Verifications	MPE (± 0,5%) rounded to the nearest scale interval
19840	99,20 kg	100 kg
20265	101,325 kg	100 kg
45662	228,31 kg	220 kg
80300	401,5 kg	400 kg
86480	432.4 kg	440 kg

In the case of an ARW that is used for weighing coupled wagons (not applicable to uncoupled wagons), the errors of not more than 10 % of the weighing results taken from one or more passes of the test train shall be permitted to exceed the maximum permissible error given in table 1, but shall not exceed two times that value.

*From the 60 weighings, six measurement results (10 %) are allowed to exceed the tolerance of ± 0,5 % but none of the six measurement results (10 %) are allowed to exceed ± 1 % of the tolerance. This is only applicable for verification and type approval tests.*

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**b) the value calculated according to the accuracy class in table 1, rounded to the nearest scale interval for the mass of a single wagon equal to 35 % of the maximum wagon mass (as marked on the descriptive markings), or**

*The MPE specified in clause b) is a fixed value and would be the same MPE for all test wagons irrespective of their mass.*

*Example of interpretation of clause b):*

*Markings on ARW (see Clause 7.12, SANS 689):*

*Maximum wagon mass (Max capacity for instruments type approved before SANS 689): 80 000 kg*

*d = 50 kg*

*Class: 1*

*35 % of the maximum wagon mass (as marked on the descriptive markings):*

*35% of 80 000 kg = 28 000 kg*

*Class 1, MPE (from table 1):  $\pm 0,50$  %*

*0,5 % of 28 000 = 140 kg rounded to the nearest scale interval = 150 kg.*

*150 kg is the fixed value for the test wagons on this scale when using b) as the MPE.*

In the case of an ARW that is used for weighing coupled wagons (not applicable to uncoupled wagons), the errors of not more than 10 % of the weighing results taken from one or more passes of the test train shall be permitted to exceed the maximum permissible error given in table 1, but shall not exceed two times that value.

*From the 60 weighings, six measurement results (10 %) are allowed to exceed the tolerance of  $\pm 0,5$  % (150 kg from above example) but none of the six measurement results (10 %) are allowed to exceed  $\pm 1$  % (300 kg for the above example) of the tolerance. This is only applicable for verification and type approval tests.*

**c) 1d.**

*Example of interpretation of clause c):*

*Markings on ARW (see Clause 7.12, SANS 689):*

*Maximum wagon mass (Max capacity for instruments type approved before SANS 689): 80 000 kg*

*d = 50 kg*

*Class: 1*

*If option c) is used the MPE is "d" which is 50 kg and is also a fixed value for all test wagons on this scale.*

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**4.4 Example of interpretation of all MPE clauses during Type Approval and Verification tests for individual wagons:**

**Table 1 - Maximum permissible errors for in-motion weighing**

1	2	3
Accuracy class	Percentage of the mass of a single wagon or a train in the case of train weighing %	
	Verification	In-service inspection
0,2	± 0,10	± 0,20
0,5	± 0,25	± 0,50
<b>1</b>	<b>± 0,50</b>	<b>± 1,00</b>
2	± 1,00	± 2,00

Markings on ARW (see Clause 7.12, SANS 689):

Accuracy Class: 1

Maximum wagon mass (Max capacity for instruments type approved before SANS 689): 100 000 kg  
d=: 20 kg

Wagon Mass (kg)	MPE	MPE	MPE rounded to the nearest scale interval
19840	Clause a)	99,20 kg	100 kg
	Clause b)	<b>175 kg</b>	<b>180 kg</b>
	Clause c)	20 kg	20 kg
20265	Clause a)	101,325 kg	100 kg
	Clause b)	<b>175 kg</b>	<b>180 kg</b>
	Clause c)	20 kg	20 kg
45662	Clause a)	<b>228,31 kg</b>	<b>220 kg</b>
	Clause b)	175 kg	180 kg
	Clause c)	20 kg	20 kg
43220	Clause a)	<b>216,1 kg</b>	<b>220 kg</b>
	Clause b)	175 kg	180 kg
	Clause c)	20 kg	20 kg
80300	Clause a)	<b>401,5 kg</b>	<b>400 kg</b>
	Clause b)	175 kg	180 kg
	Clause c)	20 kg	20 kg
86480	Clause a)	<b>432.4 kg</b>	<b>440 kg</b>
	Clause b)	175 kg	180 kg
	Clause c)	20 kg	20 kg

The figures in **BOLD** are the greater of the MPE options and are to be used when determining the accuracy of the instrument (ARW)

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### 4.5 Rollback

In terms of sections 4 and 5 of SANS 689 The requirements of the standard apply to all devices that perform metrologically relevant functions, whether they are incorporated in an ARW or manufactured as a separate unit, the rollback function is typically that and does have an influence on the accuracy of the ARW if it does not function correctly.

To clear the confusion regarding the rollback function on ARWs the following shall apply:

- a. An ARW with a rollback function, that was type approved either before or after the publish date of the SANS689: 2013 edition 1, document shall be evaluated/tested during Initial and Subsequent verifications as per the requirements of 7.4.5.2 and A.9.5.
- b. The results of measurement for the test of Rollback shall be reflected in the Metrologist Notebook and the ARW Verification Certificate issued for the ARW.
- c. The implementation period to update the designated verification bodies quality manual (test procedures+ training) shall be 2 months from the effective date of this version of the Policy, which means as from 01May 2018 it is compulsory, where applicable, to perform this test during initial and subsequent verifications.

