AN APPLICATION OF R 76

New standard measurement transmission device for standard track scales

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Abstract

This paper first gives a brief introduction to the manufacture of a standard track scale that complies with the Class II accuracy requirements of OIML R 76 (1992) Nonautomatic weighing instruments. *It then outlines the main specifications and structural characteristics of the 11 m standard track scale.*

1 Introduction

OIML R 76 stipulates in subclause 3.5.1 that the mpe of a Class III scale for trade use should be as in Table 1, where e is the verification scale interval, which in China is equal to 20 kg or 50 kg for Class III nonautomatic track scales and 2 kg for Class II instruments.

Static track scales for business usage (which fall under the category of nonautomatic weighing instruments and which are widely used in China for railway transportation trade measurements) should also meet the above requirements. However, the measurement mpe of railway track scale test weight wagons should be less than 1/3 of the Class III mpe in Table 1. The standard track scale (which is the standard equipment used for measurement inspection of the test weight wagon) should be less than 1/3 of the mpe of the test weight wagon. Therefore, the mpe of the standard track scale should be less than 1/9 of the mpe of Class III in Table 1. Since the mpe of Class II scales stipulated in R 76 is 1/10 that of Class III scales, the standard track scale should meet Class II requirements.

In order to conform to the above, the standard track scale general design and construction, components and materials, installation and adjustment, etc. were all given full consideration.

2 Methods of installation and adjustment of the standard track scale

The standard instrument used to inspect the standard track scale is designed to maximum limits of analogue detection of the test weight wagon.

Table 1 Maximum permissible errors for increasing or decreasing loads

Maximum permissible errors on initial verification	For loads m expressed in verification scale intervals e			
	Class (I)	Class (II)	Class (III)	Class (IIII)
± 0.5 e	0 ≤ m ≤ 50 000	0 ≤ m ≤ 5 000	0 ≤ m ≤ 500	0 ≤ m ≤ 50
± 1 e	50 000 < m ≤ 200 000	5 000 < m ≤ 20 000	500 < m ≤ 2 000	50 < m ≤ 200
± 1.5 e	200 000 < m	20 000 < m ≤ 100 000	2 000 < m ≤ 10 000	200 < m ≤ 1 000

BIML note: Table reproduced as in OIML R 76

Table 2 Wheel axle setting data

Type	Central distance of a bogie (small wagon)	Full length of a bogie axle (small wagon)	Full length of an axle	All up
T6	2.86 m	1.60 m	4.46 m	40 t
Small counterweight for wagons of group 2	3.46 m	1.00 m	4.46 m	40.04 t
T6F / T6D C62	8.70 m	1.75 m	10.45 m	20 t to 84 t
Small counterweight for wagons of group 1	8.70 m	1.00 m	9.70 m	82.13 t

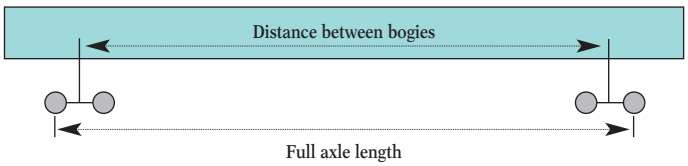

Fig. 1 Wheel axle settings

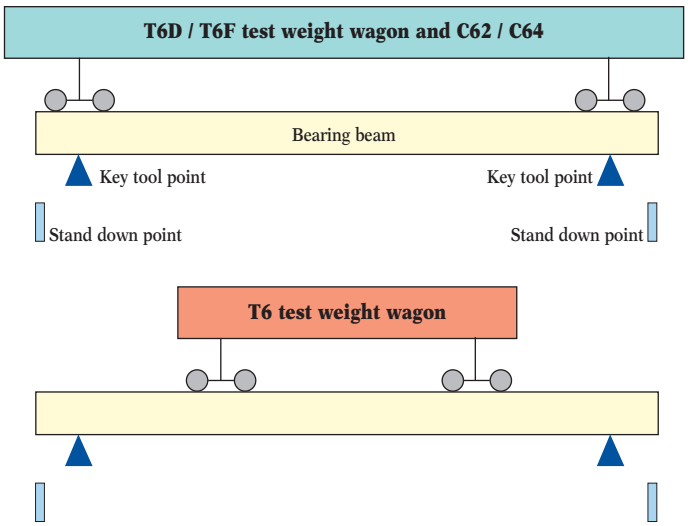

Fig. 2 Sketch of a standard track scale inspecting a test weight wagon

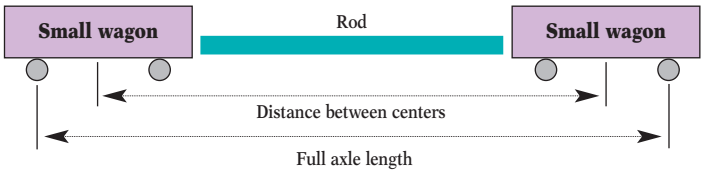

Fig. 3 Imitation of the test weight wagons

The function of the standard track scale instrument is to inspect test weight wagons, of which there are two kinds: type T6 and type T6F / T6D. The mass of the T6 is 40 t, and that of the latter types is between 20 t and 84 t. The T6 is a short axle type and the T6F / T6D are both long axle wagons: these are quite similar to the type C62 and C64 bulk cargo vehicles which account for 80 % of China's railway transportation vehicles. The wheel axle setting is depicted in Fig. 1 and relevant data presented in Table 2.

The long test weight wagon in Fig. 2 can only move 350 mm along the standard track scale while being inspected. The short test weight wagon, however, can move further on the standard track scale while being inspected, but should remain in the middle of the scale.

Figure 3 shows details of the exclusive counterweight for imitating small counterweight wagons of types T6D / T6F and T6; relevant data is presented in Table 2. The two small wagons are connected by a long central rod of mass 130 kg ± 0.1 kg (when imitating the long test weight wagon) and a short rod of mass 40 kg ± 0.1 kg (when imitating the short test weight wagon).

The distance between the centers of the two small wagons, when used to imitate the long test weight wagon, is exactly the same as the underframe of the long test weight wagon.

The axle length of the two small wagons is shorter by 0.75 m than that of the long test weight wagon, so the full axle length of the two small wagons should be increased by 0.75 m when used to imitate the long wagon. Consequently, the movable distance of the two small wagons reaches 1.1 m, which is 0.75 m longer than the long test wagon.

The mass of each small wagon is 2 500 kg ± 0.1 kg, including its attached F_2 counterbalance weight of 77 t.

Each counterbalance weighing 3 t or 2 t is weighed by a 3 t weighing scale whose sensitivity is less than 0.001 %. The counterbalance weighing 1 t or 0.5 t is weighed by a 0.5 t or 1 t weighing scale whose sensitivity is less than 0.001 %. All these counterbalances can be used to inspect standard track scales within 30 days after they have been weighed.

The above-mentioned counterbalance, small wagon and rod are made of different masses of 20.13 t, 40.13 t, 60.13 t and 82.13 t, to imitate the long test weight wagon and the short test weight wagon of 40.4 t.

Generally speaking, there are no wagons whose mass exceeds these values. This is because in China, the total mass of each bulk wagon is less than 84 t, so 100 t data are rare.

The imitated test weight wagon consisting of standard masses of the small wagon group moves to and from its rest position (to the left, to the right and in the middle of the standard track scale) 5 times to inspect the scale (i.e. just within the length of the standard track scale).

3 Main current specifications and structural characteristics of the 11 m standard track scale

Accuracy class:	OIML R 76 Class II
Maximum capacity (Max.):	100 t
Minimum capacity (Min.):	18 t
Verification scale interval (e):	2 kg
No. of verification scale intervals (n):	50 000
Length of weighing surface:	11 m
Gauge:	1 435 mm
Actual scale interval (d):	0.1 kg
Number of actual scale intervals:	1 000 000
Actual measurement value: (the same loaded wagon to and fro 5 times, weighing 10 times)	

at 20 t: random error, σ = 0.053 kg; max. error = 0.4 kg
at 40 t: random error, σ = 0.042 kg; max. error = 1.5 kg
at 60 t: random error, σ = 0.157 kg; max. error = 1.2 kg
at 82 t: random error, σ = 0.166 kg; max. error = 1.0 kg

The 11 m standard track scale satisfies the mpe requirements for Class II and its random error is only σ = 0.166 kg, which means that it has a latent capacity to improve its accuracy. ■

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