Choice of rail wheels 车轮选择

In order to choose a rail wheel, its diameter is determined by considering :

为了选择一个轨道车轮，它的直径是通过考虑以下因素来确定的：

-the load on the wheel, 轮载荷

-the quality of the metal from which it is made, 材质

-the type of rail on which it rues, 轨道类型

-the speed of rotation of the wheel, 转速

-the group classification of the mechanism. 工作级别

4.2.4.1. Rail wheel size 轮尺寸

To determine the size of a rail wheel, the following checks must be made :

要确定轨道车轮的尺寸，必须进行以下检查：

-that it is capable of withstanding the maximum load to which it will be subjected, and

- 它能够承受它将承受的最大载荷，并且

-that it will allow the appliance to perform its normal duty without abnormal wear.

- 它将允许设备执行其正常工作而不会出现异常磨损。

The two requirements are checked by means of the following two formulae :

这两个要求是通过以下两个公式来检查的：

$$P_{mean\ III} \leq P_L \cdot C_{1max} \cdot C_{2max} < 1{,}38 \cdot P_L \approx 1{,}4\ P_L$$

Taking C_{1max}=1.2 and C_{2max}=1.15

and $P_{mean\ I,II} / (b.D) \leqslant P_L.C_1.C_2$

Where:

D is the wheel diameter in mm 车轮直径

b the useful width of the rail in mm 轨道有效宽度

P_L a limiting pressure dependent upon the metal used for the wheel, in N/mm2

C_1 a coefficient depending on the speed of rotation of the wheel 转速系数

C_2 is a coefficient depending on the group of the mechanism 工作级别系数

$P_{mean\ III}$ is the mean load to be withstood by the wheel, in loading case III, in N, calculated according to the formulae in clause 4.2.4.1.1. 等效载荷

$P_{mean\ I,II}$ is the mean load in case I or II.

4.2.4.1.1.Determining the mean load 确定平均载荷

In order to determine the mean loads, the procedure is to consider the maximum and minimum loads withstood by the wheel in the loading cases considered, i.e. with the appliance in normal duty but omitting the dynamic coefficient ψ when determining $P_{mean\ I,II}$ and with the appliance not in use for $P_{mean\ III}$ .The values of P_{mean} are determined by the formula below in the three cases of loading I, II and III :为了确定平均载荷，程序是在所考虑的载荷情况下考虑车轮承受的最大和最小载荷，即设备处于正常工作状态但在确定 Pmean I,II 时省略动态系数ψ 和 器具未用于 $P_{mean\ III}$ 。 P_{mean} 的值由以下三种负载 I、II 和 III 情况下的公式确定：

$$P_{mean\ I,II,III} = (P_{min\ I,II,III} + 2 \cdot P_{max\ I,II,III}) / 3$$

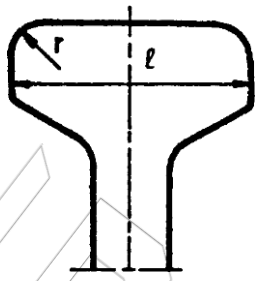
For rails having a flat bearing surface and a total width l with rounded corners of radius r at each side, we have:

对于具有平坦承载面且总宽度为 l 且每侧半径为 r 的圆角的导轨，我们有：

$$b = l - 2 \cdot r$$

for rails with a convex bearing surface, we have:

$$b = l - 4 . r / 3 \quad 4$$



4 (1) For the same width of rail head, these formulae give a greater useful bearing width For convex rails than for flat rails. This allows for the superior adaptation of a slightly convex rail to the rolling motion of the wheel.
对于相同宽度的轨头，这些公式为凸轨提供了比平轨更大的有用承载宽度。这使得略微凸出的轨道能够更好地适应车轮的滚动运动。

4.2.4.1.3.Determining the limiting pressure PL 确定极限压力 PL

The value of P_L is given in table T.4.2.4.1.3. as a function of the ultimate strength of the metal of which the rail wheel is made; P_L 的值在表 T.4.2.4.1.3 中给出。 作为制造轨道轮的金属的极限强度的函数；

The qualifies of metal refer to cast, forged or rolled steels, and spheroidal graphite cast iron.
金属的质量是指铸钢、锻钢或轧钢和球墨铸铁。

Table T.4.2.4.1.3. - Values of P_L

Ultimate strength for metal used for rail wheel 用于轨道轮的金属的极限强度	P_L in N/mm^2
σ_R > 500 N/mm^2	5,0
σ_R > 600 N/mm^2	5,6
σ_R > 700 N/mm^2	6,5
σ_R > 800 N/mm^2	7,2

In the case of rail wheels with tyres, consideration must obviously be given to the quality of the tyre, which should be sufficiently thick not to roll itself out. 对于带轮胎的轨道车轮，显然必须考虑轮胎的质量，轮胎应足够厚以防止滚出。

In the case of wheels made of high tensile steel and treated to ensure a very high surface hardness, the value of P_L is limited to that for the quality of the steel composing the wheel prior to surface treatment, according to table T.4.2.4.1.3., since a higher value would risk causing premature wear of the rail.
对于由高强度钢制成并经过处理以确保非常高的表面硬度的车轮，P_L 的值限于表面处理前构成车轮的钢的质量，根据表 T.4.2.4.1 .3.，因为较高的值可能会导致轨道过早磨损。

For a given load, however, wheels of this type have a much longer useful life than wheels of lesser surface hardness, which makes their use worthwhile in the case of appliances performing intensive service. 然而，对于给定的负载，这种类型的轮子比表面硬度较低的轮子具有更长的使用寿命，这使得它们在执行密集服务的设备的情况下值得使用。

Alternatively, it is possible to use wheels of ordinary cast iron, especially chilled cast iron, which has good surface hardness.或者，也可以使用普通铸铁制成的轮子，尤其是具有良好表面硬度的冷硬铸铁.

It must be remembered that such wheels are brittle and that their use should be avoided for high speed motions or when shock loadings are to be feared.
必须记住，这种轮子很脆，应避免在高速运动或害怕冲击载荷时使用它们。

When these are used their diameter is determined by taking P_L equal to 5 N/mm2.
当使用它们时，它们的直径是通过取 PL 等于 5 N/mm2 来确定的。

4.2.4.1.4.Determining the coefficient c1 确定系数 C1

The values of c1 depend on the speed of rotation of the wheel and are given in table T.4.2.4.1.4.a.

These same values are also given in table T.4.2.4.1.4.b. as a function of the wheel diameter and the speed in m/min.

Table T.4.2.4.1.4.a. - Values of c1

Wheel rotation speed in R.P.M.	c1	Wheel rotation speed in R.P.M.	c1	Wheel rotation speed in R.P.M.	c1
200	0,66	50	0,94	16	1,09
160	0,72	45	0,96	14	1,10
125	0,77	40	0,97	12,5	1,11
112	0,79	35,5	0,99	11,2	1,12
100	0,82	31,5	1,00	10	1,13
90	0,84	28	1,02	8	1,14
80	0,87	25	1,03	6,3	1,15
71	0,89	22,4	1,04	5,6	1,16
63	0,91	20	1,06	5	1,17
56	0,92	18	1,07		

Table T.4.2.4.1.4.b

Values of c1 as a function of the wheel diameter and the speed of travel

wheel diameter in mm	Values of c1 for travel speeds in m/min														
	10	12,5	16	20	25	31,5	40	50	63	80	100	125	160	200	250
200	1,09	1,06	1,03	1	0,97	0,94	0,91	0,87	0,82	0,77	0,72	0,66	-	-	-
250	1,11	1,09	1,06	1,03	1	0,97	0,94	0,91	0,87	0,82	0,77	0,72	0,66	-	-
315	1,13	1,11	1,09	1,06	1,03	1	0,97	0,94	0,91	0,87	0,82	0,77	0,72	0,66	-
400	1,14	1,13	1,11	1,09	1,06	1,03	1	0,97	0,94	0,91	0,87	0,82	0,77	0,72	0,66
500	1,15	1,14	1,13	1,11	1,09	1,06	1,03	1	0,97	0,94	0,91	0,87	0,82	0,77	0,72
630	1,17	1,15	1,14	1,13	1,11	1,09	1,06	1,03	1	0,97	0,94	0,91	0,87	0,82	0,77
710	-	1,16	1,14	1,13	1,12	1,1	1,07	1,04	1,02	0,99	0,96	0,92	0,89	0,84	0,79
800	-	1,17	1,15	1,14	1,13	1,11	1,09	1,06	1,03	1	0,97	0,94	0,91	0,87	0,82
900	-	-	1,16	1,14	1,13	1,12	1,1	1,07	1,04	1,02	0,99	0,96	0,92	0,89	0,84
1 000	-	-	1,17	1,15	1,14	1,13	1,11	1,09	1,06	1,03	1	0,97	0,94	0,91	0,87
1 120	-	-	-	1,16	1,14	1,13	1,12	1,1	1,07	1,04	1,02	0,99	0,96	0,92	0,89
1 250	-	-	-	1,17	1,15	1,14	1,13	1,11	1,09	1,06	1,03	1	0,97	0,94	0,91

4.2.4.1.5. Determining the coefficient c2

The coefficient c2 depends on the group classification of the mechanism and is given in table T.4.2.4.1.5.

Table T.4.2.4.1.5. - Values of c2

Group classification of mechanism	c2
M 1 to M 4	1,12
M 5	1,00
M 6	0,90
M 7 - M 8	0,80

4.2.4.2.NOTES

Note 1 : The formulae apply only to wheels whose diameters do not exceed 1,25 m. For larger diameters experience

shows that the permissible pressures between the rail and the wheel must be lowered. The use of wheels of greater diameter is not recommended.

这些公式仅适用于直径不超过 1.25 m 的车轮。 对于较大的直径，经验表明必须降低轨道和车轮之间的允许压力。 不推荐使用更大直径的轮子。

Note 2: It should be noted that the limiting pressure PL is a notional pressure determined by supposing that contact between the wheel and the rail takes place over a surface whose width is the useful width defined earlier (clause 4.2.4.1.2.) and whose length is the diameter of the wheel. The method of calculating set out above is derived from application of the HERTZ formula, which may be written :

应该注意的是，极限压力 PL 是一个名义压力，假设车轮和轨道之间的接触发生在一个表面上，该表面的宽度是之前定义的有用宽度（条款 4.2.4.1.2.），其长度是轮子的直径。 上述计算方法是应用赫兹公式推导出来的，可以写成：

$$\sigma_{cg}^{2} / (0{,}35 \cdot E) = P / (b \cdot D)$$

where:

σ_{cg}^{2} is the compressive stress in the wheel and the rail N/mm2 车轮和轨道中的压应力

E the modulus of elasticity of the metal in N/mm2 金属的弹性模量

P the wheel load in N 轮压

b and D in mm, being as defined above (clause 4.2.4.1.). 如上定义

Taking KL to represent the value $\sigma^{2}_{cg}/(0.35.E)$ which has the dimension of a pressure in N/mm2 , the relation may be written :

$$K_L=P/(b.D)$$

and characterizes the wheel pressure on the rail. The formula of clause 4.2.4.1. is obtained by putting :

并表征轨道上的车轮压力。 第 4.2.4.1 条的公式。 通过放置获得：

$$K_L=P_L.c1.c2$$