[Optional] Authors of this revision; include prior authors if minor revisions

1 General

This Standard is to provide target dimensions for scale wheels and an upper and lower limit whereby wheels within these limits will operate without fault on track built within the limits of S-3.2.

1.2 Introduction and Intended Use (Informative)

It is not the specific purpose of the NMRA STANDARDS to set production dimensions or tolerances but rather to set limits which manufacturers can use when setting their tolerances. When used to determine manufacturing tolerances, care must be taken to ensure that the production dimensions are not at the extreme edge of the range specified. Specific NMRA Tech Notes supplement the standards to provide additional guidance.

1.3 References

This standard should be interpreted in the context of the following NMRA Standards, Technical Notes, and Technical Information.

1.3.2 Normative

- S-1 General Overview
- S-1.2 General Standard Scales
- S-4 Wheels
- S-4.1 Wheels – Proto Scales
- S-4.3 Wheels with Deep Flanges
- S-3.2 Trackwork – Standard Scales
- RP-25 Wheel Contour

1.3.3 Informative

- TN-4.2 Wheels Standard Scale (Yet to be written,)

1.4 Terminology

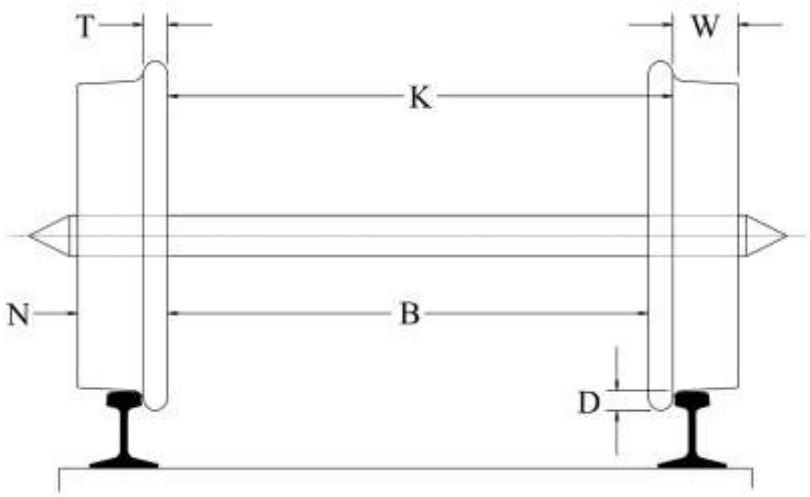
Term	Definition
Wheel set	Two wheels mounted on an axle.
Column Headings	
Check Gauge – K	The distance between the back of one wheel to the outside face of the flange on the opposite wheel.
Back-To-Back – B	The distance between the back of one wheel to the back of the opposite wheel.
Wheel Width – N	The distance from the back of a wheel to the face of the same wheel.
Flange Depth – D	The distance from the root of the wheel flange at the tread to the farthest point of the flange.

Term	Definition
Flange Width – T	The distance from the inside face of the flange to the outside face of the flange.
Tread Width – W	The width of the tread of the wheel. Total wheel width (N) minus the flange width (T). The tread width (W) measured from the outside edge of the wheel to the root of the flange (does not include the width of the flange).
Wheel Width (Code)	The width of the wheel (N) measured from the back of a wheel to the face of the same wheel. Value is expressed in fractions of an inch for very large scales, and in thousandths of an inch for all other scales. For example, Code 110 refers to a wheel width of 0.110 inches wide. Code 72 refers to a wheel width of 0.072 inches wide.

2 Data Tables

2.1 1” Scale (Ratio 1:12)

2.1.1 Standard Scale: Imperial Data Governs



K - Check Gauge
B - Back-to-Back
N - Wheel Width
T - Flange Width
W - Tread Width
D - Flange Depth

K			B (See Note 1)			N	D	T	
Check Gauge			Back-to-Back			Wheel Width	Flange Depth	Flange Width	Wheel Width
Min	Tgt	Max	Min	Tgt	Max	Nom	Max	Max	Code
Imperial (Inch)									
4.563	4.579	4.581	4.438	4.454	4.456	0.505	0.156	0.125	1/2"
Metric (mm)									
115.90	116.31	116.36	112.73	113.13	113.18	12.83	3.96	3.18	1/2"

Notes:

1 The Back-to-Back, B, is derived from the equation B=K-T. K is the primary controlling dimension. Adjust B as needed to meet the K dimension.

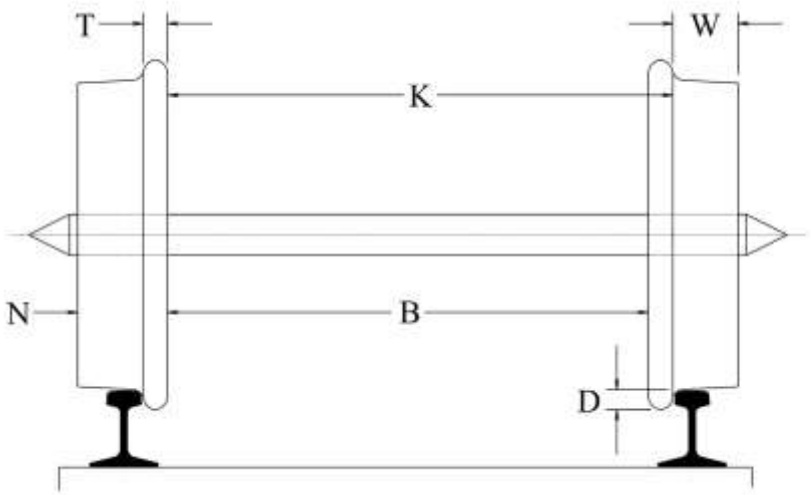
2 See **RP-25, Wheel Contour**, for recommended wheel contour.

3 To avoid difficulty wth long wheelbase locomotives in curves sharper than 20 degrees or where guardrails are used on both sides as in special trackwork, see **RP-7, Track Centers and Obstacle Clearances.** Additionally:

- Allow lateral movement in driver axles of 1 percent of the rigid wheelbase length;
- Remove flanges from center drivers.

2.2 ¾” Scale (Ratio 1:16)

30 **2.2.1 Standard Scale: Imperial Data Governs**



K - Check Gauge
B - Back-to-Back
N - Wheel Width
T - Flange Width
W - Tread Width
D - Flange Depth

K			B*			N	D	T	
Check Gauge			Back-to-Back			Wheel Width	Flange Depth	Flange Width	Wheel Width
Min	**Tgt**	Max	Min	**Tgt**	Max	**Nom**	**Max**	**Max**	**Code**
Imperial (Inch)									
3.313	3.347	3.349	3.219	3.253	3.255	0.410	0.125	0.094	13/32"
Metric (mm)									
84.15	85.01	85.06	81.76	82.63	82.68	10.41	3.18	2.39	13/32"

Notes:

* 1 The Back-to-Back, B, is derived from the equation B=K-T. K is the primary controlling dimension. Adjust B as needed to meet the K dimension.

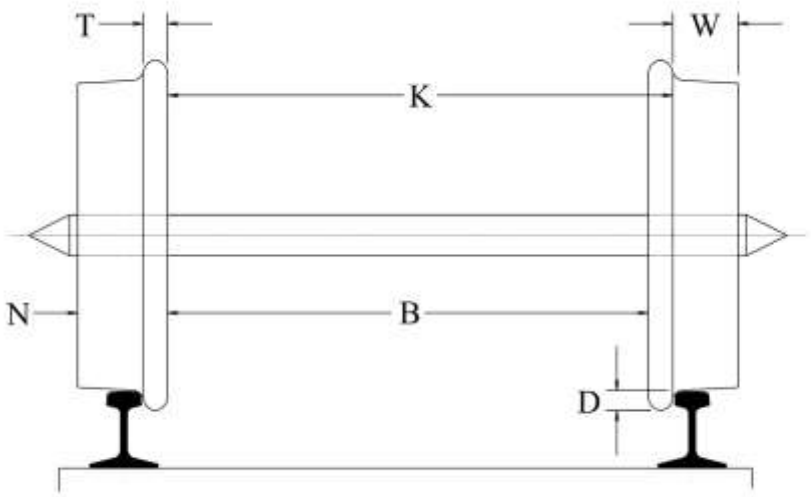
2 See **RP-25, Wheel Contour**, for recommended wheel contour.

3 To avoid difficulty wth long wheelbase locomotives in curves sharper than 20 degrees or where guardrails are used on both sides as in special trackwork, see **RP-7, Track Centers and Obstacle Clearances.** Additionally:

- Allow lateral movement in driver axles of 1 percent of the rigid wheelbase length;
- Remove flanges from center drivers.

2.3 F Scale (Ratio 1:20.3)

2.3.1 Standard Scale: Imperial Data Governs



K - Check Gauge
B - Back-to-Back
N - Wheel Width
T - Flange Width
W - Tread Width
D - Flange Depth

K			B*			N	D	T	
Check Gauge			Back-to-Back			Wheel Width	Flange Depth	Flange Width	Wheel Width
Min	Tgt	Max	Min	Tgt	Max	Nom	Max	Max	Code
F Standard Gauge									
Imperial (Inch)									
2.660	2.676	2.680	2.597	2.613	2.617	0.284	0.090	0.063	284
Metric (mm)									
67.56	67.97	68.07	65.96	66.37	66.47	7.21	2.29	1.60	284
Fn3 (36") Narrow Gauge									
Imperial (Inch)									
1.619	1.633	1.648	1.560	1.575	1.594	0.250	0.066	0.059	250
Metric (mm)									
41.12	41.48	41.86	39.62	40.01	40.49	6.35	1.68	1.50	250

Notes:

* 1 The Back-to-Back, B, is derived from the equation B=K-T. K is the primary controlling dimension. Adjust B as needed to meet the K dimension.

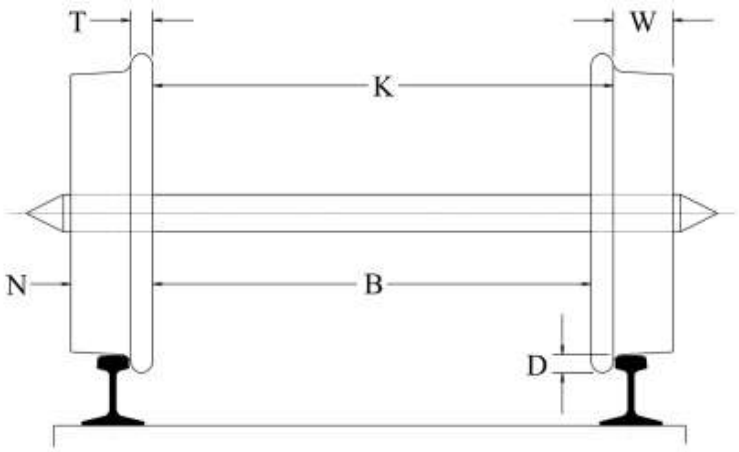
2 See **RP-25, Wheel Contour**, for recommended wheel contour.

3 To avoid difficulty wth long wheelbase locomotives in curves sharper than 20 degrees or where guardrails are used on both sides as in special trackwork, see **RP-7, Track Centers and Obstacle Clearances.** Additionally:

- Allow lateral movement in driver axles of 1 percent of the rigid wheelbase length;
- Remove flanges from center drivers.

2.4 Large Scale (Ratio Varies)

2.4.1 Standard Scale: Imperial Data Governs



K - Check Gauge
B - Back-to-Back
N - Wheel Width
T - Flange Width
W - Tread Width
D - Flange Depth

K			B*			N		D	T		
Check Gauge			Back-to-Back			Wheel Width		Flange Depth	Flange Width		
Min	**Tgt**	Max	Min	**Tgt**	Max	**Min**	**Max**	**Max**	Min	**Tgt**	Max
Imperial (Inch)											
1.619	1.633	1.648	1.570	1.575	1.594	0.236	0.271	0.066	0.041	0.059	0.061
Metric (mm)											
41.12	41.48	41.86	39.88	40.01	40.49	5.99	6.88	1.68	1.04	1.50	1.55

Notes:

* 1 The Back-to-Back, B, is derived from the equation B=K-T. K is the primary controlling dimension. Adjust B as needed to meet the K dimension.

2 A wheel tread taper of 3 degrees is recommended for all wheels.

3 "Large Scales" standards cover all common commercial scales running on LS 45mm gauge track (1:32, 1:29, 1:22.5, 1:20.3) without regard as to whether the trains are standard or narrow gauge.

4 Due to the inherent nature of large scale trains, the wheel and track standards for “Standard” (Sx.2) and “Deep Flange” (Sx.3) are identical except in terms of flange width and depth.

5 Developing a single wheel profile for all of large scale is not recommended nor needed due to the fact that there are multiple scales running on the same LS 45mm gauge track. Each scale has developed its own scale-specific profile, all of which conform to LS 45mm gauge standard.

6 While there is a stated “target” wheel width, manufacturers should take into consideration the scale of their models in determining where in that spectrum their wheels would best fall. For instance, .271” scales out to the proper width for a 5.5” wheel in 1:20.3, but would be oversized for a 1:32 model, for which .236” is more

7 With regard to 1:20.3 (also designated "F" scale), trains built to that scale running on LS 45mm gauge track are also classified Fn3. Standards for Fn3 wheels are identical to those for LS, with exception the wheels are given more specific targets for tread width and flange depth. Track standards for Fn3 are to be identical to those used for LS 45mm gauge.

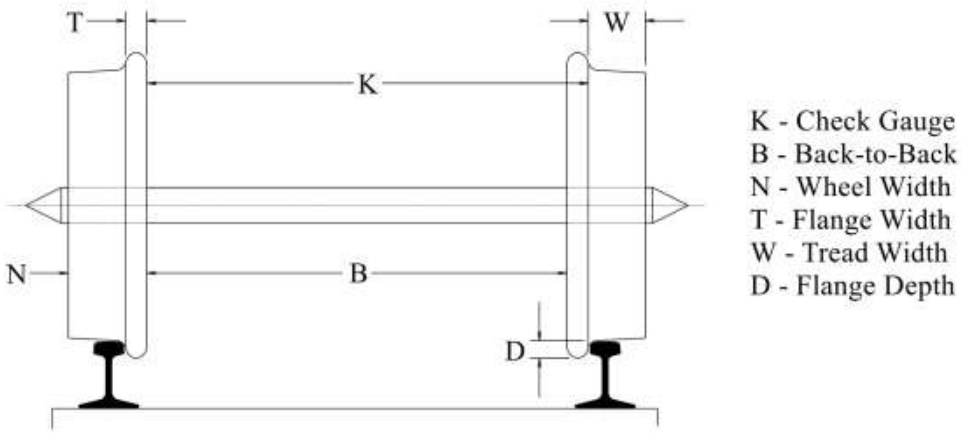
8 The standards do not specify a fillet between the tread and flange, but common practice has proven such to be beneficial to the performance of the wheel. A fillet radius between .020” and .030” depending on the proportional width of the tire is highly recommended.

9 A wheel tread taper of 3 degrees is recommended for all wheels.

10 It is traditionally viewed in the large scale community that the back-to-back spacing on the wheels is a primary dimension. Should a manufacturer or modeler opt to use flanges greater than 0.076", the back-to-back spacing should be narrowed from the published Target Value to compensate and still fall within Check-gauge tolerances for the wheels.

40 ## 2.5 O Scale (Ratio 1:48)

2.5.1 Standard Scale: Imperial Data Governs



K			B*			N	D	T	
Check Gauge			Back-to-Back			Wheel Width	Flange Depth	Flange Width	Wheel Width
Min	Tgt	Max	Min	Tgt	Max	Nom	Max	Max	Code
O Standard Gauge									
Imperial (Inch)									
1.171	1.177	1.179	1.132	1.138	1.140	0.145	0.036	0.039	145
Metric (mm)									
29.74	29.90	29.95	28.75	28.91	28.96	3.68	0.91	0.99	145
On3 (36") Narrow Gauge									
Imperial (Inch)									
0.697	0.703	0.705	0.666	0.672	0.674	0.116	0.030	0.031	116
Metric (mm)									
17.70	17.86	17.91	16.92	17.07	17.12	2.95	0.76	0.79	116
On30 (30") Narrow Gauge									
Imperial (Inch)									
0.596	0.603	0.605	0.566	0.573	0.575	0.110	0.028	0.030	110
Metric (mm)									
15.14	15.32	15.37	14.38	14.55	14.61	2.79	0.71	0.76	110
On2 (24") Narrow Gauge									
Imperial (Inch)									
0.446	0.453	0.455	0.416	0.423	0.425	0.110	0.028	0.030	110
Metric (mm)									
11.33	11.51	11.56	10.57	10.74	10.80	2.79	0.71	0.76	110

Notes:

* 1 The Back-to-Back, B, is derived from the equation B=K-T. K is the primary controlling dimension. Adjust B as needed to meet the K dimension.

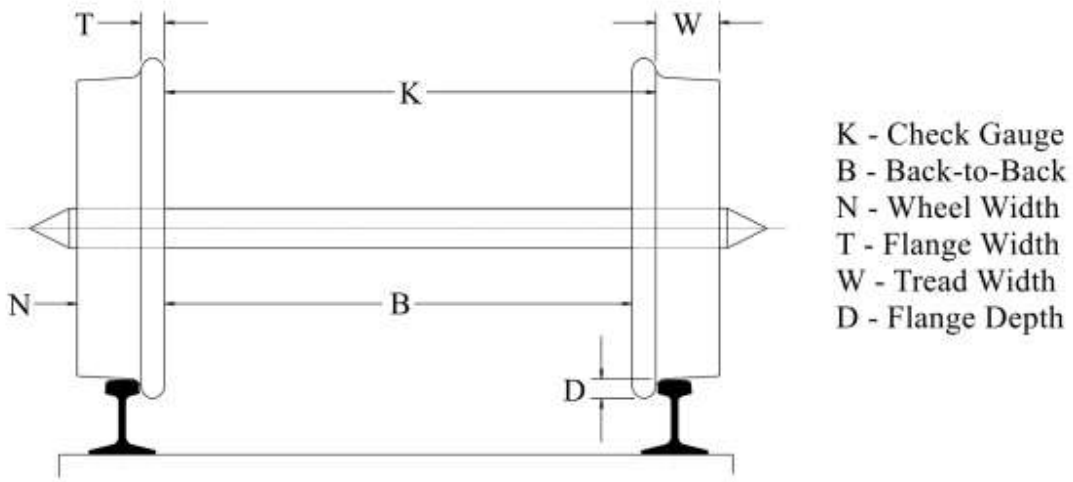
2 See **RP-25, Wheel Contour**, for recommended wheel contour.

3 To avoid difficulty wth long wheelbase locomotives in curves sharper than 20 degrees or where guardrails are used on both sides as in special trackwork, see **RP-7, Track Centers and Obstacle Clearances.** Additionally:

- Allow lateral movement in driver axles of 1 percent of the rigid wheelbase length;
- Remove flanges from center drivers.

2.6 S Scale (Ratio 1:64)

2.6.1 Standard Scale: Imperial Data Governs



K			B*			N	D	T	
Check Gauge			Back-to-Back			Wheel Width	Flange Depth	Flange Width	Wheel Width
Min	**Tgt**	Max	Min	**Tgt**	Max	**Nom**	**Max**	**Max**	**Code**
S Standard Gauge									
Imperial (Inch)									
0.830	0.837	0.839	0.800	0.807	0.809	0.110	0.030	0.030	110
Metric (mm)									
21.08	21.26	21.31	20.32	20.50	20.55	2.79	0.76	0.76	110
Sn3 (36") Narrow Gauge									
Imperial (Inch)									
0.510	0.517	0.519	0.480	0.487	0.489	0.110	0.030	0.030	110
Metric (mm)									
12.95	13.13	13.18	12.19	12.37	12.42	2.79	0.76	0.76	110
Sn2 (24") Narrow Gauge									
Imperial (Inch)									
0.370	0.375	0.377	0.345	0.350	0.352	0.088	0.023	0.025	88
Metric (mm)									
9.40	9.53	9.58	8.76	8.89	8.94	2.24	0.58	0.64	88

Notes:

* 1 The Back-to-Back, B, is derived from the equation B=K-T. K is the primary controlling dimension. Adjust B as needed to meet the K dimension.

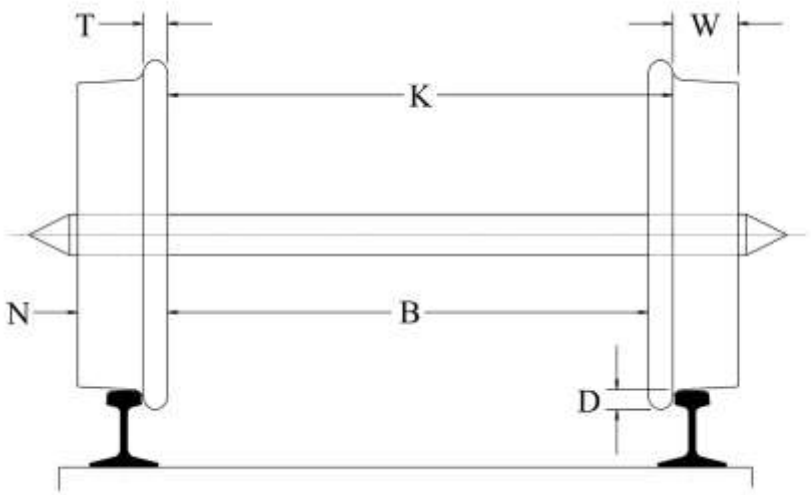
2 See **RP-25, Wheel Contour**, for recommended wheel contour.

3 To avoid difficulty wth long wheelbase locomotives in curves sharper than 20 degrees or where guardrails are used on both sides as in special trackwork, see **RP-7, Track Centers and Obstacle Clearances.** Additionally:

- Allow lateral movement in driver axles of 1 percent of the rigid wheelbase length;
- Remove flanges from center drivers.

2.7 OO Scale (Ratio 1:76.2)

2.7.1 Standard Scale: Imperial Data Governs



K - Check Gauge
B - Back-to-Back
N - Wheel Width
T - Flange Width
W - Tread Width
D - Flange Depth

K			B*			N	D	T	
Check Gauge			Back-to-Back			Wheel Width	Flange Depth	Flange Width	Wheel Width
Min	**Tgt**	Max	Min	**Tgt**	Max	**Nom**	**Max**	**Max**	**Code**
Imperial (Inch)									
0.696	0.703	0.705	0.666	0.673	0.675	0.110	0.028	0.030	110
Metric (mm)									
17.68	17.86	17.91	16.92	17.09	17.15	2.79	0.71	0.76	110

Notes:

* 1 The Back-to-Back, B, is derived from the equation B=K-T. K is the primary controlling dimension. Adjust B as needed to meet the K dimension.

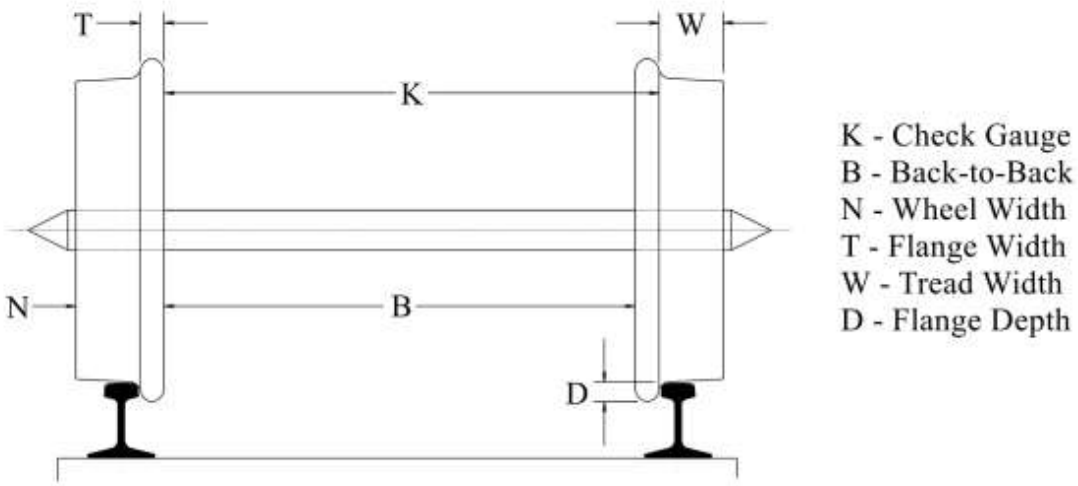
2 See **RP-25, Wheel Contour**, for recommended wheel contour.

3 To avoid difficulty wth long wheelbase locomotives in curves sharper than 20 degrees or where guardrails are used on both sides as in special trackwork, see **RP-7, Track Centers and Obstacle Clearances.** Additionally:

- Allow lateral movement in driver axles of 1 percent of the rigid wheelbase length;
- Remove flanges from center drivers.

50 ## 2.8 HO Scale (Ratio 1:87.1)

2.8.1 Standard Scale: Imperial Data Governs



K			B*			N	D	T	
Check Gauge			Back-to-Back			Wheel Width	Flange Depth	Flange Width	Wheel Width
Min	Tgt	Max	Min	Tgt	Max	Nom	Max	Max	Code
HO Standard Gauge									
Imperial (Inch)									
0.596	0.603	0.605	0.566	0.573	0.575	0.110	0.028	0.030	110
Metric (mm)									
15.14	15.32	15.37	14.38	14.55	14.61	2.79	0.71	0.76	110
HOn3 (36") Narrow Gauge									
Imperial (Inch)									
0.370	0.375	0.377	0.345	0.350	0.352	0.088	0.023	0.025	88
Metric (mm)									
9.40	9.53	9.58	8.76	8.89	8.94	2.24	0.58	0.64	88
HOn2 (24") Narrow Gauge									
Imperial (Inch)									
0.240	0.244	0.246	0.220	0.224	0.226	0.072	0.023	0.020	72
Metric (mm)									
6.10	6.20	6.25	5.59	5.69	5.74	1.83	0.58	0.51	72

Notes:

* 1 The Back-to-Back, B, is derived from the equation B=K-T. K is the primary controlling dimension. Adjust B as needed to meet the K dimension.

2 See **RP-25, Wheel Contour**, for recommended wheel contour.

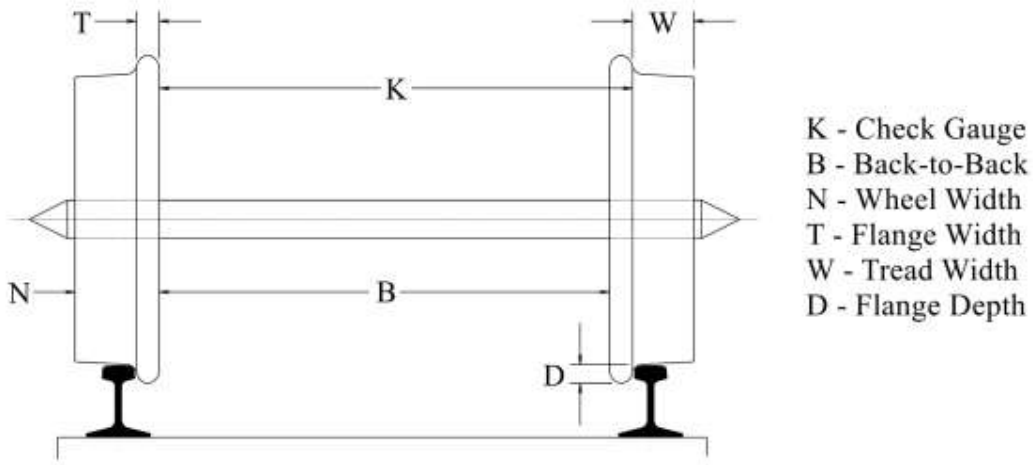
3 To avoid difficulty wth long wheelbase locomotives in curves sharper than 20 degrees or where guardrails are used on both sides as in special trackwork, see **RP-7, Track Centers and Obstacle Clearances.** Additionally:

- Allow lateral movement in driver axles of 1 percent of the rigid wheelbase length;
- Remove flanges from center drivers.

2.9 TT Scale (Ratio 1:120)

2.9.1 Standard Scale: Imperial Data Governs

55 **NOTE: Italicized values indicate changes from last published standard**



K			B*			N	D	T	
Check Gauge			Back-to-Back			Wheel Width	Flange Depth	Flange Width	Wheel Width
Min	**Tgt**	Max	Min	**Tgt**	Max	**Nom**	**Max**	**Max**	**Code**
TT Standard Gauge									
Imperial (Inch)									
0.427	0.435	0.437	0.407	0.415	0.417	0.079	0.022	0.020	79
Metric (mm)									
10.85	11.05	11.10	10.34	10.54	10.59	2.01	0.56	0.51	79
TTn42 (42") Narrow Gauge									
Imperial (Inch)									
0.317	0.321	0.323	0.297	0.301	0.303	0.072	0.026	0.020	72
Metric (mm)									
8.05	8.15	8.20	7.54	7.65	7.70	1.83	0.66	0.51	72
TTn3 (36") Narrow Gauge									
Imperial (Inch)									
0.265	0.268	0.270	*0.245*	0.248	0.250	0.072	0.022	0.020	72
Metric (mm)									
6.73	6.81	6.86	*6.22*	6.30	6.35	1.83	0.56	0.51	72

Notes:

* 1 The Back-to-Back, B, is derived from the equation B=K-T. K is the primary controlling dimension. Adjust B as needed to meet the K dimension.

2 See **RP-25, Wheel Contour**, for recommended wheel contour.

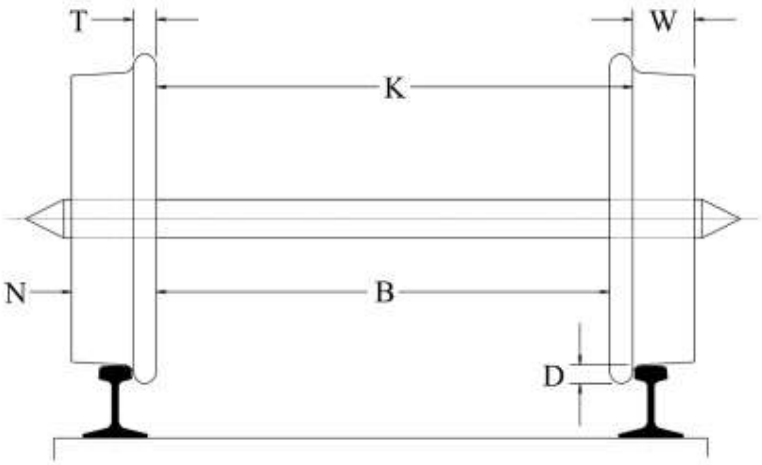
3 To avoid difficulty wth long wheelbase locomotives in curves sharper than 20 degrees or where guardrails are used on both sides as in special trackwork, see **RP-7, Track Centers and Obstacle Clearances.** Additionally:

- Allow lateral movement in driver axles of 1 percent of the rigid wheelbase length;
- Remove flanges from center drivers.

2.10 N Scale (Ratio 1:160)

2.10.1 Standard Scale: Imperial Data Governs

NOTE: Italicized values indicate changes from last published standard



K - Check Gauge
B - Back-to-Back
N - Wheel Width
T - Flange Width
W - Tread Width
D - Flange Depth

K			B*			N	D	T	
Check Gauge			Back-to-Back			Wheel Width	Flange Depth	Flange Width	Wheel Width
Min	**Tgt**	Max	Min	**Tgt**	Max	**Nom**	**Max**	**Max**	**Code**
N Standard Gauge									
Imperial (Inch)									
0.317	0.321	0.323	0.297	0.301	0.303	0.072	0.022	0.020	72
Metric (mm)									
8.05	8.15	8.20	7.54	7.65	7.70	1.83	0.56	0.51	72
Nn3 (36") Narrow Gauge									
Imperial (Inch)									
0.225	*0.227*	*0.229*	*0.211*	*0.213*	*0.215*	0.054	0.020	0.014	54
Metric (mm)									
5.72	*5.77*	*5.82*	*5.36*	*5.41*	*5.46*	1.37	0.51	0.36	54
Nn2 (24") Narrow Gauge									
Imperial (Inch)									
0.145	*0.147*	*0.149*	*0.131*	*0.133*	*0.135*	0.054	0.020	0.014	54
Metric (mm)									
3.68	*3.73*	*3.78*	*3.33*	*3.38*	*3.43*	1.37	0.51	0.36	54

Notes:

* 1 The Back-to-Back, B, is derived from the equation B=K-T. K is the primary controlling dimension. Adjust B as needed to meet the K dimension.

2 See **RP-25, Wheel Contour**, for recommended wheel contour.

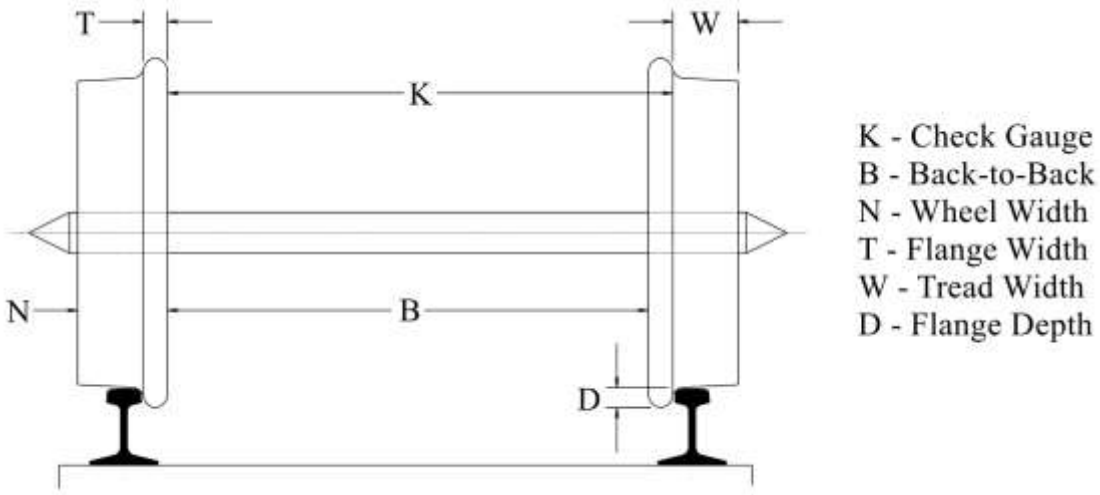
3 To avoid difficulty wth long wheelbase locomotives in curves sharper than 20 degrees or where guardrails are used on both sides as in special trackwork, see **RP-7, Track Centers and Obstacle Clearances.** Additionally:

- Allow lateral movement in driver axles of 1 percent of the rigid wheelbase length;
- Remove flanges from center drivers.

2.11 Z Scale (Ratio 1:220)

2.11.1 Standard Scale: Imperial Data Governs

NOTE: Italicized values indicate changes from last published standard



K			B*			N	D	T	
Check Gauge			Back-to-Back			Wheel Width	Flange Depth	Flange Width	Wheel Width
Min	**Tgt**	Max	Min	**Tgt**	Max	**Nom**	**Max**	**Max**	**Code**
Imperial (Inch)									
0.235	*0.237*	*0.239*	*0.221*	*0.223*	*0.225*	0.054	0.020	0.014	54
Metric (mm)									
5.97	*6.02*	*6.07*	*5.61*	*5.66*	*5.72*	1.37	0.51	0.36	54

Notes:

* 1 The Back-to-Back, B, is derived from the equation B=K-T. K is the primary controlling dimension. Adjust B as needed to meet the K dimension.

2 See **RP-25, Wheel Contour**, for recommended wheel contour.

3 To avoid difficulty wth long wheelbase locomotives in curves sharper than 20 degrees or where guardrails are used on both sides as in special trackwork, see **RP-7, Track Centers and Obstacle Clearances.** Additionally:

- Allow lateral movement in driver axles of 1 percent of the rigid wheelbase length;
- Remove flanges from center drivers.

3 Document History

Date	Description
Jan 2019	Previous release provided a target rather than limits. Several previous releases of unknown dates. The first Standard was adopted in 1936.
18-May-2026	Revision to migrate to new template. Each scale on an individual page. Provided maximum and minimum dimensions rather than previous plus and minus to avoid errors where they may be calculated mentally. There were changes to back to back (B) and therefore also check gauge (K) to TTn3, Nn3, Nn2 and Z scales because of an interference between B and Span in turnouts if B was at the minimum and S was at the maximum. No changes to other dimensions were made.  2026-05-18 NMRA Tables for S-4.2.xlsm NOTE: Tables shown for each scale are images taken from the above embedded spreadsheet. These images are static; they will not update when the spreadsheet is updated. New images will have to be made from the spreadsheet and pasted in place of the existing tables.

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