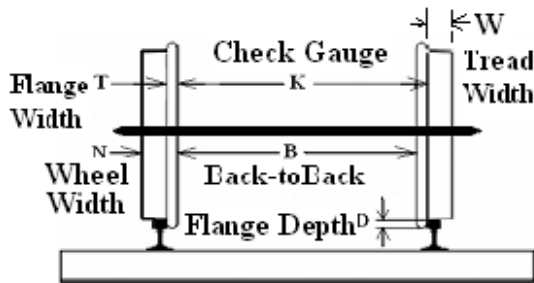


NMRA STANDARDS (IMPERIAL)
S-4.2 STANDARDS, WHEELS, STANDARD SCALE

NMRA STANDARD	
Imperial Standards	
Scale Wheels	
February 20, 2010	S-4.2



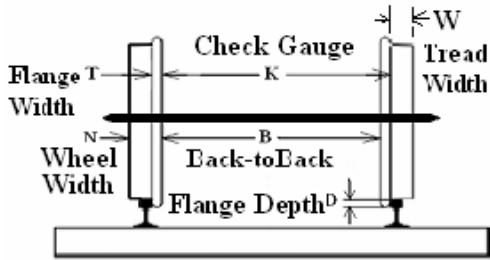
Back-to-Back, B, is derived by knowing $B = K - T$. K is the primary controlling dimension.

Scale	Scale Ratio	Standard S4.2 Wheels using Target and Asymmetric Imperial (inch) Tolerance									
		K			B			N	D	T	
		Target	Plus	Minus	Target	Plus	Minus	(Nom.)	Max	Nom	Tol
1"	1:12	4.579	0.002	0.016	4.454	0.002	0.016	0.505	0.156	0.125	+/- .002
3/4"	1:16	3.347	0.002	0.034	3.253	0.002	0.034	0.410	0.125	0.094	+/- .002
F	1:20.3	2.676	0.004	0.016	2.613	0.004	0.016	0.284	0.090	0.063	+/- .002
Fn3	1:20.3	1.633	0.015	0.014	1.575	0.019	0.015	0.250	0.066	0.059	+ .002 -.018
LS	Varied	Large Scales Shown on Separate Page									
O	1:48	1.177	0.002	0.006	1.138	0.002	0.006	0.145	0.036	0.039	+/- .002
On3	1:48	0.703	0.002	0.006	0.672	0.002	0.006	0.116	0.030	0.031	+/- .002
On30	1:48	0.603	0.002	0.007	0.573	0.002	0.007	0.110	0.028	0.030	+/- .002
On2	1:48	0.453	0.002	0.007	0.423	0.002	0.007	0.110	0.028	0.030	+/- .002
S	1:64	0.837	0.002	0.007	0.807	0.002	0.007	0.110	0.030	0.030	+/- .002
Sn3	1:64	0.517	0.002	0.007	0.487	0.002	0.007	0.110	0.030	0.030	+/- .002
Sn2	1:64	0.375	0.002	0.005	0.350	0.002	0.005	0.088	0.023	0.025	+/- .002
OO	1:76.2	0.703	0.002	0.007	0.673	0.002	0.007	0.110	0.028	0.030	+/- .002
HO	1:87.1	0.603	0.002	0.007	0.573	0.002	0.007	0.110	0.028	0.030	+/- .002
HOn3	1:87.1	0.375	0.002	0.005	0.350	0.002	0.005	0.088	0.023	0.025	+/- .002
HOn2	1:87.1	0.244	0.002	0.004	0.224	0.002	0.004	0.072	0.022	0.020	+/- .002
TT	1:120	0.435	0.002	0.008	0.415	0.002	0.008	0.079	0.026	0.020	+/- .002
TTn42	1:120	0.321	0.002	0.004	0.301	0.002	0.004	0.072	0.022	0.020	+/- .002
TTn3	1:120	0.268	0.002	0.004	0.248	0.002	0.004	0.072	0.022	0.020	+/- .002
N	1:160	0.321	0.002	0.004	0.301	0.002	0.004	0.072	0.022	0.020	+/- .002
Nn3	1:160	0.222	0.002	0.002	0.208	0.002	0.002	0.054	0.020	0.014	+/- .002
Nn2	1:160	0.145	0.002	0.002	0.131	0.002	0.002	0.054	0.020	0.014	+/- .002
Z	1:220	0.228	0.002	0.007	0.214	0.002	0.007	0.054	0.020	0.014	+/- .002

Wheel NOTES:

1. Fn3 was designed to work on LS (Large Scale) scale track so the same track and wheel geometry was used. This results in an Fn3 minimum tire width that is much narrower than the prototype. Models designed to work in dual gauge track with F scale need to use the F scale tire width of .250" min in order for the wheels to properly navigate the frogs in the dual gauge turnouts.
2. Note: HO standard wheels will work on HO fine track (with adjusted K) but HO fine wheels (code 88) are not standards on HO standard track.
3. See **RP-25** for recommended Wheel Contour. With Deeper Flanges - see **STANDARD S4.3**.
4. Wheels shall have a scale reduction in tread diameter from the prototype.
5. The adjusting of the back-to-back spacing in production is highly recommended to meet the target wheel check gauge ('K') specification
6. **Metric specifications are found on page 2.**
7. To avoid difficulty with long wheelbase locomotives in curves sharper than 20 degrees, and where guard rails are used on both sides as in special trackwork, the following are suggested: See **RP-8**
 - Allow lateral movement in driver axles of 1 percent of the rigid wheelbase length.
 - Remove flanges from center drivers.

NMRA STANDARDS (METRIC)
S-4.2 STANDARDS, WHEELS, STANDARD SCALE



NMRA STANDARD	
Metric Standards	
Scale Wheels	
February 20, 2010	S-4.2

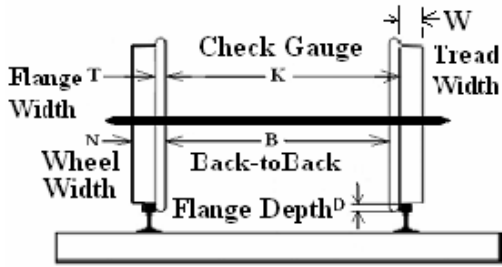
Back-to-Back, B, is derived by knowing $B = K - T$. K is the primary controlling dimension.

Scale	Scale Ratio	Standard S4.2 Wheels using Target and Asymmetric Metric (mm) Tolerance									
		K			B			N	D	T	
		Target	Plus	Minus	Target	Plus	Minus	(Nom.)	Max	Nom	Tol
1"	1:12	116.31	0.05	0.41	113.13	0.05	0.41	12.83	3.96	3.18	+/- 0.05
3/4"	1:16	85.01	0.05	0.86	82.63	0.05	0.86	10.41	3.18	2.39	+/- 0.05
F	1:20.3	67.64	0.38	0.43	66.34	0.43	0.38	7.06	2.08	1.52	+0.05 -0.10
Fn3	1:20.3	41.48	0.38	0.36	40.00	0.48	0.13	6.40	1.68	1.52	+0.05 -0.46
LS	Varied	Large Scales Shown on Separate Page									
O	1:48	29.90	0.05	0.15	28.91	0.05	0.15	3.68	0.91	0.99	+/- 0.05
On3	1:48	17.86	0.05	0.15	17.07	0.05	0.15	2.95	0.76	0.79	+/- 0.05
On30	1:48	15.32	0.05	0.18	14.55	0.05	0.18	2.79	0.71	0.76	+/- 0.05
On2	1:48	11.51	0.05	0.18	10.74	0.05	0.18	2.79	0.71	0.76	+/- 0.05
S	1:64	21.26	0.05	0.18	20.50	0.05	0.18	2.79	0.76	0.76	+/- 0.05
Sn3	1:64	13.13	0.05	0.18	12.37	0.05	0.18	2.79	0.76	0.76	+/- 0.05
Sn2	1:64	9.53	0.05	0.13	8.89	0.05	0.13	2.24	0.58	0.64	+/- 0.05
OO	1:76.2	17.86	0.05	0.18	17.09	0.05	0.18	2.79	0.71	0.76	+/- 0.05
HO	1:87.1	15.32	0.05	0.18	14.55	0.05	0.18	2.79	0.71	0.76	+/- 0.05
HOn3	1:87.1	9.53	0.05	0.13	8.89	0.05	0.13	2.24	0.58	0.64	+/- 0.05
HOn2	1:87.1	6.20	0.05	0.10	5.69	0.05	0.10	1.83	0.56	0.51	+/- 0.05
TT	1:120	11.05	0.05	0.20	10.54	0.05	0.20	2.01	0.66	0.51	+/- 0.05
TTn42	1:120	8.15	0.05	0.10	7.65	0.05	0.10	1.83	0.56	0.51	+/- 0.05
TTn3	1:120	6.81	0.05	0.10	6.30	0.05	0.10	1.83	0.56	0.51	+/- 0.05
N	1:160	8.15	0.05	0.10	7.65	0.05	0.10	1.83	0.56	0.51	+/- 0.05
Nn3	1:160	5.64	0.05	0.05	5.28	0.05	0.05	1.37	0.51	0.36	+/- 0.05
Nn2	1:160	3.68	0.05	0.05	3.33	0.05	0.05	1.37	0.51	0.36	+/- 0.05
Z	1:220	5.79	0.05	0.18	5.44	0.05	0.18	1.37	0.51	0.36	+/- 0.05

Wheel NOTES:

1. Fn3 was designed to work on LS (Large Scale) scale track so the same track and wheel geometry was used. This results in an Fn3 minimum tire width that is much narrower than the prototype. Models designed to work in dual gauge track with F scale need to use the F scale tire width of 7,21mm in order for the wheels to properly navigate the frogs in the dual gauge turnouts.
2. Note: HO standard wheels will work on HO fine track (with adjusted K) but HO fine wheels (code 88) are not standards on HO standard track.
3. See **RP-25** for recommended Wheel Contour. With Deeper Flanges - see **STANDARD S4.3**.
4. Wheels shall have a scale reduction in tread diameter from the prototype.
5. The adjusting of the back-to-back spacing in production is highly recommended to meet the target wheel check gauge ('K') specification
6. **Imperial specifications are found on page 1.**
7. To avoid difficulty with long wheelbase locomotives in curves sharper than 20 degrees, and where guard rails are used on both sides as in special trackwork, the following are suggested: See **RP-8**
 - Allow lateral movement in driver axles of 1 percent of the rigid wheelbase length.
 - Remove flanges from center drivers.

NMRA STANDARDS (IMPERIAL)
S-4.2 STANDARDS, WHEELS, STANDARD SCALE



NMRA STANDARD	
Imperial and Metric Standards Large Scale Wheels	
February 20, 2010	S-4.2

Back-to-Back, B, is derived by knowing $B = K - T$. K is the primary controlling dimension.

LS WHEELS (S4.2 Standard Scale):

Scale	Scale Ratio	Standard S4.2 Wheels using Target and Asymmetric Imperial (inch) Tolerance											
		K			B			N		D	T		
		Target	Plus	Minus	Target	Plus	Minus	Min	Max	Max	Nom	Plus	Minus
LS	Varied	1.633	0.015	0.014	1.575	0.019	0.005	0.236	0.271	0.066	0.059	0.002	0.018

Scale	Scale Ratio	Standard S4.2 Wheels using Target and Asymmetric Metric (mm) Tolerance											
		K			B			N		D	T		
		Target	Plus	Minus	Target	Plus	Minus	Min	Max	Max	Nom	Plus	Minus
LS	Varied	41.48	0.38	0.36	40.01	0.48	0.13	5.99	6.88	1.68	1.50	0.05	0.46

LS Wheel NOTES:

- 1) The term "LS" for "Large Scales" standards covers all common commercial scales running on LS 45mm gauge track (1:32, 1:29, 1:24, 1:22.5, and 1:20.3) without regard as to whether the trains are standard or narrow gauge.
- 2) 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.
- 3) 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.
- 4) 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 appropriate.
- 5) 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.
- 6) 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.
- 7) A wheel tread taper of 3 degrees is recommended for all wheels.
- 8) 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. Adjusting back-to-back spacing, 'B', is highly recommended to meet the Target wheel Check-gauge, 'K', specification using the following relationship: $B = K - T$.