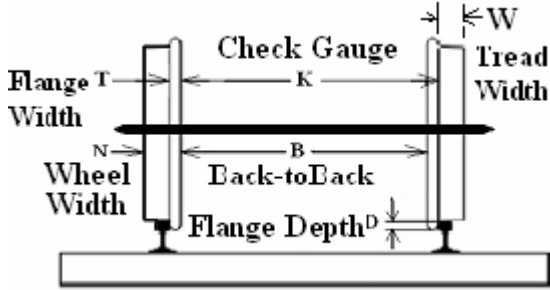


NMRA STANDARDS
S-4.3 Standards, Wheels with Deep Flanges



| NMRA STANDARD | |
|--------------------------|-------|
| Standards | |
| Wheels with Deep Flanges | |
| February 20, 2010 | S-4.3 |

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

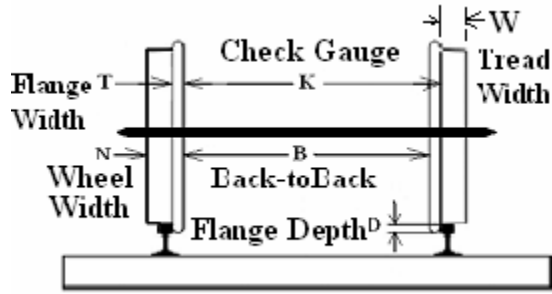
Scales with deep flanges were developed to accommodate the needs of modelers who wish to operate model trains on very sharp curves or on track that has twists which is common in outdoor environments. Compromises are often made to both selectively compress the model and/or develop mechanisms that have the ability to navigate very sharp curves. In general models in this class use wheels with larger flanges and usually use track with a larger code size.

| Scale | Scale Ratio | | Standard S4.3 Deep Flange Wheels using Target and Asymmetric Tolerance | | | | | | | | | |
|------------------|-------------|------------|--|-------|-------|--------------|-------|-------|-------|-------|--------------|---------|
| | | | K | | | B | | | N | D | T | |
| | | | Wheel Check Gauge | | | Back-to-Back | | | Width | Depth | Flange Width | |
| | | | Target | Plus | Minus | Target | Plus | Minus | Min | Max | Nom | Tol +/- |
| LSdf | Varied | Inch mm | Large Scales Shown on Separate Page | | | | | | | | | |
| O _{df} | 1:48 | Inch mm | 1.153 | 0.003 | 0.005 | 1.090 | 0.003 | 0.005 | 0.275 | 0.095 | 0.063 | 0.002 |
| | | | 29.29 | 0.08 | 0.13 | 27.69 | 0.08 | 0.13 | 6.99 | 2.41 | 1.60 | 0.05 |
| O ₂₇ | 1:48 | Inch mm | 1.153 | 0.003 | 0.005 | 1.090 | 0.003 | 0.005 | 0.275 | 0.095 | 0.063 | 0.002 |
| | | | 29.29 | 0.08 | 0.13 | 27.69 | 0.08 | 0.13 | 6.99 | 2.41 | 1.60 | 0.05 |
| S _{df} | 1:64 | Inch mm | 0.774 | 0.003 | 0.004 | 0.709 | 0.003 | 0.004 | 0.172 | 0.095 | 0.065 | 0.002 |
| | | | 19.66 | 0.08 | 0.10 | 18.01 | 0.08 | 0.10 | 4.37 | 2.41 | 1.65 | 0.05 |
| HO _{df} | 1:87 | Inch mm | 0.602 | 0.002 | 0.004 | 0.567 | 0.002 | 0.004 | 0.110 | 0.047 | 0.035 | 0.002 |
| | | | 15.29 | 0.05 | 0.10 | 14.40 | 0.05 | 0.10 | 2.79 | 1.19 | 0.89 | 0.05 |
| N _{df} | 1:160 | Inch mm | 0.318 | 0.002 | 0.003 | 0.294 | 0.002 | 0.003 | 0.087 | 0.035 | 0.024 | 0.002 |
| | | | 8.08 | 0.05 | 0.08 | 7.47 | 0.05 | 0.08 | 2.21 | 0.89 | 0.61 | 0.05 |
| Z _{df} | 1:220 | Inch mm | 0.228 | 0.002 | 0.003 | 0.210 | 0.002 | 0.003 | 0.061 | 0.024 | 0.018 | 0.002 |
| | | | 5.79 | 0.05 | 0.08 | 5.33 | 0.05 | 0.08 | 1.55 | 0.61 | 0.46 | 0.05 |

Wheel NOTES:

1. Wheels shall have a scale reduction in tread diameter from the prototype.
2. Models built to the deep flange standards typically do not operate on track built to the S.3.2 standards unless the track-work has been built to accommodate the deeper flanges. Models built to the S-3.3 standards shall be clearly labeled in order to not confuse the modeler.
3. The term LSdf scale is used to refer to range of scales developed to be able to be operated together, typically in an outdoors setting, for example a garden. LSdf models all use the same wheel and track profiles to facilitate interchange.
4. The adjusting of the back-to-back spacing in production is highly recommended to meet the target wheel check gauge ('K') specification.
5. 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 track-work, the following are suggested:
 - Allow lateral movement in driver axles of 1 percent of the rigid wheelbase length.
 - Remove flanges from center drivers.

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Scales with deep flanges were developed to accommodate the needs of modelers who wish to operate model trains on very sharp curves or on track that has twists which is common in outdoor environments. Compromises are often made to both selectively compress the model and/or develop mechanisms that have the ability to navigate very sharp curves. In general models in this class use wheels with larger flanges and usually use track with a larger code size.

Large Scale WHEELS (4.3 Deep Flange):

| Scale | Scale Ratio | Standard S4.3 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 |
| LSdf | Varied | 1.633 | 0.015 | 0.014 | 1.575 | 0.019 | 0.015 | 0.236 | 0.271 | 0.118 | 0.074 | 0.002 | 0.014 |

| Scale | Scale Ratio | Standard S4.3 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 |
| LSdf | Varied | 41.48 | 0.38 | 0.36 | 40.00 | 0.48 | 0.38 | 6.00 | 6.88 | 3.00 | 1.88 | 0.05 | 0.36 |

LSdf Wheel NOTES:

- 1) The term "LSdf" 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: $B = K - T$.