5" Gauge Track for AALS Wheelsets

Track gauge

The track gauge is normally specified as 5" with a tolerance of -0 / +$^{1}/_{32}$" or 127mm -0 / +0.8mm. The rail is generally made from rectangular bar (25 x 10 or 20 x 10) and the top of this bar (the railhead) is flat and horizontal. Most wheels have tapered treads (approx 1.5º). There is no corresponding cant on the railhead and the contact point between the wheel and rail is at or near the inner edge of the rail.

Wheelset profiles

Metric dimensions here are overly precise to reduce errors when components are summed.

AALS Preferred (aka Narrow Gauge)

Dimension	Inches	Millimetres
Back to Back (BB)	4 $^{9}/_{16}$ = 4.562	115.89
Flange Thickness (FT)	$^{5}/_{32}$ = 0.156	3.97
Root Radius (RR)	0.070	1.78
Wheel Check (BB + FT + RR)	4.788	121.64
Wheelset (BB + 2 * (FT + RR)) *	5.014	127.39
Checkrail max spacing	4 $^{17}/_{32}$ = 4.531	115.09
Wheel minimum width	$^{5}/_{8}$ = 0.625	15.88

AALS Fine Scale

Dimension	Inches	Millimetres
Back to Back (BB)	4 $^{11}/_{16}$ = 4.688	119.06
Flange Thickness (FT)	0.106	2.69
Root Radius (RR)	0.070	1.78
Wheel Check (BB + FT + RR) *	4.864	123.53
Wheelset (BB + 2 * (FT + RR)) *	5.040	128.00
Checkrail max spacing	4 $^{21}/_{32}$ = 4.656	118.27
Wheel minimum width	0.535	13.59

* reduced by railhead radius below.

Railhead radius

AALS specifications state the railhead radius (between gauge face and running face) should be from 0.5 to 1.0mm. Some UK wheelset profiles require a radius of $^{1}/_{32}$" (0.8mm) and so this value will be used in calculations in this document. This constant (called RHR here) is used when calculating the minimum permissible flangeway width, the maximum wheel check gauge, and the track gauge.

The required flangeway width is FT + RR – RHR. The maximum FT is 3.97 (see tables above) and the RR is 1.78 so the minimum flangeway width is 3.97 + 1.78 – 0.8 = 4.95mm.

The RHR also reduces the wheel check gauge. The maximum in the tables above is 123.53. With an RHR of 0.8 we can reduce this to 122.73mm.

For track to be suitable for both the above wheelset specifications we must select the smaller of some values and the larger of others. A track gauge of 127mm is sufficient due to the RHR.

Dimension	Millimetres
Flangeway width	4.95
Check gauge	122.73
Railhead Radius (RHR)	0.8
Checkrail max spacing	115.09

Gauge widening and checkrails

What must be considered with gauge widening is the effect on flangeway widths. All flangeways must be widened by the calculated amount. If both rails on a curve have a checkrail at the same point then the checkrail spacing will be reduced by the widening amount. For example, if a track has a gauge of 127mm and flangeways of 6mm then the checkrail spacing will be 115mm. With gauge widening of 2mm the track gauge will be 129mm, the flangeways will be 8mm and the checkrail spacing will be 113mm.

Wheels with thin flanges do not affect the flangeway width adjustment for checkrails at the outer rail of the curve because the flange thinning is effected by trimming the front of the flange and not the back. Flangeways on the outer rail of a curve are rare except for the wing rails at the V-crossing of a turnout.

Insufficient flangeway widening on the inner rail of the curve can be more damaging than insufficient gauge widening. Because there is no root radius on the back of a flange the leading and trailing wheelsets can't move out when the back of the flange is trapped by a checkrail. So the intermediate wheelsets have to move farther in and this will increase the lateral force on these inner wheels. Without a checkrail some wheels can move out and some in and share the problem of getting a straight wheelbase through the curve.

Track Design at V-crossings

At the turnout crossing, checkrail flangeway = 4.95 and wheel check = 122.73 so track gauge must be 4.95 + 122.73 = 127.68mm. Because checkrail max spacing is 115.09 the frog flangeway will be 127.68 – 115.09 – 4.95 = 7.64mm. This assumes a railhead radius of 0.8mm and is before any adjustment for gauge widening.

Track gauge	127.68mm
Checkrail flangeway	4.95mm
Frog flangeway	7.64mm

Each of these three measurements must be increased by any gauge widening in effect.

Track Design at K-crossings

K-crossings present more of a challenge because they occur in close proximity on both rails and both rails in the crossing area will have a check rail.

The checkrail max spacing is 115.09 and the wheel check is 122.73 so each flangeway must be 122.73 - 115.09 = 7.64mm. The track gauge will be 115.09 + 7.64 + 7.64 = 130.37mm.

The track gauge required here is 130.37mm plus any extra for gauge widening. This assumes a railhead radius of 0.8mm.

Gauge widening should not be necessary because both tracks are generally straight.