Crane rail bottom surface shape in relation to pad design

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The issue of DIN 536 dated September 1991 shows changed dimensional tolerances for the base of the rail compared with the earlier issue. This new DIN Standard represents more accurately the shape of actual rolled. In the standard the bottom of the rail is permitted to be flat or to be slightly curved so that the centre of the base is depressed towards the centre of the rail.

The current standard recognises that it is uneconomic to roll rails with an absolutely flat bottom surface and some tolerance must be permitted. Crane rails have always tended to have a bottom surface that is not flat. The consultants W.S. Atkins & Partners in England carried out a study as long ago as 1960 and found that some large rails could have a bottom surface which was 1.5mm out of flat. As a consequence of this it has been suggested that crane rail pad should be shaped to take account of the non-flat surface of the bottom of the rail. GANTRAIL have analysed this problem and concluded that it is not necessary or beneficial to have a pad that tries to fit the actual rail shape. The reasons are as follows: -

BENEFITS

The benefit of using a pad beneath the rail is that it spreads the load both across the rail and along the rail. Several studies have been conducted and reported. By way of example a finite element analysis by the Canadian consultants H.G. Engineering showed that the stress in the structure below the rail could be reduced by at least 30%. These calculations have been confirmed with tests using pressure sensitive paper and strain gauged sections of rail. Pad for crane rails is sufficiently compressible that it can take up tolerances of the bottom of the rail that is not flat. Therefore it does not make sense to spread the load along the rail and then concentrate it at the centre of the rail with a pad that may be 1.5mm thicker at the centre than at the edge, when the new DIN 536 Standard ranges from 0.0mm to 1.00mm only.

RAIL BASE TOERANCES

The tolerance on the base of the rails quoted in DIN 536 1991 edition ranges from 0.0 to 0.6mm for the smallest A45 rail to 0.0 to 1.0mm for the largest A150 rail. Therefore, for the pad to fit the average A45 rail it would have to be 0.3mm thicker at the centre and the pad to fit the average A150 rail would be 0.5mm thicker at the centre. The GANTRAIL pad has a compressibility that will easily absorb this range of surface irregularity without significant difference in the local stress under the point of load application. It would be totally inappropriate to use a pad with thickness at the centre 1.5 mm greater than at the edge. It has been show that Gantrail pad deflects a maximum of 1 mm when it is loaded. Thus a pad that is 1.5 mm thicker in the middle will not be carrying load at the edges when fully compressed between two parallel surfaces.

DIN RAILS

The current DIN shows a rail with a curvature of the top surface. This will allow the crane wheel to take up the angular position required due to the deflection of the main crane beams or rail support. It would be unwise to have a pad that is significantly thicker in the centre than the depression in the bottom of the rail. The potential problem is that load would be passed through the centre of the pad and not uniformly over the whole width.

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It has been found by analytical research into the performance of Rubber Bridge Bearings, that when a layer of rubber is compressed between two rigid surfaces, the rubber reacts in a similar fashion to a highly viscous fluid. This results in a higher pressure in the centre than at the edge. For this reason a flat section pad will automatically tend to concentrate the loads towards the centre, and the use of a pad that is thicker in the centre will accentuate this reaction to an unacceptable level. Thus GANTRAIL have concluded that as there are disadvantages to a pad which is not of constant thickness, the normal GANTRAIL Mark 7 fulfils all the requirements of modern crane operations with continuously supported DIN 536 Standard rails. However to meet market demand Gantrail is able to supply some pad sizes with thicker centre than edge.

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