BENEFITS OF 70° AND 90° VEE GROOVE GUIDE WHEELS

By Leslie Lui, Mechanical Design Engineer

INTRODUCTION

The two most common vee angles in vee groove guide wheels are 70° and 90°. The difference in vee angle causes each type of wheel to have advantages and disadvantages over the other, and users should select the wheel type that best meet their specific application requirements. Seventy (70°) degree groove guide wheels are better suited for applications where a low profile wheel and precise wheel-track alignment are required. Ninety (90°) degree groove guide wheels are better suited for applications where a small wheel diameter and high load capacity are required.

WHEEL TO TRACK CONTACT

When a vee groove guide wheel is assembled against its track, line contact perpendicular to the direction of travel forms between each mating set of running surfaces. Applied loads on the wheels are distributed along the lines of contact, so the length of line contact on the running surfaces must be sufficiently large to ensure the surfaces do not yield when substantial loads are applied to the wheel. This is why the grooves on the guide wheels cannot be very shallow. The running surfaces on 70° groove guide wheels are angled closer toward the wheels' midplane than on 90° groove guide wheels. Therefore, 70° groove guide wheels can have shorter vee heights than 90° wheels with equivalent line contact lengths on their respective tracks. However, 90° groove guide wheels will have smaller outside diameters than 70° groove guide wheels with equivalent line contact.
WHEEL ALIGNMENT

In addition to better load distribution, longer contact lengths also improve a wheel’s stability and self-alignment capability on its track. Seventy (70°) degree groove guide wheels can be better than 90° groove wheels with respect to these properties. The smaller vee angle in the 70° groove wheels means larger misalignment forces have to be applied to them than to equivalent size 90° guide wheels to get the same amount of wheel pitch rotation and axial displacement to occur.

LOAD CAPACITY

In any vee groove guide wheel-based system, any external force applied to a wheel results in both radial and axial compressive forces between the wheel and track. The angle of the vee determines how these forces are distributed in the wheel. When equal, radial compressive loads are applied to 70° and 90° vee groove guide wheel and track assemblies, the resultant compressive radial load between all contacting surfaces is the same. However, the resultant compressive axial load between all contacting surfaces on the 70° vee groove guide wheel and track assembly is higher than in the 90° groove guide wheel and track assembly. When the wheel contacts the track by its inner vee running surfaces, any axial compressive load on the wheel's running surfaces creates an outward bending moment in the wheel. This bending moment creates stress in the wheel, with the highest resultant stress occurring at the apex of the inner vee where the two running surfaces meet. When the bending stress exceeds the wheel's material strength the wheel can fail by cracking at the inner vee apex, followed by splitting into fragments. Due to the lower resultant axial load on each running surface and the gentler angle of transition between the two running surfaces, a 90° wheel will have lower bending stress at the inner vee apex than a similar sized 70° wheels subjected to the same applied radial load. Therefore, a 90° vee groove guide wheel will support more load with less risk of the wheel splitting.

ABOUT

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