Expert guidance on profile systems for machine building

The experts at MiniTec have put together an excellent guide on profile systems. Here we take a look at considerations for material choice

Profile systems have evolved to become one of the fundamental technologies used in modern machine building. The major advantage of using profile systems is that of time and cost savings. With that in mind, let's look at some of the key considerations in specifying profile systems.

The stability of any profile system depends first and foremost on the material used to make the construction profiles. Alongside the material itself, the other decisive factor determining stability is the geometry of the construction profile. The internal structure, the wall thicknesses and the arrangement and shape of the grooves all exert a direct impact on the mechanical and functional characteristics of profiles.

Aluminium is the mostly widely used material for machinery profiles, these being generally made using AlMgSi wrought alloys. The composition of this type of alloy is specified in the DIN 1712 and DIN 1725 standards, and also in a more recent standard, the DIN EN 573. Typical materials for standard profiles – according to the terminology used by DIN EN 573 – include EN AW-6005, EN AW-6060 and EN AW-6063. All differ in areas such as strength and conductivity.

The final condition of a construction profile, however, is not determined solely by the alloy, but decisively also by the method of after-treatment. The different properties characterised by F numbers in DIN 1748 and by T numbers in EN 515 are created by the use of different hardening methods. Even though DIN 1748 has been largely superseded by the more recent DIN EN 755 standard, the older standard is still generally used as a basis for manufacturer specifications.

Age-hardened aluminium profiles with high ultimate strength are classified from F25 to F28 according to DIN 1748. According to EN 515, they bear the designation T6. This corresponds to a strength grading of the type required for structural elements subjected to mechanical stress.

Surface treatment is generally a requirement in the application of aluminium materials. This is primarily to achieve protection from corrosion, but also to create a beneficial decorative effect. The type of treatment depends on the field of application and the requirements imposed on the material. For profile systems used in mechanical engineering applications, anodising has become established as the standard method of surface treatment. Anodising is generally colourless, and the thickness of the created oxide layer is generally 10µm in standard profiles. This layer thickness offers adequate corrosion protection for applications in closed rooms and under dry ambient conditions.

Electrical conductivity

The anodised finish of an aluminium profile does not in any way affect its conductivity. Although the aluminium oxide layer does exert an insulating effect, the overall conductivity of any profile system is maintained due to the PE-compatible fastening elements which penetrate the anodised layer. These standard fastening elements guarantee seamless conductivity without the need for any additional worksteps or special care during assembly. In this case, aluminium profiles fulfil the fundamental requirements imposed by VDE 0100-410/413 on electrified workplaces.

Various special materials are also employed in various areas. Composite materials are enjoying increasing use in mechanical engineering applications, offering weight savings without compromising on rigidity, and improving certain mechanical characteristics such as oscillation behaviour.

At continuous temperatures of over around 150°C or where there is any risk of contact with aggressive acids, alkalis and some other chemicals, aluminium profiles do not provide a practical option. The same applies to applications involving high dynamic loads. Instead of using a profile system for this type of application, the most sensible solution is to opt for steel.

Like aluminium profiles, steel profiles also offer the essential benefit of allowing flexible constructions to be quickly assembled with an easily and clearly manageable profile system. This benefit outweighs the drawback of the higher material and manufacturing costs involved. However, steel cannot be used to completely replace aluminium in profile systems: the expense involved in producing seamless constructions made of steel profiles with similar geometries of the type which can be produced in aluminium would be prohibitive.

In the next issue, we continue this discussion on machinery profile systems by focusing on profile geometry and behaviour under load.

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