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Tailored compressed air drying for dental applications

Which processes are suitable?

Compressed air specialists and dental equipment manufacturers have all agreed: Dental applications (Fig. 1) not only require dependable and efficient compressed air production, but also require tailored compressed air drying. However, the available processes differ greatly and not all are well suited to perform this important task. This article describes the various drying methods and looks at their strengths and potential weaknesses.

In its 2007 Annual Report, the DIN Dental Standards Committee (NADENT) stipulated that compressed air used in dental applications must be "oil-free, sterile and dry".[1] Appropriate drying is therefore a key priority for dental applications when it comes to ensuring compressed air quality. There are essentially four main approaches to achieving this goal: desiccant-, refrigeration-, membrane- and absorption drying. Used in conjunction with aftercooling they should all remove condensate from the compressed air, which can often be up to 100% saturated with moisture. However, they achieve this result in very different ways. So how do these different processes perform when it comes to meeting the rigorous demands of modern dental technology?

Desiccant drying – A process in need of tailoring

Desiccant drying is a physical process whereby water vapour is drawn from the compressed air and adsorbed on to the surface of a desiccant. The desiccant has to be regenerated at certain intervals to maintain its effectiveness, that is, it has to be freed of the moisture that has been deposited upon it. There are two different methods: heat regeneration and heatless regeneration. Both methods use purged air.

a) Desiccant dryer with heatless regeneration

In dryers with two chambers (Fig. 2), some of the compressed air that has already been dried in the one chamber is drawn off and decompressed almost to atmospheric pressure before being fed back through the desiccant bed of the other chamber. It is then released to atmosphere. This decompressed air reduces the pressure dew point within the chamber that is being regenerated. The condensed moisture on the desiccant evaporates and is removed from the desiccant bed along with the purged air. However, the reduction in pressure and the evaporation of the moisture causes a reduction in the temperature of the purged air and, thus cooled, it removes less water vapour. Consequently, up to 20 per cent of the compressed air generated by the compressor may have to be utilised for effective regeneration of the desiccant and, once drawn off for regeneration, the air is no longer available for use by the compressed air application.

In dryers with only one chamber, the purged air is drawn either from a specially provisioned container or from the main compressed air receiver. As with two chambered dryers, this air ceases to be available for use by the compressed air application. Regeneration using this method is only possible once the shut off pressure has been reached and the compressor has come to a standstill. If the compressor continuously operates over a sustained period then the inability to regenerate the desiccant will inevitably impair the quality of the compressed air.

For economical and ecological reasons this is a far from perfect solution for dental air supplies.