

Lower Costs because of Synergy Effect

Modern technology makes screw compressors even more efficient



Sigma Control, an intelligent controller developed by Siemens and Kaeser based on an industrial computer increases compressed air availability, lowers power requirements and maintenance costs. Easy onsite operation is guaranteed with an ergonomic user interface, touch keys, menu driven options and plain text display.



Recent engineering developments in the screw compressor market were mostly accentuated by the appearance of new, even more efficient controllers. This could give the impression that development in the improvement of the efficiency of compressor components has

already been exhausted. The following article shows that there is still significant potential available, the utilization of which can lead to improvement in performance and to savings in the two-figure percentage range.

Some years ago, supervisory control systems such as MVS,

the microprocessor-controlled sequencer and VESIS, the package management system, ensured extremely efficient production of compressed air. Nowadays, it is not only possible to efficiently control up to 16 different compressors with a minimum of pressure fluctuation, i.e. they are precisely matched to the actual air demand of a

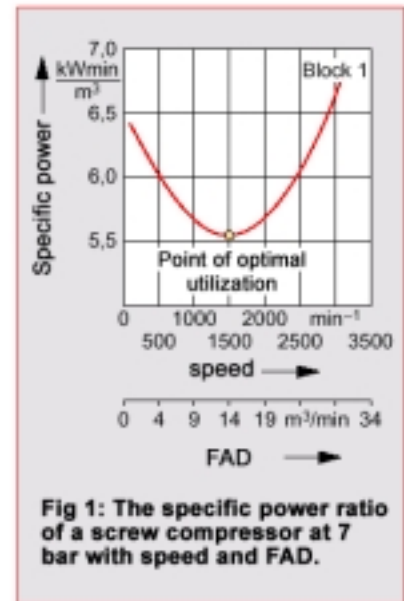
production facility which, depending on working shift is often completely different. The machines can be utilized more evenly than before, are easier to maintain and can be continuously and easily monitored because of their integration into existing control systems.

A further milestone in this development was the presentation and introduction of “Sigma Control”, the internal compressor controller. This reliable controller, designed for the extreme conditions met in a screw compressor, consists of an industrial computer made up of components that have been tested a million times over. It fully integrates the compressor into modern communications technology and makes the operation of the

compressor transparent to the user interested in optimum efficiency (fig 1). This also allows Sigma control to link the compressor to the diverse possibilities offered by Teleservice. With this technology, the compressor manufacturer can call up current operating data directly from the running compressor package via a PC over thousands of kilometers, allowing any due or imminent maintenance to be determined. The use of this intelligent internal controller also means less maintenance effort, even more energy savings and increased machine and thus air availability for the compressor user.

Optimized compressor drives increase efficiency

Regardless of who is involved in the specific



performance range of



Fig. 3: On real one-to-one drive, only a coupling is fitted between the drive motor and the air end. This is why there are no transmission losses between these components.

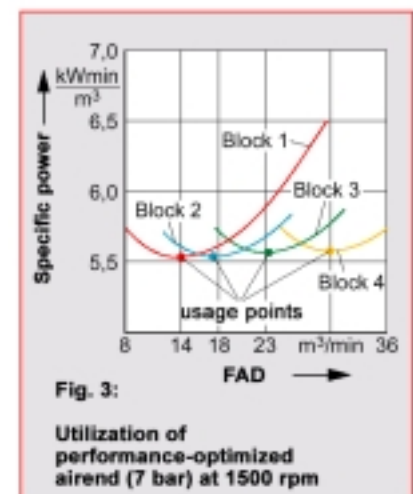


Fig. 3: Utilization of performance-optimized air end (7 bar) at 1500 rpm

screw compressors, i.e. the relationship between pump capacity and power consumption, they will quickly realize that the optimum specific performance of these machines is only achieved at a defined pressure and speed (fig 2).

Kaeser considered this fact years ago by introducing an extensive, flexible range of screw compressors. This range allowed each airend to be used within its specific optimum in steps of 0.5 bar between 3.5 and 15 bar with relation to speed, thus ensuring (at that time) the best possible airend performance.

In the meantime, new engineering technologies have put the manufacturer in the position of being able to build compressors with one-to-one drive from

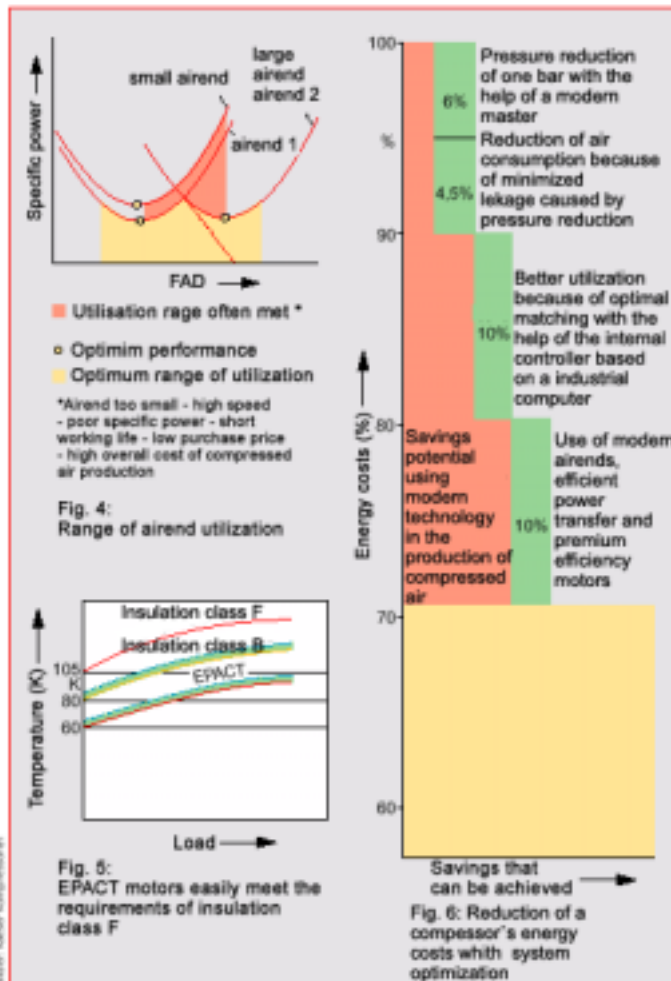
75 kW upward with a pressure range of 5.5 to 15 bar (fig. 3). These compressors work within the optimum performance ranges that can be achieved these days. Kaeser offers screw compressors within the performance range 75 to 455 kW with airends (fig. 4) that run at the same speed as the drive motor. Thus, no transmission losses are involved because no gearing is required. In addition, the compressor packages run at very low speeds of 1500 or even 1000 rpm, giving longer life to the airend and the drive motor.

These days, progressive compressor manufacturers such as Kaeser can build low-speed airends that work at their optimum specific power in every performance range.

The benefit is obvious in the enormous power savings achieved compared with conventional high-speed compressors with gear or belt drive that are normally found on the market (fig. 5). As the cost of energy for the production of compressed air is around 70 to 85 percent, this provides a considerable cost saving for the user.

Premium efficiency motors reduce costs even further

Another way of reducing the energy costs of modern air compressors is the use of so-called EPACT motors. Even as far back as the seventies, there were efforts in the USA to reduce the energy requirements of electric motors. First, minimum efficiencies were laid down in 1975.



The whole act was finalized in 1992 and the “Energy Conversation Policy Act” (EPACT) became law in 1997. Kaeser has been selling motors in Germany that comply with this strict act since 1998 (fig. 6). Users of compressors fitted with these new high-efficiency motors benefit from numerous advantages:

Lower working temperature

The electric drive motor delivers mechanical power to the air end to compress air. During this power transmission, individual components heat up, and friction in the motor bearings cause internal efficiency losses. On small electric motors,

these losses can be up to 20 percent, on motors upward of 160 kW four to five percent of the power consumption. In EPACT motors however, with correct use, this heat and therefore energy loss is significantly less.

Whereas the increase in working temperature on a conventional motor under normal loading is approximately 80 °C with a temperature reserve of 20 °C compared with insulation class F, the temperature increase of an EPACT motor under the same conditions is only 65 °C with a temperature reserve of 40 °C (fig. 7).

Long life

Lower working temperatures also mean less thermal stress on the motor,

motor bearings and the terminal box (overheated cables), resulting in extended motor life.

Six percent more air for less power consumption – up to 30 percent cost-savings

By combining all the measures described – optimization of the airend, its drive and the

use of premium efficiency motors – it is possible to increase the FAD of the compressor packages by up to six percent. In addition, savings of over ten percent can be made on specific power. If modern controllers such as MVS, Vesis and Sigma Control and the benefits of energy and cost-conscious compressor package

design are also utilized then cost savings of up to 30 percent can be achieved compared with conventional compressor installations **(fig. 8)**. Consequently, users should increasingly use synergism if they want to achieve a perceptible reduction of their compressed air production costs.