Druckluft effizient

Compressed Air Applications

Characteristics of compressed air

Compressed air is an energy form offering an unrivalled range of applications and combining speed, power, precision and safe handling. These characteristics make compressed air irreplaceable in many cases. However, there are applications in which compressed air is in competition with other forms of energy such as electricity or hydraulics which are of interest. Here, the principle of economic efficiency demands a precise cost-benefit analysis. The relatively high costs of producing compressed air always have to be weighed against factors such as working speed, reliability, maintenance costs etc. The best available technology should be taken as a base. Compressed air applications have made tremendous progress in recent years with regard to energy efficiency.

The versatility of compressed air becomes very clear if one looks at application examples:

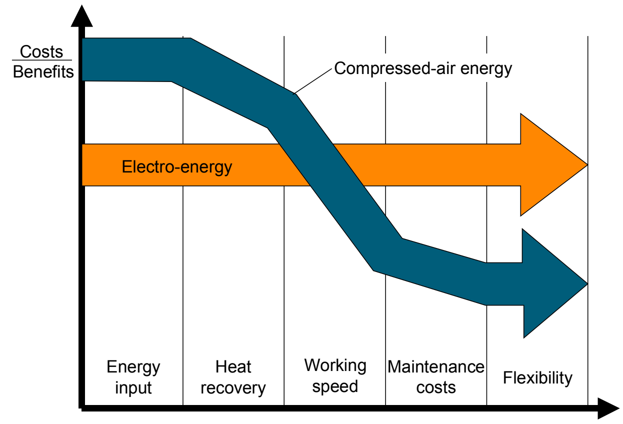

Fig. 1: Qualitative cost-benefit comparison taking into account relevant parameters

Working and energy air

As an important field of application for compressed-air, pneumatics has shown a two-digit growth rate for years. More and more new patents are being filed on compressed-air cylinders, air engines and compressed-air valves.

Compressed Air Facts

Fig. 2: Automation using compressed air

The speed, precision, flexibility and miniaturisation of these components play an important role.

Without compressed air the degree of automation essential for the competitiveness of German companies would not be possible.

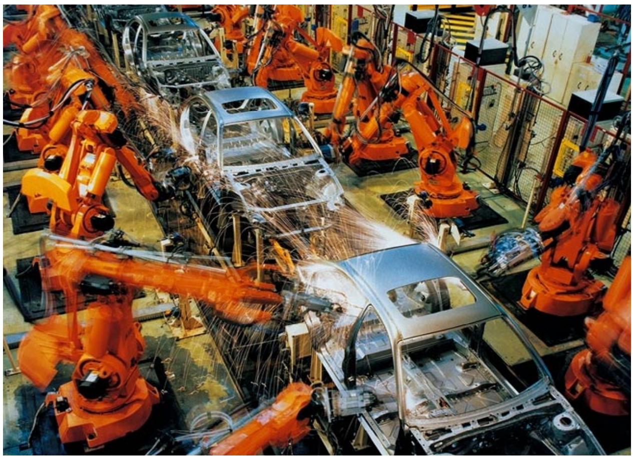

Fig. 3: Robots operated using compressed air

Life today cannot be imagined without a multitude of products which can only be produced using compressed air.

Fig. 4: Plastic bottles

Another special feature of compressed-air devices is their possible application in explosion-proof areas.

For example, compressed-air hoists ensure that there are no sparks caused in varnishing plants.

Fig. 5: Explosion-proof mechanical hoist

To equate compressed air only with old-fashioned applications does not correspond to the state-of-the-art. For example, cleaning work benches using compressed air is no longer up-to-date. In many cases, a hand brush would also do the job. However, if compressed air is still being used for such a task then it is recommended to use optimised jets which achieve a maximum cleaning effect with minimal air consumption.

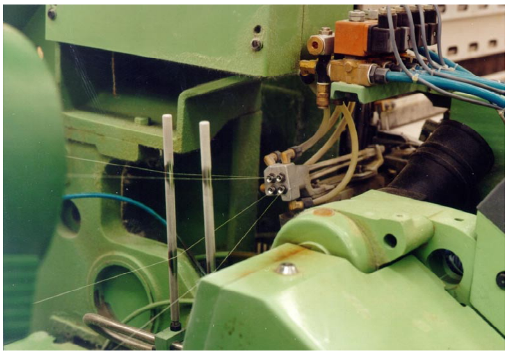

Fig. 6: Air-jet loom

Active air

You talk about 'active air' if compressed air is being used as a transport medium. Current application examples are transporting bulk goods, shooting the shuttle back and forth in looms, applications in air bearings or the recently rediscovered pneumatic post.

Several advantages of compressed air can be shown based on the example of air bearings. Laser guns for aiming GEO satellites have to be positioned exactly and automatically guided. In order to achieve the necessary precision of ±1/3600 degrees, the optical system is air cushioned. The air bearings allow completely smooth and infinitely variable telescope movements for high measurement accuracy and shield it from vibrations. Without compressed air, such modern methods of geodesy would hardly be practicable.

Process air

If compressed air is directly incorporated as a process medium in certain processes, then it is called process air. Common areas of application are drying processes, the aeration of clarifiers or air for fermentation processes.

Fig. 7: Fermenting and bottling

Industrial Vacuum

Industrial vacuum technology is closely related to compressed air. Several applications can be solved using either compressed air or a vacuum. Using an industrial vacuum it is possible to pack, dry, stretch, perform suction, hoist, position and many others. More and more sectors are recognising the merits of vacuum applications.

The electronic industry can be cited as an example, where production depends on absolute precision with the largest possible output. In accordance with "clean production", extremely precise, very small vacuum pumps ensure the exact handling of electronic circuit boards under clean-room conditions and their fitting with microchips. The stable, controlled vacuum "grasps" the chip and positions it at exactly the right place on the printed circuit board.

Fig. 8: Circuit board production

Pressure ranges

Different applications require different pressures. It is very rarely economically justifiable to compress to the highest pressure required and then subsequently reduce the pressure again. Therefore it is necessary to categorise the pressure ranges and apply correspondingly suitable generation systems.

- **Vacuum and blower applications**

  These range from rough vacuums up to the excess pressure range of approx. 1 bar. These pressure levels can be generated very economically using rotary valve vacuum pumps, rotary piston blowers and side channel fans.

  There is the possibility to generate industrial vacuums using compressed air but in almost every case this would represent a misuse of compressed air. Specialised vacuum pumps operate on only a fraction of the energy input necessary for compressed air.

- **Low pressure applications**

  Low pressure applications refer to those in the range from 2 up to 2.5 bar excess pressure. Rotating positive-displacement compressors are generally used here, but turbo compressors are also feasible for extremely large amounts.

  Specifically in low pressure applications which make do with much lower excess pressures than the classical 6 bar, it can frequently be observed that these appliances are connected to the 7-bar grid. At the point of use, the pressure is then simply reduced accordingly. In such cases it should be a matter of urgency to check whether the introduction of a separate low pressure supply could raise economic efficiency.

- **Standard pressure applications**

  There is a broad range of compressors available for standard pressure applications which are served from a 7-bar grid. The specifications regarding the amount and quality of air determine which combination of compressors operates most economically

- **High pressure applications**

  Oscillating positive-displacement compressors such as piston compressors or membrane compressors have their field of application in the two and three figure bar range. Radial turbo compressors may also be an economic choice when large amounts of air are involved.

  It is quite common that a few high pressure consumers can be supplied very economically via the standard compressed air network with decentralised booster compressors close to the high pressure consumers.

Correct pressure

Every consumer of compressed air requires a certain working pressure in order to be able to deliver an optimal performance. For example, for tools which are powered with only 5 instead of the necessary 6 bar, the on-load speed falls by 25 % even though the idling speed only drops by 5 %. Regular checks are therefore indispensable to see whether the required working pressure is available, especially under full load conditions. Pressure losses due to an insufficient piping cross-section or bottlenecks can only be detected if the compressed air is actually flowing. Excess operating pressures do not bring any gains in performance. They only increase the consumption of compressed air and the wear and tear of the equipment

Quality of compressed-air

There is a similar picture for insufficiently processed compressed-air. Particles, damp and oil afflict compressed-air equipment and increase their fault liability. Increased wear and tear and output losses are still relatively small problems compared with total failure which may lead to loss of production. But even if the compressed-air equipment is operating trouble-free, impurities can enter processes via insufficiently conditioned compressed-air which may result in the loss of whole production batches.

Conclusion

Whoever selects his compressed-air applications with care, adjusts the compressed-air system accordingly and consistently monitors the parameters relevant for economic efficiency and operating safety, has certainly made a decision in favour of a modern and efficient energy supply.

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VDMA
Drucklufttechnik

The campaign “Druckluft effizient“ aims to motivate the operators of compressed-air systems to optimise their systems and save substantial costs. It is conducted by the **German Energy Agency** (dena), the **Fraunhofer Institute Systems and Innovation Research** (Fraunhofer ISI; project management), and the **Federation of the Engineering Industries** (VDMA) with support of the Federal Ministry for Economics and Labour (BMWA) and the following industrial enterprises:

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