

# Compressed air

**Druckluft ist neben Elektrizität der wichtigste Energieträger in der Industrie. Jeder sollte sich deshalb zumindest mit den Grundlagen auskennen. Auch in Englisch.**

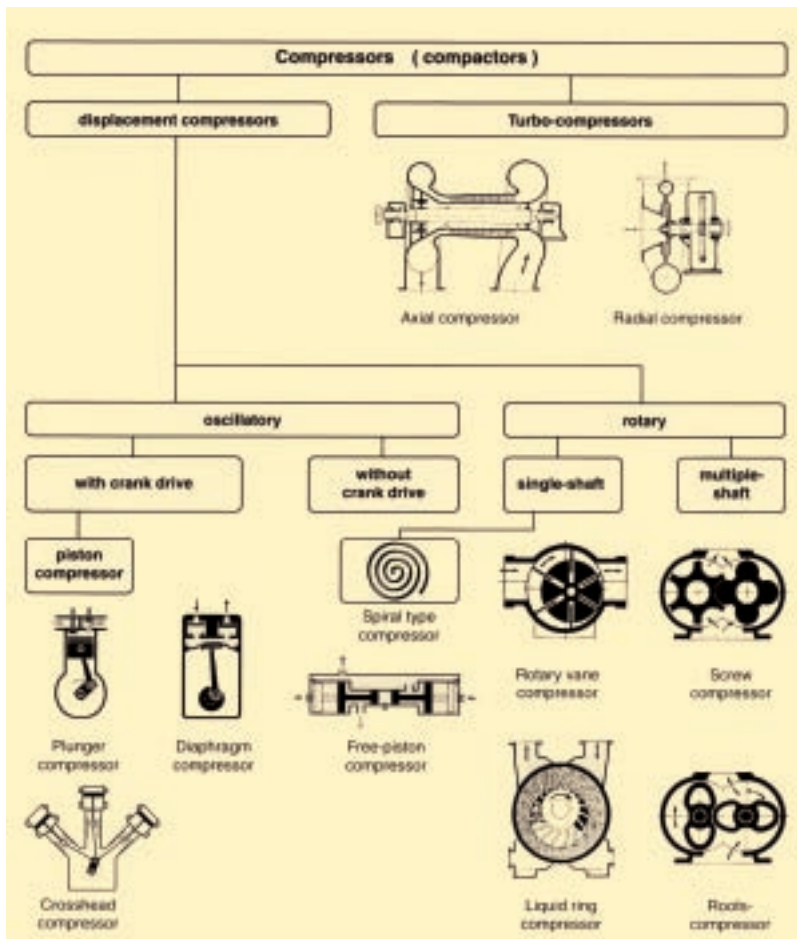
## Fundamentals of compressed air

The air in our environment, the atmosphere, contains 78% *Nitrogen*, 21% *Oxygen* and 1% other gases. As with all gases, the air consists of molecules. If the air is *enclosed* in a tank (constant volume), then these molecules *bounce* off the walls of the tank and generate pressure. The higher the temperature, the greater the movement of air molecules, and the higher the pressure generated. Boyle and Mariotte found the following *interrelationship*:

The volume of gas is *inversely proportional to pressure* (Boyle-Mariotte's Law)

This means: When the temperature is increased and the volume remains constant, the pressure rises **or** when the volume is reduced and the temperature remains constant, the pressure rises **or** when the temperature is increased and the pressure remains constant, the volume increases.

*Types of compressors: The summary shows the compressors divided according to their operating principle.*



Ventilators are *flow machines* that pump nearly atmospheric air. With ventilators only slight changes to density and temperature *occur*. Vacuum pumps are machines that *induct* gases and steam in order to create a vacuum. Compressors (compactors) are engines used for pumping and compressing gases to any pressure.

## Compressed air generators

*Dynamic compressors* are for instance turbo-compressors by which running wheels equipped with *blades* accelerate the gas to be compressed. Fixed *direction gear* on the blades converts speed energy into pressure energy. Dynamic compressors are to be preferred for large quantities of medium and low medium pressures.

On *displacement compressors* the compression chamber closes after taking in the air. The volume is reduced and the air compressed by force. Displacement compressors are to be preferred for small quantities of medium and high medium pressures.

## Compressed air treatment

Modern production equipment needs compressed air. The many conditions in which it is used *range from* untreated blowing air to absolutely dry, oil-free and sterile compressed air. The *impurities* in our atmosphere are usually invisible to the naked eye. But they can seriously *impede* the reliable operation of a pneumatic system and consumer devices, and have an *adverse* effect on products:

### Solid matter particle in the compressed air

- Dust and other particles cause *scuff*. This effect is increased if the particles combine with lubricating oil or grease to form a *grinding paste*.
- Particles that are *hazardous* to health.
- Chemically aggressive particles

### Oil in the compressed air

- Old and different oil in the pneumatic system. *Resinified oil* can reduce pipe diameters and cause blockages. This increases flow resistance.
- With pneumatic *conveyance*, oil can stick to the product conveyed and thus cause block-

ages. In the food and pharmaceutical industries compressed air must be free of oil for health reasons.

### Water in the compressed air

- Corrosion in the pneumatic system. Rust forms in the pipelines and operating elements and causes leaks.
- Gaps in lubricant films lead to mechanical defects.
- Electrical elements can form when some metals come in contact with water.
- In low temperatures water in the network can freeze and cause frost damage, reduce pipe diameter and block pipes.

## The pneumatic system

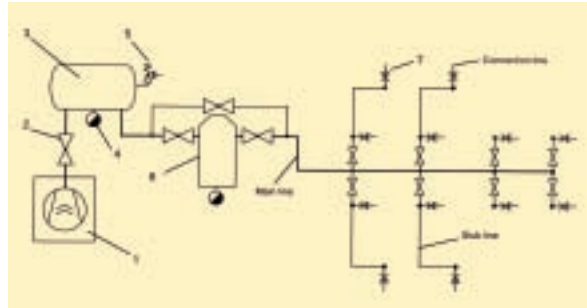
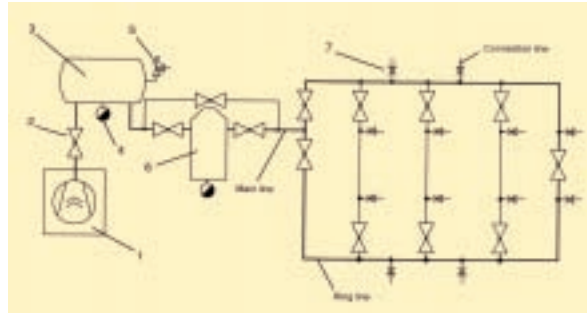
**Compressed air receivers:** They have various important tasks in a pneumatic system. The compressor builds up a store of compressed air inside the receiver. The compressed air *requirement* can be covered at intervals from this store. Additionally, *fluctuating* use of compressed air is compensated for and peak requirements are covered. Due to the way they operate, piston compressors generate a pulsing volume flow. These pressure fluctuations *impair* the operation of various consumer devices. The *compressed air receiver* is used to balance out these fluctuations in pressure. Compression causes the *moisture* in the air to form *droplets* of water (condensate). This water is usually drawn into the compressed air receiver with the volume flow.

<i>adverse</i>	ungünstig
<i>blade</i>	Schaufel, Blatt
<i>bounce, to</i>	abprallen
<i>compressed air receiver</i>	Druckluftbehälter
<i>condensate drain</i>	Kondensatableiter
<i>conveyance</i>	Förderung
<i>crank drive</i>	Kurbeltrieb
<i>crosshead</i>	Kreuzkopf
<i>diaphragm</i>	Membran
<i>direction gear</i>	Leitapparat
<i>displacement compressor</i>	Verdränger/Verdichter
<i>droplets</i>	Tröpfchen
<i>dynamic compressor</i>	dynamischer Verdichter
<i>enclose, to</i>	einschließen
<i>flow machine</i>	Strömungsmaschine
<i>fluctuating</i>	schwankend
<i>free-piston</i>	Freikolben
<i>grinding</i>	schleifend
<i>hazardous</i>	gefährlich

The condensate collects on the floor of the receiver and is removed by a suitable condensate collector.

### Compressed air circuit:

A central compressed air supply needs a pipeline circuit to deliver compressed air to the individual devices. The main line connects the compressor station with the compressed air treatment and the compressed air receiver. Distribution lines are connected to the main line. They are laid through the entire operation and bring compressed air to the devices. They should always take the form of a ring line wherever possible. This increases the economy and security of operation of the line as a whole. The distribution lines can also take the form of a *stub line*. They have the advantage of needing less material than ring lines. But they also have the disadvantage that they must be of larger size than ring lines and frequently cause high pressure losses. ■



Compressed air supply with ring line (above) and stub line (below).

- 1 = Compressor
- 2 = Not-return valve
- 3 = Compressed air receiver
- 4 = Condensate drain
- 5 = Safety valve
- 6 = Compressed air dryer
- 7 = Compressed air connections

<i>impair, to</i>	beeinträchtigen
<i>impede, to</i>	behindern
<i>impurity</i>	Verunreinigung
<i>induct, to</i>	ansaugen
<i>interrelationship</i>	Zusammenhang
<i>inversely</i>	umgekehrt
<i>liquid ring</i>	Flüssigkeitsring
<i>moisture</i>	Feuchtigkeit
<i>Nitrogen</i>	Stickstoff
<i>Not-return valve</i>	Absperrventil
<i>occur, to</i>	auftreten
<i>Oxygen</i>	Sauerstoff
<i>piston</i>	Hubkolben
<i>plunger</i>	Tauchkolben
<i>range from, to</i>	sich erstrecken über
<i>resinify, to</i>	verharzen
<i>requirement</i>	Bedarf
<i>rotary vane</i>	Vielzellen
<i>screw</i>	Schraube
<i>scuff</i>	Verschleiß
<i>shaft</i>	Welle
<i>stub line</i>	Stichleitung
<i>treatment</i>	Behandlung

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