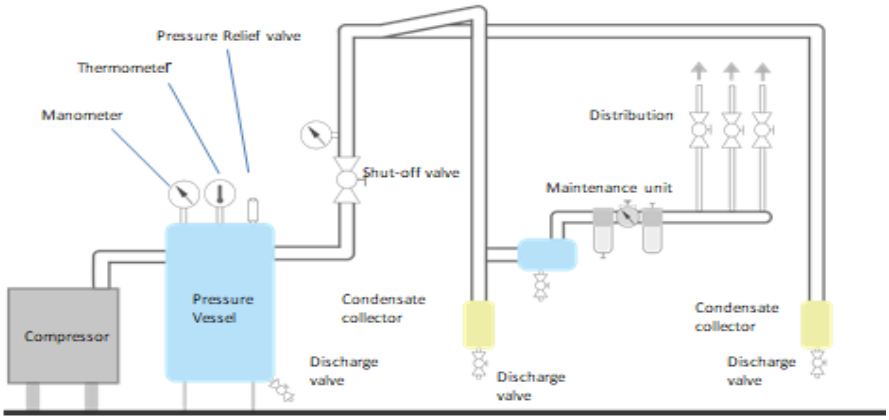
This project has received funding from the European Union's H2020 Coordination Support Action under Grant Agreement No. 894356.

Best Practice	SIZING AND TYPE OF COMPRESSOR	CAIR-05
Application	Compressed Air Systems	
SME sector	Industrial	
SME Sub-sector	All	
Technical description	Many compressors are oversized and/or controlled badly, thus resulting in a workload of only 50%. The most common way to control a compressor is the load /no-load control. This method puts the compressor into idle running mode instead of switching it off. This results in fewer control cycles of the motor, extending its life cycle, but is also very energy consuming. Further unnecessary energy consumption comes from oversizing of the compressors. This can happen for various reasons: • Reduction of the demand (e.g., closure of production lines or halls) • Highly fluctuating demand • Misconception	
Recommendation for optimisation	It is recommended to replace the old, oversized and discontinuously controlled compressors with newer ones, driven by VFDs. VFD (Variable Frequency Drive) driven compressors offer the possibility to regulate the rotation speed of the engine in a set range by modulating the frequency. This way the supply can be matched almost perfectly with the demand (0,1 bar difference). Compressor manufactures offer a wide range of VFD driven compressors with controlling units. Compressors, which already fit size wise, can be upgraded by adding VFDs. This is only recommended in some cases. In most cases the viable solution is to install the optimal compressor units with controls, after measuring the demand and operating hours. Due to the regulation, the pressure in the system can be ideally kept at a range of 0,1bar around the demanded value. The pressure excess of the unregulated compressors, due to their fixed start/stop points, is avoided and about 6% to 10% of energy can be saved per bar system pressure.	
Technical considerations	The optimal operating range of VFD driven compressors is at about 40% to 70% of their full output. Above or beyond this range, the energy consumption rises rapidly.	

This project has received funding from the European Union's H2020 Coordination Support Action under Grant Agreement No. 894356.

Schemes and diagrams	 Scheme of an industrial compressed air system	
Economics	Investments vary from the type of intervention that is carried out on the line. For the replacement of a compressor, costs start at 3,000-4,000 EUR.	
Energy savings	By using a VFD driven compressor, the energy demand of a badly sized compressor can be reduced by about 25-30%. The pressure excess of the unregulated compressors, due to their fixed start/stop points, is avoided and about 6% to 10% of energy can be saved per bar system pressure. Potential savings of 15% by replacing low-quality components.	
Economic savings	From 10 to 30%	
Average Payback Time	3-6 years	
Emissions	0.702 $kgCO_2/kWh_{el}$ (CO_2 emitted by production for one hour of 1 Nl/min of compressed air)	
Environmental benefits	Reduction in CO_2 emissions due to reduced energy needs. Reduction of NO_x.	
Main NEBs (Multiple benefits)	☒ Environmental benefits ☒ Increased productivity ☐ Work environment/ Health/Safety ☐ Maintenance	The more stable pressure supply can lead to an increase in the quality of the products.

This project has received funding from the European Union's H2020 Coordination Support Action under Grant Agreement No. 894356.

	☒ Maintenance	
Replicability	Medium	
Related measures	• CAIR-01: Optimisation of compressed air users/appliances • CAIR-01: Optimisation of the pressure in the system • CAIR-03: Switch-off of appliances in non-operational times • CAIR-04: High Level Control • CAIR-06: Network Optimization • CAIR-07: Reduction of leakages • CAIR-08: Heat recovery	
Case study	Installation of a VFD driven compressor (Austria, 2013) • Initial Situation: the compressor used was an old, unregulated one with time-controlled condensate separation. Heavily fluctuating demand caused the compressor to perform high idle runtimes. • Description of the optimisation: by adding a modern VFD driven compressor to the system, the overall pressure level in the system could be reduced, leading to a reduction of leakages. The new compressor can also be operated in part load, covering the frequently occurring, reduced demand. The pressure level of the appliances can be controlled individually. • Implementation costs: 57,400 EUR • Payback time: 5 years	
References	Kulterer, K., Huber J., Ruthner H., Oetiker H., Pucher C., Steinbrugger, C.: Leitfaden für Energieaudits zur Optimierung von Druckluftsystemen, klimaaktiv energieeffiziente betriebe, Wien 2015 Larrabee C.: Managing Multiple-Compressor Systems: Utilizing Controls to Improve Performance 3E Strategy, Department of Mechanical engineering, University of cape town: How to save energy and money in compressed air systems	

This Best Practice was developed by the Impawatt Project (GA No. 785041) and adapted for the GEAR@SME Project (GA No. 894356)