INDUSTRY 4.0

COST EFFECTIVE COMPRESSED AIR PRODUCTION





COST EFFECTIVE COMPRESSED AIR PRODUCTION

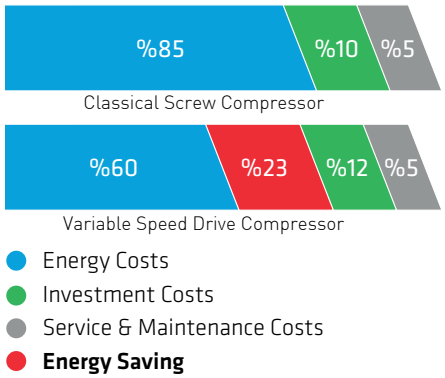
WITH VARIABLE SPEED CONTROL

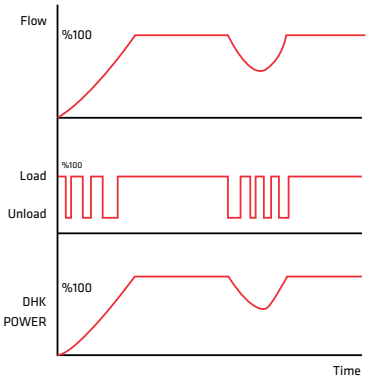
In the case of classic oil-injected load/idle compressors, the compressor consumes full power in load operation, while it consumes unnecessary energy in idle state. In Lupamat DHK series compressors, the inverter adjusts the motor speed based on the air consumption. Depending on the motor revolution, the power drawn from the network varies.

In Lupamat centrifugal fan compressors, the cooling fan saves extra energy by controlling the speed with the inverter.



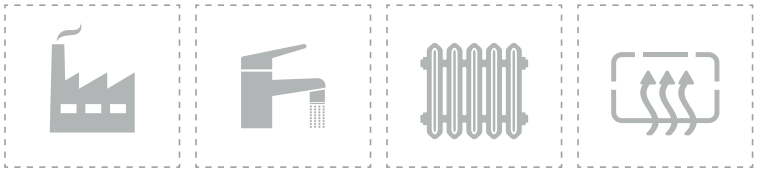
300 days / year, 12 hours / day, 0.13 € / kWh, 90kW Lupamat DHK compressor with 70% air production specifications provides a profit of 9438 € per year.





HEAT RECOVERY SYSTEM

In oil-injected compressors, the heat generated after the air and oil are compressed in the screw and the heat generated by the electric motor can be saved as energy. This heat energy allows the hot air to be directed through the hood to provide ambient heating. Additionally, hot water can be obtained by heat gain exchangers added to the oil and air circuits. The obtained hot water can be used in the process or in the radiator to be used as a ambient heater. Hence, 91% of the disposed heat energy will be recovered.

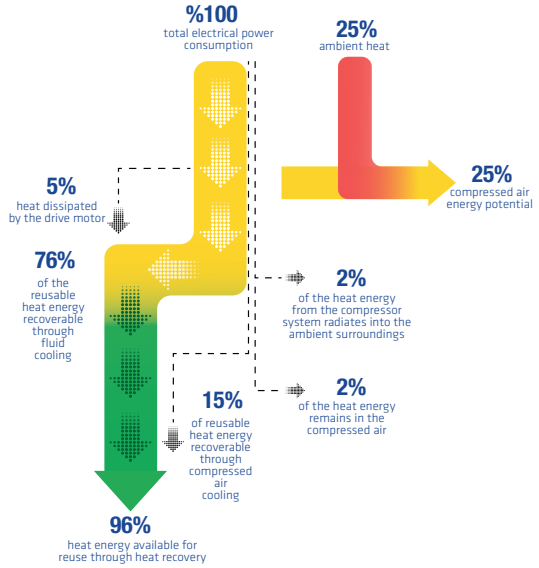




Energy Gain (kCAL / year) =
0,91 x Compressor Power (kW) x 860 (kCAL / kWh) x Annual Operating Hours (Hour)
= 0.91 x 90kW x 860kCAL / kWh x 3600Hour
=253562400 kCAL/year

Financial Gain =
Energy Gain / (kCAL / kWh) x (€ / kWh) / Heater Efficiency =
(253562400 / 860)* 0,05) / 0,85 = 17343 €/Year

Calculated according to Oil Price = 0,75 € / Liter and Heater Efficiency = 85%
Total operating hours is assumed as 3600 hour/year according to 300 days/year,12 hours/day



THE APPLICATION OF PROPORTIONAL CONTROL VALVE

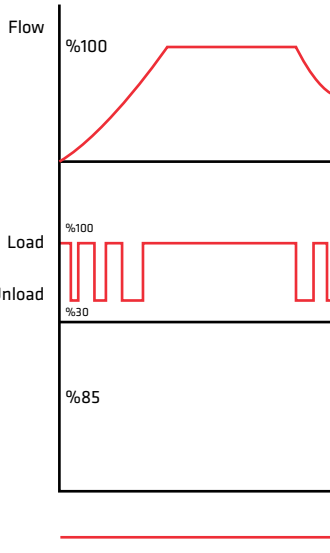
In load/idle compressors, the suction flap is controlled by a proportional control valve and brought to an intermediate position when the desired pressure is approached.

Due to the flap in the intermediate position, the compressor does not go into idle state, therefore unnecessary energy loss in the idle state is reduced. Also, a stable pressure is achieved.

Savings Calculation =
Percentage of Consumption x Compressor Power (kW) / Motor Efficiency x Yearly Operating Hours (Hour / Year) x Proportional Control Valve Efficiency
= 0.7 x (90 kW / 0.95) x 3600 Hours / Year x 0.15 = 35810kWh / Year

Financial Saving =
0,13 € / kWh x 35810kWh / Year = 4655 € / Year
Proportional Control Valve Efficiency was established at 15% at 70% consumption.

Due to the prolonged time spent in load state, the working life of bushings and flaps of pneumatic systems and suction control valve is extended.



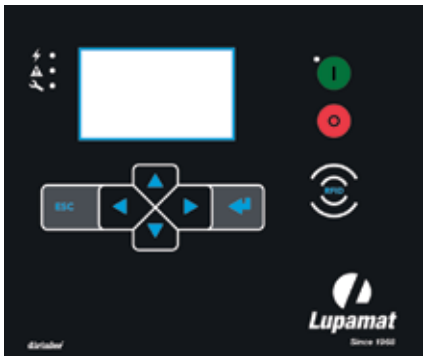


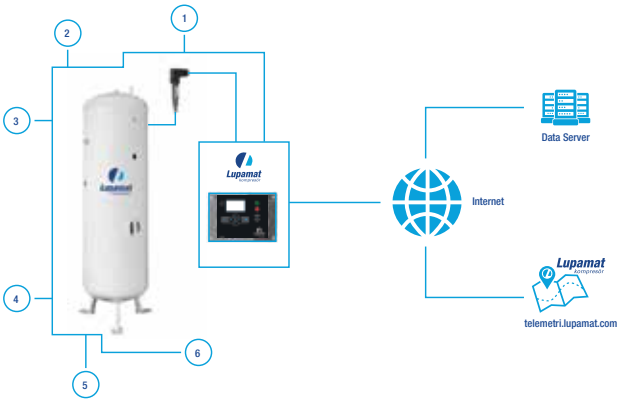
CENTRAL MANAGEMENT SYSTEM

Central management system communicates with Lupamat control panels at multiple compressor stations and compressors are activated according to the consumption need and the compressor age. Therefore, the energy loss caused by needlessly activated compressors is prevented. It keeps the operating hours of compressors with comparable power at an equal.
Thus, maintenance planning can be done.

In case of failure, it activates the backup compressor. It manages up to 6 compressors.
The telemetry system automatically informs the user in case of malfunction or maintenance by e-mail. It also directly communicates with "Lupamat Telemetry System" and provides the trouble shooting immediately.

Remote Monitoring System allows easy monitoring of compressor maintenance times, failure records and pressure, temperature information. Via the Remote Monitoring System, predictive maintenance can be carried out, and the blockages at air or separator filters can be detected. Unforeseen downtimes can be prevented by detecting possible problems in advance.









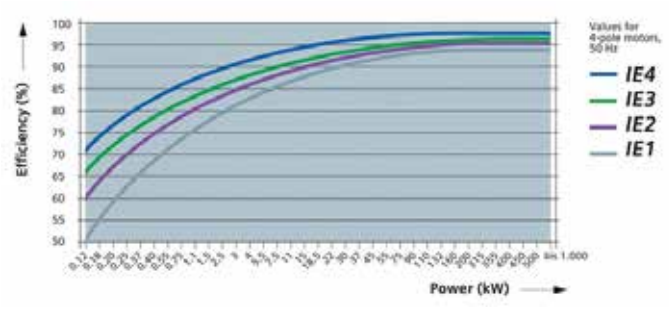
EFFICIENT MOTOR USE

The main engines and fan motors are used in screw compressors.
The efficiency of these motors is classified as IE1, IE2, IE3, IE4 according to IEC60034-2-1.
These efficiencies vary based on motor brand and type.
Lupamat compressors use IE3 / IE4 efficient motors for PLUS and PREMIUM series.

Energy Consumption Calculation = Motor Power (kW) / Motor Efficiency x Yearly Operating Hours (Hour / Year) x Electricity Unit Price (€ / kWh)
3.1% energy gain from using IE4 efficiency class engine instead of IE1.

IE4	%96,5	335751 kWh/Year	43648 €/Year	% 3,1
IE3	%95,2	340336 kWh/Year	44244 €/Year	% 1,7
IE2	%94,6	342494 kWh/Year	44254 €/Year	% 1,1
IE1	%93,5	346524 kWh/Year	45048 €/Year	% 0

**The data on the table is calculated for 90kW, 3000 rpm motor.*
Unit Price of Electricity 0.13 €/kWh.



EFFICIENT ACCESSORY USE



Coupling : In belt/pulley mechanisms, efficiency loss due to friction is 1-2%. These losses can be avoided by using couplings.



Air / Oil Seperator : LUPAMAT brand air / oil separators provide long-term use, lower resistance and lower oil consumption. Inefficiencies caused by pressure loss due to poor quality or clogged separator leads to 3% increased cost.



Air Filter : MANN / HUMMEL brand air intake filters ensure long-term operation and lower resistance. The blockage status of the filter can be monitored from the screen via the 50 mbar blockage sensor. A compressor operating with a clogged filter (100 mbar) causes 10% inefficiency in air production.



Oil Filter : LUPAMAT brand oil filters provide long-term use and efficient particle filtration. These filters prolong the oil life. The clogging status of the filter can be monitored via the sensor that detects the blockages at the filter. Due to the lack of adequate lubrication in a compressor operating with a clogged oil filter, the temperature will rise and the screw rotors will be damaged. Our filters have a bypass feature as standard

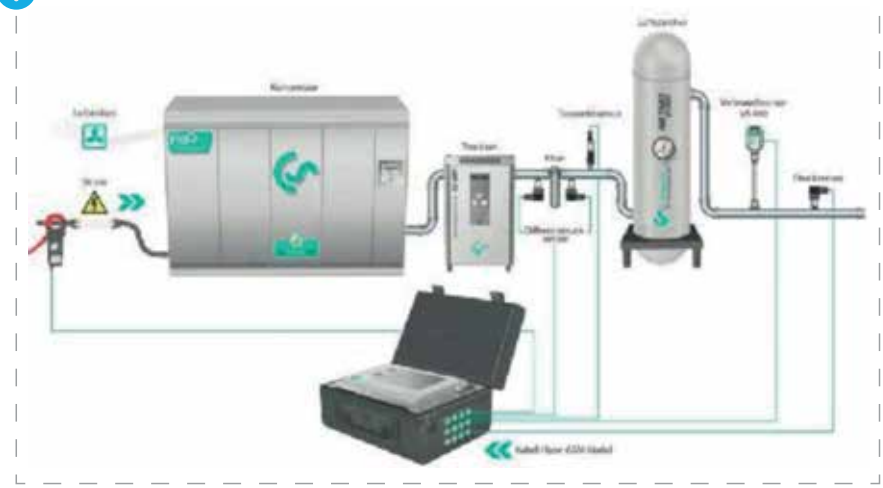
Additional pressure losses due to clogging of the dryer filters are also cause for extra energy consumption. For this reason, it should be preferred that the filters have pollution indicator.

Lupamat Compressor has 2 years standart warranty for all his products.

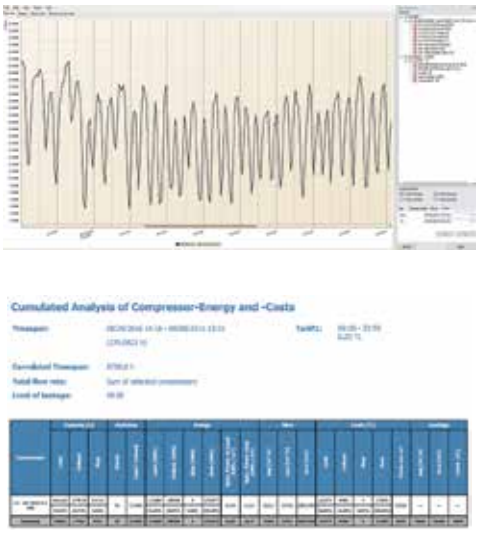
The warranty periods can be extended to 4 years with periodic maintenance agreements.

EXPERT PERSONNEL CONSULTANCY

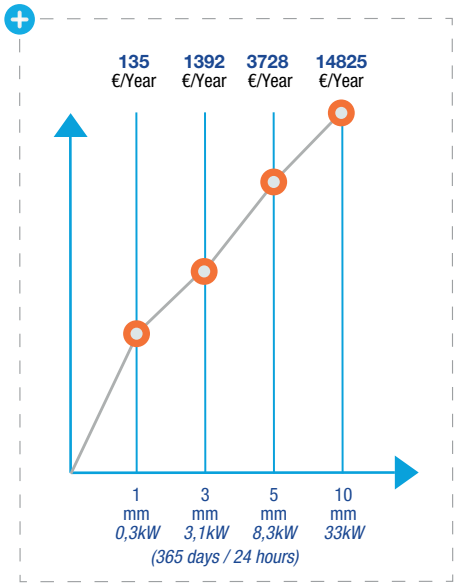
Choosing the right compressor according to the facility's changing needs for flow, pressure, air quality and consumption amount. Selection of the appropriate compressor housing and its design, consultancy about the installation of in-house pipelines Measuring and analyzing the current capacity Air consumption prediction and cost analysis for the future based on this recorded data Real consumption flow rate measurement via thermal mass measurement method.



For chosen compressors with wrong pressures (10Bar - 7.5Bar);
= 0.7 x 15,7kW x 3600 Hour/Year = 39564 kWh/Year
Earnings = 39564kWh/Year x 0,13 € / kWh = 5143 €
90kW compressor selection,
70% consumption,
Electricity Unit Cost 0,13 € / kWh



LEAKAGE CONTROL
AND REDUCTION



** 6 bar air pressure Electricity Unit Price: 0,13 €/kWh*

Air leaks in the system are an important opportunity to save energy. Air leaks usually occur at safety valves, pipe and hose connections, cut-off valves, and pneumatic tools. One of the following methods can be used for leak detection;

Ultrasonic Detector : Picks up and amplifies the sound of leaks and turns it into an audible sound.

Soap Bubbles : Applied to junctions and valves. This method is suitable for small amounts of leaks.

Perfume Use : A perfume with a strong smell is placed at the air intake of the compressor. Leakage areas will be detectable via the perfume smell they give off.

Branch Isolation : All branches should be examined. The air-consuming elements in the branch are closed. A pressure gauge is placed on the branch. Branch inlet is isolated from the main distribution line via valves etc. If the pressure falls, there is an air leak.





Leakage Calculation for Load/Idle Compressor: (QxT)/(T+t)

T : Operation time on load t : Idle time Q : Compressor capacity
General Leakage Calculation: V x (P1-P2)/ T x 0,0354
V : Total Volume (m^3) P1 : Initial pressure (Bar)
P2 : Pressure after time T (Bar)
T : Measured duration (Minute)

LUPAMAT COMPRESSOR:	OTHER COMPRESSOR:
AIR END: VMX160 RD: AERZENER	AIR END: VMX110 RD :AERZENER
PRESSURE: 10 BAR	PRESSURE: 10 BAR
POWER CONSUMPTION: 110 KW	POWER CONSUMPTION: 110 KW
FAD:16,7 M3/MIN.	FAD:15,4 M3/MIN.
ROTATION OF AIR END: 2280 RPM	ROTATION OF AIR END: 4085 RPM
SPECIFIC POWER:6,58 KW/M3/MIN.	SPECIFIC POWER: 7,14 KW/M3/MIN.
(shaft power)	

FOR EXAMPLE: IF THE COMPANY WORKS 8000 HOURS IN 1 YEAR AND NEED 15 M3/MIN. AIR CAPACITY
7,14-6,58)X15X8000X0,13€ =8.736 €
AIR END PRICE DIFFERENCE : 2800€