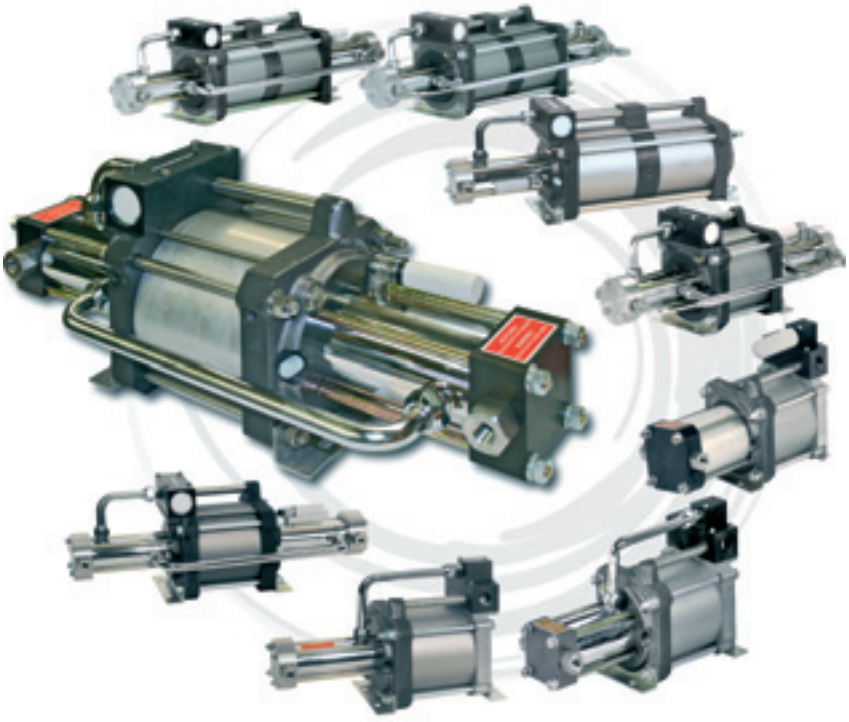
MAXIMATOR®

HIGH PRESSURE TECHNOLOGY · HYDRAULICS · PNEUMATICS · TESTING EQUIPMENT

Operating Instructions Compressors



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MAXIMATOR

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1 Basic information

High-pressure compressors made by MAXIMATOR are suitable for oil-free compression of gases and compressed air. The compressors are mainly employed in:

- ❒ Pressure tests with gases
- ❒ Transfer of gases
- ❒ Gas recuperation
- ❒ Charging of nitrogen accumulators
- ❒ Feeding of seal gas system
- ❒ Gas-assisted processes
- ❒ CO_2 foaming
- ❒ Filling of aqualung cylinders
- ❒ Leakage testing

Commercially available gases, such as argon, helium and nitrogen, can be compressed to pressures up to 1500 bars.

1.1 Notes on the Operating Instructions

These present Operating Instructions describe the configuration of compressors and provides information relating to their appropriate operation and maintenance. Please, thoroughly study the Operating Instructions prior to the first use of a MAXIMATOR compressor. The Operating Instructions facilitate a swift understanding of all technical details and contain all necessary information for proper utilisation of our compressors. The Operating Instructions include technical data, a technical description, and information regarding start-up, operation and maintenance. Each and any provided technical data as well as dimensions and weights are valid as at the printing date of these Operating Instructions. Such data may deviate for the actual compressor model without fundamentally changing the material information and lose validity. Deviations from narrative and pictorial information depend on the respective specific technical features and accessories, which means that the customer may not derive any claims whatsoever from such. Please, make sure to comply with all maintenance, erection and operating notes provided in these present Operating Instructions to ensure full function and safety. MAXIMATOR compressors may only be used for applications and purposes listed in these Operating Instructions. The manufacturer will not recognise any claims due to inappropriate operation and insufficient maintenance. Please, make sure to note and observe all documentation regarding compressor components and all other documents and records attached in the annex thereto. All relevant accident prevention regulations and other generally accepted safety requirements must be observed and complied with.

1.2 Use to the intended purpose

MAXIMATOR compressors may only be operated with media for which they are suitable according to the media endurance schedule. Any other media have to be tested by us for compatibility with compressor materials prior to their use. Compressor drives are rated for compressed air up to 10 bars, other gases than those indicated have to be tested by us for compatibility with compressor materials prior to their use. Changes at, and modifications of, compressors are not permitted for safety reasons. All maintenance, erection and operating notes provided in these Operating Instructions have to be complied with in order to ensure full functioning and safety.

1.3 Warranty and liability

As a rule, the „General Conditions of Sale and Delivery" provided by the compressors manufacturer are valid.

Warranty and liability claims in case of personnel injury and/or property damage shall be excluded when such are attributable to one or more of the below causes:

- ❒ Use of a compressor to other than the intended purpose.
- ❒ Inappropriate start-up, operation and/or maintenance of a compressor.
- ❒ Changes at a compressor.
- ❒ Operation of a compressor with defective safety installations improperly mounted safety and protection installations.
- ❒ Non-observance of notes and advices given in these Operating Instructions regarding compressor start-up, operation and maintenance.
- ❒ Insufficient monitoring of compressor components that are subject to wear and tear.
- ❒ Inappropriate repair work.

2 Safety notes

2.1 General safety directives

Safety of the machines is governed by the below EC Directives:

- ❒ Directive 89/655/EEC
- ❒ Accident prevention regulations VSG 1.1, VSG 3.1
- ❒ Machine Directive 98/37/EC, Annex II A

as well as the applied harmonised standards

- ❒ EN ISO 12100-1 and 12100-2, EN 294, EN 349, EN 418
- ❒ Accident prevention regulations of German Employers' Liability Insurance Association [*Berufsgenossenschaft*]

Compressors may emanate hazards when used by non-skilled personnel, inappropriately or for any other than the intended purpose.

Every person that is ordered to operate or maintain the compressors must have read and understood the complete Operating Instructions prior to carrying out any of such operations. This applies also when the person already with the compressors or received training on compressors.

The owner is advised to request its personnel to verify perusal of the contents of these Operating Instructions in writing. Knowledge of the contents of the Operating Instructions is one prerequisite to protect operatives from hazards as well as avoid faults and thus operate the compressors safe and without disturbances or malfunctions. The Operating Instructions shall be accessible to operating and maintenance personnel at any time! Responsibility for accident-free operation of compressors is the owner or its authorised personnel that is employed in operating or maintaining the compressors.

All notes regarding labour safety refer to the currently valid regulations in the European Community. The applicable laws and national regulations have to be kept in other countries. Both in the European Community and in non-EU countries, the owner is obliged to determine the present status of codes and regulations. Beside the labour safety notes in these Operating Instructions, the generally valid safety and accident prevention regulations must be observed and complied with.

All information provided in these Operating Instructions has to be observed without any restrictions!

2.2 Symbols and signal words

HAZARD

Types and sources of hazards that may result in serious personal injuries or death.
Measures to avert such hazards.

CAUTION

Types and sources of hazards that may result in personal injuries or property damage.
Measures to avert such hazards.

NOTE

Advice for users and useful information.

NOTE

Environmental impacts

2.3 Fundamental Safety measures

2.3.1 Technical condition

Please, observe the following:

- ❒ In order to avoid hazards and ensure optimal performance, do not carry out any changes or modifications at the compressors.
- ❒ The user is obliged to operate the compressors in an appropriate and safe operating condition. The technical condition must conform to all statutory requirements and regulations.
- ❒ Inspect the compressors prior to each start-up for damage and appropriate condition.
- ❒ Any changes at the compressors that have an impact on their safety have to be reported by personnel at once to the owner.

2.3.2 Safety notes relating to compressor operation

Check the compressors for operating safety prior to each start-up!

Observe the following safety notes during compressor operation:

- ❒ All generally valid safety and accident prevention regulations have to be observed!
- ❒ Make sure to know all installations, actuators and controls as well as their functions prior to starting the compressors!
- ❒ Caution at all pneumatically actuated parts!
- ❒ Make sure during the entire operation that on-site conditions are conducive to the application of the compressors.
- ❒ Stop the compressors at once when any changes are noticed during their operation.

CAUTION

Make sure to observe all applicable safety regulations when compressing hazardous gases.

CAUTION

Make sure to depressurise the compressors prior to starting any work on the units.

CAUTION

Setting and repair work may only be carried out by certified workshops!

2.3.3 Safety notes relating to maintenance and repair

Operating disturbances that are caused by insufficient or inappropriate maintenance may result in very high repair costs and long downtimes of the compressors. The manufacturer will not assume any liability for damage that is due to inappropriate maintenance and care! Required maintenance intervals are specified in a maintenance schedule.

Please, observe the following:

- ❒ The compressors may only be serviced, maintained and repaired by service personnel of the manufacturer or specifically trained and instructed skilled personnel.
- ❒ Each and any maintenance and repair work at the compressors may only be carried out when the compressors have been switched off and depressurised.

2.3.4 Requirements to owner's personnel

- ❒ The hazards that may emanate from the compressors have to be pointed out to personnel before starting any work.
- ❒ Hazards of injury may emanate from the compressors when not operated by properly skilled persons.
- ❒ Each person that is instructed to start up, maintain or repair the compressors must have completely read and understood these Operating Instructions.
- ❒ The Operating Instructions must be accessible to the personnel at any time. It is recommended that taking note of the contents of the Operating Instructions be documented in writing.
- ❒ Upon instruction of the owner personnel has to wear protective clothing.
- ❒ All Safety notes in these Operating Instructions and in all pertaining documents must be observed and complied with at any time and without any restrictions.
- ❒ A compressor has to be immediately switched off when hazards are detected that may result in personal injury.
- ❒ Personnel must have well-founded knowledge of the following operational sequences, in-house regulations and behaviours:

  - Operating sequences of the compressors

  - Limitation, safeguarding and marking of hazard zones

  - Behaviour and measures in cases of hazards or emergency

2.4 Specific safety notes

2.4.1 Safety in case of emissions

Depending on the specific type of application, expanding compressed air will generate a certain noise level. Air leaving the silencer may be soiled with water, oil or grease. It is also possible that small ice crystals form at the silencer that may come loose and hurl away. Persons near running compressors may have to wear protective goggles and, as the case may be, ear protection.

2.4.2 Safety in case of defective compressors

During operation of the compressors, both the drive part and the high-pressure part are under pressure. Exiting gases are under high pressure after a defective but also during normal operation and must not be caught or deflected by objects or body parts. It must be ensured that upon a defect, the compressor concerned is immediately depressurised and repaired.

HAZARD

Maintenance and repair work may only be carried after the compressors were depressurised.

2.4.3 Safety at the place of installation

The compressors must not be operated in confined containers. Drive air flowing out may burst the container. Hydraulic bolted unions at suction and pressure nozzles must not be loosened. Bolted unions must be firmly tightened to avoid leakages and damage. Compressors must be installed so that controls and actuating elements as well as bolted unions are freely accessible at any time.

3 Technical Description

Basically, MAXIMATOR compressors operate according to the pressure intensifier principle. Large areas are charged with a low pressure (air piston) and generate via the small surface areas a high pressure (HP piston). Pulsation is generated by an impulse-controlled 4/2-way valve (servo-valve). The servo-valve alternately admits pressure to the top and bottom side of the air piston. The servo-valve is selected via two 2/2-way valves (pilot valves) which are mechanically actuated by the air piston in its stop positions. The pilot valves aerate and ventilate the actuation compartment of the servo-valve. Drive air provides the restoring force for the servo-valve. In the actuation compartment, the servo-valve has a larger effective area than in the control compartment to which compressed air is continually admitted. The HP piston generates the volume flow by means of check valves (intake valve, pressure valve). The outlet pressure depends on the pre-selected drive pressure. The formulae in chapter 3.5 „Calculation of final pressure" can be used to calculate the static final pressure. The compressor comes to a stop upon reaching the final pressure and ceases to consume air. The compressor only re-starts upon a pressure drop on the high-pressure side or a pressure increase on the drive side.

3.1 Functioning of a high-pressure compressor

Drive air-flows from the port (7) through the servo-valve (8) to the bottom side of the air piston (9). The air piston moves to the right. An intake stroke is carried out on the left side. The inlet valve (2) opens and the gas to be compressed flows through the port (S) into the compression compartment of the compressor. A pressure stroke is carried out on the right side. The inlet valve (12) shuts. The outlet valve (10) opens and the compressed gas flows out of the port (P). When the air piston (9) has reached its right stop position, it actuates the pilot valve (13). Control air gets from the port (5) through the opened pilot valve (13) to the large servo-valve side. The servo-valve (8) is moved into the other switching position and drive air is now charged to the right side of the air piston (9). The piston moves to the left. Now the compressor carries out a pressure stroke on the left side and an intake stroke on the right side. Expanding drive air leaves the working compartment through the silencer (6). In compressors with a pressure ratio > 5 air is led through cooling cylinders and used to cool the high-pressure parts.

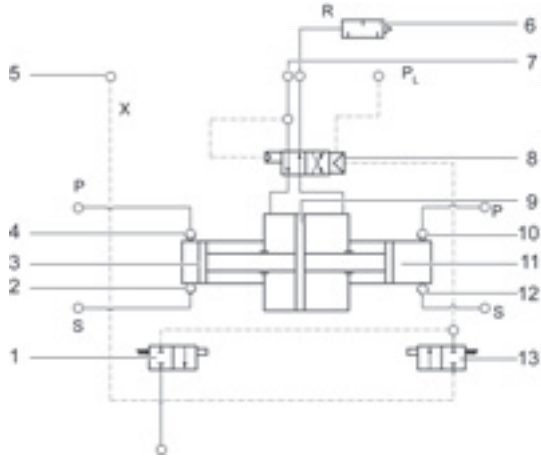


Fig. 1: Functioning principle of a compressor

1 Pilot valve
2 Inlet valve
3 HP piston
4 Outlet valve
5 Pilot valve Air
6 Outlet Drive air
7 Air port
8 servo-valve
9 Air piston
10 Outlet valve
11 HP piston
12 Inlet valve
13 Pilot valve

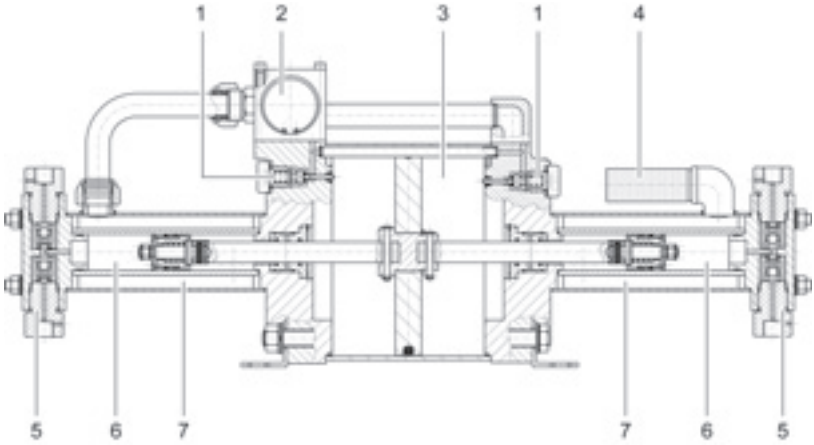


Fig. 2: Compressor components (Example)

1 Pilot valve
2 servo-valve
3 Drive part
4 Silencer
5 Compressor head with inlet/outlet valve
6 HP part
7 Cooling cylinder

3.2 Overview of compressors

Designation	Figure	Brief characteristic
DLE 2-1		❑ Output capacity 150 l_N/min at 3 bars admission pressure and 6 bars operating pressure ❑ Drive pressure 6 bars ❑ small size ❑ price-efficient solution
DLE 2		❑ Output capacity 190 l_N/min at 3 bars admission pressure and 10 bars operating pressure ❑ Drive pressure 6 bars ❑ large stroke volume ❑ low pulsation rate
DLE 2-1-2		❑ Output capacity 160 l_N/min at 3 bars admission pressure and 10 bars operating pressure ❑ Drive pressure 6 bars ❑ small size ❑ high operating pressure
DLE 2-2		❑ Output capacity 205 l_N/min at 3 bars admission pressure and 16 bars operating pressure ❑ Drive pressure 6 bars ❑ high operating pressure ❑ low pulsation rate
DLE 5-1		❑ Output capacity 145 l_N/min at 8 bars admission pressure and 15 bars operating pressure ❑ Drive pressure 6 bars ❑ compact model ❑ price-efficient solution

Designation	Figure	Brief characteristic
DLE 5		❑ Output capacity 145 l_N/min at 8 bars admission pressure and 15 bars operating pressure ❑ Drive pressure 6 bars ❑ compact model ❑ price-efficient solution
DLE 2-5		❑ Output capacity 80 l_N/min at 2 bars admission pressure and 25 bars operating pressure ❑ Drive pressure 6 bars ❑ compact model ❑ price-efficient solution
DLE 5-1-2		❑ Output capacity 145 l_N/min at 8 bars admission pressure and 30 bars operating pressure ❑ Drive pressure 6 bars ❑ High admission pressure ❑ high operating pressure
DLE 5-2		❑ Output capacity 210 l_N/min at 8 bars admission pressure and 40 bars operating pressure ❑ Drive pressure 6 bars ❑ high output capacity ❑ low pulsation rate
DLE 2-5-2		❑ Output capacity 104 l_N/min at 4 bars admission pressure and 40 bars operating pressure ❑ Drive pressure 6 bars ❑ high operating pressure ❑ low admission pressure
DLE 15-1		❑ Output capacity 95 l_N/min at 15 bars admission pressure and 50 bars operating pressure ❑ Drive pressure 6 bars ❑ small size ❑ price-efficient solution

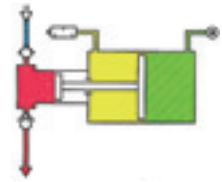
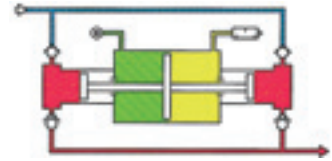
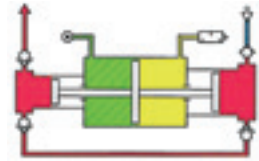
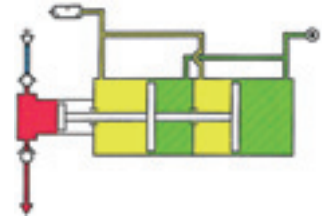
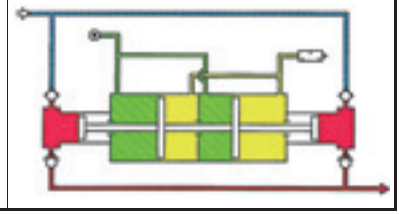
Designation	Figure	Brief characteristic
DLE 15		❑ Output capacity 160 l_N/min at 15 bars admission pressure and 60 bars operating pressure ❑ Drive pressure 6 bars ❑ Large stroke volume ❑ low pulsation rate
DLE 5-15		❑ Output capacity 75 l_N/min at 4 bars admission pressure and 60 bars operating pressure ❑ Drive pressure 6 bars ❑ high output capacity ❑ low admission pressure
DLE 15-1-2		❑ Output capacity 90 l_N/min at 15 bars admission pressure and 80 bars operating pressure ❑ Drive pressure 6 bars ❑ high pressure ratio ❑ small size
DLE 15-2		❑ Output capacity 130 l_N/min at 15 bars admission pressure and 100 bars operating pressure ❑ Drive pressure 6 bars ❑ high pressure ratio ❑ low pulsation rate
DLE 5-15-2		❑ Output capacity 102 l_N/min at 10 bars admission pressure and 120 bars operating pressure ❑ Drive pressure 6 bars ❑ high operating pressure ❑ low admission pressure
DLE 30-1		❑ Output capacity 82 l_N/min at 25 bars admission pressure and 83 bars operating pressure ❑ Drive pressure 6 bars ❑ small size ❑ price-efficient solution

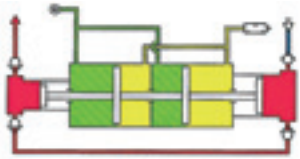
Designation	Figure	Brief characteristic
DLE 30		❑ Output capacity 125 l_N/min at 25 bars admission pressure and 120 bars operating pressure ❑ Drive pressure 6 bars ❑ high output capacity ❑ low pulsation rate
DLE 5-30		❑ Output capacity 63 l_N/min at 3 bars admission pressure and 100 bars operating pressure ❑ Drive pressure 6 bars ❑ high output capacity ❑ low admission pressure
DLE 15-30		❑ Output capacity 98 l_N/min at 15 bars admission pressure and 100 bars operating pressure ❑ Drive pressure 6 bars ❑ high output capacity ❑ high admission pressure
DLE 30-1-2		❑ Output capacity 82 l_N/min at 25 bars admission pressure and 150 bars operating pressure ❑ Drive pressure 6 bars ❑ high compression rate ❑ small size
DLE 30-2		❑ Output capacity 125 l_N/min at 25 bars admission pressure and 150 bars operating pressure ❑ Drive pressure 6 bars ❑ high compression rate ❑ high output capacity
DLE 5-30-2		❑ Output capacity 52 l_N/min at 4 bars admission pressure and 150 bars operating pressure ❑ Drive pressure 6 bars ❑ high compression rate ❑ low admission pressure

Designation	Figure	Brief characteristic
DLE 15-30-2		❑ Output capacity 105 l_N/min at 30 bars admission pressure and 200 bars operating pressure ❑ Drive pressure 6 bars ❑ high output capacity ❑ low admission pressure
DLE 75-1		❑ Output capacity 85 l_N/min at 70 bars admission pressure and 240 bars operating pressure ❑ Drive pressure 6 bars ❑ small size ❑ price-efficient solution
DLE 75		❑ Output capacity 150 l_N/min at 75 bars admission pressure and 300 bars operating pressure ❑ Drive pressure 6 bars ❑ small stroke volume ❑ low pulsation rate
DLE 15-75		❑ Output capacity 75 l_N/min at 11 bars admission pressure and 200 bars operating pressure ❑ Drive pressure 6 bars ❑ low admission pressure ❑ high operating pressure
DLE 30-75		❑ Output capacity 95 l_N/min at 30 bars admission pressure and 250 bars operating pressure ❑ Drive pressure 6 bars ❑ low admission pressure ❑ high output capacity
DLE 75-1-2		❑ Output capacity 90 l_N/min at 70 bars admission pressure and 400 bars operating pressure ❑ Drive pressure 6 bars ❑ high pressure ratio ❑ small size

Designation	Figure	Brief characteristic
DLE 75-2		❑ Output capacity 130 l_N/min at 70 bars admission pressure and 400 bars operating pressure ❑ Drive pressure 6 bars ❑ low pulsation rate ❑ high output capacity
DLE 15-75-2		❑ Output capacity 50 l_N/min at 15 bars admission pressure and 500 bars operating pressure ❑ Drive pressure 6 bars ❑ high pressure ratio ❑ low admission pressure
DLE 30-75-2		❑ Output capacity 60 l_N/min at 40 bars admission pressure and 600 bars operating pressure ❑ Drive pressure 6 bars ❑ high pressure ratio ❑ high admission pressure

3.3 Compressor designs

Technical characteristics	Design
Compressors with one drive piston	
One-stage, single-acting (e.g. DLE 15-1)	
One-stage, double-a(e.g. DLE 15)	
Two-stage (e.g. DLE 15-75)	
Compressors with two drive pistons	
One-stage, single-acting (e.g. DLE 15-1-2)	
One-stage, double-acting (e.g. DLE 15-2)	

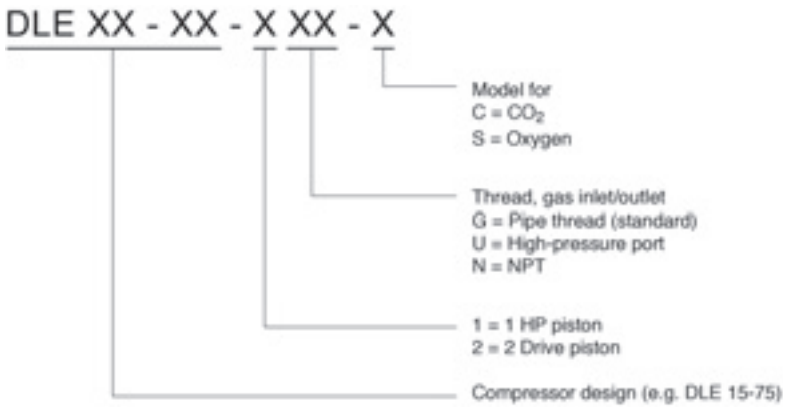
Technical characteristics	Design
Two-stage (e.g. DLE 15-75-2)	
Legend	P_L Luftantrieb — P_A Gasvordruck P_B Betriebsdruck — Abluft Luftantrieb = Air drive Gasvordruck = Gas admission pressure Betriebsdruck = Operating pressure Abluft = Exhaust air

3.4 Type ordering code

NOTE

Type ordering codes are required for ordering compressors.

The type ordering code for our compressors is structured as follows:



3.5 Calculation of final pressures

The static final pressure of a compressor is calculated for the respective compressor type with the following formulae:

Compressor type	Calculation of static final pressure
Single-acting one-stage e.g. DLE 5-1	PB = PL * i
Double-acting one-stage e.g. DLE 15	PB = i * PL + PA
Two-stage e.g. DLE 5-30	PB = i2 * PL + i2 / i1 * PA
Single-acting one-stage with 2 drive parts e.g. DLE 15-1-2	PB = PL * i
Double-acting one-stage with 2 drive parts e.g. DLE 30-2	PB = i * PL + PA
Two-stage with 2 drive parts e.g. DLE 15-75-2	PB = i2 * PL + i2 / i1 * PA
Legend: PB PL PA i i1 i2	 Operating pressure Drive pressure Gas admission pressure Pressure ratio Pressure ratio Stage 1 Pressure ratio Stage 2

4 Erection and start-up

4.1 General notes on erection at place of application

Our compressors can be installed in any desired position. A vertical position entails certain advantages for the durability of sealings because then gravity will not have to be absorbed by any of the sealings. Fixing angles are provided for fastening the compressors. Make sure to avoid ingress of any foreign matter into the compressor ports during erection (e.g. drilling dust during wall mounting). Remove the blind plugs from compressor ports only just prior to fastening the respective ports.

4.2 Compressed air system

The compressed-air port requires mounting of a compressed air control unit made by MAXIMATOR downstream of the compressor. The compressed air control unit consists of pressure filter, water separator, shut-off valve, pressure controller, pressure gauge and, if need be, safety valve.

Fig. 3: Compressed air control unit

If the owner of the compressor does not install a compressed air control unit, compressed air quality has to be ensured according to the requirements of the manufacturer.

Requirements to compressed air quality:

- ❑ Solid matter
  Maximum particle size 5 µm
  Maximum particle concentration 5 mg/m³
- ❒ Dew point
  Up to +10 °C, water content of 9.4 g/m³
  Up to + 2 °C, water content of 5.6 g/m³

4.2.1 Compressed air lubrificator

A compressed air lubrificator is not necessarily required. All moving compressor parts are treated with special grease during erection. The grease may become gummy when the compressor is operated with extremely dry air for a longer period of time. Use of a compressed air lubrificator is recommended in such cases.

CAUTION

After use of a compressed air lubrificator the compressor must never be operated without this oiler. The oil of the compressed air lubrificator purges grease from the compressor so that permanent lubrication cannot be ensured. Special grease made by the manufacturing company may be used for re-lubrication. When employing a compressed air lubrificator, the oil content of compressed air should be 1 mg/m³ to 5 mg/m³.

4.2.2 Pipe cross sections

The compressed air port must not be specified smaller than the port thread. Reduction to smaller port threads may result in performance losses and malfunctions of the compressor. Excessively long supply pipes may give rise to problems due to pressure drop in smaller pipes.

4.2.3 Direct pilot-valve air

The compressors are designed for operation with direct pilot-valve air. The pilot-valve air should be connected upstream of the pressure controller in the drive air pipe. The compressor can reverse better at lower drive pressures. However, the compressor does not function when the direct pilot-valve air is not connected.

4.3 High-pressure system

The employed HP pipes and accessories parts must be matched to the compressor as regards pressure and cross sections. Otherwise the performance capacity and safety of the compressor may be impaired.

4.3.1 Inlet

The compressors have to e charged with the admission pressure of the gas to be compressed in order to achieve economically efficient output capacities and the indicated final pressures. Compressors with a pressure ratio of 2 can be operated without admission pressure. When there is no admission pressure available, an optimal compressor performance can only be realised by an under-pressure tight intake pipe because compressor medium may be soiled by ambient air. Cutting-ring bolted unions must not be used. A filter with a maximum mesh width of 10 µm has to be installed into the admission pressure pipe in order to avoid damage at intake and pressure valves as well as the HP sealing.

4.3.2 Pressure pipe

The pressure pipe and the pertaining accessories must withstand the maximum outlet pressure of the compressor. The pressure strength may only be fallen short of when an adequate safety valve is installed in the pressure pipe. The cross section of the pressure pipe must not be smaller than that of the pressure port. A smaller cross section will reduce output capacity and lead to higher warming of the compressor medium.

4.3.3 Compressor medium

The compressors may only be used for media that are listed in the media endurance schedule. Any other media have to be tested before utilisation by MAXIMATOR for compatibility with compressor materials.

4.4 Start-up

The compressor starts to convey medium as soon as drive air and direct pilot-valve air are available. Escaping drive air is used for cooling HP parts in compressors with higher pressure ratios. When the compressor runs in continuous operation with a high stroke frequency, there may be strong warming of the compressor despite cooling. This may result in excessive wear and tear at sealings. In order to avoid overheating it is necessary to monitor the temperature of the compressed gas. Temperatures in excess of 100 °C at the compressor outlet have to be avoided.

5 Maintenance and servicing

5.1 Maintenance notes

The air drives of all compressors are pre-treated with high-performances grease during erection and require no other form of lubrication. During maintenance and servicing work of the compressors, the servo-valves and air pistons shall be treated with an acid- and silicon-free high-performances grease provided by the manufacturing company.

5.2 Servicing

Possible fault	Cause of fault	Fault removal
Compressor fails to run at low air pressure.	Friction of O-rings on servo-valve is too high.	❒ Re-lubricate. ❒ Replace O-rings on servo-valve.
	O-rings swell due to use of wrong oil or lubricant.	❒ Change O-rings. ❒ Use acid- and silicon-free lubricant.
Compressor fails to run or operates only slowly.	Exhaust or servo-valve covered with ice.	❒ Dewater compressed air with water separator.
	Formation of residue in the silencer.	❒ Clean the silencers. ❒ Replace, if need be.
Compressor fails to run. Air escapes through the exhaust.	O-rings at servo-valve are defective.	❒ Change and grease O-rings.
	O-ring at air piston is defective or worn out.	❒ Change and grease O-ring.
Compressor fails to run. Air flows through small boring at servo-valve housing.	Servo-valve is hung up.	❒ Clean servo-valve and sleeve. ❒ Check O-rings and sleeve and replace, if need be. ❒ Lubricate.
Compressor fails to run. Air escapes through small boring in bottom cap.	Pilot valve in top or bottom cap is hung up.	❒ Clean and grease pilot valve. ❒ Check for wear and tear and replace, if need be.
Compressor runs with high frequency and short strokes.	Pilot valve in top or bottom cap is defective.	❒ Clean and grease pilot valve and replace, if need be.

5.3 Repair

NOTE

Repair instructions for the compressors can be found on the Internet at www.maximator.de.

CAUTION

Repair work has to be carried out by qualified skilled operatives. Make sure to observe absolute cleanliness. Minor impurities may cause serious damage at precision-machined compressor components.

NOTE

You can ship defective compressors for repair to MAXIMATOR. All repair work is conducted by qualified personnel in clean rooms.

Individual parts of the compressors can be ordered as spare parts from MAXIMATOR. Sealings are subject to high wear and tear. The order numbers and compositions of sealing kits in indicated in the respective drawing. Said drawing is part of each compressor documentation and is enclosed to the packaging of the compressors. Please, quote the serial number of the compressor when ordering spare parts. The serial number (a 6-digit number) is located on the machine plate and the compressor housing.

5.3.1 Liability for material defects

For compressors, manufacturer grants a warranty of twelve (12) months on material quality and workmanship. Said warranty commences on the compressor shipment date.

This warranty does not cover defects caused by application of inadmissible medias and foreign matter in the drive or media. This shall also apply to excision of maximum operating pressure. This warranty does also not apply to damage resulting from normal wear and tear (wear parts, such as sealings, guiding elements, etc.), improper operation and inadequate maintenance.

6 Technical data

Type	Pressure ratio (i1 / i2)	Compression ratio max.	Admission pressure min. pA	Admission pressure max. pA	Max. operating pressure bars pB	Piston capacity cm^3	Ports Inlet	Ports Outlet	Weight kg	Max. operating temp. °C
DLE 2-1	1:2	1:10	0	20	20	922	G 1/2	G 1/2	15	60
DLE 5-1	1:5	1:15	2	50	50	373	G 1/2	G 1/2	15	60
DLE 15-1	1:15	1:20	7	150	150	122	G 1/4	G 1/4	13	100
DLE 30-1	1:30	1:20	15	300	300	60	G 1/4	G 1/4	13	100
DLE 75-1	1:75	1:20	35	750	750	25	G 1/4	G 1/4	13	100
DLE 2	1:2	1:10	0	40	40	1844	G 1/2	G 1/2	20	60
DLE 5	1:5	1:15	2	100	100	746	G 1/2	G 1/2	20	60
DLE 15	1:15	1:20	7	300	300	244	G 1/4	G 1/4	18	100
DLE 30	1:30	1:20	15	600	600	120	G 1/4	G 1/4	18	100
DLE 75	1:75	1:20	35	1500	1500	50	G 1/4	G 1/4	18	100
DLE 2-5	1:2 / 1:5	1:25	0	0,8*PL	100	922	G 1/2	G 1/2	20	60
DLE 2-15	1:5 / 1:15	1:45	2	6*PL	300	373	G 1/2	G 1/2	19	100
DLE 5-30	1:5 / 1:30	1:90	2	2*PL	600	373	G 1/2	G 1/4	19	100
DLE 15-30	1:15 / 1:30	1:40	7	15*PL	600	122	G 1/4	G 1/4	19	100
DLE 15-75	1:15 / 1:75	1:100	7	3,5*PL	1500	122	G 1/4	G 1/4	19	100
DLE 30-75	1:30 / 1:75	1:50	15	20*PL	1500	60	G 1/4	G 1/4	19	100
DLE 2-1-2	1:4	1:10	0	40	40	922	G 1/2	G 1/2	22	60
DLE 5-1-2	1:10	1:15	4	100	100	373	G 1/2	G 1/2	22	60
DLE 15-1-2	1:30	1:20	10	300	300	122	G 1/4	G 1/4	20	100
DLE 30-1-2	1:60	1:20	20	600	600	60	G 1/4	G 1/4	20	100
DLE 75-1-2	1:150	1:20	45	1500	1500	25	G 1/4	G 1/4	20	100
DLE 2-2	1:4	1:10	0	40	40	1844	G 1/2	G 1/2	25	60
DLE 5-2	1:10	1:15	4	100	100	746	G 1/2	G 1/2	25	60
DLE 15-2	1:30	1:20	10	300	300	244	G 1/4	G 1/4	23	100
DLE 30-2	1:60	1:20	20	600	600	120	G 1/4	G 1/4	23	100
DLE 75-2	1:150	1:20	45	1500	1500	50	G 1/4	G 1/4	23	100
DLE 2-5-2	1:4 / 1:10	1:25	0	1,6*PL	100	922	G 1/2	G 1/2	25	60
DLE 5-15-2	1:10 / 1:30	1:45	2	12*PL	300	373	G 1/2	G 1/4	24	100
DLE 5-30-2	1:10 / 1:60	1:90	2	4*PL	600	373	G 1/2	G 1/4	24	100
DLE 15-30-2	1:30 / 1:60	1:40	7	30*PL	600	122	G 1/4	G 1/4	24	100
DLE 15-75-2	1:30 / 1:150	1:100	7	7*PL	1500	122	G 1/4	G 1/4	24	100
DLE 30-75-2	1:60 / 1:150	1:50	15	40*PL	1500	60	G 1/4	G 1/4	24	100

*Compression ratio = Operating pressure / admission pressure

Abbreviations:
pL = Air drive, pA = Gas admission pressure , pB = Gas outlet pressure

NOTE

The admissible, maximum operating temperature is 60 - 100 °C.
Water-cooling systems can be optionally provided.

Maximum stroke frequency is 90 – 110 strokes per minute at 50 % ED.

HAZARD

Under-runs of the minimum admission pressure (pA_{min}) are not admissible and may result in damage at the compressors.

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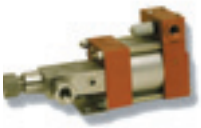

- Hochdruck-Pumpen für verschiedene Flüssigkeiten (Öl, Wasser, Emulsion usw.)
- High-pressure pumps for different liquids (oil, water, emulsion etc.)
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- Druckluft-Erhöher
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- Prüfstände für Druckprüfungen, Berstdruckprüfungen und Impulsprüfungen
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