MAXIMATOR
Maximum Pressure.

Assembly Instructions Pursuant to the Machinery Directive &
Operating Manual Pursuant to EX Directive

MAXIMATOR - Booster

Booster DLE 2 (-1, -2) – DLE 75 (-1, -2, -3)

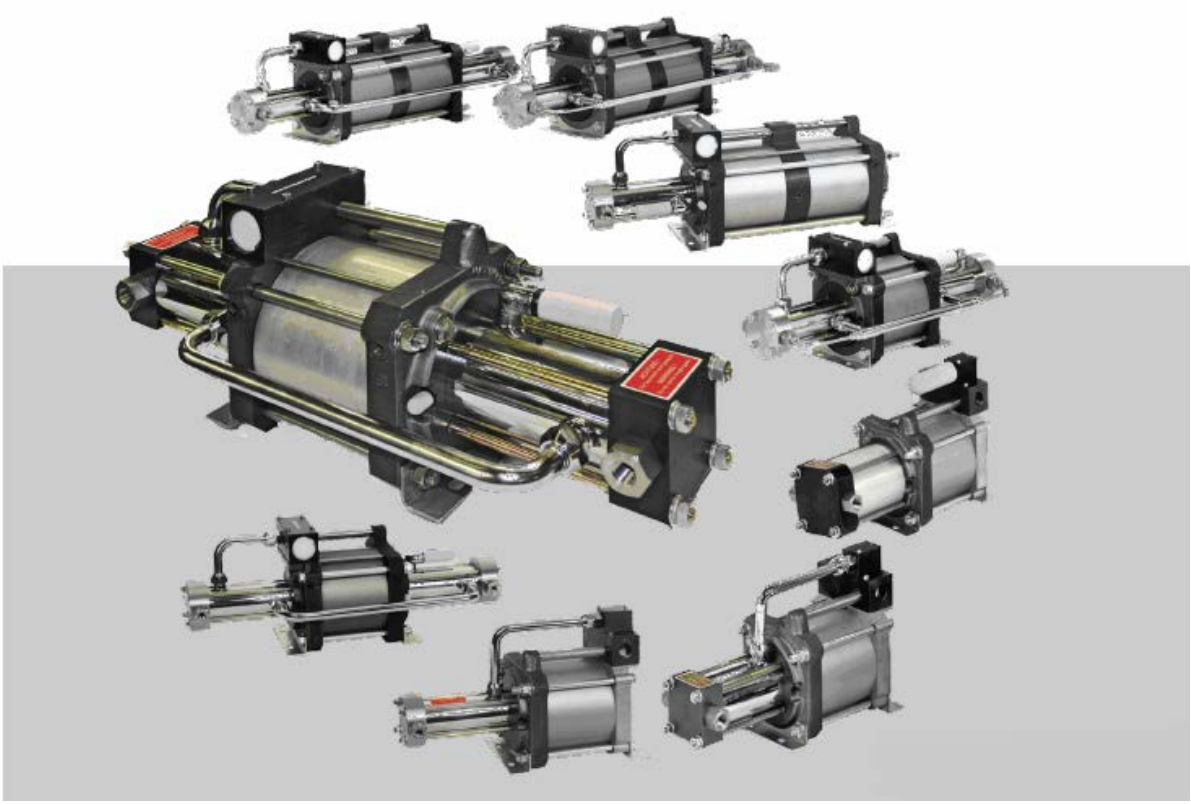

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Table of Content

1 General

1.1 Information on this manual

This manual enables safe and efficient handling of the booster. The manual is part of the booster and must be kept in the direct vicinity of the booster, accessible for members of personnel at all times.

Members of personnel must have carefully read and understood this manual before beginning work. A basic prerequisite for safe work is compliance with all specified safety information and handling instructions in this manual.

Beyond this, the local work safety regulations and general safety conditions apply for the area of use of the booster.

Illustrations in this manual are generally provided for understanding and may differ from the actual design.

In addition to this manual, the instructions for installed components in the appendix apply.

1.2 Pictogram explanation

Safety Instructions

Safety information in this manual is marked with symbols. The safety information is introduced with signal words that express the extent of the hazard.

WARNING!

This combination of the symbol and signal word refers to possible hazardous situations that can lead to light, minor, major or even fatal injury if they are not avoided.

NOTE

This combination of the symbol and signal word refers to possible hazardous situations that can lead to damage and environmental pollution if they are not avoided.

Special safety notes

The following symbols are used in safety information to draw particular attention to the dangers:

WARNING!

This combination of the symbol and signal word marks contents and instructions for correct use of the booster in areas at risk of explosion.

If a note marked like this is not taken into account, there is an increased danger of explosion and major or fatal injuries can result.

Safety notes in handling instructions

Safety notes can relate to certain, individual handling instructions. Such safety notes are embedded in the handling instructions so that they do not interrupt the reading flow when performing the action. The signal words previously described are used.

Example:

1. Loosen the screw.

2. 

ATTENTION!

Jamming danger on cover!

Carefully close the cover.

3. Tighten the screw.

Tips and recommendations

This symbol highlights useful tips, recommendations and information for efficient and trouble-free operation.

Further marks

To highlight handling instructions, results, lists, references, and other elements, the following marks are used in this manual.

Marking	Explanation
→	Step-by-step instructions
⇨	Results of steps taken
📖	Reference to sections of this Manual and other applicable documents
■	List in undefined order

1.3 Copyright

1.4 Customer service

Our customer care service is available to provide technical information and repairs.

Address	Maximator GmbH Lange Straße 6 D-99734 Nordhausen.
Phone: customer service Mon. – Fri.: 7 am – 5 pm CET	+49 (0) 3631 9533-5026 +49 (0) 175 2688386 (Service manager)
Customer hotline telephone Mon. – Fri.: 8 am – 10 pm CET Sat. - Sun. and holidays: 8 am to 8 pm CET	+49 (0) 1805 629 462 867
Fax	+49 (0) 3631 9533-5065
E-mail	service@maximator.de
Internet	www.maximator.de

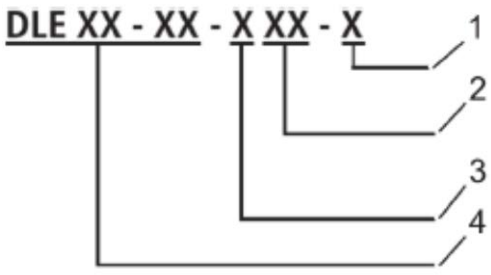
We are always interested in information and application experiences as this could be valuable for the improvement of our products.

1.5 Type plate

The type plate is found in the centre of the drive part of the booster and contains the following information:

- Manufacturer
- Type (information from the type designation code)
- Calendar week/year of construction
- Gas pressure min. inlet
- Gas pressure max. outlet
- Max. air drive
- Pressure ratio
- Max. possible compression ratio

1.6 Type designation code



The type designation code for the respective booster is structured as follows:

1 Version for C = CO_2, S = oxygen

2 Thread gas inlet and outlet G = Pipe thread (BSP - Standard), U = High-pressure connection, N = NPT

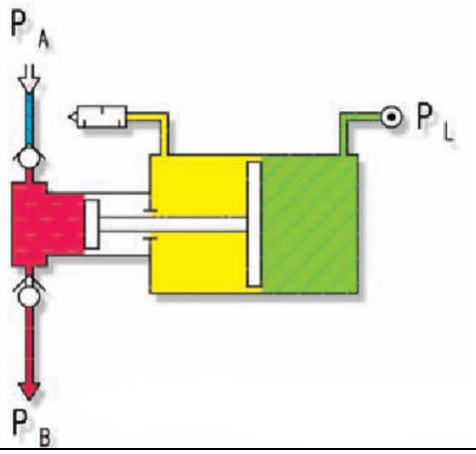
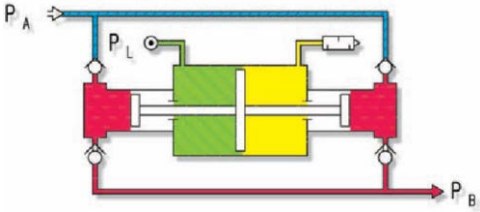
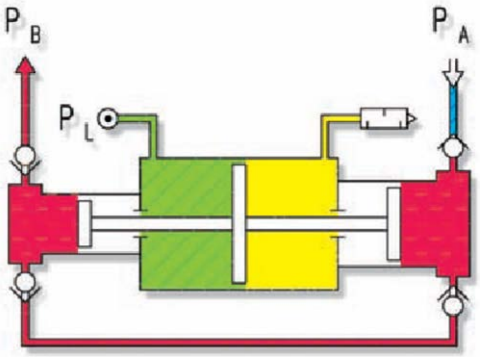
3 1 = 1 High-pressure piston, 2 = 2 drive pistons

4 Design (e.g. DLE 15-75)

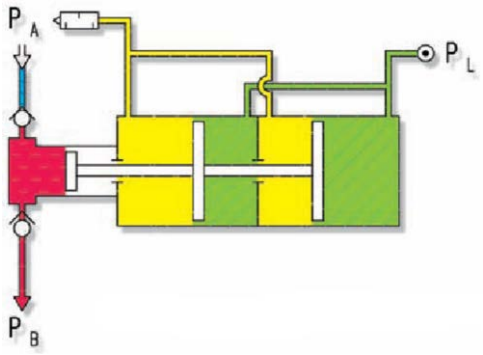
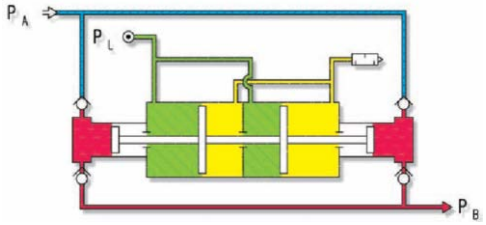
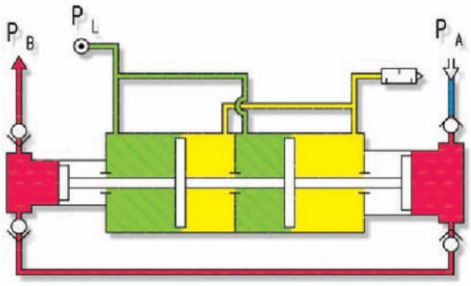
1.7 Models

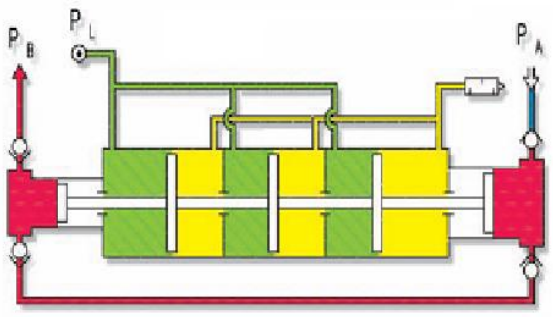
The individual booster type models are listed below.

Booster with one drive piston

Design	Chart
One-stage, single-acting Types_ ▪ DLE 2-1 ▪ DLE 5-1 ▪ DLE 15-1 ▪ DLE 30-1 ▪ DLE 75-1	
Double-acting, single-stage Types_ ▪ DLE 2 ▪ DLE 5 ▪ DLE 15 ▪ DLE 30 ▪ DLE 75	
Double-acting, two-stage Types_ ▪ DLE 2-5 ▪ DLE 5-15 ▪ DLE 5-30 ▪ DLE 15-30 ▪ DLE 15-75 ▪ DLE 30-75	

Booster with two drive pistons

Design	Chart
One-stage, single-acting with two air pistons Types_ ▪ DLE 2-1-2 ▪ DLE 5-1-2 ▪ DLE 15-1-2 ▪ DLE 30-1-2 ▪ DLE 75-1-2	
One-stage, double-acting with two air pistons Types_ ▪ DLE 2-2 ▪ DLE 5-2 ▪ DLE 15-2 ▪ DLE 30-2 ▪ DLE 75-2	
Double-acting, two-stage with two air pistons Types_ ▪ DLE 2-5-2 ▪ DLE 5-15-2 ▪ DLE 5-30-2 ▪ DLE 15-30-2 ▪ DLE 15-75-2 ▪ DLE 30-75-2	

Design	Chart
Double-acting, three-stage with three air pistons Types_ ▪ DLE 30-75-3	

Legend:

	P_L = Air drive		P_B = Operating pressure
	P_A = Gas pre-pressure shut-off valve		= Outlet air

1.8 Calculating the operating pressure

Before the booster is commissioned, the operating pressure needs to be calculated. The booster's static final pressure is calculated for the corresponding type using the following formulae:

There is a list of the booster types in chapter 4.4 "Performance values".

There is a legend for calculating the operating pressure below the table.

Compressor type	Calculation of static operating pressure
One-stage, single-acting	$P_B = P_L * i$
Double-acting, single-stage	$P_B = i * P_L + P_A$
Two-stage	$P_B = i_2 * P_L + i_2 / i_1 * P_A$
Single-acting, one-stage with 2 drive parts	$P_B = P_L * i$
Double-acting, one-stage with 2 drive parts	$P_B = i * P_L + P_A$
Two-stage with 2 drive parts	$P_B = i_2 * P_L + i_2 / i_1 * P_A$

Legend:

P_L = Drive pressure

P_B = Operating pressure

P_A = Gas pre-pressure shut-off valve

i = Pressure ratio

i_1 = Pressure ratio stage 1

i_2 = Pressure ratio stage 2

2 Safety

This section provides an overview of all significant safety aspects for optimum protection of persons as well as safe and trouble-free operation of the system. Further task-related safety information is contained in the sections for the individual service life phases.

2.1 Proper use

The compressed air-driven booster of the series DLE 2 (-1, -2) – DLE 75 (-1, -2) are incomplete machines and are designed for installation in other machines. The booster only serve oil-free compression of gases within the meaning of the Machinery Directive. Only booster media that are approved for the booster (Chapter 2.4.1 "Approved booster media (gases)") may be used. The booster are driven with compressed air or nitrogen at a maximum drive pressure of 10 bar.

These booster can, if marked accordingly, be used in explosion protected areas.

Intended use also refers to compliance with all details in this user manual.

Any usage beyond the intended use and/or different type of use of the system is forbidden and counts as improper use.

2.2 Warranty and Liability

In principle, the "General Conditions of Sale and Delivery" supplied by the manufacturer of the booster shall apply. The “General Conditions of Sale and Delivery" can be found under:

http://www.maximator.de/flycms/en/web/29/-/Business+Conditions.html

Warranty and liability claims shall be precluded if they are due to one or more of the following causes:

- Abnormal use of the booster.
- Incorrect putting into service, operation or maintenance of the booster.
- Changes to the booster and incorrect repair work.
- Operating the booster with defective safety devices or incorrectly installed safety and protective devices.
- Failure to comply with the information in these instructions in respect of putting into service, operation and maintenance.
- Inadequate surveillance of booster parts that are subject to abrasion.

2.3 Predictable Improper Use

WARNING!

Dangers associated with improper use!

Improper use of the booster of the DLE 2 (-1, -2) – DLE 75 (-1, -2) series can lead to dangerous situations.

- Never use booster for the respective gases other than those listed in chapter 2.4 "Authorised booster media (gases)"
- Always contact MAXIMATOR before using special media!
- The booster must not be operated in enclosed vessels.
- Never perform any unauthorised conversions or technical changes to the booster.
- Compressed air may never be used for artificial respiration.
- Never use the booster in any other way than described in this operating manual.
- Never exceed the technical limits or pressures stated in this operating manual.
- The booster may only be operated when in perfect technical condition.
- Always pay attention to all information on installation, maintenance or troubleshooting in this operating manual.
- Booster cannot be used for
    - producing pharmaceutical products with direct contact
    - producing / processing food

2.4 General hazards

The following section lists residual risks emanating from the booster even if the system is used as intended.

In order to reduce the risks of injury and damage and to avoid dangerous situations, all safety information listed here and the safety information in further sections of this manual must be taken into account.

2.4.1 Dangers due to pressurised gases

Pressurised components

WARNING!

Risk of injury due to pressurised components!

Compressed air or gas can escape from compressed air lines, screw connections or pressurised components. This compressed air or these gases cause eye injuries, swirl up dust, and cause uncontrolled movements in the lines leading to serious injuries.

Defective pressurised components can also case uncontrolled movements that can lead to major injuries.

- Before assembling or dismantling hoses, lines, screw connections or quick couplers, always make sure that they are depressurised. Fully release the pressure accumulators slowly.
- Always wear personal protection equipment

Ensure that defective pressurised components are immediately replaced by qualified personnel (machine and system constructor).

2.4.2 Dangers due to low temperatures

Cold surfaces

WARNING!

Risk of injury due to cold and icy surfaces!

Components such as the exhaust silencer and cooling lines can cool down heavily due to expanding air or gas and ice over. Skin contact with cool water surfaces can lead to irritations and problems with the skin.

- Always wear protective work clothing, goggles and protective gloves when working near to cold or icy surfaces.

Make sure that all surfaces have warmed to room temperature before beginning any work.

2.4.3 Hazards due to explosion

Explosion protection

When working in an explosive area, the national or international regulations for working in explosive areas must be observed.

2.5 Dangers due to fluids and substances

Delivery media

WARNING!

Risk of injury due to incorrect handling of booster media!

Incorrect handling of booster media can lead to serious poisoning or fatal injury or illness.

- Always pay attention to the manufacturer's safety data sheet.
- Always ensure that there is sufficient ventilation when working with gases.
- Do not smoke inside the danger zone and the surrounding area. Avoid all naked flames, fire and sources of ignition.
- Always keep breathing apparatus that does not require circulation air ready for emergencies.
- If anyone displays signs of suffocation, immediately treat them with breathing apparatus that does not require circulation air, put them in the recovery position in the fresh air and keep them warm. Start first aid with resuscitation measures if the person has stopped breathing. Seek immediate medical assistance.

Leaks

WARNING!

Risk of injury caused by unforeseen leaks of the booster medium in the case of dangerous or inflammable gases!

A leak quantity of 60 ml/min (static with helium) is allowed for leaks at the designated leak boreholes Z1 and Z3. If the booster media (toxic or flammable) leaks at non-designated places, this may lead to serious poisoning resulting in illness or death. Leaks can occur due to wear, old seals or leaking connections. These may be:

- Leaks in the drive part (escaping drive medium)
- Leaks on suction and pressure pipes
- Leaks on the seal on the booster head / high-pressure part and escaping booster medium through the exhaust gas silencer. **The medium is directed into the ambient air!** (If necessary, discharge exhaust air safely)

Purging interfaces

From a technical point of view, the most important aspect when compressing hazardous and flammable gases is to avoid the formation of explosive atmospheres. As gas leakages cannot be ruled out, MAXIMATOR booster have to be purged with inert gas (preferably nitrogen) prior, during and after use.

If no purging is carried out, these areas are characterised by Zone 0 and a type-examination is required. In the current version, the booster do not meet the requirements of category 1. Therefore, operation without purging is expressly prohibited.

(Chapter 6.4.3 "Purging plans for MAXIMATOR booster")

Contact the manufacturer about using other media that involve special instructions. Refer to the contact data on page 9 in this operating manual.

Remove the plug from the SFP (special purging port) for dangerous gases and ensure the pipes are dimensioned adequately. The SFP is marked separately on the caps with the designation "SFP".

2.5.1 Authorised booster media (gases)

Compressor media (gases)

The booster media authorised for compressing with booster are listed below.

WARNING!

Risk of accidents due to failure to observe the authorised booster media!

Failure to observe the authorised booster media and the specific information can lead to serious accidents.

- Only compress booster media that are authorised for the respective booster models. To check this, compare the type information on the type plate with the information in the table.
- Always observe the separate information about the respective booster medium.

Compressing hazardous gases!

Always observe the following to avoid dangerous situations:

- Always set up booster in a well ventilated room. **RISK OF ASPHYXIATION!**
- Check tightness with a leak detection spray at regular intervals (on a weekly basis depending on operating conditions).
- The contents of the leaking pipes must always be discharged correctly without pressure.
- For booster in rooms or buildings, it must be possible to shut off the gas supply coming from outside safely and quickly from a safe point.
- Always create pipe connections to booster that ensure durable tightness of connections.

Compressor medium (Gases)	Formula symbol	Compressor types	Special information about sealing the booster medium
Argon	Ar	all models	Well ventilated room
N-Butane	C_4H_{10}	all models	Connect and purge SFP (special purging port) and leak boreholes, high-pressure seal is not 100% gas-tight.
Compressed air		all models	Well ventilated room
Carbon monoxide	CO	DLE xxx-C	Connect and purge SFP (special purging port) and leak boreholes, high-pressure seal is not 100% gas-tight.
Carbon dioxide	CO_2	DLE xxx-C	Well ventilated room
Ethane	C_2H_6	all models	Connect and purge SFP (special purging port) and leak boreholes, high-pressure seal is not 100% gas-tight.
Ethylene	C_2H_4	all models	Connect and purge SFP (special purging port) and leak boreholes, high-pressure seal is not 100% gas-tight.
Freon (F-12)	CCL_2F_2	DLE xx-CR	Connect and purge SFP (special purging port) and leak boreholes, high-pressure seal is not 100% gas-tight.
Helium	He	all models	Well ventilated room
Hydrogen	H_2	DLE xxx-(H2)	Connect and purge SFP (special purging port) and leak boreholes, high-pressure seal is not 100% gas-tight.
Methane	CH_4	all models	Connect and purge SFP (special purging port) and leak boreholes, high-pressure seal is not 100% gas-tight.

Compressor medium (Gases)	Formula symbol	Compressor types	Special information about sealing the booster medium
Acid gas (Natural gas with some hydrogen sulphide components)		DLE xxx-NACE	Connect and purge SFP (special purging port) and leak boreholes, high-pressure seal is not 100% gas-tight.
Propane	C_3H_8	all models	Connect and purge SFP (special purging port) and leak boreholes, high-pressure seal is not 100% gas-tight.
Nitrogen	N_2	all models	Well ventilated room
Nitrous oxide	N_2O	all models	Connect and purge SFP (special purging port) and leak boreholes, high-pressure seal is not 100% gas-tight.
Oxygen	O_2	DLE xxx-S	Connect leak boreholes, lubricate with a grease suitable for oxygen (oxygen cleaning), max. compression ration 1:4** Oil and grease-free drive air, observe BGR 500 Max. operating pressure 350 bar
Sulphur-hexafluorine	SF_6	DLE xxx-CR	Connect and purge SFP (special purging port) and leak boreholes, high-pressure seal is not 100% gas-tight.
Xenon	XE	all models	Well ventilated room

*Purging port for high-pressure leaks

**taking into account the ignition temperature of grease (see Chapter 4.5 page 44) minus a safety reserve of 80°C

2.5.2 Hazards from oxygen

Oxygen

WARNING!

Risk of injury due to noncompliance with standards and guidelines on handling oxygen

- Lubricate with a grease suitable for oxygen as recommended by Maximator (oxygen cleaning)
- Max. compression ratio 1:4*
- Oil and grease-free drive air (observe BGR 500) / max. allowed value 0.01 mg/m³ **
- Cable flow velocity max. 8 m/s (IGC 33/06/E)
- Max. operating pressure 350 bar
- Max. allowed residual oil or residual grease on surfaces of 200 mg/m² (IGC 33/06/E)**

**taking into account the ignition temperature of grease (see Chapter 4.5 page 44) minus a safety reserve of 80°C

** modify maintenance intervals accordingly (see chapter 7.2 Inspection and maintenance intervals)

2.6 Duties of manufacturers of complete machines

2.6.1 Safety devices

Before commissioning the booster, it needs to be installed and incorporated into the safety system.

2.6.2 Work and hazard areas

The hazard area surrounds the booster.

2.6.3 Manufacturer

The following text defines a manufacturer as the organisation that installs the booster into complete machines.

The manufacturer must pay attention to the additional obligations resulting from installation of the booster in a facility or system.

- The manufacturer must ensure that a full risk assessment has been produced upon installation of the booster in a facility or system, and that the necessary measures for risk elimination have been initiated.
- The manufacturer must ensure that the booster are incorporated in the emergency stop concept of the facility/system.
- The manufacturer must ensure that all pressure hoses, pressure lines, couplings and screw connections are designed and sized for the pressure ranges of the booster.

2.6.4 Manufacturer duties

Information that needs to be securely forwarded to the operator.

The booster are used in commercial operations. The operator of the booster is therefore subject to the legal obligations on work safety.

Alongside the safety information in this manual, the valid safety, work protection and environmental protection regulations must be complied with for the area of use of the booster.

The following particularly applies:

- The operator must inform himself of the valid work safety regulations and also establish additional risks in a risk assessment that can result due to the special working conditions in the place of use of the booster. He must implement them in the form of operating instructions for operation of the booster.
- During the entire service life of the booster, the operator must check whether the operating instructions he has produced correspond with the current status of regulations and adapt them if necessary.
- The operator must clearly regulate and specify the responsibilities for installation, operation, troubleshooting, maintenance and cleaning.
- The operator must ensure that all persons using these booster have read and understood this manual. Furthermore, he must regularly train members of personnel and inform them about the risks.
- The operator must provide members of personnel with the necessary protective equipment and give binding instructions on wearing the necessary protective equipment.

The operator is also responsible for ensuring that the booster are always in a perfect technical condition. The following applies:

- The operator must ensure that the booster is incorporated in the emergency-stop equipment or in the safety chain of the system in which the booster are installed.
- The operator must ensure that, when aggressive booster media and/or poisonous gas are used, lines are mounted to collect the leaks of aggressive booster media and/or poisonous gas in corresponding containers, and that aggressive and poisonous media are disposed of correctly.
- The operator must ensure the booster is purged with nitrogen before beginning repair work when compressing aggressive, flammable, dangerous, or poisonous gases.

- The operator must ensure that only booster media ↳ listed in chapter 2.4.1 "Authorised booster media (gases) on page 22) are compressed with the booster. The media compatibility for this must be verified.
- The operator must ensure that the operating media (compressed air and gases) are pre-installed and stored in accordance with the regulations.
- The operator must ensure that all pressure hoses, pressure lines, couplings and screw connections are designed and sized for the pressure ranges of the booster.
- The operator must ensure that the right medium connections are provided and that they can be secured with a separate shut-off valve.
- The operator must ensure that the connections for the booster medium (compressed air and gases) work correctly.
- The operator must ensure that the booster is always kept and operated in perfect technical condition.
- The operator must ensure that sufficient lighting is always available in the booster working area.
- The operator must ensure that all malfunction and repair work is exclusively performed by personnel trained by MAXIMATOR.
- The operator must ensure that all warning, information and safety signs on the booster are always kept complete and legible.
- The operator must ensure that the booster are checked for damage and functional integrity before they are put into service.

Additional operator duties in terms of explosion protection

The operator has additional obligations arising from the EC directive for the improvement of health and safety at work that can be endangered by an explosive atmosphere.

This includes following organizational measures:

- Explosive area markings
- Clear signs on all bans
- Creation of explosion protection documents for each zone
- Issue of access ban for unauthorised persons

2.6.5 Personnel requirements

Qualifications

WARNING!

Risks caused by insufficiently qualified persons!

There is a risk of serious injury and considerable damage if unqualified personnel carries out work on booster or remains in the danger zone around the booster.

Only MAXIMATOR personnel may carry out work.

Keep unqualified personnel out of the danger zones.

The following personnel qualifications for the various tasks are stated in this manual:

Machine and system constructors are capable of carrying out the work given to them on the basis of their professional training, knowledge and experience as well as knowledge of the relevant regulations. Furthermore, the machine and system constructor is familiar with the installation, assembly and connection of machines, can independently recognise possible dangers and knows how to avoid them.

Personnel refers to persons from whom it is expected that they will reliably perform the work. Persons whose reaction capacity is influenced, e.g. by drugs, alcohol or medication, are not permitted.

The valid age and specific job regulations for the site must be observed when choosing personnel.

2.7 Personal protection equipment

Personal protection equipment serves the purpose of protecting persons against impairments to health and safety at work.

Members of personnel must wear personal protection equipment, which is separately listed in individual sections of this manual, during various work on and with the booster.

Description of personal protection equipment

Personal protection equipment is explained in the following

Protective work clothing

Protective work clothing is closely fitting items of anti-rip clothing with tight sleeves and no protruding parts.

Protective goggles

Protective goggles are intended to protect eyes against projecting parts and splashes of fluids.

Protective gloves

Working gloves protect the hands against friction, abrasion, puncture, and severe injuries as well as against contact with hot or cold surfaces.

Safety shoes

Safety footwear protects the feet against crushing, falling parts, and slipping on slippery surfaces.

Ear protectors

The hearing protection protects against continuous noise that exceeds the allowed noise level and could cause permanent hearing damage.

2.8 Labelling

The following symbols and information signs are found in the working area. They relate to the direct environment in which they are applied.

WARNING!

Danger involved with illegible signs!

Over the course of time, labels and signs can become dirty or otherwise unrecognisable, so that the dangers cannot be identified and the necessary operating instructions cannot be followed. This results in the risk of injury.

- All safety, warning and operating information must always be kept in a legible condition.
- Damaged signs or labels must be replaced immediately.

Signs on the booster

The signs attached to the booster are shown in the following illustration.

The signs may vary depending on the booster version.

Figure	Description
	Warning! Not suitable for oxygen.
	Warning! Keep oil and grease-free, cleaned for OXYGEN SERVICE.

2.9 Spare parts

WARNING!

Risk due to the use of wrong spare parts!

Use of the wrong or faulty spare parts can lead to malfunctions. This can lead to major or fatal injuries and can cause significant material damage.

Only use original spare parts from MAXIMATOR or spare parts explicitly authorised by MAXIMATOR.

Consult the MAXIMATOR in case of any uncertainty.

2.10 Environmental protection

NOTE!

Danger for the environment due to incorrect handling of pollutant substances!

Incorrect handling of substances hazardous to the environment, especially incorrect disposal, can result in significant environmental damage.

Always pay attention to the manufacturer's instructions on handling substances dangerous to the environment and their disposal.

If pollutant substances accidentally escape, take immediate measures. If in doubt, inform the local authorities about the damage and ask about suitable measures.

3 Layout and function

3.1 Overview

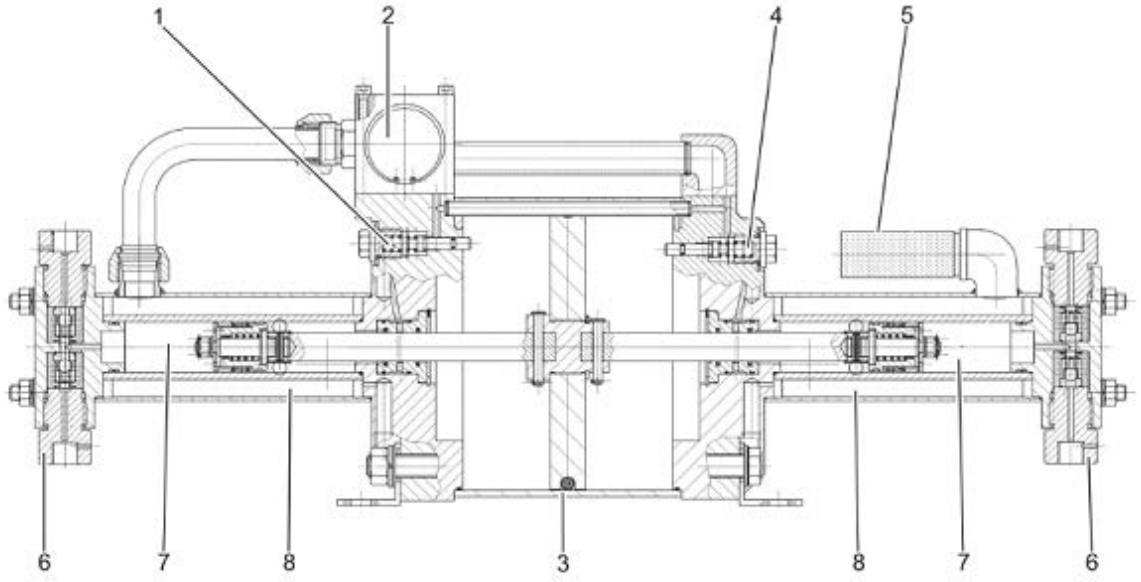


Fig. MAXIMATOR booster Type DLE 15

1	Pilot valve 1	5	Exhaust silencer
2	Control slide valve (4/2-way valve)	6	Compressor head with suction and pressure valve
3	Air cylinder	7	Pressure cylinder
4	Pilot valve 2	8	Cooling cylinder

3.2 Brief description

The booster basically work according to the pressure intensifier principle. They serve to compress gases and compressed air to high pressure levels and are operated with a drive pressure of maximum 10 bar. The drive pressure is necessary to compress the respective booster medium to the higher operating pressure. The reduction ratio of the pumps is based on the ratio of the piston surface of the large air piston to the piston surface of the small high pressure piston. The preliminary pressure (see performance values) needs to be selected depending on the booster type.

3.3 Assembly description

Pilot valve

The pilot valves serve the stop position switchover by the air piston. The pilot valves are actuated in the stop positions by the air piston and issue air impulses to the control slide valve. In this way, the pilot valves aerate and ventilate the actuation compartment of the control slide valve. This allows the control slide valve to be moved from one stop position to the other.

Control slide valve

The control slide valve alternately applies compressed air to the top and bottom of the air piston. The control slide valve is controlled via the pilot valves and ensures that the drive air can reach the respective opposite side of the air piston.

Drive part

The drive part serves to take the drive air (compressed air) and actuates the high-pressure part of the booster via a piston rod thereby compressing the respective booster medium to a higher pressure.

Compressor head with inlet and outlet valve

The booster head closes the compression chamber and separates this spatially from the ambient pressure. The booster head contains the inlet and outlet valves. The gas that is to be compressed enters and exits the compression chamber of the booster through these inlet and outlet valves.

High-pressure unit

The high-pressure part of the booster serves to compress the gas. The high-pressure part comprises the pressure cylinder booster head with inlet and outlet valves and the high-pressure piston with sealing and guide elements.

Exhaust silencer

The exhaust air silencer serves to reduce the noise when the expanding drive air is discharged from the booster. The drive air exits the booster via the exhaust air silencer after it has completed its task. The exhaust air silencer may be made of plastic or aluminium depending on the booster model.

Cooling cylinder (does not apply for DLE and DLE 2)

The cooling cylinder serves to insulate and cool the high-pressure part of the booster. The cooling cylinder surrounds the high-pressure cylinder. The expanding (very cold) drive air is directed into the space between these two cylinders to cool the high-pressure cylinder during operation.

3.4 Functional principle of the booster

The circuit diagram of the booster is shown in the chart below:

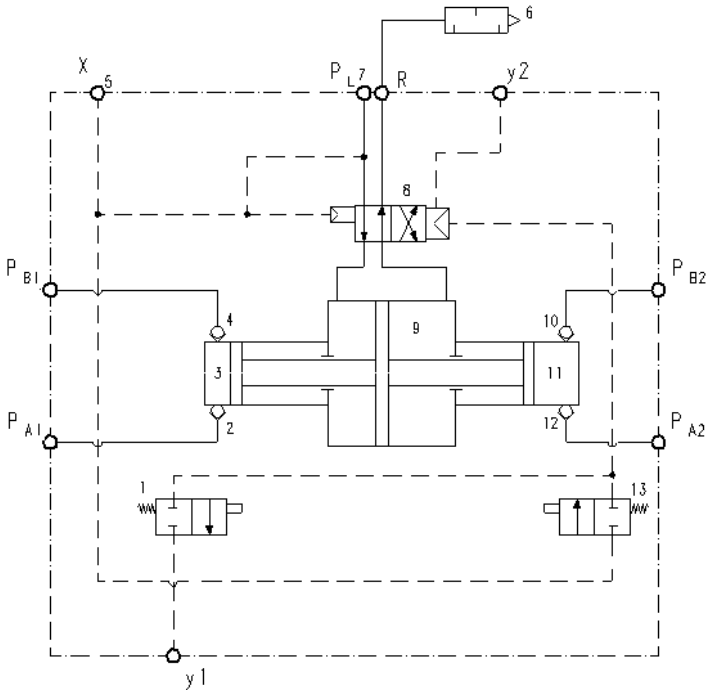


Fig. Circuit diagram of the booster

1	Pilot valve in bottom cap	8	Control slide valve
2	Inlet valve (A1)	9	Air piston
3	High-pressure piston	10	Outlet valve (B2)
4	Outlet valve (B1)	11	High-pressure piston
5	Pilot valve air port (X)	12	Inlet valve (A2)
6	Exhaust silencer (R)	13	Pilot valve top cap
7	Air port (P_L)		

Explanation of effects

Drive air flows from the air port (7) through the control slide valve (8) to the bottom of the air piston (9). The air piston moves in the drive part to the right thereby creating a suction stroke on the left side of the high-pressure part. The inlet valve (2) opens and the gas to be compressed flows through the port (AA) into the compression compartment of the high-pressure part. A pressure stroke is performed on the right-hand side of the high-pressure part.

During the pressure stroke the inlet valve (12) is closed, the outlet valve (10) opened and the compressed gas flows from the port (B). If the air piston (9) has reached its right-hand stop position in the drive part, it actuates and opens the pilot valve (13). This means that the direct pilot valve air (X-port) moves from port (5) to the large side of the control slide valve (8) of the booster and switches to the opposite switch position.

The drive air now flows to the right-hand side of the air piston (9). The air piston moves to the left side of the drive part. The pressure stroke is now carried out in the left high-pressure part and a suction stroke is carried out on the right side. The expanding drive air exits the working compartment via the exhaust air silencer (6).

In booster models with a pressure ratio > 5, the air is channeled through cooling cylinders and used to cool the high-pressure parts.

3.5 Ports

The booster are supplied without any screw connections or pipelines. The information about the port values ("Mechanical port values") must be observed for all interface connections. A connection drawing for all ports that need to be mounted is always enclosed with the booster.

The booster have the following interfaces:

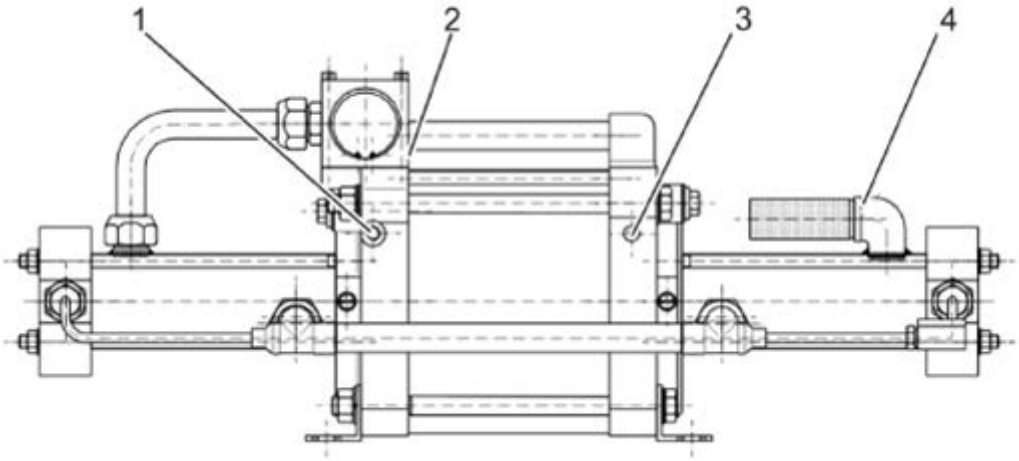


Fig. Front view booster

Pos-No.	Designation	Ports	Function
1	Control port “X“	G 1/8“	Connection for direct pilot valve (uncontrolled and filtered) control air ≥ drive air (max. 10 bar)
2	Air port control slide valve “Y“	Borehole	Venting and aeration of the control slide valve (impulse-shaped air exit)
3	Outlet air port pilot valve	M5	Venting the pilot valve. This connection can be used as a port for the stroke counter. The air exits in impulses here. Therefore, this port may not be closed.
4	Exhaust silencer port	G1/2“	Outlet of the expanding drive air

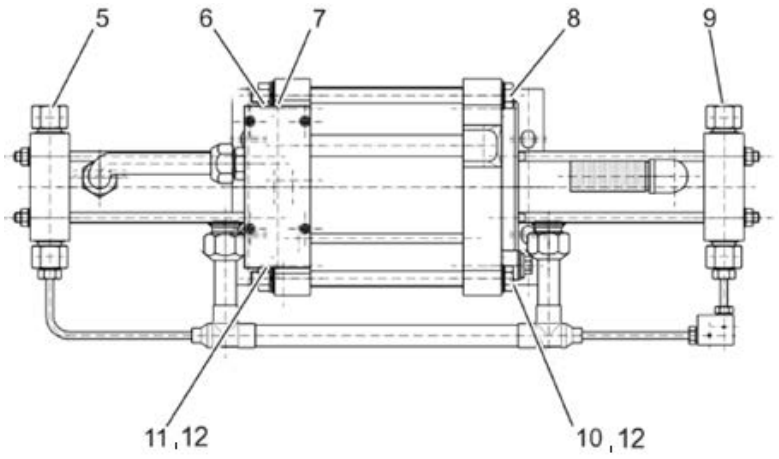


Fig. Top view booster

Pos-No.	Designation	Ports	Function
5	Outlet port "B"	Depends on model	Outlet of operating pressure
6	Leak port high-pressure side "Z_3"	G1/8“	Ventilation of the high-pressure cylinder behind the piston. Alternate suction and expulsion (alternately fitted with silencer).
7	Operating port “P_L“	G3/4“	Input of the compressed drive air (max. 10 bar)
8	Leak port high-pressure side "Z_1"	G1/8“	Ventilation of the high-pressure cylinder behind the piston. Alternate suction and expulsion (alternately fitted with silencer).
9	Inlet port “A“	Depends on model	Inlet of preliminary pressure
10	Leakage port air side “Z_2“	G1/8“	Diverting the leak from the drive part
11	Leakage port air side “Z_4“	G1/8“	Diverting the leak from the drive part
12	Purging port "SFP"	G1/8“	Port for purging the rear piston space

3.6 Delivery

The booster is supplied without pipes or screw connections.

Scope of delivery:

Denomination	Quantity
Compressor	1
Bracket for mounting	2
Assembly instructions and operating manual Booster DLE 2 (-1, -2) – DLE 75 (-1, -2, -3)	1
Drawing set (sectional drawing, parts list, port / sectional drawing	1
Installation declaration pursuant to the Machinery Directive	1
If necessary declaration of conformity acc. to ATEX 94/9/EC	1

3.7 Accessories

The following accessories are available for the booster.

Air control unit

Sealing sets

The individual sealing sets are available from the manufacturer as complete sealing kits. These sealing kits are required whenever faults are remedied. See also, sectional drawing and parts list of the booster.

4 Technical data

4.1 Operating conditions

Environment

Description	Value	x
Temperature range	-20 to + 60*	°C
Max. altitude meters	Unlimited	m**

* Temperature range taking into account the compressed air quality.

** Above sea level

Operating medium

Description	Value	x
max. operating temperature	100	°C
Particle size, max.	10	µm

Duration

Description	Value
Operating time (ED)	50 % ED for stroke frequency > 30 strokes per minute
Operating time	100 % ED for stroke frequency > 30 strokes per minute

Pneumatic (air quality acc. to ISO 8573-1)

Description	Value	Unit
Oil-free compressed air	*possible	
max. compressed air purity level of oil (class 4)	5	mg/m³
max. particle number for a size of 0.1 - 0.5 µm (class 3)	not stated	pcs
max. particle number for a size of 0.5 - 1.0 µm (class 3)	90,000	pcs
max. particle number for a size of 1.0 - 5.0 µm (class 3)	1,000	pcs
max. solids, particle concentration (class 6)	5	mg/m³
max. pressure dew-point in humidity (class 4)	+3	°C

To avoid damage to seals and their counter surfaces, a filter with a fineness of max. 10µm must be installed.

Oil in the oiler must comply with DIN 51524 – ISO VG 32.

The residual oil or residual grease of the drive medium may not exceed 0.01 mg/m³ for oxygen devices!

*After using the oiler for the first time, the drive medium always needs to be oiled when continuing to use the oiler (oil washes pneumatic grease from the drive air).

4.2 Noise emissions

e.g.: DLE on base plate at 10 bar drive pressure

Description	Value	Unit
Noise emissions	81	dB(A)

The noise emissions measurement was performed at a height of 1.6 meters and at a distance of 1 meter from the test bench. The detected noise emissions were measured with 10 bar counter-pressure at full load operation and may vary depending on use and the installation situation.

4.3 Dimensions and weights

The following is a list of the dimensions and weights of all booster types.

The values listed as follows are approximate and may vary slightly.

Type	Width mm	Height mm	Depth mm	Weight kg
DLE 2-1	440	275	180	15
DLE 5-1	440	275	180	15
DLE 15-1	450	275	180	13
DLE 30-1	450	275	180	13
DLE 75-1	450	275	180	13
DLE 2	600	275	180	20
DLE 5	600	235	180	20
DLE 15	620	235	180	18
DLE 30	620	235	180	18
DLE 75	620	235	180	18
DLE 2-5	600	235	180	20
DLE 5-15	610	235	180	19
DLE 5-30	610	235	180	19
DLE 15-30	620	235	180	19
DLE 15-75	620	235	180	19
DLE 30-75	620	235	180	19

Type	Width mm	Height mm	Depth mm	Weight kg
DLE 2-1-2	610	275	180	22
DLE 5-1-2	610	235	180	22
DLE 15-1-2	615	235	180	20
DLE 30-1-2	615	235	180	20
DLE 75-1-2	615	235	180	20
DLE 2-2	780	275	180	25
DLE 5-2	780	235	180	25
DLE 15-2	800	235	180	23
DLE 30-2	800	235	180	23
DLE 75-2	800	235	180	23
DLE 2-5-2	780	235	180	25
DLE 5-15-2	790	235	180	24
DLE 5-30-2	790	235	180	24
DLE 15-30-2	800	235	180	24
DLE 15-75-2	800	235	180	24
DLE 30-75-2	800	235	180	24
DLE 30-75-3	997	235	210	24
8 DLE 3	990	350	220	55
8 DLE 6	990	350	220	55
8 DLE 1,65	810	350	220	40

4.4 Performance values

Type	Stroke capacity cm³	Max. Operating pressure P_B (static) bar	Max. Compression ratio	Pressure ratio ($i=i_1/i_2$)	Max. Operating temperature °C	Primary pressure	
						min. P_A	max. P_A*
DLE 2-1	922	20	1:10	1:2	60	0	20
DLE 5-1	373	50	1:15	1:5	60	2	50
DLE 15-1	122	150	1:20	1:15	100	7	150
DLE 30-1	60	300	1:20	1:30	100	15	300
DLE 75-1	25	750	1:20	1:75	100	35	750
DLE 2	1844	40	1:10	1:2	60	0	40
DLE 5	746	100	1:15	1:5	60	2	100
DLE 15	244	300	1:20	1:15	100	7	300
DLE 30	120	600	1:20	1:30	100	15	600
DLE 75**	50	1500	1:20	1:75	100	35	1500
DLE 2-5	922	70	1:25	1:2/1:5	60	0	0.8 x PL
DLE 5-15	373	198	1:45	1:5/1:15	100	2	1.6 x PL
DLE 5-30	373	330	1:90	1:5/1:30	100	2	0.5 x PL
DLE 15-30	122	450	1:40	1:15/1:30	100	7	7.5 x PL
DLE 15-75**	122	875	1:100	1:15/1:75	100	7	2.5 x PL
DLE 30-75**	60	1050	1:50	1:30/1:75	100	15	12 x PL
DLE 2-1-2	922	40	1:10	1:4	60	0	40

Type	Stroke capacity cm³	Max. Operating pressure P_B (static) bar	Max. Compression ratio	Pressure ratio ($i=i_1/i_2$)	Max. Operating temperature °C	Primary pressure	
						min. P_A	max. P_A*
DLE 5-1-2	373	100	1:15	1:10	60	4	100
DLE 15-1-2	122	300	1:20	1:30	100	10	300
DLE 30-1-2	60	600	1:20	1:60	100	20	600
DLE 75-1-2**	25	1500	1:20	1:150	100	45	1500
DLE 2-2	1844	40	1:10	1:4	60	0	40
DLE 5-2	746	100	1:15	1:10	60	4	100
DLE 15-2	244	300	1:20	1:30	100	10	300
DLE 30-2	120	600	1:20	1:60	100	20	600
DLE 75-2**	50	1500	1:20	1:150	100	45	1500
DLE 2-5-2	922	100	1:25	1:4/1:10	60	0	1.6 x PL
DLE 5-15-2	373	300	1:45	1:10/1:30	100	2	3.2 x PL
DLE 5-30-2	373	600	1:90	1:10/1:60	100	2	1 x PL
DLE 15-30-2	122	600	1:40	1:30/1:60	100	7	15 x PL
DLE 15-75-2**	122	1500	1:100	1:30/1:150	100	7	5 x PL
DLE 30-75-2**	60	1500	1:50	1:60/1:150	100	15	24 x PL
DLE 30-75-3**	60	2400	1:50	1:90/1:225	100	30	30 x PL

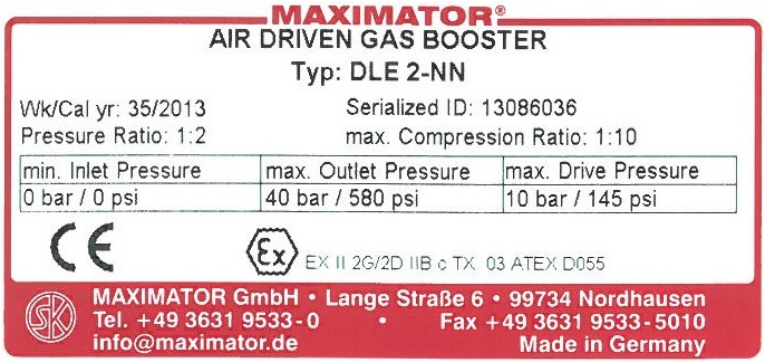
* = Maximum allowed pressure which may be exerted by the high-pressure part onto the booster. Compression ratio = operating pressure / primary pressure

** At operating pressures in excess of 1050 bar, the MAXIMATOR high-pressure connection and the associated MAXIMATOR screw connections must be used.

4.5 Explosion Protection

Ex-marking

The explosion identification is found in the drive part of the booster on the type plate.



Marking	Denomination	Explanation
	CE symbol	Conformity identification acc. to attachment X of the Directive 94/9/EC. CE-symbol is attached on delivery.
II	Equipment group	The booster may be used in explosive areas, except mines.
2D/2G	Equipment category	For equipment categories 2G/2D an explosive atmosphere containing gases (G) and dust (D) may occur occasionally. The device guarantees a high level of safety and can be used in Zone 1 and Zone 2 / 21 and 22.
IIB	Explosion group	For use with substances from group IIB, e.g. propane
IIC	Explosion group	For use with substances from group C, e.g. hydrogen
C	Ignition protection category	Constructive safety for non-electrical devices in explosive areas according to DIN EN 13463-5.
TX	Additional markings	The temperature depends on the operating parameters.

Operating manual pursuant to Explosion Protection Directive

If the booster bear an ex-symbol and come with a declaration of conformity in compliance with 94/9/EC, they can be used in explosive areas. They correspond to Group II Category 2G/2D Explosion Group IIB constructive safety. Exceptions are devices marked with H2 or EXIIC that fall under the Explosion Group IIC.

A prerequisite for safe operation is that the booster is correctly connected to the earth potential.

Compressor temperature depends on the medium temperature, the degree of compression and other operating conditions.

The temperature achieved during compression should not exceed the max. allowed temperature.

For ideal gases, the max. expected temperature can be calculated by the following adiabatic change in state formula:

$$T_2 = \left[\frac{P_2}{P_1}\right]^{\frac{\chi-1}{\chi}} \cdot T_1$$

with

T2 (Temperature after compression (in K)

T1 (Temperature prior to compression (in K)

P2 (Pressure after compression (in bar)

P1 (Pressure prior to compression (in bar)

χ (Isentropic exponent

The isentropic exponent can be read for standard gases in the following table or other tables.

Gas	X	Gas	X
Argon	1.66	Helium	1.66
Carbon dioxide	1.3	Air	1.4
Nitrogen	1.4	Xenon	1.67

Tab. Isentropic exponent

Due to the fact that the compression occurs in a heat exchange with the environment, the actual temperature always remains below the calculated adiabatic temperature.

If the temperature of the compressed gas lies below the maximum admissible temperature, steps must be taken to ensure that operating conditions do not change in the respective explosion zone. A slight differential pressure would result in a higher temperature!

Prior to commissioning, the air has to be removed from the systems, e.g. by evacuation or purging. The safest method is by purging with nitrogen, when an oxygen content of below 1 percent by volume is reached inside the plant. When decommissioning, it is necessary to render the equipment free of gas by evacuation or purging.

Please observe in all purging procedures that purge gas always takes the path of lowest resistance. Therefore, the purge gas flow must be directed so that "dead pockets" are avoided.

If the temperature of the compressed gas exceeds the maximum allowed temperature, the compression needs to run through several stages and be cooled between the individual compression stages. Sensor monitoring is necessary.

The assembly instructions pursuant to the Machinery Directive (2006/42/EC) are an integral part of these operating instructions.

The following must be observed:

→ Preliminary pressures on the booster must be monitored

→ Allowed compression ratios may not be exceeded

5 Transport, packaging and storage

5.1 Transportation safety instructions

Incorrect transport

NOTE!

Damage to property caused by incorrect transport

Incorrect transportation could result in serious transport damage.

- Proceed with caution when unloading transport items and with inner company transports and pay attention to the symbols and information on the packaging.
- Only remove the packaging shortly before assembly

5.2 Packaging

On packaging

The individual packages have to be packed suitably for the expected transport conditions. Only environmentally friendly materials are used for the packaging.

The packaging should protect the individual components from transport damage, corrosion and other damage until they are required for assembly. Therefore do not destroy the packaging and remove only shortly before the assembly.

Handling packaging materials

Dispose of packaging materials according to the valid legal regulations and local conditions.

5.3 Storage

Storage of packing items

Store packages under the following conditions:

- Do not store outdoors.
- Store the system in a dry and dust-free environment.
- Do not expose to aggressive media.
- Protect against sunlight.
- Avoid mechanical shocks.
- Storage temperature. -20 to 60°C
- Relative air humidity: max. 60%
- In case the equipment is stored longer than 3 months, the general condition of assembly groups and packaging must be inspected regularly. If necessary, service the parts.

Under some circumstances, there may be information on storage on the packing items that goes beyond the requirements stated here. Follow the instructions accordingly.

6 Installation and commissioning

6.1 Safety information for installation and commissioning

Incorrect installation and commissioning

WARNING!

Risk of injury due to incorrect installation and commissioning!

Incorrect installation or commissioning may cause serious injuries or damage.

- Ensure that all installation work in accordance with the information and details in this manual has been carried out and completed.

Explosion protection

WARNING!

Risk of explosion during installation!

- Only carry out assembly work if there is no risk of an explosive atmosphere.

Suitable action **must** taken to always ensure the static-dissipating properties.

Failure to observe these instructions leads to loss of explosion protection.

Safety during compression of explosive substances

Avoiding explosive atmospheres in confined spaces and outdoors

The formation of an explosive atmosphere in areas adjacent to the equipment is prevented by observing the following requirements:

- The equipment must be installed in well-ventilated areas (if possible, outdoors).
- The equipment must be leak-proof and remain so.
- Venting lines from safety valves, leakage lines and similar lines must be directed to the outside of the building.
- For equipment in rooms or buildings, it must be possible to shut off the gas supply coming from outside safely and quickly from a safe point.

Always produce pipe connections to systems so that they ensure durable tightness of connections.

6.2 Pre-requisites for Installation

Position the booster so that the following conditions are fulfilled:

- The place of assembly must be level. Evenness min. 1 mm.
- The booster must have a safe and fixed stand or seat.
- The booster may not be subjected to any oscillations or vibrations.
- The booster must be easily accessible from all sides.
- The booster must be constructed so that it is not subjected to any external sources of heat.
- We recommend installing the booster in a dust-free environment.

Assembly instructions

6.3 Installing the booster

Make sure to always observe the following safety notes relating to assembly in chapter 2.

The booster must be mounted / attached to the designated attachment boreholes using screws or bolts with thread size M 10 and a strength of at least 4.6. The preferred installation position is vertical.

6.4 Mounting Connection Lines

Notes

The booster is supplied without any screw connections or pipelines. Observe the information in ↳ "Mechanical port values" and ↳ Attachment B "Connection drawing".

Unpredictable movements

WARNING!

Risk of injury due to unpredictable movements of compressed air lines!

Lines in the internal compressed air network can move unpredictably in the event of a load change (ripped hose) and can lead to injuries.

- Depressurise the connection lines before beginning any assembly work.
- All pipelines must be safely anchored to the floor or walls.
- All pipelines must be laid so that no tripping hazards are created.
- Always wear personal protection equipment.

Use of Incorrect Connection Lines

ATTENTION!

Danger of damage to property due to the use of incorrect connection lines!

Use of the wrong sized pipelines or screw connections can lead to malfunctions and material damage on the booster.

- The pipework and lines must be adjusted to the maximum output pressure of the booster.
- The tightening torque of the respective screw connections must be complied with.

A cross-section of high-pressure pipes and lines may not be smaller than the cross-section of the connections.

A prerequisite for correct installation is the availability of a professionally projected, installed and maintained compressed air network and an additional shut-off valve installed at the entrance of the compressed air network.

6.4.1 Port sizes

Mechanical port values

Type	Ports Inlet[1]	Ports Outlet[1]	Recommended inner diameter of pipes in mm		
			Drive air	Primary pressure	Operating pressure
DLE 2-1	G ½	G ½	19	13	13
DLE 5-1	G ½	G ½	19	13	13
DLE 15-1	G ¼	G ¼	19	6	4
DLE 30-1	G ¼	G ¼	19	6	4
DLE 75-1	G ¼	G ¼	19	6	4
DLE 2	G ½	G ½	19	13	13
DLE 5	G ½	G ½	19	13	13
DLE 15	G ¼	G ¼	19	6	4
DLE 30	G ¼	G ¼	19	6	4
DLE 75	G ¼	G ¼	19	6	4
DLE 2-5	G ½	G ½	19	13	13
DLE 5-15	G ½	G ¼	19	13	4
DLE 5-30	G ½	G ¼	19	13	4
DLE 15-30	G ¼	G ¼	19	6	4
DLE 15-75	G ¼	G ¼	19	6	4
DLE 30-75	G ¼	G ¼	19	6	4
DLE 2-1-2	G ½	G ½	19	13	13
DLE 5-1-2	G ½	G ½	19	13	13

Type	Ports Inlet[1]	Ports Outlet[1]	Recommended inner diameter of pipe mm		
			Drive air	Primary pressure	Operating pressure
DLE 15-1-2	G ¼	G ¼	19	6	4
DLE 30-1-2	G ¼	G ¼	19	6	4
DLE 75-1-2	G ¼	G ¼	19	6	4
DLE 2-2	G ½	G ½	19	13	13
DLE 5-2	G ½	G ½	19	13	13
DLE 15-2	G ¼	G ¼	19	6	4
DLE 30-2	G ¼	G ¼	19	6	4
DLE 75-2	G ¼	G ¼	19	6	4
DLE 2-5-2	G ½	G ½	19	13	13
DLE 5-15-2	G ½	G ¼	19	13	4
DLE 5-30-2	G ½	G ¼	19	13	4
DLE 15-30-2	G ¼	G ¼	19	6	4
DLE 15-75-2	G ¼	G ¼	19	6	4
DLE 30-75-2	G ¼	G ¼	19	6	4
DLE 30-75-3	G ¼	4H	19	6	4
8 DLE 3	G ½	G ½	19	13	13
8 DLE 6	G ½	G ½	19	13	13
8 DLE 1,65	G ½	G ½	19	13	13

[1] see other ports

The maximum output of the booster can be achieved when the recommended pipe inner diameter is complied with.

Other ports

The inlet and outlet ports listed under 3.5. are standard ports. The following is a list of other connection options for inlets and outlets; they must comply to the information of the type key. See also ↳ Chapter 1.5 "Type plate" in these operating instructions.

Inlet port

Port designation Inlet port	Dimensions	Compressor types
N*	NPT ½“	DLE 2, DLE 5
	NPT ¼“	DLE 15 to DLE 75
U	9/16 – 18 UNF for ¼“ high-pressure pipe, ports 4H acc. to MAXIMATOR	DLE 15 to DLE 75

Port: outlet

Port designation Outlet port	Dimensions	Compressor types
N*	NPT ½“	DLE 2, DLE 5
	NPT ¼“	DLE 15 to DLE 75
U	9/16 – 18 UNF for G ¼“ high-pressure pipe, ports 4H acc. to MAXIMATOR	DLE 15 to DLE 75

** At operatung pressures in excess of 1050 bar, it is recommended using the MAXIMATOR high-pressure connection and the associated MAXIMATOR screw connections.

The following combinations of inlet and outlet screw connections are possible **GG, GU, UU, NU** and **NN.**

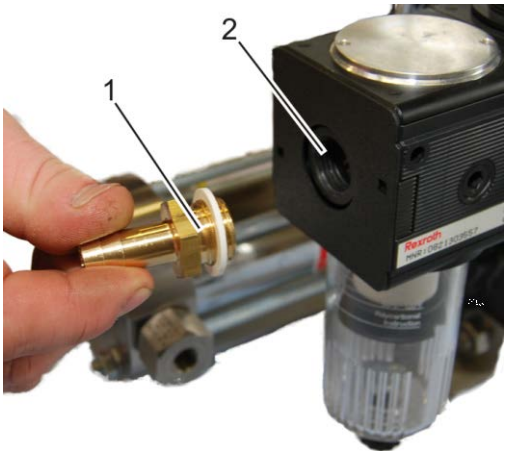
6.4.2 Connect drive air

Depending on the version, the drive air port on the booster either needs to be mounted to the air drive port (P_L) of the control slide valve casing or to the compressed air control unit (accessories) if available. When using drive air lines, hose lines or screw connections, observe the information in "Mechanical port values" and Attachment B "Connection drawing".

The following describes the assembly of the drive air to a compressed air control unit.

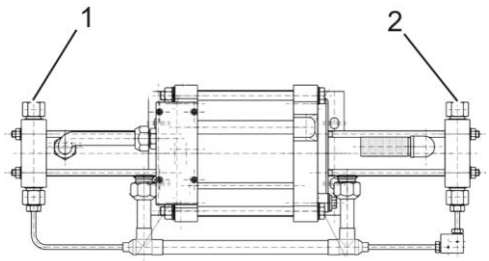
1. Unscrew the plug on the drive air connection (1) of the control slide valve casing or the compressed air control unit (2).

2. Insert the adapter or pipe (G 3/4“) (1) into the drive air connection (P_L) of the compressed air control unit (2) with the seal and tighten with a torque of 50 Nm.



6.4.3 Connect the incoming pipe of preliminary pressure and outlet pipe of the operating pressure

When using drive air lines, hose lines or screw connections, observe the information in ↳ "Mechanical port values" and ↳ Attachment B "Connection drawing".

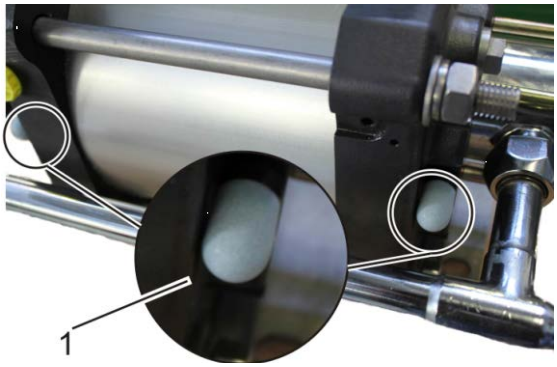


1. Remove the plug at the inlet and outlet ports (1 and 2).
2. Connect the inlet and outlet pipes as shown in the connection drawing.

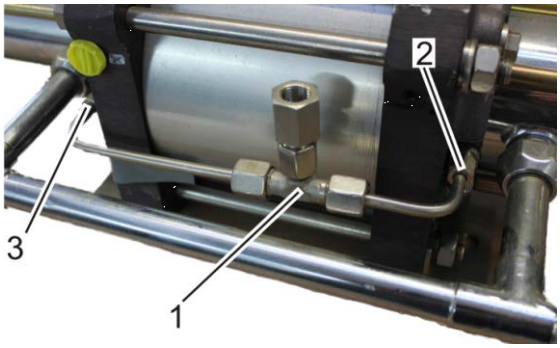
6.4.4 Mount separate leakage line

When compressing flammable or hazardous gases, an additional leak line needs to be mounted to the booster.

1. Unscrew the ventilation silencer (1) from the leak ports Z_1 and Z_3.



2. Connect the leak pipe (1) to the leak ports Z_1 (2) and Z_3 (3).
3. Mount separate leakage line according to the leak pipe.



6.4.5 Purging plans fo compression of hazardous and flammable gases.

Purging plans for MAXIMATOR booster		
Purging plan for single-phase single-acting booster:	Purging plan for single-phase double-acting booster:	Purging plan for two-phased booster:
(With SFP purging interface and Z1 leakage connection on the high-pressure side). Purging procedure: 1. Prior to booster start-up, connect the nitrogen supply to the pre-pressure port (PA) and to the purging interface (SFP). 2. Switch on the booster for approx. 1 min. (depending on the volume to be purged). 3. Switch off the booster after completion of the purging process. 4. Afterwards, the pre-pressure line (P_A) can be connected to the gas supply. During compression, the purging interface is continuously purged with nitrogen. 5. After completion of compression, the booster compartment is purged again as described under item 2.	(With SFP purging interface and Z_1 and Z_3 leakage connection on the high-pressure side). Purging procedure: 1. Prior to booster start-up, connect the nitrogen supply to the pre-pressure port (PA) and to the purging interface (SFP). 2. Switch on the booster for approx. 1 min. (depending on the volume to be purged). 3. Switch off the booster after completion of the purging process. 4. Afterwards, the pre-pressure line (P_A) can be connected to the gas supply. During compression, the purging interface is continuously purged with nitrogen, because in single-phase, double-acting booster no respiratory air is sucked in via the leakage ports. 5. After completion of compression, the booster compartment is purged again as described under item 2.	(With SFP purging interface and Z_1 and Z_3 leakage connection on the high-pressure side). Purging procedure: 1. Prior to booster start-up, connect the nitrogen supply to the pre-pressure port (PA) and to the purging ports (SFP). 2. Switch on the booster for approx. 1 min. (depending on the volume to be purged). 3. Switch off the booster after completion of the purging process. 4. Afterwards, the pre-pressure line (P_A) can be connected to the gas supply. During compression, the purging interface is continuously purged with nitrogen. 5. After completion of compression, the booster compartment is purged again as described under item 2.

Volume flow for gas purging:

Depending on the type of booster, different volume flows must be ensured to provide for sufficient purging performance. The table below shows the minimum required volume flow.

For booster marked in red, volume flow is only required during start-up and decommissioning. No volume flow is required during operation.

Apart from purge gas volume flow, the cross sections of purging lines are also significant. We recommend not to fall below an inner diameter of 4 mm. If the diameter is smaller, this involves the hazard of gas pressure accumulating inside the purge line. Under certain circumstances, the high-pressure component of the booster might be damaged.

Also make sure the purge line exit remains unobstructed.

Type	**Volume flow l_N/min**
DLE 2-1	190
DLE 5-1	90
DLE 15-1	40
DLE 30-1	20
DLE 75-1	10
DLE 2	170
DLE 5	90
DLE 15	30
DLE 30	20
DLE 75	10
DLE 2-5	110
DLE 5-15	60
DLE 5-30	70
DLE 15-30	20
Type	**Volume flow l_N/min**
DLE 15-75	30
DLE 30-75	10

DLE 2-1-2	190
DLE 5-1-2	90
DLE 15-1-2	30
DLE 30-1-2	20
DLE 75-1-2	10
DLE 2-2	170
DLE 5-2	80
DLE 15-2	30
DLE 30-2	20
DLE 75-2	10
DLE 2-5-2	100
DLE 5-15-2	60
DLE 5-30-2	70
DLE 15-30-2	20
DLE 15-75-2	20
DLE 30-75-2	10
DLE 30-75-3	10

6.5 Installing the exhaust silencer

The following describes how the exhaust silencer is mounted.

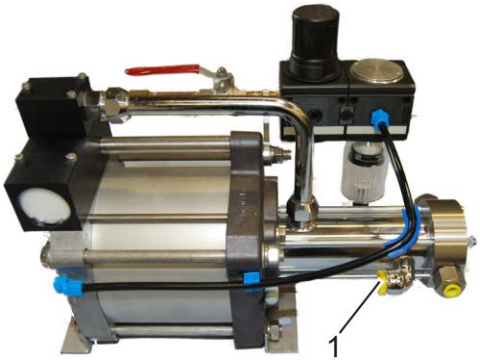
The exhaust air silencer may be made of plastic or aluminium depending on the booster model. Assembly of the exhaust air silencer is always identical. If hazardous or flammable gases are used as a drive medium, the exhaust gas must be discharged separately using the silencer port.

Personnel: Machine and system constructors

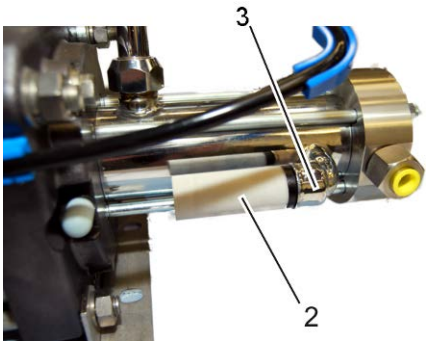
Protection equipment: Personal protection equipment

1. Keep the exhaust silencer ready.

2. Unscrew the plug from the exhaust air port.



3. Place the exhaust air silencer (2) on the exhaust air port (3) and tighten by hand.



6.6 Commissioning

The following describes how the booster is commissioned.

Personnel: Machine and system constructors

Protection equipment:
- Protective work clothing 
- Protective goggles 
- Safety shoes 

Special tool: Leak detection spray

Test before commissioning

1. Check all medium connections for correct installation.
2. Check all pipelines for mechanical damage.
3. Open booster medium (gases) at the transport gas container.

   (The booster medium flows inwards.
4. Open the compressed air line of the compressed air supply to the booster.

   (the booster begins to pump.

The exhaust air silencer may be made of plastic or aluminium depending on the booster model. Assembly of the exhaust air silencer is always identical.

When using a compressed air unit, the drive air is supplied to the manometer of the compressed air control unit when the compressed air supply is opened. In this case, the function of the manometer also needs to be checked.

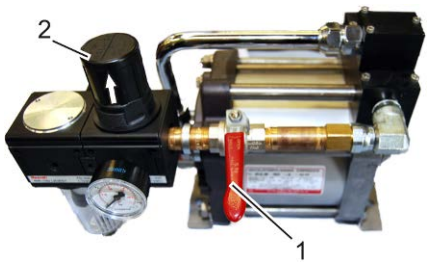
5. Search for leaks using leak detection spray on all ports.

Check whether manometer functions correctly.

During commissioning, the function of the manometer on the compressed air control unit must be checked (this is not part of the standard delivery scope). Proceed as follows:

1. Keep the ball cock (1) of the compressed air control unit (2) closed.

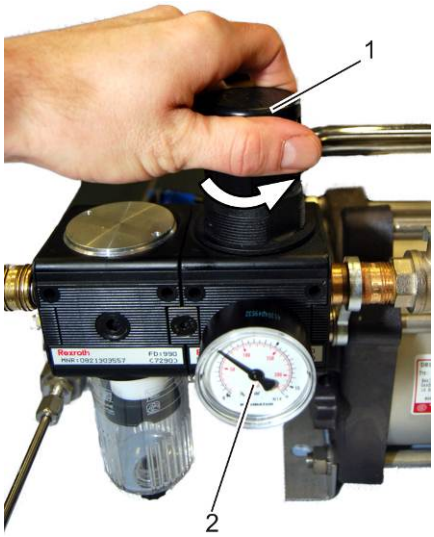
The ball cock (1) is closed as shown in the adjacent picture.



2. Open ball valve
3. Pull the pressure control button (1) upwards.

   → The controller audibly clicks out of the lock.
4. Set the required drive pressure by turning the controller (1) to the right and monitor on the manometer (2).

   → The drive air is applied.



5. Open the venting screw (1) on the water separator (2) and release the water.

7 Operation

7.1 Safety instructions for operation

7.1.1 General dangers at the work station

Noise

WARNING!

Risk of injury due to noise level!

The noise level occurring in the work area can cause major hearing damage depending on the installation type and expanding air.

- Always wear personal protection equipment when working on a running booster.

Only remain in the danger zone if necessary.

The noise level depends on the installation situation and can only be determined after installation.

Flying ice crystals and accumulations of liquid!

WARNING!

Risk of injury due to flying ice crystals and accumulations of liquid!

Ice can develop on the exhaust air silencer of the booster, which is ejected and can be launched by the expanding air. The ejected ice crystals can lead to eye injuries and liquid accumulations on the floor.

- Always wear protective goggles during work.
- Always soak up liquid accumulations with suitable media.
- Always wear anti-slip safety footwear.

Attach warnings and instructions at or near to the area where the accumulations of liquid on the floor or ejected ice crystals can occur.

Incorrect operation

WARNING!

Risk of injury due to incorrect operation!

Incorrect operation may cause serious personal injuries or major material damage.

- Perform all operating steps according to the instructions and information in this manual.

7.2 Inspection and maintenance intervals

Personnel: to be defined by the system constructor

It is recommended that the inspections listed in the following are carried out before and during operation.

- Check all screw connections and pipelines for damage.

Maintenance interval*	Maintenance step
Before and after every use	a. System check to ensure it functions safely
	b. Dehumidify the air system
	c. Check the ports are tight (leak detection spray)
Every 20,000 strokes or 3-6 months	a. Inspection and lubrication of slide control valve, pilot valve or O-rings in the drive part: if necessary, replace
	b. Check booster for leaks (at screw connections and seals
	c. Check and, if necessary, tighten, stud bolts, non-return valves and screw connections.
Every 6 months	a. Replace oxygen and air filters
Every 12 months	a. Carry out pressure test on the booster pipes (leak detection spray)
	b. Check, clean and, if necessary, replace non-return valves.
	c. Cleaning the booster**
As required or after wear (over 500-1000 work hours, 2,000,000 strokes or every 18 months)	a. Replace all seal and guide elements

* In the case of oxygen, it should be noted that when the oxygen pressure exceeds 30 bar (max. 70°C) the allowed value for residual oil or residual grease on the surface may not exceed 200 mg/m² (IGC 33/06/E). The residual oil or residual grease of the drive medium may not exceed 0.01 mg/m³. The values need to be monitored and the maintenance intervals adapted accordingly! Please observe the BGR 500 2.32 "Operation of oxygen systems".

Likewise, all equipment in system carrying oxygen must be verifiably suitable for oxygen and the designed pressures and temperatures depending on the construction type and material

** Only MAXIMATOR personnel can carry out the maintenance on oxygen devices after 12 months!

→ MAXIMATOR spare parts are not cleaned and need to be treated (cleaned separately before installation!

MAXIMATOR devices should be sent to your local MAXIMATOR representative for repairs. Please ensure that they are purged with inert gas first (see purge plan)! The declaration of no objection must completed and enclosed (available on the MAXIMATOR Homepage www.MAXIMATOR.de).

8 Dismantling and Disposal

Safety Instructions

After the end of the booster's service life, it must be dismantled and disposed of in an environmentally friendly manner.

Explosion protection

WARNING!

Explosion protection during dismantling

Introducing sources of ignition such as sparks, naked flames, and hot surfaces can lead to explosions in the explosion zone.

- Obtain written approval before beginning dismantling.
- Purge the booster with nitrogen before beginning to dismantle it to rinse out residues of poisonous and flammable gases.
- Only dismantle when an atmosphere at risk of explosion has been excluded.
- Only use tools that are approved for use in explosive protection areas.

Failure to observe these instructions leads to loss of explosion protection.

Incorrect dismantling

WARNING!

Risk of injury in case of incorrect disassembly!

Stored residual risks, sharp components, points and corners on or in the booster or on the necessary tools can cause injuries.

- Ensure that there is sufficient space before beginning work.
- Shut off all operating media to the booster.
- Make sure that the workplace is clean and tidy. Loose components and tools on top of another or lying about pose potential accident risks.

Consult the manufacturer in case of any uncertainty

Deinstallation

1. Shutdown booster, depressurise and fully release stored pressure.
2. Purge the booster with nitrogen.
3. Release attachment screws.

Then correctly clean assemblies and components and dismantle under consideration of the valid local work protection and environmental protection regulations.

Disposal

If no agreement for the recovery or the disposal was made, recycle the disassembled components correctly:

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Einbauerklärung nach 2006/42/EG, Anhang II, Nr.1 B

Inhalt gemäß 2006/42/EG, Anhang II, Nr.1 B.

Anschrift Hersteller: MAXIMATOR GmbH
Lange Straße 6
99734 Nordhausen

Der Dokumentationsbeauftragte ist bevollmächtigt, die speziellen technischen Unterlagen nach Anhang VII B zusammenzustellen:
dokumentationsbeauftragter@maximator.de / Tel.: 03631-9533-5109

Die Bauart von Druckluftbetriebenen Kompressoren der Baureihe : **DLE X, DLE X-X, DLE X-1, DLE X-2, DLE X-1-2, DLE X-X-2, 8 DLE X**

ist eine unvollständige Maschine nach Artikel 2g und ausschließlich zum Einbau in oder zum Zusammenbau mit einer anderen Maschine oder Ausrüstung vorgesehen.
Grundlegende Sicherheits- und Gesundheitsschutzanforderung gemäß Anhang I dieser Richtlinie kommen zur Anwendung und wurden eingehalten:
Auflistung siehe separate Anlage
Die speziellen technischen Unterlagen gemäß Anhang VII B wurden erstellt und sie werden der zuständigen nationalen Behörde auf Verlangen in elektronischer Form übermittelt.
Folgende harmonisierte Normen (oder Teile dieser Normen) wurden angewendet :
DIN EN ISO 12100-1
DIN EN ISO 12100-2
Diese unvollständige Maschine darf erst dann in Betrieb genommen werden, wenn festgestellt wurde, dass die Maschine, in die unvollständige Maschine eingebaut werden soll, den Bestimmungen der Maschinenrichtlinie entspricht.

Declaration of Incorporation acc. to 2006/42/EC, Annex II, Nr.1 B

Contents acc. to 2006/42/EC, Annex II, Nr.1 B.

Name and address of manufacturer: MAXIMATOR GmbH
Lange Straße 6
99734 Nordhausen/Germany

The documentation officer is authorised to compile the relevant technical documentation as set forth in Annex VII B:
dokumentationsbeauftragter@maximator.de / Tel.: +49(0)3631-9533-5109

The model of air driven compressors type: **DLE X, DLE X-X, DLE X-1, DLE X-2, DLE X-1-2, DLE X-X-2, 8 DLE X**

is a partly completed machinery as defined in Article 2g and exclusively envisaged for installation into or assembly with other machinery or equipment.
Essential health and safety requirements (EHSR) acc. to Annex I to this directive have been applied and complied with:
See separate Appendix
The relevant technical documentation according to Annex VII B was compiled and will be forwarded to the competent national authority in electronic format upon request.
The following harmonised standards (or parts of such standards were applied:
DIN EN ISO 12100-1
DIN EN ISO 12100-2
The partly completed machinery must not be put into service until the final machinery into which it is to be incorporated has been declared in conformity with the provisions of the Directive on Machinery.

Déclaration d'incorporation de quasi-machines conformément à la Directive 2006/42/CE, Annexe II, Nr.1 B

Contenu conforme à la Directive 2006/42/CE, Annexe II, Nr.1 B.

Adresse du fabricant : MAXIMATOR GmbH
Lange Straße 6
99734 Nordhausen/Germany

La personne en charge de la documentation a procuration pour établir la documentation technique spéciale conformément à l'Annexe VII B : dokumentationsbeauftragter@maximator.de / Tél. : 03631-9533-5109

Le modèle de surpresseurs de gaz type: **DLE X, DLE X-X, DLE X-1, DLE X-2, DLE X-1-2, DLE X-X-2, 8 DLE X**

est une quasi-machine conformément à l'Article 2g et elle est destinée uniquement à être intégrée ou dans une autre machine ou un autre équipement ou à réaliser avec ceux-ci un ensemble cohérent.
Les exigences essentielles de santé et de sécurité conformément à l'Annexe I de la Directive ont été appliquées et respectées :
Voir la liste en Annexe
La documentation technique spéciale conformément à l'Annexe VII B a été établie et sera transmise sous forme électronique, sur réquisition, aux services nationaux compétents.
Les normes harmonisées suivantes (ou des parties de ces normes) ont été appliquées :
DIN EN ISO 12100-1
DIN EN ISO 12100-2
Cette quasi-machine ne pourra être mise en service qu'après avoir constaté que la machine dans laquelle la quasi-machine est intégrée, satisfait aux prescriptions de la Directive sur les machines.

Nordhausen, den 06.07.2012 (Nordhausen, 06 July 2012) [Nordhausen, le 06 juillet 2012]

i.V.

Jochen Diemer (Technischer Leiter) (Chief Technical Officer) [Directeur technique]

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Anlage zur Einbauerklärung gemäß 2006/42/EG Anhang II, Nr.1 B

Beschreibung der grundlegenden Sicherheits- und Gesundheitsschutzanforderungen gemäß 2006/42/EG, Anhang I, die zur Anwendung kommen und eingehalten wurden :

Nr.	Grundlegende Anforderungen	Zutreffend	Erfüllt
1.1.1.	Begriffsbestimmung	Ja	Ja
1.1.2.	Grundsätze für die Integration der Sicherheit	Ja	Ja
1.1.3.	Materialien und Produkte	Ja	Ja
1.1.4.	Beleuchtung	Nein	
1.1.5.	Konstruktion der Maschine im Hinblick auf die Handhabung	Ja	Ja
1.1.6.	Ergonomie	Nein	
1.1.7.	Bedienungsplätze	Nein	
1.1.8.	Sitze	Nein	
1.2.	Steuerungen und Befehlseinrichtungen		
1.2.1.	Sicherheit und Zuverlässigkeit von Steuerungen	Ja	Nein
1.2.2	Stellteile	Nein	
1.2.3.	Ingangsetzen	Ja	Nein
1.2.4.	Stillsetzen	Ja	Nein
1.2.4.1	Normales Stillsetzen	Ja	Nein
1.2.4.2	Betriebsbedingtes Stillsetzen	Nein	
1.2.4.3	Stillsetzen im Notfall	Ja	Nein
1.2.4.4	Gesamtheit von Maschinen	Nein	
1.2.5.	Wahl der Steuerungs- oder Betriebsarten	Nein	
1.2.6.	Störung der Energieversorgung	Ja	Nein
1.3.	Schutzmaßnahmen gegen mechanische Gefährdungen		
1.3.1.	Risiko des Verlusts der Standsicherheit	Ja	Nein
1.3.2.	Bruchrisiko beim Betrieb	Ja	Ja
1.3.3.	Risiken durch herabfallende oder herausgeschleuderte Gegenstände	Ja	Ja
1.3.4.	Risiken durch Oberflächen, Kanten und Ecken	Ja	Ja
1.3.5.	Risiken durch mehrfach kombinierte Maschinen	Nein	
1.3.6.	Risiken durch Änderungen der Verwendungsbedingungen	Nein	
1.3.7.	Risken durch bewegliche Teile	Ja	Ja
1.3.8.	Wahl der Schutzeinrichtungen gegen Risiken durch bewegliche Teile	Nein	
1.3.8.1	Bewegliche Teile der Kraftübertragung	Nein	
1.3.8.2	Bewegliche Teile, die am Arbeitsprozess beteiligt sind	Nein	
1.3.9.	Risiko unkontrollierter Bewegungen	Nein	
1.4.	Anforderung an Schutzeinrichtungen		
1.4.1.	Allgemeine Anforderungen	Nein	
1.4.2.	Besondere Anforderungen an trennende Schutzeinrichtungen	Nein	
1.4.2.1	Feststehende trennende Schutzeinrichtungen	Nein	
1.4.2.2	Bewegliche trennende Schutzeinrichtugen mit Verriegelung	Nein	
1.4.2.3	Zugangsbeschränkende verstellbare Schutzeinrichtungen	Nein	
1.4.3.	Besondere Anforderungen an nichttrennende Schutzeinrichtungen	Nein	
1.5.	Risiken durch sonstige Gefährdungen		
1.5.1.	Elektrische Energieversorgung	Nein	
1.5.2.	Statische Elektrizität	Ja	Ja
1.5.3.	Nichtelektrische Energieversorgung	Ja	Nein
1.5.4.	Montagefehler	Ja	Ja
1.5.5.	Extreme Temperaturen	Nein	
1.5.6.	Brand	Ja	Ja
1.5.7.	Explosion	Nicht zutreffend oder gesondert bescheinigt	
1.5.8.	Lärm	Ja	Nein

1.5.9.	Vibrationen	Nein	
1.5.10.	Strahlung	Nein	
1.5.11.	Strahlung von aussen	Ja	Ja
1.5.12.	Laserstrahlung	Nein	
1.5.13.	Emission gefährlicher Werkstoffe und Substanzen	Ja	Nein
1.5.14.	Risiko, in einer Maschine eingeschlossen zu werden	Nein	
1.5.15.	Ausrutsch-, Stolper- und Sturzrisiko	Ja	Nein
1.5.16.	Blitzschlag	Nein	
1.6.	Instandhaltung		
1.6.1.	Wartung der Maschine	Ja	Nein
1.6.2.	Zugang zu den Bedienungsständen und den Eingriffspunkten für die Instandhaltung	Nein	
1.6.3.	Trennung von Energiequellen	Ja	Nein
1.6.4.	Eingriffe des Bedienungspersonals	Ja	Ja
1.6.5.	Reinigung innen liegender Maschinenteile	Nein	
1.7.	Information		
1.7.1.	Informationen und Wartungshinweise an der Maschine	Nein	
1.7.1.1	Information und Informationseinrichtungen	Nein	
1.7.1.2	Warneinrichtungen	Nein	
1.7.2.	Warnung vor Restrisiken	Nein	
1.7.3.	Kennzeichnung der Maschinen	Ja	Ja
1.7.4.	Betriebsanleitung	Nein	
1.7.4.1	Allgemeine Grundsätze für die Abfassung der Betriebsanleitung	Nein	
1.7.4.2	Inhalt der Betriebsanleitung	Nein	
1.7.4.3	Verkaufprospekte	Nein	
2.	Zusätzliche grundlegende Sicherheits- und Gesundheitsschutzanforderungen an bestimmte Maschinengattungen	Nein	
2.1.	Nahrungsmittelmaschinen und Maschinen für kosmetische oder pharmazeutische Erzeugnisse	Nein	
2.2	Handgehaltene und/ oder handgeführte tragbare Maschinen	Nein	
2.2.2.	Tragbare Befestigungsgeräte und andere Schussgeräte	Nein	
2.3.	Maschinen zur Bearbeitungen von Holz und von Werkstoffen mit ähnlichen physikalischen Eigenschaften	Nein	
3.	Zusätzliche grundlegende Sicherheits- und Gesundheitsschutzanforderungen zur Ausschaltung der Gefährdungen, die von der Beweglichkeit von Maschinen ausgehen.	Nein	
4.	Zusätzliche grundlegende Sicherheits- und Gesundheitsschutzanforderungen zur Ausschaltung der durch Hebevorgänge bedingten Gefährdungen.	Nein	
5.	Zusätzliche grundlegende Sicherheits- und Gesundheitsschutzanforderungen an Maschinen, die zum Einsatz unter Tage bestimmt sind.	Nein	
6.	Zusätzliche grundlegende Sicherheits- und Gesundheitsschutzanforderungen an Maschinen, von denen durch das Heben von Personen bedingte Gefährdungen ausgehen.	Nein	

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Appendix to Declaration of Incorporation according to 2006/42/EC Annex II, No.1 B

Description of essential health and safety requirements as defined in 2006/42/EC, Annex I, which were applied and complied with:

No.	Essential requirements	Applicable	Complied
1.1.1.	Definitions	Yes	Yes
1.1.2.	Principles of safety integration	Yes	Yes
1.1.3.	Materials and products	Yes	Yes
1.1.4.	Lighting	No	
1.1.5.	Design of machinery to facilitate its handling	Yes	Yes
1.1.6.	Ergonomics	No	
1.1.7.	Operating positions	No	
1.1.8.	Seating	No	
1.2.	Control systems		
1.2.1.	Safety and reliability of control systems	Yes	No
1.2.2.	Control devices	No	
1.2.3.	Starting	Yes	No
1.2.4.	Stopping	Yes	No
1.2.4.1	Normal stop	Yes	No
1.2.4.2	Operational stop	No	
1.2.4.3	Emergency stop	Yes	No
1.2.4.4	Assembly of machinery	No	
1.2.5.	Selection of control or operating modes	No	
1.2.6.	Failure of the power supply	Yes	No
1.3.	Protection against mechanical hazards		
1.3.1.	Risk of loss of stability	Yes	No
1.3.2.	Risk of break-up during operation	Yes	Yes
1.3.3.	Risk due to falling or ejected objects	Yes	Yes
1.3.4.	Risks due to surface, edges or angles	Yes	Yes
1.3.5.	Risks related to combined machinery	No	
1.3.6.	Risks related to variations in operating conditions	No	
1.3.7.	Risks related to moving parts	Yes	Yes
1.3.8.	Choice of protection against risks arising from moving parts	No	
1.3.8.1	Moving transmission parts	No	
1.3.8.2	Moving parts involved in the process	No	
1.3.9.	Risks of uncontrolled movements	No	
1.4.	Required characteristics of guards and protective devices		
1.4.1.	General requirements	No	
1.4.2.	Special requirements for guards	No	
1.4.2.1	Fixed guards	No	
1.4.2.2	Interlocking movable guards	No	
1.4.2.3	Adjustable guards restricting acces	No	
1.4.3.	Special requirements for protective devices	No	
1.5.	Risks due to other hazards		
1.5.1.	Electricity supply	No	
1.5.2.	Static electricity	Yes	Yes
1.5.3.	Energy supply other than electricity	Yes	No
1.5.4.	Errors of fitting	Yes	Yes
1.5.5.	Extreme temperatures	No	
1.5.6.	Fire	Yes	Yes
1.5.7.	Explosion	Not applicable or certified separately	
1.5.8.	Noise	Yes	No
1.5.9.	Vibrations	No	
1.5.10.	Radiation	No	
1.5.11.	External radiation	Yes	Yes
1.5.12.	Laser radiation	No	

1.5.13.	Emissions of hazardous materials and substances	Yes	No
1.5.14.	Risk of being trapped in a machine	No	
1.5.15.	Risk of slipping, tripping or falling	Yes	No
1.5.16.	Lightning	No	
1.6.	Maintenance		
1.6.1.	Machinery maintenance	Yes	No
1.6.2.	Access to operating positions and servicing points	No	
1.6.3.	Isolation of energy sources	Yes	No
1.6.4.	Operator intervention	Yes	Yes
1.6.5.	Cleaning of internal parts	No	
1.7.	Information		
1.7.1.	Information and warnings on the machinery	No	
1.7.1.1	Information and information devices	No	
1.7.1.2	Warning devices	No	
1.7.2.	Warning of residual risks	No	
1.7.3.	Marking of machinery	Yes	Yes
1.7.4.	Instructions	No	
1.7.4.1	General principles for the drafting of instructions	No	
1.7.4.2	Contents of the instructions	No	
1.7.4.3	Sales literature	No	
2.	Supplementary essential health and safety requirements for certain categories of machinery	No	
2.1.	Foodstuffs machinery and machinery for cosmetics or pharmaceutical products	No	
2.2	Portable hand-held and/or hand-guided machinery	No	
2.2.1.	General		
2.2.2.	Portable fixing and other impact machinery	No	
2.3.	Machinery for working wood and material with similar physical characteristics	No	
3.	Supplementary essential health and safety requirements to offset hazards due to the mobility of machinery	No	
4.	Supplementary essential health and safety requirements to offset hazards due to lifting operations	No	
5.	Supplementary essential health and safety requirements for underground work	No	
6.	Supplementary essential health and safety requirements for machinery presenting particular hazards due to the lifting of person	No	

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Annexe à la déclaration sur quasi-machine conformément à la Directive 2006/42/CE Annexe II, n°1 B

Description des prescriptions essentielles de santé et de sécurité conformément à la Directive 2006/42/CE, Annexe I, ayant été appliquées et qui sont respectées :

N°	Exigences fondamentales	Applicables	Réalisées
1.1.1.	Définitions	Oui	Oui
1.1.2.	Principes d'intégration de la sécurité	Oui	Oui
1.1.3.	Matériaux et produits	Oui	Oui
1.1.4.	Eclairage	Non	
1.1.5.	Conception de la machine en vue de sa manutention	Oui	Oui
1.1.6.	Ergonomie	Non	
1.1.7.	Poste de travail	Non	
1.1.8.	Siège	Non	
1.2.	Systèmes de commande		
1.2.1.	Sécurité et fiabilité des systèmes de commande	Oui	Non
1.2.2.	Organes de service	Non	
1.2.3.	Mise en marche	Oui	Non
1.2.4.	Arrêt	Oui	Non
1.2.4.1	Arrêt normal	Oui	Non
1.2.4.2	Arrêt pour des raisons de service	Non	
1.2.4.3	Arrêt d'urgence	Oui	Non
1.2.4.4	Ensemble de machines	Non	
1.2.5.	Sélection des modes de commande ou de fonctionnement	Non	
1.2.6.	Défaillance de l'alimentation en énergie	Oui	Non
1.3.	Mesures de protection contre les risques mécaniques		
1.3.1.	Risque de perte de stabilité	Oui	Non
1.3.2.	Risque de rupture en service	Oui	Oui
1.3.3.	Risques dus aux chutes, aux éjections d'objets	Oui	Oui
1.3.4.	Risques dus aux surfaces, aux arêtes ou aux angles	Oui	Oui
1.3.5.	Risques dus aux machines combinées	Non	
1.3.6.	Risques dus aux variations des conditions de fonctionnement	Non	
1.3.7.	Risques liés aux éléments mobiles	Oui	Oui
1.3.8.	Choix d'une protection contre les risques engendrés par les éléments mobiles	Non	
1.3.8.1	Eléments mobiles de transmission	Non	
1.3.8.2	Eléments mobiles concourant au travail	Non	
1.3.9.	Risques dus aux mouvements non commandés	Non	
1.4.	Caractéristiques requises pour les protecteurs et les dispositifs de protection		
1.4.1.	Exigences de portée générale	Non	
1.4.2.	Exigences particulières pour les protecteurs	Non	
1.4.2.1	Protecteurs fixes	Non	
1.4.2.2	Protecteurs mobiles avec dispositif de verrouillage	Non	
1.4.2.3	Protecteurs réglables limitant l'accès	Non	
1.4.3.	Exigences particulières pour les dispositifs de protection	Non	
1.5.	Risques dus à d'autres dangers		
1.5.1.	Alimentation en énergie électrique	Non	
1.5.2.	Electricité statique	Oui	Oui
1.5.3.	Alimentation en énergie autre qu'électrique	Oui	Non
1.5.4.	Erreurs de montage	Oui	Oui
1.5.5.	Températures extrêmes	Non	
1.5.6.	Incendie	Oui	Oui
1.5.7.	Explosion	Ne s'applique pas ou attestée séparément	
1.5.8.	Bruit	Oui	Non

1.5.9.	Vibrations	Non	
1.5.10.	Rayonnements	Non	
1.5.11.	Rayonnements extérieurs	Oui	Oui
1.5.12.	Rayonnement laser	Non	
1.5.13.	Emission de matières et de substances dangereuses	Oui	Non
1.5.14.	Risque de rester prisonnier dans une machine	Non	
1.5.15.	Risque de glisser, de trébucher ou de tomber	Oui	Non
1.5.16.	Foudre	Non	
1.6.	Entretien		
1.6.1.	Entretien de la machine	Oui	Non
1.6.2.	Accès aux postes de travail ou aux points d'intervention	Non	
1.6.3.	Séparation de la machine de ses sources d'énergie	Oui	Non
1.6.4.	Intervention de l'opérateur	Oui	Oui
1.6.5.	Nettoyage des parties intérieures	Non	
1.7.	Informations		
1.7.1.	Informations et avertissements sur la machine	Non	
1.7.1.1	Informations et dispositifs d'information	Non	
1.7.1.2	Dispositifs d'alerte	Non	
1.7.2.	Avertissements sur les risques résiduels	Non	
1.7.3.	Marquage des machines	Oui	Oui
1.7.4.	Notice d'instructions	Non	
1.7.4.1	Principes généraux de rédaction de la notice d'instructions	Non	
1.7.4.2	Contenu de la notice d'instructions	Non	
1.7.4.3	Documents commerciaux	Non	
2.	Exigences essentielles complémentaires de santé et de sécurité pour certaines catégories de machines	Non	
2.1.	Machines destinées à l'industrie alimentaire et machines destinées à l'industrie cosmétique ou pharmaceutique	Non	
2.2	Machines portatives tenues et/ou guidées à la main	Non	
2.2.2.	Appareils portatifs de fixation et autres machines à chocs	Non	
2.3.	Machines à bois et matériaux ayant des caractéristiques physiques similaires	Non	
3.	Exigences essentielles complémentaires de santé et de sécurité pour pallier les dangers dus à la mobilité des machines	Non	
4.	Exigences essentielles de santé et de sécurité complémentaires pour pallier aux dangers dus aux opérations de levage	Non	
5.	Exigences essentielles de santé et de sécurité complémentaires pour les machines destinées à des travaux souterrains	Non	
6.	Exigences essentielles de santé et de sécurité complémentaires pour les machines présentant des dangers particuliers dus au levage de personnes	Non	

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EG-Konformitätserklärung

Im Sinne der EG-Richtlinie Explosionsschutz 94/9/EG.
Hiermit erklären wir, dass die Bauart von Druckluftbetriebenen Kompressoren der Baureihe:
DLE X, DLE X-X,
DLE X-1, DLE X-2, DLE X-1-2, DLE X-X-2
in der gelieferten Ausführung folgenden einschlägigen Bestimmungen entspricht:
EG-Richtlinie Explosionsschutz 94/9/EG
Angewendete nationale Normen und technische Spezifikationen:
DIN EN 1127-1
DIN EN 13463-1
DIN EN 13463-5
Gemeldete Stellen:
PTB - Braunschweig (Bundesallee 100, 38116 Braunschweig)
Eingeschaltet zur Aufbewahrung der Unterlagen nach 94/9/EG

EC Declaration of Conformity

As defined by the regulations of the EC Explosion Protection Directive 94/9/EC
Herewith, we declare that the model of air driven compressors type:
DLE X, DLE X-X,
DLE X-1, DLE X-2, DLE X-1-2, DLE X-X-2
as supplied are in conformity with the following relevant regulations:
EC Explosion Protection Directive 94/9/EC
National standards and technical specifications applied:
DIN EN 1127-1
DIN EN 13463-1
DIN EN 13463-5
Notified bodies:
PTB - Braunschweig (Bundesallee 100, 38116 Braunschweig)
Involved for preserving the documents in compliance with 94/9/EC

Déclaration de conformité CE

Au sens de la directive CE atmosphères explosives 94/9/CE
Nous certifions que le modèle de surpresseurs de gaz type:
DLE X, DLE X-X,
DLE X-1, DLE X-2, DLE X-1-2, DLE X-X-2
est conforme, à sa livraison, aux spécifications applicables suivantes:
Directive CE atmosphères explosives 94/9/CE
Normes nationales appliquées et préscriptions techniques:
DIN EN 1127-1
DIN EN 13463-1
DIN EN 13463-5
Services notifiés:
PTB - Braunschweig (Bundesallee 100, 38116 Braunschweig)
Chargé de conserver les dossiers conformément à 94/9/EG

Nordhausen, den 06.07.2012 (Nordhausen, 06 July 2012) [Nordhausen, le 06 juillet 2012]

i.V. .....

Jochen Diemer (Technischer Leiter) (Chief Technical Officer) [Directeur technique]

Betriebsanleitung nach Explosionsschutzrichtlinie

Die Kompressoren können, wenn sie ein EX-Zeichen tragen und eine Konformitätserklärung zur 94/9/EG mitgeliefert wurde in explosionsgefährdeten Bereichen eingesetzt werden. Sie entsprechen der Gruppe II Kategorie 2G/2D Explosionsgruppe IIB konstruktive Sicherheit.

Für den sicheren Betrieb ist es erforderlich, dass der Kompressor fachgerecht mit dem Erdpotential verbunden ist.

Die Temperatur des Kompressors ist von der Temperatur des Mediums, der Verdichtung und anderen Betriebsbedingungen abhängig.

Da verschiedene Gase sich bei einer Verdichtung unterschiedliche erwärmen, muss für jeden Anwendungsfall geprüft werden, ob bei der vorgenommenen Verdichtung eine Temperatur entsteht die unter der maximal zulässigen Temperatur liegt..

Die zu erwatende Temperatur läst sich für ideale Gase durch folgende Formel berechnen:

$$T_2 = \left(\frac{P_2}{P_1}\right)^{\frac{\chi-1}{\chi}} \cdot T_1$$

mit
T_2 → Temperatur nach dem Verdichten (in K)
T_1 → Temperatur vor dem Verdichten (in K)
P_2 → Druck nach dem Verdichten (in bar)
P_1 → Druck vor dem Verdichten (in bar)
χ → Isentropenexponent

Der Isentropenexponent kann für gängige Gase aus folgender Tabelle oder entsprechenden Tabellenwerken entnommen werden.

Gas	χ	Gas	χ
Argon	1,66	Helium	1,66
Kohlendioxid	1,3	Luft	1,4
Stickstoff	1,4	Xenon	1,67

Dadurch, dass die Verdichtung nicht ohne Wärmeaustausch mit der Umwelt stattfindet wird die tatsächliche Temperatur immer unter der errechneten Temperatur bleiben.

Wenn die Temperatur des verdichteten Gases unter der maximal zulässigen Temperatur liegt muss je nach Explosionszone sichergestellt werden, dass diese Betriebsbedingungen sich nicht ändern. Ein geringerer Vordruck würde zu einer höheren Temperatur führen!

Übersteigt die Temperatur des verdichteten Gases die maximal zulässige Temperatur so muss die Verdichtung durch mehrere Stufen laufen und zwischen den einzelnen Kompressionsschritten gekühlt werden.

Die Montageanleitung nach Maschinenrichtlinie (2006/42/EG) ist untrennbarer Bestandteil dieser Betriebsanleitung.

Operating instructions according to Explosion Directive

Compressors that are marked with an EX sign and are supplied with a declaration of conformity as defined in 94/9/EC may be used in areas subject to explosion hazards. They are in conformity to Group II Category 2G/2D Explosion group IIB constructive safety.

Safe compressor operation requires the compressors to be appropriately connected to the earth potential.

The temperature of compressors depends on the temperature of the medium, the degree compression and other operating conditions.

Because different gases heat up differently during compression, it must be checked for each application case whether the compression effected will bring about a temperature that is below the max. admissible temperature.

The anticipated temperature can be calculated for ideal gases with the following formula:

$$T_2 = \left(\frac{P_2}{P_1}\right)^{\frac{\chi-1}{\chi}} \cdot T_1$$

where
T_2 → Temperature after compression (in K)
T_1 → Temperature before compression (in K)
P_2 → Pressure after compression (in bar)
P_1 → Pressure before compression (in bar)
χ → Isentropic exponent

The isentropic exponent of commonly used gases can be gathered from the below table or specific table collections.

Gas	χ	Gas	χ
Argon	1.66	Helium	1.66
Carbon dioxide	1.3	Air	1.4
Nitrogen	1.4	Xenon	1.67

Due to the fact that compression always entails a heat exchange with the environment the actual temperature will always remain below the calculated temperature.

When the temperature of the compressed gas is below the max. admissible temperature it must be ensured in every area that is subject to explosion hazards that its operating conditions are not altered. A lower admission pressure would result in a higher temperature!

When the temperature of the compressed gas exceeds the max. admissible temperature, compression has to progress through several phases and cooling must be provide between the individual compression steps.

The assembly instructions according to the Machine Directive (2006/42/EG) form an inseparable part of these operating instructions.

Mode d'emploi selon réglementation ATEX (ATmosphères EXplosibles)

S'ils portent le label EX et s'ils ont été livrés avec une attestation de conformité pour 94/9/CE, les compresseurs de surpression d'air comprimé peuvent être utilisés en atmosphère explosive. Elles relèvent alors pour la sécurité de construction du groupe II, catégorie 2G/2D groupe d'explosion IIB.

Pour assurer un fonctionnement sécuritaire, il est nécessaire que le compresseur de surpression de l'air comprimé soit raccordé correctement à la terre.

La température du compresseur de surpression d'air comprimé dépend de la température de l'agent, de la compression et autres conditions d'exploitation.

Du fait que les différents gaz s'échauffent différemment sous compression, il est nécessaire de vérifier pour chaque application si, pour la compression réalisée, la température reste sous le seuil maximal admissible.

La température résultante est obtenue par la formule suivante pour les gaz idéaux :

$$T_2 = \left(\frac{P_2}{P_1}\right)^{\frac{\chi-1}{\chi}} \cdot T_1$$

avec
T_2 → température après compression (en K)
T_1 → température avant compression (en K)
P_2 → pression après compression (en bar)
P_1 → pression avant compression (en bar)
χ → exposant isentropique

Pour les gaz courants, l'exposant isentropique est donné par le tableau ci-dessous et dans les tableaux de référence appropriés.

Gaz	χ	Gaz	χ
Argon	1,66	Hélium	1,66
Dioxyde de carbone	1,3	Air	1,4
Azote	1,4	Xénon	1,67

Du fait que la compression n'est pas réalisée sans échange thermique avec le milieu ambiant, la température réelle sera toujours inférieure à la valeur de température calculée selon la formule.

Quand la température du gaz devant être comprimé doit rester inférieure au maximal admissible, il faut veiller à ce que les conditions d'exploitation ne se modifient pas, en fonction de la zone sous atmosphère explosive. Une pression d'amont faible entraînerait une température plus élevée !

Si la température du gaz comprimé dépasse la température maximale admissible, la compression doit être exécutée sur plusieurs étages et le gaz doit être refroidi entre les différentes étapes de compression.

La notice de montage selon la directive machines (2006/42/EG) est un élément indissociable de ce mode d'emploi

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EG-Konformitätserklärung

Im Sinne der EG-Richtlinie Explosionsschutz 94/9/EG.
Hiermit erklären wir, dass die Bauart von Druckluftbetriebenen Kompressoren der Baureihe:
DLE X-ExIIC, DLE X-X-ExIIC, DLE X-1-ExIIC, DLE X-2-ExIIC, DLE X-1-2-ExIIC,
DLE X-X-2-ExIIC, DLE X-H2, DLE X-X-H2, DLE X-1-H2, DLE X-2-H2, DLE X-1-2-H2, DLE X-X-2-H2
in der gelieferten Ausführung folgenden einschlägigen Bestimmungen entspricht:
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Eingeschaltet zur Aufbewahrung der Unterlagen nach 94/9/EG

EC Declaration of Conformity

As defined by the regulations of the EC Explosion Protection Directive 94/9/EC
Herewith, we declare that the model of air driven compressors type:
DLE X-ExIIC, DLE X-X-ExIIC, DLE X-1-ExIIC, DLE X-2-ExIIC, DLE X-1-2-ExIIC,
DLE X-X-2-ExIIC, DLE X-H2, DLE X-X-H2, DLE X-1-H2, DLE X-2-H2, DLE X-1-2-H2,DLE X-X-2-H2
as supplied are in conformity with the following relevant regulations:
EC Explosion Protection Directive 94/9/EC
National standards and technical specifications applied:
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DIN EN 13463-1
DIN EN 13463-5
Notified bodies:
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Involved for preserving the documents in compliance with 94/9/EC

Déclaration de conformité CE

Au sens de la directive CE atmosphères explosives 94/9/CE
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DLE X-ExIIC, DLE X-X-ExIIC, DLE X-1-ExIIC, DLE X-2-ExIIC, DLE X-1-2-ExIIC,
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est conforme, à sa livraison, aux spécifications applicables suivantes:
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Chargé de conserver les dossiers conformément à 94/9/EG

Nordhausen, den 06.07.2012 (Nordhausen, 06 July 2012) [Nordhausen, le 06 juillet 2012]

i.V. .....

Jochen Diemer (Technischer Leiter) (Chief Technical Officer) [Directeur technique]

Betriebsanleitung nach Explosionsschutzrichtlinie

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Für den sicheren Betrieb ist es erforderlich, dass der Kompressor fachgerecht mit dem Erdpotential verbunden ist.

Die Temperatur des Kompressors ist von der Temperatur des Mediums, der Verdichtung und anderen Betriebsbedingungen abhängig.

Da verschiedene Gase sich bei einer Verdichtung unterschiedliche erwärmen, muss für jeden Anwendungsfall geprüft werden, ob bei der vorgenommenen Verdichtung eine Temperatur entsteht die unter der maximal zulässigen Temperatur liegt..

Die zu erwatende Temperatur läst sich für ideale Gase durch folgende Formel berechnen:

$$T_2 = \left(\frac{P_2}{P_1}\right)^{\frac{\chi-1}{\chi}} \cdot T_1$$

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Wenn die Temperatur des verdichteten Gases unter der maximal zulässigen Temperatur liegt muss je nach Explosionszone sichergestellt werden, dass diese Betriebsbedingungen sich nicht ändern. Ein geringerer Vordruck würde zu einer höheren Temperatur führen!

Übersteigt die Temperatur des verdichteten Gases die maximal zulässige Temperatur so muss die Verdichtung durch mehrere Stufen laufen und zwischen den einzelnen Kompressionsschritten gekühlt werden.

Die Montageanleitung nach Maschinenrichtlinie (2006/42/EG) ist untrennbarer Bestandteil dieser Betriebsanleitung.

Operating instructions according to Explosion Directive

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Mode d'emploi selon réglementation ATEX (ATmosphères EXplosibles)

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Pour assurer un fonctionnement sécuritaire, il est nécessaire que le compresseur de surpression de l'air comprimé soit raccordé correctement à la terre.

La température du compresseur de surpression d'air comprimé dépend de la température de l'agent, de la compression et autres conditions d'exploitation.

Du fait que les différents gaz s'échauffent différemment sous compression, il est nécessaire de vérifier pour chaque application si, pour la compression réalisée, la température reste sous le seuil maximal admissible.

La température résultante est obtenue par la formule suivante pour les gaz idéaux :

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avec
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Azote	1,4	Xénon	1,67

Du fait que la compression n'est pas réalisée sans échange thermique avec le milieu ambiant, la température réelle sera toujours inférieure à la valeur de température calculée selon la formule.

Quand la température du gaz devant être comprimé doit rester inférieure au maximal admissible, il faut veiller à ce que les conditions d'exploitation ne se modifient pas, en fonction de la zone sous atmosphère explosive. Une pression d'amont faible entraînerait une température plus élevée !

Si la température du gaz comprimé dépasse la température maximale admissible, la compression doit être exécutée sur plusieurs étages et le gaz doit être refroidi entre les différentes étapes de compression.

La notice de montage selon la directive machines (2006/42/EG) est un élément indissociable de ce mode d'emploi

MAXIMATOR®

Maximum Pressure.

EG-Konformitätserklärung

Im Sinne der EG-Richtlinie Explosionsschutz 94/9/EG.
Hiermit erklären wir, dass die Bauart von Druckluftbetriebenen Kompressoren der Baureihe:
X DLE X
in der gelieferten Ausführung folgenden einschlägigen Bestimmungen entspricht:
EG-Richtlinie Explosionsschutz 94/9/EG
Angewendete nationale Normen und technische Spezifikationen:
DIN EN 1127-1
DIN EN 13463-1
DIN EN 13463-5
Gemeldete Stellen:
PTB - Braunschweig (Bundesallee 100, 38116 Braunschweig)
Eingeschaltet zur Aufbewahrung der Unterlagen nach 94/9/EG

EC Declaration of Conformity

As defined by the regulations of the EC Explosion Protection Directive 94/9/EC
Herewith, we declare that the model of air driven compressors type:
X DLE X
as supplied are in conformity with the following relevant regulations:
EC Explosion Protection Directive 94/9/EC
National standards and technical specifications applied:
DIN EN 1127-1
DIN EN 13463-1
DIN EN 13463-5
Notified bodies:
PTB - Braunschweig (Bundesallee 100, 38116 Braunschweig)
Involved for preserving the documents in compliance with 94/9/EC

Déclaration de conformité CE

Au sens de la directive CE atmosphères explosives 94/9/CE
Nous certifions que le modèle de surpresseurs de gaz type:
X DLE X
est conforme, à sa livraison, aux spécifications applicables suivantes:
Directive CE atmosphères explosives 94/9/CE
Normes nationales appliquées et préscriptions techniques:
DIN EN 1127-1
DIN EN 13463-1
DIN EN 13463-5
Services notifiés:
PTB - Braunschweig (Bundesallee 100, 38116 Braunschweig)
Chargé de conserver les dossiers conformément à 94/9/EG

Nordhausen, den 09.04.2014 (Nordhausen, 09 April 2014) [Nordhausen, le 09 avril 2014]

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Peter Hanke (Produktionsleiter) (Production Manager) [Directeur de production]

Commerzbank Göttingen: IBAN: DE22260800240922882200, SWIFT DRESDEFF260
KBC Bank Düsseldorf: IBAN: DE63301205000000289902 SWIFT BANVDEHB300
Kreissparkasse Nordhausen: IBAN: DE41820540520305001469, SWIFT HELADEF1NOR
Postbank Hannover: IBAN: DE66250100300006417302, SWIFT PBNKDEFF
Postbank Saarbrücken: IBAN: DE53590100660900879667, SWIFT PBNKDEFF590 (USD only)

Geschäftsführer: Henning Willig
Sitz der Gesellschaft: Nordhausen
Registergericht: HRB 506347, Amtsgericht Jena
Steuer-Nr: 157/114/08085
USt-ID-Nr: DE 224 221799

Betriebsanleitung nach Explosionsschutzrichtlinie

Die Kompressoren können, wenn sie ein EX-Zeichen tragen und eine Konformitätserklärung zur 94/9/EG mitgeliefert wurde in explosionsgefährdeten Bereichen eingesetzt werden. Sie entsprechen der Gruppe II Kategorie 2G/2D Explosionsgruppe IIC konstruktive Sicherheit.

Für den sicheren Betrieb ist es erforderlich, dass der Kompressor fachgerecht mit dem Erdpotential verbunden ist.

Die Temperatur des Kompressors ist von der Temperatur des Mediums, der Verdichtung und anderen Betriebsbedingungen abhängig.

Da verschiedene Gase sich bei einer Verdichtung unterschiedliche erwärmen, muss für jeden Anwendungsfall geprüft werden, ob bei der vorgenommenen Verdichtung eine Temperatur entsteht die unter der maximal zulässigen Temperatur liegt..

Die zu erwatende Temperatur läst sich für ideale Gase durch folgende Formel berechnen:

$$T_2 = \left(\frac{P_2}{P_1}\right)^{\frac{\chi-1}{\chi}} \cdot T_1$$

mit
T_2 → Temperatur nach dem Verdichten (in K)
T_1 → Temperatur vor dem Verdichten (in K)
P_2 → Druck nach dem Verdichten (in bar)
P_1 → Druck vor dem Verdichten (in bar)
χ → Isentropenexponent

Der Isentropenexponent kann für gängige Gase aus folgender Tabelle oder entsprechenden Tabellenwerken entnommen werden.

Gas	χ	Gas	χ
Argon	1,66	Helium	1,66
Kohlendioxid	1,3	Luft	1,4
Stickstoff	1,4	Xenon	1,67

Dadurch, dass die Verdichtung nicht ohne Wärmeaustausch mit der Umwelt stattfindet wird die tatsächliche Temperatur immer unter der errechneten Temperatur bleiben.

Wenn die Temperatur des verdichteten Gases unter der maximal zulässigen Temperatur liegt muss je nach Explosionszone sichergestellt werden, dass diese Betriebsbedingungen sich nicht ändern. Ein geringerer Vordruck würde zu einer höheren Temperatur führen!

Übersteigt die Temperatur des verdichteten Gases die maximal zulässige Temperatur so muss die Verdichtung durch mehrere Stufen laufen und zwischen den einzelnen Kompressionsschritten gekühlt werden.

Die Montageanleitung nach Maschinenrichtlinie (2006/42/EG) ist untrennbarer Bestandteil dieser Betriebsanleitung.

Operating instructions according to Explosion Directive

Compressors that are marked with an EX sign and are supplied with a declaration of conformity as defined in 94/9/EC may be used in areas subject to explosion hazards. They are in conformity to Group II Category 2G/2D Explosion group IIC constructive safety.

Safe compressor operation requires the compressors to be appropriately connected to the earth potential.

The temperature of compressors depends on the temperature of the medium, the degree compression and other operating conditions.

Because different gases heat up differently during compression, it must be checked for each application case whether the compression effected will bring about a temperature that is below the max. admissible temperature.

The anticipated temperature can be calculated for ideal gases with the following formula:

$$T_2 = \left(\frac{P_2}{P_1}\right)^{\frac{\chi-1}{\chi}} \cdot T_1$$

where
T_2 → Temperature after compression (in K)
T_1 → Temperature before compression (in K)
P_2 → Pressure after compression (in bar)
P_1 → Pressure before compression (in bar)
χ → Isentropic exponent

The isentropic exponent of commonly used gases can be gathered from the below table or specific table collections.

Gas	χ	Gas	χ
Argon	1.66	Helium	1.66
Carbon dioxide	1.3	Air	1.4
Nitrogen	1.4	Xenon	1.67

Due to the fact that compression always entails a heat exchange with the environment the actual temperature will always remain below the calculated temperature.

When the temperature of the compressed gas is below the max. admissible temperature it must be ensured in every area that is subject to explosion hazards that its operating conditions are not altered. A lower admission pressure would result in a higher temperature!

When the temperature of the compressed gas exceeds the max. admissible temperature, compression has to progress through several phases and cooling must be provide between the individual compression steps.

The assembly instructions according to the Machine Directive (2006/42/EG) form an inseparable part of these operating instructions.

Mode d'emploi selon réglementation ATEX (ATmosphères EXplosibles)

S'ils portent le label EX et s'ils ont été livrés avec une attestation de conformité pour 94/9/CE, les compresseurs de surpression d'air comprimé peuvent être utilisés en atmosphère explosive. Elles relèvent alors pour la sécurité de construction du groupe II, catégorie 2G/2D groupe d'explosion IIC.

Pour assurer un fonctionnement sécuritaire, il est nécessaire que le compresseur de surpression de l'air comprimé soit raccordé correctement à la terre.

La température du compresseur de surpression d'air comprimé dépend de la température de l'agent, de la compression et autres conditions d'exploitation.

Du fait que les différents gaz s'échauffent différemment sous compression, il est nécessaire de vérifier pour chaque application si, pour la compression réalisée, la température reste sous le seuil maximal admissible.

La température résultante est obtenue par la formule suivante pour les gaz idéaux :

$$T_2 = \left(\frac{P_2}{P_1}\right)^{\frac{\chi-1}{\chi}} \cdot T_1$$

avec
T_2 → température après compression (en K)
T_1 → température avant compression (en K)
P_2 → pression après compression (en bar)
P_1 → pression avant compression (en bar)
χ → exposant isentropique

Pour les gaz courants, l'exposant isentropique est donné par le tableau ci-dessous et dans les tableaux de référence appropriés.

Gaz	χ	Gaz	χ
Argon	1,66	Hélium	1,66
Dioxyde de carbone	1,3	Air	1,4
Azote	1,4	Xénon	1,67

Du fait que la compression n'est pas réalisée sans échange thermique avec le milieu ambiant, la température réelle sera toujours inférieure à la valeur de température calculée selon la formule.

Quand la température du gaz devant être comprimé doit rester inférieure au maximal admissible, il faut veiller à ce que les conditions d'exploitation ne se modifient pas, en fonction de la zone sous atmosphère explosive. Une pression d'amont faible entraînerait une température plus élevée !

Si la température du gaz comprimé dépasse la température maximale admissible, la compression doit être exécutée sur plusieurs étages et le gaz doit être refroidi entre les différentes étapes de compression.

La notice de montage selon la directive machines (2006/42/EG) est un élément indissociable de ce mode d'emploi