Operating instructions

for compressor series

43.2.2.01.01.10.21

Air cooled compressor, 2-stages

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Appendix

1 Introduction

Before starting up the compressor, the customer must ensure that the operating and maintenance personnel have carefully read through these operating instructions and that all information and warnings, especially safety regulations are carried out correctly in every detail.

Furthermore, these operating instructions help you achieve optimal operating results with the compressor you have received as well as ensuring virtually fault-free operation and long service life of the plant. In addition it helps you comply with the specified safety requirements for your employees.

The contents do not claim to be complete. General professional knowledge is assumed. At the same time, "NEUENHAUSER KOMPRESSORENBAU GMBH" is not responsible for statements made in documentation from other manufacturers in so far as this type of documentation has been included with these operating instructions and are a part thereof.

Every compressor is subjected to extensive, successful tests on the test stand before it is delivered.

It is expressly prohibited to copy this text or the drawings/photographs or parts thereof.

2 General technical data

2.1 Technical data for the series 09.2.2.01.01 - 43.2.2.01.01

A technical data sheet is attached

Note:

- The mentioned weights are valid for compressor-blocks
- The performance data was achieved at 1013 mbar and 20 °C
- The performance data have a tolerance of ± 5 %
- Select a driving power approx. 10% higher

The permanent noise level at a distance of 1m from the compressor is a maximum of: 89 dB (A)[1].

The customer is responsible for the electrical connections and the control connections of the compressor. If the compressor has already been equipped with accessories for automatic operation, the customer does not need to connect the control units.

[1] Measured under real operating conditions in the working area of the operating personnel along the compressor at a distance of 1 metre.

2.2 List of electrical ”consumers”

Ser. no.:	No.	Designation	Individual power consumption (kW)
1.	2	condensation valves	0,03 (if present)
2.	1	electr. terminal friction clutch	see Appendix (if present)
3.	1	electrical motor	according to rating plate

Note: Before connecting the plant please check that the plant’s operating voltage and frequency agrees with that of the mains.

3 Use and description of the compressor

The above mentioned compressor model complies with the current requirements of the relevant classification companies and has been constructed in accordance with the regulations valid at the time of delivery/completion.

The use the compressor as intended includes compression of atmospheric air without aggressive, abrasive and / or explosive components.

Technical or pre-compressed gases may only be used after consultation with and approval by NEUENHAUSER KOMPRESSORENBAU GMBH .

The compressor may only be used intermittently (it must not be in permanent operation – time switched on: max. 70%), whereby the air required by the consumer may only be 70% of the compressors performance. If the compressor is on for more than one hour or if the relative humidity of the air taken in is greater than 80%, the water must be removed from the compressor at intervals (approx. 1 x an hour).

If the compressor is used in another way exceeding the use described here, it is deemed to be incorrect use. The "NEUENHAUSER KOMPRESSORENBAU GMBH" shall not be liable for any damage resulting from any such incorrect use nor shall they be liable for any increased wear and tear resulting from incorrect use or for damage resulting from incorrect handling and / or treatment of the compressor, in these cases the operator shall be solely responsible.

It is not permitted to use the compressor for any other use other than that intended by the manufacturer and other than that described in these operating instructions.

NEUENHAUSER KOMPRESSORENBAU GMBH must be consulted if the conditions under which the compressor is used change, e.g. if the surrounding conditions change or the connection values change, if there are any constructional changes, modifications to the original compressor etc..

The compressor has been equipped with an impeller flywheel protection, safety valves and pressure gauges for all stages. It has also been equipped with touch-guards on all hot pipes.

Special descriptions and instructions, which are possibly enclosed in the appendix, apply if the compressor has been delivered with accessories for automatic operation. These and additional equipment can be delivered at a later stage after consultation with NEUENHAUSER KOMPRESSORENBAU GMBH .

Due to their construction, NEUENHAUSER COMPRESSORS are virtually maintenance free and insensitive. You should not perform any disassembly work or inspections except for those check-ups and tests which have been listed in these instructions unless it should become necessary due to operational faults.

3.1 Description and construction

3.1.1 Cooling

The cooling air is taken in using a impeller flywheel, the blades of which have been fitted to the flywheel in accordance with the direction of rotation required. The compressed air is drastically cooled in the compact, outer lamella coolers which follow on after the respective compression stages of the compressor.

3.1.2 Room ventilation and cooling air intake

The cooling air required to cool the compressor is taken from the machine room. As the ambient temperature greatly influences the perfect functioning of the compressor, please ensure that the machine room does not reach temperatures above a maximum of 45°C even after the machine has been running for longer periods of time. If this cannot be guaranteed, additional ventilation must be installed to ensure that sufficient fresh air is directed into the machine room..

In addition, please ensure that there is no danger of frost at the location at which the compressor is to be positioned. If in doubt, heat the area where the compressor is to be located and ensure that there is no condensation left in the coolers. Furthermore, at temperatures below 0°C, the viscosity of the oil is too high and not admissible.

3.1.3 Pistons

The piston (120) has been designed as a differential piston and separates the compression spaces into the 1st and 2nd compression stages. The 1st compression stage is formed by the piston floor and sealed against the compression space of the 2nd stage by the 3 piston rings (130) of the 1st stage. The 2nd compression stage is formed by the ring area of the reduced piston diameter and sealed against the crank space by 3 piston rings (131) and 1 oil scraper ring (132). The ratio of the piston areas results in the stage pressure ratio. The oil scraper ring prevents too much lubrication oil from the crank space accessing the compression space.

The piston has been cast using pressure sealed special cast iron with good emergency running properties. The piston pin (121) has been fitted into the drill holes on its lower part and is secured by 2 retaining rings (133).

The rotation movements of the crankshaft (060) cause the piston (120) to oscillate by means of the connecting rod (080). The connecting rod is forged of tough special steel. The divided connecting rod foot holds the connecting rod bearing (upper and lower pan).

In the case of compressor models 09.2.2.01.01 and 18.2.2.01.01 the connecting rod bearing is made of white metal which has been cast into the connecting rod foot itself, in the case of models 28.2.2.01.01 – 43.2.2.01.01 it is made of bronze pans with white metal. The connecting rod foot is held together by means of the connecting rod screws (081, 083).

The crankshaft (060) is made of tough spheroidal graphite iron. The bearing in the drilled holes of the crankcase is achieved using easy running ball bearings (070, 071). It is carefully balanced using counterweights in order to ensure the smooth and quiet running of the machine.

3.1.4 Cylinder

The cylinder has been made of special cast iron with good emergency running properties and has two receptacles for the suction (161) and pressure valve (162) of the 2nd stage in the side of the compression chamber of the 2nd stage. The cast cooling ribs are sufficiently large so that heat transfer under normal operating conditions is guaranteed (see chapter 3.1.2 ”Room ventilation and cooling air intake”).

3.1.5 Cylinder head

The cylinder head (151) closes the top of the compression chamber of the 1st stage and fixes the combined suction and pressure valve (160) of the 1st stage. The heat is transferred away using cooling ribs which are sufficiently large.

3.1.6 Valves

The valves in both stages are tried and tested, automatic, spring loaded special ring plate valves. The 1st stage has been equipped with a combined suction and pressure valve (160), the 2nd stage has been equipped with a suction valve (161) and a pressure valve (162). Each stage has been equipped with a safety valve which is identified with LP (low pressure 1st stage) (310) and HP (high pressure 2nd stage) (311).

3.1.7 Lubrication equipment

All moving apparatus is lubricated using the supply of oil in the crank oil pan. An oil ring (061) directs the oil to the oil catching ring (062). Due to the centrifugal force, the oil is pressed into the connecting rod bearing (085) from here. The remaining parts of the crank drive and the cylinders and pistons of the 2nd stage are lubricated by the oil propelled forward by the spatter pin. The piston course of the 1st stage is lubricated by oil mist. Due to the pressure gradient between the crankcase and the air sucked into the 1st stage, the oil mist is transported to the piston course through an oil induction pipe. The oil mist is mixed with the air taken in in the cylinder head. The oil mist lubrication is preset by NEUENHAUSER KOMPRESSORENBAU GMBH using an adjustable valve (030). Compressor models 09.2.2.01.01 and 18.2.2.01.01 have not been equipped with an adjustable valve. The adjustable valve may only be adjusted after prior consultation with NEUENHAUSER KOMPRESSORENBAU. If this condition is ignored, the guarantee becomes void. An oil level monitoring unit with an alarm, which if required, can also switch off the compressor, can be provided upon request.

3.2 Operation

The downwards moving piston (120) generates a vacuum in the cylinder area of the 1st stage. The result of this is that the suction part of the combined suction and pressure valve opens so that atmospheric air flows into the cylinder space through the air filter. When the bottom dead centre has been reached, the suction valve of the 1st stage closes automatically and the upwards moving piston compresses the air sucked in.

The pressure part of the combined suction and pressure valve of the 1st stage (160) is opened because of the increasing pressure. The compressed air is pressed out of the air space of the 1st stage into the cylinder head (151) and to the suction valve of the 2nd stage (161) via a connecting pipe (210) through the intermediate cooler of the 1st stage.

Whilst the piston is moving upwards, the suction valve of the 2nd stage opens automatically in the cylinder space of the 2nd stage. This cylinder space has been designed as a ring space. Compared to the stage pressure ratio, its volume is smaller than the piston capacity of the 1st stage. This stage design means that the driving machinery is relatively balanced as far as load and torque distribution are concerned. The downwards moving piston (120) compresses the pre-compressed air to its final pressure and transports it into the pressure hose to the compressed air container through the pressure valve of the 2nd stage (162) and the cooler of the 2nd stage.

4 Work place description, utilization, starting up and operation

4.1 Guarantee

The compressor delivered complies with state-of-the-art technology and with the safety regulations valid at the time of delivery / completion.

If any damage has been caused to the compressor for any of the reasons listed below, the compressor will not be covered by the guarantee:

- ignoring operating instructions
- personnel which has been insufficiently trained or instructed
- natural wear and tear of wearing parts
- faulty or negligent treatment of the compressor
- compression / transport of media which have not been approved
- the compressor has not been monitored and its operation has not been checked by operating / service personnel within the specified intervals
- repairs and/ or changes which have been performed during the period of guarantee without the approval of NEUENHAUSER KOMPRESSORENBAU GMBH, shall relieve NEUENHAUSER KOMPRESSORENBAU GMBH from their guarantee obligations.

Furthermore the operator is himself responsible for ensuring that:

- the UVV[2] and safety regulations are complied with during transport, erection and preparations for operating the machinery, during operation and repairs
- nobody can enter the danger zones whilst the compressor is running
- no incorrect changes or changes to the compressor which have been performed without obtaining the prior approval of "NEUENHAUSER KOMPRESSORENBAU GMBH", especially those which have been made to the safety devices, are NOT undertaken
- faulty starting up and improper operation is not possible
- the compressor is not used in an unsuitable or improper way
- the machinery is always used in the correct way and that any conditions of use which have not been specified in the contract are excluded
- the compressor is monitored and its operation checked by the operating / service personnel within the specified intervals.

[2] UVV = Unfall Verhütung Vorschriften= accident prevention regulations

4.2 Safety regulations

For the operation of the compressor and all measures specified in these operating instructions, the currently valid work protection and accident prevention regulations (UVV) as well as those of the trade association (BG) applicable to the operator of the compressor and the location of the machinery, must be adhered to.

This includes:

- VBG[3] - 1: "General regulations"
- VBG - 4: "Electrical plant and operating means"
- VBG - 5: "Power driven equipment"
- VBG - 10: "Continuous handling equipment"
- VBG - 121: "Noise"
- VBG - 16: "Compressor"

The DIN[4] and VDE[5] regulations regarding safety apply when working on the electrical equipment of the compressor. In addition to the specified regulations and safety regulations, the following must be taken into consideration:

- any safety conditions applicable to the place of erection of the compressor and any safety conditions required by the authorities responsible
- regulations of the country, as well as regional, local and company regulations or directives applicable to the plant and / or place of erection.

Apart from the safety regulations, medical and hygiene regulations or directives must also be taken into consideration.

If any statements in these operating instructions do not comply with the locally required regulations, then the stricter (national) version is to be applied.

When handling dangerous liquids and / or those which can pollute the groundwater e.g. lubricants or grease, solvents or cleansing materials or other chemical substances, the regulations of WHG[6] as well as UVV 1.0 must be complied with.

The following always applies to all repair and maintenance work for the compressor:

- protect the compressor effectively from being switched on and attach a sign stating that repairs are being carried out,
- separate compressor from the compressed air system
- close all stop valves in the pipelines
- de-air (release pressure) all pipelines and pressure capacities in the compressor before the repair work commences – open condensation drain cocks/ valves
- attach safety devices before starting the compressor up again

[3] VBG = Verband der gewerblichen Berufsgenossenschaften= Association of trade associations

[4] DIN = Deutsche Institut für Normung = German industrial standards

[5] VDE = Verein Deutscher Ingenieure = Association of German Engineers

[6] WHG = Wasser Haushalts Gesetz = Water management law

4.3 Basic operation and starting up of the compressor

The compressor you have been delivered has been constructed in accordance with the current stand of technology and has successfully completed extensive tests and is safe to operate and functional.

Before connecting to the operator's electricity supply, please check whether the operating voltage and frequency agree with that of the mains supply.

After the plant has been connected to the electricity supply, the direction of rotation of the electric motor must be checked (see direction of arrow on the impeller flywheel protector. If necessary the electrical connection must be corrected.

The compressor can present a danger to limb and life of the operating personnel or third parties or can impair the plant itself if it is used / operated incorrectly or improperly by personnel which is not sufficiently qualified or has not received sufficient instruction.

Only trained and instructed personnel may operate the compressor.

Please ensure that the compressor is only used in the correct manner as specified in chapter 3.

The operator of the compressor must ensure that whilst the compressor is in operation, no persons are present in the danger zones[7].

The compressor may only be used, maintained and repaired by persons who are familiar with the compressor and the operating instructions and who have been informed about all possible dangers involved.

4.4 Operating and starting up

Before work starts or the shift starts, the compressor must be prepared for operation. Checks and inspections must be performed step by step. Please refer to the maintenance table (Table 4.4.1) for daily maintenance tasks (e.g. lubrication etc.). In the case of new plant, please take note of the earlier maintenance dates (according to operation hours) (Chapter 5.2).

Safety instructions:

The operating personnel must read the entire operating instructions independently before starting the plant up and take any measures only in accordance with the rules and safety regulations specified therein. Upon customer request, the operating and maintenance personnel can be instructed in depth by "NEUENHAUSER KOMPRESSORENBAU GMBH" after the compressor has been delivered or after it has been erected. If the information received should not be sufficient, or if any special problems should occur during operation or maintenance which have not been dealt with in sufficient detail in these operating instructions, you can request the necessary information directly from "Neuenhauser Kompressorenbau GmbH". Safe working techniques must be used when performing any work and the local work protection and safety regulations must be

[7] dangerous areas:
- hot components (e.g..: lines, pipes, cylinder, ...)
- safety, drain and condensation valves
- rotating and other moving parts

complied with. Any means of working which may impair the safety of people and / or the compressor must be prohibited.

The cause of any fault must be determined in every case and rectified. The compressor must not be switched on again until the cause of the fault has been rectified!

Once all preparations for operation have been completed, the compressor is operated and started up from the switching cabinet and only if all panels/ safety devices have been closed.

The regulations, warning and information must be taken note of in all cases e.g. whilst operating, starting up or stopping the compressor.

Before the compressor is switched on for the first time and any other subsequent time, it is the operator's responsibility to ensure that:

- the compressor has been erected and secured according to the regulations
- the operating personnel is familiar with the compressor and its safety devices and that they are familiar with and follow all information contained within the operating instructions
- all preparations for starting up have been completed
- no persons are present in the danger zone[8] of the compressor or are even working on it.

[8] *) danger zones: The following are regarded as being dangerous zones, e.g.:

- hot components (e.g. hoses, pipes, cylinders, ...)
- safety, drainage and condensation valves

4.4.1 Starting the compressor up for the first time or after longer periods of inactivity

Attention: For transport purposes, the compressor has been delivered to you without any oil. Please only fill in oil in accordance with the lubrication recommendations. See lubrication recommendations in Chapter 8.

The following table specifies the checks which must be performed before or whilst starting up the compressor. Please ensure that the sequence of the tasks undertaken specified in the table is adhered to.

In addition please also take note of the instructions in Chapter 4.3.

In order to check the mobility of the movable parts of the compressor, the impeller flywheel (280) must be turned manually a number of times before the compressor is started up.

Checks:

Type of check	When is it required?	Completion / task
Cleanliness of the driving space	• when the machine is started up for the first time • after the machine has not been in use for > 12 weeks	Open the motor. Remove oil residues and dirt with a clean cloth. **Attention:** Do not use cleaning wool. If very dirty, rinse with spray oil or diesel fuel. Do not use petrol or benzole.
Fill up oil/check oil level	• when starting up for the first time • after the machine has not been in use for > 12 weeks	Check oil level on dip stick. Oil level must not sink below the bottom mark.

Type of check	When is it required?	Completion / task
Valve and piston lubrication (oil mist lubrication)	• when starting up for the first time • after the machine has not been used for > 4 weeks	remove air filter (300) and fill a few drops onto the induction nozzle. Watch oil intake whilst compressor is running. Approx. 2 drops/minute are sufficient. During tests at the manufacturer, the oil mist lubrication of the compressor has been set precisely. Any possible readjustment may only be performed after consultation with NK and only after the machine has reached operating temperature. Compressor models 09.2.2.01.01 and 18.2.2.01.01 are not to be adjusted.
Check that safety valves (310,311) do not leak.	• when machine is started up for the first time • after machine has not been operated for > 12 weeks	visual check of safety valve. Can you feel any air escaping?
Draining condensation/start-up relief	• before checking direction of rotation. • before switching on • (not applicable with automatic systems)	open condensation drainage valves in order to ensure that cooler, oil and water separator have been drained.
Direction of rotation	• when starting up for the first time • after repairing the compressor or working on the electric system	switch motor on for a short time and note direction of rotation. Allow condensation to be blown out. Normal direction of rotation is clockwise (to the right) seen from the drive side looking at the flywheel (see direction of arrow on safety device of flywheel)

4.4.2 Starting up

4.4.2.1 Normal starting up of the aggregate without automatic unit

If the compressor has been equipped with manually operated condensation drainage cocks (330), they must be opened every time before the compressor is started. They serve as start-up relief and drain the compressor of condensation.

- Open valves in the air intake hoses on the compressed air container
- Switch on drive motor
- After the operating speed has been reached and when no more condensation drains out, close the condensation drainage cocks.
- Air intake starts up.
- Check pressure on pressure gauges. If the pressure indicated deviates from the values in the table by more than 20%, the compressor is faulty (see Chapter 5: maintenance, repairs and rectification of faults).

Once the final pressure has been reached, switch off the motor!

- Close the valves in the air intake hoses.
- Open condensation drainage cocks.

4.4.2.2 Normal starting up of an aggregate equipped with an automatic unit

If the compressor has been equipped with solenoid valves for automatic operation, the solenoid valves take over the task of automatic condensation drainage/ start-up relief by means of time relays. After the compressor has been switched on, the solenoid valves (7 – 15 seconds, can be adjusted) stay open to drain the condensation away and at the same time take the load off the compressor.

If the switch of the selection switch ”manual-0-automatic” is on automatic, the compressor starts up automatically when the pressure falls below the starting up pressure and once the switch-off pressure has been reached, the compressor switches off automatically. The pressures at which the compressor switches on and off can be adjusted.

If the switch is in the ”manual” position, the compressor is started up manually. The compressor starts up immediately without taking the switching on pressure set at the pressure switch into account. The start-up relief and drainage of the condensation take place automatically. Once the final pressure has been reached the compressor must be switched off manually (switch position 'O'), as the pressure switch is not effective in the ”manual” position.

If the amount of time that the compressor has been switched on exceeds one hour or if the relative humidity of the air taken in is greater than 80%, the compressor must be drained regularly (approx. once an hour).

4.5 The operator's obligations

The operator of the compressor is responsible for checking the operating safety of the compressor every time it is started up.

The operator must ensure that during all tasks, the appropriate legal work safety and accident prevention regulations as well as work protection and safety directives of these operating instructions are adhered to in all aspects.

Furthermore, the operator is responsible for ensuring that all his employees are suitably qualified, that they receive instruction regarding the operation of the compressor, that they are aware of the potential for danger and that they have read and understood the operating instructions. Any danger due to lack of knowledge must be excluded whilst the compressor is operational.

The operator must also ensure that the operating personnel wear the specified protective clothing[9]. If necessary the operator must provide this clothing. Its use as well as the compliance with other specified protective and disposal measures must be monitored.

In addition, the operator must ensure that the compressor is monitored in accordance with the following table.

Type of check	When is it required	Check whether
Manometer pressure	twice daily	operating pressure is correct in accordance with Chapter 5.4.8.1.
Safety valves	twice daily	you can feel air escaping
Oil level	twice daily	fill level is sufficient

4.6 Duties of the operating and maintenance personnel

Every person who is requested to perform one of the measures specified in these operating instructions where the compressor is located or in the workshop, must read and understand the complete operating instructions.

Operating and maintenance personnel must use safe working techniques when working with the compressor and take note of the work protection and accident prevention regulations with possible local supplements.

The operator's operating and maintenance personnel must ensure that:

- every kind of working technique which impairs the safety of humans and the compressor in any way whatsoever is prohibited
- work performed on the compressor as well as the operation of the compressor must be performed only by qualified personnel
- before starting work, all persons have been informed about the equipment and operating elements as well as their function and the danger zones of the compressor

[9] Protective working clothing: helmet, ear protection, safety shoes etc.

- before the compressor is switched on, it is in an operational state, that all safety devices are in place and that nobody is endangered by the compressor when its starts up
- no persons which have not been expressly authorized to do so are present in the danger zones of the compressor, are working on the compressor or are undertaking any other tasks or interfering in the operation of the compressor whilst it is in operation
- the compressors are visually checked at least once per day for visible damage. Reports about any changes to the compressor or operating conditions must be made to the person specified by the operator,
- in the case of faults which impair safety, the compressor is shut down immediately.
- that repairs are only performed if the compressor has been cut off from the mains supply and that it is secured again before it is started up again
- legible safety, work protection and danger notices have been attached to the compressor by the operator,
- that no unauthorized changes are made to the compressor
- that the environmental regulations concerning e.g. the disposal of waste material are strictly adhered to
- cleanliness and clarity are ensured at the location of the compressor and that easy access to the switching cabinet is always possible
- all operating and monitoring elements are clearly identified

4.7 Danger potential

Preparing the compressor for operation:

The compressor must be checked for visible damage and the safety devices must be checked to ensure that they are in perfect working order.

Normal operation:

Oil level measurements may only be performed when the compressor is switched off.

If there is any danger of frost, the compressor must be protected against freezing, e.g. by draining it (condensation, cooling water etc.)

The compressor may only be operated and monitored from the switching cabinet. It is strictly prohibited to be present in the danger zones. Maintenance work must only be performed when the compressor is switched off and taking into consideration the obligations and duties of the operating and maintenance personnel (Chapter 4.6).

Abnormal operation:

In the case of functional faults or impaired functioning such as :

- abnormal operating noises
- unusually loud noises, smoke development
- erratic operation and / or inadmissible high vibrations or oscillations,
- exceeding the operating data (final pressure, ambient temperature, possibly cooling water temperature)
- blown safety valves
- functional faults displayed on the switching cabinet etc.

the compressor must be shut down immediately and checked thoroughly.

4.8 Influences on the environment and workplace

The compressor has been manufactured using the machine materials usually used for the intended purpose and to a large extent insensitive to environmental influences within the usual framework. Atmospheric or ambient temperatures which exceed or do not reach the limits for use can reduce the performance of the compressor and / or cause functional problems. Please inform "NEUENHAUSER KOMPRESSORENBAU GMBH" of extreme ambient conditions (temperatures, humidity, dust etc.) for them to check these, possibly special protective measures are necessary. Please check the manuals of the respective manufacturer enclosed in the appendix for limits of use and / or special measures for the driving motor.

If the compressor is used correctly and for what is was intended and if the conditions of use and safety conditions based on the utilisation purpose of the compressor are taken into consideration, it will not present any danger.

Third parties are not affected.

5 Repairs, maintenance and fault rectification

5.1 Repairs and maintenance

5.1.1 Safety instructions

Before performing any repairs, the operator must ensure that:

- the compressor has been shut down and cleared and that it is not possible to accidentally switch it back on again
- the maintenance personnel is familiar with the compressor, i.e. that they have received sufficient training, that they can perform all work correctly and safely and that they follow these operating instructions and those by any other manufacturers.

Cleaning and repair work may only be performed on the compressor if it has been shut down and cleared and is secured in a manner which prevents accidental switching on. To clean the compressor, do not use any aggressive, easily inflammable solvents or cleaning agents which might endanger health. Substances which contain tri-, per-, or tetrachloroethylene must also not be used.

If any fuses are faulty, please only replace them with original fuses with the specified current strength.

All controlling devices must not be adjusted during repairs! Loose screw connections must be tightened immediately using the usual tools and taking into consideration the specified torque (Chapter 5). Worn or damaged parts must be replaced immediately, please only use original replacement parts. If other replacement parts are used instead of original ones, the guarantee becomes null and void.

In the case of welding work being performed on the plant, please take note of the welding regulations and safety regulations. Only perfect tools may be used in accordance with the usual regulations.

Repairs may only be carried out by specially trained personnel who are familiar with the operating instructions!!

NOBODY MUST BE PRESENT WITHIN THE DANGER ZONE!!!!

REPAIR WORK, SETTING UP WORK, MAINTENANCE AND CLEANING WORK MAY ONLY BE PERFORMED IF THE MACHINE HAS BEEN SHUT DOWN, SWITCHED OFF, CLEARED AND SECURED !!!!!

<u>Welding work :</u>

If welding is to be performed on the plant, the mains switch must be switched off and the plant must be cut off from the mains supply. The control of the compressor must be protected separately (galvanic separation etc.).

The operator is responsible for ensuring that the work protection and accident prevention regulations as well as the guidelines, directives and warnings specified in Chapter 4.2 are adhered to during all service and maintenance work.

Working on the electric system:

Please only use original fuses. If fuses which are too strong are used, the electronic plant will be destroyed!! Please replace damaged cables immediately.

Note:

Ignoring the operating instructions as well as incorrect and insufficient maintenance which does not comply with the specifications, is deemed to be improper use. The operator is solely liable for any damage resulting from this!!!

After maintenance and repair work, the direction of rotation of all drives must be checked (see Chapter 4.4.1) and if necessary the electrical connection must be changed. The direction of rotation may only be changed by exchanging two outside conductors of the connecting cable.

Assembly / disassembly may only be performed by specially trained and qualified personnel.

Please ensure that the compressor has been completely disconnected from the mains electricity supply.

5.1.2 Cleaning

Any dirt has been polluted by operating substances (e.g. lubricants etc.) and must therefore be collected and disposed of correctly (see Chapter 4)

5.2 Maintenance instructions

A well-cared for machine is always an indication of how careful the mechanical engineer is, helps limit operational faults and lengthens its service life.

Keyword	Intervals	Completion / task
Oil change	• for the first time after 60 operating hours • second change after 300 operating hours • all further oil changes after 500 operating hours.	• Open oil drainage screw (031), allow oil to drain. remove covers (003) and (004), clean motor with a clean cloth. **ATTENTION!** Do not use cleaning wool, petrol or benzole. • Screw in oil drainage screw (031) again, if necessary use new sealing ring (024). • Fit covers (003,004) • Fill lubricating oil using oil from the lubrication oil list via the oil filling screw (008) up to the upper fill level mark. • Tighten oil filling screw (008).
Cylinder lubrication	• For the first time when the machine is delivered or after 60 operating hours • Second check after 300 operating hours • All further checks after 500 operating hours. • In the case of new adjustments[10] check immediately after adjustment. Further checks after 60, 300, then after every 500 operating hours.	Visual check of oil supply: • The combined valve for the 1st stage must be covered in oil. • The floor of the piston and the cylinder of the 1st stage must be covered with oil. (see Chapter 4.4.1)

[10] New adjustments may only be made when the machine has reached operating temperature and in consultation with NK (see chapter 4.4.1: Valve and piston lubrication)

Keyword	Intervals	Completion / task
Valves (160 – 162)	• For the first time after 60 operating hours • The after every 500 operating hours	Remove valves (160,161,162) and clean. Whether or not the valves are clean can be checked using a solvent of low viscosity which is poured into the grooves of the valve seat in the direction of flow of the air. If the valve reeds leak, the solvent will flow out of the grooves over the valve reeds. If there is any coke present in the valves, clean the valves thoroughly or if necessary replace with a new one. (see Chapter 5.4.1 and 5.4.2)
Safety valves (310, 311)	• 500 operating hours • At least in accordance with the regulations of the employer's liability insurance association	Remove safety valves (310, 311) and check whether they leak and check start to leak pressure (see Chapter 5.4.8.2).
Valves - 2. stage (161, 162)	• For the first time after 60 operating hours • then every 500 operating hours.	**ATTENTION!** When fitting new or conditioned valves of the 2nd stage avoid any mixing up. Suction valve (161) Must be fitted into valve seat with deep rim. Pressure valve (162) must be inserted into valve seat with shallow rim. The nut of the valve must always face the outside. All valves can be re-used after their reeds and springs have been carefully checked and conditioned.
Motor control	• 500 operating hours	Remove covers (003) and (004) and check all bearing positions for abnormal bearing air. Close casing again.

Keyword	Intervals	Completion / task
Air intake filter (300)	• 100 operating hours, depending on degree of pollution of air use oil bath air filter	• For compressor model 09.2.2.01.01 and 18.2.2.01.01 remove damper cover and blow through paper filter, replace if necessary. • For compressor models 28.2.2..01.01 - 43.3.3.01.01 remove filter, clean well in washing oil, cold cleanser or soda water, blow through and dry well. Before fitting it again, put a few drops of clean oil on it.
Manometer (302, 321)	• 500 operating hours	To dampen vibrations, the manometers have been filled with glycerine, however, they must be protected from falls and impacts. (see Chapter 5.4.8.1)
Accessories for automatic operation (if included in delivery)	• 500 operating hours	Check for perfect functioning, if necessary clean dirty solenoid valves. If necessary take special description for compressor control into consideration.
Return valve in pressure hose between compressor and compressed air container	• 500 operating hours	Check for perfect seal and hence avoid accidents. By opening the condensation drainage valve (330), when the compressor is at a standstill, the compressed air hose on the compressor side is not under pressure After the valve is closed, no pressure may build up. If there is a pressure build-up, clean return valve, if necessary replace it.

Keyword	Intervals	Completion / task
Oil and water separator	• For the first time after 60 operating hours • Then every 100 operating hours	Remove sinter filter cartridge and replace.
Piston rings/oil scraper rings (130-132)	• For the first time after 60 operating hours • Then after 1000 operating hours or obvious reduction of performance and increased oil consumption	Remove cylinder head (151), remove combined valve (160) and remove covers (003, 004). Remove the bottom half of the connecting rod bearing of the connecting rod (085) and pull piston (120) out with an upwards motion. For more detailed description see repairs (Chapter 5.4.3). In the case of model 09.2.2.01.01 remove piston pin (121) beforehand and only remove connecting rod half if required as the connecting rod foot is larger than the diameter of the cylinder and therefore cannot be taken out through the cylinder.
Connecting rod bearing	• For the first time after 60 operating hours • then every 100 operating hours	When crank casing (001) is open move connecting rod (080) around to check whether there is too much play. Max. amount of play is 0,08 to 0,1 mm in connecting rod bearing (085). There should be no play of the piston pin bushing (082).

5.3 Interruptions and rectification

5.3.1 Faults and trouble-shooting

The faults described below, possible causes and their removal is intended to help you to perform repairs yourself. Instructions on how to rectify faults have been listed in Chapter 5.4 and Chapter 5.2.

Fault	Cause	Trouble-shooting
The compressor requires an unusually long time to fill up the compressed air container(s).	Air intake filter (300) dirty.	Remove air intake filter (300) and check (see Chapter 5.2)
	Valves (160-162) dirty or seals (171-173) on the valves are not in perfect condition	Check functioning of valves (160-162) on display of pressure gauge (302)-(321) in individual stages (operating pressure according to Table, Chapter 5.4.8.1)
	Suction valve side - combined valves 1st stage leaks (160)	Irregular noises when valve closes, air is blown back out of the filter (300).
	Pressure valve side - combined valve 1st stage leaks (160)	Intermediate pressure according to Chapter 5.4.8.1 is not reached.
	Suction valve 2nd stage leaks (161)	Intermediate pressure on pressure gauge 1st stage (302) is more than 20% above the value specified in Chapter 5.4.8.1
	Pressure valve 2nd stage (162) leaks.	The air temperature on the exhaust nozzle increases significantly above normal.

Fault	Cause	Trouble-shooting
The compressor requires an unusually long time to fill the compressed air container(s).	Piston rings and oil scraper rings worn (130-132)	The pressure gauges (302, 321) show normal pressure, however, performance is insufficient. In crank casing (001), unusually high pressure is found through blow out from breather valve (008).
	Oil and water separator	Sinter filter cartridge dirty. Excessive increase in dirt in 2nd stage, safety valve blows.
	Valves coked up (160-162)	Remove valves and check for leaks, if necessary clean or replace with new ones. (see Chapters 5.4.1 and 5.4.2)
	Safety valves blow off	Oil and water separator
Creaking noise in crank casing (001)	Crank shaft bearings not in order (070,071)	Excessive overheating increase in temperature of bearing. Can be felt on bearing cover (010,002).
Knocking sounds in the crank casing (001)	Connecting rod pans (085) worn or piston pin bushing (082) knocked out	Whilst crank casing (001) is open, move connecting rod (080) to and fro to see if there is too much play. Max. play 0,08 to 0,1 mm in connecting rod bearing (085). It should not be possible to detect any play on piston pin bushing (082). Rotate flywheel manually. It must not be possible to detect a so-called ”dead gear”
	Valve of 2nd stage	Clean valves, if necessary replace

Fault	Cause	Trouble-shooting
Unusually high oil consumption	Crank casing (001) leaks	Check all seals, especially shaft sealing ring (072) and spacer ring (063).
	Setting for cylinder lubrication has been wrongly adjusted (only for 28.2.2- 43.2.2)	Observe oil supply after air filter (300) has been removed and idling unit (if include in delivery) by immersing a cardboard strip into the induction channel whilst the machine is running (see Chapter 4.4.1)
	Cylinder (150) worn out	Replace cylinder (150)
	Oil scraper ring (132) burnt in or broken	Check oil scraper ring (132).
	Piston rings (130,131) worn	Increase in pressure in crank casing, check piston rings (130,131) (see Chapter 5.4.8.6)
Piston rings (130,131) wear out quickly	Insufficient cylinder lubrication	Increase in pressure in crank casing (001), oil level too low, cylinder lubrication not set correctly.
Water in the lubricating oil	Condensation from the air deposits itself on the piston rings (131) of the 2nd stage as condensation	Drain cooler (200, 220) more frequently. If automatic mode, check functioning of condensation drainage or solenoid valves.
Rattling of coupling	Elastic rubber studs are defective	Replace rubber elements

5.4 Repair instructions

5.4.1 Removal and fitting of the combined valve of the 1st stage (160)

Removed filter (300), take off ventilator impeller cover (350), dismantle connected pipes (210,211,230), remove cooler attachments (cooler 210,211) attached to cylinder head (151) with hexagonal nut (181) and hexagon head screw (035) attached to crank casing (001). Remove oil induction pipe (011) from screw plug (030) and dismantle. Now the cylinder head can be removed (151). Remove silicon-o-ring (173) and valve (160) and check, if necessary replace. Clean dirty parts. When fitting, reverse the above sequence. If the silicon-o-ring (173) is hard in places, replace with a new one immediately.

For compressors with induction control:

When assembling take care to ensure that the pressure pins (418) are in the correct position. The tips must be placed on the suction valve plate of the combined valve of the 1st stage (160) so that they can move. The spring (421) must also be positioned correctly (intermediate piece 420).

Attention:

The correct assembly of the combined valve can be seen in the enclosed drawing (Ve_3324-a).

5.4.2 Removal and fitting of suction (161), pressure valve (162) of the 2nd stage

Remove the suction valve 2nd stage (161) by dismantling the connected pipes (211) and undoing the nuts (181).

Remove the pressure valve of the 2nd stage (162) by removing the impeller cover (350), dismantling the connected pipes (230) and undoing the nuts (181).

Remove suction (161) or pressure valve (162) with its seal and check. Assemble again in the reverse order. Check that the torque for the hexagonal nuts (181) is correct in accordance with those specified in Chapter 5.4.8.3.

Attention: If both valves are to be checked at the same time, do not mix up valves accidentally. Please take note of instructions in ”Care and maintenance”. Only tighten the nuts (181) with the specified torque.

5.4.3 Removal and fitting of the piston

Remove cylinder head (151) and valves (160 – 162) in accordance with Chapters 5.4.1 and 5.4.2. Dismantle inspection covers (003,004). Loosen self-tightening hexagonal nut (083) of the connecting rod foot (080) and remove lower half of the connecting rod bearing (080). The piston can be removed upwards from the cylinder (150).

Attention:

In the case of models 09.2 2.01.01 remove piston pin first (121) and pull piston out through the cylinder (120). The connecting rod (080) can only be removed through the crank area opening once the inspections covers (003/004) have been removed.

Clean or replace piston rings (130,131) and oil scraper ring (132). Before fitting the piston (129) please ensure that the piston ring joints (130, 132) are displaced by 180° and that the piston ring joints are 90° displaced from the valve drill holes of the 2nd stage. The bezel of the oil scraper ring (132) must point towards the piston floor (120) of the 2nd stage.

Before the piston (120) is replaced, the cylinder face (150) and the crank pin of the crankshaft (060) must be lubricated slightly. If a piston fitting ring is available this is pushed over the piston rings (130) of the 1st stage from the connecting rod side (080). The piston (120) is directed into the cylinder (150). If the piston pin (121) was not removed during dismantling, please note that the number on the side of the connecting rod foot (080) is positioned on the same number on the side of the crank shaft (060).It must be possible to read the numbers of the bearing pans of the connecting rod from the same side. The numbers are all from left to right either the right way round or upside down. The piston (120) is driven into the cylinder gently using a hammer.

As soon as resistance can be felt, the piston rings of the 2nd stage (131) must be pressed through the valve opening of the 2nd stage using a suitable object and guided over the step in the cylinder (120). Please ensure that the connecting rod screws in the connecting rod (080) doe not damage the face of the crank pin of the crank shaft (060). The connecting rod bearing is closed using the connecting rod screw (081) and the self-tightening nuts (083). When assembling the connecting rod, tighten with torque in accordance with Chapter 5.4.8.4.

If a new piston (120) is to be fitted, the upper and lower gaps must be adhered to (see Chapter 5.4.8.3). The overall gap of the 1st stage is the distance between the piston floor and the valve of the 1st stage. Measure the gap when the piston is in the upper dead point with a diminishing scale between the support for the copper seal (171) upon which the combined suction and pressure valve of the 1st stage rests and the piston floor. The thickness of the copper seal is added on.

The gap for the 2nd stage is the distance between the slant of the piston (120) (transition from large to small diameter) to the slant of the cylinder in the lower dead point position. To measure the gap, a small strip of tin or soldering wire is pushed through the valve drill hole of the suction (161) over pressure valve (162) of the 2nd stage. Then the crankshaft is turned manually past the lower dead point. The relatively soft metal is deformed and the remaining thickness is equivalent to the size of the gap which should be equivalent to that specified in Table 5.4.8.3.

In the case of model 09.2.2.01.01, the connecting rod (080) is pushed through the crank space opening which has been made accessible by removing the inspection covers (003,004). The piston (120) is fitted from above. The piston pin (121) must be inserted when the crank shaft (060) is in the lowest pin position (bottom dead point).

5.4.4 Removing the crankshaft bearings

Before removing the crankshaft (060), the piston (121) must be removed in accordance with Chapter 5.4.3 and the impeller wheel (280) must be removed by loosening the hexagon head screw and removing the washer (281).

Pull out the safety pin (006) for the oil ring (061) and hang the oil ring (061) over the bearing cover (002). Loosen the hexagon head screws (032) and pull out the crank shaft (060) with bearing cover (002) using ”two forcing screws” (either hexagon screw nut (032) or spindle screw). After the retaining ring has been loosened, the bearing cover (002) is removed. The shaft seal (072) and spacer ring (063, compressor : 092.2.01.01 – 18.2.2..01.01) are to checked and replaced if necessary. If the ball bearings (071, 070) are replaced, please note that the new bearings must be heated up to approx. 90 – 100°C in an oil bath immediately before being fitted into the compressor.

Then pull bearing (070, 071) onto crank shaft (060). The bearing cover (002) can be positioned on the crank shaft (060). A straining screw is positioned between the crank webs of the crank shaft so that the play of the crank webs are not altered when the crankshaft (060) is fitted.

In the case of compressor models 09.2.2.01.01 - 18.2.2.01.01 fit the spacer ring after the bearing cover (002) has been placed in position.

The crankshaft (060) with the fitted bearing lid (002) is positioned in the flat crank casing (001) The free ball bearing (070) is inserted in the drill holes above the oil drainage plug (024) and the bearing cover (002) is tightened using 4 fixing screws..

If the bearing (070) can only be positioned in its drill holes with difficulty because of unfavourable tolerances, the ball bearing must be driven on using a brass mandril and gentle hammering. The bearing cover (002) is finally screwed tight, the straining screw between the crank webs and the mobility of the shaft bearing is checked. If necessary it is corrected by hammering gently on the face side of the crank casing above the oil drainage screw (031) on the opposite side of the impeller wheel. The oil ring (061) is brought back into to its normal position and the safety pin is pushed back into place. When working in these areas, make sure everything is kept extremely clean in order to avoid later damage to the bearing. The piston is built in in accordance with Chapter 5.4.3.. The impeller wheel (280) is positioned on the shaft cone of the crank shaft and secured with a washer (281) and a hexagonal head screw .

5.4.5 Replacing the connecting rod pans

Remove the connecting rod (080) and pistons (120) in accordance with chapter 5.4.3.

On compressor models 09.2.2.01.01 and 18.2.2.01.01, the connecting rod bearing is made of white metal which has been cast into the connecting rod foot of the connecting rod. If the connecting bearing has too much play, the connecting rod (080) must be replaced. The bearing valve must be adapted to fit the crankshaft.

Compressors 28.2.2.01.01 - 43.2.2.01.01 have been equipped with a connecting rod bearing (085) which sits in a divided connecting rod foot of the connecting rod (080). The connecting rod pans (085) must be replaced if play is too great. The amount of play of the bearing of the new connecting rod bearing pans (085) must be adapted to suit the crankshaft (060). The connecting rod screws (081, 083) may only be tightened using the torque specified in Chapter 5.4.8.4.. The connecting rod (080) may not have any obvious play on the crankshaft (060), but must be easy to turn.

5.4.6 Replacing the piston pin bushing

Remove the connecting rod (080) and the piston (120) in accordance with the instructions in Chapter 5.4.3.

The piston pin bushing (082) may only be removed and refitted using a brass mandril and when the compressor is cold. It should be possible to turn the fitted piston pin (121) easily in the fitted piston pin bushing (082) but without any obvious play.

Attention: The oil drilling of the piston pin bushing (082) must be aligned with the drilled hole in the connecting rod eye of the connecting rod (080). When the piston (120) is built in again please ensure that the piston pin (121) does not damage or displace the new piston pin bushing (082). Assemble everything in accordance with Chapter 5.4.4.

5.4.7 Seals

Leaking seals can sometimes be rectified by tightening the appropriate screws. However, if tightening the screws does not stop leaks, replace the seals. If the crankshaft seal leaks, please replace it in accordance with the instructions specified in Chapter 5.3.4.

5.4.8 Final inspection

After any kind of repairs have been performed, the following checks are necessary: turn the impeller flywheel (280) manually a number of times and check as follows:

If		Then
the valves (160,161,162) have not been fitted properly	the piston moves sluggishly or knocks at the dead points.	Check that valves have not been fitted in the wrong way round.
the gaps have been correctly set at the top on the piston floor and at stage step (2nd stage) in accordance with Chapter 5.4.8.3	the piston knocks at the bottom and / or top dead point.	Check the gap when the valves have been taken out.

5.4.8.1 Table for stage pressures

Operating pressure 2nd stage	20	25	30	35	40	bar
Operating pressure 1st stage	5,6	5,6	5,8	6,0	6,4	bar

5.4.8.2 Table for set pressures of safety valves

At operating pressure 2nd stage	20	25	30	35	40	bar
Safety valve 2nd stage	22	27,5	33	38,5	44	bar
Safety valve 1st stage	10	10	10	10	10	bar

The safety valve of the 2nd stage has been set depending on the operating pressure of the plant, the safety valve of the 1st stage has been set to 10 bar based on the pressure the compressor was designed for.

5.4.8.3 Table for the torque of the nuts (181)

For the intermediate pieces of the high pressure valves:

Compressor model	Torque	
09.2.2.01.01	16	Nm
18.2.2.01.01	16	Nm
28.2.2.01.01	16	Nm
35.2.2.01.01	16	Nm
43.2.2.01.01	16	Nm

5.4.8.4 Table for torque of the connecting rod foot (081,083)

Compressor model	Torque	
09.2.2.01.01	27	Nm
18.2.2.01.01	27	Nm
28.2.2.01.01	90	Nm
35.2.2.01.01	90	Nm
43.2.2.01.01	90	Nm

5.4.8.5 Table for gaps for pistons

Compressor volume 1st stage:	Gap 0,6 to 1,5 mm
Compressor volume 2nd stage:	Gap 0,4 to 1,2 mm

6 Assembly / disassembly of the compressor

6.1 Checks to be performed when compressor is delivered

Scope of delivery:

The scope of delivery can be seen on the order confirmation sent by NEUENHAUSER KOMPRESSORENBAU GMBH.

Please check whether delivery is complete immediately after delivery. This is particularly important for loose equipment which has been included in delivery, for example the pressure switch. The NEUENHAUSER KOMPRESSORENBAU GMBH must be informed immediately and in writing of any missing or damaged parts!

Transport damage:

Please check the compressor for transport damage immediately after delivery. If damage due to transport is discovered or even assumed, it must be recorded e.g. with Polaroid photographs and / or hand-drawn sketches upon which the damage has been marked plus a detailed description (report) of the damage. Damage caused by transport must be reported in writing to the carrier delivering the compressor and to the NEUENHAUSER KOMPRESSORENBAU GMBH. Please include so-called hidden transport damage i.e. that damage which might possibly not be detected until the compressor has been dismantled, in your report as a precaution.

If this report / complaint is not made in time (i.e. after receipt of goods) insurance cover may be forfeited!

6.2 Special assembly aids

- Aids: Crane with suitable stoppers
- Aids: 2 x fitters, 1 x electrician

6.3 Erection at the location of use

To transport the compressor please use the transport and load bearing devices (eye bolts etc.).

The generally applicable transport and safety regulations are to be taken into consideration. Avoid the danger of frost at the place of erection.

The client is responsible for the electrical connection of the compressor. Therefore the customer is also responsible for checking the electrical system of the overall system.

Attention:

Approx. 1 week after the compressor has been started up for the first time the screws of the connection terminals of the switching equipment as well as the terminal strips in the switching cabinets must be tightened. In addition, the maintenance instructions specified in Chapter 5.2 must be complied with.

Please take note of the accident prevention regulations and any other safety instructions applicable to the operator’s company when erecting the compressor at its designated location.

If the compressor is to be erected in extremely dusty surroundings, please reduce and if necessary halve, the maintenance intervals specified in Chapter 5.2.

Please ensure that there is sufficient space in accordance with the dimensions of the compressor (see drawings) and also sufficient service space for maintenance work.

The switching panel on the compressor must always be freely accessible, furthermore escape exits must also be kept free.

Faults due to vibrations can be avoided by positioning the compressor on a good foundation or if it is positioned elastically using rubber–metal connections on a solid base.

6.3.1 Installing in ships

The aggregate is fitted and connected by the yard. It should not be erected on top of tank areas in order to avoid vibrations. In the past positioning the compressor according to the principle ”middle compressor on middle of web frame” has proven to be very successful.

6.3.2 Installing on land and as stationary system

The aggregate should be erected on a vibration-free, solid base. To avoid the transmission of vibrations we recommend that it is erected on elastic rubber-metal constructions..

6.3.3 Removing the compressor

If the compressor and / or motor is to be removed, the compressor must be cleared. In addition all pipes must be de-aired and the electricity cables must be disconnected. Please follow the instructions in Chapter 4 when working on the compressor.

Before the compressor or the motor is disconnected from the base frame we recommend that the compressor and motor are pinned together with 2 sleeves. This saves complicated aligning when assembling again.

When fitting the compressor again, the alignment of the compressor and drive must be checked carefully. If the compressor shaft and drive shaft are not properly aligned the coupling and bearings will wear down very quickly.

6.4 Storage regulations

The insides of the compressors delivered by NEUENHAUSER KOMPRESSORENBAU GMBH have been coated with a special oil to prevent corrosion which guarantees protection against corrosion for 12 months or as agreed and specified on the order confirmation, if the compressor is stored at 15°C in a dry and dust-free room.

During the entire storage and assembly period, the crankshafts must be rotated every 2 weeks so that the correct places of the compressor are covered in oil. To do this, the impeller flywheel of the respective compressor should be turned 2 or 3 times manually without the help of tools.

We shall not be liable for any damage which has occurred due to improper treatment and corrosion before and during installation or insufficient maintenance during this period.

7 Spare parts list

All spare parts are kept in store at our extensive spare parts store. They are dispatched as quickly as possible or as agreed to everywhere in the world. In especially urgent cases we can deliver spare parts even on Sundays or public holidays. Specialist engineers are available at all times for repairs and maintenance.

Please provide the following information when ordering spare parts:

1. **Compressor model**
2. **Factory no.**
3. **Dispatch address**
4. **Type of dispatch required**

Spare parts can be ordered at the following address:

NEUENHAUSER KOMPRESSOREN GMBH
Ladestraße 5
D - 49828 Neuenhaus
Germany

TEL.: +49 (0) 5941 – 604-0
FAX: +49 (0) 5941 – 604-202
E-MAIL: NK@NEUENHAUSER.DE
Internet: www.neuenhauser.de

NEUENHAUSER KOMPRESSORENBAU GMBH recommend that you always have the following spare parts in store in order to be able rectify faults which occur through natural wear and tear or unexpected operating conditions:

1 set each of valve plates for the 1st and 2nd stage

1 set each of valve springs for the 1st and 2nd stage

1 set each of piston rings and oil scraper rings

1 set of seals

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Pos.	Teilebezeichnung	Parts name
001	Kurbelgehäuse	crankcase
002	Lagerdeckel	bearing cover
003	Schaulochdeckel	inspection cover
004	Deckel für Peilstab	cover for dip stick
005	Rückhaltestift	retaining pin
006	Sicherungsdraht	safety pin
007	Ölpeilstab	oil dip stick
008	Öleinfüllschraube und Überdruckventil	oil filling screw an breather
009	Ring im Deckel 004	ring in cover 004
010	Deckel	cover
011	Ölansaugrohr	oil induction pipe
020	Dichtung für 002	gasket for 002
021	Dichtung für 003 + 004	gasket for 003 + 004
022	Dichtung für 010	gasket for 010
023	Runddichtring	round rubber ring
024	Dichtring	sealing ring
030	Verschraubung	
031	Verschlußschraube	screw plug
032	Sechskantschraube	hexagon head screw
033	Sechskantschraube	hexagon head screw
034	Sechskantmutter	hexagonal nut
035	Sechskantschraube	hexagon head screw
037	Stiftschraube	stud bolt
038	Federring	spring washer
039	Federring	spring washer
060	Kurbelwelle	crankshaft
061	Schmierring	oil ring
062	Ölfangtasche	oil catching ring
063	Distanzring	spacer ring
064	Gegengewicht	counterweight
070	Rillenkugellager	ball bearing
071	Rillenkugellager	ball bearing
072	Wellendichtring	shaft sealing ring
073	Sicherungsring	retaining ring
074	Sicherungsring	retaining ring
075	Paßfeder	key
076	Sechskantschraube	Hexagon head screw
077	Sicherungsblech	
078	Senkschraube	sunk screw

Pos.	Teilebezeichnung	Parts name
080	Pleuelstange	connecting rod
081	Pleuelstangenschraube	connecting rod screw
082	Kolbenbolzenbuchse	piston pin bushing
083	spezial Sechskantmutter	special hexagonal nut
085	Pleuellager	connecting rod bearing
087	Schleuderstift	spatter pin
090	Pleuelstange komplett	connecting rod, complete
092	Kurbelwelle komplett bestehend aus: 060-078 ohne 072 und 075 mit 090	crankshaft, complete consisting of: 060 to 078 without 072 and 075 with 090
120	Kolben	piston
121	Kolbenbolzen	piston pin
130	Kolbenring 1. Stufe	piston ring 1st stage
131	Kolbenring 2. Stufe	piston ring 2nd stage
132	Ölabstreifring	oil scraper ring
133	Sicherungsring	retaining ring
150	Zylinder	cylinder
151	Zylinderkopf	cylinder head
152	Zwischenstück	intermediate piece
160	komb. Ventil 1. Stufe	comb. valve 1st stage
161	Saugventil 2. Stufe	suction valve 2nd stage
162	Druckventil 2. Stufe	pressure valve 2nd stage
170	Dichtung	gasket
171	Dichtung	gasket
172	Dichtung	gasket
173	Silikonring	silicon-o-ring
180	Stiftschraube	stud
181	Sechskantmutter	hexagonal nut
182	Stiftschraube	stud
183	Federring	spring washer
200	Kühler 1. Stufe	cooler 1st stage
204	Schwenkverschraubung	slewable screw cap

Pos.	Teilebezeichnung	Parts name
210	Verbindungsrohr 1. St.	connecting pipe 1st stage
211	Verb.-rohr 1./2. Stufe.	conn. pipe 1st/2nd stage
220	Kühler 2. Stufe	cooler 2nd stage
224	Schwenkverschraubung	slewable screw cap
226	Verschraubung	screw cap
230	Verbindungsrohr 2. St. Für Kompressor-Typ 09.2.2.01.01 sind Teile 220 – 230 nicht Standard	connecting pipe 2nd stage for compressor-type 09.2.2.01.01 parts 220 – 230 are not standard
280	Lüfterschwungrad	impeller flywheel
281	Scheibe	washer
282	Ventilatorrad	impeller
284	Innensechskantschraube	
285	Sechskantschraube	hexagon head screw
286	Sicherungsblech	safety disc
287	Federring	spring washer
288	Sechskantmutter	hexagonal nut
300	Ansaugluftfilter	air intake filter
301	Manometerventil	pressure-gauge valve
302	Manometer 1. Stufe	pressure gauge 1st stage
305	Sechskantschraube	hexagon head screw
310	Sicherheitsventil 1. St.	safety valve 1st stage
311	Sicherheitsventil 2. St.	safety valve 2nd stage
315	Verschlußschraube	screw plug
316	Dichtring	gasket
317	Dichtring	gasket
318	Dichtring	gasket
320	Manometerventil	pressure-gauge valve
321	Manometer 2. Stufe	pressure gauge 2nd stage
326	Dichtring	gasket
327	Dichtring	gasket
330	Kondensatablaßhahn	condensation drain cock
350	Ventilator-Verkleidung	impeller cover

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Pos.	Teilebezeichnung	Parts name
	Leerlaufentlastung pneumatisch Sonderzubehör	unloading device pneumatic (optional) extra
430	Druckgehäuse	pressure casing
431	Kopf für Druckbolzen	head for pressure bolt
432	Klemmplatte	clamping plate
433	Membrane	membrane
434	Sechskantschraube	hexagon head screw
435	Verschraubung	screw cap
440	Stiftschraube	stud

Pos.	Teilebezeichnung	Parts name
	Leerlaufentlastung manuell Sonderzubehör	unloading device manual (optional) extra
400	Gehäuse	casing
401	Exzenterwelle	eccentric shaft
402	Schalthebel	switch lever
403	Sicherungsring	retaining ring
405	Federring	spring washer
406	Sechskantmutter	hexagonal nut
410	Stiftschraube	stud
412	Vebindungsstück	connection piece
413	Schraube	screw
415	Druckbolzen	pressure bolt
416	Splint	cotter pin
417	Druckplatte	pressure plate
418	Druckstift	pressure pin
419	Federteller	disc for spring
420	Zwischenstück	intermediate piece
421	Feder	spring

8 Recommended lubricants

	Designation DIN 51502/VDL 150	Remarks
	Agip DICREA 150	Mineral oil
	Aral Motanol HE 150	Mineral oil
	BP Energol RC 150	Mineral oil
	Castrol Aircol PD 150	Mineral oil
	Actro EP VDL 150	Mineral oil
	ELF Dacnis P150	Mineral oil
	Verdichteroel 3022 N	Mineral oil
	FINA EOLAN AC 150	Mineral oil
	Mobil RARUS 429 **Mobil RARUS 829**	Mineral oil **Synthetic oil**
	Shell Corena Oel P 150	Mineral oil
	TOTAL Cortusa 150	Mineral oil

Appendix:

Drawing	Description	
TD 43.2.2.01.01.10	Technical data sheet compressor	
Ag_21842	Assembly drawings	
So_20352-b-00	Flow diagram	
Ve_3314-a-99	Combined valve 1st stage	
Ve_3324-a-99	Valve 1st and 2nd stage	
Ve_3304-d-00	Safety valve	
Ar_20203-0-00	Flexible hoses for hp air connection	
Ar_20213-0-00	Flexible hose for condensate drain connection	
Ve_20724-0-99	Oil and water separator	
Hn_20103-0-99	Coupling	
Ve_20703-0-99	Electrical solenoid valve	
Au_20323-0-99	Pressure switch	
	Wiring and service diagram	