Rail Vehicle Systems

B-LC20.145

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Description

Motor compressor set
SL24-15

KNORR-BREMSE

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This document was originally written in German.

Revision history

Meanings of changes N and R

Type of change		Explanation
N Change **has no** consequences: Preceding revision may continue to be used	N1	Validity changed
	N2	Text and/or graphics changed
	N3	Document structure changed
R Change **has** consequences: Preceding revisions are **nil and void**!	R1	Technical features changed
	R2	Text and/or graphics changed
	R3	Safety notes amended

Changes made

Revision	Date	Section	Type of change					
			N1	N2	N3	R1	R2	R3

Table of contents

1 General information

DANGER
Please read this document carefully from start to finish to ensure safety of operation and to avoid personal injuries and damage to equipment.

1.1 Technical changes

KNORR-BREMSE reserves the right to change the unit or this document at any time without giving special notice.

1.2 Target group for this document

This document is intended for use by persons qualified by KNORR-BREMSE, who

- have the skill, experience, safety awareness and professional ability
  - to remove and install the unit,
  - to inspect, service and debug the unit,
- have read and understood this document from start to finish and
- are familiar with the safety codes and accident prevention regulations for these activities.

NOTE
This document will be useful to other target groups as well, e.g. project engineers. However, it does not claim to provide complete information for such target groups.

1.3 Notes and warning messages

Warning messages are subdivided into the following hazard levels in this document:

DANGER
Failure to comply with these instructions will lead to irreversible personal injuries which may have fatal consequences.

WARNING
Failure to comply with these instructions may lead to irreversible physical injuries which may have fatal consequences.

CAUTION
Failure to comply with these instructions may lead to personal injuries and/or to damage to the unit or the environment.

Safety notes have a specific structure which is explained here for DANGER:

DANGER
Source of the danger
Consequence of the danger
Remedial measures

Notes do not contain any messages relevant to safety and are intended merely to complete the reader's information.

NOTE
Notes contain useful hints and additional information about the unit.

Warning messages in other parts of this Description draw your attention to the individual risks concerning your use of the product. Warning messages and notes generally precede the descriptions of the relevant applications.

2 Introduction

This Description contains particulars specific to the unit and discusses operation, installation, removal, function testing and maintenance of the unit when installed on-board.

2.1 Associated documents

B-LC20.125	Description of the compressor
B-LF10.44	Description of the three-phase motor
B-LD70.21	Description of the dry-type air filter
B-LD75.22	Description of the vacuum indicator
B-LD90.22	Description of the operating hour counter
B-LC00.26	Description of the relief valve
B-OS10.25	Description of the safety valve
I-LC00.29	Storage Instructions
I-LC00.30	Oil grades

The related installation drawings and circuit diagrams specific to each item number must be consulted.

3 Basic safety information

3.1 Validity

WARNING
Validity note (item number or type designation) ignored!

The consequences may be personal injuries and damage to the unit.

The validity notes in the document must always be taken into account. The item number or type designation is stated on the name plate and must agree with the validity note stated in this document.

This document is valid for units with item number:

II87801

NOTE
Please contact KNORR-BREMSE Rail Services if the unit cannot be uniquely identified, e.g. because the name plate is illegible or missing.

3.2 Authorized use of the product

The unit named in Section 3.1 shall only be used in the system that has been designed and engineered by KNORR-BREMSE for the accompanying vehicle.

Other applications and assignments, as well as changes, attachments and modifications may jeopardize the safety, reliability and functionality of the system. They invalidate any warranty on the part of KNORR-BREMSE and transfer the liability to the operator.

KNORR-BREMSE must always be consulted before any other application or assignment is implemented.

3.3 Operator's commitment to due care

3.3.1 Assignment of personnel

The operator shall ensure that the personnel assigned to the specified activities possesses the qualifications defined for the given target group.

3.3.2 Availability of the document

The operator shall ensure that the present document is always available to the relevant personnel in a complete, up-to-date and readable form.

3.3.3 Amendments to the document

The operator shall ensure that, at the place of use, the present document is regularly amended by, or replaced with, instructions based on:

- statutory accident prevention regulations
- statutory accident protection regulations
- trade association regulations

3.3.4 Spares and wearing parts

The operator shall ensure that none other than genuine KNORR-BREMSE parts or KNORR-BREMSE-approved spares or wearing parts are used.

The installation of spares other than approved may impair the safety and reliability of a particular unit or of the overall system and invalidates any warranty on the part of KNORR-BREMSE.

4 Technical description

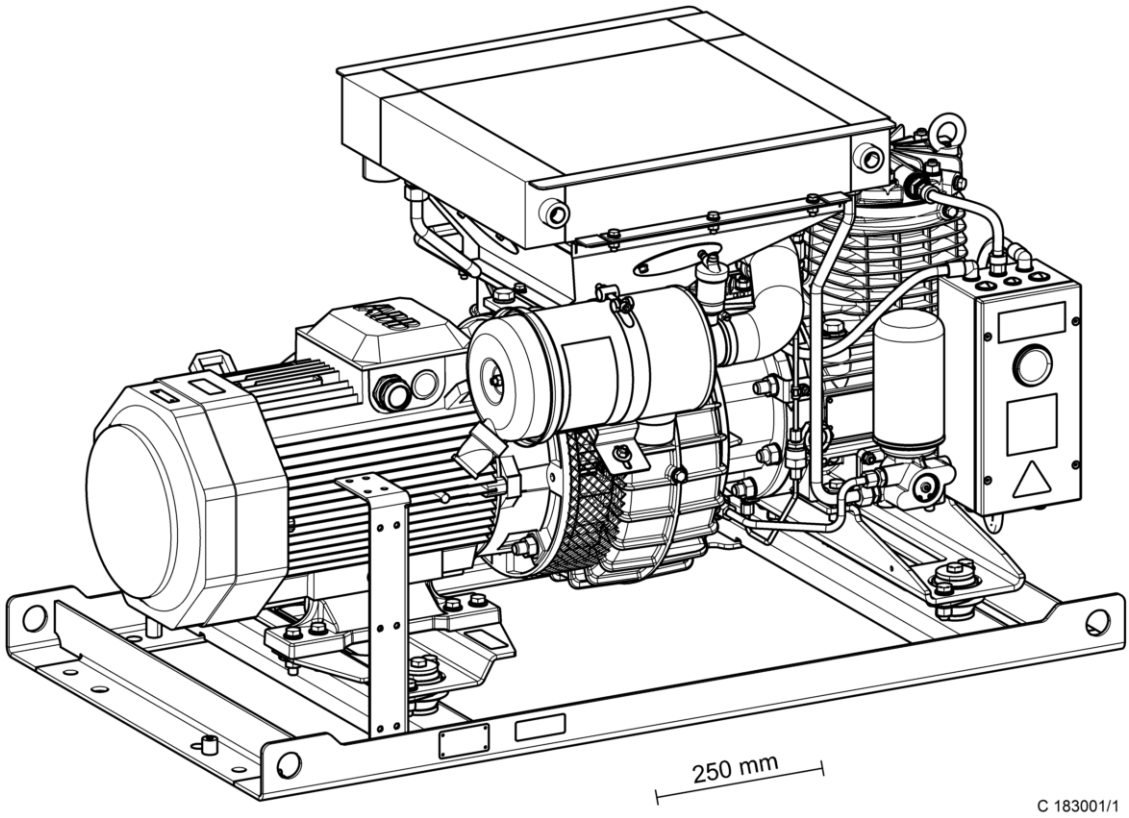


Figure 1 Motor compressor set SL24-15

4.1 Technical features

The applicable installation drawing contains the technical particulars as well as the data specific to the system.

4.2 Structure

See Figure 2

The motor compressor set consists essentially of the following main assemblies:

- Compressor (a)
- Three-phase motor (b)
- Resilient mounting (c)
- Dry-type air filter (d)
- Electrical system (e)

This self-supporting compact set is joined to the frame (h) through the resilient mounting (c).

The motor compressor set is distinguished by the following features:

- The vacuum indicator (f) shows when the air filter (d) requires attention.
- Startup enable pressure switch (g)
  - The power supply to the drive motor might perhaps be briefly interrupted on board while the vehicle is running. This in turn might cause the set's drive motor to stop briefly. To allow the motor compressor set to restart at low load, the pressure must first be discharged internally through the relief valve. If the motor compressor set is caused to stop, it must therefore not be allowed to restart in less than six seconds. This compulsory break is induced by a pressure switch attached to the compressor's relief valve. The vehicle builder is responsible for evaluating the signal from the pressure switch, and also for activating the drive motor accordingly.

CAUTION
Cutoff temperature of working substances is exceeded.
Damage to equipment, total failure possible.
The unit must be forcibly switched off by devices to be provided on board.

- Any level beyond the cutoff temperature of working substances is signalled by the temperature switch (l).

NOTE
The motor compressor set must not be operated without oil temperature monitoring by the temperature switch.

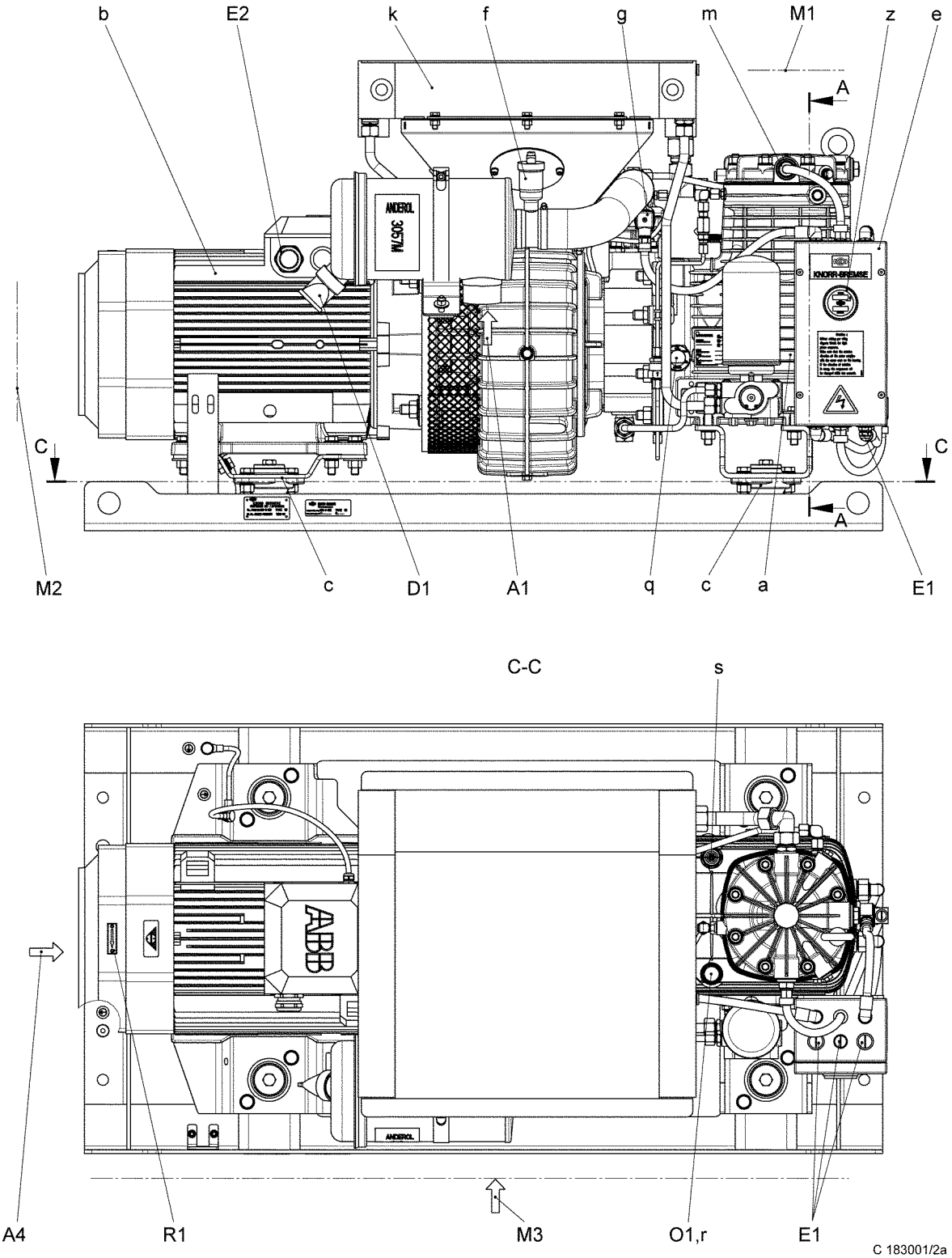
The vehicle builder is responsible for evaluating the signal from the temperature switch, and also for activating the drive motor accordingly.

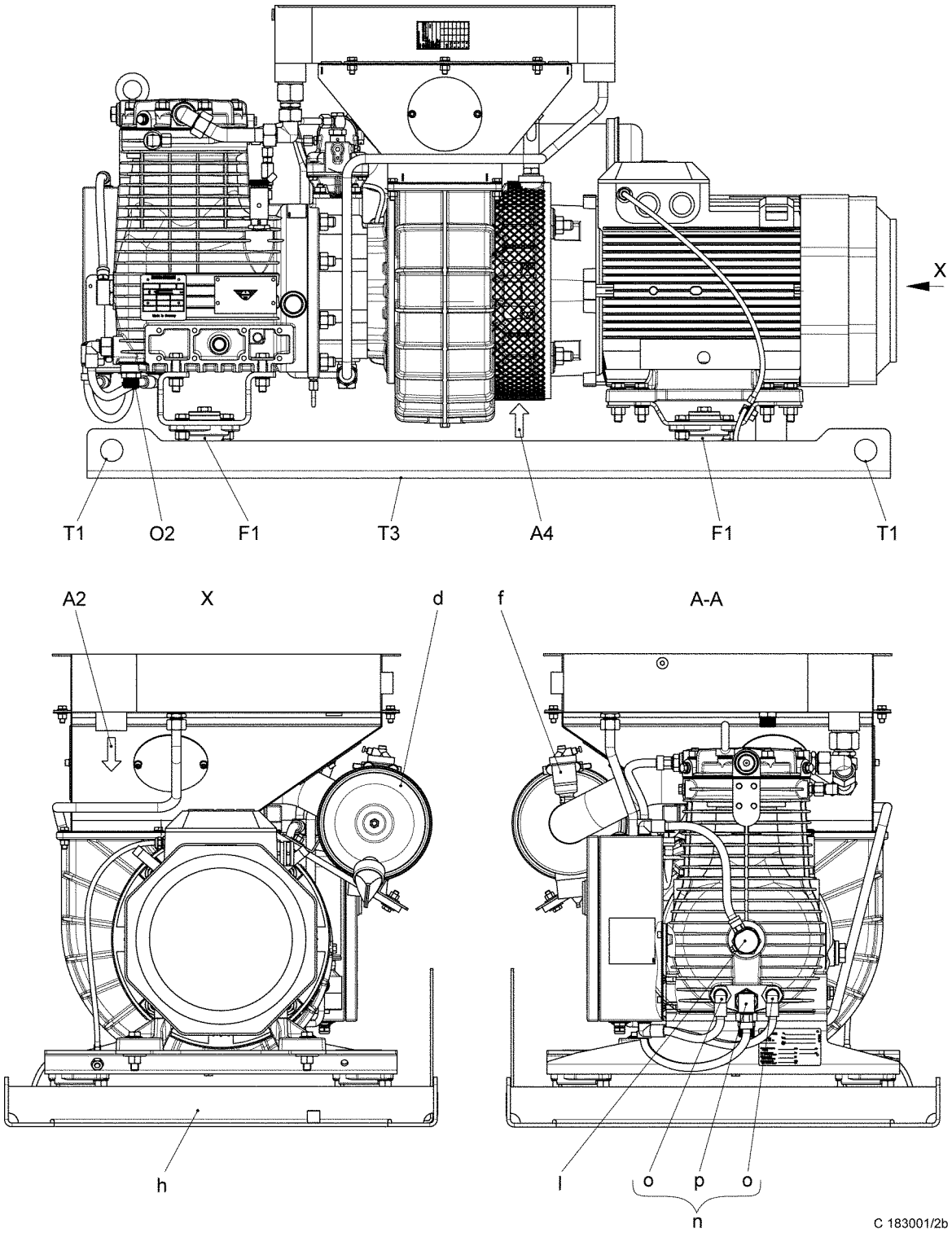
CAUTION
Cutoff temperature of working substances is exceeded!
Total failure, damage to equipment possible.
If the temperature monitor trips and the motor compressor set fails as a result of this effect, please contact KNORR-BREMSE Rail Services as regards testing and repair.

- To meet the stringent safety requirements of rail vehicle engineering, the set features a temperature monitor (m) that goes beyond the statutory demands.
  - The temperature monitor contains a fuse-link that will break the circuit in case the temperature rises to 150±10°C. The vehicle builder is responsible for activating the three-phase motor (b) accordingly.
  - The temperature monitor protects the compressor from severe damage.
  - If the temperature monitor trips and the motor compressor set fails as a result of this effect, please contact KNORR-BREMSE Rail Services as regards testing and repair.

CAUTION
Beware of operating the motor compressor set during the preheating phase!
The unit will be damaged and/or its functionality impaired.
Before the compressor is allowed to start up, the enable signal from the compressor's thermostat must, on all accounts, be processed by devices to be provided on board the vehicle.

- The motor compressor set is equipped with a thermostat-controlled oil preheater (n). The oil preheater is used for applications in cold climates. It is switched on downward of -20°C (±5°C), such as after the compressor has been idle for several hours. The heater enables the compressor to start reliably, even at extremely low temperatures. Depending on the ambient temperature, preheating takes about 10 to 50 minutes.
- The operating hour counter (z) serves to record the running time and number of starts of the motor compressor set. The servicing appointments can be observed exactly in this way. The operating hour counter can be read only when power is applied.





a	Compressor	**z**	Operating hours counter
b	Three-phase motor	**A1**	Air inlet
c	Resilient mounting	**A2**	Air outlet
d	Dry-type air filt	**A4**	Cooling air
e	Electrical system	**D1**	Dust outlet
f	Vacuum indicator	**E1**	Cable fitting (control)
g	Startup enable switch	**E2**	Cable fitting (motor)
h	Frame	**F1**	Resilient mounting
k	Cooler	**M1**	Clearance for removal
l	Temperature switch	**M2**	Clearance for cooling air
m	Temperature monitor	**M3**	Servicing side
n	Oil preheater	**O1**	Oil filler hole
o	Cartridge heater	**O2**	Oil drain
p	Thermostat	**R1**	Rotation, right-hand
q	Oil sight glass	**T1**	Transport lug
r	Oil dipstick	**T3**	Supporting surface
s	Safety valve		

Figure 2 Motor compressor set

4.3 Working principle

The compressor (a) is driven by the three-phase motor (b).

The compressor (a) aspirates air through the dry-type air filter (d) and compresses it without pulsations.

The safety valve (s) serves to protect the compressor (a) from gauge pressure.

The compressed air is cooled down in the combined oil/air cooler (k) and output through the air outlet (A2) to downstream assemblies (e.g. micromesh oil filter and air dryer unit).

The cooling air (A4) is aspirated by the centrifugal fan of the compressor (a) and discharged through the combined oil/air cooler (k).

NOTE
For more information about the working principle of the compressor and component assemblies please refer to the related documents (see Section 2.1).

5 Installation and removal

DANGER
Beware of a moving vehicle!
A vehicle allowed to move inadvertently will cause personal injury.
It is vital to observe the working rules for arresting a vehicle.

WARNING
Beware of incorrect handling and storage!
Falling objects will cause personal injuries and damage to equipment.
Mount the unit stably on a special shipping pallet.
Secure the unit to avoid displacement.
Use lifting gear that is suited to the weight of the unit.
Use seaworthy packaging for overseas shipment.

NOTE
Use the suspension points or transport lugs to carry the unit in a hanging position, or a suitable shipping trestle to transport it in a standing position (strapped down or screwed in place).

5.1 Installation

See Figure 2

CAUTION
Beware of contaminating the pneumatic system!
Device and/or system functions will fail.
Integrate the unit into the vehicle in such a way that no kind of cleaning substance can penetrate the pneumatic system when the vehicle is being cleaned, e.g. in a car wash.
Do not operate the unit while cleaning is in progress.

CAUTION
Beware of contaminating the pneumatic system!
Device and/or system functions will fail.
Keep out dirt during installation. If necessary, blow out the pipes of the pneumatic system.

CAUTION
Beware of disregarding the installation instructions!
Safety will be diminished and functions restricted.
Installation instructions and installation drawings must be taken into account.

CAUTION
Beware of installing untested units!
Safety will be diminished and functions restricted.
Make sure that units are always tested before they are installed.
The system must have been tested and found to be in order before the vehicle is cleared for service.

NOTE
It is vital to observe the manufacturer's safety instructions and directions for the use of cleaning substances, sealants, adhesives, auxiliary products, working substances, etc.

5.1.1 Requirements

The unit can be installed with standard tools.

The unit is designed for installation anywhere in the sprung part of a vehicle, provided it is protected from wet and dirt. The place of installation must be defined accordingly during engineering design of the vehicle.

All the installation notes in the installation drawing of the unit, especially any and all data stated there regarding bolted joints, must be observed and translated suitably into practice. The working standards named there are obligatory and serve to meet the demand for high quality assembly.

5.1.2 Procedure

DANGER
High voltage!

Danger of physical injuries that have fatal consequences.

Before starting work, have the onboard power supply switched off by authorized electricians only, and prevent it from being restored without due authorization.

WARNING
Bolted joints loosening of their own accord!

The following consequences are imaginable in given mounting scenarios: loss of functionality, damage to motor compressor set, derailment due to loss of motor compressor set.

It is vital to apply the torque settings from the installation drawing, and to observe the assembly rules specified by the vehicle builder and/or vehicle operator.

NOTE
The motor compressor set must be kept as level as possible. Any permanent slanting angle must be avoided. The slanting angles that occur briefly while the vehicle is running and the compressor is turning must not exceed 14°.

NOTE
To simplify servicing, the motor compressor set should be installed so as to give good access to the servicing side M3 (for topping up oil and attending to the oil filter).

- Using suitable lifting gear, locate the motor compressor set at the place of installation. Observe the rules for safe transport (see Section 5).
- Attach the motor compressor set at the place of installation via the frame (h) using fasteners (observe the vehicle builder's documents).

NOTE
Do not allow the exhaust air to cross the incoming cooling air (if necessary, provide a separate exhaust duct for the hot exhaust gases). The intake temperature defined in the installation drawing is the maximum acceptable value.

NOTE
A flexible pipe to take up vibrations and thermal expansion is required between the motor compressor set's port A2 and the rigid pipes beyond.

DANGER
Ports plugged or clogged!
Failure of device and/or system functions that might cause the brake system to fail.
Provide for a free flow through the ports.

- Take the covers off the ports of the motor compressor set and off the pipes to be connected.

NOTE
The piping must be laid so as to prevent condensing water from collecting at the air supply port A2. It should therefore be made to fall towards the system.

- Connect the air outlet (A2) to the onboard pneumatic system.
- Connect the motor compressor set to the onboard network. Wire the unit as shown in the electric circuit diagram. Every motor compressor set comes ex works with a circuit diagram in the terminal box.

5.1.3 Leakage testing

DANGER
High voltage!
Danger of physical injuries that have fatal consequences.
The work of testing a unit equipped with electric components must always be left to specially trained and authorized personnel.
Never allow a leakage testing substance to get into contact with electrically live components.

Carry out the leakage test by applying a leakage testing substance. The test may be performed alternatively with a soap solution if no such special products are available.

- Test the pipe connections for leakage at the maximum acceptable working pressure. Air bubbling is unacceptable.
- Leak testing substances and all traces of soap must be removed immediately after the test.

5.1.4 Function testing

The unit is an integral part of a system and must be tested for correct interaction with this system in the manner instructed by the railway administration / vehicle builder.

- Checking the oil filling

CAUTION
Use of unacceptable working substances.
Damage to equipment, total failure possible.
The oil grade must agree with the installation drawing and/or oil label. Never mix different types of oil.

NOTE
It is vital to use the specified procedure.

- Check the oil level either on oil sight glass (q) or by using oil dipstick (r) (observe the particulars in the relevant documents; see Section 2.1). The compressor comes filled with oil from the manufacturer.
- If the motor compressor set has been overhauled, it must be filled with the specified oil (see installation drawing for oil quantity).
- If a new compressor block has been installed, it will have to be pre-oiled with new oil prior to commissioning (observe the particulars in the relevant documents; see Section 2.1).
- After the compressor has run for the first time, check the oil level and correct if necessary.

- Checking the direction of rotation

CAUTION
Motor turning in the wrong direction!
Inadequate lubrication will cause the motor compressor set to go down. Cooling is no longer dependable because the centrifugal fan is turning in the wrong direction.
It is vital to check for compliance with the direction indicator arrows.

- Start up the motor compressor set for just a very brief instant (about 1 second).
- Sight-checking: Watch whether the centrifugal fan or the coupling is turning in the specified direction (direction indicator arrow R1).
- Checking manually: Cover up the intake port of air filter (d) with one hand. Provided the direction of rotation is correct, you must feel the air sucking at your hand while startup is still in progress.

Starting the test run

CAUTION
Beware of incorrect commissioning!
Subsequent damage to the unit is possible.
To avoid damaging the unit, make sure that it is operated at its project-specific duty cycle throughout commissioning.

- Before returning the motor compressor set to service after overhaul, check whether all openings in the compressor housing are closed by pressure-tight fits. The safety valve (s) must be closed and the oil dipstick O1 screwed in by a pressure-tight joint.
- Oil leaking from the fittings or any part of the housing is unacceptable.
- Test the air pipe connections for leakage in accordance with Section 5.1.3.
- Make sure that the motor compressor set is operating correctly in conjunction with the downstream components of the pneumatic system.
- Check the noise emission.

5.2 Removal

See Figure 2

WARNING
Pneumatic system is under high pressure!
Particles flung outwards will, for instance, cause severe eye injuries.
Observe the safety regulations for pneumatic systems.
Prior to removal, unload the pressure from the (sub)system.

CAUTION
Beware of contaminating the pneumatic system!
Device and/or system functions will fail.
Keep out dirt after removal, such as by masking the ports.

5.2.1 Requirements

The unit can be removed with standard tools.

5.2.2 Procedure

DANGER
High voltage!
Danger of physical injuries that have fatal consequences.
Before starting work, have the onboard power supply switched off by authorized electricians only, and prevent it from being restored without due authorization.

NOTE
Take care not to damage any of the sealing, sliding or guiding surfaces.

- Turn off the supply of compressed air and vent all the reservoirs and air pipes connected to the unit. Do not allow any more compressed air to reach the unit.
- Switch off the power supply and prevent it from being restored. Do not allow electric power to reach the unit any longer.
- Disconnect the motor compressor set from the onboard network, and secure the electric leads on the vehicle.
- To discharge any gauge pressure still left in the housing of compressor (a), unscrew the oil dipstick (r) by two turns, and wait for the pressure to drop in the compressor housing.

- Unscrew the compressed air pipe from air outlet (A2), and plug the open pipe ends with suitable stoppers.
- Attach suitable lifting gear to the transport lugs (T1) of the motor compressor set.
- Release the fasteners on the frame (h) and remove them.
- Hoist the motor compressor set out of the vehicle and put down and secure on a suitable shipping pallet (see Section 5 as regards the rules for safe transport!).

NOTE
To learn exactly how to remove the motor compressor set from the vehicle, please refer to the vehicle builder's documents on this subject.

6 Maintenance

Maintenance at KNORR-BREMSE is basically subdivided into:

- Inspection
- Servicing
- Repair
- Overhaul

The maintenance intervals required for the activities described below must be timed according to the statutory operating requirements, the service conditions under which the unit is used, and the environmental influences in the area where the vehicles are run. An interval stated generally for all projects will therefore be of only limited validity.

KNORR-BREMSE has the capacity to test the state of its equipment regularly during the life-cycle. The aim of this service is to find jointly with the customer the best maintenance interval for each individual project. The interval applicable to a specific project can be derived from the targets named in the table. The first target is always more significant than the successively lesser targets.

NOTE
For tables of maintenance activities and requisite intervals please refer to the related documents in Section 2.1.

6.1 Inspection

The external condition of the unit, and the system functionality for which the unit is used must be checked at regular intervals as specified by the vehicle operator.

NOTE
The documents listed in Section 2.1 contain further information about inspecting the component assemblies.

6.2 Servicing

NOTE
As regards servicing the component assemblies please refer to the applicable documents (see Section 2.1).

6.3 Repair

Please contact KNORR-BREMSE Rail Services if the unit happens to develop a malfunction that cannot be corrected by the measures described in Section 7.2.

NOTE
As regards repairing the component assemblies please refer to the applicable documents (see Section 2.1).

6.4 Overhaul

KNORR-BREMSE gives top priority to safety and quality.

To help fulfil this claim, KNORR-BREMSE provides an overhauling service for its own equipment. KNORR-BREMSE performs overhauls in its capacity as the original equipment manufacturer, while accounting for the safety aspects of the production processes.

KNORR-BREMSE Rail Services have the experience and technical equipment needed for performing professional overhauls.

6.4.1 Interval

To judge when overhauls are required under the actual service conditions, you are urged to inspect a few randomly selected units for functionality and condition after a sufficient period of operation, and dismantle them to check for wear.

Activity	Interval
Overhauling random sample	As instructed by the vehicle operator on the basis of service conditions
Overhaul	1. According to vehicle operator's project-specific experience
	2. In accordance with project-specific maintenance schedule, if any*
	3. After 12,000 compressor operating hours or 8 years (recommended/specified by KNORR-BREMSE)
* If a project-specific maintenance schedule is drawn up, it must be worked out jointly by the customer and KNORR-BREMSE.	

NOTE
As regards overhauling the component assemblies please refer to the applicable documents (see Section 2.1).

7 Troubleshooting

If the unit starts to malfunction, trace possible problems on board. Causes of problems can be corrected with the help of the directions proposed for debugging.

7.1 Special tools

Not required

7.2 Procedure

NOTE
As regards debugging the component assemblies please refer to the applicable documents (see Section 2.1).

8 Disposal

CAUTION
Improper disposal of environmentally harmful substances is dangerous!
This would mean unnecessary and legally punishable harm to the environment.
Observe the waste disposal regulations of the responsible authorities.

KNORR-BREMSE units consist essentially of metal, rubber and plastic parts. Electronic components, auxiliary products and working substances are used as well.

All materials must be separated as best possible from one another for the purposes of proper disposal. The national regulations on disposal must be observed.