Übersetzung der Originalbetriebsanleitung
Translation of the original instruction

RUTHMANN

Operating and Maintenance Instructions

RUTHMANN-Steiger®

Type **TB270**

Serial No. **27409**

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Revision sheet				
Index	Date	Chapter-No. / Title / Execution	changed	checked

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0 General

Before putting the Ruthmann-Steiger into operation, during operation and during maintenance of the Ruthmann-Steiger the instructions of the owners as well as the instructions of these operating and maintenance instructions must be observed at all events.
Differences between illustrations shown in these Operating Instructions and the execution delivered can become possible due to different constellations of the machine and chassis, but have, however, hardly any influence on the handling.

Explanations of the pictographs

Danger!

Special indications or rules and bans in order to avoid any injury to persons and/or damage to property.

Attention!

Indications or rules and bans in order to avoid damage.

Note

Indications, among other things, concerning the use of the machine to which special attention should given.

Indications concerning environmental protection.

Reference to further chapters of maintenance or to further maintenance instructions.

0.1 Preface

This manual contains important information regarding operation, maintenance and care for the Ruthmann-Steiger. Regarding operation, maintenance and care of the carrier chassis we refer you to the Operating and Maintenance Instructions of the chassis manufacturer.

Observing the above-mentioned documentation helps you to work with the Ruthmann-Steiger safely, in a proper way and efficiently. Apart from this you avoid damages, reduce repair costs and fault times and increase the reliability and duration of live of the Ruthmann-Steiger.
It is up to you to keep the Ruthmann-Steiger ready for use and safe by reading and observing our manual, observing our instructions and providing regular maintenance and care.
The manual must be available at the Ruthmann-Steiger any time. In case other people (apart from you) work with or at the Ruthmann-Steiger, make sure that these people are trained and read and study this manual.

In general:
The operator of the Ruthmann-Steiger is responsible for other persons, animals and things within the area of danger of the Ruthmann-Steiger not to be injured/damaged.
The Ruthmann-Steiger was designed and build in accordance with basical safety and health regulations.

Note

As operator you have to ensure that the Ruthmann-Steiger still does full fill the requirements in condition according to the operational safety regulations and/or similar, specific local regulations.

You must take all measurements in accordance with the state of the art to ensure that the operating staff gets an aerial platform with which the safety and health protection is granted in case of proper use.
You are responsible for a regular check of the condition of the Ruthmann-Steiger by an expert and to let it have put down in writing. We recommend to use our INSPECTION-SERVICE and to let carry out according to BGR 500 – 2.10 „Operation of Aerial Platforms" a yearly inspection by the Ruthmann-Service in accordance with BGG 945 „Inspection of Aerial Platforms". In this way you demonstrate your operat-

ing staff, your employees or your customers, that you place a Ruthmann-Steiger to their disposal, which absolutely comply to para 3 of „Gefährdungsbeurteilung" (endangering criterions), chapter 3 of the „Betriebssicherheitsverordnung" (Operational Safety Regulations).

Unauthorized modifications, substantial conversions, rendering safety devices inoperative, the resetting of safety valves and inexpert operation release us from any liability. The labels fixed at the Ruthmann-Steiger must be observed.

Please call, mail or fax us. We are always at your entire disposal for any queries. In case of any questions, correspondence and especially when ordering spare parts please always indicate the type and serial no. of the Ruthmann-Steiger.

We wish a good journey!

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0.2 Remarks for the owner / entrepreneur

Note

Apart from the remarks here please especially observe the notes in chapter 1.

- Your internal directives (e.g. accident prevention) must be added to our manual.
- It is the duty of the owner to make sure that all operators of the Ruthmann-Steiger take note of the relevant documents.
- Only use operators, which are trained and instructed. The owner / entrepreneur must explicitely authorize the operators to use the Ruthmann-Steiger. This authorization must be done in writing. The responsibilities of the personnel for operation, inspection, maintenance and repair must be clearly defined.
- The responsibility for operation of the Ruthmann-Steiger must be determined. The responsible person has the right to reject third party instructions which endanger the safety.

0.2.1 Instruction / Introduction

- As owner / entrepreneur you are obliged to instruct and inform the operators about existing legal prescriptions and regulations in relation to accident prevention and about the existing safety-devices of the Ruthmann-Steiger.
- The operators must have understood the instruction and must observe it. With this the awareness of the operators for safety and dangers shall be increased. The operators must receive a written confirmation of the instruction.

0.2.1.1 Some examples of subjects for the instruction / introduction

The following list of subjects is only exemplary. In order to realize a complete introduction, this list must be completed in accordance to the application of the Ruthmann-Steiger.

1. Safety

- Rules relating to ACCIDENT PREVENTION,
- General legal prescriptions,
- General Safety remarks,
- Personal protective equipment,
- Safety notes for commissioning of the Ruthmann-Steiger,
- Safety notes for operation of the Ruthmann-Steiger,
- Meaning of the inscriptions / labels on the Ruthmann-Steiger,
- Use of the safety-devices of the Ruthmann-Steiger,
- Measurements in case of emergency,
- Behaviour in case of accidents, first-aid,
- etc..

2. Information about the Ruthmann-Steiger

- Technical Specifications,
  - Technical Data,
  - Working ranges,
  - etc.,
- Construction,
- Hydraulic System,
- Control system, emergency control
- etc..

3. Taking into operation of the Ruthmann-Steiger

- Measurements – like visual and functional check – which are necessary for guaranteeing the safety of the Ruthmann-Steiger,
- Definition of transport and basic position,
- Line of action at the working site,
  - Securing within public road traffic,
  - Subsoil of stabilizing jacks,
- Safety-measurements – e.g. earthing,
- Preventive measurements for winter operation,
- etc..

4. Operation of the Ruthmann-Steiger

- Access (Entering and leaving the working cage),
- Location and use of the emergency cut-off devices, control elements / displays,
- Safe extension of the stabilizing jacks (positioning) on the working site,
- Boom movement,
- Use of the emergency control (emergency lowering), the overriding emergency system and the emergency control in extreme situations,
- Special experiences made with the Ruthmann-Steiger,
- etc..

5. Maintenance

- Correct use of fuel and lubricants,
- Cleaning and maintenance,
- Inspection, maintenance, repair,
- Special experiences with maintenance,
- etc..

0.2.1.2 Sample „Certificate of Instruction“

Header Header Header Header Header Header *Company Logo*

Certificate

Mrs./Mr.
.....
.....
.....

was instructed on DD.MM.YYYY
into the operation and function of the Ruthmann-Steiger,

Type: TB270

Serial No.: 27409

acc. to the Accident Prevention Act „Operation of Aerial Platforms“ (BGR 500 - 2.10)

The Operating Instructions for the Ruthmann-Steiger was handed over and/or it was taken notice of it.
The safety regulations and instructions will be observed.

Signature of Instructor
.....

Signature of instructed person
.....

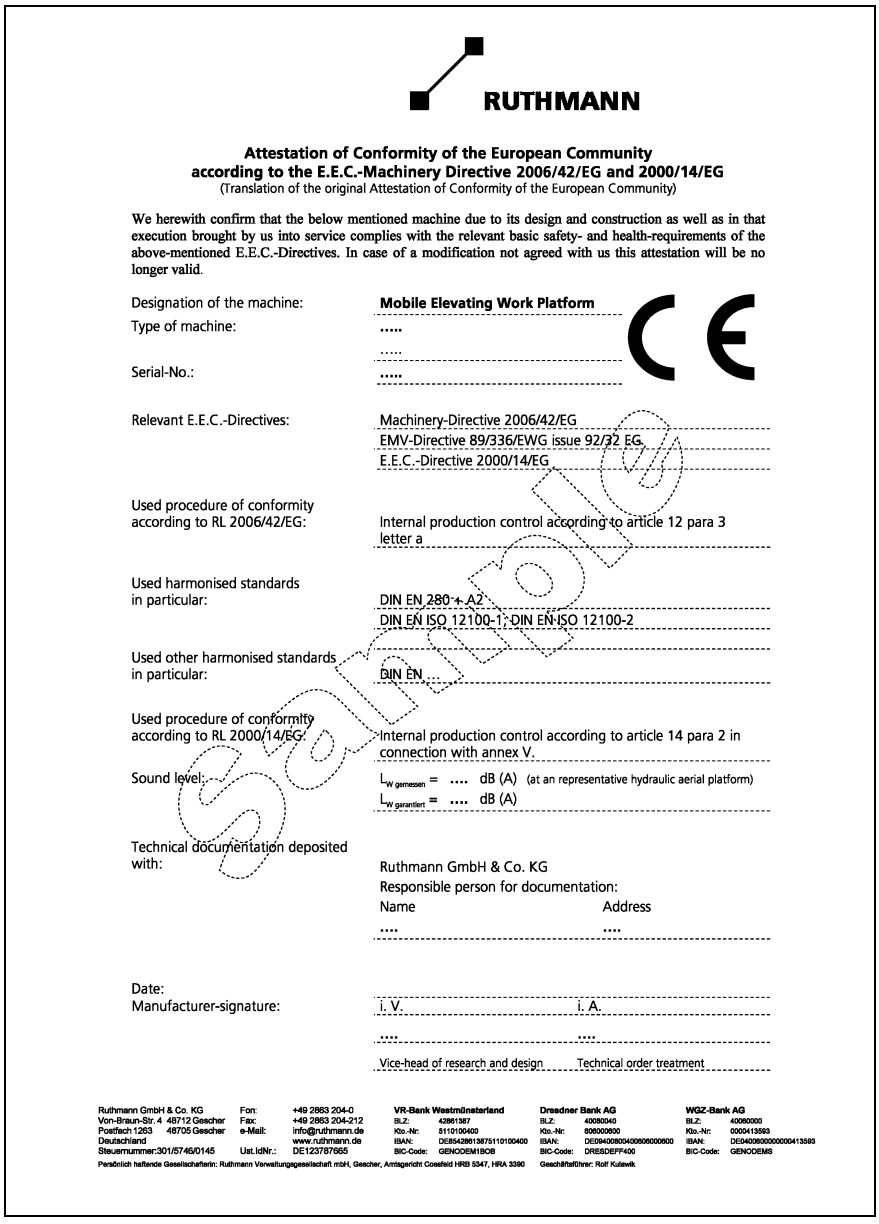
Place, Date

Company
Address

Footer Footer Footer Footer Footer Footer Footer Footer Footer Footer Footer Footer

0.3 Attestation of Conformity of the European Community

The Ruthmann-Steiger will be supplied with CE-mark and Attestation of Conformity of the European Community according to the E.E.C.-Machinery Directive 2006/42/EG and the noise protection directive „Outdoor-Directive“ 2000/14/EG.



RUTHMANN

Attestation of Conformity of the European Community
according to the E.E.C.-Machinery Directive 2006/42/EG and 2000/14/EG
(Translation of the original Attestation of Conformity of the European Community)

We herewith confirm that the below mentioned machine due to its design and construction as well as in that execution brought by us into service complies with the relevant basic safety- and health-requirements of the above-mentioned E.E.C.-Directives. In case of a modification not agreed with us this attestation will be no longer valid.

Designation of the machine:	**Mobile Elevating Work Platform**
Type of machine:	.....
	.....
Serial-No.:	.....
Relevant E.E.C.-Directives:	Machinery-Directive 2006/42/EG
	EMV-Directive 89/336/EWG issue 92/32 EG
	E.E.C.-Directive 2000/14/EG
Used procedure of conformity according to RL 2006/42/EG:	Internal production control according to article 12 para 3 letter a
Used harmonised standards in particular:	DIN EN 280 + A2
	DIN EN ISO 12100-1, DIN EN ISO 12100-2
Used other harmonised standards in particular:	DIN EN ...
Used procedure of conformity according to RL 2000/14/EG:	Internal production control according to article 14 para 2 in connection with annex V.
Sound level:	$L_{W\ gemessen}$ = ... dB (A) (at an representative hydraulic aerial platform)
	$L_{W\ garantiert}$ = ... dB (A)
Technical documentation deposited with:	Ruthmann GmbH & Co. KG
	Responsible person for documentation:
	Name / Address
	.... / ....
Date:	
Manufacturer-signature:	i. V. / i. A.
	.... / ....
	Vice-head of research and design / Technical order treatment

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VR-Bank Westmünsterland BLZ: 42861387 Kto.-Nr: 5110100400 IBAN: DE85428613875110100400 BIC-Code: GENODEM1BOB
Dresdner Bank AG BLZ: 40080040 Kto.-Nr: 606000600 IBAN: DE09400800400606000600 BIC-Code: DRESDEFF400
WGZ-Bank AG BLZ: 40060000 Kto.-Nr: 0000413593 IBAN: DE04006000000000413593 BIC-Code: GENODEMS
Persönlich haftende Gesellschafterin: Ruthmann Verwaltungsgesellschaft mbH, Gescher, Amtsgericht Coesfeld HRB 5347, HRA 3390 Geschäftsführer: Rolf Kulewik

A copy of the Attestation of Conformity of the European Community will be handed over by delivery.

0.4 Terms

RUTHMANN-Steiger®	A mobile aerial platform designated for carrying persons to a place of work where they have to carry out their jobs from the working cage.
Operating Staff	Instructed persons, which are at least 18 years old and who are in full possession of their physical and intellectual ability and who are also in possession of the required driving licence. They are also responsible for putting the mobile aerial platform into operation, for the operation, for the „daily“ inspection and transport of the mobile aerial platform.
Basic position	The firmly defined starting position of the Ruthmann-Steiger. In the basic position, the operational staff is able to get into the working cage.
Travelling position	The firmly defined position, in which the Ruthmann-Steiger is transported to the place of work.
Boom	The carrying construction which makes it possible to move the working cage towards a desired position to be worked at.
Lifting arm	Telescopic connecting arm (boom system) between turret and working cage.
Working cage (Load suspension device)	The carrying construction, which can be brought with a load into a working position from where work can be carried out.
Max. Carrying Capacity	Permissible load of the working cage.
Perm. number of persons	Permissible number of persons in the working cage.
Load on cage	Permissible load of the working cage

	depending on the number of persons in the cage, so that the max. carrying capacity will not be exceeded.
Cage control	Operation of the Ruthmann-Steiger by the operating staff from the working cage.
Electrical locking device	To cancel certain movements / functions.
Joystick	Control lever at control panel on working cage.
Push button (push function)	Push-button-actuated switch gears with which the push button and the corresponding contact element come back into their initial position, after releasing it.
Push button (push-to-lock-function)	Push-button-actuated switch gears with which the push button and the corresponding contact element remains as long in its pressed position as a second switch movement releases the locking itself and therewith a shifting-over into the initial position is effected.
Luminous push button	Push button switch with a transparent push button and a lamp inside, which indicated the switched position by shining.
Warning / Pilot lamp	Signal lamp which indicates malfunctions or switched positions by shining.
LED	Light-emitting diode
IDS	Information - and Diagnosis - System
Superordinate emergency control system	A device, enabling you to bring the working cage into its basic position in case of a failure of the main driving power. The movements are controlled from the working cage (emergency lowering).
Emergency control	Additional control device (emergency control device) at substructure of the

	Ruthmann-Steiger, which is only for the emergency lowering or maintenance work.
Stabilizing jack basis	Variant of jacking of the Ruthmann-Steiger with regard to the jacked width.
Minimum jacking	The rear jacking is vertically extended inside the vehicle profile up to ground contact. Front jacks variable. You have the choice to stabilize the machine only with the rear stabilizing jacks or with all 4 stabilizing jacks.
Danger area	Area at or near by the Ruthmann-Steiger, where one or several person(s) is/are exposed to a danger.
Working range	Area, in which the persons can carry out works from the working cage, according to the outfit of the Ruthmann-Steiger, under observance of the permissible loads and forces, under normal working conditions. Eventually the Ruthmann-Steiger can have several working ranges
Expert witness	Expert witnesses are persons, who have due to their professional education and experiences special knowledge with respect to hydraulic aerial platforms and who are familiarized with the relevant state health and safety regulations, Accident Prevention Act and generally accepted technical regulations (e.g. DIN-data-sheets, EN-data-sheets). They should be in a position to check the Ruthmann-Steiger and to judge it in an expert's report.
Expert	Experts are persons, who have due to their professional education and experience sufficient knowledge with respect to hydraulic aerial platforms and who are familiarized with the relevant state health and safety regulations, Accident Prevention Act and generally accepted technical regulations (e.g.

DIN-data-sheets, EN-data-sheets) so far as they are in a position to judge the operating-safe condition of the Ruthmann-Steiger.

1 Applications and Safety Instructions

1.1 Applications for the Ruthmann-Steiger

1.1.1 Use of the Ruthmann-Steiger according to the requirements

The Ruthmann-Steiger is designated for bringing persons to their working places, where they have to carry out their jobs from the working cage. These jobs can **e.g.** be:

- Control jobs,
- Cleaning jobs,
- Mounting jobs,
- Maintenance jobs,
- Repair jobs,
- Painting jobs, or
- Tree pruning jobs.

The working cage crew has to enter and leave the working cage at the access place designated for that.
The observation of the prescribed instructions for operation, maintenance and repairs also belong to the proper use according to the requirements.
The Ruthmann-Steiger may only be used by persons who have familiarized with it and who have been informed about the corresponding risks.

Note

The appropriate accident prevention rules as well as other generally applicable regulations concerning safety, industrial medicine and traffic rules must be observed.

1.1.2 Foreseeable misuse

Applications other than those mentioned in chapter 1.1.1. are not permitted.

The Ruthmann Steiger must, among other things, **not** be used:

- for crane work,
- for fire-fighting operations,
- for towing of loads and trailers,
- for pulling of lines,
- for transportation of dangerous goods,
- for transportation of material and goods in the working cage,
- for abrasive blasting jobs [1],
- for different sorts of sports,
- for use in potentially explosive areas (no explosion protection).

Note

[1] For abrasive blasting jobs a special outfit of the Ruthmann-Steiger becomes necessary.

1.2 Safety Instructions

Danger!

By only putting the Ruthmann-Steiger into operation or handling of it a danger can occur. Even if all instructions are observed remaining dangers cannot be excluded.

Note

Apart form the safety instructions outlined in this chapter „safety“ also the special safety instructions added to the following chapters must be observed!

1.2.1 Basic Rules

- Before each time it is put into operation the unit must be checked for roadworthiness and operational safety!
- Safety devices must not be rendered ineffective.
- Safety devices must be kept free of snow and ice before putting it into operation and during operation.
- The operating instructions of the Ruthmann-Steiger must be observed.
- Apart from the instructions of these operating instructions also observe the legally prescribed and generally valid safety and accident prevention rules for the relevant application of the Ruthmann-Steiger!
- The operating instructions of the chassis manufacturer must be observed!
- When using public roads the legal requirements must be observed!
- If the working cage is lowered under 4.5 m over ground with working cage rotated to the side within the traffic range of vehicles the area underneath the working cage and the boom must be protected.
- Only persons may be entrusted with the operation who:
  - are instructed and have confirmed that in writing ,
  - are at least 18 years old,
  - are in possession of their full physical and mental ability,
  - are in possession of the necessary driving licence.

- It is prohibited to work with/on the Ruthmann Steiger under the influence of alcohol or other drugs.
- Operation of the Ruthmann-Steiger in potentially explosive areas is prohibited.
- If more than one person are on or in the area of the Ruthmann-Steiger, a supervisor must be determined.
- Before commencing work the operating staff must familiarize themselves with all devices and operating elements as well as with their functions! During operation it is too late for that!
- Only switch on the ignition from driver's cab. The engine must not be started by a shortcut of the electrical connections at the starter!
- Check the immediate vicinity before starting driving. Take care that there is sufficient visibility!
- When dealing with fuel take special care

  - increased danger of fire! -

  Never refill fuel nearby open fire or flammable sparks. Do not smoke during the refilling procedure!
- Attention during handling with brake liquid and battery acid

  - toxic and corrosive - !
- Only work with good lighting conditions and visibility!
- Danger of crushing is existent during the following situation:
  - opening and closing of doors and windows of driver's cab,
  - opening and closing of entrance of working cage,
  - opening and closing of other doors and flaps at Ruthmann-Steiger,
  - opening and closing of covers of emergency lowering devices,
  - extension and retraction of jacks,
  - lowering of boom,
  - rotation of boom,
  - moving of working cage in the area of obstacles at working site.
- During operation of the Ruthmann-Steiger it is prohibited to walk onto the covers or load platform (in case of optional equipment to walk onto the roof of the storage compartment).
- During operation it is prohibited to run with the Ruthmann Steiger into an obstacle, to run into the working cage or into the boom system.
- During the following work you have to take special care not to slip, to stumble or to fall down:
  - walking onto covers and load platforms,
  - entering the driver's cab,
  - entering the working cage,
  - getting out of the driver's cab,
  - getting out of the working cage.

- During operation there is a special danger of burning and scalding at the following places:
  - hydraulic oil lines (in case of defect),
  - circuit of cooling water,
  - vehicle engine and exhaust gas system,
  - auxiliary heating element of vehicle,
  - brake system.
- The communication with the operating staff must be ensured.
- Operation must immediately be stopped when:
  - safety devices fail,
  - malfunctions occur,
  - malfunctions or faults occur in the control system,
  - stability is unexpectedly no longer given,
  - visibility is restricted,
  - wind situation/wind force is impermissible,
  - operating staff gets tired or are no longer attentive.
- In case of an arising thunderstorm operation must be stopped.
- In case of arising danger within or nearby the surroundings of the Ruthmann-Steiger actuate warning device.
- Missing or illegible labels must immediately be replaced.
- Missing warning signs must be replaced immediately.
- Operation of the Ruthmann-Steiger may only commence with filled compressed-air system.
- Ensure roadworthiness and stable positioning!
- Wheel wedges must be used at slopes and gradients.
- The permissible axle loads and the permissible total weight of the Ruthmann-Steiger must not be exceeded.
- The underground must withstand the maximum pressures occurring underneath the jacks.
- You have to ensure the most horizontal positioning possible.
- The Ruthmann-Steiger must not be brought into swinging motions. Jerky movements must be avoided.
- In case of a wind force exceeding 6 Beaufort Scale (wind speed: 12.5 m/s) operation has to be stopped.
- It is prohibited to install anything which would increase the wind force on the Ruthmann-Steiger.
- Unnecessary sojourns on or in the area of the Ruthmann-Steiger and in the area of the rotating device is prohibited during operation.
- Switch-on the lights when its getting darker and in case of bad visibility.

- Never leave the Ruthmann-Steiger alone as long as the engine is still in operation!
- The vehicle engine and the auxiliary heating element must never run in closed rooms and during fuel filling procedures!

- Danger of poisoning! -

1.2.2 Carriage of persons

- Co-drivers may only be carried if a proper co-driver's seat is provided.
- Above that a carrying of persons is not permissible!

1.2.3 Driving

- The operating instructions of the chassis manufacturer must be observed.
- Before starting driving snow and ice must be removed from the following surfaces :
  - roof surface of the driver's cab,
  - covers, load platform,
  - other surfaces from which ice and snow could get off during driving movements.
- During travelling motion
  - the Ruthmann-Steiger must be in travelling position,
  - doors of the driver's cab must be closed,
  - covers, flaps and other doors of the vehicle must be closed.
- The driving route must be in such a condition that stability is not restricted.
- The driver must have full visibility of the road and the area to drive through.
- You may only drive longer distances with the Ruthmann Steiger in the travelling position and with the working cage unmanned. It is prohibited to transport materials and goods in the working cage. There must be no obstacles within the area of driving.
- Pay attention to a soft starting and braking. Sudden and jerky driving movements should be avoided.
- In case of driving up or down a hill and driving crosswise to a slope sudden driving of bending must be avoided.

- Never disengage the clutch and shift when driving on a slope! The road performance as well as the steering and braking ability will be affected by the high centre of gravity of load. Therefore always be sure there is sufficient steering and braking ability.
- Keep sufficient distance from embankments, ditches etc.
- When driving through underpasses, bridges etc. pay attention to the height of the vehicle.
- When driving around bends pay attention to the lateral motion of the rear of the vehicle, caused by the rear overhang!
- In case of a failure of the travelling drive take the Ruthmann-Steiger in tow in accordance with the operating instructions of the chassis manufacturer.

1.2.4 Operating the Steiger

- The operating staff always has to ensure during each movement that no other persons or themselves do not get into danger.
- In case of „One-man-operation“ the driver’s cab windows must be closed and the doors be locked.
- The working cage may only be entered or left over the corresponding entry determined for that.
- The permissible carrying capacity must not be exceeded.

  - Danger of tilting! -
- We recommend wearing the safety belts during operation of the Ruthmann Steiger in the working cage.
- If a motor saw is used and if 2 persons are in the working cage there must be a protection grid between these two persons.
- Only after having extended the stabilizing jacks of the Ruthmann-Steiger properly may the boom be lifted.
- Loads (e.g. tools) must be fixed on the working cage in such a way that it cannot change its position unintentionally.
- Lateral forces may not exceed 400 N.
- Line pulls are prohibited.
- You must not throw things/material from or towards the working cage.
- Taking additional loads which endangers the stability of the Ruthmann-Steiger is prohibited. ***- Danger of tilting! -***
- Additional load after actuation of the load moment limitation is prohibited. ***- Danger of tilting! -***

- The working height and outreach must **not** be extended by means of ladders, boards or other things .
- The control of all operational movements of the working cage may only be carried out from the operating staff in the working cage.
- Emergency control may only be used in case of a control failure of the working cage for the rescue of persons out of the working cage, upon their consent and for maintenance purposes.
- In case of a failure of the control and a defective emergency lowering device the fire brigade must immediately be called to rescue the operating staff still in the working cage!

1.2.5 Leaving the Ruthmann-Steiger

- When leaving the Ruthmann-Steiger protect it against rolling away:
  - actuate hand brake,
  - switch off engine,
  - use wheel wedges at slopes and gradients.
- When leaving the Ruthmann Steiger remove the ignition key and lock the driver's cab!

1.2.6 Electrical system of the Ruthmann-Steiger

- The battery (negative pole) must be disconnected before working at the electrical system and the connector plugs must be removed from the electronic parts with the ignition switched off! An external mains supply must not be connected!
- Pay attention to correct connection in case of a battery exchange - always first connect the positive pole and afterwards the negative pole!
- Attention with the battery gas – it is **highly explosive!**
- Sparking and open fire must be avoided nearby batteries!
- While charging, the plastic cover must be removed from the battery in order to avoid an accumulation of highly explosive gases! Do not charge the battery too fast!
- Only use original fuses.

  - Danger of Fire! -
- If a socket is used in the working cage an earth leakage circuit breaker must be installed in the supply main.

1.2.7 Hydraulic system of the Ruthmann-Steiger

- Parts of the hydraulic system are under high pressure!
- When searching for leakage suitable devices must be used due to the danger of injury!
- The hydraulic system or parts of the hydraulic system must always be depressurised before working on it.
- Check the hydraulic system and hoses regularly and replace them in case of damage or ageing!
- The safety devices must be checked regularly!
- It is not permissible to interchange the hydraulic connections!

- Danger of accident! -

1.2.8 Brakes, wheels, tyres of chassis

- See operating instructions of chassis manufacturer.

1.2.9 Maintenance

- According to Operational Safety Regulations „Betriebssicherheitsverordnung - BetrSichV“ (§ 3 and § 4 etc.) the operator has to ensure a regular inspection of the working media. In this way possible safety relevant malfunctions should be determined systematically and removed. According to „Berufsgenossenschaftliche Regeln für Sicherheit und Gesundheit bei der Arbeit“ (BGR 500 chapter 2.10 - Operation of Aerial Platforms -) the operator of the hydraulic aerial platforms must let the machine check at least once a year by an expert. The results of these expert inspections must be kept in writing.
  We recommend to contact our **RUTHMANN-Service** due to necessary special knowledge necessary for such expert inspections.
- Additional inspections by an expert become necessary after modifications and after substantial repair work at carrying parts.
- Only suitable persons with a knowledge of the subject may be engaged with the maintenance and repair jobs. We recommend our Ruthmann-after-sales-service.

- The spare parts must comply with the technical requirements determined by the manufacturer. Only Ruthmann-spare parts or spare parts allowed by us may be used for repair.
- When carrying out maintenance jobs always secure the vehicle against rolling away!
  - Actuate hand brake.
  - Use wheel wedges.
- Lifted parts of the Ruthmann-Steiger must be secured against unintended movements during maintenance work.
  - e.g. boom in boom rest or support boom.
- Maintenance and repair work may only be carried out with the engine stopped and the ignition switched off.
- Do not let the engine run in closed rooms without having connected the exhaust hoses!

- Danger of poisoning! -

- Before starting electrical welding jobs on the vehicle the electrical system must be switched to be voltage-free (e.g. disconnect battery) and secure against switching on again. Pull off the plug connections of the electronic components with the ignition switched off. Fix the bondings of the welding outfit clean and well conductive at close range of the welding outfit. If these instructions are not observed, bearing points as well as electrical and electronic elements and sensors can be destroyed!
- Before electrostatic painting jobs all plug connections of the electronic components must be pulled off with the ignition switched off.
- During painting jobs, overheating must be avoided.
- Residual energy in the vehicle can lead to an endangerment. Depending on the kind of work which must be carried out the battery must be disconnected, the pressure be deflated from the air tank, the engine be switched off and the driver's cab be locked.
- Forgotten tools mean a special danger. Therefore always properly remove all tools after carrying out maintenance and repair work.
- For maintenance and repair of the carrier chassis the operating and maintenance instructions of the chassis manufacturer are binding. Otherwise see these operating and maintenance instructions.
- Liquids (fuel, hydraulic oil, brake liquid, water) which come out under high pressure can penetrate the skin and cause serious injuries. Therefore immediately consult a doctor, since otherwise serious infections can arise!
- Avoid each contact with the skin as well as the breathing in of the steam of hydraulic liquids. Wear protection gloves and protection glasses.

- Cleansing agents, brake liquids, cooling fluid, oils, fuels and filters must be disposed properly!
- Only refill fuel with switched-off engine!

- Smoking ban! -

- Pay attention to prescribed qualities of all operating materials and only keep them in approved containers!
- Attention when draining hot oil!

- Danger of scalding! -

- Dispose the drained oil properly!
- After finishing maintenance and repair work the protection must be re-installed!

1.2.10 Use of Aerial Platforms at or nearby installations being under voltage

- Never move the aerial platform or parts of the Ruthmann-Steiger towards installations being under voltage, e.g. unknown overhead lines!

  - Danger to life! -

  Touching of parts being under voltage can have fatal consequences!
- When working at or nearby installations being under voltage the regulations of the operator of the electrical installation must be observed.
- If the parts of the installation being under voltage cannot be e.g.:
  - switched free of voltage and earthed or
  - electrically insulated or
  - covered and/or shielded,
  - or protected in another way,

  for protection of persons while working, a sufficient safety distance to the parts being under voltage must at all events be kept. Determine safety measurements always in co-operation with the operator of the plant.
- Safety distances (protection distance) according to the „German regulations of the profession/trade association for safety and health during work“ (BGV A3) for working at parts being under voltage:

Nominal voltage				Safety distance *[1]
up to		1000 V (1 kV)		1,0 m
over	1 kV	up to	110 kV	3,0 m
over	110 kV	up to	220 kV	4,0 m

over	220 kV	up to 380 kV	5,0 m
with unknown nominal voltage			5,0 m

*[1] *Depending on the different countries maybe other safety distances (protection distances) may apply. The operating staff must ask about the corresponding local regulations for safety distances.*

You must not go below the prescribed safety distances with all Steiger movement. They apply in all directions against direct touching also to machines, tools and material. Influences from outside, e.g. possible oscillating motions of the working cage or overhead lines in case of wind must be observed when calculating the safety distances.

- If you have no information about possible parts being under voltage, you have to keep the maximum safety distance at all events.
- Even with materials which are less conductive a flashover can occur in case of wetness.

1.2.11 Earthing of Aerial Platforms when being used at transmitting stations, wind power stations or transformer stations

- When working on or nearby e.g. transmitting stations or wind power stations or transformer stations the regulations of the operating authority of the plant must be observed.
- Before commencing work on or nearby e.g. transmitting stations or wind power stations or transformer stations the Ruthmann-Steiger must properly be connected to the ground if necessary.
- If no regulations for the earthing of the Ruthmann-Steiger are known, the earthing measurements must always be discussed with the operator of the plant before starting work.

1.2.12 Use of Aerial Platforms in residential and/or sensitive areas

- The operating hours of hydraulic aerial platforms are regulated by the local regulations of the country (e.g. „Machines and Noise protection Regulation“). Residential and/or sensitive areas are e.g.:
  - Residential areas, small housing estates,
  - Health resorts and areas nearby hospitals,
  - Areas around hospitals and nursing stations,

- Areas for accommodation of foreign guests,
- Special areas for recreation,
- etc.

- Before starting work, in the above-mentioned areas, the operating times must be taken out of the legal regulations. For the use outside the legal regulations special case approvals must be obtained if necessary.

1.2.13 Starting aids

- When connecting starting aid cables or a starting aid device, operation of the Steiger has to be switched off.
- The operating instructions of the manufacturers of the chassis and engine must be observed.

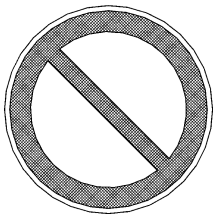
1.3 Labelling

- Die labelling on the Ruthmann-Steiger must be observed. It gives apart from the operating elements among other things exact statements concerning safety health, for persons, who work with the Ruthmann-Steiger and/or stay within the area of the Ruthmann-Steiger. By combination of form, colour, clear text and/or pictures (symbols), the above-mentioned statements are being made clear especially with the safety signs.
- Safety signs fixed to the Ruthmann-Steiger:
  - Forbid any behaviour which can result in a danger (prohibition sign)
  - Warn against risks and dangers (warning sign)
  - Give further safety hints (informative signs)
  - etc.

  If the safety statement of a prohibition or warning sign alone is not sufficient, additional signs give further information. The additional sign is fixed directly beneath or next to the prohibition and warning sign.
- The labelling of the Ruthmann-Steiger must always kept complete and in a legible condition. If signs/labels are damaged or illegible, the operator must ensure that the corresponding signs/labels are replaced immediately.

1.3.1 Pictures on Safety signs

- **Prohibition and warning signs**



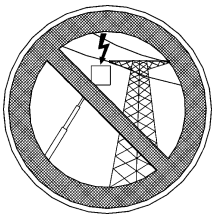
Prohibition sign in general. This prohibition sign is always given in connection with an additional sign.

It is prohibited to enter on the platform!

Access into the danger zone is prohibited!
The sojourn within the danger zone is prohibited!

If the Ruthmann-Steiger is lifted, the driver's cab must be empty and unloaded. I.e. it is forbidden to stay in the driver's cab, if the front axle is lifted! It is not allowed to put additional load into the driver's cab. It is also not allowed to mount additional load, fittings or pieces on the driver's cab! It is not allowed to use the front accesses!

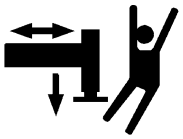
Use of high-pressure cleaner, water or steam jet, etc. is forbidden!



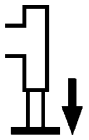
Working at or nearly electric installations being under voltage, is forbidden!
Keep safety distance!

Pay attention to danger. This warning sign is always used in connection with an additional sign.

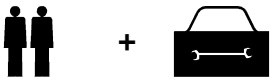
- **Additional- and informative signs**



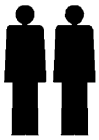
Beware of jacks! Danger for bruises!
Always supervise the jacks being extended or retracted!



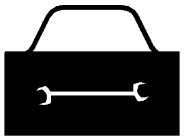
Supporting force on surface.



XXX Maximum carrying capacity of working cage.

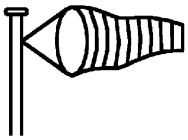


Permissible number of persons in the working cage. In this example two persons.

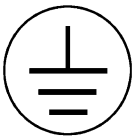


Permissible additional load (e. g. tools and material) on working cage.

Permissible lateral force.



Permissible windspeed.



Earthed conductor connection.

- **Type plate**

A-rated sound power level.

1.4 Personal protective equipment

The personal protective equipment of the operators must be adapted to the application of the Ruthmann-Steiger.
The operator must wear a suitable personal protective equipment in case the danger of accidents or a health defect cannot be excluded by means of certain measurements. This personal protective equipment must be kept in an orderly condition during the complete action time.

In order to increase safety, we recommend wearing a restraint system against falling during operation of the Ruthmann Steiger in the working cage.

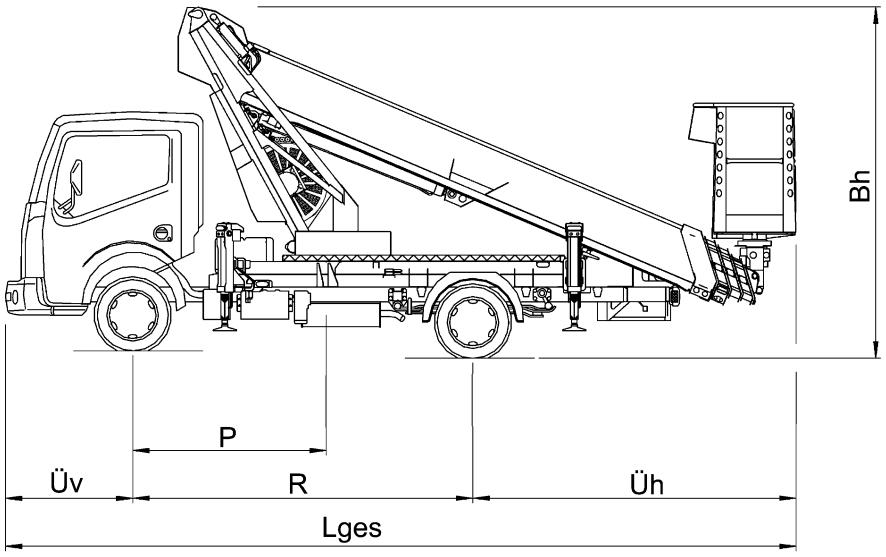
The legal prescriptions in force for protective equipment must be observed!

2 Technical Specifications

2.1 Technical Data

Steiger Type	TB270
Serial No.	27409
Chassis Type	Nissan Cabstar 35.12 / 2900
Chassis ID No.	VWASNFF24C3142505

2.1.1 Dimensions and weights of the vehicle in total



Overall length (Lges) in travelling position	approx. 6,75 m
Overall height (Bh) in travelling position	approx. 2,96 m
Vehicle width max.	approx. 2,10 m
Front overhang (Üv)	approx. 1,09 m
Wheelbase (R) of vehicle	approx. 2,90 m
Rear overhang (Üh)	approx. 2,76 m
Placement of turret(P)	approx. 1,65 m

Tyres	
Chassis	195 / 70 R 15 C

Weights	
Perm. total weight	3500 kgs
Perm. front axle load (driving of vehicle)	1750 kgs
Perm. front axle load (operating of Steiger)	1600 kgs
Perm. rear axle load	2200 kgs
Own weight	approx. 3340 kgs

Danger!

It is not allowed to stay in the driver's cab if the front axle is lifted! It is not allowed to put additional load into the driver's cab. It is also not allowed to mount additional load, fittings or pieces on the driver's cab! It is not allowed to use the front accesses!

2.1.2 Details about the Steiger-superstructure

2.1.2.1 Main data

Working height	max. approx. 27,00 m
Lifting height (platform height)	max. approx. 25,00 m
Limitation of lifting height Max. working programmable from (programmable telescopic extension limitation) (Optional extra)	approx. 11,00 m in steps of approx. 1,00 m
Max. outreach with fully extended jacks	approx. 14,80 m
Maximum cage carrying capacity	230 kgs
Perm. lateral force	max. 400 N
Wind load	max. wind force 6 windspeed 12,5 m/s
Perm. positioning inclination	max. 5°; tyres ground clearance; between 1° and 5° the outreach will be adapted automatically
Inclination of ground to be levelled out (at which a placing of the Ruthmann Steiger is possible provided the permissible siting inclination without supporting the jack plates is kept)	lengthwise: approx. 8,9°; crosswise: approx. 9,9°
Insulation	no

2.1.2.2 Stabilizing jacks

Kind of jacks	front:	horizontal-vertical-jacking
	rear:	horizontal-vertical-jacking
Jacked width with fully extended jacks (outer edge of jack plates)	front:	approx. 3,52 m
	rear:	approx. 3,31 m
Jacked width with unilaterally extended jacks within vehicle profile (outer edge of jack plates)	front:	approx. 2,83 m
	rear:	approx. 2,72 m
Jacked width with jacks extended on both sides within vehicle profile (from outer edge of jack plates)	front:	approx. 2,13 m
	rear:	approx. 2,13 m
Supporting forces on surface (horizontal positioned, even lifted vehicle)	front left:	29 kN
	front right:	29 kN
	rear left:	19 kN
	rear right:	19 kN

2.1.2.3 Boom

Boom execution	5-fold-telescopc-lifting arm
Telescopic extension	approx. 16,60 m (synchro-mesch)
Angle of elevation	approx. 79°
Range of rotation of boom (with full jacking)	approx. 2 x 225°

2.1.2.4 Working cage

Kind of the working cage (Conditions when delivered)	aluminium working cage
Dimensions	approx. 1,40 m x 0,70 m
Height of protection	approx. 1,10 m
Maximum carrying capacity	230 kgs
Permissible number of persons	2
Permissible additional load (Optional extras, tools and material must be regarded as additional load!)	70 kgs = 230kgs - 2 Persons (160kgs)
Entrance	front (on the right in driving direc-tion)
Socket	230 V / 16 A / 50 Hz
Socket (Optional extra)	2-pole 12 V
Adjustable searchlight, demountable (Optional extra)	12 V / 55 W
Connection for air-/water hose (Optional extra)	Operating pressure max. 150 bar Temperature max. +80°C
Communication between working cage and driver's cab	no
Swivelling angle of working cage	approx. 2 x 90°
Insulation	no

2.1.2.5 Control / Drive

Control	electronic proportional control
Operating voltage	12 V
Control voltage	12 V
Power supply (internal)	Vehicle battery
Control stands	- Cage control - Emergency control
Operation- and malfunction sensor	- warning and pilot lamps - Plain text indication
Regulation of engine revolution acc. to switched-on power take-off	automatically to approx. 1000 min^{-1}
Hydraulic pump	internal gear pump
Auxiliary drive for emergency lowering	hand pump
Operable temperature range	- 15° C to + 50° C

2.1.2.6 Noise level

Sound pressure level (relating to an engine revolution of approx. 1000 min^{-1})	
in the working cage	L_p 70 dB (A)
at emergency control	L_p 70 dB (A)
Guaranteed sound power level	L_W 92 dB (A)

2.1.3 Details about chassis

The technical details about the chassis can be taken from the operating instructions of the chassis-manufacturer.

2.1.4 Static and dynamic controls by the manufacturer

The objective responsibility as well as type, content and accomplishment of the controls before the first putting into operation may be gathered e.g. from the principle 945 of the Accident Prevention and Insurance Association „Control of working aerial platforms„, part I and from DIN EN 280 „Mobile elevating work platforms“. In the context of determining compliance with the safety requirements and measurements, the following controls were carried out with the engine stabilized in a horizontal position:

- Stability test,
- Overload test,
- Functional test.

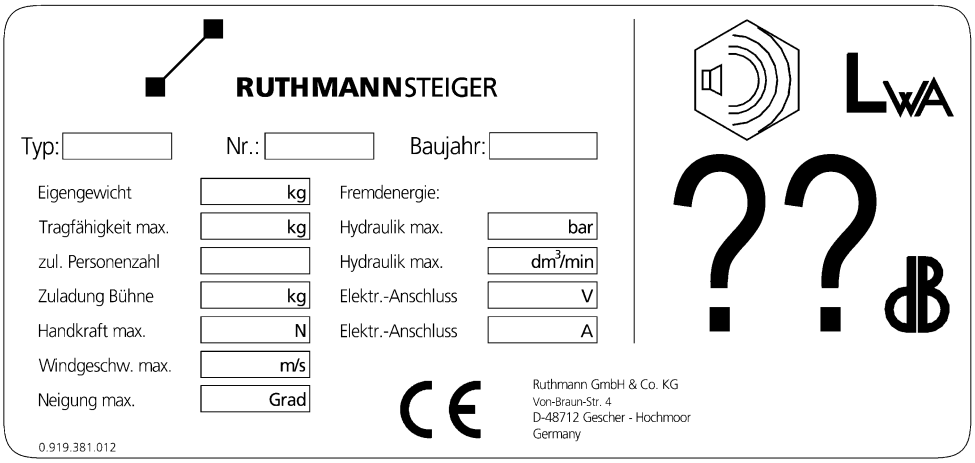
The results of the controls are enclosed as abridgment of the inspection certificate to the delivery documents.

The controls show that the Ruthmann-Steiger

- is stable,
- is structurally sound,
- all functions work correctly and safely and
- the markings are fitted.

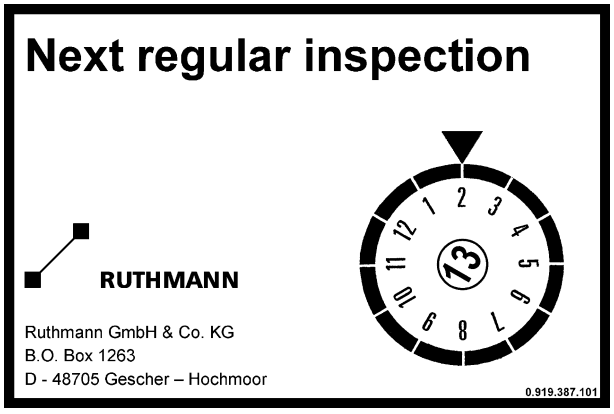
2.2 Type plate, CE-mark and inspection plate

Type plate with CE-mark and indication of acoustic capacity level (Example)



Our inspection plate with the date for the next annual inspection.

(Example)



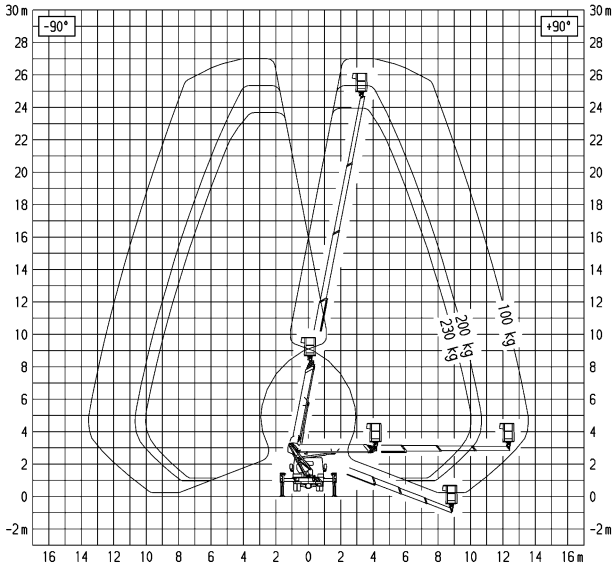
2.3 Working ranges

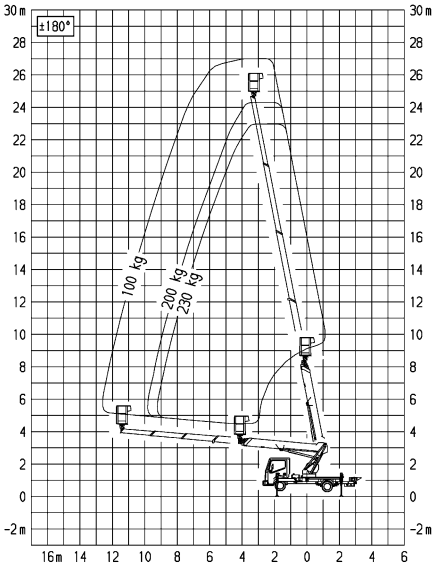
The working ranges are based et al. on the following jacking-variants:
(The permissible inclination of positioning must not be exceeded.)

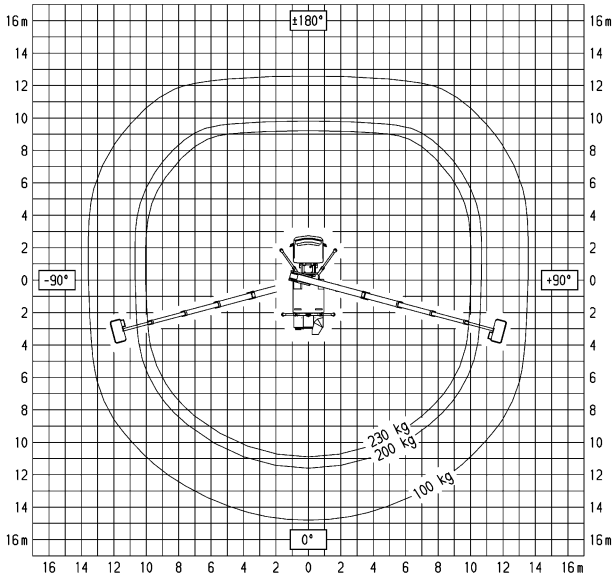
1. Fully jacking
   - All jack arms are completely extended horizontally.
   - All jacks have ground contact.
   - The vehicle wheels have ground clearance.
2. Left-hand side jacking within vehicle profile
   - The jack arms remain *on the left-hand side* horizontally completely in their retracted position. They are extended horizontally completely on the opposite side.
   - All jacks have ground contact.
   - The vehicle wheels have ground clearance.
3. Right-hand side jacking within vehicle profile
   - The jack arms remain *on the right-hand side* horizontally completely in their retracted position. They are extended horizontally completely on the opposite side.
   - All jacks have ground contact.
   - The vehicle wheels have ground clearance.
4. Jacking within the vehicle profile on both sides
   - The jack arms remain completely retracted on both sides in horizontal position.
   - All jacks have ground contact.
   - The vehicle wheels have ground clearance.
5. Minimum jacking
   - The jack arms remain completely retracted on both sides in horizontal position.
   - The rear jacks have ground contact – the position of the front jacks is variable.
   - The vehicle wheels have ground **contact**.

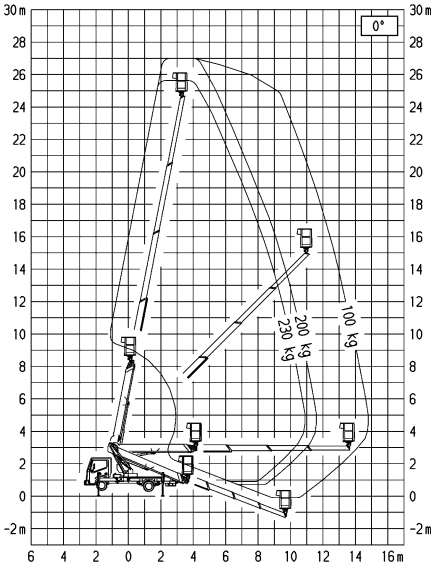
The working range „Fully jacking“ is shown below. The further working ranges may be gathered from the annex.

2.3.1 Working range with fully extended jacks









The working ranges refer to a lifted Ruthmann-Steiger, this means: the tyres of the vehicle have left the ground. The maximum inclination of positioning is in this example 1°.The working cage is rotated. From a positioning inclination of 1° up to a maximum permissible positioning the outreach will be reduced accordingly. The maximum permissible positioning inclination must not be overexceeded (see item 2.1.2. ”Indications for Steiger-superstructure – main parameter”).

2.4 Beaufort-Scale

Extract of the Beaufort-Scale

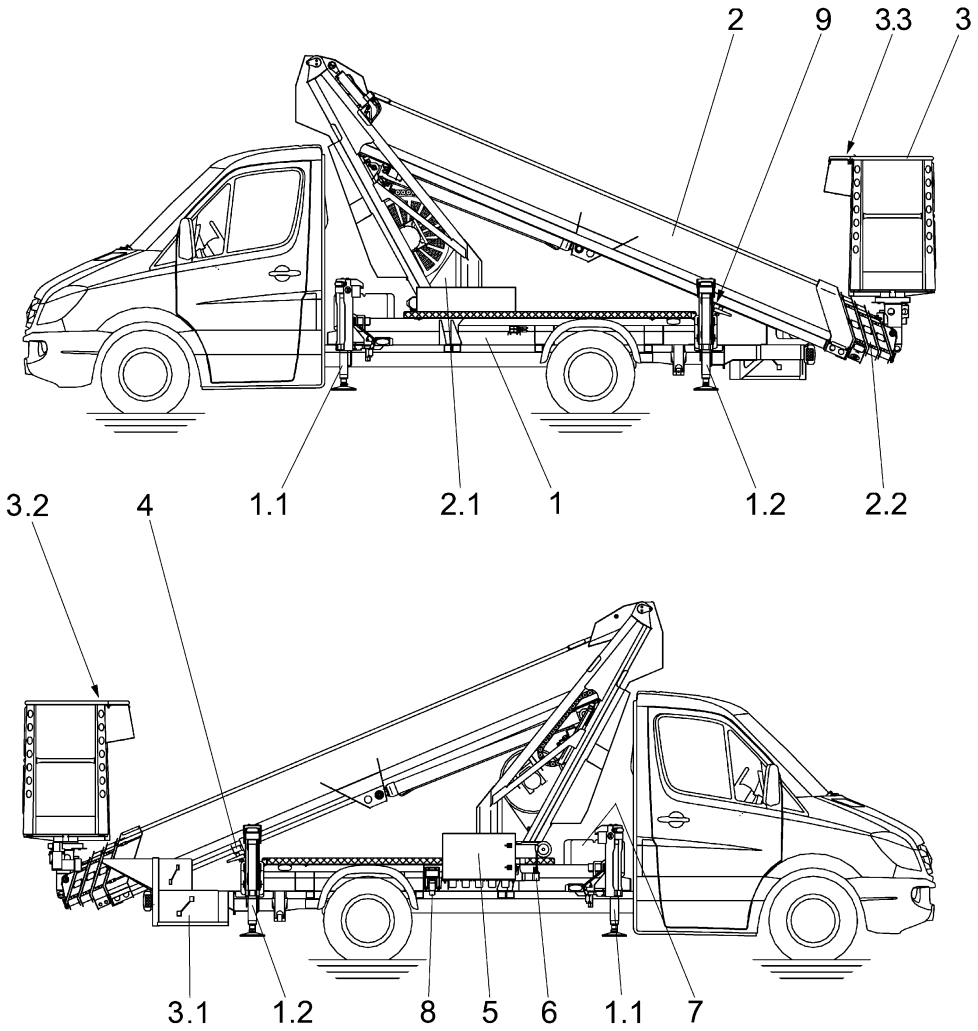
Wind force		Wind speed		Effect of the wind in interior	Impact pressure
Degree [1]	Description	m/s	km/h		N/m²
5	fresh breeze	8,0 - 10,7	29 - 38	Small deciduous trees begin to sway, white crest in lakes.	40 - 72
6	**strong breeze**	**10,8 - 13,8**	**39 - 49**	**Strong branches in motion, whistling noise in telegraph poles, umbrellas can hardly be hold.**	**73 - 119**
7	stiff breeze	13,9 - 17,1	50 -61	Complete trees in motion, strong resistance when walking against the wind	120 - 183

[1] Beaufort-degree

Beaufort-Scale according to the British Admiral and Hydrograph Sir Francis Beaufort (1774 - 1852) for estimating the wind force according to the observed effects.
The indications of the above table refer to an internationally determined measuring height of 10 m above ground on open terrain. With similar Beaufort degrees you have to calculate with wind speeds increased by 20% at a measuring height of 30 m above ground.
For operation of the Ruthmann-Steiger the permissible wind speed of 12,5 m/s must not be exceeded. According to the Beaufort-Scale this means a wind force of **6-Beaufort-degree**. Exceeding this the operation must be stopped. You have to observe that with increasing working height also the wind speed gets higher.

3 Description of the Ruthmann-Steiger

3.1 Construction of the Steiger



1. Steiger-substructure
   - 1.1 Jacks in front
   - 1.2 Jacks in the rear
2. Boom
   - 2.1 Turret
   - 2.2 Boom system (lifting arm)
3. Working cage
   - 3.1 Steps
   - 3.2 Entrance
   - 3.3 Operating panel „Working cage“
4. Boom rest
5. Switch box „Emergency control“
6. Hand pump
7. Hydraulic oil tank
8. Power supply „working cage“
9. Levelling indicator

3.1.1 Description of individual constructional components

3.1.1.1 Steiger-substructure

The Steiger-substructure consists of a welded base frame with cover. The base frame is used as an auxiliary frame. It takes in connection with the carrier chassis the boom loads occurring from the Steiger-operation and passes them over the stabilizing jacks onto the ground. The rotating device installed at the base frame is designated for rotating the boom. The hydraulic drive units, lines and control elements are mounted in or at base frame. The base frame is covered by a special aluminium deck plate/cover. For maintenance purposes and for manual operation of the solenoid valves (emergency lowering) the covers can be removed.

3.1.1.2 Stabilizing jacks

The Ruthmann-Steiger including the chassis is lifted by mechanically/hydraulically actuated stabilizing jacks. There are moveable jack plates at the stabilizing jacks, which can compensate slight unevenness of ground. Yellow blinker lamps at the jacks shine as long as the jacks are extended and the ignition of the Steiger is switched-on.

3.1.1.3 Boom

The boom is the lifting device of the Ruthmann-Steiger. It is elevated („boom up“) and lowered („boom down“) by means of a lifting cylinder. The boom consists of the following main constructural groups:

- Turret
  The turret welded as framework made of steel hollow sections is situated above the Steiger-substructure. It is the rotating column of the boom. The rotating device is located on the turret plate. It makes the connection to the Steiger-substructure. The rotating device mainly consists of ball bearing slewing gear and a worm gear with spring-loaded parking brake. The rotating device is driv-

en by a hydraulic motor to be regulated in infinitely variable stages.

- Boom system (lifting boom)
  The boom system consists of telescopic steel booms. The boom elements are guided over plastic gliders. The boom system is extended and retracted respectively synchronously by an exterior hydraulic cylinder and corresponding towing ropes and/or towing chains.

The lines necessary for the power track are guided inside the boom system. A cable / hose drum is situated inside of the turret. This drum is equipped with a spring drive (flat coil) enabling the rolling up or off resp. of the supply lines depending of the angle of elevation of the boom and the telescopic extension of the boom system. There are flaps at the boom system for maintenance jobs. Levelling of the working cage is achieved during lifting or lowering movements of the boom by means of a hydrostatic cage levelling system.

3.1.1.4 Working cage

The standard working cage consists of a aluminium tube sheet construction with a front access with self-closing door. Support rings for safety belts are installed at the working cage. On the right on top of the working cage a switch box is installed with the operating panel for the operational movements. You can easily enter the working cage from the basic position by means of the steps mounted at Steiger-substructure.

3.1.1.4.1 Socket 230 Volts

A 2-pole socket for 230 Volts is provided in the working cage, which is fed from below at Steiger-substructure over a 3-pole CEE-coupling with differential-current switch (FI-protection).

3.1.1.4.2 **Line to working cage for air or water resp.** (Optional extra)

The connection for air and/or water resp. installed at optional extra on the working cage is designed for an operating pressure of max. 150 bar and a temperature of max. +80°C.

3.2 Hydraulic System

The movements of the Ruthmann-Steiger are made mechanically/hydraulically. A hydraulic pump installed at the power take-off of the vehicle engine supplies the hydraulic energy. Electromagnetic way valves control the extension and retraction of the hydraulic cylinders. The speeds of the movements are regulated hydraulically by means of proportional valves. Pressure relief valves are installed in order to secure the hydraulic system. Hydro locks installed directly to the hydraulic cylinders prevent the working cage from collapsing in case of pipe or hose burst.
A return filter installed in the hydraulic oil tank protect the hydraulic aggregate against soil particles by filtering of the complete stream of the returned oil. The ventilation filter integrated in the filter housing ensures filtering of the drawn in air and avoids impermissible variations of pressure in the tank.

In case of a failure of the drive or the power take-off, an emergency lowering of the working cage by means of hand pump laterally installed on the right side beneath the switch box at Steiger-substructure is possible. Then the hydraulic energy is produced by a manual actuation of the pump.

3.3 Description of the control system

The control system is for operation and supervision of the Ruthmann-Steiger. It consists, among other things, of two independent processor systems (main processor and control processor), which supervise each other mutually. By the sensory mechanism e.g. the condition of the jacks, angle of rotation of the boom etc. is given to the control system.

The control system allows an operation from the following control places:

1. Control stand „Cage control“; from the working cage.
2. Control stand „Emergency control“, from switch box from below at Steiger-substructure.

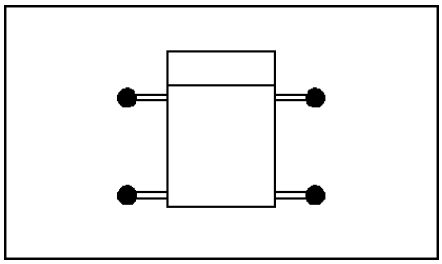
The control stands are locked against each other. It means: e.g. if the door of the switch box of the control stand „Emergency control“ (placed on the right side of the vehicle) is opened, the Steiger cannot be operated by means of the control panel in the working cage.
The usual movements of the Ruthmann-Steiger are operated by means of the control panel in the working cage. The control stand „Emergency control“ must be locked against impermissible operation.

3.3.1 Battery voltage control

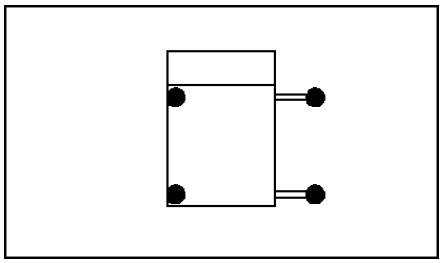
The distribution voltage of the vehicle’s battery is controlled through the control system. If the distribution voltage falls below a determined value memorised in the control system, a buzzer at the control panel in the working cage signals that the battery’s voltage is too low. In this case, the engine must be started immediately in order to maintain the distribution voltage and to charge the battery.

3.3.2 Stabilizing jack base

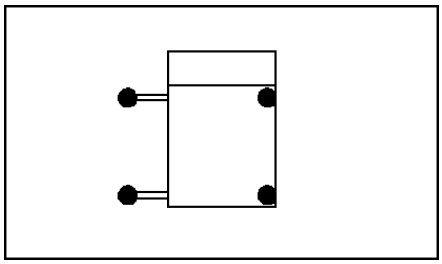
- *Fully jacking*
  Stabilizing jacks completely extended horizontally and vertically on both sides.



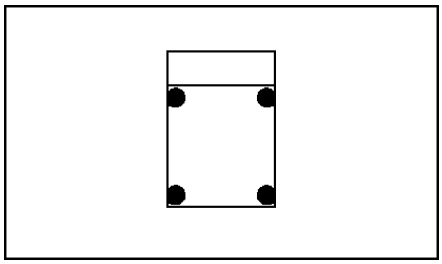
- *Left-hand side jacking within vehicle profile*
  Stabilizing jacks extended vertically on left side within the vehicle profile - and horizontally and vertically on right side.



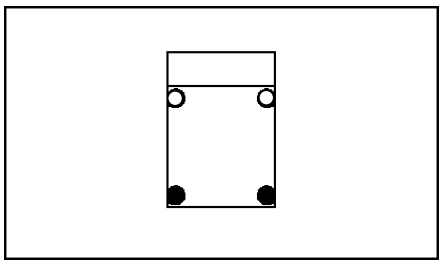
- *Right-hand side jacking within vehicle profile*
  Stabilizing jacks extended vertically on right side within the vehicle profile - and horizontally and vertically on left side.



- *Jacking within the vehicle profile on both sides*
  Stabilizing jacks extended on both sides within vehicle profile.



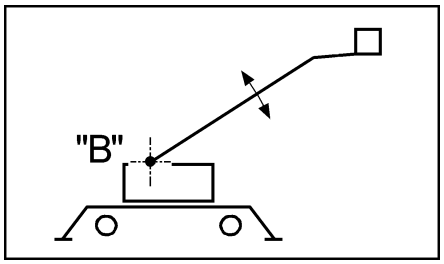
- *Minimum jacking*
  The rear jacking is vertically extended inside the vehicle profile up to ground contact. Front jacks variable.



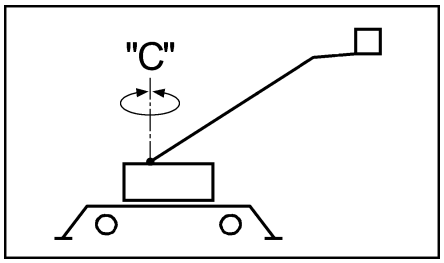
The control system detects the stabilizing jack base by means of the sensor technology.

3.3.3 The Steiger's movements

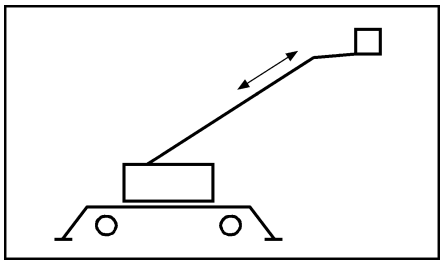
- *Boom up / down (Raise / Lower)*
  Movements that put the working cage at a greater or lower elevation. The boom (lifting arm) moves around horizontal „B“ axis.



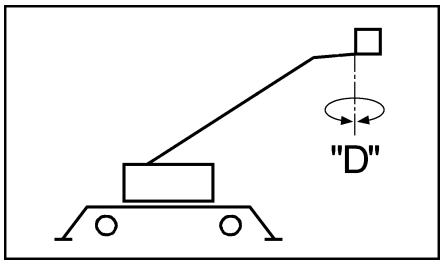
- *Rotation left / right*
  Movement of the boom (turret) around the vertical „C“ axis.



- *Telescope out / in (Telescope extended / retracted)*
  Extension or retraction of the boom system (lifting arm).



- *Rotate cage left / right*
  Movement of the working cage around the vertical „D“ axis.



In case of danger, electrical triggering of the Steiger's movements can be disconnected by actuating an EMERGENCY CUT-OFF switch.

3.3.4 Switch boxes

The Ruthmann Steiger includes among others the following switch boxes.

- Switch board of **instrument installation** inside driver's cab:
  - Changeover-switch „Power take-off".
    - Switching on and/or off of the hydraulic pump drive (power take-off).
    - This switches operation on and off (main switch). After the computer control system is started, the control stand „Cage control" is automatically released if it is not otherwise electrically locked. The switching-on of the „Emergency control" occurs when opening the door of the switch box „Emergency control".
  - Pilot lamp „Steiger not in transport position".
  - Pilot lamp „Stabilizing jacks not in basic position".

- Switch box in the **working cage**:
  - Operating panel with joysticks and push buttons,
  - Emergency Cut-off push button,
  - Pilot and warning lamps.

- Switch box at **Steiger-substructure** on the right in travelling direction:
  - Processor control,
  - Proportional amplifier,
  - emergency control,
  - Emergency Cut-off push button,
  - fuse block,
  - Ball valve for manual emergency lowering.

3.3.5 Control stand „Cage control“

The operation is designed as sensitive, electronic proportional control for the following movements:

- Boom (lifting arm) up or down,
- Rotation of boom to the left or right,
- Telescope in or out.

The speed control of the movements are carried out proportionally depending on the deflection of the joystick.
By means of a fine control device an exact positioning of the working cage with an absolutely reduced speed can be achieved.

Extension and retraction of the stabilizing jacks as well as rotation of the working cage is made at a constant speed.

Up to three movements are possible simultaneously, that means 2 movements can be driven at the same time with left joystick. If per joystick only one movement should be executable, the operation of three executable boom movements in total can also be switched onto two boom movements to be executed simultaneously.

Control of the stabilizing jacks is carried out automatically by means of a push-button. By just pushing one push-button the selected position of the stabilizing jacks is realized.

3.3.6 Control stand „Emergency control“

The following movements can be carried out by means of the emergency control:

- same movements as with control stand „Cage control“,

The movements are started by depressing the corresponding push buttons. Two speeds can be chosen:

- Normal speed
  Movements run as fast as with operating method „Cage control“ with fully moved joystick.
- Fine control
  real reduction of the normal speed

The movements start automatically slow and stop slowly (exception: rotation of working cage).
The emergency control offers the possibility to carry out two movements simultaneously, as described under control stand „Cage control“.

3.3.7 Electrical locking devices

Electrical locking devices make certain platform movements and functions inoperative.

3.3.8 Limitation of outreach depending on the angle of rotation

The Ruthmann-Steiger is equipped with a load moment limitation (LML) which restricts the lateral outreach by a locking device depending on boom position, extended telescope and the actual load on working cage. Shortly before this limitation is triggered, all the movements that would increase the load moment are automatically steadily slowed and switched off when the load moment limitation (LML) is reached. At switch box on cage the warning lamp „LML Cut-off“ additionally illuminates. Then only movements are possible which will not exceed the permissible load moment.
In addition to the „telescope out“ and „boom down“ movements, in some areas this also affects the „rotate boom“ movement. If the permissible load moment is reached by a rotating movement of the boom, then this movement will also be disconnected. To rotate it further in the direction for disconnection anyway, first another movement that reduces the load moment has to be carried out.

In addition to the limitation of the load moment, the telescopic extension of the boom is also locked by the telescopic extension limitation. Depending on the boom’s angle of elevation and the cage load, the telescope can be extended to certain maximum boom lengths. The „telescope out“ movement is disconnected when the extension limitation is reached. As with the load moment limitation, the warning lamp „LML-cut-off“ also lights up on the switch box for the working cage. No further telescopic extension is then possible.

Depending on the instance of use, either the load moment limitation or the telescopic extension limitation might be triggered first.

3.3.9 Automatic levelling device

By means of a push button all jacks can horizontally or vertically be extended or retracted respectively at the same time. Due to specific resistances within the hydraulic system and due to differences in friction of the cylinders the extending speeds of the jacks can be different. The control trys during vertical extension of the stabilizing jacks to lift the Steiger within the permissible siting inclination, as long as at least one jack is completely extended (automatic levelling device). When one stabilising jack has been completely vertically extended, no automatic levelling of the jacks will be carried out with regard to the permissible siting inclination. It is absolutely necessary to check the inclination of the Steiger!

3.3.10 Automatic adjustment of the working cage and of the telescope

After switching on operation and triggering the „boom up“ movement the first time, the working cage will be aligned automatically and the telescope adjusted. For this, the boom has to be located in the boom rest (basic position). Only after the adjusting is finished the „boom up“ movement triggered will start up.

3.3.11 Soft starting and soft stopping of Steiger movements

For the following movements a soft starting or stopping respectively is possible due to the electrical control:

- Jacks up or down,
- Boom (lifting arm) up or down,
- Boom rotation to the left or right,
- Telescope in or out.

3.3.12 Cushioning of final positions

The speeds of the following movements will automatically be reduced before reaching the final position:

- Boom (lifting arm) up or down,
- Boom rotation to the left or right,
- Telescope in or out.

The final positions of the corresponding cylinders or the position of the boom for a swivelling angle of approx. 225° to either side are determined as final positions. The rotating movement of the boom (final positions approx. 225° to either side) is not restricted mechanically.
Before reaching the corresponding final position the speed of the movement will automatically be reduced even with the joystick fully deflected.

3.3.13 Securing of the driver's cab and of the rear stabilising jacks when rotating or lowering the boom

If the boom is raised to less than a certain angle, then rotational movements will be automatically stopped shortly before reaching the driver's cab or the rear stabilising jacks. Any further rotation toward the driver's cab or stabilising jacks is then only possible after the boom has been raised above the angle mentioned above. Lowering movements of the boom can also only be carried out to this angle when the boom is located above or near the driver's cab or stabilising jacks.

3.3.14 Memory

„Memory“ facilitates recurring movements to certain target positions (working cage positions). When a target position is reached it can then be saved. Such a target position can then be moved to automatically from any other position. The route previously travelled will not be retraced, however!
The target position saved will be kept (even after the Ruthmann-Steiger is switched off) until a different position is saved.

3.3.15 Automated positioning aid for centre position of boom

The automated positioning aid makes it possible to bring the boom easily into its centre position in order to facilitate lowering of the boom into its boom rest.
As soon as the boom is lowered well below its horizontal position with the telescope retracted, but is still lifted higher than the boom rest and is moved from a lateral position towards the centre position, the rotating movement will be interrupted in the centre position over the boom rest. In this position the boom can be lowered into its boom rest.

3.3.16 Moving the Steiger into the basic position automatically

Regardless of the position in which the boom is currently in, the Ruthmann Steiger can be automatically moved to the basic position by push button.
First the boom is moved to the basic position. Then the stabilising jacks are retracted.

3.3.17 Operating panel of Emergency Control

Plain text indication:

The indication is for information and diagnosis purposes. It consists of an LC-display of 4 lines with 20 characters per line. Operating messages or handling instructions are indicated automatically by the computer control on the display. Also the sensory system (limit switches, approach switches, etc.) can be controlled over the display. This allows a fast check of the Ruthmann-Steiger and in a lot of cases a fault diagnosis by phone through our after-sales-service.
The display can best be read from vertical viewing direction. A too long exposition of the display to the sun and heating up to over 50° must be avoided. With temperatures below 0°C the display will become more and more unclear and illegible.

Control panel:

The control panel consists of a touch panel with 28 control keys. The control keys are partly given several functions.
The control panel serves e. g.:

- for emergency control,
- for scrolling of plain text indication.

3.3.17.1 Change-over language

The computer control has a comfortable language administration of the operation and information messages. The plain texts exist in different languages. After starting the computer control the text appears on the plain text indication in that language which was chosen last.
Only by “depressing a key” the operating personnel can switch-over the language on the operating panel. All indicated operating and information messages of the plain text indication then will be given in the chosen language.

3.4 Fuses

The power circuits and its consumers are secured with electrical fuses.

3.4.1 Fuses carrier chassis

Indications concerning the electrical fuse protection of the carrier chassis are to be taken from the operating instructions of the chassis manufacturer.

3.4.2 Fuses Ruthmann-Steiger

- Fuses next to vehicle battery
  F10 25 A ↓ Power supply battery
  F11 20 A ↓ Power supply battery

- Fuses inside driver's cab (depend on the carrier-chassis)
  F102 3 A ↓ Connection power supply over ignition

- Printed circuit board for fuses in switch box (emergency control) at Steiger-substructure. A printed circuit board with fuses is mounted at the interior side of the rotatable frame. The fuses are accessible from outside.

  F1 7,5 A ↓ Flashing beacon / rotating flashing beacon turret left
  F2 7,5 A ↓ Flashing beacon / rotating flashing beacon turret right
  F3 10 A ↓ Heating element control panel of cage, searchlight cage, flashing beacon / rotating flashing beacon cage
  F4 ↓ Free
  F5 3 A ↓ Pilot lamps driver's cab, ignition
  F6 ↓ Free
  F7 5 A ↓ Blinker lamps on jacks
  F8 ↓ Free
  F9 ↓ Free
  F10 3 A ↓ Limit switches, approach switches, push buttons for commands
  F11 3 A ↓ Power unit computer control, CAN-module, joystick pilot lamps cage

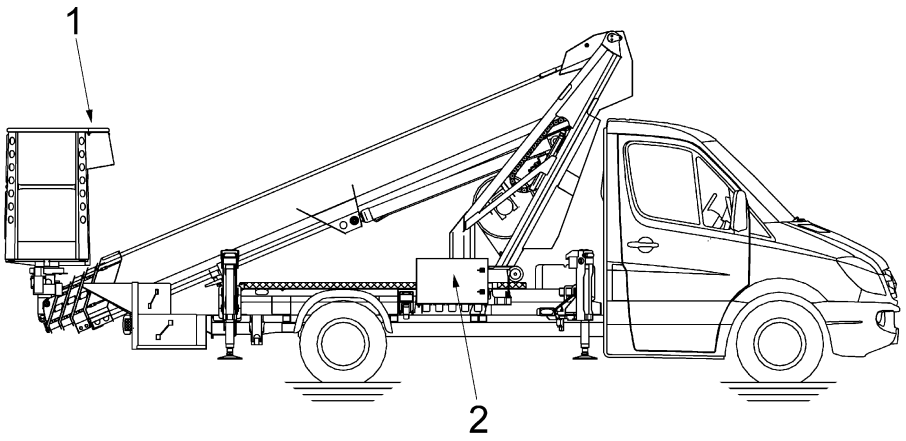
F12	3 A	↓ Line exits computer control without safety cut-off, pick-up matrix
F13	7,5 A	↓ Proportional valve „Telescope“, valve „Telescope in“
F14	7,5 A	↓ Proportional valve „Boom“, proportional valve „Rotation“, valves „Cage up/down“, relay „Cage rotation left/right“,
F15	15 A	↓ Valves „Jacks“, „Boom up/down“, „Rotation left/right“, „Telescope out“,
F16		↓ Free
F112	7,5 A	↓ E-motor „Cage rotation left/right“ (Printed Circuit Board A22)

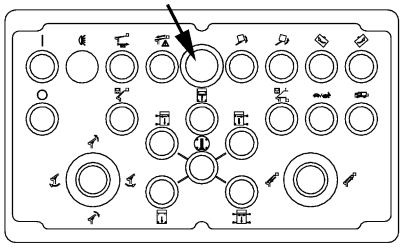
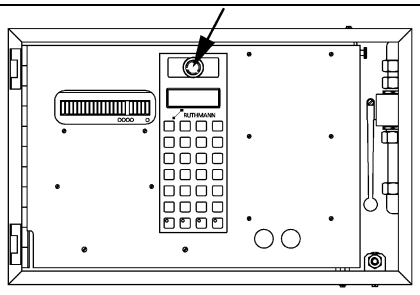
On the right side of the fuse F 16 there are another four fuse bases. The left one is a fuse test base. The three right bases are for spare fuses. If a functioning fuse is inserted into the test base the green light emitting diode marked with „Test“ will illuminate on the right below the base. The control stand „Cage control“ or „Emergency Control“ must be switched-on for that.

4 Operating elements and displays

4.1 Arrangement of Emergency Cut-off Push buttons

The Ruthmann-Steiger is equipped with the following Emergency Cut-off push buttons:



1. At the switch box on working cage.	
1. In the switch box at Steiger-substructure on the right side in travelling direction, above touch panel of emergency control.	

4.2 Operating elements and displays of the chassis

Operation of the chassis can be gathered from the operating instructions of the chassis-manufacturer.

4.3 Operating elements and displays of the Ruthmann-Steiger

4.3.1 Operating elements and indications on the instrument panel in the driver's cab

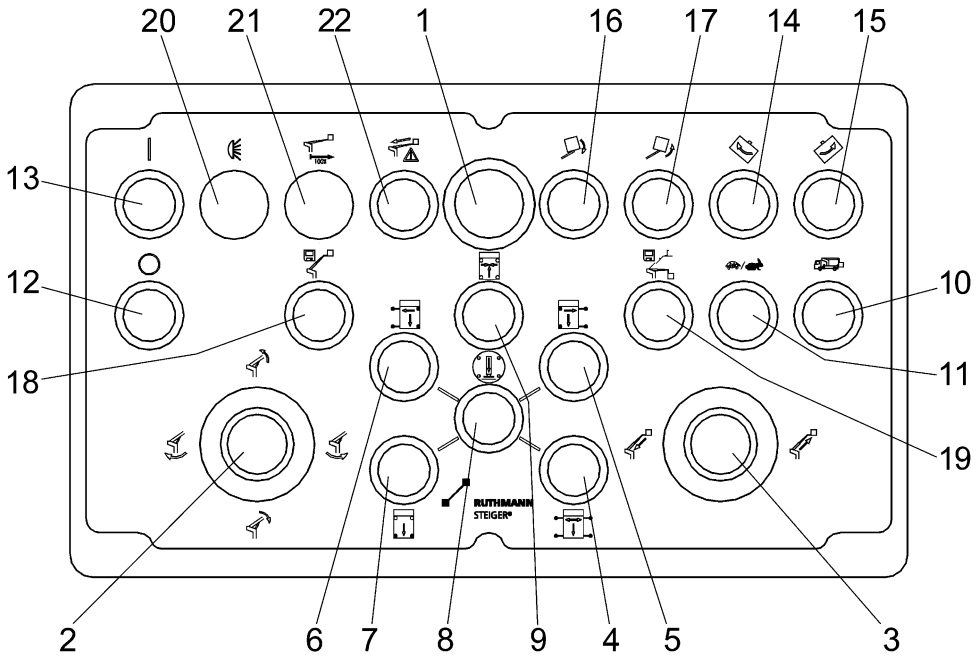
On the switch board of the instrument installation, the switch „Power take-off“ (main switch) is situated on the left near the steering wheel. By means of this switch the hydraulic pump drive operation as well as the Steiger are switched on and/or off at the same time. Please also see Operating Manual of chassis manufacturer.

There are two additional pilot lamps at the switch board. The pilot lamps signals that the Steiger is not in its transport position. They extinguish, when operation of the Steiger is switched off and the subsequent signals of the sensory mechanism contact.

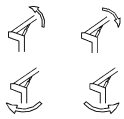
1.		Pilot lamp „Steiger **not** in transport position“	extinguishes if: • Boom system in its boom rest.
1.		Pilot lamp „Stabilizing jacks **not** in basic position“	extinguishes if: • Stabilising jacks retracted.

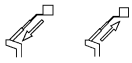
The form and position of the switch and/or the pilot lamps can slightly change depending on the outfit of the carrier chassis (please also see Operating Manual of chassis manufacturer).

4.3.2 Control panel at switch box on working cage



1. Push button, red „Emergency Cut-Off“
   - ⇓ interrupts immediately the electrical selection of the Steiger movements.

1.  Joystick
   - ⇓ Control lever for Steiger movements:
     - Boom up / down
     - Boom rotation left / right

1.  Joystick
   - ⇓ Control lever for Steiger movements:
     - Telescope in / out.

1.  Luminous push button „Full jacking“ / „Jack rear right“
   - ⇓ <u>Push function</u>:
     - Jacking-variant with stabilizing jacks extended horizontically on the left and right.
     - Jacking on both sides within vehicle profile after having reached the minimum jacking.
     - Activates push button „Jack vertical down“ for control of rear right jack.
   - ⇓ <u>Blinking light</u>:
     - Jack has ground contact.
   - ⇓ <u>Permanent light</u>:
     - With minimum jacking, only two luminous push button for jacks illuminate simultaneously: „Jack rear right“ and „Jack rear left“.
     - All illuminated push buttons for

jacks shine at the same time, when the control system detects a different correct jacking-variant.
Check inclination by means of levelling indicator!

1.  Luminous push button „Left within profile“ / „Jack front right“

- Push function:
  - Jacking variant with stabilizing jacks extended horizontically *on the right side*, on the left side within the vehicle profile.
  - Jacking on both sides within vehicle profile after having reached the minimum jacking.
  - Activates push button „Jack vertical down“ for control of front right jack.
- Blinking light:
  - Jack has ground contact.
- Permanent light:
  - See luminous push button „Full jacking / Jack rear right“.

1.  Luminous push button „Right within profile“ / „Jack front left“

- Push function:
  - Jacking variant with stabilizing jacks extended horizontically *on the left side,* on the right side within the vehicle profile.
  - Jacking on both sides within vehicle profile after having reached the minimum jacking.
  - Activates push button „Jack vertical down“ for control of front left jack.
- Blinking light:
  - Jack has ground contact.
- Permanent light:
  - See luminous push button „Full jacking / Jack rear right“.

1.  Luminous push button „Minimum jacking“ / „Jack rear left“

- Push function:
  - Minimum jacking.
  - Activates push button „Jack vertical down“ for control of rear left jack.
- Blinking light:
  - Jack has ground contact.
- Permanent light:
  - See luminous push button „Jack rear right“.

1.  Push button

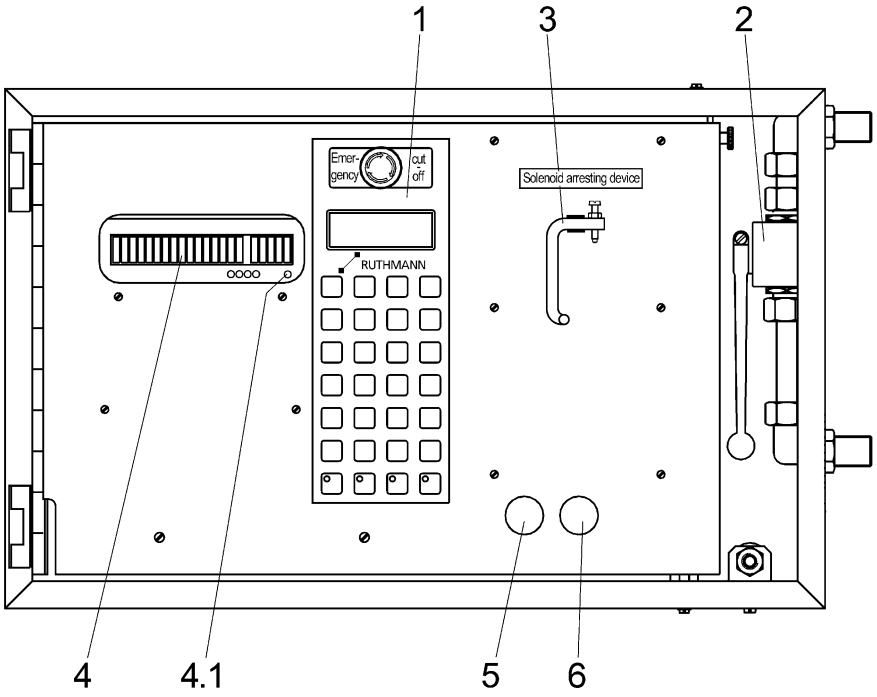
- Push function, only vertical extension

		„Jack vertical down“	of the stabilizing jack. Only in connection with push button „Jack rear left“, „Jack front left“, „Jack front right“ and / or „Jack rear right“.
1.		Push button „Jacks up“	⇓ Push function, all stabilizing jacks drive in first vertically, then horizontically.
1.		Luminous push button „Basic Position“	⇓ Push function, move Steiger into the basic position automatically. ⇓ <u>Permanent light:</u> - Steiger **not** in basic position.
1.		Push button „Special Function“	⇓ Switching the fine control on or off.
1.		Push button „Stop“	⇓ Push function, stops vehicle engine.
1.		Push button „Start“	⇓ Push function, starts vehicle engine.
1.		Push button „Cage Rotation left“	⇓ Push function, working cage is rotated to the left.
1.		Push button „Cage Rotation right“	⇓ Push function, working cage is rotated to the right.
1.		Push button „Cage down“	⇓ Push function, working cage downwards (inclination).
1.		Push button „Cage up“	⇓ Push function, working cage upwards (inclination).
1.		Push button „Memorize position“	⇓ Push function, save a target position of the working cage that has been moved into.
1.		Push button „Move into position“	⇓ Push function, move into a target position of the working cage that has been saved.
1.		Push button „Searchlight“ (Optional extra)	⇓ Push-to-lock-function, switching the searchlight on cage on or off.
1.		Warning lamp, red „LML-cut-off“	⇓ <u>Permanent light</u>: - Movements increasing the load moment are locked. ⇓ <u>Blinking light</u>: - Blinks when a movement of the Steiger is carried out with the fine adjustment control switched on. - Blinks if a „partly Emergency Cut-Off“ is existent.

- Blinks if the computer control has switched over to „Emergency Cut-Off“.

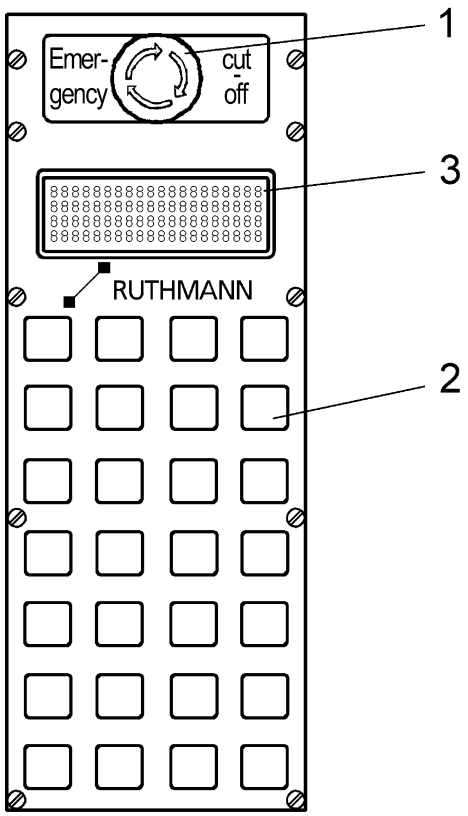
1.		Luminous push button „Bridge safety cut-out“	⇩ Push function, possibility to bridge the safety cut-out by a „conditional emergency cut-off“. First the telescope should then be retracted. - Emergency operation, misusage is strictly forbidden! - ⇩ <u>Blinking light</u>: - Blinks if a fault is existent („Restricted Steiger-operation“). - Blinks in turn with the warning lamp „LML-Cut-off“, if the computer control has switched-over to „Emergency Cut-Off“
1.		Buzzer	⇩ <u>Continuous sounding</u>: - Push button „Bridge safety cut-out“ is activated, even though there is no „partly Emergency Cut-Off“. - Battery’s voltage (distribution voltage) too low, start engine.

4.3.3 Switch box (emergency control) at Steiger-substructure



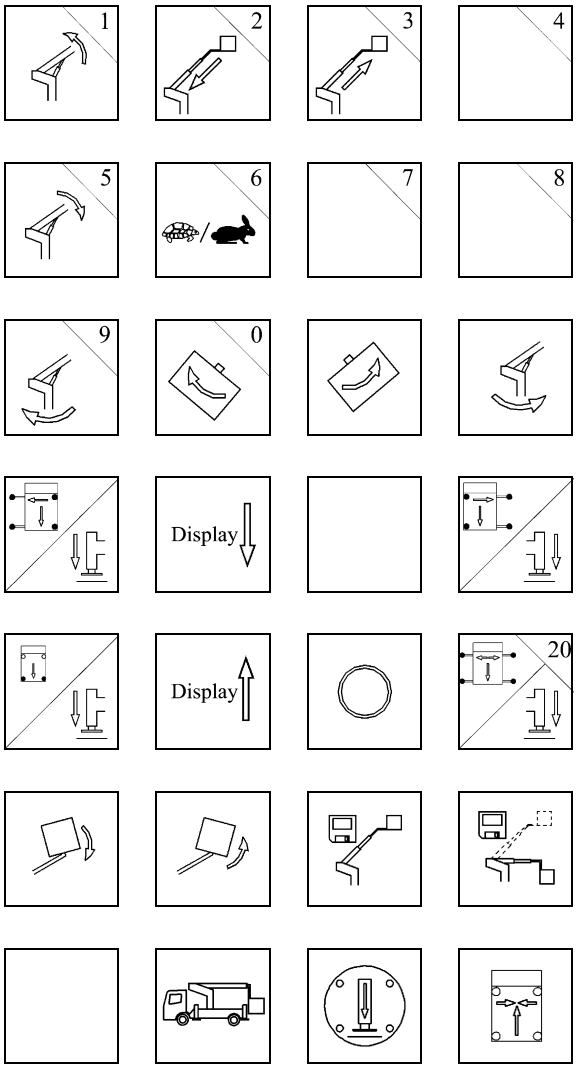
1.	Operating panel Emergency Control	↓ Operating panel and plain text indication
1.	Ball cock	↓ Emergency operation
1.	Solenoid arresting device	↓ Emergency operation, for solenoid valves
1.	Printed circuit board for fuses	↓ Consumers and power circuits are secured by means of lead fuses of different power
4.1	Green LED on printed circuit board for fuses	↓ Test function fuse
5.	Push button „Motor start“	↓ Push button function, starts vehicle engine (only possible with switched-on ignition).
5.	Optional extra	

4.3.3.1 Operating Panel „Emergency Control“



1. Emergency Cut-off push button
   - ↓ interrupts immediately the electrical selection of Steiger-movements
2. Touch Panel
   - ↓ Emergency Control;
   - scrolling of Operation and information messages;
   - Programming (input of password, setting of clock, etc.)
   - numeric input
3. Plain text indication
   - ↓ indicates operational, informative and fault messages

4.3.3.2 Touch panel of Emergency Control



Coordination of functional push buttons from left to right and from top to bottom (Observe optional extra, see control panel of working cage):

1.		boom up	↓ - Lifting of boom; numerically marked with „1“
1.		telescope in	↓ - Retract telescope; numerically marked with „2“
1.		telescope out	↓ - Extend telescope; numerically marked with „3“
1.		free	↓ without function; numerically marked with „4“

1.		boom down	↓ - Lowering of boom; numerically marked with „5“
1.		special function	↓ switching the fine control on or off; numerically marked with „6“
1.		free	↓ without function; numerically marked with „7“
1.		free	↓ without function; numerically marked with „8“
1.		rotation left	↓ - Rotate turret towards the left; numerically marked with „9“
1.		cage rotation left	↓ - Rotate working cage to the left; numerically marked with „0“
1.		cage rotation right	↓ - Rotate working cage to the right
1.		rotation right	↓ - Rotate turret to the right
1.		right within profile / jack front left	↓ - Jacking variant with stabilizing jacks extended horizontically *on the left side,* on the right side within the vehicle profile. - jacking on both sides within vehicle profile after having reached the minimum jacking. - activates function key No. 27 for control of front left jack
1.		page up	↓ scrolling of plain text indication, the next „display page“ will be shown
1.		free	↓ without function
1.		left within profile / jack front right	↓ - Jacking variant with stabilizing jacks extended horizontically *on the right side*, on the left side within the vehicle profile. - jacking on both sides within vehicle profile after having reached the minimum jacking. - activates function key No. 27 for control of front right jack
1.		minimum jacking / jack rear left	↓ - Minimum jacking. - activates function key No. 27 for control of rear left jack
1.		page down	↓ scrolling of plain text indication, the previous „display page“ will be shown
1.		motor stop	↓ switch-off vehicle engine

1.		full jacking / jack rear right	↓ - Jacking-variant with stabilizing jacks extended horizontically on the left and right. - jacking on both sides within vehicle profile after having reached the minimum jacking - activates function key No. 27 for control of rear right jack
1.		cage down	↓ - Working cage downwards (inclination)
1.		cage up	↓ - Working cage upwards
1.		save position	↓ save a target position of the working cage that has been moved into
1.		move into position	↓ move into a target position of the working cage that has been saved
1.		free	↓ optional extra
1.		basic position	↓ move the Steiger into the basic position automatically
1.		jack vertical down	↓ Only vertical extension of the stabilizing jack. Only in connection with function key „jack rear left“, „jack front left“, „jack front right“ and / or „jack rear right“.
1.		Jacks up	↓ all stabilizing jacks drive in first vertically, then horizontically

4.3.3.3 Operational and informative messages of the plain text indication

After switching on the control stand „Cage control“ or „Emergency Control“ the plain text indication shows the first „display page“, provided no fault message is existent. If a fault message is existent the indication automatically goes to the corresponding page and shows the fault message.
In order to transmit the wealth of information, corresponding abbreviations had been chosen for the components. Underneath each abbreviation a corresponding number is mentioned (switch signal or indication of angle) with the following meaning:

- „1“ ➧ Signal is existent,
- „0“ ➧ Signal is not existent,
- „ZZZ“ ➧ Indication of angle in degrees.

Example: (Display page „1“)

Display line 1:	**1 %TEL Time %LML**
2:	**70 08.35 80**
3:	**FLdn RLdn FRdn RRdn**
4:	**1 1 1 1**

In this special case the „1“ underneath the abbreviations means that the jacks have contact with the ground.

In the following list the messages and their meanings are explained.

Plain text indication	Meaning
RUTHMANN-Steiger **TB 270 ?,?t**	➧ Starting page with designation of the Steiger type
Next regular inspection according UVV!	➧ Date of yearly inspection by an expert in month and year. The date is being shown instead of the starting page after starting the computer control, as soon as the date is reached or has passed. If a Steiger movement is carried out the indication changes over to the starting page. A new input of the date is done by the Ruthmann after-sales-service.

Plain text indication	Meaning	
x %TEL Time %LML **FLdn RLdn FRdn RRdn**	x	Display page
	%TEL	Value of telescopic extension in percent (100% = max. telescopic extension allowed)
	Time	Time of internal clock of computer control
	%LML	Value of load moment in percent, 100% = LML-cut-off
	FLdn	Jack front left ground contact
	RLdn	Jack rear left ground contact
	FRdn	Jack front right ground contact
	RRdn	Jack rear right ground contact
x WHcm WWcm 0.1AB **TCdeg RAdeg Tcylcm**	x	Display page
	WH	Working height in cm (approx. platform height + 2 m)
	WW	Working distance in cm (approx. distance from the centre of the turret to the rear edge of the working cage + 50 cm)
	0.1AB	Angle of elevation of boom in 1/10 degrees
	TCdeg	Rotation angle of boom in degrees (teeth counter)
	RAdeg	Rotation angle of boom in degrees (potentiometer)
	Tcylcm	Telescope cylinder extension in cm
x FAdn NoGear **FLoutRLoutFRoutRRout**	x	Display page
	FAdn	Front tyres ground contact (Front axle down) (optional extra)
	NoGear	„1“, if no gear is shifted
	FLout	Jack front left horizontally extended
	RLout	Jack rear left horizontally extended
	FRout	Jack front right horizontally extended
	RRout	Jack rear right horizontally extended

Plain text indication	Meaning		
x ChainUp ChainLow **FLin RLin FRin RRin**	x	↓	Display page
	Chain Up	↓	Break of a chain or a rope in the upper boom system. Serial connection of the switches „chain break“ or „rope break“.
	Chain Low	↓	Break of a chain or a rope in the lower boom system. Serial connection of the switches „chain break“ or „rope break“.
	FLin	↓	Jack front left retracted
	RLin	↓	Jack rear left retracted
	FRin	↓	Jack front right retracted
	RRin	↓	Jack rear right retracted
x WhelfrR WhelfrF **Ilon Icros Tot0.1D**	x	↓	Display page
	WhelfrR	↓	Rear wheels free signal (unloaded)
	WhelfrF	↓	Front wheels free signal (unloaded)
	Ilon	↓	Vehicle’s longitudinal inclination as 1/10 of a degree
	Icros	↓	Vehicle’s transverse inclination as 1/10 of a degree
	Tot0.1D	↓	Total inclination of vehicle as 1/10 of a degree
x Brest Tele Boomlif **BoomEnd Brest^**	x	↓	Display page
	Brest	↓	Boom in its rest
	Tele	↓	Telescope retracted
	Boomlif	↓	Boom lifted
	Boom End	↓	Boom in final position (max. angle of elevation is reached)
	Brest^	↓	not provided
x Mercur D+ TelSer **DoorsClos Cacon**	x	↓	Display page
	Mercur	↓	Mercury ring switch
	D+	↓	„1“, if vehicle engine runs and the alternator is in working order
	TelSer	↓	Teleservice (optional extra)
	Doors Clos	↓	Doors to driver’s cab closed

Plain text indication	Meaning
	Cacon ↓ not provided
LimitRollup	Limit Rollup ↓ „0“, the chain for the power track is not correctly rolled up.
This page is not used	↓ Blank page inserted. Use the „Display up“ or „Display down“ function keys to scroll further.
EC.Right EC.Left RC **cage**	EC. Right ↓ Door of „Emergency control“ on vehicle’s right side open EC.Left ↓ Door of „Emergency control“ on vehicle’s left side (optional extra) open RC ↓ Remote control (optional extra) is switched-on cage ↓ Cage control is switched-on
Fully jacked or **On the left in the profile jacked** or **On the right in the profile jacked** or **Only in profile jacked** or **Minimal jacking** or **Incorrect jacked**	↓ Indication of jacking. Numerical values for the Ruthmann-after-sales-service
x Weekday **DD.MM HH:MM YYYY**	↓ Indication of date and time „weekday day.month hour:minute year“
No fault message available	↓ If a fault is determined within the sensory system, the indication automatically switches over to that page. Here the corresponding fault number and a plain text note to the determined fault appear. As long as no fault is ascertained after the last switching on the message „No fault message existent““. A page number will not be indicated.
Read out fault memory? yes=special	↓ Indication of fault messages out of the fault memory.

Plain text indication	Meaning
Fault memory deleted on	↓ Indication of last deletion of fault memory „day.month hour:minute year“.
Numerical values	↓ Numerical values for the Ruthmann-after-sales-service.

Button depressed on E-control right side
or
Button depressed on E-control left side
or
Button depressed on remote control
or
Button depressed on work. cage control
	↓ Indication of depressed buttons according to the pick-up matrix.
	Example:
	`Button depressed on`
	`5`
	`E-control right side`
	The first button on the second line of the emergency control (placed on the right side of the vehicle) is depressed. No page number is indicated.

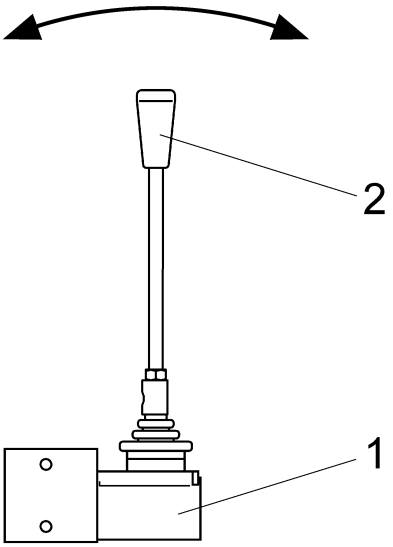
Volt HP KP	↓ Voltage in Volt. The values are displayed for the central processing unit (CPU) and for the control processor (CP).
Software-Version	↓ Software version of Ruthmann-Steiger.
Change-over language Change=sp.funct	↓ Language administration.
Password required Cont.=special funct. or **Password already typed in**	↓ The following pages can only be read after input of password.
This page is not used	↓ Blank page inserted. Use the „Display up“ or „Display down“ function keys to scroll further.
3 movements at the same Change=sp.funct or **2 movements at the same Change=sp.funct**	↓ Okay for possibility, that a number of up to three Steiger movements are possible simultaneously.
Sens.cont. from cage possible Change=Sp.f or **Sens.cont. from cage no pos Change=Sp.f**	↓ Okay for possibility to switch on or switch off the sensitive control through the push button „Special function“ on the control board in working cage.
2 jacks at minimal jacking chan=sp.func	↓ Jacking variant for minimum jacking. Either only the rear jacks or all 4 jacks are extended verti-

Plain text indication	Meaning
or **4 jacks at minimal jacking chan=sp.func**	cally. In both cases the working range remains the same.
Min. dist.to ground! Change = sp.funct. or **Nomin.dist.toground! Change = sp.funct.**	↓ only with the optional extra „Locking device to avoid moving below ground level".
Set clock? Yes = Special Funct.	↓ Setting of internal clock.
Change Password? Yes = Special Funct.	↓ Changing of password.
Adjusttlscopeextsion in m with sp. funct.	↓ only with the optional extra „Programmable telescopic extension limitation"
Since New=sp.funct **Steiger h min**	↓ Optional extra "Running time meter". Indication of the operation hours, counted from the last new setting.

4.3.4 Superordinate Emergency Control System

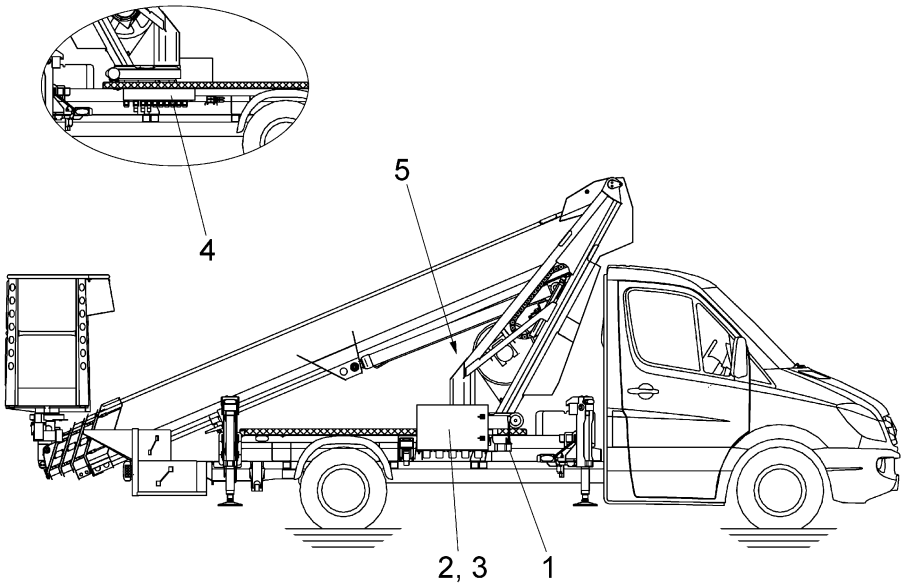
4.3.4.1 Hand pump

The hand pump is situated next to switch box of emergency control at the Steiger-substructure.



1. Hand pump
   - ➧ Drive of the hydraulics in case of a hydraulic pump failure
2. Hand pump lever

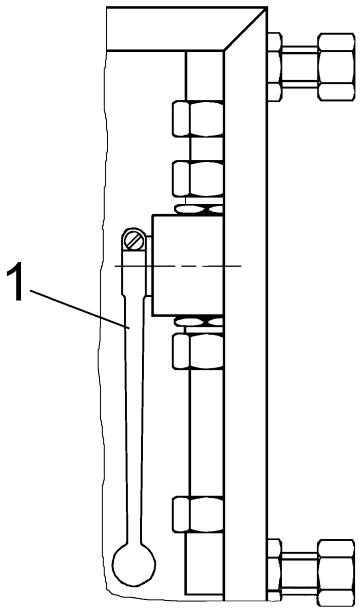
4.3.5 Emergency control system in extreme cases



1. Hand pump.
2. Ball cock (in switch box).
3. Solenoid arresting device (in switch box).
4. Way valves for extension and retraction of stabilising jacks and for rotation of boom (under cover, on the left-hand side).
5. Way valves for control of boom and of working cage (behind cover).

4.3.5.1 Ball cock

The ball cock is situated at the rear interior wall of the switch box at Steiger-substructure.



1. Hand lever

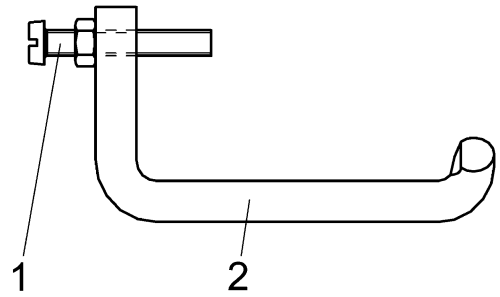
🡻 Ball cock closed - lever in direction of tube conduit.

🡻 Ball cock opened - lever in horizontal position.

Ball cock shown in closed condition.

4.3.5.2 Solenoid arresting device

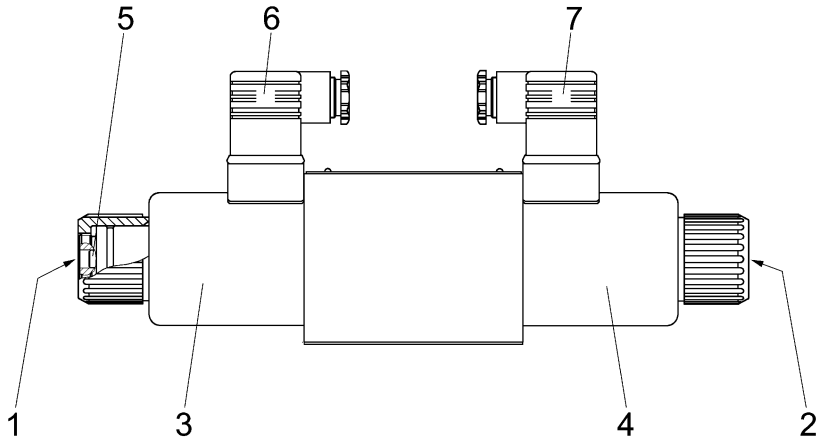
The solenoid arresting device for the manual emergency operation of the solenoid valves is situated at switch box at the Steiger-substructure next to the operating panel of the emergency control.



1. Actuating screw with counter nut (adjustable)
   🡻 Actuation solenoid head
2. Bow
   🡻 Arresting device

4.3.5.3 Way valves / Solenoid valves

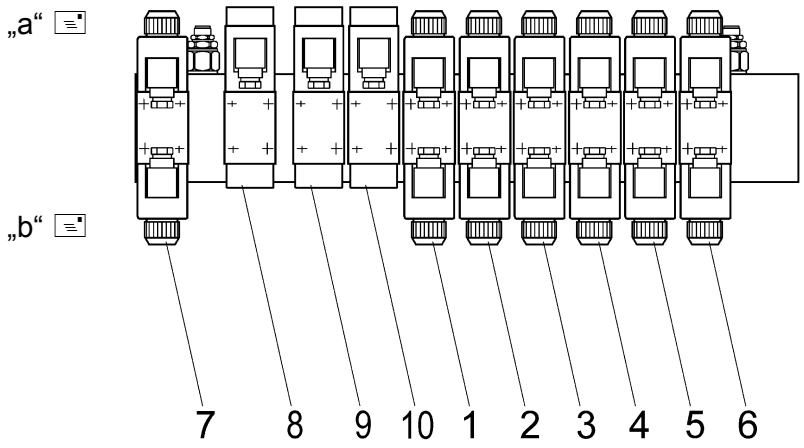
Example:

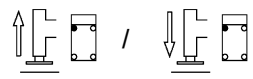
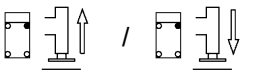
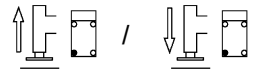
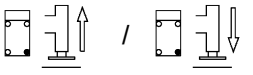
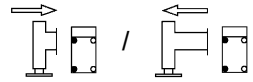
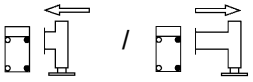


1. Manual emergency override left. Receiver for actuating screw of solenoid arresting device.
2. Manual emergency override right. Receiver for actuating screw of solenoid arresting device.
3. Solenoid left.
4. Solenoid right.
5. Plunger.
6. Implement socket left.
7. Implement socket right.

4.3.5.3.1 Way valves for extension and retraction of the jacks and for rotation of boom

At base frame there are the following solenoid valves:

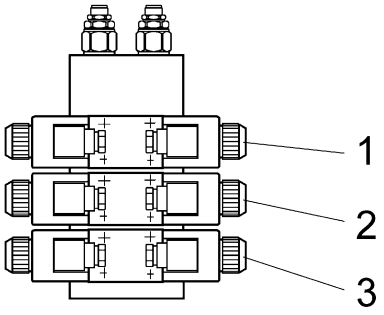


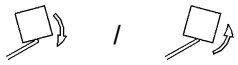
No.	Manual override „a“ / „b“	Function
1.		↓ Front left jack vertically up or down.
1.		↓ Front right jack vertically up or down.
1.		↓ Rear left jack vertically up or down.
1.		↓ Rear right jack vertically up or down.
1.		↓ Left jacks both horizontally in or out.
1.		↓ Right jacks both horizontally in or out.
1.		↓ Boom (turret) rotation to the right or left.

1. Proportional valve	↓ Speed regulation (not to be controlled manually)
1. Proportional valve	↓ Speed regulation (not to be controlled manually)
1. Proportional valve	↓ Speed regulation (not to be controlled manually)

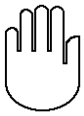
4.3.5.3.2 Way valves for control of boom and of working cage

The following solenoid valves are situated at turret:



No.	Manual override left / right	Function
1.		↓ Inclination levelling of working cage down or up.
1.		↓ Boom (lifting arm) lowering and lifting.
1.		↓ Telescope in or out.

5 Taking into operation



Attention!

If faults are determined when putting it into operation, operation must not be started. Operation may only start after elimination of the faults.

Note

Apart from the following explanations especially the safety instructions in chapter 1.2 must be observed.

The Ruthmann-Steiger must be checked for roadworthiness and operating safety each time before it is put into operation.

5.1 Definition of transport and basic position

Transport and basic position are identical.

Position of the components				
Component				**Position**
Stabilizing jacks	Jack	front	left	**retracted**
	Jack	front	right	**retracted**
	Jack	rear	left	**retracted**
	Jack	rear	right	**retracted**
Boom	Turret			**centre position**
	Boom system			**in boom rest**
	Telescope			**retracted**
Working cage	Door			**closed**

Switch positions and indicator lights	
Switch/Pilot lamp	**Position/Indication**
Switch „Power take-off“ (Steiger operation ON / OFF)	**„OFF“**
Pilot lamp „Steiger **not** in transport position“ (with the ignition switched on)	**„OFF“**
Pilot lamp „Stabilizing jacks **not** in basic position“ (with the ignition switched on)	**„OFF“**

The Ruthmann-Steiger may **only** be driven to the working site in transport position.

5.2 Measurements before starting a journey

The Operating Instructions of the chassis manufacturer must be observed.

- Additional checks before starting the engine:
  - visually for damage (fissures, deformations, corrosion at carrying parts, fastening and locking of removable connections, leakages etc.)
  - Ruthmann-Steiger in **transport position,**

- Additional checks after switching on the ignition:
  - The Pilot lamps „Steiger not in transport position“ and „Stabilizing jacks not in basic position“ on the electrical control panel of the instrument panel has to have extinguished.

5.3 Measurements to be taken before operating of Ruthmann-Steiger

Before starting work the operating staff must familiarize themselves with the surroundings of the work site. To the surroundings of the work site belong e.g. obstacles within the working and traffic range, carrying capacity of the ground and the necessary securing of the building site to the public traffic area.

Note

If several persons are working in or in the area of the Ruthmann-Steiger, a supervisor must be determined.

- Checks before operating the Ruthmann-Steiger:
  - Fuel reserves,
  - Oil level in hydraulic oil tank,
  - Rotating flashing beacons,
  - Visual check for damage (fissures, deformations, corrosion at carrying parts, fastenings and locking of removable connections and covers, leakages, etc.),
  - Check of the spaces for the sequences of movements of the mechanical constructional components incl. all hydraulic cylinders,
  - Cleanness and function of the sensory system,
  - Earthing (e.g. when being used at or nearby transmitting stations, wind power stations or transformer stations).

Note

Check fuel and engine oil levels acc. to operating instructions of chassis manufacturer.
Check hydraulic oil level with cold oil, vehicle standing in horizontal position and with switched-off hydraulic pump drive.

5.3.1 Location

Note

The intended location must carefully be checked. The operating staff is reliable for the safe positioning of the Ruthmann-Steiger.

- The location must be inspected before.
- The distance of embankments, ditches, etc. must be sufficient.
- Space for extension of jacks.
- Space for extension and rotation of the boom.
- Sufficient ventilation of location.
- The wind speed must be determined. In case of wind speeds of v_{Wind} > 12,5 m/s operation is not permissible (chapter 2.4).

5.3.1.1 Securing within public road traffic

If the Ruthmann-Steiger is used within road traffic, it must be secured against the traffic acc. to the local regulations of the country (e.g. German Road Traffic Act StVO).
Before starting the protection work having an effect on the road traffic, the closings and markings of the working site must be discussed/agreed with the competent authority.
When using certain things for the regulation and steering of the traffic you have to take special care of safety. Markings, traffic signs and traffic installations should steer the traffic usefully, they should not contradict each other and in such a way guide the traffic safely. The perception must not be restricted by the use of too many traffic installations. The traffic signs and traffic installations must correspond to the prescribed regulations (e.g. German Road Traffic Act „StVO).

Securing against traffic dangers can e.g. be done by:

- Switching-on of the rotating flashing beacons discernible from all sides. Please note that the rotating flashing beacons have a high electricity consumption. One might let the vehicle engine run for the whole period of operation!

- Traffic sign (building site)
- Traffic installations, as e.g.:
  - Warning lights,
  - Road closing devices, as e.g.
    - Barriers,
    - leading/warning bars),
    - leading cones l,
    - mobile closing panel (with or without warning flag)
    - mobile closing panel with blinking arrow (with or without warning flag).
- Safety guards

The securing of working sites and the use of road closing devices is effected in accordance with the German regulations for the securing of work sites at roads (RSA).

Attention!

If the boom and/or the working cage is lowered under 4,5 m above ground within the traffic area of road vehicles - with working cage rotated to the side -also the area underneath the working cage must be secured.

5.3.1.2 Subsoil of stabilizing jacks

Danger!

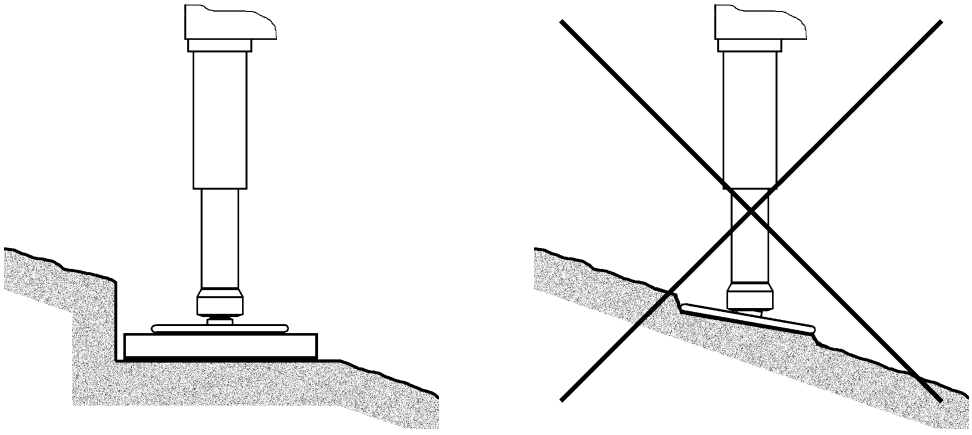
When the jacks become less effective, e.g. if one jack sinks into the ground, a danger of tilting occurs! Asphalt and concrete plates can be underflowed. Underneath the asphalt and the concrete plates respectively there can be canals.

Avoid jacking:

- ***on drain covers, grids,***
- ***on canal systems, cable ducts and pipework,***
- ***within the area of kerbstones, so that the jack plates do not lay on completely,***
- ***on floating sand,***
- ***on filled-up soil,***
- ***etc..***

The subsoil must be even. If necessary make an even area. The hinged feet level out slight unevenness of the ground, but they do not serve for levelling out of inclinations in a slope.

example



right wrong

The jacks must be freely moveable during positioning procedure. You must check, whether the subsoil withstands the maximum load occurring under the jack plates of the stabilizing jacks. The supporting forces are indicated at each stabilizing jack.

General indications concerning the permissible surface pressures:

- unpaved grounds approx. 25 - 35 N/cm^2
- paved ground approx. 50 - 60 N/cm^2
- road topping approx. 75 - 100 N/cm^2

On soft or unpaved ground or if the permissible surface pressure is exceeded, the jack plates must be increased by suitable supporting plates. It must be ensured that the vehicle cannot slip off. Subsoil and supporting plates must be undamaged and free of ice, oil, grease and other greasy stuffs.
When the conditions of the ground change, e.g. due to rain or thaw, the stability of the Ruthmann-Steiger can be reduced also during operation.

5.3.2 **Earthing** (Optional extra)

Before using the machine at or nearby e.g. transmitting stations, wind power stations or transformer stations it maybe becomes necessary to earth the Ruthmann-Steiger according to the instructions of the operator. When using the Ruthmann-Steiger nearby wind power stations static charging can make an earthing of the „Ruthmann-Steiger“ necessary. The radius, within which earthing measurements become necessary, depends on the transmitting power of the transmitting station and on the lifting height of the working cage. With big machines this can even be several kilometres.

Further information concerning this can be obtained from the owner. Kind of earthing of the Ruthmann-Steiger must be agreed with the persons responsible for the plant and for the work.

The following connections (earthing cable, cross section $\geq$ 50 mm^2) must at least be established :

- from working cage to boom (lifting arm),
- from boom (lifting arm) to turret,
- from turret to chassis,
- from chassis to earth.

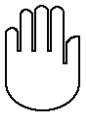
It can also become possible that the person responsible for the plant or for the work prescribes to lay an earthed metal grid on the working cage floor.

5.4 Preventive measurements for winter operation

In order to warrant a faultless operation of the Ruthmann-Steiger during winter time, at temperatures below zero, among other things, the following preventive measurements must be carried out.

- Keep the door locks running free and free of ice.
- Avoid accumulations of water remains. Draining holes for water must be free.
- Check the sensory system for cleanness. All limit switches and approach switches must be kept free of snow and ice
- Ensure softness of rubber buffers.
- Keep steps and floor of working cage free of snow and ice.
- Ensure that the retraction and extension chains are free of ice.
- Gliding parts in and at components must not be frozen.
- The spring drive (flat coil) of the cable / hose drum must not be frozen.
- Take care of an oil exchange in the hydrostate in case of extreme cold temperatures. This can be achieved for example through a lower speed of „Steiger-movements“.

6 Operation



Attention!

Operation must immediately be stopped if any malfunction is determined during operation. Only after rectification of the malfunction operation may again be started.

Note

In case of „One-man-operation“ the driver’s cab door must be closed and the driver’s cab doors be locked.
Apart from the following explanations especially the safety instructions of chapter 1.2 must be observed.

6.1 Emergency Cut-off Push button

In case of danger the control can be interrupted by depressing the red push button „Emergency Cut-Off“. The corresponding Emergency Cut-off push buttons (chapter 4.1) must be checked before starting work.

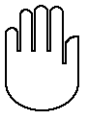
Release of Emergency Cut-off push button:

- Control panel „Working Cage“: Unlock push button by pulling.
  Operating panel „Emergency Control“: Turn push button clockwise until the push button jumps out again.
- Do not select any movement when releasing the push button.

Function test of the Emergency Cut-off push button:
Actuate the Emergency Cut-off push button during one Steiger-movement, e.g. „Jacks down“.

- The electrical selection of the Steiger-movement is interrupted.
- The warning lamp „LML-Cut-off“ blinks.
- Movements can only again be selected, if the Emergency Control push button is released.
- Afterwards give once again the order for driving.

6.2 Travelling operation



Attention!

In order to avoid a damage of the Ruthmann-Steiger during the journey, the transport of material and goods in the working cage is forbidden (exception: shunting movements)!

Note

Please also see chapter 1.2.

Pre-condition:

- Putting the Ruthmann-Steiger into operation acc. to chapter 5.
- Ruthmann-Steiger in **transport position**.

Component	Position/Indication	Execution in driver's cab
Vehicle engine	Start	Start in accordance with the operating instructions of the chassis-manufacturer

The operation of the driving is to be done in accordance with the operating instructions of the chassis-manufacturer.

6.3 Switching on and off of hydraulic pump drive (power take-off)

Switching on:

Attention!

While the power take-off is switched on and as long as the power take-off is switched on, the gas pedal must not be actuated either directly or indirectly, e.g. through the cruise control. The heating switch „Heat“ must not be actuated.

Note

While the power take-off is running (switch „power take-off“ actuated), the engine will automatically be switched-off if a gear is engaged (driving motion) or if the hand brake is released. A switched-off engine cannot be started by means of the ignition key if the power take-off is running and if the hand brake is released.

Component	Position/Indication	Execution in driver's cab
Hand brake	actuated	actuate in acc. with the operating instructions of the chassis-manufacturer.
Manual transmission	neutral position	in acc. with the operating instructions of the chassis-manufacturer.
Vehicle engine	runs	start in acc. with the operating instructions of the chassis-manufacturer, in case vehicle engine is not yet running.
Clutch pedal	depressed	completely depress
Power take-off	on	switch on in acc. with the operating instructions of the chassis-manufacturer. If there is a gear aggregate (slow / fast), this gear aggregate will have an effect on the number of revolutions of the power take-off (hydraulic pump drive). See operating and

		maintenance instructions of the vehicle's manufacturer.
Clutch pedal	released	release.
Pilot lamp „Power take-off“	shines	see operating instructions of the chassis-manufacturer.
Engine revolution		automatically pre-regulated.

Switching-off:

Component	Position/Indication	Execution in driver's cab
Clutch pedal	depressed	completely depress.
Power take-off	OFF	switch off in acc. with the operating instructions of the chassis-manufacturer.
Clutch pedal	released	release.

6.4 Switching the control stands on or off

6.4.1 Putting into or out of operation

The operation (Steiger operation) is switched on and off over a relais connected to the switch „Power take-off“. By switching on of the power take-off also the computer control of the Steiger will be started at the same time. In the plain text indication of the emergency control, the first display page (starting page) appears, if no fault message is existing.

The selection of the control stand is effected when opening the lock-up door of the control stand „Emergency control“ at the Steiger-substructure and when actuating the selector switch „Remote control“, which is available as optional extra.

Should e.g. the door of the switch box of the control stand „Emergency control“ be opened and / or the remote control be switched on, the following steps will be respected:

1. „Emergency control“ is activated,
2. „Remote Control“ (optional extra) is activated,
3. „Steiger operation (from the working cage)“ is activated.

6.4.2 Switch on or off control stand „Cage control“:

Pre-condition:

- Operation is switching-on.
- If existing put the selector switch „Remote control“ (optional extra) on Pos. „Off“.
- The door of the switch box „Emergency control“ is closed.

If the selector switch „Remote Control“ (Optional extra) is on Pos. „Off“ and if the door of the switch box „Emergency control“ is closed, the control stand „Steiger operation“ (Cage control) in the working cage is automatically selected. If one of the above-mentioned conditions is missing, the control stand in the working cage is automatically switched-off.

6.4.3 Switch on or off control stand „Emergency Control“:

Note

The control stand „emergency control“ at the Steiger-substructure has to be closed after each utilisation in order to secure the machine against impermissible operation.
The „Emergency control“ may only be used in case of emergency for emergency lowering in mutual agreement of the working cage crew and for maintenance purposes.

Pre-condition:

- Operation is switching-on.

Component	Position/Indication	Execution at Steiger-substructure
Control stand „Emergency control“	On	Open the door of the switch box „Emergency control“.

or

Control stand „Emergency control“	Off	Close the door of the switch box „Emergency control“.

6.5 Operating the Steiger

Pre-condition:

- Putting the Ruthmann-Steiger into operation acc. to chapter 5,
- vehicle engine started and operating pressure of the compressed-air system (if provided) built up,
- hydraulic pump drive switched-on,
- control stand „Cage control“ switched-on.

In the control stand selection „Cage control“ all Steiger movements are controlled over the operating panel of the working cage.

Note

All operational movements of the Ruthmann-Steiger are only possible with running vehicle engine. The ignition and the hydraulic pump drive (power take-off) must be kept switched on during the whole Steiger operation.

Danger!

It is not allowed to stay in the driver's cab if the front axle is lifted! It is not allowed to put additional load into the driver's cab. It is also not allowed to mount additional load, fittings or pieces on the driver's cab! It is not allowed to use the front accesses!

6.5.1 Entering and leaving the working cage

Danger!

It is prohibited to enter or to leave resp. the working cage if the working cage is lifted! You may only enter or leave the working cage in a position in which a safe entering or leaving resp. is possible. E.g. in transport position.

By exceeding the maximum carrying capacity of the working cage or of the Steiger the stability of the Ruthmann-Steiger is endangered. Constructional components of the Ruthmann-Steiger can be damaged. The maximum carrying capacity must not be exceeded. Please see type plate and main technical data of the Ruthmann-Steiger.

Entering:

- Go upstairs.
- Open door.
- Enter working cage.
- Close door.

Note

We recommend putting on the safety belts.

Leaving:

- Open door.
- Leave working cage.
- Close door.
- Go downstairs.

6.5.2 Handling of the operating panel in the working cage

6.5.2.1 **Leather covering** (Optional extra)

A heat-resistant leather covering is installed on the switch box of the working cage for protection. For operation it is folded upwards. For this the plastic snap locks must be pulled to the side up to the engaging point. Do not pull out completely. Then the cover can be folded upwards.

Note

We recommend closing the cover again for protection after finishing the work and leaving the working cage.

6.5.2.2 **Switch off or start vehicle engine**

Component	Position/indication	Execution at operating panel
Vehicle engine	Stop	actuate push button „Stop“

or

Vehicle engine	Start	Actuate push button „Start“

Note

For switching off or starting the vehicle engine keep the push button as long depressed until the engine has stopped or started respectively. When the vehicle engine has been turned off, it must not be restarted for a short period of a few seconds. When the vehicle engine has been turned off, it cannot be started from the operation panel of the working cage using the „Start“ push button with shifted gear and/or the parking brake has not been set.

6.5.2.3 Switching the searchlight on or off resp. (optional extra)

Pre-condition:

- Switch on control stand „Cage control“ or „Emergency Control“.

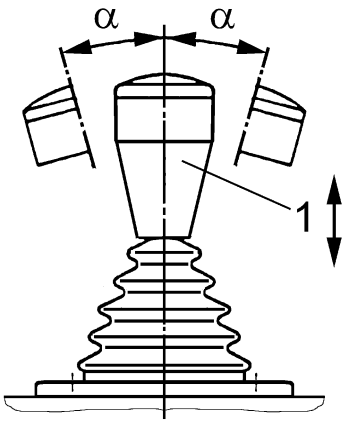
Component	Position/Indication	Execution at operating panel
Searchlight	on	actuate push button „Searchlight“

or

Searchlight	off	actuate push button „Searchlight“

6.5.2.4 Operation of the joystick

1. Unlock joystick by pulling the notch (1).
2. Move joystick into the direction of the inscription of the desired movement. The speed of the movements is controlled over the angle of deflection (α).
3. For stopping the movement put back the joystick in the neutral position.



Attention!

In order to avoid swinging motions, a sudden deflection and release of the joystick must be avoided.

You can set the control in such a way that either four or two boom movements can be carried out simultaneously. The following points must be observed during operating the joystick:

„3 movements at the same“

With the left joystick two of its designated boom movements can be carried out simultaneously. In addition to that, the third movement can be carried out with the right joystick.

„2 movements at the same“
After shifting over onto two boom movements, with each joystick one of those boom movements related to it can be carried out. The boom firstly carries out that movement of the joystick, which was driven as first movement out of neutral position.

6.5.3 Extension of stabilizing jacks

Before extending the jacks of the Ruthmann-Steiger the working range and the correspondingly necessary supporting basis must be fixed. The following jack base positions are e.g. possible:

- Full extension of stabilizing jacks,
  All jack arms are completely extended horizontally.
- Unilateral extension of jacks within vehicle profile,
  The jack arms remain unilaterally horizontally completely in their retracted position. They are extended horizontally on the opposite side.
- Extension of jacks on both sides within vehicle profile.
  The jack arms remain completely retracted on both sides in horizontal position.
- Minimum jacking.
  The jack arms remain completely retracted on both sides in horizontal position. The rear jacks have ground contact – the position of the front jacks is variable / not relevant.

The jack arm must either completely be extended horizontally or completely be retracted horizontally. Intermediate positions for the horizontal extension are forbidden. The computer control recognizes, in relation to the degree of extension of the jack arms and the interrogation of the ground-contact of the jack-cylinders, the working range permissible for that jacking situation.

- For extension of the jacks there must be sufficient space available.
- Keep sufficient distance to pits and embankments (see e.g. German Standards DIN 4124 „Construction Pits and Ditches“).
- The jack plates must have horizontal contact with the ground and must not jam. They must be freely moveable during positioning procedure.
- The Ruthmann-Steiger must not be able to slip.
- In case of insufficient jack stroke the jack plates must be supported accordingly.
- The jacks have to be extended at least until the boom movement is released by the main control. All jacks must have ground contact. For minimum jacking only the rear stabilizing jacks must have ground contact. The position of the front jacks in this case is not relevant.
- For the working range with „full jacking“, „unilateral jacking within the vehicle profile“ or „jacking within the vehicle profile on both sides“ the

wheels of the vehicle must be discharged and free of load, that means: the wheels must have left the ground **(ground clearance).**

- The inclination of positioning of the Ruthmann-Steiger must be controlled by means of the levelling indicator. The permissible inclination of positioning must not be exceeded.
- You have to take care that the vehicle is lifted warping-free.

Jacking must be effected in such a way that the stability of the Ruthmann-Steiger is guaranteed at all times.

Danger!

By reducing stability a danger of tilting becomes existent! Stability can be reduced by:

- ***Modification of soil conditions,***
- ***Sinking in of the jacks,***
- ***Leakage at the jack hydraulics.***

The proper jacking must also be supervised during operation. Especially e.g. after a break the extended stabilizing jacks as well as the siting inclination of the Steiger must be checked! Steiger operation must be stopped immediately, if stability is no longer guaranteed.

Pre-condition:

- The subsoil withstands the corresponding loads of the jacks,
- Telescope is retracted,
- Boom in boom rest.

Danger!

Danger of bruising during extension and retraction of stabilizing jacks! Always supervise the jacks being extended or retracted!

Attention!

In order to avoid a damage of the jacks, they must always as first step be extended horizontally and afterwards vertically extended. Retraction of the jacks is car-

ried out in the reverse sequence.
The Steiger-substructure and the jacks might be damaged, if the vertical jacks are considerably unequally extended or retracted. You have to take care that the jacks are extended and retracted in such a way that the vehicle remains without warping as far as possible.
The doors to the driver's cab have to be shut! In case one door of the driver's cab is open (only a few millimetres), the stabilising jacks cannot be moved by the control system.

Note

As soon as a jack leaves its basic position, the pilot lamp „Basic position“ will shine.
The inclination of the Ruthmann-Steiger must be checked by means of the levelling indicator and if necessary compensated by extending individually the stabilizing jack vertically according to the permissible siting inclination.

6.5.3.1 Full jacking

By means of the push-button „Full jacking“ all stabilizing-jack-arms are extended together horizontically. As soon as full horizontal extension is completed, the cylinders of the stabilizing-jacks are extended vertically.

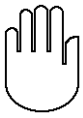
<table>
<tr><th>Component</th><th>Movement / Indication</th><th>Execution at operating panel</th></tr>
<tr><td>Jacks left and
Jacks right</td><td>completely horizontally extension</td><td rowspan="2">Actuate push button „Full jacking“ (keep depressed).</td></tr>
<tr><td>Jacks left and
Jacks right</td><td>afterwards vertically extension</td></tr>
<tr><td colspan="3">The computer control system stops the movement automatically when:
all the stabilising jacks have contact with the ground,
the wheels of the vehicle are unloaded, i.e. lifted off the ground
and the electronically measured inclination of the Steiger is within the permissible positioning inclination.
The inclination of the Steiger must at all events be controlled by means of the levelling indicator!</td></tr>
<tr><td>Pilot lamps
„Jack front left“,
„Jack rear left“,
„Jack front right“,
„Jack rear right“</td><td>shines</td><td></td></tr>
<tr><td>Pilot lamp, red
„Basic position“</td><td>shines</td><td></td></tr>
</table>

6.5.3.2 Unilateral jacking within vehicle profile

For example with the push-button „Left within profile“ the stabilizing jack arms on the right side are extended together and in an horizontal way. On the opposite side the stabilizing jack arm rest within the vehicle profile. As soon as the stabilizing jack arms on the right side are horizontically fully extended, all jack cylinders drive out vertically.

Note

As long as no vertical movement of the stabilizing jacks has started, you can change within the push button „Left within profile“, „Right within profile“, „Full jacking“ or „Minimum jacking“. The stabilizing jack arms will then be automatically adapted to each jacking situation.



Attention!

Damage of jacking! Do not change the push button for the jacks in case the jacks are vertically extended. A jack cylinder, which is vertically extended, can damage the jacking-system when e.g. when the jack-plate slides on the ground or when it hits an edge!

Component	Movement / Indication	Execution at operating panel
Jacks right	completely horizontally extension	Actuate push button „Left within profile“ (keep depressed).

or

Jacks left	completely horizontally extension	Actuate push button „Right within profile“ (keep depressed).
Jacks left and Jacks right	afterwards vertically extension	

The computer control system stops the movement automatically when: • all the stabilising jacks have contact with the ground, • the wheels of the vehicle are unloaded, i.e. lifted off the ground • and the electronically measured inclination of the Steiger is within the permissible positioning inclination. The **inclination** of the Steiger must at all events be **controlled** by means of the levelling indicator!		
Pilot lamps „Jack front left“, „Jack rear left“, „Jack front right“, „Jack rear right“	shines	
Pilot lamp, red „Basic position“	shines	

6.5.3.3 Jacking on both sides within vehicle profile

The jacking on both sides within vehicle profile is carried out by means of the push button „Minimum jacking“ together with one of the three push buttons for jacks „Left within profile“, „Right within profile“ or „Full jacking“.

Component	Movement / Indication	Execution at operating panel
Jacks rear	vertically extension	Actuate push button „Minimum jacking“ (keep depressed).
The computer control system stops the movement automatically when: • the rear stabilising jacks have contact with the ground.		

or *(according to adjustment)*

Jacks left and Jacks right	vertically extension	Actuate push button „Minimum jacking“ (keep depressed).
The computer control system stops the movement automatically when: • all the four stabilising jacks have contact with the ground.		

afterwards

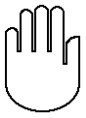
Jacks left and Jacks right	vertically extension	Actuate one of the three push buttons for jacks (keep depressed).
The computer control system stops the movement automatically when: • all the stabilising jacks have contact with the ground, • the wheels of the vehicle are unloaded, i.e. lifted off the ground • and the electronically measured inclination of the Steiger is within the permissible positioning inclination. The **inclination** of the Steiger must at all events be **controlled** by means of the levelling indicator!		
Pilot lamps „Jack front left“, „Jack rear left“, „Jack front right“, „Jack rear right“	shines	
Pilot lamp, red „Basic position“	shines	

6.5.3.4 Minimum jacking

For a minimum vertical jacking the Ruthmann-Steiger can be positioned alternatively only with the rear stabilizing jacks or with all four stabilizing jacks. The adjustment (minimum jacking with two or four jacks) is carried out by means of the control panel of the emergency control. The jacking variant does not influence the „working range for minimum jacking". The working range is identical in both cases.

Danger!

Danger of overturning. The wheels of the vehicle must not be pressed in a different way into the vehicle springs due to unevenness of ground (e.g. kerbings, potholes etc.)! The tire pressure of the vehicle wheels must correspond to the value indicated at the Ruthmann-Steiger. Check the tire pressure before operation of the stabilizing jacks!
The inclination of the Steiger must at all events be controlled by means of the levelling indicator!



Attention!

Overloading of the front axle! In case of minimum jacking only with the rear stabilizing jacks, the rear jacks must not be extended too much, otherwise the front axle will be overstressed and possibly damaged.

Note

The wheels of the vehicle rest completely on ground (braking effect). This can avoid e.g. a „slump" of the Ruthmann-Steiger on a slope. Eventually the Ruthmann-Steiger must be secured against slump (e.g. on plain and slippery ground) by means of other appropriate measurements.
The automatic positioning device does not work with the „Minimum jacking".

Component	Movement / Indication	Execution at operating panel
Jacks rear	vertically extension	Actuate push button „Minimum jacking“ (keep depressed).
The computer control system stops the movement automatically when: • the rear stabilising jacks have contact with the ground.		

or *(according to adjustment)*

Jacks left and Jacks right	vertically extension	Actuate push button „Minimum jacking“ (keep depressed).
The computer control system stops the movement automatically when: • all the four stabilising jacks have contact with the ground.		
Pilot lamps „Jack rear left“ „Jack rear right“	shines [1]	
Pilot lamp, red „Basic position	shines	

*)[1] The pilot lamps shines, when the electronically measured inclination of the Steiger is within the permissible positioning inclination. The **inclination** of the Steiger must at all events be **controlled** by means of the levelling indicator!*

In case it is <u>not</u> possible to position the Ruthmann-Steiger within the admissible siting inaccuracy by means of the push-button „Minimum jacking”, the complete jacking system can be extended vertically by means of one of the other three stabilizing jack push buttons „Left within profile”, „Right within profile” or „Full jacking”. That means that the front and rear jack cylinders drive out vertically. The computer control system then trys to lift the Ruthmann-Steiger within the admissible siting inaccuracy. The wheel grip and therefore **the braking effect of the vehicle wheels can get lost.**

6.5.3.5 Retraction of jacks

Note

By means of the push button „Jacks up“ all stabilizing jack cylinders are retracted together. As soon as all stabilizing jack cylinders are retracted completely, the horizontically extended stabilizing jack arms drive in.

Component	Movement / Indication	Execution at operating panel
Jacks left and Jacks right	vertically retraction	Actuate push button „Jacks up“ (keep depressed).
Pilot lamp, „Jack front left“ „Jack rear left“ „Jack front right“ „Jack rear right“	extinguished	
Vehicle wheels	Contact with the ground	
Jacks left and Jacks right	afterwards horizontally retraction [1]	
Pilot lamp, red „Basic position	extinguished	

[1] horizontically extended stabilizing jack arms

6.5.3.6 Individual control of the vertical stabilizing jacks

Note

It is only allowed to use the individual control of the stabilizing jacks, when the axles of the chassis are released. The wheels of the chassis must have ground clearance.
By means of the push-button „Jack vertical down“ and the push-button for the corresponding stabilizing jack, the stabilizing jack cylinders can be vertically extended in an individual way.

Component	Movement / Indication	Execution at operating panel
Jacks left and/or Jacks right	vertically extension	Depress push button „Jack vertical down“ as well as also actuate push button „Jack front left“, and/or Depress push button „Jack vertical down“ as well as also actuate push button „Jack rear left“, and/or Depress push button „Jack vertical down“ as well as also actuate push button „Jack front right“, and/or Depress push button „Jack vertical down“ as well as also actuate push button „Jack rear right“. **Check inclination** of the Steiger!

6.5.4 Boom movements

Boom movements are only permissible, if the jacks of the Ruthmann-Steiger are properly extended.

Danger!

Other persons, things and the Ruthmann-Steiger can be endangered through Steiger movements. The Ruthmann-Steiger can be damaged so much by touching e.g. an obstacle that the safety of the personnel in the working cage is no longer guaranteed. Important construction components (e.g. bolts, hydraulic components etc.) can be damaged or ripped down so that it can lead to serious accidents. The operating staff has to ensure during all movements of the Ruthmann-Steiger, that it does not endanger itself or other persons! It is not permitted to touch obstacles / things with the Ruthmann-Steiger, with the working cage or the with the booms. Steiger movements are only permissible, when the working range can be seen over. This concerns the area below the working cage, too.

Pre-condition:

- extend the jacks of the Ruthmann-Steiger properly.

In case of proper jacking the following pilot lamps will shine at operating panel:

Component	Movement / Indication	Execution
Pilot lamp, red „Basic position	shines	
Pilot lamp, „Jack front left“ „Jack rear left“ „Jack front right“ „Jack rear right“	shines	The **inclination of positioning** of the Steiger **must be controlled** by means of the levelling indicator.

Always carry out the movement „boom up“ as first movement of the boom.

Note

In order to avoid dangers and to give the machine a longer life, the telescope should be retracted firstly if possible when bringing the boom back into its basic position and afterwards rotate the boom to the centre / longitudinal axle of the Steiger. Then the boom has to be lowered into its rest.

6.5.4.1 „Boom up“ or „Boom down“

Component	Movement / Indication	Execution at operating panel
Boom (lifting arm)	lifting	left joystick ⌫ „Boom up“

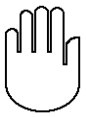
or

Boom (lifting arm)	lowering	left joystick ⌫ „Boom down“

6.5.4.2 „Rotation to the left“ or „Rotation to the right“ of boom

Pre-condition:

- Boom is lifted.



Attention!

In order to avoid any touching the boom must be lifted to such a degree that a rotation of the boom is possible without touching anything (boom rest, rotating flashing beacon, etc.).

Component	Movement / Indication	Execution at operating panel
Boom (Turret)	rotation left	left joystick ⌫ „Rotation left“

or

Boom (Turret)	rotation right	left joystick ⌫ „Rotation right“

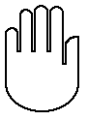
6.5.4.3 „Telescope out“ or „Telescope in“

Component	Movement / Indication	Execution at operating panel
Telescope	extension	right joystick ⌫ „Telescope out“

or

Telescope	retraction	right joystick ⌫ „Telescope in“

6.5.5 „Cage rotation left“ or „Cage rotation right“



Attention!

To avoid overloading and thus damage to the drive, release the push button immediately when the maximum angle of rotation has been reached.

Component	Movement / Indication	Execution at operating panel
Working cage	rotation left	Actuate push button „Cage rotation left“.

or

Working cage	rotation right	Actuate push button „Cage rotation right“.

6.5.6 Adjustment of working cage inclination „Cage up/Cage down“

Component	Movement / Indication	Execution
Working cage	move upwards	Actuate push button „Cage up“.

or

Working cage	move downwards	Actuate push button „Cage down“.

Note

Bear in mind that the movement will only be carried out for three seconds, even if the push button continues to be pressed. If it should be carried out for any longer, then the push button has to be pressed again. As soon as the working cage reaches an inclination e. g. towards the rear of more than 10° to horizontal line, a safety cut-off occurs. Such a cut-off can be cancelled using the „Bridge Safety Cut-off“ push button, and the working cage positioned horizontally by pressing the „Cage Up“ push button.

6.5.7 Automatic positioning aid of centre position of boom

Pre-condition:

- Telescope retracted,
- Boom lifted above boom rest and lifted beneath the horizontal position.

Component	Movement / Indication	Execution at operating panel
Boom (Turret)	rotation left	left joystick ⌫ „Rotation left“ 🡻 Just before reaching the centre position the rotating speed will be reduced automatically.

or

Boom (Turret)	rotation right	left joystick ⌫ „Rotation right“ 🡻 Just before reaching the centre position the rotating speed will be reduced automatically.

Boom (Turret)	stops	**automatically** 🡻 As soon as the centre position of boom is reached, the rotating movement will be stopped.

Starting the rotating movement once again will only be possible,

- if with moved joystick you wait for a period of delayed time,
- or if the joystick is brought back into neutral position after stopping the movement „Boom rotation“ and afterwards again be moved.

The automatically reduced rotating speed is now again be released.

6.5.8 Memory

Save target position:

Note

The target position saved will be kept (even after the Ruthmann-Steiger is switched off) until a different position is saved.

Component	Movement / Indication	Execution at operating panel
Position of the working cage	save	Actuate push button „Memorize position“.

Move into target position:

Danger!

There is a danger of collision with any obstacles there might be on the way to the target position!
The operating staff must themselves be sure that no collision occurs between the working cage, the boom system or any obstacles when automatic movement to a target position is carried out! If there should be any obstacle on the way the computer control system takes, then it must be moved around manually using working cage's control panel. Afterwards, the movement can be continued by pressing and holding down the „Move into position“ push button.

Component	Movement / Indication	Execution at operating panel
Target position of the working cage	move	Actuate push button „Move into position“ (keep depressed).
The target position saved will be moved into automatically again by movements of the boom as long as the push button cited above is pressed. In most cases, the order of the movements of the boom will not be the same as the first time it is moved into the target position and this is saved.		

6.5.9 Moving the Steiger into the basic position automatically

Danger!

There is a danger of collision with any obstacles there might be on the way to the Steiger's basic position!
The operating staff must themselves be sure that no collision occurs between the working cage, the boom system or any obstacles when automatic movement to the Steiger's basic position is carried out! If there should be any obstacle on the way the computer control system takes, then it must be moved around manually using working cage's control panel. Afterwards, the movement can be continued by pressing and holding down the „Basic position" push button.

Note

If at the beginning or during the automatic driving into basic position single movements are blocked due to e.g. the load moment limitation, the operator must possibly himself move the boom out of the locking by operating the joystick.
Afterwards, the automatic movement can be continued by pressing and holding down the „Basic position" push button.

Component	Movement / Indication	Execution at operating panel
Boom system and stabilising jacks	move to basic position	Actuate push button „Basic position" (keep depressed).
The basic position is moved into automatically as long as the above-mentioned push button is pressed. First the boom system is automatically moved to the basic position and then the stabilising jacks are retracted.		

6.6 Handling of operating panel of emergency control

Steiger movements (Control commands):

Pre-condition:

- Hydraulic pump drive switched-on.
- Control stand „Emergency Control“ switched-on.

In the control stand selection „**Emergency Control**“ the push buttons of the operating panel are released, among other things, for the control of the Steiger:

- Switching-off / -on of vehicle engine,
- Extend / retract stabilizing jacks,
- Boom movements,
- Cage rotation,
- Modification of working cage inclination „Cage up / Cage down“.

Note

The emergency control may only be used in case of emergency under mutual agreement with the cage crew and for maintenance purposes.

The movements are started by depressing the corresponding push buttons. Some of the push buttons are given several functions. For starting a Steiger-movement the push button of the component to be moved must be actuated at first and then the second push button of the corresponding movement. After having started the second push button can be released again. The movement will be carried out as long as it is stopped by releasing the first push button or by interruption through the control.

6.6.1 Switching off or on of vehicle engine

Component	Position/Indication	Execution
Vehicle engine	Stop	Actuate push button „Motor stop“.

or

Vehicle engine	Start	Actuate push button „Motor start“.

Note

For stopping or starting of vehicle engine keep the push button as long depressed as the vehicle engine has come to a standstill or has started. When the vehicle engine has been turned off, it cannot be restarted for a short period of a few seconds. When the vehicle engine has been turned off, it cannot be started with the push button with shifted gear and/or the parking brake has not been set.

6.6.2 Movement of jacks

Remarks, instructions and pre-conditions of chapter „Operating the Steiger“ must be observed.

Full jacking

Component	Movement / Indication	Execution
Jacks left and Jacks right	completely horizontally extension	Depress push button „Full jacking“ (keep depressed).
Jacks left and Jacks right	afterwards vertically extension	
The computer control system stops the movement automatically when: • all the stabilising jacks have contact with the ground, • the wheels of the vehicle are unloaded, i.e. lifted off the ground • and the electronically measured inclination of the Steiger is within the permissible positioning inclination. The **inclination** of the Steiger must at all events be **controlled** by means of the levelling indicator!		

Unilateral jacking within vehicle profile

Component	Movement / Indication	Execution
Jacks left	completely horizontally extension	Depress push button „Right within profile“ (keep depressed).

or

Jacks right	completely horizontally extension	Depress push button „Left within profile“ (keep depressed).
Jacks left and Jacks right	afterwards vertically extension	

The computer control system stops the movement automatically when: • all the stabilising jacks have contact with the ground, • the wheels of the vehicle are unloaded, i.e. lifted off the ground • and the electronically measured inclination of the Steiger is within the permissible positioning inclination. The **inclination** of the Steiger must at all events be **controlled** by means of the levelling indicator!

Jacking on both sides within vehicle profile

Component	Movement / Indication	Execution
Jacks rear	vertically extension	Depress push button „Minimum jacking“ (keep depressed).
The computer control system stops the movement automatically when: • the rear stabilising jacks have contact with the ground.		

or *(according to adjustment)*

Jacks left and Jacks right	vertically extension	Depress push button „Minimum jacking“ (keep depressed).
The computer control system stops the movement automatically when: • all the four stabilising jacks have contact with the ground.		

afterwards

Jacks left and Jacks right	vertically extension	Actuate one of the three push buttons for jacks (keep depressed).
The computer control system stops the movement automatically when: • all the stabilising jacks have contact with the ground, • the wheels of the vehicle are unloaded, i.e. lifted off the ground • and the electronically measured inclination of the Steiger is within the permissible positioning inclination. The **inclination** of the Steiger must at all events be **controlled** by means of the levelling indicator!		

Minimum jacking

Component	Movement / Indication	Execution
Jacks rear	vertically extension	Depress push button „Minimum jacking“ (keep depressed).
The computer control system stops the movement automatically when: • the rear stabilising jacks have contact with the ground. The **inclination** of the Steiger must at all events be **controlled** by means of the levelling indicator!		

or *(according to adjustment)*

Jacks left and Jacks right	vertically extension	Depress push button „Minimum jacking“ (keep depressed).
The computer control system stops the movement automatically when: • all the four stabilising jacks have contact with the ground. The **inclination** of the Steiger must at all events be **controlled** by means of the levelling indicator!		

Retraction of jacks

Component	Movement / Indication	Execution
Jacks left and Jacks right	vertically retraction	Depress push button „Jacks up“ (keep depressed).
Vehicle wheels	Contact with the ground	
Jacks left and Jacks right	afterwards horizontally retraction	

Individual control of the vertical stabilizing jacks

Component	Movement / Indication	Execution
Jacks left and/or Jacks right	vertically extension	Depress push button „Jack vertical down“ as well as also actuate push button „Jack front left“, and/or Depress push button „Jack vertical down“ as well as also actuate push button „Jack rear left“, and/or Depress push button „Jack vertical down“ as well as also actuate push button „Jack front right“, and/or Depress push button „Jack vertical down“ as well as also actuate push button „Jack rear right“. **Check inclination** of the Steiger!

6.6.3 Boom movement

Remarks, instructions and pre-conditions of chapter „Operating the Steiger“ must be observed.

„Boom up“ or „Boom down“

Component	Movement / Indication	Execution
Boom (lifting arm)	lifting	Actuate push button „boom up“.

or

Boom (lifting arm)	lowering	Actuate push button „boom down“.

Boom „rotation left“ or „rotation right“

Component	Movement / Indication	Execution
Boom (Turret)	rotation left	Actuate push button „Rotation left“.

or

Boom (Turret)	rotation right	Actuate push button „Rotation right“.

„Telescope out“ or „Telescope in“

Component	Movement / Indication	Execution
Telescope	extension	Actuate push button „Telescope out“.

or

Telescope	retraction	Actuate push button „Telescope in“.

6.6.4 „Cage rotation left“ or „Cage rotation right“

Component	Movement / Indication	Execution
Working cage	rotation left	Actuate push button „Cage rotation left“.

or

Working cage	rotation right	Actuate push button „Cage rotation right“.

6.6.5 Adjustment of working cage inclination „Cage up/Cage down“

Component	Movement / Indication	Execution
Working cage	move upwards	Actuate push button „Cage up“.

or

Working cage	move downwards	Actuate push button „Cage down“.

Note

As soon as the working cage reaches an inclination of more than 10° to horizontal line, an emergency cut-off occurs.

6.6.6 Information- and Diagnosis-System (IDS)

By means of the push button „page up“, „page down“ the operative and informative messages are indicated on the display (plain text indication). If the push buttons „page up“ and „page down“ are pressed together, then the first display page will be shown on the display, no matter which page was shown before.

Pre-condition:

- Operation is switching-on.

The following functions can e.g. be carried out:

- change-over language,
- input of password,
- alteration of password,
- setting of clock.

When the functions above are carried out, control commands will not be executed.

6.6.6.1 Change-over language

The language of the plain text indication can be changed at the operating panel of the emergency control in the following way:

Plain text indication	Execution
	Scroll to the corresponding display page of the plain text indication by means of the push button „page up“.
Change-over language **Change=sp.funct**	On this page the plain text of another language can be activated by actuation of the push button “Special function”. With each depressing the push button “Special function” the plain text changes to the next possible language. The push button must be actuated as often as the desired language appears. If the plain text again appears in that language as at the beginning of the shift-over-procedure, then maybe the desired language is not available.

	Continue using the button „Display up“ or „Display down“.

Note

The language adjusted in this way will be kept as long, even after switching-off the machine, as it is again be switched back.

6.6.6.2 Password

The following programme sequences which can be called up over the operating panel are protected by a password:

- Alteration of password,
- Setting of the clock.

For getting the entitlement for carrying out above-mentioned action, the input of the password becomes necessary, i.e. you must press certain keys in a certain order. You can determine the password yourself and change it at any time. There’s also the possibility of carrying out the above-mentioned action without having given a password before. Over the function „Change Password?“ the access to above-mentioned actions can be released. This can be done in that way that no certain order of keys is depressed after the announcement to give the new password, but to close the input of the new password immediately by depressing the push button „Special function“. You also proceed in the same way after the demand „Input of password again“.

Note

We recommend using the possibility of password-protection and to determine a password. When the Ruthmann-Steiger is delivered ex works no password is given!

The password can consist of a sequence of keys of max. 5 depressed keys. The push button „Special function“ is excluded. 27^5 = 14,34 millions of combination possibilities can be taken. Therefore you must always remembered this.

Note

If the password is not known any longer, our after-sales-service can again be read it out.

6.6.6.2.1 Input of password

For the input of the password firstly the push button „page up“ must be depressed as often as on the display the message „Password required! Cont. = Special Funct.“ or „Password already typed in“ appears

Plain text indication	Execution
	Scroll to the corresponding display page of the plain text indication by means of the push button „page up“.
x Password required! Cont.=Special funct.	Depress push button „Special function“
Input of Password then Special funct.	Input of key sequence (max. 5 symbols) [1]
	Depress push button „Special function“

Password correct

following display page	Depress push button „page up“ as often, until the desired protected page is reached.

Password wrong

No permission! Cont.=Special funct.	Depress push button „Special function“ [2]
x Password required! Cont.=Special funct.	Depress push button „Special function“
Input of Password then Special funct.	Input of key sequence (max. 5 symbols) [1]

Note

1 During the input the function of the push buttons for Steiger movements is interrupted. Now the necessary push buttons must be depressed in the right sequence. The push button „Special function“ itself cannot be part of the password.

2 By depressing the push button „Special function“ the input can be repeated. You also can continue with operation of the Ruthmann-Steiger. The function of the keys/push buttons are no longer released.

Note

Authorization for access is given until the operation is switched-off. After repeated switching-on of the operation the authorization for access is eliminated.

6.6.6.2.2 Alteration of Password

For this the actually valid password must be fed at first upon corresponding demand.

Plain text indication	Execution
	Feed password
	Scroll to the corresponding display page of the plain text indication by means of the push button „page up“.
x Change Password? Yes = Special funct.	Depress push button „Special function“
Input of Password then Special funct.	Input of key sequence (max. 5 symbols)
	Depress push button „Special function“
Again input of password then Special f.	Feed same key sequence once again [1]
	Depress push button „Special function“

Passwords identically

Password changed	Alteration of password finished.

Passwords different

Passwords different	Password had not been changed.

Note

1 The second input should avoid another password than the intended one from being stored. Only now will the password be changed in the memory.

6.6.6.3 Setting of clock

The clock should be set correctly, since occurred faults are memorized with date and time.

Plain text indication	Execution
	Input of password
	Scroll to the corresponding display page of the plain text indication by means of the push button „page up“.
x Set clock? **Yes = Special funct.**	Depress push button „Special function“ [1]
DDMMYYHHMMW W:1=Mo,2=Tu,3=We.7=So	Input of numeric key sequence: [2] e.g.: 15050108352

after input of the last character the following automatically appears

Tuesday 15.05. 8:35 2001	

The panel is again released for Steiger-movements.

Note

1 During the input the function of the keys for Steiger-movements is interrupted.

2 The abbreviation DDMMYYHHMMW means:
DD 2-digit number for day
MM 2-digit number for month
YY 2-digit number for year
HH 2-digit number for hour
MM 2-digit number for minute
W 1-digit number for week day

1 = Monday
2 = Tuesday
3 = Wednesday
4 = Thursday
5 = Friday
6 = Saturday
7 = Sunday

6.6.7 Switching-over of the boom movements which should be carried out simultaneously

Plain text indication	Execution
	Input of password
	Scroll to the corresponding display page of the plain text indication by means of the push button „page up“.
3 movements at the same Change=sp.funct or **2 movements at the same Change=sp.funct**	Depress push button „Special function“. By means of push button „Special function” you shift-over from „3 movements at the same” to „2 movements at the same” and vice versa.

6.6.8 Changing of the jacking variant with „Minimum jacking“

The jacking-variant has no influence on the „working range for minimum jacking“. The working range is identical in both cases.

Plain text indication	Execution
	Input of password
	Scroll to the corresponding display page of the plain text indication by means of the push button „page up“.
2 jacks at minimal jacking chan=sp.func or **4 jacks at minimal jacking chan=sp.func**	Depress push button „Special function“. By means of push button „Special function” you shift-over from „2 stabilizing jacks with minimum jacking“ to „4 stabilizing jacks with minimum jacking“ and vice versa.

6.6.9 Deactivation or activation of the possibility of sensitive control

The switching on of the possibility of sensitive control from the control board in the working cage can be deactivated or activated by means of the software. For the control panel of the emergency control the sensitive control, however, is generally functioning in order to execute the movements in two different speeds.

Plain text indication	Execution
	Input of password
	Scroll to the corresponding display page of the plain text indication by means of the push button „page up“.
Sens.cont. from cage possible change=Sp.f or **Sens.cont. from cage no pos change=Sp.f**	Depress push button „Special function“. With the button „Special function“ the possibility of sensitive control for the control board in the working cage is now deactivated or activated.

6.7 Sensitive control

The fine adjustment control is possible from control stand „Cage control“ as well as from „Emergency Control“.
With the fine adjustment control switched on, all movements, except for the movement „Cage rotation“, run at a clearly reduced speed.

- Switching on of fine adjustment control:

  1. Depress push button „Special function“ shortly (do **NOT** keep depressed).
  2. Carry out Steiger movement.
     The warning lamp „LML Cut-off“ blinks during a movement of the Steiger.
     On the display of emergency control the message „Fine adjustment control“ appears.

- Switching off of fine adjustment control:

  Depress push button „Special function“ shortly (Do **NOT** keep depressed).

Note

Switching the fine adjustment control on and off is also possible during Steiger movements.
During movements of the boom with the „Move into position“ memory function, if the fine adjustment control has been switched on, it will be automatically switched off. The fine adjustment control will also be switched off when the Steiger is automatically moved into the basic position.
The switching on of the sensitive control from the control board in working cage can be activated or deactivated by means of the software after having entered the password of the user.

7 Emergency control system (Emergency Lowering)

Danger!

In case of a defective control and emergency lowering devices (emergency control, hand pump, solenoid valves, etc.) an emergency lowering is not possible without danger.
For rescue of the cage crew in case of defective control system and emergency lowering devices, operation must be stopped immediately and the fire brigade must be called!

Note

Apart from the following explanations especially the safety instructions of chapter 1.2 must be observed.

The emergency control system of the Ruthmann-Steiger must only be used for emergency lowering and for maintenance purposes!
Emergency lowering of the Steiger must only be carried out in case of emergency and in mutual agreement with the operating staff.

- **Failure of main drive power.**
  ↓ Emergency lowering in case of failure of the main drive power (vehicle engine, hydraulic pump, etc.) and function of the electrical / electronic system.
- **The operating staff in working cage are no longer in a position to carry out the operational Steiger-movements.**
  ↓ Emergency lowering with functioning main drive power and functioning electrical / electronic system.
- **Failure of electrical / electronic system (extreme case)**
  ↓ Emergency lowering in case of failure of electrical / electronic system.

Note

Always first check, whether an Emergency Cut-off push button is depressed and if so, probably for that reason control over the corresponding control stand is no longer possible (chapter 6.1).

7.1 Failure of main drive power

Emergency lowering by means of the superordinate emergency control system (chapter 4.3). In case of a failure of the main drive power the necessary pressure and volume flow of the hydraulic liquid is produced by actuating the hand pump. The electrical locking devices of the Steiger remain functioning. The Steiger-movements are controlled from the working cage.

- Keep ignition and control stand „Cage control“ switched-on.
- The vehicle engine **must be** switched off!
- Move boom into its basic position (chapter 6.5).
  Produce pressure and volume flow of hydraulic liquid with selected movement by actuating the hand pump.
- Retract jacks (chapter 6.5).
  Produce pressure and volume flow of hydraulic liquid with selected movement by actuating the hand pump.

7.2 Failure of operating staff

The operating staff in the working cage is no longer in a position to carry out the operational Steiger-movements. Emergency lowering by means of emergency control. The Steiger-movements are selected by means of the emergency control from switch box at Steiger-substructure.

- Keep ignition switched-on.
- Select control stand „Emergency Control“.
  Open switch box (emergency control) at Steiger-substructure by means of a key.
- Move boom into basic position (chapter 6.6).
- Retract jacks (chapter 6.6).
- Switch off control stand „Emergency control“.
  Lock switch box (emergency control).
- Main switch onto position „OFF“.

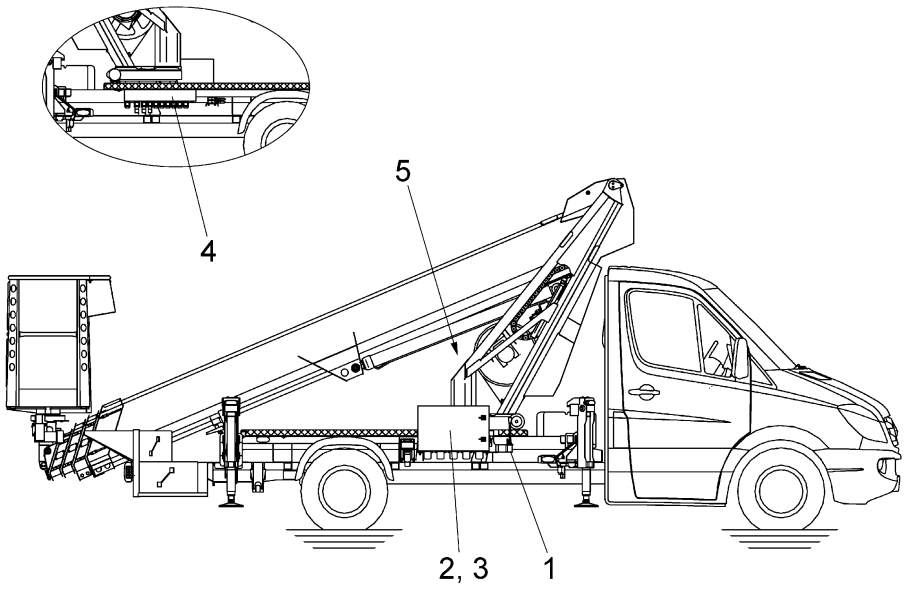
7.3 Failure of electrical system / electronic system (extreme case)

Danger!

A danger of tilting is existent due to boom movements, which increase the load moment! In case of failure of the electrical / electronic system these locking devices are out of function! Therefore always the telescope must be retracted completely as first step. When carrying out emergency lowering you have to take special care!
If the working cage cannot be moved safely into a position, in which a safe leaving of the working cage is possible, the fire brigade must be called for the rescue of the cage crew.

Attention!

The boom and boom rest will be damaged by the movement „Extend telescope“ if the boom is in the boom rest and locked by the bolt. The telescope must not ever be extended while in this boom position. First raise the boom, and then extend the telescope.



1. Hand pump.
4. Way valves for extension and retrac-

2. Ball cock (in switch box).
3. Solenoid arresting device (in switch box).

tion of stabilising jacks and for rotation of boom (under cover, on the left-hand side).
5. Way valves for control of boom and of working cage (behind cover).

Emergency lowering by means of emergency control system in extreme cases (chapter 4.3). All movements of the Ruthmann-Steiger can be carried out by manual operation of the valves.

- Switch off ignition.
- Main switch onto position „OFF“.
- Open switch box (emergency control) at Steiger-substructure by means of a key.
- Release butterfly nuts of covers of the way valves and remove or fold the covers downwards respectively.
- Remove solenoid arresting device out of the support in switch box at Steiger-substructure.
- Bring lever of ball cock (switch box) into horizontal position.
- Move boom into its basic position (chapter 6.5).

Danger!

For reason of stability it is absolutely necessary to retract the telescope completely first before lowering the boom. Especially when the unit is jacked unilaterally or within the vehicle's profile only pay attention that the boom is not lowered on that side where the jacks are only driven out within the vehicle's profile. Danger of tilting. In that case its is imperative that the boom is rotated to its centre (middle) position before it is lowered.

Attention!

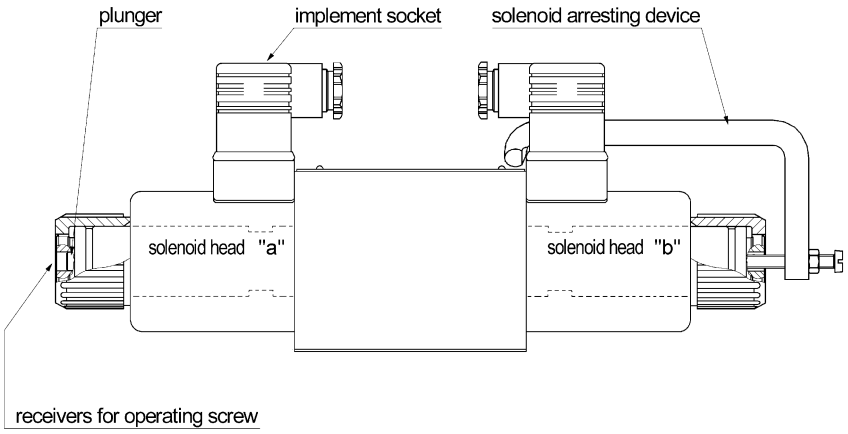
In order to avoid a breaking of cables and hoses, always move the boom back into that direction, from which the position had been driven to.

Note

– Retract telescope completely as first step.

- Rotate boom back into its centre position.
- Lower the boom.

- Put the solenoid arresting device onto the solenoid head of way valve of the desired position.



* Insert operating screw into the operating receiver designated for that at the solenoid head.
* Fix clamp behind the implement socket.
  The operating screw must be adjusted in such a way that the necessary operating way of the ram in the solenoid head is carried out. In the tappet there must not be any noticeable clearance of motion. The actuated screw as well as the counter nut must be tightened firmly.

- Produce the pressure and volume flow of the hydraulic liquid by means of the hand pump.
- The speed can be regulated over the frequency of the pumping movements.
- Stop pumping movements when the desired position is reached.
- Remove solenoid arresting device **immediately** again from the solenoid head of the way valve.

- Retract stabilizing jacks always as last movement(chapter 6.5).
  - Manual operation is effected as described under item „Move boom into basic position“.
- Bring ball cock lever back into vertical position.
- Put solenoid arresting device back into its support.
- Close covers of way valves, tighten butterfly nuts.
- Lock switch box at Steiger-substructure.

7.4 Emergency lowering after an interruption of the Steiger movements through a „conditional emergency cut-off“

The movements of the Steiger have been interrupted through a conditional emergency cut-off (safety cut-out). Conditional emergency cut-off can be triggered off through:

- inclination of the working cage by more than 10° to the horizontal line (mercury ring switch),
- considerable exceeding of the max. perm. load moment,
- considerable exceeding of the max. perm. cage carrying capacity (if cage overload detecting device is existing),
- defective sensory elements, e.g.:
  - Angle sensor „boom“,
  - pressure sensor,
  - etc..

Now, in order to move the Steiger in its basic position (emergency lowering) by means of the control panel in the working cage, it is possible to bridge the safety cut-out if no emergency cut-off switches are actuated.

Danger!

A danger of tilting is existent due to boom movements, which increase the load moment! Therefore always the telescope must be retracted completely as first step. When carrying out emergency lowering you have to take special care!
If the working cage cannot be moved safely into a position, in which a safe leaving of the working cage is possible, the fire brigade must be called for the rescue of the cage crew.

Certain Steiger movements, released through the computer control, can be carried out by the operating staff from the control stand in the working cage and when actuating simultaneously the push button „bridge safety cut-out“. The Steiger movements will be effected at a reduced speed.

Note

- First retract all the telescopes completely.
- Rotate boom back into its centre position. If necessary please lift the boom before carrying out the rotation.
- Afterward lower the boom.

Should the safety cut-out be annulled through the execution of above-mentioned movements, it is possible to take the Steiger into normal operation after having found out for which reason a safety cut-out took place. If it is not possible to find out the reason or if faults are discovered, the operation must be stopped immediately. After having eliminated these faults, the Steiger can be taken into operation once again.

7.5 Manual adjustment of cage inclination

Danger!

Persons and things can fall out! If persons are in the working cage you have to take special care. The working cage may only be positioned horizontally! The angle of inclination must only be modified by hand pump operation.

- Switch main switch onto position „OFF“.
- Open switch box (emergency control) at Steiger-substructure by means of a key.
- The vehicle engine **must** be switched off!
- Release knurled screws of the cover at turret and remove the cover.
- Take solenoid arresting device out of support in switch box at Steiger-substructure.
- Bring ball cock lever (switch box) into horizontal position.
- Bring working cage into horizontal position.
  - Put solenoid arresting device according to chapter 7.3 onto solenoid head of way valve „Levelling up“.
  - Produce the pressure and volume flow of the hydraulic liquid by means of the hand pump, until the working cage is in horizontal position.
  - The speed can be regulated over the frequency of the pumping movements.
  - Stop pumping movements when the horizontal position of the cage is reached.
  - Remove solenoid arresting device **immediately** from the solenoid head of the way valve.
- Bring ball cock lever back into its vertical position.
- Put solenoid arresting device back into its support.
- Close cover of way valves, tighten knurled screws.
- Close switch box at Steiger-substructure.

8 Rectification of malfunctions

Danger!

As long as malfunctions are existent, operation must be stopped and kept stopped. Operation may only again be started after proper rectification of the malfunction.

Note

If the malfunctions/faults cannot be rectified according to the indications made here or if they are still existent, the Ruthmann-after-sales-service must be notified.

8.1 Handling problems on the control during Steiger-operation

No Steiger-movement is possible.	
Possible cause	Remedy
– Hydraulic pump drive off.	– Switch on hydraulic pump drive (power take-off).
– Revolution of power take - off is too low	– Please pay attention to the sequence when starting the hydraulic pump drive (power take-off). Eventually you have to start the hydraulic pump drive once again new. – Increase the revolution. Notify Ruthmann-after sales service if the revolution is fixed and programmed.
– Operation off.	– Start operation.
– Door of „emergency-control“ is opened.	– Close the door of „emergency control“ switch box to control the movements from the working cage.
– Emergency Cut-off push button is actuated.	– Rectify fault and release Emergency Cut-off push button.
– Fuse defective.	– Check fuses for proper function. Replace defective fuses.
– Inclination of working cage exceeding 10°	– Reduce inclination of working cage.

Lifting of boom not possible / is interrupted.	
Possible cause	Remedy
– Jacks of Steiger not properly extended.	– Extend jacks properly.

Lowering of boom not possible / is interrupted.	
Possible cause	Remedy
– LML-cut-off	– Reduce load moment by e. g. ∗ retraction of telescope, ∗ reduction of working cage load.
– Working cage rotated too far to the left or right.	– Rotate working cage back toward the centre position.
– Chain for power track is slack. The cable /hose drum does not roll up the chain for power track.	– Carry out for a short time a movement so that the chain for the power track will be tightened and be rolled off from the cable / hose drum, e.g. ∗ move boom upwards, ∗ extension of telescope. **Attention**: Carry out the movement with precaution while observing the cable / hose drum. If the chain can afterwards be rolled up or off resp. without problems, however the cause must be found out. If necessary, an existent default must be eliminated.

Delayed cage levelling.	
Possible cause	Remedy
– Operating temperature of hydraulic oil in hydrostate still not reached (cold hydraulic oil e.g. in winter time).	– Increase oil temperature. Change the inclination of the unmanned working cage several times by means of the movements „Cage up“ and „Cage down“ using the emergency control system. – Reduce speed, move joystick not so far.

Boom rotation not possible / is interrupted.	
Possible cause	Remedy
– Jacks of Steiger not properly extended	– Extend jacks properly.
– Boom in boom rest.	– Lifting of boom.
– Max. angle of rotation in corresponding working range reached.	– No increase of swivelling angle possible with the boom constellation remaining the same. – Rotate back.
– Load moment too high.	– Reduce load moment by e.g. ∗ retraction of telescope, ∗ lifting of boom, ∗ reduction of working cage load.
– Boom lowered completely and telescope not retracted.	– Retract telescope. – Lifting of boom.

Telescope extension not possible / is interrupted.	
Possible cause	Remedy
– Boom in boom rest.	– Lifting of boom.
– LML-cut-off.	– Reduce load moment by e.g. reduction of working cage load. – Rotate the boom in the direction that allows a greater load moment. – Lifting of boom.
– The telescopic extension limitation has responded.	– Rotate the boom in the direction that allows a greater load moment. – Lifting of boom.

Telescope retraction not possible / is interrupted.	
Possible cause	Remedy
– Chain for power track is slack. The cable /hose drum does not roll up the chain for power track.	– Carry out for a short time a movement so that the chain for the power track will be tightened and be rolled off from the cable / hose drum, e.g. ∗ extension of telescope. **Attention**: Carry out the movement with precaution while observing the cable / hose drum. If the chain can afterwards be rolled up or off resp. without problems, however the cause must be found out. If necessary, an existent default must be eliminated.

Cage rotation not possible / is interrupted.	
Possible cause	Remedy
– Boom rotated too far.	– Lifting of boom.

Extension of jacks not possible.	
Possible cause	Remedy
– Door to driver's cab open.	– Close door to driver's cab.
– Telescope not retracted.	– Retract telescope.
– Boom (turret) not in centre position.	– Rotate boom (turret) into centre position.
– Boom not completely lowered into boom rest.	– Lower boom into boom rest.

Retraction of jacks not possible.	
Possible cause	Remedy
– Door to driver's cab open.	– Close door to driver's cab.
– Telescope not retracted.	– Retract telescope.
– Boom (turret) not in centre position.	– Rotate boom (turret) into centre position.
– Boom not completely lowered into boom rest.	– Lower boom into boom rest.

8.2 Effect of a malfunction on Steiger-operation

If the computer control ascertains a fault in the sensory system or control, normally only a limited operation of the Ruthmann-Steiger is possible to reach the basic position. Afterwards operation must be stopped. If considerable faults occur the control switches onto Emergency Cut-off. The blinking warning lamp „LML-cut-off“ shows the operating staff in the working cage that a fault is existent. At the same time a corresponding plain text indication concerning possible causes of the fault and the corresponding fault-number is indicated on the display. The display changes automatically over to the page of the fault message, independent of which page had been selected before.

8.2.1 Restricted Steiger-operation

Recognizable in the working cage at the blinking pilot lamp „Bridge safety cut-out“. Depending on the kind of malfunction restricted Steiger-movements are still possible. Even also if no restriction of the movements is noticed, operation must be stopped and the Steiger must be brought into its basic position.

8.2.2 Conditional Emergency Cut-off

„Conditional Emergency Cut-off“ can be triggered off through:

- emergency cut-off push button,
- inclination of the working cage by more than 10° to the horizontal line (mercury ring switch),
- considerable exceeding of the max. perm. load moment.

In the working cage discernible at the blinking red warning light „LML-Cut-off“. Steiger-operation is interrupted.
A conditional Emergency Cut-off, which was caused by a considerable exceeding of the load moment, may possibly be removed by reduction of working cage load or by retraction of the telescope. If the malfunction had been caused by a too large working cage inclination, the working cage must be positioned horizontally.

8.2.3 Emergency Cut-off

Emergency Cut-off can be triggered off by:

- defective sensory system,
- defective control system.

In the working cage discernible at blinking of the pilot lamp „Bridge safety cut-out“ and the red warning lamp „LML-cut-off“. No Steiger-operation is possible. If the sensory or control system is defective an emergency lowering according to chapter 7.3 must be carried out.

8.3 Reading of fault memory

Note

If with blinking pilot lamp „Bridge safety cut-out“ no restriction of the driving operation is determined, you should, however, read out the fault memory and notify the Ruthmann-after-sales-service if necessary.

The faults are stored with date and time of their occurrence. The fault memory can be read out at any time, not only by the after-sales-service, but also from the operator.

Plain text indication	Execution
	Depress push button „page up“
	as often as the corresponding display page appears
x Read out fault memory? Yes = Special Funct.	Depress push button „Special function“
Number of fault messages stored.	Depress push button „Special function“
Latest fault message stored.	Depress push button „Special function“
Fault message before the last.	Depress push button „Special function“ etc.
	Leaving the programme
fault message stored	Depress push button „page up“
following display pages	
	or
fault messages stored	Depress push button „Display down“
previous display pages	

The display firstly shows the number of fault messages stored. With each further depressing the push button „Special function“ the fault messages stored appears in the reverse sequence as they appeared. So the last fault message appears at first and the oldest message last. The contents of the

fault memory can **only** be deleted by the Ruthmann-after-sales-service.

8.3.1 Meaning of the fault messages and information about remedy

The following listing should help to analyse malfunctions of the Ruthmann-Steiger. The codes, possible causes and remedy possibilities mentioned below should facilitate the search for the source of the faults. Work may only be carried out by adequately trained expert personnel.

Code	Possible cause	Remedy
1 - 5	– Vehicle voltage too low. – Fuse F11 on printed circuit board for fuses defective. – Safety relay at control system defective.	– Check vehicle battery – Check fuse F 11. – Notify RUTHMANN-after-sales-service.
7	– Programme switch in main or control processor system adjusted wrongly. – Fuse defective.	– These switches are sealed and may only be re-adjusted by the RUTHMANN-after-sales-service! – Check fuse.
8	– Vehicle voltage too low. – Program switch of the control incorrect adjusted. Does not correspond to model codification.	– Check vehicle battery. – Notify RUTHMANN-after-sales-service.
13	– Programme switch adjusted wrongly.	– These switches are sealed and may only be re-adjusted by the RUTHMANN-after-sales-service!
14	– Supply voltage of control system wrong. – Control system defective.	– Check supply voltage. – Notify RUTHMANN-after-sales-service.
15	– Supply voltage of control system wrong. – Control system defective.	– Check supply voltage. – Notify RUTHMANN-after-sales-service.
16	– LML switch in main or control processor system adjusted wrongly.	– These switches are sealed and may only be re-adjusted by the RUTHMANN-after-sales-service!

Code	Possible cause	Remedy
17	– Limit switches of jacks or approach switches adjusted too sensitively. – Contacts of the limit switches of jacks humid or corrosive. – Control system defective.	– Notify RUTHMANN-after-sales-service.
18	– Inclination of working cage above 10° or below -10°. – Mercury ring switch supplies 0 Volt.	– Reduce inclination of working cage. – Notify RUTHMANN-after-sales-service.
24	– Supply voltage of control system wrong. – Control system defective. – Error in the dual-port-RAM	– Check supply voltage. – Notify RUTHMANN-after-sales-service.
25	– Signal inclination meter „Boom“ wrong.	– Notify RUTHMANN-after-sales-service.
26	– Signal inclination meter „Boom“ wrong.	– Notify RUTHMANN-after-sales-service.
27	– Signal inclination meter „Boom“ between main and control processor are different.	– Notify RUTHMANN-after-sales-service.
28	– Signal inclination meter „Boom in basic position“ wrong.	– Notify RUTHMANN-after-sales-service.
40	– Signal cable length transducer wrong.	– Notify RUTHMANN-after-sales-service.
41	– Signal of cable length transducer between main and control processor are different.	– Notify RUTHMANN-after-sales-service.
45	– Meter reading of rotation angle detection of main and control processor are different.	– Notify RUTHMANN-after-sales-service.
46	– Meter reading of rotation angle detection in case of Signal „Boom rest“ wrong.	– Notify RUTHMANN-after-sales-service.
48	– Registration of swivelling angle by counter and potentiometer at rotating device wrong.	– Notify RUTHMANN-after-sales-service.
50	– Signal pressure sensor piston side wrong.	– Notify RUTHMANN-after-sales-service.
51	– Signal pressure sensor piston side wrong	– Notify RUTHMANN-after-sales-service.

Code	Possible cause	Remedy
52	– Signal pressure sensor piston side of main and control processor are different.	– Notify RUTHMANN-after-sales-service.
53	– Signal pressure sensor ring side wrong.	– Notify RUTHMANN-after-sales-service.
54	– Signal pressure sensor ring side wrong.	– Notify RUTHMANN-after-sales-service.
55	– Signal pressure sensor ring side of main and control processor are different.	– Notify RUTHMANN-after-sales-service.
57	– Max. perm. differential pressure of main and control processor wrong.	– Notify RUTHMANN-after-sales-service.
58	– Actual differential pressures of main and control processor different. – Signals of pressure sensors piston and ring side of main and control processor different.	– Notify RUTHMANN-after-sales-service.
59	– Operational perm. load moment considerably exceeded – Cage overloaded. – Pressure sensor piston or ring side defective.	– Reduce load moment, extend telescope less far. – Unload working cage. – Notify RUTHMANN-after-sales-service.
62	– Signal of cable length transducer in basic position wrong.	– Notify RUTHMANN-after-sales-service.
63	– Signal of joystick „Boom“ at main and control processor different.	– Notify RUTHMANN-after-sales-service.
64	– Signal of joystick „Telescope“ at main and control processor different.	– Notify RUTHMANN-after-sales-service.
66	– Signal of joystick „Rotation“ at main and control processor different.	– Notify RUTHMANN-after-sales-service.
71	– Limit switches „chain break / rope break“ supply 0 Volt.	– Notify RUTHMANN-after-sales-service.
72	– Limit switch „Telescope in“ defective.	– Notify RUTHMANN-after-sales-service.

Code	Possible cause	Remedy
74	– Limit switch „Jack front left extended“ defective. – Limit switch or approach switch „Jack front left retracted“ defective. – Limit switch „Jack front left ground contact“ defective.	– Notify RUTHMANN-after-sales-service.
75	– Limit switch „Jack rear left extended“ defective. – Limit switch or approach switch „Jack rear left retracted“ defective. – Limit switch „Jack rear left ground contact“ defective.	– Notify RUTHMANN-after-sales-service.
76	– Limit switch „Jack front right extended“ defective. – Limit switch or approach switch „Jack front right retracted“ defective. – Limit switch „Jack front right ground contact“ defective.	– Notify RUTHMANN-after-sales-service.
77	– Limit switch „Jacks rear right extended“ defective. – Limit switch or approach switch „Jack rear right retracted“ defective. – Limit switch „Jack rear right ground contact“ defective.	– Notify RUTHMANN-after-sales-service.
78	– Approach switch „Boom rest“ or approach switch „Boom lifted“ defective.	– Notify RUTHMANN-after-sales-service.
79	– Signal angle sensor „Boom in basic position“ (= turret in centre position) wrong.	– Notify RUTHMANN-after-sales-service.
80	– Signal angle sensor „Ball bearing slewing gear“ wrong.	– Notify RUTHMANN-after-sales-service.
81	– Signal angle sensor „Ball bearing slewing gear“ wrong.	– Notify RUTHMANN-after-sales-service.
82	– Signals angle sensor „Ball bearing slewing gear“ of main and control processor different.	– Notify RUTHMANN-after-sales-service.

Code	Possible cause	Remedy
84	– Signal inclination meter „Vehicle longitudinal axis“ between main and control processor are different.	– Notify RUTHMANN-after-sales-service.
86	– Signal inclination meter „Vehicle transverse axis“ between main and control processor are different.	– Notify RUTHMANN-after-sales-service.
93	– Switch „Jack retracted“ defective. – Switch „Wheels free“ (axle inquiry) defective.	– Notify RUTHMANN-after-sales-service.
94	– Voltage of joystick „Boom“ wrong.	– Notify RUTHMANN-after-sales-service.
95	– Voltage of joystick „Rotation“ wrong.	– Notify RUTHMANN-after-sales-service.
96	– Voltage of joystick „Telescope“ wrong.	– Notify RUTHMANN-after-sales-service.
99	– Program-cycles too long.	– Notify RUTHMANN-after-sales-service.
100 to 121	– Exits defective. – Fuse F 15 defective.	– Notify RUTHMANN-after-sales-service. – Check fuse.
122 to 131	– Exits defective. – Fuse F 14 defective.	– Notify RUTHMANN-after-sales-service. – Check fuse.
132 to 147	– Exits defective. – Fuse F 13 defective.	– Notify RUTHMANN-after-sales-service. – Check fuse.
148 to 201	– Digital entries defective.	– Notify RUTHMANN-after-sales-service.
226	– The working cage is outside of the permissible sector.	– The boom must manually be moved back into the permissible sector by means of the solenoid valves.
228	– Consumer load defective.	– Check fuse of the consumer load. – Notify RUTHMANN-after-sales-service.
233	– Total inclination of vehicle between main and control processor are different.	– Notify RUTHMANN-after-sales-service.

Code	Possible cause	Remedy
254	– Signal of swivelling angle „cage“ wrong.	– Notify RUTHMANN-after-sales-service.

9 Maintenance

Note

Apart from the following explanations especially the safety instructions in chapter 1.2 must be observed.

The Ruthmann-Steiger was designed and constructed according to the basic safety and health requirements. It is up to you to maintain the readiness for use and the safety of the Ruthmann-Steiger. In order to keep the Ruthmann-Steiger in good condition and therefore to warrant a safe and effective operation, the Ruthmann-Steiger must be serviced and maintained regularly.

Note

As operator you have to ensure that the Ruthmann-Steiger still does full fill the requirements in condition according to the operational safety regulations and/or similar, specific local regulations.

We explicitly point out that all prescribed checks (as e.g. the yearly expert inspections acc. to BGG 945), inspections, maintenance and repair work must be carried out conscientiously. Otherwise we refuse any liability and warranty claims. For execution of such work a special knowledge is necessary, which cannot be conveyed in connection with these operating instructions.
Only original Ruthmann-spare parts or other spare parts approved by us should be used for maintenance. If other parts are used our liability and warranty will extinguish.

Note

The „daily“ inspection work may only be carried out by the operating personnel. In addition to this inspection, maintenance and repair work must only be carried out by persons which are trained on that and which have the explicit order.
„Persons trained on that“ are persons, which are due to their training/education, experience and instructions as well as due to their knowledge of the corresponding standards, regulations, accident preventions acts and function of the

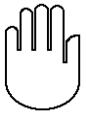
Ruthmann-Steiger entitled to carry out the work and which are also able to recognize and to avoid possible dangers.
For maintenance, especially for expert inspections and for carrying out repair work we recommend contacting our **RUTHMANN-after-sales-service** or other personnel authorized by us.

Indications concerning maintenance work at chassis are to be taken from the operating instructions of the chassis manufacturer.

Danger!

- ***Before starting maintenance work the Ruthmann-Steiger must be taken out of operation and must be protected against inadvertent and unauthorized instances of it being put into operation.***
- ***Attention when handling with hot operating and auxiliary material (Danger of burning and scalding). Parts of the hydraulic system are also under pressure even with the machine taken out of operation. Each contact with the skin as well as breathing in of steams of the hydraulic liquids should be avoided. Wear protection gloves and protection glasses. Greases, hydraulic- and gear oil etc. are detrimental to health. During handling with greases and oils the corresponding safety data sheets for each product must be observed.***
- ***When working at the electrical system all lines must be switched voltage-free (e.g. ignition off, disconnect battery). The voltage-free condition must be checked and be secured against unintended switching-on (e.g. pull out ignition key).***
- ***Defective or damaged machines, constructional components or constructional groups must immediately be replaced or repaired through the Ruthmann-after-sales-service or through personnel authorized by us.***
- ***After finishing the maintenance work a function test of the machine, of the emergency cut-off push button and of the safety devices must be carried out.. All***

safety devices must be re-installed properly.



Attention!

It must always be avoided that dirt or other pollutions can get into the hydraulic system. Cleanness is of paramount importance during maintenance of the hydraulic system.
When working especially at the hydraulic system only use fibre-free cloths.

When handling with oil you have to take care that no oil can get into the earth or into the sewerage system.
Used oil, used grease and oily or greasy cloths respectively must be disposed in a way which is not harmful to the environment. Biological oils and mineral oils must be disposed separately. For reasons of disposal and the necessary expert knowledge, we recommend letting the maintenance and repair work carried out by the Ruthmann-after-sales-service or by personnel authorized by us.

Note

If regulations and safety data are not observed and result in damage any warranty claim expires.
Apart from the below explanations especially the safety instructions of chapter 1.2 must be observed.

For certain maintenance work (e.g. function test) operation of the Ruthmann-Steiger becomes necessary. In these cases special care should be taken. After finishing this work the Ruthmann-Steiger must again be taken out of operation and secured accordingly for further maintenance work.

Sealed constructional components must only be opened by Ruthmann-after-sales-service. Inspection, maintenance and repair work at these constructional components may only be carried out by the Ruthmann-after-sales-service or by personnel authorized by us.

9.1 Lubrication

9.1.1 Lubricants

Lubricants quality: Grease							
Part-No. [1]	Designation	Marking	Consis-tence - class	Range of service temperature [°C]	Basic oil viscosity [mm²/s] at 40° C	Worked penetra - tion [0,1 mm]	Soap ba-sis
911.158	ARAL Aralub HL 2	K2K-30	2	-30 to +120	ca. 90	265 - 295	Li
911.161	ARAL Long time grease H	KP2K-30	2	-30 to +130	ca. 100	265 / 295	Li

Lubricants quality: mineral oils						
Part-No. [1]	Designation	Marking	Viscosity Class	Viscosity [mm²/s] at 40° C	at 100° C	Density [kg/m³] at 20°C
911.412	KLÜBER Lubrication Structovis BHD	-	-	4800	210	910

Lubricants quality: Hydraulic oils						
Part-No. [1]	Designation	Marking	Viscosity Class	Viscosity [mm²/s] at 40° C	at 100° C	Density [kg/m³] at 15°C
911.142	ARAL Vitam GF 22	HLP	ISO VG 22	22	4,5	865
911.137	PANOLIN HLP SYNTH 22	VDMA Bl. 24568 HEES	ISO VG 22	21,8	4,7	920

[1] Ruthmann- Part-No.

9.1.2 Lubricating point list

Note

Before greasing the grease nipples must be cleaned. Remarks concerning execution of inspection and maintenance work please see chapter 9.4.5.

Lubricating point list			
Ser. No.:	**Component / Lubricating point**	**Lubricant used in our work** (Part-No. [1])	**Qty.**
1	Jacking / guidance jack cylinder	911.161	
	Jacking / gliding surfaces of jack arm	911.161	
	Jacking / ground contact inquiry	911.161	
	Jacking / hinged foot (joint of jack plate)	911.161	
2	Boom / gliding surfaces of telescope	911.161	
	Boom / extension ropes	790.100	
	Boom / retraction chains	911.412	
3	Boom rest / locking bolt	911.161	
4	Rotating device / ball bearing slewing gear	911.161	
	Rotating device / worm gear	911.161	
5	Hydraulic oil in system (standard)	911.142	85 ltr.
	Hydraulic oil in system (optional extra)	911.137	85 ltr.

[1] Ruthmann-Part-No.

If other lubricants are used an evaluation concerning the aggressivity of the greases and oil compared with the constructional components used by us must be carried out. If lubricants are mixed with each other the acceptability of the lubricants

- under each other,
- to light metal and non-ferrous heavy metals,
- to plastics,
- to anticorrosive and preservatives

must be checked.

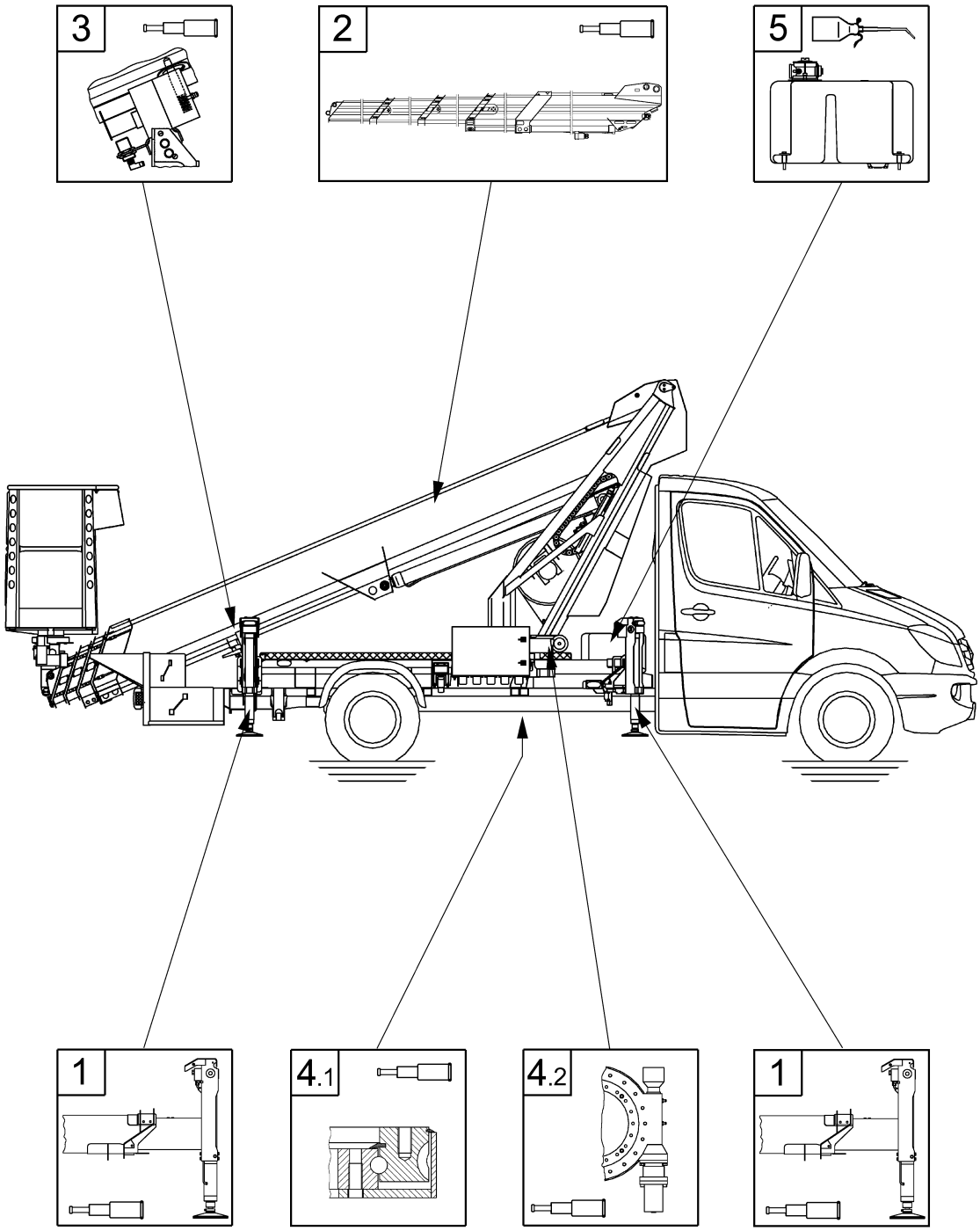
Note

We recommend using if possible that lubricant which had

been used for the initial start-up also for the next lubrications of the construction parts. Before you change the lubricant we recommend discussing that with the Ruthmann-after-sales-service.

Hydraulic oils which are not harmful to the environment must not be mixed with each other. The mixing can modify the applicability and the biodegradability. Dispose hydraulic oils which are not harmful to the environment separately. Hydraulic systems with hydraulic oil which is not harmful to the environment must be marked accordingly.

9.1.3 Lubricating point plan



9.2 Tightening Moments

Note

The indicated tightening moments are only valid for those cases mentioned below; they are not valid in general.

9.2.1 Screw connections

Tightening moments depend on quality of screws, thread friction and on screw head supporting surface. The values mentioned in the table „M_A in Nm“ are valid for a coefficient of friction of μ_{tot} = 0,14. This corresponds to a slightly oiled screw.

All supporting surfaces must be even and free of paint, acid, dirt and rust. The screws must not be mounted with MoS_2-containing lubricants.

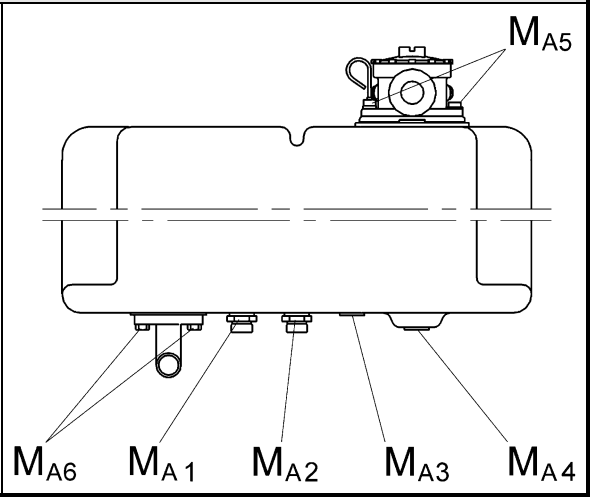
Tightening moments of the screw fittings (μ_{tot} = 0,14)

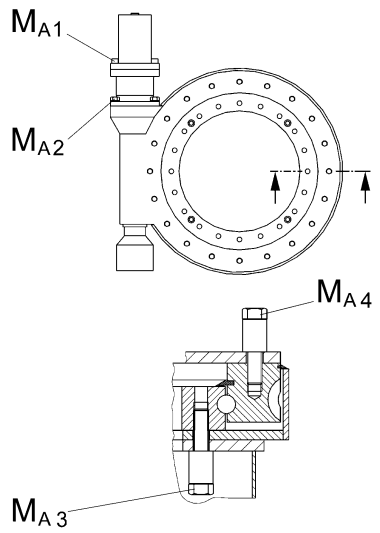
No.	Fitting	Screw		Tightening moment
		Dimensions	Quality	M_A (Nm)
1	**Chassis** (see operating instructions of chassis manufacturer)			
	Fixation of the base frame			
2.1	Base frame - chassis	M 10	10.9	64
	Plastic hydraulic oil tank			
3.1	Threaded plug „connection hand pump“	G 1/2 A	--	15 $^{\pm 2}$
3.2	Threaded plug „connection secondary drive“ (optional extra) or plug screw	G 1/2 A	--	15 $^{\pm 2}$
3.3	Screw plug	G 1/2 A	--	15 $^{\pm 2}$
3.4	Oil draining screw	G 1/2 A	--	15 $^{\pm 2}$
3.5	Return filter - hydraulic oil tank	M 8	8.8	15 $^{\pm 2}$
3.6	Connection flange suction line - hydraulic oil tank	M 8	8.8	15 $^{\pm 2}$

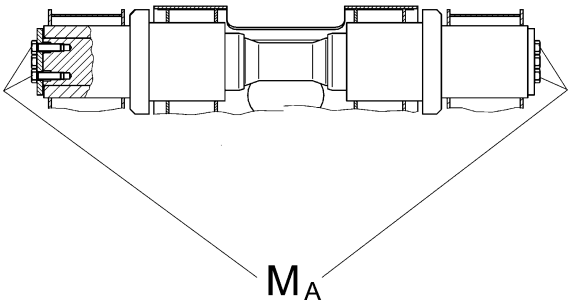
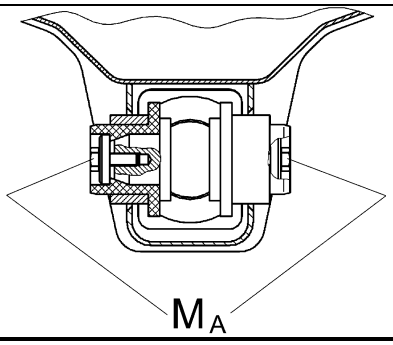
	Rotating device			
4.1	Hydraulic engine - stopping brake	M 12	10.9	117
4.2	Stopping brake - worm gear	M 12	10.9	117
4.3	Ball bearing slewing gear - base frame	M 16	10.9	240
4.4	Ball bearing slewing gear - turret plate	M 16	10.9	240
	Bearing points with plastic bushing and bolt lock			
5.1	Bearing point turret - boom	M 8	10.9	28
5.2	Bearing point boom - lifting cylinder	M 10	8.8	39
	Further bolt locks			
6.1	Bolt locks with disc and countersunk screw	M 5	5.8	3
		M 6	10.9	11
		M 8	10.9	25
		M 10	8.8	35
		M 16	10.9	210
6.2	Axle support	-	-	-
	Boom system			
7.1	Boom „V“ - console telescope cylinder	M 8	8.8	20
7.2	Boom „IV“ - axle rope roller	M 8	10.9	28
7.3	Boom „III“ - axle rope roller	M 6	10.9	11
7.4	Boom „II“ - axle rope roller	M 6	10.9	11
	Jacking			
8.1	Cylinder clip	M 8	8.8	20
8.2	Jack arm - extension cylinder	M 8	10.9	28 (Loctite)
8.3	Jack bock to the basic frame - extension cylinder	M 8	10.9	28 (Loctite)

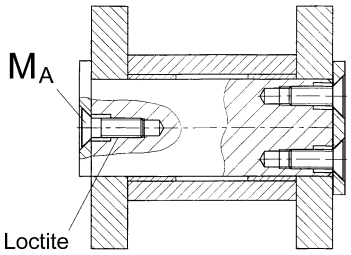
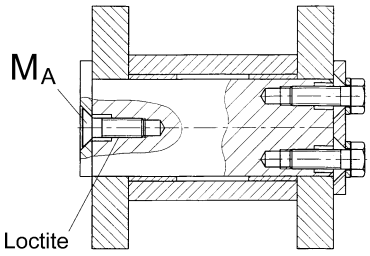
Prestressed screw fittings which are not mentioned above must be tightened at a tightening moment reduced up to 80% according to VDI-regulations VDI 2230.

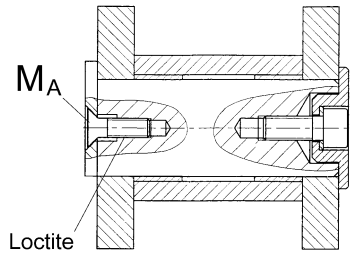
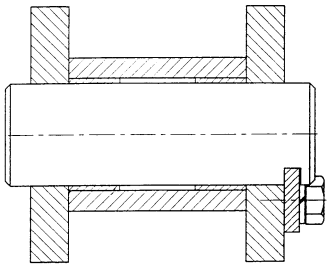
The screw connections mentioned above are shown in the sketches. The corresponding tightening moments can be taken from the above table.

Plastic hydraulic oil tank		
M_A 1	Threaded plug „connection hand pump“	
M_A 2	Threaded plug „connection secondary drive“ (optional extra) or plug screw	
M_A 3	Screw plug	
M_A 4	Oil draining screw	
M_A 5	Return filter - hydraulic oil tank	
M_A 6	Connection flange suction line - hydraulic oil tank	

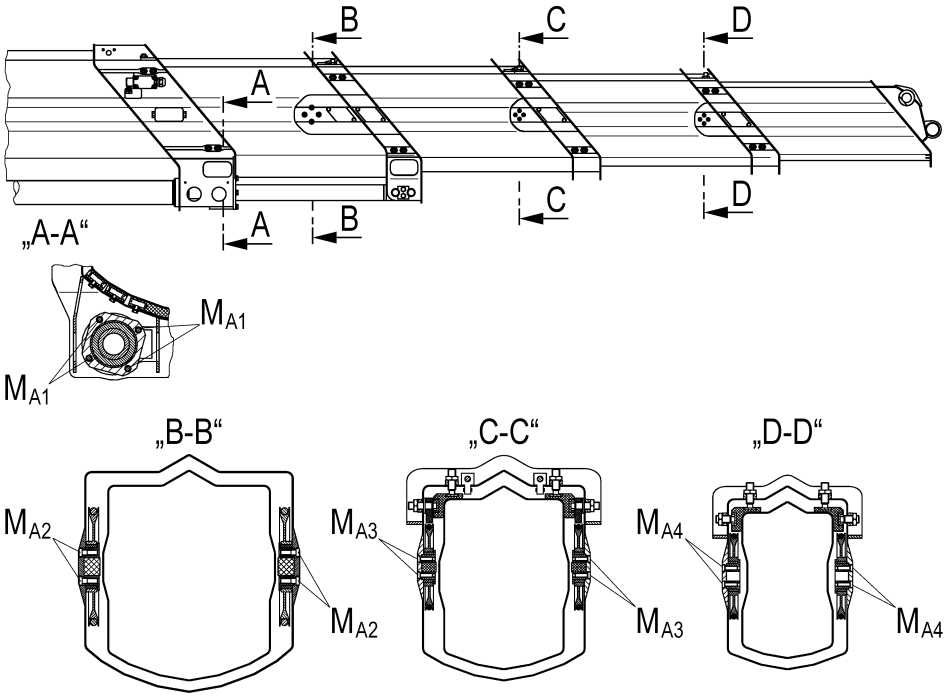
Rotating device		
M_A 1	Hydraulic engine - stopping brake	
M_A 2	Stopping brake - worm gear	
M_A 3	Ball bearing slewing gear - base frame	
M_A 4	Ball bearing slewing gear - turret plate	

Bearing points with plastic bushes and bolt locks		
	Bearing point turret - boom	
	Bearing point boom - lifting cylinder	

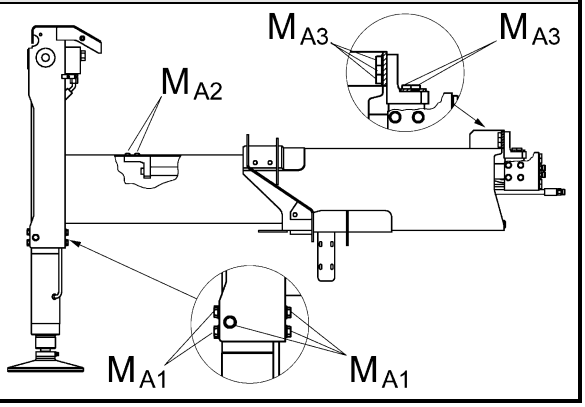
Further bolt locks		
	Bolt locks with disc and countersunk screw	
	Bolt locks with disc and countersunk screw	

	Bolt locks with disc and countersunk screw	
	Axle support	

Boom system



M_A 1	Boom „V“ - console telescope cylinder
M_A 2	Boom „IV“ - axle rope roller
M_A 3	Boom „III“ - axle rope roller
M_A 4	Boom „II“ - axle rope roller

Jacking		
M_A 1	Cylinder clip	
M_A 2	Jack arm - extension cylinder	
M_A 3	Jack bock to the basic frame - extension cylinder	

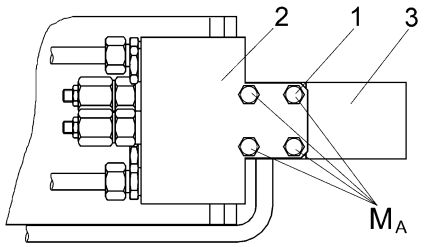
9.2.2 Connection pieces at hydraulic cylinders

Tightening moments Screw fittings Connecting pieces					
No.	Fitting „Connecting piece - cylinder“	Screw Designation	Screw Dimension	Screw Quality	Tightening moment M_A (Nm)
1.	Jack cylinder (vertical) (only with screw fitting)	Cheese-head screw	M 8 M 8	8.8 10.9	25 36
1.	Extension cylinder of jack arm (horizontal)	Hex. screw	M 8	8.8	20
1.	Hydrostat cylinder (master cylinder)	Hex. screw	M 8	8.8	20
1.	Lifting cylinder	Hex. screw	M 8	8.8	20
1.	Telescope cylinder	Hex. screw	M 8	8.8	20
1.	Hydrostat cylinder (slave cylinder)	Hex. screw	M 8	8.8	20

Example

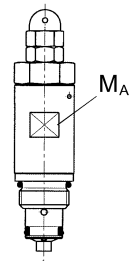
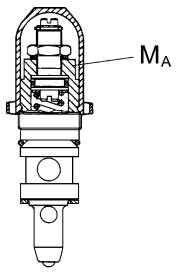
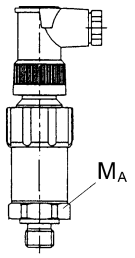
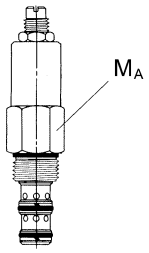
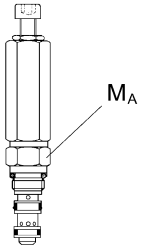
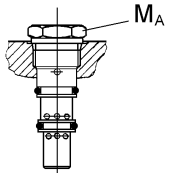
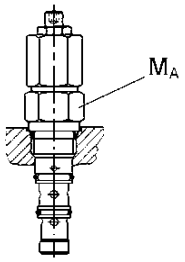
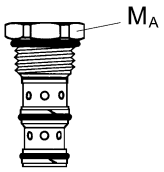
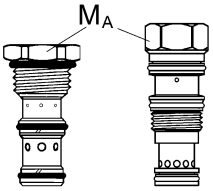
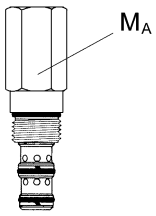
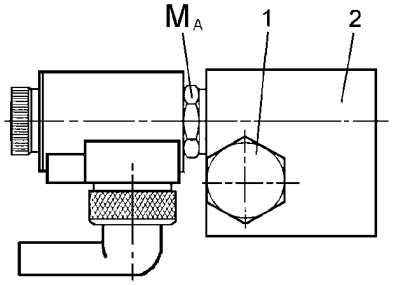
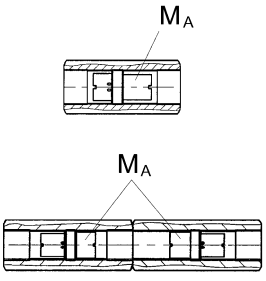
Connecting piece with hexagonal screw fitting

1. Hex. screw
2. Connecting piece
3. Hydraulic cylinder

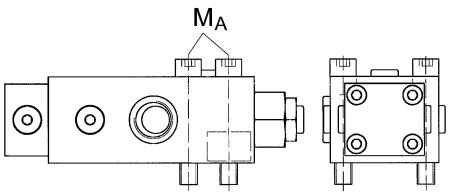
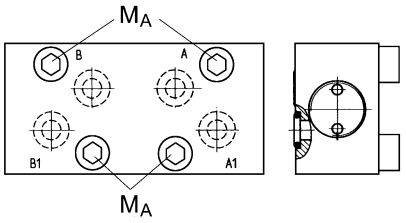
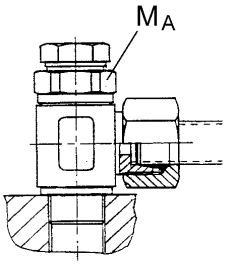
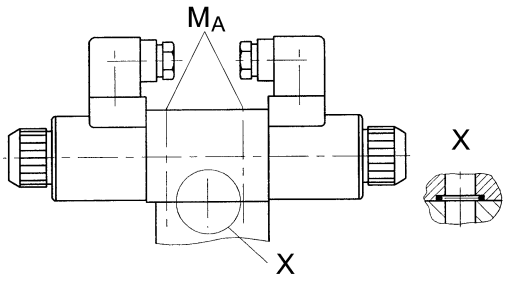


9.2.3 Valves

Tightening moments Screw-in valves				
No.	Valve	Part-No.	Dimensions	Tightening moment M_A (Nm)
1	Pressure relief valve	435.043 435.044	M 20 x 1,5 M 20 x 1,5	25^{+5} 25^{+5}
2	Pressure relief valve (DBV) for block installation	435.003 435.010	M 30 x 1,5 M 30 x 1,5	70^{+30} 70^{+30}
3	Pressure transformer	541.996 541.999	G 1/4 A G 1/4	$25^{\pm5}$ $25^{\pm5}$
4	Pressure reduction valve	435.035		40
5	Pressure regulation valve	435.022	G 1/2	20
6	Check valve	431.027 431.028 431.029 435.004 435.041	G 1/2 G 1 G 1/2 M 20x1,5 M 20x1,5	20^{+5} 20^{+5} 20^{+5} 45^{+5} 45^{+5}
7	Lock valve	433.006 433.010 433.020 435.040	G 1/2 G 1 M 20x1,5 M 20x1,5	20^{+5} 20^{+5} 45^{+5} 45^{+5}
8	Shuttle valve	432.016	7/8-14UNF-2B	40
9	Press. compensating regulator valve	435.033 435.036	M 20x1,5 7/8-14UNF-2A	45^{+5} 40
10	Internal pilot sequence valve	435.037 435.039	7/8-14UNF-2A 7/8-14UNF-2A	40 40
11	Check valve, to be disengaged electrically	430.197 430.198 430.199	M 20x1,5 M 20x1,5 M 20x1,5	25^{+5} 25^{+5} 25^{+5}
12	Oil flow regulating valve	435.005 435.047 435.048 435.049 435.050 435.051 435.052 435.053 435.054 435.055	G 1/4 G 1/4 G 1/4 G 1/4 G 3/8 G 1/4 G 3/8 G 3/8 G 1/2 G 1/4	3 - 6 3 - 6 3 - 6 3 - 6 5 - 8 3 - 6 5 - 8 5 - 8 8 - 12 3 - 6

Examples			
Pressure relief valve	Pressure relief valve for block installation	Pressure transform-er	Pressure reduction valve
			
Pressure regulation valve	Check valve	Lock valve	Shuttle valve
			
Press. compensat-ing regulator valve	Internal pilot se-quence valve		
			
Check valve (hollow screw. (1) connecting piece. (2))		Oil flow regulating valve	
			

Tightening moments of fitted valves					
No.	Valve		Part-No.	Dimensions	Tightening moment M_A (Nm)
1	Brake valve		433.126	M 12	100
			433.127	M 12	100
	Brake valve	Brake valve Check valve	433.077	M 8 M 10	40 81
		Brake valve Check valve	433.078	M 8 M 10	40 81
		Brake valve Check valve	433.081	M 8 M 10	40 81
2	Dual check valve		431.014	M 8	25
	Check valve		433.125	M 8	40
3	Check valve and pressure relief valve		435.019	M 18 x 1,5	65^{+5}
			435.023	M 18 x 1,5	65^{+5}
4	4/2 Way valve	NG 6	431.521	M 5	6^{+2}
		NG 6	432.072	M 5	6^{+2}
	4/3 Way valve	NG 6	432.055	M 5	6^{+2}
		NG 6	432.056	M 5	6^{+2}
		NG 6	432.057	M 5	6^{+2}
		NG10	432.078	M 6	11^{+3}
	Prop. way valve	NG 4	0.506.169.000	M 5	5
		NG 6	432.172	M 5	6^{+2}
	Proportional flow control valve	NG 6	432.175	M 5	6^{+2}
		NG 6	432.182	M 5	6^{+2}
		NG 6	432.185	M 5	6^{+2}
		NG 6	432.186	M 5	6^{+2}
		NG 6	432.188	M 5	6^{+2}
		NG10	-	M 6	11^{+3}
	Prop. pressure relief valve	NG 6	435.024	M 5	8,9

<table>
<tr><td colspan="3">Examples</td></tr>
<tr><td>Brake valve</td><td colspan="2">Dual check valve / Check valve</td></tr>
<tr><td> 
</td><td colspan="2"> 
</td></tr>
<tr><td>Check valve and Pressure relief valve</td><td colspan="2">Way valve / Prop. flow control valve / Prop.- Pressure relief valve (NG 6 / NG 10)</td></tr>
<tr><td> 
</td><td colspan="2"> 
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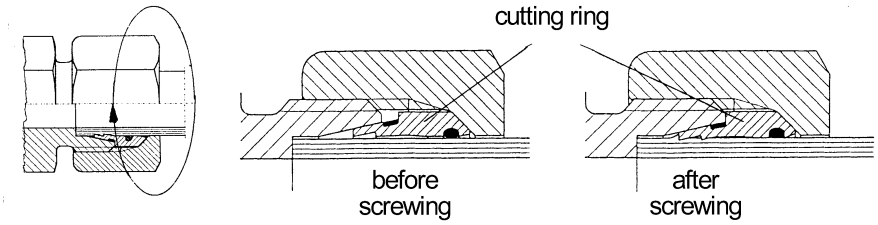
</table>

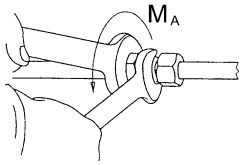
9.2.4 Cutting ring fittings

The tightening moments are valid for mounting of galvanized fittings with waxed union nut.

Example:



The cutting ring is mounted on block. Hold up the fitting piece by means of a screw wrench when tightening the union nut.

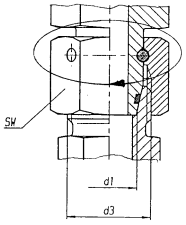


Tightening moments (M_A) for cutting ring fittings				
Part-No. Cutting ring	Tube AD light series	M_A ±5% (Nm)	Tube AD heavy series	M_A ±5% (Nm)
400.606	L 6	30	S 6	35
400.806	L 8	40	S 8	45
401.006	L 10	50	S 10	60
401.206	L 12	65	S 12	75
401.506	L 15	100		
401.607			S 16	120
401.806	L 18	150		
402.006			S 20	210
402.218	L 22	195		
402.258			S 25	290
403.116	L 28	250		
403.156			S 30	350
403.506	L 35	395		
403.636	L 42	500		

9.2.5 Connection pieces and DKO-fittings

The tightening moments are valid for connection pieces and DKO-fittings with galvanized and yellow chromalized surface protection. (Union nuts waxed, acc. to German standards „DIN ISO 4042“).

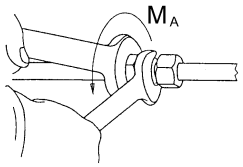
Example:



Form A
interior buffer

Form B
frontal buffer

Hold up the fitting piece by means of a screw wrench when tightening the union nut.

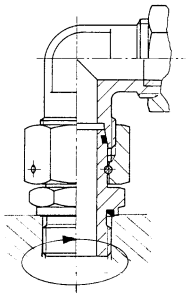


Tightening moments (M_A) for connecting pieces and DKO-fittings					
Series L = light S = Heavy	Tube AD (mm) d1	Form	metric thread d3	Span of the jaw	M_A ±5% (Nm)
L	6	A	M 12 x 1,5	14	20
L	8	A	M 14 x 1,5	17	25
L	10	A	M 16 x 1,5	19	35
L	12	A	M 18 x 1,5	22	35
L	15	A	M 22 x 1,5	27	60
L	18	B	M 26 x 1.5	32	85
L	22	B	M 30 x 2	36	110
L	28	B	M 36 x 2	41	130
L	35	B	M 45 x 2	50	215
L	42	B	M 52 x 2	60	330
S	6	A	M 14 x 1,5	17	25
S	8	B	M 16 x 1,5	19	40
S	10	B	M 18 x 1,5	22	50
S	12	B	M 20 x 1,5	24	60
S	14	B	M 22 x 1,5	27	75
S	16	B	M 24 x 1,5	30	80
S	20	B	M 30 x 2	26	120
S	25	B	M 36 x 2	46	170
S	30	B	M 42 x 2	50	250
S	38	B	M 52 x 2	60	350

9.2.6 Screwed end of fittings

In the following table the tightening moments for screwed ends are indicated (acc. to German standards DIN 3852, Form E).

Example:

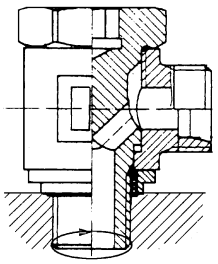


Tightening moments (M_A) for screwed ends of fittings						
Series L =light S = heavy	metric thread	M_A ±5% (Nm)		Withworth pipe thread	M_A ±5% (Nm)	
		Steel/Cast	Al		Steel/Cast	Al
L 6	M 10 x 1	20	13	G 1/8 A	20	13
L 8	M 12 x 1,5	30	30	G 1/4 A	40	35
L 10	M 14 x 1,5	45	40	G 1/4 A	40	35
L 12	M 16 x 1,5	60	50	G 3/8 A	80	55
L 15	M 18 x 1,5	80	65	G 1/2 A	110	95
L 18	M 22 x 1,5	130	110	G 1/2 A	100	95
L 22	M 26 x 1,5	190	180	G 3/4 A	180	170
L 28	M 33 x 2	300	300	G 1 A	300	300
L 35	M 42 x 2	600	400	G 1 1/4 A	600	400
L 42	M 48 x 2	800	600	G 1 1/2 A	800	600
S 6	M 12 x 1,5	40	30	G 1/4 A	50	35
S 8	M 14 x 1,5	60	40	G 1/4 A	50	35
S 10	M 16 x 1,5	80	50	G 3/8 A	90	55
S 12	M 18 x 1,5	110	65	G 3/8 A	90	55
S 14	M 20 x 1,5	140	90	G 1/2 A	160	95
S 16	M 22 x 1,5	170	110	G 1/2 A	140	95
S 20	M 27 x 2	250	180	G 3/4 A	250	170
S 25	M 33 x 2	450	300	G 1 A	400	300
S 30	M 42 x 2	600	400	G 1 1/4 A	600	400
S 38	M 48 x 2	800	600	G 1 1/2 A	800	600

9.2.7 Banjo bolts with swivelling screw-fitting

The tightening moments are valid for banjo bolts with steel-swivelling screw-fitting (WHO) with PTFE-seal.
The surface is zinc coated, yellow chromed and coated for gliding. Pay attention to the various tightening moments in relation to the material of the screw-in drilling of the counter body made of steel / cast or aluminium.

Example:



Tightening moments (M_A) for WHO-fittings				
Part-No. fitting	Series L =light S = heavy	metric thread	M_A ±5% (Nm)	
			Steel/Cast	Al
401.256	L 12	M 16 x 1,5	80	50
401.556	L 15	M 18 x 1,5	120	65
402.081	S 20	M 27 x 2	270	180

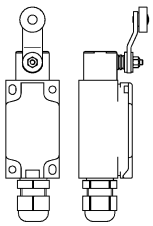
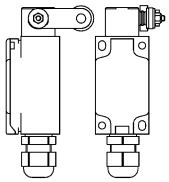
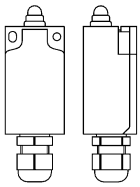
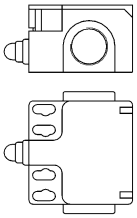
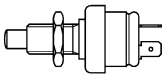
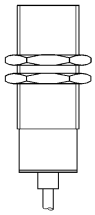
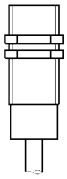
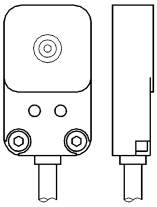
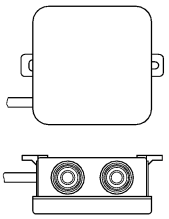
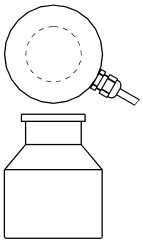
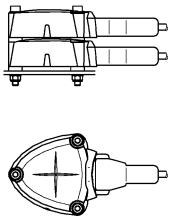
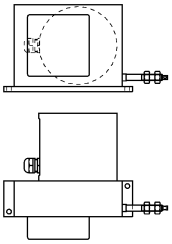
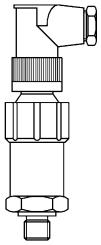
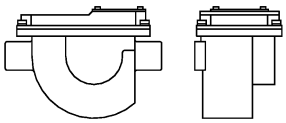
Part-No. fitting	Series L =light S = heavy	Withworth pipe thread	M_A ±5% (Nm)	
			Steel/Cast	Al
400.857	L 8	G 1/4 A	50	35
401.257	L 12	G 3/8 A	80	55
401.557	L 15	G 1/2 A	150	95

9.3 Sensor technology

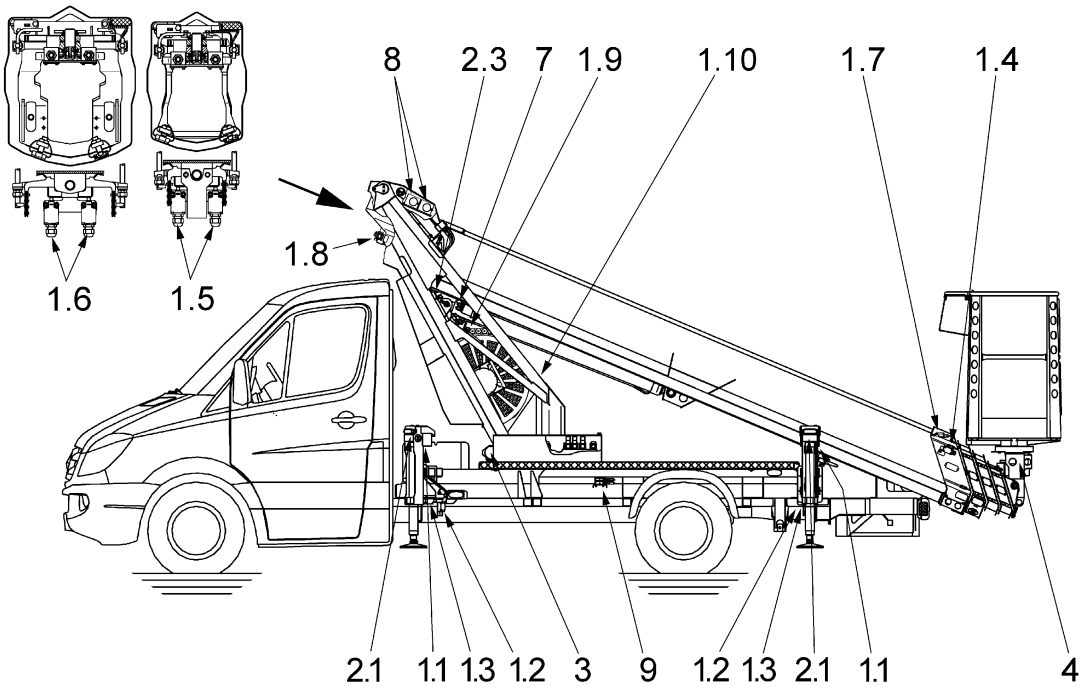
Note

The sensor technology is partly integrated inside the components, like e.g. boom system, base frame, and stabilizing jacks and/or provided with covers.

List of sensors		
No.	Function	Kind of sensor
1.1	Jack ground contact	Limit switches
1.2	Jack horizontally extended	
1.3	Jack horizontally retracted	
1.4	Telescope retracted	
1.5	Rope / chain brake telescope	
1.6	Rope / chain brake telescope	
1.7	Chain brake telescope	
1.8	Rope brake telescope	
1.9	Boom lifted	
1.10	Chain for power track slack	
2.1	Jack vertically retracted	Approach switches
2.2	Boom in its rest	
2.3	Boom in final position (max. angle of elevation is reached)	
2.4	Front wheels free signal (unloaded)	
2.5	Rear wheels free signal (unloaded)	
3	Rotation angle of boom	Swivelling angle sensor (Angle sensor)
4	Rotation angle of working cage	Swivelling angle sensor (Potentiometer)
5	Angle of elevation of boom	Inclination sensor
6	Cut-off in case of impermissible working cage inclination	Mercury ring switch (on control panel of working cage)
7	LML	Pressure transformer
8	Telescope cylinder extension	Cable length transducer
9	Vehicle's inclination	Inclination sensor
10	Door of „Emergency control“ open	Press pin switch

Example)*				
Limit switches				Press pin switch
				
Approach switches				Mercury ring switch
				
Angle sensor	Inclination sensor	Cable length transducer		Pressure trans-former
				
Inclination sensor				
				

)* The illustrated sensors are elementary representations. The sensor technology of the Ruthmann-Steiger itself can differ from it in form and type.


8
2.3
7
1.9
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1.8
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2.1
1.1
1.3
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3
9
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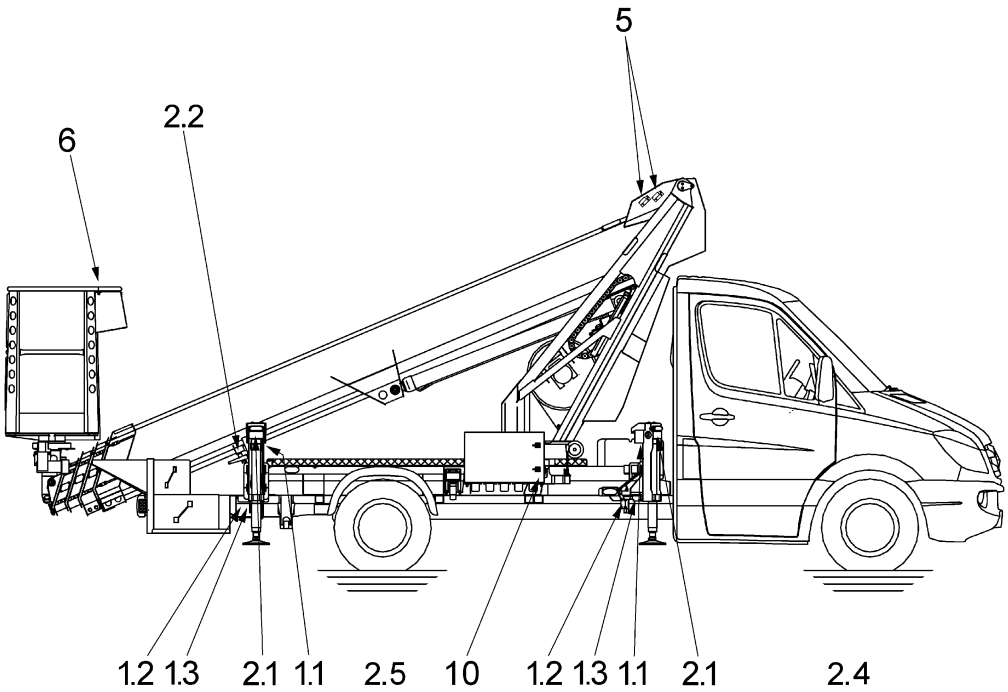
4


5
2.2
6
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10
1.2
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2.4

9.4 Inspection and Maintenance

Before substantial inspection and repair works are started the Ruthmann-Steiger must be cleaned. All defects found during the inspection have to be eliminated immediately.

9.4.1 Inspection List / Maintenance List

Explanations concerning the intervals:

d = daily or per working shift
300 h = after 300 operating hours
600 h = after 600 operating hours
a = annually

I = Inspection work
W = Maintenance work
S = Test by an expert

Inspection List / Maintenance List

Component	Work to be carried out	Interval d	300 h	600 h	a	Remark, other intervals
	Generally					
Lighting	Check for function and cleanness	I				
	Clean					W, if necessary
Oper. materials	Check fuel reserve	I				
Complete vehicle	visually for damage (fissures, deformations, corrosion)	I				
	Check painting (scratches, crack-offs)	I				
	Visual and function test of safety devices	I				
	Ruthmann-Steiger					
Ruthmann-Steiger complete	Regular inspection acc. to BGR 500 - 2.10				S	
	Visual check	I				
	Clean		W			W, if necessary
	Check inscription for completeness and legibility	I				

Component	Work to be carried out	Interval d	300 h	600 h	a	Remark, other intervals
	Check free spaces for movement sequences of mech. and hydr. constr. components	I				
	Check free spaces for movement sequences of power track		I			
	Check power tracks for fastening and damage				I	
	Check fastening of removable connections for firm hold				I	
	Check superstructures for fastening and damage				I	
	Check covering of roof of driver's cab (optional extra) for fastening and damage				I	I, firstly after three months
Bearing points and bolt locks (Ruthmann-Steiger complete)	Check bearing points with plastic bushes and screw fittings of bolt locks				I	I, firstly after 300 h
	Check other bearing points as well as bolt locks and its screw fittings				I	
	Bearing points with DU-bushes clean and grease or cover dividing points / contact surfaces with oil				W	if grease nipple provided grease bearing point
Bearing points with plastic bushes	Visual check	I				
	Cleaning		W			W, if necessary
Jacking	Check well-running		I			
	Check tear at guiding device				I	
	Clean and grease gliding surfaces of jack arms		W			W, if necessary
	Ground contact interrogation: Grease the screw pressure spring, bolt and the oblong hole bearing		W			W, if necessary
	Guiding device jack cylinder: Clean and grease the area of the guide rings		W			W, if necessary
	Jack plate Grease hinged presser foot				W	W, if necessary after cleaning of the Steiger
Turret	Visual check	I				
	Check baffles and guiding devices of the chains for power track for wear				I	
Boom	Check well-running	I				
	Check tear at guiding devices				I	
	Grease telescope gliding surfaces		W			W, if necessary after cleaning of the Steiger
	Check prestressing of retraction chains and extension ropes				I	
	Check ropes for surface corrosion and damages				I	
	Check wear at the rope groove of the rope roller				I	
	Grease extension ropes					W, if necessary
	Check chains for surface corrosion and link corrosion				I	

Component	Work to be carried out	Interval d	300 h	600 h	a	Remark, other intervals
	Grease retraction chains					W, if necessary
Boom rest	Grease locking bolt		W			W, if necessary after cleaning of the Steiger
Working cage	Visual check	I				
	Check protection device	I				
	Check door	I				
	Check support rings for seat belts	I				
	Check condition of cage floor	I				
	Cleaning		W			W, if necessary
Levelling indicator	Visual check	I				
	Check fastening for firm hold				I	
	Functional test				I	

Hydraulic system

Rotating device	Visual check	I				
	Check screw connections of ball bearing slewing gear				I	I, firstly after 100 h to 300 h
	Check fastening for firm hold of parking brake and hydraulic engine				I	
	Check tear of bearing				I	
	Grease slide way		W			W, if necessary
	Grease worm gear		W			W, if necessary
	Check tightness	I				
	Check hydr. connections for firm hold and damage				I	
	Function test of parking brake (multiple disk brake)				I	
Hydraulic cylinder	Visual test	I				
	Check fastening for firm hold				I	
	Check tightness	I				
	Check hydraulic connections for firm hold and damage				I	
	Check free spaces for movement sequences of the hydraulic cylinders	I				
	Check surface of piston rods for damage and corrosion	I				
Hydraulic pump	Visual test	I				
	Check fastening for firm hold				I	
	Check tightness	I				
	Check hydraulic connections for firm hold and damage				I	
Hand pump	Visual test	I				
	Check fastening for firm hold				I	
	Check tightness	I				
	Check hydraulic connections for firm hold and damage				I	
	Function test		I			
	Cleaning					W, if necessary

Component	Work to be carried out	Interval				Remark, other intervals
		d	300 h	600 h	a	
Ball cock	Visual test	I				
	Check fastening for firm hold				I	
	Check tightness	I				
	Check hydraulic connections for firm hold and damage				I	
	Check well-running		I			
Safety valves at Hydraulic cylinders	Visual test	I				
	Check fastening for firm hold				I	
	Check tightness		I			
	Check hydraulic connections for firm hold and damage				I	
	Adjusting values					I, if necessary
	Function test		I			
Way valve	Visual test	I				
	Check fastening for firm hold				I	
	Check tightness	I				
	Check hydraulic connections for firm hold and damage				I	
Cable / hose drum	Check well-running	I				
	Check fastening for firm hold				I	
	Check tightness	I				
	Check hydr. connections for firm hold and damage				I	
	Check pretension of the drawing-in spring.				I	
	Clean chain for power track				W	W, if necessary
	Check chain for power track for wear				I	
Hydraulic-hose and tube lines	Visual test	I				
	Check fastening for firm hold				I	
	Check tightness	I				
	Check hydraulic connections for firm hold and damage				I	
	Check hose elongation inside the boom and chain for power track				I	
	Check labelling on the hydraulic hoses and connection points for completeness and legibility				I	
	Exchange hydraulic hoses					W, every 6 years
Hydraulic tank	Visual test	I				
	Check fastening for firm hold				I	
	Check tightness	I				
	Check hydraulic connections for firm hold and damage				I	
	Check hydraulic oil level	I				
	Clean hydraulic oil return filter / renew filter element				W	W, firstly after 50 h to. 300 h
	Exchange of hydraulic oil					W, after 3000 h, every 6 years at the latest

Component	Work to be carried out	Interval d	300 h	600 h	a	Remark, other intervals
	Check drained hydraulic oil					I, after 3000 h, every 6 years at the latest

Electric system

Emergency - Cut-off Push button	Visual test	I				
	Check electrical connections for firm hold and damage				I	
	Function test	I				
Signal device	Function test	I				
	Perception				I	
Limit switch	Visual test	I				
	Check fastening for firm hold				I	
	Check electrical connections for firm hold and damage				I	
	Clean mechanical actuation					W, if necessary
	Function test				I	
Approach switch	Visual test	I				
	Check fastening for firm hold				I	
	Check electrical connections for firm hold and damage				I	
	Cleaning					W, if necessary
	Function test				I	
Swivelling angle sensor	Visual test	I				
	Check fastening for firm hold				I	
	Check electrical connections for firm hold and damage				I	
	Cleaning					W, if necessary
	Function test				I	
Cable length transducer	Visual test	I				
	Check fastening for firm hold				I	
	Check fastening of spring hook / eyelet bolt				I	
	Check well-running				I	
	Check electrical connections for firm hold and damage				I	
	Clean traction cable					W, if necessary
	Function test				I	
Inclination meter	Visual test	I				
	Check fastening for firm hold				I	
	Check electrical connections for firm hold and damage				I	
	Cleaning					W, if necessary
	Function test				I	
Valve plug	Visual test	I				
	Check fastening for firm hold				I	
	Check electrical connections for firm hold and damage				I	
Wiring	Visual test	I				
	Check fastening for firm hold				I	

Component	Work to be carried out	Interval				Remark, other intervals
		d	300 h	600 h	a	
	Check electrical connections for firm hold and damage				I	
Operating devices	Visual test	I				
	Check fastening for firm hold				I	
	Check electrical connections for firm hold and damage				I	
	Check pilot and warning lamps	I				
	Check joystick and rubber sleeve		I			
	Check push buttons and luminous push buttons		I			
	Function test of operating elements		I			
Computer control	Visual test	I				
	Check fastening for firm hold				I	
	Exchange button cells					W, every 6 years

9.4.2 Check by an expert

The technical responsibility and execution of the testing should be taken from the Steiger's inspection book. The inspector must document the findings in the book and sign it. The operating organization of the Ruthmann Steiger or its authorised representative has to confirm any faults there might be confirmed by signing and dating them and remedy such before the Steiger is used any further. The elimination of faults has to be countersigned in writing in the inspection book.

9.4.2.1 Regular inspections

The Ruthmann-Steiger must be checked by an expert in intervals of at least one year after first putting into operation of the Ruthmann-Steiger. For more detailed information, refer to the Steiger's inspection book.

9.4.2.2 Extraordinary inspections

The Ruthmann-Steiger including carrier-chassis must be checked by an expert witness before putting it again into operation after carrying out modifications of the construction and substantial repair work at carrying parts.

9.4.3 Inspection work, which can be carried out by the operating staff

Before putting the Ruthmann-Steiger into operation the operating staff must carry out the „daily inspection“. That are visual and function tests, which are necessary for warranting the safety.

9.4.4 Cleaning and Maintenance

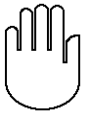
Expert maintenance and regularly cleaning (e.g. every 2-3 weeks) maintains the value of the Ruthmann-Steiger.
Strong air pollution, salty air (e.g. at the coast) and other climatic conditions may require under certain circumstances a more intensive care of the Ruthmann-Steiger. Especially after having been in contact with abrasives (e.g. salt in winter) the Ruthmann-Steiger should be cleaned, since otherwise the paint could be damaged and constructional components could corrode.
The Ruthmann-Steiger may only be cleaned from outside by means of water and vehicle detergents customary in commerce. Scouring agents, solvents, turpentine and benzine etc. are not allowed.

When buying and using cleansing agents you should also consider the ecofriendliness. Rests must be disposed as hazardous waste depending on their pollution class. Only clean the Ruthmann-Steiger on suitable washing places.

Danger!

Cleansing agents can be harmful to health!
Cleaning agents and care products must be kept always surely!

Before cleaning the Steiger with water, steam beam (high pressure water cleaner) or cleansing agents all those openings have to be covered or glued over, in which - for reasons of safety and / or function - no water, steam or cleansing agents is allowed to pour in. Particularly in danger are control boxes, sensors, (limit switches, proximity switches, etc.) and valves. After cleaning all covers or stickers must be removed completely.



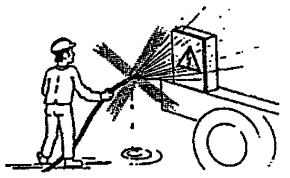
Attention!

Electrical constructional components, switch boxes etc. must also not from outside be cleaned by means of a high-pressure-cleaner ! Use soft cloth, sponge or similar for cleaning purposes!

When using a high-pressure water cleaner the corresponding operating instructions of the manufacturer concerning spray pressure and spray distance must be observed.

Attention!

- **Bird droppings, insects, resin and grease remains must be washed off immediately, since they contain substances, which can damage the painting and other plastic components considerably.**
- **After using the Ruthmann-Steiger for tree-pruning, the wood shavings must be removed immediately. E.g. at boom system, the covers of boom ends must firstly be removed. Should an accumulation of wood shavings be found out, authorised personnel must carefully remove this.**
- **Movement spaces of moveable parts must be cleaned immediately.**
- **Direct sun light must be avoided when washing the machine.**
- **Do never point the water or steam stream onto the following parts of the Ruthmann-Steiger:**



  - **electrical components,**
  - **electrical lines,**
  - **hydraulic components,**
  - **hydraulic lines,**
  - **insulators,**
  - **Lock caps, e.g.:**
    - **Locking hydraulic oil tank,**
    - **etc.,**
  - **bearing points,**
  - **sealing points z. B.**
    - **door sealings,**
    - **sealings of control boxes,**
    - **rotary shaft seal,**
    - **etc.,**
  - **brake system.**

- **Colour painting**
  Only treat with acid- an solvent-free cleansing and conservation agents. In case of fading paint the surface can be improved by means of a car polish customary in trade. You have to observe the instructions of the polish manufacturer.

Polish remains must be disposed ecologically.

- **Plastic parts** (e.g. bearing points, boom rest, working cage)
  Clean with humid cloth and water. Should that not be sufficient, only suitable solvent-free cleaning agents must be used.

- **Aluminium side-walls and covers**
  Brush off with water and add if necessary a neutral cleansing agent.

- **Door sealings**
  Rub the door sealing at switch box with French chalk.

Rests of detergents or used cloth must be disposed ecologically.

After cleaning especially by means of a high-pressure cleaner the gliding surfaces must again be greased slightly. The Ruthmann-Steiger should be protected by a conservation depending on influence due to weather conditions or chemical influences.

9.4.5 Remarks concerning execution of inspection and maintenance work

9.4.5.1 Lighting system

Inspection and maintenance of the lighting system of the chassis has to be carried out in accordance with the operating and maintenance instructions of the manufacturer

- Check the complete lighting system, blinker lamps, brake lamps and rotating flashing beacons daily for proper function and cleanness, clean if necessary.
- Defective lights must immediately be replaced.

9.4.5.2 Complete Ruthmann-Steiger

The complete Steiger-superstructure, as e.g. base frame, stabilizing jacks, boom, working cage, must be checked with regard to

- condition and cleanness,
- fissures,
- deformation / damage,
- varnish / painting,
- corrosion,
- legibility of inscription,
- spaces for movement of the mechanical and hydraulic components as well as of the power track,
- fastening and locking of removable fittings,
- etc.

Damage to the paintwork, as e.g. scratches or rockfall damage, must immediately be repaired in order to avoid corrosion. In case of corrosion at carrying constructional components please consult the Ruthmann-after-sales-service.

If damage of the Ruthmann-Steiger, e.g. collision damage, etc. discernible at damage to paintwork and bumps, a check becomes immediately be necessary. This check must be carried out by an expert. Damage must be rectified before the next time it is put into operation or before continuation of operation.

9.4.5.3 Bearing points / Bolt locking

- Bearing points and bolt locking must be checked for:
  - good condition and cleanness,
  - wear, fissures and damage,
  - well-running of bearing,
  - firm hold of screw fittings of bolt locking

  If bolt locks get loose the reason must be ascertained and the fault must be rectified. We recommend having the repair of defective bearings and bolt locks carried out by the Ruthmann-after-sales-service or by personnel authorized by us accordingly.

- Clean bearing points from outside. Do not use high-pressure cleaner and / or chemical detergents.

- Grease DU-bush-bearing points with provided lubrication point (grease nipple) according to maintenance list.

- Cover the DU-bush-bearing points without any grease nipple with oil at the separation points / contact points.

9.4.5.4 Bearing points with plastic bushes

- Visual test concerning condition and cleanness, firm hold, fissures and damage.

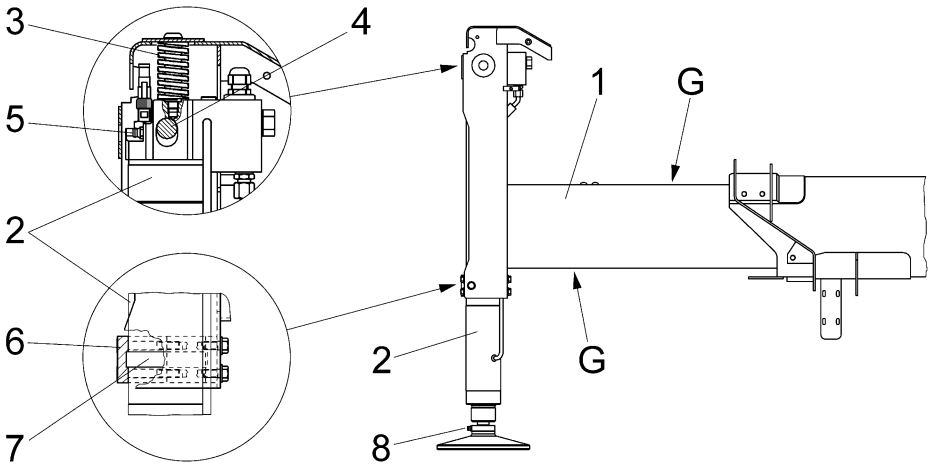
- Plastic bushes must be free of grease and oil - **do not** grease or oil.

- Plastic bushes must be free of paint - **do not** cover with paint.

- Clean regularly bearing points from outside (e.g. by means of a cloth). **Do not use high-pressure cleaner and chemical detergents!**

9.4.5.5 Stabilizing jacks

- Inspection see „Complete Ruthmann-Steiger“. Further checks:
  - well-running of guiding devices and cylinders for movement sequences,
  - wear of guiding devices and gliding surfaces, etc.,
  - functioning of the ground contact inquiry.



- Clean gliding surfaces of telescope of jack arm (1). Grease gliding surfaces according to maintenance list. Extend jack arm (1) horizontally and grease the corresponding gliding surfaces (G) and gliders slightly, e.g. by means of a brush. Extend and retract the jack arm afterwards horizontally several times to achieve a distribution of the grease. The procedure must perhaps be repeated.

- Grease the mechanism of ground contact inquiry according to the intervals indicated in the maintenance list. Grease the screw pressure spring (3) and the oblong hole bearing (4) of the head of the hydraulic cylinder. The oblong hole bearing can be greased with the grease nipple (5)

- Clean the cylinder guide in the area of the clamp (6) thoroughly. Bring grease from outside into the gap between clamp and cylinder according to the maintenance list.
  - 2 hydraulic cylinder (jack cylinder)
  - 6 Cylinder clamp
  - 7 Guide ring

  Do not demount the clamp for the greasing procedure.

- Grease the hinged foot (joint of jack plate) with the grease nipple (8).

9.4.5.6 Turret

- Inspection see „Complete Ruthmann-Steiger“. Further checks:
  - Free spaces for movement sequences of the chain for power track. Impurities must be removed immediately.
  - Contamination, damage and wear of baffles and guiding devices.

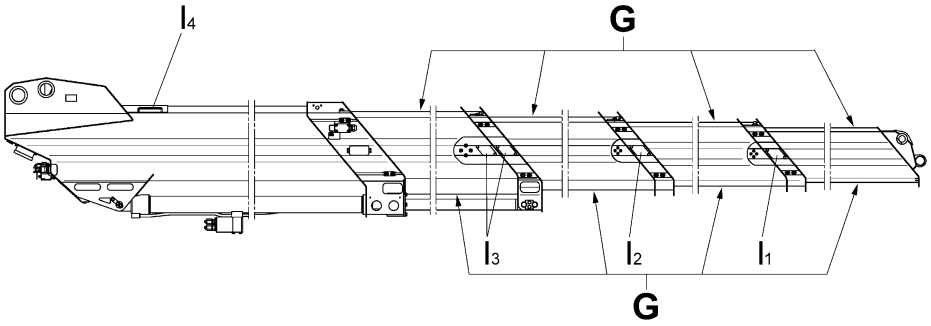
9.4.5.7 Boom

- Inspection see „Complete Ruthmann-Steiger“. Further checks:

  - No occurrence of noise of the telescopes.
  - Well-running of retraction chains and extension ropes, guide rollers, power track.
  - Contamination, damage and wear of telescope guiding devices, gliding surfaces, retraction chains and extension ropes, guide rollers, power track, etc.
  - Prestressing of retraction chains and extension ropes. Both chains and/or ropes, belonging to the system (retraction „E“ and/or extension „A“) must approximately take the same load ($E_{1.1} = E_{1.2}$; $E_{2.1} = E_{2.2}$ and $E_{3.1} = E_{3.2}$ / $A_{1.1} = A_{1.2}$; $A_{2.1} = A_{2.2}$ and $A_{3.1} = A_{3.2}$).
  - Wearing length of retraction chains. Elongation of extension ropes. Among other things a reduction of the diameter of the extension ropes is an indication for a rope elongation. Ropes with a reduced diameter, even with only short ropes, must be exchanged.
  - Check retraction chains for surface rust, joint rust, stiffness of joints, twisted, loose or broken chain bolts, broken shackles. In case of damaged chain the chain must be replaced immediately.
  - Check extension ropes for surface rust, broken wires in the rope strands and right fit in pressed steel fitting. Ropes showing a considerable external wear will relatively often have broken wires in the rope strands. Damaged extension ropes must immediately be exchanged.
  - Check the fixing points of the retraction chains and extension ropes.

The retraction chains inside the boom system must be checked e.g. by means of an endoscope. The inspection by means of an endoscope becomes possible without comprehensive demounting of parts. The extension ropes and rope rollers can be checked through the inspection apertures („I_1“ to „I_3“) at the corresponding boom head (left and right). You can additionally also demount the scraper (brushes) at boom head for inspection of extension ropes. In order to control the limit switches cables / chain brake, two further inspection ports („I4“) are situated at the top on the boom’s foot of the boom „V“. For this purpose, the booms must slightly be extended

- The telescopes of the boom are guided by gliders. In order to have a possibly low wear and slippage resistance a lubrication of the gliding surfaces becomes necessary in intervals according to the maintenance list (or depending on the use also earlier).



Extend the telescope for lubrication (greasing) as far as possible and grease the gliding surfaces („G“) slightly, e.g. by means of a radiator paint brush.

Note

Do not grease too much to avoid an accumulation of grease inside the booms.

- Regrease extension ropes according to inspection list. Therefore remove inspection apertures („I_1“ to „I_3“) at the corresponding boom head (left and right). You can additionally also demount the scraper (brushes) at boom head. As long as there is a sufficient grease film on the rope, a regreasing is unnecessary. The lubricant should be liquid at the beginning, to ensure that it can penetrate into the rope between the rope strands and wires. During greasing procedure extend or retract the telescope. Do not overgrease the ropes.

Attention!

Do not grease the polyester slide bearings of the rope pulleys in the boom system or do not wet them with oil!

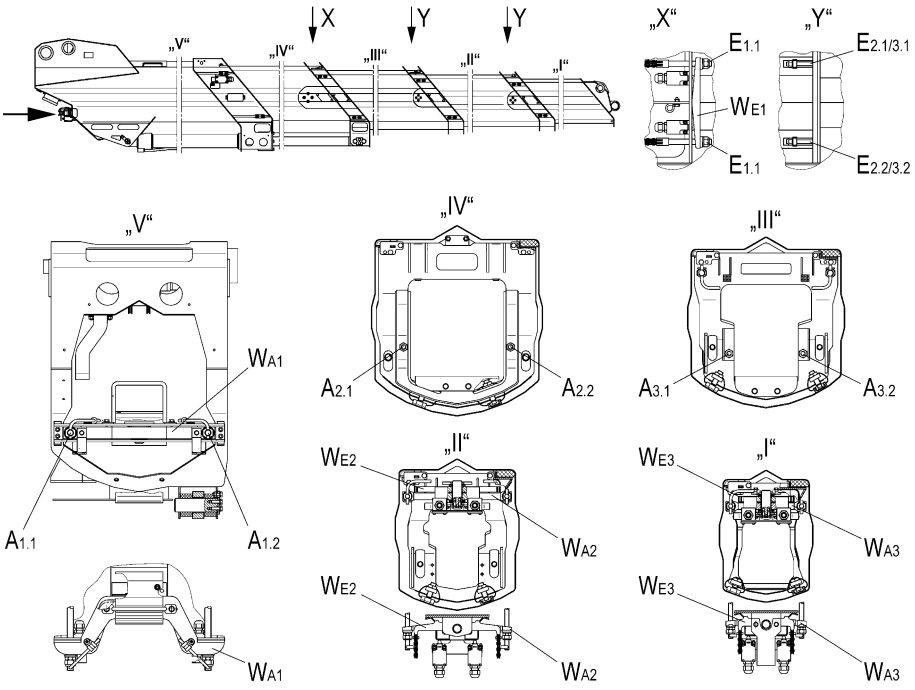
- Grease retraction chains according to maintenance list. There must be no dirt at the outside of the chain. For an effective lubrication a sufficient quantity of lubricant must be brought into the chain links or joints during each lubrication procedure.

- Re-adjust prestressing of retraction chains and extension ropes in case of a too big chain dip and/or rope slack.

Attention!

A too strong prestressing can lead to the demolition of the machine. You have to take care that the telescope will not be twisted as a result of the re-stretching.

- Extend the telescope as far as possible with horizontal boom and unloaded cage.
- Retract the telescope slightly.
- Check rope slack of the extension ropes.
- Re-stretch extension ropes if necessary.



- Re-stretch extension ropes by means of adjustment screw ($A_{1.1,\ 1.2}$; $A_{2.1,\ 2.2}$ or $A_{3.1,\ 3.2}$). A sufficient rope slack must always remain. Pay attention to regular distances between the boom heads during re-stretching procedure.
- The two extension ropes have to be prestressed approximately equally so that under operating conditions they will take approximately the same load. The position of the corresponding rocker

(W_{A1}; W_{A2} or W_{A3}) for the rope stressing device must continue to run perpendicular to the two ropes. The nuts have to rest completely on their bearing surfaces and must at no events be tilted.

* When re-stretching the extension ropes also the corresponding retraction chains will be stretched. You have to take care that the retraction chains will not be overloaded. The position of the rocker (W_{E1}; W_{E2} or W_{E3}) for the corresponding chain stressing device must continue to run perpendicular to the two chain strands. The nuts of the adjustment screws ($E_{1.1,\ 1.2}$; $E_{2.1,\ 2.2}$ or $E_{3.1,\ 3.2}$) have to rest completely on their bearing surfaces and must at no events be tilted.

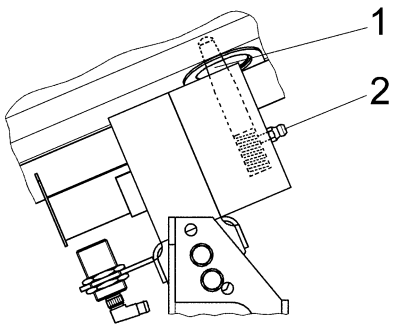
Due to necessary knowledge of such work we recommend to let have the re-spanning of the chains and ropes carried out by the Ruthmann-after-sales-service.

– Check prestressing of the retraction chains and extension ropes after a running-in period. Extend and retract telescope several times and check functionality. A small distance between the boom heads must remain in retracted position.

- We recommend to exchange the extension ropes after 10 years at the latest. Only original Ruthmann-replacement extension chains may be used.

9.4.5.8 Boom rest

Clean boom rest. Check locking bolt (1) for damages and wear. Grease it over grease nipple (2) according to the interval of the maintenance list.



9.4.5.9 Working cage

- Inspection see „Complete Ruthmann-Steiger“. Further checks:
  - Ground of working cage for wear, damages, its anti-slipping function and its solidity,
  - sufficient height of skirting board,
  - stability and height of side walls,
  - steps for wear, damages, their anti-slipping function and their solidity,
  - check door for free moveability, check the closing mechanism,
  - check the supports for safety-belts for damages and fastening.

Danger!

The further use of supports, safety ropes and safety belts after an accident is very dangerous, since parts like e.g. anchorages, ropes, belts could be damaged and therefore do no longer warrant a sufficient protection. The complete supports including ropes for safety belts must be replaced after an accident. We recommend having this work carried out by the Ruthmann-after-sales service or by personnel authorized by us. We also recommend replacing the safety belts.

9.4.5.10 Hydraulic system

- Check free spaces for movement sequences of hydraulic cylinder, especially of installed hydraulic cylinders. Remove impurities immediately.
- Check fastenings of constructional components. Check tube- and hose connections for firm hold.
- Check tube- and hose connections for damage like e.g. bends, fissures, porose surfaces or corrosion.
- Check tightness.
  - Check tightness of safety valves at the hydraulic cylinders with permissible load acc. to BGG 945:
    - extend stabilizing jacks,
    - lift boom,
    - extend telescope.

    Keep Ruthmann-Steiger in this position. There must be no change in the position for a period of 5 minutes. If a change of the position occurs, the reason must be found out and the fault must immediately be rectified!
- Check hydraulic cylinder and scraper for tightness and damage.
- Check surface of piston rod of hydraulic cylinder for damage.
- Check well-running of ball-cock by actuating it several times.

9.4.5.11 Rotating device

Attention!

Cleaning a rotating device with steam stream or high-pressure cleaner is not permissible!

- Inspection see „Complete Ruthmann-Steiger“. Further checks:

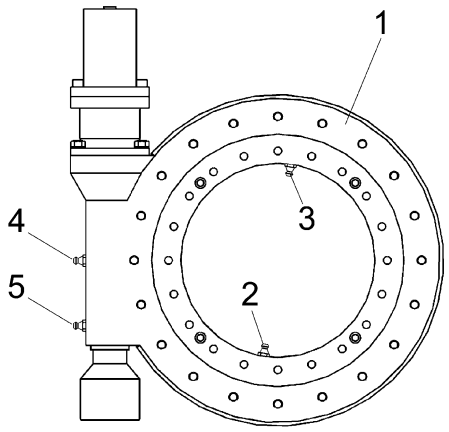
  - Tipping slackness of the ball bearing slewing gear.
    The demounting slackness is 0,5 mm.
  - Rotation slackness between worm and worm.
    The demounting slackness is 1,0 mm.

  The demounting slacknesses refer to a measuring point directly at the diameter of the master gauche for holes of the outer ring (worm gear) of rotating device.

Attention!

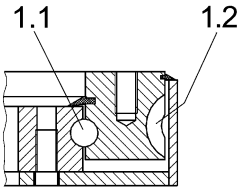
If the demounting slackness is exceeded, operation of the Ruthmann-Steiger must remain discontinued and the rotating device must be replaced.

- Grease rotating device according to maintenance list. First grease slide way (1.1) of the ball bearing slewing gear (1) with the grease nipple (2) and (3).



1. Ball bearing slewing gear
   1.1. Slide way
   1.2. Worm gear (outer ring)

2 - 5 Grease nipples



Danger!

During rotating movement of the boom nobody is allowed to stay within the radius of danger of the rotating column (turret).

The slide way (1.1) of the ball bearing slewing gear (1) is greased with the grease nipples (2 and 3). The grease nipples are accessible from the underside of the base frame. During greasing with the first grease nipple (2) the boom will be further rotated by approx. 180°. After rotating the boom back it will be greased with the second grease nipple (3).
By the rotating movement of the boom a better distribution of the grease inside the bearing is achieved. The lubrication points must always be greased so generously that at the complete bearing splits and seals resp. a collar of fresh grease appears.
Afterwards grease the worm gear by means of the grease nipples (4 and 5). During greasing procedure the boom must carry out a rotating movement, to ensure that the grease is being distributed over the complete worm gear (1.2).

9.4.5.12 Hydraulic pump

- Check hydraulic pump for normal running noises and vibrations.
  - Check flange connection for firm hold .
  - Check tightness.

  If any unusual noises, vibrations occur, you have to ascertain the reason and possible faults must be eliminated.

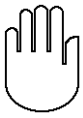
9.4.5.13 Hand pump

- Function test of hand pump according to inspection list. Keep hand pump well-running by actuating it for several times.
- Clean if necessary. Do not use a high-pressure cleaner and chemical detergents.

9.4.5.14 Safety- and way valves

- Check adjustment values of valves.
- Adjustment values may only be modified by the Ruthmann-after-sales service and personnel authorized by us.
- Clean if necessary. Do not use a high-pressure cleaner and chemical detergents.

9.4.5.15 Cable / hose drum



Attention!

Cleaning the cable / hose drum with steam stream or high-pressure cleaner is not permissible!
Do not carry out boom movements without coverings of the energy guiding chains at turret. If the cable / hose drum does not roll up in case of a fault, the energy chain can be damaged. If so, the boom movements will not be interrupted. After maintenance works, screw again coverings at turret in a correct way.

- Check cable / hose drum for fastening, closeness and normal running noises. In case of leakages or exceptional running noises, the cause must be found out and the default must be eliminated.
- Check elongation of electric lines and hydraulic hoses in the chain for power track. If necessary, carry out maintenance works.
- Check pretension of spring drive. If necessary, adjust.

Danger!

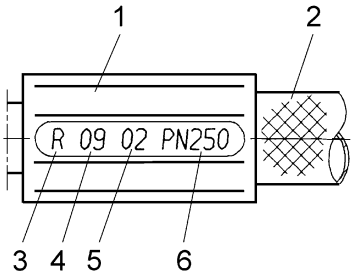
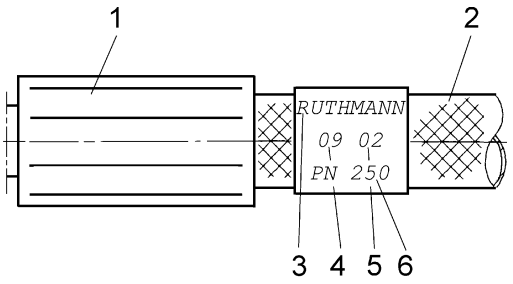
Risk of injury by opening the spring drive. The drive is under high spring pressure. The spring drive may only be opened by authorised personnel. *Due to the necessary know-how,* we recommend letting the maintenance and repair work carried out by the Ruthmann-after-sales-service or by personnel authorized by us.

- In case the chains for power track are constantly exposed to exceptional surroundings (intense contamination), it is recommended to clean the chains for power track in regular intervals adapted to the conditions.

9.4.5.16 Hydraulic hose lines

- Check elongation of hydraulic hoses, e.g. of the power track inside the boom, and repair if necessary.

- Hydraulic hose lines are naturally exposed to an ageing process, e.g. light, temperatures, movements and impulse frequencies have an influence on the working life of hydraulic hoses. We recommend, according to state of the art, to exchange the hydraulic hoses after 6 years.
  Only original Ruthmann spare hydraulic hoses may be used. The hoses are marked correspondingly by means of a stamping on the instrument panel or by a sticking label in the area of the instrument panel.

Marking by means of	
Stamping	**Sticked label**
	

1. Instrument panel
2. Hose
3. Marking of manufacturer
4. Year of construction
5. Month of construction
6. max. dynamic operating pressure (in bar)

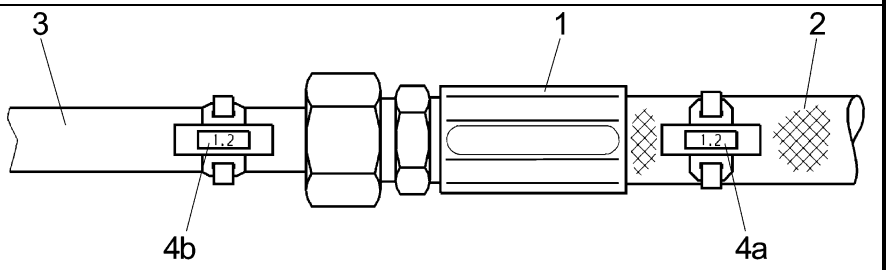
Danger!

There is a danger of accidents caused by hydraulic hoses connected incorrectly! Hydraulic connections must not ever be interchanged. It must be assured that any hydraulic hoses changed or taken off are reconnected to their respective connections for them.

- To avoid interchanging the connections, the hydraulic hoses with which the hose ends are not visible at the same time are labelled correspondingly. Their respective connection points have the same labelling as the

respective hydraulic hoses. The labelling on the hydraulic hoses and connection points must not be removed or rendered illegible. Short hydraulic hoses, with which the hose ends are visible at the same time, are excepted from such labelling.

Labelling of the connection



1. Instrument panel
2. Hose
3. Line (example)

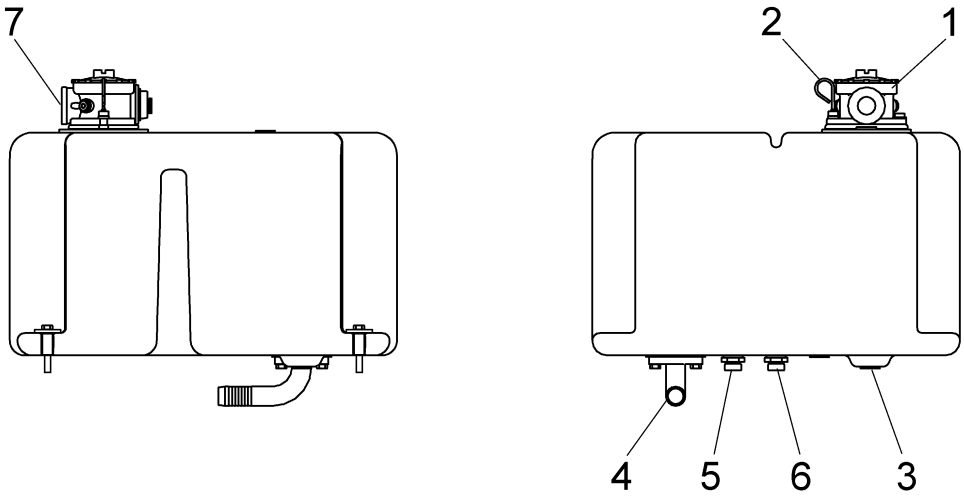
4a. Labelling (e.g. „1.2“) of the hydraulic hose line

4b. Labelling (e.g. „1.2“) of the connection point (e.g. line, bulkhead screwed connection, hydraulic block)

9.4.5.17 Hydraulic tank

Attention!

Let hydraulic oil barrels rest for a longer time before taking oil out of it.
Do not leave the tank cover at hydraulic oil tank open longer than absolutely necessary. Close hydraulic oil barrels immediately after taking out oil.



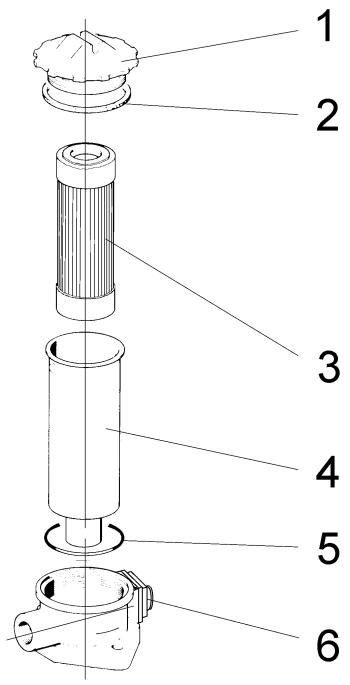
1. Return filter
2. Oil dip stick
3. Oil draining screw
4. Suction line hydraulic pump
5. Suction line hand pump
6. Suction line secondary drive (optional extra)
7. Connection return line

- Check hydraulic oil level.
  - Ruthmann-Steiger in travel position.
  - Steiger out of operation, engine off.
  - Check oil level by means of oil dip stick (2).
    The oil level may only be measured with horizontally positioned vehicle, since otherwise the oil dip stick will not show the actual oil level. Check oil level with cold hydraulic oil.
    The hydraulic oil stand must be between the upper and the lower marking at dip stick (2).
  - If necessary add oil according to lubrication point list.

- Clean hydraulic tank if necessary. Do not use a high-pressure cleaner or chemical detergent.

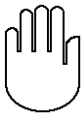
- Change of hydraulic oil according to maintenance list. Every time you change the oil also maintain the return filter
  - Clean the area around the hydraulic oil tank in order to avoid that dirt can get into the tank.
  - Drain the used oil into a suitable receptacle.
  - Filling of tank with hydraulic oil over a preceded filter aggregate.
  - Drain the used oil out of the hydraulic system. Check oil level inside the tank. Refill hydraulic oil into the tank over a preceded filter aggregate.

- Exchange return filter element of hydraulic oil according to maintenance list.
  - Open filter cover (1) and remove together with flat sealing (2).
  - Take the filter element (3) upwards out of the filter pot (4) by slightly turning and pulling it.
  - Take out filter pot (4) with O-ring (5) and clean by means of diesel oil or benzine.
  - Exchange filter element (3).
  - Replace damaged seals.
  - The installation of the filter pot and of the filter element is to be carried out in reverse sequence.
  - Open the ventilation filter (6) and replace the filter element.
  - Mounting of the ventilation filter (6) is carried out in reverse sequence
  - Screw-on the filter cover (1) manually (Tightening moment 15 Nm).



9.4.5.18 Electric system

- Check fastenings of appliances and constructional components for firm hold.



Attention!

The connecting plugs of the printed circuit boards may only be plugged-in or -off, if the operating voltage is switched-off (voltage-free). The operating voltage may only be switched-on, if all plugs of the printed circuit board are either removed or inserted.
Never connect voltage from outside onto the exits.

- Check fuses for firm hold and if necessary for proper function.
- Check switch box for tightness and accumulation of condensation.
- Function check of Emergency Cut-off push button and safety devices. Actuation of the Emergency Cut-off push button must consequently stop the electrical driving of Steiger-movements.
- Check
  - plug connections,
  - pressure and luminous push button keys,
  - joystick and rubber sleeves,
  - limit switches,
  - approach switches,
  - pressure sensor,
  - swivelling angle sensor,
  - inclination sensor,
  - cable length transducer,
  - solenoid valve plug

  for cleanness, humidity and mechanical and electrical function ability.
- Remove dirt, dust deposits, ice / snow etc. from the limit switches and approach switches.
- Clean operating devices and appliances if necessary.

Attention!

In order to avoid damage to operating elements, solenoid valves, switch boxes, limit switches, approach switches, batteries, etc. do also from outside not use a

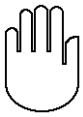
high-pressure cleaner or chemical detergents for cleaning these parts. Use a soft cloth, sponge or similar for cleaning purposes! Take care that no water can get into the units! Clean battery only with screwed-on inspection plug.

- Keep mechanical system of limit switches well-running.
- Check the cables for insulation, corrosion of contacts damage.

9.4.5.19 Batteries

Danger!

Battery acid is extremely corrosive! Do not tilt the battery. Acid can escape out of the degassing aperture. During charging procedure a highly-explosive detonating gas will be produced! Fire, sparks, open light and smoking is forbidden! Wear eye protection and gloves. Battery acid must not get in contact with the eyes, hands, clothes and painting of vehicle. In case of contact with the eyes immediately wash them out with cold water. Afterwards directly consult a doctor. Neutralize battery acids on hand or clothes by means of soap suds and much water. Consult the doctor if necessary. After swallowing battery acid immediately consult the doctor!



Attention!

In order to avoid the formation of sparklings at the poles of the battery, no charging cable being under voltage must be connected or disconnected to the battery.

The notes of the manufacturer of the battery must be observed.

Old batteries and cleaning cloths must be disposed in a way which is not harmful for the environment. Do not dispose old batteries in the domestic waste, but give them off in a collecting point. For reasons of disposal and of the necessary

knowledge and tools we recommend letting have the battery and battery acid changed by the Ruthmann-after-sales-service or personnel authorized by us.

Vehicle battery

- Check oil level of the battery liquid.
- Check charging condition of battery. Re-charge battery if necessary (no rapid charge). The capacity will decrease with sinking temperature. A considerably cooled down battery only has a fraction of its performance. Therefore re-charge more often during winter time.
- Clean battery if necessary. Keep battery poles clean. Grease slightly the pole binders (connecting poles) by means of an acid-free and acidproof grease (e.g. vaseline).
- When changing the battery, please duly observe the operating and maintenance instructions of the manufacturer of the battery.

Button cells of the computer system

- We recommend letting the rechargeable button cells changed after 6 years. A change is absolutely necessary after 8 years. E.g. the change can be carried out during the regular check (check by an expert).

9.5 Repair

Before carrying out substantial repairs clean the Ruthmann-Steiger.

For reasons of necessary expert knowledge, tools and disposal, we recommend having the repair work carried out by the Ruthmann-after-sales-service or personnel authorized by us.

9.5.1 Repair of varnish / painting

Danger!

Refinishing of painting may only be done under consideration of safety regulations locally prescribed, since solvents can possibly be released.
Do not keep spray cans inside the vehicle. Danger of bursting!

Inferior damage of painting, as e.g. scratches or rock-falls must immediately be covered with paint (paint pen or spray can), before corrosion can occur. If parts are corroded, the corrosion must carefully and completely be removed and afterwards these parts must expertly be corrected.
In case of corrosion at carrying components the Ruthmann-after-sales-service must be notified.

Paint rests must be disposed ecologically.

9.5.2 Exchange of constructional components

Constructional components that fit together with screws must always be mounted back by means of screws of the same size and quality class. Screws with microencapsulated adhesive and self-locking nuts must be replaced after each demounting. All supporting surfaces must be even and free of paint, acid, dirt and rust. Screw fittings secured with Loctite must again be secured expertly with Loctite. Before using Loctite the EC-safety data sheet must be observed. For tightening moments of screws please see chapter 9.2.

10 Optional equipment

10.1 Programmable telescopic extension limitation

Using the programmable telescopic extension limitation it is possible to limit the maximum extent to which the telescope can be extended. The extension limitation set (the maximum working height that can currently be reached) can be read and programmed on the plain text display of the control panel for the emergency control system. The following maximum working heights can be set:

- Lowest maximum working height: approx. 11 m
- Greatest maximum working height: approx. 27 m
- Gradation: approx. 1 m

The programming of the extension limitation desired is carried out as follows:

Plain text indication	Execution
	Input of password.
	Scroll to the corresponding display page of the plain text indication by means of the push button „page up“.
Adjusttlscopeextsion in m with sp.funct. „momentary max. attainable working height in metres“	Depress push button „Special function“. Each time the „Special function“ button is pressed the value displayed will increase by the gradation cited above. When the maximum value is reached, the next time the „Special function“ button is pressed the indication will jump to the minimum value possible to set.
	Continue using the button „Display up“ or „Display down“.

Note

The value set in this manner will be kept (even after the ignition is switched off) until it is reprogrammed. After such programming it is a good idea to switch off the ignition once so

that the access authorisation will be cancelled to the page cited above, which was obtained by entering the password.

10.2 Supporting plates with relieving

The supporting plates are made of plastic. The bottom is rubber impregnated. It reduces the risk of damages of the ground and increases the skid resisting properties. Through the relieving on the upper side of the supporting plates we obtain a higher degree of safety against a “slump” of the Ruthmann-Steiger. The recessed grips mounted on the supporting plates facilitate the handling of the plates.

- When using in general the supporting plates, take also in consideration a change of the slipping risk owing to e.g. influence of the weather such as snow and ice in winter or humidity by rain and/or fog. Hereby the skid resisting properties can be reduced.
- The supporting plates must not be damaged and must be free from ice, oil, grease or other lubricants.
- Please observe the general information concerning the admissible surface pressures. Take also in consideration admissible surface pressures, which are changing due to e.g. influence of the weather.
- It **is not allowed** to **heap up** several above mentioned supporting plates under the jack plates!
- It must be assured that the jack plates are exactly inside the relieving of the supporting plates after the positioning of the Ruthmann-Steiger.
- It is not allowed to press the supporting plate in the earth on one side by exceeding locally the admissible surface pressure of the ground. Because of that the supporting plates might so incline that the stabilizing jacks might roll-off or might be damaged. ***- Danger of tilting! -***
- The **operating staff are** now as ever reliable for **the safe positioning of the Ruthmann-Steiger.** The use of the supporting plates does not replace the duty of the operating staff to exercise care.
- If necessary the Ruthmann-Steiger must be secured against slipping through other suitable measurements.

10.2.1 Handling

Put on the supporting plates with the relieving upwards and if possible all-over the ground. But the relieving has to be positioned so that the jack plate is at best centric in the relieving. The jack plate must absolutely be inside the relieving. Take into consideration that you may push the jack plate on the supporting plate during the positioning of the Steiger.

10.2.2 Cleaning and maintenance

Only use suitable solvent-free cleansing agents and care products to clean the supporting plates. Replace damaged supporting plates.

11 Hydraulic Plan

- Hydraulic Plan

Document - no.: 0.550.125.100

12 Electrical documentation

- Wiring diagram TB 270

  Document - No.: 0.850.286.100

- MV interface Nissan Cabstar

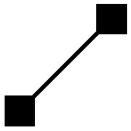
  Document - No.: 0.850.196.186

13 Spare Parts

14 Appendix

14.1 Working ranges

- Working range „TB 270 Nissan Cabstar“ page 1 to 5
  Document - No.: 0.928.339.000



14.2 Safety data sheets of the lubricants used in our work

Lubrication Part-No [1]	Designation	Data-Sheet-No.	Date
• 911.158	ARAL Aralub HL 2	456.137	30.01.2007
• 911.161	ARAL Long time grease H	456.147	07.07.2008
• 911.412	KLÜBER Lubrication Structovis BHD	-	02.09.2008
• 911.142	ARAL Vitam GF 22	456.346	30.01.2007
• 911.137	PANOLIN HLP SYNTH 22	-	24.01.2007

[1] Ruthmann-Part-No.

Note

The attached safety data sheets are not subject to our regular revision.