

**ASSEMBLY
AND OPERATION MANUAL**
Electric wire rope hoists, type MH and MHM



TABLE OF CONTENTS

1. GENERAL SAFETY REQUIREMENTS.....	1
1.1. GENERAL REQUIREMENTS TO THE CUSTOMER.....	1
1.2. GENERAL SAFE OPERATION REQUIREMENTS	2
2. PURPOSEFUL UTILIZATION	3
2.1. DESIGNATION.....	3
2.2. ELECTRIC HOIST CONTROL.....	4
3. TECHNICAL DESCRIPTION.....	5
3.1. DESIGNATION OF THE ELECTRIC HOISTS.....	5
3.2. ROPE ELECTRIC HOIST CLASSIFICATION ACCORDING TO LOAD MODE	6
3.3. CLIMATIC MODIFICATIONS OF THE ELECTRIC HOISTS	7
3.3.1. Electric hoists for normal climatic zone	7
3.3.2. Electric hoists for cold climatic zones	8
3.3.4. Tropical electric hoists	9
3.4. POWER SUPPLY.....	9
3.5. DESCRIPTION OF THE ELECTRIC HOIST	10
3.5.1. Lifting mechanism.....	10
3.5.1.1. Electric motor with a built-in brake	11
3.5.1.2. Elastic clutch.....	11
3.5.1.3. Planetary reducer	11
3.5.1.4. Drum	11
3.5.1.5. Rope guide	11
3.5.1.6. Body.....	11
3.5.1.7. Block - hook.....	11
3.5.1.8. Control block.....	12
3.5.2. Traveling mechanism	12
3.5.3. Extras.....	14
3.5.3.1. Latch key	14
3.5.3.2. Thermo-protection	14
3.5.3.3. Load limiter	14
3.5.3.4. Emergency button	14
4. ASSEMBLAGE AND PUTTING THE ELECTRIC HOIST INTO MOTION	15
4.1. REQUIREMENTS TO THE ASSEMBLAGE	15
4.2. SHIPMENT AND STORAGE	16
4.2.1. Packing.....	16
4.2.2. Shipment.....	16
4.2.3. Unpacking.....	16
4.2.4. Storage	16
4.2.4.1. Conservation	17
4.3. CONNECTION WITH THE ELECTRIC NETWORK	18
4.3.1. Principal wiring diagrams.....	21
4.4. CHECKING THE CORRECT PHASING OF THE ELECTRIC HOIST AND THE OPERATION OF THE END LIMIT SWITCH	28
4.5. CHECKING THE LUBRICATION OF THE ELECTRIC HOIST BEFORE PUTTING INTO EXPLOITATION.....	29
4.6. FIXING THE ROPE	29
4.7. ASSEMBLAGE OF STATIONARY ELECTRIC HOISTS	31
4.8. MONORAIL STRUCTURE AND ASSEMBLY OF TRAVELLING MECHANISM TO IT.....	33
4.8.1. Monorail track.....	36
4.9. OPERATION AND MAINTENANCE OF ELECTRIC HOISTS.....	39
4.9.1. Maintenance of the hoist	40

5. OPERATION AND MAINTENANCE	42
5.1. MAINTENANCE	42
5.1.1. Periodical inspections.....	42
5.1.2. Lubrication and adjustments	42
5.1.3. Repairs	43
5.1.4 The maintenance plan	43
5.1.5. Periods of repeating the inspections	43
5.2. CHECKING THE WEAR OF THE ROPE. DISCARDING AND REPLACEMENT	44
5.2.1. Checking the wear of the rope	44
5.2.2. Replacement of the rope	45
5.2.2.1. Removing the old rope	45
5.2.2.2. Mounting the new rope.....	46
5.3. ASSEMBLAGE OF NEW ROPE GUIDE AND MAINTENANCE DURING OPERATION.....	46
5.4. OPERATION AND MAINTENANCE OF ELECTRIC MOTORS WITH BUILT - IN BRAKE	48
5.5. MAINTENANCE OF THE PLANETARY REDUCER	49
5.6. MAINTENANCE OF THE TRAVELLING MECHANISM.....	50
5.7. EXPLOITATION AND CHECKING OF THE ROLLER BLOCK AND THE LOAD HOOK.....	50
5.8. INSPECTION AND MAINTENANCE OF THE CLUTCH	50
5.9. ANTIFRICTION BALL - AND NEEDLE BEARINGS	51
5.10. BEARING SCREW JOINTS.....	51
5.11. CONTROL BLOCK	52
5.12. LUBRICATION	53
5.12.1. Lubrication scheme	53
5.12.2. Recommendable materials.....	54
5.13. POSSIBLE FAILURES IN THE ELECTRIC EQUIPMENT AND METHODS REMOVAL.....	56
5.14. NOISE DATA	57
6. STEPS TO ATTAINMENT OF SAFE WORKING PERIODS.....	58
6.1. KEEPING RECORDS OF THE PROCEDURES	60
6.1.1. Keeping records by storing operation duty data (Class 1)	60
6.1.2. Keeping records of operating hours by timers and furnishing documentary evidence of the loading conditions by the user (Class 2)	60
6.1.3. Keeping record of operating hours and loading conditions by the user (Class 3)	60
6.2. DETERMINING THE ACTUAL OPERATION PERIOD	60
6.2.1. The actual operation period is defined acc.to 6.1.1	60
6.2.2. Determining the actual period of operation when keeping records according to 6.1.2 and 6.1.3	60
6.2.2.1. Method coefficient of record keeping	60
6.2.2.2. Determining of operating duration	61
6.2.2.3. Determining the actual coefficient of loading mode <i>Km</i>	61
6.3. OVERHAUL	64
7. ENVIRONMENTAL PROTECTION	65
7.1. AFTER UNPACKING	65
7.2. REPAIR OPERATIONS	65
7.3. PRODUCT REJECTION.....	65
Form 1 REGISTER FORM FOR CALCULATION OF EACH INSPECTION PERIOD	66



The technical data of each electric hoist is given in its passport - a separate document to which the present manual is enclosed.

1. GENERAL SAFETY REQUIREMENTS



Read and study the present document prior to putting the electric hoist into operation!

1.1. GENERAL REQUIREMENTS TO THE CUSTOMER

- To ensure the good working order and reliable operation of your hoist keep strictly to the requirements for maintenance and operation given in this Manual.
- Keep strictly to the requirements for safe operation in order to prevent dangers for the personnel and damages of the electric hoist.
- The repairs shall be furnished only with spare parts supplied by the manufacturer and ordered acc.to the spare parts catalogue, enclosed with the passport.
- The connection of the electric hoist with the power supply shall be furnished only by an qualified electrician acc.to p.4.3.
- Assemblage and putting the electric hoist into exploitation shall be done by qualified persons, authorized by BALKANCARPODEM – Sofia.
- Apart from this manual during assemblage and operation the requirements of the corresponding country's normative documents requirements for safe operation of electrical and lifting appliances shall be observed.
- The safe operation requirements in this Manual are in accordance with the following European norms:
 - Machine Directives 89/392 EWG, 91/368 EWG, 93/44 EWG, 93/68 EWG
 - EN 292-1:1991 Sicherheit von Maschinen
 - EN 292-2:1991 Sicherheit von Maschinenand with those valid in Germany:
 - VBG 8 Winden, Hub und Zuggeräte
 - VBG 9 Kräne
 - VBG 9a Lastaufnahmeeinrichtung im Hebezeugbetrieb
 - DIN 15018 Grundsätze für Stahltragwerke
 - DIN 15020 und FEM Grundsätze für Seiltriebe
 - DIN EN 60294-1:1992 (VDE 0113, Teil 1) Sicherheit von Maschinen
 - DIN IEC 44 (Sec) 170 (VDE 0113, Teil 32) Sicherheit von Maschinen

1.2. GENERAL SAFE OPERATION REQUIREMENTS



Nevertheless that in the corresponding sections there are given some directions for safe operation the following specific requirements shall be observed:

1. Lifting and moving of loads over the personnel is not allowed.
2. Check the state of the rope and if necessary discarded it. While replacing it with a new one, make sure its both ends are tightly secured.
3. After each rope replacement as well as after repair and re-assembly of the electric hoist check the phasing and the limit switch adjustment for upper and lower position of the loading hook (p.4.4).
4. At reaching the maximum permissible axial stroke of the electric motor rotor, readjust the brake (p.5.4)
5. While carrying maintenance and repair activities on the electric, make sure that: there is no load on the hook; the power supply switch is turned off and unauthorized switching on is eliminated.
6. Check the loading hook for cracks and deformations as well as the good working order of the fuse for self-release of the load.
7. Check the bearing screw joints for avoiding eventual their self-unwinding.
8. Check the reliable connection of cable protective conductors to the grounding terminals in the electric board as well as the transformer and the electric.
9. When a traveling mechanism is used, put at both ends of the rail track buffers to limit its movement.
10. In all cases of disassembly of the push button cover the outer surfaces of the metal screws which fasten its housing with electrical insulating material.
11. Daily, before starting work, check the operation of the brake and the limit switch.
12. Do not use the limit switch as an operational one in any case.
13. Do not leave the lifted load out of sight.
14. Do not exceed the rated capacity.
15. Do not lift loads at an angle and do not drag them.
16. Do not try to detach firmly fixed loads (e.g. frozen to the ground).
17. End positions in vertical and horizontal movement can be used only if an operating limit switch. Is provided.

2. PURPOSEFUL UTILIZATION

2.1. DESIGNATION

The MH electric hoist is designed to be operated as independent load-lifting devices or as units to be implemented in other material handling equipment. They either stationary or movable, designed to operate indoors or outdoors under shelter, while observing the operation and overloading conditions as stated in the passport of the unit.

The electric hoist is not designed to operate in chemically aggressive and explosive environment.

The possible hazards have been considered and eliminated in the construction process and the customer is notified thereof by the present Manual by the safe operation instructions according to the requirements of VBG9 and VBG8. For further facilitation of the customer, excerpts of VBG9 and VBG8 are cited in p.4 and 5 of the present Manual.

■ Use the electric hoist purposefully only and with regard to the technical data given in the passport. Each deviation implies residual risks.

■ Observe the prescribed operation modes. Do not use heavier modes than indicated.

■ Maintenance and repair works shall be carried out only by persons whose qualification complies with the requirements of the respective country's requirements for work with material-handling equipment.

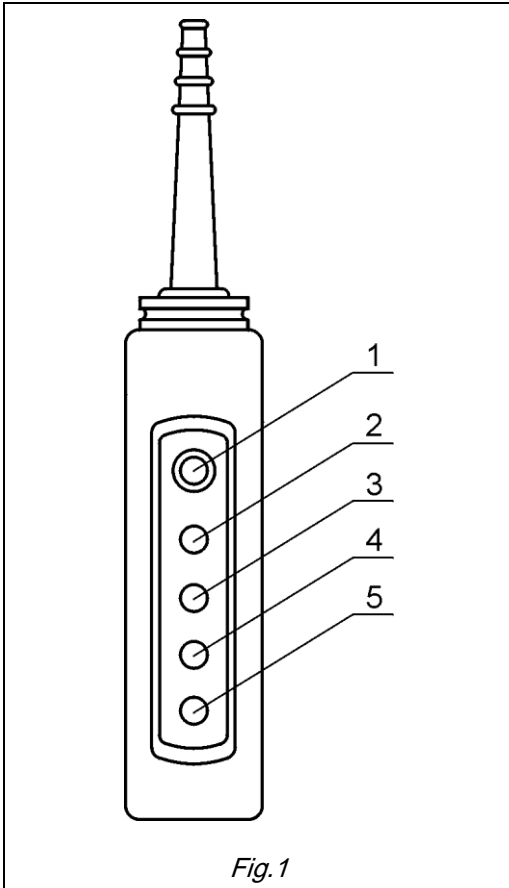
■ Ensure the observance of all requirements for safe operation and the related: assemblage, initial putting into operation, maintenance and servicing, laid down in: the present Manual, the normative documents cited herein, the European normative documents, the respective country's normative documents.

Regularly fill in the diaries related to inspections (p.4 and 6). Timely carry out the inspections according to VBG9 §26 and VBG §23.

■ If load-gripping devices are used, they must be operated, maintained and tested in accordance with manufacturer's directions as given in the Operation Manual, VBG 9a or corresponding normative documents of the respective country.

■ Do not change or modify the electric diagram. Do not use the push buttons and limit switches for other purposes but indicated.

2.2. ELECTRIC HOIST CONTROL



Usually the STOP-button (Pos. 1) is at the top and then follow the buttons:
 2 - LIFT;
 3 - LOWER;
 4 - LEFT movement;
 5 - RIGHT movement.

Different arrangements are also possible.

Next to the buttons is located the marking, clarifying their action, in accordance with FN E 52-124. Fig.1 shows a push button for electric hoist with travel mechanism. When the latter is not provided the push button contains 3 buttons - poss. 1, 2 and 3.

The lifting mechanism as well as the travelling one can be with single- or double-speed electric motors.

The speed of the single-speed motor is regarded as the basic one. The double-speed motors have basic speed and micro-speed. The combinations are given in p.4.3.1.

In the double-speed case, for movement in a certain direction, the same button, which is dual-acting, is used: with actuating the first stage the movement is effected at basic speed and with actuating the second stage - at micro-speed.

The button designations are shown in Table 1.

Table 1

Pos. (fig.1)	Modification	Designation acc.to FN E 52-25	Button function
1	1	0 ○	STOP-button
2	1	↑↑ ○	Lifting the load at basic speed
	2	▲ ○	Lifting at basic and micro-speed
3	1	↓↓ ●	Lowering at basic speed
	2	▼ ●	Lowering at basic and micro-speed
4	1	← ●	Left movement at basic speed
	2	◀ ●	Left movement at basic and micro-speed
5	1	→ ●	Right movement at basic speed
	2	▶ ●	Right movement at basic and micro-speed



On customer's request different button marking may be arranged.

3. TECHNICAL DESCRIPTION

3.1. DESIGNATION OF THE ELECTRIC HOISTS

EK N 20 MH 6 - 25 4/1 H6 V4/1

V4/1 - Lifting speed, m/min

Size	V1			V2		
	1/1, 2/2	2/1, 4/2	4/1	1/1, 2/2	2/1, 4/2	4/1
Lifting speed (50 Hz): basic/micro, m/min						
MH 3						
MHM 4	16	8	4	24	12	6
MHM 5	16/4	8/2	4/1	24/4	12/2	6/1
MH 6						
MH 7-25	16	8	4			
MH 7-32	16/4	8/2	4/1	-	-	-
MH 7-40						
MH 7-50	12,5 12,5/3,2	6,3 6,3/1,6	3,2 3,2/0,8	-	-	-
MH 7-63	10,5 10,5/2,6	5,2 5,2/1,3	2,6 2,6/0,65	-	-	-

H6 - Lifting height, m

4/1 - Reeving

1/1	2/2	2/1	4/2	4/1
-----	-----	-----	-----	-----

25 - The effort in the rope (ropes) from the drum, kN

6 - Size

MH - Electric rope hoist, type MH or MHM

20 - Traveling speed, m/min

Basic	8	10	12	15	20	32
Basic / Micro	-	-	12/4	15/5	20/6	32/10

Traveling mechanism

N - Monorail trolley normal headroom

K - Monorail trolley low headroom

D - Double rail crane trolley

Type of traveling mechanism

EK - Electric trolley

RK - Hand trolley

SK - Free trolley

Extras (p. 3.5.3):

- Voltage and frequency;
- Load limiter;
- Thermo-protection;
- Emergency button;
- Latch-key.

3.2. ROPE ELECTRIC HOIST CLASSIFICATION ACCORDING TO LOAD MODE

Table 2

Type of loading				Mean working time per day [hours]		
1. Light				2 ÷ 4	4 ÷ 8	8 ÷ 16
2. Medium				1 ÷ 2	2 ÷ 4	4 ÷ 8
3. Heavy				0,5 ÷ 1	1 ÷ 2	2 ÷ 4
4. Very heavy				0,25 ÷ 0,5	0,5 ÷ 1	1 ÷ 2
Operation duration, %				30	40	50
Frequency of switching, h ⁻¹				180	240	300
Operation mode group		FEM 9.511 / DIN 15020		1Am	2m	3m
		ISO 4301/1		M4	M5	M6
Capacity, kg, for reeving:				Modification		
1/1, 2/2	4/2, 2/1	4/1	Size			
400	800	1600	MH 3 MHM 4 MHM 5	-		MH 3-04 MHM 4-04 MHM 5-04
500	1000	2000		-	MH 3-05 MHM 4-05 MHM 5-05	-
800	1600	3200	MHM 4	-	-	MHM 4-08 MH 6-08
1000	2000	4000	MH 6	-	MHM 4-10 MH 6-10	-
1250	2500	5000	MHM 5	-	-	MHM 5-12 MH 6-12
1600	3200	6300	MH 6	-	MHM 5-16 MH 6-16	-
2000	4000	8000	MH 6	-	-	MH 6-20 MH 7-20
2500	5000	10000	MH 7	-	MH 6-25 MH 7-25	-
3200	6300	12500		-	MH 7-32	-
4000	8000	16000		MH 7-40	-	-
5000	10000	20000		-	MH 7-50	-
6300	12500	25000		MH 7-63	-	-

3.3. CLIMATIC MODIFICATIONS OF THE ELECTRIC HOISTS

The climatic modifications of the electric hoist of BALKANCARPODEM - Sofia are in accordance with IEC 721-3 (DIN IEC 721T3) for climatic zones according to IEC 721-2-, p.5.3, and are shown in Table 3.

Table 3

Nr	Climatic zones	Climatic modifications Category acc.to the location in operation	Designation
1	normal	for operation under shelter	N - II
2	cold	for operation under shelter	F – II
3	tropical	for operation under shelter	T – II
4	marine	for operation under the provisions of the Marine Register	M – II

The term “under shelter” denotes that there is no direct, or there is considerably reduced, impact of the sun radiation and precipitation on the article.

The climatic modification is indicated in the item’s passport.

The articles are ensured against penetration of small particles or liquids according to IEC 529, DIN 40050 and EN 60204-1:1992. The protection degree is given in the article and cannot be lower than IP65 for the push button, IP54 for the electric panel and electric motor terminal box.

3.3.1. Electric hoists for normal climatic zone

The electric hoists for normal climatic zone operate in the following environmental conditions: air temperature from -20°C to $+40^{\circ}\text{C}$; relative air humidity – from 30% to 95%; sea level – up to 1000 m. These conditions correspond to the requirements of EN 60204, p.4.4.

If the sea level is over 1000 m the reduced cooling due to air rarefaction is considered to be compensated by the diminishing of the maximum temperature. For insulation class F of the electric motor the admissible environmental temperature is in dependence with the sea level:

Sea level	from 1001 to 2000	from 2001 to 3000	from 3001 to 4000
Air temperature, $^{\circ}\text{C}$	+30	+19	+9

At sea level over 2000 m bear in mind the aggravated conditions for arc-extinguishing in the commutation equipment.

3.3.2. Electric hoists for cold climatic zones

These electric hoists operate in the following environmental conditions: air temperature from -40°C to $+40^{\circ}\text{C}$; relative air humidity - from 30% to 95%; sea level - up to 1000 m.

3.3.3. Marine electric hoists

The electric hoists produced in accordance with the Marine Register are intended for repair and assembly activities in machine departments of vessels. Not intended to operate on deck.

They are protected against the influence of bioactive factors and air, containing sea salts, and are designed to operate at high relative humidity up to $95\pm 3\%$ at air temperature $+40^{\circ}\text{C}$. The temperature range is from -20°C to $+40^{\circ}\text{C}$, the sea level - up to 200 m.

The constructive difference between normal and marine hoists lies in the usage of insulation materials, protective varnishes and metal coatings, suitable for the marine climatic zone.

The details are protected against corrosion by metal and varnish coatings.

The electric motors and the control blocks are worked out in compliance with the Marine Register requirements. The insulation materials are humidity- and heatproof and of respective mechanical strength. The protective and the impregnating varnishes and enamels are humidity- and heatproof as well.

As a whole unit the electric hoist is intended for operation in environmental conditions with the next features: vibrations, prolonged swinging along or across the hoist axis, jars.



The electric hoists produced acc.to the Marine Register which are included in ship material handling equipment must be provided with fixing devices that guarantee the attachment of the travelling mechanism to the monorail track when the electric hoist is not in operation.

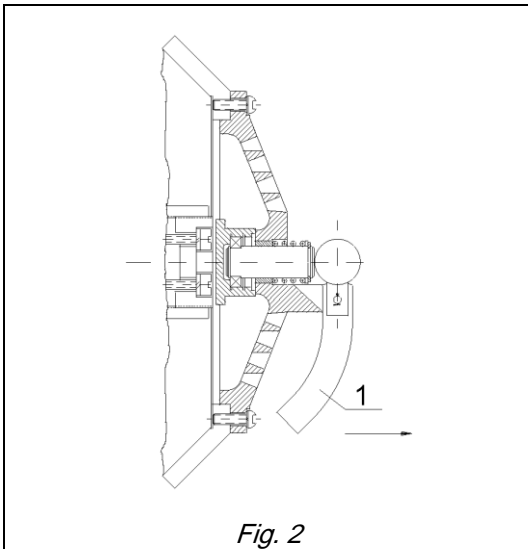


Fig. 2

Place a device on the electric motor shield (fig. 2) by which you can lower the load when there is power supply breakage.

3.3.4. Tropical electric hoists

They are designed to operate at temperature range from -20°C to $+40^{\circ}\text{C}$, relative humidity from 30% to 95%.

The constructive difference between normal and tropical hoists lies in the usage of insulation materials, protective varnishes and metal covers which are suitable for the tropical climatic zone.

For the mechanical parts of the hoist metals and alloys with increased corrosion resistivity are used. All other metal details are protected against corrosion by special coverings.

The electric motors and the control blocks are acc.to IEC721 with climatic protection T, class II. The insulation materials are humidity- and heat-proof and have the necessary mechanical strength. The protective and impregnating varnishes and enamels are also humidity- and heat-proof; they form firm coatings and possess the required elasticity. The electric motors and control blocks are intended for operation in environmental conditions with the next features: high humidity, availability of biological factors, air saturated with dust, sand fractions and aerosols.

3.4. POWER SUPPLY

The power supply network for the electric hoist is of three phases, rated voltage 380V and rated frequency 50Hz, which is in compliance with DIN 0530, Part 1, §50.

On customer's request the electric hoists may be worked out for different ratings, as the voltage may be up to 660V.

In accordance with the Bulgarian standards the electric motor ensures normal operation of the lifting and travelling mechanisms with rated load when the power supply ratings are as follows:

- voltage: $\pm 10\%$ of its rated value and frequency: $\pm 5\%$ of its rated value;
- at simultaneous deviation of voltage and frequency, the sum of the absolute values of the deviations shall not exceed 10%.

The electric hoist can operate in accordance with the requirements of VDE 0530 §11b and IEC 34-1, p.12.3, which define lower range of deviations.

3.5. DESCRIPTION OF THE ELECTRIC HOIST

Generally, the electric hoist consists of two modules - lifting mechanism and travelling mechanism.

Two constructive modifications are available:

a) stationary hoists - fixed to a plane and consists of a lifting mechanism only;

b) movable hoists - include - lifting mechanism and travelling mechanism

Regarding the mutual allocation of the lifting mechanism and the travelling mechanisms two modifications are available:

- electric hoists with normal headroom where the lifting mechanism is situated under the travelling mechanism;

- electric hoists with low headroom where the lifting mechanism is situated sideways of the travelling mechanism. This enables the distance from the place of suspension of the load on the hook to the surface of rolling of travel wheels (headroom) to be diminished.

3.5.1. Lifting mechanism

The lifting mechanism consists of the following constructive blocks (fig.3):

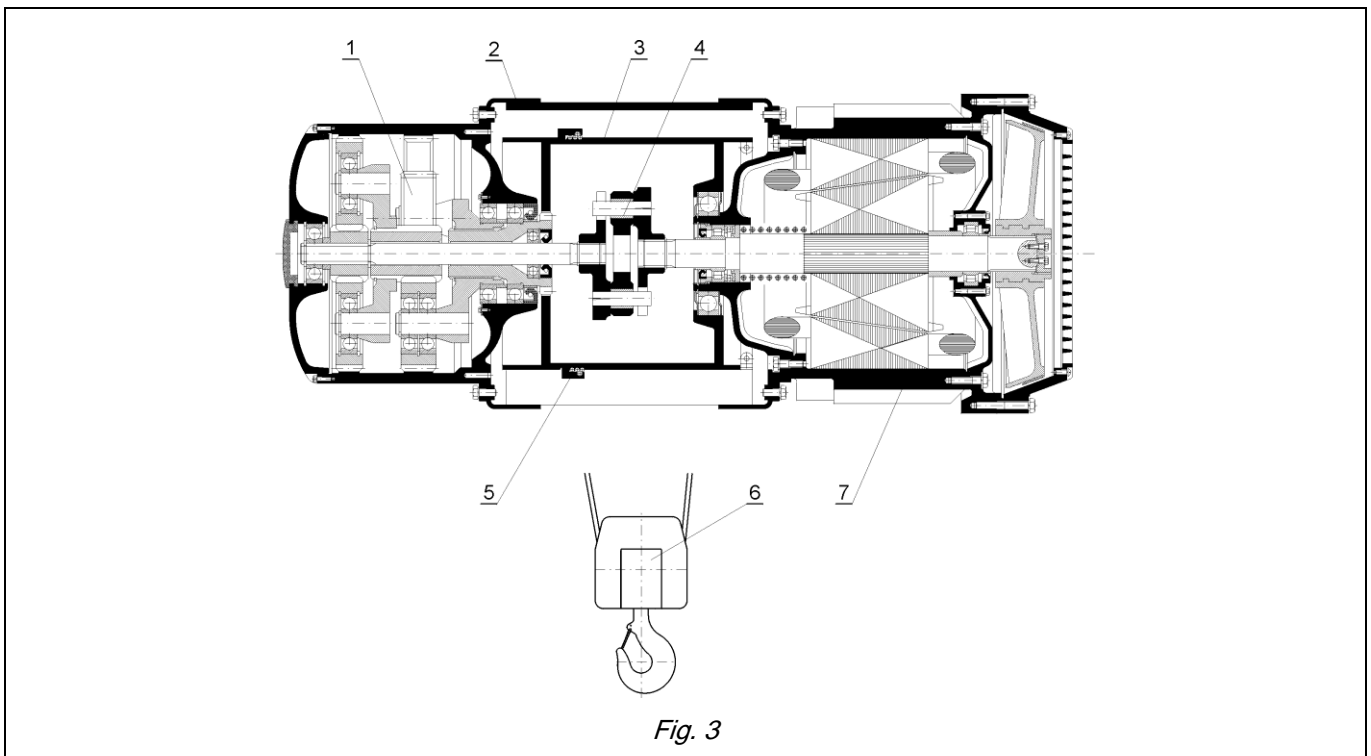


Fig. 3

- 1 - Planetary reducer
- 2 - Body housing
- 3 - Drum with a rope
- 4 - Clutch
- 5 - Rope guide
- 6 - Roller block-hook
- 7 - Electric motor with a built-in brake

3.5.1.1. Electric motor with a built-in brake

For actuation of the lifting mechanism an induction electric motor is used with a conical rotor and a built-in conical brake working under the influence of a helical spring. Releasing the brake is done by axial shift of the rotor after voltage feed (supply) in the electric motor when apart from the torque in the electric motor an axial electromagnetic force rises that draws the rotor to the stator.

By using two-speed electric motors there is a possibility for micro speed of hoisting.

On customer's request the electric motor can be with thermal protection which is built in the stator windings.

3.5.1.2. Elastic clutch

The transmission of the electric motor torque to the gear box shaft is done by axial compensating elastic clutch which ensures axial shift of the rotor at minimum resistance.

3.5.1.3. Planetary reducer

The reducing of the high revolutions of the electric motor to the revolutions necessary for the drum is done by two-stage planetary reducer. Its position outside the drum gives a possibility for a review and convenience during assembly and disassembly to the housing of the electric hoist.

Gear wheels of separate transmissions in the gear box are made from high-grade steels with appropriate heat treatment. They are camped on rolling ball-bearings and are oil-lubricated.

3.5.1.4. Drum

The drum of the lifting mechanism is activated by evolvent groove connection centrally with the help of a hollow shaft coming from the planetary reducer. This shaft and the guiding plate II degree are camped on rolling bearings which support the drum from the side of the reducer by means of groove connection. From the other side it is camped on the front shield of the electric motor.

Screw grooves for arrangement of the rope are manufactured with the corresponding profile in accordance with FEM and DIN requirements.

3.5.1.5. Rope guide

It consists mainly of two functional elements - guiding nut and a pressing spring by means of which the guiding and proper arrangement of hoisting rope over drum grooves is ensured.

3.5.1.6. Body

The joining link and the bearing part of the lifting mechanism - the housing represents an integral welding structure formed by two steel flanges connected with profiled longitudinal beams.

Accepted geometrical shape is convenient for building in electric hoists in different appliances without any additional elements and ensures many possibilities for the loading rope to go out of the drum.

3.5.1.7. Block - hook

The structure of the block hook at different numbers of rope falls ensures the necessary reliability at rending tension from the load through the hook and the bearing elements to the sections of the loading rope. Semi-lids of the block cover the rollers and have the necessary hardness and strength against impact with stationary solid objects.

The diameter, the groove of the roller and the dimension of the hook are chosen in accordance with FEM 9.661 and FEM 9.511, respectively DIN 15020.

3.5.1.8. Control block

Control block represents a separate assembly unit including circuit closers for control of the lifting mechanism and traveling mechanism, reducing transformer, push button and some other elements concerning special executions (main circuit closer, rectifier for the auxiliary brake, electronic block for the load limiter, etc.).

Normally electric power supply of the electric hoists is 380V at frequency 50 Hz. On customer's request they can be manufactured for other voltages and frequencies.

The voltage used in the operating circuit is safe - 42 V obtained by means of reducing transformer.

Control is executed by pendant push button in which electric and mechanical interlock among the buttons for various of movements of the lifting mechanism and the electric trolley is provided.

For protection against short circuit in the operating circuit a safety fuse is provided. On customer's request two fuses can be provided. In the same circuit the limit switch is connected for both directions of movement of the hook. When the first stage of the switch for a given direction is actuated the movement of the hook in the opposite direction is not blocked and actuating the second stage blocks the movement in both directions because the main contactor switches off.

A latchkey for switching of the operating circuit is provided in the electrical equipment of the electric hoist.

3.5.2. Traveling mechanism

Depending on the exploitation needs to the lifting mechanism a mechanism for horizontal movement of the load on monorail and double rail tracks can be assembled with the following suspension:

- a) Stiff suspension - normal headroom at number of rope falls 2/1 and 4/1 the lifting mechanism is assembled under the travelling mechanism (fig. 4 A);
- b) Swinging - the lifting mechanism swings in certain limits around an axis parallel to the monorail track (fig. 4 B);
- c) Joint - in addition apart from the lifting mechanism the travel wheels pairs can rotate around an the vertical axis (fig. 4 B I);
- d) Stiff suspension - 2/1 and 4/1, low headroom – the lifting mechanism is assembled laterally to the rail track. Thus decreasing of the headroom is achieved (fig. 5);
- e) Lifting mechanism with double rail trolley (fig. 6).

In the fig. 4 the construction of normal headroom hoists is shown. It consists of: electric motor (2), reducer (3), driving block (4) and driven block (5).

The lifting mechanism (1) is fixed to the travelling mechanism by the frame (8). Some electric hoists are provided with two travelling mechanisms (poss. 7 and 9).

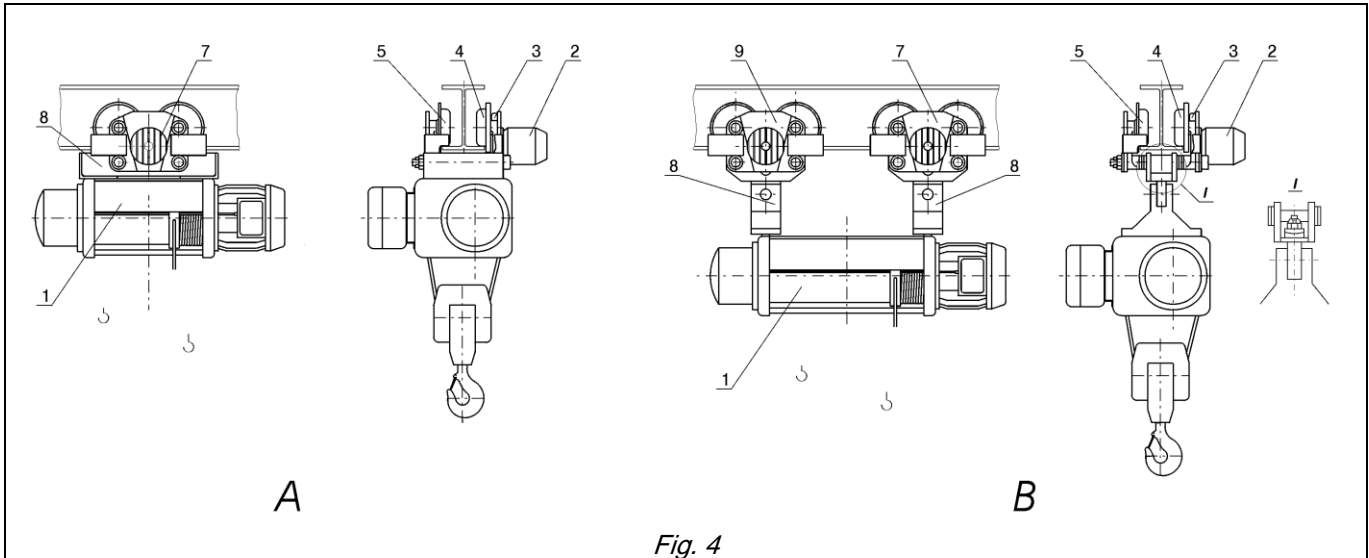


Fig. 4

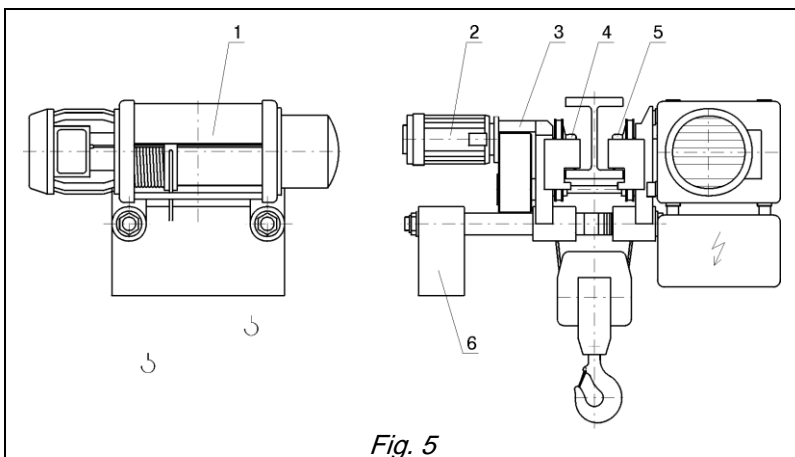


Fig. 5

For the low headroom hoists (fig. 5) a box with counterweight is provided (6).

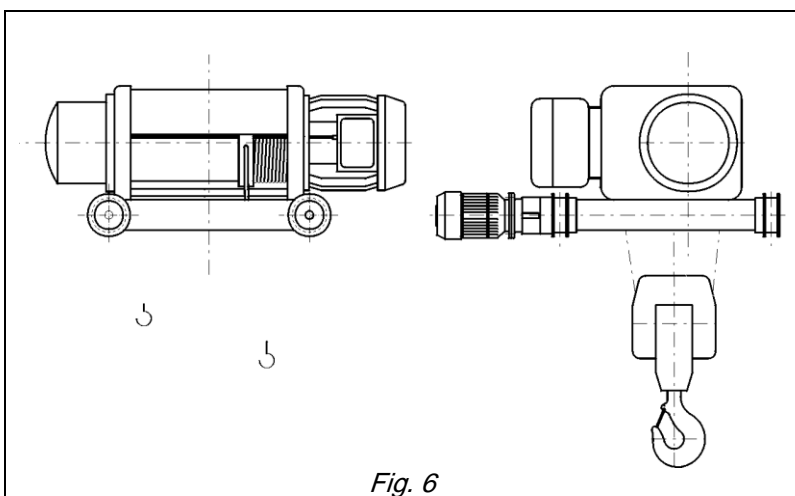


Fig. 6

Double rail trolley (fig. 6).

3.5.3. Extras

On customer's request the electric hoists may be supplied with: latch key, thermo-protection, load limiter, emergency button.

3.5.3.1. Latch key

Intended to protect the hoist against unnecessary operation.

3.5.3.2. Thermo-protection

To the windings of the lifting motor some thermostats are built in - one per each phase and winding (three for single-speed electric motors and six for double-speed ones).

The thermostat is bimetallic, electrically isolated from the winding. When the pre-set temperature depending on the insulation class is reached, the thermostat actuates and switches off its normally closed contacts. The contacts of the three (for singlespeed motors), respectively, of the six thermostats (for doublespeed motors) are connected in series. Thus when at least one thermostat actuates it will block the lifting. The only possible motion is lowering. When the electric motor cools off the lifting will be possible again.



If the thermo-protection actuates and the lowering of the load is indispensable, it must be done at the higher lowering speed with minimum switching.

3.5.3.3. Load limiter

The load limiter is intended to block the operation LIFT if the load exceeds the rated one by more than 10%.

Having in mind all different models of load limiters in usage there is a special Operation Manual for them.

3.5.3.4. Emergency button

Intended to switch off the main contactor Q (figs.11 to 16) when emergency situations occur.

4. ASSEMBLAGE AND PUTTING THE ELECTRIC HOIST INTO MOTION



Before starting works to assemble and put the electric hoist into motion, carry out an outer inspection for eventual mechanical and other damages due to shipment.

4.1. REQUIREMENTS TO THE ASSEMBLAGE

When designing and planning the location of the electric hoist keep to the safety requirements. According to VBG9 §11 for avoiding the hazard of bruising and cutting, the external parts of the electric hoist, excluding the bearing parts, must be situated at least 0,5 m away from other parts, such as buildings or parts of buildings, columns, pipes, machines, materials on stock, etc.

Some quotations from VBG9 and VBG8, related to the assemblage, are given in table 4.

Table 4

Requirement	Document	Quotations from the source
Safe distances	VBG9	§32 The contractor shall make sure that for the rail and stationary cranes at least 0,5 m safety distance be kept between the outer movable crane parts and the stored materials.
Assemblage	VBG9	§40 /1/ The contractor shall make sure that movable cranes be used only on load-bearing base /3/The contractor assigns a person in charge who will control the dismounting of the movable cranes for transportation with regard to their weight and sizes acc.to Assembly Manual
	VBG8	§25When assembling the mechanisms their control place should be situated or safeguarded in such a way, so that the operator won't be endangered neither by the mechanism, nor by the load-bearing means or the load.
	VBG8	§31 If the operator leaves the mechanism control place with load hanging from the former, the dangerous zone under the load must be safeguarded



Ensure free passage (path) for the person, controlling the electric hoist from the floor.

4.2. SHIPMENT AND STORAGE

4.2.1. Packing

The wooden packing ensures the electric hoists against mechanical damages and the influence of the climatic factors for during shipment and storage.

The packing is in accordance with the type of the vehicle and the climatic zones of the countries (classified acc. to IEC 721-1-2), across which the machine is shipped.

When handling the packed article observe the following requirements: The boxes shall lie only on their base; shall be stored in dry premises only; shall be gripped at the indicated places (when using load-gripping devices). These requirements are indicated on the box sides by relevant signs.

4.2.2. Shipment

When shipping the electric hoists do not put other loads on.

Place the cases with electric hoists tightly in the vehicle or fasten them by additional means.

The vehicles shall be covered.

The shipping and storage conditions are in accordance with EN 60204-1:1992:

Temperature range: -25°C to +55°C as for a short term (up to 24 hours) it may reach 70°C.

4.2.3. Unpacking

Carefully dismount the wooden case, release the two bands fixing the polythene stuff to the article (the bands are around the reducer and the electric motor). Remove the polythene stuff. Unscrew the screws fixing the article to the wooden case base. Make sure the push button, control cable and hook with roller block will not be damaged.

4.2.4. Storage

Store the articles, packed and conserved, in storehouses. The conservation conditions for normal climatic zones are in accordance with EN 60204-1:1992, p.4.5.

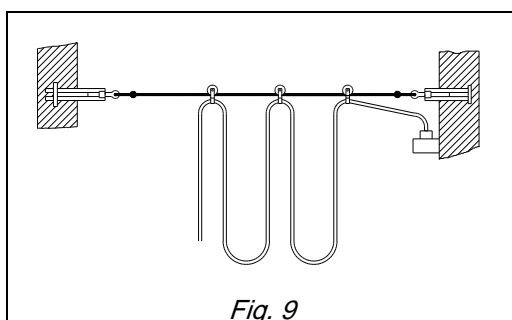
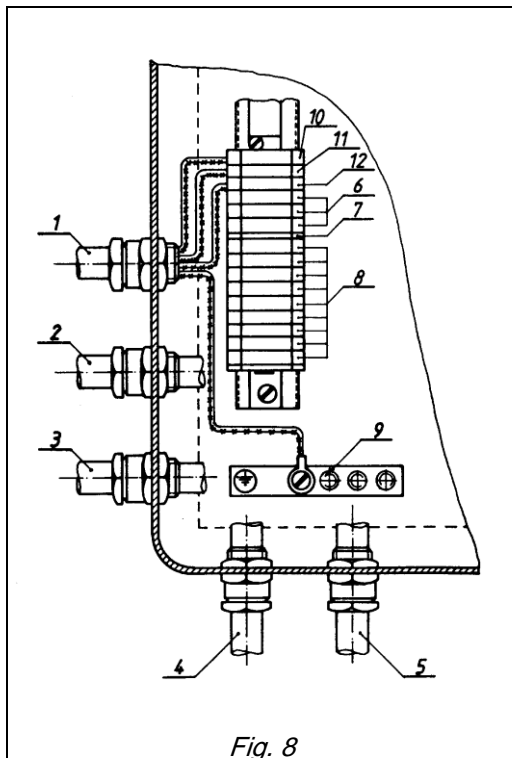
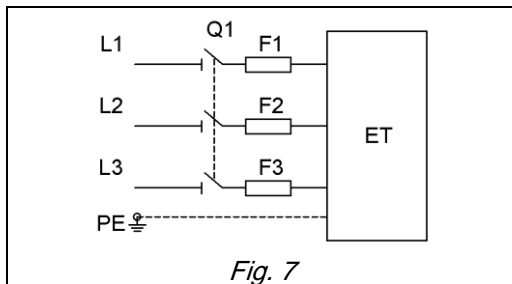
Non-packed electric hoists may be stored only in productions halls or sheltered storehouses of humidity according to p.3.3.

An article that has been in operation may be stored only after conservation.

4.2.4.1. Conservation

- a) conservation of electric hoists for normal climatic zones** Grease all unprotected metal parts with consistent grease Aralub FDPO, BP Energrease HT-EROO or compatible.
- b) Preservation of marine and tropical electric hoists** If the marine and tropical electric hoists will not be operated more than 3 months an obligatory conservation of the surfaces subject to corrosion shall be carried out.
- The premises, where the conservation takes place, should be clean, dust-free and without vapours. The temperature should be in the range +10°C to +25°C and the relative air humidity - 50-60%. Before beginning of conservation, the article must stay in a room for some hours in order to avoid condensing of moisture on its surfaces.
- The quality of the conservation depends strongly on the cleanness of the surfaces before laying on the conservation material. All traces of rust and remainders of paint, grease, moisture, dust and other impurities must be totally removed.
- To reduce the influence of aggressive climatic factors the conservation must always be followed by packing of the item.
- For the tropical and marine electric hoists and for their spare parts the following conservation materials are to be used
- For period up to 3 years - sodium nitrate
- The water solution of sodium nitrate (20-25% for steel and 25-30% for cast iron) must be laid on the cleansed surfaces, greases and when it dries up, the conservation grease must be laid on.
- Use the following conservation greases: GOI-54 (GOST 3276-54), CIATIM 201 (GOST 6267-74), AMC-3 (GOST 2712-52), Arlaub FDPO, BP Energrease HT-EPOO, Esso Getriebfließfett, Shell Special H, Mobil Gargoyle Fett 1200 W.
- Lay on the cleansed surfaces the following conservation greases: GOI-54 (GOST 3276-54), CIATIM 201 (GOST 6267-74), AMC-3 (GOST 2712-52), Arlaub FDPO, BP Energrease HT-EPOO, Esso Getriebfließfett, Shell Special H, Mobil Gargoyle Fett 1200 W.
- For period up to 1 year
- Lay on the cleansed surfaces the following conservation greases: CIATIM 203 (GOST 8773-58), CIATIM 221 (GOST 9433-60).
- Before usage all conservation greases must be heated to temperature of 110°C-120°C, then they must be left to cool off for about 1,5-2 hours to enable releasing any available moisture.
- Lay on the conservation greases by means of brushes or by special revolver oil gun, provided with heating device. Best results are achieved by using oil guns. When laying on the greases by brush the layer must be dried up with hot gases, by a benzine lamp for example. Make sure that the greases are treated by the gases only, not by the flames. Only in this case the quality of the conservation may equal to the one, obtained by the usage of revolver oil gun.
- It's very important that all operations related with the conservation - cleansing, conservation material laying on and packing be carried out in immediate sequence without time gaps between them.

4.3. CONNECTION WITH THE ELECTRIC NETWORK



Before coupling check if the voltage and frequency, indicated on the nameplate, are in compliance the ratings of the electric network to which the hoist is going to be connected.

The electric hoist should be connected and put into motion according to the attached wiring diagram. Before doing this you must check if the voltage and frequency indicated on the nameplate meet the requirements of the electrical network to which the hoist is going to be connected.

The electric hoist is connected to the power supply by the circuit breaker Q1 and the safety fuses F1, F2 and F3 (fig. 7). The function of the circuit breaker is to break off the unloaded electric circuit when inspection and maintenance activities are executed.

The circuit breaker is so selected as to ensure breaking of all the poles.

To secure against its improper or unnecessary usage it's recommendable to place it in the electric board of the working place or to be mounted in some unaccessible place.

The power supply cable is connected to the hoist as shown on Fig. 8: the three phases of the power supply cable 1 are connected to terminals, marked as positions 10, 11 and 12 and marked with symbols L1, L2 and L3. The power supply cable is fixed to clamp 13.

The rest connections between the separate electric modules are made by the manufacturer as follows: cable to the electric motor of the hoisting unit, cable to the control switch 4, cable to the load limiter 5. Terminals 6 represent the connections of the power supply circuit, terminals 8 - of the operating circuit. Separating plate 7 is placed between the terminals of the power supply circuit and the operating circuit.

The current carrying from the circuit breaker to the hoist is done by cables (fig. 9). The recommended cable is SKPT (BDS 1473-80) which is with increased resilience against mechanical loading. The cable may be chosen acc. to DIN VDE 0100, part 726 requirements or some compatible one as well.

The recommended cables are with increased resilience against mechanical loading.

As movable cables may be used:

- H07RN-F according to DIN 0282 part 810;
- NGFLGou according to DIN 0250, part 809;
- compatible with these.

As stationary cables the following may be used:

NYM according to DIN VDE 0250, part 204; NYY according to DIN VDE 0271 or compatible.

In Table 5 the necessary rated currents of the main safety fuses are given as well as the supply cable cross section for coupling to the electric network.

Table 5

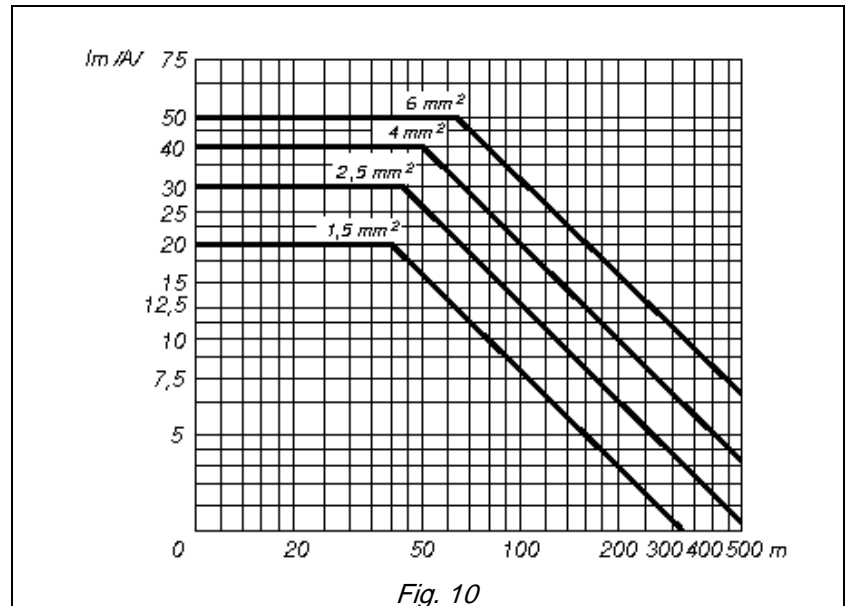
Size	Electric motor (Types)	Safety fuses rated current (A)			Supply cable maximum length, m								
					500 V		380 V			220 V			
		500 V	380 V	220 V	2,5 mm ²	4 mm ²	2,5 mm ²	4 mm ²	6 mm ²	2,5 mm ²	4 mm ²	6 mm ²	10 mm ²
Single-speed													
MH 3	KG 1608-6	6	10	16	198	-	115	-	-	38	-	-	-
	KG I 1608-4	10	16	25	135	-	78	-	-	26	-	-	-
MHM 4	KG 2008-6	10	16	25	111	-	65	-	-	21	33	-	-
	KG I 2008-4	16	20	35	80	-	46	-	-	15	24	-	-
MHM 5	KG 2011-6	16	20	35	88	-	51	82	-	17	27	40	-
	KG I 2012-4	25	35	63	48	-	28	45	-	10	16	24	-
MH 6	KG 2412-6	35	50	80	48	78	28	44	67	-	15	22	35
	KG I 2714-4	50	63	100	29	47	17	27	41	-	-	16	22
MH 7	KG 2714-6	50	80	125	25	40	-	22	35	-	-	11	18
Double-speed													
MH 3	KG I 2110-24/6 CT100LB-12/4BR II	10	16	25	135	-	78	-	-	26	-	-	-
	KG I 2110-24/4	10	16	25	128	-	75	-	-	25	40	-	-
MHM 4	KG I 2612-24/6 P160 M4-24/6	16	20	35	80	-	46	-	-	15	24	-	-
	KG I 2612-24/4 P160 M4-24/4	25	35	50	54	-	32	50	-	10	16	24	-
MHM 5	KG II 2714-24/6 P160 M5-24/4	16	20	35	73	-	53	85	-	17	27	40	-
	KG II 2714-24/4	35	50	80	42	67	24	40	67	-	13	19	30
MH 6	KG I 3317-24/6 P200 M6-24/6	50	63	100	29	47	17	27	41	-	-	16	22
	KG I 3317-24/4 P200 M6-24/4	80	100	160	18	29	10	17	25	-	-	8	14
MH 7	KG 3517-24/6 P200 M7-24/4	50	80	125	25	40	-	22	35	-	-	11	18

Data in Table 5 apply for network frequency both 50 and 60Hz.

For voltages different from these in Table 5 apply the following approach:

The rated current of the fuses and is defined depending on the total current I_M , obtained by summing the rated currents of all electric motors as stated on their factory nameplates or the hoist passport. The length L_k and cross-section of the supply cable are defined in the following way:

- having in mind the total current calculate the cable cross-section and choose the nearest higher standard value;
- define the cable length according to the minimum voltage drop requirement.



- obtained total current is recorded on the vertical axis (current scale) on the nomogram (fig. 10) and through the intersection point draw a line, parallel to the abscise until it crosses the lines indicating the cross-section of the cable wires ($1,5 mm^2$, $2,5 mm^2$, $4 mm^2$ and $6 mm^2$);
 - from the intersection point of the so defined line with the calculated cross-section graph draw a vertical line to the abscise which displays the admissible (maximum) length of the supply cable for the respective cross-section.
- If the mentioned lines do not intersect, select the intersection point of the line indicating bigger wire cross-section.

Protective conductor coupling

Couple the protective conductor to the terminal from the protective busbar, marked as required by DIN EN 60204-1, p.5.2.

The other busbar terminals are not marked. They couple all not current-carrying metal parts for leveling the potential as required by DIN EN 60204-1:1991, p.8.2.3.

4.3.1. Principal wiring diagrams

Generally, for the control of the electric hoists reversible electric diagrams are used. These are shown on figs. 11, 12, 13, 14, 15 and 16.

The meaning of the designations are as follows:

L1, L2, L3 - electric network phases

S1 - stop button

T1 - transformer

F1, F2, F3 - safety fuses

Q - main contactor

Push buttons:

S2 - control cut-out switch button for LOWERING

S3 - control cut-out switch button for LIFTING

S4 - control cut-out switch button for RIGHT movement

S5 - control cut-out switch button for LEFT movement

S6 - end switch

M - electric motor

K1-K8 – contactors

K9 – contactor time relay

B1 - load limiter electronic block

The function of the contactors is shown in the wiring diagrams by putting the following symbols under the coil signs:

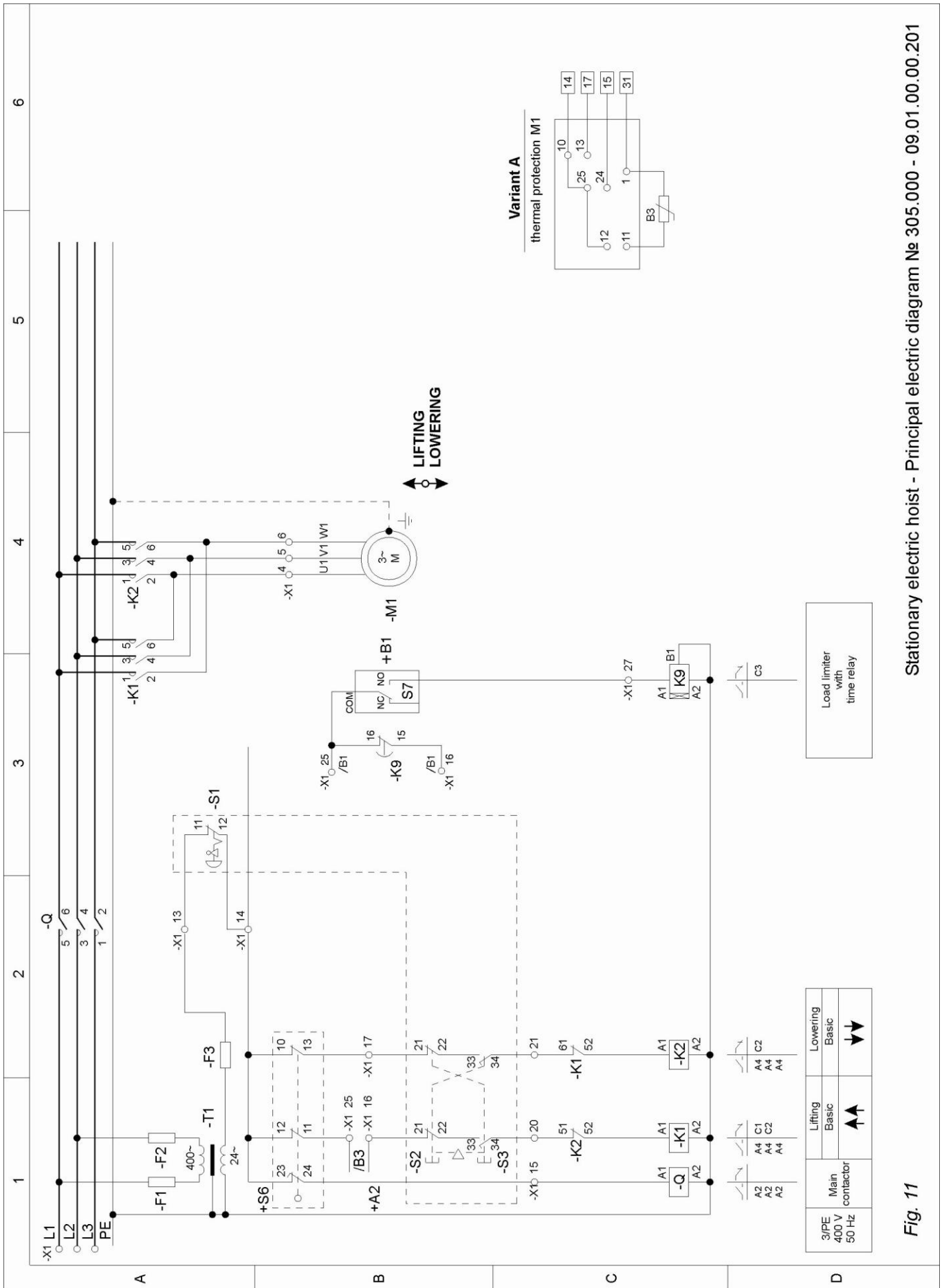
Symbols	Contactor function
↑↑	Contactor for "LIFT" at basic-speed – K1
↑	Contactor for "LIFT" at micro-speed – K3
↓↓	Contactor for "LOWER" at basic-speed – K2
↓	Contactor for "LOWER" at micro-speed – K4
← ←	Contactor for "LEFT" at basic-speed – K5
← ← ←	Contactor for "LEFT" at basic- and micro-speed – K5
→ →	Contactor for "RIGHT" at basic-speed – K6
→ → →	Contactor for "RIGHT" at basic- and micro-speed – K6
↔ ↔	Contactor for "LEFT" and "RIGHT" at basic-speed – K7
↔	Contactor for "LEFT" and "RIGHT" at micro-speed – K8

The symbols under the motor designation denote:

↑ ○ ↓	Electric motor for lifting mechanism
←○→	Electric motor for travelling mechanism



Variant A of the electric wiring diagrams applies when thermal protection is available.



3/PE 400 V 50 Hz Main contactor	Lifting	Lowering
	Basic	Basic
	↔↔	↔↔

Fig. 11

Stationary electric hoist - Principal electric diagram № 305.000 - 09.01.00.00.201

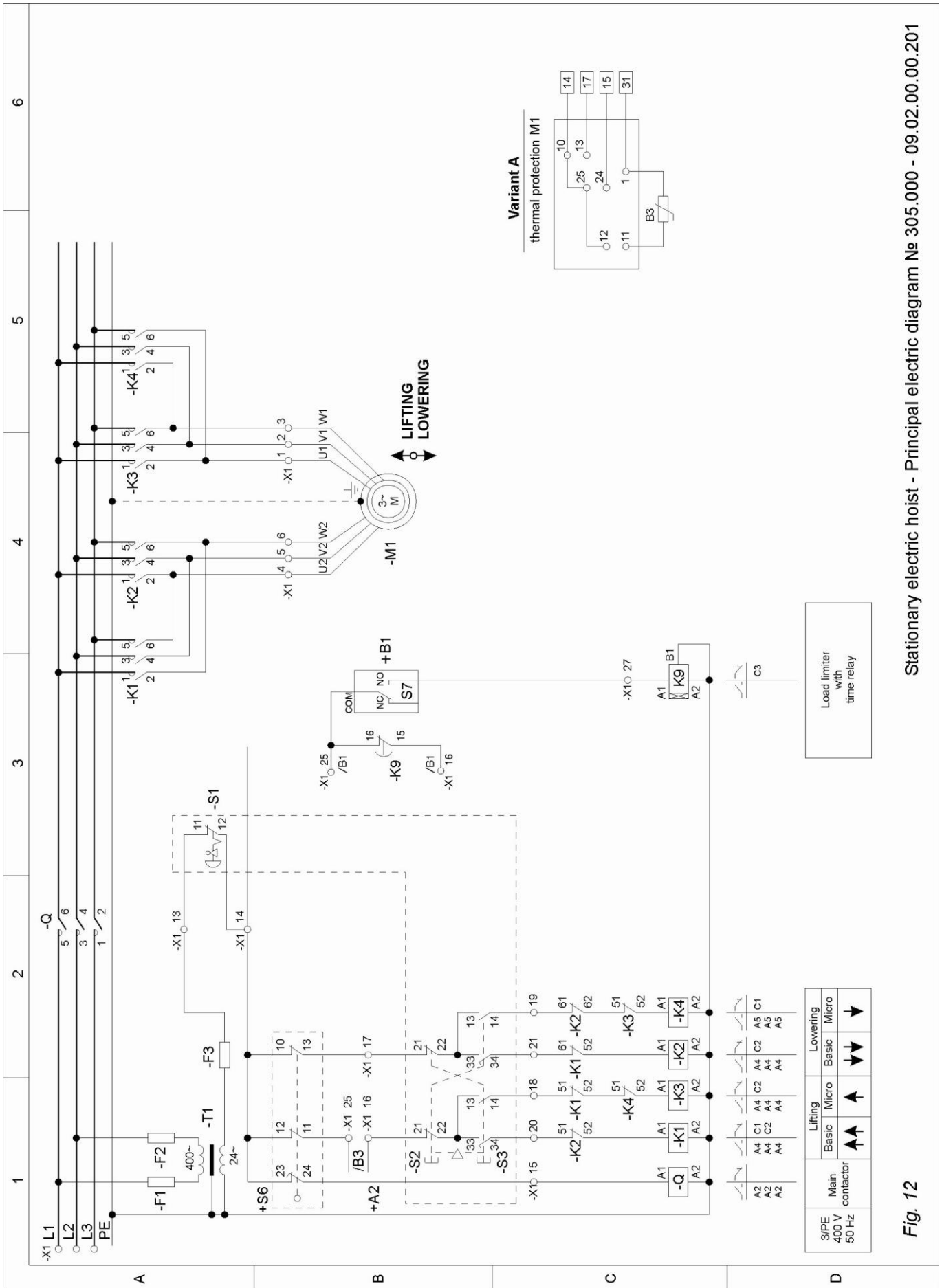


Fig. 12

Stationary electric hoist - Principal electric diagram № 305.000 - 09.02.00.00.201

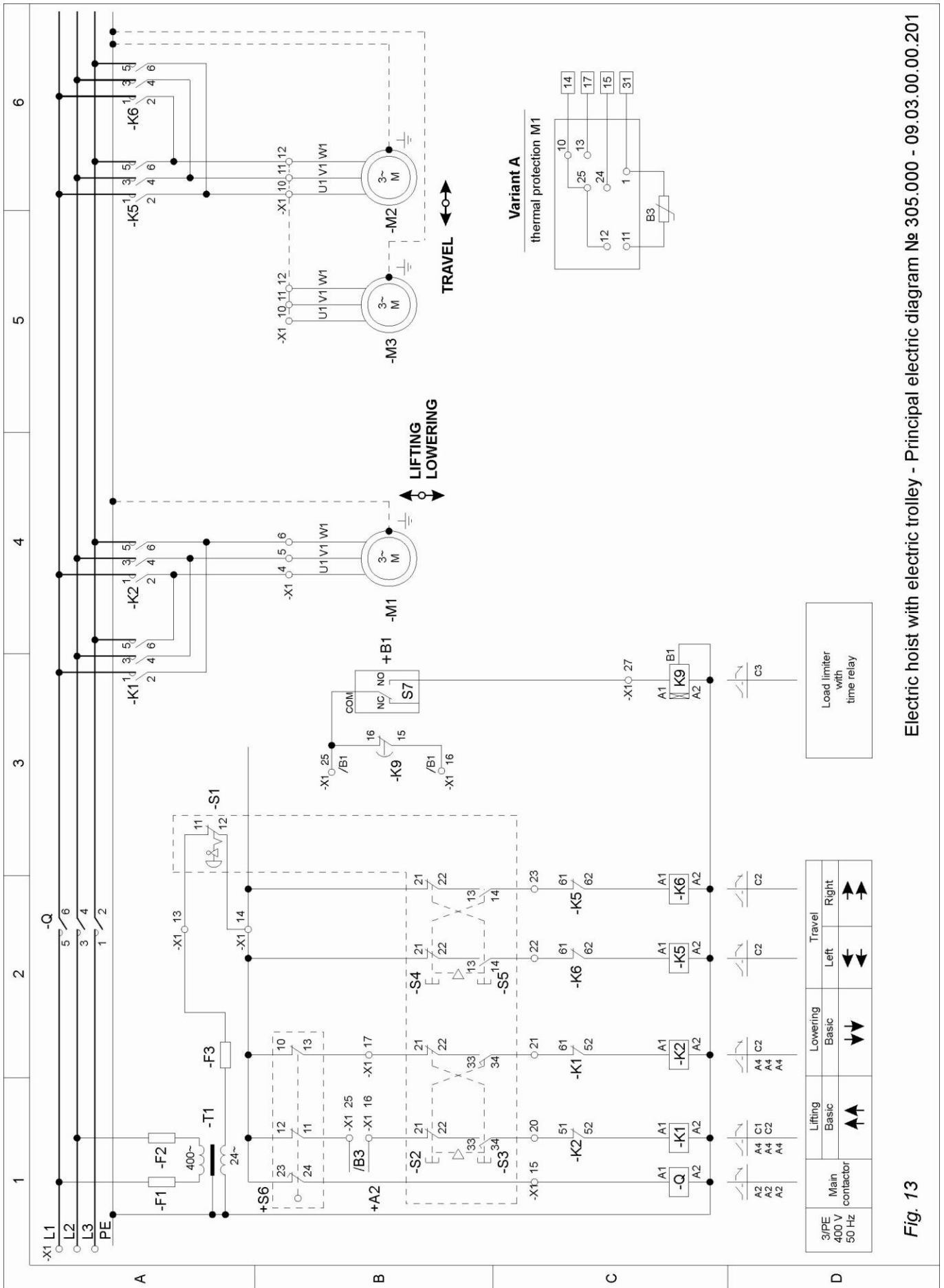
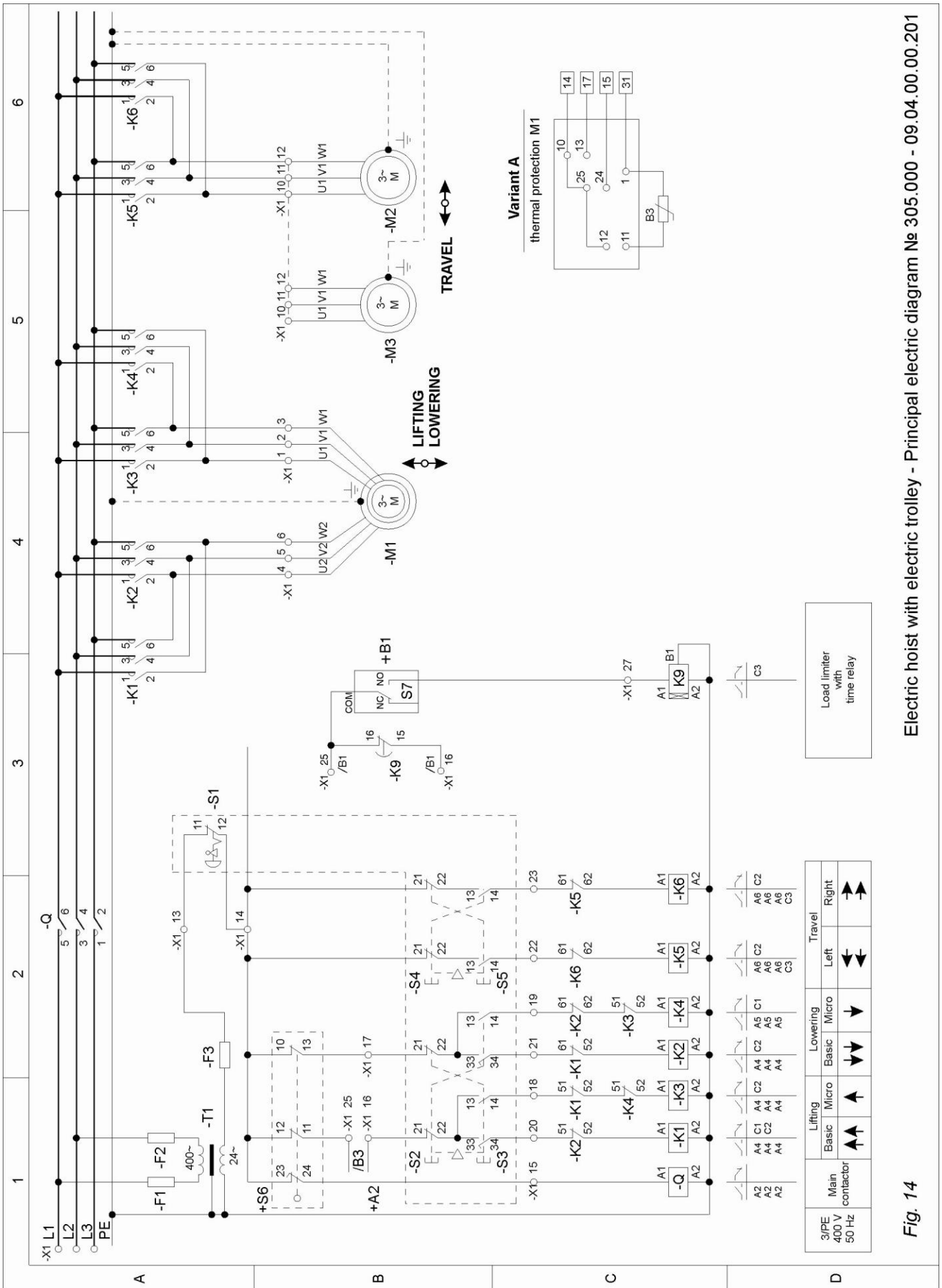


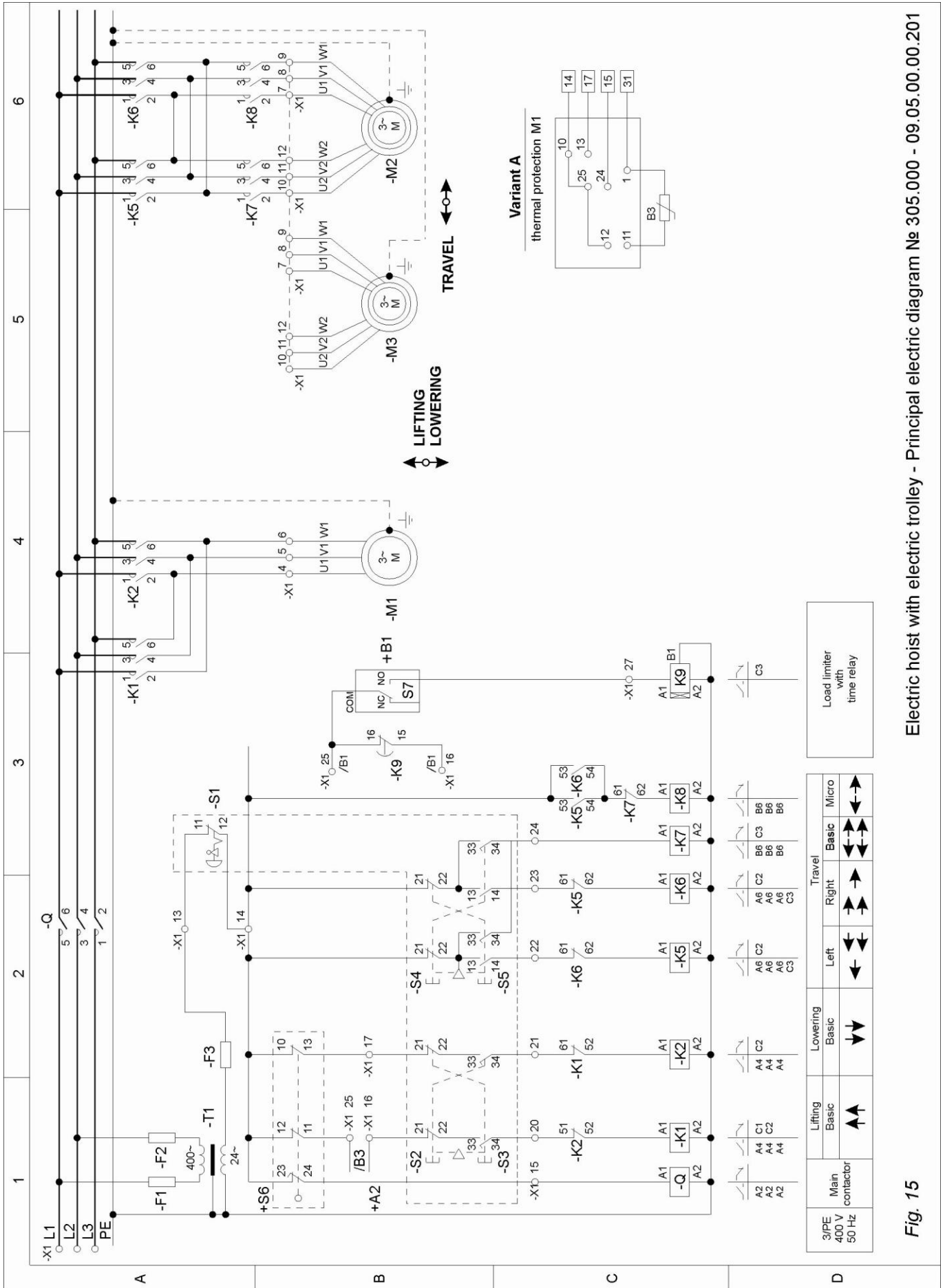
Fig. 13

Electric hoist with electric trolley - Principal electric diagram № 305.000 - 09.03.00.00.201



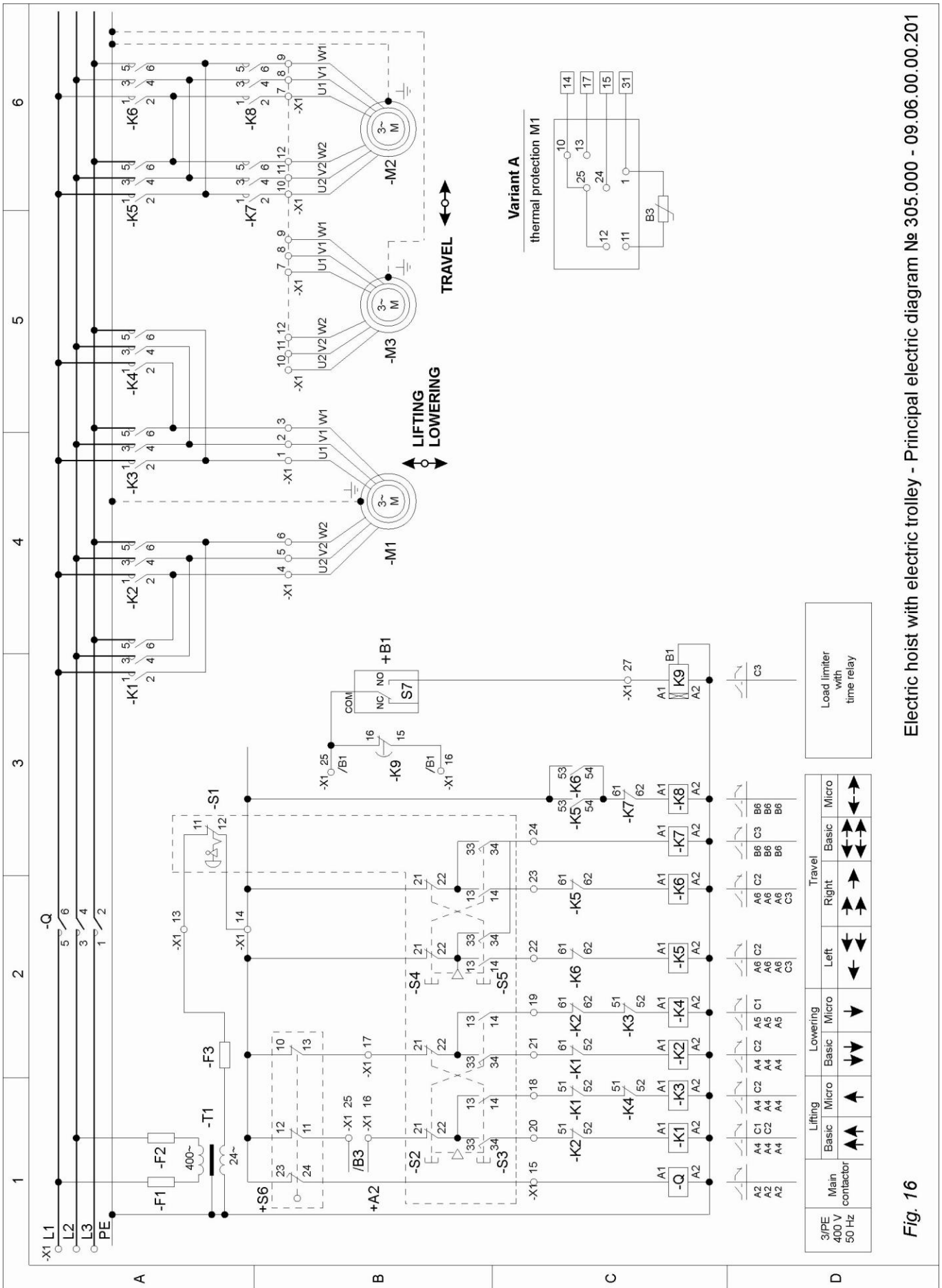
Electric hoist with electric trolley - Principal electric diagram № 305.000 - 09.04.00.00.201

Fig. 14



Electric hoist with electric trolley - Principal electric diagram № 305.000 - 09.05.00.00.201

Fig. 15



Electric hoist with electric trolley - Principal electric diagram № 305.000 - 09.06.00.00.201

Fig. 16

4.4. CHECKING THE CORRECT PHASING OF THE ELECTRIC HOIST AND THE OPERATION OF THE END LIMIT SWITCH

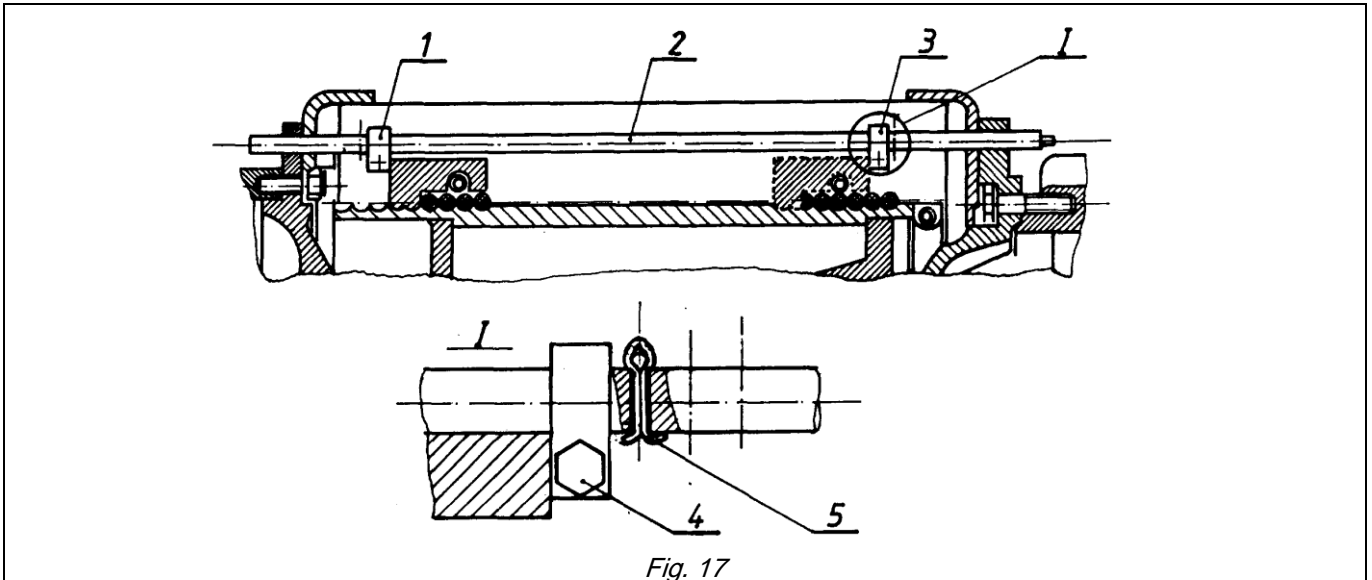
Check the correct phasing in the following cases:

- prior to putting the hoist into operation;
- after repairs;
- after displacement.

In the cases check the end limit switch function as well.

a) Checking the correct phasing

The direction of movement of the loading hook depends on the order of phase connection. Check the correct phasing in the following manner: push the button for lifting (pos.2 of fig.1). If the hook moves downwards, exchange two of the phases of the supply cable (fig. 7).



b) Checking the end limit switch function

The end limit switch terminates the motion of the lifting mechanism in both directions in accordance with the disposition of the two limiting rackets 1 and 3 (fig. 17) along the bar 2. The bar actuates the end limit switch disposed in the electric panel.

The check is performed as you put the hook-block about its medium position in relation to the lifting height. After that with the button "upward" pressed put the bar of the limit switch into motion by hand in the direction of movement of the rope guide, corresponding to direction "upward"; the movement of the hook-block shall cease.



The lever system of the limit switch is adjusted for using the entire lifting height. Adjustment for other intermediate positions of the hook, i.e. using the limit switch as operational one is not allowed.

c) Adjusting the lever system actuating the end limit switch

If during operation adjustment of the emergency end limit switch is needed, it may be effected by changing the location of the limiting rackets 1 and 3 on the bar 2 (fig.17). The limiting racket 1, located from the side of the electric motor, adjusts the distance between the floor and the lowest point of the load hook - lower end position. The limiting racket 3 adjusts the distance between the lowest point of the hoist and the roller block - upper end position.

After adjusting the two limiting rackets fasten the bolts 4 and secure them by with cotter pins 5.

Checking the adjustments:

- for upper end position of the hook-block

The unloaded hook shall move upwards until the end limit switch actuates. In this case maximum brake path is realized.

- for lower end position of the hook-block

The unloaded hook shall move downwards until the end limit switch actuates. In this case maximum brake path is realized.

The second stage of the end limit switch is of emergency function and switches off the main contactor. In this case:

- The distance between the lowest point of electric hoist and the highest point of the roller block shall be at least 100 mm.
- The distance between the floor and the lowest point of the hook shall be at least 100 mm and there must be at least 3 full winding of the rope on the drum.

4.5. CHECKING THE LUBRICATION OF THE ELECTRIC HOIST BEFORE PUTTING INTO EXPLOITATION

All details and sub-assemblies of the hoist are lubricated with sufficient quantity of oils and greases, ensuring its normal operation. The type, the specifications and the quantity of the lubricants are given in table 21.

Before putting the hoist in operation it's necessary to check and, if needed, to grease the points, shown in the lubrication scheme - table 20.

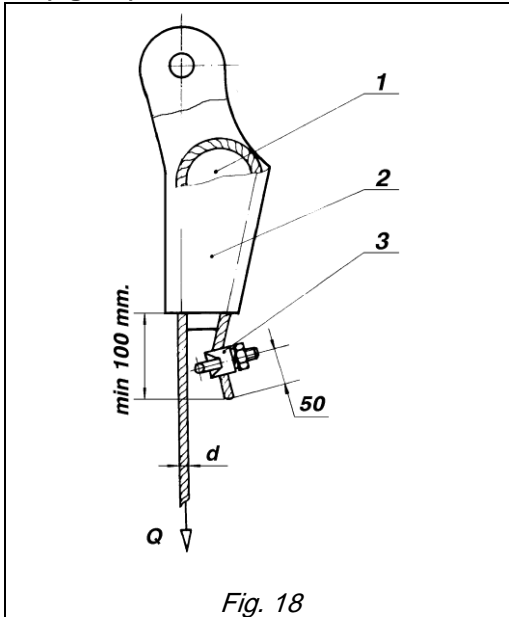
4.6. FIXING THE ROPE



The fixing of the rope is of primary significance for the safe hoist operation.

Depending on the size of the electric hoist and the conditions of packing, the hook-block can be delivered disassembled from the rope. In such cases, while assembling it, keep to the following requirements: - the rope shouldn't be twisted and must be tight. Fix the rope ends as in the following order:

**a) fixing the rope end to the body
(fig. 18)**



Fix the rope of diameter "d" in the wedge bush 2, so that its bearing section would lie on the vertical side of the wedge 1. In accordance with DIN 15020, part 1, p.6.4, at the end of the rope a clamping element 3 is mounted to secure the rope ends from falling out. The clamp complies with DIN 1142 and is fastened by 2 SC-type nuts which also comply with DIN 1142, as shown in table 6.

While using table 6 bear in mind that the rated clamp size is equal to the biggest rope diameter.

In assemblage observe the distances shown on fig.18:

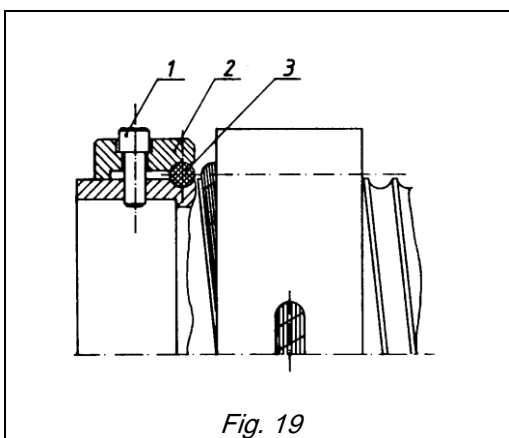
- the distance between the rope end and the wedge bush 2 shall be at least 100mm, denoted by 100min. The maximum values are:
 - 250mm for electric hoists of capacities 0,5 and 1t;
 - 350mm for electric hoists of capacities 2, 3,2 and 5t;
 - 450mm for electric hoists of capacity 8t.

- the distance between the clamp 3 and the rope end shall be 50 mm.

Table 6

Clamp's rated size	Nut size, SC-type	Tightening moment, Nm
5	M5	2,0
6,5	M6	3,5
8 (7)	M8	6,0
10	M8	9,0
13 (12)	M12	33
16 (15)	M14	49
19 (18)	M14	67,7
22	M16	107
26	M20	147
30	M20	212
34	M22	296
40	M24	363

**b) fixing the rope to the drum
(fig. 19)**

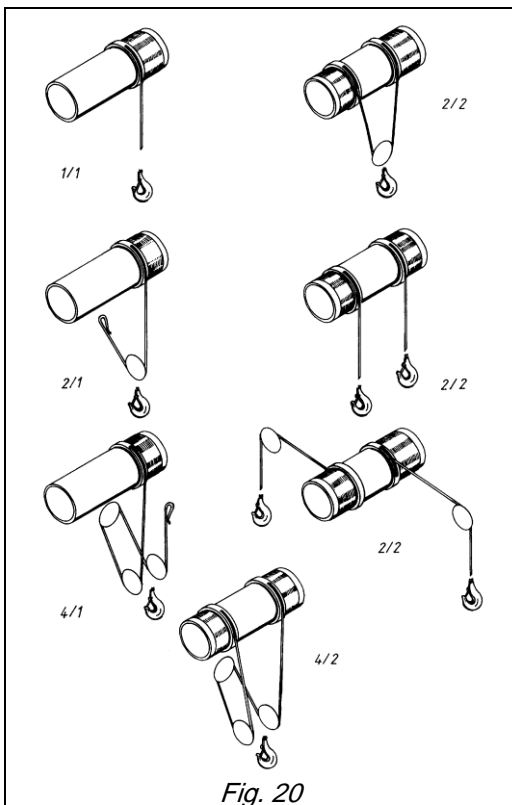


Fix the rope end 3 to the drum by clamps 2 and fasten each of them by two bolts 1. The sizes and strength classes of the bolts are given in Table 7. The bolts tightening moments are given in Table 19.

Table 7

Effort in rope fall, kg	Bolt size mm	Strength class
500	M 6	8.8
1000	M10	8.8
1600	M10	8.8
2500	M12	8.8
4000	M16	8.8

c) mounting the rope through the hook and the roller of the reeving system



While mounting the rope through the hook and the roller of the reeving system make sure the rope won't twist.

While mounting the rope through the hook and the roller of the reeving system make sure the rope won't twist. After wedging the ropes and the hook shall not be inclined to twist and intertwine.

The manner of mounting the rope through the hook and the roller of the reeving system is shown on fig. 20.

4.7. ASSEMBLAGE OF STATIONARY ELECTRIC HOISTS

There are two possibilities to locate an electric hoist to a plane:

■ on to a horizontal plane (standing modification) - fig.21/ A & D

■ under a horizontal plane (underhung modification) - fig.21/B

On request the stationary electric hoists may be produced to be fixed to a vertical plane (wall) - fig. 21/C.

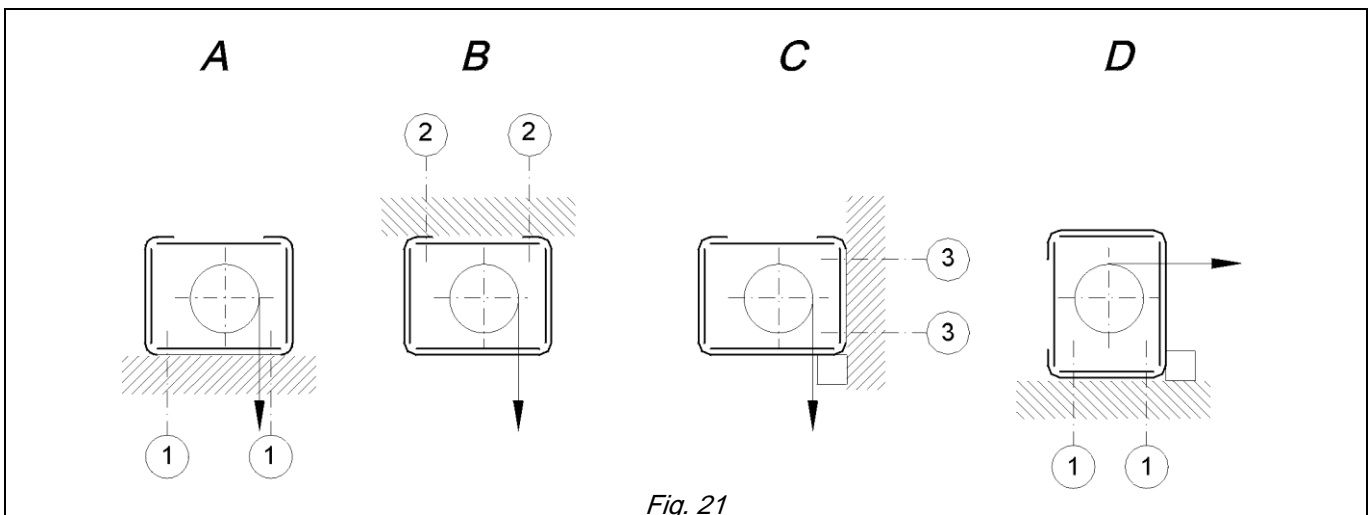


Fig. 21

The applicability of the different fastening types - fig. 22, poss.1, 2 & 3 to the different type of assemblage is indicated on fig. 21 by the encircled numbers.

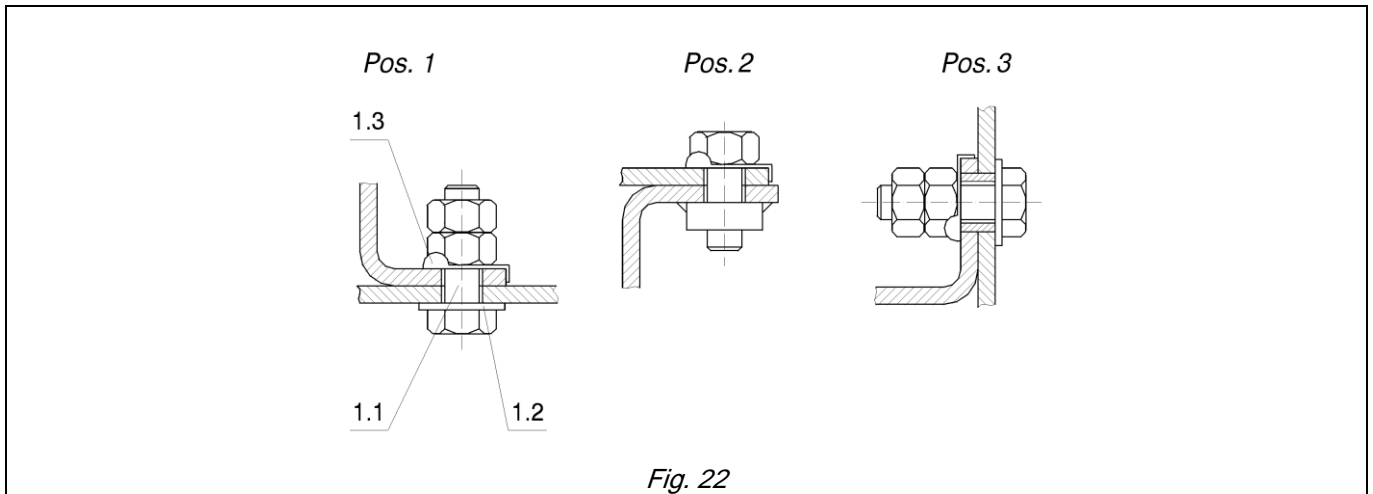


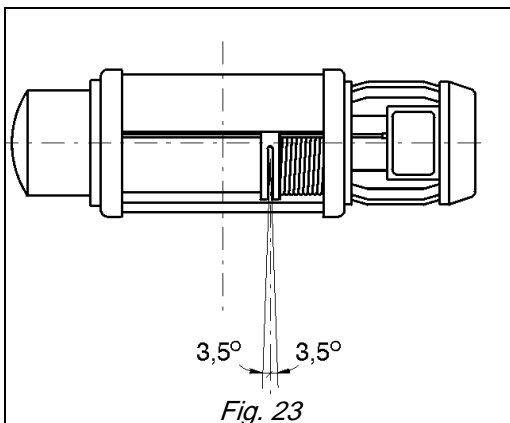
Table 8 shows the following information:

■ for the underhung position are given: the hole diameter of the body under which the welded nut is situated and the bolt, the washer and the spring washer necessary for the fastening. The tightening moment is given in Table 19.

■ for the standing position only the hole diameter of the body is shown. The customer selects the bolt and the nut according to the hole keeping to the following requirement: the strength class of the screw shouldn't be less than 8,8 and of the nut - than 8. The tightening moment is given in Table 19.

Table 8

Type	Pos. Nr	Name	MH 3		MHM 4		MHM 5		MH 6		MH 7	
			Designation	Qty	Designation	Qty	Designation	Qty	Designation	Qty	Designation	Qty
On to horizontal plane	1.1	Hole diameter, mm	∅ 15	4	∅ 21	4	∅ 21	4	∅ 25	4	∅ 28	4
		Bolt - strength class 8,8	M14	4	M20	4	M20	4	M24	4	M27	4
	1.2	Washer DIN 125 - St	B14	4	B20	4	B20	4	B24	4	B27	4
	1.3	Fixing washer DIN 463	M14	4	M20	4	AT20	4	M24	4	M27	4
Under horizontal plane		Hole diameter, mm	∅ 15	4	∅ 17	4	∅ 17	4	∅ 21	4	∅ 25	4



The holes for fixing to a vertical plane are not shown, but the fastening elements are according to figs. 21 and 22, according to the body holes and according to the strength class requirement for the bolt and the nut as per the standing position.

The lateral deflection of the rope towards drum channel axis influences the time for wearing of the wires and it should be as low as possible. When assembling the hoist bear in mind that the admissible angle deflection of the axis must be of such a value, so that the lateral deflection of the rope doesn't exceed 3,5° (fig. 23). That is achieved by levelling the plane to which the hoist is attached.

4.8. MONORAIL STRUCTURE AND ASSEMBLY OF TRAVELLING MECHANISM TO IT

Designing the monorail track movement of electric hoist should be done only by implementing standard profiles.

Mount the monorail structure on the load-bearing structure and fasten the rails in such a manner so that the electric hoists would travel safely. Designing and carrying out the assemblage of the railway shall be performed by authorized persons only in accordance with the relevant country's normative documents (For Germany DIN 15 018, DIN 4132, etc.)

The travelling mechanisms of the electric hoists are designed to move on standard profiles (DIN 1025):

■ hot-rolled I-profiles (DIN 1025 B1.1) of numbers I 200 to I 600 (profile width $b=90$ to 215). These profiles are with sloped profile base.

■ hot-rolled I-profiles type IPE (DIN 1025 B1.5 of numbers IPE 180 to IPE 600 (profile width $b=91$ to 220). These profiles are with rectangular bases.

■ hot-rolled I-profiles type IPB (DIN 1025 B1.2 of numbers IPB 100 to IPB 1000 (profile width $b=100$ to 300). These profiles are with rectangular bases.

When bending the profiles bear in mind the following:

- obtaining simple curves is required (i.e. constant radii)
- deformations of the bent sections of the profiles, greater than prescribed by DIN 1025, are not admissible.



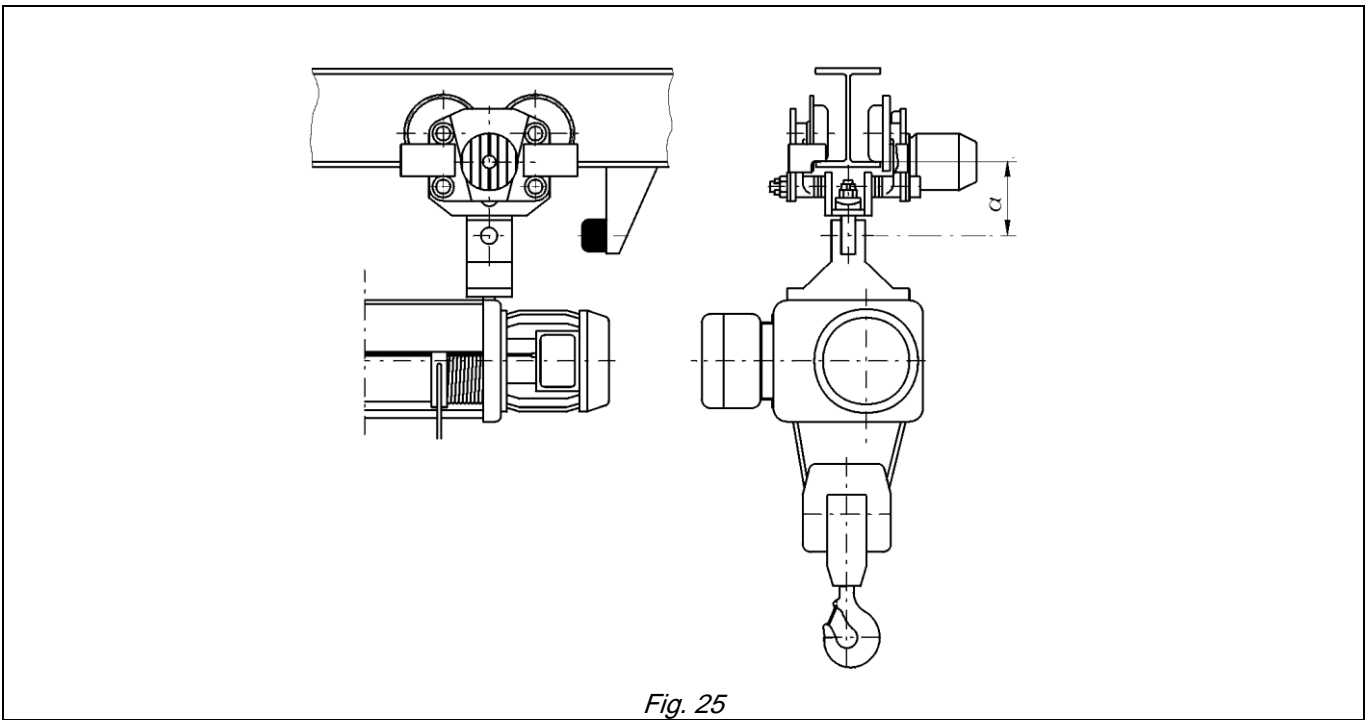
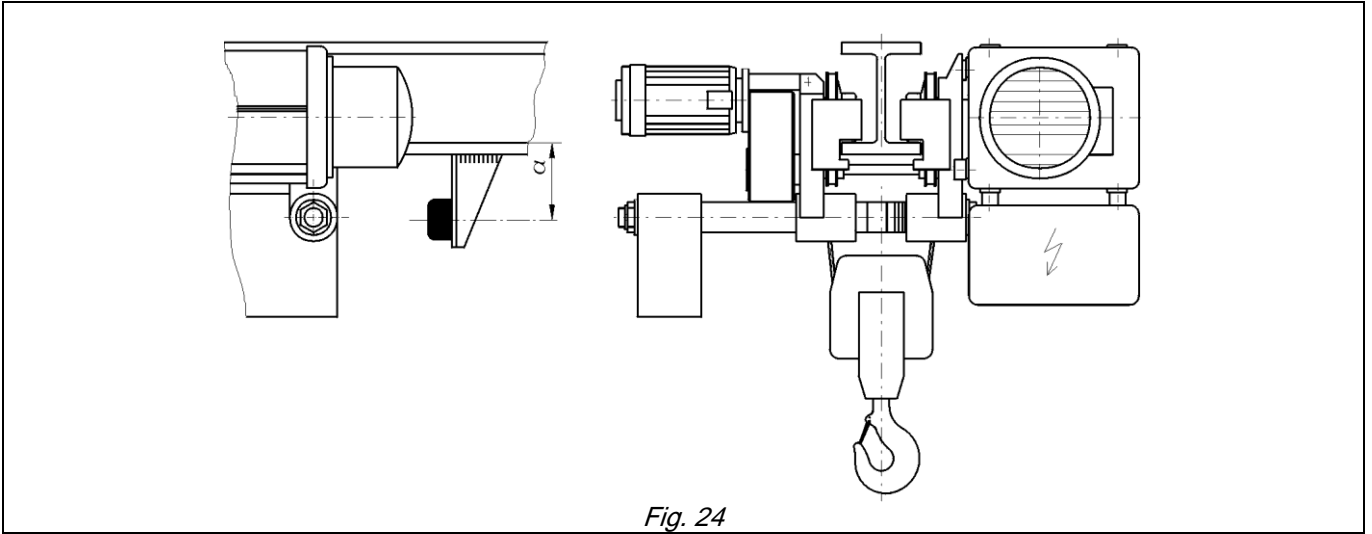
It is not admissible:

- a) to use profiles with sizes smaller than prescribed in the passport;
- b) to use railway track sections

Bear in mind the following:

- There shouldn't be any obstacles to the movement of the travelling mechanism like beam suspending elements, joining plates; bolt heads, etc.
- Do not paint the surface where the travel wheels roll as the paint hinders the good engagement between the wheels and the track.
- To ensure normal operation of the travelling mechanism regularly cleanse the railway track from oils, greases, ice. etc.
- During operation be aware of cracks and wear of the monorail track and, if available, proceed according to the relative country's normative documents requirements.

To prevent dangerous deformations that might emerge when the travelling mechanism reaches the end of the rail put rubber buffers (VBG 9, §19) as shown on fig. 24 for the low headroom hoists and on fig. 25 for the standard headroom hosts. Rubber bumpers are recommended.



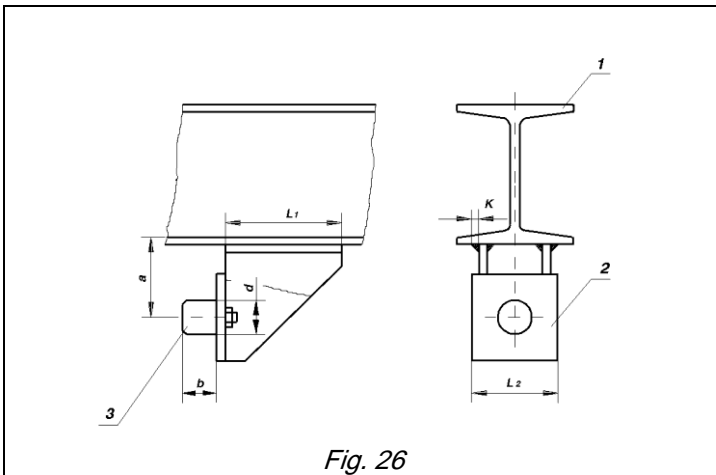


Fig. 26

The bumpers of the DEMAG company are recommended. Their assemblage is shown on fig. 26: fasten the bumper 3 by screw joint to the console 2, which is to be welded to the rail 3. The welding shall be in accordance with the requirements of DIN 15 018, part 1, p.6, and of category K.

The data necessary for the ordering and assemblage of the bumpers is given in Table 9.

Table 9

Size	Capacity, kg		a, mm	Bumper					Console			
	Reeving			b, mm	d, mm	Thread	Type	Catalogue number	L1, mm	L2, mm	K	Catalogue number
	2/1	4/1										
MH 3	1000	2000	190.0	100	95	M12	GZP100	81152344	100	100	4	331301
MHM 4	2000	4000	197.5	100	95	M12	GZP100	81152344	100	100	4	331301
MHM 5	3200	-	197.5	100	95	M12	GZP100	81152344	100	100	4	331301
	-	6300	215.0	100	95	M12	GZP100	81152344	100	100	4	331301
MH 6	5000	-	215.0	100	95	M12	GZP100	81152344	100	100	4	331301
	-	10000	245.0	100	95	M12	GZP100	81152344	100	100	4	331301
MH 7	8000	-	262.0	120	122	M12	GZP130	81152444	100	100	4	331301
	-	16000	275.0	120	122	M12	GZP130	81152444	110	100	4	331302

4.8.1. Monorail track

Unhinged (rigid mounted) trolley

The construction of the trolley is convenient and simple, easy to assemble, disassemble and operate. Designed for monorail tracks of different profile sizes.

The travel mechanism may be attached to the monorail track in two ways:

A. Assemblage of travelling mechanism when the monorail end is accessible:

- dismount the support from the monorail track;
- attach the travelling mechanism to the monorail track end;
- mount the support below to the monorail

B. Assemblage of travelling mechanism when the monorail end is inaccessible:

- loosen the elements, defining the distance between the driving and driven travel wheels;
- increase the distance between the travel wheels;
- attach the travelling mechanism to the monorail track from below;
- fasten the elements, defining the distance between the travel wheels.

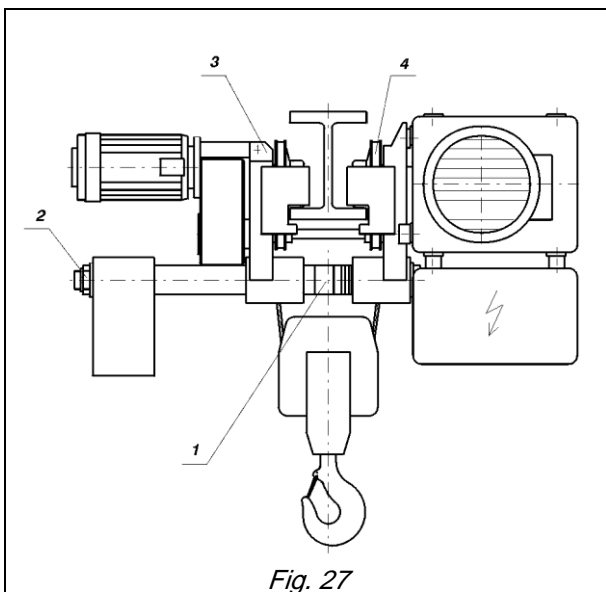


- *The elements, fixing the distance between the travel wheels shall be locked and secured against self-unscrewing.*
- *Ensure clearance of 0,5-4mm between the wheel flange and the railway base, which is of great significance for proper operation.*

The adjustments of the travelling mechanism for different profile widths and the B-type assemblage are in dependence of its construction.

a) Travelling mechanism for low headroom electric hoist

The assembly diagram is shown in fig. 27.



Carry out the B-type assemblage in the following order:

- dismount the coffer pin securing the castle nuts 2 to the bars 1; unscrew the castle nuts 2;
- increase the distance between the travel wheels by distancing the driving block 3 and driven block 4;
- attach the traveling mechanism to the monorail track from below;
- screw the crown nuts 2 with tightening moment according to Table 19 (nut strength class 5) and fix them by the cotter pins.

Balancing the low headroom electric hoists

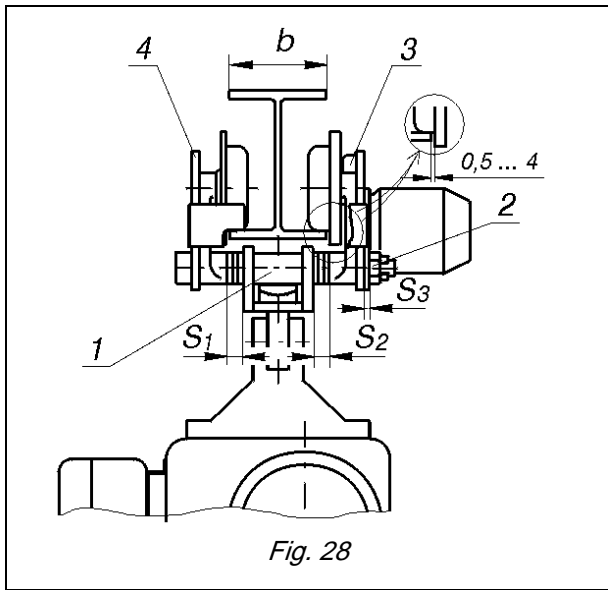
For low headroom electric hoists after assemblage of the hoisting and travelling mechanisms to the monorail track balancing should be performed. In the counterweight box 6, specially designed for this purpose (fig. 5) put metal scrap. It is recommended after putting the balancing material in the box to cover it with concrete with thickness about 2 cm.

The weight of the counterweight box (concrete layer included) is according to Table 10.

Table 10

Size	Reeving	Type of hoist	Necessary counterweight, kg						
			H1	H2	H3	H4	H5	H6	H7
MH 3	2/1	Box weight	8	10	12	15	20	-	-
		With basic speed	22	25	30	30	30	-	-
		With micro-speed	47	48	50	50	50	-	-
	4/1	Box weight	-	-	12	15	20	-	-
		With basic speed	-	-	27	30	35	-	-
		With micro-speed	-	-	42	45	50	-	-
MHM 4	2/1	Box weight	12	14	15	16	20	-	-
		With basic speed	70	80	85	105	115	-	-
		With micro-speed	100	105	115	130	130	-	-
	4/1	Box weight	-	-	15	16	20	-	-
		With basic speed	-	-	85	100	110	-	-
		With micro-speed	-	-	110	125	130	-	-
MHM 5	2/1	Box weight	16	17	18	18	22	-	-
		With basic speed	85	90	100	120	130	-	-
		With micro-speed	120	130	135	155	170	-	-
	4/1	Box weight	-	-	18	18	22	-	-
		With basic speed	-	-	75	90	105	-	-
		With micro-speed	-	-	110	125	140	-	-
MH 6	2/1	Box weight	-	18	20	20	22	-	-
		With basic speed	-	170	175	220	250	-	-
		With micro-speed	-	218	230	242	280	-	-
	4/1	Box weight	-	-	20	20	22	-	-
		With basic speed	-	-	165	210	235	-	-
		With micro-speed	-	-	220	230	270	-	-
MH 7	2/1	Box weight	-	29	33	37	41	44	45
		With basic speed	-	265	290	314	350	385	410
		With micro-speed	-	310	330	360	395	430	435
	4/1	Box weight	-	-	-	37	41	44	45
		With basic speed	-	-	-	305	335	365	395
		With micro-speed	-	-	-	350	390	415	435

b) Travelling mechanism for normal-headroom electric hoist



The travelling mechanism is shown in fig. 28.

Carry out the B-type assemblage in the following order:

- dismount off the studs 1 the cotter pins, securing the nuts 2;
 - unscrew the nuts 2;
 - increase the distance between the travel wheels by distancing the driving block 3 and driven block 4;
 - attach the travelling mechanism to the monorail track from below;
 - screw the nuts 2 with tightening moment according to Table 19 (nut strength class 5) and fix them by the cotter pins.
- After assemblage there must be clearance $f = 0,5\div 4$ mm between the wheel flange and the railway base.

Adjusting the travelling mechanism for other widths b of the monorail track

Performed by shifting the set of bushes defining the sizes S1 and S2 to the set of bushes defining the size S3 (or reverse), while observing the condition $S1 + S2 + S3 = \text{const}$. Bushes width is 2.5 mm. Quantity of bushes as shown in table 11.

Table 11

Capacity, kg	Dimension according Fig.28	Profile acc. GOST 19425-74				Profile acc. DIN 1025 BI.1									
		Designation				Designation									
		18M	24M	30M;36M	45M	200	220	240	60	280	300	320	340	360	380
		Profile width b				Profile width b									
		90	110	130	150	90	98	106	113	119	125	131	137	143	149
Quantity															
500 and 1000	S1	2	6	10	-	2	4	5	7	8	9	10	-	-	-
	S2	2	6	10	-	2	4	5	7	8	9	10	-	-	-
	S3	16	8	-	-	16	12	10	3	4	2	-	-	-	-
2000 and 3200	S1	-	-	3	7	-	-	-	-	-	-	3	4	5	7
	S2	-	-	3	7	-	-	-	-	-	-	3	5	6	7
	S3	-	-	8	-	-	-	-	-	-	-	8	5	3	-
5000 and 8000	S1	-	-	3	7	-	-	-	-	-	-	3	4	5	7
	S2	-	-	3	7	-	-	-	-	-	-	3	5	6	7
	S3	-	-	8	-	-	-	-	-	-	-	8	5	3	-

4.9. OPERATION AND MAINTENANCE OF ELECTRIC HOISTS

Before initial starting have the following checks carried out by authorized qualified personnel.

- check the suspension of the hoist;
- check the end limit switch for the highest and the lowest hook position (check with unloaded electric hoists);
- check if bumpers are available and their reliable functioning;
- check if the direction of the hook movement coincides with the one, indicated on the buttons of the push button;
- check the functioning of all devices, related to the safe operation of the hoist (end limit switch, etc.);
- check the settings of all electrical devices, necessary for operation;

Before initial starting and after significant changes and subsequent putting into motion the hoist shall undergo tests, performed by persons, authorized in the respective country. [VBG8 §23 (1) and VBG9 §25]. The customer assigns the necessary managing, servicing and maintaining personnel in accordance with DIN 15030, p.5.

Periodical tests shall be furnished at least once a year by qualified persons [VBG9 §26 (1) and VBG8 §23 (2)].

In accordance with VBG9 §27 the customer shall make sure that the results from the tests be filled in a the electric hoist's. It's recommendable, for Germany, to use as a diary the Crane Diary as described in VBG9 §27 (order number ZN 1/29), which is delivered to the customer by the supplier.

In the other countries such a diary is to be used as required by the normative documents, valid in the country, where the hoist is being operated. Copies of the article's passport and the certificates for the rope and the hook are enclosed with the diary.

If such normative documents do not exist, the following diary layout is recommended:

1. Title page, stating: "Diary of the electric hoist" and containing the serial number of the hoist, the customer and inventory number.
2. Enclose copies of the article's passport and the certificates for the rope and the hook.
3. "Test Results prior to initial putting into motion or after repairs"

Table 12

Type of test	Normative document defining the test	Result		Note	Authorized expert's signature	Date
		Yes	No			
Preliminary						
Assembly						
Final						

4. "Results of periodical annual tests"

The periodical tests are carried out in accordance with

Table 13

Test type	Result	Name and company of the authorized expert	Authorized expert signature	Date
Periodical	Defects not observed. (Defects found, described in Record No:			
Periodical	Defects not observed. (Defects found, described in Record No:			

4.9.1. Maintenance of the hoist

The operator of the hoist must be well acquainted with this Manual and be instructed on the requirements for safe operation. Operator's clothing shall be in accordance with the working conditions.

In operation the requirements of the respective country shall be observed.

The operator shall always have at hand the Assembly and Operation Manual or a copy from the Requirements for Safe Operation, which must be placed near the power supply circuit breaker or on easy-accessible place.

The requirements to the operator and maintenance personnel of the electric hoists according to VBG8 and VBG9 are given in Table 15. According to VBG9 §2 the electric hoists with travelling mechanism are considered to be crane equipment. The term "hoist operator" shall be regarded as crane operator.

Table 14

Requirement	Source	Quotations from the source
Requirements to the hoist operator and maintenance personnel	VBG8 §24	(1) The assemblage, technical maintenance and independent service of the mechanisms shall be proceeded only by persons, acquainted with them.
Daily inspection of the brake and the end limit switch	VBG9 §30	(1) At beginning operation the crane operator shall check the function of the brake and the emergency end limit switches. He must be aware of eventual failures of the crane. (2) If failures endangering the operation safety occur, the crane operator must cease crane operation.
Secure the crane against the impact of strong wind	VBG9 §30	(6) The crane operator must make sure that cranes exposed to wind in gales and at finishing the works are strengthened by wind protective devices.
The load shall not be lifted or shifted over people	VBG9 §30	(9) When using devices holding the load by magnetic, suction or friction forces without additional protection, the load shall not be shifted over people
Securing the people hanging the load	VBG9 §30	(10) The loads being hung by hand may be shifted only after a signal from the person hanging them by the signal post or from another responsible man, pointed out by the contractor.
Crane operator shall always watch the load	VBG9 §30	Until there is load on the crane, the crane operator must hold the control device in hand.
Emergency end switch shall not be used for other purposes	VBG9 §30	(13) The emergency end switch must not be used as normal operation one
Inspection for obvious faults	VBG8 §27	Before beginning operation, the operator must check the function of the emergency end switch. He must watch the mechanisms, including bearing means, rollers, equipment and bearing structure for obvious faults.
Electric hoist shall not be overloaded	VBG9 §31	(2) The cranes must not be loaded over the value, admissible at that moment.
Operation with other lifting appliances	VBG9 §33	(1) If the working area is crossed by more cranes, the contractor or a person authorized by him must define the working path and make sure that the crane operators communicate freely between themselves.
Transportation of people is forbidden	VBG9 §36	(1) Transportation of people with the load or by load-lifting devices is forbidden.
Loads shall not be dragged	VBG9 §37	(1) Dragging loads as well as pulling vehicles with loads is forbidden.
Tightly stuck loads shall not be forced to tear apart	VBG9 §38	(1) The contractor may use the crane to tear apart tightly connected loads only if the crane is provided with load limiter.
Impulse switching of the electric motor shall be avoided - otherwise the contacts of the contactors may get welded		
Hoist operatin in proximity with electrical equipment under voltage	VBG9 §39	(1) The contractor must make sure that, at operation with crane near to electrical equipment under voltage, there is no possibility to endanger people due to contact with it (2) The crane operator must be aware not to be endangered by electric shock when operating the crane near electrical equipment under voltage.
Lifting of inflammable liquids	VBG8 §15	The mechanisms, designed to lift inflammable liquids must be provided with two independent brakes
Handling loads that could stick or jam.	VBG8 §33	(5) If loads must be transported, which along their path may stick or jam, thus resulting in occurrence of additional uncontrolled forces, only mechanisms with load limiters must be used

5. OPERATION AND MAINTENANCE

General instructions

- The maintenance and the repair activities should be performed only with unloaded electric hoist.
- The auxiliary means for holding the load shall be removed.
- Carry out regular annual inspections according to the requirements of VBG8 §23 (2) and VBG9 §26 (1).
- Except the requirements, take into consideration the following:

Table 15

Inspection and maintenance requirements	Quotations from VBG9
<ul style="list-style-type: none"> ■ The circuit breaker must be switched off and ensured against switching in by placing warning table at the place of switching off. 	§41 (1) The inspections and the maintenance works shall be performed only when the crane is switched off and ensured against unqualified switching in.
<ul style="list-style-type: none"> ■ The circuit breaker is not to be switched off only when activities with active hoist must be performed (lubrication of the rope, functional tests of electrical elements, etc. 	(2) Paragraph 1, sentence 1 are not valid when the inspection and maintenance works must be performed with active hoist and when during its operation there is: <ol style="list-style-type: none"> a) no danger of falling or bruising b) no danger of touching electrical equipment under voltage c) communication with the crane operator with speech or signals
<ul style="list-style-type: none"> ■ During maintenance or repair works a working platform or similar equipment must be available 	§10 For maintenance or repair works on the mechanical and electrical equipment which can't be performed from the floor working places must be available, or platforms that can be accessed freely and the work with them won't endanger the workers
<ul style="list-style-type: none"> ■ Putting the electric hoist into motion after repair works, working in the area of the electric hoist 	§43 After repair works or activities in the area of crane movement the cranes may be switched on only if the contractor or his assistant permits again their operation. Before the permission the contractor and his assistant shall check that: <ol style="list-style-type: none"> 1. the works are completely finished 2. the whole crane is in condition operate safely 3. all workers have left the crane

5.1. MAINTENANCE

The regular and correct maintenance and servicing guarantee the faultless operation of the electric hoists. They should not be operated in a heavier operation mode than the one, prescribed by the manufacturer.

The maintenance of the electric hoists includes checking the technical state, adjustments and settings, finding out defects and their removal, technical maintenance (lubrication, etc.).

5.1.1. Periodical inspections

The periodical inspection are necessary to ensure faultless operation of the machine.

The kind and frequency of the inspections are given in Table 16. The points of the description of the groups and subassemblies to be inspected are also given in the table.

5.1.2. Lubrication and adjustments

The necessary maintenance as regards the lubricants is given in Table 20 and the lubricants in use for the different spots are given in Table 21.

The period of carrying out the adjustments is given in Table 16, containing as well the point where their description is.

The period of these activities depends on the production conditions, including the cleaning of the fastenings from dust and dirt.

If more than three months have past after the purchase of the hoist without it being used, checks for initial putting into motion shall be carried out according to the maintenance plan (Table 16).

5.1.3. Repairs

Repairs include removal of small defects noticed during the inspections, such as:

- damages of the cables;
- light activities as replacement of contactors and relays.

They don't include harder and more responsible activities that must be coordinated with the producer, such as:

- change in the electric diagram;
- implementation of additional devices;

If necessary, repair works under voltage are permitted in case that safe operation precautionary measures have been taken.

The possible failures in the electric equipment and the methods to settle them are given in Table 22.

5.1.4 The maintenance plan

The maintenance plan is given in table 16. Bear in mind that it's worked out for operation in normal conditions according to the hoist operation mode group (FEM 9.511). If the hoist operates in a heavier mode, these periods must be shortened.

Table 16

Nr	On initial putting into operation	Daily, on beginning of operation	After first 3 months	After first 12 months	Further, after every 12 months	Type of check and maintenance
1	■	■				Brake operation. If load dragging or increased stopping distance are observed, adjust the axial rotor stroke of the electric motor (p.5.4)
2	■	■				The operation of the end limit switch (p.4.4) and the STOP-button.
3	■	■				Visual inspection of: -the push button and its cable (5.11a) - the hook with roller block (5.7)
4		■				The rope - for damages and torn wires (5.2)
5			■		■	The action of the rope guide and the fastening of the rope (4.6)
6			■		■	The roller block and the detail Hook (5.7)
7			■		■	Bearing screw joints (5.10)
8			■		■	Welded joints
9			■		■	The state of the bumpers. Replace them if mechanical damages are observed.
10				■		The state of the travel wheels and the hinged joints in the travelling mechanism, the clearance between the flanges or the guiding rollers and the monorail track (4.8).
11			■		■	The general appearance of the electrical equipment (5.11)
12				■		Check and, if necessary, improve the anti-corrosion protection.

5.1.5. Periods of repeating the inspections

■ The unit must be checked at least once a year by experts. As experts may be called persons from the Technical Surveillance Services and experts, authorized to carry out the inspections.

■ During repairs only original manufacturer's spare parts shall be used.

5.2. CHECKING THE WEAR OF THE ROPE. DISCARDING AND REPLACEMENT

The maintenance of the rope is related to its regular lubrication (Table 20) and the checks for wear.

The rope as well as the rope guide can have longer life only when they are regularly cleaned and lubricated, thus decreasing the corrosion as well.

The lubricant should be laid in moderate quantities and uniformly along the whole length of the rope.

If due to production considerations the rope is not lubricated by the user, decreasing of wear time should be expected. The usage of non-lubricated ropes must be specially agreed on.

5.2.1. Checking the wear of the rope

The period of inspections for wear of the rope is given in Table 16. Discard the rope in accordance with the requirements of DIN 15020, B1.2 and ISO 4309

The criteria for estimation the state of the rope are stated in DIN 15020, B1.2:

a) appearance and number of the torn wires

The inspection for torn wires is made with unloaded rope kept manually in working position which allows better visual check of the torn wires.

Discarding the rope with regard to the number of torn wires at a definite length along its axis is performed in accordance with Table 17, which complies with DIN 15020 B1.2 and ISO 4309.

Table 17

Number of bearing wire in the outer rope strands n	Appropriate ropes	Number of visible wire breakages, leading to discard							
		Operation mode groups FEM 9.511: 1Am				Operation mode groups (FEM 9.511) 2m, 3m			
		Ordinary lay		Lang's lay		Ordinary lay		Lang's lay	
		At a segment of length 6d and 30d, where d - rope diameter							
		6d	30d	6d	30d	6d	30d	6d	30d
To 50		2	4	1	2	4	8	2	4
51 to 75		3	6	2	3	6	12	3	6
76 to 100	8x7(1+6)	4	8	2	4	8	16	4	8
101 to 120	6x19(1+6+12) 6x19(1+6+6F+12) 36x7(1+6)	5	10	2	5	10	19	5	10
121 to 140		6	11	3	6	11	22	6	11
141 to 160	8x19(1+6+6F+12)	6	13	3	6	13	26	6	13
161 to 180	6x36[1+7+(7+7)+14] 8x19(1+6+6(6)+1.O.C)	7	14	4	7	14	29	7	14
181 to 200		8	16	4	8	16	32	8	16
201 to 220		9	18	4	9	18	35	9	18
221 to 240	6x37(1+6+12+18)	10	19	5	10	19	38	10	19
241 to 260		10	21	5	10	21	42	10	21
261 to 280		11	22	6	11	22	45	11	22
281 to 300		12	24	6	12	24	48	12	24
over 300		0,04.n	0,08.n	0,02.n	0,04.n	0,08.n	0,16.n	0,04.n	0,08.n

b) location of the torn wires

If there is torn tuft, the rope must be replaced immediately.

c) decreasing the rope diameter due to operation.

If at a long part of the rope it has decreased its rated diameter more than the limits given in ISO 4309 and DIN 15020 B1.2, it must be discarded even if there are no torn wires.

If the wires of the top layer of the rope have decreased their rated diameter by 40%, it must be discarded.

d) corrosion

The corrosion of the outer wires may be detected visually.

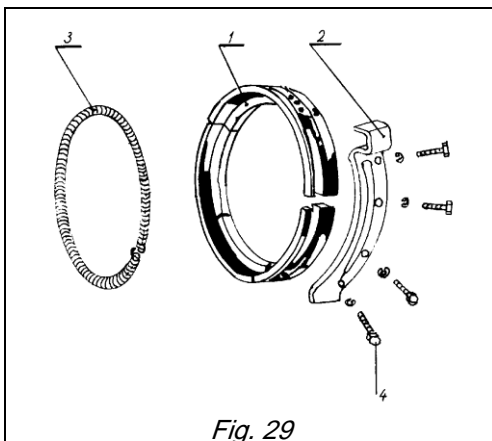
e) alteration of the shape of the rope.

The check must be carried out by qualified person. The different kinds of deformations are given in ISO 4309 and DIN 15020 B1.2.

The most typical deformations leading to discarding of the rope are: deformation to a basket shape; local increasing of the rope diameter; local decreasing of the rope diameter; stratification and outward bending of the wires in the tuft; damages due to heat influence or electric arc; plastic deformations; the wire tends to go outwards; plastic deformations.

5.2.2. Replacement of the rope

5.2.2.1. Removing the old rope



The replacement of the rope is carried out in the following manner:

- lower down the block-hook until it lies on a stiff support without waiting for the end limit switch for lower end position to actuate;
- release the guide pos.2, fixed with screws 4 and guide 2, from the guiding nut 1 (fig. 29). Unbutton the screw-spring 3, pressing the rope, and pull it together with the guiding nut;
- switch the electric hoist on again for lowering and unwind the other windings on the drum; then release the end of the rope from the drum. Pull out the other end from the wedge bush by hammering out the wedge.

5.2.2.2. Mounting the new rope

- clean the helical grooves of the drum and lubricate with the lubricants, recommended in table 21;

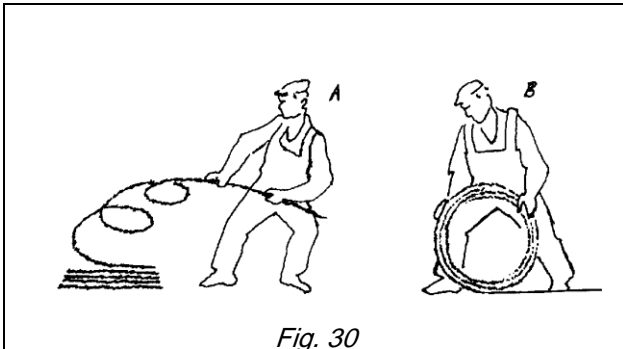


Fig. 30

- put the preliminary prepared new rope of sufficient length and ends against processed unravelling under the electric hoist and unwind it in the manner shown in fig. 30B; do not unwind the rope as shown in fig. 30A.

- after fixing the end of the rope to the drum take it and press it to the groove; then switch on the electric hoist by pressing the button "LIFT", after that the rope begins to wind. After five to six windings have been realized switch off the electric motor.

The rope reeled in this manner should be secured against loosening. Wooden wedge between the covered with rope part of the drum and the longitudinal beam can be put for this purpose.

The next operation is assemblage of the rope guide, described in p.5.3, and after that the remaining part of the rope is reeled.

Using gloves during rope-handling is recommended for safety considerations.

5.3. ASSEMBLAGE OF NEW ROPE GUIDE AND MAINTENANCE DURING OPERATION

Before starting the assemblage of a new rope guide it shall be disassembled to its components (fig. 29).

- 1 - guiding nut,
- 2 - guide,
- 3 - clamp spring

The order for assembly is shown on figs. 31, 32, 33, 34, 35 and 36 in the following sequence:

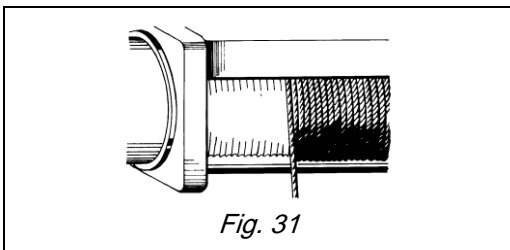


Fig. 31

- a) lubricate the windings of the guiding nut and the groove in which the clamp spring lies with grease.

Shift, under some angle the rope, outgoing from the window of the electric hoist housing, over the drum windings, reeled in advance (fig. 31), then stretch it well and tread on it on the floor so that it won't loosen after being released of the wooden wedge that holds it tight.

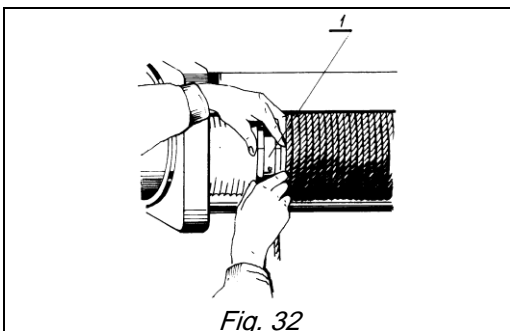


Fig. 32

- b) put the open guiding nut on the drum and assemble it in such a way so that it will enter with its windings the nearest groove relative to the rope (fig. 32);

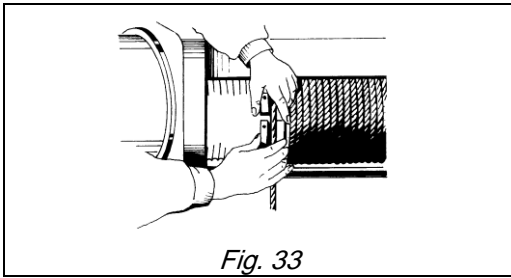


Fig. 33

c) the rope, shifted under an angle relative to its windings, returns to its initial position on the respective groove of the drum and the end section of the guiding nut shall be shifted in such a manner so that it will be seen from the lower side of the drum. Then the rope shall be adjusted in order to go out of the window, covering both end sections of the guiding nut (fig. 33);

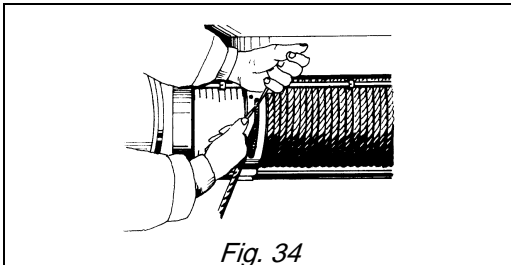


Fig. 34

d) insert the clamp spring into the special groove of the guiding nut with catching the both ends by two more springs or hooks and after stretching to its working length, interlock the hooks without twisting (fig. 34).

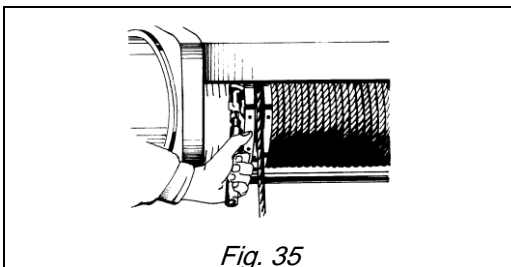


Fig. 35

e) Insert pins in the holes, drilled especially for this purpose, laterally to the first and last section of the guiding nut. By means of a wrench catch and draw the pins until the guiding nut lies tight on the drum (fig.35);

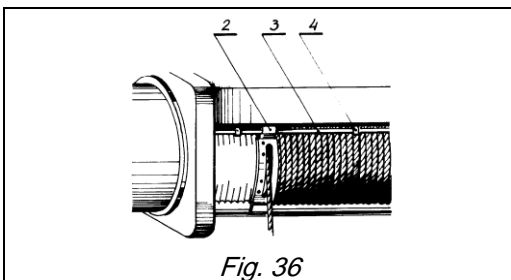


Fig. 36

f) shift the preliminary mounted guide at the free end of the rope and put it on the guiding nut, couple the two sectors and thus the guiding nut is finally attached to the drum (fig.36).

After rope guide assemblage the lever system of the end limit switch for upper and lower position of the hook is to be mounted.

There shall not be any rope-loosening with this manner of rope assemblage.

The remaining non-reeled part of the rope can be wound to the desired position after switching the electric hoist on by pressing the button "lift". Make sure no rope twisting occurs, especially when it is driven through the roller of the block-hook and the other rollers of the reeving system, and while fixing the other end of the rope as well. After wedging in the wedge bush to the housing or the cross-beam, the rope falls and the block-hook shall not be inclined to twist and intertwine. If this should happen, the end of the rope shall be released from the wedge sleeve and after removing the twist it shall be wedged again.

The rope shall not be reeled in to the end of the drum in any case, i.e. the hook shouldn't reach upper end position before assembling the lever system of the limit switch and its adjustment for switching off.

Before adjusting the limit switch lower the block-hook to its lower end position in order to check if the first winding of the rope is placed well in the groove of the drum. Otherwise the rope shall be forced to lie tightly in the groove of the drum.

After that hang a load on the hook in order to tighten up the rope and to achieve exact adjustment of lower and upper end positions according to p.4.4.

At changing the rope length i.e. because of elongation arising in the process of exploitation it is possible to change the place of the restricting rings on the bar.

5.4. OPERATION AND MAINTENANCE OF ELECTRIC MOTORS WITH BUILT - IN BRAKE

To ensure safe brake operation it's important to maintain the air gap between the ferodo disk and the friction surface (with the brake unactuated) in certain limits.

The initial (minimum) axial stroke of the rotor of the electric motors with a built-in conical brake is determined by the plant-manufacturer. Brake ferodo wears out during exploitation and as a result the axial stroke of the rotor respectively the stopping distance increases.

That's why you should make regular checks and if necessary to adjust the brake; at reaching the limit for wearing out you should change ferodo lining in order to recover the initial position of the rotor.



The brake doesn't work at axial shift greater than 2,5 to 3mm. Maximum permissible axial stroke of the rotor during exploitation – up to 2.5 mm.

Adjustment of the brake disc, i.e. the axial stroke of the rotor of the electric motor can be done in the following way:

a) hoisting electric motor

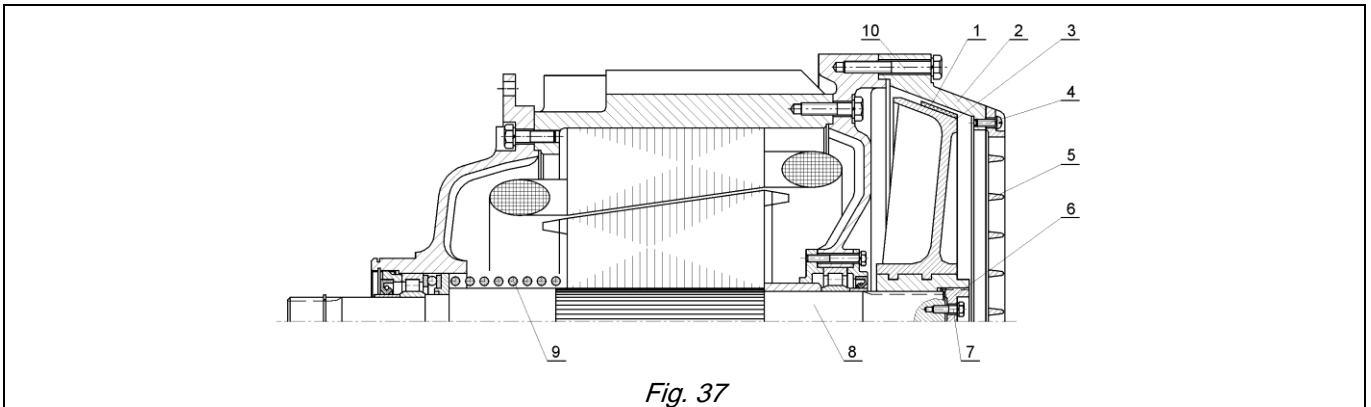
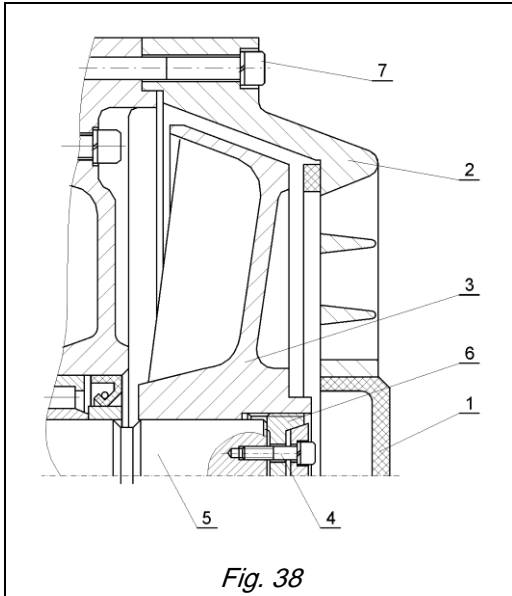


Fig. 37

- adjustment is carried out with unloaded hoist;
- remove grid 5 fixed with screws 4;
- unscrew bolts 7 fixing the adjusting nut 6 to the shaft 8 of the electric motor;
- screw the adjusting nut with a special key to support
- unscrew the adjusting nut 6 until normal axial stroke (i.e 0,5-1mm). The axial stroke of the rotor in this position is $L=2n$, where "2" is the thread pitch and "n" is the number of revolutions recorded at unwinding the adjusting nut;
- unscrew the adjusting nut to 1/4 or 1/2 revolutions in order to establish normal axial stroke.
- screw both fixing bolts pos. 7 of the adjusting nut 6;
- place the grid 5 and fasten with screws 4.

When the ferodo cone is worn out and its thickness reaches 1...2 mm it should be replaced with a new one and the adjustment is done in the described above way.

b) Electric motor with flywheel-brake for travel mechanisms



In order to recover the initial position of the rotor of the electric motor for the travelling mechanism where the brake disc acts frontly an insignificant axial shift is sufficient.

- disassemble the grid - pos.1 from the rear shield of the electric motor;

- measure the distance from the head of the locking bolt 4 of the shaft to the body pos. 2 of the electric motor;

- press the shaft pos. 5 forward by hand and measure the distance mentioned above again.

If there is a difference greater than 1,5 mm between both measurements the brake shall be adjusted and for that purpose you should do the next:

- unscrew the locking bolt pos. 4;

- screw the adjusting nut pos.6 with a special key to 1/2 revolution thus providing for an axial rotor stroke of 0,5 mm;

- tighten the locking bolt pos.4;

- measure the axial stroke and if it's greater than 1.5 mm or less than 0.7 mm the adjustment should be done again.

During exploitation and maintenance of electric motors with a built-in brake follow the requirements which are very important:

- *feeding and grounding leads should be tightened well for good contact;*
- *bearing sockets should be filled with a lubricant according to the lubrication plan;*
- *don't change the position of the adjusting nut on the front shield of the electric motors determined by the producer;*
- *at each adjustment of the brake you should check the thickness of the frictioning material (ferodo lining);*
- *if it's less than 1,5 mm replace it with a new one;*
- *during every survey you should check that the bolts of the rear shield of the electric motor and the housing of the brake are safely tightened.*

5.5. MAINTENANCE OF THE PLANETARY REDUCER

The general maintenance of the planetary gearbox consists of checking the oil state and its change. Following the directions for terms of oil change, type and quantity of the lubricant is very important for the good working order of the separate gears and the reducer as a whole.

At first oil change the reducer should be flushed with petrol, benzene, etc. For that purpose you should use double quantity of the flushing material in comparison to the oil quantity and pour it in the reducer in order it penetrate everywhere.

The electric hoist is switched on and the hook is lowered and lifted (without load) 5 times to a height of 1m. After that the flushing liquid is drained and the oil is poured to the level of the control stopper.

It is recommended to change the oil of the reducer after operation of the electric hoist because the worked off oil should be drained in warm state.

5.6. MAINTENANCE OF THE TRAVELLING MECHANISM

The maintenance of the travelling mechanism requires mainly control of the state of the travel wheels, gears inspection especially for those which are not covered and maintenance of the rail track.

Maximum permissible wearing out of the gears of the tooth rim of the driving travel wheels is up to 40% from the tooth thickness.

Maximum wearing out of flanges of the travel wheels shouldn't exceed 40% from the thickness.

If the recommended looseness between the guiding nut and the rail - 3 mm (4 mm for stiff jointless trolleys) increases for each side because of wearing out or other reasons, the trolley should be adjusted. For this purpose the pins that block the carriers of the driven and driving block are loosened and after their new positioning corresponding to the given looseness are tightened again.

The trolleys shouldn't be used for dragging loads on the floor.

You should handle the electric hoist very carefully in the area of the buffer devices and avoid strong impacts which can lead to damages.

In relation to the maintenance of the reducer of the travelling mechanism regular checking of the oil level at definite intervals is required and if necessary change it with a new one.

5.7. EXPLOITATION AND CHECKING OF THE ROLLER BLOCK AND THE LOAD HOOK

Exploitation of rope rollers with cracks and breakages along the ledge is not allowed.

The permissible wearing out of the groove for the rope is 25% from its diameter for cast iron and plastic rollers.

The load hook should be checked for cracks or deformations. This can be found by measuring the control distance between the two marks on the horn and stem of the hook.

At exceeding the given values in the table below the hook should be discarded and replaced with a new one.

Table 18

Capacity, t	1	2	3,2	5	8	12,5
Control dimension, mm	55	70	85	90	105	160

No matter the checks according to Table 18, during the periodical inspections of the detail "hook" as given in Table 16 tests for cracks and deformations must be proceeded in accordance with DIN 15405.

5.8. INSPECTION AND MAINTENANCE OF THE CLUTCH

Because of the specific position of the elastic clutch which has the necessary reliability corresponding to the operation lifetime of the electric hoist for the prescribed by the manufacturer operating conditions it is recommended to check the clutch every 3 years, which can be furnished at dismounting of the travel mechanism. The check refers mainly to the state of the grooves and the elastic body. If any ruptures or other damages of the elastic body are found it must be replaced with a new one.

5.9. ANTIFRICTION BALL - AND NEEDLE BEARINGS

All antifriction bearings that are not a part of the transmission mechanisms (planetary reducer) like the bearings of the drums, electric motors, roller block hook and the other rollers from the reeving system and the bearings of the travel wheels of the trolley are lubricated by the plant-manufacturer with the necessary quantity of grease. The next change of lubricant is done according to the lubrication plan - Table 20 and before lubrication the bearings should be cleaned and flushed with benzene or benzine (but not petrol) and then filled in up to 2/3-rd with grease.



At disassembly of the front bearing shield of the electric motor in order to change the lubricant you mustn't at any rate change the position of the adjusting nut fixed by the manufacturer.

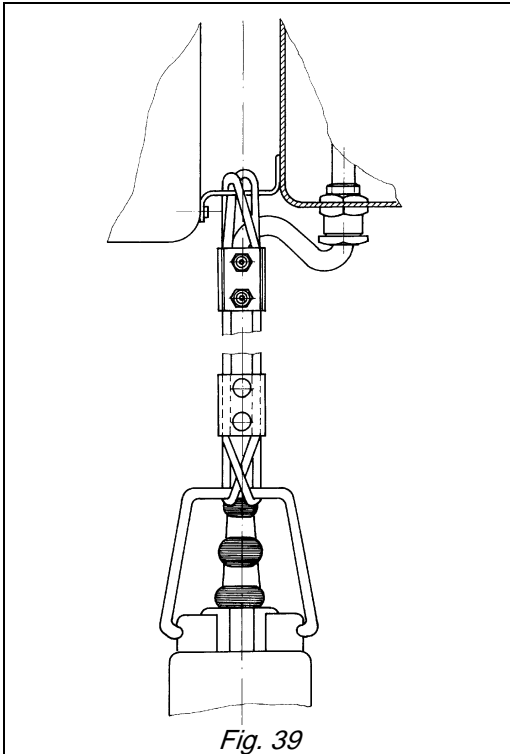
5.10. BEARING SCREW JOINTS

The bearing screw joints: body - electric motor, body - planetary reducer, hoisting mechanism - trolley, trolley - reducer attached to it – trolley electric motor and roller block - hook require regular checks and if you find some looseness tighten them with the respective moment given in Table 19. Keep in mind that all bearing screw joints possess strength class as follows: the bolts - 8,8 and the nuts - 8.

Table 19

Strength class of the joints		Size of nut and screw, mm	M6	M8	M10	M12	M14	M16	M18	M20	M24	M30	M36	M42
Screw	Nut	Type	Tightening moment, Nm											
5.6	5	minimum	3,7	7,5	17,2	30,0	45,0	60,0	90,0	120,0	190,0	510,0	700,0	1110,0
		maximum	5,0	10,0	23,0	40,0	60,0	80,0	120,0	180,0	255,0	676,0	980,0	1556,0
6.8	6	minimum	6,0	13,5	27,0	45,0	71,2	97,5	217,5	187,5	307,0	817,0	1120,0	1780,0
		maximum	8,0	18,0	36,0	60,0	95,0	130,0	290,0	250,0	410,0	1083,0	1570,0	2490,0
8.8	8	minimum	8,2	19,5	36,7	67,5	101,2	157,5	217,5	307,5	484,5	1100,0	1500,0	2370,0
		maximum	11,0	26,0	49,0	86,0	135,0	210,0	290,0	410,0	646,0	1459,0	2090,0	3320,0
10.9	10	minimum	10,5	26,2	51,7	90,0	142,5	221,2	303,7	435,0	682,0	1548,0	2100,0	3335,0
		maximum	14,0	35,0	69,0	120,0	190,0	295,0	405,0	580,0	910,0	2052,0	2940,0	4668,0

5.11. CONTROL BLOCK



The faultless operation and high reliability of the electric hoist as lifting mechanism depends on the good working order of its electrical equipment. That's why regular checks are required and if any malfunctions are observed, remove them immediately.

The necessary checks are as follows:

a) daily check of the push button

Check daily the push button for visible defects. Do not operate the electric hoists if any of the following defects have been observed:

- cracks in the housing;
- such damages on the push button cable, making the wires visible;
- the push button cable is outside the protective muff;
- the fastening of the bearing wire of the push button cable to the push button or to the electric panel has weakened (fig. 39);
- loosened or damaged buttons.

The removal of the above mentioned defects shall be carried by qualified personnel only.

The illegibility of the marking for the functions of the buttons is considered not so serious defect, but shall be taken care of immediately.

b) checking the electrical equipment according to Table 16, p.11.

Pay attention to the following:

- the state of the grounding conductors, i.e. if they are well tightened to the special grounding busbar in the electric panel;
- the fastening of the bearing steel core of the push button cable to the panel and the housing of the push button. It shall always be in tight condition in order not to load the command cable.
- the sealing of the cable inlets to the electric board and to the electric motors;
- the sealing between the base and the cover of the electric panel;
- the state of the contactors;
- the state of the reducing transformer and the end limit switch;
- the fastening of the fuses of the supply and operational circuits;
- Checking the state of the load limiter: check for mechanical damages on the sensor block; check for mechanical damages on the electronic block; check for loosened units; checking the load limiter adjustment.

Inspections and repairs of the electrical equipment shall be performed under the management of the person, responsible for the operation, who is acquainted with the electric hoist's accompanying documentation and the safe operation requirements, cited in the present Manual, as well as the respective country's normative documents.

5.12. LUBRICATION
5.12.1. Lubrication scheme

Table 20

Pos	Point of lubrication	Fig. 40				Type of lubrication	
		■ On initial putting into operation	■ After 3 months of operation	■ After 12 months of operation	■ After every 12 months		
				■ After every 12 months	■ After each 36 months		
1	Reducer for lifting	■	■	■	■	Change oil	pour it
2	Splined joint reducer-drum				■	Change grease	filling with grease
3	Drum - rope grooves			■	■	Clean and grease	by brush
4	Rope guide - spring channel and leading profile edge	■	■	■	■	Clean and grease	by brush
5	Rope		■	■	■	Clean and grease	filling with grease
6	End limit switch lever system	■	■	■	■	Clean and grease	by brush
7	Bearings of the roller for the rope, the hook				■	Change grease	filling with grease
8	Splines of the clutch				■	Change grease	filling with grease
9	Bearings drum - lifting electric motor				■	Change grease	filling with grease </td
10	Bearings of the lifting electric motor				■	Change grease	filling with grease
11	Axles of the wedge bush and the traverse		■	■	■	Clean and grease	by brush
12	Bearings of the motor of the travelling mechanism				■	Change grease	filling with grease
13	Travelling mechanism reducer	■			■	Change oil	pour it
14	Grooves ewducwr-shaft-travel wheel				■	Change grease	by brush
15	Jointed connection between the hoisting and travelling mechanism		■	■	■	Change grease	filling with grease
16	Bearing of the travel wheels				■	Change grease	filling with grease
17	Bearings of the guiding rollers of the travelling mechanism				■	Change grease	filling with grease
18	Tooth rim of the driving travel wheel			■	■	Change grease	filling with grease

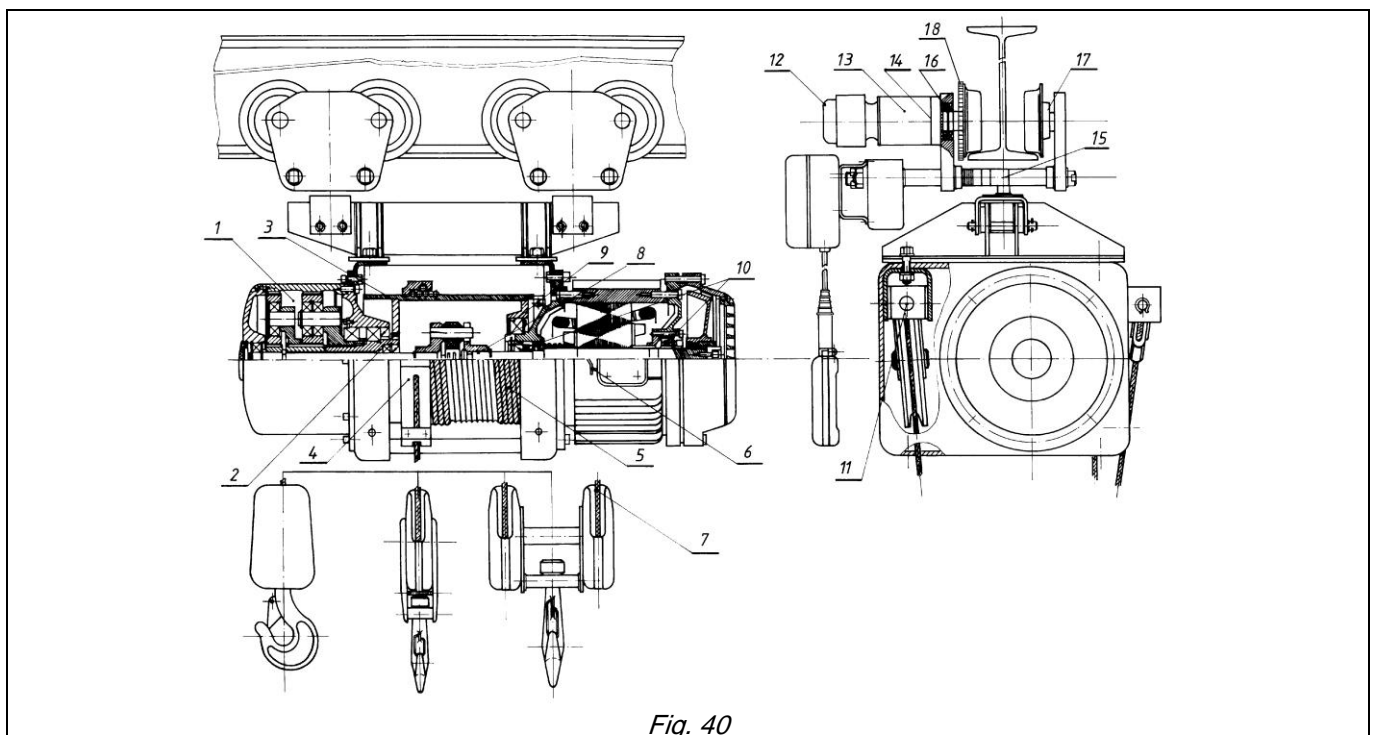


Fig. 40

5.12.2. Recommendable materials

Table 21

Place to lubricate, fig. 40		Lubricant features	Recommendable materials	Amount of lubricant for pos.				
Type of lubricant	1			2	3	4	5	
10, 12	Grease	Dripping temperature - not lower than 180°C	Operation temperature - 25°C to + 165°C	Pos. 10		Pos. 12		
			Fuchs RenoLit DurapLex 2, Shell Alvania EP Fett 2, Esso Unirex N 2, BP Energrease LS - EP 2, AraL AraLub FK2,	Size	V, g	Size	V, g	
			Operation temperature - 40°C to + 220°C	MH 3	50	MH 3	50	
			Fuchs Wacker Siliconfett Mittel, Aero Shell Grease 15A Siliconfett, Fuchs Wacker Siliconfett 300 mittel.	MHM 4	60	MHM 4	50	
7, 9, 16, 17	Grease	Dripping temperature - not lower than 180°C Penetration : 220÷430	Operation temperature - 25°C to + 80°C	Size	Qty, g			
			MOBIL-MOBILPLEX 48, BP Energrease HT 3.		Pos.			
			Operation temperature - 40°C to + 80°C		7	9	16	17
			MOBIL-MOBILLUX 2, Fuchs RenoLit FLM 2.		MH 3	40	20	60
2, 8, 14	Grease	Dripping temperature - not lower than 180°C Penetration : 300÷340 Applicable to heavy duty splined joints	Operation temperature - 25°C to + 120°C	Size	Qty, g			
			Aral Fett P64037, Aralub PMD1, BP Mehrzweckfett L21M, Esso Mehrzweckfett M, Mobil Grease Spezial, Texaco Molytex Grease EP2, Fuchs Renolit FLM2,		Pos.			
			Operation temperature - 50°C to + 150°C		2	8	14	
			Fuchs Renolit FLM2.		MH 3	40	4 - 6	10
	MHM 4	60	4 - 6	10				
	MHM 5	60	4 - 6	10				
	MH 6	80	4 - 6	10				
	MH 7	80	4 - 6	10				

Table 21 - cont'd

1	2	3	4	5							
3, 4, 5, 6, 11, 15, 18	Grease	Dripping temperature - not lower than 95°C Penetration : 220÷430	Operation temperature -25°C to + 80°C	Size	Qty, g						
			Aralub FDPO, BP Energrease HT-EPOO Esso Getriebfliessfett Shell Special H Mobil Gargoyle Fett 1200 W		Pos.						
				MH 3	50	50	50	5	40	10	30
				MHM 4	60	60	60	5	40	15	40
				MHM 5	60	60	60	5	40	20	40
			Operation temperature - 40°C to +120°C	MH 6	75	75	75	5	40	20	50
			Fuchs Renolit 500 EP	MH 7	90	90	90	5	40	25	60
(13)	Grease	Dripping temperature - 120°C Penetration - 250÷320	Operation temperature -25°C to + 80°C	Size		Qty, g					
			BP-Energrease HT EP1 Mobil-Mobilplex 46	MH 3		160					
				MHM 4		300					
			Operation temperature - 40°C to +120°C	MHM 5		300					
			Mobil-Mobilux EP2	MH 6		350					
				MH 7		750					
1, [13]	Oil	Viscosity acc. to ISO 220 (150) Viscosity 220 cst at 40°C Freezing temperature -25° (-40°) Temperature of inflammation 190°C (180°) Classification acc. to the exploitation levels as per API not lower then GL-4 Applicable to planetary reducers	Mobil-Mobilgear 632, Mobil-Mobilube GX90, BP-Hypogear 90 EP, Shell Spirax Heavy Duty 90, EP 220 (Klueber, Syntheso), D220 EP, Esso S220), (Shell - Tivela-82)	Size	Qty, l						
					Pos.						
					1			[13]			
				MH 3	0.45			0.40			
				MHM 4	0.80			0.60			
MHM 5	0.80			0.60							
MH 6	1.20			1.00							
MH 7	2.00			1.75							



1. Symbols used: * - for operating temperatures from -40°C to +40°C.
2. Pos. (13) - for travelling mechanism for normal - headroom electric hoist; [13] - for low - headroom electric hoist

5.13. POSSIBLE FAILURES IN THE ELECTRIC EQUIPMENT AND METHODS REMOVAL

The possible failures in the electric equipment and the methods of their removal are given in Table 22

Table 22

Nr	Fault	Cause	Correction
1	Equipment won't switch on	1. A safety fuse of the reducing transformer has burnt	1.1. Replace it with a new one
		2. Mains lead fuse has burnt	2.1. Replace it with a new one
		3. Breakage in the operational circuit	3.1. Check the wiring diagram (figs.11-16) and recover the broken circuit
		4. Contactor coil burnt or ruptured	4.1. Replace it with a new one
		5. End limit switch activated or blocked	5.1. Check it and recover its normal position
2	With pressed control button the lifting motor does not rotate	1. Conical brake has stuck	1.1. Take off the fan grid and press several times the shaft with switched off and unloaded hoist
		2. Mechanical blocking in the electric hoist or the motor	2.1. Disassemble and remove the failure
3	Fuses F1-F3 burn out when the motor is switched on (fig. 7)	1. Winding breakthrough to frame mass Check with a megaohm-meter	1.1. Re-wind
		2. Breakthrough between phases	2.1. Re-wind
4	Electric motor is unusually noisy	1. Bearings have worn out	1.1. Replace them
5	Electric motor drones and does not rotate when loaded	1. Only two of the phases are in action	1.1. Check the mains
			1.2. Check the operation of the contactors. Change the contact bridges or the contactor springs if necessary
			1.3. Check the state of the stator coil
		2. Working voltage is lower than minimum required	2.1. Check the supply voltage by voltmeter
6	Motor get overheated	1. Rated load is exceeded	1.1. Observe the prescribed load ratings
		2. Voltage is asymmetric	2.1. Switch off the hoist until symmetry resumes
		3. Voltage is above admissible ratings	3.1. Follow the prescribed ratings
		4. Heavier operation mode in effect	4.1. Observe the prescribed operation modes
7	Electric motor goes on working with push button switched off	1. Contactor contact tips have welded	1.1. Replace the contact bridges
		2. Contactors' magnet system has stuck	2.1. Check the counteracting springs and clean the magnet's front surfaces
		3. Push button contacts have welded	3.1. Replace them with new ones
8	Limit switch does not actuate properly but switches off the main contactor	1. Incorrect phasing of the supply cable	1.1. Exchange any two of the phases
		2. Limiting rackets on the bar Phase loosened	2.1. Adjust and tighten the limiting rackets
		3. Contactor for relevant direction has stuck	3.1. Remove the sticking and replace the contactor, if necessary
		4. Limit switch has blocked	4.1. Check the limit switch. Mend it, if possible; otherwise replace it

5.14. NOISE DATA

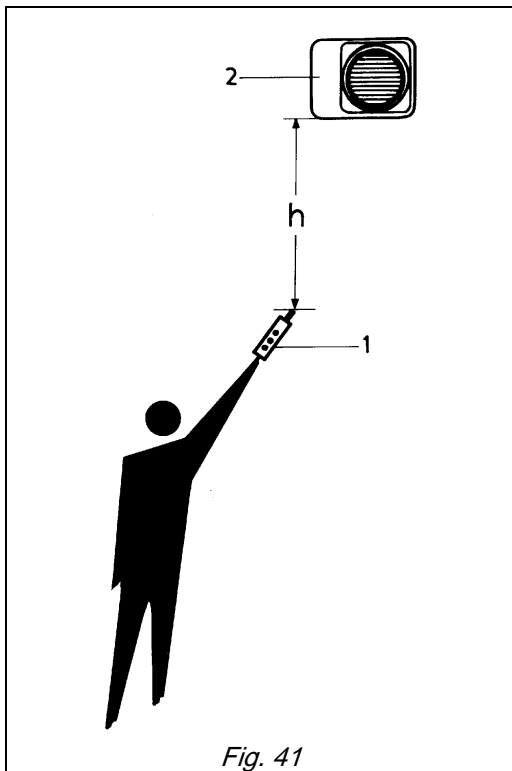


Fig. 41

The noise data is obtained on measurement basis.

The measurement conditions are:

1. **Environment:** operating premises or outdoor space without sound-reflecting surfaces around.
2. **Hoist operation mode:** the hoisting mechanism works with rated load, at normal temperature mode of the electric motor and maximum lifting speed.
3. **The microphone** of the noise measuring device (fig. 41) must be placed at a distance "h" from the hoist. "h" takes the values:
 - 5m - for electric hoists of lifting height up to 12 m;
 - 10m - for electric hoists of lifting height over 12 m;
4. **The distance between the microphone and the walls** must be greater than:
 - 1,2 m - for measurements in operating premises;
 - 3,5 m - for measurements outdoors.

The data for the admissible values of the noise and the noise pressure are given in Table 23

Table 23

Lifting speed	Reeving			Size			
				MH 3	MHM 4, MHM 5	MH 6	MH 7
	1/1	2/1	4/1	Sound levels acc.to scale A not higher than:			
V1 (m/min)	16	8	4	80	82	84	85
V2 (m/min)	24	12	6	82	84	85	-

6. STEPS TO ATTAINMENT OF SAFE WORKING PERIODS

The here presented rules, worked out in compliance with FEM 9.755 are intended to provide for measures for safe working periods during the whole operation duration.

The basic terms, referred to and defined in FEM 9.755, are:

- **Theoretical operation D** - the calculated full operation time of a series hoisting mechanism, as classified acc. to FEM 9.511, for operation period of about 10 years.

- **Actual durability of operation $S(h)$** - determined depending on the working hours, loading conditions and factors, related to the method of record-keeping. It is a value that reflects the effective usage of the series hoisting mechanism.

- **Total operation duration (h)** - the period from initial starting till final discarding.

- **Safe working period (SWP)** - period that complies to the requirement:

$$\frac{\text{Actual operation } S}{\text{Theoretical operation } D} \leq 1$$

The probability for damages is decreased to a minimum when the actual operation duration is less than the theoretical one.

The electric hoists produced by BALKANCARPODEM Ltd correspond to the groups defined in FEM 9.511 and ISO 4301/1, as the classification group of each hoist is written in its passport.

The theoretical operation D of the appliances is acc.to FEM 9.755 and is shown in Table 24.

Table 24

Groups acc.to:	FEM 9.511	1Am	2m	3m
	ISO 4301/1	M4	M5	M6
Designation	Loading type $K (Km)$	Theoretical operation $D(h)$		
L1	light $K=0,5$ ($Km1=1,125=0,5^3$)	6300	12500	25000
L2	medium $0,5 < K < 0,63$ ($Km2=1,25=0,63^3$)	3200	6300	12500
L3	heavy $K=0,5$ ($Km3=1,5=0,8^3$)	1600	3200	6300
L4	very heavy $0,8 < K < 1$ ($Km=1=1^3$)	800	1600	3200

To ensure safe working within the full period of operation it is necessary to observe the following prerequisites:

- correct selection of serial hoists that will be suitable for the loads in accordance with FEM 9.511.
- keeping to the prescribed check-up intervals (periodical check-up at least once a year);
- observing the manufacturer's operation and maintenance instructions.
- carrying out of overhauls.

The actual operation durability is the real criterion for the effective service of both serial hoist and its related loads.

The probability of real mismatch between the actual and the theoretical durability tends to grow up during the presumed period. This also implies that the working period up to the time of the first overall repair (that is the safe working period) should be properly corrected. For that reason the customer has to keep records on both operation time (hours) and operation mode during the period. Once a year the customer should furnish a documentary evidence of the actual operating duration in special register form (Sample 1) It's advisable that the documentary records be carried out along with the regular annual inspection.

The user is responsible for keeping the records. On the ground of the records furnished, the authorized inspector will check up whether the actual operation has reached the limits of the theoretical one. Safe working period is achieved whenever the condition

$$S(h) < D(h)$$

is fulfilled; otherwise the unit should undergo general repair.

The general repair (overhaul) is claimed by the customer. It is carried out either by BALKANCARPODEM Ltd or by authorized persons. The manufacturer warrants the product for the new period of time.

The calculation method is based upon comparison between the actual operating durability " S " and the theoretical period of working by relating both to the very heavy duty of loading (class 4). If, for example the electric hoist is of group 2m, its theoretical operation period for class 4 is $D=1600$ hours.

If the electric hoist operates only partially loaded, its theoretical working period " D " will increase considerably. Thus for hoists operating only with half of their rated loads " D " will increase eight times.

6.1. KEEPING RECORDS OF THE PROCEDURES

The actual duration of operation $S(h)$ of the serial hoist represents its effective work calculated on the basis of:

- operating hours for the inspection interval;
- operation duty;
- correction coefficient;

There are three usable ways of keeping records, divided into three classes:

6.1.1. Keeping records by storing operation duty data (Class 1)

The loading conditions and the respective number of operating hours as well are registered by means of suitable instruments. The actual operation " S " can be obtained by evaluation of the data stored.

6.1.2. Keeping records of operating hours by timers and furnishing documentary evidence of the loading conditions by the user (Class 2)

The user furnishes documentary evidence of the loading conditions and the respective hours of operation during which the loading mentioned was in effect.

The serial hoist is provided with a clock-counter and/or run-way counter as well as a load limiter.

6.1.3. Keeping record of operating hours and loading conditions by the user (Class 3)

The user will keep documentary records of the loading conditions and the respective operating hours without using suitable instruments.

6.2. DETERMINING THE ACTUAL OPERATION PERIOD

6.2.1. The actual operation period is defined acc.to 6.1.1

The actual duration S_i of the inspection period is defined in compliance with FEM 9.755

$$S_i = \left(K_{mi} \cdot T_{oi} \right)$$

where " i " is the ordinal number of the inspection;

K_{mi} is the real coefficient of the loading conditions during the inspection periods.

T_{oi} are the working hours during the inspection period.

The theoretical period of operation is reached when:

$$S = \sum_{i=1}^n S_i \leq D$$

where " n " is the number of the inspections carried out.

6.2.2. Determining the actual period of operation when keeping records according to 6.1.2 and 6.1.3

The actual operation duration of the inspection period is determined by the following equation:

$$S_i = K_{mi} \cdot T_{oi} \cdot f$$

where T_{oi} is the number of the recorded operating hours for the inspection period;

" f " is the method coefficient of record keeping.

The check for the exhausting of the theoretical operation period is carried out as for 6.2.1.

The check for the exhausting of the theoretical operation period is carried out as for 6.2.1.

6.2.2.1. Method coefficient of record keeping

Since accuracy and reliability in record keeping tend to decrease from class 1 to class 3, the evaluation of the actual operating duration goes in direct dependence on the method of record keeping. This is taken into consideration for the value of " S_i " by means of the " f " coefficient which is determined according to Table 25.

Table 25

Nr	Method of record keeping	Coeff. <i>f</i>
1	Keeping record by storing operation duty data	1,0
2	Keeping record of operation hours by means of counters and evaluation of operation duty	1,1
3	Evaluation of operation hours and duty	1,2

6.2.2.2. Determining of operating duration

The time period during which the unit is running is defined as operating duration. It is determined through the value shown by the counter. The latter counts the time *Toi* during which the unit has been running. The measuring unit for time is the hour.

When there is no counter available, the operating duration for the inspection period is calculated by using the next equation:

$$Toi = \frac{2 \cdot H \cdot N \cdot T \cdot Dp}{60 \cdot V}$$

where: *V* (m/min) - lifting speed;

N - the number of cycles per hour;

H - the average value of the lifting height in meters per cycle.

Cycle is meant to denote both lifting and lowering;

T - working time duration measured in hours per day;

Dp - working days for the inspection interval.

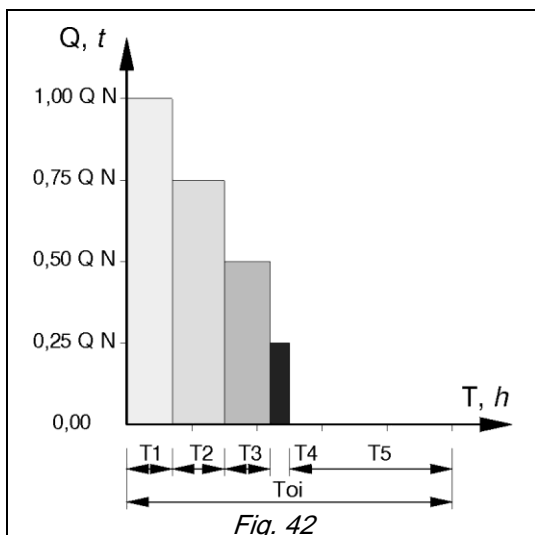
6.2.2.3. Determining the actual coefficient of loading mode *Km*

The actual coefficient of loading *Kmi* is determined by the user for each inspection period.

Table 24 presents the values for the coefficient *Kmi* for all kinds of loading (light, medium, heavy and very heavy) as well as its relation to the compound coefficient of loading

K: *Kmi*=*K3*

In the case the documentary record is made without storing the type of the operation duty, "*Kmi*" is calculated by the next simple method:

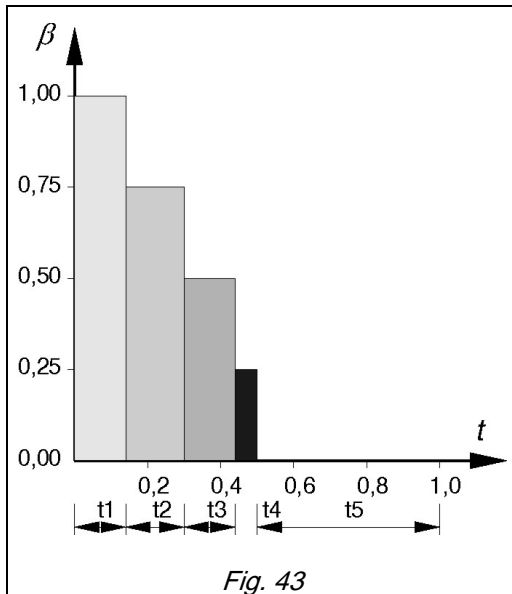


a) Drawing a chart of operation loading

On the basis of the recorded data concerning both operation loading and hours, it is possible to draw down a bar-chart of the loading as shown on fig. 42 which presents the change in loading *Q* as a function of the time *T* on the assumption that the hoist was operated with the following loads: *Q_N*; *0,75.Q_N*; *0,5.Q_N*; *0,25.Q_N* and without any load. For these load the next operation periods are defined from the record keeping: *T1*; *T2*; *T3*; *T4*; *T5*.

Q_N designates the rated capacity of the electric hoist.

The time of record keeping *Toi* for the inspection period is equal to the sum total of *T1*; *T2*; *T3*; *T4* and *T5*.



b) Drawing a modified loading chart

For further use the chart from fig. 42 is drawn in relative units (as shown on fig. 43). The load unit is Q_N and the time Toi unit is.

The ratio between the actual load and the rated capacity designated by $\beta = \frac{Q}{Q_N}$ is marked along the Y-axis while the X-

axis contains the values of these time periods during which the electric hoist has operated under a certain load. All time periods t_j are calculated as parts of the total time under loading Toi :

$$t_j = \frac{T_j}{Toi}$$

Because of the simplified presentation of operation under loading the ratio between the actual and rated load β should take the values: $\beta_1 = 1$; $\beta_2 = 0.75$; $\beta_3 = 0.5$; $\beta_4 = 0.25$

c) Calculation of the Kmi coefficient

By using the data from the chart on fig. 43 it's possible to determine Kmi for the inspection period:

$$Kmi = \beta_1^3 \cdot t_1 + \beta_2^3 \cdot t_2 + \beta_3^3 \cdot t_3 + \beta_4^3 \cdot t_4$$

With regard to the accepted simplifications it could be rendered as:

$$Kmi = 1^3 \cdot t_1 + 0.75^3 \cdot t_2 + 0.5^3 \cdot t_3 + 0.25^3 \cdot t_4$$

The quantity values in these equations are taken from fig. 42

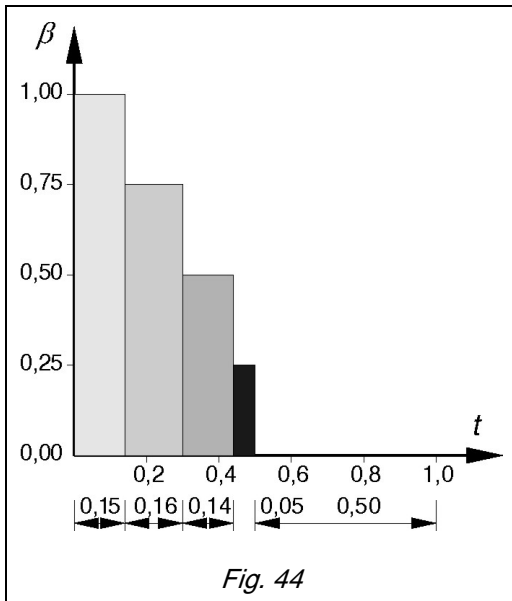
For the calculations of the Kmi coefficients take into consideration:

- the rated load includes the net load and the weight of the load-holding devices;
- the accepted method is in compliance with FEM 9.511 and is valid in case that:

$$\frac{\text{Gripping devices weight}}{\text{Rated load}} \leq 0.05$$

If this condition is not satisfied the calculation of the Kmi coefficient is to be done according to FEM 9.511.

After determining the actual operating period it should be compared to the theoretical one.



EXAMPLE:

Carry out first inspection check-up of an electric hoist pertaining to 2m group with next calculation data:

Lifting speed - 24m/min

Cycles per hour - 20

Average lifting height - 11m

Working time duration per day - 8 hours

Number of days for the inspection period - 250

The documentary record done acc.to 4.2.3. testifies that the hoist has transported loads as follows:

15% of the time with rated load;

16% of the time with 3/4 of the rated load;

14% of the time with 1/2 of the rated load;

5% of the time with 1/4 of the rated load;

50% of the time without any load;

According to the recorded data the operation time for the inspection period is:

$$T_{o1} = \frac{2.11.20.8.250}{60.24} = 611.1 \text{ , hours}$$

The loading diagram is shown on fig.46. So, the actual coefficient K_{m1} is:

$$K_{m1} = 1^3 \cdot 0.15 + 0.75^3 \cdot 0.16 + 0.5^3 \cdot 0.14 + 0.25^3 \cdot 0.05 = 0.2357$$

The actual operation duration for the inspection period is:

$$S_1 = 0.2357 \cdot 611.1 \cdot 1.2 = 172.84 \text{ , hours}$$

The theoretical operating duration after the inspection period is equal to:

$$D = 1600 - 172.84 = 1427.16 \text{ , hours}$$

When all calculations are made, the results are recorded in the Register Form 1.

When the theoretical operating duration is exhausted the hoist is allowed to continue operation after overhaul only.

If the documentary recording is properly kept the electric hoist should undergo overhaul not later than 10 years after the date it was set into operation. The record mentioned is to be kept according to 6.1.2. and 6.1.3 and the repairs are to be carried out in compliance with FEM 9.755.

6.3. OVERHAUL

The overhaul is a total check-up of the electric hoist aiming to find out all defective or close to defective parts and their replacement. The purpose is to make the hoist to be as a new one.

When carrying out repair works it's necessary to keep all labour safety instructions set out in this Manual and the respective regulations valid in the country where the hoist is run as well.

The overhaul must be done by manufacturer's personnel or by a company that is legally authorized to furnish that service. Records for the repairs must be filled in the check-up register.

Overhaul works are carried out in accordance with Table 26. It indicates all details and parts that are to be replaced at the time of the overhaul regardless of their condition.

The check-up and the permission for further operation are to be furnished by the specialists of BALKANCARPODEM Ltd or by a company authorized by BALKANCARPODEM Ltd to furnish that kind of services.

The person in charge of the check-up must determine the following items:

- the feasible theoretical operation;
- the maximum time period until next repair;

This information is recorded in the check-up register.

When the overhaul is over the electric hoist is once again put into operation in accordance with the specific documents that are in effect in the country, where the hoist is operated.

Table 26

No:	Name	Check for cracks	Check for wear	Replacement
1	2	3	4	5
	LIFTING MECHANISM			
1	Body	■		
2	Drum	■	■	
3	Rope		■	
4	Rope rollers	■	■	
5	Rope guide		■	
6	Tooth rim of the reducer	■	■	
7	Cover and flange of the reducer	■		
8	Planetary gears guides	■		
9	Planetary gears axles	■	■	
10	Sun gears and planetary gears			■
11	Input shaft of the reducer			■
12	Output shaft of the reducer: geared bush	■		
13	Clutch			■
14	Brake disk	■		
15	Electric motor shaft	■	■	
16	Electric motor flange	■		
17	Hook with nut			■
18	All bearings			■
19	All rubber gaskets			■
20	Splined joints	■	■	
21	End limit switch			■
22	Commutation equipment			■
23	Traverse	■		
24	Frame	■		
25	Bearing bolts			■

Table 26 - cont'd

1	2	3	4	5
	TRAVELLING MECHANISM			
1	Brake disk	■		
2	Electric motor shaft	■		
3	Electric motor flange	■		
4	Travel wheels		■	■
5	Planetary gears guide	■		
6	Planetary gears axles	■	■	
7	All gears			■
8	Cover and flange of the reducer	■		
9	Tooth rim of the reducer	■		
10	All bearings			■
11	All rubber gaskets			■
12	Bearing elements: side-walls, axles, studs	■	■	

7. ENVIRONMENTAL PROTECTION

7.1. AFTER UNPACKING

We are selling our products in ecologically clean packing, subject to recycling or processing without danger to the surroundings. We kindly ask you to avoid environmental pollution after the final unpacking of the product. Please contact the respective organization authorized to perform the packing destruction.

7.2. REPAIR OPERATIONS

When the product is under repair (partial or capital), the components subject to replacement must be destroyed in a way avoiding environmental pollution:

- The oil of the gear units is drained and submitted for second processing.
- The rubber parts and elements are set apart and submitted to the group of rubber waste.
- The plastic parts are set apart and submitted to the group of plastics.

The asbestos free ferodo of the motor brake is set apart and submitted as industrial waste.

7.3. PRODUCT REJECTION

The product is subject to rejection when spending its operational resources.

The different hoist components (when deposited) can cause environmental pollution. They must be destroyed separately due to that reason:

- The oil of the gear units is drained and submitted for second processing.
- The black metals are set apart and submitted for remelting.
- The cables, the electric control and the stator windings are set apart and submitted for second processing of the copper parts.
- The rubber parts and elements are set apart and submitted to the group of rubber waste.
- The plastic parts are set apart and submitted to the group of plastics.
- The asbestos free ferodo of the motor brake is set apart and submitted as industrial waste.

**REGISTER FORM
FOR CALCULATION OF EACH INSPECTION PERIOD**

Checkup	Date		Operating duration Toi,h	Operating duration by the following loading conditions					Coefficients		Operation period, h		
	From	To		Q_N	$0,75.Q_N$	$0,5.Q_N$	$0,25.Q_N$	No load	Kmi	f	Actual S(h)	Theoretical D(h)	Remainder D(h)-S(h)
1	12.04.03	12.08.03	611,1	0,15	0,16	0,14	0,05	0,50	0,2357	1,2	172,84	1600	1427,16
2													
3													
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balkancarpodem

BALKANCARPODEM Ltd

1040 Sofia, Bulgarien

18, Kliment Ohridsky Blvd.

Tel. (+359 2) 975 33 95

Fax (+359 2) 975 33 89

e-mail: mail@bcp.bg

http://www.bcp.bg

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