Foggy Bottom Station

Washington Metropolitan Area Transit Authority

Operation & Maintenance Manual

Schindler 9700™ Escalators

Schindler Elevator Corporation

Schindler

Revision Record

Revision:	1st submission	2nd submission
Date:	August 2011	March 2012

Prepared:	ISO-checked:	Released:
Date: March 2012 Name: Johann Ludwig	Date: March 2012 Name: David Evans Name: Chris Anayiotos	Date: March 2012 Name: Chuck Spell

Schindler Elevator Corporation
609 Industrial Drive
Clinton, NC 28328-9745, USA
Tel. +1 910 590 5547
Fax +1 910 590 5575

Table of Contents

VOLUME II – Maintenance

Use & Limitation of the Manual

This Operation & Maintenance Manual contains important guidelines for the safe and proper operation and maintenance of Schindler 9700 escalators for WMATA as well as special product information on this product line and applies to all types and order numbers as listed in the location table.

The Operation & Maintenance Manual serves as a universal reference book for all persons dealing with the operation, monitoring or maintenance of Schindler 9700 escalators for WMATA.

This Operation & Maintenance Manual has been prepared for escalator experts, i.e., basic knowledge of this special field is required and expected.

Spare Parts
Original parts and accessories are designed specifically for this product line. It has to be pointed out that parts and accessories not supplied by the manufacturer have neither been checked nor released by the latter. The installation and/or use of such parts as well as the use of second-hand parts may deteriorate predetermined design characteristics, such as the service life, the safety of operation and the traveling comfort, and may impair the safety of the unit as a whole.

The manufacturer will not be liable to the operator in any way for damage caused by the use of duplicates or second-hand parts not checked by the manufacturer/representative.
If an affected party sues the manufacturer directly, the manufacturer shall have the right of recourse against the owner/operator of the unit in question, given noncompliance as mentioned above.

After-Sales Service
The manufacturer's after-sales service guarantees many years of trouble-free operation. Therefore, it is recommended that routine maintenance work be carried out by the manufacturer's organization in order to ensure the use of original spare parts.

If third parties are called upon to maintain the unit, the use of original parts when replacing old ones shall be ensured. Whenever non-proprietary parts are used, this shall be noted in the "Unit Documentation" of the manufacturer/representative.

Troubleshooting going beyond the scope outlined in this Operation & Maintenance Manual should be done by the manufacturer's organization. Otherwise it shall be ensured prior to any repair work that the necessary measures are agreed on with the manufacturer.

Schindler ISO 14001 Certificate

LRQA
Business Assurance

CERTIFICATE OF APPROVAL

This is to certify that the Environmental Management System of:

Schindler Elevator Corporation
Morristown, New Jersey, USA

has been approved by Lloyd's Register Quality Assurance
to the following Environmental Management System Standard:

ISO 14001:2004

The Environmental Management System is applicable to:

New Product and Modernization Operations for the Engineering and Manufacture of Hydraulic and Traction Elevators and Elevator Components, Escalator Products and Steps, Repair of Electrical and Electronic Assemblies, Warehousing of Modernization Products and Corporate Facility Management for Headquarters Operations.

This certificate is valid only in association with the certificate schedule bearing the same number on which the locations applicable to this approval are listed.

Approval
Certificate No: UQA 0113837

Original Approval: April 13, 2011
Current Certificate: April 13, 2011
Certificate Expiry: March 31, 2014

Issued by: Lloyd's Register Quality Assurance, Inc.

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This approval is carried out in accordance with the LRQA assessment and certification procedures and monitored by LRQA.
Macro Revision 13

LRQA Business Assurance

CERTIFICATE SCHEDULE

Schindler Elevator Corporation

Locations:	Activities:
SEC America Corporate Office Morristown, New Jersey, USA	Corporate Facility Management for Headquarters Operations and Engineering of Traction and Modernization Products.
Gettysburg Plant Gettysburg, Pennsylvania, USA	Engineering and Manufacture of Hydraulic and Traction Elevators and Elevator Components.
Clinton Plant Clinton, North Carolina, USA	Engineering and Manufacture of Escalators Products and Manufacture of Escalator Steps.
Modernization Distribution Center Holland, Ohio, USA	Warehousing of Modernization Products and Repair of Electrical and Electronic Assemblies.

Approval
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Schindler ISO 9001 Certificate

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Schindler Elevator Corporation
20 Whippany Road
Morristown, New Jersey 07962, USA

has been approved by Lloyd's Register Quality Assurance
to the following Quality Management System Standards:

ISO 9001:2008

The Quality Management System is applicable to:

Sales, Application Engineering, Manufacturing, Installation, Modernization and Servicing of Elevators, Escalators and Moving Walks.

This certificate is valid only in association with the certificate schedule bearing the same number on which the locations applicable to this approval are listed.

Approval
Certificate No: UQA 0100032

Original Approval: January 12, 1992
Current Certificate: December 1, 2011
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LRQA
Business Assurance

CERTIFICATE SCHEDULE

Schindler Elevator Corporation

Locations:	Activities:
Schindler Elevator Company 20 Whippany Road Morristown, New Jersey 07962, USA	Management of the Quality System, Sales, Application Engineering, Purchasing, Human Resources, Modernization
Center of Service Excellence 1530 Timberwolf Drive Holland, Ohio 43528, USA	Service Marketing , Service Field Support Service Engineering & Technology Repair Marketing Schindler Customer Service Network (SCSN) Service Maintenance & Reliability Purchasing and Warehousing of Modernization Product and Electronic Systems & Support (ESS).
Elevator Plant 1200 Biglerville Road Gettysburg, Pennsylvania 17325, USA	Contract Management, Application Engineering, Purchasing, Manufacturing and Warehousing of Elevators and Architectural Products.
Escalator Plant 609 Industrial Drive Clinton, North Carolina 28328, USA	Contract Management, Purchasing, Application Engineering and Manufacture of Escalators and Moving Walks.
Step Plant 821 Industrial Drive Clinton, North Carolina 28328, USA	Manufacture of Escalator Steps.

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CERTIFICATE SCHEDULE

Schindler Elevator Corporation

AREA EAST:

Washington DC
6800 Muirkirk Road
Beltsville, Maryland 20705, USA

Sales, Installation, Modernization and Servicing of Elevators, Escalators and Moving Walks.

Baltimore, Maryland
1730 Twin Springs Road, Suite 222
Baltimore, Maryland 21227, USA

Allentown/Harrisburg, Pennsylvania
Hedgewood Drive, Suite 210
Allentown, Pennsylvania 18106, USA

Philadelphia/Atlantic City
840 North Lenola Road, Suite 4
Moorestown, New Jersey 08057, USA

Long Island, New York
7 Midland Avenue
Hickeville, New York 11801, USA

New York City (Uptown, Downtown, WTC)
6201 12th Avenue, 4th Floor
New York, New York 10036, USA

Morristown, New Jersey (North Jersey)
20 Whippany Road
Morristown, New Jersey 07962, USA

Charlotte, North Carolina/
Charleston, South Carolina
900 Center Park Drive, Suite D
Charlotte, North Carolina 28217, USA

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Schindler Elevator Corporation

AREA EAST (Continued):

Atlanta, Georgia
6600 Highlands Parkway
Smyrna, Georgia 30082, USA

Sales, Installation, Modernization and Servicing of Elevators, Escalators and Moving Walks.

Raleigh, North Carolina
2101 Westinghouse Boulevard, Suite 102
Raleigh, North Carolina 27604, USA

Richmond, Virginia
8801 Park Central Drive, Suite 100
Richmond, Virginia 23227, USA

AREA NORTH CENTRAL:

Chicago Suburban
853 North Church Court
Elmhurst, Illinois 60126, USA

Sales, Installation, Modernization and Servicing of Elevators, Escalators and Moving Walks.

Chicago Downtown
100 South Wacker Drive, Suite 1575
Chicago, Illinois 60606, USA

Cleveland, Ohio
18013 Cleveland Parkway, Suite 140
Cleveland, Ohio 44135, USA

Indianapolis, Indiana
2325 Executive Drive
Indianapolis, Indiana 46241, USA

Lansing/ Grand Rapids, Michigan
3135 Pine Tree Road, Suite B
Lansing, Michigan 48911, USA

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Schindler Elevator Corporation

AREA NORTH CENTRAL (Continued):

Detroit, Michigan
Livonia Corporate Center, Building 5
28451 Schoolcraft Road
Livonia, Michigan 48150, USA

Sales, Installation, Modernization and Servicing of Elevators, Escalators and Moving Walks.

Toledo, Ohio
1530 Timberwolf Drive, Suite B
Holland, Ohio 43528, USA

Cincinnati, Ohio
5426 Duff Drive
Cincinnati, Ohio 45246, USA

Columbus, Ohio
3607 Interchange Road
Columbus, Ohio 43204, USA

Boston, Massachusetts
23 Walpole Park South Drive
Walpole, Massachusetts 02081, USA

Hartford, Connecticut/
Springfield, Massachusetts
850 Brook Street
Rocky Hill, Connecticut 06067, USA

Pittsburgh, Pennsylvania
230 Bilmar Drive
Pittsburgh, Pennsylvania 15205

Buffalo/ Rochester, New York
80 Curtwright Drive, Suite 3
Williamsville, New York 14221, USA

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AREA NORTH CENTRAL (Continued):

Albany / Syracuse, New York
12 Walker Way
Albany, New York 12205, USA

Sales, Installation, Modernization and Servicing of Elevators, Escalators and Moving Walks.

Milwaukee, Wisconsin
Campbell Drive, Suite 8
Menomonee Falls, Wisconsin 53051, USA

Madison, Wisconsin
1906 Wright Street
Madison, Wisconsin 53704, USA

Des Moines, Iowa
3000 Justin Drive, Suite F
Urbandale, Iowa 50322, USA

Minneapolis, Minnesota/
Fargo, North Dakota
895 Blue Gentian Road
Eagan, Minnesota 55121, USA

AREA SOUTH CENTRAL:

Dallas, Texas
8105 North Belt Line Road, Suite 120
Irving, Texas 75063, USA

Sales, Installation, Modernization and Servicing of Elevators, Escalators and Moving Walks.

Tulsa, Oklahoma
3168 South 108th Street, Suite 370
Tulsa, Oklahoma 74146, USA

St. Louis, Missouri
3640 Market Street
St. Louis, Missouri 63110, USA

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AREA SOUTH CENTRAL (Continued):

Kansas City, Missouri
1802 Jasper Street
North Kansas City, Missouri 64116, USA

Sales, Installation, Modernization and Servicing of Elevators, Escalators and Moving Walks.

Shreveport, Louisiana/ Little Rock, Arkansas
3825 Gilbert Drive #150
Shreveport, Louisiana 71104, USA

Houston, Texas
1201 West Loop North, Suite 130
Houston, Texas 77055, USA

San Antonio/ Austin, Texas
12961 Park Central, Suite 1460
San Antonio, Texas 78216, USA

New Orleans, Louisiana/ Memphis, Tennessee/ Jackson, Mississippi
656 Timer Saver Avenue
Harahan, Louisiana 70123, USA

South Florida
7100 TPC Drive, Suite 300
Orlando, Florida 32822, USA

North Florida/ Jacksonville, Florida
13800 NW 2nd Street, Suite 140
Sunrise, Florida 33325, USA

Birmingham, Alabama
2716 7th Avenue South
Birmingham, Alabama 35233, USA

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AREA SOUTH CENTRAL (Continued):

Tampa, Florida 5833 Barry Road Tampa, Florida 33634, USA	Sales, Installation, Modernization and Servicing of Elevators, Escalators and Moving Walks.
Puerto Rico G.P.O. Box 364005 San Juan, Puerto Rico 00936	

AREA WEST:

Irvine, California 3585 Cadillac Avenue, Suite B Costa Mesa, California 92626, USA	Sales, Installation, Modernization and Servicing of Elevators, Escalators and Moving Walks.
Los Angles, California 16450 Foothill Boulevard, Suite 200 Sylmar, California 91342, USA	
San Diego, California 9810 Summers Ridge Road, Suite 140 San Diego, California 92121, USA	
San Francisco/ Sacramento, California 555 McCormick Street San Leandro, California 94577, USA	
Honolulu Hawaii 99-1151 Iwaena Street Aiea, Hawaii 96701, USA	
Denver, Colorado 6950 West Jefferson, Suite 210 Lakewood, Colorado 80235	

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Schindler Elevator Corporation

AREA WEST (Continued):

Boise, Idaho/ Spokane, Washington
743 McGregor Court, Suite 140
Boise, Idaho 83705

Sales, Installation, Modernization and Servicing of Elevators, Escalators and Moving Walks.

Salt Lake City, Utah
6265 South Valley View Boulevard, Suite H
Las Vegas, Nevada 89118, USA

Phoenix/ Tucson, Arizona
8270 South Kyrene Road, Suite 110
Tempe, Arizona 85284, USA

Las Vegas, Nevada
6265 South Valley View Boulevard, Suite H
Las Vegas, Nevada 89118

Seattle, Washington
15413 NE 95th Street
Redmond, Washington 98052, USA

Portland, Oregon
13122 NE David Circle, Suite 400
Portland, Oregon 97230, USA

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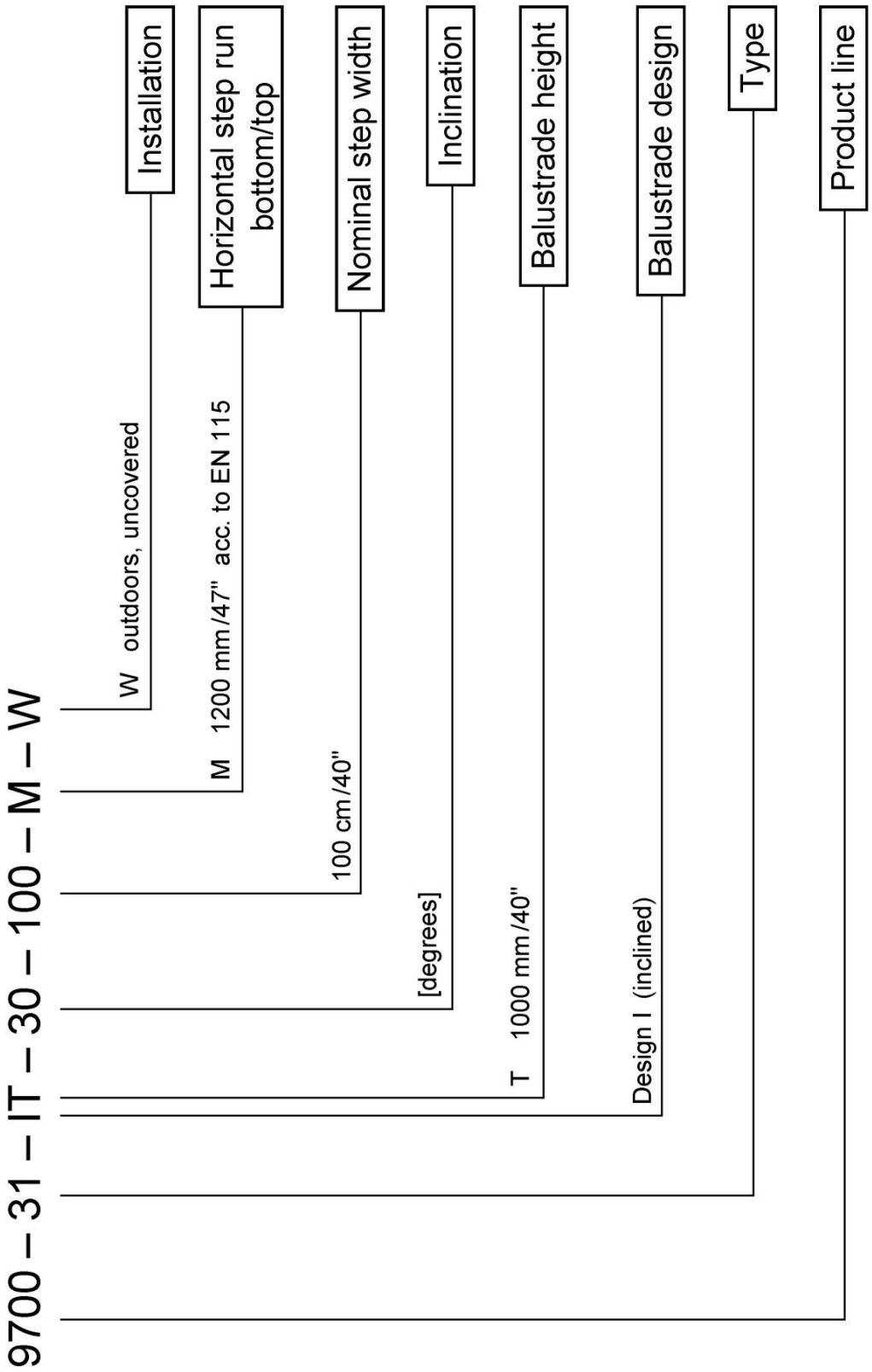
Location Table

Station	Identification		Type	Step Width		Rise		Motor Rating [kW]	Balustrade Design
	Schindler	WMATA		[mm]	[inch]	[mm]	[ft]		
Foggy Bottom	ESF4548	01	9700-31-IT-30-100-M-W	1000	40	9906	32.50	1 x 30	Design I
	ESF4548	02	9700-31-IT-30-100-M-W	1000	40	9906	32.50	1 x 30	Design I
	ESF4549	03	9700-31-IT-30-100-M-W	1000	40	9906	32.50	1 x 30	Design I

Type Specification



Legend

Symbol	Function
	Hint
	Cross reference
	Electric voltage
	Warning
	Danger

VOLUME I

Technical Description & Operating Instructions

1 General Description of the Escalator

1.1 Introduction

The Schindler 9700 escalator was designed especially for public transportation buildings, for either indoor or outdoor installation. It is used in subways, underground passageways, rail stations, airports and public buildings.

The escalator is compact and preassembled at the factory, and the results of quality checks and functional inspections are recorded. The escalator is then disassembled into units specially prepared for transportation to the installation site.

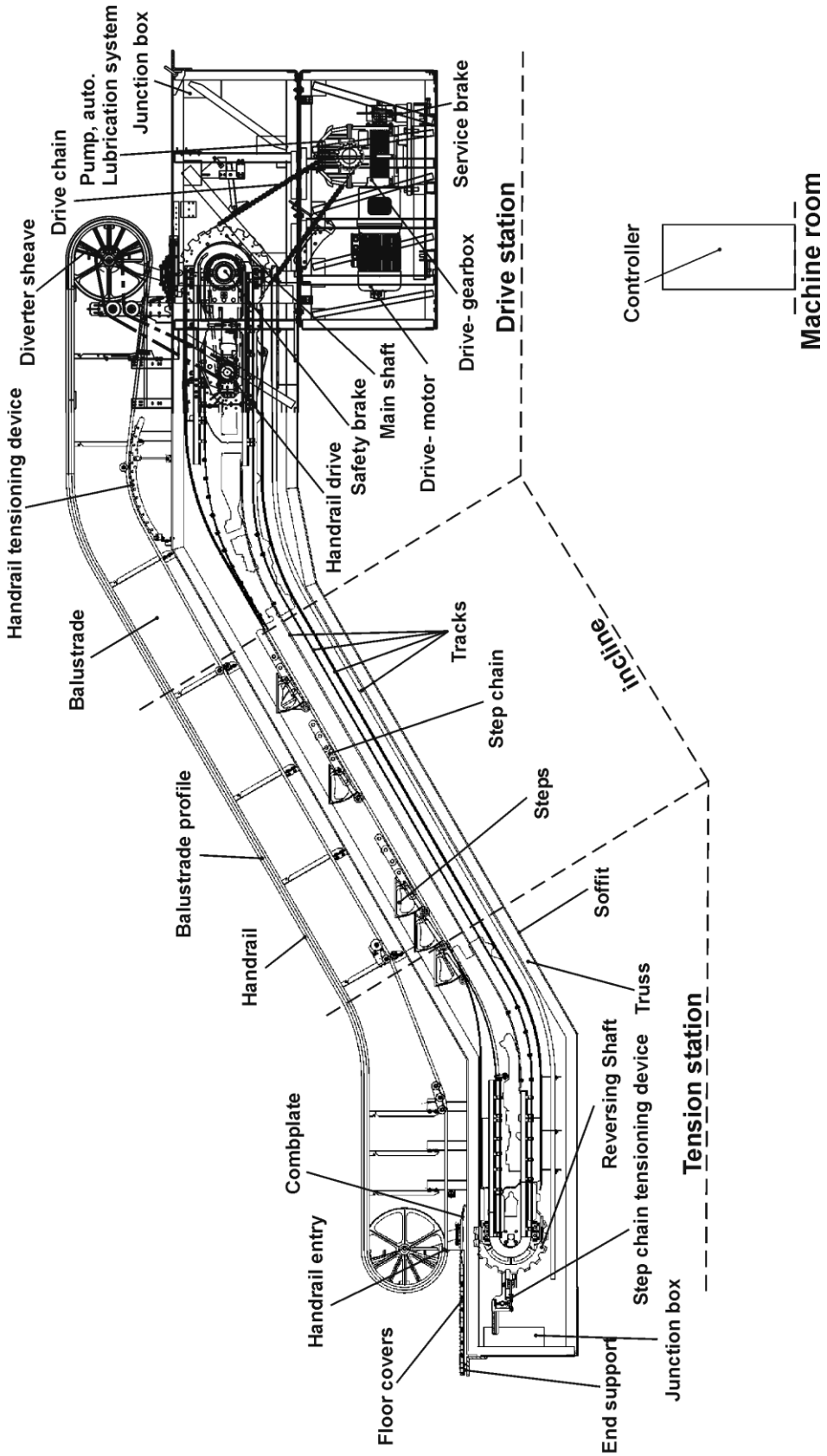
Range of Application

- The unit is intended for conveying persons (passengers) and their hand baggage in the upward or downward direction.
- In general, goods may not be transported on the escalator.
- If, by way of exception, means of transportation, such as push chairs, trolleys or baggage carts, are carried on escalators, the special measures agreed to by the manufacturer of the escalator, the manufacturer of the above-mentioned means of transportation and the operator shall be followed.
- It is also pertinent to the agreed use of the unit to consider all directions given in the operating instructions and to properly perform the inspection and maintenance work.

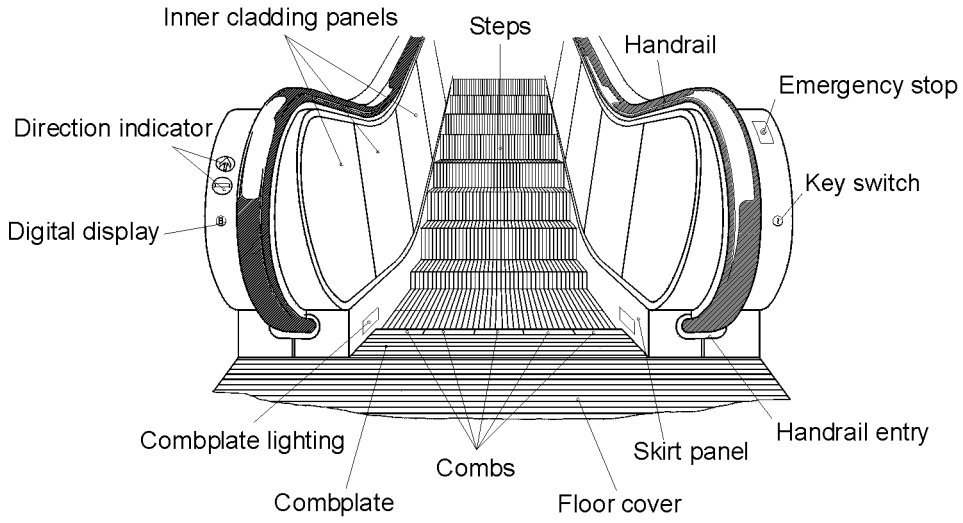
The escalator consists of the following main component groups:

- Truss
- Drive unit
- Track system
- Step band
- Handrail section
- Balustrade
- Electrical system

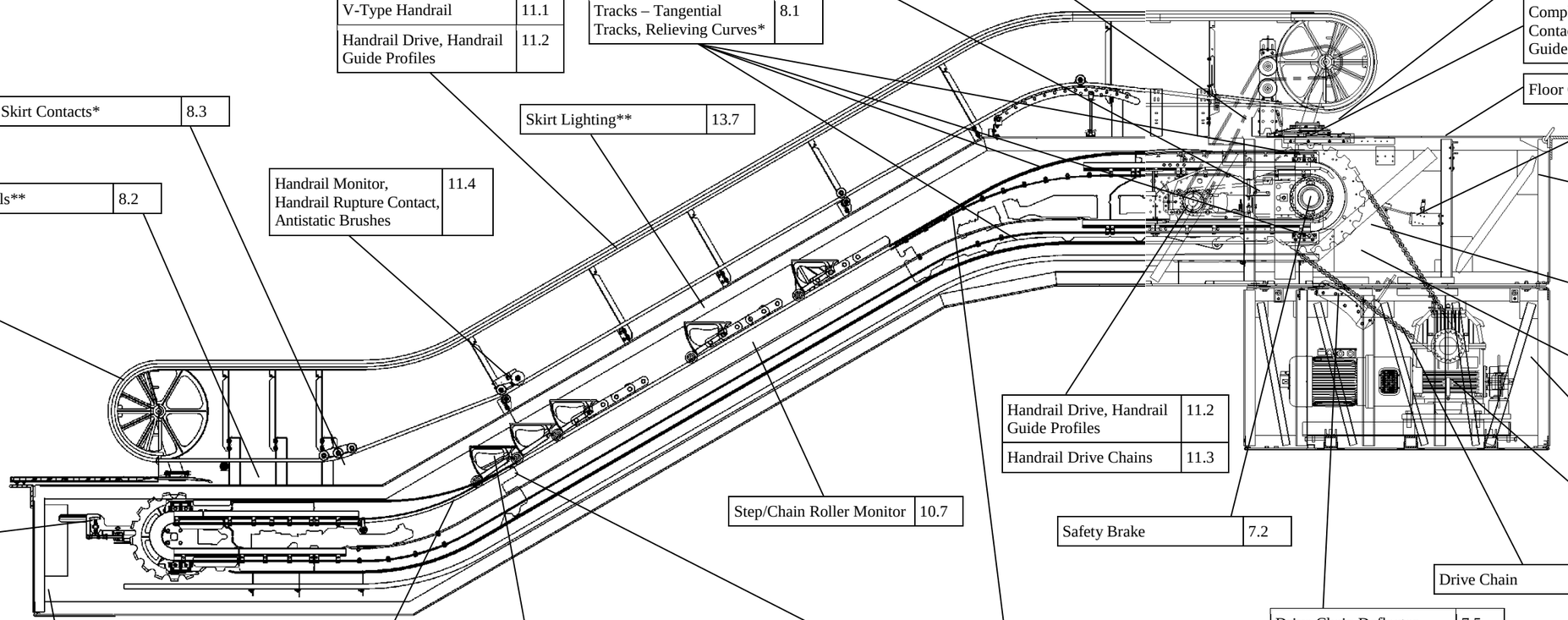
1.2 Overview of the Main Components



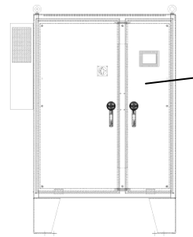
View


Inner cladding panels
Steps
Handrail
Emergency stop
Direction indicator
Key switch
Digital display
Combplate lighting
Combs
Skirt panel
Handrail entry
Combplate
Floor cover

1.3 Overview of the Maintenance Instructions by Sections



Step Gap Lighting*	13.6
Combplate Lighting*	13.5
V-Type Handrail	11.1
Handrail Drive, Handrail Guide Profiles	11.2
Tracks – Tangential Tracks, Relieving Curves*	8.1
Handrail Entry Contacts*	12.1
Complates, Combplate Contacts, Combs, Lateral Guides*	9.1
Floor Covers*	9.2
Skirt Contacts*	8.3
Skirt Lighting**	13.7
Drive Chain Contact	7.4
Skirt Panels**	8.2
Handrail Monitor, Handrail Rupture Contact, Antistatic Brushes	11.4
Control Cabinet and Boxes*	13.1
Maintenance Operating Panel*	13.9
Displays	13.2
Operating Panels*	13.3
Direction Indicators*	13.4
Guard Plates*	9.3
Step Chain Locking Device	10.4
Handrail Drive, Handrail Guide Profiles	11.2
Handrail Drive Chains	11.3
Automatic Lubrication System	10.8
Drive	7.1
Step Chain Tensioning Device, Chain Tension Contacts	10.3
Step/Chain Roller Monitor	10.7
Safety Brake	7.2
Drive Chain	7.3
Drive Chain Deflector	7.5
Water Level Monitor	13.8
Step Upthrust Contacts*	8.4
Steps, Step Disassembly, Guide Pads, Step Rollers, Bushings	10.1
Step Chains	10.2
Guide Pad Lubrication (Lubrication Step)	10.9
Step Level Contacts, Antistatic Brushes	10.5
Step Band Monitor	10.6



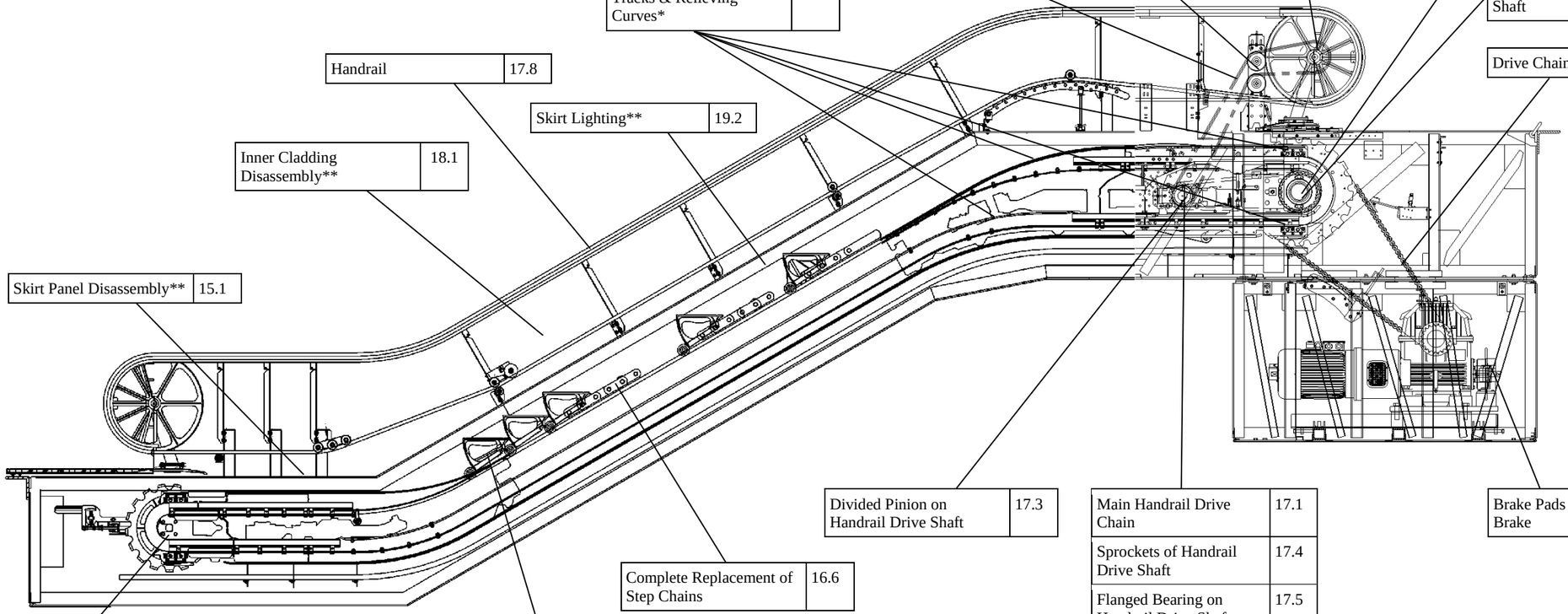
Machine room

Escalator Control System – PLC	4
Control Cabinet and Boxes	13.1
Displays	13.2

* drive and tension stations

** drive station, tension station, incline

1.4 Overview of the Repair Instructions by Sections



Secondary Handrail Drive Chains	17.2
Sprockets or Bearings of Secondary Handrail Drive Chain Tensioning Device	17.6
Bearings or Sprockets of Handrail Diverter Sheave*	17.7
Main Shaft – Bearing Replacement	14.3
Diveded Pinion on Main Shaft	14.4
Drive Chain	14.1
Replacement of Tangential Tracks & Relieving Curves*	15.3
Handrail	17.8
Skirt Lighting**	19.2
Inner Cladding Disassembly**	18.1
Skirt Panel Disassembly**	15.1
Diverter Sprocket – Bearing Replacement	15.2
Step Guide Pads	16.1
Step Rollers	16.2
Step Hooks	16.3
Step Chain Rollers	16.4
Replacement of Yellow Plastic Step Edges	16.5
Complete Replacement of Step Chains	16.6
Divided Pinion on Handrail Drive Shaft	17.3
Main Handrail Drive Chain	17.1
Sprockets of Handrail Drive Shaft	17.4
Flanged Bearing on Handrail Drive Shaft	17.5
Brake Pads – Service Brake	14.2

Machine room

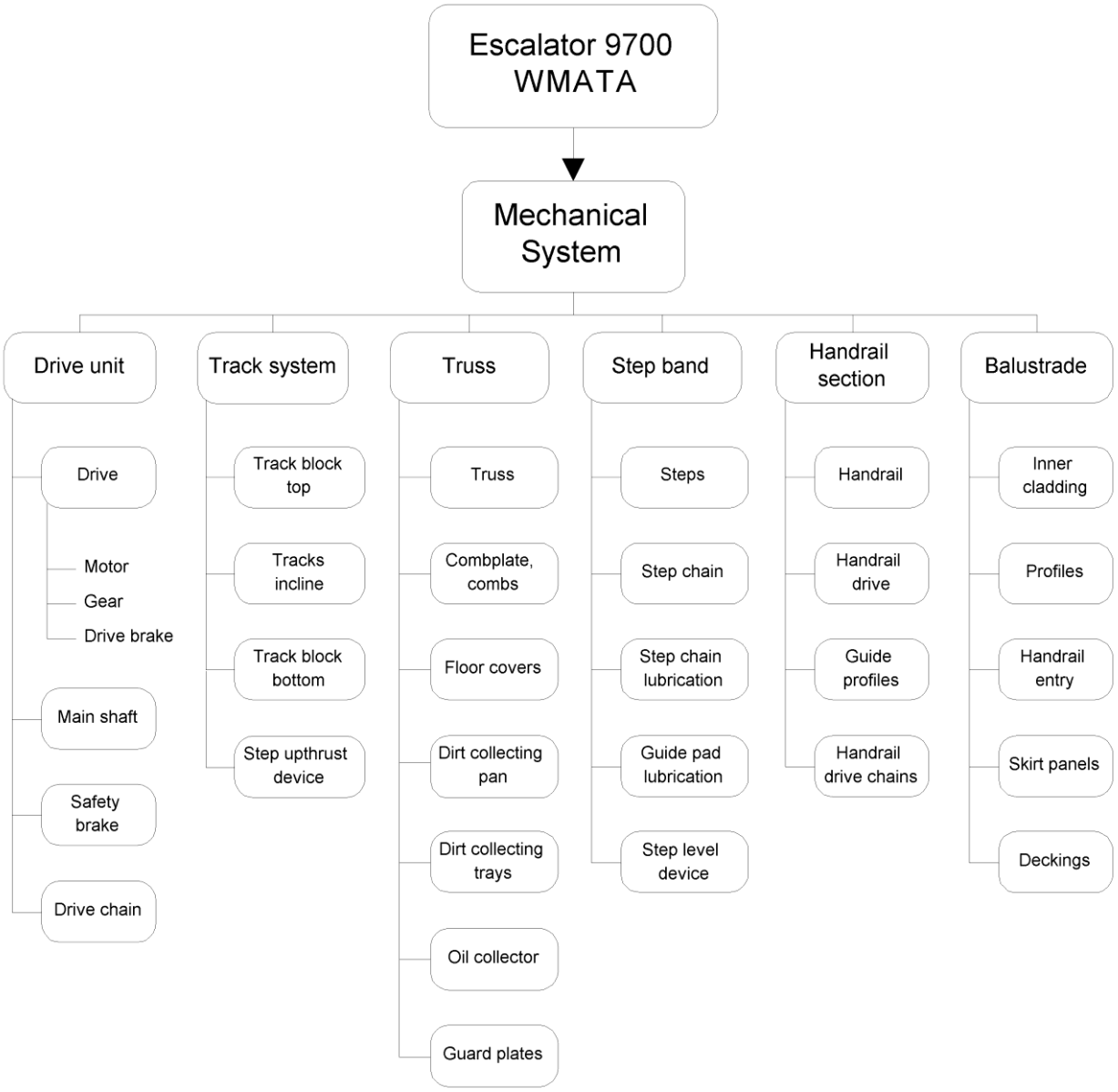
Replacement of PLC Components	19.1

* drive and tension stations

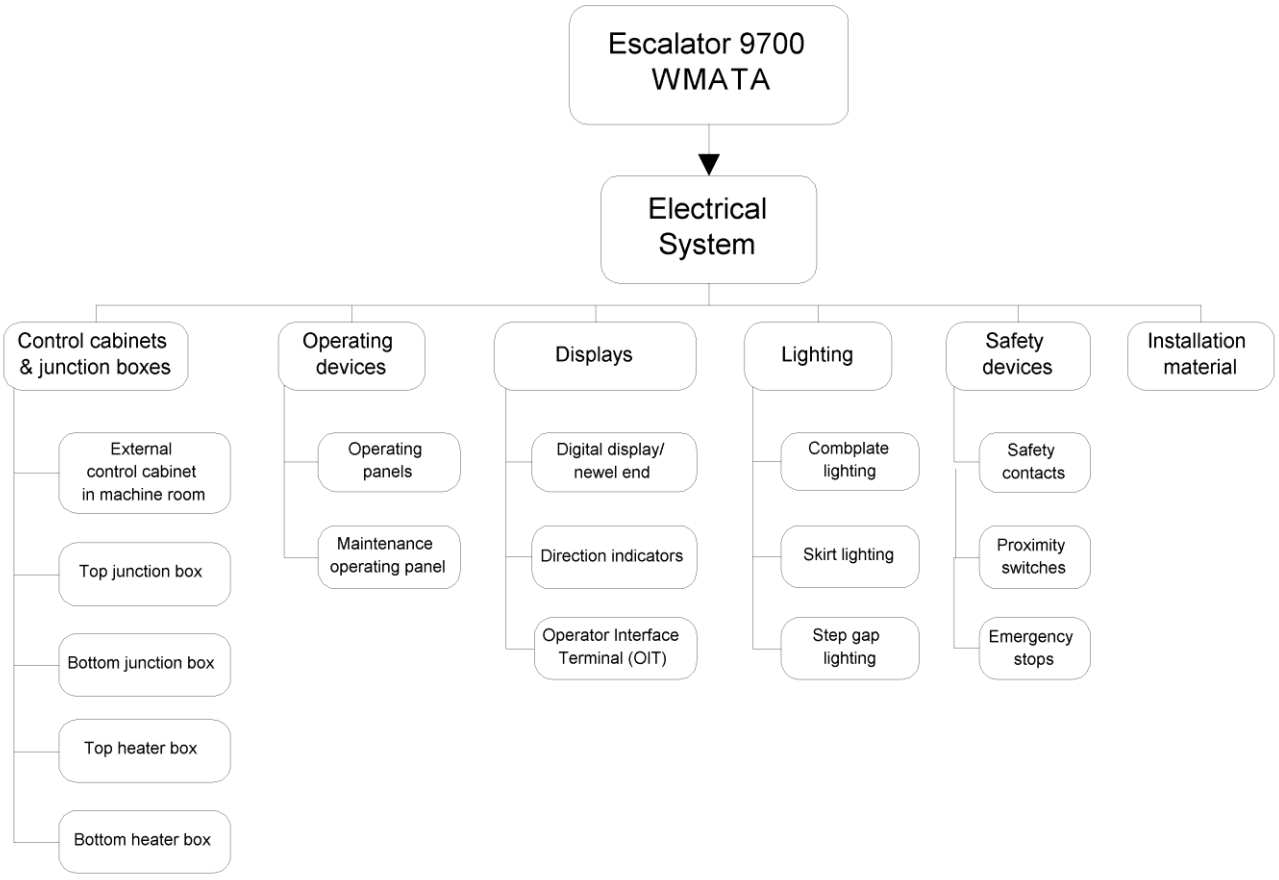
** drive station, tension station, incline

1.5 Network Diagrams

1.5.1 Network Diagram – Mechanical System



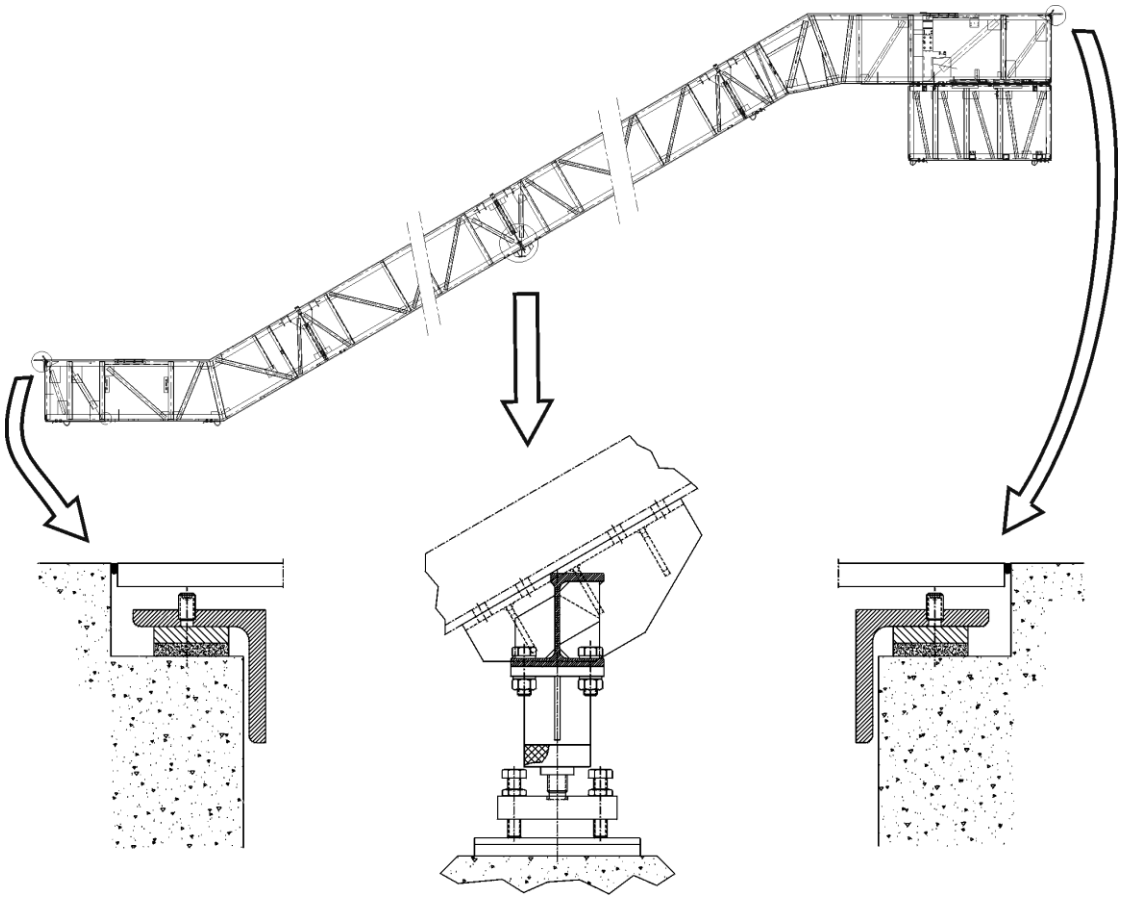
1.5.2 Network Diagram – Electrical System



2 Description of the Mechanical System

2.1 Truss

2.1.1 Truss and Support



The truss is a welded framework with a structural strength that complies with national regulations. The truss units are assembled with high-tensile elements and positioned with shoulder bolts. Load bearing capacity is determined by chord (L-profile) dimensions and truss height in the middle section, which are selected depending on the load.

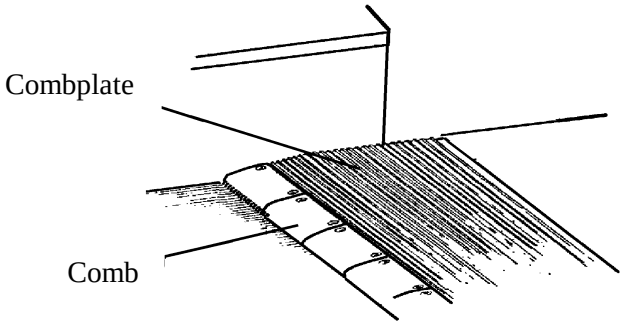
The truss is divided into an upper section (drive station), a lower section (return or tension station), an inclined section and an additional cage beneath the upper section in which the drive is located. It is secured to the building via end supports and, if necessary, intermediate supports (depending on the rise and additional loads). The flexible end supports consist of angle sections, and special support blocks have been fastened to the lower flanges of the truss for the intermediate supports.

The supports are vertically adjustable and rest on rubber cushions designed to prevent the transmission of vibrations (structure-borne noise) to the structure of the building.

To protect the truss against corrosion, it is painted with a finishing coat, RAL 7031.

2.1.2 Combplates, Combs

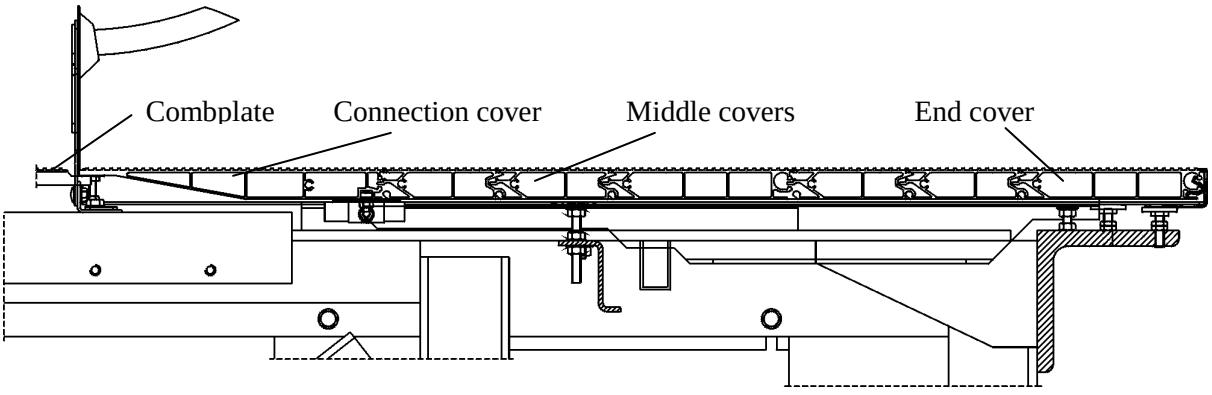
The combplates are the tread plates on both escalator ends for entering or exiting the step band. They consist of a steel plate with a tread surface of ribbed aluminum profiles. The individual combs are screwed onto the front edge of the combplate. These combs mesh with the tread surface of the steps. The combplates are movably mounted so that they can move horizontally and vertically when foreign objects caught in the step grooves or between two steps strike them. When the combplate is shifted, a contact (combplate contact) interrupts the escalator's safety circuit and shuts the unit down.



For more detailed information, see Maintenance Instructions Q 409 460, Combplates, Combplate Contacts, Combs, Lateral Guides

2.1.3 Floor Covers

Ribbed aluminum profiles (see also Combplates) cover the maintenance spaces and serve as a connection between the finished floor and the combplate. This surface finish makes the covers skid-proof and extremely wear-resistant. The floor cover profiles rest on a factory-welded steel frame which is leveled and centered during installation.
The front edge of the connection cover rests on the combplate, the sides are inserted into the frame. The connection cover is secured with screws against shifting.
The floor covers can be opened for maintenance work.



For more detailed information, see Maintenance Instructions Q 409 457, Floor Covers

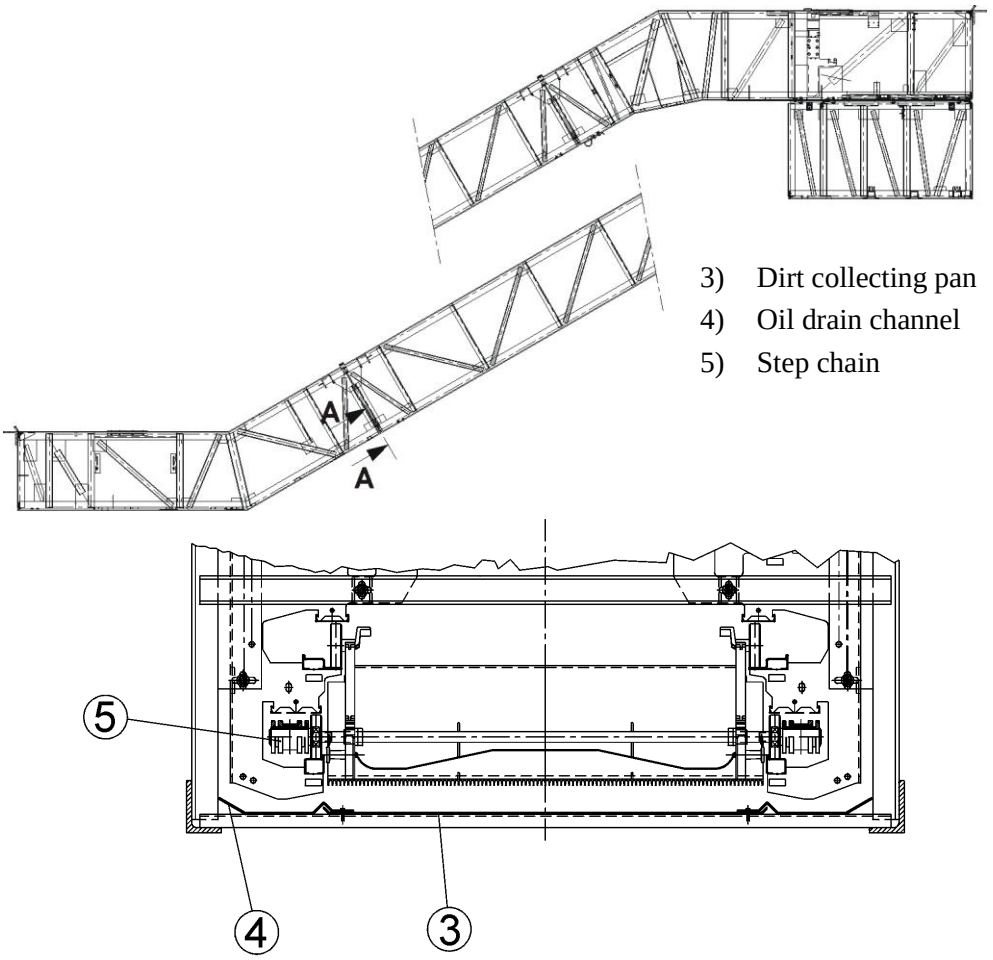
2.1.4 Lateral Cladding and Soffit Cladding

The escalators are not equipped with lateral or soffit claddings.

2.1.5 Dirt Collecting Pan, Dirt Collecting Trays

The dirt collecting pan is made of smooth, galvanized sheet steel and covers the entire width of the interior of the escalator. It is inserted between the truss bottom and the step band. Since it covers the cross struts of the truss, the dirt collecting pan provides a smooth surface to clean the inside of the escalator with a brush carriage.

The dirt collecting trays are made of galvanized sheet steel and are designed to collect the dirt transported by the steps. The drive and tension stations accommodate two dirt collecting trays each.



3) Dirt collecting pan
4) Oil drain channel
5) Step chain

2.1.6 Oil Drain Channels, Oil Collectors

See figures above

The oil drain channels are made of galvanized sheet steel and are accommodated directly beneath the step chains. Together with the dirt collecting trays, they are screwed to the truss bottom and additionally secured by means of brackets. They are always used together with an automatic lubrication system and can always be installed on request.

Oil drain channels catch any excess oil from the step chains and transport it to the oil collectors, which are located at the lower ends of the oil drain channels.

2.1.7 Water Level Monitor

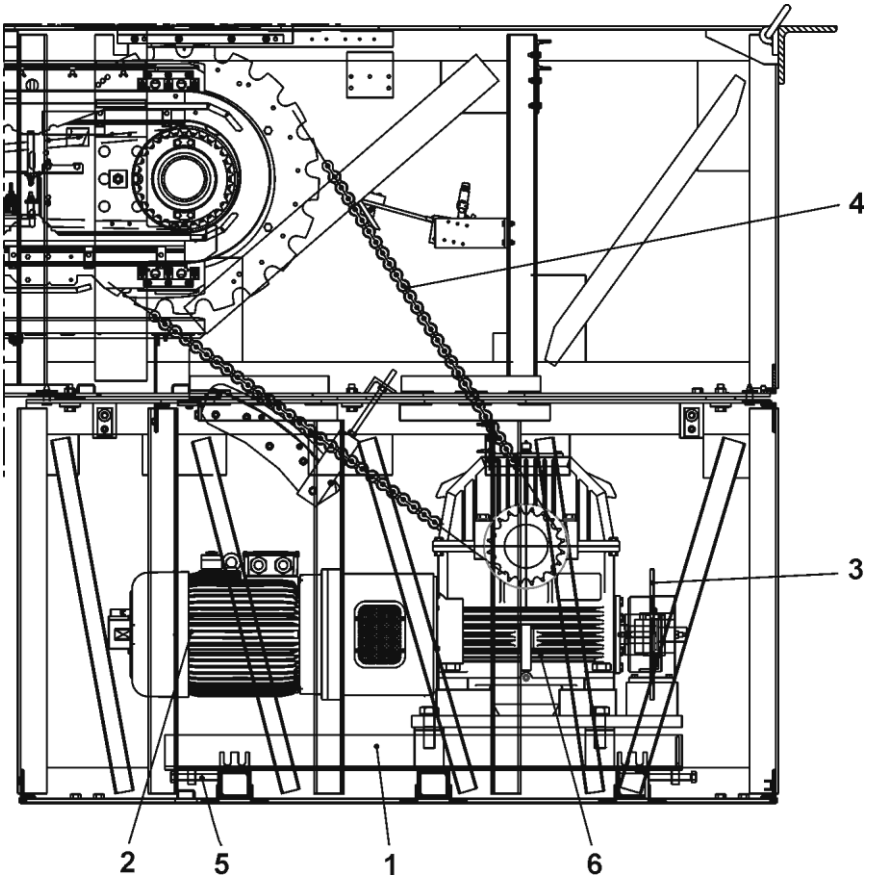
The water level monitor is located below the truss in the tension station. When water rises to the tip of the ultrasonic sensor between the forks, the water level monitor activates an alarm.

1) Level monitor

For more detailed information, see Maintenance Instructions Q 409 484, Water Level Monitor

2.2 Drive Unit

Schindler 9700 escalators for WMATA are equipped with horizontal drive units in an additional cage beneath the upper section of the truss.



1) Base plate
2) Motor
3) Service brake
4) Drive chain
5) Tensioning screw
6) Gearbox

The drive unit consists of an electric motor, a gearbox, a resilient coupling, the flywheel, the service brake, the main shaft, a safety brake and the main drive chain. The entire drive (motor, gearbox, coupling, flywheel, service brake) is mounted on a common base plate and can be shifted longitudinally by turning the tensioning screw.

On the Schindler 9700 escalators for WMATA, the drive is installed in the drive station in an additional cage beneath the upper section of the truss and is easily accessible. Power transmission takes place directly via the motor flanged to the gearbox. The main shaft is driven from the gear shaft by means of a duplex roller chain.

2.2.1 Motor

The escalators are equipped with 6-pole three-phase squirrel-cage motors. A coupling links the motor to the gearbox.

Specifications:	
Design:	Three-phase current + ground
Motor power:	1 x 30 kW
Voltage:	460 V
Frequency:	60 Hz
Degree of protection:	IP 55
Speed:	1200 rpm at 60 Hz
Temperature range:	5–40 °C ambient temperature

The motor is suitable for inverter duty, CT 10:1, VT 10:1. Three sets of thermistors are installed, the wiring being terminated in the motor terminal box. The motor shaft has a special non-drive end (NDE) extension with a square end, and a modified motor cowl. The square end is to allow for manual rotation of the drive unit via a hand-winding ratchet, supplied loose with the drive unit package. The motor is equipped with a vibration sensor.

For more detailed information, see Maintenance Instructions Q 409 447, Drive, and Volume VJ, Renold_O&M_Manual.pdf

2.2.2 Gearbox

The worm gear unit is fitted with an enhanced sealing arrangement on the worm line, as per arrangement drawings (see Volume VJ), double oil seals fitted back to back on the wheel line, and a Filton breather to prevent ingress of atmospheric contaminants. The worm line enhanced sealing arrangement requires periodic relubrication via the grease nipples provided.

The worm shaft has extended diameters at both ends to accommodate a disk brake at the non-drive end and a motor coupling at the drive end. A fabricated motor adaptor supports a flange-mounted Nema motor, and houses the enhanced sealing cartridge at the drive end of the unit. A fan and cowl are fitted with the motor adaptor to provide ventilated cooling horizontally down the outside of the gear casing. Guards are provided to cover two cut-outs in the motor adaptor to prevent access to rotating parts. A hollow shaft encoder is mounted on the non-drive end.

Tapered roller bearings are fitted to both the worm shaft and the wheel shaft. The worm caps are shimmed to provide the required end float for the worm-shaft bearings. The wheel caps/covers are also shimmed to ensure correct gear contact and to prevent end float or preload on the wheel bearings.

The gear unit is also fitted with an inspection cover on the top of the gear casing which can be removed to inspect the gear contact.

2.2.3 Drive Chain

A precision duplex roller chain, which is used as drive chain, transmits the drive torque from the gearbox to the escalator's main shaft, which is mounted at the upper end of the escalator in the drive station track block. The drive chain tension is maintained by moving the drive chain deflection device. A switch (drive chain contact) is provided to monitor the chain tension. When actuated, the switch activates the escalator's emergency stop function.

Chain used for WMATA: duplex roller chain DIN8188-24A-2

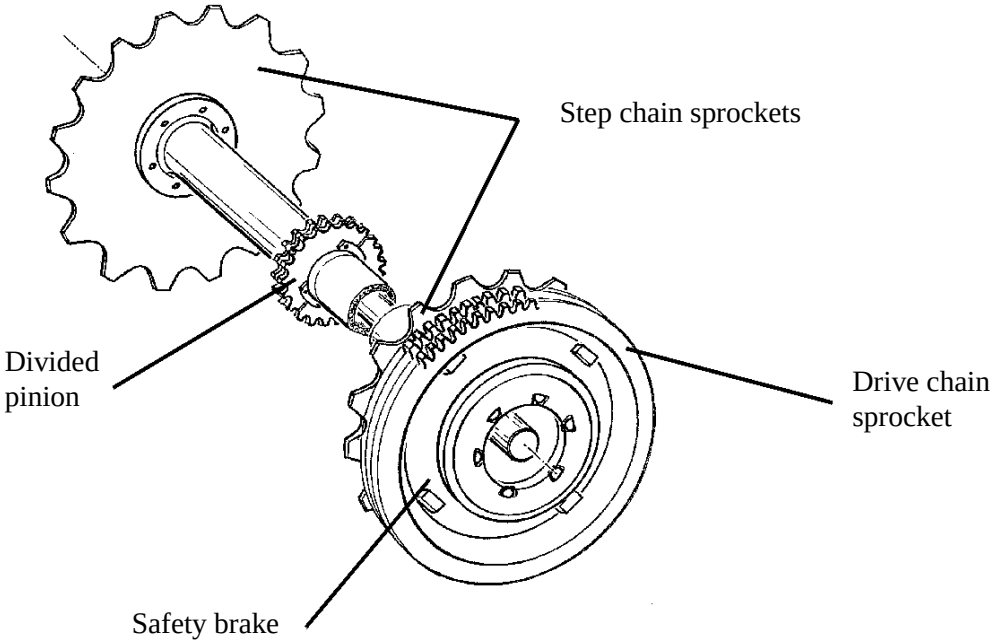
For more detailed information, see Maintenance Instructions Q 409 452, Drive Chain, and Maintenance Instructions Q 409 453, Drive Chain Contact

2.2.4 Main Drive Shaft

The main drive shaft is built into the drive station track block and drives the step band. The drive shaft itself is driven by the drive chain. It is manufactured from a hollow gray cast iron section and consists of cast iron chain drive sprockets which are fastened to the main shaft using high-tensile steel bolts and dowels. The hollow shaft is centered by tapered roller bearings on both sides on an insert axle.

The pinion for the handrail drive is secured to the hollow shaft by means of screws and dowels. In order to allow easy replacement, a two-piece sprocket is used.

Rust protection: painted with a finishing coat, RAL 7031



2.2.5 Brakes

Schindler 9700 escalators for WMATA feature two independent brakes:

- The generously dimensioned, electromagnetically released **service brake** is mounted outside the gearbox and acts via the brake disk directly on the worm shaft. The braking torque is independent of the direction of travel.

  The brake engages in the case of normal and emergency stops (due to activation of one of the safety contacts) as well as in the case of power failures. In the case of normal stops (soft stops), the brake engages with a time delay. A brake contact prevents the motor from starting with the brake engaged. The controller monitors the "open" or "closed" position of this contact.

  The brake can be manually released via a hand-release device. This function is also monitored by a brake contact. A third contact is provided for monitoring the wear of the brake pad.

For more detailed information, see Volume VJ, Renold_O&M_Manual.pdf

- The **safety brake** (disk brake) is mounted on the right end of the main shaft and, if necessary, only acts during downward travel. It is always installed together with the drive chain contact.

  The brake disk, which is provided with brake pads, is pressed against the surface of the drive chain sprocket by means of a pressure disk. Retainer blocks on the brake disk engage with a pawl which stops the rotation of the disk.

  In the case of normal stops or when triggered by safety devices not listed below, the pawl engages with a time delay.

  The pawl engages without delay in the following cases:

  – breakage or excessive elongation of the drive chain
  – 25% overspeed
  – with a time delay in case of power failure

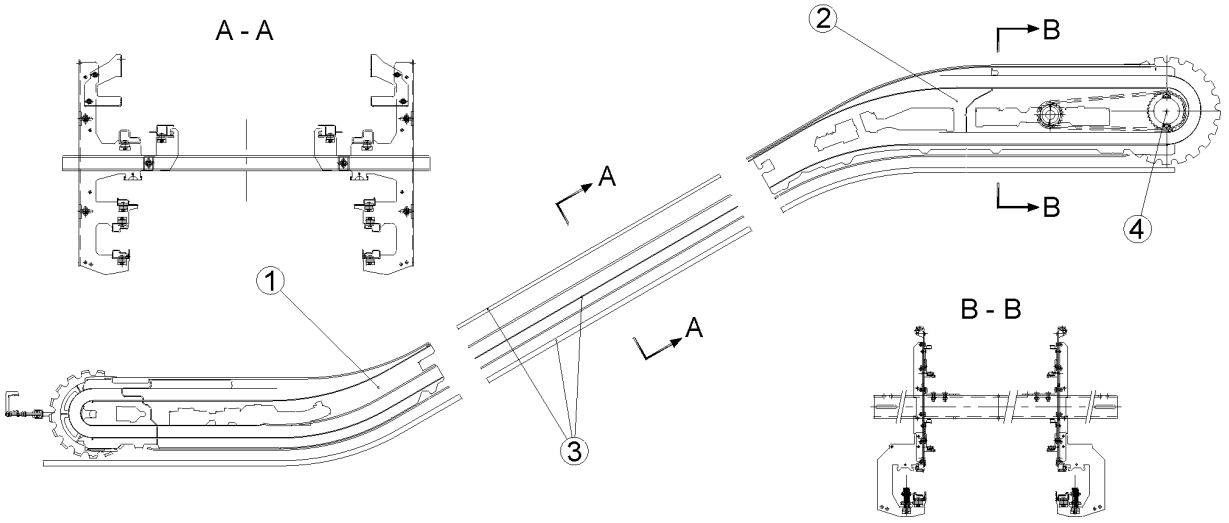
For more detailed information, see Maintenance Instructions Q 409 710, Safety Brake

2.3 Track System

The track system consists of three blocks:

- The **drive station track block** comprising two side plates connected by steel profiles with the tracks for the chain and step rollers, the mounted handrail drive shaft and the main shaft with the step chain sprockets. Easily adjustable and replaceable relieving curves for the step chains are located in the transition curves.
- The **tracks in the middle section** consisting of rolled steel profiles are fastened to ribs positioned in the truss via jigs, thus providing a load path for the step chains. The tracks are fastened with specially designed screw connections.
- The **tension station track block** is of similar construction as the drive station track block. This track block, however, also contains the tension carriage for tensioning the step chains.

  The tension carriage consists of the diverter shaft with two chain sprockets for step chain reversal, fitted on a common shaft, which is supported by roller bearings.



1) Tension station track block
2) Drive station track block
3) Tracks in middle section
4) Drive shaft

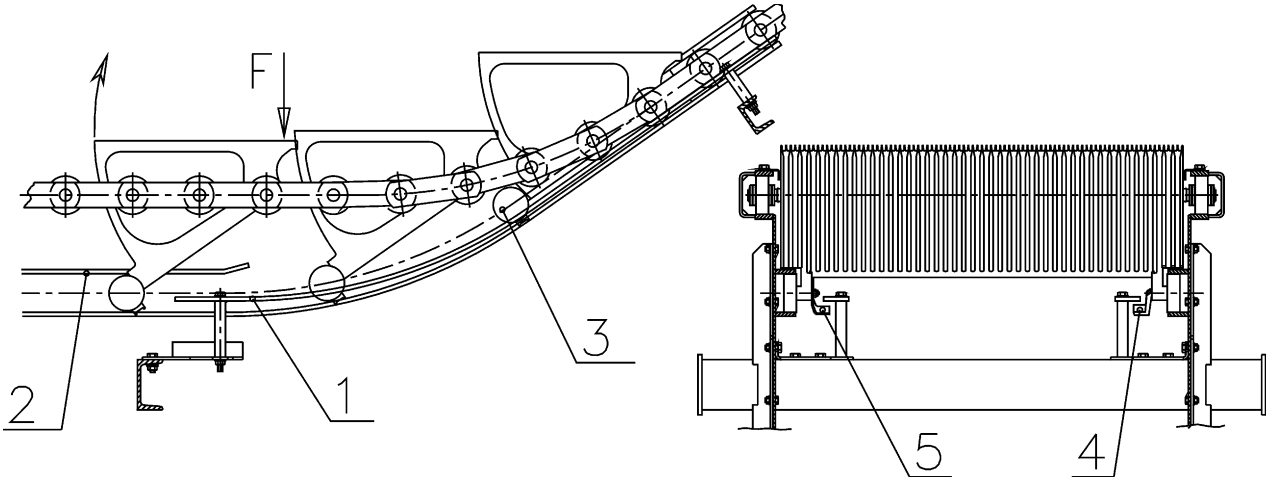
The tracks serve as guides for the step and chain rollers, ensuring that the steps reduce in height at the top and bottom of the escalator. The track blocks of the drive and tension stations are preassembled together with the drive shaft or the chain tension carriage in special jigs and installed in the truss as a subassembly. This ensures smooth running of the steps.

Rust protection: finishing coat, RAL 7031

For more detailed information, see Maintenance Instructions Q 409 619, Tracks – Tangential Tracks, Relieving Curves

2.3.1 Step Upthrust Contacts

When a step is exposed to a highly out-of-center load (F) its front edge could tilt upwards in the top and bottom transition curves. Since no countertracks can be provided at these points to keep the step rollers down, this function is performed by a step upthrust device, which keeps the step in the track system by means of an additional guide, the so-called upthrust arm.

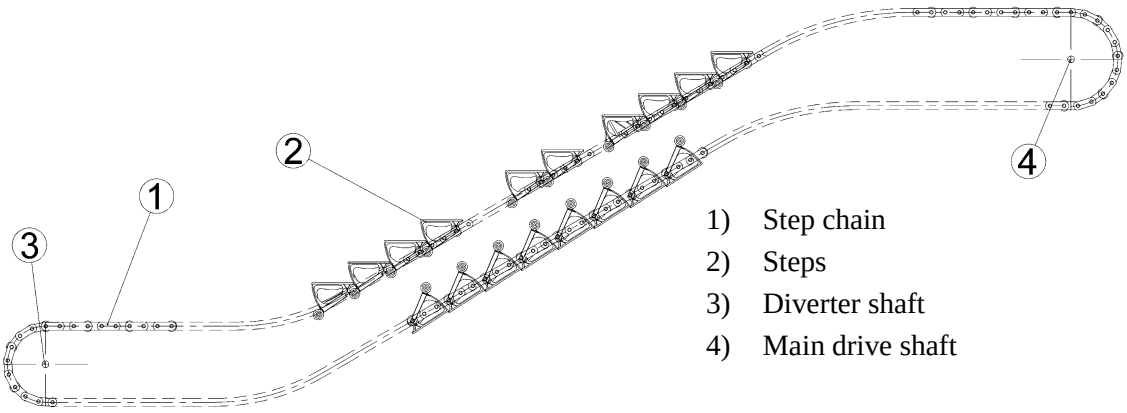


1) Upthrust arm
2) Countertrack
3) Roller
4) First step hook
5) Second step hook
F) Load

Step upthrust contacts monitor the top and bottom transition areas. If the front edge of a step abruptly thrusts up in the transition area, it triggers the contact that shuts the escalator down.

For more detailed information, see Maintenance Instructions Q 409 709, Step Upthrust Contacts

2.4 Step Band



1) Step chain
2) Steps
3) Diverter shaft
4) Main drive shaft

The step band consists of two special endless roller chains and the step axles which connect the two chains and the steps.

Every third chain pin is designed as a special pin which carries a chain roller and which serves to fasten the special divided step axles which are secured to the step chain at each end.

The steps are made of die-cast aluminum and are provided with grooves on the tread surface and at the front side. Step rollers are fitted at each side of the front of the step. The steps are fastened to the step axles by means of plastic bushings inserted into the step eyes. The sides of the bushings are fixed with straps.

The steps are painted silver, ground and provided with yellow plastic edges (laterally and back side), a yellow painted nose and a brushed tread surface. The yellow edges delineate the steps from each other more distinctly and at the same time highlight those step areas that are not to be tread on.

The rollers of the chains and the steps, which run on ball bearings, are equipped with oil and grease-proof elastic tires.

The step chains are tensioned in the bottom station by means of the spring-loaded tension carriage. A safety contact shuts the escalator down in the case of loosening chain tension (break or abnormal length).

For more detailed information, see the following Maintenance Instructions:

Q 409 600, Step Chains

Q 409 601, Step Level Contacts

Q 409 465, Step Band Monitor

Q 409 465A, Step/Chain Roller Monitor

Q 409 924, Automatic Lubrication System

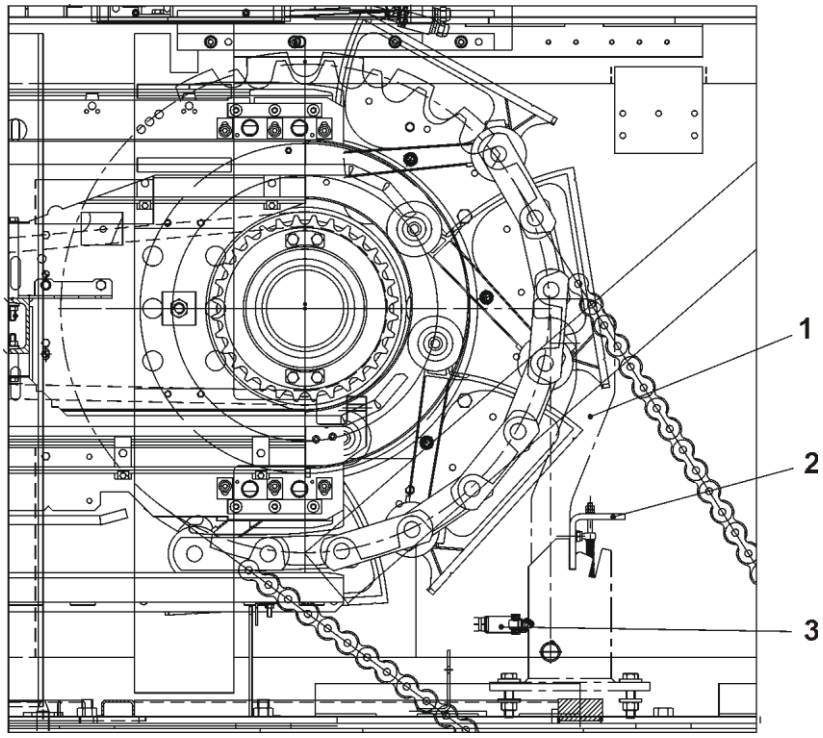
Q 409 598, Guide Pad Lubrication (Lubrication Step)

Q 409 602, Step Chain Tensioning Device, Chain Tension Contacts

Q 409 461, Steps, Step Disassembly, Guide Pads, Step Rollers, Bushings

2.4.1 Step Chain Locking Device

The step chain locking device is located in the drive station and locks the step chain by means of a lever during maintenance or repair tasks requiring the technician to work inside the step band. The left step chain is equipped with a locking device in the turn-around area. The locking device is monitored in the engaged end position by a safety switch.

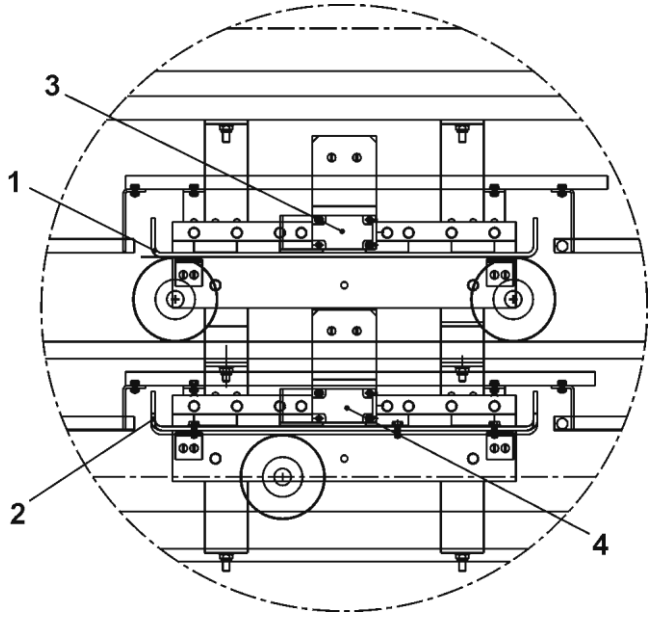


1) Locking lever
2) Handle
3) Safety switch

For more detailed information, see Maintenance Instructions Q 409 926, Step Chain Locking Device

2.4.2 Step/Chain Roller Monitor

The step/chain roller monitor is located on both sides of the inclined section of the return track. The step/chain roller monitor countinously inspects each escalator step roller and chain roller. When a roller is undersized, the monitor signals the PLC to initiate a controlled stop of the escalator. Each of both monitors is comprised of a hinged cam and a proximity switch.



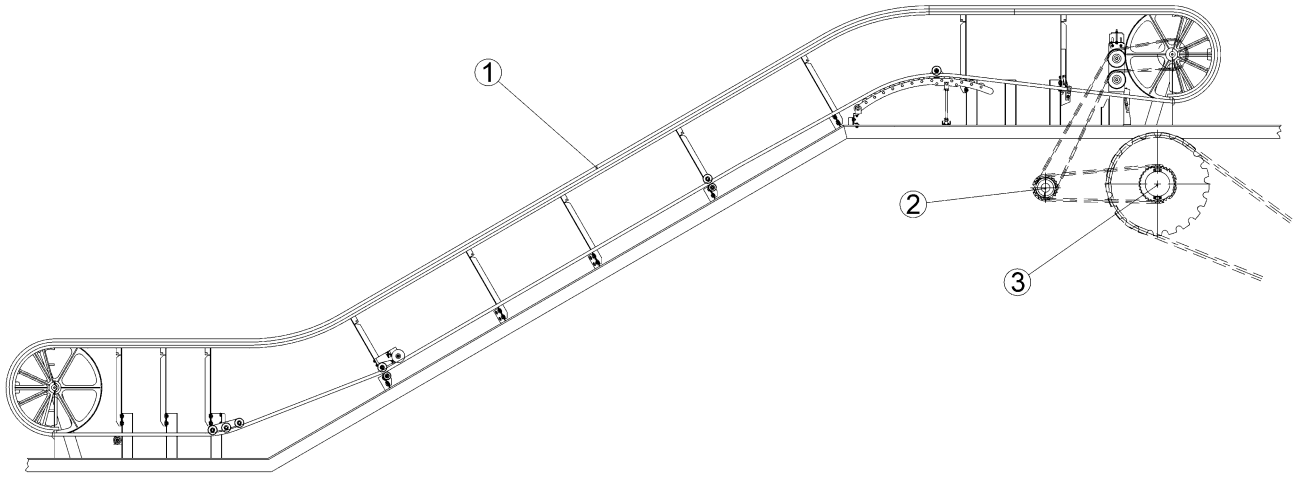
1) Cam – step roller monitor
2) Cam – chain roller montoor
3) Proximity switch – step roller monitor
4) Proximity switch – chain roller monitor

For more detailed information, see Maintenance Instructions Q 409 465A, Step/Chain Roller Monitor

2.5 Handrail System

Moving handrails are provided at each side of the escalator, running at the same speed as the step band. The handrail consists of continuously vulcanized elastomer with steel-cord reinforcement and a nylon-cord gliding surface. The handrails are driven from the handrail drive located in the balustrade newel at the top of the escalator, and run on special guide profiles and over diverter sheaves in the bottom newels. The pivoted tension roller bow is used to tension the handrail.

In their return tracks, the handrails run over support rollers and lateral guide rollers located at certain intervals.



1) Handrail
2) Handrail drive shaft
3) Main shaft

For more detailed information, see the following Maintenance Instructions:

Q 409 603, V-Type Handrail

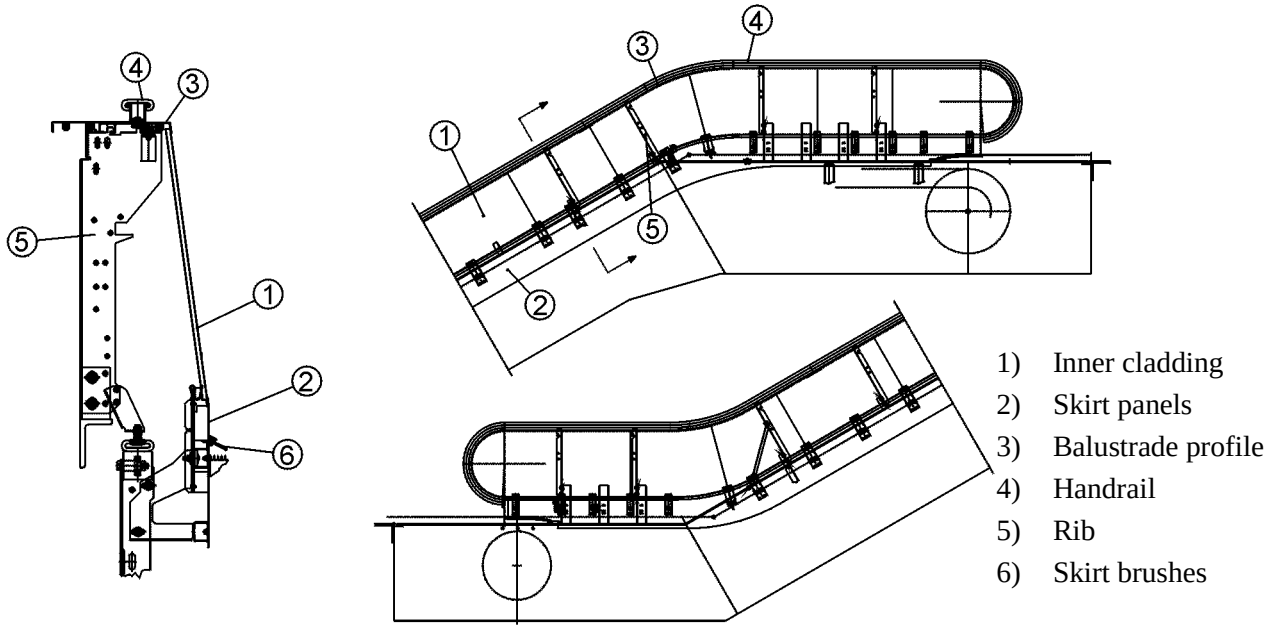
Q 409 639, Handrail Drive, Handrail Guide Profiles

Q 409 604, Handrail Drive Chains

Q 409 650, Handrail Monitor, Handrail Rupture Contact, Antistatic Brushes

2.6 Balustrade

The balustrades protect passengers from falling off the escalator.



The inside of this balustrade (inner cladding) consists of stainless steel panels built in at a slant angle. Due to its sturdiness, this balustrade provides an effective safeguard against vandalism. The steel panels are reinforced with reinforcing profiles (C-profiles) on the back and can be removed individually and easily for maintenance purposes.

The visible side of the panels is ground. All face surfaces are carefully painted with colorless chlorine India-rubber varnish.

The balustrade is equipped with a decking to accommodate the handrail guide. The handrail guide and the balustrade profile are screwed together with invisible splice plates.
The handrail diverter sheaves are located in the top and bottom balustrade newels.

- Handrail entry contacts

  A safety device (handrail entry contact) is located at each point where the handrail enters the balustrade. A rubber collar, which is connected to a safety contact, closely surrounds the contour of the handrail. When an object gets trapped between the handrail and the rubber collar, these are displaced and activate the contact. The safety circuit is then interrupted and the escalator is stopped.

- Skirt panels

  The vertical skirts of the balustrade are those parts of the balustrade facing the steps. They consist of stainless steel sheets reinforced with reinforcing profiles (C-profiles) on the back.

  They provide an enclosure and eliminate large gaps at the sides of the escalator steps. They also serve as lateral guides for the step band (guide pad on step). To achieve an absolutely smooth surface, the skirt panels are provided with a black antifriction coating on the step side to reduce the risk of foreign objects getting trapped between step and skirt panel.

- Skirt brushes

  Special brushes are fastened to the skirt panels on both sides of the step band covering the gap between the skirt panels and the moving step band.

  Skirt brushes reduce the risk of foreign objects getting trapped between skirt panel and step. They serve as deflectors and ensure that passengers keep an additional safety distance from the skirt panels.

For more detailed information, see the following Maintenance Instructions:

Q 409 639, Handrail Drive, Handrail Guide Profiles

Q 409 653, Handrail Entry Contacts

Q 409 455, Skirt Panels

Q 409 648, Skirt Contacts

3 Description of the Electrical System

3.1 Electrical Specifications

Voltage for motor connection: 480 VAC
Voltage for heating connection: 208 VAC
Voltage for light connection: 120 VAC
Voltage for safety circuit: 24 VDC

Frequency: 60 Hz

Nominal power per motor: 1 x 30 kW

3.2 Electrical Installation

The electrical lines are routed through liquid-tight rigid conduits to ensure better protection against mechanical damage.

3.2.1 Degrees of Protection for Electrical Installation

	Degree of Protection
Electrical installation	IP 54
Control cabinet and boxes	IP 54
Motor	IP 55

3.2.2 Power Supply

Power is supplied to the external control cabinet ASA via the main disconnect switch JHA.

3.2.3 Ground-Fault Circuit Interrupter

The ground-fault circuit interrupter interrupts the electric circuit as soon as an improperly high residual current passes over grounded parts, e.g., due to faulty insulation, thereby reducing the risk of injury and fire.

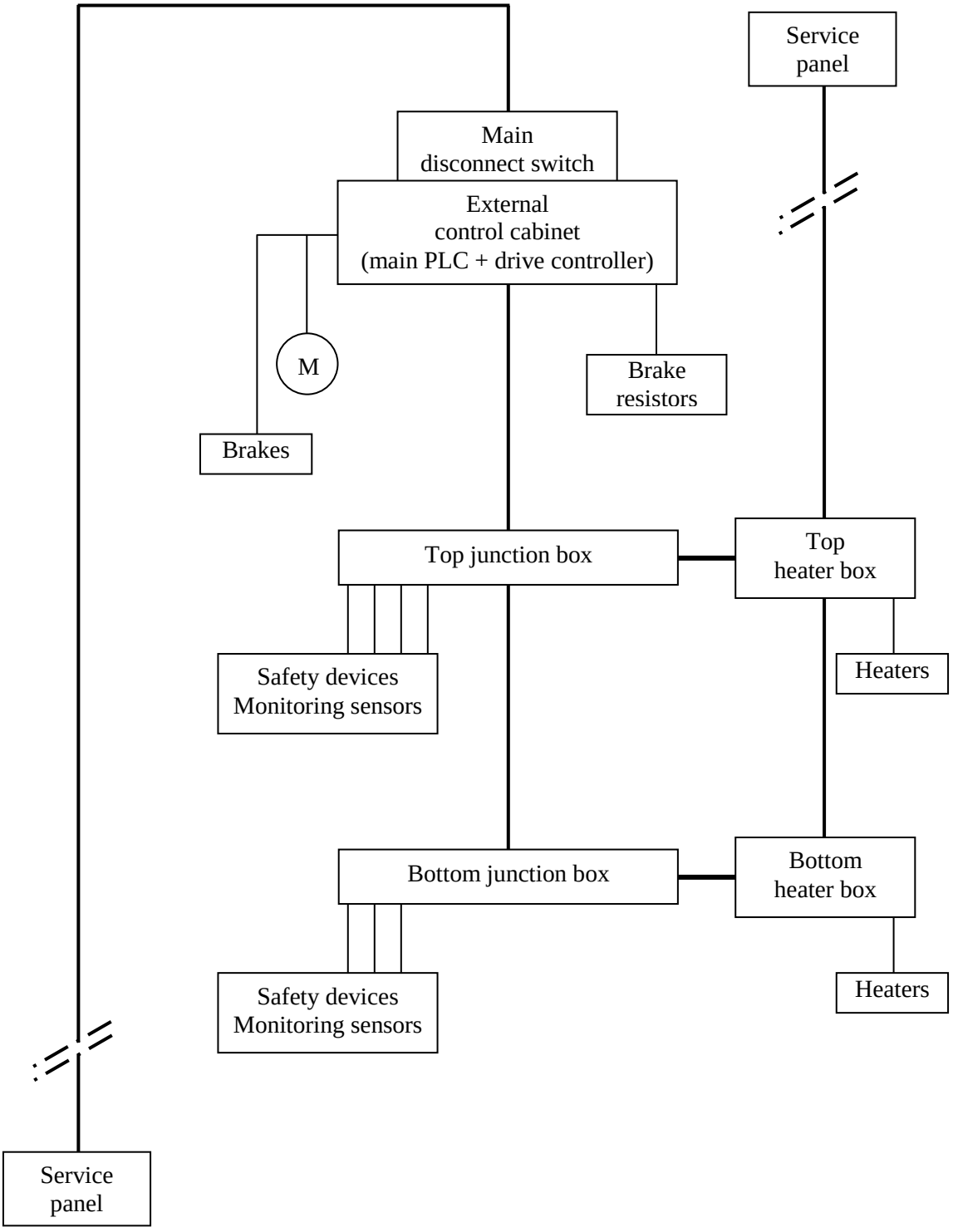
3.3 Electrical Installation Overview

The complete electrical control system consists of the following main parts:

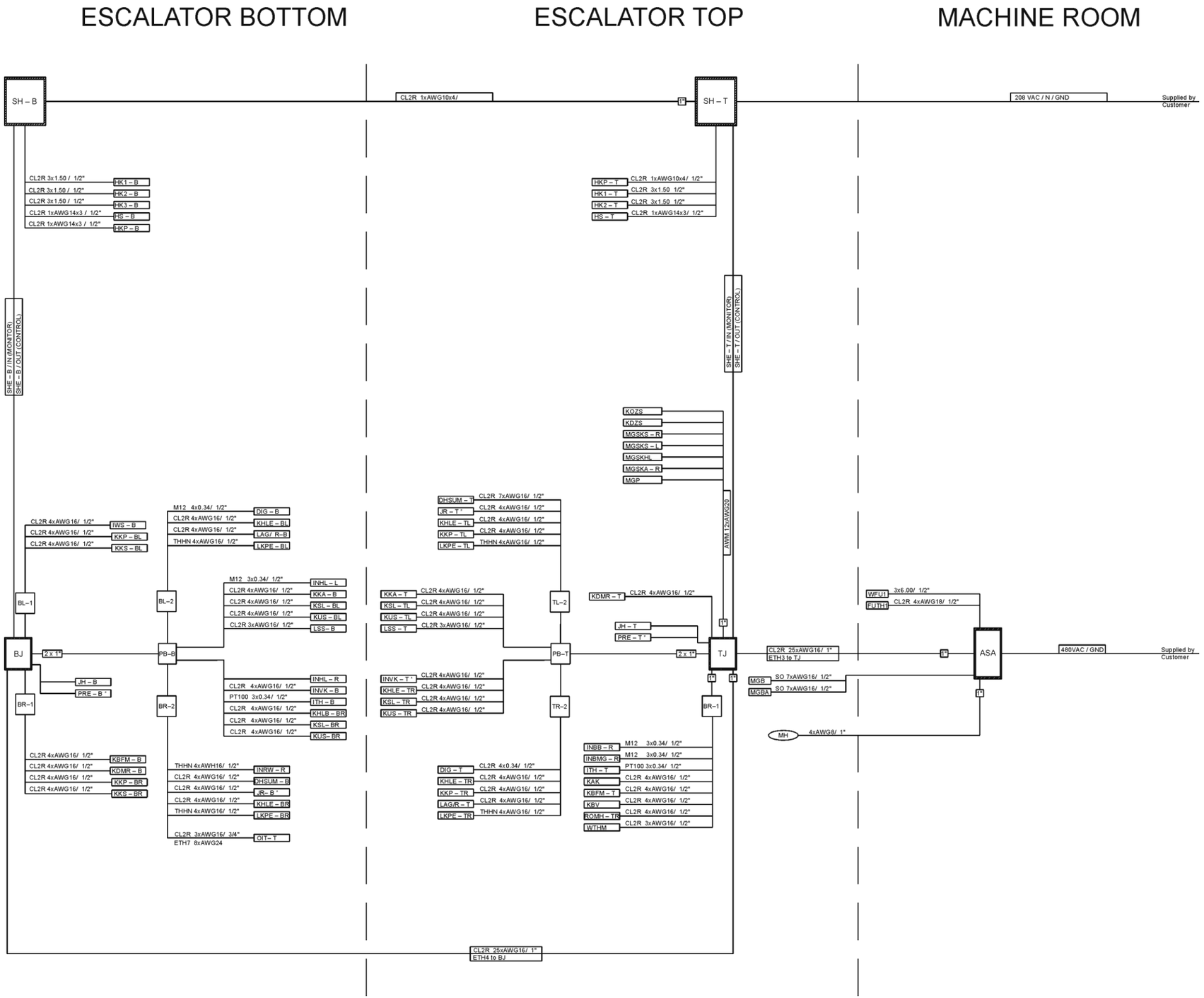
- External control cabinet
- Top junction box
- Bottom junction box
- Top heater box
- Bottom heater box
- Auxiliary pull boxes – inside and outside the truss
- Field safety devices, sensors, lighting and indicators

The external control cabinet (main PLC and drive control) with the main disconnect switch is installed outside the escalator truss. The top junction box and the top heater box with the heating disconnect switch are installed inside the drive station. The tension station accommodates the bottom junction box and the bottom heater box. All boxes inside the truss are installed permanently onto the truss by means of the proper brackets.

Electrical Installation Layout



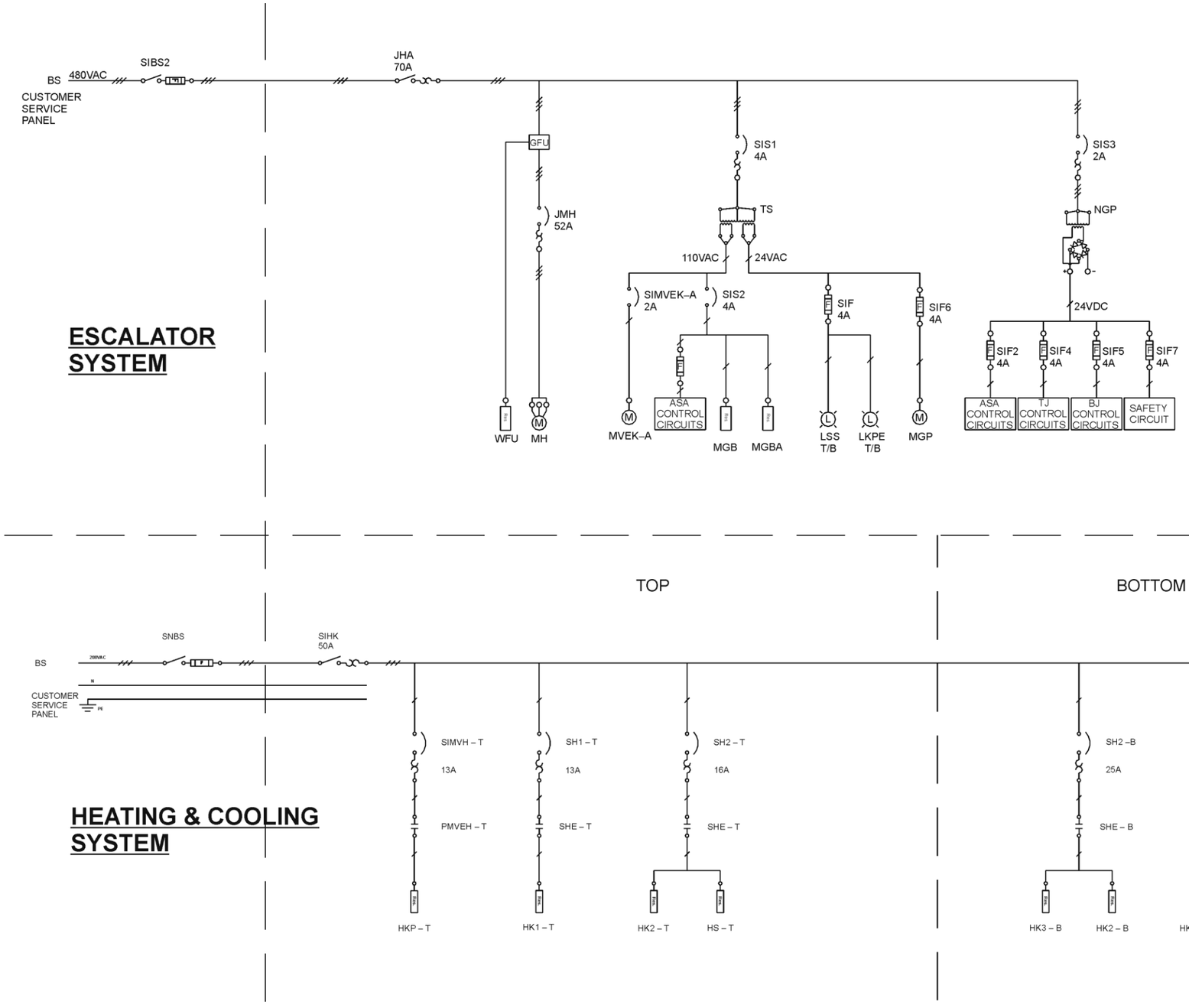
Installation Overview



Installation Overview – Legend

LEGEND	
ABBREVIATION	DESCRIPTION
BJ	Bottom Junction Enclosure
B L/R	Bottom Pull Box
DHSUM-T/B	Emergency Stop Panel (top/bottom)
DIG-T/B	*****
HK1-T/B	Step Band Heater (Top/Bottom)
HK2-B	Step Band Heater Bottom
INBB-L/R	Inductive Switch Brake Lining Control (left/right)
INBMG	Inductive Switch for Braking Distance
INHL-L/R	Inductive Switch Handrail Speed Monitoring (L/R)
INVK-T/B	Inductive Switch Speed Monitoring (top/bottom)
ITHB	PT100 Temperature Switch Bottom
ITHT	PT100 Temperature Switch Top
JR-T/B	Key Switch Direction (top/bottom)
KAK-L/R	Contact Drive Chain (left/right)
KBFM-T/B	Smoke Detector (top/bottom)
KBV-L/R	Contact Blocking Devise (left/right)
KDMR-T/B	Contact Floor Cover (top/bottom)
KDZS	Contact Pressure for Central Lube System
KHLB-B L/R	*****
KHLE-B L/R	Contact Handrail Entry Bottom (left/right)
KHLE-T L/R	Contact Handrail Entry Top (left/right)
KKA-T/B	Contact Broken Step (top/bottom)
KKP-B L/R	Contact Comb Plate Bottom (left/right)
KKP-T L/R	Contact Comb Plate Top (left/right)
KKS-B L/R	Contact Chain Tension Bottom (left/right)
KOMH-L/R	*****
KOZS	Contact Oil Level Central Lube System
KSL-B L/R	Contact Skirting Panel Bottom (left/right)
KSL-T L/R	Contact Skirting Panel Top (left/right)
KSL1-T L/R	Contact Skirting Panel Top (left/right)
KUS	Contact Upthrust
LA-T/B	Indicator Lights
LKPE-B L/R	Combplate Lamps
LKPE-T L/R	Combplate Lamps
LSS-T/B	Step Demarcation Lights Top/Bottom
MGB-L/R	Magnectic Brake (left/right)
MGBA-L/R	Magnectic Safety Brake Active (left/right)
MH-L/R	Main Motors
HKP-T/B	Heating Fan Motor Top/Bottom
MVEK	Cooling Fan Pit
MZS	Motor for Central Lube System
PIT	Bottom Pit Enclosure
SH-T/B	Heater Contacts Enclosure
TC	Top Control Enclosure
TD	Top Drive Enclosure
TJ	Top Junction Enclosure
TL-1/2	Top Pull Box Left
TR-1/2	Top Pull Box Right
TV	Main Terminal Box
TV1	Motor Contact Enclosure
WFU	Brake Resistors
WTHM-L/R	*****

Power Single Line Diagram



Power Single Line Diagram – Legend

LEGEND	
ABBREVIATION	**DESCRIPTION**
ASA	External Dirve & Controls Cabinet
BJ	Bottom Junction Enclosure
BS	Supplied by Customer
GFU	Variable Frequency Drive
JHA	Main Disconnect
JMH	Motor Overload Protection Switch
LKPE - T/B	Combplate Lights (top/bottom)
LSS - T/B	Step Demorcation (top/bottom)
MGB - L/R	Magnctic Service Brake (left/right)
MGBA - L/R	Magnectic Safety Brake Active (left/right)
MGP	Piston Pump for Central Lube System
MH	Main Motor
MVEK - A	Heat Exchanger for ASA Enclosure
NGP	480VAC/ 24DC 10A Power Supply
SIBS2	Main Circuit fused by Customer
SIF1	Fuse 24VAC GMA Escalator Lights
SIF2	Fuse 24VAC GMA ASA Enclosure
SIF4	Fuse 24VAC GMA Junction Box top
SIF5	Fuse 24VAC GMA Junction Box bottom
SIF6	Fuse 24VAC GMA Piston Pump System
SIMVEK - A	MCB 2A Heat Exchanger
SIS1	MCB 4A to Primary Control Transformer
SIS2	MCB 4A/110VAC Brakes and Controls
SIS3	MCB 2A to Primary Power Supply
TJ	Top Junction Enclosure
TS	Control Transformer 480VAC/ 110VAC
WFU	Dynamic Brake Resistors Bank

LEGEND	
ABBREVIATION	**DESCRIPTION**
BS	Supplied by Customer
HK1 - B	Step Band Heater bottom
HK2 - B	Step Band Heater bottom
HK3 - B	Step Band Heater bottom
HK1 - T	Step Band Heater top
HK2 - T	Step Band Heater top
HS - B	Combplate Heater bottom
HS - T	Combplate Heater top
HKP - B	Pit Heating bottom
HKP - T	Pit Heating top
MVEK	Cooling Fan pit
PMVEH - B	Control Contact for Heating Fan Motor bottom
PMVEH - T	Control Contact for Heating Fan Motor top
SBL T/B	Control Contact for Lighting
SH1 - B	Circuit Breaker for Combplate Heater bottom
SH2 - B	Circuit Breaker for Step Band Heater bottom
SH1 - T	Circuit Breaker for Combplate Heater top
SH2 - T	Circuit Breaker for Step Band Heater top
SHE - B	Control Contact for Heat bottom
SHE - T	Control Contact for Heat top
SIHK	Heating Circuit Breaker
SIMVH - B	Circuit Breaker Motor Heating Fan bottom
SIMVH - T	Circuit Breaker Motor Heating Fan top
SLSS T/B	Circuit Breaker for Demarcation Lights
SNBS	Main Circuit fused by Customer

The external control cabinet and the various boxes are as follows:

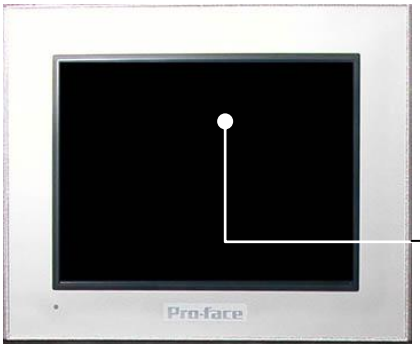
- Drive & control cabinet ASA
  - Main PLC modules
    Master CPU module AC500 PM591-ETH
    Slave CPU module AC500 PM591-ETH
    Input/output module DC532
    High-speed counter DC541
    Dummy coupler module TA524
  - Variable frequency drive
  - Multiport Ethernet switch
  - Main disconnect switch
  - Core balance transformer
  - Control transformer
  - Supply voltage terminals
  - 24-VDC power supply
  - Fuses and circuit breakers
  - Relays
  - Main contactors and contactors
  - Motor overload protection switch
  - Ground-fault protection
  - Interface modules
  - Timer
  - Terminal strips and motor terminals
  - OIT
- Top junction box TJ/bottom junction box BJ
  - Ethernet bus coupler
  - Digital input modules
  - Digital output modules
  - PTC input modules (TJ)
  - Relay output modules
  - RTD thermocouple module
  - Lighting relay
  - Piston pump relay (TJ)
  - Vibration monitoring
  - Terminals
  - Maintenance plug connection
  - Emergency stop button

- Top heater box SH-T/bottom heater box SH-B
  - Heating disconnect switch (SH-T)
  - Main circuit breakers
  - Control contactors
  - Residual current device RCD heating (SH-T)
  - Incoming phases terminals
  - Ground terminals
  - Terminals

3.4 Operating Devices

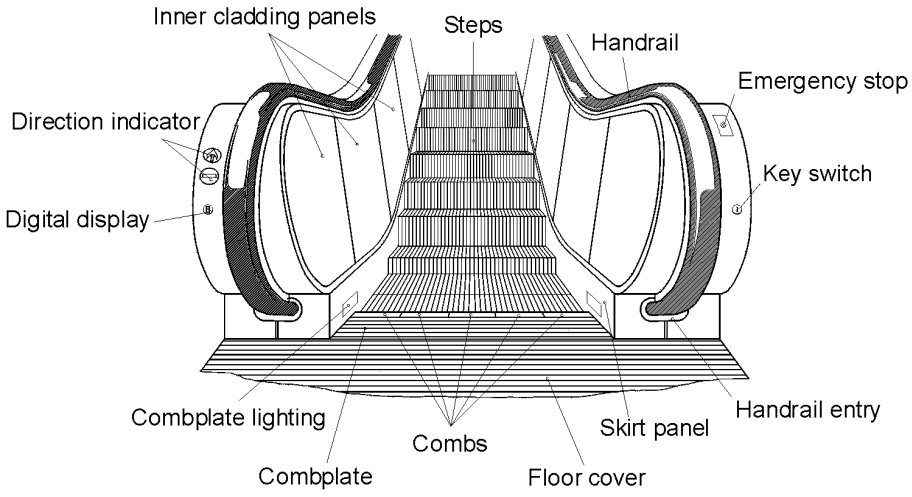
3.4.1 Arrangement of Operating Devices

3.4.1.1 Operating Devices on External Control Cabinet Door



OIT touch screen terminal Pro-Face AGP3300-T1-D24

3.4.1.2 Operating Devices in the Balustrade Newels



3.4.2 OIT on the External Control Cabinet Door

The OIT (Operator Interface Terminal) is an interfacing system of the Schindler MICONIC F PLC control system that provides an interface between the escalator and the operator making it easier to keep track of all escalator conditions. The OIT communicates with the controller in real time and displays the event history, error messages (for normal and inspection modes), the status of the escalator and other useful information. In addition to switching the operating mode between "Continuous" (standard) and "Manual" (maintenance), the operator can also perform various technical tests via the OIT.

3.4.3 Key Switches in the Balustrade Newels

The key switches are used to start the escalator in the desired direction of travel.

- Start-up:

  To start the unit, turn the direction key switch in the sense of the desired direction of travel.

- Shutdown:

  To shut the unit down, turn the direction key switch against the direction of travel. The system then coasts to a stop (soft stop) without any mechanical braking process. The brake only engages shortly before full stop.

3.4.4 Stop Buttons

Pressing one of the STOP buttons (emergency stop) initiates immediate deceleration, just as in the case of activation of safety switches. Stop buttons should only be used in the case of an emergency!

The stop buttons are labeled with the term "STOP" and are located at the top and bottom newel ends. Additional stop buttons are located in the drive and tension stations. Any further stop buttons are to be provided by the customer.

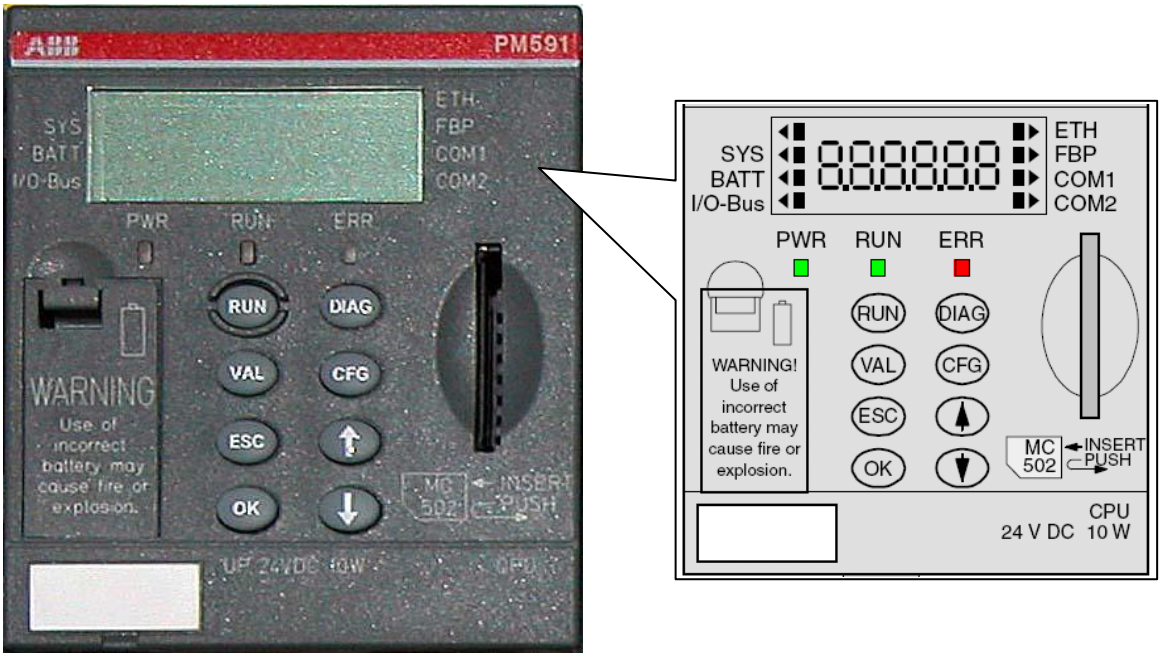
3.4.5 Maintenance Operating Panel

This manual control unit allows remote-controlled dynamical adjustment of the escalator from different points of the escalator during maintenance work.
The regular operating devices and any remote controls are deactivated while the maintenance operating panel remains plugged in.

3.5 Displays

3.5.1 Digital Displays on the Main PLC

The CPU is equipped with an LCD digital display with background lighting as well as status LEDs.

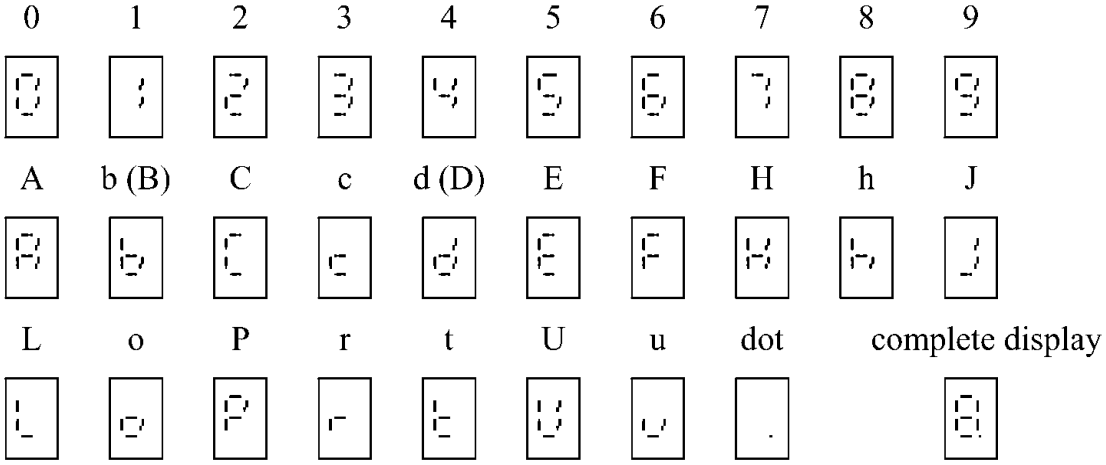


- The 6-digit 7-segment status display shows:
  - the CPU status (e.g., RUN or STOP)
  - error codes and error classes
  - address modifications and parameters of the integrated couplers (Ethernet)
  - values at the channels of I/O modules
- The triangle displays show:
  - what is currently selected (active)
- The square displays show:
  - that the CPU and the bus are communicating
- The status LEDs show:
  - the status of the power supply
  - the status of the CPU
  - the occurrence of an error

3.5.2 Digital Displays in the Newel Ends

The balustrade newel ends are equipped with a maximum of two 2-digit digital displays. The displays are connected to the main PLC via digital outputs.

3.5.2.1 Readings on the Digital Display



3.5.3 OIT on the External Control Cabinet Door

The OIT (Operator Interface Terminal) displays the event history, error messages, the status of the escalator and other useful information. In addition to switching the operating mode between "Continuous" (standard) and "Manual" (maintenance), the operator can also perform various technical tests via the OIT.

3.5.4 Direction Indicators

The direction indicators are mounted in the balustrade newel ends at the drive and tension stations. Each direction indicator consists of LED elements showing the respective direction of travel to the user.

3.6 Smoke Detectors

Smoke detectors are installed in the drive and tension stations of the escalator. If the smoke detector detects smoke in the unit, the buzzer is activated for the specified time. The unit is shut down after this time has elapsed.

3.7 Lighting

3.7.1 Step Gap Lighting

Special green fluorescent tubes at the drive and tension stations demarcate the individual steps optically.

3.7.2 Combplate Lighting

Additional lighting is provided at the escalator landings. Two LED spots are installed in the balustrade skirting on both sides of the combplates.

3.7.3 Skirt Lighting

An additional lighting is provided in the skirt area. The LED light strips are installed in the skirt lighting profiles on the vertical upper end of the skirt panels.

3.8 Controlled Drive

The escalator controller is equipped with a heavy-duty variable frequency drive (VFD/GFU), installed in line between the two isolation contactors, the motor protection switches and the motors. The VFD can start the motor gradually, reducing inrush current, and run the escalator at full speed in both directions at full capacity. The VFD is equipped with a dynamic braking resistor bank which dissipates any energy regenerated by the motor during downward travel.

The VFD can also stop the escalator with predetermined deceleration according to customer requirements. In inspection mode, the escalator runs by default at 10% of its nominal speed and is adjustable to 100%.

The VFD is integrated in the Modbus TCP/IP network system and is fully accessible for control and monitoring by the master PLC. The VFD is configured according to job characteristics for proper and optimum performance.

For more detailed information about this module, refer to the following publications:

Refer to this document	ABB Publication
ACS800 Drives Hardware Manual	en_800_01_hw_H_scrres.pdf
Ethernet Adapter Module RETA-01	en_RETA_01_um_d.pdf

3.9 MICONIC F PLC Heating and Cooling Control – J 595 001

3.9.1 Design

The heating system of this unit consists of a step band heating, a combplate heating for the top and bottom combplates, a heating fan in the top and bottom escalator pit and a heat exchange unit in the external control cabinet.

3.9.2 Mode of Operation

The heating system has separate electrical feed lines. A transformer, two heating contactors as well as heating circuit breakers are provided. The heating system only works when the escalator controller is powered.

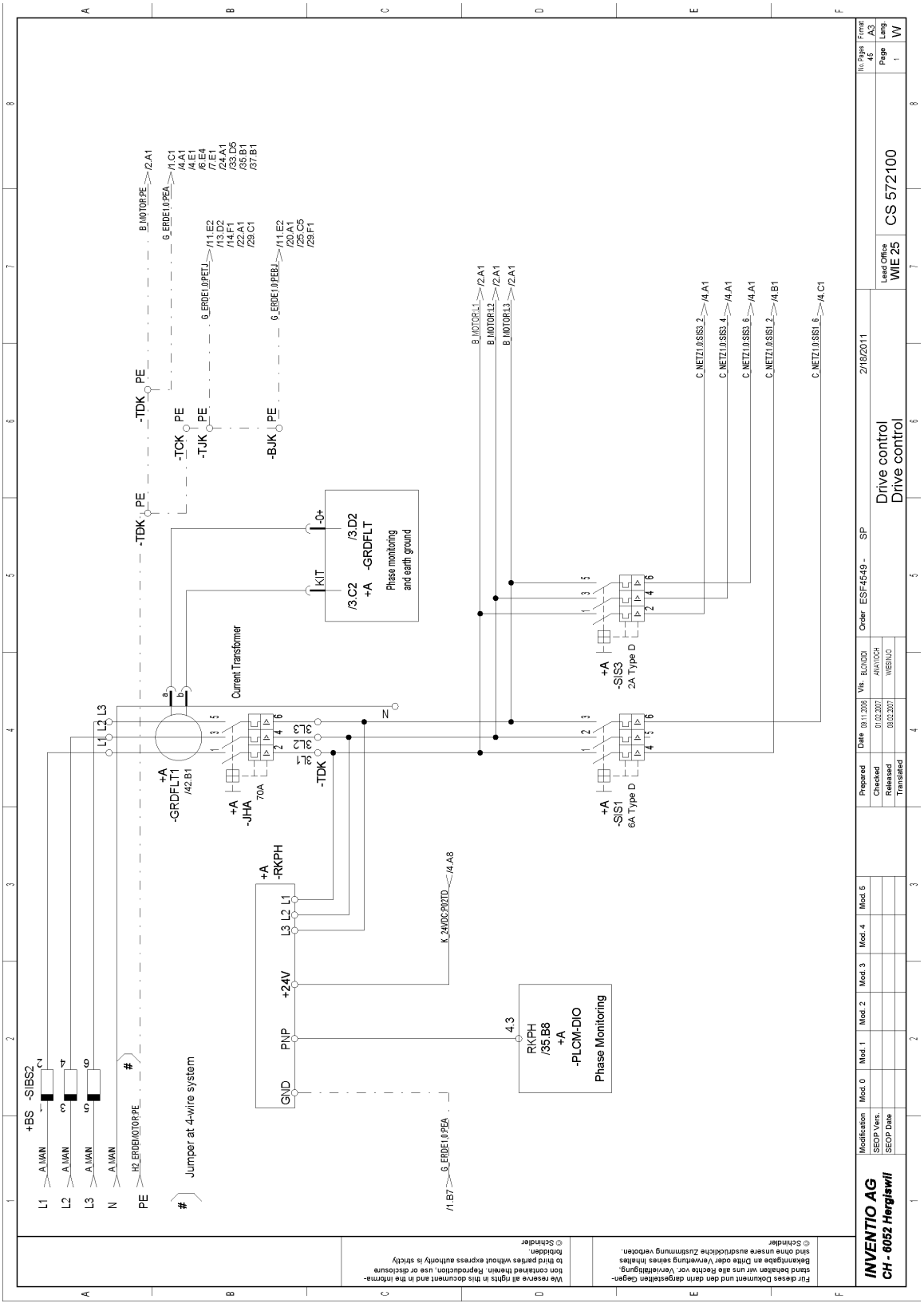
Each combplate is provided with two PT 100 temperature sensors which are connected to interface modules in the top and bottom junction boxes. The PT 100 temperature sensors ITH-T and ITH-B check the combplates for frost. These thermostats are set to a temperature range between 3 °C (37.4 °F) and 7 °C (44.6 °F) according to specifications and the wiring diagram. If the temperature falls below 3 °C (37.4 °F), the escalator is not shut down. Instead, a warning appears on the display. The truss heating as well as the heaters in the top and bottom stations are controlled via the combplate heating function.

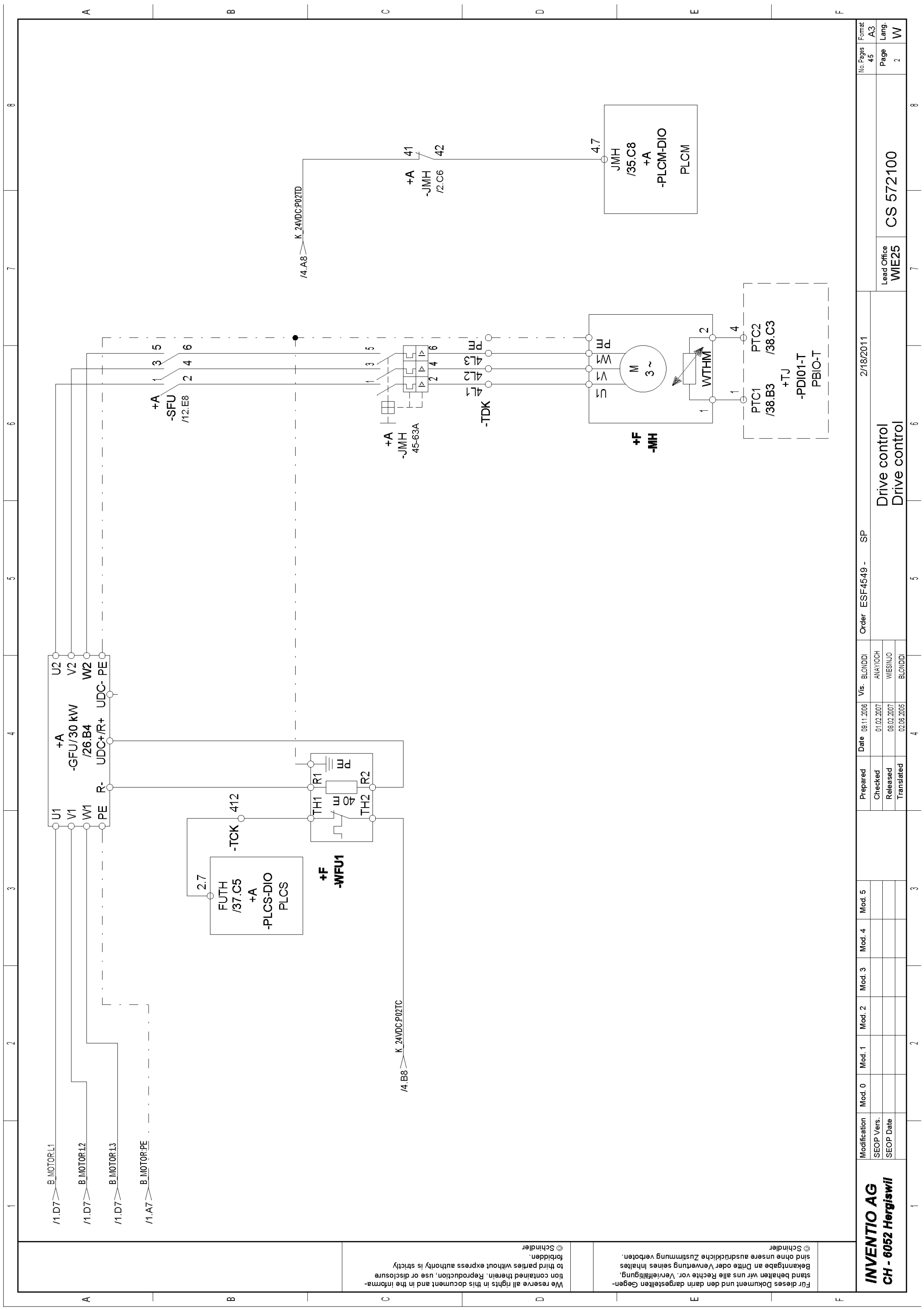
The ITH-B sensor measures the temperature of the bottom combplate. If the temperature of the bottom combplate is less than 3 °C (37.4 °F), the heating contactor SHE-B is energized and the bottom combplate heating and the truss heaters at the bottom of the escalator are switched on.
The escalator continues to operate at rated speed.
If the temperature of the bottom combplate rises above 7 °C (44.6 °F), the heating is switched off.

The ITH-T sensor measures the temperature of the top combplate. If the temperature of the top combplate is less than 3 °C (37.4 °F), the heating contactor SHE-T is triggered and the top combplate heating as well as the truss heaters at the top of the escalator are switched on.
The escalator continues to operate at rated speed.
If the temperature of the top combplate rises above 7 °C (44.6 °F), the heating is switched off.

The heaters in the top and bottom pits of the escalator operate with the step band heaters. The purpose of these heaters is to maintain ambient temperature within an acceptable range required by the electronic and mechanical devices such as motor, gearbox, etc.

3.10 Wiring Diagrams

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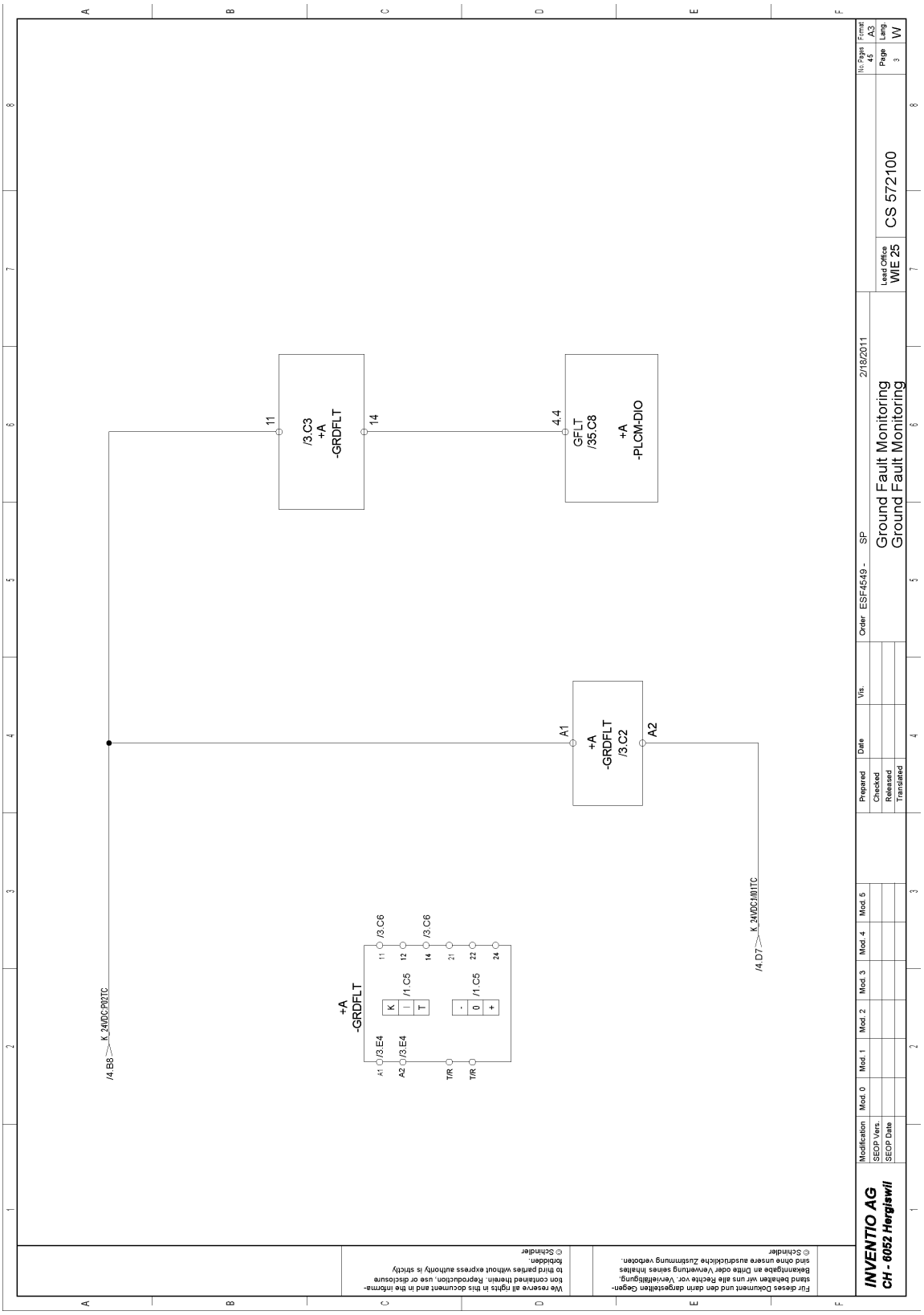
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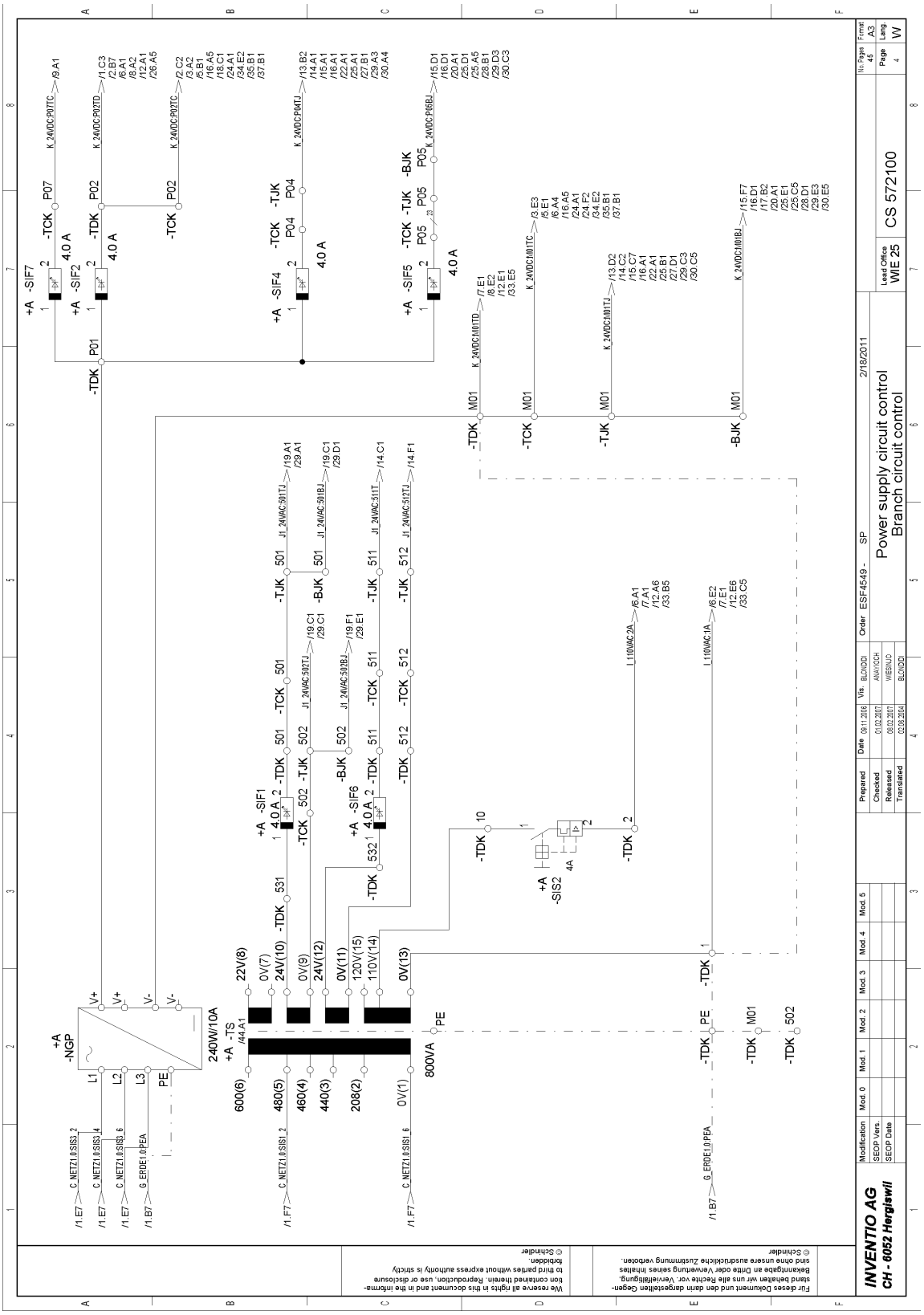
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L_110VAC:1A
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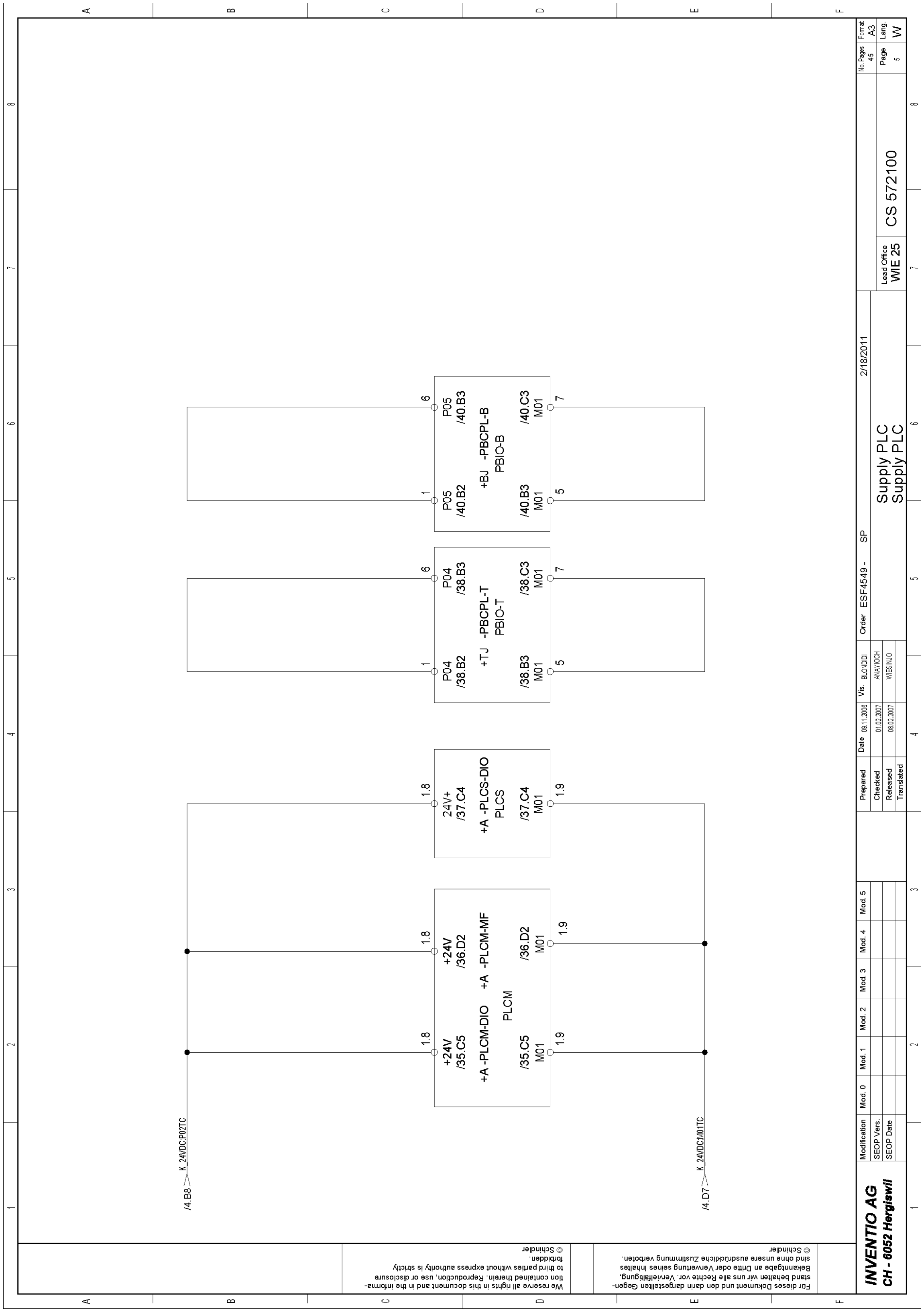
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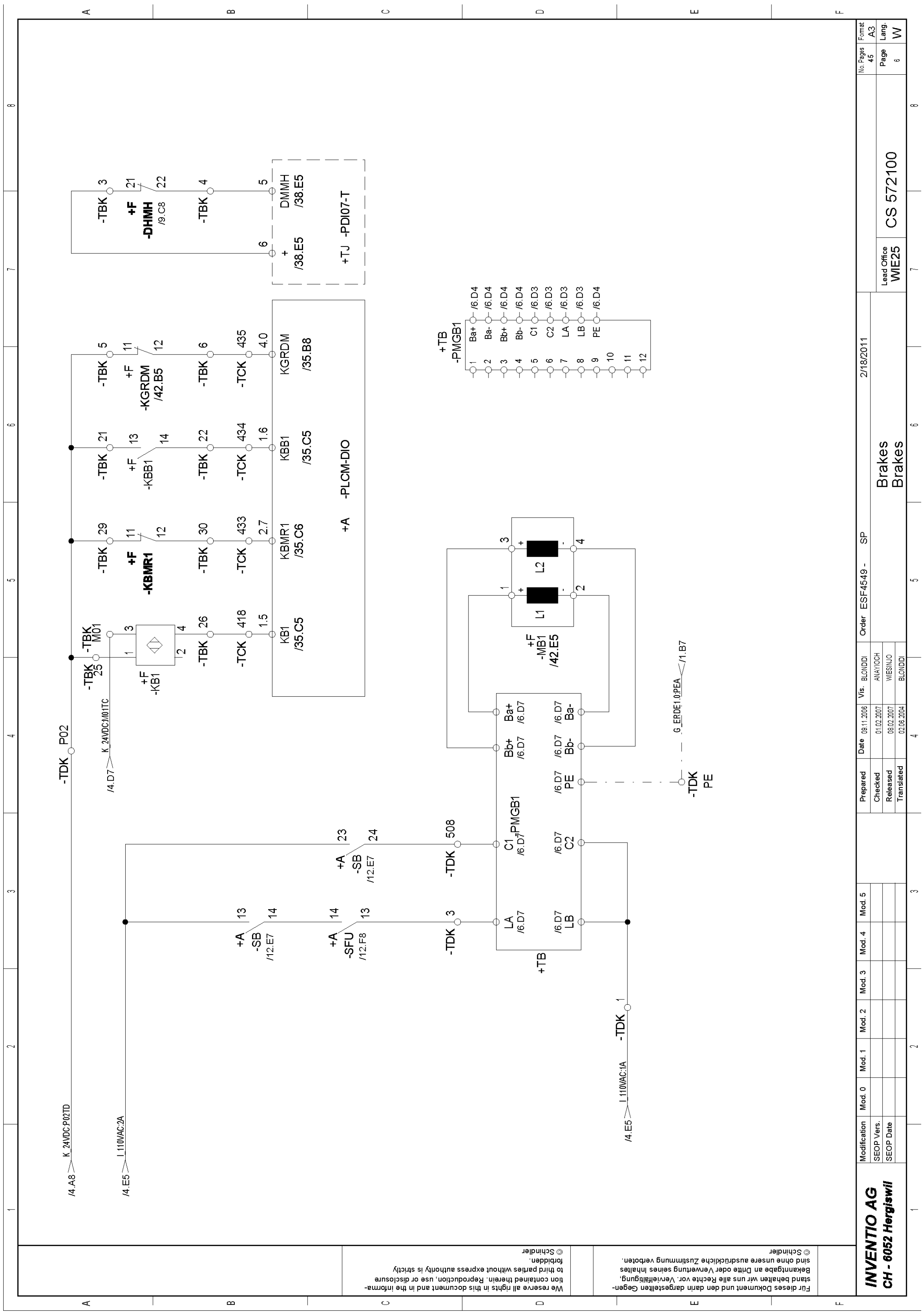
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CH - 6052 Hergiswil
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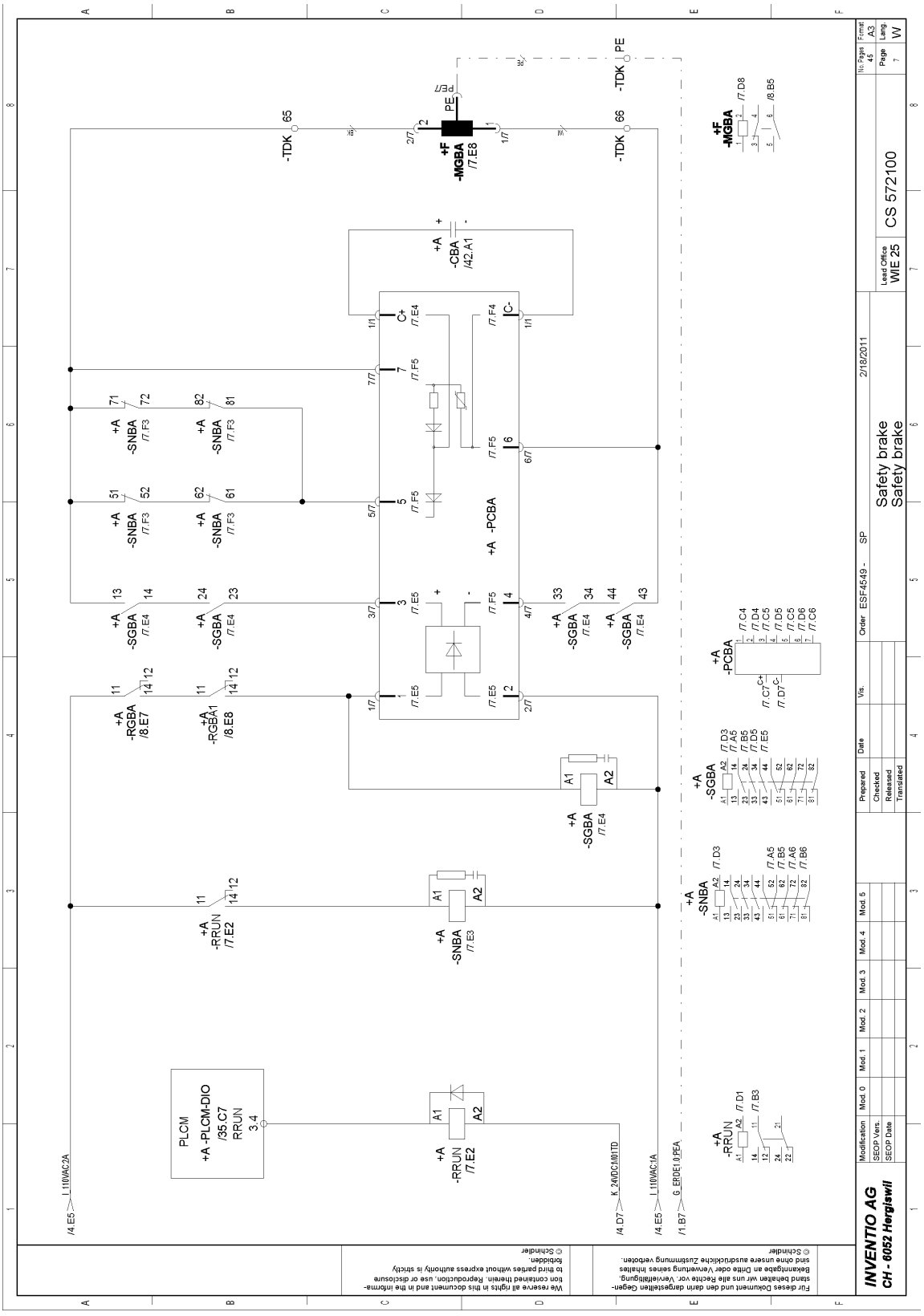
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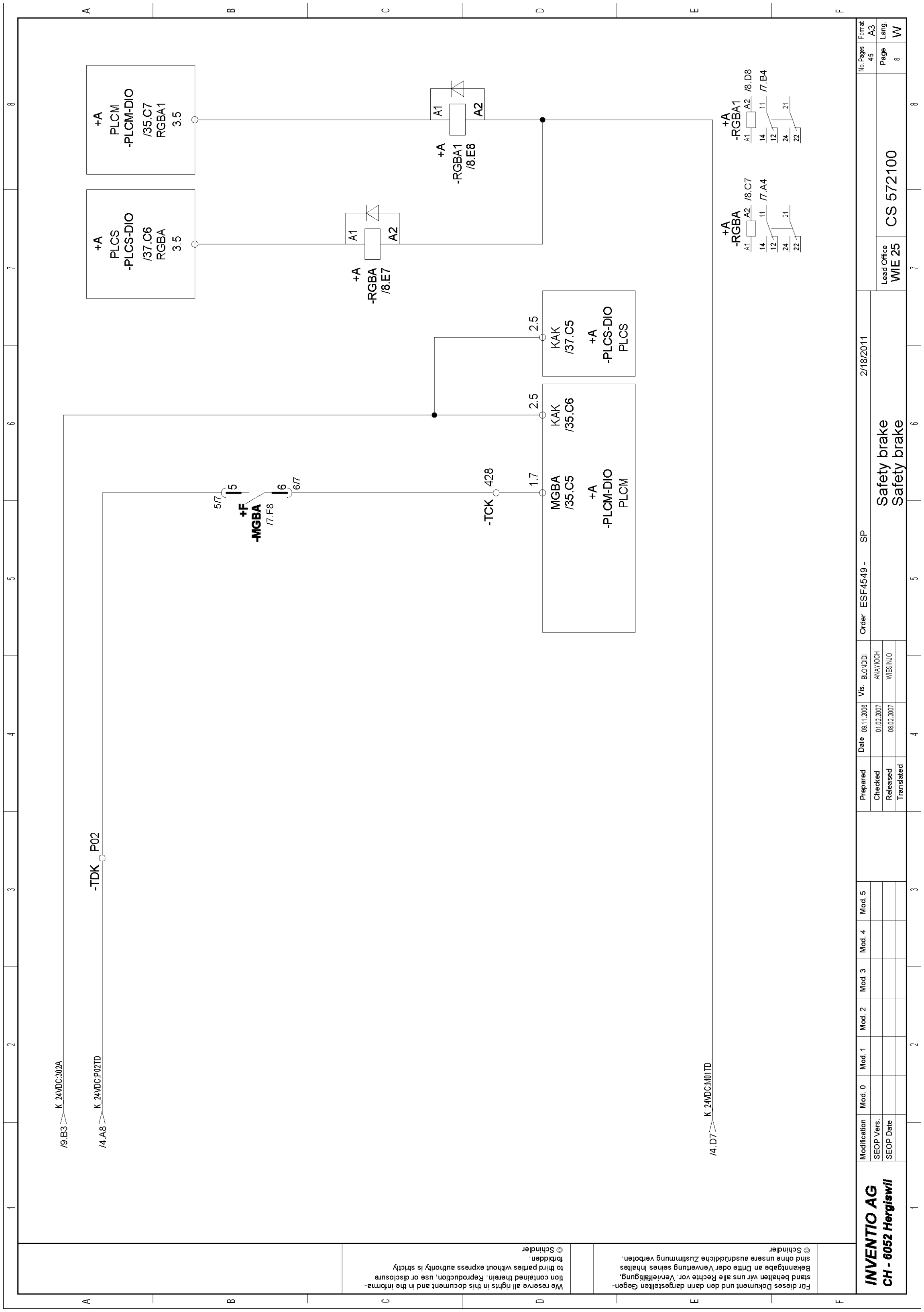
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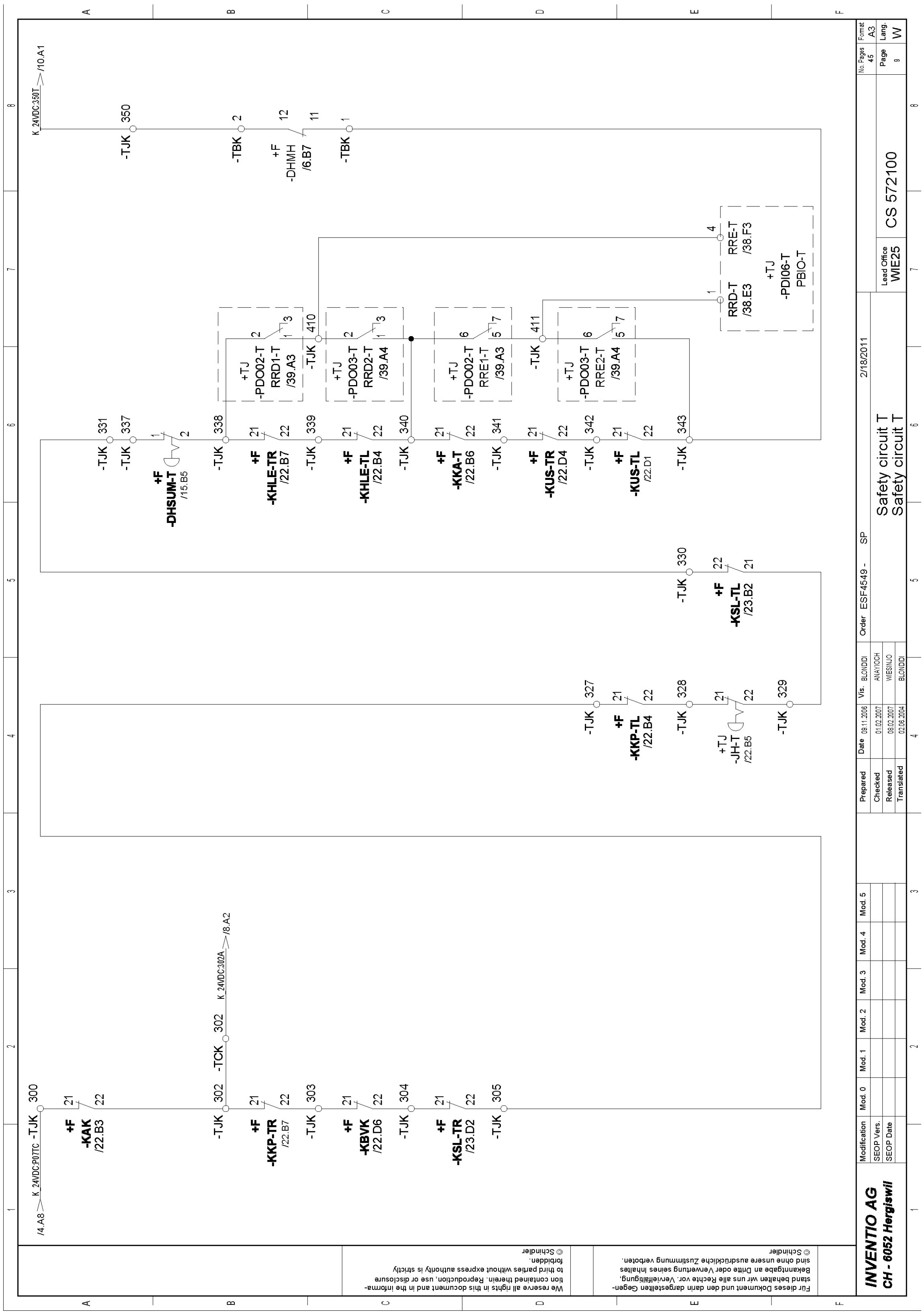
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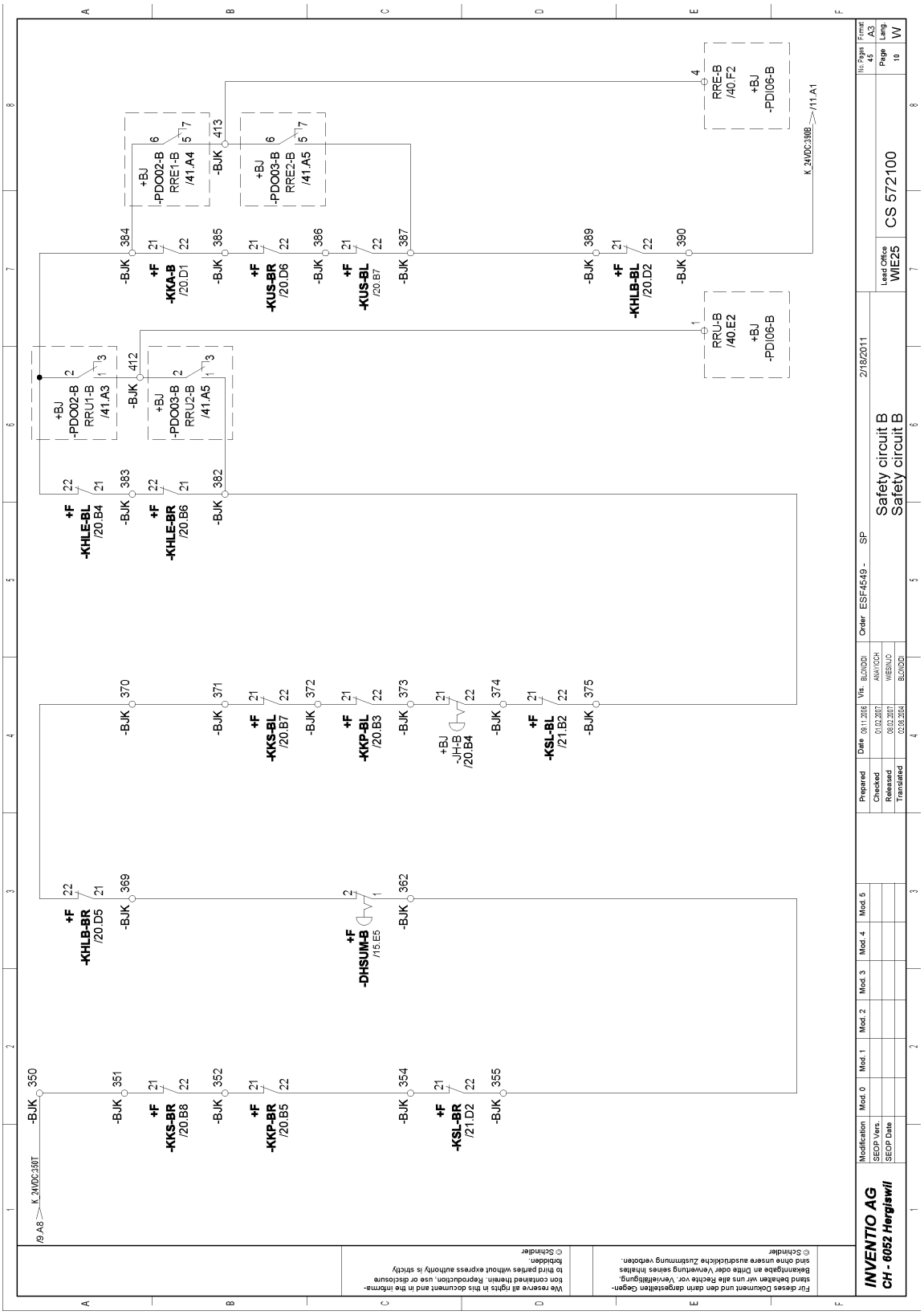
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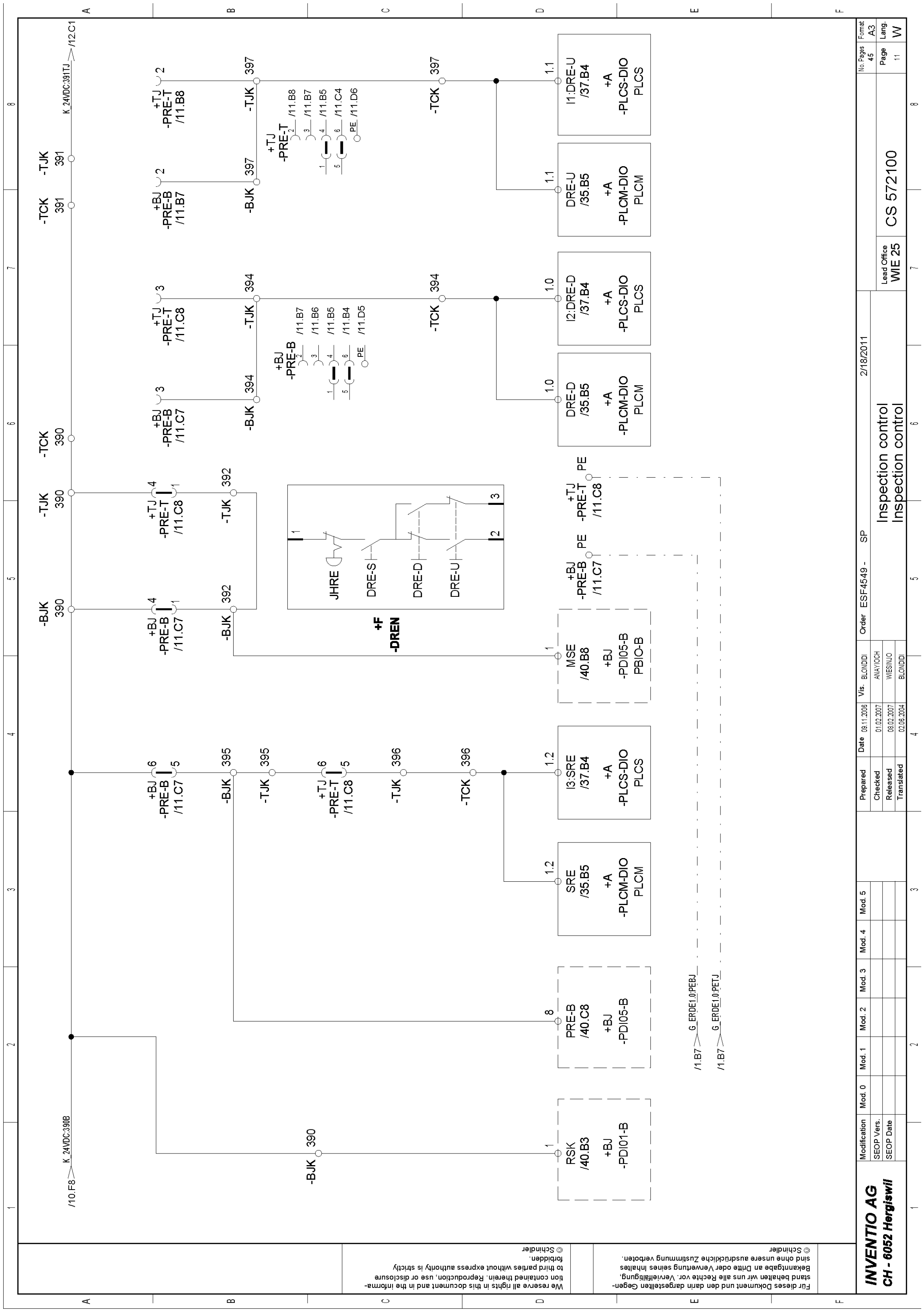
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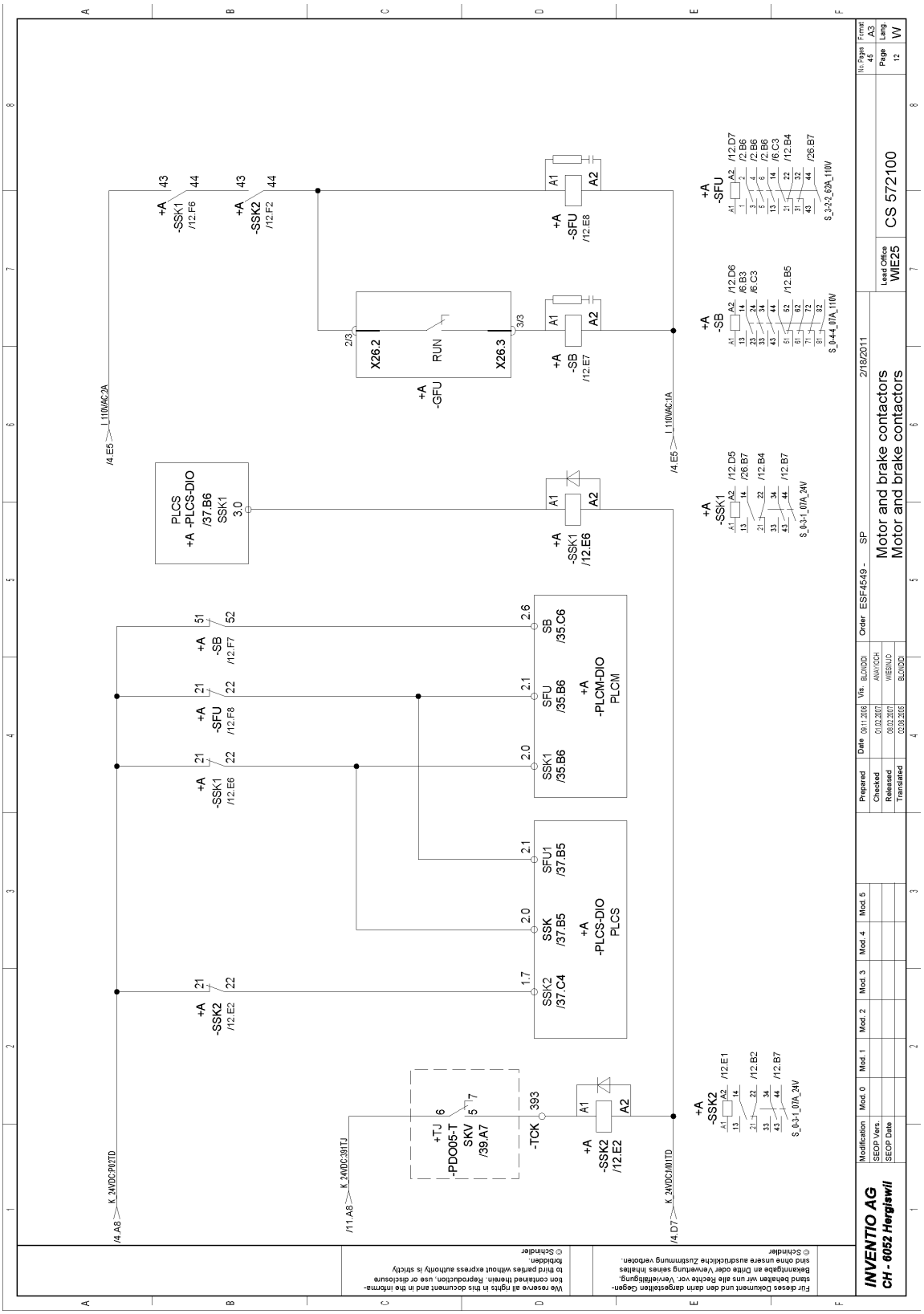
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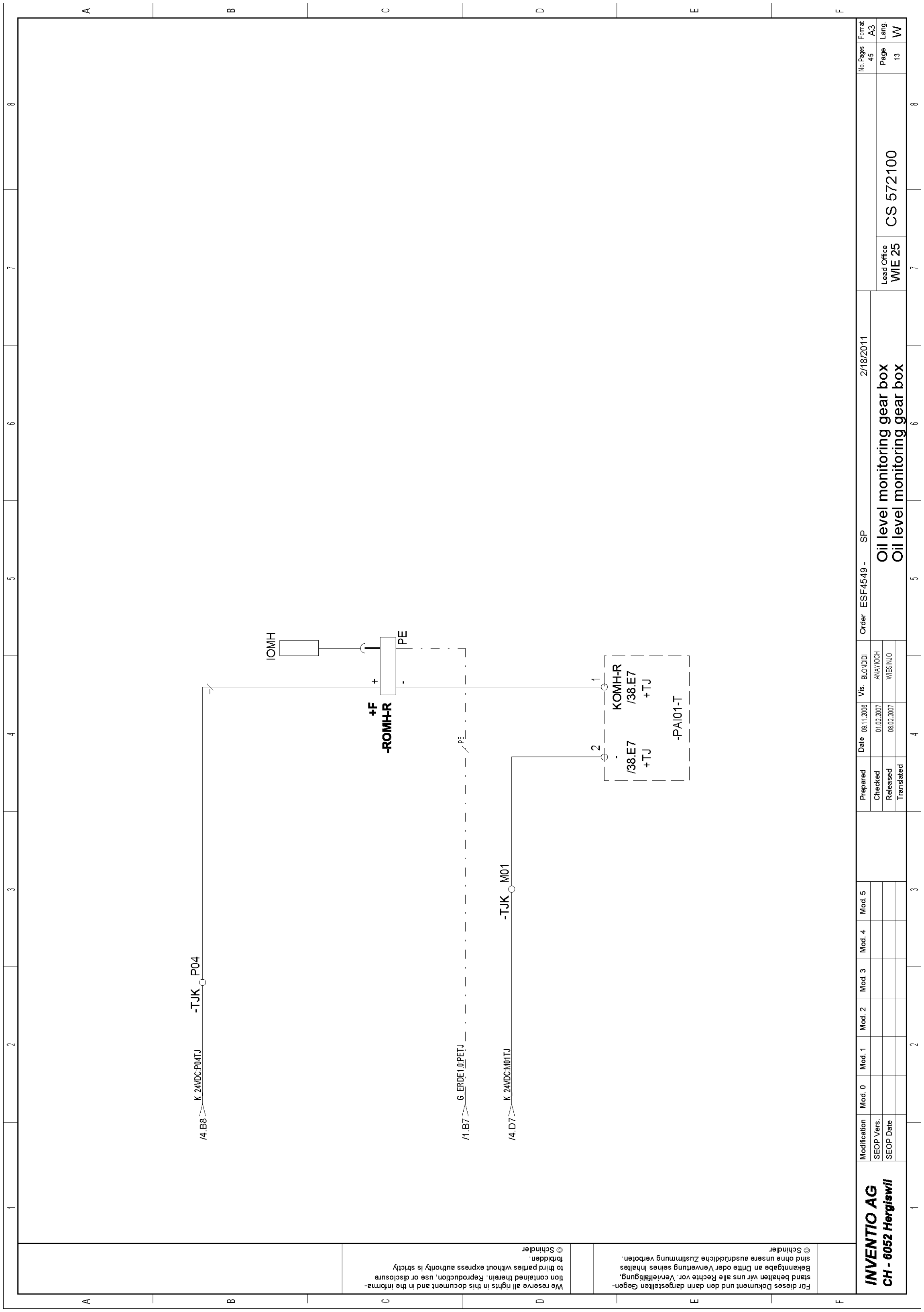
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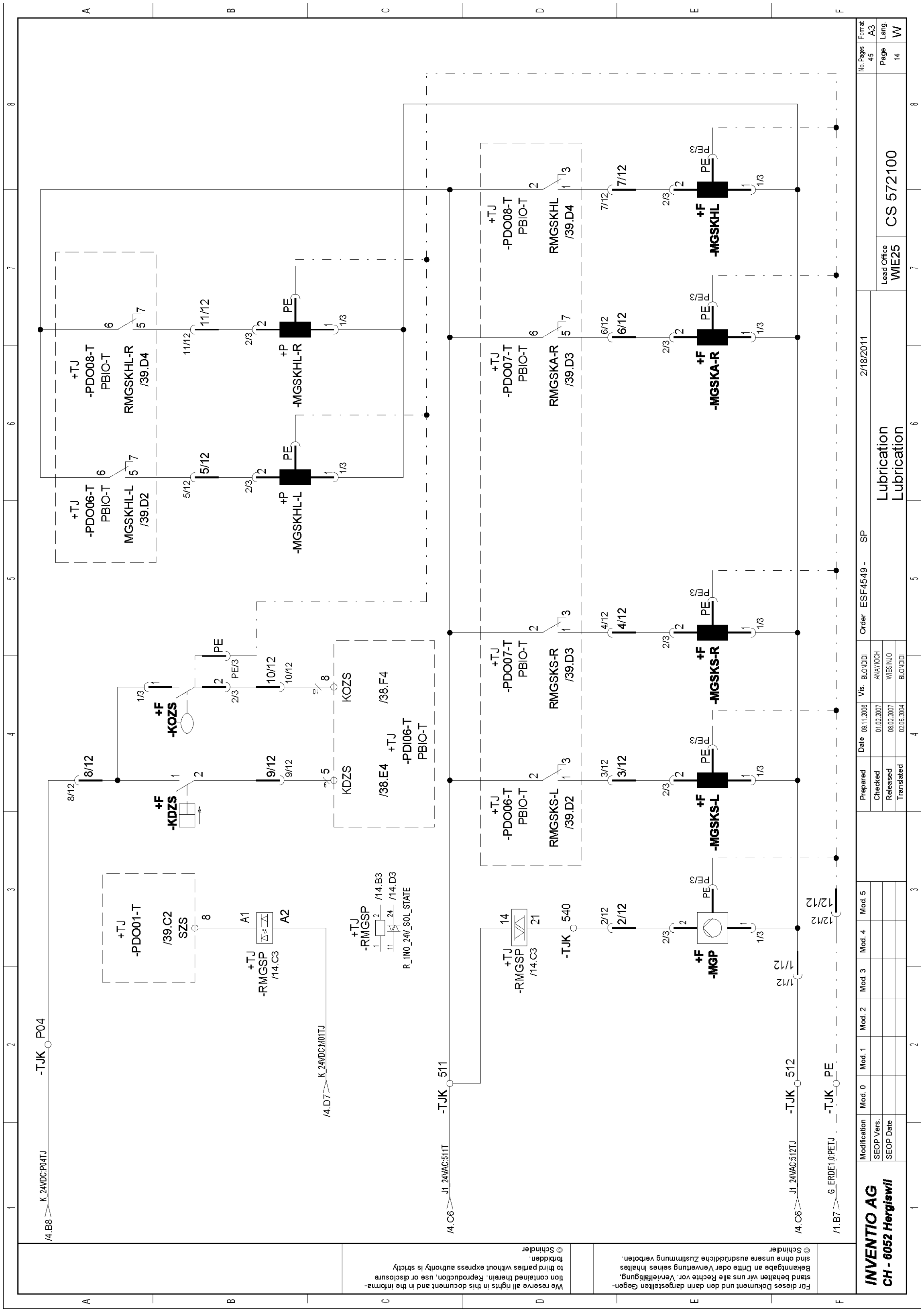
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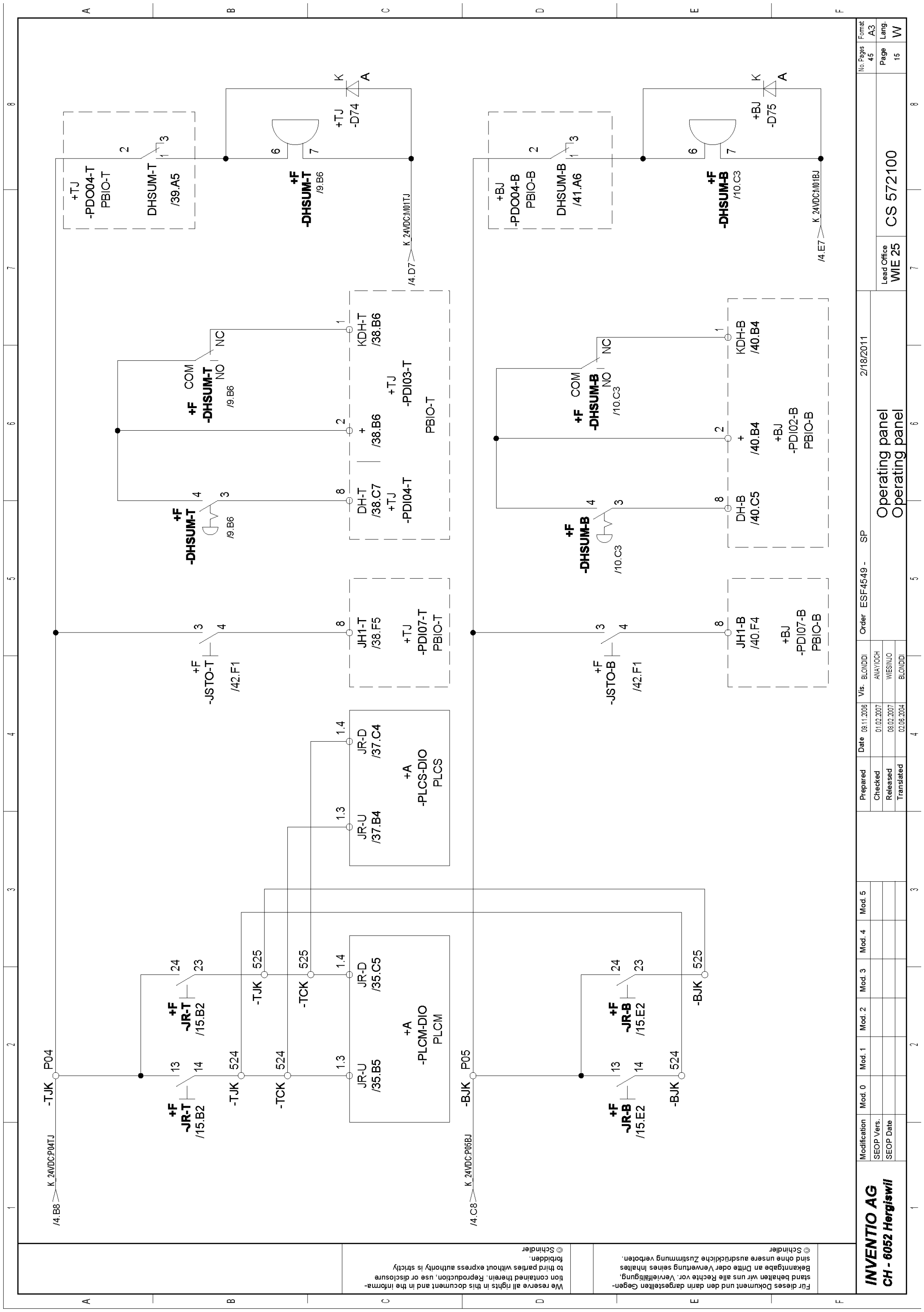
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Operating panel
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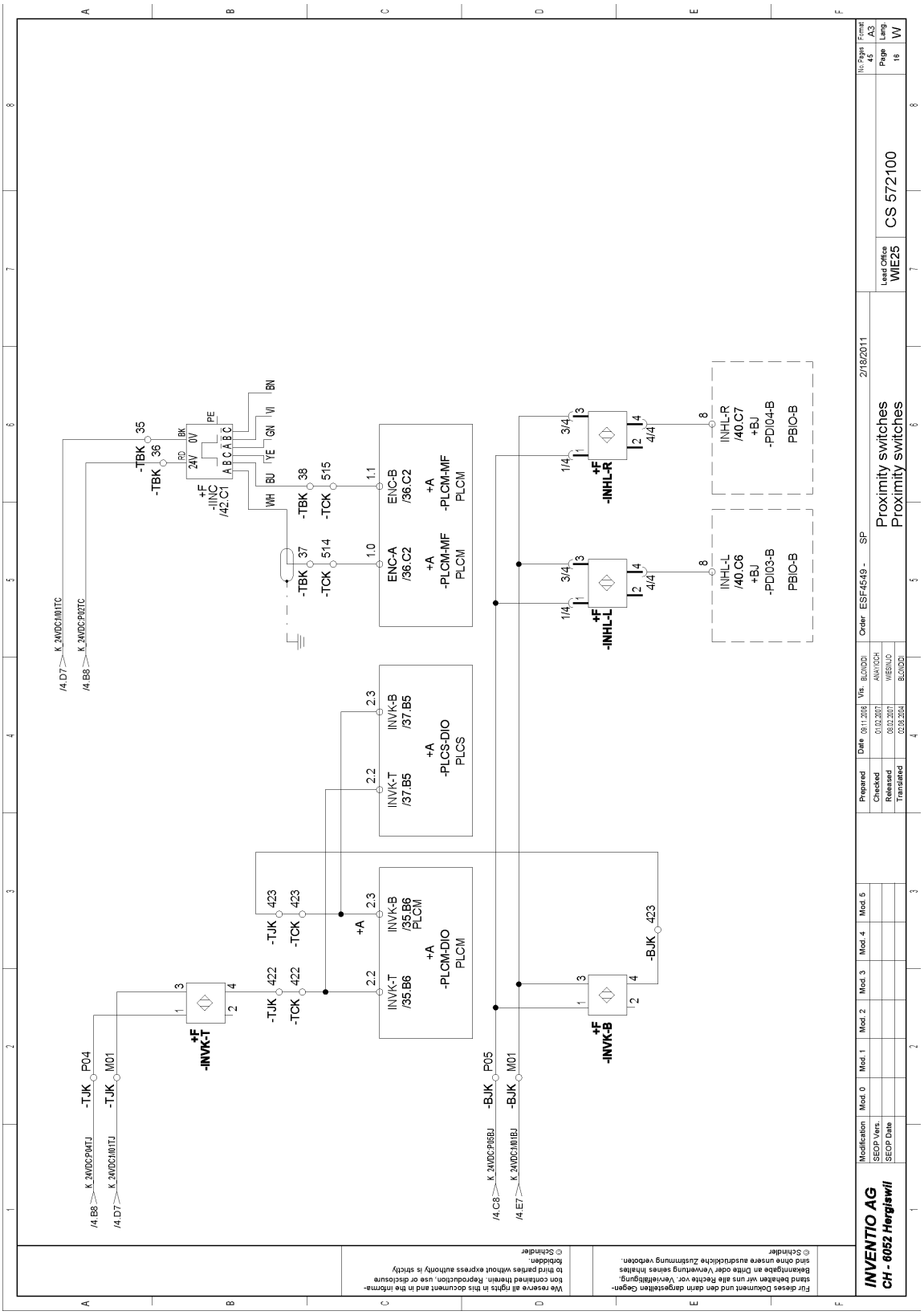
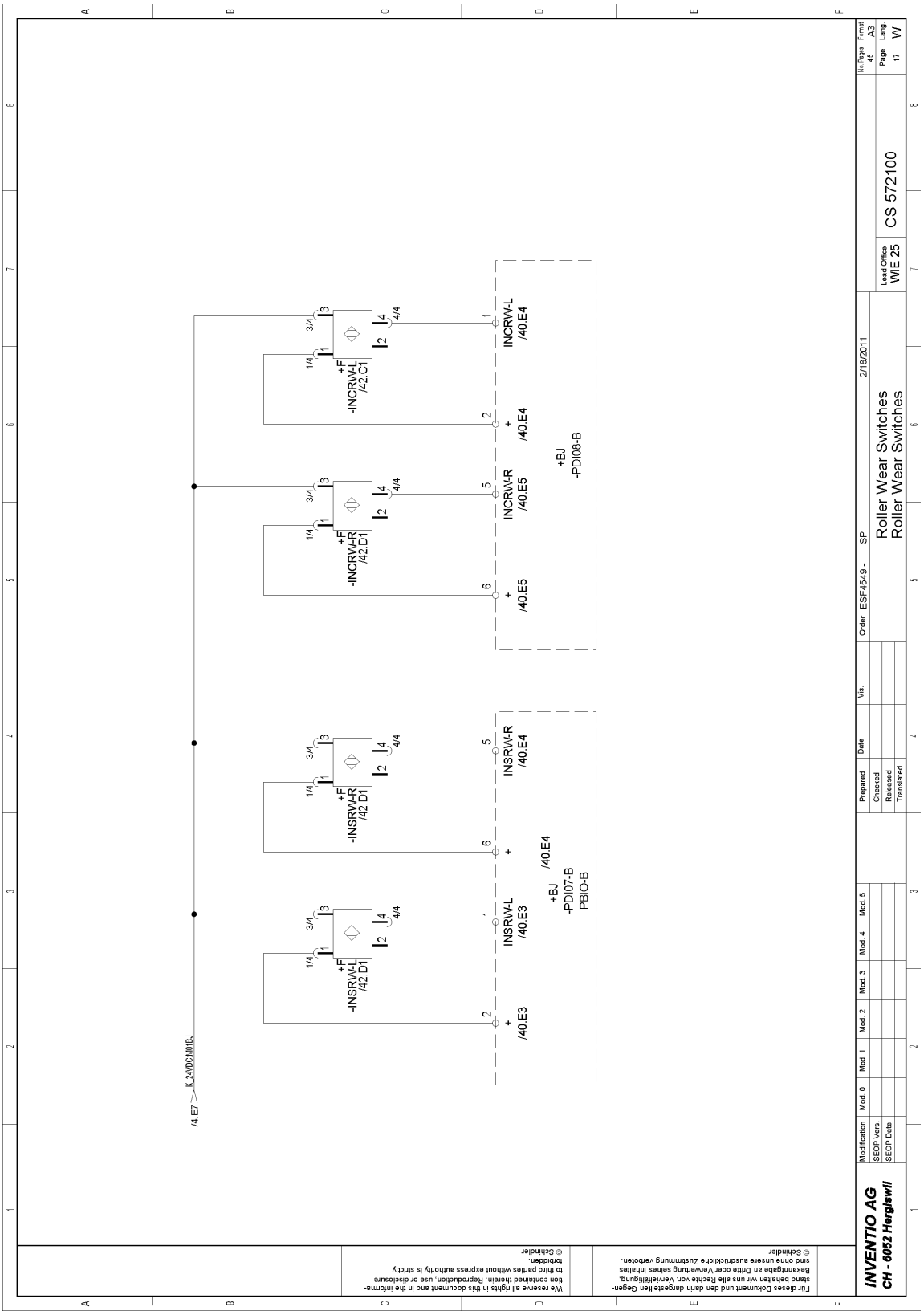
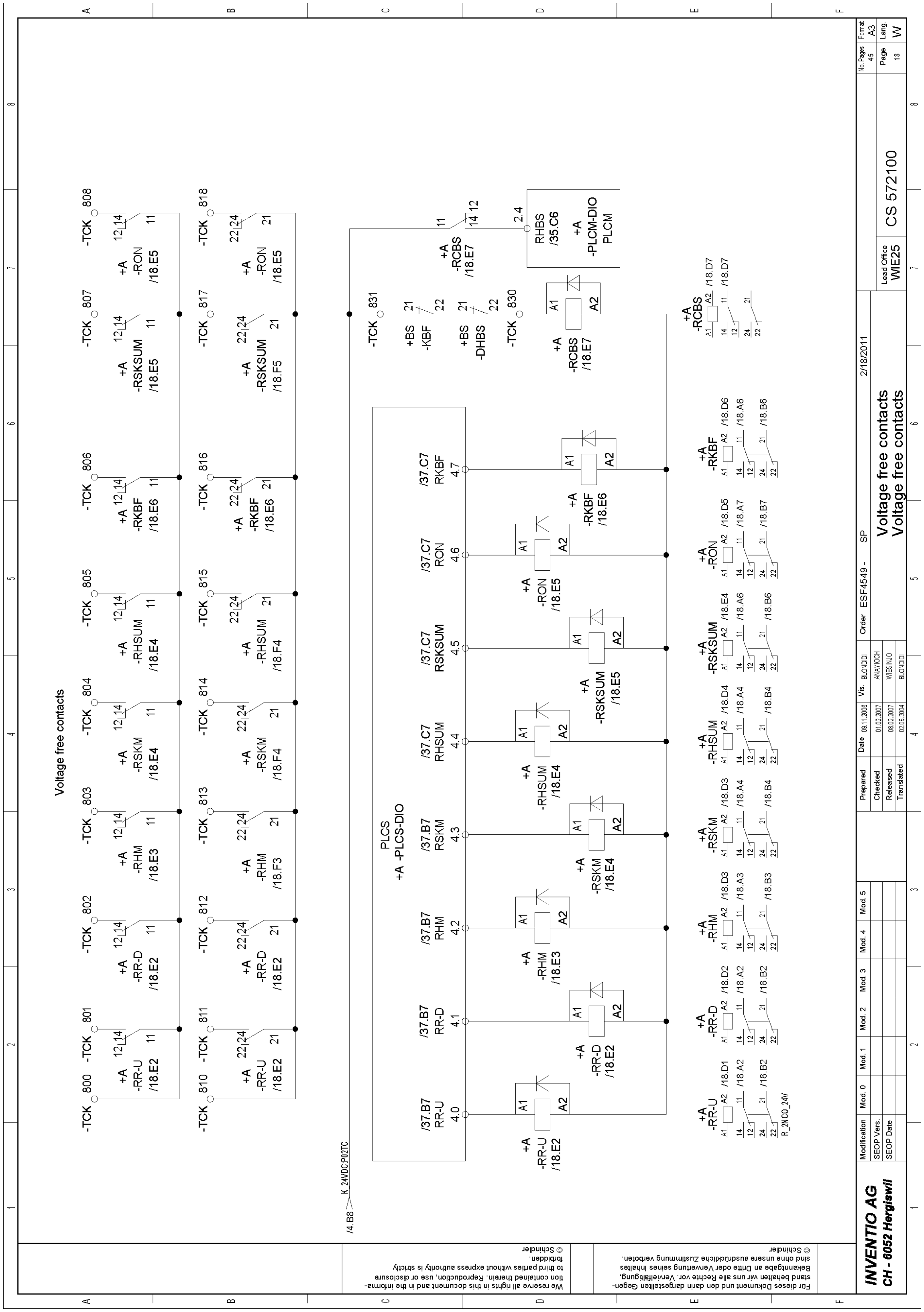
ESF4549 - SP
2/18/2011


Proximity switches
Proximity switches
CS 572100
INVENTIO AG
CH - 6052 Hergiswil
-INVK-T
-INVK-B
-INHL-L
-INHL-R
-PLCM-DIO
-PLCS-DIO
ENC-A /36.C2
ENC-B /36.C2
INHL-L /40.C6
INHL-R /40.C7
-PDI03-B
-PDI04-B
PBIC-B


/4.E7
K 24VDC.M8IBJ
-INSRW/-L
/42.D1
-INSRW/-R
/42.D1
-INCRW/-L
/42.C1
-INCRW/-R
/42.D1
+F
1/4
3/4
4/4
INSRW/-L
/40.E3
INSRW/-R
/40.E4
INCRW/-L
/40.E4
INCRW/-R
/40.E5
+BJ
-PDI07-B
PBIC-B
-PDI08-B
Roller Wear Switches
Roller Wear Switches
CS 572100
INVENTIO AG
CH - 6052 Hergiswil


Voltage free contacts
PLCS
+A -PLCS-DIO
RHBS
/35.C6
+A
-PLCM-DIO
PLCM
Voltage free contacts
Voltage free contacts
CS 572100
INVENTIO AG
CH - 6052 Hergiswil
Lead Office
WIE25
Order ESF4549 - SP
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Prepared
Checked
Released
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No. Pages 45
Format A3
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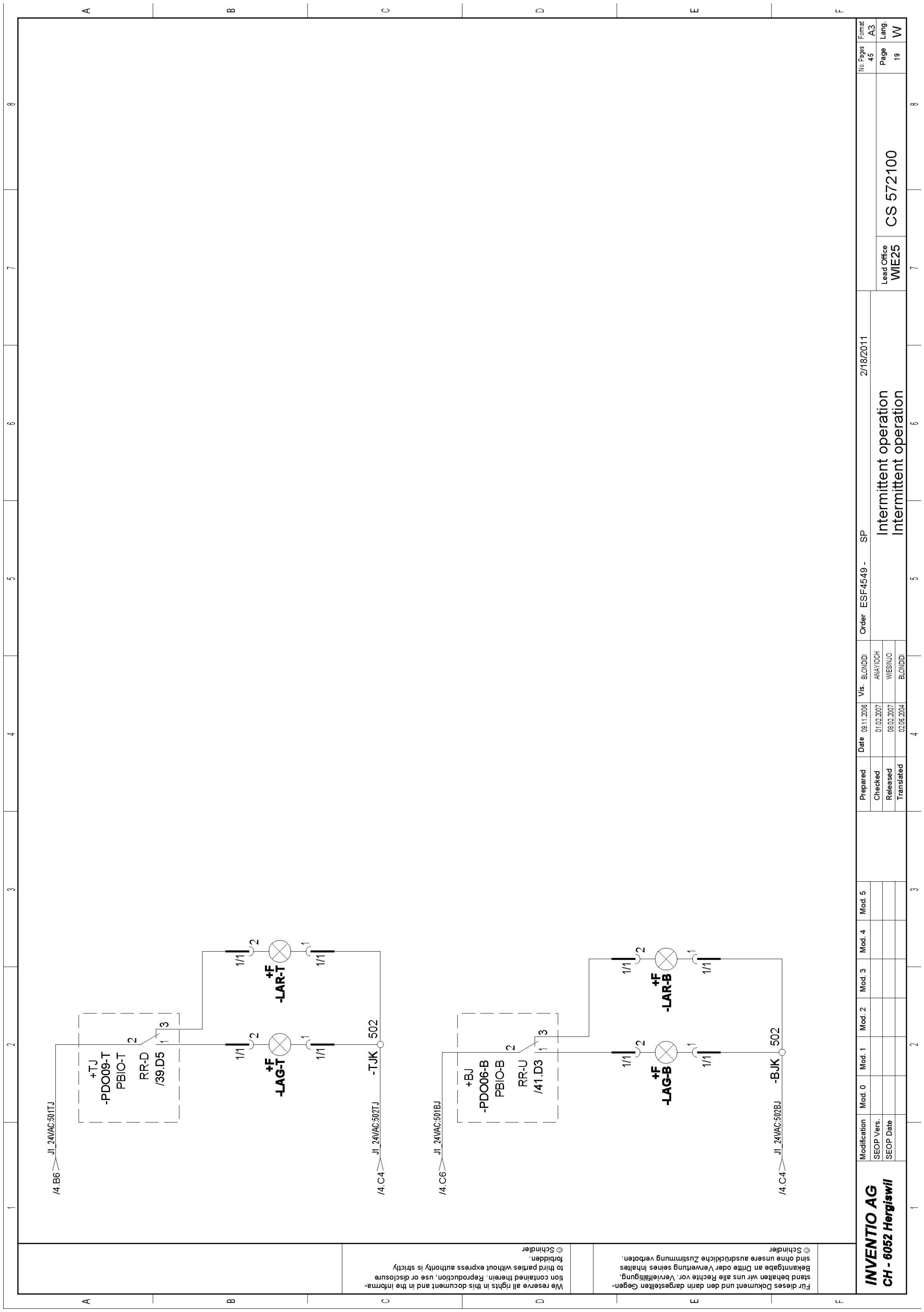
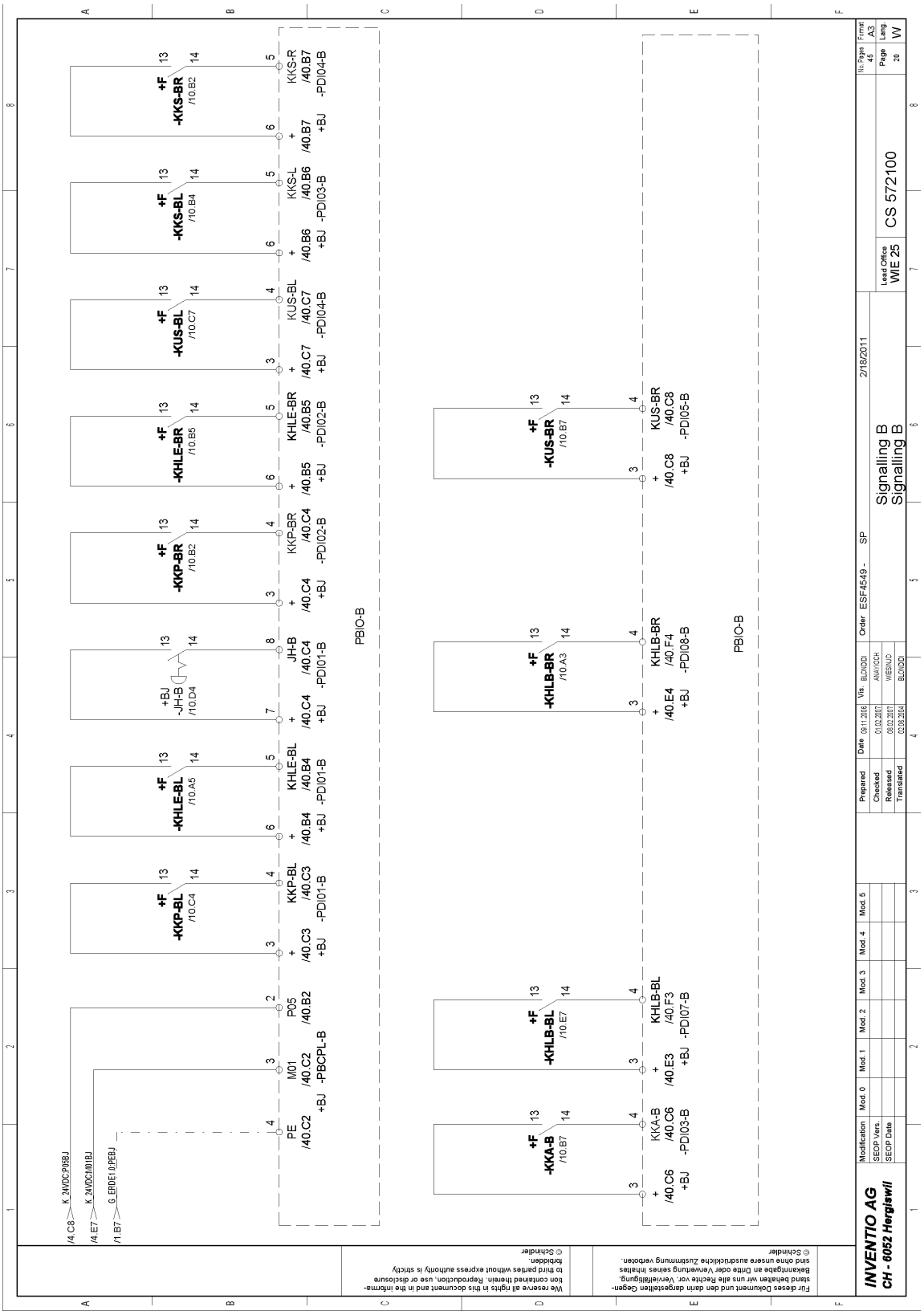
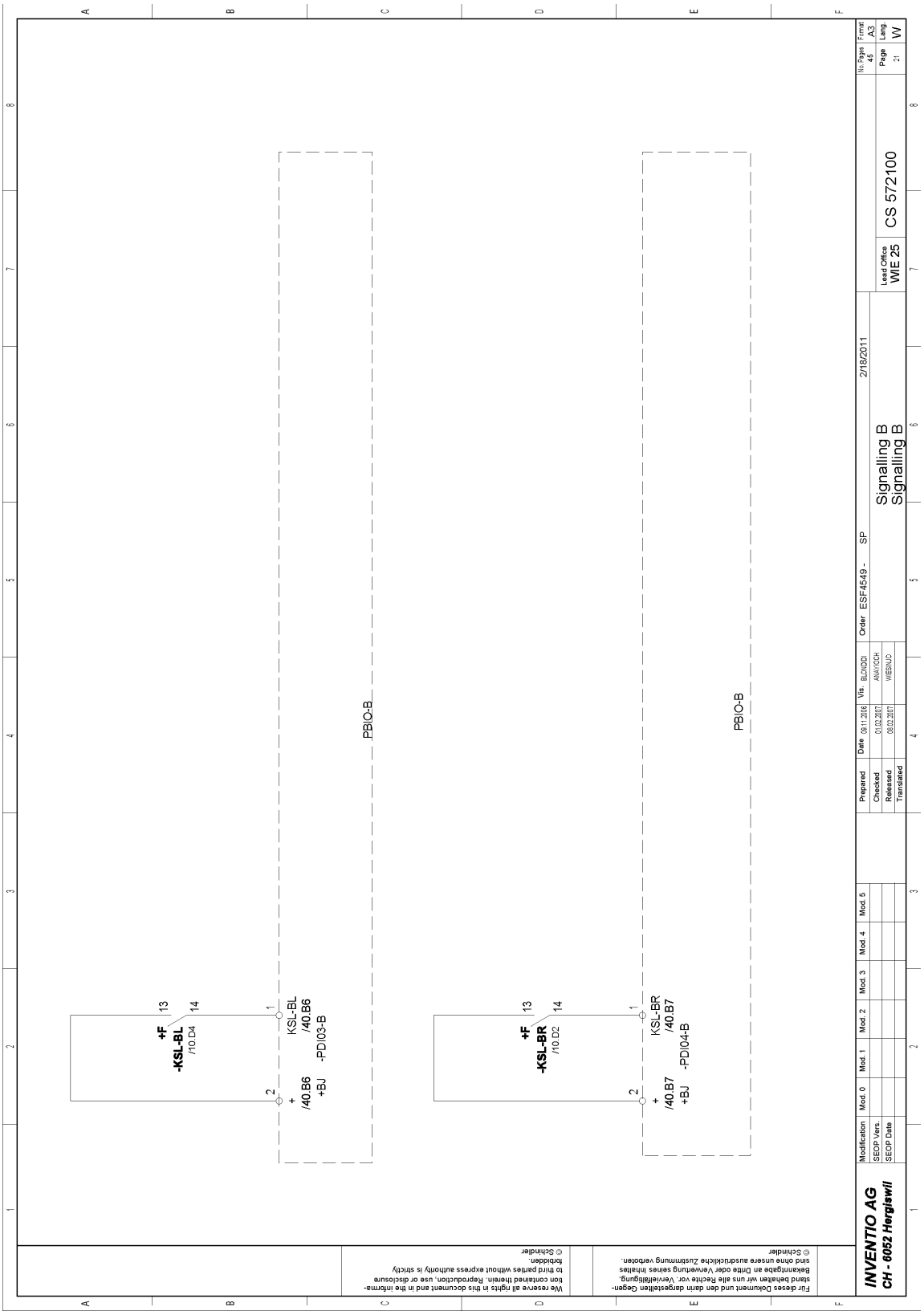
Lang. W


+TJ
-PDO09-T
PBIO-T
RR-D
/39.D5
+F
-LAG-T
+F
-LAR-T
-TJK
502
+BJ
-PDO06-B
PBIO-B
RR-U
/41.D3
+F
-LAG-B
+F
-LAR-B
-BJK
502
/4.B6
/4.C4
/4.C6
/4.C4
Order ESF4549 - SP
2/18/2011
Intermittent operation
Intermittent operation
Lead Office
WIE25
CS 572100
INVENTIO AG
CH - 6052 Hergiswil


INVENTIO AG
CH - 6052 Hergiswil
Signalling B
Signalling B
2/18/2011
CS 572100
Lead Office WIE 25
PBIO-B
PBIO-B
-KKP-BL /10.C4
-KHLE-BL /10.A5
-JH-B /10.D4
-KKP-BR /10.B2
-KHLE-BR /10.B5
-KUS-BL /10.C7
-KKS-BL /10.B4
-KKS-BR /10.B2
-KKA-B /10.B7
-KHLB-BL /10.E7
-KHLB-BR /10.A3
-KUS-BR /10.B7
-PBCPL-B
-PDI01-B
-PDI01-B
-PDI01-B
-PDI02-B
-PDI02-B
-PDI04-B
-PDI03-B
-PDI07-B
-PDI08-B
-PDI05-B
-PDI03-B
-PDI04-B


+F
-KSL-BL
/10.D4
13
14
1
2
KSL-BL
/40.B6
-PDI03-B
+
/40.B6
+BJ
PBIO-B
+F
-KSL-BR
/10.D2
13
14
1
2
KSL-BR
/40.B7
-PDI04-B
+
/40.B7
+BJ
PBIO-B
INVENTIO AG
CH - 6052 Hergiswil
Signalling B
Signalling B
CS 572100
Lead Office
WIE 25
2/18/2011
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Mod. 0
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SEOP Vers.
SEOP Date
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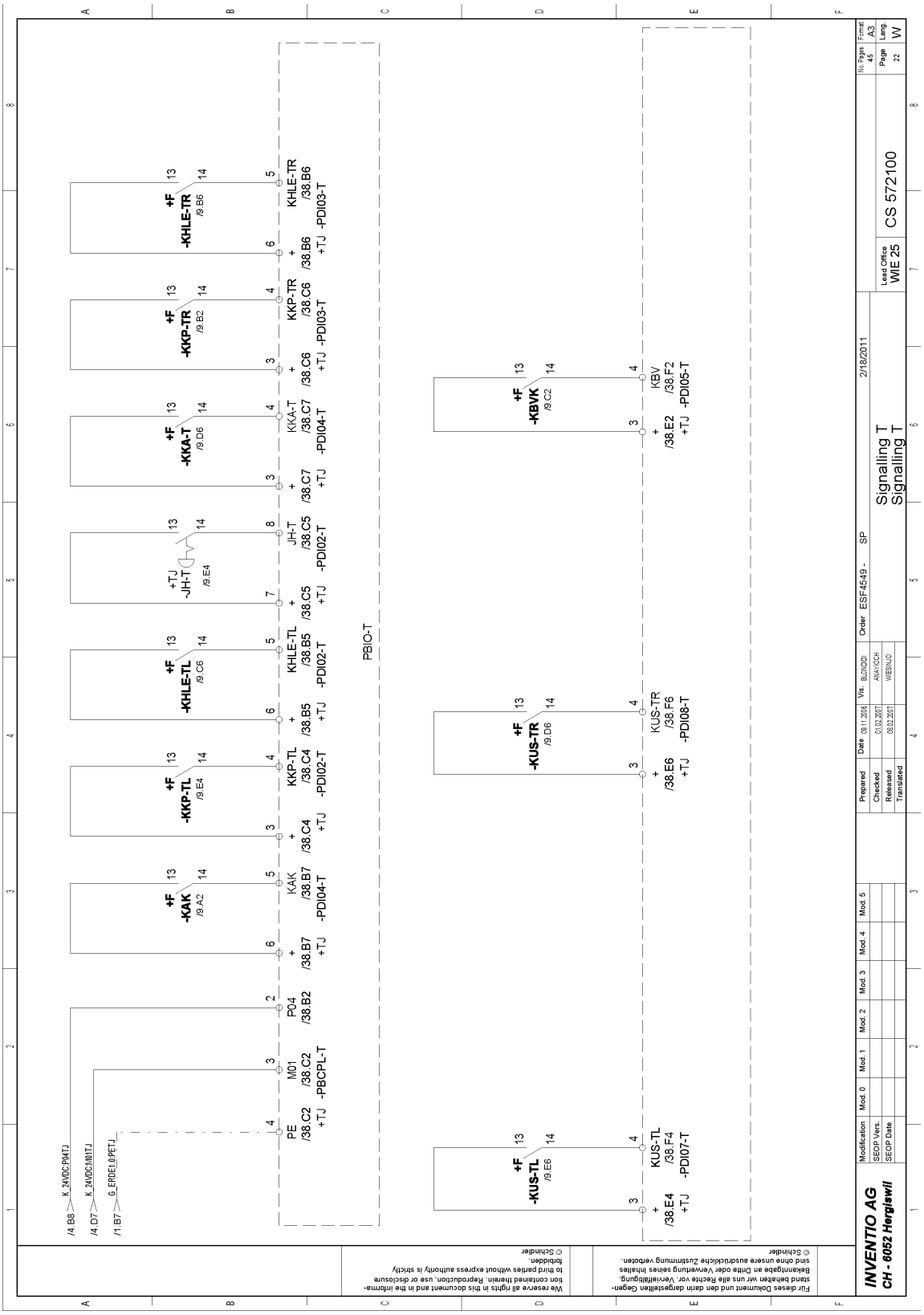
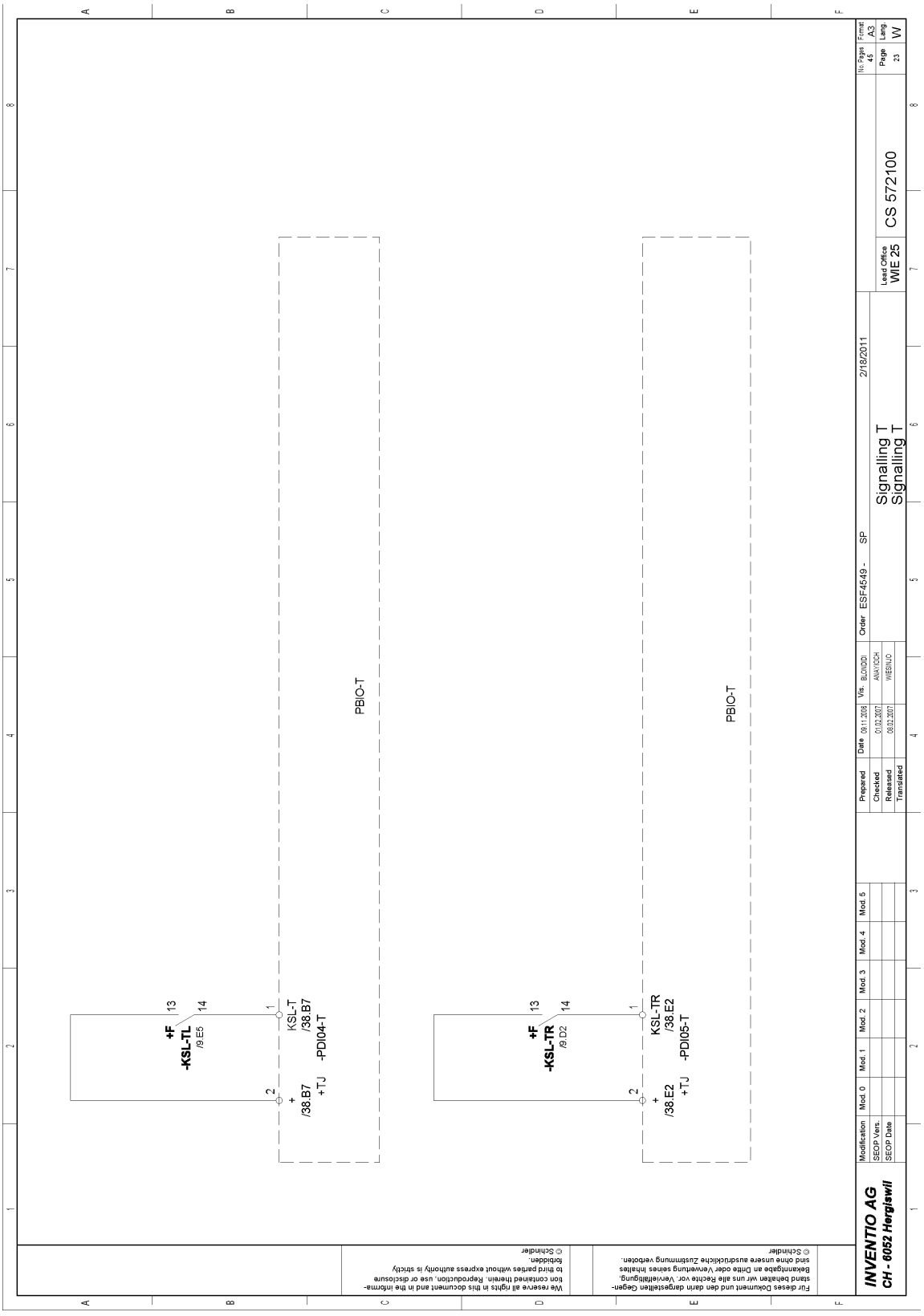
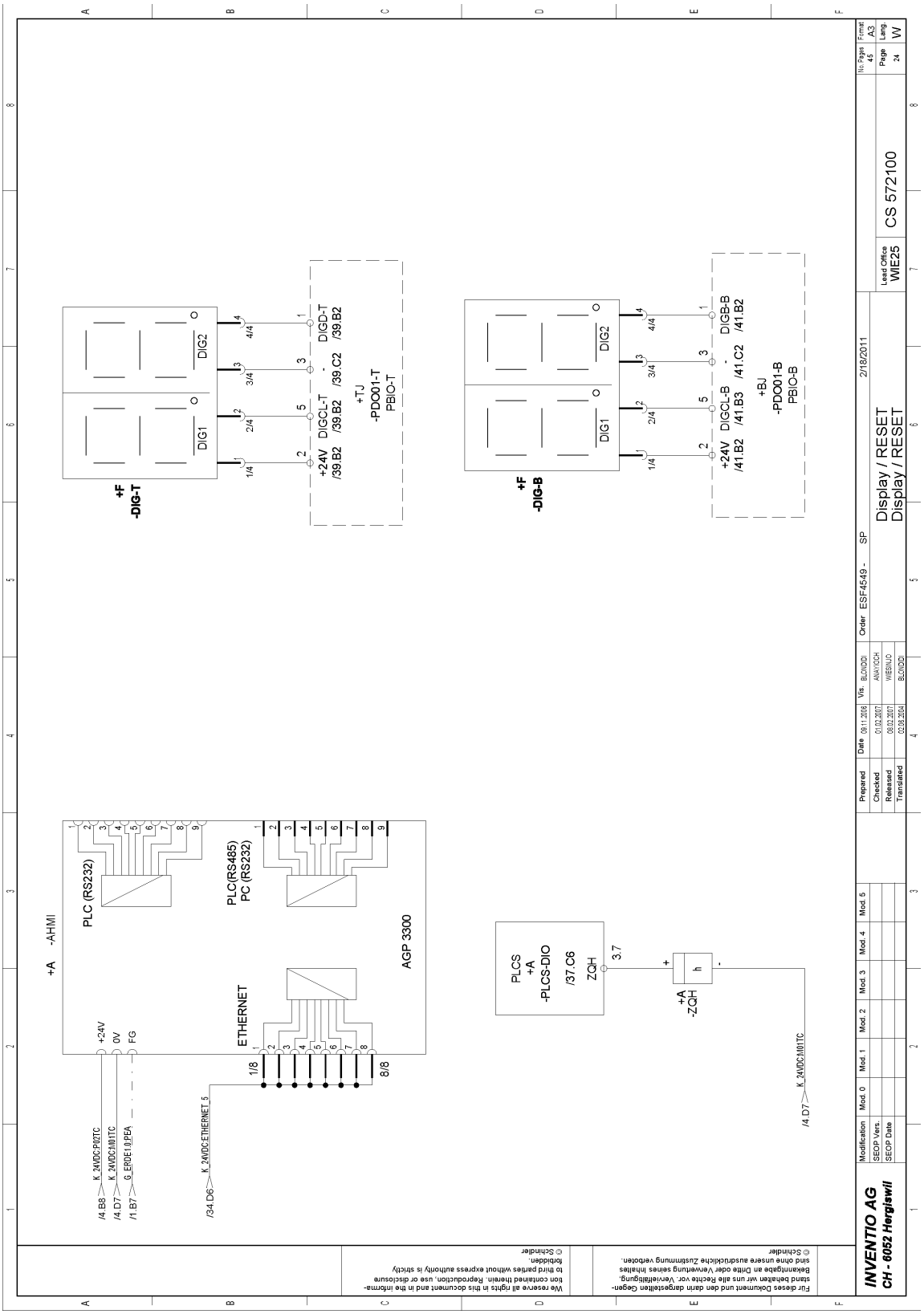

PBIO-T
-KAK /9.A2
-KKP-TL /9.E4
-KHLE-TL /9.C6
-JH-T /9.E4
-KKA-T /9.D6
-KKP-TR /9.B2
-KHLE-TR /9.B6
-KUS-TL /9.E6
-KUS-TR /9.D6
-KBVK /9.C2
-PDI04-T
-PDI02-T
-PDI07-T
-PDI08-T
-PDI05-T
-PDI03-T
-PBCPL-T
Signalling T
Signalling T
CS 572100
INVENTIO AG
CH - 6052 Hergiswil


PBIO-T
+F
-KSL-TL
/9.E5
13
14
1
2
KSL-T
/38.B7
-PDI04-T
+TJ
/38.B7
PBIO-T
+F
-KSL-TR
/9.D2
13
14
1
2
KSL-TR
/38.E2
-PDI05-T
+TJ
/38.E2
Signalling T
Signalling T
CS 572100
Lead Office WIE 25
2/18/2011
Order ESF4549 - SP
INVENTIO AG
CH - 6052 Hergiswil


+F
-DIG-T
DIG1
DIG2
+24V /39.B2
DIGCL-T /39.B2
DIGD-T /39.B2
/39.C2
+TJ
-PDO01-T
PBIO-T
+F
-DIG-B
+24V /41.B2
DIGCL-B /41.B3
DIGB-B /41.C2 /41.B2
+BJ
-PDO01-B
PBIO-B
+A -AHMI
PLC (RS232)
PLC(RS485)
PC (RS232)
ETHERNET
AGP 3300
+24V
0V
FG
1/8
8/8
K_24VDC.P02TC
K_24VDC.M01TC
G_ERDE1.0.PEA
K_24VDC.ETHERNET.5
/4.B8
/4.D7
/1.B7
/34.D6
PLCS +A -PLCS-DIO /37.C6 ZQH
3.7
+A -ZQH
/4.D7
Display / RESET
Display / RESET
2/18/2011
Order ESF4549 - SP
Lead Office WIE25
CS 572100
No. Pages 45
Page 24
Format A3
Lang. W
Prepared 08.11.2006 BLOWDD
Checked 01.02.2007 ANAYDDH
Released 09.02.2007 WIESNLO
Translated 02.09.2004 BLOWDD
Modification
SEOP Vers.
SEOP Date
Mod. 0
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Mod. 2
Mod. 3
Mod. 4
Mod. 5
INVENTIO AG
CH - 6052 Hergiswil
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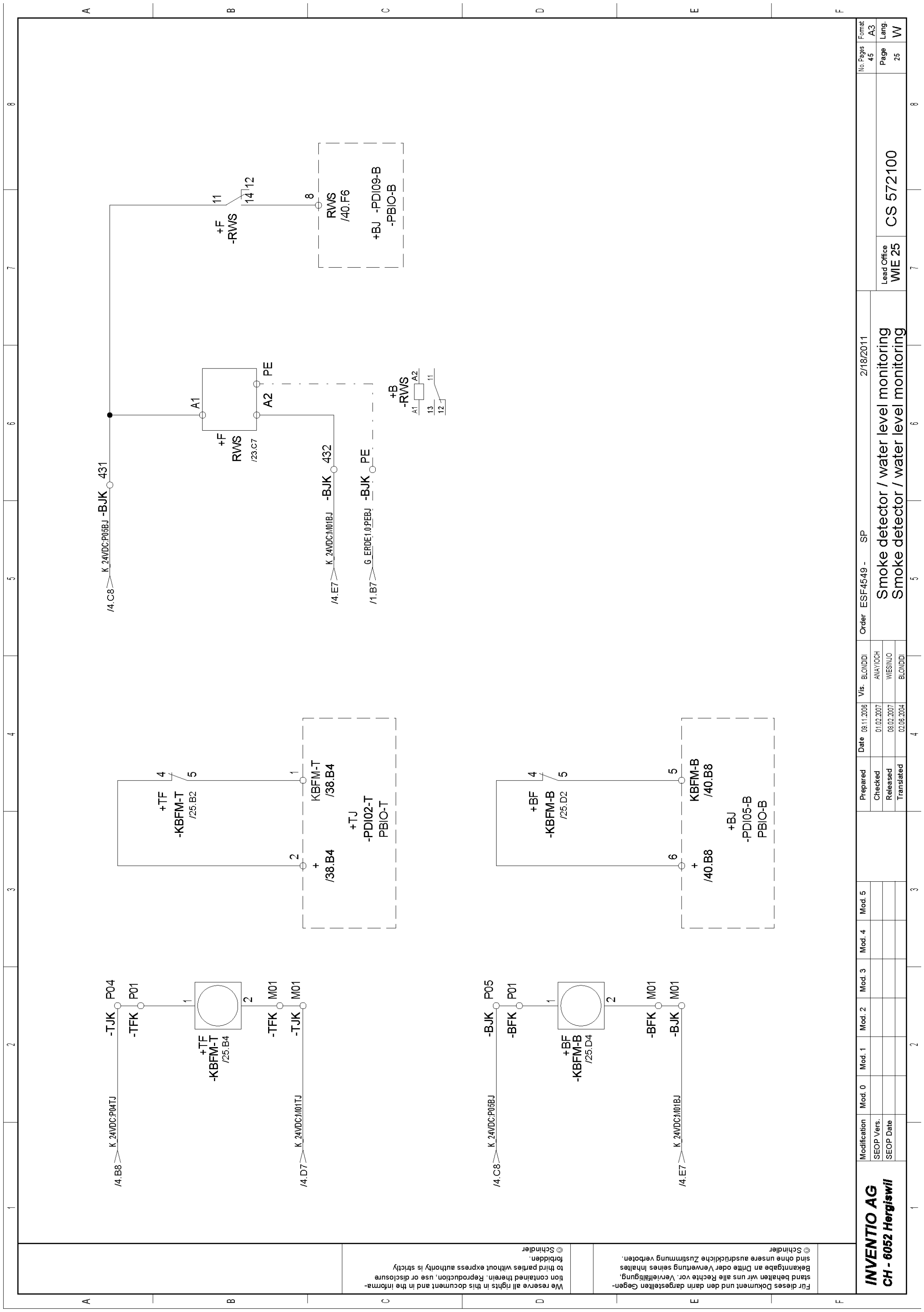
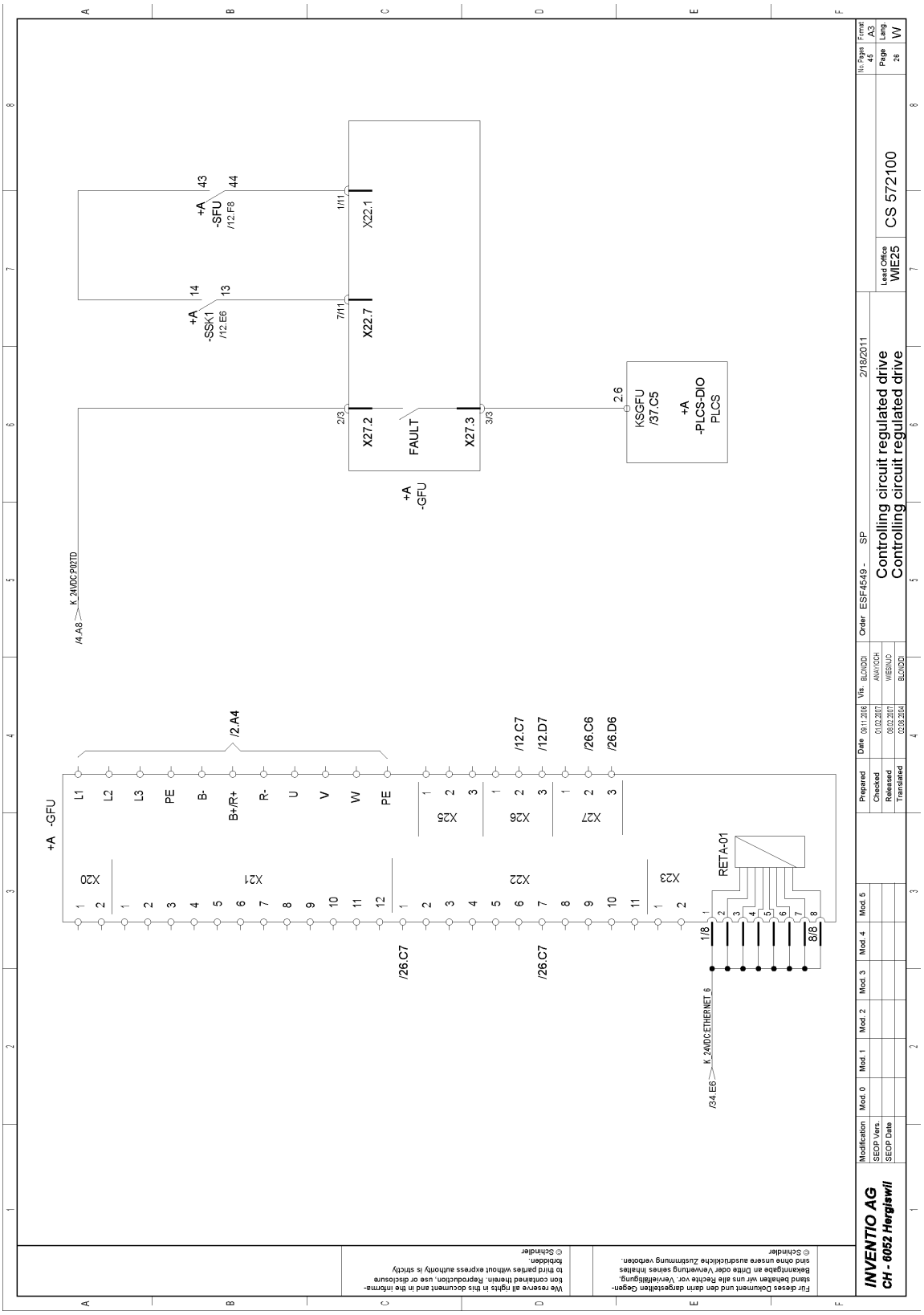

Smoke detector / water level monitoring
Smoke detector / water level monitoring
INVENTIO AG
CH - 6052 Hergiswil
CS 572100
WIE 25
Order ESF4549 - SP
2/18/2011
-TJK P04
-TFK P01
+TF
-KBFM-T
-TFK M01
-TJK M01
-BJK P05
-BFK P01
+BF
-KBFM-B
-BFK M01
-BJK M01
+TJ
-PDI02-T
PBIO-T
+BJ
-PDI05-B
PBIO-B
+F
RWS
+F
-RWS
+BJ -PDI09-B
-PBIO-B
+B
-RWS
-BJK 431
-BJK 432
-BJK PE


+A -GFU
L1
L2
L3
PE
B-
B+/R+
R-
U
V
W
PE
/2.A4
X20
X21
X22
X23
X25
X26
X27
/12.C7
/12.D7
/26.C6
/26.D6
/26.C7
/26.C7
RET.A-01
1/8
8/8
/34.E6
K_24VDC:ETHERNET 6
/4.A8
K_24VDC:P02TD
+A -GFU
X27.2
FAULT
X27.3
2/3
3/3
2.6
KSGFU /37.C5
+A -PLCS-DIO PLCS
+A -SSK1 /12.E6
14
13
7/11
X22.7
+A -SFU /12.F8
43
44
1/11
X22.1
INVENTIO AG
CH - 6052 Hergiswil
Controlling circuit regulated drive
Controlling circuit regulated drive
ESF45-49 - SP
Order
Lead Office WIE25
CS 572100
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SEOP Date
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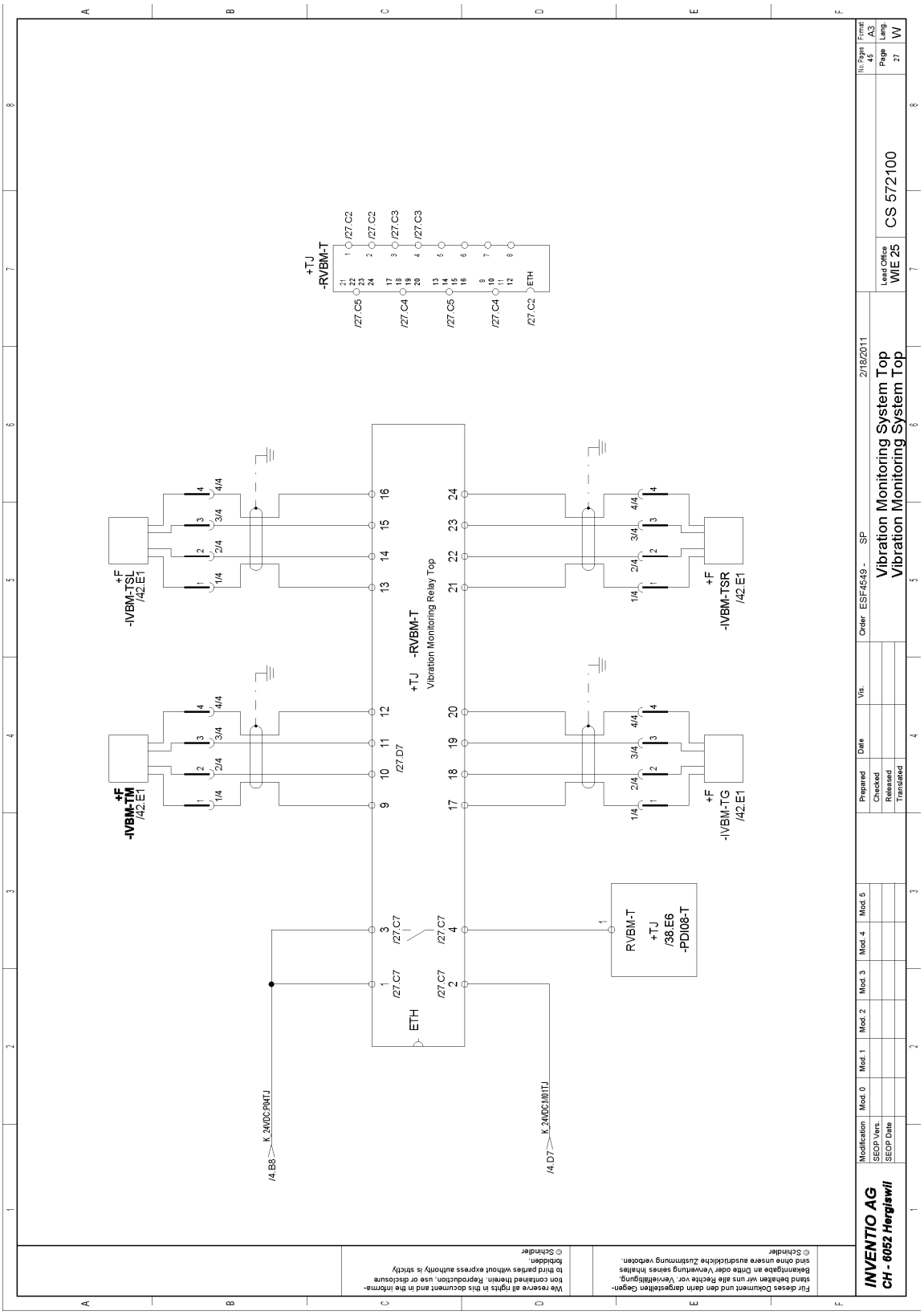
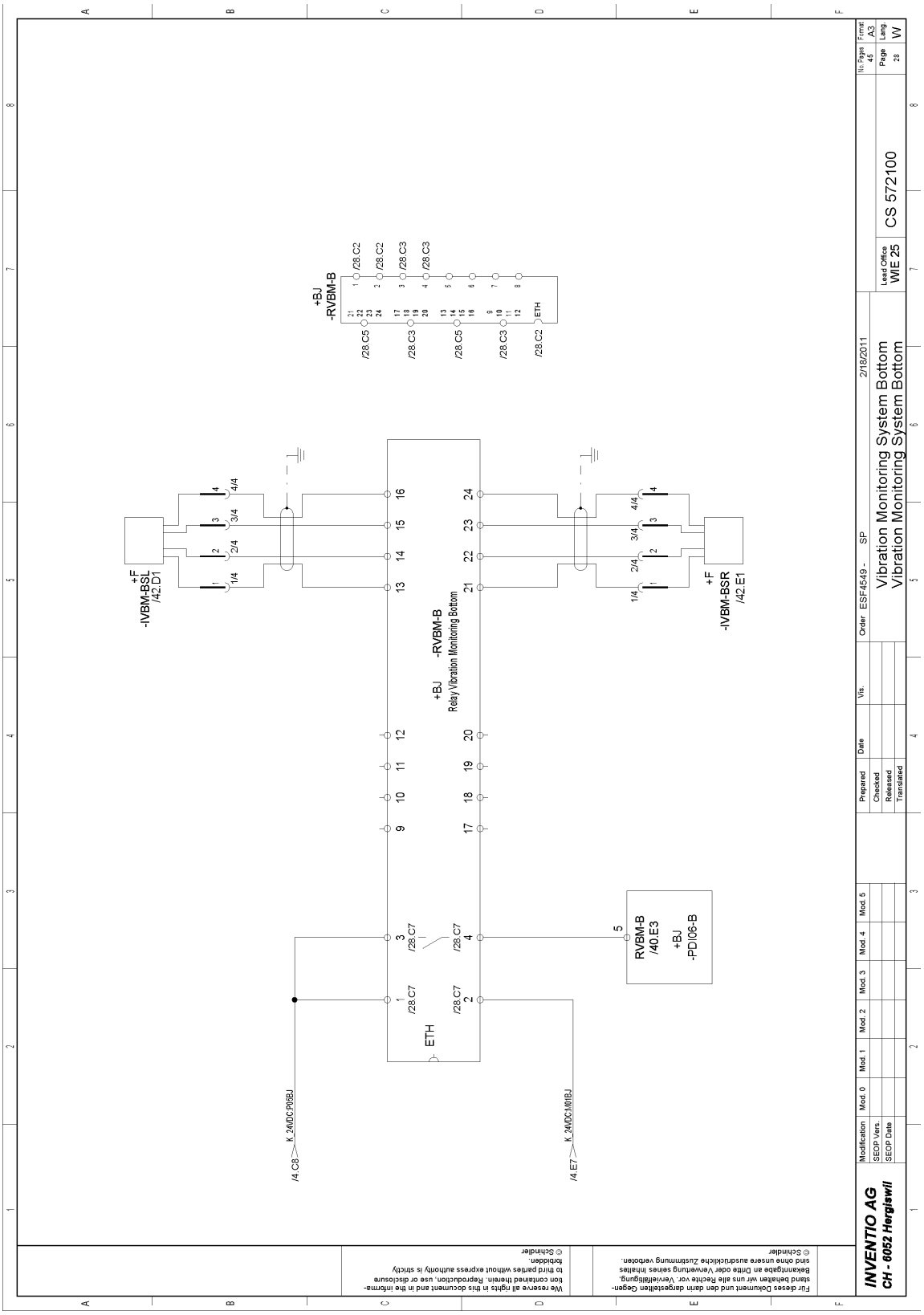
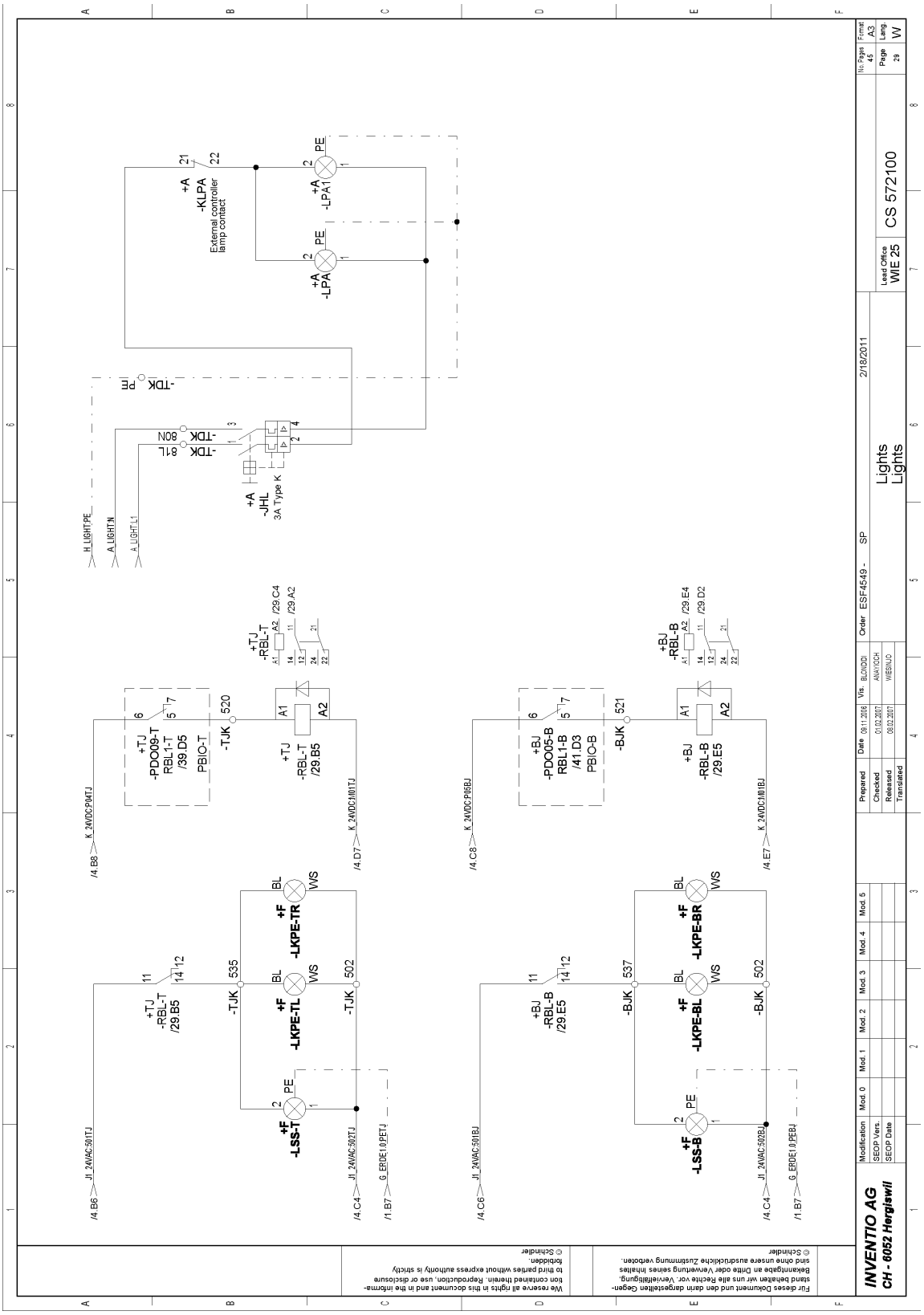

+TJ
-RVBM-T
/27.C2
/27.C5
/27.C4
/27.C3
ETH
+F
-IVBM-TSL
/42.E1
+F
-IVBM-TSR
/42.E1
+F
-IVBM-TM
/42.E1
+F
-IVBM-TG
/42.E1
+TJ -RVBM-T
Vibration Monitoring Relay Top
/27.D7
RVBM-T
+TJ
/38.E6
-PDI08-T
/4.B8
K_24VDC.P04TJ
/4.D7
K_24VDC.M01TJ
Vibration Monitoring System Top
Vibration Monitoring System Top
CS 572100
INVENTIO AG
CH - 6052 Hergiswil


+BJ
-RVBM-B
/28.C2
/28.C2
/28.C3
/28.C3
/28.C5
/28.C3
/28.C5
/28.C3
/28.C2
ETH
+F
-IVBM-BSL
/42.D1
+F
-IVBM-BSR
/42.E1
+BJ
-RVBM-B
Relay Vibration Monitoring Bottom
/28.C7
/28.C7
/28.C7
/28.C7
ETH
RVBM-B
/40.E3
+BJ
-PDI06-B
/4.C8
K_24VDC.P05BJ
/4.E7
K_24VDC.M01BJ
Vibration Monitoring System Bottom
Vibration Monitoring System Bottom
CS 572100
INVENTIO AG
CH - 6052 Hergiswil


Lights
Lights
2/18/2011
CS 572100
Lead Office WIE 25
INVENTIO AG
CH - 6052 Hergiswil
+A -KLPA
External controller lamp contact
+A -LPA1
+A -LPA
+A -JHL
3A Type K
-TDK PE
-TDK 81L
-TDK 80N
H LIGHT PE
A LIGHT N
A LIGHT L1
+TJ -RBL-T /29.B5
+TJ -PDO09-T RBL1-T /39.D5 PBIO-T
-TJK 520
+TJ -RBL-T /29.B5
+TJ -RBL-T /29.C4 /29.A2
K_24VDC-P04TJ
K_24VDC-M01TJ
/4.B8
/4.D7
+F -LKPE-TR
+F -LKPE-TL
+F -LSS-T
-TJK 535
-TJK 502
J1_24VAC-501TJ
J1_24VAC-502TJ
G_ERDE1.0,PETJ
/4.B6
/4.C4
/1.B7
+BJ -RBL-B /29.E5
+BJ -PDO05-B RBL1-B /41.D3 PBIO-B
-BJK 521
+BJ -RBL-B /29.E5
+BJ -RBL-B /29.E4 /29.D2
K_24VDC-P06BJ
K_24VDC-M01BJ
/4.C8
/4.E7
+F -LKPE-BR
+F -LKPE-BL
+F -LSS-B
-BJK 537
-BJK 502
J1_24VAC-501BJ
J1_24VAC-502BJ
G_ERDE1.0,PEBJ
/4.C6
/4.C4
/1.B7
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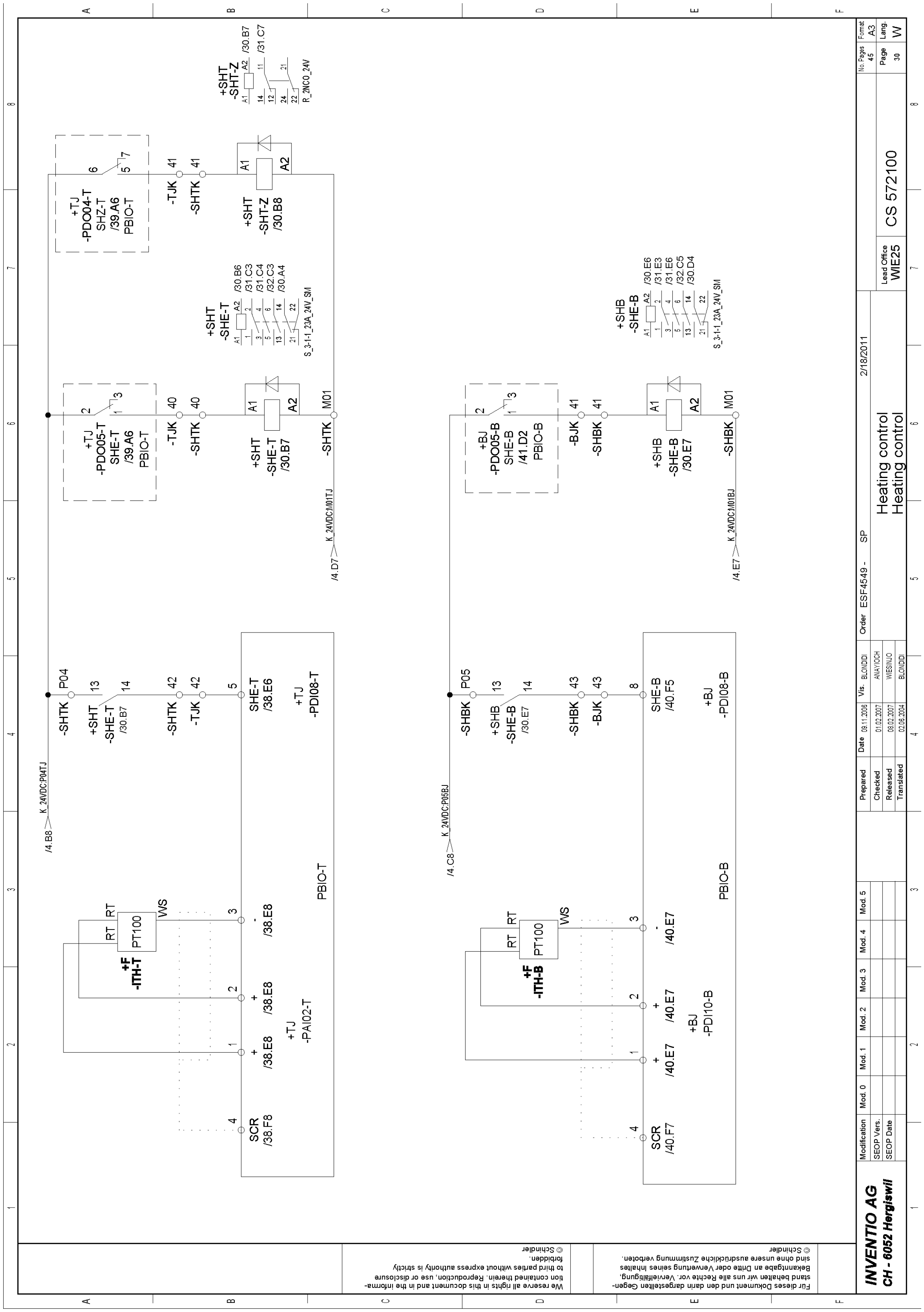
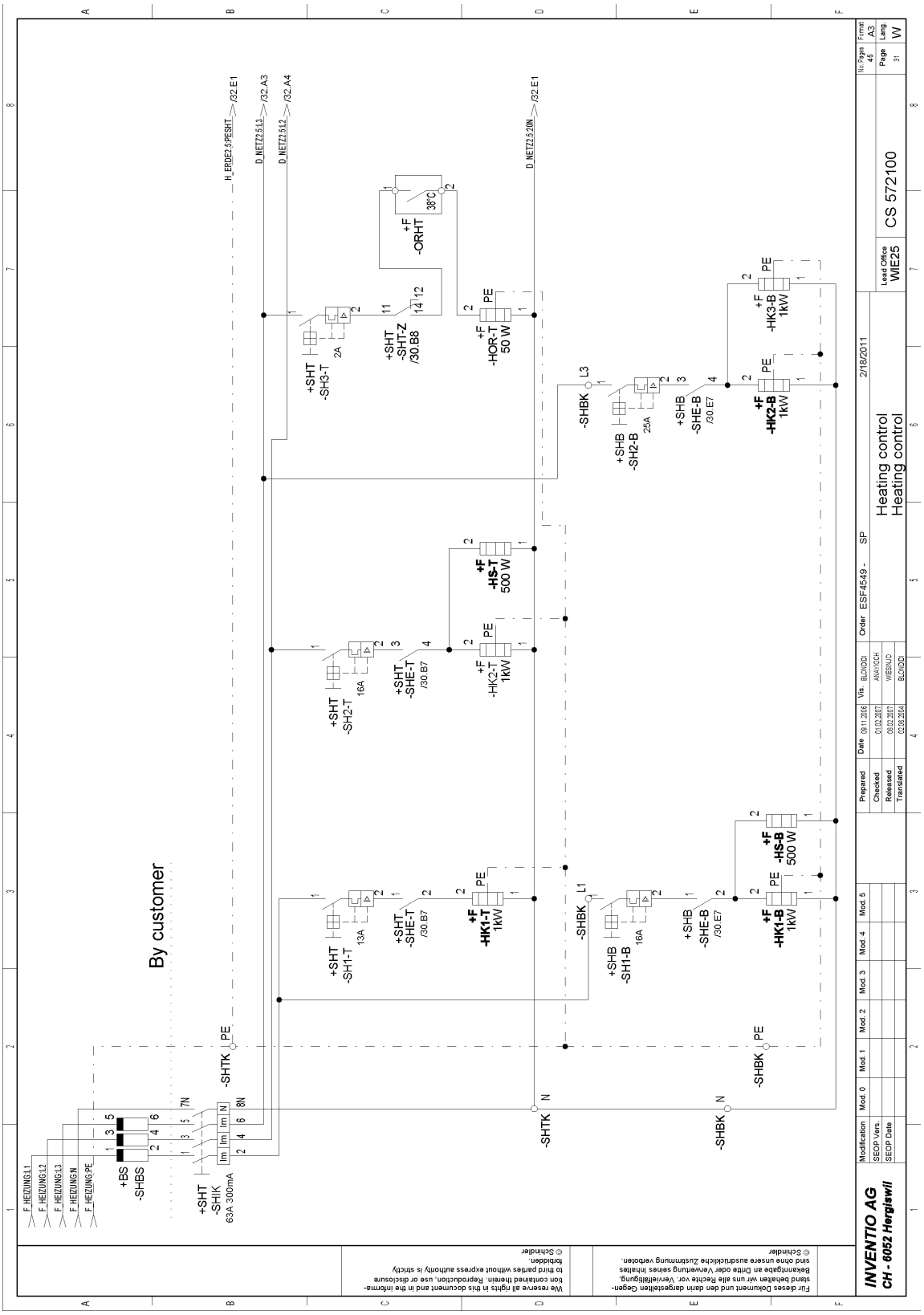
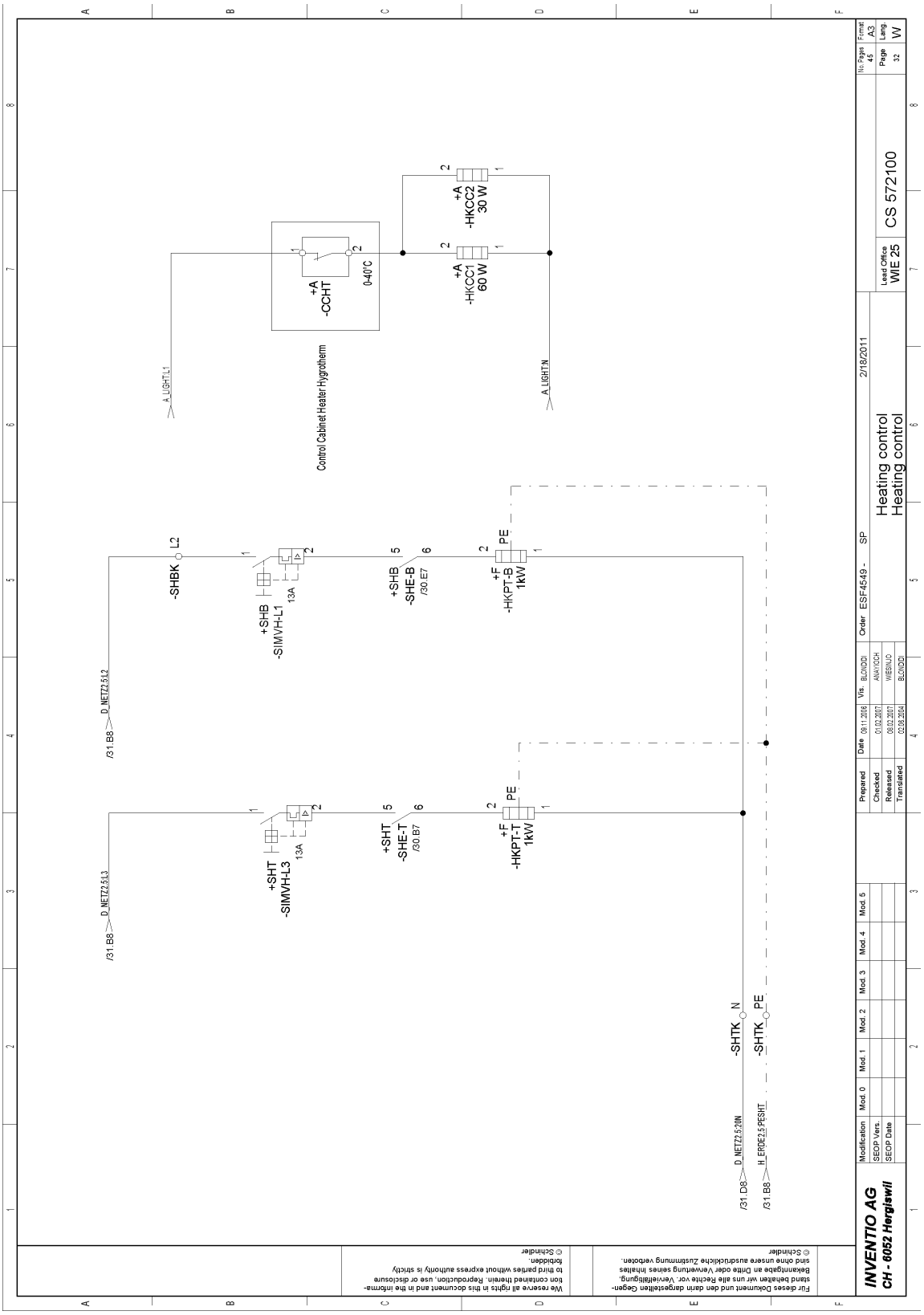

Heating control
Heating control
CS 572100
WIE25
INVENTIO AG
CH - 6052 Hergiswil
Order ESF4549 - SP
2/18/2011
+TJ
-PDO04-T
SHZ-T
/39.A6
PBIO-T
+TJ
-PDO05-T
SHE-T
/39.A6
PBIO-T
+BJ
-PDO05-B
SHE-B
/41.D2
PBIO-B
+SHT
-SHT-Z
/30.B8
+SHT
-SHE-T
/30.B7
+SHB
-SHE-B
/30.E7
+F
-ITH-T
+F
-ITH-B
PT100
+TJ
-PAI02-T
+TJ
-PDI08-T
+BJ
-PDI10-B
+BJ
-PDI08-B
PBIO-T
PBIO-B




A LIGHT L1
A LIGHT N
+A -CCHT 0-40°C
Control Cabinet Heater Hygrotherm
+A -HKCC2 30 W
+A -HKCC1 60 W
-SHBK L2
+SHB -SIMVH-L1 13A
+SHB -SHE-B /30.E7
+F -HKPT-B 1kW
PE
/31.B8 D_NETZ2.5/L2
+SHT -SIMVH-L3 13A
+SHT -SHE-T /30.B7
+F -HKPT-T 1kW
/31.B8 D_NETZ2.5/L3
-SHTK_N
-SHTK_PE
/31.D8 D_NETZ2.5:20N
/31.B8 H_ERDE2.5:PESHT
Heating control
Heating control
Order ESF45-49 - SP
2/18/2011
Lead Office WIE 25
CS 572100
No. Pages 45
Page 32
Format A3
Lang W
Prepared 08.11.2006 BLOWDI
Checked 01.02.2007 ANAYDOH
Released 09.02.2007 WIESNILO
Translated 02.09.2004 BLOWDI
Modification
SEOP Vers.
SEOP Date
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Mod. 1
Mod. 2
Mod. 3
Mod. 4
Mod. 5
INVENTIO AG
CH - 6052 Hergiswil
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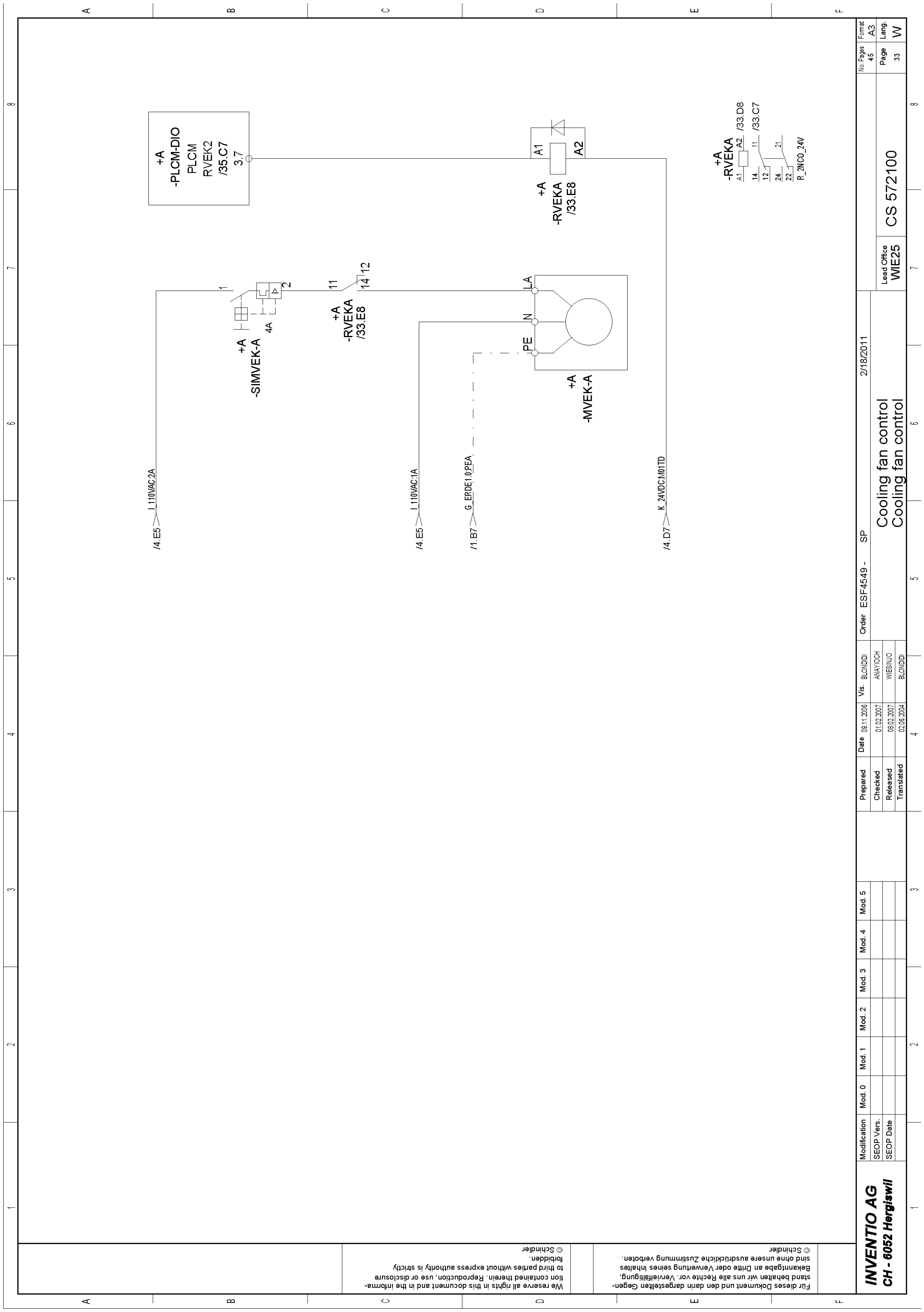
+A
-PLCM-DIO
PLCM
RVEK2
/35.C7
3.7
+A
-RVEKA
/33.E8
A1
A2
+A
-RVEKA
A1
A2
/33.D8
/33.C7
R_2NCO_24V
+A
-SIMVEK-A
4A
+A
-RVEKA
/33.E8
LA
N
PE
+A
-MVEK-A
/4.E5
I_110VAC:2A
/4.E5
I_110VAC:1A
/1.B7
G_ERDE1.0:PEA
/4.D7
K_24VDC:M01TD
Cooling fan control
Cooling fan control
CS 572100
Lead Office
WIE25
Order ESF4549 - SP
2/18/2011
No. Pages 45
Format A3
Page 33
Lang. W
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Released
Translated
Date
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BLONDIDI
Modification
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SEOP Date
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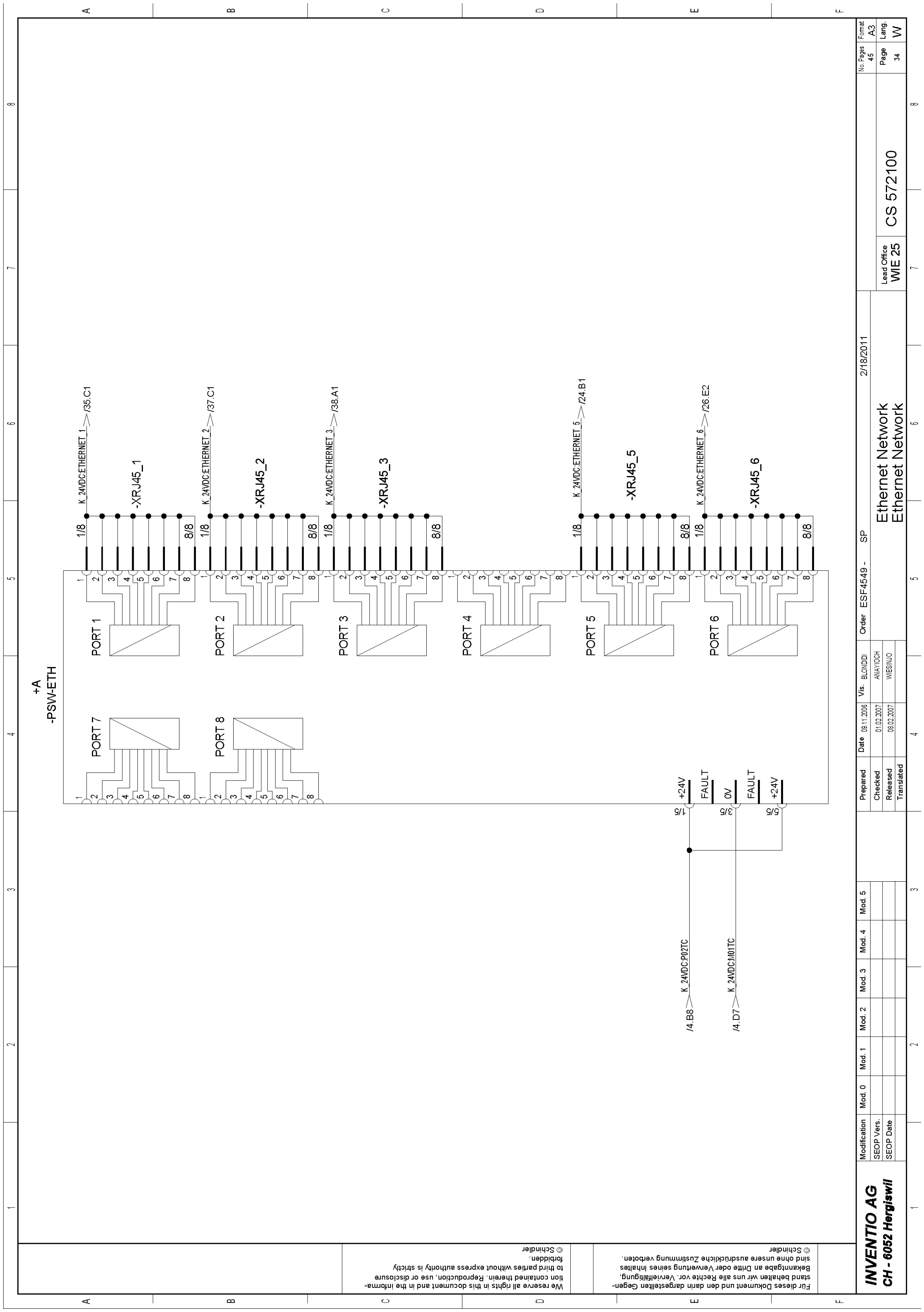
Mod. 2
Mod. 3
Mod. 4
Mod. 5
INVENTIO AG
CH - 6052 Hergiswil


+A
-PSW-ETH
PORT 1
PORT 2
PORT 3
PORT 4
PORT 5
PORT 6
PORT 7
PORT 8
-XRJ45_1
-XRJ45_2
-XRJ45_3
-XRJ45_5
-XRJ45_6
K_24VDC:ETHERNET_1 /35.C1
K_24VDC:ETHERNET_2 /37.C1
K_24VDC:ETHERNET_3 /38.A1
K_24VDC:ETHERNET_5 /24.B1
K_24VDC:ETHERNET_6 /26.E2
+24V
FAULT
0V
FAULT
+24V
/4.B8 K_24VDC:P02TC
/4.D7 K_24VDC:M01TC
Ethernet Network
Ethernet Network
CS 572100
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INVENTIO AG
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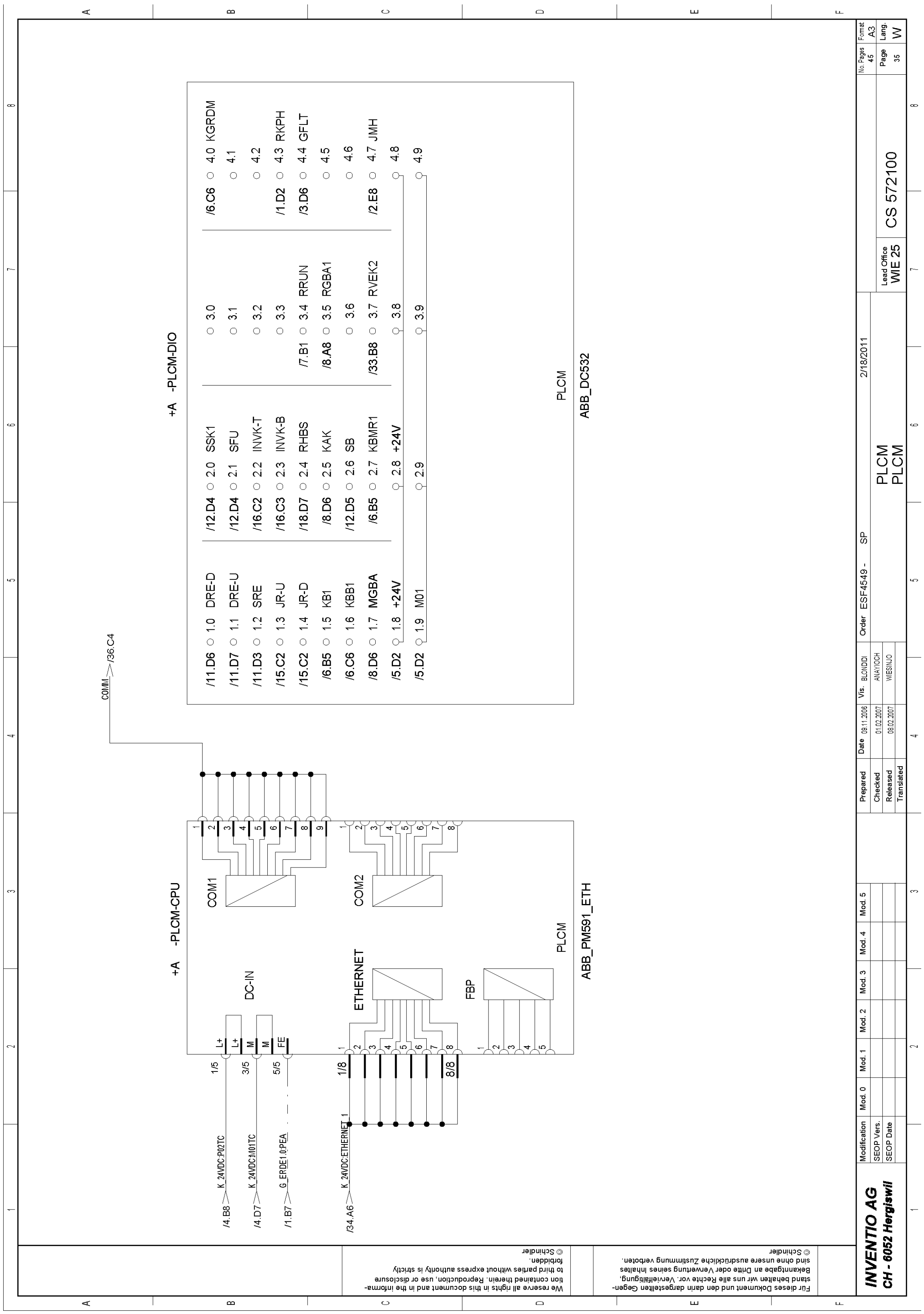
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INVENTIO AG
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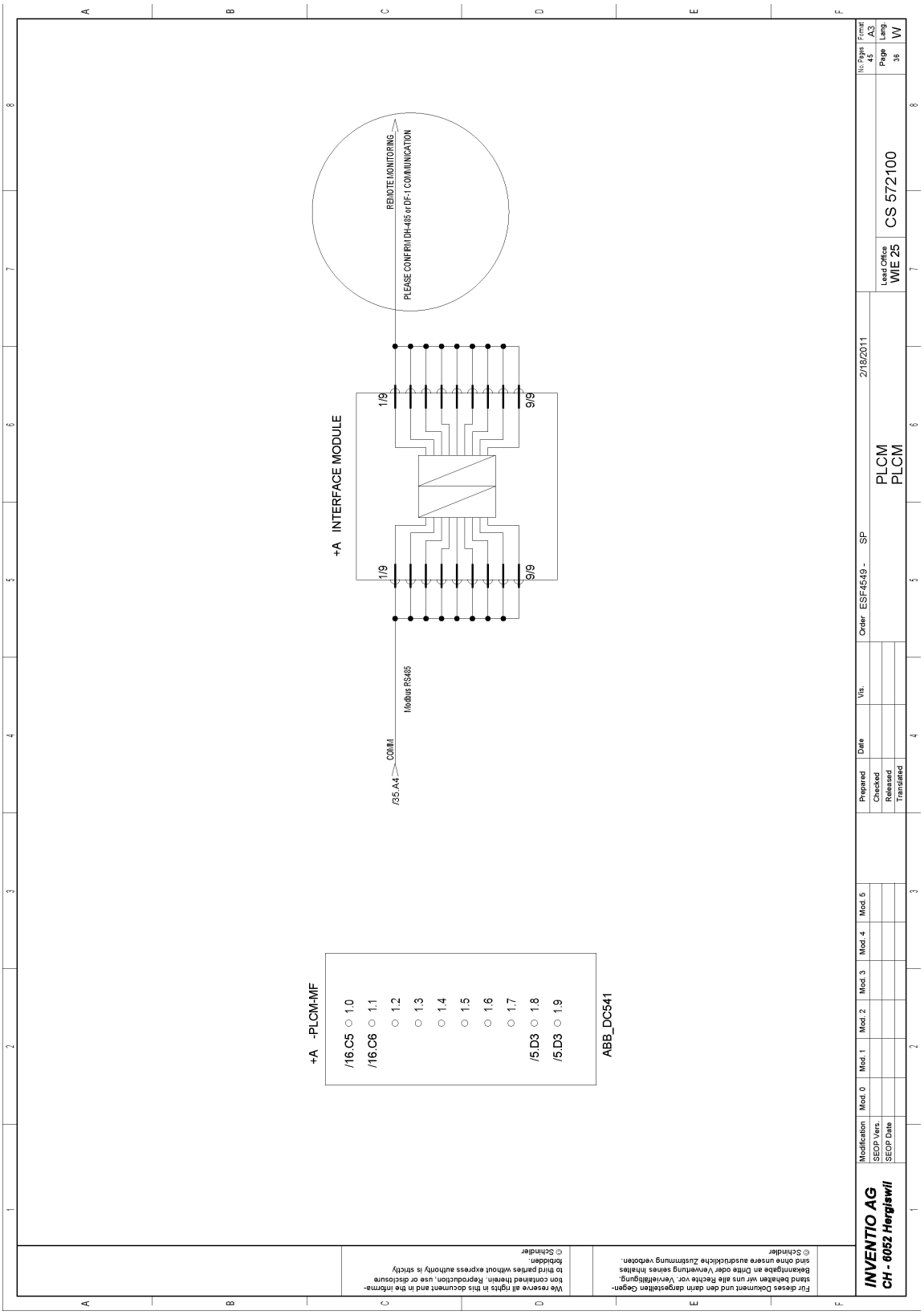
REMOTE MONITORING
PLEASE CONFIRM DH-485 or DF-1 COMMUNICATION
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9/9
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INVENTIO AG
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Modification
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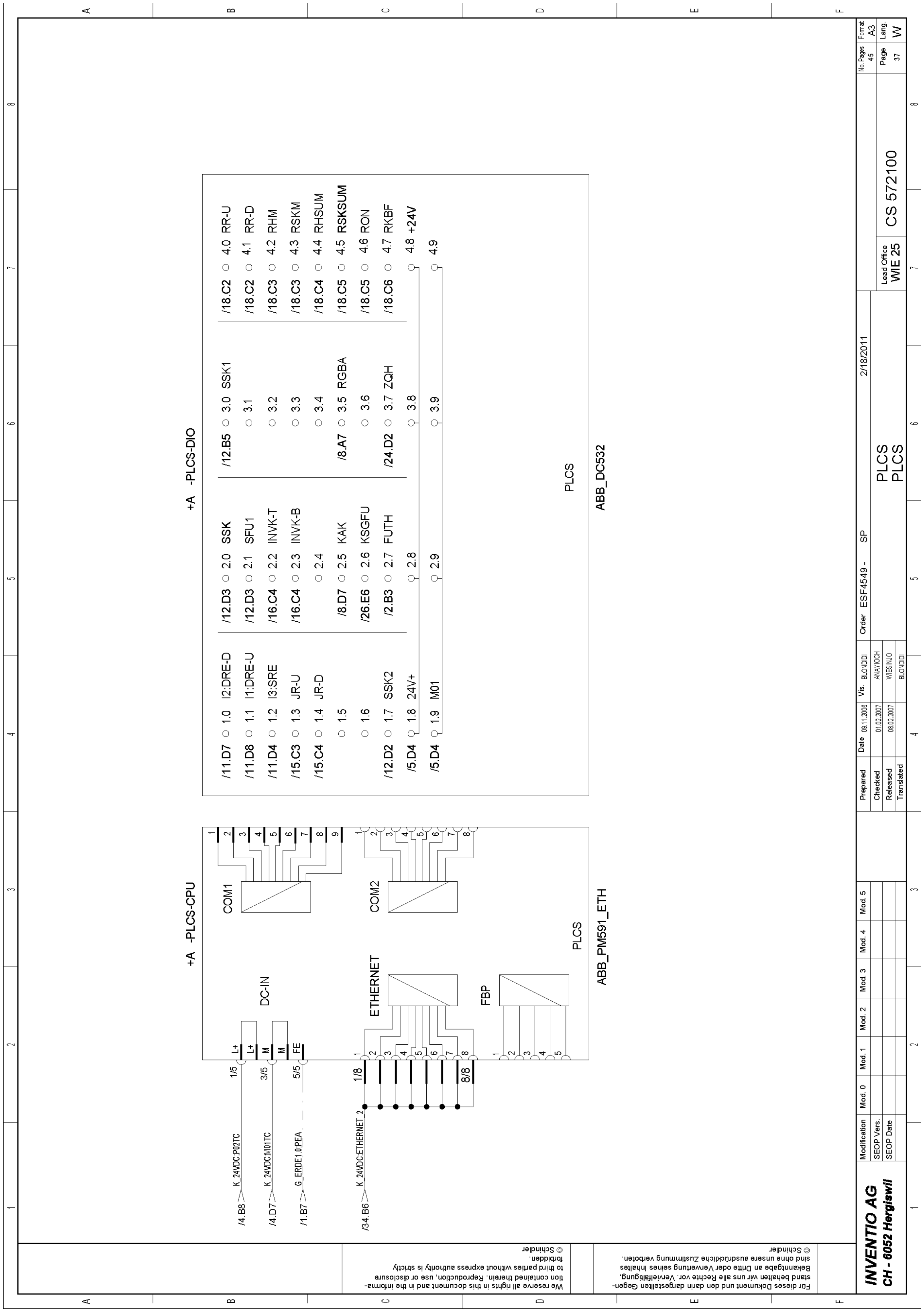
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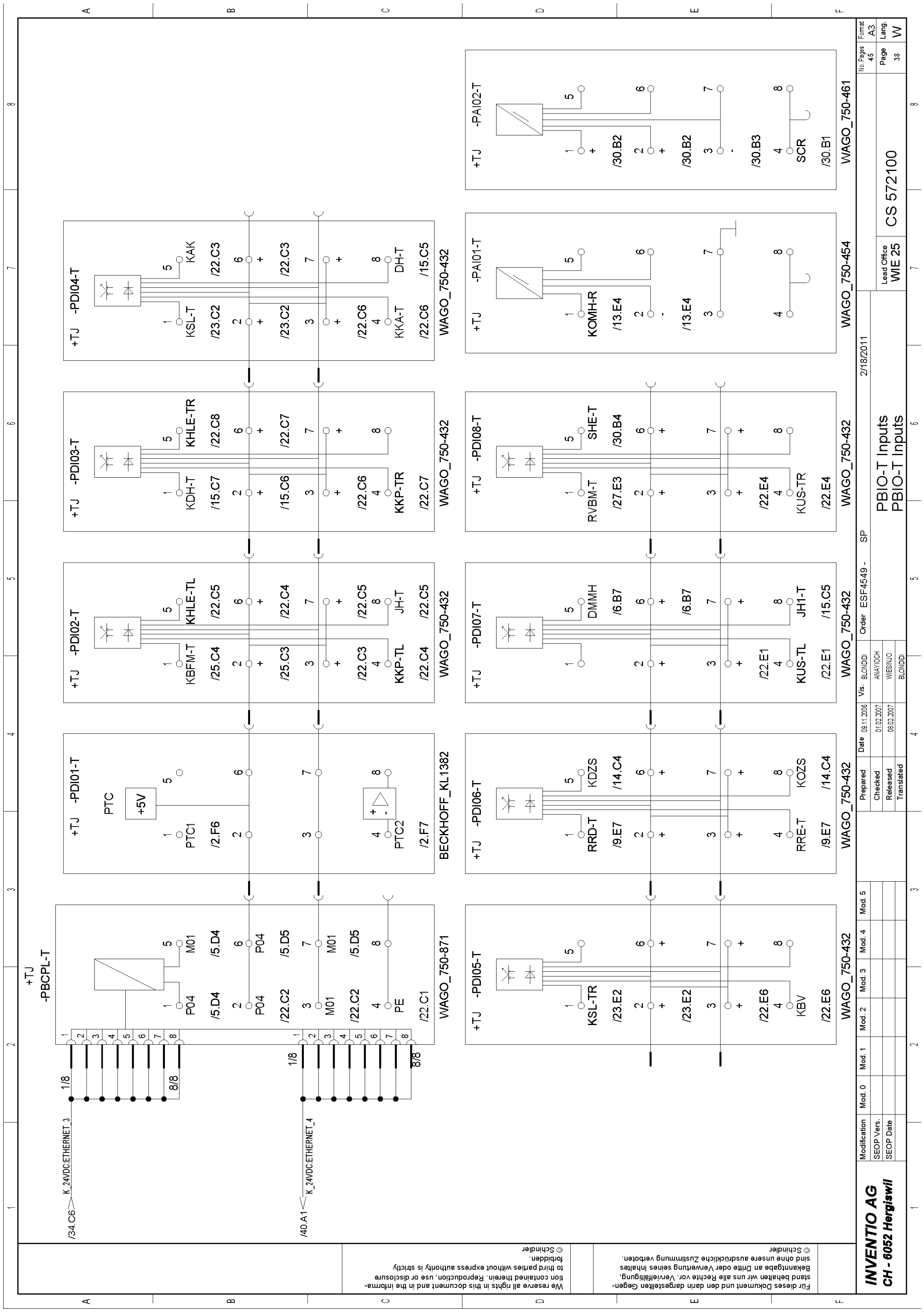
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K_24VDC:ETHERNET_4
INVENTIO AG
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PBIO-T Inputs
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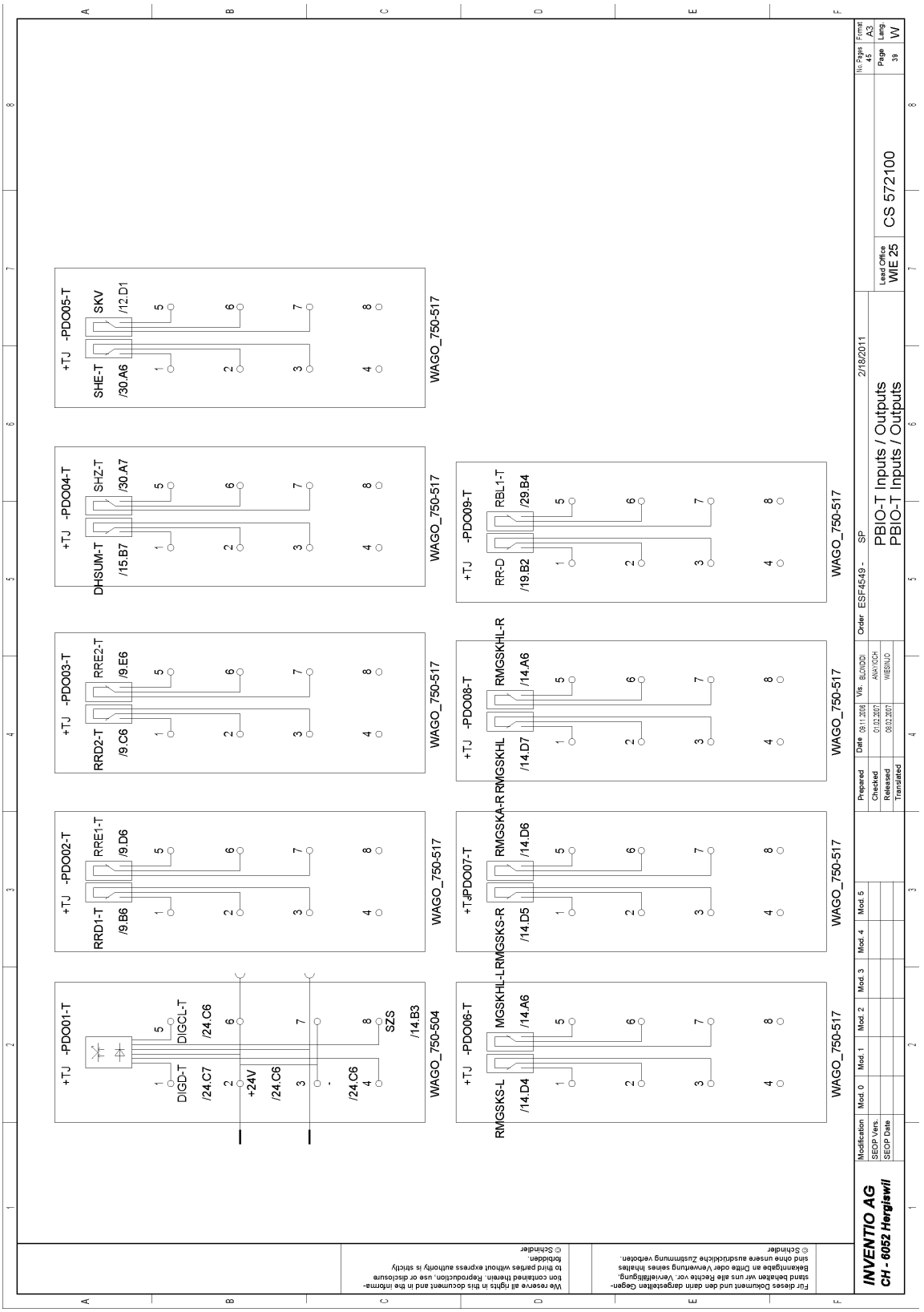
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+TJ -PDO08-T
+TJ -PDO09-T
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WAGO_750-517
DIGD-T
DIGCL-T
+24V
SZS
RRD1-T
RRE1-T
RRD2-T
RRE2-T
DHSUM-T
SHZ-T
SHE-T
SKV
RMGSKS-L
MGSKHL-L
RMGSKS-R
RMGSKA-R
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PBIO-T Inputs / Outputs
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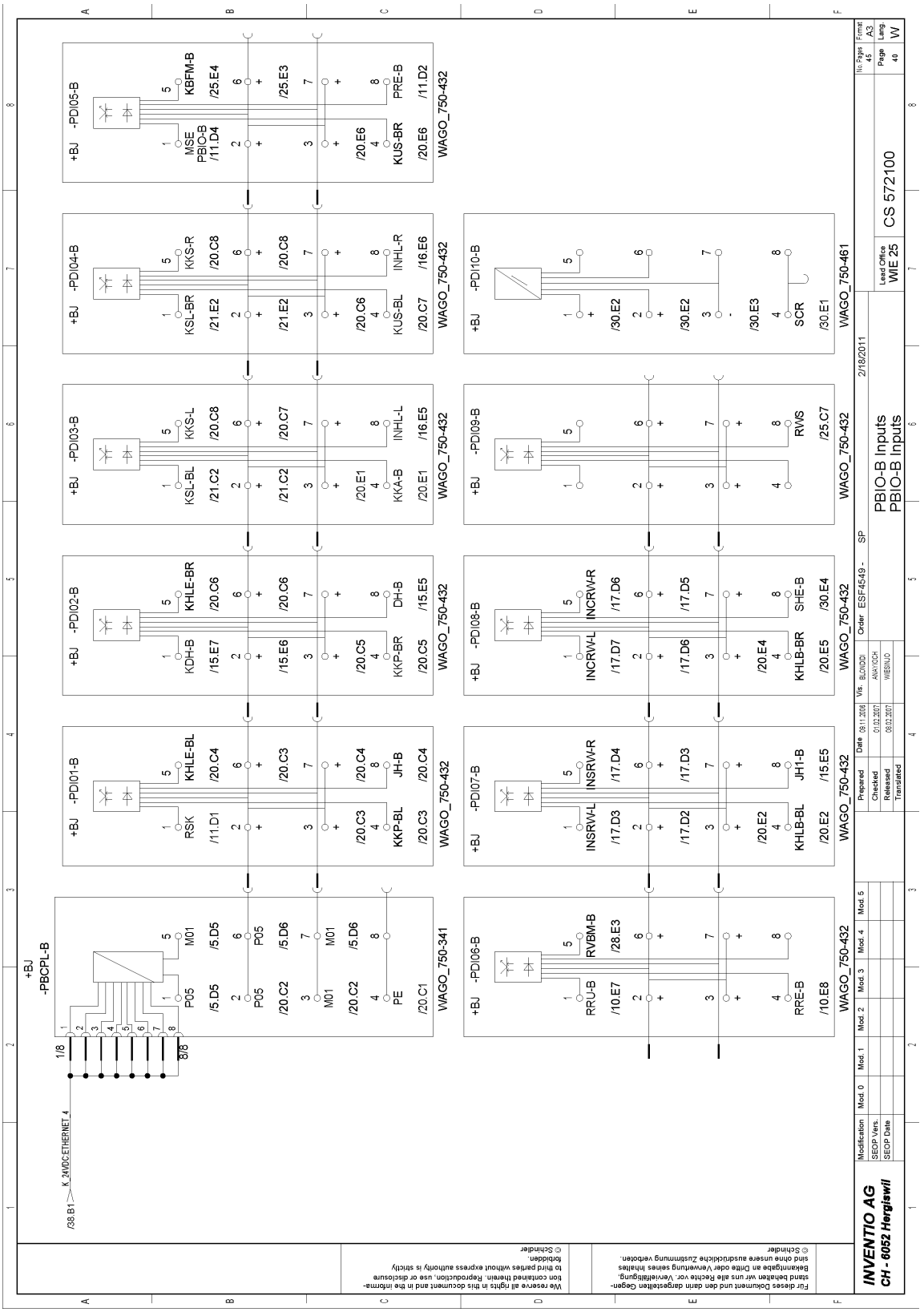
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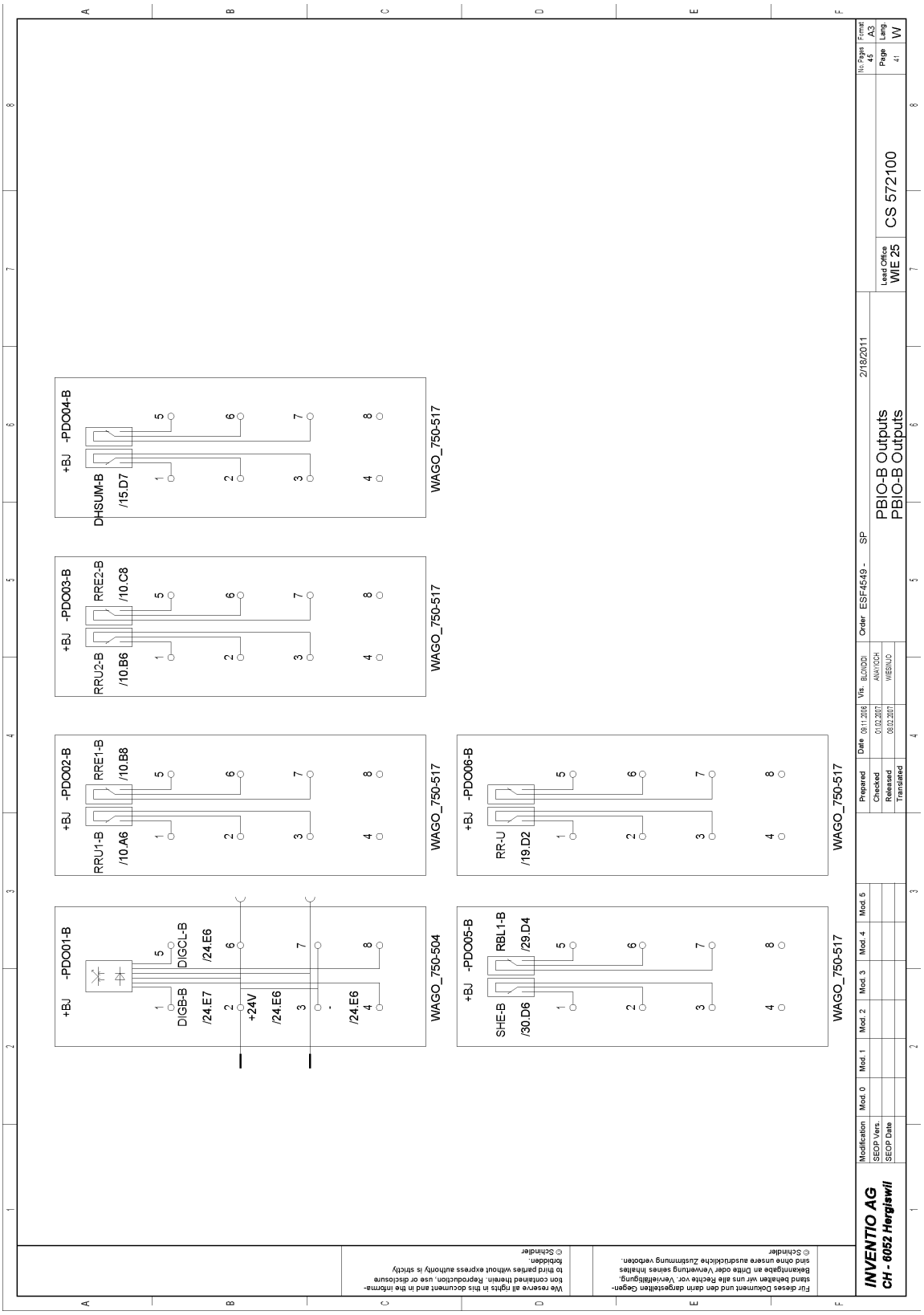

/24.A3	+A	-AHMI	GRAPHICAL DISPLAY	/6.B4	+F	-KB1	CONTACT BRAKE RELEASE
/7.D7	+A	-CBA	CAPACITOR SAFETY BRAKE	/6.A6	+F	-KBB1	CONTACT BRAKE LINING
/32.C7	+A	-CCHT	CONTROL CABINET HEATER THERMOSTAT	/18.C7	+BS	-KBF	CONTACT IN CASE OF FIRE BY CUSTOMER
/15.C8	+TJ	-D74	DIODE	/25.D2	+BF	-KBFM-B	SMOKE DETECTOR BOTTOM
/15.F8	+BJ	-D75	DIODE	/25.B2	+TF	-KBFM-T	SMOKE DETECTOR TOP
/18.D7	+BS	-DHBS	BUTTON STOP BY CUSTOMER	/6.B5	+F	-KBMR1	CONTACT BRAKE RELEASE MECHANICAL RELEASE 1
/9.B8	+F	-DHMH	STOP BUTTON MAIN DRIVE	/9.C2	+F	-KBVK	CONTACT BLOCKING DEVICE
/10.C3	+F	-DHSUM-B	EMERGENCY STOP PANEL USA BOTTOM	/14.B4	+F	-KDZS	CONTACT PRESSURE CENTRAL LUBRIC. SYSTEM
/9.B6	+F	-DHSUM-T	EMERGENCY STOP PANEL USA TOP	/6.B6	+F	-KGRDM	CONTACT GUARD MASTER
/24.D6	+F	-DIG-B	DIGITAL DISPLAY BOTTOM	/10.E7	+F	-KHLB-BL	CONTACT BROKEN HANDRAIL BOTTOM LEFT
/24.B6	+F	-DIG-T	DIGITAL DISPLAY TOP	/10.A3	+F	-KHLB-BR	CONTACT BROKEN HANDRAIL BOTTOM LEFT
/11.B5	+F	-DREN	FOR MAINTENANCE PANEL	/10.A6	+F	-KHLE-BL	CONTACT HANDRAIL ENTRY BOTTOM LEFT
/26.A3	+A	-GFU	FREQUENCY CONVERTER	/10.B6	+F	-KHLE-BR	CONTACT HANDRAIL ENTRY BOTTOM RIGHT
/3.C2	+A	-GRDFLT	GROUND FAULT MONITORING	/9.C6	+F	-KHLE-TL	CONTACT HANDRAIL ENTRY TOP LEFT
/1.B4	+A	-GRDFLT1	CURRENT TRANSFORMER	/9.B6	+F	-KHLE-TR	CONTACT HANDRAIL ENTRY TOP RIGHT
/31.F3	+F	-HK1-B	HEATER BOTTOM	/10.B7	+F	-KKA-B	CONTACT BROKEN STEP BOTTOM
/31.D3	+F	-HK1-T	HEATER 1 TOP	/9.C6	+F	-KKA-T	CONTACT BROKEN STEP TOP
/31.D4	+F	-HK2-T	HEATER 2 TOP	/10.C4	+F	-KKP-BL	CONTACT COMB PLATE BOTTOM LEFT
/31.F7	+F	-HK3-B	HEATER 3 BOTTOM	/10.B2	+F	-KKP-BR	CONTACT COMB PLATE BOTTOM RIGHT
/32.D7	+A	-HKCC1	CONTROL CABINET HEATER	/9.E4	+F	-KKP-TL	CONTACT COMB PLATE TOP LEFT
/32.D7	+A	-HKCC2	CONTROL CABINET HEATER	/9.B2	+F	-KKP-TR	CONTACT COMB PLATE TOP RIGHT
/32.D5	+F	-HKPT-B	HEATER BOTTOM PIT	/10.B4	+F	-KKS-BL	CONTACT CHAIN TENSION BOTTOM LEFT
/32.D3	+F	-HKPT-T	HEATER TOP PIT	/10.B2	+F	-KKS-BR	CONTACT CHAIN TENSION BOTTOM RIGHT
/31.D7	+F	-HOR-T	HEATER OIL RESERVOIR	/29.B8	+A	-KLPA	CONTACTLAMP EXTERNAL CONTROLLER
/16.B6	+F	-IINC	MAIN DRIVE ENCODER	/14.B4	+F	-KOZS	CONTACT OIL-LEVEL CENTRAL LUBRIC. SYSTEM
/17.C6	+F	-INCRW-L	CHAIN ROLLER DETECTION LEFT	/10.D4	+F	-KSL-BL	CONTACT SKIRTING PANEL BOTTOM LEFT
/17.C5	+F	-INCRW-R	CHAIN ROLLER DETECTION RIGHT	/10.C2	+F	-KSL-BR	CONTACT SKIRTING PANEL BOTTOM RIGHT
/16.E5	+F	-INHL-L	INDUCTIV SWITCH HANDRAIL SPEED MONITOR LEFT	/9.E5	+F	-KSL-TL	CONTACT SKIRTING PANEL TOP LEFT
/16.E6	+F	-INHL-R	INDUCTIV SWITCH HANDRAIL SPEED MONITOR RIGHT	/9.C2	+F	-KSL-TR	CONTACT SKIRTING PANEL TOP RIGHT
/17.C3	+F	-INSRW-L	STEP ROLLER DETECTION LEFT	/10.C7	+F	-KUS-BL	CONTACT UPTHRUST BOTTOM LEFT
/17.C4	+F	-INSRW-R	STEP ROLLER DETECTION RIGHT	/10.B7	+F	-KUS-BR	CONTACT UPTHRUST BOTTOM RIGHT
/16.E2	+F	-INVK-B	INDUCTIV SWITCH SPEED MONITORING BOTTOM	/9.E6	+F	-KUS-TL	CONTACT UPTHRUST TOP LEFT
/16.B2	+F	-INVK-T	INDUCTIV SWITCH SPEED MONITORING TOP	/9.D6	+F	-KUS-TR	CONTACT UPTHRUST TOP RIGHT
/30.D3	+F	-ITH-B	PT100 TEMP. SENSOR BOTTOM	/19.E2	+F	-LAG-B	DIRECTION INDICATOR GREEN BOTTOM
/30.A3	+F	-ITH-T	PT100 TEMP. SENSOR TOP	/19.B2	+F	-LAG-T	DIRECTION INDICATOR GREEN TOP
/28.B5	+F	-IVBM-BSL	SENSOR VIBRATION MONITORING	/19.E2	+F	-LAR-B	DIRECTION INDICATOR RED BOTTOM
/28.E5	+F	-IVBM-BSR	SENSOR VIBRATION MONITORING BOTTOM SHAFT RIGHT	/19.B3	+F	-LAR-T	DIRECTION INDICATOR RED TOP
/27.E4	+F	-IVBM-TG	SENSOR VIBRATION MONITORING TOP GEARBOX	/29.E2	+F	-LKPE-BL	LAMP COMB PLATE BOTTOM LEFT
/27.A4	+F	-IVBM-TM	SENSOR VIBRATION MONITORING TOP MOTOR	/29.E3	+F	-LKPE-BR	LAMP COMB PLATE BOTTOM RIGHT
/27.A5	+F	-IVBM-TSL	SENSOR VIBRATION MONITORING TOP SHAFT LEFT	/29.B2	+F	-LKPE-TL	LAMP COMB PLATE TOP LEFT
/27.E5	+F	-IVBM-TSR	SENSOR VIBRATION MONITORING TOP SHAFT RIGHT	/29.B3	+F	-LKPE-TR	LAMP COMB PLATE TOP RIGHT
/1.B4	+A	-JHA	DISCONNECTING MEANS	/29.C7	+A	-LPA	LAMP EXTERNAL CONTROLLER
/10.C4	+BJ	-JH-B	SWITCH STOP BOTTOM	/29.C8	+A	-LPA1	LAMP EXTERNAL CONTROLLER
/29.B6	+A	-JHL	Controller Light CB	/29.E1	+F	-LSS-B	LAMP STEP GAP BOTTOM
/9.E4	+TJ	-JH-T	SWITCH STOP TOP	/29.C2	+F	-LSS-T	LAMP STEP GAP TOP
/2.C6	+A	-JMH	MOTOR PROTECTIVE SWITCH	/6.D5	+F	-MB1	MOTOR BRAKE RELEASE
/15.E2	+F	-JR-B	KEY SWITCH DIRECTION BOTTOM	/7.E8	+F	-MGBA	MAGNET SAFETY BRAKE ACTIVE
/15.B2	+F	-JR-T	KEY SWITCH DIRECTION TOP	/14.E3	+F	-MGP	MOTOR LUBRICATION PUMP
/15.E4	+F	-JSTO-B	PUSH BUTTON STOP BOTTOM	/14.E7	+F	-MGSKA-R	MAGNETIC VALVE FOR LUBRICATION DRIVE CHAIN RIGHT
/15.B4	+F	-JSTO-T	PUSH BUTTON STOP TOP	/14.E7	+F	-MGSKHL	MAGNETIC VALVE FOR LUBRICATION HANDRAIL DRIVE CHAIN
/9.A2	+F	-KAK	CONTACT DRIVE CHAIN	/14.B6	+P	-MGSKHL-L	MAGNETIC VALVE FOR LUBRICATION HANDRAIL DRIVE CHAINLEFT

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/14.B7	+P	-MGSKHL-R	MAGNETIC VALVE FOR LUBRICATION HANDRAIL DRIVE CHAINRIGHT	/34.D4	+A	-PSW-ETH	ETHERNET SWITCH
/14.E4	+F	-MGSKS-L	MAGNETIC VALVE FOR LUBRICATION STEP CHAIN LEFT	/29.E5	+BJ	-RBL-B	RELAY LIGHTING BOTTOM
/14.E5	+F	-MGSKS-R	MAGNETIC VALVE FOR LUBRICATION STEP CHAIN RIGHT	/29.B5	+TJ	-RBL-T	RELAY LIGHTING TOP
/2.D6	+F	-MH	MOTOR MAIN	/18.E7	+A	-RCBS	RELAY STOP BY CUSTOMER
/33.D6	+A	-MVEK-A	COOLING FAN CONTROL CABINET	/8.E7	+A	-RGBA	RELAY SAFETY BRAKE TOP
/4.B2	+A	-NGP	POWER SUPPLY 24VDC	/8.E8	+A	-RGBA1	RELAY SAFETY BRAKE TOP
/31.C7	+F	-ORHT	THERMOSTAT OIL RESERVOIR HEATING	/18.E3	+A	-RHM	RELAY SIGNALLING STOP
/38.D6	+TJ	-PAI01-T	ANALOG INPUT MODULE BOTTOM	/18.E4	+A	-RHSUM	RELAY BUZZER STOP
/38.D7	+TJ	-PAI02-T	PT- RESISTANCE MODULE TOP	/18.E6	+A	-RKBF	RELAY FIRE ALARM SHUTDOWN
/40.A2	+BJ	-PBCPL-B	FIELDBUS COUPLER BOTTOM	/1.B3	+A	-RKPH	PHASE MONITORING
/38.A2	+TJ	-PBCPL-T	FIELDBUS COUPLER TOP	/14.C3	+TJ	-RMGSP	RELAY LUBRICATION PUMP
/7.E4	+A	-PCBA	PC-BOARD CAPACITOR SAFETY BRAKE		+F	-ROMH-R	CONTACT OIL-LEVEL GEAR BOX RIGHT
/40.A3	+BJ	-PDI01-B	DIGITAL INPUT MODULE BOTTOM	/18.E5	+A	-RON	RELAY SIGNALLING RUNNING
/38.A3	+TJ	-PDI01-T	PTC MODULE TOP	/18.E2	+A	-RR-D	RELAY DIRECTION DOWN
/40.A4	+BJ	-PDI02-B	DIGITAL INPUT MODULE BOTTOM	/18.E2	+A	-RR-U	RELAY DIRECTION UP
/38.A4	+TJ	-PDI02-T	DIGITAL INPUT MODULE TOP	/7.E1	+A	-RRUN	RELAY MICONIC F RUNNING
/40.A5	+BJ	-PDI03-B	DIGITAL INPUT MODULE BOTTOM	/18.E3	+A	-RSKM	RELAY SIGNALLING SAFETY CIRCUIT
/38.A5	+TJ	-PDI03-T	DIGITAL INPUT MODULE TOP	/18.E5	+A	-RSKSUM	RELAY BUZZER SAFETY CIRCUIT
/40.A6	+BJ	-PDI04-B	DIGITAL INPUT MODULE BOTTOM	/28.C7	+BJ	-RVBM-B	RELAY VIBRATION MONITORING BOTTOM
/38.A6	+TJ	-PDI04-T	DIGITAL INPUT MODULE TOP	/27.C7	+TJ	-RVBM-T	RELAY VIBRATION MONITORING TOP
/40.A8	+BJ	-PDI05-B	DIGITAL INPUT MODULE BOTTOM	/33.E8	+A	-RVEKA	RELAY COOLING FAN CONTROL CABINET
/38.D2	+TJ	-PDI05-T	DIGITAL INPUT MODULE TOP	/25.C6	+B	-RWS	RELAY WATER LEVEL DETECTION
/40.D2	+BJ	-PDI06-B	DIGITAL INPUT MODULE BOTTOM		+F	-RWS	
/38.D3	+TJ	-PDI06-T	DIGITAL INPUT MODULE TOP	/12.E7	+A	-SB	CONTACTOR BRAKE
/40.D3	+BJ	-PDI07-B	DIGITAL INPUT MODULE BOTTOM	/12.E7	+A	-SFU	CONTACTOR FREQUENCY CONVERTER
/38.D4	+TJ	-PDI07-T	DIGITAL INPUT MODULE TOP	/7.E4	+A	-SGBA	CONTACTOR SAFETY BRAKE ACTIVE
/40.D4	+BJ	-PDI08-B	DIGITAL INPUT MODULE BOTTOM	/31.E3	+SHB	-SH1-B	CIRCUIT BREAKER 1 HEATING BOTTOM
/38.D5	+TJ	-PDI08-T	DIGITAL INPUT MODULE TOP	/31.C3	+SHT	-SH1-T	CIRCUIT BREAKER 1 HEATING TOP
/40.D5	+BJ	-PDI09-B	DIGITAL INPUT MODULE BOTTOM	/31.E6	+SHB	-SH2-B	CIRCUIT BREAKER 2 HEATING BOTTOM
/40.D6	+BJ	-PDI10-B	PT- RESISTANCE MODULE BOTTOM	/31.C4	+SHT	-SH2-T	CIRCUIT BREAKER 2 HEATING TOP
/41.A2	+BJ	-PDO01-B	DIGITAL OUTPUT MODULE BOTTOM	/31.C6	+SHT	-SH3-T	CIRCUIT BREAKER 3 HEATING OIL RESERVOIR
/39.A1	+TJ	-PDO01-T	DIGITAL OUTPUT MODULE TOP	/31.A1	+BS	-SHBS	FUSE HEATING BY CUSTOMER
/41.A3	+BJ	-PDO02-B	DIGITAL OUTPUT MODULE BOTTOM	/30.E7	+SHB	-SHE-B	CONTACTOR HEATING BOTTOM
/39.A3	+TJ	-PDO02-T	DIGITAL INPUT MODULE TOP	/30.B7	+SHT	-SHE-T	CONTACTOR HEATING TOP
/41.A4	+BJ	-PDO03-B	DIGITAL OUTPUT MODULE BOTTOM	/31.B1	+SHT	-SHIK	CIRCUIT BREAKER HEATING
/39.A4	+TJ	-PDO03-T	DIGITAL OUTPUT MODULE TOP	/30.B8	+SHT	-SHT-Z	RELAY OIL RESERVOIR HEATER
/41.A5	+BJ	-PDO04-B	DIGITAL OUTPUT MODULE BOTTOM	/1.A2	+BS	-SIBS2	FUSE BY CUSTOMER MAIN CIRCUIT
/39.A5	+TJ	-PDO04-T	DIGITAL OUTPUT MODULE TOP	/4.B4	+A	-SIF1	FUSE 1 MAINS 24VDC
/41.C2	+BJ	-PDO05-B	DIGITAL OUTPUT MODULE BOTTOM	/4.A7	+A	-SIF2	FUSE 2 MAINS 24VDC
/39.A6	+TJ	-PDO05-T	DIGITAL OUTPUT MODULE TOP	/4.C7	+A	-SIF4	FUSE 4 MAINS 24VDC
/41.C3	+BJ	-PDO06-B	DIGITAL OUTPUT MODULE BOTTOM	/4.C7	+A	-SIF5	FUSE 5 MAINS 24VDC
/39.C1	+TJ	-PDO06-T	DIGITAL OUTPUT MODULE TOP	/4.C4	+A	-SIF6	FUSE 3 MAINS 24VAC
/39.C3	+TJ	-PDO07-T	DIGITAL OUTPUT MODULE TOP	/4.A7	+A	-SIF7	FUSE 7 MAINS 24VDC
/39.C4	+TJ	-PDO08-T	DIGITAL OUTPUT MODULE TOP	/33.B6	+A	-SIMVEK-A	CIRCUIT BREAKER COOLING FAN CONTROL CABINET
/39.C5	+TJ	-PDO09-T	DIGITAL OUTPUT MODULE TOP	/32.C5	+SHB	-SIMVH-L1	CIRCUIT BREAKER MOTOR FAN HEATING L1
/35.B3	+A	-PLCM-CPU	PLC MASTER CPU	/32.C3	+SHT	-SIMVH-L3	CIRCUIT BREAKER MOTOR FAN HEATING L3
/36.C2	+A	-PLCM-MF	HIGH SPEED COUNTER	/1.D4	+A	-SIS1	CIRCUIT BREAKER 1
/37.B3	+A	-PLCS-CPU	PLC SLAVE CPU	/4.D3	+A	-SIS2	CIRCUIT BREAKER 110/120 V
/6.D6	+TB	-PMGB1	CONTROL BRAKE 1	/1.E4	+A	-SIS3	CIRCUIT BREAKER 3
/11.B6	+BJ	-PRE-B	SOCKET MAINTENANCE BOTTOM	/7.E3	+A	-SNBA	CONTACTOR MAIN SUPPLY SAFETY BRAKE ACTIVE
/11.B8	+TJ	-PRE-T	SOCKET MAINTENANCE TOP	/12.E5	+A	-SSK1	CONTACTOR 1 SAFETY CIRCUIT

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/12.E2	+A	-SSK2	CONTACTOR 2 SAFETY CIRCUIT
/4.B2	+A	-TS	TRANSFORMER
/2.C3	+F	-WFU1	BRAKE RESISTOR
/24.E2	+A	-ZQH	OPERATING HOUR METER

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LOCATING PLACE

+A	CONTROL CABINET EXTERNAL
+B	CONTROL CABINET BOTTOM
+BS	BY CUSTOMER
+F	ESCALATOR / PASSENGER CONVEYOR / CPE
+HS	CONTROL CABINET LIGHTING HIGH VOLTAGE
+NS	CONTROL CABINET LIGHTING LOW VOLTAGE
+T	CONTROL CABINET TOP
+T1	TERMINAL BOX TOP
+TJ	TERMINAL BOX DISCONNECTING MEANS
+TV	TERMINAL BOX MAINS
+TV1	CONTROL CABINET SOFTSTARTER

COLOURLEGEND

BL	BLUE	OR	ORANGE	VI	VIOLET
BR	BROWN	RT	RED		
GE	YELLOW	SC	SCREEN		
GN	GREEN	SW	BLACK		
GR	GREY	WS	WHITE		

CONTROL CABINET

SW	BLACK	200 - 600 VAC
BR	BROWN	110 VAC
GR	GREY	24 VDC
VI	VIOLET	22 VAC

CROSSREFERENCES

EXAMPLE: /1.7 DIAGRAM NO.: 1 PATH NO.: 7

TERMINAL TORQUE	Nm	LB. INCH	WIRE CU ONLY
TRANSFORMER	0,7	7	60°C
K1-07	1,2	11	60°C
K3-07, K3-22	1,2	11	60°C
UK 10,16	1,5	14	60°C
PKZM0	1,7	15	75°C
GROUND BAR	1,8	16	60°C
PKZ2/ZM	1,8	16	75°C
USLKG 10	1,8	16	60°C
K3-32	2,8	25	60°C
SMC3	2,8	25	60°C
K3-50, 62, 74	4	36	60°C
UK 35	4	36	60°C
USLKG 35	4	36	60°C
NZM6	10	90	60°C
NZM2 > AWG8	5	44	75°C
NZM2 < AWG8	14	123	75°C

INVENTIO AG CH - 6052 Hergiswil	Modification	Mod. 0	Mod. 1	Mod. 2	Mod. 3	Mod. 4	Mod. 5	Prepared	Date 20110218	Vis.	Order ESF4549 - SP 2/18/2011			No. Pages 45	Format A3
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4 Escalator Control System – PLC

4.1 MICONIC F PLC System Description – J 595 009

1 Escalator Control System Overview

The PLC controller is a dual PLC-based control system using two ABB AC500 PM591 series processors for redundancy. The master and slave PLC control logics within the PLC controller monitor all safety devices, sensors as well as the communication bus and control all escalator-related operations, such as up and down operation, controlled and emergency stops, event diagnostics, lighting, heating, cooling, etc.

The PLC controller is a DIN-rail mounted modular system in the external control cabinet and is connected to I/O modules. A hard-wired safety circuit, which runs from the bottom to the top of the escalator and includes all safety devices, is used as a redundant system to guarantee safe operation of the escalator.

The electrical power and control distribution configurations are based on specific project requirements as shown on the drawings "Installation overview" and "Power single line diagram".

See Section 3.3, Electrical Installation Overview

The system also provides other monitoring functions such as temperature monitoring and gear level monitoring. The controller provides for interfacing to a SCADA system via Ethernet connection and supports a remote indicator panel hardwire interface according to the customer's specifications. An Operator Interface Terminal or HMI is integrated in the front door of the control cabinet.

The complete escalator control system consists of the following major subsystems:

- Remote control and drive cabinet (ASA)
- Remote I/O system (decentralized modules) top junction box (TJ)
- Remote I/O system (decentralized modules) bottom junction box (BJ)
- Heater box in the top pit (SH-T)
- Heater box in the bottom pit (SH-B)

1.1 Remote Control and Drive Cabinet ASA

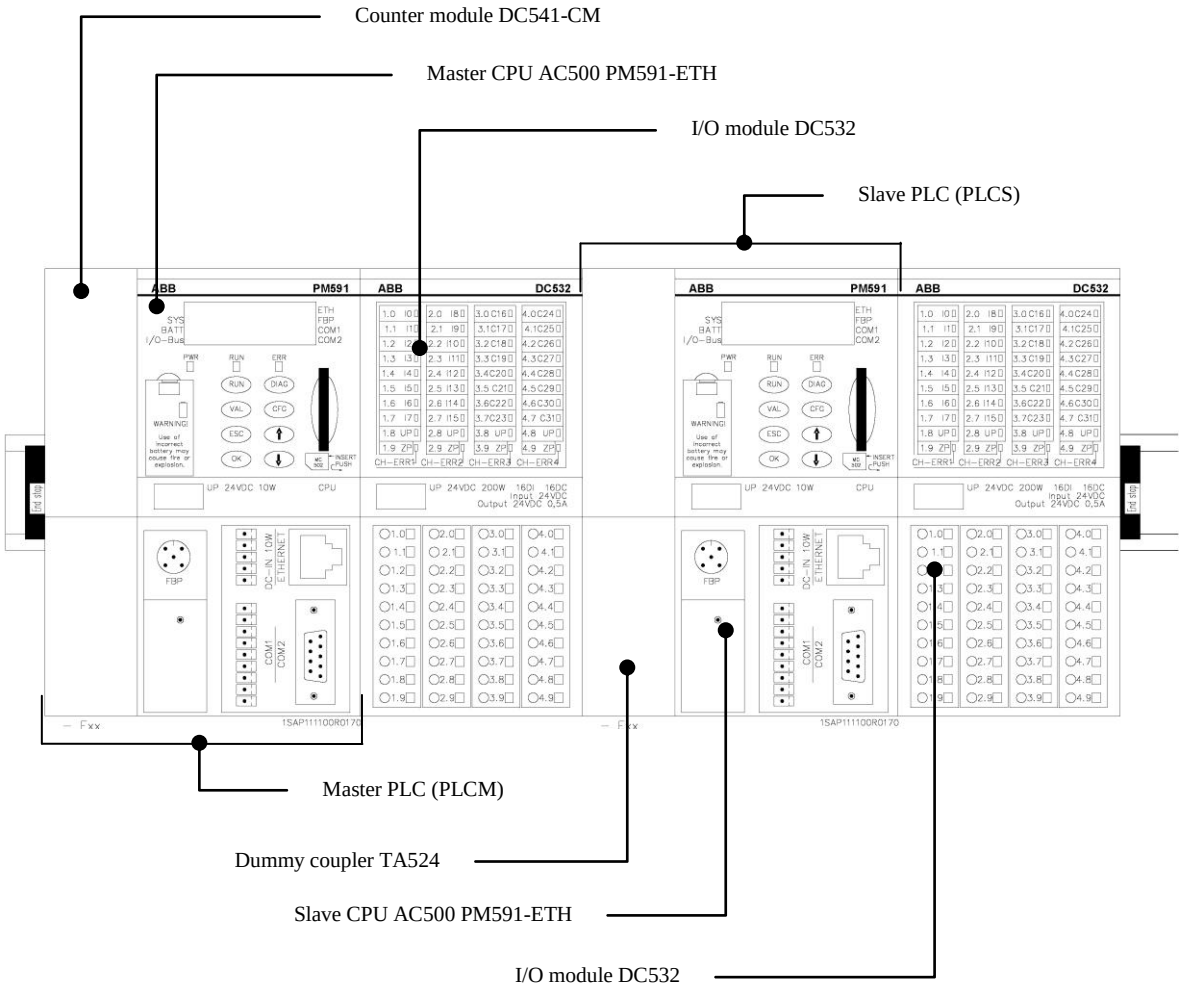
The external control cabinet is located inside a remote machine room and contains the following key components:

- All main contactors for motor operation.
- An inverter to drive the main motor. The inverter is designed to run the motor continuously under full design passenger load on an escalator configured for down and up directions of travel.
- Thermal and phase protection via motor protection switch and VFD.
- A dynamic braking resistor bank is provided to dissipate heat generated by a downward moving escalator when using the inverter.
- Master and slave PLCs for redundant control and monitoring of the escalator.
- An OIT for troubleshooting, maintenance purposes and statistical data collection.

For more detailed information, see Maintenance Instructions Q 409 478, Control Cabinet and Boxes

1.1.1 Redundant PLC System

The redundant PLC system is composed of the master and slave CPUs as well as the I/O modules.

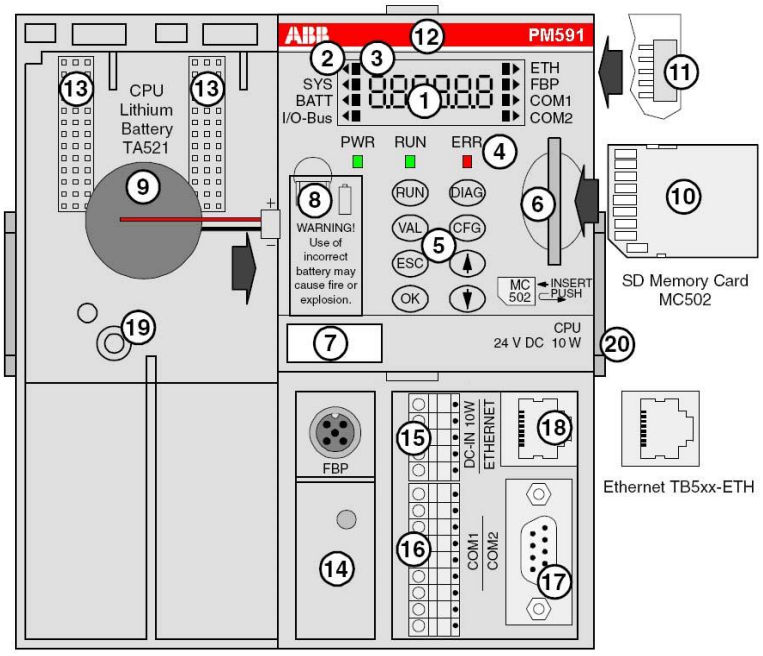


1.1.1.1 PLC Module AC500 CPU PM591-ETH (PLCM, PLCS)

The master PLC module is a central processor unit that logically links and diagnoses commands and responds accordingly. It processes the individual data it receives via Modbus TCP/IP from the slave PLC, the drive, the two communication bus couplers in the top and bottom junction boxes and the OIT and it issues commands accordingly.

The slave PLC module acquires data from the peripherals (contacts, sensors, displays), distributes data to the peripherals, and forwards the appropriate data to the master PLC. The PLCS also checks whether the starting and stopping of the escalator conform with redundancy requirements.

The CPUs are supplied with flash memory storage. For this reason this design doesn't require battery back-up.



Elements of the CPU

1 Six 7-segment status displays with background lighting
2 Triangle displays for "Item"
3 Square displays for "Status"
4 Status LEDs
5 Pushbuttons
6 Slot for the SD Memory Card
7 Label
8 Compartment for the Lithium battery
9 Lithium battery TA521
10 SD Memory Card MC502

Elements of the CPU Terminal Base

11 I/O-Bus (10-pole, female) to electrically connect the first I/O Terminal Unit
12 Slot for the CPU (CPU is mounted)
13 Slots for couplers (max. 4)
14 Interface for FieldBusPlug
15 Supply for 24 V DC
16 Serial interface COM1
17 Serial interface COM2
18 Network interface (Ethernet)
19 Holes for wall mounting
20 DIN rail

The eight pushbuttons on the front panel can be used for manual operation of the CPU. They have the following functions:

Button	Function
RUN	toggles the CPU between RUN and STOP mode
VAL	reserved for future use
ESC	quit menu without saving
OK	leave menu after saving
DIAG	diagnosis, evaluate error code in detail
CFG	set address for ARCNET, CS31 and FBP
▲	move up selection or increase value (e.g., address) by 1
▼	move down selection or decrease value (e.g., address) by 1

The LED indicators have the following functions:

LED	Color	Function
PWR	green	indicates that the power supply of the CPU is ON
RUN	green	indicates that the CPU is running (is OFF with STOP)
ERR	red	indicates that an error occurred (extinguishes after error acknowledgement)

For more detailed information about this module, refer to the following publications:

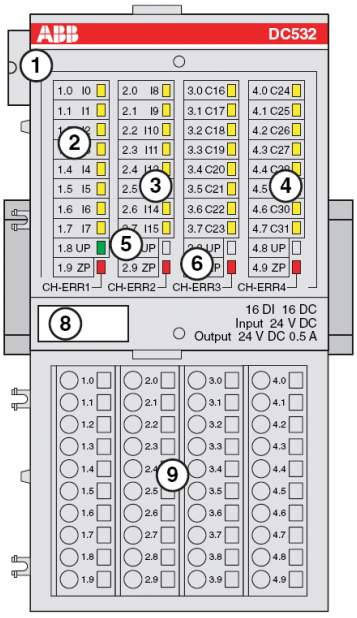
Refer to this document	ABB Publication
PM591 Installation Instruction	2CDC125004M5502.pdf
AC500 System Description	2CDC125016M0201.pdf
AC500 Manual	2CDC125028M0202.pdf

1.1.1.2 I/O Module DC532

The digital input/output module DC532 is used as a remote expansion module at the AC500 CPU.
It contains 32 channels with the following features:

- 16 digital inputs 24 V DC in two groups (1.0...2.7), with no potential separation between the channels and
- 16 digital inputs/outputs 24 V DC in two groups (3.0...4.7), of which each can be used
  - as an input,
  - as a transistor output with short-circuit and overload protection, 0.5 A rated current or
  - as a high-speed counter.

The electrical connection of the I/O channels is made via the 40 terminals of the I/O terminal unit.
I/O modules can be replaced without rewiring the terminal units.



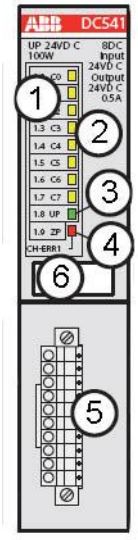
1) I/O bus
2) Allocation terminal number
3) 16 yellow LEDs signal status I0-I15
4) 16 yellow LEDs signal status C16-C31
5) 1 green LED process voltage UP
6) 4 red LEDs to display errors
8) Label (TA525)
9) I/O terminal unit TU515/TU516

For more detailed information about this module, refer to the following publications::

Refer to this document	ABB Publication
DC532 Installation Instruction	2CDC124018M5502.pdf
Digital I/O modules S500, Overview	2CDC124028M0203[1].pdf
AC500 System Description	2CDC125016M0201.pdf
AC500 Manual	2CDC125028M0202.pdf

1.1.1.3 Counter Module DC541-CM

This high-speed counter module is used for monitoring the motor speed. The input of this module is connected to the ENC encoder on the motor shaft.



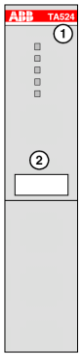
1) Allocation terminal number – signal name
2) 8 yellow LEDs signal status C0-C7
3) 1 green LED process voltage UP
4) 1 red LED to display faults
5) I/O terminal (C0-C7, UP +24 V, ZP 0 V)
6) Label (TA525)

For more detailed information about this module, refer to the following publications:

Refer to this document	ABB Publication
Installation instructions DC541-CM	Install DC541.pdf
System technology of the DC541-CM module	DC541CM.pdf

1.1.1.4 Dummy Coupler Module TA524

This module is used to protect the coupler slot against accidental contact and dust.



1) Type
2) Label

For more detailed information about this module, refer to the following publications:

Refer to this document	ABB Publication
AC500 Accessories (page 6-8)	2CDC125030M0201.pdf
AC500 System Description	2CDC125016M0201.pdf
AC500 Manual	2CDC125028M0202.pdf

1.1.2 Operator Interface Terminal

The OIT provides an interface between escalator and customer/operator.

OIT touch screen terminal Pro-Face AGP3300-T1-D24

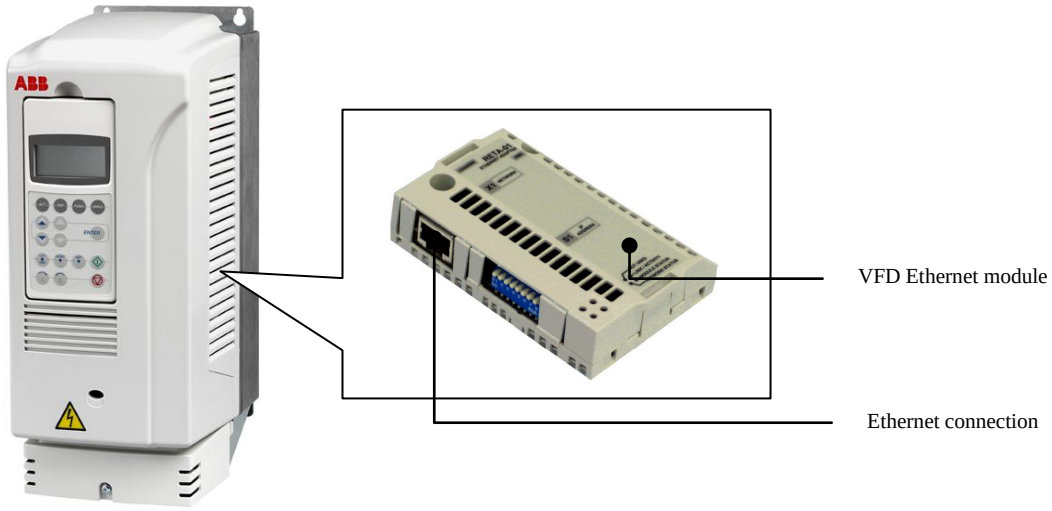
Ethernet controller port

For more detailed information about this module, refer to the following publication:

Refer to this document	ABB Publication
Pro-Face GP3000 Series Hardware Manual	Agp3300_e.pdf
AGP3300T Advanced HMI	Agp3300t_b.pdf

1.1.3 VFD Ethernet Module

The VFD Ethernet module constitutes the interface between the VFD and the main PLC and is connected via the Ethernet switch.

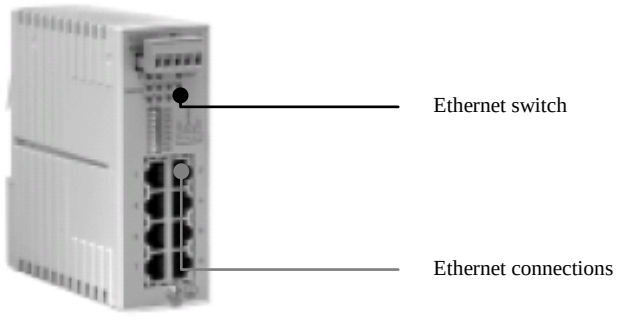


For more detailed information about this module, refer to the following publications:

Refer to this document	ABB Publication
ACS800 Drives Hardware Manual	en_800_01_hw_H_scrres.pdf
Ethernet Adapter Module RETA-01	en_RETA_01_um_d.pdf

1.1.4 Ethernet Switch

The data exchange between all relevant controller components takes place via the Ethernet switch.



For more detailed information about this module, refer to the following publication:

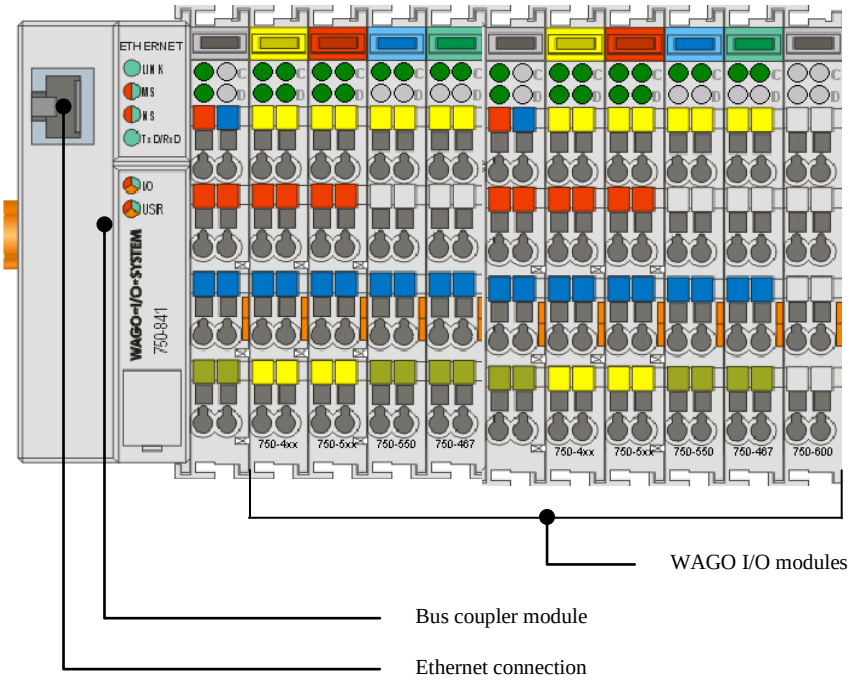
Refer to this document	Schneider Publication
ConneXium Ethernet Switch Quick Reference Guide	31005416_k11_000_02[1].pdf

1.2 Remote I/O Boxes TJ/BJ

The remote I/O boxes are used to reduce the field wiring to the main control panel and to simplify the installation process and field troubleshooting. Remote I/O boxes are installed permanently in the top and bottom pits of the escalator. The remote I/O blocks are equipped with self-diagnostic functions and monitored by the PLC processors. The system prevents the escalator from starting if a remote I/O block problem is detected. Each remote I/O box contains the necessary input and output points according to the project-specific requirements and as described in other sections of this manual.

1.2.1 WAGO I/O Modules

The WAGO I/O modules are used to connect the input and output points to the main PLC via the Ethernet switch.

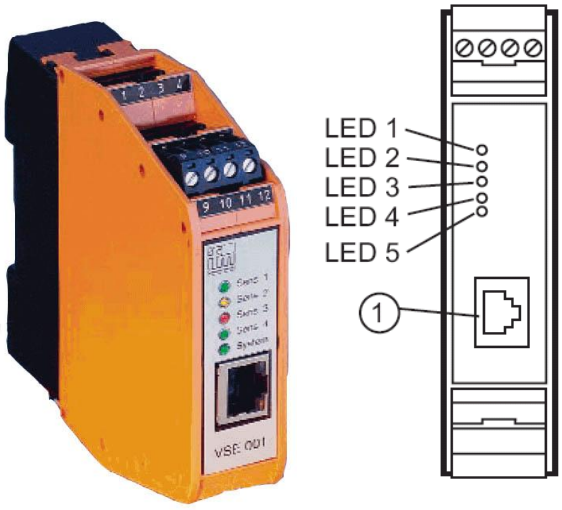


For more detailed information about this module, refer to the following publication:

Refer to this document	WAGO Publication
WAGO-I/O-System TCP/IP 750-841	m084100e.pdf
WAGO-I/O-System TCP/IP 750-871	d087100e.pdf

1.2.2 Vibration Monitoring Module VSE001

The diagnostic electronics VSE001 is equipped for the connection of vibration sensors. It evaluates the sensor signals and indicates whether a preset vibration value for the corresponding sensor has been reached.



For more detailed information about this module, refer to the following publications:

Refer to this document	IFM Publication
Installation instructions, diagnostic electronics for vibration sensors VSE001	704106DEFRUK.pdf

1.3 Heater Boxes SH-T/SH-B

A 208 VAC power supply for truss/pit heaters is separated from the escalator controller power supply. Two PT 100 sensors are provided to monitor and control the heaters in the top and bottom sections of the escalator. All functions shall be integrated via the top and bottom remote I/O boxes.

Two control panels are installed in the top and bottom pits for all heating elements (truss, combplate and pit heating) and the cooling fan (only top pit). The control panels accommodate appropriately sized circuit breakers, heating contactors and a heating disconnect switch (only top pit). The enclosures are rated NEMA 12.

For more detailed information, see Controller Instructions J 595 001, MICONIC F PLC Heating and Cooling Control

1.4 Vibration Monitoring System VMS

The sensors RVBM for the vibration monitoring system are installed on the main drive motor, the gearbox as well as the bearing housings of the main shaft and the reversing shaft. The function is integrated via the top junction box TJ and the bottom junction box BJ and is connected to the respective vibration diagnostics module VSE001.

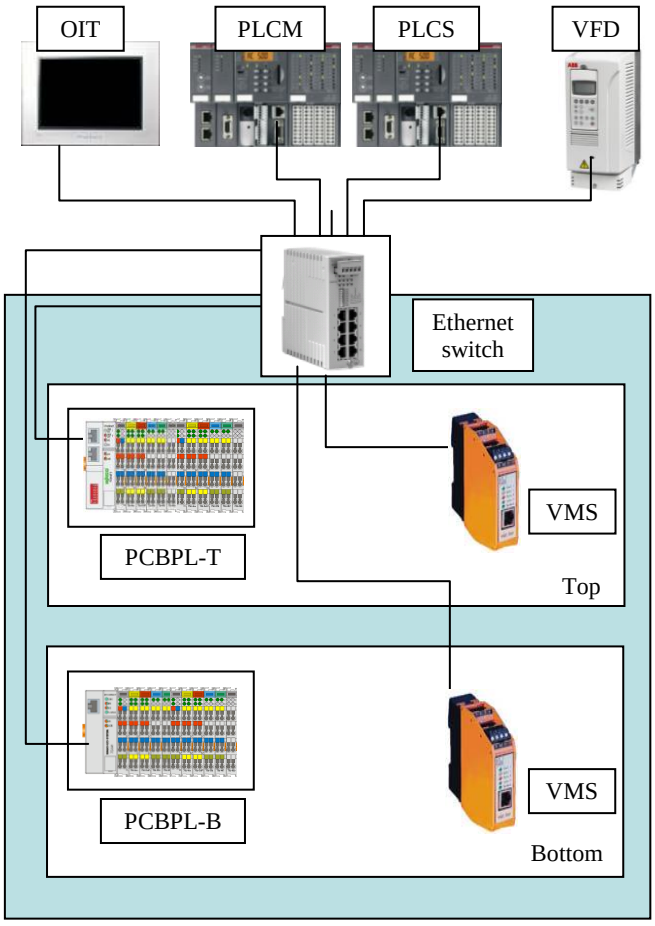
2 Network System Overview

The network system on the MICONIC F PLC is the data bus which interconnects all critical intelligent devices. This system uses the Modbus Ethernet TCP/IP protocol and all devices can be addressed and configured based on this communication protocol. The network topology of this system is star and no termination resistor is required.

The following table shows all devices and their default addresses.

Network Device	Network Address
Master PLC (PLCM) This controller gathers all the data from the other communication devices and distributes commands based on conditions. This device is located in the external control cabinet in the upper left corner of the right compartment.	10.131.65.11
Slave PLC (PLCS) This controller gathers data for redundancy and provides independent commands to critical operations in parallel with the master PLC. This device is located to the right of the master PLC in the right compartment of the external control cabinet.	10.131.65.12
Bus coupler TJ (PBCPL-T) This bus coupler is used for reading the safety switches state, sleep mode sensors, lubrication system sensors and for controlling devices located at the upper end such as lubrication system, lights, etc. This device is located in the top junction box.	10.131.65.13
Bus coupler BJ (PBCPL-B) This bus coupler is used for reading the safety switches state and for controlling devices located at the lower end such as lights, displays etc. This device is located in the bottom junction box.	10.131.65.14
Variable frequency drive (VFD) The Modbus TCP/IP module for the VFD is plugged into a free slot on the front face of the VFD which is located in the left compartment of the external control cabinet. Through this module the master PLC gains full read-and-write access to the VFD. All monitoring and control functions for the VFD are managed through this module.	10.131.65.15
Operator Interface Terminal (OIT) One OIT is located on the right door panel of the external cabinet and gathers important data from the master PLC and displays them on various screen configurations, e.g., on the main screen, the fault and event screen etc. For more detailed information, see the OIT section.	10.131.65.16
Vibration monitoring system (VMS-T) The VMS-T is located in the top junction box. Its primary function is to monitor vibrations on the main motor shaft and the main shaft bearings. It sends a hardwire warning signal to the PLC, and the recorded data can be downloaded to the laptop via Ethernet connection and the appropriate software tool.	10.131.65.17
Vibration monitoring system (VMS-B) The VMS-B is located in the bottom junction box. Its primary function is to monitor vibrations on the reversing shaft bearings. It sends a hardwire warning signal to the PLC, and the recorded data can be downloaded to the laptop via Ethernet connection and the appropriate software tool.	10.131.65.18

An industrial Ethernet switch is utilized as main hub to connect the above devices as shown in the figure below.



All remote I/O boxes, the VFD, the OIT, the VMS and all condition monitoring components are connected and communicate on a common network platform Modbus TCP/IP. Optionally, the master processor (PLCM) may communicate over Ethernet or other networks to remote monitoring systems and in accordance with customer requirements.

The master processor manages (reads and writes) any data exchange from and to the remote I/O bus couplers, the slave processor, the variable drive (VFD) and the vibration monitoring system (VMS). The slave processor only reads data from the PLCM, remote I/O bus couplers, the VFD and the VMS for redundancy. On the other hand, the OIT manages all communication between OIT and master processor; this is secondary to the escalator overall safety and control functions. In case of a communication failure, the controller (master or slave processor) shuts down the unit and displays the related error code on the OIT screen.

2.1 Modbus TCP/IP Network Faults and Troubleshooting

The following fault codes are associated with the Modbus TCP/IP network:

Fault Code	Description	Troubleshooting
FA- COMMCM-Comm failure PLCM	PLCM cable not connected properly or defective	Check cable and connections
FB- COMMCS-Comm failure PLCS	PLCS cable not connected properly or defective	Check cable and connections
	No 24-VDC supply on PLCS	Check 24 VDC on PLCS
FC- COMMTJ-Comm failur,coupler TJ	Bus coupler cable not connected properly or defective	Check cable and connections
	No 24-VDC supply on bus coupler or SIF4 is blown	Check 24 VDC on bus coupler at TJ Replace fuse
FD- COMMBJ-Comm failur,coupler BJ	Bus coupler cable not connected properly or defective	Check cable and connections
	No 24-VDC supply on bus coupler or SIF4 is blown	Check 24 VDC on bus coupler at BJ Replace fuse
FE- COMMVFD-Comm. Failure VFD	Communication module cable not connected properly or defective	Check Cable and connections
	No incoming power	Establish incoming power
FF- REDNCY-Redundant. Check Fail (M&S)	Communication is down	Check above conditions

Hints!

- No external termination resistor is required and all network grounding is achieved via the individual couplers.
- In the case of a complete communication failure, the problem is related to the power. In this case, check for loose wires on the 24-VDC system. A loose wire in any section of the network system could cause total network failure.
- In the case of an isolated communication failure, first check the Ethernet cable with an Ethernet cable inspection tool. If the cable is in order, proceed with replacing the coupler. Do not forget that the new coupler must be properly configured. Use extra care!

2.1.1 Ethernet Switch Check

The Ethernet switch check comprises the following actions:

- Power is on and fault LED is off
- All occupied ports are properly connected (green LED is permanently on)
- All occupied ports are active (except vibration monitoring) (orange LED is flashing)

2.1.2 Bus Coupler Check

The bus coupler check comprises the following actions:

- Power is on and fault LED is off, where applicable
- Cable is properly plugged in
- Communication LED is flashing (see the device manual for more information)

2.1.3 Ethernet Cable Check

The Ethernet cable check comprises the following actions:

- RJ-45 plugs visually OK and plugged in securely
- Connectors are clean and dry
- Cable is not under stress
- Visually check cable condition
- Cable is away from power wires, in particular away fromVFD wiring!

3 Commissioning

3.1 Aids

The escalator is factory-assembled and tested according to the contract-specific installation list.

The following aids are required for commissioning:

- Volt-ohm-milliammeter
- Test lamp
- Contract-specific documents

3.2 Main Line Connection

Warning: Circuit breakers!

Switch off the circuit breakers in the building!

According to the schematics, installation instructions and electrical layout drawings proceed as follows:

- Connect "MH-A" (motor). Verify correct termination of all conductors.
- Connect line "TJ-A". Verify correct termination of all conductors.
- Connect "MGB-A". Verify correct termination of all conductors.
- Connect "MGBA-A". Verify correct termination of all conductors.
- Connect "WFU1". Verify correct termination of all conductors.
- Connect "FUTH". Verify correct termination of all conductors.
- Plug in at both ends Ethernet lines "ETH3" and "ETH4".
- Complete the heating circuit. The customer must fuse the heating circuit separately.
- Complete the lighting circuit. The customer must fuse the lighting circuit separately.

3.3 Checks Before Initial Start-Up

- Switch off the circuit breaker SIS1 and push to activate the top junction box emergency stop button (to interrupt the safety circuit).
- Turn on the unit (JHA main switch) to power the entire control system and PLC.
  - The PLC boots up, and communication between the I/O modules and the OIT is established via the I/O bus and RS-232 respectively.
  - The initialization process of the operating system can be followed via the OIT. Upon completion, the home screen is displayed.
- When system booting is completed, the error code "E_2A" (top junction box emergency stop) should be displayed on the OIT screen. If error codes are displayed, proceed with troubleshooting following error codes on the OIT.
- Switch on MCB SIS1 to enable brake release and main contactors operation.
  - Top junction box emergency stop activated error "E_2A"
  - Pull top junction box emergency stop to reset
- The system automatically checks whether the start/stop key switches are in the "off" position.

Warning: Do not start unit!

DO NOT TRY TO START THE ESCALATOR!

3.4 Initial Start-Up

3.4.1 Testing Inspection Mode

Warning: Reset error codes!

All error codes should be reset before the unit is ready to run in either manual or automatic mode.

1. The VFD should be in remote mode.
2. Set the escalator to manual mode. On the OIT, go to the "Escalator Status" screen and press the mode selector switch. "MANUAL MODE" should be displayed on the screen.
3. Open the inspection outlet and connect the maintenance operating panel (top or bottom station).
4. Run the unit up and down and verify the direction.
5. Disconnect the maintenance operating panel, close the inspection outlet and try to run the unit from the other landing.

3.4.2 Testing Continuous Mode

Warning: Reset error codes!

All error codes should be reset before the unit is ready to run in either manual or continuous mode.

1. Set the escalator to "KEY START".
2. All alarms must be reset.
3. The OIT displays "KEY START" and "ESC_READY_GO".
4. Use the key switch to start and stop the unit.

3.5 Checks During Standstill

During standstill the following checks are performed:

- Service brake (must be engaged)
- Safety brake (disengaged during inspection operation, engaged in all other cases)
- Speed during standstill (check whether the unit stands still)

  Start/stop key switch (must be in OFF position)

3.6 Key Switch Start

- Starting continuous operation:
  - Turn the direction key switch in the balustrade newel in the desired direction of travel.
  - Upon start-up with the key switch, the unit switches to continuous operation.

3.7 Normal Operation

3.7.1 Start-Up Phase

Hint!

The start-up phase takes 10 seconds for completion. Following the start-up phase, the unit switches to rated operation (speed).

- During the start-up phase, the following checks are performed:
  - Safety brake (must be disengaged)
  - Main contactors
  - VFD and service brake at the same time (service brake must be disengaged)
  - Speed check (checks whether the unit starts up)
  - Missing-step check
- To start the unit, the brakes are released and the unit is accelerated according to the predetermined acceleration time.

3.7.2 Rated Operation

- During rated operation, the following additional checks are performed:
  - Step band speed check (check for nominal speed)
  - Motor speed check
  - Handrail speed check

3.8 Stopping the Unit

3.8.1 Normal Stop (Soft Stop)

During a normal stop (soft stop), the VFD decelerates the escalator from nominal speed to 0.2 m/s, whereupon the VFD and the drive contactors are deactivated and the service brake is engaged.

Hint!

This reduces the wear and tear of the brake band.

For more detailed information, see Diagram 1 below

- A normal stop is initiated by turning the direction key switch against the direction of travel.
- In the course of a normal stop, the service brake engages immediately under the following circumstances:
  - The speed of the step band falls below 0.2 m/s.
  - The safety circuit is interrupted.
  - The unit does not come to a standstill after 10 seconds.
- With a safety brake installed:

  When initiating a normal stop by means of the key switch, the safety brake engages with a time delay.

The speed limits of the over- and underspeed device are set as shown in Diagram 2 below.

Diagram 1:

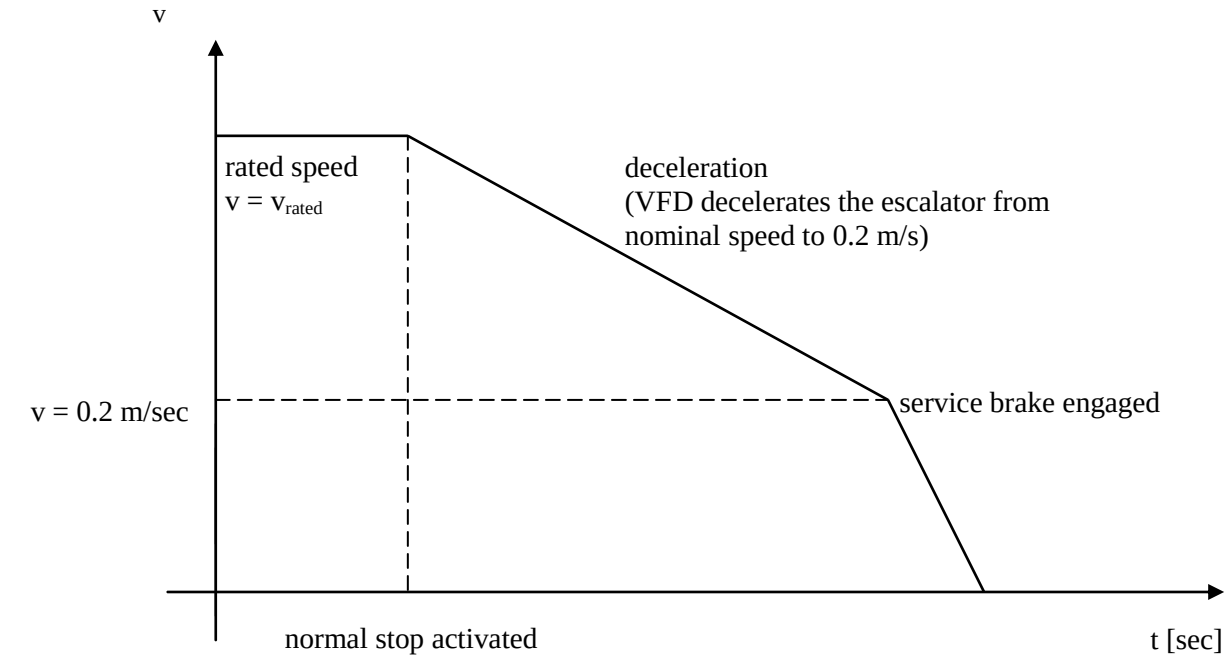
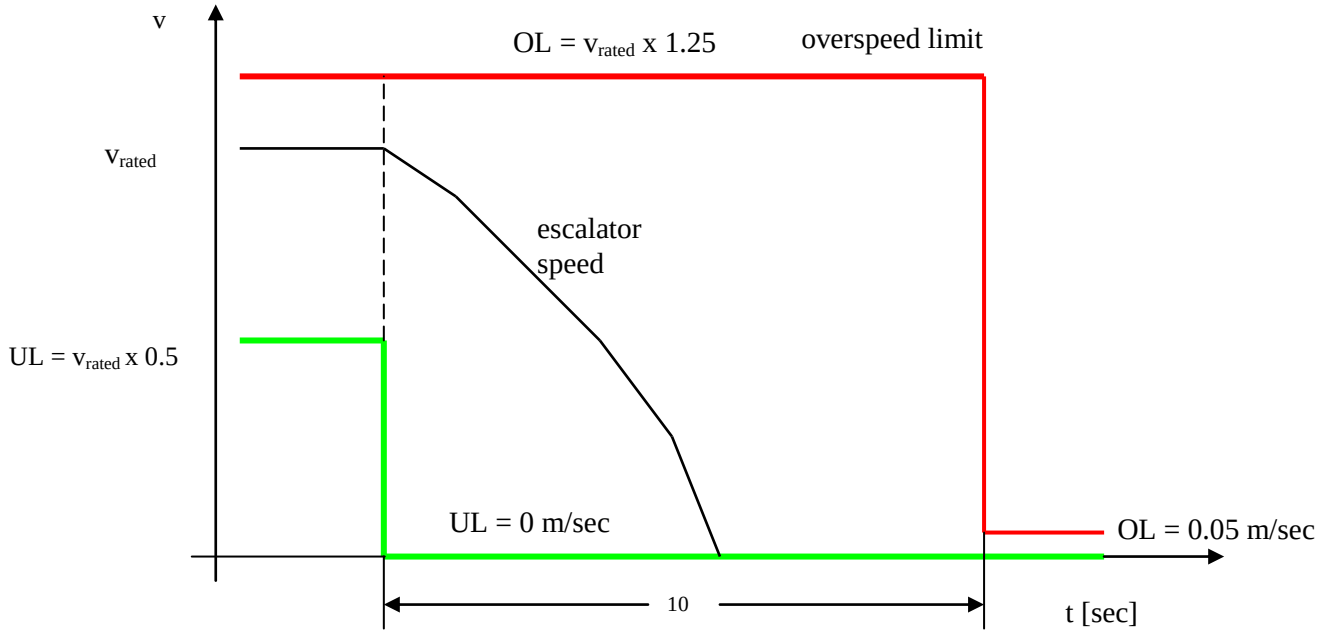


Diagram 2:



OL … overspeed limit
UL … underspeed limit

3.8.2 Emergency Stop

Hint!

Stopping the escalator by immediately applying the service brake is called an "emergency stop".

- An emergency stop is initiated:
  - when a dangerous operating state (e.g., overspeed, underspeed, missing step, etc.) is detected;
  - when the safety circuit is interrupted;
  - when a normally open (NO) contact of one of the safety devices is triggered.

3.8.3 Safety Brake

The safety brake acts directly on the main shaft of the escalator and works independently of the drive chain.
The safety brake is engaged when the unit is idle. At start-up, the safety brake is disengaged. During operation, the solenoid is always energized.

When the unit is to be stopped with the safety brake, this engages immediately.

For more detailed information, see Controller Instructions J 572 810, Operating State Messages and Error Codes

During a normal stop as well as in all other cases, the safety brake engages with a time delay.

To avoid sudden stops during power loss, a brake delay system is deployed to provide for a delay of approx. 2 seconds on safety brake engagement.

3.9 Inspection Operation

The inspection mode is set by changing the operating mode on the OIT to manual, followed by plugging in the maintenance operating panel in the top or bottom pit.

During inspection operation, the safety circuit must be completed. If available, the safety brake is released.

Except for the PTC resistor monitor of the drive unit, no electronic monitoring functions are active during inspection operation.

The escalator is operated via the maintenance operating panel.

With a frequency converter (VFD), the speed of the inspection run amounts to 10 percent of the nominal speed, as specified by the customer.

4.2 MICONIC F PLC Legend

This table explains the abbreviations used for the respective locations in the table beneath.

Abbreviation	Location
+A	External control cabinet
+BF	Connection of bottom smoke detector
+BJ	Bottom junction box
+BS	Connection by customer, bottom
+F	Escalator
+SHB	Bottom heater box
+SHT	Top heater box
+TB	Brake terminal box
+TF	Connection of top smoke detector
+TJ	Top junction box

The following legend explains the abbreviations used throughout the instructions.

Location	Abbreviation	Description
+A	AHMI	GRAPHICAL DISPLAY
+A	CCHT	CONTROL CABINET HEATER THERMOSTAT
+A	GFU	FREQUENCY CONVERTER
+A	GRDFLT	GROUND FAULT MONITORING
+A	GRDFLT1	CURRENT TRANSFORMER
+A	HKCC	HEATER CONTROL CABINET
+A	JHA	DISCONNECTING MEANS
+A	JMH	MOTOR PROTECTIVE SWITCH
+A	MVEKA	COOLING FAN CONTROL CABINET
+A	NGP	POWER SUPPLY 24 VDC
+A	PLCMCPU	PLC MASTER CPU
+A	PLCMMF	HIGH SPEED COUNTER
+A	PLCSCPU	PLC SLAVE CPU
+A	PSWETH	ETHERNET SWITCH
+A	RCBS	RELAY STOP BY CUSTOMER
+A	RGBA	RELAY SAFETY BRAKE TOP
+A	RGBA1	RELAY SAFETY BRAKE TOP
+A	RHM	RELAY SIGNALLING STOP
+A	RHSUM	RELAY BUZZER STOP
+A	RKBF	RELAY FIRE ALARM SHUTDOWN
+A	RKPH	PHASE MONITORING
+A	RON	RELAY SIGNALLING RUNNING
+A	RRD	RELAY DIRECTION DOWN
+A	RRU	RELAY DIRECTION UP
+A	RSKM	RELAY SIGNALLING SAFETY CIRCUIT
+A	RSKSUM	RELAY BUZZER SAFETY CIRCUIT
+A	RVEKA	RELAY COOLING FAN CONTROL CABINET

Location	Abbreviation	Description
+A	SB	CONTACTOR BRAKE
+A	SFU	CONTACTOR FREQUENCY CONVERTER
+A	SIF1	FUSE 1 MAINS 24 VDC
+A	SIF2	FUSE 2 MAINS 24 VDC
+A	SIF4	FUSE 4 MAINS 24 VDC
+A	SIF5	FUSE 5 MAINS 24 VDC
+A	SIF6	FUSE 6 MAINS 24 VDC
+A	SIF7	FUSE 7 MAINS 24 VDC
+A	SIMVEKA	CIRCUIT BREAKER COOLING FAN CONTROL CABINET
+A	SIS1	CIRCUIT BREAKER 1
+A	SIS2	CIRCUIT BREAKER 110/120 V
+A	SIS3	CIRCUIT BREAKER 3
+A	SSK1	CONTACTOR 1 SAFETY CIRCUIT
+A	SSK2	CONTACTOR 2 SAFETY CIRCUIT
+A	TS	TRANSFORMER
+A	ZQH	OPERATING HOUR METER
+BF	KBFMB	SMOKE DETECTOR BOTTOM
+BJ	D75	DIODE
+BJ	JHB	SWITCH STOP BOTTOM
+BJ	PBCPLB	FIELDBUS COUPLER BOTTOM
+BJ	PDI01B	DIGITAL INPUT MODULE BOTTOM
+BJ	PDI02B	DIGITAL INPUT MODULE BOTTOM
+BJ	PDI03B	DIGITAL INPUT MODULE BOTTOM
+BJ	PDI04B	DIGITAL INPUT MODULE BOTTOM
+BJ	PDI05B	DIGITAL INPUT MODULE BOTTOM
+BJ	PDI06B	DIGITAL INPUT MODULE BOTTOM
+BJ	PDI07B	DIGITAL INPUT MODULE BOTTOM
+BJ	PDI08B	DIGITAL INPUT MODULE BOTTOM
+BJ	PDI09B	DIGITAL INPUT MODULE BOTTOM
+BJ	PDI10B	PT RESISTANCE
+BJ	PDO01B	DIGITAL OUTPUT MODULE BOTTOM
+BJ	PDO02B	DIGITAL OUTPUT MODULE BOTTOM
+BJ	PDO03B	DIGITAL OUTPUT MODULE BOTTOM
+BJ	PDO04B	DIGITAL OUTPUT MODULE BOTTOM
+BJ	PDO05B	DIGITAL OUTPUT MODULE BOTTOM
+BJ	PDO06B	DIGITAL OUTPUT MODULE BOTTOM
+BJ	PREB	SOCKET MAINTENANCE BOTTOM
+BJ	RBLB	RELAY LIGHTING BOTTOM
+BJ	RVBMB	RELAY VIBRATION MONITORING BOTTOM
+BJ	RWS	RELAY WATER LEVEL DETECTION
+BS	DHBS	BUTTON STOP BY CUSTOMER
+BS	KBF	CONTACT IN CASE OF FIRE BY CUSTOMER
+BS	SHBS	FUSE HEATING BY CUSTOMER
+BS	SIBS2	FUSE BY CUSTOMER MAIN CIRCUIT
+F	DHMH	STOP BUTTON MAIN DRIVE

Location	Abbreviation	Description
+F	DHSUMB	EMERGENCY STOP PANEL USA BOTTOM
+F	DHSUMT	EMERGENCY STOP PANEL USA TOP
+F	DIGB	DIGITAL DISPLAY BOTTOM
+F	DIGT	DIGITAL DISPLAY TOP
+F	DREN	FOR MAINTENANCE PANEL
+F	HK1B	HEATER BOTTOM
+F	HK1T	HEATER 1 TOP
+F	HK2T	HEATER 2 TOP
+F	HK3B	HEATER 3 BOTTOM
+F	HKPTB	HEATER BOTTOM PIT
+F	HKPTT	HEATER TOP PIT
+F	IINC	MAIN DRIVE ENCODER
+F	INBBR	INDUCTIVE SWITCH BRAKE PAD CONTROL RIGHT
+F	INCRWL	CHAIN ROLLER DETECTION LEFT
+F	INCRWR	CHAIN ROLLER DETECTION RIGHT
+F	INHLL	INDUCTIVE SWITCH HANDRAIL SPEED MONITOR LEFT
+F	INHLR	INDUCTIVE SWITCH HANDRAIL SPEED MONITOR RIGHT
+F	INSRWL	STEP ROLLER DETECTION LEFT
+F	INSRWR	STEP ROLLER DETECTION RIGHT
+F	INVKB	INDUCTIVE SWITCH SPEED MONITORING BOTTOM
+F	INVKT	INDUCTIVE SWITCH SPEED MONITORING TOP
+F	ITHB	PT100 TEMP. SENSOR BOTTOM
+F	ITHT	PT100 TEMP. SENSOR TOP
+F	IVBMBSL	SENSOR VIBRATION MONITORING
+F	IVBMBSR	SENSOR VIBRATION MONITORING BOTTOM SHAFT
+F	IVBMTG	SENSOR VIBRATION MONITORING TOP GEARBOX
+F	IVBMTM	SENSOR VIBRATION MONITORING TOP MOTOR
+F	IVBMTSL	SENSOR VIBRATION MONITORING TOP SHAFT LEFT
+F	IVBMTSR	SENSOR VIBRATION MONITORING TOP SHAFT RIGHT
+F	JRB	KEY SWITCH DIRECTION BOTTOM
+F	JRT	KEY SWITCH DIRECTION TOP
+F	JSTOB	PUSH BUTTON STOP BOTTOM
+F	JSTOT	PUSH BUTTON STOP TOP
+F	KAK	CONTACT DRIVE CHAIN
+F	KB1	CONTACT BRAKE RELEASE
+F	KBB1	CONTACT BRAKE PAD
+F	KBMR1	CONTACT BRAKE RELEASE MECHANICAL RELEASE
+F	KBV	CONTACT BLOCKING DEVICE
+F	KDZS	CONTACT PRESSURE AUTOMATIC LUBRIC. SYSTEM
+F	KGRDM	CONTACT GUARD MASTER
+F	KHLBBL	CONTACT BROKEN HANDRAIL BOTTOM LEFT
+F	KHLBBR	CONTACT BROKEN HANDRAIL BOTTOM RIGHT
+F	KHLEBL	CONTACT HANDRAIL ENTRY BOTTOM LEFT
+F	KHLEBR	CONTACT HANDRAIL ENTRY BOTTOM RIGHT
+F	KHLETL	CONTACT HANDRAIL ENTRY TOP LEFT

Location	Abbreviation	Description
+F	KHLETR	CONTACT HANDRAIL ENTRY TOP RIGHT
+F	KKAB	CONTACT BROKEN STEP BOTTOM
+F	KKAT	CONTACT BROKEN STEP TOP
+F	KKPBL	CONTACT COMBPLATE BOTTOM LEFT
+F	KKPBR	CONTACT COMBPLATE BOTTOM RIGHT
+F	KKPTL	CONTACT COMBPLATE TOP LEFT
+F	KKPTR	CONTACT COMBPLATE TOP RIGHT
+F	KKSBL	CONTACT CHAIN TENSION BOTTOM LEFT
+F	KKSBR	CONTACT CHAIN TENSION BOTTOM RIGHT
+F	KOZS	CONTACT OIL LEVEL
+F	KSLBL	CONTACT SKIRT PANEL BOTTOM LEFT
+F	KSLBR	CONTACT SKIRT PANEL BOTTOM RIGHT
+F	KSLTL	CONTACT SKIRT PANEL TOP LEFT
+F	KSLTR	CONTACT SKIRT PANEL TOP RIGHT
+F	KUSBL	CONTACT UPTHRUST BOTTOM LEFT
+F	KUSBR	CONTACT UPTHRUST BOTTOM RIGHT
+F	KUSTL	CONTACT UPTHRUST TOP LEFT
+F	KUSTR	CONTACT UPTHRUST TOP RIGHT
+F	LAGB	DIRECTION INDICATOR GREEN BOTTOM
+F	LAGT	DIRECTION INDICATOR GREEN TOP
+F	LARB	DIRECTION INDICATOR RED BOTTOM
+F	LART	DIRECTION INDICATOR RED TOP
+F	LKPEBL	LAMP COMBPLATE BOTTOM LEFT
+F	LKPEBR	LAMP COMBPLATE BOTTOM RIGHT
+F	LKPETL	LAMP COMBPLATE TOP LEFT
+F	LKPETR	LAMP COMBPLATE TOP RIGHT
+F	LSSB	LAMP STEP GAP BOTTOM
+F	LSST	LAMP STEP GAP TOP
+F	MGBA	SOLENOID SAFETY BRAKE ACTIVE
+F	MGP	MOTOR LUBRICATION PUMP
+F	MGSKAR	SOLENOID VALVE FOR LUBRICATION DRIVE CHAIN
+F	MGSKHL	SOLENOID VALVE FOR LUBRICATION HANDRAIL DRIVE CHAIN
+F	MGSKHLL	SOLENOID VALVE FOR LUBRICATION HANDRAIL DRIVE CHAIN LEFT
+F	MGSKHLR	SOLENOID VALVE FOR LUBRICATION HANDRAIL DRIVE CHAIN RIGHT
+F	MGSKSL	SOLENOID VALVE FOR LUBRICATION STEP CHAIN LEFT
+F	MGSKSR	SOLENOID VALVE FOR LUBRICATION STEP CHAIN RIGHT
+F	MH	MOTOR MAIN
+F	ROMHR	CONTACT OIL LEVEL
+F	RWS	RELAY WATER LEVEL DETECTION
+F	WFU1	BRAKE RESISTOR
+SHB	SH1B	CIRCUIT BREAKER 1 HEATING BOTTOM
+SHB	SH2B	CIRCUIT BREAKER 2 HEATING BOTTOM
+SHB	SHEB	CONTACTOR HEATING BOTTOM
+SHB	SIMVHL1	CIRCUIT BREAKER MOTOR FAN HEATING L1
+SHT	SH1T	CIRCUIT BREAKER 1 HEATING TOP

Location	Abbreviation	Description
+SHT	SH2T	CIRCUIT BREAKER 2 HEATING TOP
+SHT	SHET	CONTACTOR HEATING TOP
+SHT	SHIK	CIRCUIT BREAKER HEATING
+SHT	SIMVHL3	CIRCUIT BREAKER MOTOR FAN HEATING L3
+TB	MB1	MOTOR BRAKE RELEASE
+TB	PMGB1	CONTROL BRAKE 1
+TF	KBFMT	SMOKE DETECTOR TOP
+TJ	D74	DIODE
+TJ	JHT	SWITCH STOP TOP
+TJ	PAI01T	PT RESISTANCE
+TJ	PBCPLT	FIELDBUS COUPLER TOP
+TJ	PDI01T	PTC MODULE TOP
+TJ	PDI02T	DIGITAL INPUT MODULE TOP
+TJ	PDI03T	DIGITAL INPUT MODULE TOP
+TJ	PDI04T	DIGITAL INPUT MODULE TOP
+TJ	PDI05T	DIGITAL INPUT MODULE TOP
+TJ	PDI06T	DIGITAL INPUT MODULE TOP
+TJ	PDI07T	DIGITAL INPUT MODULE TOP
+TJ	PDI08T	DIGITAL INPUT MODULE TOP
+TJ	PDI09T	DIGITAL INPUT MODULE TOP
+TJ	PDO01T	DIGITAL OUTPUT MODULE TOP
+TJ	PDO02T	DIGITAL OUTPUT MODULE TOP
+TJ	PDO03T	DIGITAL OUTPUT MODULE TOP
+TJ	PDO04T	DIGITAL OUTPUT MODULE TOP
+TJ	PDO05T	DIGITAL OUTPUT MODULE TOP
+TJ	PDO06T	DIGITAL OUTPUT MODULE TOP
+TJ	PDO07T	DIGITAL OUTPUT MODULE TOP
+TJ	PDO08T	DIGITAL OUTPUT MODULE TOP
+TJ	PDO09T	DIGITAL OUTPUT MODULE TOP
+TJ	PRET	SOCKET MAINTENANCE TOP
+TJ	RBLT	RELAY LIGHTING TOP
+TJ	RMGSP	RELAY LUBRICATION PUMP
+TJ	RVBMT	RELAY VIBRATION MONITORING TOP

4.3 Parameters

1 General

The escalator controller provides for several parameters for different operating states. The parameters regarding the variable frequency drive can be changed by the operator via the OIT within a predefined range according to customer requirements.

1.1 Parameter Settings on the OIT

The following parameters can be changed via the OIT:

Parameter	Description	Range
Maintenance speed (m/s)	Step band speed in inspection mode	77-500 (value = m/s*1000) Default = 125

For more detailed information, see Controller Instructions J 595 027, Operator Interface Terminal (OIT)

4.4 Operating State Messages and Error Codes – J 572 810

1 Operating State Messages

1.1 Operating State Messages on the OIT

All operating state messages are displayed on the OITs in the front door of the external control cabinet ASA as well as in the balustrade newels.

The following types of messages are generated by the system:

Type	Message
Faults	Shows all fault messages that occur during normal operation of the escalator. The unit is shut down once the fault occurs.
Status	Shows the escalator status messages during operation.

1.2 Operating State Messages on the Newel End Displays

The following messages are displayed on the 2-digit digital displays in the newel ends:

Display Code		Message
r	0	Inspection operation
d	0	Unit ready for operation
d	*	Continuous operation
*	u	Up
*	d	Down
*	0	Key switch not in "off" position
0	0	Inspection operation

The display code "d0", "Unit ready for operation", and the last error are displayed alternately.
Example: If the last error was an emergency stop ("14"), the codes "d0" and "14" are displayed alternately.

2 Status Messages

The status messages are displayed in tabular form on the warnings screen as well as in the top left corner of the main screen. On the main screen, the number of messages which can be displayed simultaneously is limited to six.

Status Message	Explanation
MAINTENANCE	OIT mode selector button on MANUAL Escalator at standstill
NORMAL	OIT mode selector button on KEY START Escalator at standstill
ESC_READY_GO	Escalator is ready to be started via key switch in the balustrade newel Escalator at standstill
ESC_STOPPED	Escalator is stopped
ESC_FAULT	A fault occurred on the unit and is shown on the related screens Escalator is shut down
ESC_NMNL	Escalator is running at nominal speed
ESC_RUN_UP	Escalator is running in upward direction
ESC_RUN_DOWN	Escalator is running in downward direction

3 Resetting Errors

If an error is displayed on the OIT or the digital display, it cannot be reset until the conditions for resetting have been met.
Errors can be reset with the RESET touch button on the OIT display upon entering the password for Level 1.

4 Electronically Interlocked Errors

Electronic interlocking of errors is programmed and stored in the CPU. Changes can only be made with the ABB Codesys.

4.1 Errors Interlocked Electronically as Standard

The following errors are interlocked as standard in the software:

- Combplate contact
- Step chain tension contact
- Drive chain contact
- Missing-step check
- Overspeed
- Underspeed

5 Errors With Safety Brake Application

As with electronically interlocked errors, safety brake application is also programmed in the CPU. When activated, selected errors engage the safety brake.

5.1 Standard Safety Brake Application

The following errors are parameterized with safety brake application as standard in the software:

- Breakage or excessive elongation of the drive chain
- Overspeed 25%
- Power failure with delay

6 Error Table

Error properties:

+A = safety brake

+C = electronically interlocked

Display Code	Abbreviation	Error Message	Error Properties	Corrective Actions	Ref. Doc.
00	E_JR_T/B	00-JR_T/B-Start key SW (Not Centered)			Q 409 661
10	E_KKP_TL	Combplate contact, top left		• Check combs for damage • Check step for damage (before and beneath the combplate) • Check whether: – combplate returns to its initial position – side adjusting screws are set too tightly – skirt panel touches combplate – antilift screws are set too low – combplate guide is heavily fouled	Q 409 460
11	E_KHLE_TL	Handrail entry contact, top left		• Check handrail entry for trapped foreign objects • Check rubber collar for damage • Check collar for correct setting • Check contact setting	Q 409 653
12	E_KSL_TL	Skirt contact, top left		• Check for foreign objects trapped between step and skirting • Check for visible defects of step or skirting	Q 409 648
14	E_DH_T	Emergency stop, top	—	• Check stop button for damage • Start the unit	Q 409 661
15	E_KKP_BL	Combplate contact, bottom left		• Check combs for damage • Check step for damage (before and beneath the combplate) • Check whether: – combplate returns to its initial position – side adjusting screws are set too tightly – skirt panel touches combplate – antilift screws are set too low – combplate guide is heavily fouled	Q 409 460
16	E_KHLE_BL	Handrail entry contact, bottom left		• Check handrail entry for trapped foreign objects • Check rubber collar for damage • Check collar for correct setting • Check contact setting	Q 409 653
17	E_KKS_BR	Chain tension contact, bottom right	+C	• Visual check of step band • Check contact setting • Check spring tension • Reset error	Q 409 602
18	E_INBMG	15% motor overspeed	+C	• Check INBMG – Activate inspection operation – Perform technical test • Check sensor setting • Reset error	Volume VJ

Display Code	Abbreviation	Error Message	Error Properties	Corrective Actions	Ref. Doc.
19	E_KAK_R	Drive chain contact, right	+A +C	• Check chain tension • Check chain for excessive elongation • Check chain for breakage • Reset error • Release the safety brake, if available (during down travel)	Q 409 453
1A	E_KBFM_T	Smoke detector, top		• Check for smoke or dust • Check smoke detector functionality	—
1C	E_INBMG_MU	Motor underspeed	+C	• Check all three phases (measure between ground and phase) • Check INBMG – Activate inspection operation – Perform technical test • Check sensor setting • Reset error	Volume VJ
1D	E_KUS_TR	Step upthrust contact, top right		• Check for trapped objects: – between riser and rear edge of adjacent step – between riser and skirting (during down travel)	Q 409 709
1F	E_KSL_BL	Skirt contact, bottom left		• Check for foreign objects trapped between step and skirting • Check for visible defects of step or skirting	Q 409 648
24	E_WTHM_TR	Motor thermistor, right		• Check motor temperature • With PES versions A to C, connect the PTC resistor between 1 and A2 (instead of 2)	—
25	E_SFE	Contactor dropout check		• Check whether the motor, SB, SKV and SRE contactors are in position of rest • Check whether the SFE contactor picks up	—
28	E_KKA_B	Step level contact, bottom	+C	• Check steps for damage and deflection • ATTENTION: Inspection run only possible with KKA-B jumpered in the safety circuit Reset error Manually reset step level contact (if error cannot be reset electronically – mechanically interlocked design) DO NOT FORGET to remove jumper from KKA-B in the safety circuit afterwards	Q 409 601
2A	E_JH_T	Stop button, top		• Release the JH-T switch	Q 409 480
2B	E_KHLB_BL	Handrail rupture contact		• Check handrail for damage or breakage • Check handrail tension	Q 409 650
2C	E_JH_B	Stop button, bottom		• Release the JH-B switch	Q 409 480
2D	E_KSGFU	Controlled drive failure		• Read out error on GFU (see error table GFU reference manual)	—
30	E_INVK_TB1	15% PLC-S overspeed	+C	• Check INVK-T and INVK-B – Activate inspection operation – Perform technical tests • Reset error	Q 409 710

Display Code	Abbreviation	Error Message	Error Properties	Corrective Actions	Ref. Doc.
31	E_INVK_TB2	PLC-S underspeed	+C	• Check drive chain for breakage • Check INVK-T and INVK-B – Activate inspection operation – Perform technical tests • Check whether main contactors pick up • Check whether the motor has all three phases present • Reset error	Q 409 710
32	E_INHL_ML	Handrail monitor, left PLC-M		• Check handrail speed • Try to stop the handrail by hand • Activate inspection operation – Perform technical test	Q 409 650
33	E_INHL_MR	Handrail monitor, right PLC-M		• Check handrail speed • Try to stop the handrail by hand • Activate inspection operation – Perform technical test	Q 409 650
34	E_MGB	Service brake contact		• Check power supply of brake solenoid • Check brake solenoid for malfunction	Volume VJ
35	E_MGBA	Active safety brake		• Check pawl setting • Check pawl for free movement • Check lifting solenoid of pawl	Q 409 710
36	E_KKA_T	Step level contact, top	+C	• Check steps for damage and deflection • ATTENTION: Inspection run only possible with KKA-B jumpered in the safety circuit Reset error Manually reset step level contact (if error cannot be reset electronically – mechanically interlocked design) DO NOT FORGET to remove jumper from KKA-B in the safety circuit afterwards	Q 409 601
38	E_INBMG_FLT	Initiator for braking distance measurement		• Check INBMG – Activate inspection operation – Perform technical test	Volume VJ
39	E_INVK_T1	Missing step or pallet, top, PLC-S	+C	• Check step or pallet band for completeness • Check power supply of initiator • Check initiator setting – Activate inspection operation – Perform technical tests • Reset error	Q 409 465
3A	E_INVK_T2	Initiator defective, top, PLC-S		• Check power supply of initiator • Check initiator setting – Activate inspection operation – Perform technical tests • Replace initiator (if defective)	Q 409 465

Display Code	Abbreviation	Error Message	Error Properties	Corrective Actions	Ref. Doc.
3B	E_INVK_B1	Missing step or pallet, bottom, PLC-S	+C	• Check step or pallet band for completeness • Check power supply of initiator • Check initiator setting – Activate inspection operation – Perform technical tests • Reset error	Q 409 465
3C	E_INVK_B2	Initiator defective, bottom, PLC-S		• Check power supply of initiator • Check initiator setting – Activate inspection operation – Perform technical tests • Replace initiator (if defective)	Q 409 465
3E	E_INVK_TB3	15% PLC-M overspeed	+C	• Check INVK-T and INVK-B – Activate inspection operation – Perform technical tests • Reset error	Q 409 710
3F	E_INVK_TB4	PLC-M underspeed	+C	• Check drive chain for breakage • Check INVK-T and INVK-B – Activate inspection operation – Perform technical tests • Check whether main contactors pick up • Check whether the motor has all three phases present • Reset error	Q 409 710
43	E_KOMH_TR	Oil level, drive motor		• Wait for 5 minutes • Manually check oil level	Q 409 447
45	E_PRE_T	Cover of inspection outlet open, top		• Close inspection cover • Activate "Engineer on Site" • Open inspection cover • Check whether the SRE contactor drops out	Q 409 480
48	E_KHLE_TR	Handrail entry contact, top right		• Check handrail entry for trapped foreign objects • Check rubber collar for damage • Check collar for correct setting • Check contact setting	Q 409 653
49	E_KHLE_BR	Handrail entry contact, bottom right		• Check handrail entry for trapped foreign objects • Check rubber collar for damage • Check collar for correct setting • Check contact setting	Q 409 653
4A	E_KKP_TR	Combplate contact, top right		• Check combs for damage • Check step for damage (before and beneath the combplate) • Check whether: – combplate returns to its initial position – side adjusting screws are set too tightly – skirt panel touches combplate – antilift screws are set too low – combplate guide is heavily fouled	Q 409 460

Display Code	Abbreviation	Error Message	Error Properties	Corrective Actions	Ref. Doc.
4B	E_KKP_BR	Combplate contact, bottom right		• Check combs for damage • Check step for damage (before and beneath the combplate) • Check whether: – combplate returns to its initial position – side adjusting screws are set too tightly – skirt panel touches combplate – antilift screws are set too low – combplate guide is heavily fouled	Q 409 460
4C	E_RSK	Safety circuit interruption		• Check pcb connector for proper fit • Check how far the safety circuit is energized	—
50	E_INHL_L	Handrail monitor, left, PLC-S		• Check handrail speed • Try to stop the handrail by hand • Activate inspection operation • Perform technical test	Q 409 650
51	E_INHL_R	Handrail monitor, right, PLC-S		• Check handrail speed • Try to stop the handrail by hand • Activate inspection operation • Perform technical test	Q 409 650
53	E_SEIS	Seismic monitor		• Check relay • Check external evaluation	—
55	E_WFU	Braking resistor		• Check for soiling • Short circuits to ground • Check resistance value	—
57	E_JEOS_T	Engineer on Site			—
75	E_PRE_B	Cover of inspection outlet open, bottom		• Close inspection cover • Activate "Engineer on Site" • Open inspection cover • Check whether the SRE contactor drops out	Q 409 480
7B	E_KUS_TL	Step upthrust contact, top left		• Check for trapped objects: – between riser and rear edge of adjacent step – between riser and skirting (during down travel)	Q 409 709
80	E_JMH	Motor Right overload device			Q 409 478
86	E_KBV_L	Step chain locking device contact, top left		• Check whether the step chain locking device is engaged • Check contact setting • Reset error	Q 409 926
87	E_KKS_BL	Chain tension contact, bottom left	+C	• Visual check of step band • Check contact setting • Check spring tension • Reset error	Q 409 602
88	E_KUS_BL	Step upthrust contact, bottom left		• Check for trapped objects: – between riser and rear edge of adjacent step – between riser and skirting (during down travel)	Q 409 709
8E	E_KAK_M	PLC-M drive chain contacts P1227			Q 409 453

Display Code	Abbreviation	Error Message	Error Properties	Corrective Actions	Ref. Doc.
8F	E_KAK_S	PLC-S drive chain contacts P1233			Q 409 453
90	E_THBB_R	Thermal switch brake band, right			Volume VJ
C0	E_INCRW-L	Chain roller detection left		• Check rollers for minimum thickness • Check sensor setting • Reset error	Q 409 465A
C1	E_INSRW-L	Step roller detection left		• Check rollers for minimum thickness • Check sensor setting • Reset error	Q 409 465A
C2	E_INCRW-R	Chain roller detection right		• Check rollers for minimum thickness • Check sensor setting • Reset error	Q 409 465A
C3	E_INSRW-R	Step roller detection right		• Check rollers for minimum thickness • Check sensor setting • Reset error	Q 409 465A
CC	E_INBMG_MO	25% motor overspeed	+A +C	• Check INBMG – Activate inspection operation – Perform technical test • Check sensor setting • Reset error • Release the safety brake, if available (during down travel)	Volume VJ
CE	E_INVK_TB5	25% PLC-S overspeed	+A +C	• Check INVK-T and INVK-B – Activate inspection operation – Perform technical tests • Reset error	Q 409 710
CF	E_INVK_TB6	25% PLC-M overspeed	+A +C	• Check INVK-T and INVK-B – Activate inspection operation – Perform technical tests • Reset error	Q 409 710
D0	E_JMH1_R	Motor disconnect switch, right			Q 409 478
D1	E_KBFM_B	Smoke detector, bottom		• Check for smoke or dust • Check smoke detector functionality	—
D8	E_KUS_BR	Step upthrust contact, bottom right		• Check for trapped objects: – between riser and rear edge of adjacent step – between riser and skirting (during down travel)	Q 409 709
D9	E_INBB	Brake pad monitor, service brake		• Check brake pad for minimum thickness • Replace brake pad (if too thin)	Volume VJ
DA	E_RHBS	Stop button, customer-provided		• Check emergency stop at remote location • Check the RHBS relay	—
DB	E_KWS_B	Water level monitor		• Check for ingress of water	Q 409 484
DF	E_KDZS	Central lubrication pressure		• Check automatic lubrication system – Level switch – Manometric switch – State of lines	Q 409 924

Display Code	Abbreviation	Error Message	Error Properties	Corrective Actions	Ref. Doc.
E0	E_KSL_TR	Skirt contact, top right		• Check for foreign objects trapped between step and skirting • Check for visible defects of step or skirting	Q 409 648
E1	E_KSL_BR	Skirt contact, bottom right		• Check for foreign objects trapped between step and skirting • Check for visible defects of step or skirting	Q 409 648
E4	E_DH_B	Emergency stop, bottom		• Check stop button for damage • Start the unit	Q 409 661
E5	E_KHLB_BR	Handrail rupture contact, bottom right			Q 409 650
E7	E_INVK_B3	Missing step or pallet, bottom, PLC-M	+C	• Check step or pallet band for completeness • Check power supply of initiator • Check initiator setting – Activate inspection operation – Perform technical tests • Reset error	Q 409 465
EA	E_INBMG_D	Braking distance exceeded	+A +C	• Check braking distance • Check INBMG – Activate inspection operation – Perform technical test	Volume VJ
EC	E_INVK_T3	Initiator defective, top, PLC-M		• Check power supply of initiator • Check initiator setting – Activate inspection operation – Perform technical tests • Replace initiator (if defective)	Q 409 465
EF	E_MSP	Motor overload device			—
F0	E_INVK_T4	Missing step or pallet, top, PLC-M	+C	• Check step or pallet band for completeness • Check power supply of initiator • Check initiator setting – Activate inspection operation – Perform technical tests • Reset error	Q 409 465
F1	E_INVK_B4	Initiator defective, bottom, PLC-M		• Check power supply of initiator • Check initiator setting – Activate inspection operation – Perform technical tests • Replace initiator (if defective)	Q 409 465
F7	E_RGBA	RGBA contactor dropout check	+C	• Check function of RGBA and RGBA1 relays	—
F8	E_RSK_BP	SCct bypass test failure			—
FA	E_COMMCM	Communication failure PLCM		• Check cable and connections	—
FB	E_COMMCS	Communication failure PLCS		• Check cable and connections • Check 24 VDC on PLCS	—
FC	E_COMMTJ	Communication failure COUPLER TJ		• Check cable and connections • Check 24 VDC on bus coupler at TJ • Replace fuse	—

Display Code	Abbreviation	Error Message	Error Properties	Corrective Actions	Ref. Doc.
FD	E_COMMBJ	Communication failure COUPLER BJ		• Check cable and connections • Check 24 VDC on bus coupler at BJ • Replace fuse	—
FE	E_COMMVFD	Communication failure VFD		• Check cable and connections • Establish incoming power	—
FF	E_REDNCY	Redundancy check PLCM & PLCS		• Check above conditions	—
J7	E_J7	PARA verification error PLC-M/PLC-S			—

4.5 Technical Tests – J 572 812

1 General

Technical tests are performed via the technical test screen. The desired technical test is set by pressing the corresponding button on the OIT display. The test will be automatically deactivated when exiting the screen.
Technical tests are automatically deactivated, if the OIT is not used for 30 seconds.

For more detailed information, see Controller Instructions J 595 027, Operator Interface Terminal (OIT)

2 Overview of Technical Tests

The technical tests for the step band can be performed via the master or the slave PLC.

Test
Master step band overspeed 15%
Master step band high overspeed 25%
Master step band underspeed 50%
Slave step band overspeed 15%
Slave step band high overspeed 25%
Slave step band underspeed 50%
Motor overspeed 15%
Motor high overspeed 25%
Motor underspeed 50%
Instant lubrication
First lubrication
Lubrication system check

2.1 Master Step Band Overspeed 15%

Hint!

This test can only be performed during normal operation.

This test must be activated during standstill with the unit ready for operation. Start the unit in the desired direction of travel. Following start-up delay (approx. 15 seconds), the speed limit is set to a shutdown with an overspeed error "E_3E". To acknowledge the error press the reset button on the OIT display.

2.2 Master Step Band High Overspeed 25%

Hint!
This test can only be performed during normal operation.

This test must be activated during standstill with the unit ready for operation. Start the unit in the desired direction of travel. Following start-up delay (approx. 15 seconds), the speed limit is set to a shutdown with a high overspeed error "E_CF". To acknowledge the error press the reset button on the OIT display.

2.3 Master Step Band Underspeed 50%

Hint!
This test can only be performed during normal operation.

This test must be activated during standstill with the unit ready for operation. Start the unit in the desired direction of travel. Following start-up delay (approx. 15 seconds), the speed limit is set to a shutdown with an underspeed error "E_3F". To acknowledge the error press the reset button on the OIT display.

2.4 Slave Step Band Overspeed 15%

Hint!
This test can only be performed during normal operation.

This test must be activated during standstill with the unit ready for operation. Start the unit in the desired direction of travel. Following start-up delay (approx. 15 seconds), the speed limit is set to a shutdown with an overspeed error "E_30". To acknowledge the error press the reset button on the OIT display.

2.5 Slave Step Band High Overspeed 25%

Hint!
This test can only be performed during normal operation.

This test must be activated during standstill with the unit ready for operation. Start the unit in the desired direction of travel. Following start-up delay (approx. 15 seconds), the speed limit is set to a shutdown with a high overspeed error "E_CE". To acknowledge the error press the reset button on the OIT display.

2.6 Slave Step Band Underspeed 50%

Hint!
This test can only be performed during normal operation.

This test must be activated during standstill with the unit ready for operation. Start the unit in the desired direction of travel. Following start-up delay (approx. 15 seconds), the speed limit is set to a shutdown with an underspeed error "E_31". To acknowledge the error press the reset button on the OIT display.

2.7 Motor Overspeed 15%

Hint!
This test can only be performed during normal operation.

This test is only available when the unit is equipped with a speed monitor.
This test must be activated during standstill with the unit ready for operation. Start the unit in the desired direction of travel. Following start-up delay (approx. 15 seconds), the speed limits are set to a shutdown with a motor overspeed error "E_18". To acknowledge the error, press the RESET button on the OIT display.

2.8 Motor High Overspeed 25%

Hint!
This test can only be performed during normal operation.

This test is only available when the unit is equipped with a speed monitor.
This test must be activated during standstill with the unit ready for operation. Start the unit in the desired direction of travel. Following start-up delay (approx. 15 seconds), the speed limits are set to a shutdown with a motor overspeed error "E_CC". To acknowledge the error, press the RESET button on the OIT display.

2.9 Motor Underspeed 50%

Hint!
This test can only be performed during normal operation.

This test is only available when the unit is equipped with a speed monitor.
This test must be activated during standstill with the unit ready for operation. Start the unit in the desired direction of travel. Following start-up delay (approx. 15 seconds), the speed limits are set to a shutdown with a motor underspeed error "E_1C". To acknowledge the error, press the RESET button on the OIT display.

2.10 Instant Lubrication

Hint!

This test can be activated both during inspection and normal operation, whereas the lubrication cycle itself can only be activated during normal operation.

The current lubrication off-period is set to 0, thus starting a new lubrication cycle. The lubrication fault is reset.

The start of the lubrication cycle can be delayed by up to 10 seconds.

If the technical test is activated, the solenoid valves for all grease points are activated successively. The grease point can be changed by pressing the "Next grease point" button, thus switching over to the next grease point. After the last grease point, lubrication is stopped and the overtravel time is set to 2 seconds.

For more detailed information, see Controller Instructions J 595 027, Operator Interface Terminal (OIT)

2.11 First Lubrication

Hint!

This test can only be activated during normal operation of the escalator.

This test is used for the initial lubrication. The technical test starts 3 successive complete lubrication cycles during normal operation. This initial lubrication is a prerequisite for an optimum lubrication of the chains.

Once the 3 successive lubrication cycles are successfully completed, the test is exited automatically.
If the unit is stopped or if a lubrication fault occurs, the counter is automatically stopped.

For more detailed information, see Controller Instructions J 595 027, Operator Interface Terminal (OIT)

2.12 Lubrication System Check

Hint!

This test can be activated both during operation of the escalator as well as during standstill.

This technical test is used to fill the lubrication system, to check the lubrication system for leakages, to check the operation of every single grease point and to fill the distributor.

For more detailed information, see Controller Instructions J 595 027, Operator Interface Terminal (OIT)

4.6 Monitoring Functions – J 572 814

1 Network System

The PLC controller communicates with the I/O modules via the Modbus TCP/IP bus system. In case of any abnormal activities on the data bus, the controller shuts down the unit and displays the related error code on the OIT screen.

2 Brake Systems

The escalator is equipped with a drive brake system and the safety brake.

The drive brake system consists of the service brake. This brake is equipped with a brake release contact and a second contact which is engaged in case of a manual brake release. In addition, the brake pad wear is monitored by a limit switch.

The brake solenoid which is used for the safety brake is equipped with two contacts which are used to monitor the status of the solenoid.

2.1 Service brake

The service brake is checked to be engaged during standstill and to be released during travel. In the event of a failure, the error code "E_34" is displayed.
The service brake is monitored via the input (brake solenoid).

2.2 Safety Brake

The safety brake is checked to be engaged during standstill and to be released during travel.
If the safety brake does not pick up, the unit is shut down immediately with the error "E_35".

If the safety brake pawl has engaged, the brake can only be released again by an upward travel in inspection mode.

The check-back signal of the safety brake is wired to their own input. The safety brake is monitored via the input MGBA (standard brake solenoid active). The error code "E_35" corresponds to a failure of the safety brake.

3 Safety Switches and Sensors

Safety switches have two independent contacts, one normally closed (NC) for the safety circuit and one normally open (NO) for signaling. In each switch, the NO contact is wired directly to an input point to enable the PLC to monitor each safety device. For the purpose of redundancy, all NC contacts of the safety devices are wired in series providing a hard-wired safety circuit to the controller. Each set of contacts within the switch operates independently. The escalator can be stopped either by the NC or the NO contact.

In addition to the safety devices, the controller monitors the speed of the motor, the left and right handrails and the step band; each device must operate within predetermined limits to allow the escalator to run. In addition, an algorithm based on feedback information from the monitoring sensors determines the absence of a step from the escalator.

3.1 Speed Monitor

The speed monitor is always active, except during inspection operation.
In the drive station, the speed is monitored by the main PLC and the INVK-T sensor. In the return station, the speed is monitored by the main PLC and the INVK-B sensor.

The error code for master overspeed 115% is "E_3E", for master overspeed 125% "E_CF", and for master underspeed "E_3F". The error code for slave overspeed 115% is "E_30", for slave overspeed 125% "E_CE", and for slave underspeed "E_31".These errors are electronically interlocked as standard.

With 25% overspeed, the safety brake engages in addition to the service brake.

Tolerance limits in rated operation:

- Overspeed 115%: maximum of 15% above rated speed
- Overspeed 125%: maximum of 25% above rated speed
- Underspeed: 50% below rated speed

Tolerance limits at standstill:

- Overspeed: 0.05 m/s
- Underspeed not possible

3.2 Missing-Step Check

The PLC checks whether any steps are missing. The 2 step sensors INVK-B and INVK-T and the motor speed sensor INBMG are used for this monitoring function.
The pulses from the step band initiators (INVK-T, INVK-B) and the motor speed sensor (INBMG) are compared for the missing-step check.

Error codes:
"E_39" PLC-S for missing step, top (INVK_T1)
"E_3A" PLC-S for defective initiator, top (INVK_T2)
"E_3B" PLC-S for missing step, bottom (INVK_B1)
"E_3C" PLC-S for defective initiator, bottom (INVK_B2)

"E_F0" PLC-M for missing step, top (INVK_T4)
"E_EC" PLC-M for defective initiator, top (INVK_T3)
"E_E7" PLC-M for missing step, bottom (INVK_B3)
"E_F1" PLC-M for defective initiator, top (INVK_B4)

3.3 Handrail Speed Check

The handrail speed is monitored with the INHL-L and INHL-R sensors, whereas the step band speed is measured with INVK-T and INVK-B.

The monitor is not active until the rated operation phase has started (10 sec. after start-up).
If the speed difference between either handrail and the step band exceeds 15%, the unit is shut down with a time delay of 5 seconds. A buzzer sounds during this time .

Error codes:
"E_32" for PLC-M for left handrail (INHL_ML)
"E_33" for PLC-M for right handrail (INHL_MR)

3.4 Key Switch Check

After every contactor dropout check, the key switches are checked to ensure that they are in the OFF position.
If they are in the ON position, the digital display reads "00" until the key switches are in the OFF position.

3.5 Contactor Dropout Check

Each main and auxiliary contactor provides a signal via a normally closed contact to the PLCM or PLCS for a dropout check which is carried out every time the escalator stops. To maintain a high integrity level, the contactors which are controlled by the PLCM are monitored by the PLCS and vice versa.
The SSK and SSK1 are activated by the PLCM and the PLCS respectively and when the safety circuit is closed, the dropout check is completed successfully and a command is issued for starting in either direction.

During the contactor dropout check the error "E_25" may occur.

3.6 Anti-Reversing Device

The anti-reversing monitoring function is active as soon as the escalator starts up. If the direction of rotation of the motor does not match the requested direction of rotation of the escalator, the unit is shut down with the fault code "E_26". This function is realized by the incremental encoder installed on the motor shaft.

3.7 Motor Speed Monitor

The motor speed is monitored during rated operation. The motor speed is measured by the high-speed counter and the IBMG sensor and compared to the tolerance limits.

Tolerance limits in rated operation:

- Overspeed 115%: maximum of 15% above rated speed
- Overspeed 125%: maximum of 25% above rated speed
- Underspeed: 50% below rated speed

With 25% overspeed, the safety brake engages in addition to the service brake.

Error codes:
"E_18" for 15% overspeed
"E_CC" for 25% overspeed
"E_1C" for underspeed

3.8 Braking Distance

The braking distance is measured and if the braking distance is not within the limits of 200 mm and 300 mm, the unit is switched off with the error "E_EA".

4.7 Control Functions – J 572 815

1 Escalator Drive

- Normal or continuous operation

  In normal operation, the escalator can be started only by means of the start/stop key switch in either direction. The motor starts directly on-line via the frequency converter in soft start mode.

- Manual operation

  In manual operation, the escalator can only be run in either direction by means of the maintenance operating panel. The motor runs via the frequency converter and at inspection speed which is specified by the customer (usually 10% of nominal speed).

2 GFU Plus Frequency Converter

The GFU Plus frequency converter has a built-in braking unit and is equipped with the necessary dynamic braking resistor bank to enable the drive to run the escalator under all load conditions as specified by the contract and in any direction.

The GFU Plus provides a nominal speed of 0.5 m/s (100 fpm) that cannot be altered and an inspection speed that can be adjusted from 0.05 m/s (10 fpm) to 0.5 m/s (100 fpm).

3 Brake System

The brake system is composed of the drive brake system as well as the safety brake system.

3.1 Service Brake System

The drive brake system consists of the service brake. This brake is mounted laterally outside the gearbox. The brake disk is directly connected to the gear shaft.

For more detailed information, see Volume VJ, Renold_O&M_Manual.pdf

3.2 Safety Brake System

A safety brake is mandatory for all chain-driven escalators. The brake is applied to the main drive shaft.

For more detailed information, see Maintenance Instructions Q 409 710, Safety Brake

If any PLC module reports a safety brake-related error, the unit is shut down and the safety brake is engaged.

The safety brake engages in the following cases:

- breakage or excessive elongation of the drive chain (without delay)
- 25% overspeed (without delay)
- power failure (with time delay)

4 Dry Contacts

The escalator is equipped with dry contacts, i.e., voltage-free contacts. They are used for visual and audible indications on the remote status panel.
The dry contacts are released during inspection operation and in the "Engineer on Site" mode. This does not apply to the following relay:
The RSKM is triggered.

4.1 RSKM

The RSKM outputs an added-up error message, except for key switch stop "E_41".
If there is no fault, the relay is picked up.

4.2 RHM

The RHM is triggered when an emergency stop button (DH) is pressed. It is reset either at the next start or when the operating system is restarted.

4.3 RR-U, RR-D

The relay for the corresponding direction is picked up when the unit is in continuous or automatic operation and no errors or stop commands have occurred.

4.4 RSKSUM, RHSUM

The relay is energized when an error is present and the emergency stop button is activated respectively. It is reset either at the next start or when the operating system is restarted.

4.5 RON

This relay is always energized when the escalator is running in the up or down direction for either continuous or inspection mode.

5 Direction Indicators

Direction indicators are used to signal to the passengers as to whether they can enter the escalator from the respective landing or not.

The green direction indicators are activated for the corresponding direction when the unit is in continuous operation and no errors or stop commands have occurred.
The red direction indicators for the corresponding direction are illuminated when the unit is in continuous operation and no errors or stop commands have occurred or when the unit is at a standstill.

6 Lighting

The escalator lighting system comprises the step gap lighting, the combplate lighting and the skirt lighting. The step gap lighting, the combplate ligthing and the skirt lighting are switched on when the unit is in continuous operation.

7 Buzzer

Each emergency stop button, installed at the top and bottom landings, is equipped with a buzzer as an audible alarm signal for the passengers.

The buzzer or a siren is activated by the software in the following cases:

- Handrail underspeed
- Cover contact of the emergency stop button (DH)
- During an emergency stop and with a specified delay
- Smoke detector in the unit with a specified delay

  If the smoke detector detects smoke in the unit, the buzzer is activated for the specified time. The unit is shut down after this time has elapsed.

8 Heating Control

The heating system only works when the escalator controller is powered. The top heater box is equipped with a heating disconnect switch in the door. In continuous mode, the heating works with the PT 100 sensor control.

For more detailed information, see Controller Instructions J 595 001, MICONIC F PLC Heating and Cooling Control

9 Automatic Lubrication

The automatic lubrication system with piston pump consists of a piston pump and one valve for each grease point. This allows accurate lubrication of every single grease point.

The oil level is permanently monitored. If the oil level is below minimum, no lubrication can be started and the OIT error screen displays a message. This warning disappears when oil is refilled. For the lubrication off-period, the distance traveled by the step band is measured in kilometers.

At the beginning of a lubrication cycle, the system is tested for leakages. The piston pump is operated with a timing interval of 1 sec. After 100 strokes at the most, the pressure switch has to confirm the leak tightness of the system. If the system is leaking, lubrication is stopped with an error. Upon completion of the leakage test, the pressure is released via the valves of the step chains.
The timing interval of the piston pump during lubrication of the chains depends on the motor speed. (Lubrication in sleep mode is possible.) With piston pumps with two 60-mm³ strokes, the pump's stroke interval for the short chains (drive and handrail drive chain) is twice as long as for the step chain.

The chains are lubricated in the following order:

- Right step chain
- Left step chain
- Right secondary handrail drive chain
- Left secondary handrail drive chain
- Main handrail drive chain
- Drive chain

If a valve does not open, the pressure switch signals the higher pressure after some strokes with an error. If the pressure in the distributor is not released within the next 5 seconds, the error is stored and the system switches to the next grease point. During the next lubrication cycle, the system tries to reactivate the malfunctioning valve.

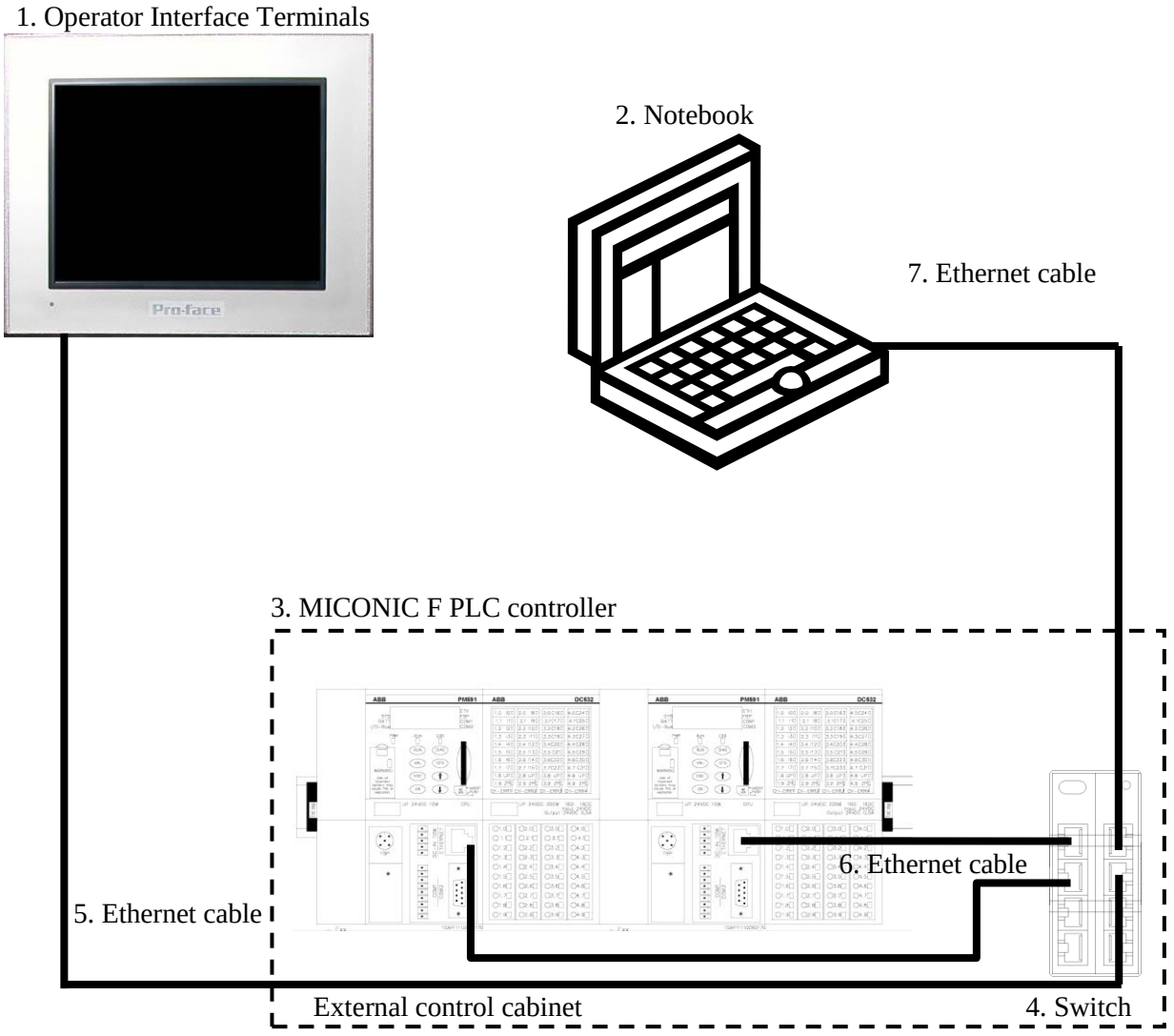
If the unit is stopped during lubrication, lubrication continues on the next normal run.

The lubrication system is equipped with an oil reservoir heating. The heater is mounted in the top plate of the oil reservoir and wired in series with a thermostat switch. The thermostat opens at 53 °F (11.7 °C) and closes at 38 °F (3.3 °C) and is only activated when the heating system is activated.

4.8 Operator Interface Terminal (OIT) – J 595 027

1 General Information

1.1 Controller Layout

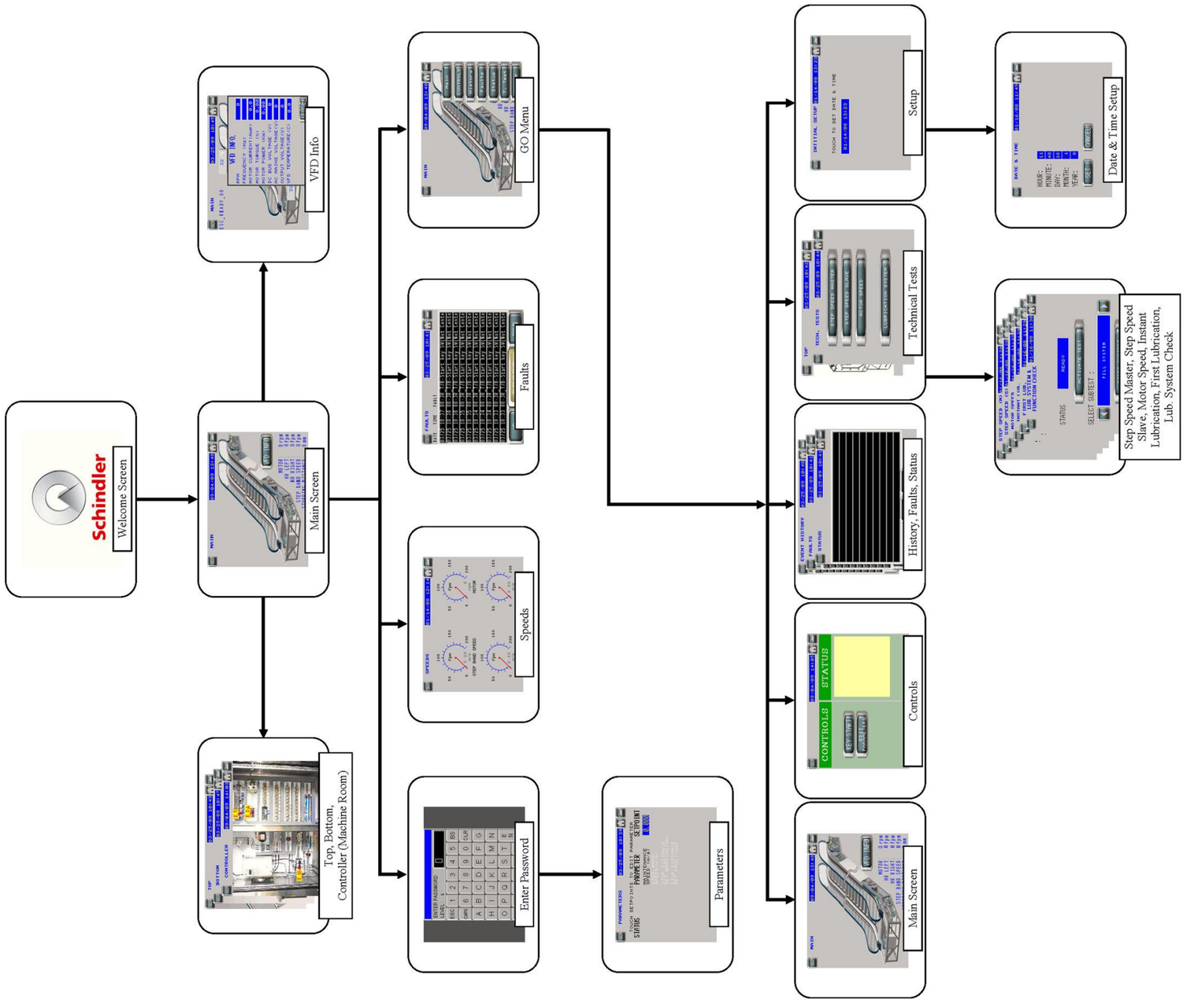


1.2 Function Description of the OIT

The OIT (Operator Interface Terminal) is an interfacing system of the Schindler MICONIC F PLC control system. The OIT communicates with the controller in real time and shows the status of the escalator and displays error codes, statistics and other useful information. Via the OIT, the operator can reset any electronically interlocked errors, review statistics of the escalator, and run various technical tests. The OIT provides an interface between the escalator and the customer/operator, thus making it easier to stay informed about all escalator states.

2 Operating Instructions – OIT External Control Cabinet

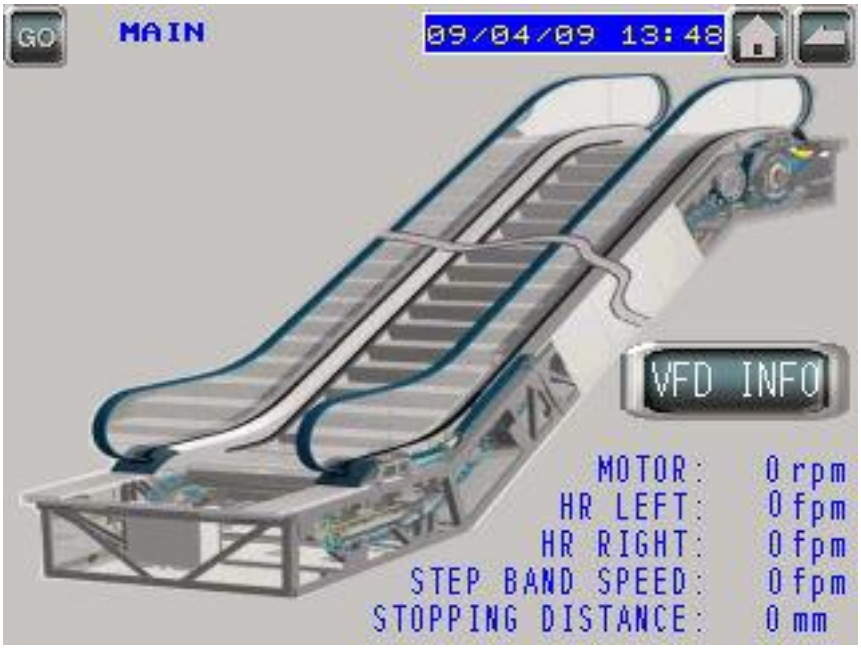
2.1 Overall Screen Structure



2.1.1 Welcome Screen

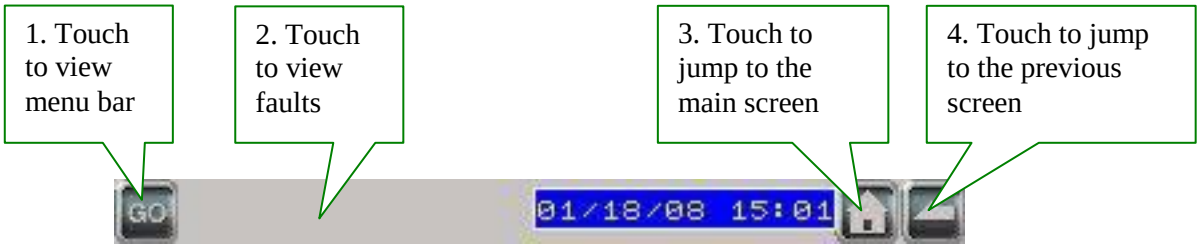
- When the OIT is powered, the following screen is displayed.

- Touch anywhere on the above screen to display the following screen.



2.1.2 Toolbar

- The following toolbar is accessible from all screens (except for the welcome screen).



2.1.2.1 Go Menu

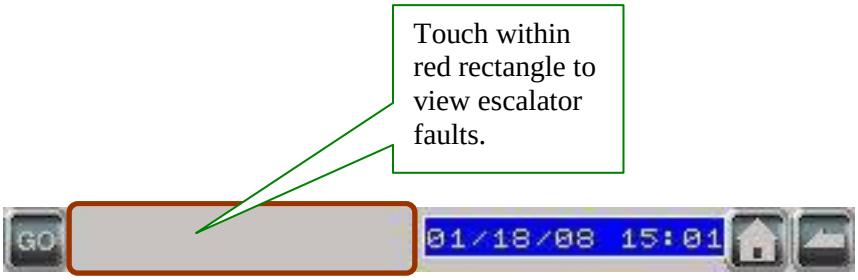
- Touch **[**GO**]** on the toolbar to display the following menu options.

- Touch anywhere outside the above menu on the screen to exit.

> For more detailed information about the different menu options, see Section 2.1.4, Accessing the Menu Bar [GO]

2.1.2.2 Jumping to the Fault Screen

- Touch anywhere within the area enclosed by the red rectangle on the toolbar to view escalator faults from any screen.



2.1.2.3 Jumping to the Main Screen

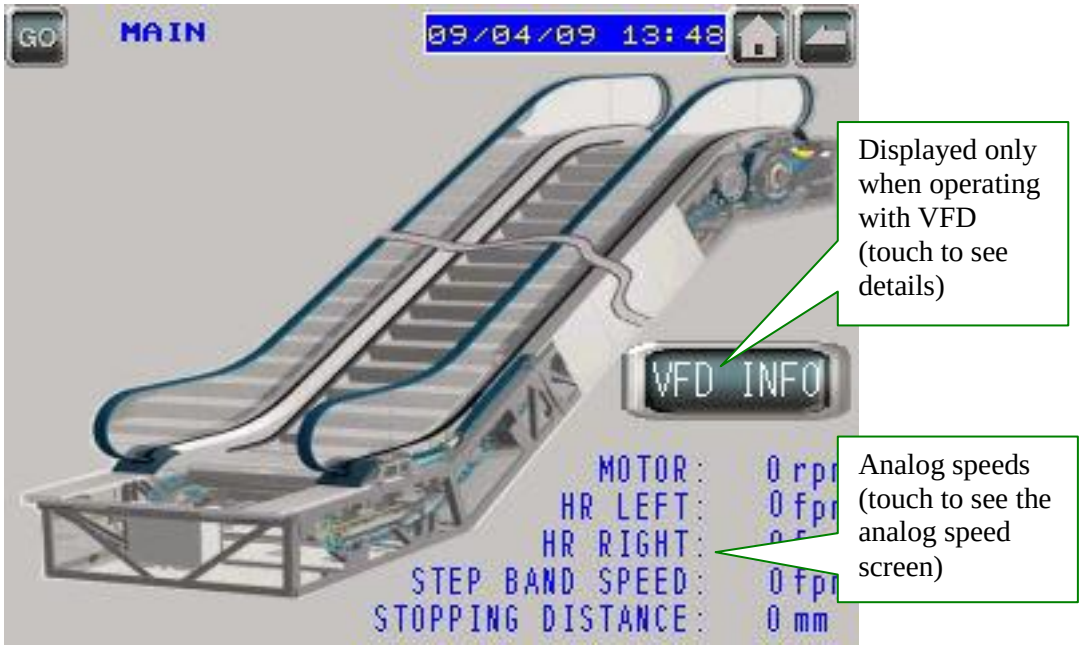
- To jump to the main screen from any screen, touch the following button on the toolbar.

2.1.2.4 Jumping to the Previous Screen

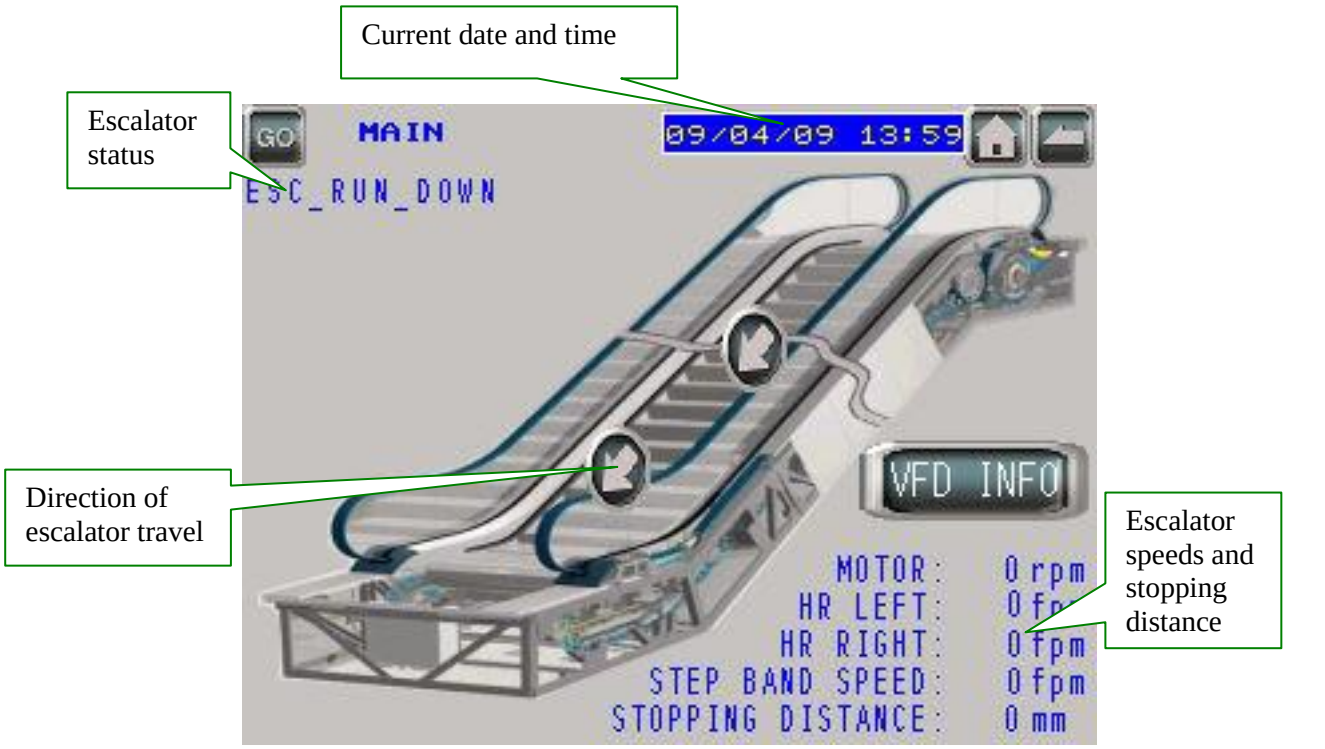
- To jump to the previous screen, touch the following button on the toolbar.

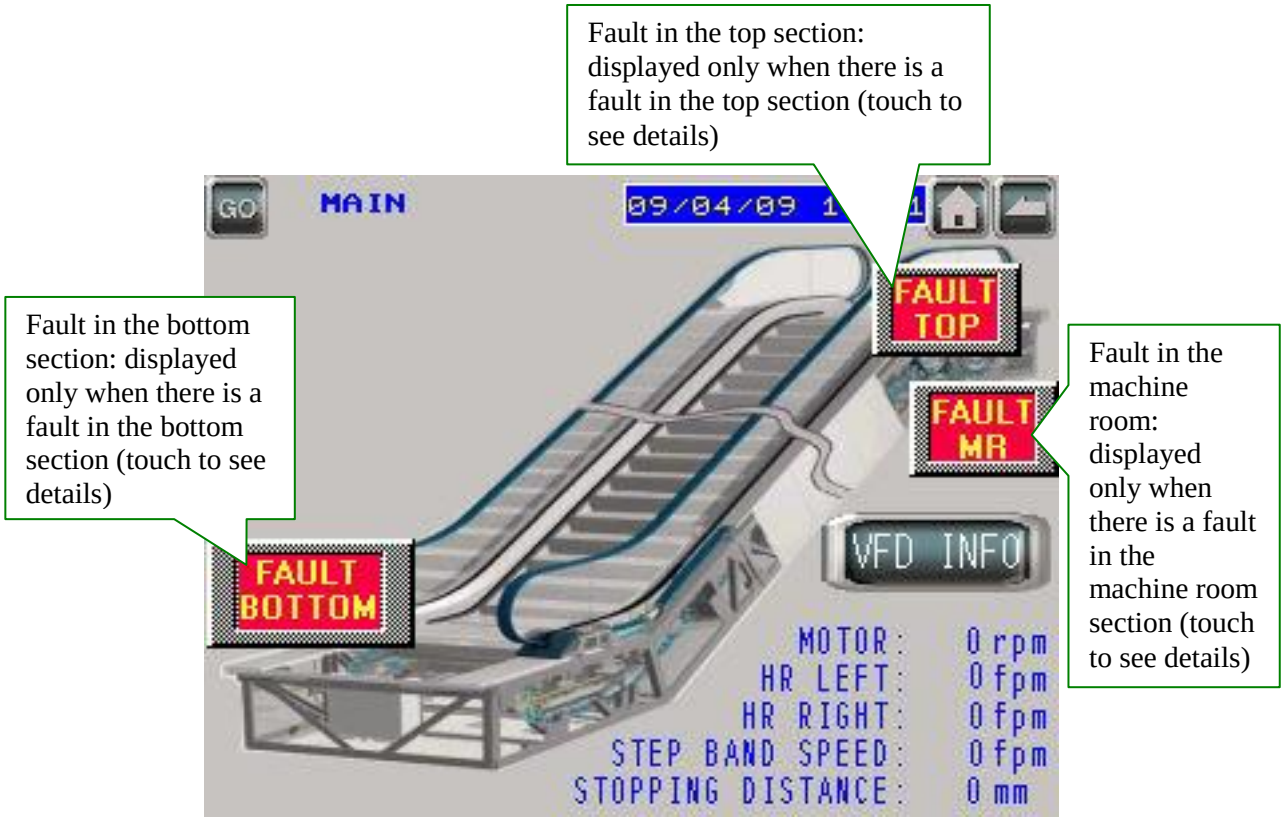
2.1.3 Main Screen

- Touch anywhere on the welcome screen to display the following screen.
- Press anywhere in the labeled sections to go to the desired screens.



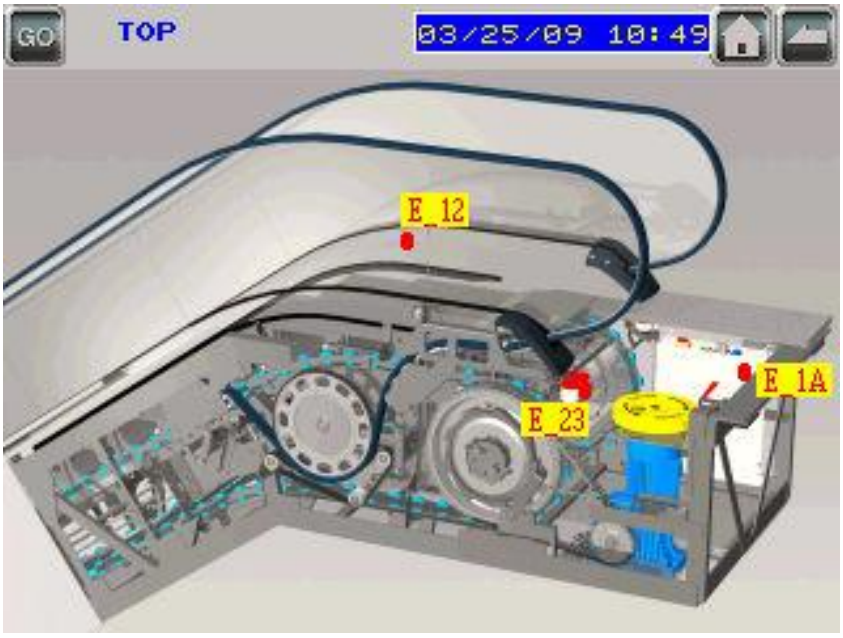
- In addition to the above options, the following information can also be viewed from/on the main screen.





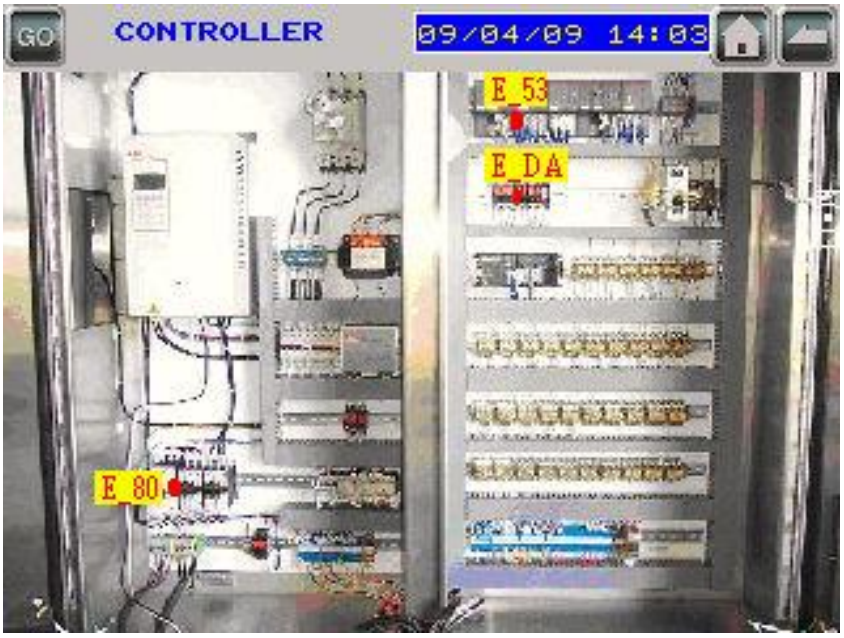
2.1.3.1 Viewing Faults in the Top Section of the Escalator

- The fault flag [FAULT TOP] pops up automatically on the main screen whenever there is a fault in the top section of the escalator.
- Touch this flag to see the exact location of the fault in the top section of the escalator.



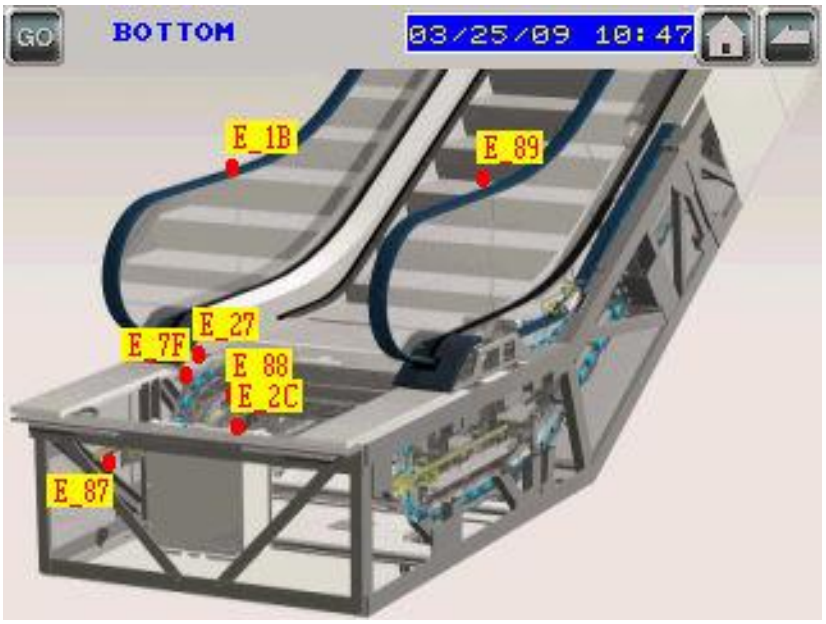
2.1.3.2 Viewing Faults in the Machine Room

- The fault flag [FAULT MR] pops up automatically on the main screen whenever there is a fault in the machine room (controller).
- Touch this flag to go to the controller screen.



2.1.3.3 Viewing Faults in the Bottom Section of the Escalator

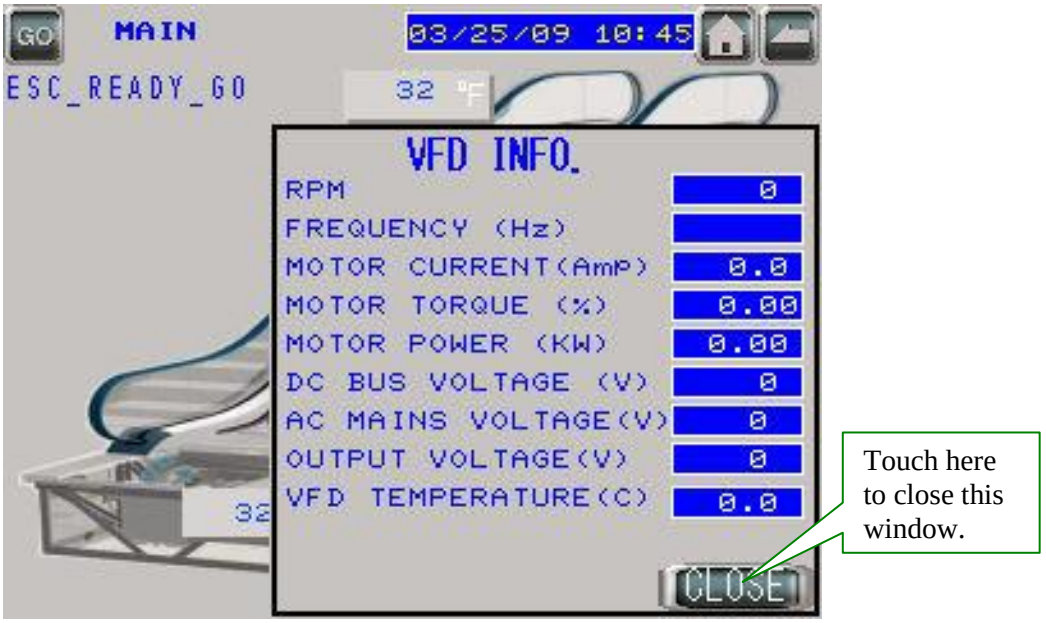
- The fault flag [FAULT BOTTOM] pops up automatically whenever there is a fault in the bottom section of the escalator.
- Touch this flag to see the exact location of the fault in the bottom section of the escalator.



2.1.3.4 Viewing the Variable Frequency Drive Information

Hint!
The [VFD INFO] button is used to view VFD information.

- Touch this button to display the VFD information in a pop-up window.



- Touch [CLOSE] to close the VFD INFO window.

2.1.4 Accessing the Menu Bar [GO]

- Touch [GO] in the top left corner to display the following menu bar.

Hint!

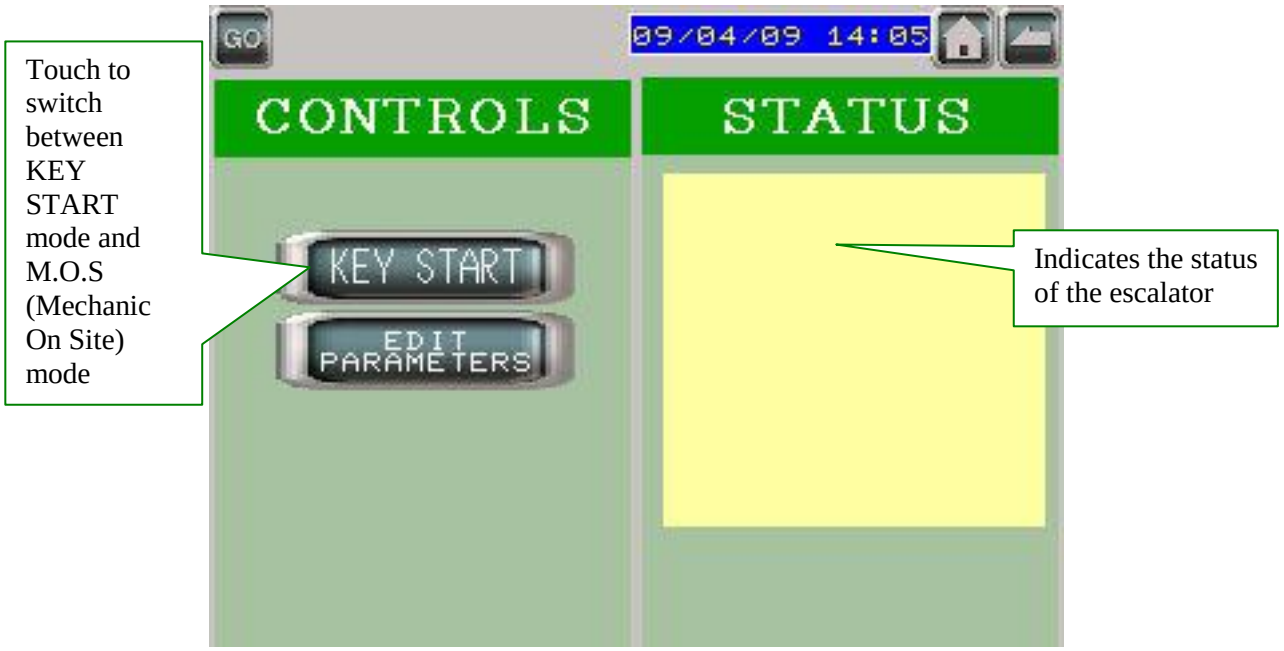
The menu can be accessed from all screens by touching [GO] in the top left corner.

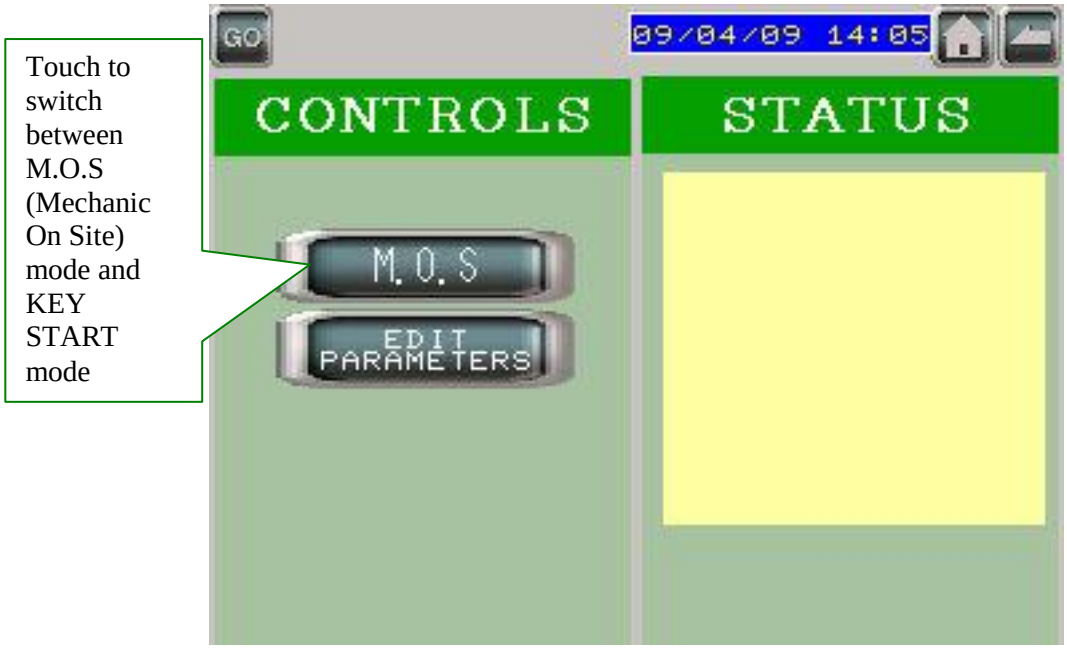
2.1.4.1 Jumping to the Main Screen Using the Menu

- Touch [GO] and then [Main] on any screen to display the main screen.

2.1.4.2 Jumping to the Controls Screen Using the Menu

- Touch [GO] and then [CONTROLS] on any screen to display the Controls screen.





- Touch [EDIT PARAMETERS] to go to the Edit Parameters screen.

For more detailed information, see Section 2.2, Changing the Escalator Parameters (Password Required)

2.1.4.3 Jumping to the Event History Log Screen Using the Menu

- Touch [GO] and then [History] on any screen to display the event history screen.

- The event history screen displays the event history log for the escalator along with the date and time at which the events occurred.
  - All status messages
  - All active fault messages
- Use [UP] and [DOWN] to scroll through the list.

Hint!

The event history log can be downloaded to a USB stick and can then be viewed as a MS Excel document.

For more detailed information, see Section 2.4.1, Downloading the Event History Log From the Event History Screen

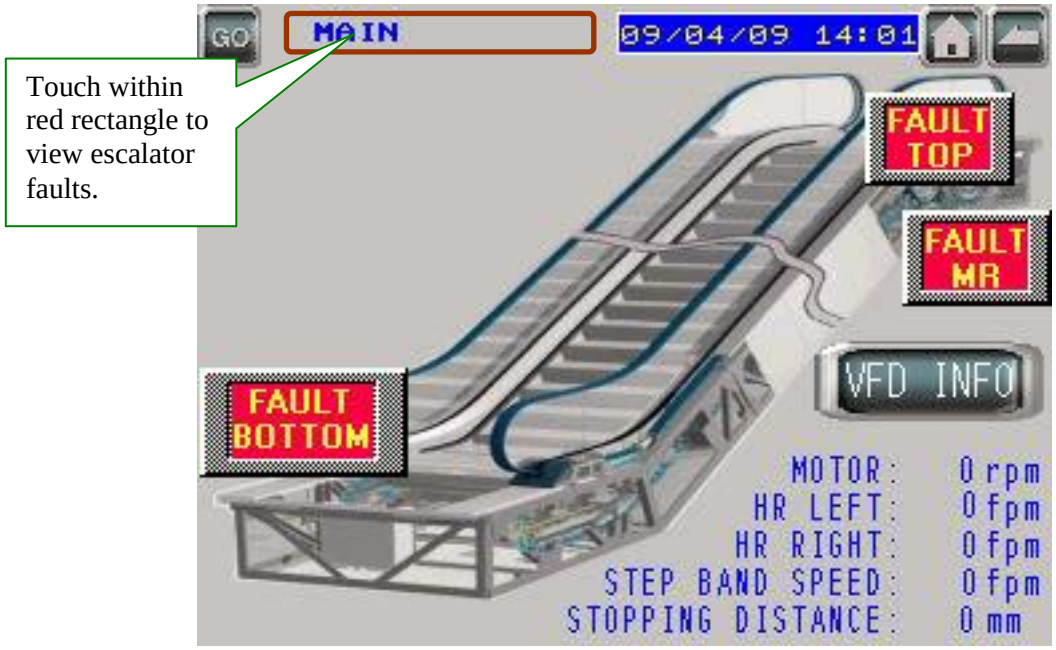
2.1.4.4 Jumping to the Faults Screen Using the Menu Bar

- Touch [GO] and then [Faults] on any screen to go to the faults screen.

- The faults screen displays escalator faults along with the date and time at which the faults occurred.
- Use [UP] and [DOWN] to scroll through the list.
- Use [RESET] to reset the occuring faults. A reset is only possible upon removal of the cause.

Hints!

- The escalator fault window pops up automatically as soon as a fault occurs in the escalator or machine room.
- Escalator faults can be accessed from any screen (except for the FAULT screen itself, the EVENT HISTORY Screen and the STATUS screen) by touching within the area enclosed by the red rectangle in the figure below.



2.1.4.5 Jumping to the Status Screen Using the Menu

- Touch [GO] and then [Status] on any screen to go to the status screen.

- The status screen displays the escalator status.
- Use [UP] and [DOWN] to scroll through the list.

2.1.4.6 Jumping to the Technical Tests Screen Using the Menu

- Touch [GO] and then [T. Test] on any screen to go to the technical tests screen.

- The following tests **cannot** be performed if the escalator is running and the following screen is displayed:
  - STEP SPEED MASTER
  - STEP SPEED SLAVE
  - MOTOR SPEED

Technical test "STEP SPEED MASTER"

- Touch [STEP SPEED MASTER] on the technical tests screen.

Hint!
The escalator must be at standstill.

- The following screen is displayed.

- The desired test can then be selected by touching one of the three touch buttons.
  - 50% UNDERSPEED
  - 15% OVERSPEED
  - 25% OVERSPEED

  Example: When [50% UNDERSPEED] is touched, the STATUS on this screen changes from READY to ACTIVE.

- Upon selection of a specific test, the operator can start the escalator, and with a delay of approximately 15 seconds the selected test simulates forcing the escalator to shut down.

Technical test "STEP SPEED SLAVE"

- Touch [STEP SPEED SLAVE] on the technical tests screen.

Hint!
The escalator must be at standstill.

- The following screen is displayed.

- The desired test can then be selected by touching one of the three touch buttons.
  - 50% UNDERSPEED
  - 15% OVERSPEED
  - 25% OVERSPEED

  Example: When [50% UNDERSPEED] is touched, the STATUS on this screen changes from READY to ACTIVE.

- Upon selection of a specific test, the operator can start the escalator, and with a delay of approximately 15 seconds the selected test simulates forcing the escalator to shut down.

Technical test "MOTOR SPEED"

- Touch [MOTOR SPEED] on the technical tests screen.

Hint!
The escalator must be at standstill.

- The following screen is displayed.

- The desired test can then be selected by touching one of the five touch buttons.
  - 50% UNDERSPEED
  - 15% OVERSPEED
  - 25% OVERSPEED

  Example: When [50% UNDERSPEED] is touched, the STATUS on this screen changes from READY to ACTIVE.

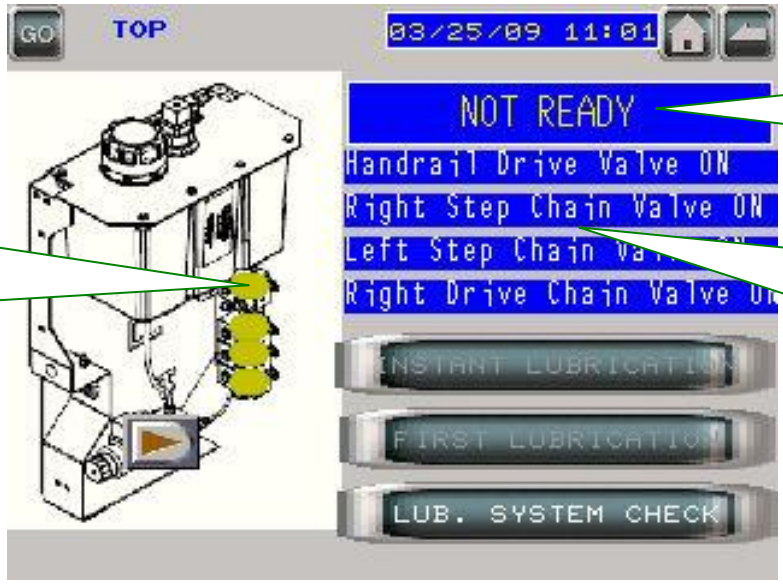
- Upon selection of a specific test, the operator can start the escalator, and with a delay of approximately 15 seconds the selected test simulates forcing the escalator to shut down.

Technical tests "LUBRICATION SYSTEM"

- Touch [LUBRICATION SYSTEM] on the technical tests screen to display the following screen.

Hint!
The sub-test buttons are active when the escalator is on.

Indicates that piston pump is ON



Indicates that valves are ON: with respect to the status message to the right

Status of the lubrication system

Status messages: with respect to the valve indicator to the left

Technical test "INSTANT LUBRICATION"

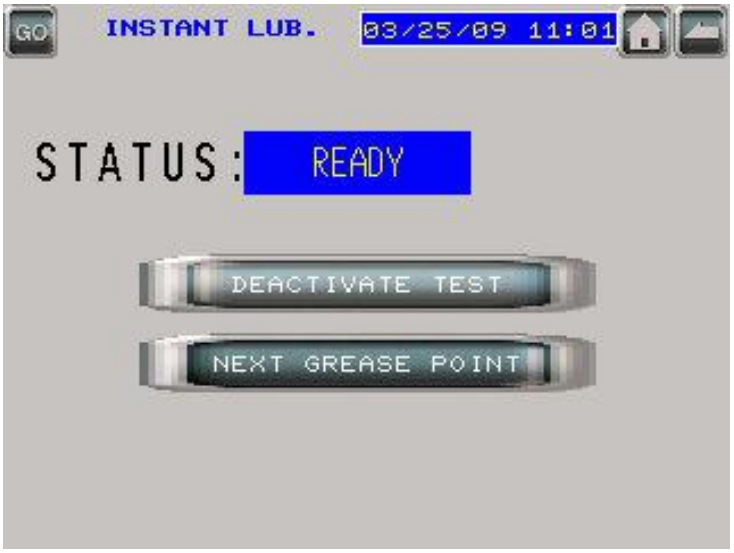
- Touch [INSTANT LUBRICATION] on the Lubrication System screen.

Hint!

To carry out instant lubrication, the escalator must be running.

- The following screen is displayed.

- Touch [ACTIVATE TEST] to perform the test. The following screen is displayed.
- The test can be deactivated at any point by touching [DEACTIVATE TEST] once the test is active.



- Upon activation of the instant lubrication test, the solenoid valves for the grease points are successively activated.

Hint!

The operator has the option to manually switch from one solenoid valve to the next by touching [NEXT GREASE POINT] on the above screen.

- Upon completion of the technical test, the following screen is displayed.

Technical test "FIRST LUBRICATION"

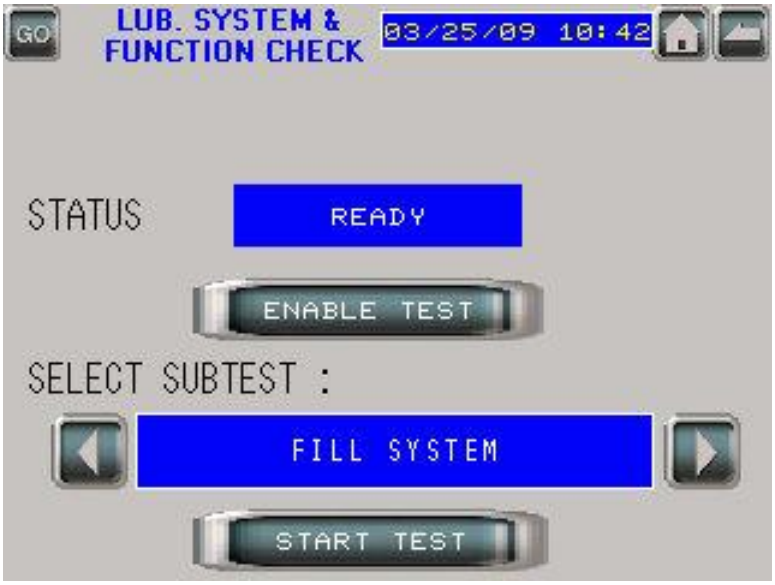
- Touch [FIRST LUBRICATION] on the Lubrication System screen.
- The following screen is displayed.

- Touch [ACTIVATE TEST] to perform the test.

- The test can be deactivated at any point by touching [DEACTIVATE TEST] once the test is active.

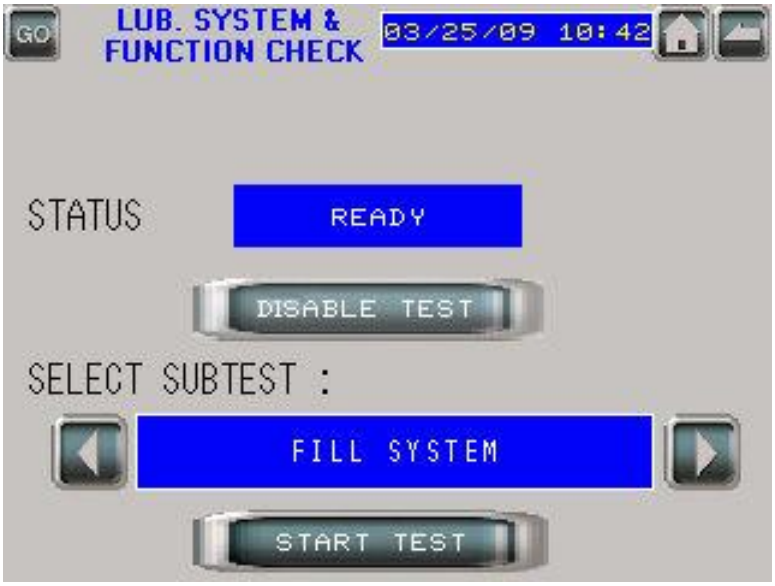
Technical test "LUBRICATION SYSTEM CHECK"

- Touch [LUB. SYSTEM CHECK] on the Lubrication System screen.
- The following screen is displayed.



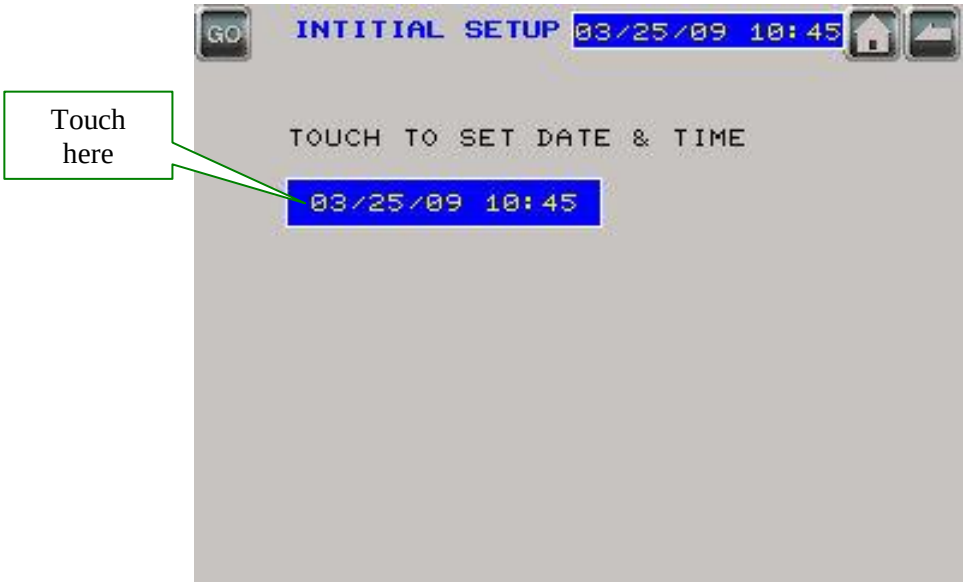
- Touch [ENABLE TEST] to start one of the subtests.

- Use the left and the right scroll buttons in the SELECT SUBTEST section to scroll through the following subtests:
  - FILL SYSTEM
  - LEAKAGE CHECK
  - RIGHT STEP CHAIN
  - LEFT STEP CHAIN
  - RIGHT HANDRAIL DRIVE CHAIN
  - LEFT HANDRAIL DRIVE CHAIN
  - MAIN HANDRAIL DRIVE CHAIN
  - RIGHT DRIVE CHAIN
  - FILL DISTRIBUTOR
- Upon selection of the desired subtest, touch [START TEST] to activate the selected subtest.
- To stop the subtest at any point, touch [DISABLE TEST] in the STATUS section of this screen.

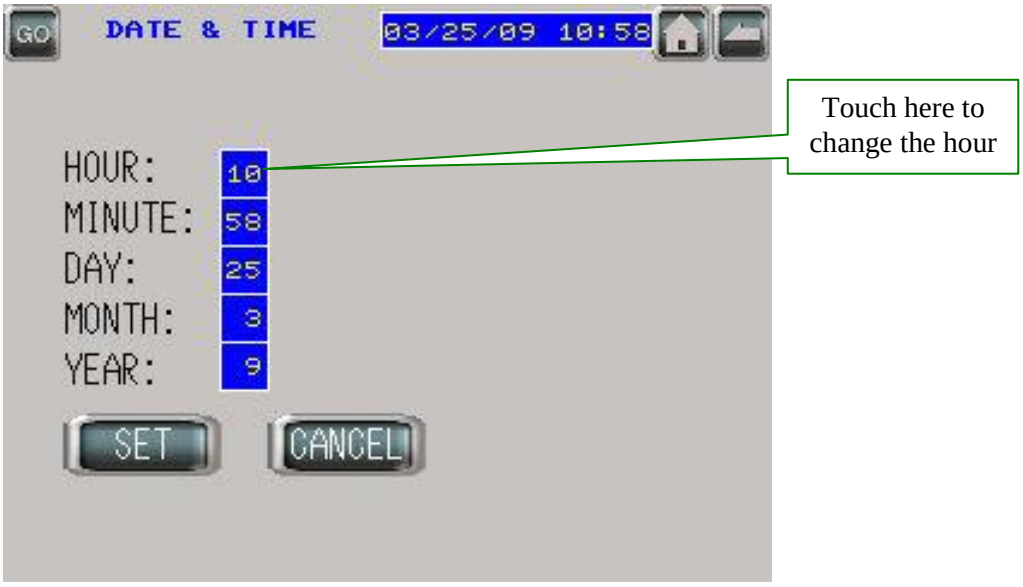


2.1.4.7 Jumping to the Initial Setup Screen Using the Menu

- Touch [GO] and then [Setup] on any screen to go to the initial setup screen.
- The following screen is displayed.



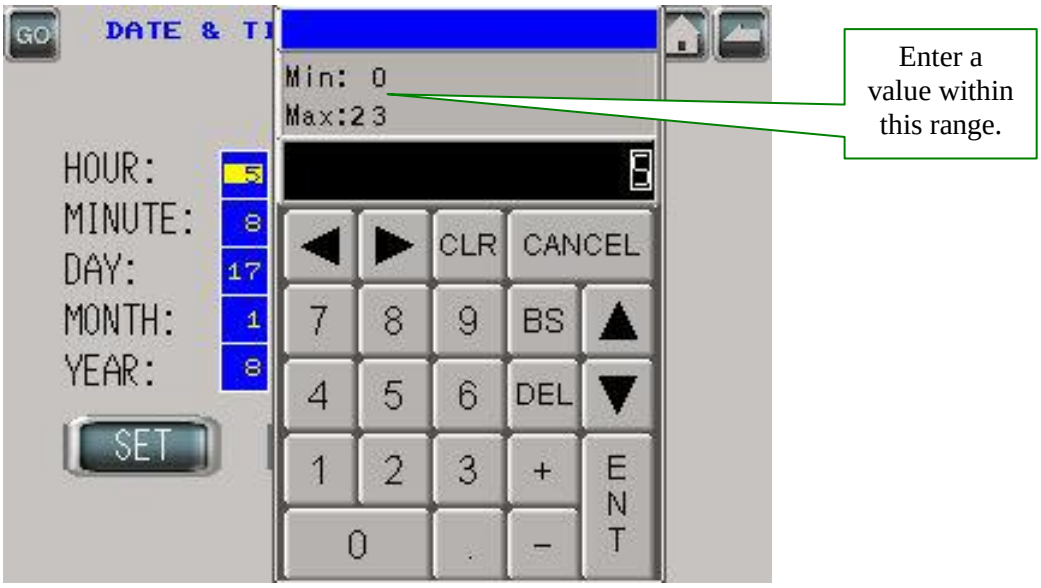
- Touch the blue field on the above screen to display the following screen.



- Touch the blue squares next to HOUR, MINUTE, DAY, MONTH and YEAR to set the hour, minute, day, month and year respectively.

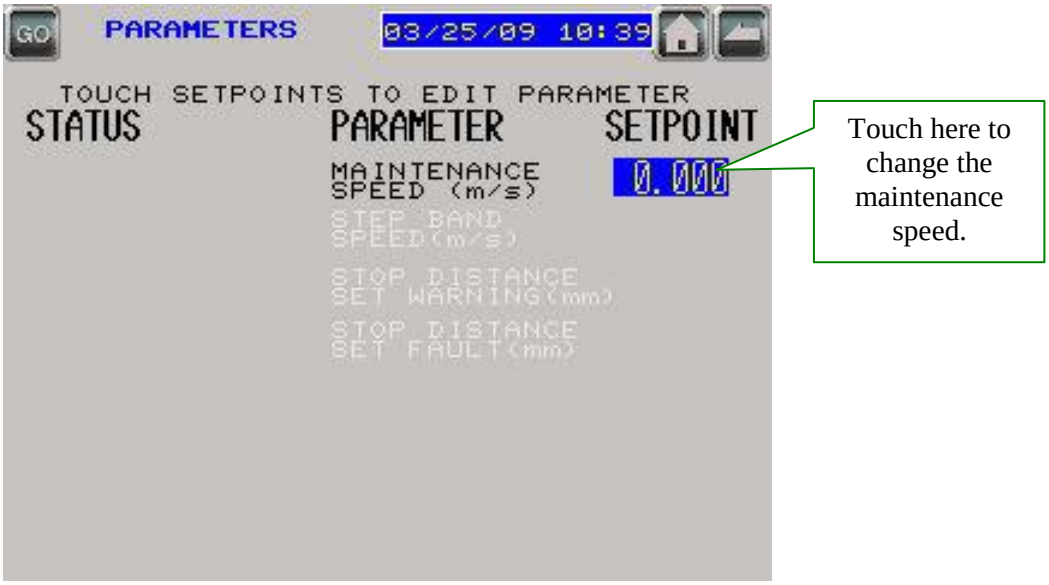
Example: Changing the hour

– Upon touching the blue square next to HOUR, a keypad pops up.
– Use the keypad to set the HOUR value, then touch [SET] on the DATE & TIME screen to change the hour setting.



2.2 Changing the Escalator Parameters (Password Required)

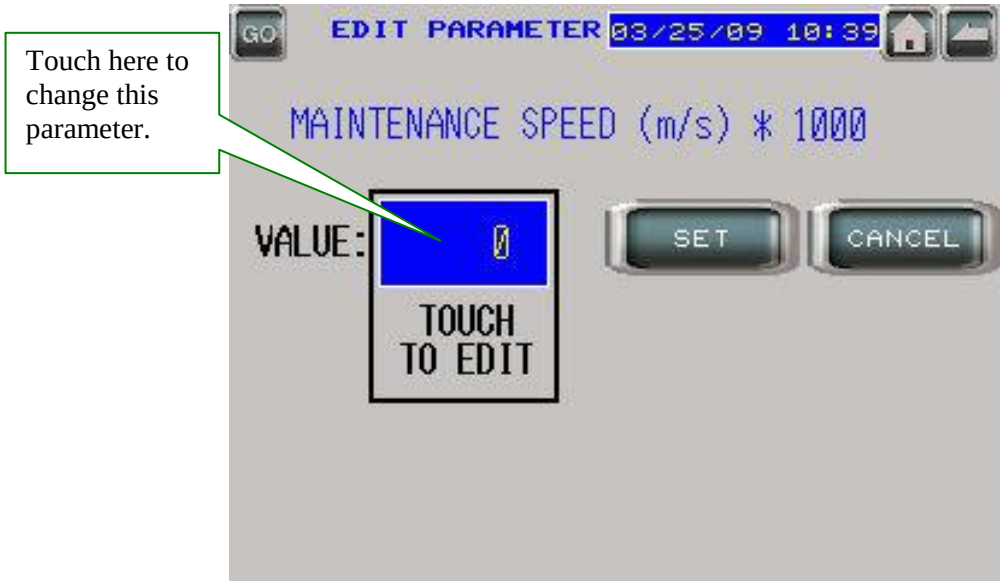
- Touch [EDIT PARAMETERS] on the Controls screen to display the Parameters screen.
- The operator can change the below parameters of the escalator. All other parameters are not accessible and cannot be changed.
  - MAINTENANCE SPEED



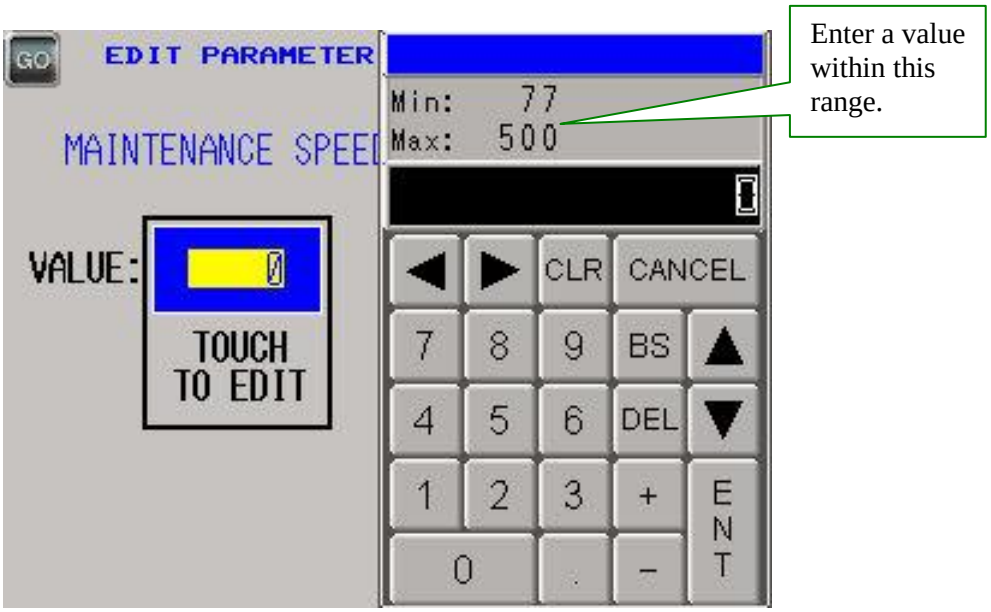
- Upon touching the blue field next to the parameter that needs to be changed, the EDIT PARAMETER screen is displayed.

  Example: Changing the maintenance speed

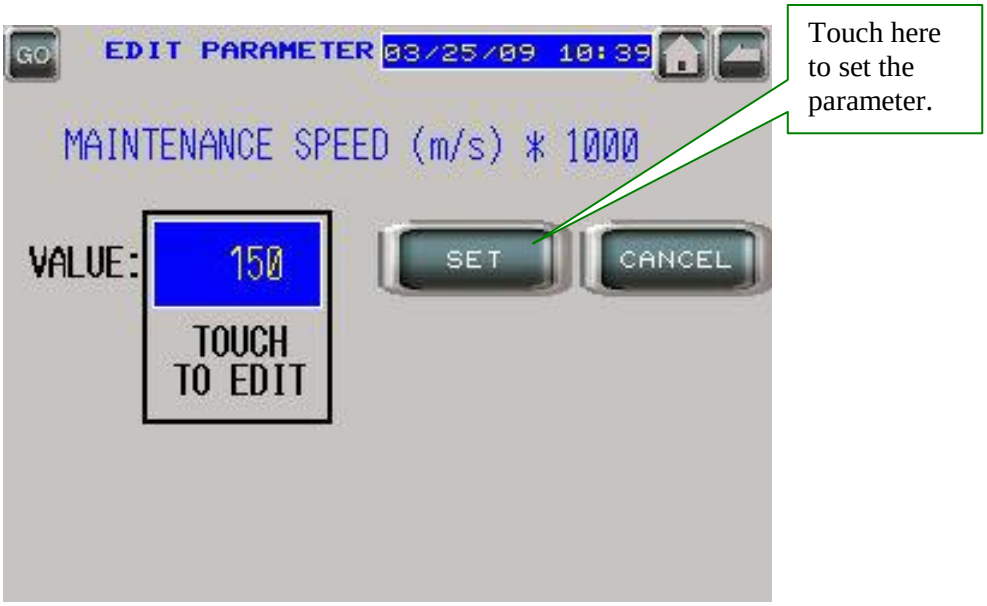
  – Upon touching the blue field next to MAINTENANCE SPEED, the following screen is displayed.



– Upon touching the blue VALUE field as shown above, a keypad pops up.
– Use this keypad to enter a value within the specified range as shown on the following screen.

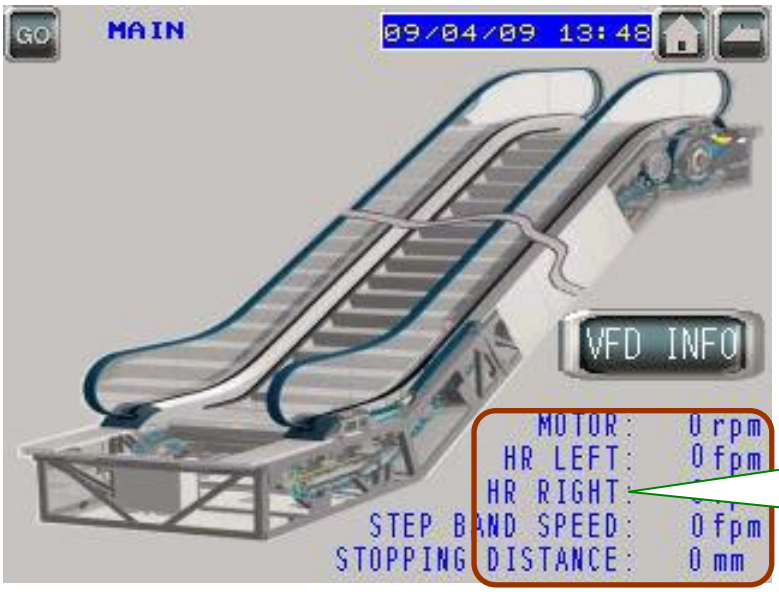


– Upon having entered the value, touch [SET] on the EDIT PARAMETER screen.

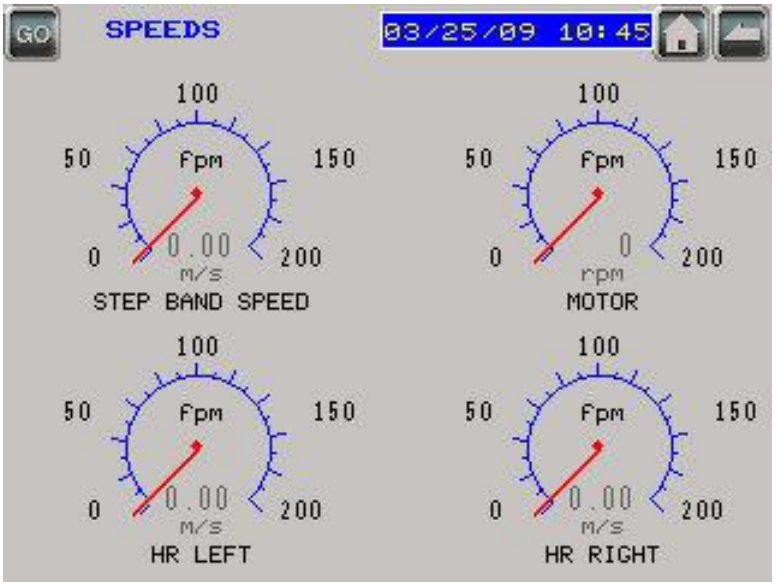


2.3 Viewing Analog Speeds

- This screen displays the following speeds of the escalator in analog form:
  - Step band speed
  - Motor speed
  - Left handrail speed
  - Right handrail speed



- The following screen is displayed.



2.4 Using the USB Drive

2.4.1 Downloading the Event History Log From the Event History Screen

- Insert the USB drive stick into the USB slot on the back of the OIT.
- On the event history screen, touch the [DOWNLOAD] button on the bottom left of the screen.

- Upon completion of the download of the history onto the USB drive, the [DOWNLOAD] button is replaced by the [DONE] button as shown on the following screen.

- If the USB drive is not plugged in and the [DOWNLOAD] button is touched, the [DOWNLOAD] button is replaced by the [ERROR] button as shown on the following screen.

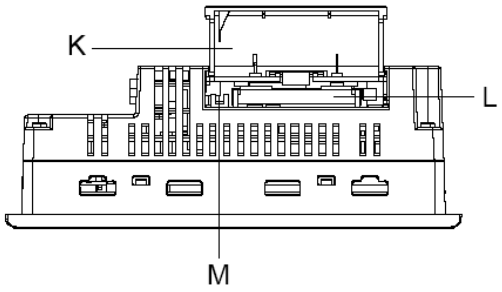
2.4.2 Transferring the OIT Project From the CF Card to the OIT Unit

Hints!

- Boot the OIT from a CF card to recover a locked unit or a new unit and transfer the project file.
- An OIT project must exist on the OIT, before a project update from an USB drive can take place.

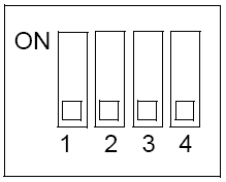
1. Turn off the OIT.
2. Flip the DIP switches 1 and 4 (first and last) to the up position. The DIP switch bank is located next to the CF card input on the back of the OIT.
3. Insert the CF card into the OIT.
4. Turn on the OIT.

   The OIT will start up and switch to the CF transfer mode.

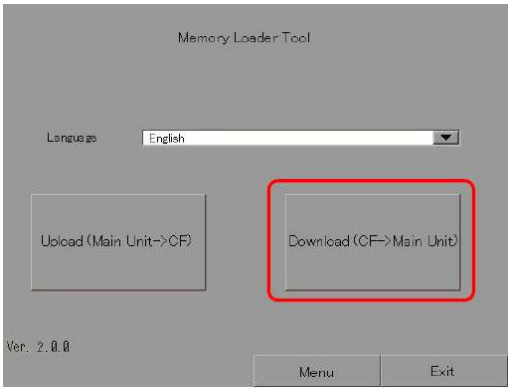


K: CF Card cover
L: CF Card interface

M: DIP switches



5. The following screen appears. Touch [Download (CF→Main Unit)].
6. Wait until the download is finished.



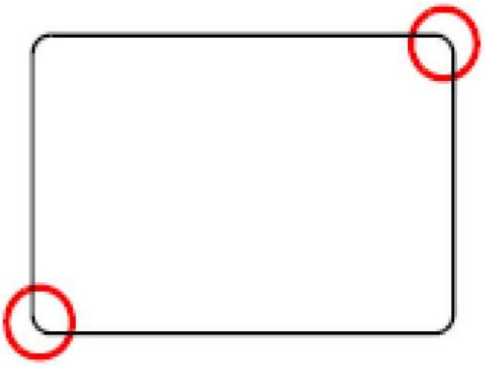
7. Turn off the OIT and remove the CF card or alternatively turn off the DIP switch 1.
8. Turn on the OIT. The project is now on the OIT.

2.4.3 Updating the OIT Project From the USB Drive to the OIT Unit

Hint!

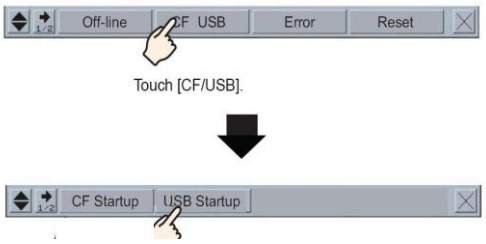
Before an OIT project can be updated from an USB drive, an OIT project must be present at the OIT (Installed in the factory or transferred from a CF card).

1. Turn off the OIT.
2. Plug in the USB drive into the OIT.
3. Turn on the OIT.
4. First touch the top right corner and then the bottom left corner (or first the top left corner and then the bottom right corner) on the OIT screen within 0.5 seconds to display the system menu bar at the bottom of the screen.

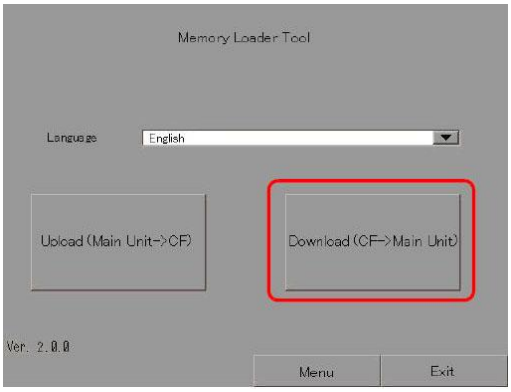


5. Touch [CF USB] on the displayed system menu bar.
6. Then touch [USB Startup] to automatically reset the OIT unit.

   The OIT will reboot and switch to USB copy mode.



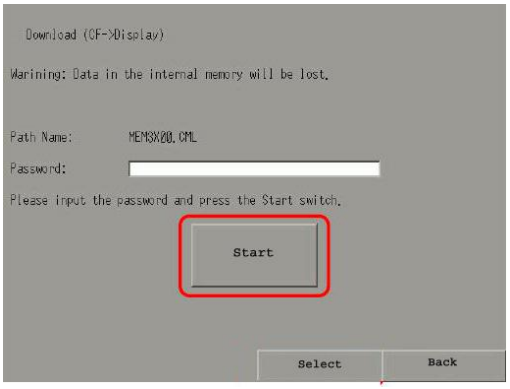
7. The following screen appears. Touch [Download (CF→Main Unit)].



8. The following screen appears. Touch [Start] and then [Yes] to start downloading the project from the USB drive and wait until the following messages are displayed:

   OS Data write complete (4/4).
   System /Project data write co…
   SRAM data write completed (2…
   Successfully completed.
   Please push Back button.

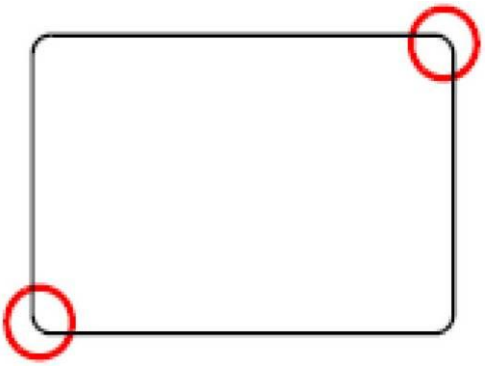
   This may take several minutes.



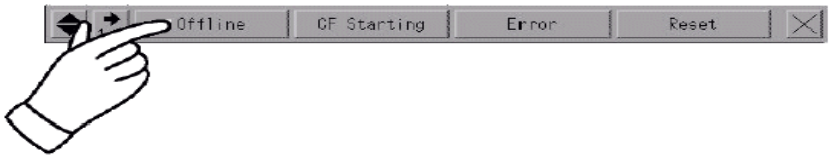
9. Touch [Back] twice followed by [Exit] and [Yes] to automatically restart the system.

2.4.4 Assigning an IP Address to the OIT

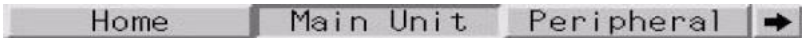
1. First touch the top right corner and then the bottom left corner (or first the top left corner and then the bottom right corner) on the OIT screen within 0.5 seconds to display the system menu bar at the bottom of the screen.



2. Touch [Offline] on the displayed system menu bar to enter the offline mode.



3. Once in offline mode, touch [Main Unit].



4. When the main unit screen is displayed, touch [Ethernet]. The Ethernet screen is displayed.
5. Touch the IP address input field to display the numeric touch keys and enter an IP address. Proceed in the same way to specify Subnet Mask and Gateway (on the next screen).
6. Touch [Exit] and then [Yes] to terminate the offline mode.
7. The IP address, the subnet mask and the gateway address are set.

5 Operating Instructions: Start-Up, Shutdown, Emergency Procedures

5.1 Remarks on the Operating Instructions

Operating states described below which could jeopardize the safety of persons are marked with the symbol shown in the margin.

5.1.1 Field of Application

- These operating instructions apply only to the specified type and project number. They become mandatory at the time of handover of the unit to the customer/operator.
- Before handover, only persons authorized by the manufacturer are allowed to carry out any kind of work on the unit.
- After handover, only persons authorized by the operator are allowed to carry out any kind of work on the unit. The manufacturer assumes no liability for improper work performed on the unit.

5.1.2 General Information

- Full knowledge of the operating instructions, the safety guidelines and the locally applicable safety regulations is a prerequisite for the safe and trouble-free operation of the escalator.
- The operating instructions contain guidelines for the safe operation of the escalator.
- These operating instructions and the safety guidelines contained therein shall be observed by all persons performing work on the escalator. Furthermore, if the maintenance work is performed by more than one person, one of them shall be assigned to manage and coordinate work.
- In addition, locally applicable regulations and provisions regarding accident prevention shall be observed.

5.1.3 Responsibilities of the Operator

The operator undertakes to allow only those persons to work on the unit

- who are familiar with the basic regulations on occupational safety and accident prevention, who have been trained in handling the escalator and
- who have read and acknowledged the safety guidelines of these operating instructions.

5.1.4 Responsibilities of the Staff

All persons appointed to carry out work on the escalator undertake

- to observe the basic regulations on occupational safety and accident prevention,
- to take note of the safety guidelines contained in these operating instructions and to comply with all standards which apply to the unit (e.g., AMSE A17.1),
- to assign one person to manage and coordinate work – if maintenance is carried out by 2 or more persons – and to obey instructions from this person.

5.1.5 Hazards When Handling the Escalator

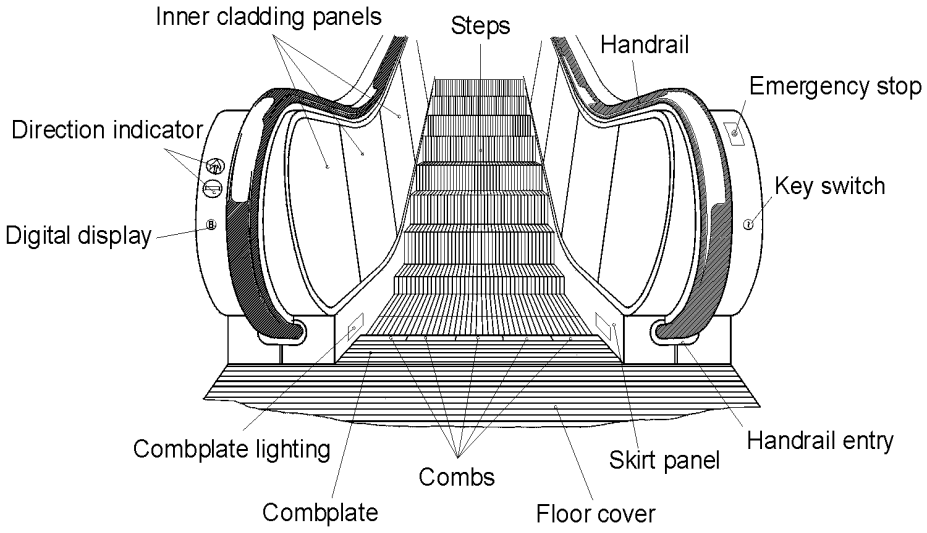
This escalator has been designed and manufactured in accordance with the relevant state-of-the-art and generally recognized safety regulations. Nevertheless, using the escalator may endanger the life or physical safety of users or third parties or cause damage to the escalator or other tangible assets.

Hint!
The escalator may only be used as intended and in perfect, technically safe condition!

If failures occur which could jeopardize the safety of persons or the safe operation of the escalator, the unit shall be switched off immediately.

The escalator may only be restarted after successful troubleshooting.

5.2 Designation of Operator-Relevant Components



5.3 Access and Environment

5.3.1 Structural Surroundings

The following shall be guaranteed on a continuing basis:

- The floor covers as well as their structural surroundings must be kept free of built-in components or equipment.
- As defined in AMSE A17.1, the top and bottom access areas must provide sufficient free space. These areas must be kept free of built-in components or equipment as well.
- The escalator must be free of obstacles at all times.
- The overhead clearance of the escalator must be free of obstacles at all times. It must be ensured that no objects extend into this space.
- It must be ensured that the entire area next to and above the handrails is free of obstacles at all times.
- It must be ensured that the area above the steps delimited by the above mentioned lateral and vertical handrail distances is always free of obstacles as prescribed.
- Nonskid and secure floor connections flush with the access areas (top and bottom) must be provided.
- Overhead clearance above the steps must be in conformity with AMSE A17.1.
- The escalator as well as its access areas must be illuminated according to AMSE A17.1.
- The separate mechanical or machine rooms must be kept dry and free of dust. The necessary maintenance rooms must be available.
- The operator or the customer must ensure that appropriate measures in compliance with local design regulations have been taken to prevent passengers from falling over the balustrade (with regard to balustrade height and handrail height, the escalator is exclusively designed for a safe use).
- Lateral protective barriers (railings) must be provided next to the newel ends ensuring that passengers do not mistake the handrail turn-around for a fixed balustrade or a fixed railing thus injuring themselves or being dragged along by the moving handrail.
- In case of parallel, crisscross or side-by-side escalators the space between balustrades must be kept free of objects, built-in parts or goods.
- It must be ensured that the escalator's supporting points and intermediate supports in the building remain unchanged and stable over time and meet the static requirements.

5.3.2 Environmental Conditions

- This escalator is designed for ambient temperatures from -20 °C (-4 °F) to +40 °C (+104 °F). Temperatures must not fall below or exceed the indicated temperature range for extended periods of time. If the ambient temperature falls below 2 °C (35.6 °F), the escalator must be kept running continuously to prevent ice or frost damage. If temperatures exceed or fall below the specified temperature range for a longer period of time, the manufacturer's representative or the manufacturer must be consulted without delay to prevent possible damage to the unit.
- Care should be taken that the relative humidity does not exceed 50% when the maximum temperature of 40 °C (104 °F) is reached as this could affect the safety, the proper functioning, and the service life of the unit. At 20 °C (68 °F) (room temperature), a maximum relative humidity (not condensing) of 90% is acceptable. If the relative humidity exceeds the specified value, the manufacturer's representative or the manufacturer must be consulted! Bedewing not allowed!
- Care should be taken that no harmful substances such as sand, water, dirt, dust, ice, snow, waste water, solvents, cleansing agents, chemicals, etc., enter the unit as these could affect the safety, the proper functioning and the service life of the unit. If this happens, the necessary cleaning work must be carried out upon consultation with the manufacturer's representative or the manufacturer!

5.4 Commissioning

After carrying out the risk assessment, taking the required additional measures and providing the escalator with the necessary signs for information and warning, the operative unit is to be handed over by the manufacturer/representative to the client/operator.

- The operator shall fulfill the responsibilities according to Section 5.1.3.
- From now on, the operator assumes responsibility regarding the operation of the escalator.

5.5 Operation of the Escalator

5.5.1 General Information

- Escalators may only be started up by specially authorized and trained persons. These persons must be familiar with the operating instructions (see Section 5.1.4).
- Prior to start-up, all checks according to Section 5.5.2 must be carried out.
- The keys for starting the escalator shall not be accessible to unauthorized persons.
- During the operating time of the escalator, an authorized person familiar with the operating instructions must be within easy reach.

5.5.2 Checks Before Start-Up

Hint!

Before start-up of the escalator, it must be ensured that all prerequisites for safe operation are in place.

- The maintenance openings (floor covers) at the top and bottom landings must be closed.
- The steps and the combs must be clean and free of foreign objects (water, ice, snow, sand, dirt, solvents, cleansing agents, chemicals, stones, nails, etc.).
- The decking profiles must be securely fastened without gaps.
- The skirt panels must neither be damaged nor displaced.
- The deflector brushes (skirt brushes, handrail entry brushes, etc.) should not be damaged.
- The inner and outer claddings must be intact.
- The combs must be in perfect condition without any broken or bent teeth.
- The handrail must not show any contractions or damage. In addition, the handrail must not show any of the criteria contained in the handrail Q-report (Q 409 749). If these criteria are met, the handrail must be immediately replaced.
- The escalator must not show visible damage (among other things, the glass balustrade must be checked for excessive gaps and the unit must be checked for any damage caused by vandalism).
- The escalator and the access areas must be illuminated according to AMSE A17.1.
- The free space at the upper and lower landings must be in accordance with AMSE A17.1 and kept free of equipment and built-in parts at all times.
- There must be unrestricted access to the escalator.
- The escalator must be free of obstacles.
- The entire area next to and above the handrails must be free of obstacles at all times.

- The overhead clearance of the escalator must be free of obstacles at all times. It must be ensured that no objects extend into this space.
- Obstacles on and/or near the escalator must be avoided. The relevant requirements are described in Section 5.3.1, Structural Surroundings.
- The proper functioning of the stop buttons and emergency stop buttons must be ensured.
- The pictographs at the upper and lower landings must be readily visible.

Pictograph according to AMSE A17.1

- The pictographs must conform to the relevant provisions and be affixed readily visible according to the relevant provisions.

5.5.3 Starting the Escalator

- Safety guidelines
  - The person who starts the escalator must be able to oversee the entire unit.
  - At the time of start-up, the escalator must be empty.
- Description of the start-up procedure
  - Turn the key switch in the sense of the desired direction of travel.
  - Upon start-up of the escalator, turn the switch into neutral position and withdraw the key.
- Measures before releasing the unit for use
  - A functional check of the emergency stop devices and shutoff devices in the access and exit areas of the escalator must be carried out.
  - The step band must be run for a complete cycle under supervision to ensure its proper operation (see Section 5.5.4).
  - If all checks have been carried out without revealing any deficiencies, the escalator can be released for use.

5.5.4 Checks at Start-Up and During Operation

Escalators must be shut down immediately

- if the handrails aren't running properly or at a speed approximating the speed of the step band;
- if the escalator shows abnormal running behavior such as
  - step band running with jolts,
  - one of the handrails stopping occasionally, or
  - unusual running noise;
- if combs get damaged during operation (broken or bent teeth);
- if skirt panels, decking profiles, glass panels or inner/outer cladding panels get damaged during operation;
- if parts of the escalator are missing (e.g., steps, glass panels, skirt panels, inner deckings, outer deckings, floor covers, inner or outer cladding panels, etc.).

Hint!

If the escalator had to be switched off due to one of the above reasons, the maintenance company must be notified immediately. A restart is only permitted upon proper inspection and troubleshooting.

5.5.5 Stopping (Switching Off) the Escalator

5.5.5.1 Normal Stop (Soft Stop)

Hint!

For safety reasons, escalators may only be stopped when no passengers are on the unit.

Normal stops are initiated by actuating one of the direction key switches:

- Turn the direction key switch against the direction of travel. This causes the motor to be switched off and the escalator to slowly decelerate (soft stop).

5.5.5.2 Manually Actuated Emergency Stop

- When a stop button is actuated, the escalator is shut down.

  The stop buttons are

  – labeled "STOP";
  – located at the top and bottom landings.

  Additional stop buttons are provided in the central part of high-rise escalators.

Hint!

Manually actuated emergency stops are provided for the safety of the passengers and should only be used in cases of emergency.

5.5.5.3 Automatically Actuated Emergency Stop

Automatic emergency stops are triggered by the built-in safety devices.

5.5.6 Restarting the Escalator

- Restarting the escalator (Section 5.5.3) is only permitted after the checks according to Section 5.5.2 have been carried out.
- If the escalator cannot be restarted, refer to Section 5.6.

5.6 Troubleshooting

5.6.1 Troubleshooting by Trained, Qualified Staff

- The following faults may be corrected by properly trained and qualified staff of the operator (according to Section 5.5.1):
  - Missing power supply in the building
  - The main switch for the escalator in the building is switched off
  - Missing or defective fuses for the escalator
  - Emergency stops actuated by skirt contacts, handrail entry contacts, or combplate contacts
  - Manually actuated emergency stops according to Section 5.5.5.2
- The restart of the escalator is only permitted upon successful troubleshooting and when carried out in accordance with Section 5.5.6.
- If the escalator cannot be restarted, the maintenance company shall be put in charge of troubleshooting.

5.6.2 Troubleshooting by Maintenance Company

- All other faults must be corrected by a maintenance company.

  Examples for these faults are:
  - Wedged objects or damage in the combplate area
  - Damaged steps
  - Abnormal running behavior
  - Damaged handrails

- Both the maintenance company and its staff must fulfill the prerequisites and obligations according to Section 5.1.4 as well as AMSE A17.1.
- The restart of the escalator is only permitted upon successful troubleshooting and when carried out in accordance with Section 5.5.6.
- If the escalator cannot be restarted, the manufacturer's representative must be notified without delay.
- If faults put passengers at risk or cause injuries, the manufacturer's representative or the manufacturer must be notified without delay.

5.6.3 Electrical Diagnosis

- Errors can be diagnosed by means of the digital displays (on the boards or in the newel ends).

For more detailed information, see Controller Instructions J 595 027, Operator Interface Terminal (OIT)

- The escalator may be restarted by trained staff of the operator only after the following error codes:

Error Number	Cause of Error	(R) Reset / (N) Non-Reset Required
10	Combplate contact, top left	R
11	Handrail entry contact, top left	R
12	Skirt contact, top left	N
E1	Skirt contact, top right	N
14	Emergency stop actuated	N
15	Combplate contact, bottom left	R
16	Handrail entry contact, bottom left	R
1F	Skirt contact, bottom left	N
E3	Skirt contact, bottom right	N
48	Handrail entry contact, top right	R
49	Handrail entry contact, bottom right	R
4A	Combplate contact, top right	R
4B	Combplate contact, bottom right	R
23, D2	Skirt contact, incline, left	N
29, E2	Skirt contact, incline, right	N
2E	Stop switch on external control cabinet	N

If the error number and "d0" flash alternately, the error has been eliminated and the unit is ready for operation.

The unit must be restarted in accordance with Section 5.5.6.

Hint!

In the case of other electrical faults, the maintenance company must be notified.

VOLUME II

Maintenance

6 General Information

6.1 Introduction – Q 409 713

1 Introduction

Regular maintenance is essential for the upkeep of an escalator, prevents damage and has to be scheduled individually.

The following factors, listed according to their significance, influence the running characteristics and the wear and tear of an escalator to a high degree and form the basis for determining the maintenance intervals:

1. Indoor/outdoor installation
2. Operating time per week
3. Degree of dirt accumulation
4. Frequency of use

For outdoor installations, atmospheric exposure and the resulting degree of dirt accumulation are the main factors to be considered when determining the maintenance intervals. Factors such as operating time and frequency of use are of secondary importance in this regard.

For indoor installations, which are neither exposed to weather nor to excessive dirt accumulation, the operating time of the escalator is the decisive factor to be considered when determining the maintenance intervals.

The maintenance intervals which we have determined on the basis of these criteria represent the minimum requirements to be met in order to maintain the good running characteristics and the safe operating condition of escalators.

Longer maintenance intervals would affect operational safety and are therefore not admissible.

Shorter maintenance intervals which may be required by

- local regulations or
- contractual provisions

provide a somewhat better guarantee that the running characteristics and the operational safety are maintained. Experience has shown, however, that the advantages gained from shorter maintenance intervals do not justify the additional expenditure.

2 Maintenance Intervals

To simplify matters, the maintenance operations can be divided into two "maintenance categories":

Minor maintenance jobs: comprising the inspection of the main functions, basic cleaning, and lubrication

Major maintenance jobs: including the inspection of all other functions and devices as well as additional cleaning and lubrication relevant for the running characteristics

2.1 Number of Annual Maintenance Jobs for Public Traffic

12 times a year, subdivided into

- 8 minor maintenance jobs
- 4 major maintenance jobs

2.2 Initial Maintenance

250 operating hours upon initial start-up of the escalator **at the latest**, the first maintenance operation should be performed including thorough and sufficient lubrication of all chains.

Subsequently, the maintenance intervals indicated in Section 2.1 above apply.

3 Maintenance Operations Schedule Structure

The operations schedule is organized as a step-by-step checklist, the sequence of the individual steps (operations) ensuring an optimum cycle for overall maintenance. One or more operations can be listed for each subject (component) (e.g.: Subject: Control cabinet → Operation: check all internal electrical connections, vacuum and clean).

	Loc.		Subject	Operation	Maint.			Comment	Instructions
	D	T			K	G	V		
24		T	Junction box	check all internal electrical connections, vacuum and clean			x	once a year	Q 409 802

If several operations to be carried out at the same maintenance interval are listed for one subject, only one item number (Column 1) is used for the respective subject, such as Item 19.

	Loc.		Subject	Operation	Maint.			Comment	Instructions
	D	T			K	G	V		
19		T	Maintenance operating panel	connect, check function	x	x			Q 409 480

If several operations to be carried out at different maintenance intervals are listed for one subject, the item number is subdivided, such as Items 36.1 and 36.2.

	Loc.		Subject	Operation	Maint.			Comment	Instructions
	D	T			K	G	V		
36.1		T	Step chain tension contacts	check setting and function		x			Q 409 602
36.2		T	Step chain tension contacts	correct setting			x	distance of contact roller: 2 mm	Q 409 602

Column 2 – "Location": This column gives the location or the area in which the respective operation is to be carried out:

D = Drive station
T = Tension station
M = Machine room

Column 5 – "Maintenance":

K = Minor maintenance job

All checked off operations are to be carried out at the intervals given for this maintenance category.

G = Major maintenance job

Comprises all operations of the minor maintenance job category as well as a number of additional operations. The intervals for this maintenance category are multiples of the intervals for the minor maintenance job category.

V = Variable intervals

For **time-dependent** operations, these intervals may be multiples of the intervals for the major maintenance job category (e.g. once a year, every two years).

For **condition-dependent** operations, these intervals may vary according to condition criteria (e.g., retensioning the step chain or drive chain, readjusting the step guides, etc.).

Column 6 – "Comment": This column contains the "variable intervals" either as a time interval or as a condition criterion as well as setting information or information on aids required for this operation.

Column 7 – "Instructions": This column lists the section of the Operation & Maintenance Manual, containing a detailed description of the respective operation or set values as well as the maximum permissible deviations.

6.2 Safety Precautions – Q 409 580

1 General

In addition to the following general safety instructions all applicable local, national and international safety regulations must be observed. Any specific safety instructions given in the manufacturer's publications must be followed.

Only properly trained and authorized staff shall be permitted to operate or handle any portion of the equipment. This also applies to settings, adjustments, inspections and maintenance.

Warning: Safety precautions!

Every precaution should be taken to prevent accidents and incorrect operation.

Suitable protective equipment, warning notices and accessories must be available and maintained in a serviceable condition. Some examples are:

- Insulating protective clothing (gloves, boots, overalls, headgear)
- Eye protectors (goggles, protective masks)
- Ear protectors
- Mask (inhalation protection)
- Use only adequate tools, equipment and materials!
- The guidelines on the material safety data sheet for lubricants (oils, greases, etc) have to be observed!

2 Commencement of Work

Before starting to work on a unit, the person in charge must ensure that all persons involved are familiar with the work to be carried out.

The following "Six Safety Rules" must be observed:

1. Before starting maintenance work, put up barriers (i.e. hinged floor cover) and "Out of order" signs.
2. As soon as a floor cover has to be removed and before entering the pit, connect the maintenance operating panel.
3. Perform all trial runs with the maintenance operating panel.
4. Turn off and lock the main disconnect switch in the machine room when carrying out maintenance work inside the step band.
5. Always engage the step chain locking device when carrying out maintenance work inside the step band.
6. Never turn on escalators under load!

3 Completion of Work

Upon completion of work, remove all tools, accessories and safety devices from the site in such a way that no danger arises. When the operating condition of the unit has been restored, the "permit to work" must be returned to the engineer, duly signed by the head of the work crew, before the unit may be taken into operation.

6.3 Tools and Aids – Q 409 649

The tools listed below are required for maintenance in addition to the normal hand tools:

Name		Quantity
Eccentric	SDZ 393 759	2
Special wrench for floor covers	SMZ 273 593	1
Open-end wrench	30 mm	2
Open-end wrench	24 mm	2
Open-end wrench	19 mm	2
Open-end wrench	17 mm	2
Open-end wrench	13 mm	2
Open-end wrench	10 mm	1
Open-end wrench	8 mm	1
Tubular socket wrench	24 mm	1
Hexagonal socket	30 mm	1
Extension	1000 mm	1
Ratchet or T-handle		1
Box wrench, offset	19 mm	1
Box wrench, offset	17 mm	1
Box wrench, offset	13 mm	1
Allen wrench	3 mm	1
Allen wrench	4 mm	1
Phillips screwdriver	No. 1	1
Phillips screwdriver	No. 2	1
Screwdriver	3 mm	1
Screwdriver	5 mm	1
Screwdriver	8 mm	1
Screwdriver with hex shank	12 mm	1
Pipe wrench		1
Vacuum cleaner		1
Portable lamp		1
Dust brush		1
Marking tool		1
Torque wrench with ratchet head	(range 10 to 40 Nm)	1
Hexagonal bit socket	5 mm	1
Hexagonal bit socket	8 mm	1
Extension	250 mm	1
"Wago" screwdriver		1
0.5 mm feeler gage (sheet metal strip)		2
Protective gloves, size M	VVA050041	1
Protective gloves, size L	VVA050043	1
Suction cups (inclined balustrade)	NAN279265	2

6.4 Torque Settings for Bolts

Unless otherwise noted, the tightening torques listed below are applicable for bolts and nuts tightenend on Schindler units with a torque wrench or an impact wrench:

Wrench Size [mm]	Nominal Dimension [mm]	Tightening Torque [Nm]		
		Standard Bolt 8.8		HT Bolt 10.9
		Torque Wrench	Impact Wrench	Torque Wrench
8	M5	6	6	—
10	M6	10.5	10	—
13	M8	25	24	—
17	M10	50	47	—
19	M12	86	82	—
24	M16	215	200	250 (270)*
30	M20	410	390	450 (490)*
32	M22	—	—	650 (710)*
36	M24	710	670	800 (880)*
46	M30	1400	1350	–

**Test torque for HT bolts 10.9*

Hint!

The test torques for standard bolts 8.8 exceed the tightening torques with torque wrench by 10-15%. The test torques for HT bolts 10.9 are given in parentheses. Test torques may only be applied by means of a torque wrench.

6.5 Cleaning Instructions for Escalators – Q 409 193

Since local markets offer different brands of the cleansing agents, no product names have been specified. The only exception are the cleansing agents for handrails which are available from the handrail manufacturer as well as from Schindler Vienna.

Components	Cleansing Agents/Aids	Application	Remarks
Step, aluminum silver/black w/o plastic inserts	Oil and grease-dissolving agents	Clean the affected surfaces with a brush or a cloth.	Do not use thinners or similar solvents!
	Wet cleaning with steam cleaner	Disassemble the step and remove the step rollers.	Should the sound-deadening coat on the step's inside be damaged, a new coat must be applied.
	Dry cleaning with brush or step cleaning device	With the unit in operation, clean only in the traveling direction. **Attention:** Should the brushes get trapped in the step band, shut off the unit by means of the emergency stop button!	
Step, aluminum silver with plastic inserts	Oil and grease-dissolving agents	Clean the affected surfaces with a brush or a cloth.	**Attention:** Take care that no benzene or oil-dissolving agents get in contact with the plastic inserts!
	Wet cleaning with steam cleaner	See above	See above
	Isopropyl alcohol/soap suds	Apply the cleansing agent with a brush or a cloth and wipe it off with a clean rag.	**Attention:** Immediately replace damaged or brittle plastic inserts (risk of cracking)!
Handrails	Basic cleanser Wipe-on/wipe-off cleanser Preserver	Apply according to the instructions supplied with the cleansing agents.	EHC: basic cleanser and preserver
Inner & outer deckings Skirt panels	Soap-based cleanser or non-abrasive cleanser for sheet metal	Apply with a cloth and wipe off with a clean rag.	**Attention:** Do not use scouring cleaniung tools! Do not use aggressive cleaning agents!
	For stainless steel, see Additional Information on next page		
Floor covers aluminum	Commercial non-abrasive floor cleansers	Preclean with a sponge or cloth and wipe off with a clean rag.	**Attention:** Do not apply too much liquid to prevent water from entering the unit!

Additional Information for Stainless Steel Surfaces

Hints!

- Even stainless steel will corrode if the passive layer is damaged or exposed to an aggressive environment, dirt or iron particles (e.g., abrasive material from tracks) and/or mild acids (de-icing salt, chlorides contained in cleaners etc.).
- Therefore, treat surfaces at least 2 to 3 times a year with stainless steel care spray!
- If required, heavily exposed surfaces (outdoor installations, areas exposed to de-icing agents, severe dirt accumulation, etc.) must be treated every 2 to 4 weeks.

Hints!

- Use separate cleaning cloths for stainless steel!
- For regular cleaning use stainless steel care sprays (e.g., Metaflux 70-55)! For stubborn dirt use special cleaner for stainless steel!
- For further information, visit www.euro-inox.org.

Warning: Damage due to construction work!

- Remove lime and mortar stains with special cleaner for stainless steel and rinse with demineralized water!
- Do not use construction cleaners for tiles or ceramics (cement film remover, cleaners containing hydrochloric acid, etc.)! If required, rinse thoroughly with demineralized water!
- Remove deposits of iron particles immediately! If required, have surfaces re-treated with special stainless steel pickling products by a qualified company!

Warning: Cleaning agents!

Never use the following cleaning agents:

- cleaning agents containing chlorine
- cleaning agents containing hydrochloric acid
- silver polish
- bleaching agents

Additional Information on the Use of Cleaning Machines

Warning: Cleaning machines!

The use of cleaning machines (e.g., Tread Master and CIMEX) is only permitted if the manufacturer of the cleaning machine can submit a written authorization by the manufacturer of the escalator.

Due to the excessive load on the floor covers, it is not permitted to clean them with a motor sweeper or a similar self-propelled cleaning machine! (Load-carrying capacity: 500 kg/m^2; point load: max. 250 kg)

6.6 Lubrication System, Lubrication Schedule – Q 594 036

Item	Part to Be Lubricated	Method of Lubrication	Lubricant	Quantity	1st Oil Change	Following Oil Changes	Method of Checking
1	Drive unit	Oil bath	SHELL: Omala RL 320 MOBIL: SHC 632 ESSO: Teresso SHP 320 CASTROL: Alpha T 320	12.5 l	10,000 h or after one year at the latest	10,000 h not later than one year after the last oil change	Oil level sensor
		For more detailed information, see Volume VJ, Renold_O&M_Manual.pdf					
2a 2b	Drive chain(s) Handrail drive chains	Automatic *) (automatic lubrication system)	KLÜBER: Küberoil GEM 1-46N* ZEPF: Ultrafit-Syntex*)	6 l			Oil container at pump
3	Step chains	Automatic (automatic lubr.)	KLÜBER: Küberoil GEM 1-46N* ZEPF: Ultrafit-Syntex*)	6 l			Oil container at pump
4	Safety brake (moving parts)	Manual	BP: Energol GR-XP460 ESSO: Spartan EP460 SHELL: Omala 460				Lubrication acc. to maintenance schedule (at least once a year)
5	Step bushings	Manual	BP: Energrease LS3 MOBIL: Mobilux EP2 ESSO: Beacon 3 KLÜBER: Klüberplex BEM 41-132**) SHELL: Alvania R3				Lubrication acc. to maintenance schedule (at least every 2 years)
6	Gliding surfaces of the skirts	Automatic (lubrication step)	SIMALUBE-SL14 SIMALUBE SYNTLUB2031***)	0.25 l		every 9 months	Lubricant dispenser
7	Handrail drive shaft bearing	Manual	SHELL: Alvania EP 2	0.25 l		every 9 months	Lubrication acc. to maintenance schedule (at least once a year)

STANDARD

OPTIONAL

Mineral oil

Synthetic oil

***)** **These oils are to be used only for automatic lubrication, covered outdoor installations, uncovered outdoor installations and ambient temperatures <+10 °C (<+5 0°F)!**

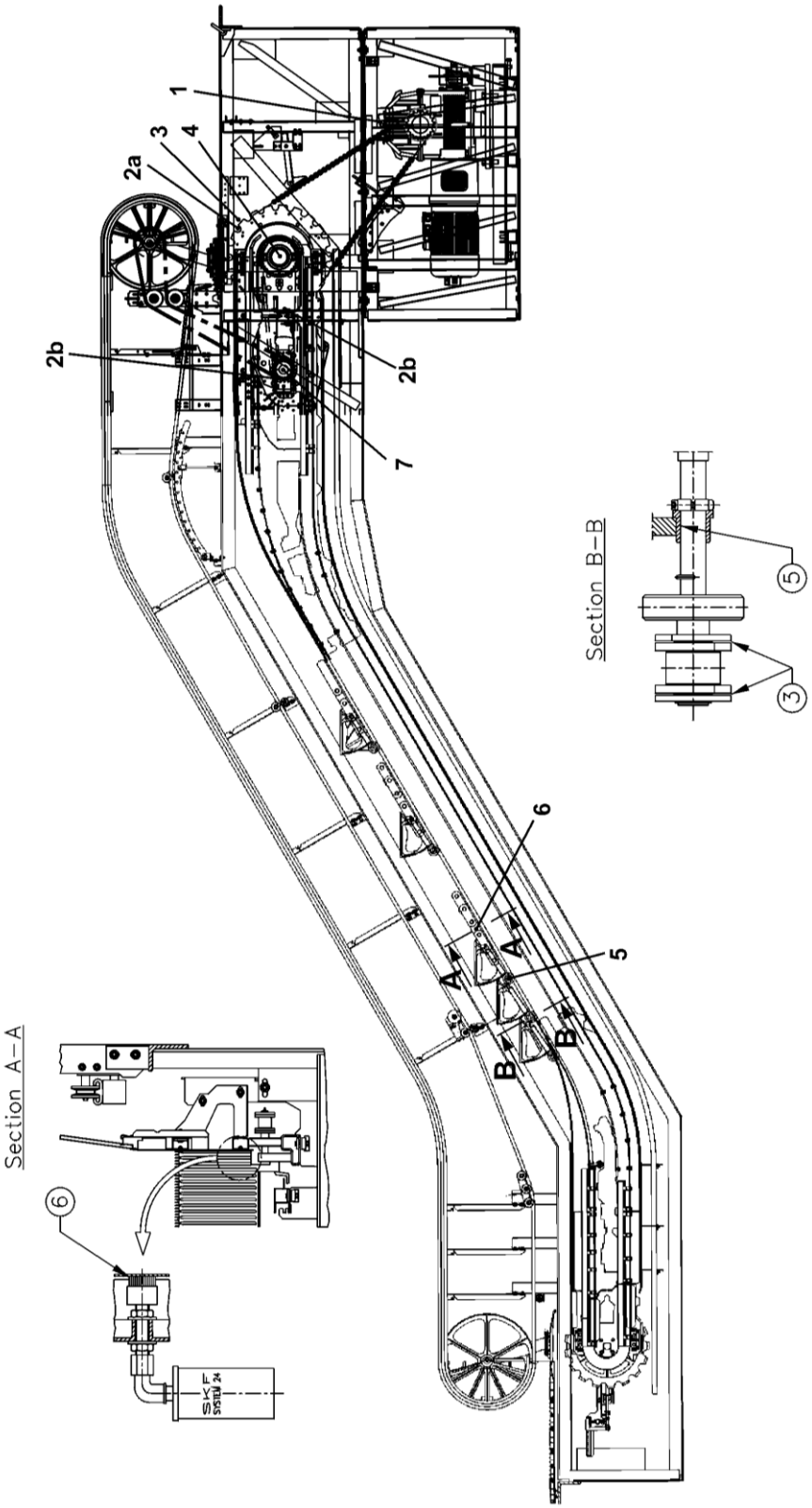
**) Semi-synthetic grease

***) Biodegradable according European Standard: CEC-L-33-A-93 > 95%
Equals water hazard class: NWG

Warning: Miscibility of oils!

Consider miscibility with mineral oils and other synthetic oils.

For the associated Maintenance Operations Schedule, see Q 409 614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MASS

6.7 Maintenance Operations Schedule – Q 409 614

The maintenance operations can be divided into three types of work:

- Minor maintenance work (K): to be performed 8 times a year
- Major maintenance work (G): to be performed 4 times a year
- Variable intervals (V): depending on operating time or condition (usually once a year, unless otherwise noted)

	Loc.		Subject	Operation	Maint.			Comment	Instructions
	D	T			K	G	V		
1			Control room	notify	x	x			—
2	D	T	Protective barriers	set up	x	x			—
3	D	T	"Engineer on Site"	activate	x	x		OIT	J 595 027
4	D	T	Emergency stop	check function	x	x			Q 409 480
5	D	T	Key switches	check function	x	x		direction, soft stop	Q 409 661
6	D	T	Direction indicators	check function	x	x			Q 409 716
7	D	T	Combplate lighting	check function	x	x			Q 409 476
8	D	T	Step gap lighting	check function	x	x			Q 409 477
9	D	T	Skirt lighting	check function	x	x			Q 409 475
10	D	T	Digital display in balustrade	check function	x	x			Q 409 808
11	D	T	Balustrades (inner deckings/inner claddings)	check condition and fastening	x	x			—
12	D	T	Skirt brushes	check condition	x	x			—
13	D	T	Deflectors, protective barriers	check condition	x	x			—
14	D	T	Pictographs (instructions for use)	check condition	x	x			—
15	D	T	Step band	check for quiet running	x	x		noise, vibrations	—
16	D	T	Handrails	check for quiet operation and speed	x	x		noise, vibrations	—
17		T	Floor covers	remove	x	x			Q 409 457
18		T	Smoke detector	check function		x			—
19		T	Maintenance operating panel	connect, check function	x	x			Q 409 480
20		T	Stop button, junction box	check function	x	x			Q 409 802
21		T	Guard plate (pit)	remove	x	x			Q 409 487
22		T	3 maintenance steps	disassemble		x			Q 409 461
23		T	Escalator pit	clean	x	x			—
24		T	Junction box	check all internal electrical connections, vacuum and clean			x	once a year	Q 409 802
25	D	T	Step gap lighting	clean		x			Q 409 477

	Loc.		Subject	Operation	Maint.			Comment	Instructions
	D	T			K	G	V		
26	D	T	Step rollers – tracks	clean		x			Q 409 619
27	D	T	Step guideways along skirt panels	clean		x		lubrication by lubrication step	Q 409 455
28	D		Oil collector for handrail drive chain	clean		x			—
29	D	T	Handrail guide profiles	check condition, clean		x		wear, alignment of joints	Q 409 639
30	D	T	Handrail diverter sheaves	clean V-shaped groove		x			Q 409 639
31	D	T	Insides of handrails	check condition, clean		x		vacuum lips and gliding layer	Q 409 603
32	D		Handrail deflection pulley assemblies	check condition, clean		x			Q 409 639
33		T	Steps	check condition		x		tread ribs in order	Q 409 461
34.1		T	Step chains	check tension		x		spring length: max. 120 mm with H ≤ 13 m max. 133.5 mm with H > 13 m	Q 409 602
34.2		T	Step chains	retension			x	to spring length: 115 mm with H ≤ 13 m 130 mm with H > 13 m	Q 409 602
34.3		T	Step chains	check lubrication state		x		"wet" chain links	Q 409 600
35		T	Spring clips of step axles	check condition			x	once a year, randomly check 8 pcs., min. 2.5 mm	Q 409 600
36.1		T	Step chain tension contacts	check setting and function		x			Q 409 602
36.2		T	Step chain tension contacts	correct setting			x	distance of contact roller: 2 mm	Q 409 602
37		T	Step entry	check step position	x	x		straight/slanted/out-of-line	Q 409 602
38.1		T	Step guides	check condition and setting		x		steps must not knock	Q 409 460
38.2		T	Step guides	correct setting			x	0.3-0.6 mm play on each side	Q 409 460
39.1		T	Tangential guides	check condition and setting		x		0.4-0.7mm play between chain roller and guide	Q 409 619
39.2		T	Tangential guides	correct setting			x		Q 409 619
40.1		T	Combplate	check movability and setting		x		horizontally, vertically	Q 409 460
40.2		T	Combplate	correct setting			x	height: 4^{-1} mm lateral setting: centered to steps	Q 409 460
40.3		T	Combplate guides	clean, lubricate			x	clean and lubricate every two years	Q 409 460
41		T	Combplate contacts	check function		x			Q 409 460
42.1		T	Combs	check condition	x	x			Q 409 460
42.2		T	Combs	corrosion protection			x	loosen combs and lubricate screws once a year	Q 409 460
43		T	Water level monitor	check function		x			Q 409 484
44		T	Handrail entry contacts	check function		x			Q 409 653
45		T	Skirt contacts	check function		x			Q 409 648

	Loc.		Subject	Operation	Maint.			Comment	Instructions
	D	T			K	G	V		
46		T	Step upthrust contacts	check function, lubricate		x			Q 409 709
47		T	Step level contact	check function, clean, lubricate		x			Q 409 601
48		T	Antistatic brushes	check condition & setting		x		brushes must touch the underside of the riser	Q 409 601
49.1		T	Relieving curves tension station/top	check setting		x		max. 1 mm play between chain roller and guide	Q 409 619
49.2		T	Relieving curves tension station/top	correct setting			x	to 0.5-0.7 mm play	Q 409 619
50		T	Guide pads	check condition			x	two times a year, min. head width: 6 mm	Q 409 461
51		T	Chain rollers	check condition		x			Q 409 600
52		T	Step rollers	check condition		x			Q 409 461
53		T	Step bushings	lubricate			x	if required (squeaking noise)	Q 409 461
54		T	Maintenance operating panel	remove	x	x			Q 409 480
55		T	Step band monitor	check function		x		key switch start	Q 409 465
56		T	Handrail rupture contacts	check function		x			Q 409 650
57		T	Handrail monitor	check function		x			Q 409 650
58		T	Antistatic brushes	check condition & setting		x		brushes must touch the handrail	Q 409 650
59	D		Floor covers	remove	x	x			Q 409 457
60	D		Pit lighting	check function		x			—
61	D		Smoke detector	check function		x			—
62	D		Maintenance operating panel	connect, check function	x	x			Q 409 480
63	D		Stop button, junction box	check function	x	x			Q 409 802
64	D		Guard plate (pit)	remove	x	x			Q 409 487
65	D		Escalator pit	clean	x	x			—
66	D		Junction box	check all internal electrical connections, vacuum and clean			x	once a year	Q 409 802
67	D		Motor air intakes	clean		x			Q 409 447
68.1	D		Tangential guides	check condition and setting		x		0.4-0.7mm play between chain roller and guide	Q 409 619
68.2	D		Tangential guides	correct setting			x		Q 409 619
69	D		Step entry	check step position	x	x		straight/slanted/out-of-line	Q 409 602
70.1	D		Step guides	check condition and setting		x		steps must not knock	Q 409 460
70.2	D		Step guides	correct setting			x	0.3-0.6 mm play on each side	Q 409 460
71.1	D		Combplate	check movability and setting		x		horizontally, vertically	Q 409 460
71.2	D		Combplate	correct setting			x	height: 4^{-1} mm lateral setting: centered to steps	Q 409 460

	Loc.		Subject	Operation	Maint.			Comment	Instructions
	D	T			K	G	V		
71.3	D		Combplate guides	clean, lubricate			x	clean and lubricate every two years	Q 409 460
72	D		Combplate contacts	check function		x			Q 409 460
73.1	D		Combs	check condition	x	x			Q 409 460
73.2	D		Combs	corrosion protection			x	loosen combs and lubricate screws once a year	Q 409 460
74.1	D		Machine room fan	check function	x	x			—
74.2	D		Machine room fan	clean		x			—
75.1	D		Drive chain(s)	check tension		x		max. sag: 30 mm	Q 409 452
75.2	D		Drive chain(s)	retension			x	to a sag of 10-15 mm	Q 409 452
75.3	D		Drive chain(s)	check lubrication state			x	"wet" links	Q 409 452
76	D		Drive chain contact, mechanical	check condition and function		x		min. height of chain glider: 13 mm	Q 409 453
77	D		Drive chain deflector	check condition and function		x		groove depth: 8.5 mm	Q 409 453A
78	D		Speed monitor (Encoder)	check function		x			Volume VJ
79	D		Vibration monitor	check condition	x	x			Volume VJ
80.1	D		Service brake	check setting		x			Volume VJ
80.2	D		Service brake	correct lifting range			x		Volume VJ
80.3	D		Brake pad (service brake)	check condition and setting		x		min. lining thickness	Volume VJ
80.4	D		Brake contact (service brake)	check function		x			Volume VJ
80.5	D		Brake pad monitor (service brake)	check visually		x			Volume VJ
80.6	D		Braking distance	measure	x	x		OIT display	J 595 027
81	D		Step chain locking device	check function, clean, lubricate		x			Q 409 926
82	D		Safety brake	check function and braking distance		x		simulating overspeed	Q 409 710
83	D		Rods of all brakes	lubricate		x		safety brake	Q 409 710
84	D		Reduction gear	check oil level		x			Volume VJ
85	D		Transmission bearings	check for noise		x		abnormal bearing noise?	Volume VJ
86	D		Motor bearings	check for noise		x		abnormal bearing noise?	Volume VJ
87	D		Oil level of lubrication system	check and refill	x	x			Q 409 924
88.1	D		Oil application brushes for chain lubrication	check setting and condition		x			Q 409 924
88.2	D		Oil application brushes for chain lubrication	correct setting			x	the brushes must slightly touch the link plates	Q 409 924
89	D		Handrail entry contacts	check function		x			Q 409 653
90	D		Skirt contacts	check function		x			Q 409 648
91	D		Step level contact	check function, clean, lubricate		x			Q 409 601

	Loc.		Subject	Operation	Maint.			Comment	Instructions
	D	T			K	G	V		
92	D		Antistatic brushes	check condition & setting		x		brushes must touch the underside of the riser	Q 409 601
93	D		Step/chain roller monitor	check function, clean, lubricate		x			Q 409 465A
94	D		Step upthrust contacts	check function, lubricate		x			Q 409 709
95.1	D		Relieving curves drive station/top	check setting		x		min. play of chain roller: 0.2/0.8/0.2 mm	Q 409 619
95.2	D		Relieving curves drive station/top	correct setting			x	max. play: 0.7/1.3/0.7 mm	Q 409 619
96	D		Wearing bands (relieving curves)	check condition		x		min. thickness: 1.5 mm	Q 409 619
97.1	D		Relieving curves drive station/bottom	check setting		x		min. play of chain roller: 0.2/0.9/0.2 mm	Q 409 619
97.2	D		Relieving curves drive station/bottom	correct setting			x	max. play: 0.8/1.5/0.8 mm	Q 409 619
98	D		Plastic profiles/wearing bands (relieving curves)	check condition		x		min. thickness of wearing band: 1.5 mm	Q 409 619
99.1	D		Handrail main drive chain	check tension		x		max. sag: 30 mm	Q 409 604
99.2	D		Handrail main drive chain	retension			x	to a sag of 10-15 mm	Q 409 604
99.3	D		Handrail main drive chain	check lubrication state			x	"wet" links	Q 409 604
100.1	D		Handrail secondary drive chains	check tension		x		max. sag: 30 mm	Q 409 604
100.2	D		Handrail secondary drive chains	retension			x	to a sag of 10-15 mm	Q 409 604
100.3	D		Handrail secondary drive chains	check lubrication state			x	"wet" links	Q 409 604
101.1	D		Handrails	check tension		x		sag: 8-12 mm	Q 409 639
101.2	D		Handrails	correct tension			x	sag: ~ 12 mm	Q 409 639
102	D		Guard plate (pit)	install	x	x			Q 409 487
103	D		Maintenance operating panel	remove	x	x			Q 409 480
104	D		Floor covers	close	x	x			Q 409 457
105		T	Maintenance operating panel	connect	x	x			Q 409 480
106.1		T	Lubrication step(s) – application brush	check condition, clean, check setting		x			Q 409 598
106.2		T	Lubrication step(s) – application brush	correct setting			x	brush to step edge: $4.0^{+0.5}$ mm (step with plastic edges)	Q 409 598
106.3		T	Grease cartridge	replace			x	every 9 months	Q 409 598
107		T	3 maintenance steps	install		x			Q 409 461
108		T	Guard plate (Pit)	install	x	x			Q 409 487
109		T	Maintenance operating panel	remove	x	x			Q 409 480
110		T	Floor covers	close	x	x			Q 409 457

	Loc.		Subject	Operation	Maint.			Comment	Instructions
	D	T			K	G	V		
111	D M		External control cabinet	check all internal electrical connections, vacuum and clean			x	once a year	Q 409 802
112.1	D M		VFD fan	check function	x	x			—
112.2	D M		VFD fan	clean		x			—
112.3	D M		Control cabinet fan	check function	x	x			—
112.4	D M		Control cabinet fan	clean		x			—
113	D	T	Visible surfaces of escalator	carry out final cleaning	x	x		remove traces of work	—
114	D	T	"Engineer on Site"	deactivate	x	x		OIT	J 595 027
115	D	T	Protective barriers	remove	x	x			—
116			Control room	notify of startup	x	x			—

Maintenance checklist key:

Location – D = drive station
T = tension station
M = machine room

Maintenance – K = minor maintenance work (8 times a year)
G = major maintenance work (4 times a year)
V = variable intervals (depending on operating time or condition)

7 Maintenance of Drive & Brakes

7.1 Drive – Q 409 447

1 General

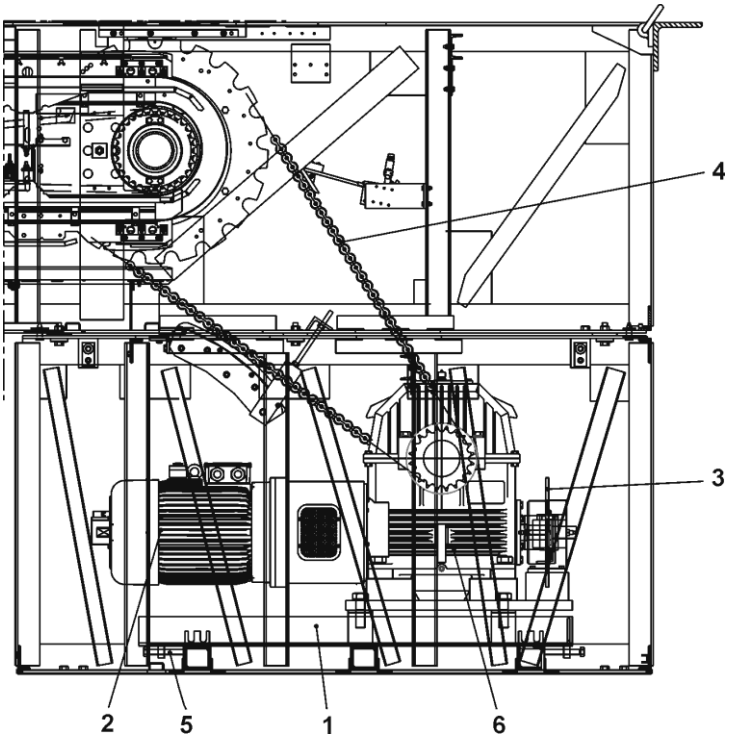
The following subsections give an overview of these instructions. The details are covered by the attached instructions prepared by Renold Gears, unless otherwise noted.

For more detailed information, see Volume VJ, Renold_O&M_Manual.pdf

2 Mode of Operation

2.1 Drive Unit

Fig. 447-01



1) Base plate
2) Motor
3) Service brake
4) Drive chain
5) Tensioning screw
6) Gearbox

The drive unit consists of an electric motor, a gearbox, a resilient coupling, the flywheel, the service brake, the main shaft, the safety brake and the main drive chain. The motor, the gearbox, the coupling, the flywheel and the service brake are mounted on a common base plate.

With Schindler 9700 escalators for WMATA, the drive is installed in the drive station in an additional cage beneath the upper section of the truss and is easily accessible.

2.2 Motor, Encoder and Vibration Sensor

The motor is suitable for inverter duty, CT 10:1, VT 10:1. Three sets of thermistors are installed, the wiring being terminated in the motor terminal box. The motor shaft has a special non-drive end (NDE) extension with a square end, and a modified motor cowl. The square end is to allow for manual rotation of the drive unit via a hand-winding ratchet, supplied loose with the drive unit package.

The motor is also equipped with a vibration sensor RVBM which is installed on top of the main drive motor. This vibration sensor is connected via the top junction box TJ respectively the bottom junction box BJ to the vibration diagnostics module VSE001. This module evaluates the sensor signals and indicates whether a preset vibration value for the corresponding sensor has been reached.

For more detailed information, see Controller Instructions J 595 009, MICONIC F PLC System Description, Section 1.2.2, Vibration Monitoring Module VSE001

2.3 Gearbox

The worm gear unit is fitted with an enhanced sealing arrangement on the worm line, as per arrangement drawings (see appendix), double oil seals fitted back to back on the wheel line, and a Filton breather to prevent ingress of atmospheric contaminants. The worm line enhanced sealing arrangement requires periodic relubrication via the grease nipples provided.

The worm shaft has extended diameters at both ends to accommodate a disk brake at the non-drive end and a motor coupling at the drive end. A fabricated motor adaptor supports a flange-mounted Nema motor, and houses the enhanced sealing cartridge at the drive end of the unit. A fan and cowl are fitted with the motor adaptor to provide ventilated cooling horizontally down the outside of the gear casing. Guards are provided to cover two cut-outs in the motor adaptor to prevent access to rotating parts.

Tapered roller bearings are fitted to both the worm shaft and the wheel shaft. The worm caps are shimmed to provide the required end float for the worm-shaft bearings. The wheel caps/covers are also shimmed to ensure correct gear contact and to prevent end float or preload on the wheel bearings.

The gear unit is also fitted with an inspection cover on the top of the gear casing which can be removed to inspect the gear contact.

A hollow shaft encoder ENC is mounted on the shaft extension. The input of this encoder is connected to the high-speed counter module DC541-CM and used for monitoring the motor speed during rated operation.

The measured motor speed is compared to the tolerance limits:

- Speed warning +5%: maximum of +5% above rated speed
- Speed warning -5%: maximum of -5% below rated speed
- Overspeed 15%: maximum of 15% above rated speed
- Overspeed 25%: maximum of 25% above rated speed
- Underspeed 20%: 20% below rated speed

With 25% overspeed, the safety brake engages in addition to the drive brake.

Error codes:
"E_18" for 15% overspeed
"E_CC" for 25% overspeed
"E_1C" for 20% underspeed

For more detailed information, see Controller Instructions J 595 009, MICONIC F PLC System Description, Section 1.1.1.3, Counter module DC541-CM

2.4 Drive Chain

A precision roller chain, which is used as a drive chain, transmits the drive torque from the gearbox to the escalator's main shaft, which is mounted at the upper end of the escalator in the drive station track block. The drive chain tension is maintained by moving the drive chain deflection device. A switch (**drive chain contact**) is provided to indicate loosening chain tension. When operated, the switch activates the escalator's emergency stop function.

For more detailed information, see Maintenance Instructions Q 409 452, Drive Chain, and Maintenance Instructions Q 409 453, Drive Chain Contact

2.5 Brakes

Schindler 9700 escalators for NYCT feature three independent brakes:

- The generously dimensioned, solenoid-released **service brake** is mounted outside the gearbox and acts via the brake disk directly on the worm shaft. The braking torque is independent of the direction of travel.

  The brake engages in the case of normal and emergency stops (due to activation of one of the safety contacts), as well as in the case of power failures. In the case of normal stops (soft stops), the brake engages with a time delay. A brake contact prevents the motor from starting with the brake engaged. The controller monitors the "open" or "closed" position of this contact.

  The brake can be manually released via a hand-winding device. This function is also monitored by a brake contact. A third contact is provided for monitoring the wear of the brake pad.

- The **safety brake** (disk brake) is mounted on the end of the main shaft and, if necessary, only acts during downward travel. It is always installed in tandem with the drive chain contact.

  The brake disk which is provided with brake pads is pressed against the surface of the drive chain sprocket by means of a pressure disk. Retainer blocks on the brake disk engage with a pawl which stops the rotation of the disk.

  In the case of normal stops or stops caused by safety devices not listed below, the pawl engages simultaneously with the service brake in the upward direction of travel and with a time delay of approx. 3 seconds in the downward direction of travel.

  The pawl engages without delay in the following cases:

  – breakage or excessive elongation of the drive chain
  – 25% overspeed

  and with a time delay in the case of power failure.

For more detailed information, see Maintenance Instructions Q 409 710, Safety Brake

3 Related Faults and Troubleshooting

The following troubleshooting routines are associated with the drive, the drive brake system and the encoder:

Fault Code	Description	Troubleshooting
18-ENC-15% Motor Overspeed	Defective encoder System not configured properly	Check the actual speed of the motor. With the motor overspeeding, contact the factory.
1C-ENC_MU-15% Motor Underspeed	Defective encoder System not configured properly	Check the actual speed of the motor. With the motor overspeeding, contact the factory.
24-WTHM_TR-Motor	Motor windings are overheated	If the motor is overheated, consider what may be the cause, e.g., frequent start-ups during maintenance, loss of one phase or defective motor windings.
	PTC thermistor or wiring is defective	If the motor feels warm from outside, wait until it has cooled down. If the fault persists, check the PTC thermistor by measuring the resistivity with an ohmmeter. Under normal conditions, the reading should not exceed 400 Ohms. If the PTC does not show any faults, check the wiring according to the schematics.
	PTC module is defective	If none of the above measures can solve the problem, replace the module.
26-ENC-Rotation	Two motor phases are swapped	Check the motor direction in maintenance mode and correct the phase sequence accordingly.
	Drive chain too tight	This extra stress on the drive chain suffices to force the escalator into the other direction when the unit is restarted and the service brake is released. Adjust the drive chain according to the instructions given in the manual.
38-ENC_FLT-Encoder Failure	Encoder or high-speed counter module is defective	Check whether the PLC displays the fault code "E_38". In this case, the HSC module is defective. Replace the module.
		Start the unit if no signal is received on the HSC module and wiring is correct. Then, check the encoder and replace it, if necessary.
	Loose wiring	Check and correct any wiring problems according to the schematics.
43-KOMH_TR-Gear Oil Level	Gear oil level too low	Check the oil level and add oil, if necessary.
	Oil level gage switch defective	Refer to the manufacturer's manual.

Fault Code	Description	Troubleshooting
70-KB1-Service Brake Release Fault Mntr	Switch not working properly	Check the switch's adjustment and functionality. Adjust or replace the switch, if necessary.
	Service brake does not engage	Faulty brake system. Refer to the manufacturer's manual for further information.
73-KBMR1-Service Brake Manual Release	Service brake is manually released	Reset the brake back to its normal position. Refer to the manufacturer's instructions.
	Switch not working properly	Check the switch's adjustment and functionality. Adjust or replace the switch, if necessary.
	Service brake manual release does not reset	Faulty brake system. Refer to the manufacturer's manual for further information.
76-KGRDM-Mtr Shaft Cover Removed	The shaft cover is removed or not installed properly	Place the shaft cover in its proper position.
	Defective switch	Check the switch's adjustment and functionality. Adjust or replace the switch, if necessary.
CC-ENC_MO-25% Motor Overspeed	Defective encoder System not configured properly	Check the actual speed of the motor. With the motor overspeeding, contact the factory.
D9-KBB1-Service brake Pad Mntr	Brake pads worn out	Replace the brake pads.
	Switch not properly adjusted	Adjust the switch according to the manufacturer's instructions.
DD-DHMH-Drive Machine E-STOP	E-stop is engaged	Pull and reset the drive machine e-stop.
EA-ENC_D-Braking Dist. Exceeded	Service brake not working properly	Check and correct the brake's functionality. Adjustment may be needed. Refer to the manufacturer's manual.
F7-RGBA-RGBA	Safety brake solenoid is defective	Replace the solenoid.
	Safety brake not adjusted properly	Visually inspect the solenoid's behavior during the brake function test and determine which adjustments are necessary.
	Control relays defective	Replace the relays.

7.2 Safety Brake – Q 409 710

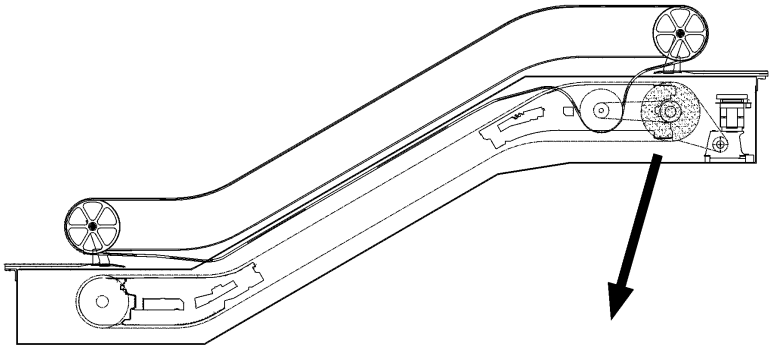
1 Description and Mode of Operation

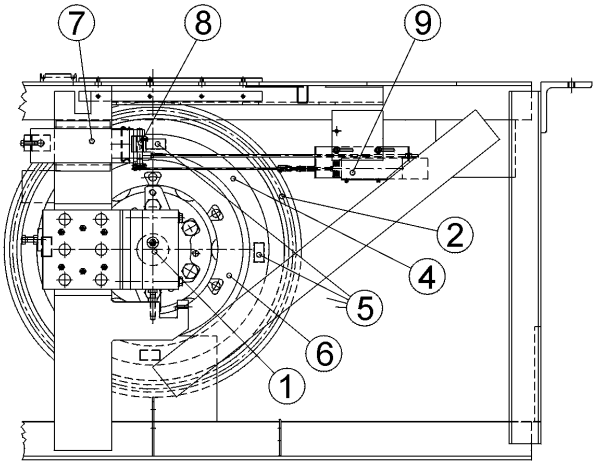
The safety brake acts directly on the main shaft (1).

1.1 Description

- The safety brake is designed as an annular disk brake and is accommodated in the drive sprocket (2). It is always installed together with the speed monitor and the drive chain contact.
- The brake disk (4) which is provided with brake pads (3) on both sides, is pivoted in the drive sprocket (2).
- Twelve retainer blocks (5) are arranged on the outside of the brake disk. The brake disk (4) is pressed against the drive sprocket (2) by means of a pressure disk (6).
- A pawl-type lock (7) which is actuated by a solenoid, is fastened to the truss. In the case of danger, this lock blocks the brake disk (4). The safety brake only works in the **downward** direction.

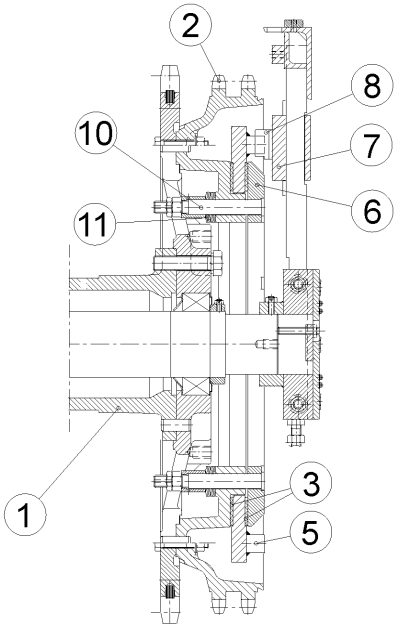
Fig. 710-01





1) Main shaft
2) Drive sprocket
4) Brake disk
5) Retainer blocks
6) Pressure disk
7) Pawl-type lock
8) Pawl
9) Solenoid

Fig. 710-02



3) Brake linings
10) Thrust bolt
11) Disk spring assembly

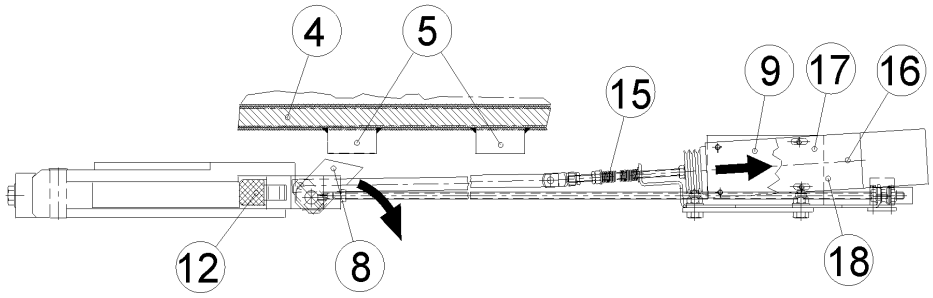
Hint!

For rises of up to approx. 10 m (depending on load regulations and speed) only **one** safety brake is installed on the right side of the main shaft. For higher rises, **two** safety brakes are installed – one on the right and one on the left side of the main shaft.

1.2 Mode of Operation

- The safety brake is an **active** brake, i.e. the pawl (8) locks when the escalator is idle and is released by the solenoid (9) when the escalator is started.
- The main shaft (1) can turn freely with the brake disk (4).

Fig. 710-03: *Start*



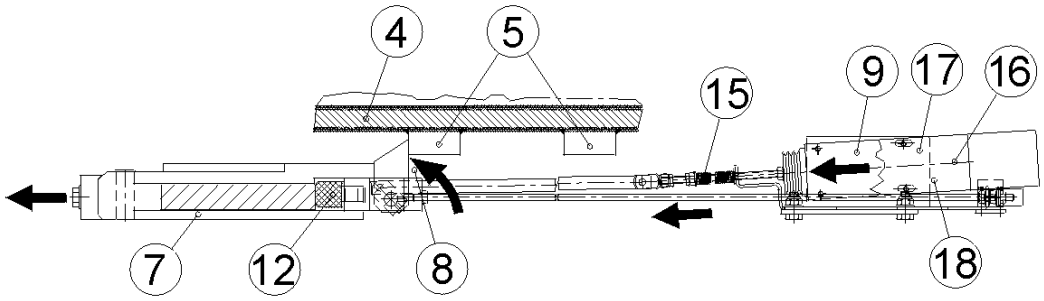
9) Solenoid
12) Rubber cushion
15) Spring
16) Armature
17) Break contact (safety circuit)
18) Make contact (signaling)

Hint!

When the solenoid (9) picks up, the armature (16) actuates the break contact (17), the safety circuit is completed, and the motor can start.

- In the case of danger, the solenoid (9) drops out, and the pawl (8) locks.
  - The retainer block (5) of the brake disk (4) is stopped by the pawl (8), and the brake disk is blocked.

Fig. 710-04: *Stop*



  - The contact (17) opens the safety circuit.

Hint!

The entire pawl-type lock (7) is mounted in the truss and can be shifted longitudinally → a rubber cushion (12) dampens the blow when the braking process is initiated.

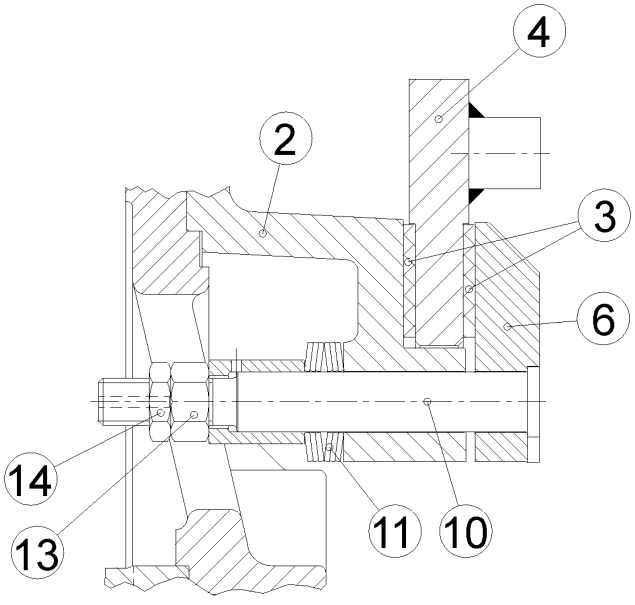
- The escalator is brought to a standstill due to the friction between the brake disk (4), the pressure disk (6) and the drive sprocket (2).

Hint!

The contact pressure of the brake disk (4) against the drive sprocket (2) – and thus the braking distance – can be adjusted by means of the 6 disk spring assemblies (11).

Fig. 710-05

2) Drive sprocket
3) Brake linings
4) Brake disk
6) Pressure disk
10) Thrust bolt
11) Disk spring assembly
13) Nut
14) Counternut



- The tightening torque VCBN (Nm) of the nut (13) depends on the production order and is set at the factory.

Identification		Tightening Torque VCBN
Schindler	WMATA	[Nm]
ESF4548	01	50
ESF4548	02	50
ESF4549	03	50

Hint!

Verification: The tightening torque VCBN is indicated on the data sheet (see the installation folder which comes with every escalator).

- When the escalator is stopped normally or by a safety device **not** listed below, the pawl (8) engages with a time delay of approx. 3 seconds.
- In the following cases of danger, the pawl engages **without delay**:
  - breakage or excessive elongation of the drive chain
  - overspeed 125%
  - power failure with delay

2 Maintenance

2.1 Functional Check

Hint!

The functional check is carried out with the speed monitor by simulating over- or underspeed.

For more detailed information, see Controller Instructions J 572 812, Technical Tests, Sections 2.1 to 2.9

- Simulation is activated when the escalator is ready for operation and idle.
- Activate the technical test menu.

For more detailed information, see Controller Instructions J 595 027, Operator Interface Terminal (OIT)

- Press one of the marked touch buttons to select one of the speed tests.
- Start the escalator with the key switch in the downward direction within 30 seconds, and keep the service brake disengaged.
- Following start-up delay (15 sec.), over- or underspeed will be detected and the pawl (8) will engage. The escalator is shut off electronically and interlocked.

  The faults screen appears indicating the error code related to the technical test.

  Error codes:

  "E_3E" for 15% master overspeed

  "E_CF" for 25% master overspeed

  "E_3F" for master underspeed

  "E_30" for 15% slave overspeed

  "E_CE" for 25% slave overspeed

  "E_31" for slave underspeed

  No error code "Safety brake engaged": "E_35"
- Visual check of the braking distance:

  The braking distance should be more or less the same as the braking distance of the service brake.
- Reset:
  - Touch the RESET touch button on the faults screen to reset the error.
  - Speed simulation is deactivated by exiting the test screen or after 30 seconds has elapsed without any activities.
  - If the fault is still active press RESET to reset the error.
- Start the escalator with the key switch in the **downward** direction (direction of the tension station):
  - The pawl **cannot** open.
  - The escalator is shut down but **not** interlocked after 3 seconds.
  - Error code: "E_35"
- Release the pawl:

  Turn the key switch to run the escalator for a short distance in the **upward** direction (direction of the drive station) until the pawl (8) can swing out past the retainer block (5).

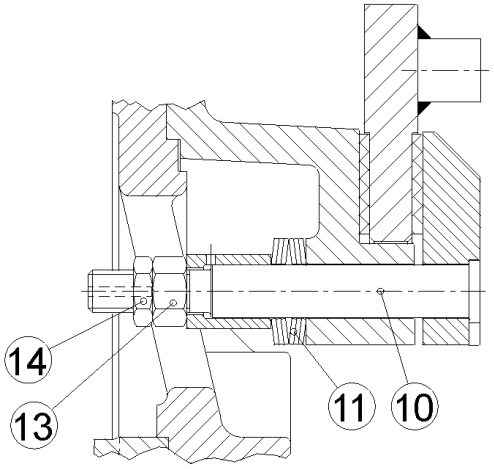
2.2 Readjusting the Braking Distance

Hint!

If the visually determined braking distance deviates from the braking distance of the service brake by more than 30%, the braking distance must be readjusted.

- Adjust the braking distance by changing the preset tension of the disk spring assemblies (11).

Fig. 710-06



10) Thrust bolt
11) Disk spring assembly
13) Nut
14) Counternut

– Remove the counternuts (14).
– Use the nuts (13) to change the preset tension of all 6 disk spring assemblies (11) by the same value.

Hints!

- Use a torque wrench.
- For the theoretical tightening torque VCBN [Nm] preset at the factory, see the table below.

Identification		Tightening Torque VCBN
Schindler	WMATA	[Nm]
ESF4548	01	50
ESF4548	02	50
ESF4549	03	50

Hint!

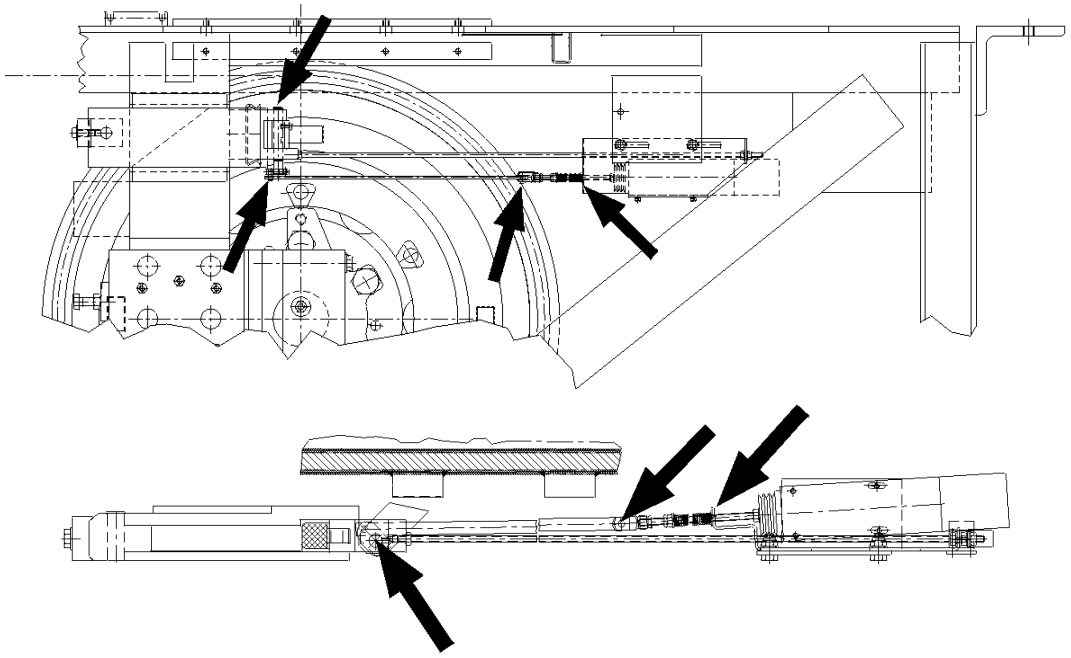
Verification: The tightening torque VCBN is indicated on the data sheet (see the installation folder which comes with every escalator).

– Retighten the counternuts.

2.3 Lubrication

- Lubricate the pivots of the rod and the pawl.

Fig. 710-07



- Use mineral oil.

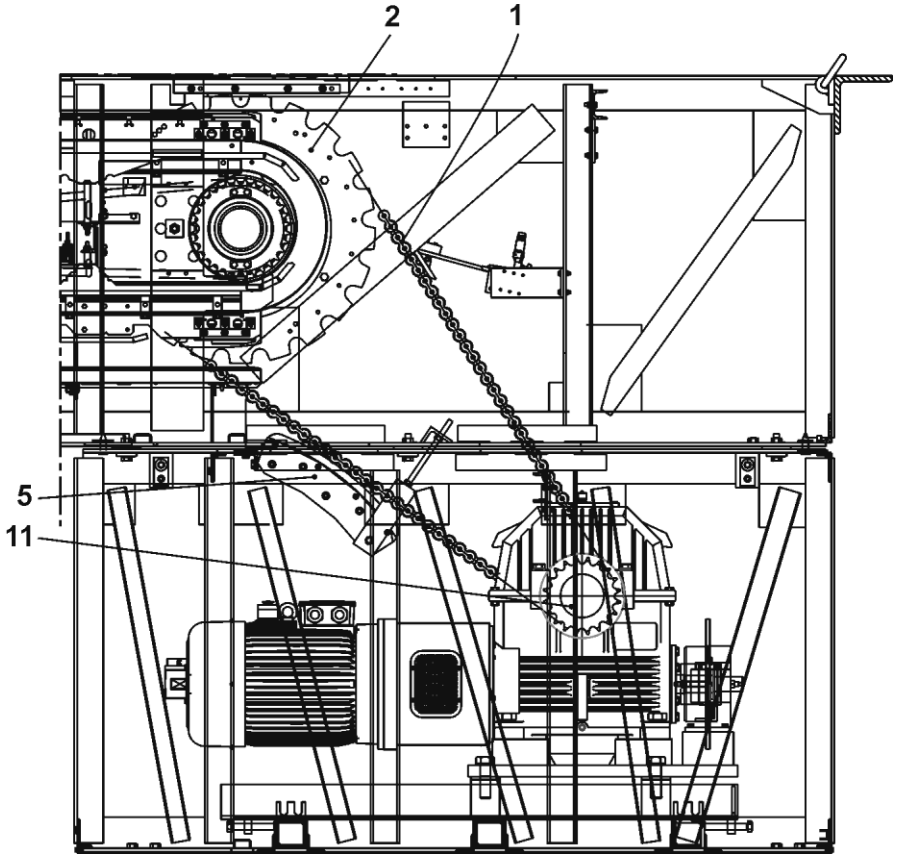
For more detailed information, see Maintenance Instructions Q 594 036, Lubrication System, Lubrication Schedule

7.3 Drive Chain – Q 409 452

1 Description and Mode of Operation

- The drive chain (1) is a duplex chain that transmits the driving torque to the main shaft (2).
- The drive chain (1) is tensioned by longitudinally shifting the entire drive unit with the pinion (11) by means of threaded spindles.
- The chain strand is guided via chain deflectors (5) with a plastic guide.

Fig. 452-01



1) Drive chain
2) Main shaft
5) Chain deflector
11) Pinion

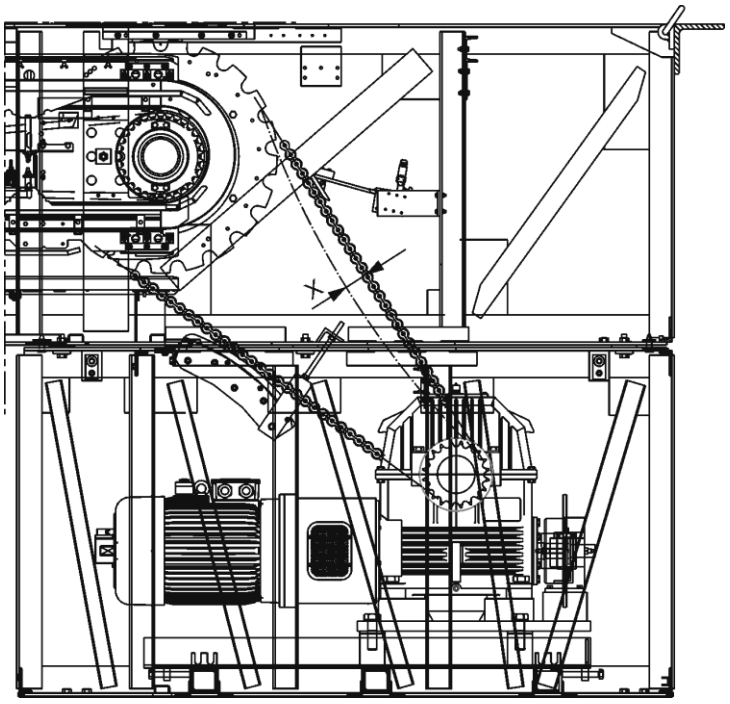
2 Maintenance

2.1 Chain Tension

2.1.1 Checking the Tension

- Optimum chain tension is achieved when the return strand of the chain has a sag X of 40 mm.
- Retension the chain when the sag equals or exceeds 70 mm.

Fig. 452-02



2.1.2 Retensioning the Chain

- Shift the drive unit until the sag X = 40 mm.
- Distribute the sag X to both chain strands.

Warning: Overtensioning on one side!

Otherwise, one of the chain strands might be overtensioned.

- The drive unit can be shifted within the range of the slots in the base frame.
- Measure the chain elongation between two far-off chain links on a straight chain strand.

Hint!

When the max. permissible chain elongation of 2% is reached, the chain has to be replaced!

2.2 Lubrication

Use the following lubricants to lubricate the drive chain:

Warning: Outdoor installation & ambient temperature!

With automatic lubrication system, uncovered outdoor installaton and ambient temperatures < 10 °C, only oils indicated below may be used!

	Lubrication Method	BP	ESSO	KLÜBER	MOBIL	SHELL	ZEPF
1	Automatic lubrication system			Mineral oil			Synthetic oil
		–	–	Klüberoil GEM 1-46N	–	–	Ultrafit-Synthex
		Only use these particular, water-repellent oils. These oils are **not** suited for manual lubrication.					

For more detailed information, see Maintenance Instructions Q 409 924, Automatic Lubrication System

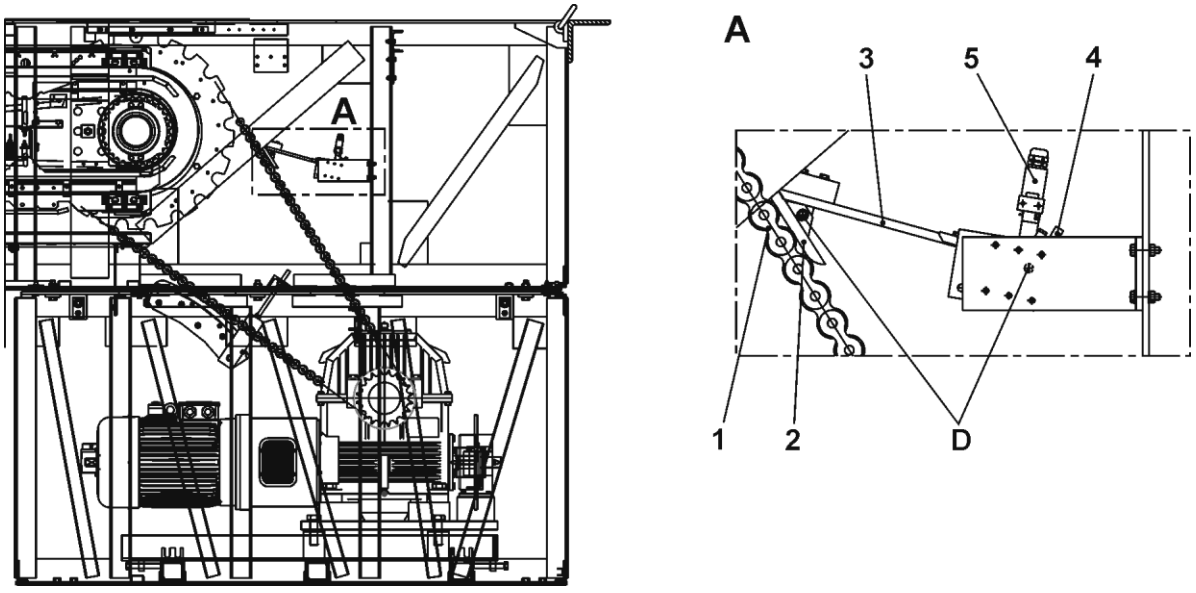
7.4 Drive Chain Contact – Q 409 453

1 Description and Mode of Operation

1.1 Description

- With escalators of the Schindler 9700 product line, the drive chain contact is installed as standard.
- The oil- and abrasion-resistant chain glider is mounted on a pivoted lever and rests on the drive chain. When the chain breaks or slackens beyond the permissible value, the safety brake is actuated via a contact and stops the escalator.
- This safety device is mainly installed for chain breaks, since the drive brake is inactive in this case.

Fig. 453-01



1) Drive chain
2) Chain glider
3) Lever
4) Trigger
5) Contact
D) Pivot points

1.2 Mode of Operation

- When the drive chain (1) breaks or slackens beyond the permissible value (wear and tear), the chain glider (2) and the lever (3) resting on the chain tilt down.
- The trigger (4) which is firmly attached to the lever, swivels upward and actuates the contact (5) which in turn actuates the safety brake.

2 Maintenance

2.1 Functional Check

- Connect the maintenance operating panel.

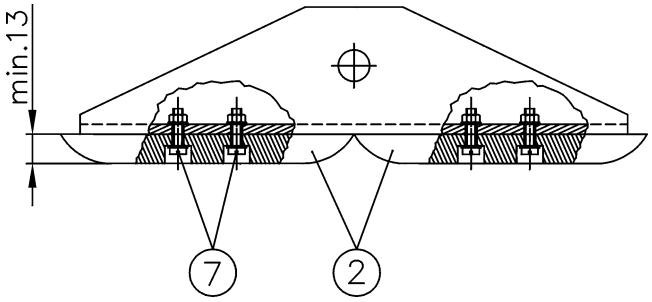
Hint!

With the maintenance operating panel connected, the safety brake is always disengaged.

- Actuate the contact manually.
  - The solenoid immediately drops out and the pawl engages.
    Error code: "E_19" electronically interlocked
- Reset the error.

2.2 Checking the Condition of the Chain Glider

Fig. 453-02



2) Chain glider
7) Fastening screws (AM5x20)

- Minimum height of chain glider (2): 13 mm

Warning: Pay attention to screw heads!

The heads of the screws (7) must **not** glide on the chain rollers!

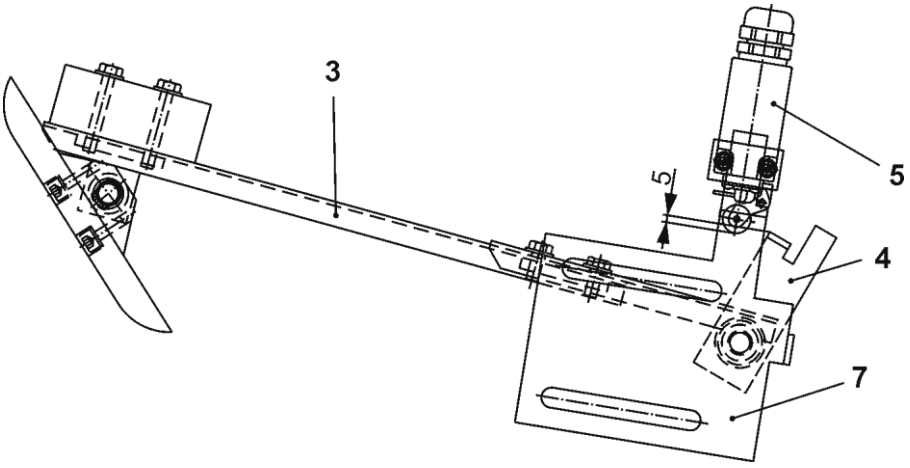
- Replace the chain glider (2) as soon as it equals or falls short of the minimum height.

2.3 Adjusting the Contact

Hint!

A setting check is only required during commissioning or upon replacement of the proximity switch.

Fig. 453-03



3) Lever
4) Trigger
5) Contact
7) Base plate

- With the lever (3) tilted down, the contact roller and the trigger (4) should overlap by $3.5^{+0.5}$ mm.
- The length of the spring should measure between 215 and 230 mm.

7.5 Drive Chain Deflector – Q 409 453A

1 Description and Mode of Operation

1.1 Description

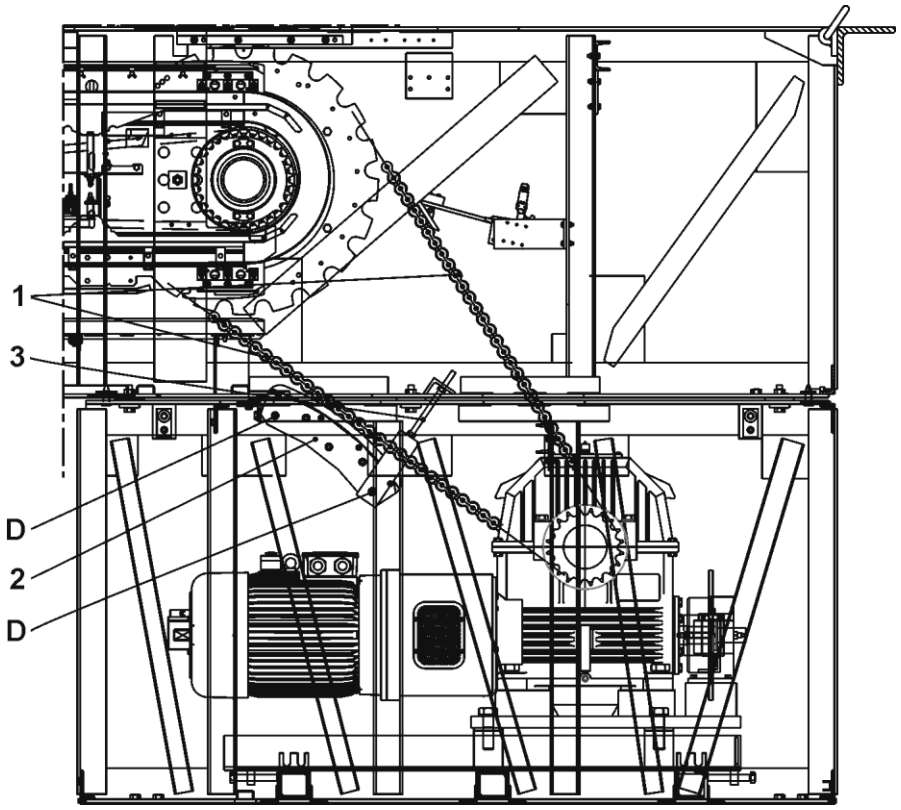
The drive chain deflector is installed to guide the drive chain and to prevent improper vibration of the drive chain.

1.2 Mode of Operation

Oil- and abrasion-resistant chain gliders are mounted on the drive chain deflector.
The drive chain (1) is supported by drive the chain deflector (2) which is moved via a threaded rod (3).

Fig. 453A-01

1) Drive chain
2) Drive chain deflector
3) Threaded rod
D) Pivot points



2 Maintenance

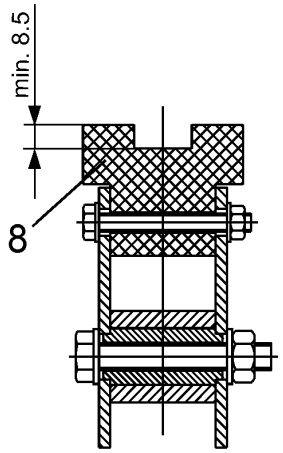
2.1 Functional Check

- Check the guidance of the drive chain (1) by the drive chain deflector (2) during inspection operation of the escalator.
- Check the vibration behavior of the drive chain (1) during inspection operation of the escalator.

2.2 Checking the Condition of the Chain Guides

Fig. 453A-02

8) Chain guide

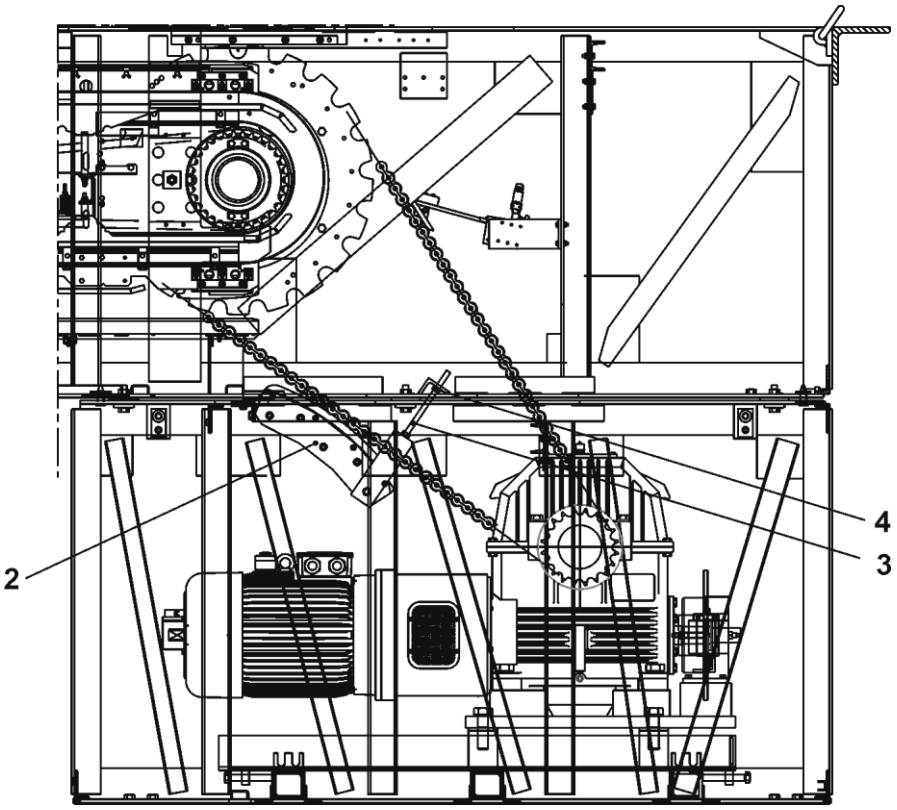


- Minimum permissible depth of the chain guide groove: 8.5 mm
- Replace the chain guide (8) as soon as the groove equals or falls short of the minimum permissible depth.

2.3 Adjusting the Deflector

Hint!
A setting check is only required during commissioning or upon replacement of the deflector.

Fig. 453A-03



2) Drive chain deflector
3) Threaded rod
4) Lock nuts

- Adjust the drive chain deflector with the threaded rod (3) by means of the lock nut (4).

2.4 Lubrication

- Lubricate the pivot points (D) (see Fig. 453A-01) with mineral oil.

  Use extreme-pressure mineral oils, viscosity VG 460:

BP	ESSO	KLÜBER	MOBIL	SHELL
Energol GR-XP 460	Spartan EP 460	Klüberoil GEM 1-460N	Oil DTE24	Omala 460

8 Maintenance of Tracks & Skirt Panels

8.1 Tracks – Tangential Tracks, Relieving Curves – Q 409 619

1 Description and Mode of Operation

The track system consists of three blocks:

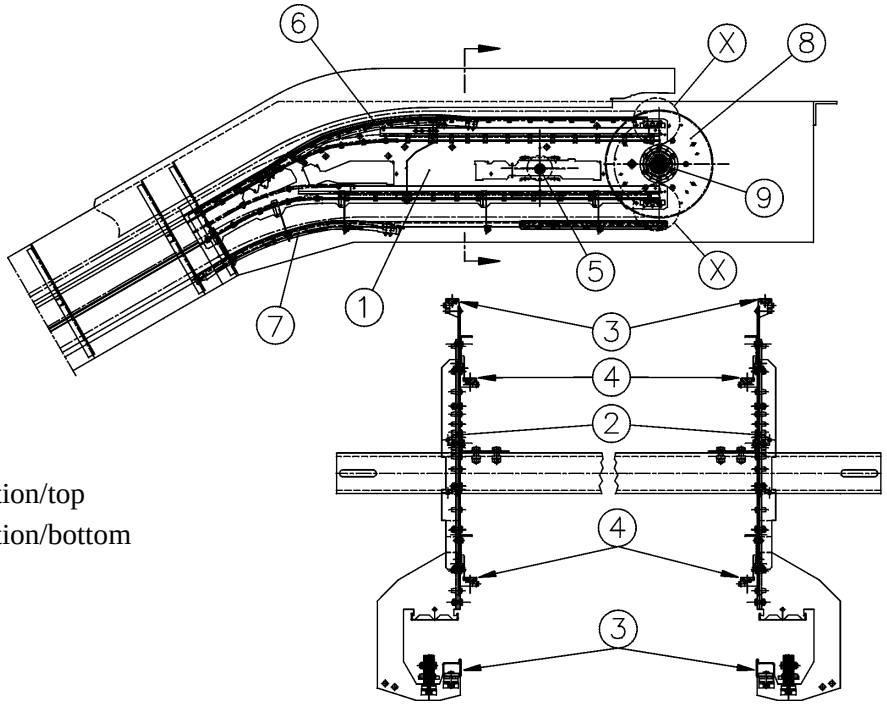
- Drive station track block (1)

  consisting of the side plates (2) with the tracks for the chain rollers (3) and the tracks for the step rollers (4) as well as the handrail drive shaft (5).

  The step chains are supported by relieving curves (6) and (7) both in the transition curve of the advance track and in the transition curve of the return track.

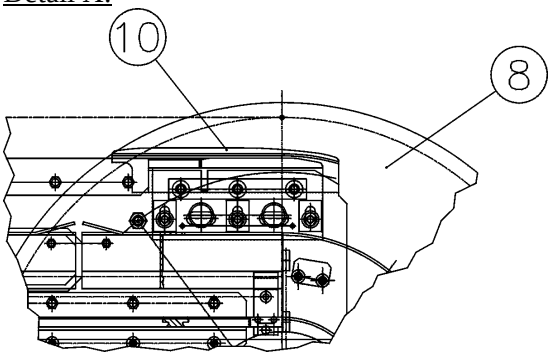
  In addition, the step chains are supported by tangential tracks (10) at the nip points of the main shaft's (9) sprockets (8).

Fig. 619-01



1) Track block
2) Side plates
3) Chain roller tracks
4) Step roller tracks
5) Handrail drive shaft
6) Relieving curve, drive station/top
7) Relieving curve, drive station/bottom
8) Step chain sprocket
9) Main shaft

Detail X:

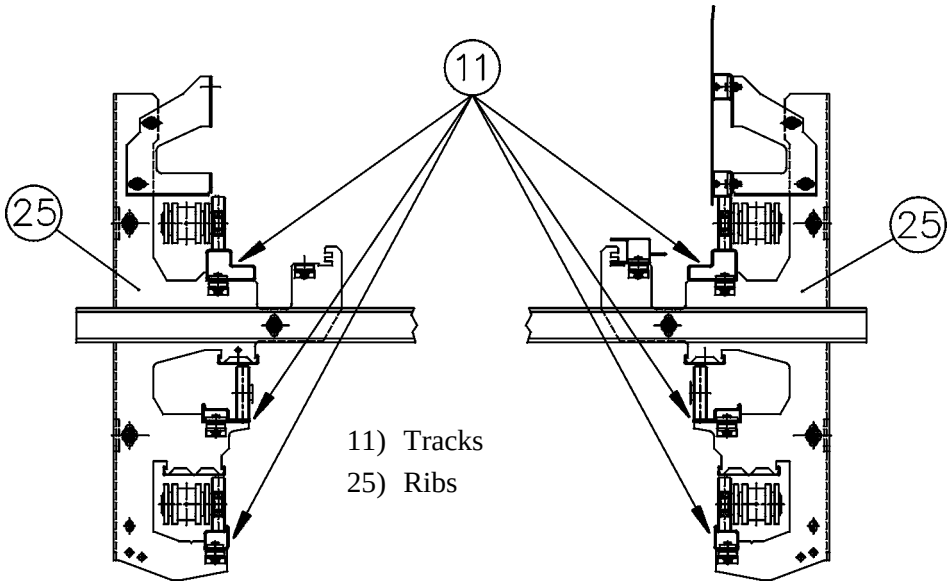


8) Step chain sprocket
10) Tangential track

- Middle section

  The sectional steel tracks (11) are mounted on ribs (25) which are positioned during installation by means of jigs.

Fig. 619-02



11) Tracks
25) Ribs

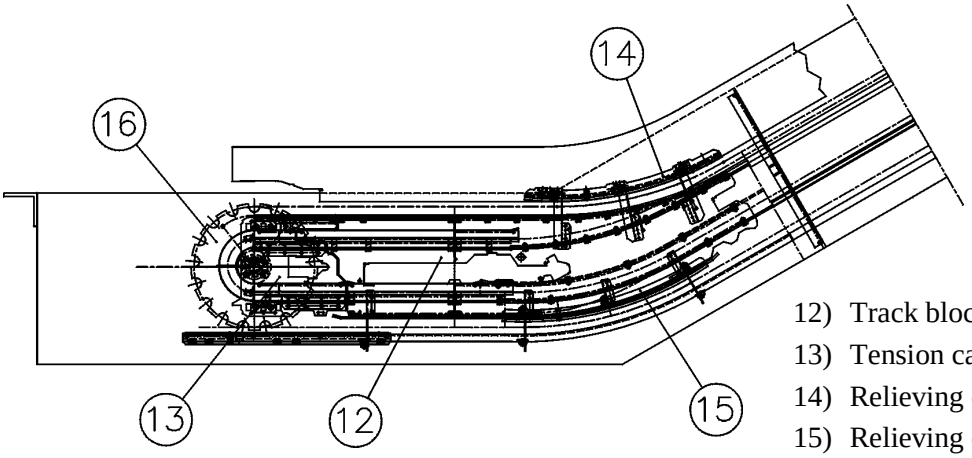
- Tension station track block (12)

  has the same structure as the drive station track block; in addition, containing the tension carriage (13) for tensioning the step chains.

  Step chains of all sizes are supported by relieving curves in the transition curve of the advance track (14), whereas only step chains of the sizes 2 and 3 are supported by relieving curves in the transition curve of the return track (15).

  In addition, the step chains are supported by tangential tracks (10) at the nip points of the tension carriage's (13) newel chain sprockets (16) (see Detail X, Fig. 619-01).

Fig. 619-03



12) Track block
13) Tension carriage
14) Relieving curve, tension station/top
15) Relieving curve, tension station/bottom (not applicable)
16) Newel chain sprocket

2 Maintenance

2.1 Cleaning

- Clean the step roller advance track (17) over its entire length (by means of a spatula).

Warning: "Bouncing" steps!

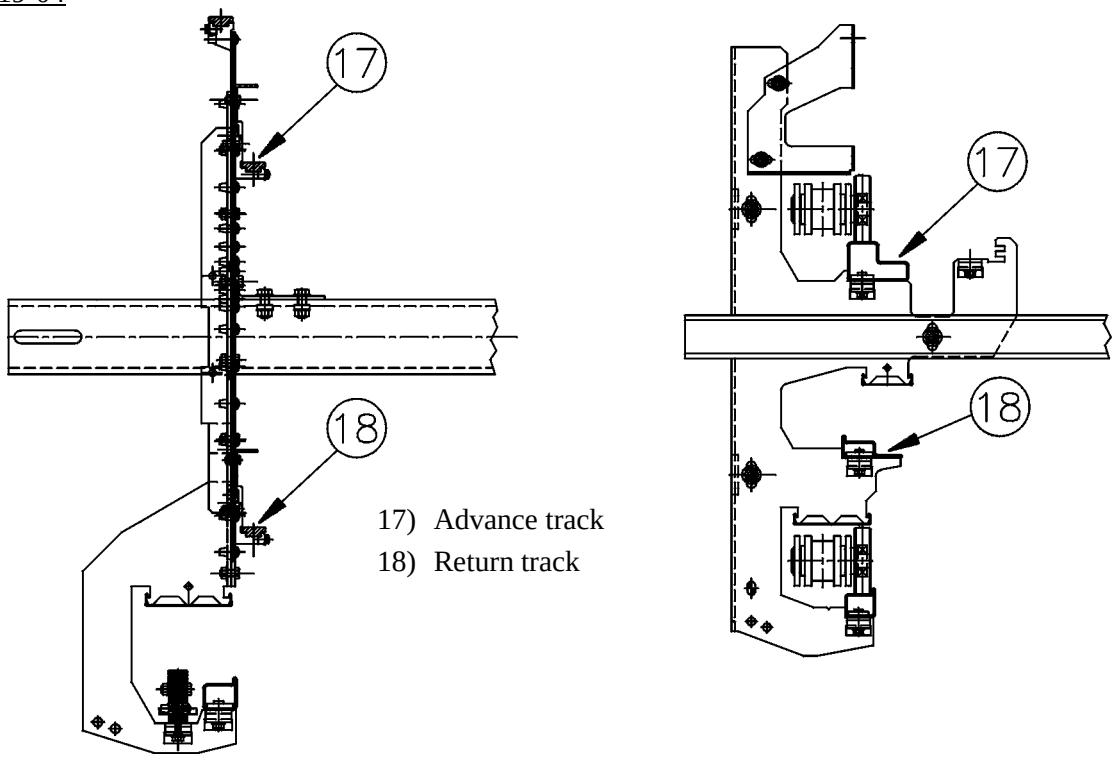
Undulating accumulations of oil and dust on the tracks cause unloaded steps to "bounce" → noise.

Hint!

Do **not** lubricate the tracks.

- Check whether the step roller return track (18) is soiled and clean it, if necessary.

Fig. 619-04



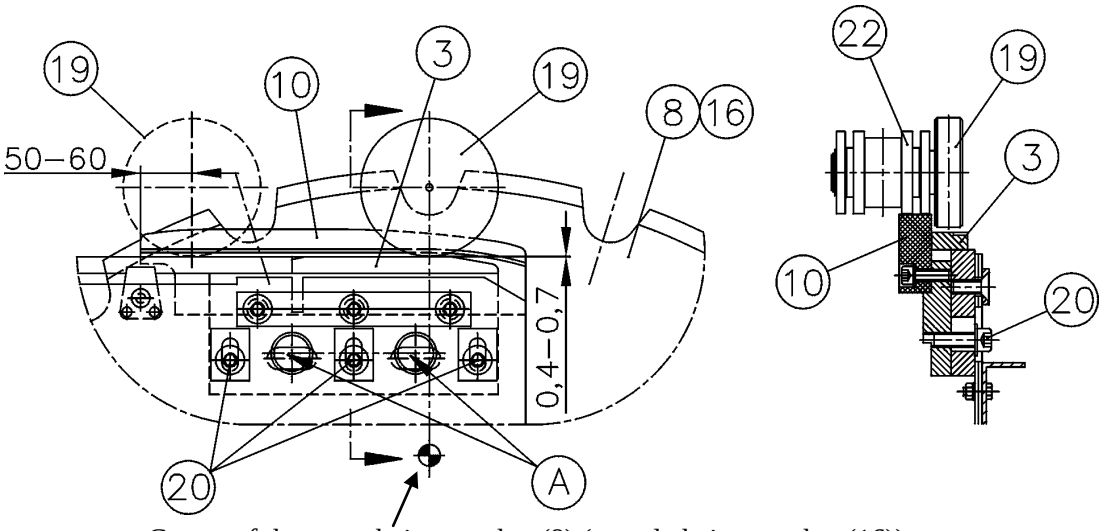
17) Advance track
18) Return track

In the Track Block Area *In the Middle Section*

2.2 Checking the Setting of the Tangential Tracks

2.2.1 Tangential Track in the Advance Track

Fig. 619-05



Center of the step chain sprocket (8) (newel chain sprocket (16))

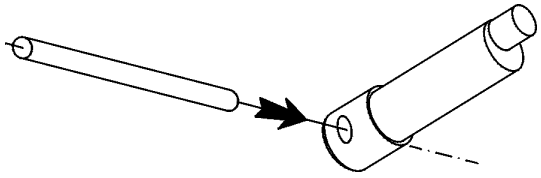
3) Chain roller track
10) Tangential track
19) Chain roller
20) Clamping screws
22) Step chain
A) Location holes

- With the chain roller (19) positioned at the center of the step chain sprocket (8) (or the newel chain sprocket (16)), it should have a distance of 0.4 to 0.7 mm from the chain roller track (3).
- With the chain roller (19) positioned at a distance of approx. 50 to 60 mm from the tangential track's (10) rear edge, it should abut the track (3) or have a distance of max. 0.2 mm from the track (3).
- Readjustment:
  - Loosen the clamping screws (20).
  - Insert eccentrics (21) (preferably 2 pcs.) into the location holes (A).
  - With the chain roller (19) positioned at the center of the step chain sprocket (8):

    Turn the eccentrics in the location holes (A) until the tangential track (10) abuts the step chain sidebars (22) with light pressure; tighten the front clamping screw (20) by hand.
  - With the chain roller (19) positioned at a distance of approx. 50 to 60 mm from the tangential track's (10) rear edge:

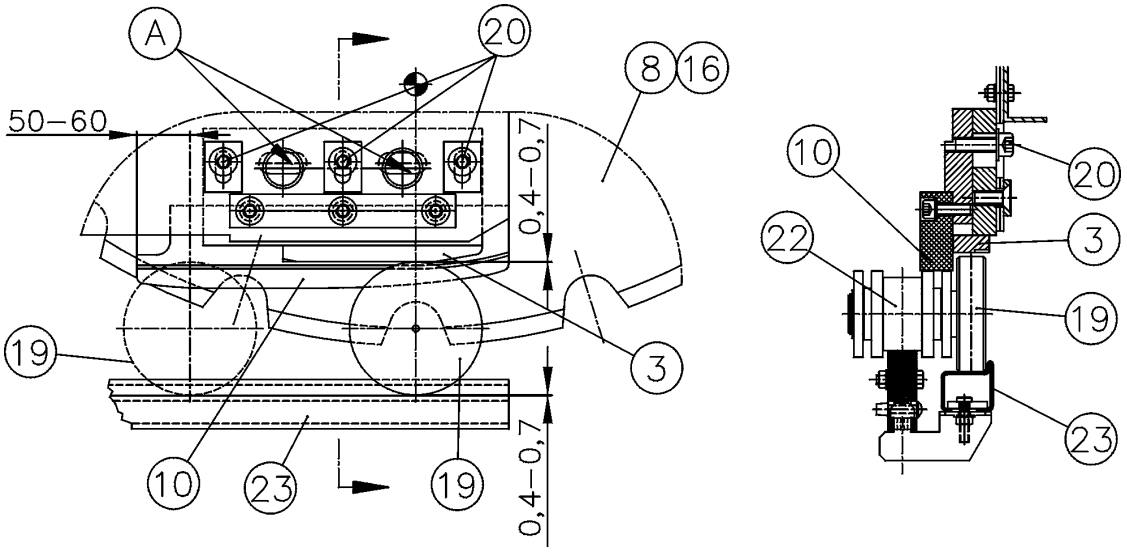
    Turn the eccentric in the second location hole (A) to adjust the tangential track (10) so that the chain roller (19) abuts the track (3) or has a distance of max. 0.2 mm from the track (3).
  - Tighten all clamping screws (20).

Fig. 619-06 *Eccentric (Drawing Z 552 485, ID no. SDZ 393 759)*



2.2.2 Tangential Track in the Return Track

Fig. 619-07



23) Return track

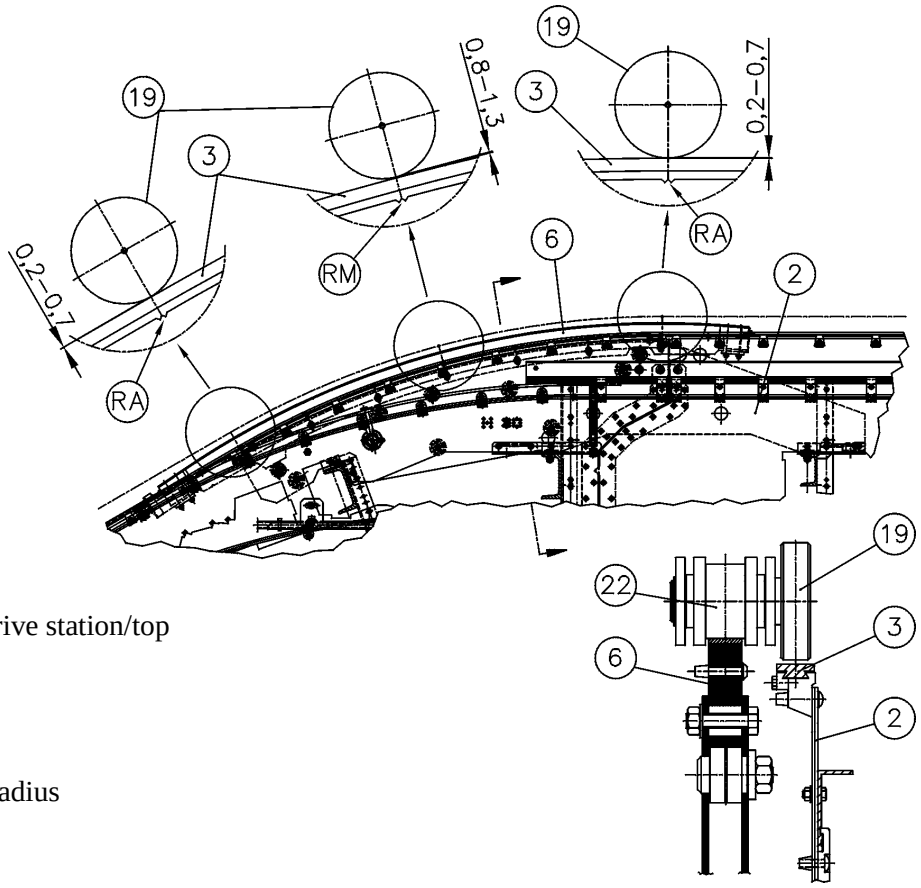
- With the chain roller (19) positioned at the center of the step chain sprocket (8) (or the newel chain sprocket (16)), it should have a distance of 0.4 to 0.7 mm from the track (3) as well as from the return track (23).
- With the chain roller (19) positioned at a distance of approx. 50 to 60 mm from the tangential track's (10) rear edge, it should abut the return track (23) or have a distance of max. 0.2 mm from the return track (23).
- Readjustment:

  Proceed as described under Section 2.2.1, Tangential Track in the Advance Track.

2.3 Checking the Relieving Curve, Drive Station/Top

2.3.1 Setting Check

Fig. 619-08



2) Side plate
3) Chain roller track
6) Relieving curve, drive station/top
19) Chain roller
22) Step chain

RA: Starting points of radius
RM: Center of radius

Hint!

The starting points (RA) and the center of the radius (RM) are marked on the side plate (2) by w-shaped symbols.

- The gap between the chain roller (19) and the track (3) shall measure:
  - 0.2 to 0.7 mm at both starting points of the radius (RA)
  - 0.8 to 1.3 mm at the center of the radius (RM)

Hint!

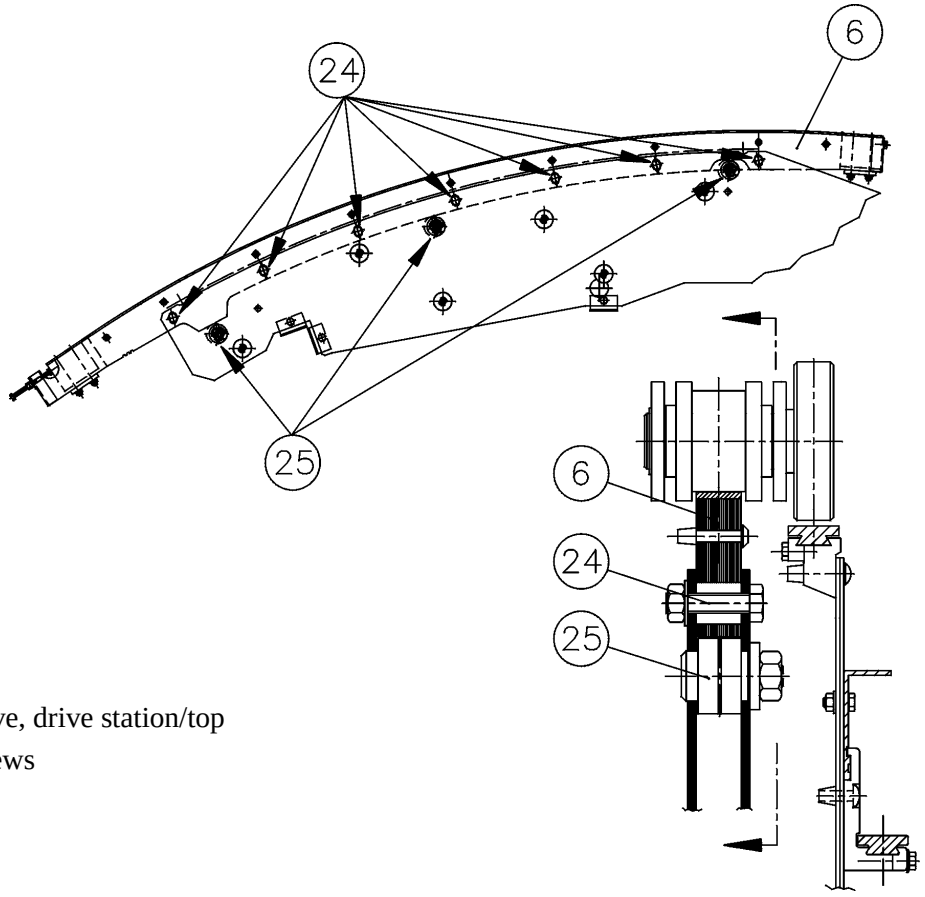
As soon as the minimum permissible gap of 0.2 mm at the starting point of the radius or 0.8 mm at the center of the radius is reached, the relieving curve must be readjusted.

Warning: Damage to plastic tire!

If the chain rollers exert pressure on the track in the area of the radius, uncontrolled forces will act on the plastic tire and destroy it within a relatively short time.

- Readjustment:

Fig. 619-09



6) Relieving curve, drive station/top
24) Clamping screws
25) Eccentrics

– Loosen the nuts of the clamping screws (24).

Hint!
The heads of the clamping screws are welded to the support plate of the relieving curve.

– Loosen the clamping nuts of the eccentrics (25).

Hint!
With Schindler 9700-20, only 2 eccentrics; with Schindler 9700-30, 3 eccentrics

– Turn the eccentrics (25) to lift the relieving curve (6) until the gap between the chain roller (19) and the track (3) measures
approx. 0.5 to 0.7 mm at the starting points of the radius (RA) and
approx. 1.1 to 1.3 mm at the center of the radius (RM)
(see Fig. 619-08).

Hint!
Tighten the clamping nuts immediately after lifting the relieving curve by means of the eccentrics to prevent it from falling back.

– Tighten the nuts of the clamping screws (24).

- Design of the eccentrics (25)

With projecting hex nose,
wrench size 19 mm

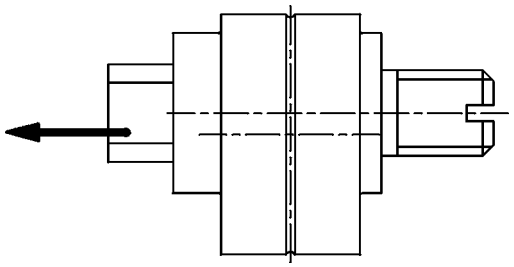
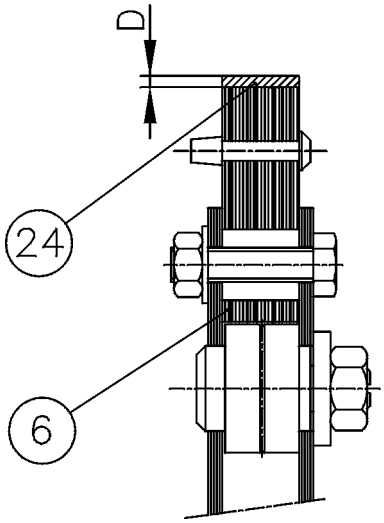


Fig. 619-10

2.3.2 Checking the Condition of the Wearing Band

Fig. 619-11



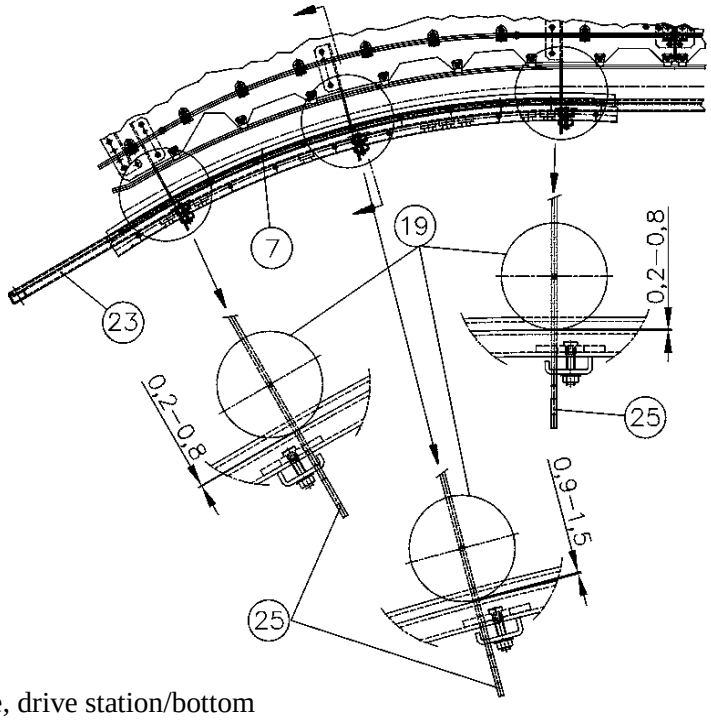
6) Relieving curve, drive station/top
24) Wearing band

- Thickness D of a new wearing band: 4.0 mm
- Minimum permissible thickness D: 1.5 mm

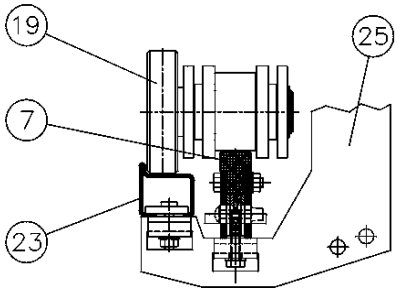
2.4 Checking the Relieving Curve, Drive Station/Bottom

2.4.1 Setting Check

Fig. 619-12



7) Relieving curve, drive station/bottom
19) Chain rollers
23) Return track
25) Ribs



Hint!

The two outer ribs (25) are located exactly at the starting points of the radius (RA), the central rib (25) at the center of the radius (RM).

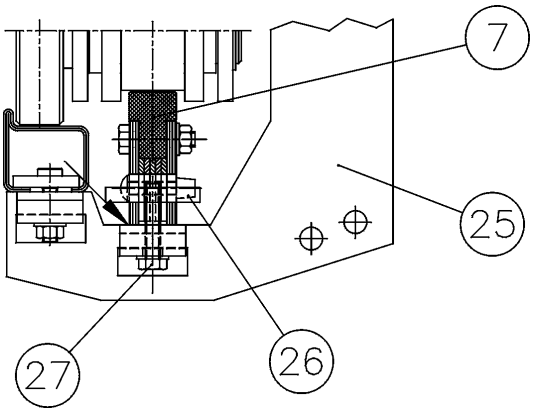
- The gap between the chain roller (19) and the return track (23) shall measure:
  - 0.2 to 0.8 mm at both starting points of the radius (RA)
  - 0.9 to 1.5 mm at the center of the radius (RM)

Hint!

If the gap at the starting points of the radius equals or falls short of 0.2 mm or the gap at the center of the radius equals or falls short of 0.9 mm, the relieving curve must be readjusted.

- Readjustment:

Fig. 619-13



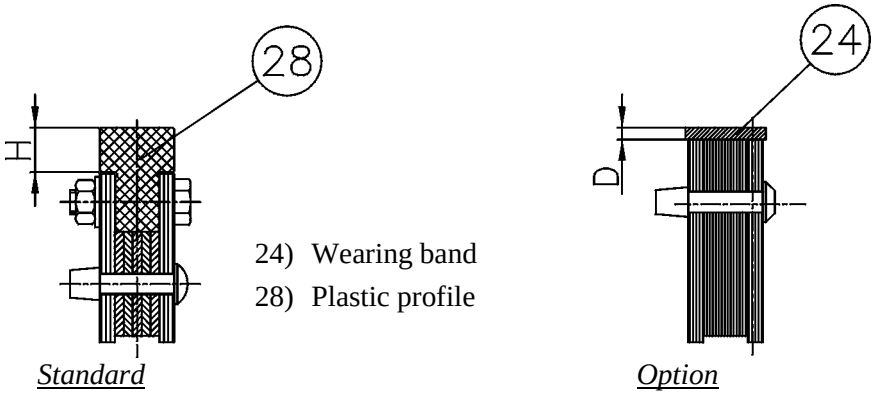
26) Threaded plate
27) Fastening screw

– Unscrew the fastening screw (27) by a couple of millimeters.
– Lift the relieving curve (7).
– Insert a sheet-metal strip of the corresponding thickness (0.5 or 0.6 mm) between the relieving curve (7) and the rib (25).
– Tighten the fastening screw (27).

2.4.2 Condition Check

Hint!
Relieving curves are equipped with plastic profiles as standard. Optionally, they are also available with wearing bands.

Fig. 619-14



24) Wearing band
28) Plastic profile

Standard *Option*

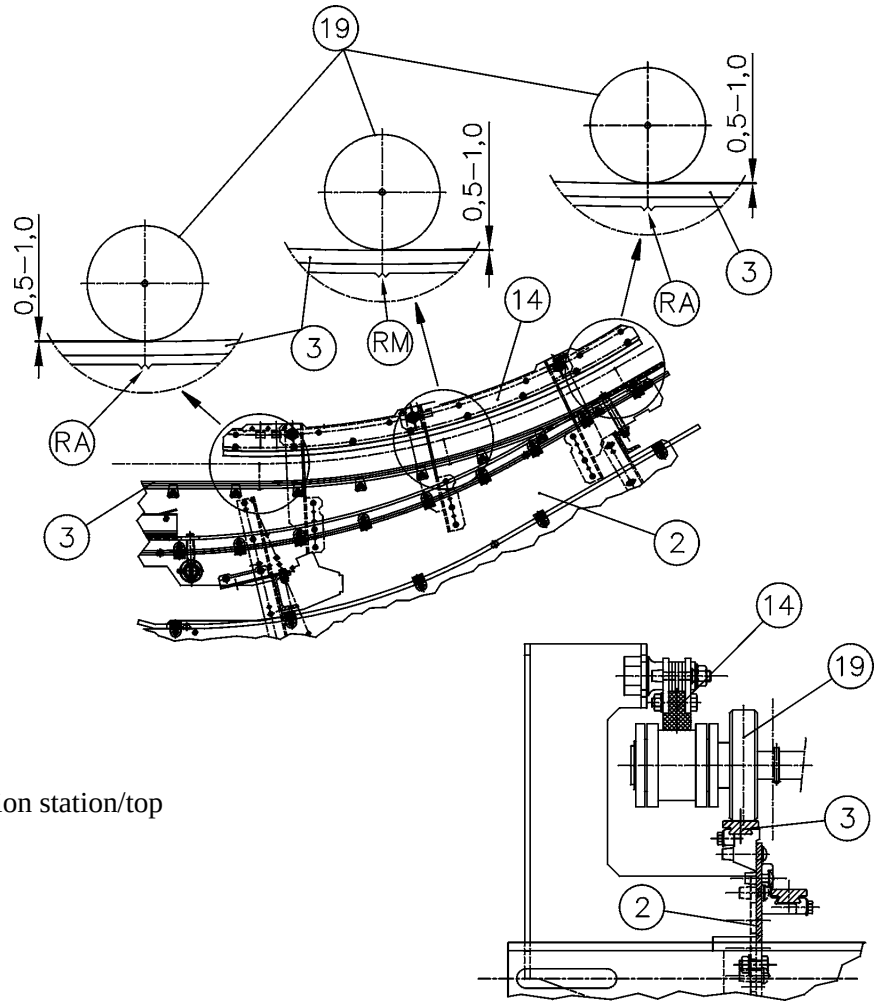
- Standard design with plastic profile (28)
  – New: H = 15 mm
  – Minimum permissible height: H = 12 mm
- Optional design with wearing band (24)
  – Thickness D of a new wearing band: 4.0 mm
  – Minimum permissible thickness D: 1.5 mm

2.5 Checking the Relieving Curve, Tension Station/Top

Hint!

For this relieving curve only a setting check is required, since it is only subjected to the step chain tension stress which virtually rules out wear and tear.

Fig. 619-15



2) Side plate
3) Chain roller track
14) Relieving curve, tension station/top
19) Chain roller

Hint!

The starting points (RA) and the center of the radius (RM) are marked on the side plate (2) by w-shaped symbols.

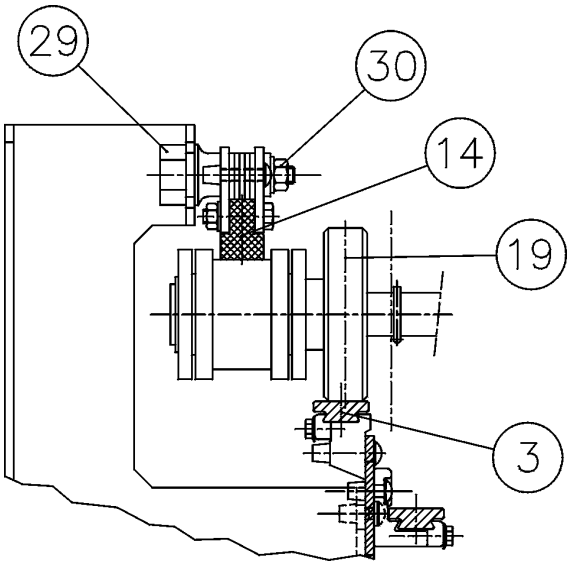
- The gap between the chain roller (19) and the track (3) shall measure:
  - 0.5 to 1.0 mm at both starting points of the radius (RA)
  - 0.5 to 1.0 mm at the center of the radius (RM)

Hint!

If the gap equals or exceeds 1.0 mm, the relieving curve must be readjusted.

- Readjustment:

Fig. 619-16



29) Eccentric screw
30) Clamping nut

– Loosen the clamping nut (30) of the eccentric screw (29).
– Turn the eccentric screw (29) to lower the tangential track until the gap between the chain roller (19) and the track (3) measures 0.5 to 0.8 mm at the points (RA) and (RM).
– Tighten the clamping nut (30).

8.2 Skirt Panels – Q 409 455

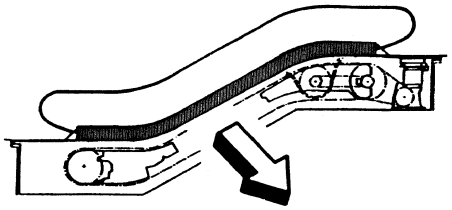
1 Description and Mode of Operation

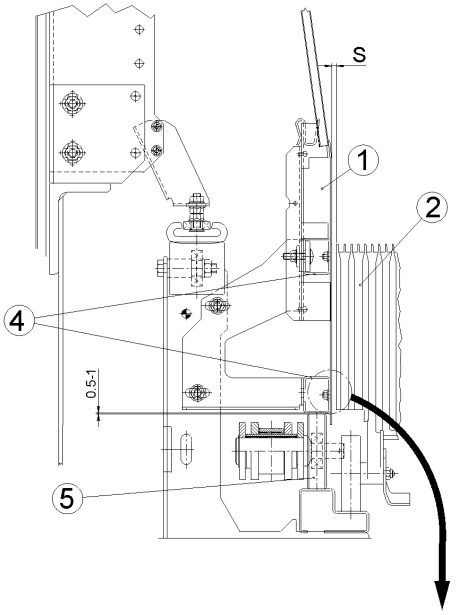
The skirt panels (1) are those parts of the balustrade skirt facing the steps (2). They serve as lateral guides of the steps (guide pads (3)) in their advance track.

Due to the risk of accidents (wedging), the surfaces and joints of the skirt panels must be absolutely smooth. In order to reduce friction resistance, they are provided with a black antifriction coating.

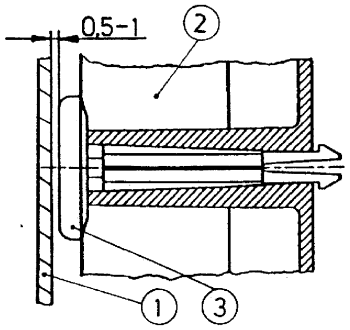
The lower reinforcing C-profiles (4) of the skirt panels (1) serve as counterguides for the step chain rollers (5) (only in the inclined part of the escalator).

Fig. 455-01





1) Skirt panel
2) Step
3) Guide pad
4) C-profiles
5) Step chain roller



2 Maintenance

2.1 Checking the Lateral Play of the Steps

Hint!
Required during commissioning and following a step crash

- According to EN 115, the gap (S) between the skirt panels (1) and the steps (2) must not exceed
  - 4 mm on one side;
  - a total of 7 mm on both sides.
- If required, correct displaced steps or readjust the skirt panels.

Hint!
When readjusting skirt panels, check the play between the guide pads (3) and the skirt panels (1): approx. 0.5-1 mm on each side

2.2 Cleaning

- Thoroughly clean the guideways of the guide pads (3) on the skirt panels (1).

Hint!
This is done from the step gap which is moved on bit by bit with the maintenance operating panel.

2.3 Lubrication

- Automatic lubrication:

For more detailed information, see Maintenance Instructions Q 409 598, Guide Pad Lubrication (Lubrication Step)

- Manual lubrication:

  Apply a thin film of an adequate lubricant (see the following table) with a brush exclusively in the area of the gliding surface of the guide pads (3).

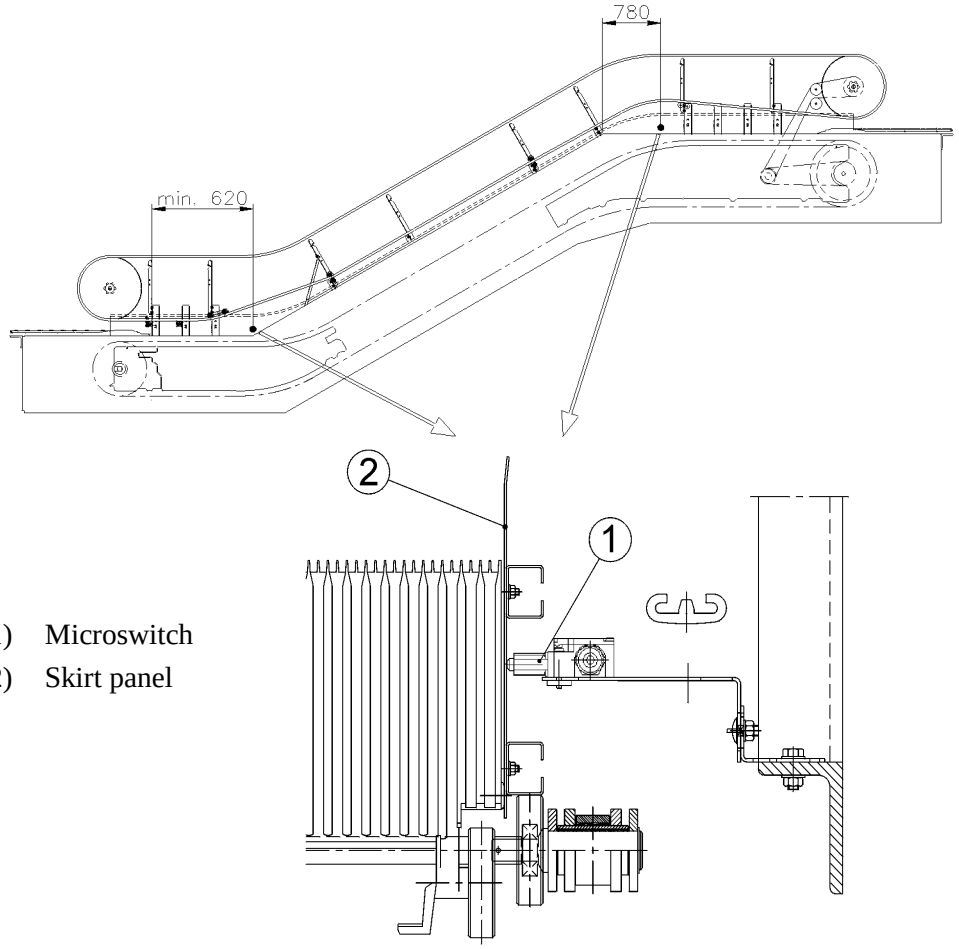
BP	ESSO	KLÜBER	MOBIL	SHELL
Energrease LS 3	Beacon 3	Klüberplex BEM 41-132	Mobilux EP2	Alvania R3

8.3 Skirt Contacts – Q 409 648

1 Description and Mode of Operation

In the area of the transition curves (both at the drive and tension stations) microswitches (1) are positioned at the back of the skirt panels (2) on both sides of the step band. If objects get caught between the steps and the skirt panels in these areas, the resulting deflection of the skirt panel causes the microswitch to switch off the escalator. The escalator is stopped before caught objects reach the combplate, which would result in more severe damage.

Fig. 648-01



1) Microswitch
2) Skirt panel

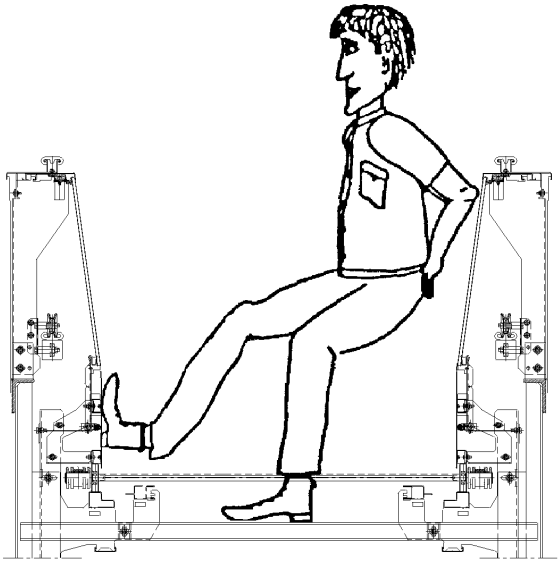
2 Maintenance

2.1 Functional Check

Hint!
Can be done with the maintenance operating panel

- Move the step gap into the area of the skirt contacts (1).
- Exert high pressure (40–50 kg) in the area of the contact to bend the skirt panel (2) to the outside. The contact (1) must be actuated.

Fig. 648-02



Hint!
It is useful to know the exact position of the skirt contacts (e.g. distance between the contact and the tips of the comb teeth, distance between the skirt panel joint and the contact).

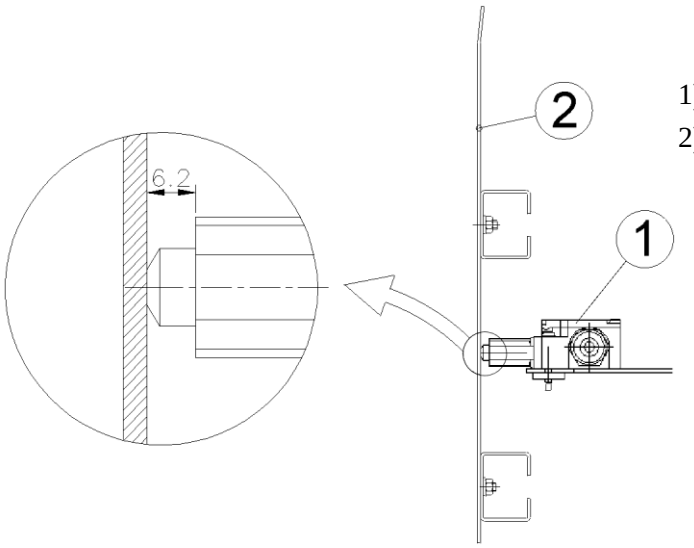
- Error codes:

  "E_12" for left contact at drive station
  "E_1F" for left contact at tension station
  "E_E0" for right contact at drive station
  "E_E0" for right contact at tension station

Hint!
It is **not** necessary to reset the contact, since the microswitch is self-resetting.

2.2 Adjusting the Contact

Fig. 648-03



1) Microswitch
2) Skirt panel

- Use the V-30394 gage to adjust the distance between the contact housing and the skirt panel to 6.2 mm.

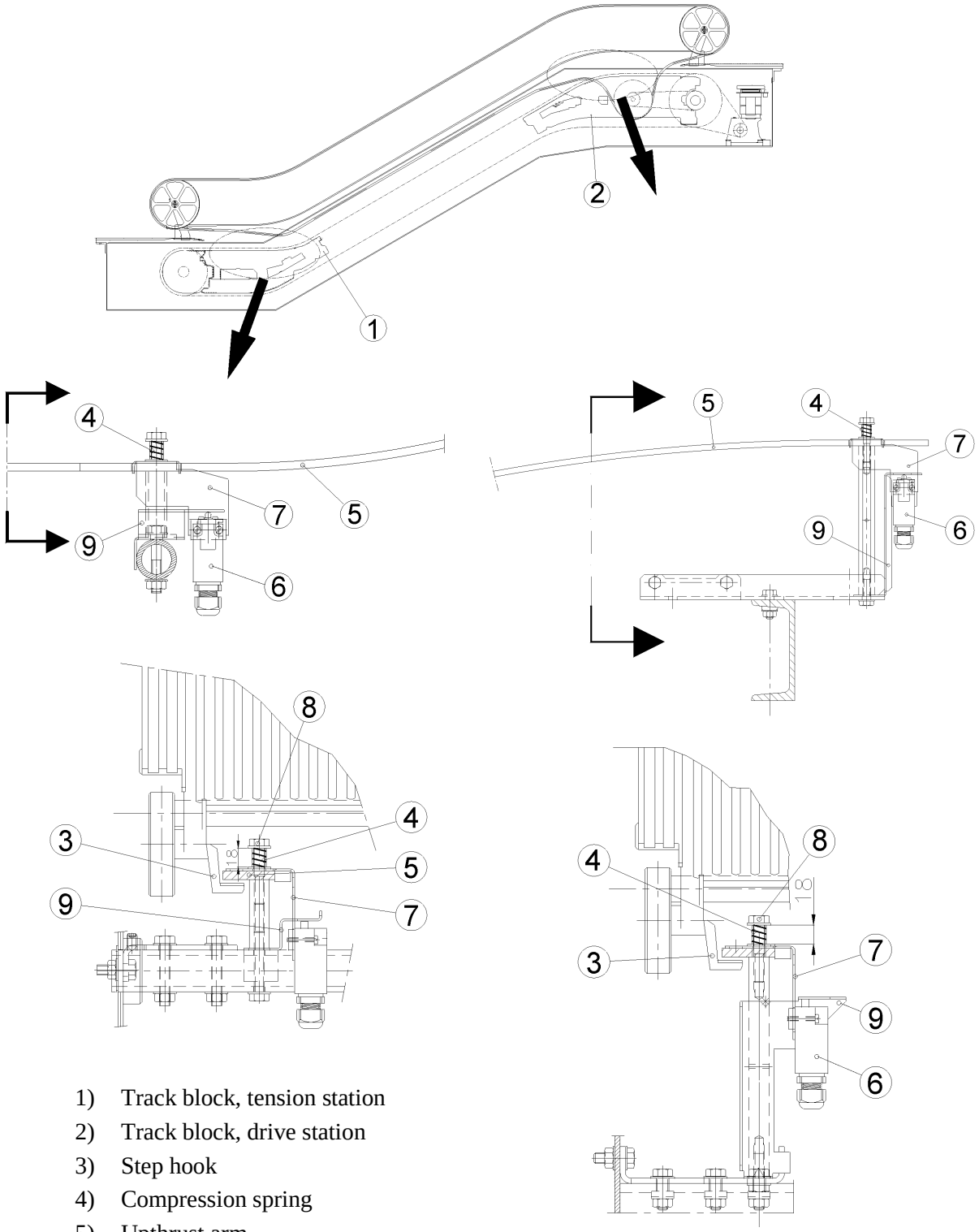
8.4 Step Upthrust Contacts – Q 409 709

1 Description and Mode of Operation

The step upthrust contacts are mounted in the track block of the tension station (1) and the track block of the drive station (2). This contact disconnects the escalator as soon as a step is lifted due to an external impact when leaving the incline and entering the transition curve.

When the step is lifted, the step hook (3) is pressed against the upthrust arm (5) which is prestressed with a compression spring (4). When the force increases, the upthrust arm and the contact (6) mounted on the upthrust arm are lifted against the spring force. The release bracket (9) actuates the contact and the escalator is shut down.

Fig. 709-01



1) Track block, tension station
2) Track block, drive station
3) Step hook
4) Compression spring
5) Upthrust arm
6) Contact
7) Mounting bracket for contact
8) Setscrew
9) Release bracket

2 Maintenance

2.1 Functional Check

- Run the step gap into the area of the step upthrust contact.
- Lift the upthrust arm (5) by hand. The contact (6) must be activated, and it should not be possible to start the escalator.

  Error codes:

  "E_1D" for step upthrust contact, top right

  "E_7B" for step upthrust contact, top left

  "E_88" for step upthrust contact, bottom left

  "E_D8" for step upthrust contact, bottom right

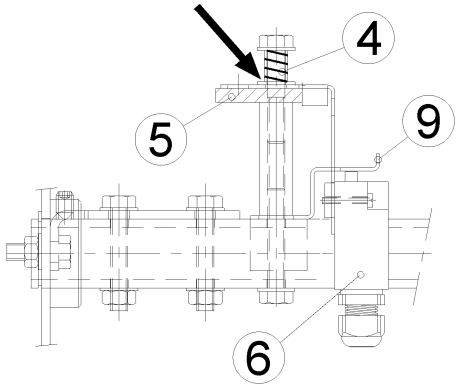
Hint!

The compressed length of the spring (4) should measure 18 mm. The spring can be readjusted by means of the setscrew (8).

2.2 Contact Setting

- The contact (6) should abut the release bracket (9) without play.

Fig. 709-02



4) Compression spring
5) Upthrust arm
6) Contact
9) Release bracket

2.3 Lubrication

- Lubricate the compression spring (4) and the drilled hole of the upthrust arm (5) (see Fig. 709-02).

9 Maintenance of Combplates & Floor Covers

9.1 Combplates, Combplate Contacts, Combs, Lateral Guides – Q 409 460

1 Description and Mode of Operation

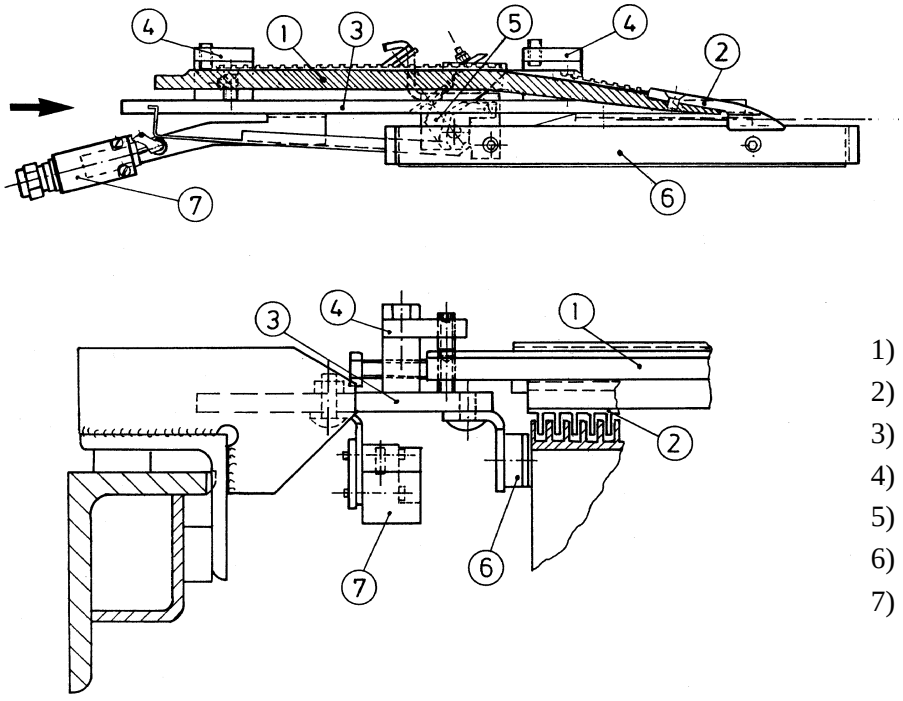
1.1 Description

The combplate is the entry or exit point for the step band. The individual combs that engage the tread surface of the steps are screwed to the front of the combplate. The laterally arranged guides ensure that the steps enter the combs centered and without knocking.

1.2 Mode of Operation

The combplate (1) is movably mounted in laterally arranged guides (4) so that it can be shifted horizontally **and** vertically when foreign objects wedged in the steps press against it with a certain force. A contact (7) interrupts the safety circuit and shuts the unit down.

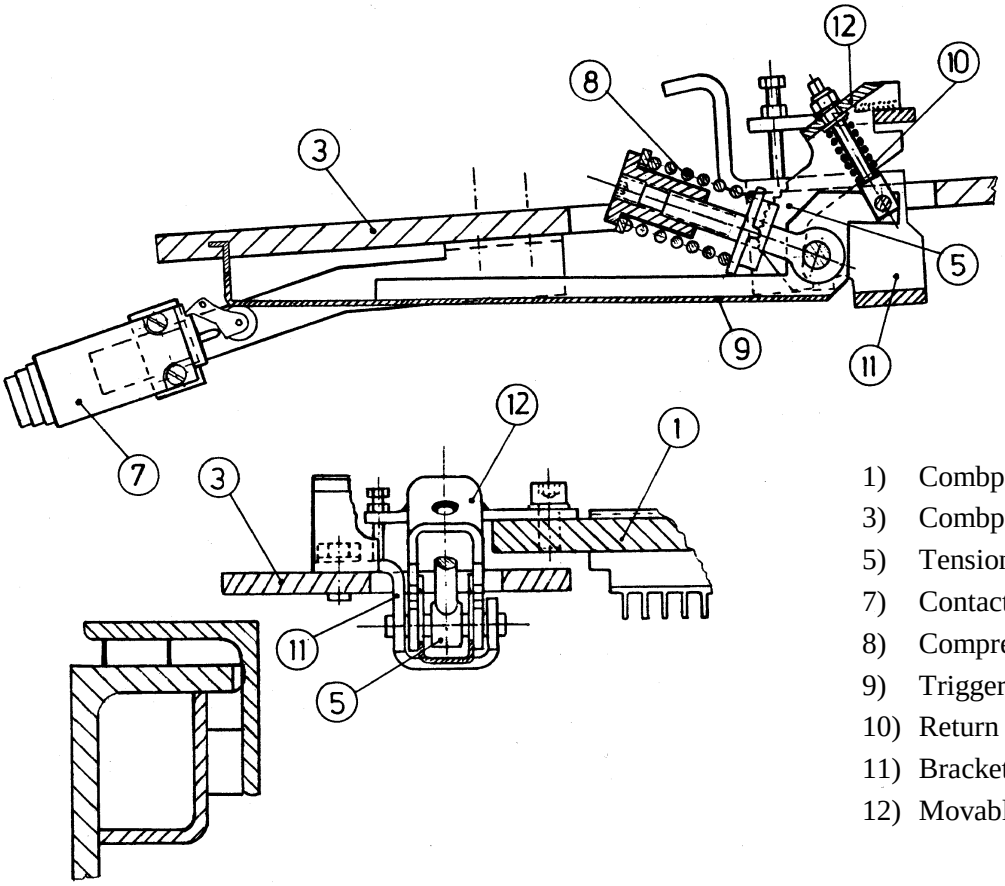
Fig. 460-01



1) Combplate
2) Combs
3) Combplate bracket
4) Guides
5) Tensioning device
6) Lateral guide
7) Contact

- The tensioning device (5) is designed to take up both horizontal and vertical forces. The triggering force of the combplate can be varied by means of the notch position of the compression spring (8) and the prestress of the spring.

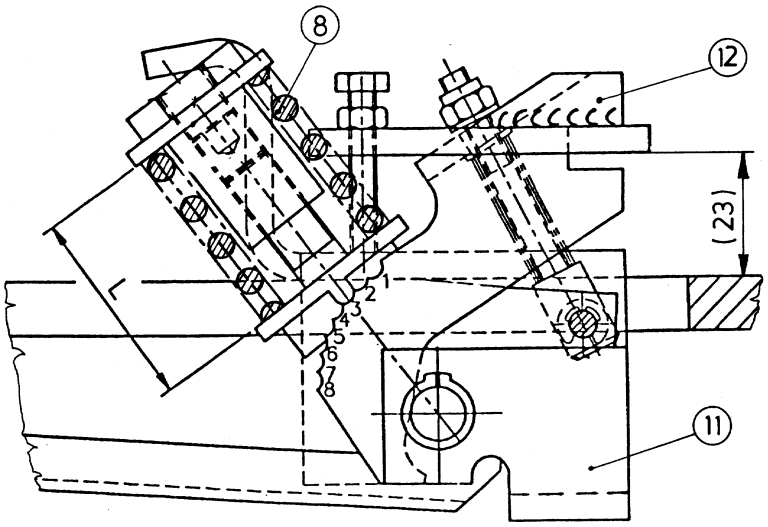
Fig. 460-02



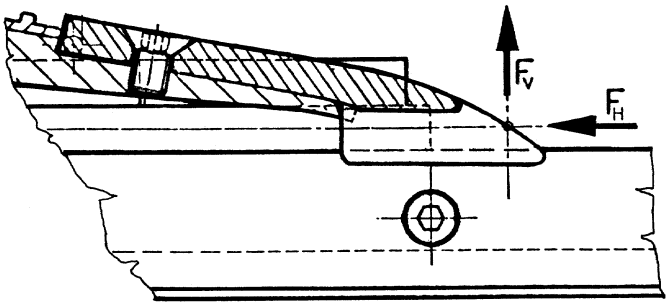
1) Combplate
3) Combplate bracket
5) Tensioning device
7) Contact
8) Compression spring
9) Triggering lever
10) Return spring
11) Bracket
12) Movable part

- Standard setting of the tensioning device (5):

Fig. 460-03



8) Compression spring
11) Bracket
12) Movable part



Settings according to:	EN 115, ANSI standard
Triggering force, horizontal:	F_H = 1500 N
Triggering force, vertical:	F_V = 668 N
Notch no.:	4
Spring length:	L = $39^{\pm 0.5}$ mm

2 Maintenance

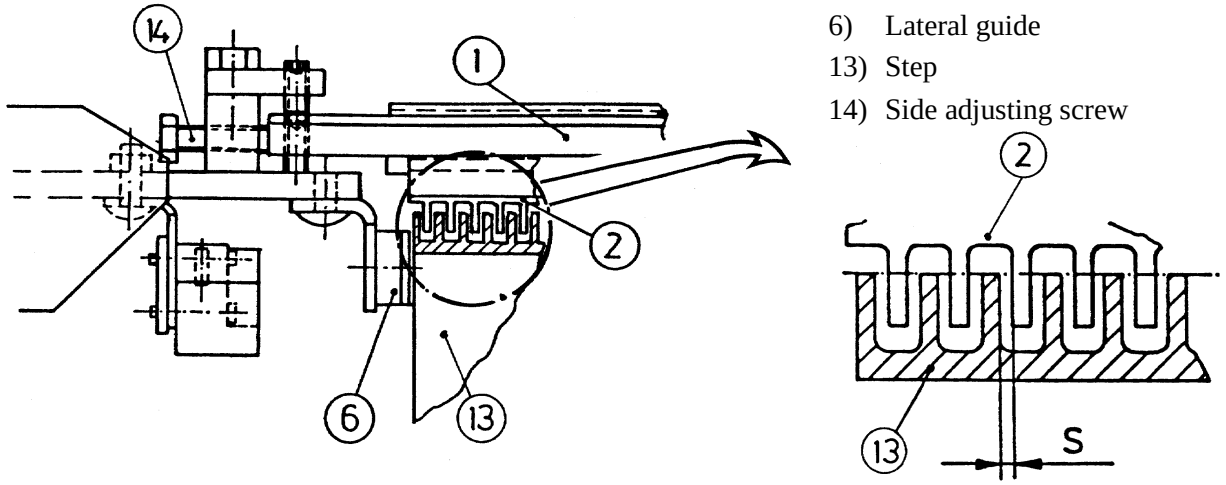
2.1 Combplate

2.1.1 Lateral Setting

2.1.1.1 Checking the Lateral Setting

Fig. 460-04

1) Combplate
2) Combs
6) Lateral guide
13) Step
14) Side adjusting screw



- The steps (13) should enter the combs **centered**.

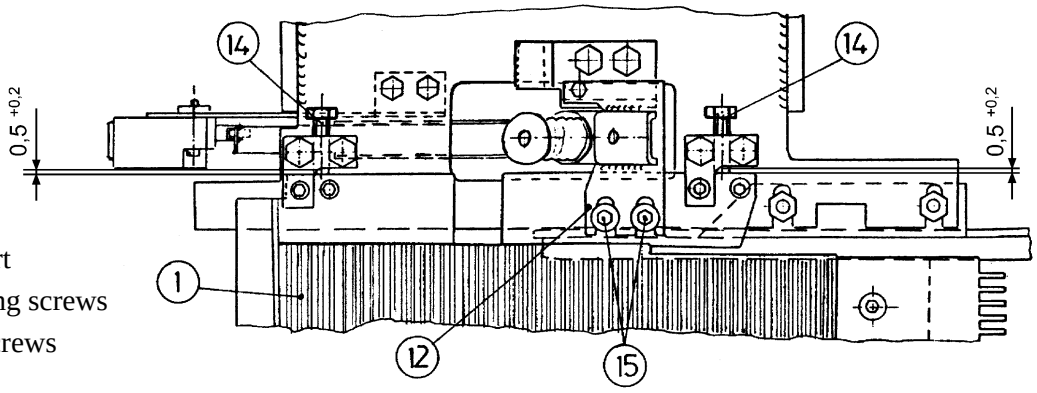
Hint!
At least check at 3 points (edge – center – edge)

- Dimension S ≥ 0.5 mm

Hint!
If S < 0.5 mm or individual **straight** teeth brush against steps, readjustment is required.

2.1.1.2 Correcting the Lateral Setting

Fig. 460-05



1) Combplate
12) Movable part
14) Side adjusting screws
15) Clamping screws

- Loosen the clamping screws (15).
- Insert a screwdriver between the combplate and the threaded block of the side adjusting screw (14) to adjust the combplate (1) so that it is centered to the steps.
- Tighten the clamping screws (15).
- Adjust the side adjusting screws (14) to a distance of $0.5^{+0.2}$ mm from the combplate (1).

STOP

Danger: Screws set too tightly!

When screws are set too tightly:

- the combplate blocks
- the combplate cannot tilt back when a lateral force is applied

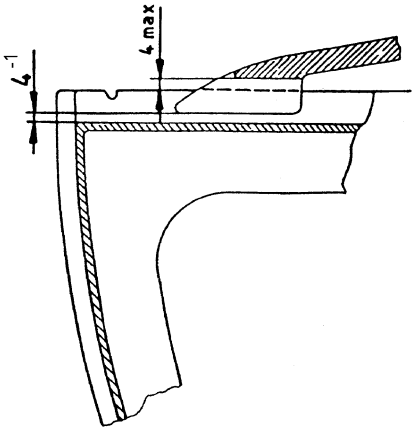
2.1.2 Height Setting

2.1.2.1 Checking the Height Setting

- Distance between comb tooth and base of tread groove: 4^{-1} mm

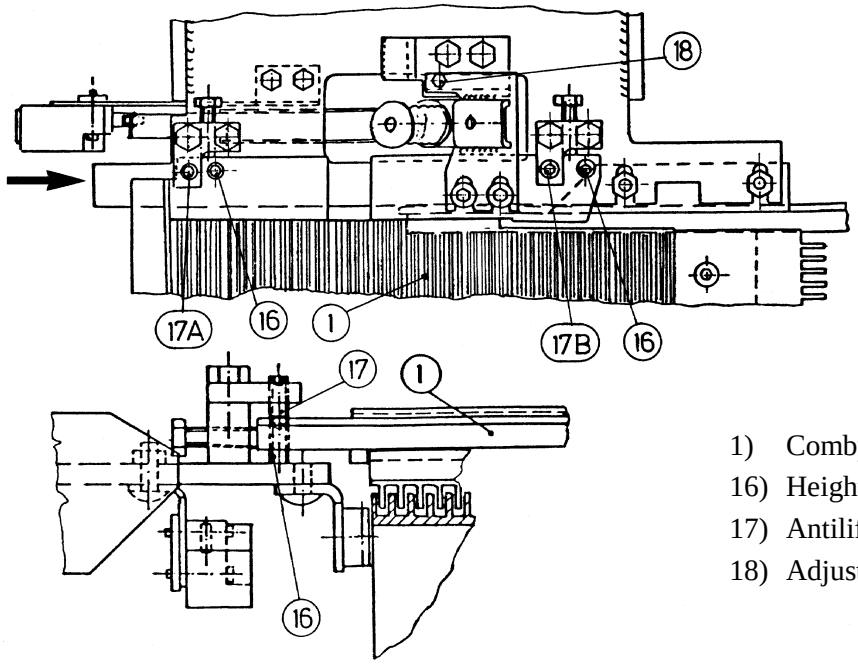
Hint!
Check with the floor cover hook (Ø 4 mm) or with a 4-mm Allen wrench.

Fig. 460-06



2.1.2.2 Correcting the Height Setting

Fig. 460-07

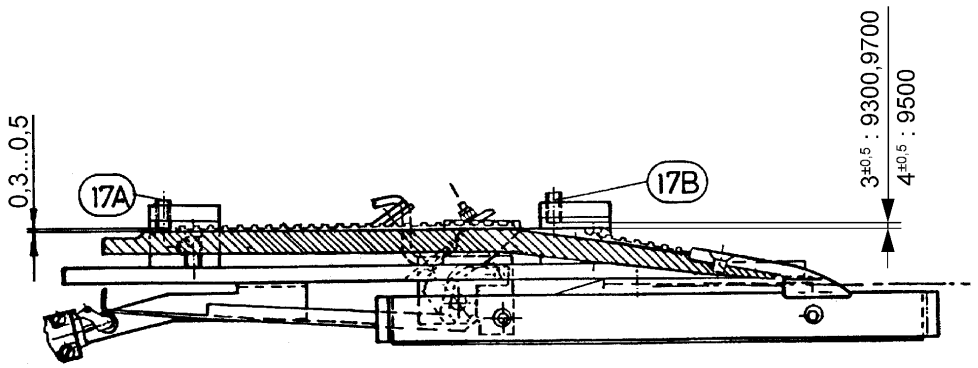


1) Combplate
16) Height adjusting screws
17) Antilift screws
18) Adjusting screw

- To raise the combplate, unscrew the antilift screws (17A) by approx. 2 mm.
- Use the height adjusting screws (16) to adjust the height of the combplate according to Fig: 460-06.
- Secure the height adjusting screws (16) with Loctite 270 threadlock (or equivalent).

- Adjusting the antilift screws (17):

Fig. 460-08

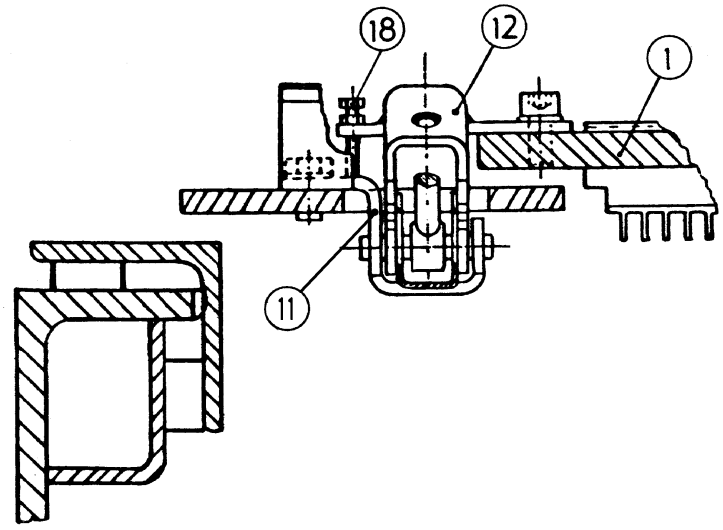


– Adjust the antilift screw (17A) to a distance of 0.3 to max. 0.5 mm from the combplate (1).
– Adjust the antilift screw (17B) to a distance of $3^{\pm 0.5}$ mm from the combplate (1).

- Correcting the height setting of the adjusting screw (18):

Hint!
This screw supports the entire tensioning device laterally when removing the combplate.

Fig. 460-09



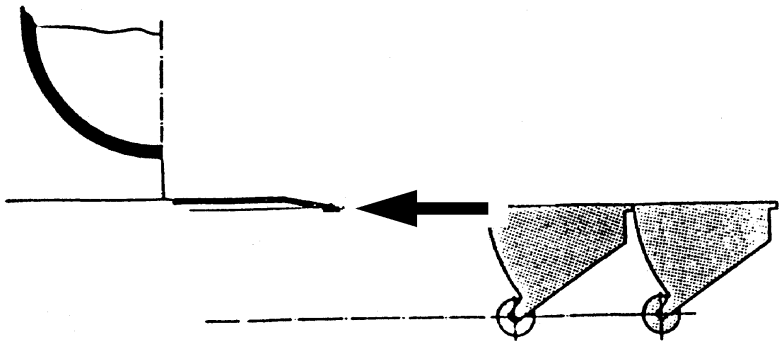
1) Combplate
11) Bracket
12) Movable part
18) Adjusting screw

Manually tighten the adjusting screw (18) until it abuts the bracket (11); then, unscrew it by **one** turn and tighten the counternut.

2.1.3 Movability Check

- With a horizontal force of 1500 N (~ 150 kg) applied on the center of the combplate, the combplate must shift back and trigger the contacts.
- Possibility to check "horizontal" triggering

Fig. 460-10



Hint!

Upon triggering the contacts, the combplate must return to its original position **without jolts**.

If this is not the case:

– dirt has accumulated in the guides,
– the lateral adjusting screws (14) are set too tightly,
– the antilift screw (17A) is set too tightly, or
– the skirt panels are too low.

- Checking whether the combplate "tilts back":

  Push the combplate back on one side in the area of an edge comb. The contact (7) on this side must be triggered.

- Checking for free up and down movability:

  Lift the combplate at the middle comb (required vertical force: 668 N (~ 70 kg)). The contacts (7) must be triggered.

2.2 Combplate Contacts

2.2.1 Functional Check

- With **one** of the contacts triggered, the safety circuit must be interrupted.

  Error codes:

  "E_10" for combplate contact, top left

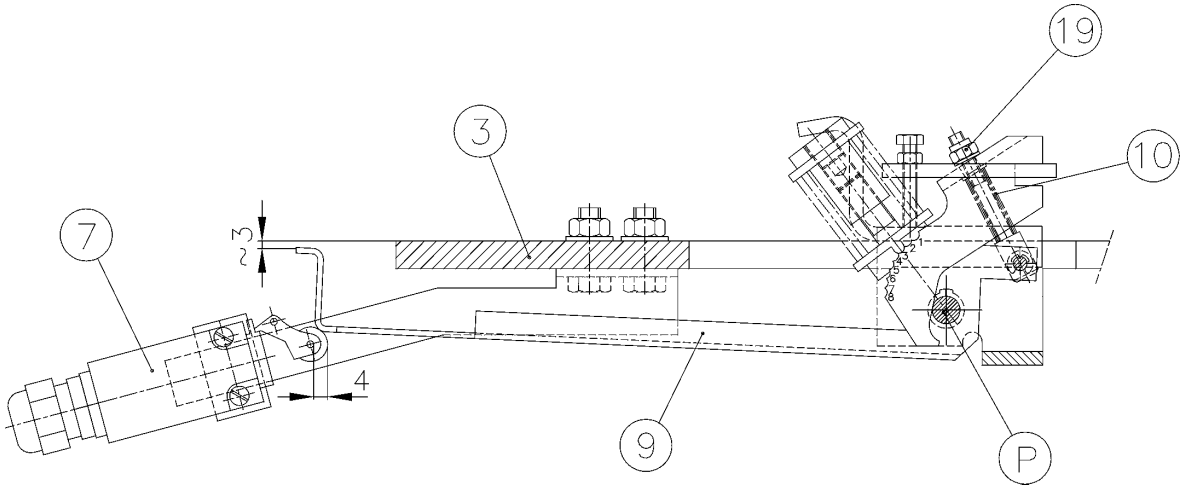
  "E_15" for combplate contact, bottom left

  "E_4A" for combplate contact, top right

  "E_4B" for combplate contact, bottom right

2.2.2 Contact Setting

Fig. 460-11



P) Pivot of triggering lever
3) Combplate bracket
7) Contact
9) Triggering lever
10) Return spring
19) Counternut

- In its initial position, the triggering lever (9) is set to the combplate bracket (3) at a distance as per the above figure.

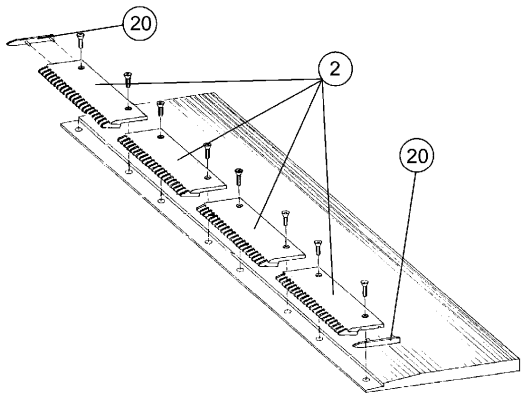
Hint!
Adjust by means of counternut (19) at the return spring (10)

- The contact roller abuts the triggering lever (9) without play.
- The contact roller must overlap the triggering lever by 4 mm.

2.3 Combs

- The yellow coated combs (2) are made of aluminum.
- The two lateral combs are provided with bonded comb inserts (20) to cover the gap between the skirt panel and the comb.

Fig. 460-12



2) Combs
20) Comb inserts

2.3.1 Checking the Condition of the Combs

- Check whether the comb teeth are straight, not twisted.
- Check for broken teeth.

Warning: Defective combs!

Defective combs, e.g. combs with broken teeth, have to be replaced. Where two adjacent teeth are missing, the escalator has to be put out of operation.

2.3.2 Corrosion Protection

- Unscrew all combs.
- Clean the support surfaces on the combs and on the combplate.
- Grease the fastening screws of the combs.

  Recommended greases:

BP	ESSO	KLÜBER	MOBIL	SHELL
Energrease LS 3	Beacon 3	Klüberplex BEM 41-132	Mobilux EP2	Alvania R3

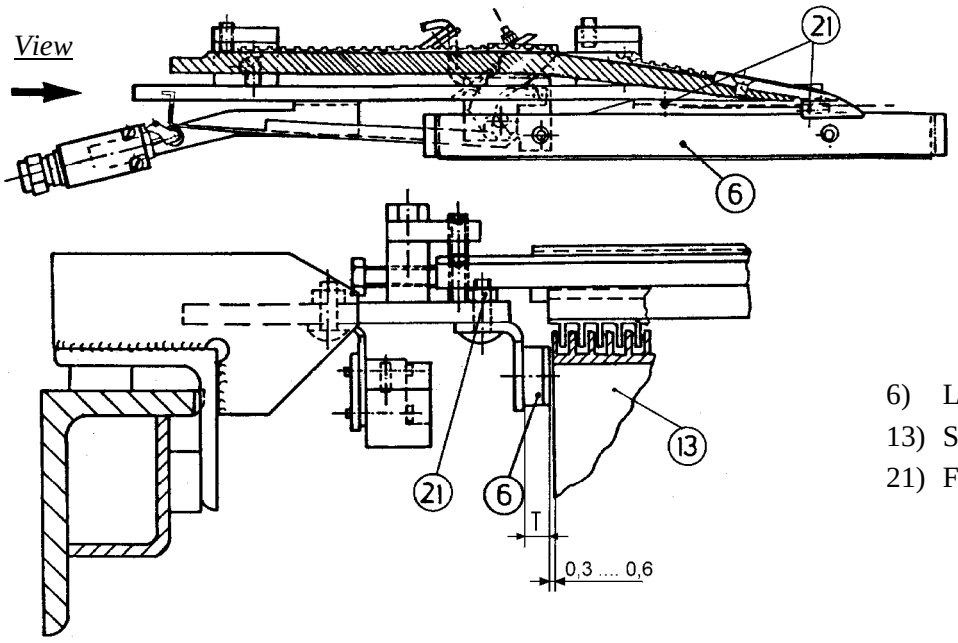
2.4 Lateral Guides

Hints!

- The lateral guides must **not** be used as guides forcing the steps into the combs. The steps should pass by the lateral guides as **freely** as possible and without knocking.
- If the steps exert pressure on the guides on one side, readjust the guides. Afterwards, the combplate must be adjusted to the **freely running** steps!

2.4.1 Setting Check

Fig. 460-13



6) Lateral guide
13) Step
21) Fastening screws

- The gap between the steps (13) and the guides (6) may measure 0.3 to 0.6 mm on each side.

2.4.2 Adjusting the Lateral Guides

See Fig. 460-13

- Loosen the fastening screws (21).
- Adjust the guides (6) so that they are in **parallel** with the steps (13) and the distance between them and the steps measures between 0.3 and 0.6 mm.

2.4.3 Checking the Condition of the Lateral Guides

- Minimum guide thickness (plastic, new: 13 mm)

  T ≥ 11 mm (see Fig. 460-13)

Warning: Worn-out guides!

Replace the plastic guides if they fall short of the minimum thickness.

9.2 Floor Covers – Q 409 457

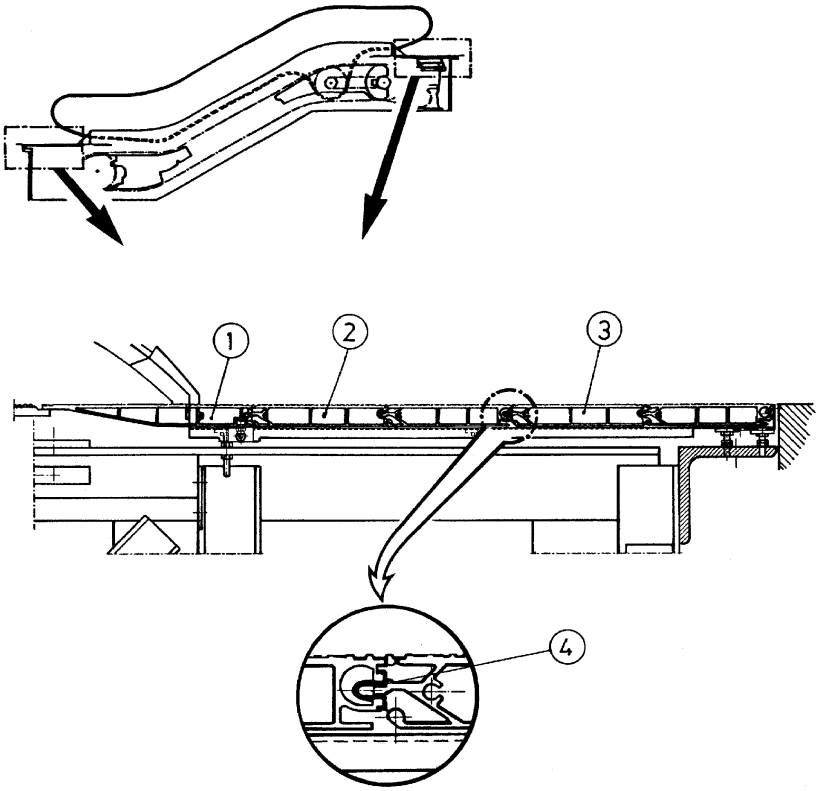
1 Description and Mode of Operation

The floor covers made out of aluminum profiles with a tread surface of stainless steel profiles with black etched patterns are located at the drive and tension stations and serve as a junction between the solid floor and the combplates.

Standard floor cover design:

- Three parts (single drive) or four parts (double drive) at the drive station
- Three parts at the tension station

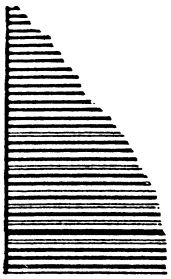
Fig. 457-01



1) Connection cover
2) Middle cover
3) End cover
4) Rubber profile

Tread surface design:

Fig. 457-02

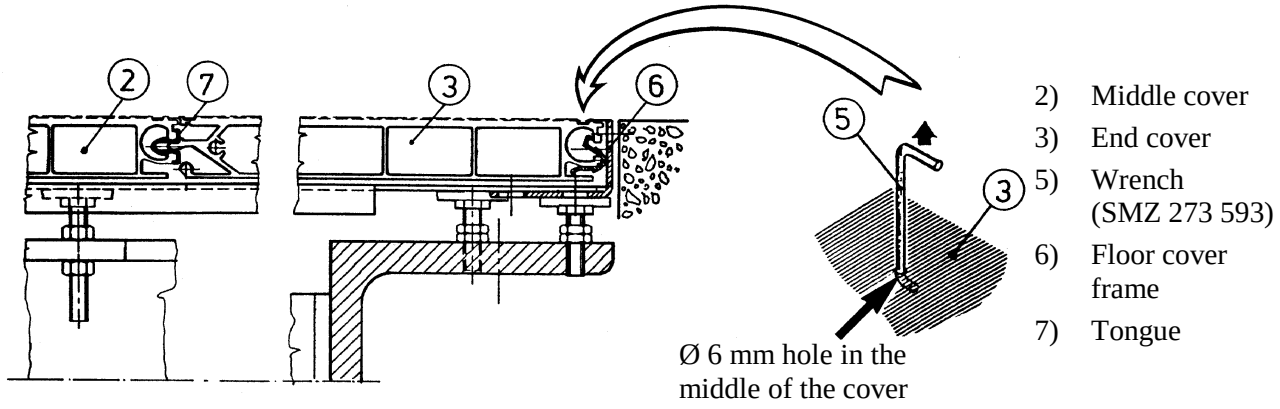


Ribbed Aluminum, Black Groove Base

2 Maintenance

2.1 Disassembling the Middle and End Covers

Fig. 457-03

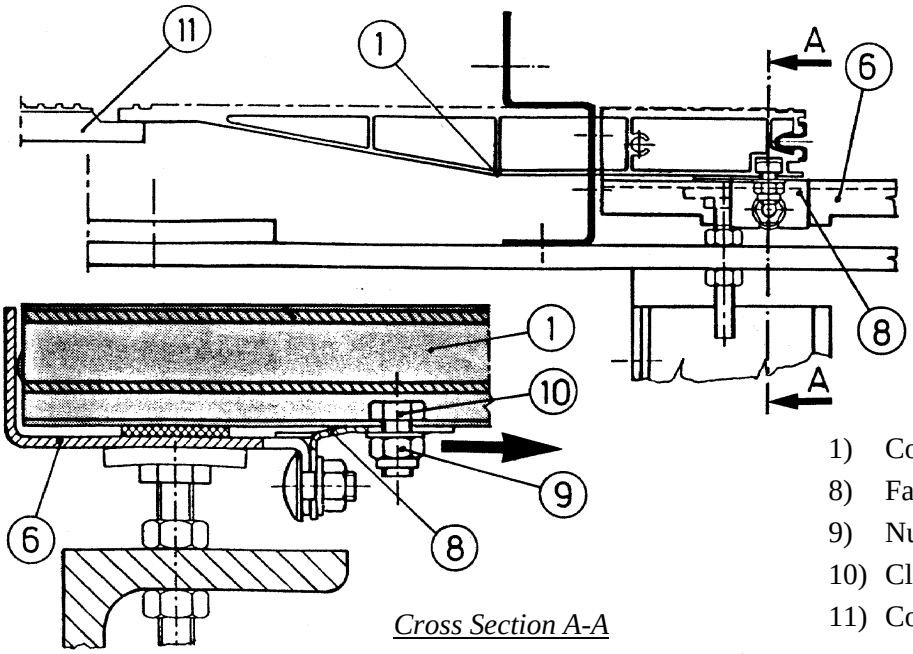


- Insert the wrench (5) into the hole, lift the cover (3) just above the floor cover frame (6) and pull it out to the back until the tongue (7) no longer engages the middle cover (2) and lift off the cover (3).
- Pull the middle cover (2) to the back until the tongue (7) no longer engages the connection cover (1) and lift it off.

2.2 Disassembling the Connection Cover

Hint!
Required when disassembling steps, combplates, etc.

Fig. 457-04



Cross Section A-A

1) Connection cover
8) Fastening angle
9) Nut
10) Clamping screw
11) Combplate

- Loosen the nut (9), pull the clamping screw (10) out of the slot of the fastening angle (8) and retighten the nut manually.
- Pull the connection cover (1) horizontally to the back and lift it off.
- Reassembly is done analogously in the reverse order.

9.3 Guard Plates – Q 409 487

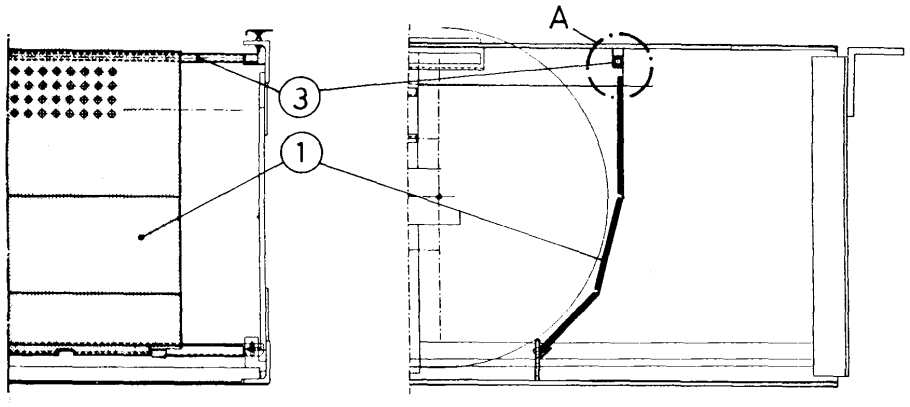
1 Description and Mode of Operation

The guard plates are located in the escalator pits of the drive and tension stations and serve as a protection against the moving step band during maintenance or repair work carried out in the escalator pits.

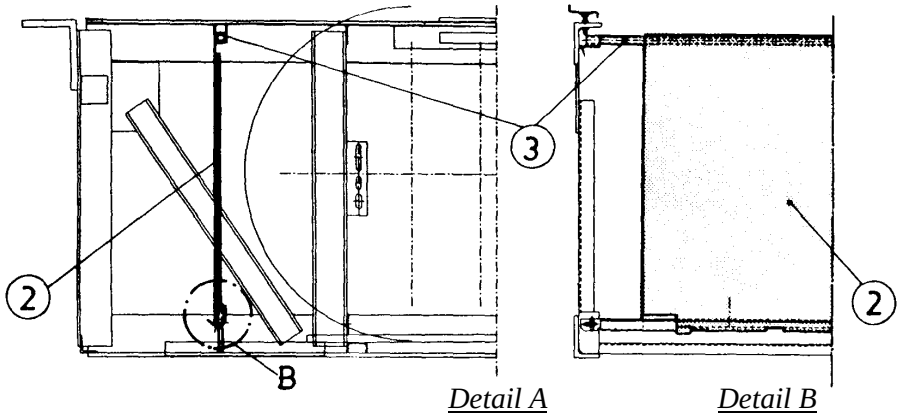
The guard plates (1) and (2) are secured on the tube (3) and inserted in the brackets (4) at the bottom sheet and, if required, can easily be removed for maintenance work. To make more room to move, the tubes (3) can also be removed from the clamping profiles (5).

Fig. 487-01

Drive Station

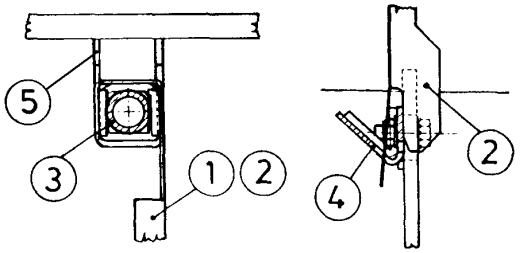


Tension Station



Detail A *Detail B*

1) Guard plate, drive station
2) Guard plate, tension station
3) Tube
4) Bracket
5) Clamping profile



10 Maintenance of Step Band

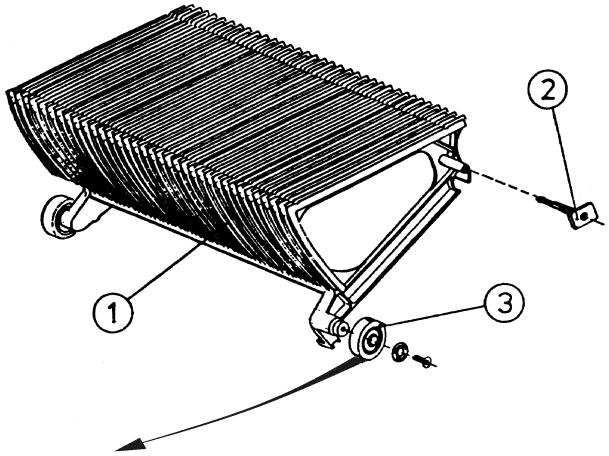
10.1 Steps, Step Disassembly, Guide Pads, Step Rollers, Bushings – Q 409 461

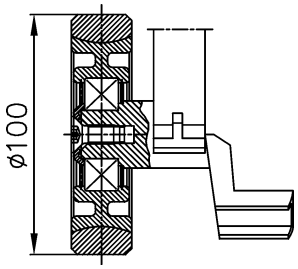
1 Description and Mode of Operation

The step is a one-piece part made of diecast light alloy. The grooves of the riser and the tread surface ensure that the rear edge and the front edge of two adjoining steps mesh in a way that foreign objects cannot get wedged between the steps. This applies to the inclined as well as the horizontal sections of the escalator.

The steps (1) glide on step rollers (3) along the tracks; along the skirt panels, the steps are guided with guide pads (2), which at the same time guarantee a minimum gap between the steps and the skirt panels.

Fig. 461-01



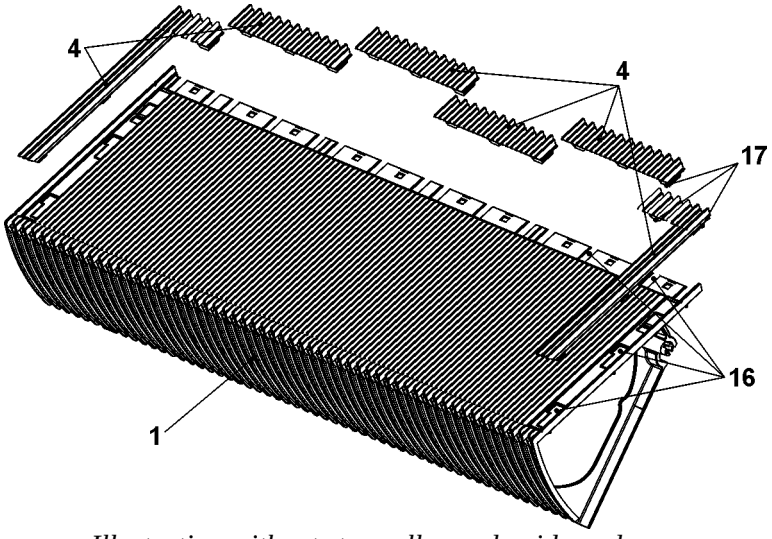


1) Step
2) Guide pad
3) Step roller

Tire color of both rollers: blue

The steps are provided with 50 mm wide, yellow plastic inserts which are snapped into place on the rear edge as well as the two sides of the tread surface. The front edge of the step is provided with yellow painted demarcations. This not only provides an excellent visual demarcation of the individual steps, but also tells the user which parts of the steps he is **not** supposed to tread on.

Fig. 461-02



1) Step
4) Plastic edges
16) Recesses
17) Catches

Illustration without step roller and guide pad

Warning: Synthetic oils!

Synthetic oils damage the plastic edges in the area of the fastening screws within a relatively short time!

Characteristics of defective plastic:

- light-yellow discoloration
- cracks
- brittleness

Hint!

Therefore, step chains of escalators equipped with steps with yellow plastic edges may **only** be lubricated with **mineral oils**!

For more detailed information, see Maintenance Instructions Q 409 600, Step Chains, Section 2.1

For how to clean the plastic edges, see Cleaning Instructions Q 409 193

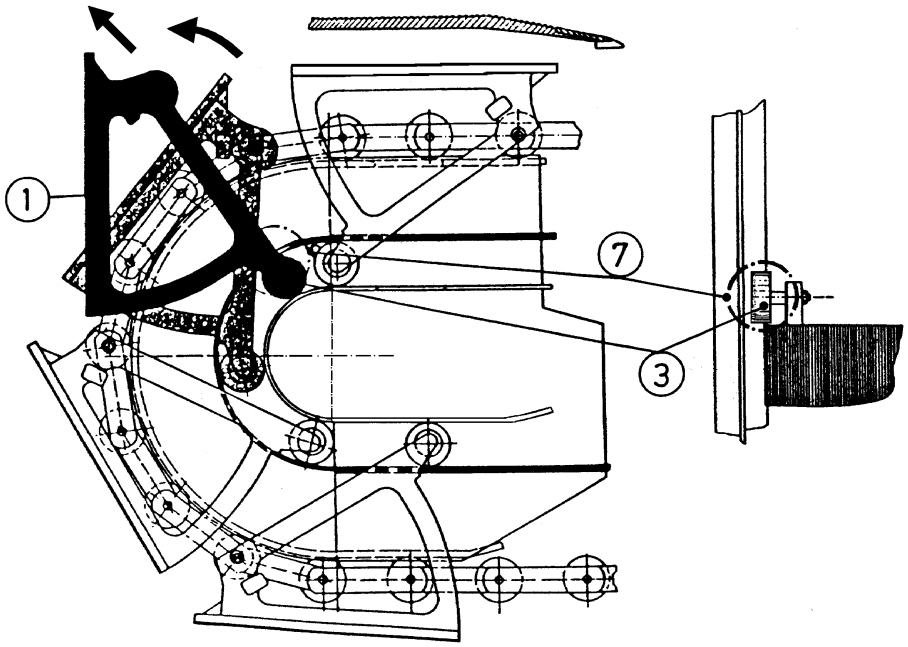
2 Maintenance

2.1 Disassembling Steps

Hints!

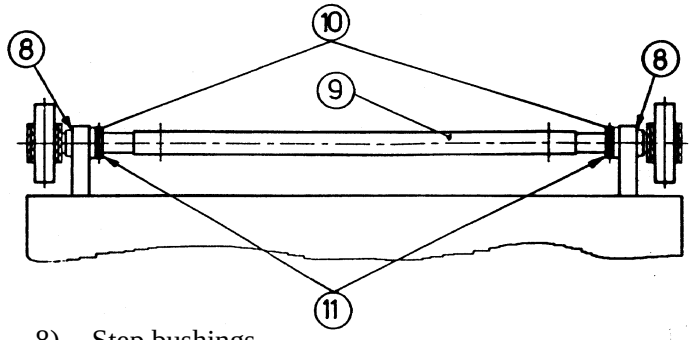
- Since escalators of this product line are exclusively equipped with divided step axles as standard, make sure to mark three maintenance steps during commissioning.
- To maintain the lateral setting of the remaining steps, remove only the steps with marked step axles during maintenance work.

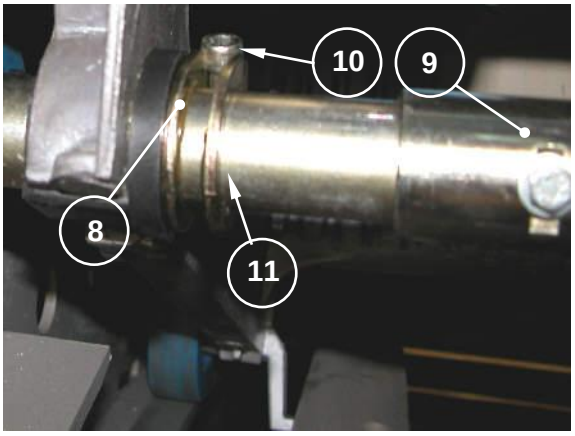
Fig. 461-03



1) Maintenance step
3) Step roller
7) Removal recess

Fig. 461-04





8) Step bushings
9) Step axle, divided
10) Strap bolts
11) Straps

Hint!

Steps are only disassembled in the tension station.

- Use the maintenance operating panel to run the step roller (3) of the last step before the first maintenance step (1) to just above the removal recess (7) (see Fig. 461-03).
  - The removal recess (7) must be completely exposed!

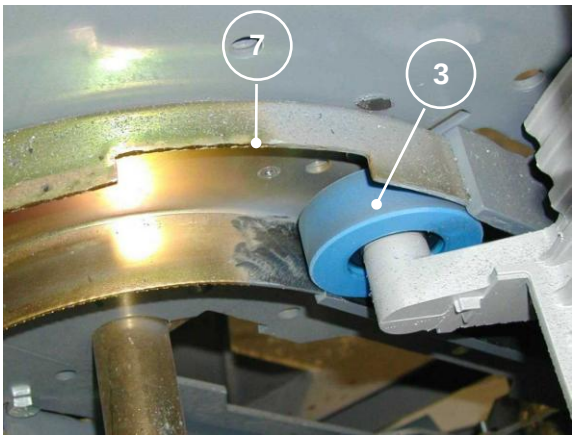


Fig. 461-05

  - Hint for maintenance technicians with little escalator experience:

    Mark the position (9a) of the step bushing (8) on one side of the step axle (9) (e.g., with a screwdriver). This marking facilitates reinstallation.

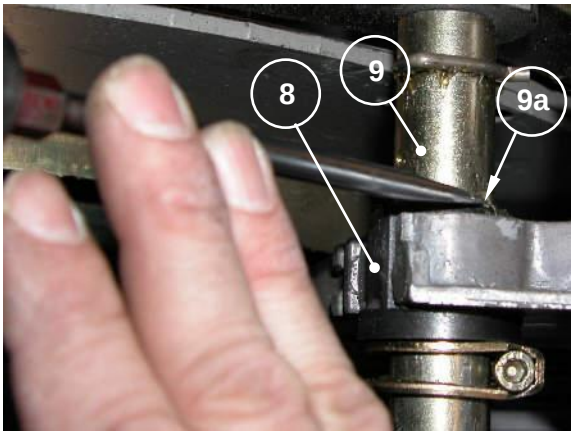


Fig. 461-06

- Open the strap bolts (10) at both sides of the axle.

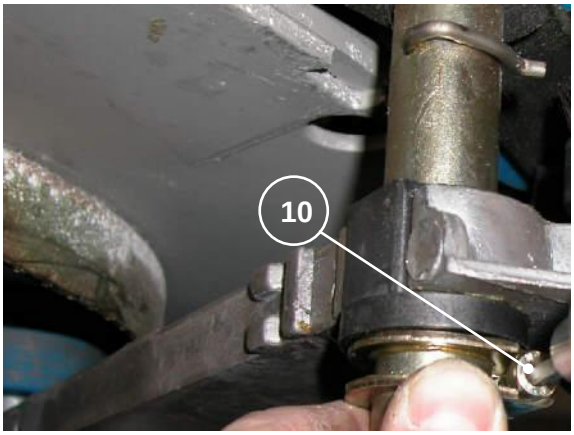


Fig. 461-07

- Shift the step bushings (8) and the straps (11) inward at both sides of the axle.
- Uncouple the step (1) from the step axle (9) in the direction of the arrow and tilt it back.

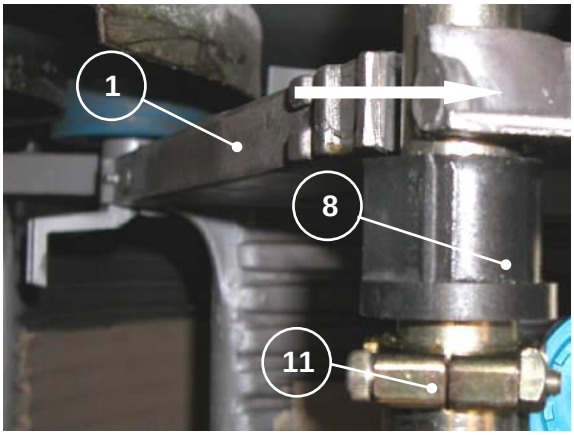


Fig. 461-08

- Lift the step (1) off vertically.
- Pull the step rollers (3) upward out of the removal recess (7). (Pull out first one and then the other side.)
- Lift the step (1) off vertically.
- Repeat the above steps for the two other maintenance steps.

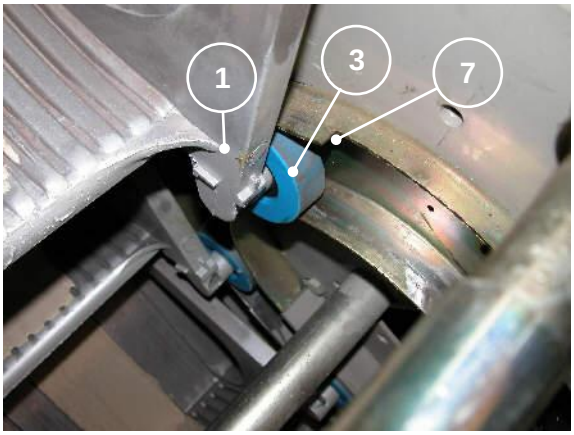


Fig. 461-09

Hint!

With shortened escalator pits it might **not** be possible to disassemble the steps from within the pit (kneel or lie down in front of the support angle to pull out and lift off the steps).

2.2 Assembling Steps

Hints!

- Assembly is done analogously in the reverse order.
- Steps are only assembled in the tension station.

- Insert the step (1) – with the step rollers (3) showing downwards – into the removal recess (7). (Insert first one and then the other side.)

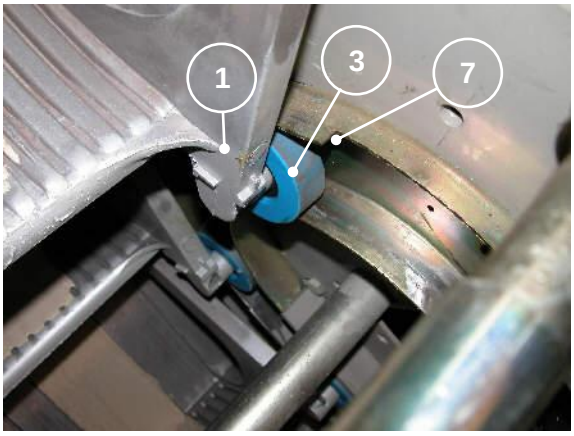


Fig. 461-10

- Tilt the step (1) forward in the direction of the arrow and attach it to the step axle (9).

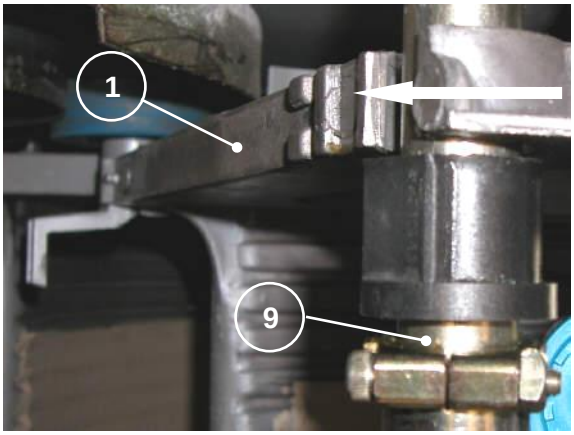


Fig. 461-11

- Lubricate the inside of the step bushings (8) according to Section 2.5.2, insert them into the step eyes and firmly press them against the step cheeks.
- Push the straps (11) towards the step bushings (8).
- If the position of the step bushing has been marked:
  - Align the step bushing with the marking (9a).
  - Tighten the strap bolts (10) to a torque of $9^{\pm 1}$ Nm.
  - Check whether the step is secured laterally without play.

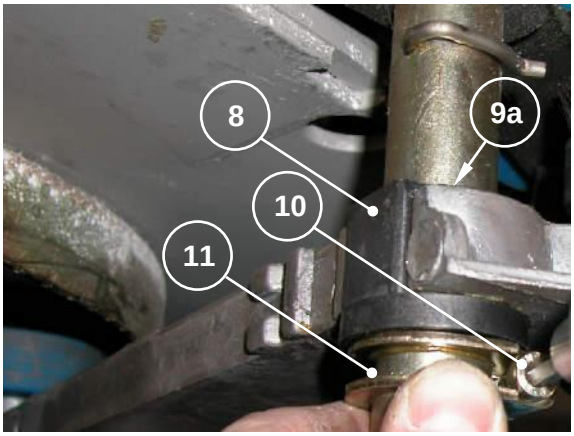


Fig. 461-12

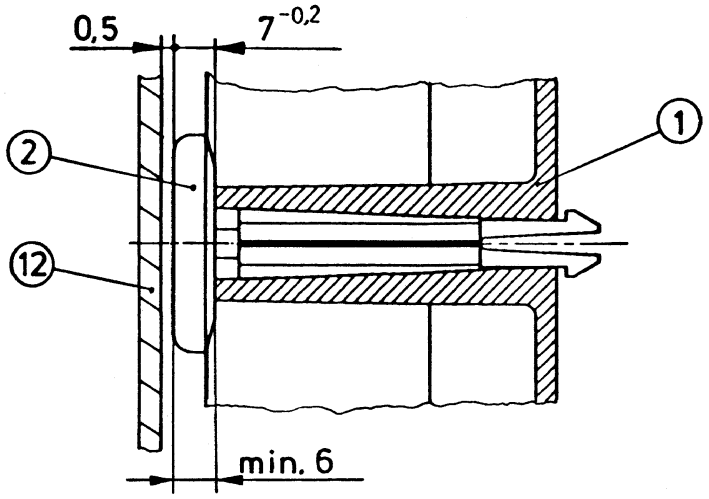
- If the position of the step bushing has **not** been marked:
  - Adjust the step so that it is centered between the step chains.
  - Run the step into the horizontal section of the escalator. Check whether the step is properly centered relative to the next step which has not been disassembled and correct its position, if necessary.
  - Run the step back and tighten the strap bolts (10).
  - Check whether the step is secured laterally without play.
  - Again run the step into the horizontal section of the escalator and once more check whether it is properly centered.
  - If necessary, again run the step back and readjust it.
- Repeat the above steps for the two other maintenance steps.

2.3 Guide Pads

2.3.1 Condition Check

- Measure the guide pads on both sides of the three disassembled maintenance steps. In case of doubt, randomly check the guide pads of additional steps.
  - Width of the head of a new guide pad: $7.0^{-0.2}$ mm
  - Minimum permissible head width: 6.0 mm

Fig. 461-13



1) Step
2) Guide pad
12) Skirt

Hints!

- If steps brush against the skirt panels, this might indicate worn guide pads (as a consequence, the coating of the skirt panels might get damaged).
- On each side of the step, the distance between the guide pad (2) and the skirt panel (12) should measure approx. 0.5 mm. If necessary, readjust the skirt panels (12) or correct displaced steps.

2.3.2 Lubrication

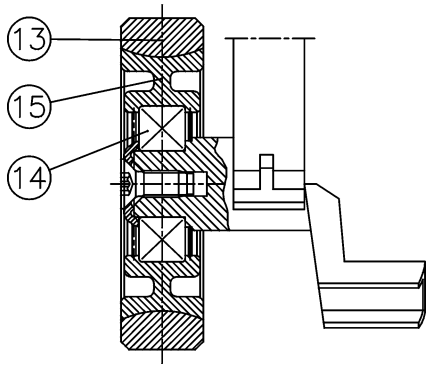
See Maintenance Instructions Q 409 598, Guide Pad Lubrication (Lubrication Step)

2.4 Step Rollers

2.4.1 Condition Check

- Check for the proper seat of the plastic tire (13) on the ball bearing (14) and, if applicable, on the hub (15).
- Check the step rollers for cracks in the plastic tires (13).
- Check the running behavior of the ball bearings (14) (the ball bearings are sealed and lubricated for their entire service life).

Fig. 461-14



13) Plastic tire
14) Ball bearing
15) Hub

- Run the step gap from the combplate at the tension station to the combplate at the drive station and check the step rollers in the return track.

Hint!

With defective plastic tires, it is clearly visible that the rollers run out vertically or laterally.

- Replace defective step rollers.

See Repair Instructions Q 409 506, Step Rollers

2.5 Step Bushings

2.5.1 Condition Check

Hint!
Only random checks necessary

- The play between the bushings and the step eye must not exceed 0.4 mm; check with a feeler gage or a corresponding wire.
- Replace worn step bushings with new ones.

2.5.2 Lubrication

- Lubricate the inside of the step bushings in the intervals indicated in the "Maintenance Operations Schedule" and when disassembling steps.

  Use lithium-soap rolling-contact bearing grease according to the following lubricant table:

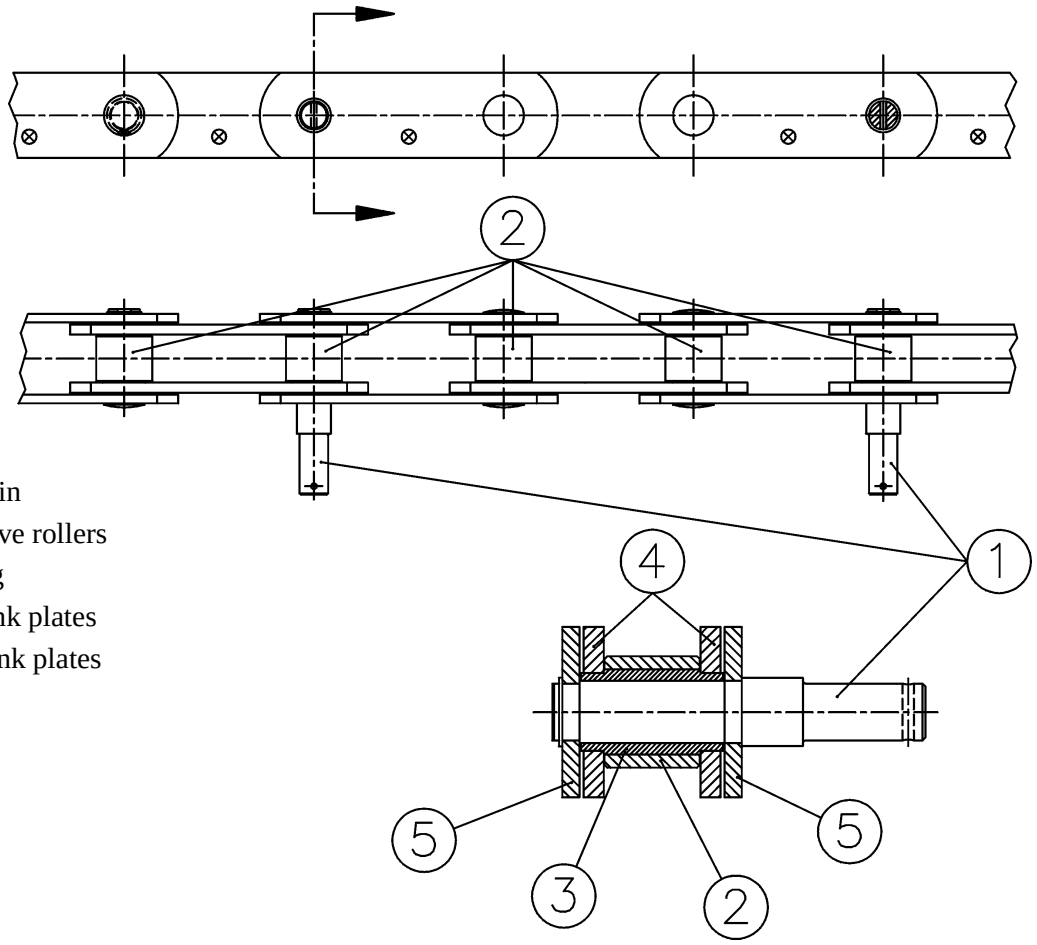
BP	ESSO	KLÜBER	MOBIL	SHELL
Energrease LS 3	Beacon 3	Klüberplex BEM 41-132	Mobilux EP2	Alvania R3

10.2 Step Chains – Q 409 600

1 Description and Mode of Operation

- Roller chains tailored to the requirements of escalators are used as step chains.
- Every third chain pin is designed as a special pin for fastening the chain roller and the step axle.
- The protective rollers of the step chains are made of hardened steel.

Fig. 600-01



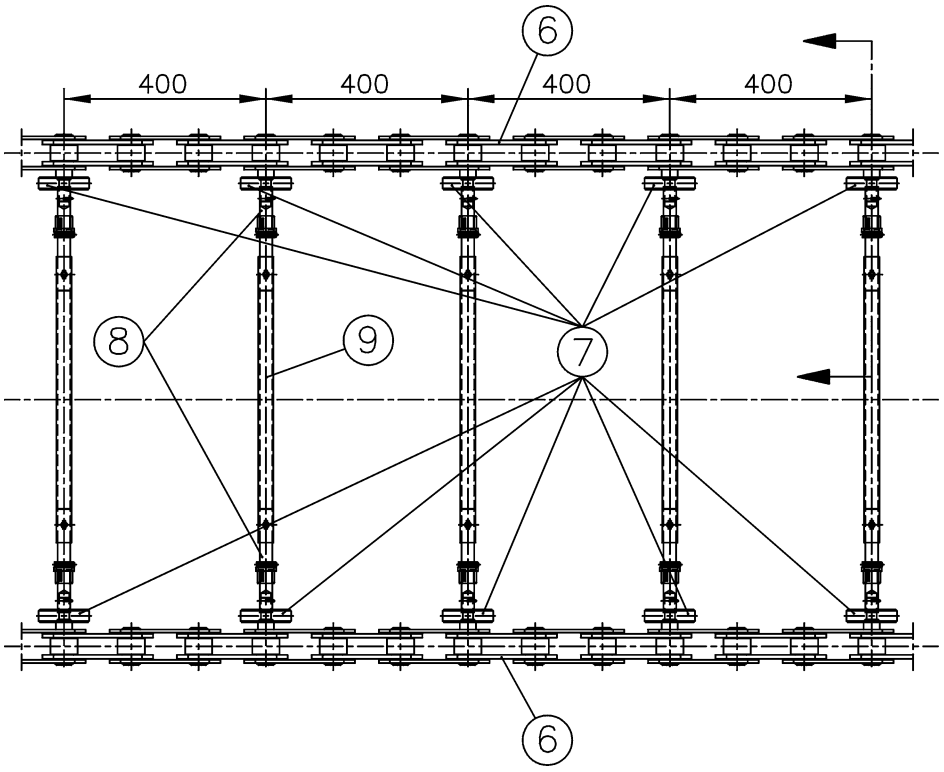
1) Chain pin
2) Protective rollers
3) Bushing
4) Inner link plates
5) Outer link plates

- The two chains are linked exclusively via **divided** step axles.

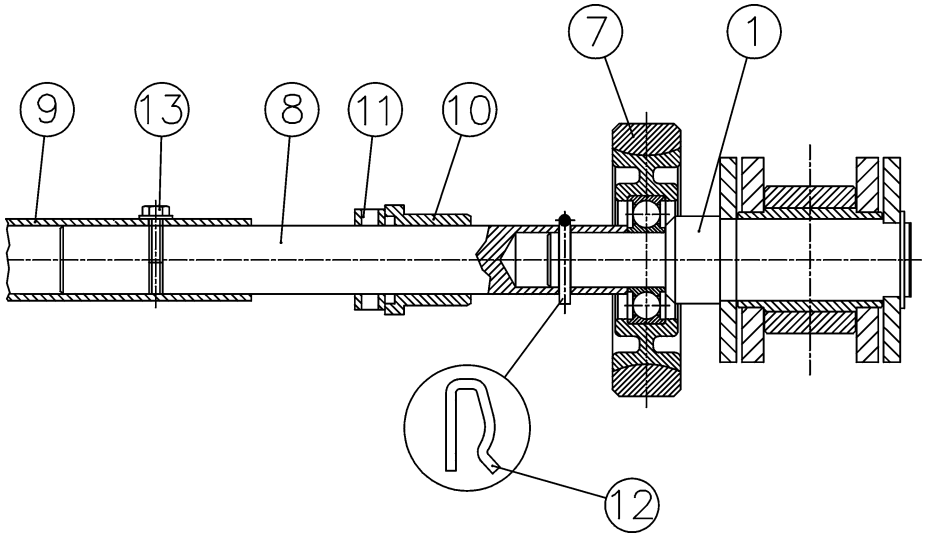
Hint!

This facilitates replacement of chain rollers.

Fig. 600-02

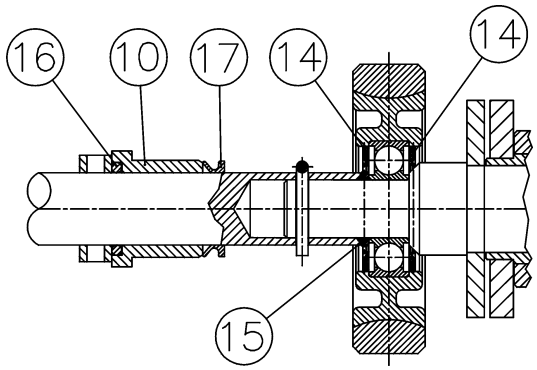


6) Step chains
7) Chain rollers
8) Step axles
9) Connecting tube
10) Step bushing
11) Strap
12) Spring clip
13) Screw



- The following protective measures are taken for covered and uncovered outdoor installations:
  - The ball bearings are sealed with grease-filled Nilos rings (14). An O-ring (15) is inserted between the axle (8) and the Nilos ring (14) to ensure a proper seat of the Nilos ring on the ball bearing.
  - The step bushing (10) is sealed by means of an O-ring (16) (on the side of the strap) and a V-ring (17).

Fig. 600-03



10) Bushing
14) Nilos rings 6204
15) O-ring 18.64 x 3.53
16) O-ring 23.4 x 3.53
17) V-ring V25A-NBR

2 Maintenance

2.1 Lubrication

Use the following lubricants to lubricate the step chains:

Warning: Outdoor installation & ambient temperature!

With automatic lubrication system, covered outdoor installaton and ambient temperatures < 10 °C, only oils indicated below may be used!

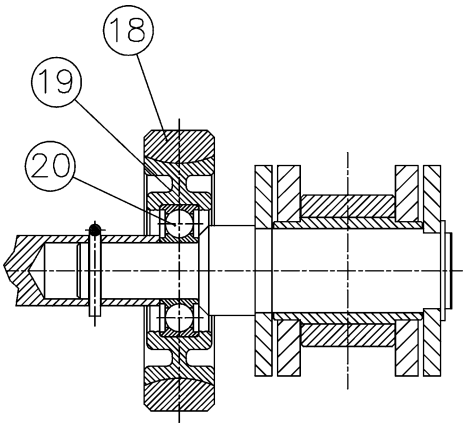
	Lubrication Method	BP	ESSO	KLÜBER	MOBIL	SHELL	ZEPF
1	**Automatic lubrication system**			Mineral oil			Synthetic oil
		–	–	Klüberoil GEM 1-46N	–	–	Ultrafit-Synthex
		Only use these particular, water-repellent oils. These oils are **not** suited for manual lubrication.					

For more detailed information, see Maintenance Instructions Q 409 924, Automatic Lubrication System

2.2 Checking the Condition of Step Chain Rollers

- Check for the proper seat of the plastic tire (18) on the hub (19) and the proper seat of the hub on the ball bearing (20).
- Check the step chain rollers for cracks in the plastic tires (18).
- Check the running behavior of the ball bearings (20) (the ball bearings are sealed and lubricated for their entire service life).

Fig. 600-04



18) Plastic tire
19) Hub
20) Ball bearing

Hints!

- Perform the checks in the tension station; advance the step chain in the **downward** direction.
- With defective plastic tires (18), it is clearly visible that the rollers run out vertically or laterally.

- Replace defective rollers.

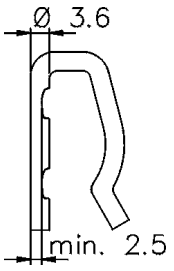
See Repair Instructions Q 409 692, Step Chain Rollers

2.3 Checking the Condition of Spring Clips

- Randomly check 8 to 10 spring clips for leg wear.

  Min. leg width: 2.5 mm

Fig. 600-05



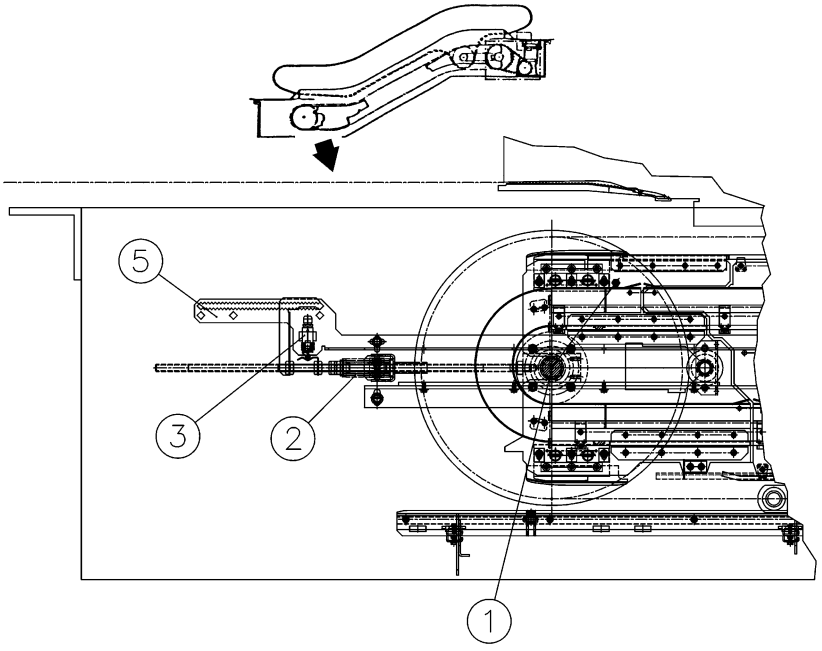
10.3 Step Chain Tensioning Device, Chain Tension Contacts – Q 409 602

1 Description and Mode of Operation

- The chain tensioning device is used to maintain the tension of the step chains.

  It is located in the tension station and consists of the tension carriage (1), tension springs (2) and monitoring contacts (3).

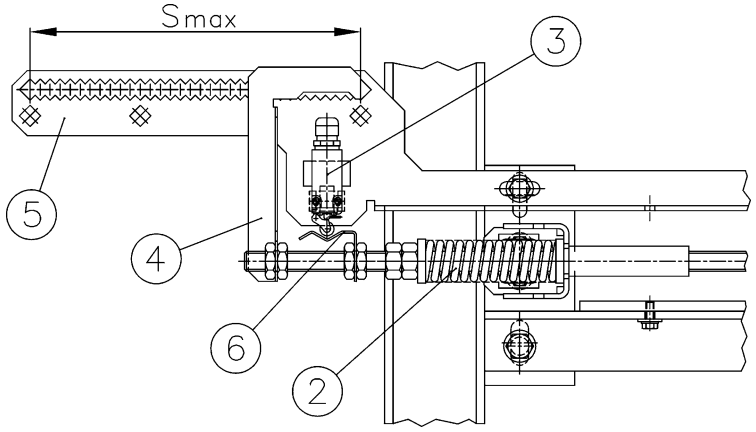
Fig. 602-01



1) Tension carriage
2) Tension spring
3) Chain tension contact
5) Tension range indicator

- The chain tension contacts (3) shut the escalator down, when
  - a step gets jammed,
  - the step chains block,
  - the step chains are elongated beyond the permissible value or
  - when a step chain breaks.

Fig. 602-02



2) Tension spring
3) Chain tension contact
4) Pointer
5) Tension range indicator
6) Actuating arm

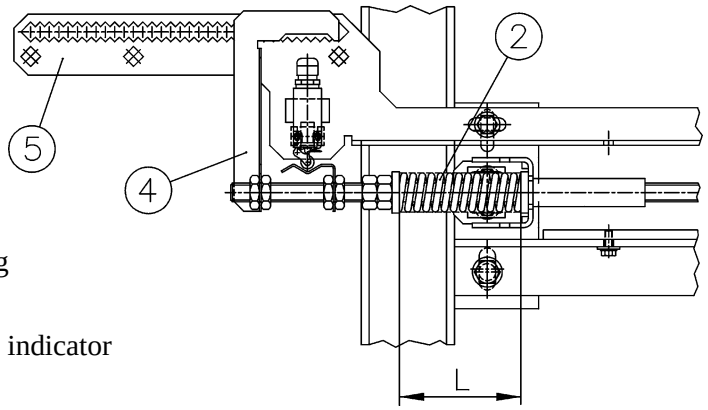
S_{max}: Max. tension range of the tension carriage
Standard: 220 mm
Optional: 330 mm

2 Maintenance

2.1 Step Chain Tension

2.1.1 Checking the Step Chain Tension

Fig. 602-03



2) Tension spring
4) Pointer
5) Tension range indicator

- Given the correct tension, the tension springs (2) are compressed to the following values:
  - with rises ≤ 13 m: $L = 115^{\pm 1}$ mm
    max. permissible elongation: 120 mm
  - with rises > 13 m: $L = 130^{\pm 1}$ mm
    max. permissible elongation: 133.5 mm

Warning: Knocking noise!

Undertensioned chains produce knocking noises when entering the sprockets.

2.1.2 Retensioning the Step Chains

- Compress the springs to the dimension "L" [mm] on both sides.
- Check the position of the pointer (4) on the tension range indicator (5) (see Fig. 602-03):

Hint!

The indicated tension range of the tension carriage must be identical on both sides.

- Check the step entry into the combplate at the tension station.

Hint!

The steps must enter the combplate horizontally, i.e. not slanted.

If **all** steps are slightly slanted – which may happen especially during the break-in period of the step chains – this can be corrected by means of **different** tensions of the two step chains:

– Tension the shorter chain strand.

Hint!

The springs must not be compressed to their solid length.

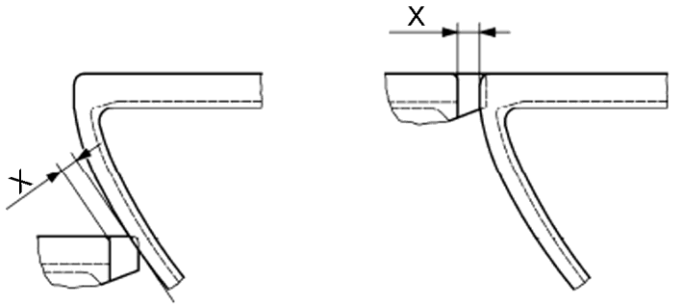
– Release the tension of the longer chain strand.

Hints!

- Readjust the chain tension after one or two months of operation.
- Upon tensioning step chains, always check and, if necessary, correct the setting of the monitoring contacts.

2.1.3 Limit Value of Step Chain Elongation

Fig. 602-03a



- Measure the distance between two consecutive steps.

Hint!

The maximum permissible **distance X=6 mm** between two steps corresponds to a step chain elongation of approx. 0.9%. With this distance, the step chains have reached their maximum permissible elongation and must be replaced.

2.2 Step Chain Tension Contacts

2.2.1 Functional Check

- With **one** contact actuated, the escalator must not start up.

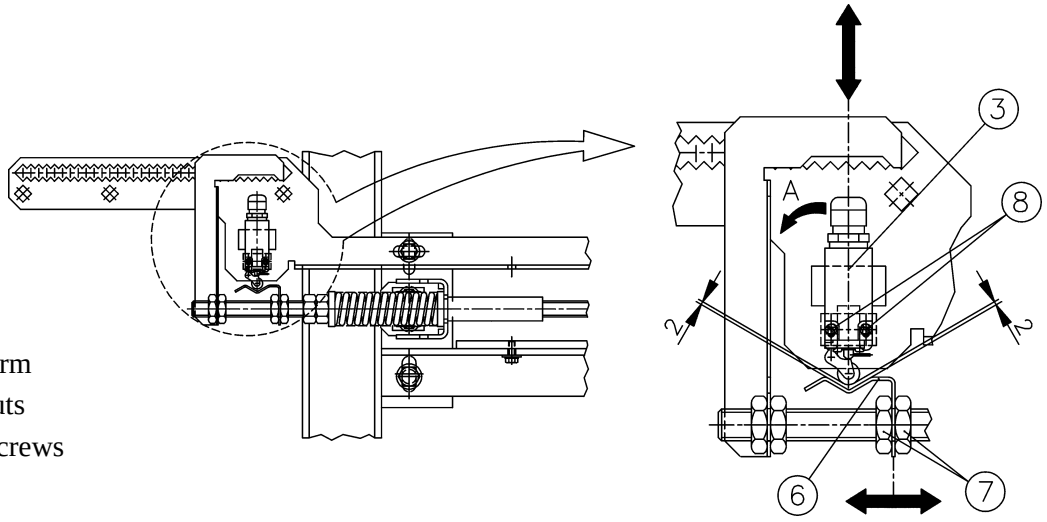
  Error codes:

  "E_17" for chain tension contact, bottom right

  "E_87" for chain tension contact, bottom left

2.2.2 Contact Setting

Fig. 602-04



3) Contact
6) Actuating arm
7) Hexagon nuts
8) Fastening screws

- 2 mm clearance between contact roller and actuating arm (6).
- The contact should be inclined by approx. 10° in the direction of the arrow "A".

Hint!

Otherwise the roller lever might get damaged when the tension slide moves backwards.

2.2.3 Readjusting the Step Chain Tension Contacts

See Fig. 602-04

- Use the nuts (7) to adjust the actuating arm (6) until it is centered to the contact roller.
- Adjusting the 2 mm clearance between the contact roller and the actuating arm (6):
  - Loosen the fastening screws (8).
  - Adjust the contact (3) so that it has the correct height and an inclination of 10° in the direction of the arrow "A" relative to the actuating arm (6).

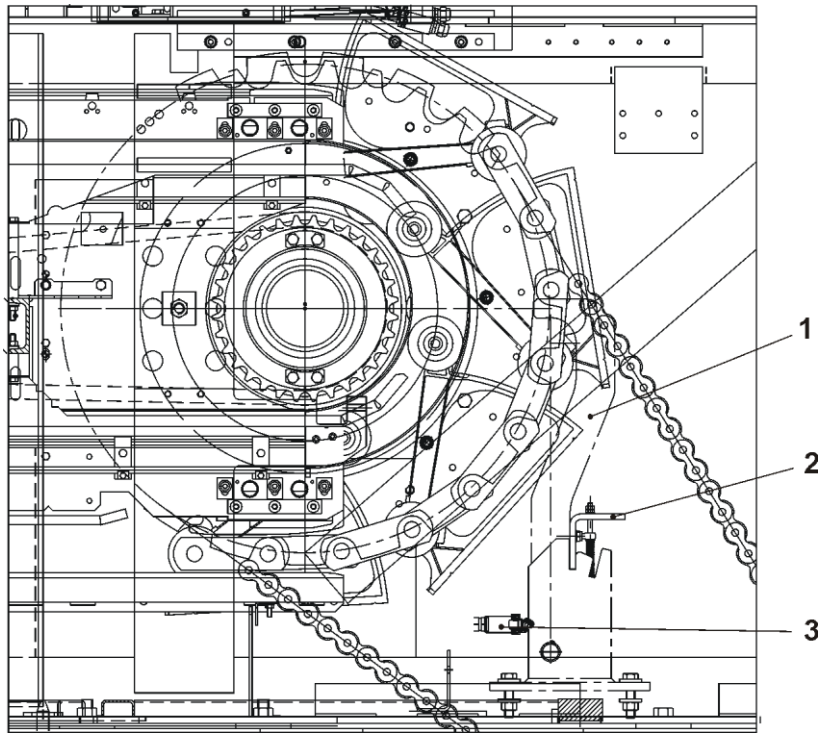
10.4 Step Chain Locking Device – Q 409 926

1 Description and Mode of Operation

The step chain locking device locks the left step chain in the turn-around area by means of a hook during maintenance or repair tasks requiring the technician to work inside the step band.

The step chain locking device is located in the drive station pit and consists of the hook (1) and the actuating lever (2). The locking device is monitored by a safety switch (3) in the engaged position of the hook (1).

Fig. 926-01: *Engaged Position*



1) Hook
2) Actuating lever
3) Contact – hook engaged

Danger: Working inside the escalator step band!

Before working inside the escalator step band:

- Make sure that the step chain strand is locked by the step chain locking device.
- Make sure that the actuating lever (2) of the step chain locking device is securely snapped in at its engaged position.

- Use the hand winding device of the drive to adjust the clearance of the step chain (4).

  The clearance of the step chain (4) must suit to the position to the hook (1).

- To anchor the step chain, pull the actuating lever (2) and shift the hook (1) forward into the clearance of the step chain (4).

  The actuating lever (2) must securely snap in at its engaged position.

- The engaged position of the hook (1) is monitored by a contact (3). This position is mandatory whenever a technician has to work inside the escalator step band or during certain repair work.
- The escalator is shut down or cannot be started, when the "hook engaged" contact (3) is actuated.

2 Maintenance

2.1 Movability of the Locking Device

2.1.1 Checking the Movability of the Locking Device

- Pull the actuating lever (2) of the step chain locking device and shift the hook (1) into the engaged position. Ensure that the actuating lever (2) snaps in at the end position (see Fig. 926-01).
- Pull the actuating lever (2) again and shift the hook (1) back to the released position. Ensure that the actuating lever (2) again snaps in at the end position (see Fig. 926-01).

Hint!

It should be possible to move the pawl with moderate effort. Otherwise, grease the gliding surface of the pawl.

2.1.2 Lubrication

- Check the lubrication state of the gliding surface of the actuating lever (2).
- Clean the lever gliding surface, if necessary.
- Grease the gliding surface of the actuating lever (2).

  Recommended greases:

BP	ESSO	KLÜBER	MOBIL	SHELL
Energrease LS 3	Beacon 3	Klüberplex BEM 41-132	Mobilux EP2	Alvania R3

2.2 Step Chain Locking Device Contacts

2.2.1 Functional Check

- With the contact actuated, the escalator must not start up.

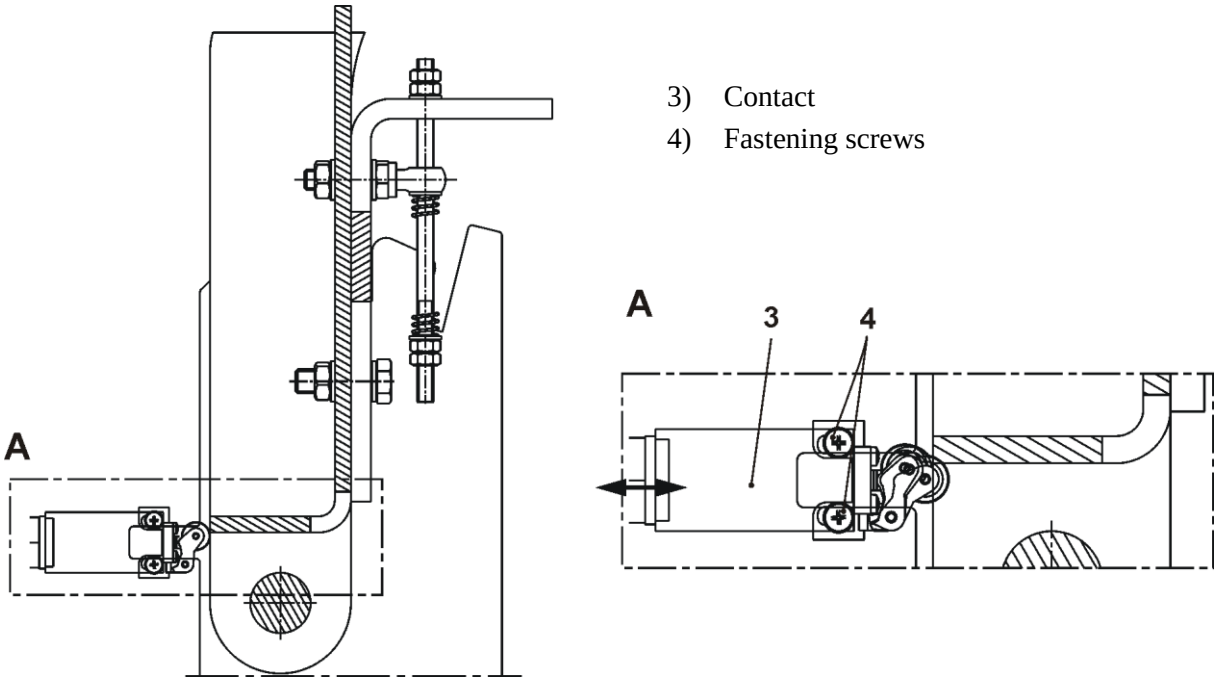
  Error code:

  "E_86" for the contact engaged

2.2.2 Contact Setting

- Contact roller with hook engaged: pressed in by $5^{\pm 0.5}$ mm.

Fig. 926-02



3) Contact
4) Fastening screws

- When readjustment is necessary, loosen the fastening screws (5), adjust the contact (2) and retighten the fastening screws.

10.5 Step Level Contacts, Antistatic Brushes – Q 409 601

1 Description and Mode of Operation

One step level contact and one antistatic brush each is located in front of the track blocks of the drive and tension stations in the inclined section of the escalator within the step band. The antistatic brush is mounted on the side of the step level contact.

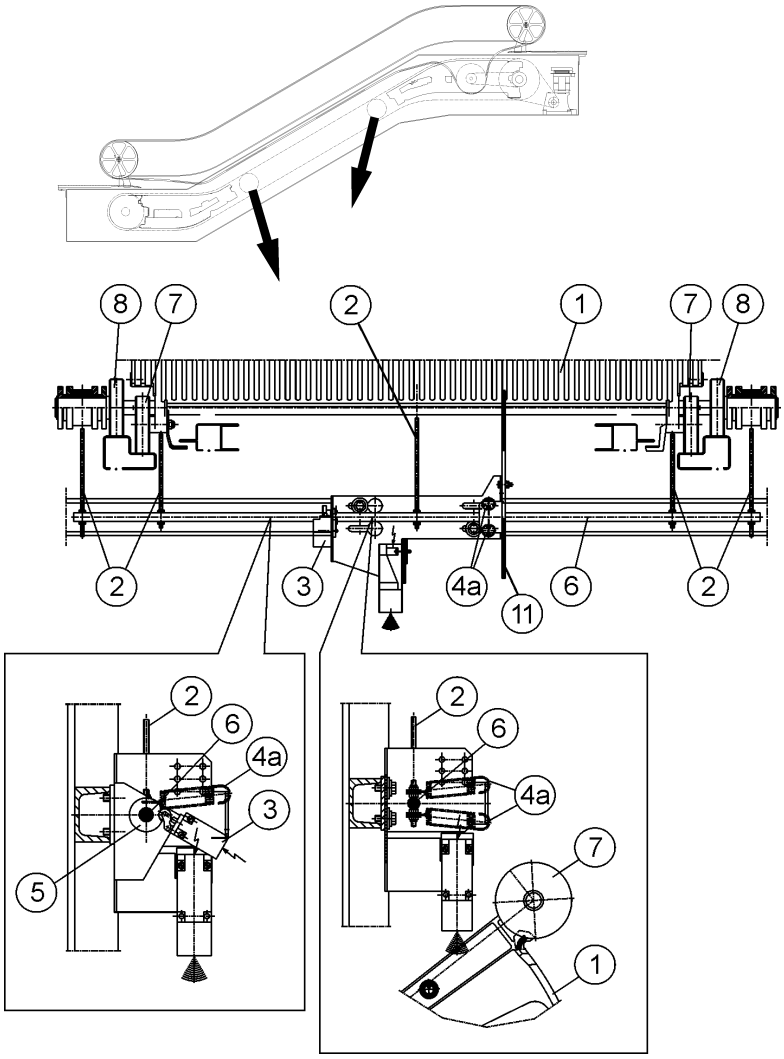
When a step (1) drops due to a break, deformation or a defective step or chain roller tire, one of the feeler pins is rotated, the contact (3) is actuated and the safety circuit is interrupted.

The interruption is electronically locked. The swiveled feeler pins are reset to their original positions by means of the two tension springs (4a). Electronic interlocking must be reset upon removal of the fault.

Hint!

The antistatic brush touches the underside of the risers thus preventing the escalator from becoming electrostatically charged.

Fig. 601-01



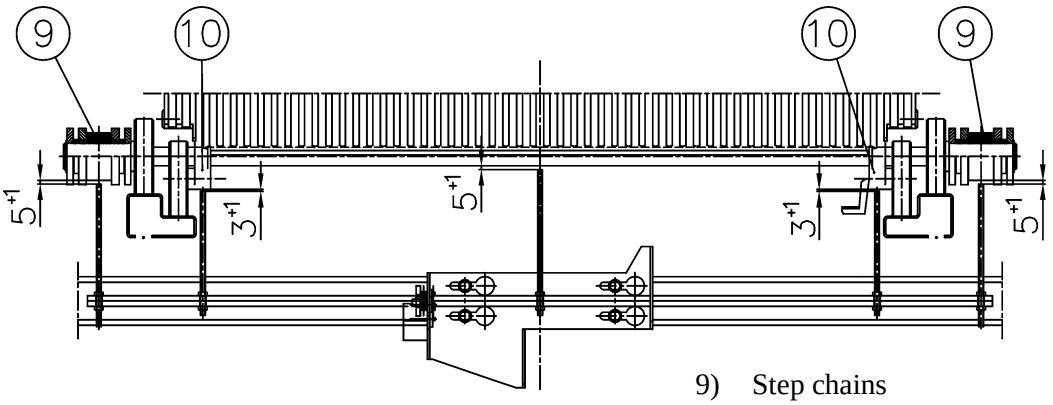
1) Step
2) Feeler pins
3) Contact
4a) Tension springs
5) Cam disk
6) Round rod
7) Step rollers
8) Chain rollers
11) Antistatic brush

2 Maintenance

2.1 Setting Check

Hint!
Required only during commissioning and following a step crash

Fig. 601-02



9) Step chains
10) Step arms

2.2 Functional Check

- Rotate one of the feeler pins (2).
- The contact (3) is actuated via the cam disk (5).

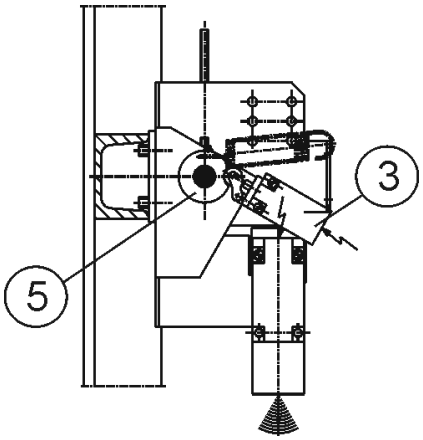
  Error codes:

  "E_28" for step level contact, bottom

  "E_36" for step level contact, top
- Reset the electronic interlocking.

2.3 Contact Setting

Fig. 601-03



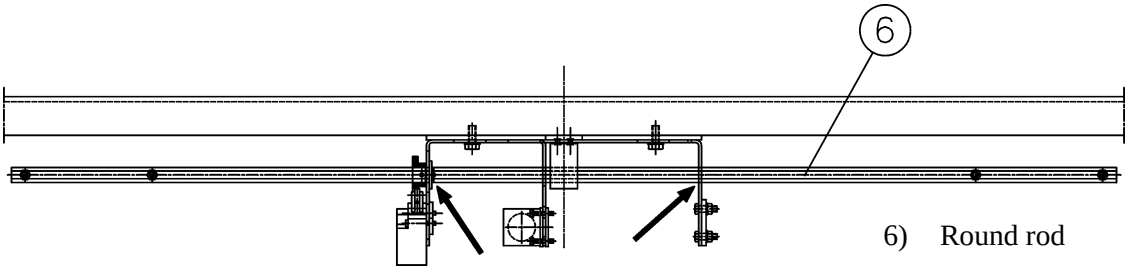
3) Contact
5) Cam disk

- The contact roller should abut the cam disk (5) without play.

2.4 Lubrication

- Oil the bearing points of the round rod (6).

Fig. 601-04



6) Round rod

For the adequate mineral oil, see the lubricant table in the Maintenance Instructions Q 409 452, Drive Chain, Section 2.2

2.5 Antistatic Brushes

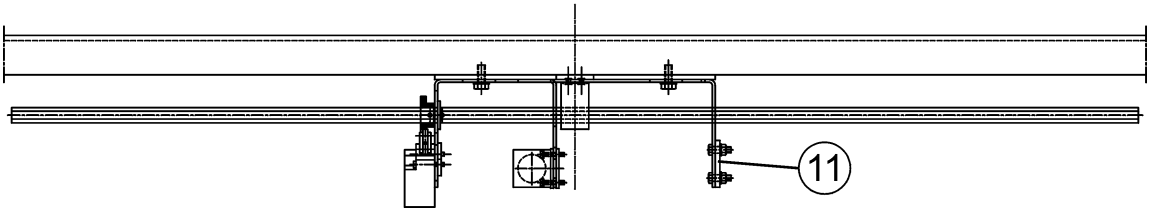
2.5.1 Setting Check

Hint!
Required only during commissioning and upon replacement of the brushes

- Check whether the antistatic brushes touch the underside of the risers (see also Fig. 601-01).

Fig. 601-05

11) Antistatic brush



2.5.2 Functional Check

- Check whether the antistatic brushes touch the underside of the risers.
- Replace highly worn, damaged or heavily soiled brushes.

Hint!
Damaged, heavily soiled or poorly adjusted brushes result in unpleasant electrostatic discharge when touching the escalator ("electric shock").

10.6 Step Band Monitor – Q 409 465

1 Description and Mode of Operation

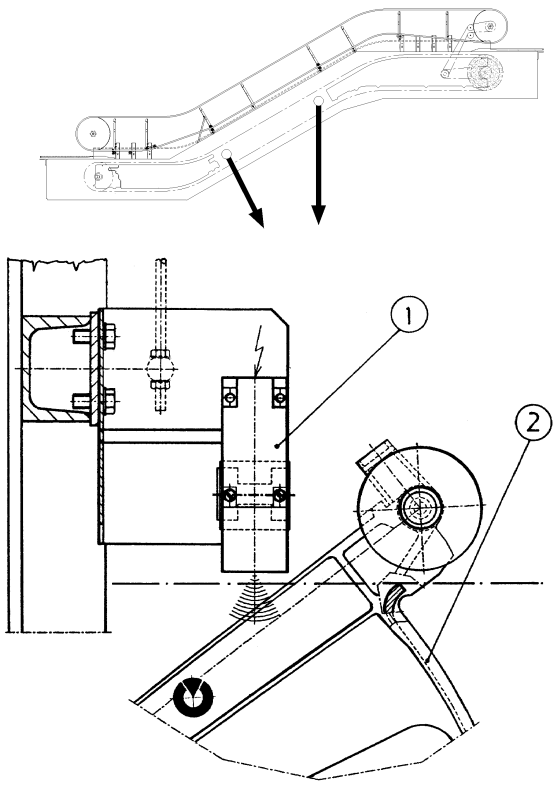
- One initiator (1) each is located in front of the track blocks of the tension and drive stations in the inclined section of the escalator (fastened to the support angle of the step level contacts).
- The pulses generated by passing steps (2) are used to monitor the following:
  – Speed of the step band

Hint!
Except for inspection operation, **always** active

  – Missing steps

Hint!
Active only during nominal operation

Fig. 465-01



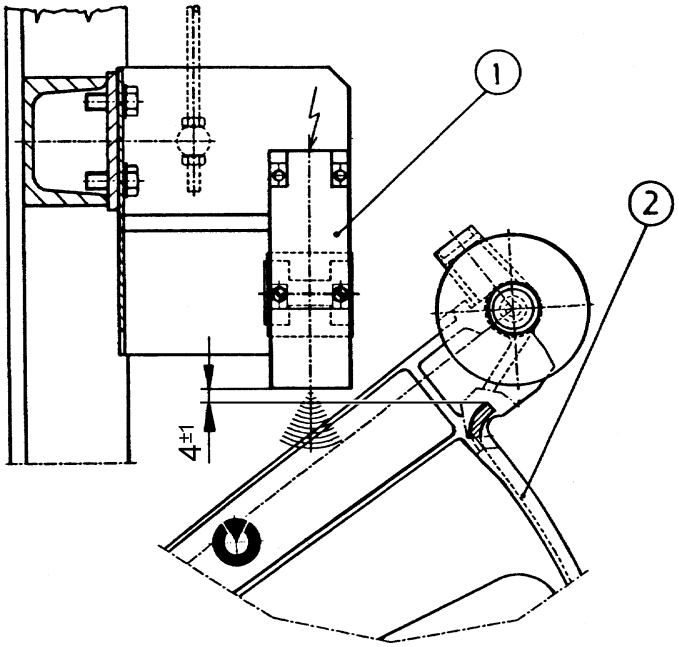
1) Initiator
2) Step

2 Maintenance

2.1 Setting Check

Hint!
Required only during commissioning, following a step crash or upon replacement of initiators.

Fig. 465-02



1) Initiator
2) Step

- Distance between initiator and edge of riser: $4^{\pm 1}$ mm

2.2 Functional Checks

2.2.1 Checking the Operation of the Missing-Step Monitor

Hint!

With at least 1 step disassembled

- Escalator ready for operation.
- Start the escalator with the key switch.
- As soon as the step gap passes the first initiator in the direction of travel, the escalator is shut off electronically and interlocked.

  Error codes:

  "E_39" for initiator at drive station PLC-S

  "E_3B" for initiator at tension station PLC-S

  "E_F0" for initiator at drive station PLC-M

  "E_E7" for initiator at tension station PLC-M
- Reset: Press RESET on the OIT faults screen.

2.2.2 Checking the Operation of the Speed Monitor

Hint!

By simulating over- or underspeed.

For more detailed information, see Controller Instructions J 572 812, Technical Tests

Hint!

Over- and underspeed may be simulated both with the drive station initiator and with the tension station initiator.

- Activate simulation mode when the escalator is ready for operation and idle.
- Activate the technical test menu.

For more detailed information, see Controller Instructions J 595 027, Operator Interface Terminal (OIT), Section 2.1.4.6

- Start the escalator with the key switch within 30 seconds.

- Following start-up delay (15 sec.), over- or underspeed will be detected. The escalator is shut off electronically and interlocked.

  The ALARMS screen appears indicating the error code related to the technical test.

  Error codes:

  "E_3E" for master overspeed 15%

  "E_CF" for master overspeed 25%

  "E_3F" for master underspeed

  "E_30" for slave overspeed 15%

  "E_CE" for slave overspeed 25%

  "E_31" for slave underspeed

- Reset
  - Touch the RESET touch button on the technical test screen to reset the error.
  - Speed simulation is deactivated by exiting the test screen or after 30 seconds have elapsed without any activities.
  - If the fault is still active, press RESET to reset the error.
- Speed limits during nominal operation:
  - For nominal speed
    Overspeed 15%: 15% higher
    Overspeed 25%: 25% higher
    Underspeed: 50% lower
  - At standstill
    Overspeed: 0.05 m/s
    Underspeed: not possible
  - For crawling speed
    Overspeed 15%: 15% higher
    Overspeed 25%: 25% higher
    Underspeed: 0.08 m/s

10.7 Step/Chain Roller Monitor – Q 409 465A

1 Description and Mode of Operation

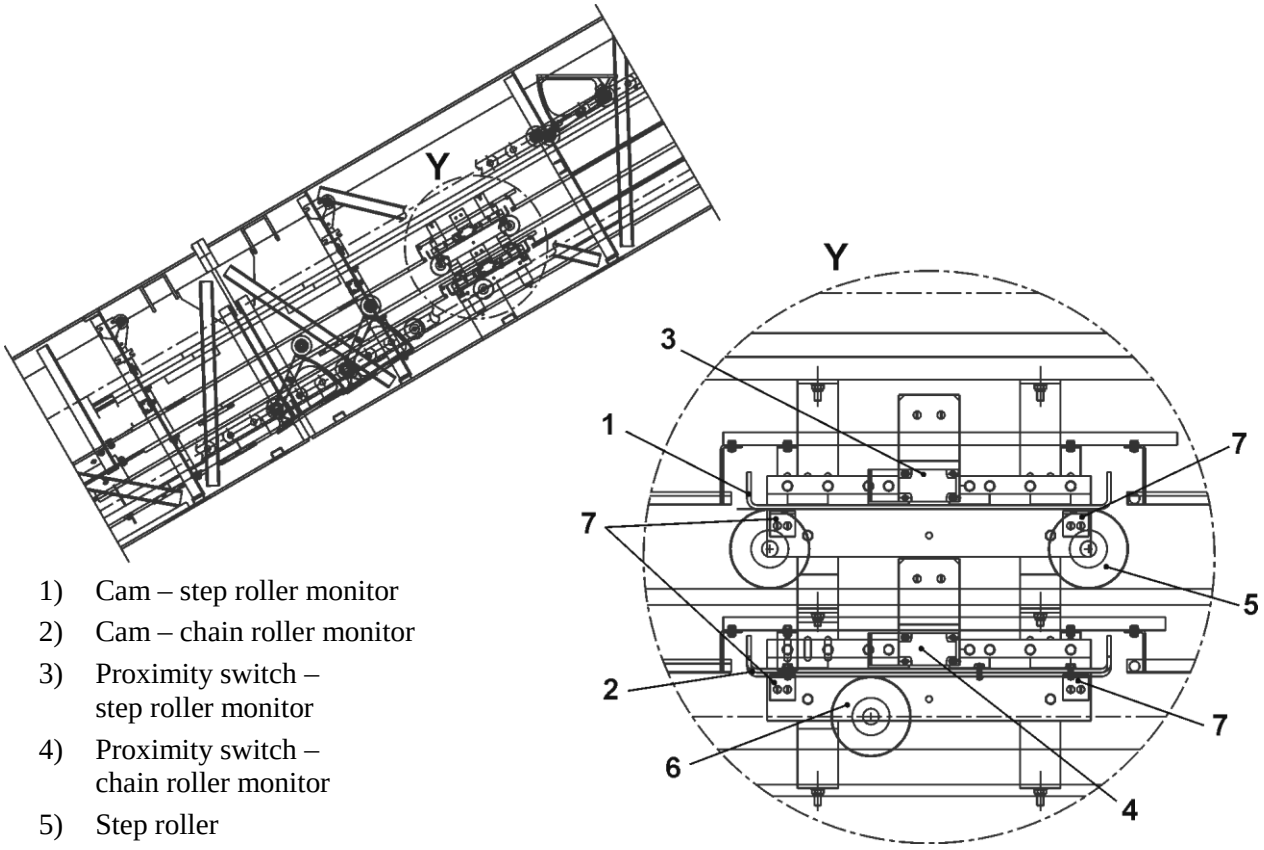
1.1 Description

- The step/chain roller monitor is located on both sides in the inclined section of the escalator. One roller monitor each is located in the return track of the step rollers and the chain rollers.
- Each monitor is comprised of a hinged cam and a proximity switch. The whole assembly is fastened to the roller tracks.
- The cam is able to rise or lower a distance slightly over 3 mm relative to the roller riding track surface. A stop bracket on each end of the cam restricts any further dropping cam movement.
- The step/chain roller monitor countinously inspects each escalator step roller and chain roller. When a roller is undersized by 3 mm the monitor signals the PLC to initiate a controlled stop of the escalator.

1.2 Mode of Operation

- As the roller first enters the monitor, the cam is supported by the entering and the exiting roller. As the roller travels further along the monitor, it becomes the sole support for the cam and will drop, if necessary, to ride against the top of the roller.
- Through its weight, the cam exerts a slight pressure against the roller to ensure it is riding on the roller track as well. For at least one entire roller revolution, the proximity switch mounte dabove the cam inspects this single roller’s diameter by determining how far the cam has dropped to ride on top of the roller. If this distance is to great, the roller diameter is undersized and the roller must be replaced.
- The proximity switch sends a signal to the PLC to initiate a controlled stop when the roller diameter of 97 mm or less is found.
- As the roller exits the monitor, the support of the cam is again shared between this existing roller and the new, entering roller.

Fig. 465A-01

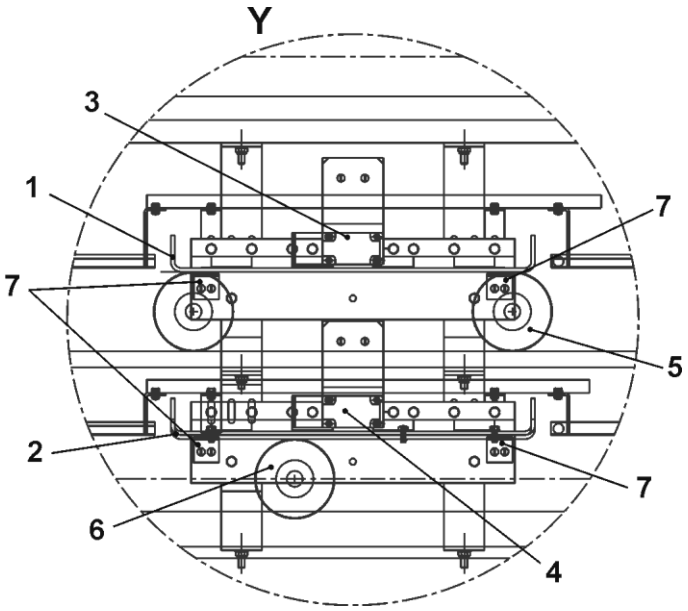


1) Cam – step roller monitor
2) Cam – chain roller monitor
3) Proximity switch – step roller monitor
4) Proximity switch – chain roller monitor
5) Step roller
6) Chain roller
7) Stop bracket

2 Maintenance

Fig. 465A-02

1) Cam – step roller monitor
2) Cam – chain roller monitor
3) Proximity switch – step roller monitor
4) Proximity switch – chain roller monitor
5) Step roller
6) Chain roller
7) Stop bracket



2.1 Functional Checks

2.1.1 Checking the Movability of the Cams

Hint!
With at least 3 steps disassembled

- Run the gap along the riding side of the track until the step/chain roller monitor assembly is accessible.
- Turn off and padlock the main switch.
- Check all 4 cams (1) (2) for free movability of the hinges.
- If a cam cannot move freely, clean and lubricate the hinged area.

For the adequate mineral oil, see the lubricant table in the Maintenance Instructions Q 409 452, Drive Chain, Section 2.2

- Check if all 8 cam stop brackets (7) are secure an in place. Adjust if necessary.

2.1.2 Checking the Operation of the Proximity Switches

Hint!
With all steps assembled

- Install a 97-mm marked test roller in place of a current roller.
- Start the escalator with the key switch in the normal direction of travel.
- As soon as the test roller passes the respective cam, the escalator is shut off electronically and interlocked.
  Error codes:
  "E_C0" for left initiator at chain roller monitor
  "E_C2" for right initiator at chain roller monitor
  "E_C1" for left initiator at step roller monitor
  "E_C3" for right initiator at step roller monitor
- Readjust the proximity switch (3) (4) if necessary.
- Replace the test roller by the normal roller.
- Reset: Press RESET on the OIT faults screen.
- Repeat the the test procedure for all remaining rollers.

10.8 Automatic Lubrication System – Q 409 924

1 Description and Mode of Operation

1.1 Description

The automatic lubrication system is installed in the pit of the drive station. It automatically lubricates the step chains as well as the drive and handrail drive chains.

The pump is equipped with a 6-liter tank and a level switch controlled via the PLC controller. The tank is made of transparent polyamide.

During the lubrication cycle, the piston pump (6) advances the oil from the container (7) to the grease points via solenoid valves (8) and hoses (9) (see Fig. 924-02).

The oil reservoir is equipped with a heating.

For more detailed information about the heating, refer to the following publications:

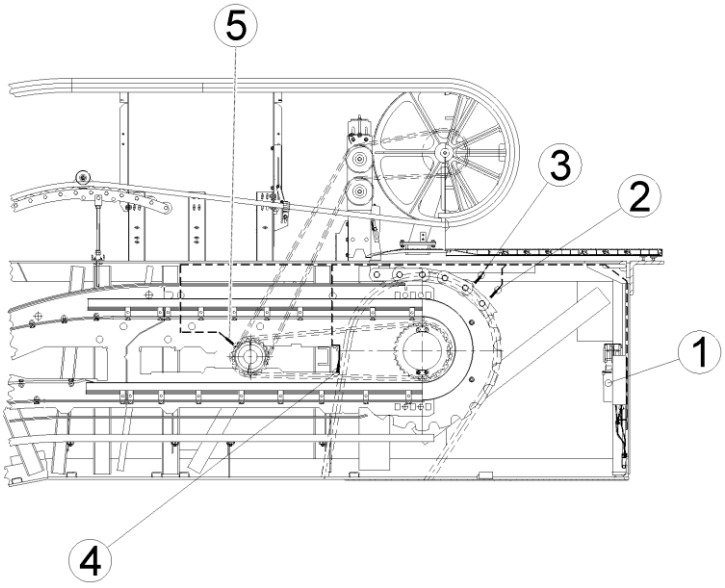
Refer to this document	Publication
CIR cartridge heater	MOD-CIR.pdf
Chromalox SBKT Control Panel Thermostat	Oil reservoir heater thermostat.pdf

Hint!

The guide pads are lubricated by a separate lubrication system.

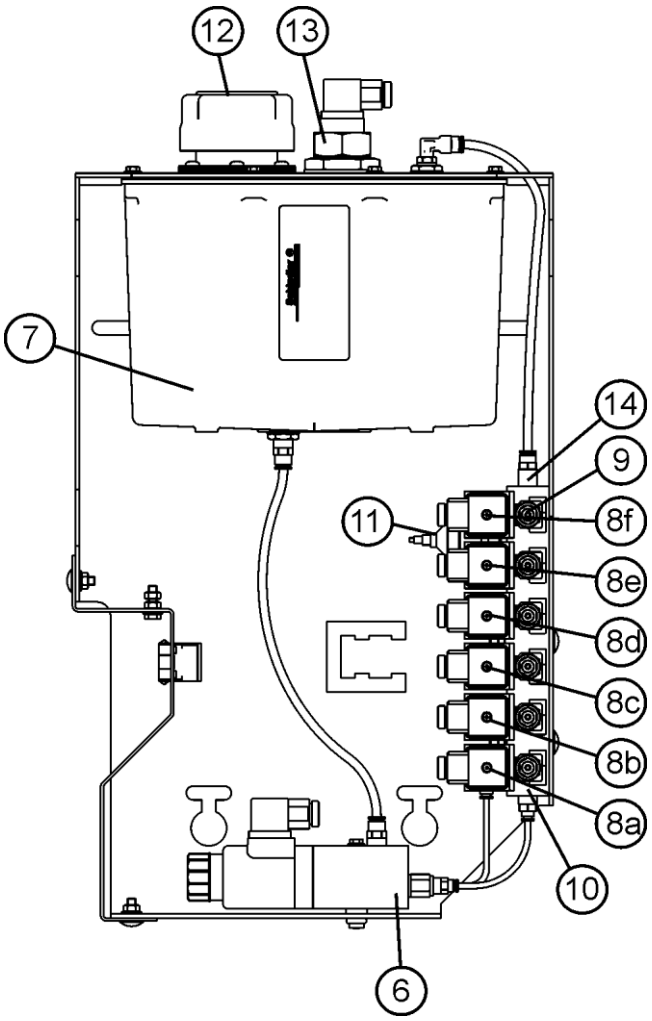
See Maintenance Instructions Q 409 598, Guide Pad Lubrication (Lubrication Step)

Fig. 924-01



1) Lubrication unit
2) Application brush, step chain
3) Application brush, drive chain
4) Application brush, main handrail drive chain
5) Application brush, secondary handrail drive chain

Fig. 924-02: *Detail A*



6) Pump
7) Container
8) Solenoid valves
9) Hoses
10) Distributor
11) Pressure switch
12) Filler hole
13) Level switch
14) Pressure relief valve

1.2 Mode of Operation

- The piston pump is controlled via the PLC controller.
- The lubrication period is controlled via the number of pump strokes and is adjusted via the control software.
- The overtravel time of the step band and the lubrication off-period are also adjusted via the control software.
- The oil quantity used per lubrication cycle is controlled by a separate solenoid valve (8) for each grease point.
- The oil level in the container is permanently monitored. If the oil level falls below the minimum permissible level, lubrication is not started and the OIT displays the error code for "Oil level too low". The message disappears as soon as the container is refilled.
- The pressure relief valve (14) limits the system pressure to 3 bar.
- The pump type is preset depending on the rise. The oil quantity per stroke differs according to the pump type amounting to 60 mm³/stroke or 120 mm³/stroke.

  For the drive and handrail drive chain, the lubrication cycle for 120 mm³/stroke is doubled.

1.2.1 Lubrication Cycle Sequence

- At the start of the lubrication cycle, a leak test is performed.
  - The pump starts to operate at a time interval of 1 stroke and builds up pressure in the system. The pressure switch (11) confirms the tightness of the system as soon as a pressure of 2 bar is reached.
  - If a pressure of 2 bar is not reached after a max. of 100 strokes, the system is leaking and lubrication is stopped with the error code for "Leakage in the system".
  - Upon completion of the leak test, the step chain lubrication valves are opened and the pressure is released.
- The individual grease points or solenoid valves are activated in the following order:
  - Right step chain
  - Left step chain
  - Right secondary handrail drive chain
  - Left secondary handrail drive chain
  - Main handrail drive chain
  - Drive chain
- If a valve does not open, the error code for "Valve doesn't open" is displayed. If the valve does not open within the next 5 seconds, the error code for "Valve hasn't opened for at least one time" is stored and lubrication is continued at the next grease point. During the next lubrication cycle, the system again tries to activate the defective valve.
- If the escalator is stopped during the lubrication period, the lubrication cycle is automatically resumed at the point where it was interrupted when the unit is started again.
- With automatic operation:
  - The unit runs for the entire lubrication period plus the additionally defined overtravel time (to distribute the lubricant).

    Since the lubrication and overtravel periods are based on the traveling distance instead of the running time, they can be performed both in normal and in sleep mode.
  - Upon expiry of the lubrication off-period, the lubrication cycle starts again.

1.2.2 Oil Reservoir Heating

The lubrication system is equipped with an oil reservoir heating. The heater is mounted in the top plate of the oil reservoir and wired in series with a thermostat switch. The thermostat opens at 53 °F (11.7 °C) and closes at 38 °F (3.3 °C) and is only activated when the heating system is activated.

2 Maintenance

Hint!
The lubrication system itself is maintenance-free.

2.1 Checks

2.1.1 Lubrication State of Chains

- Check whether the chains are "wet" at the chain links.
- If they are "dry", which is an indication for a lack of lubricant, change the lubrication period/lubrication off-period.

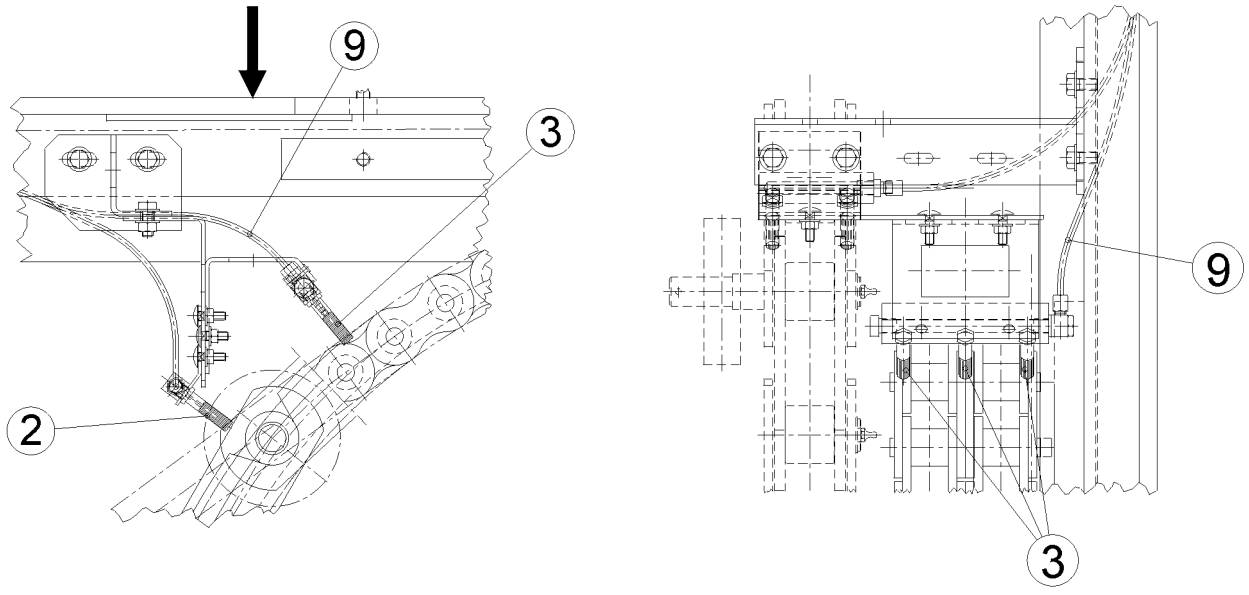
2.1.2 Oil Level in Container

Hints!
• Full container: 6 l • The oil level is checked by the level switch (13). • As soon as the oil quantity falls below the minimum level, the system signals a fault.

2.1.3 Adjusting the Oil Application Brushes

- At the drive chain

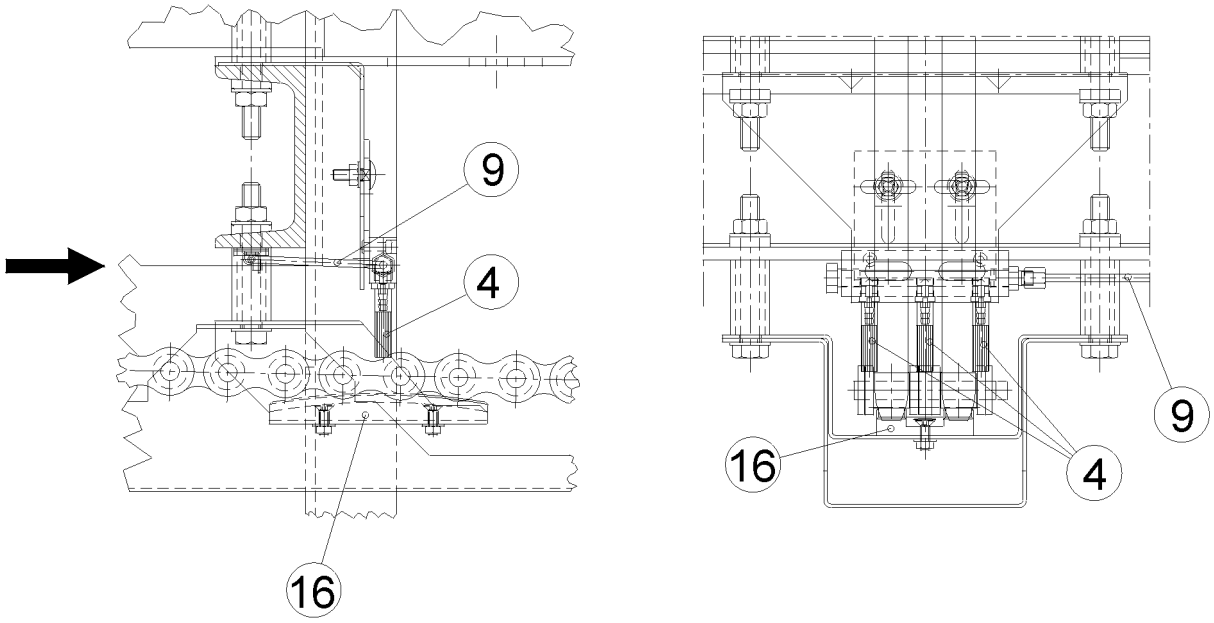
Fig. 924-03: *Drive Chain*



Hint!
The oil application brushes should touch the chains with **gentle** pressure.

- At the main handrail drive chain

Fig. 924-04: *Main Handrail Drive Chain*

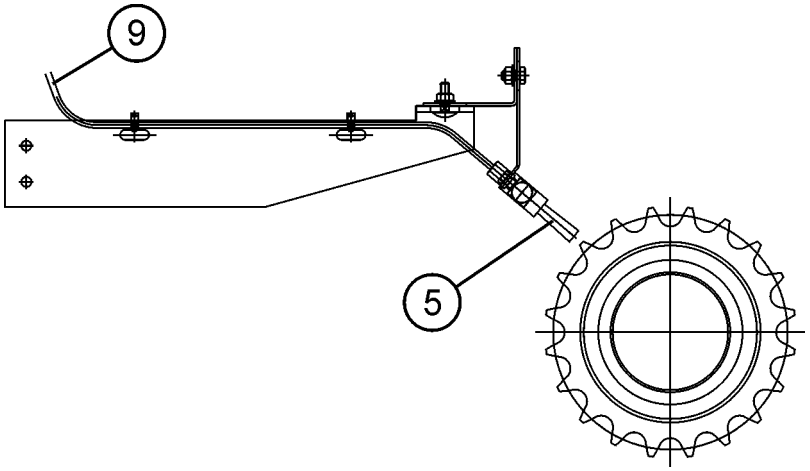


Hint!

The oil application brushes should touch the chains with **gentle** pressure.

- At the secondary handrail drive chain

Fig. 924-04a: *Secondary Handrail Drive Chain*

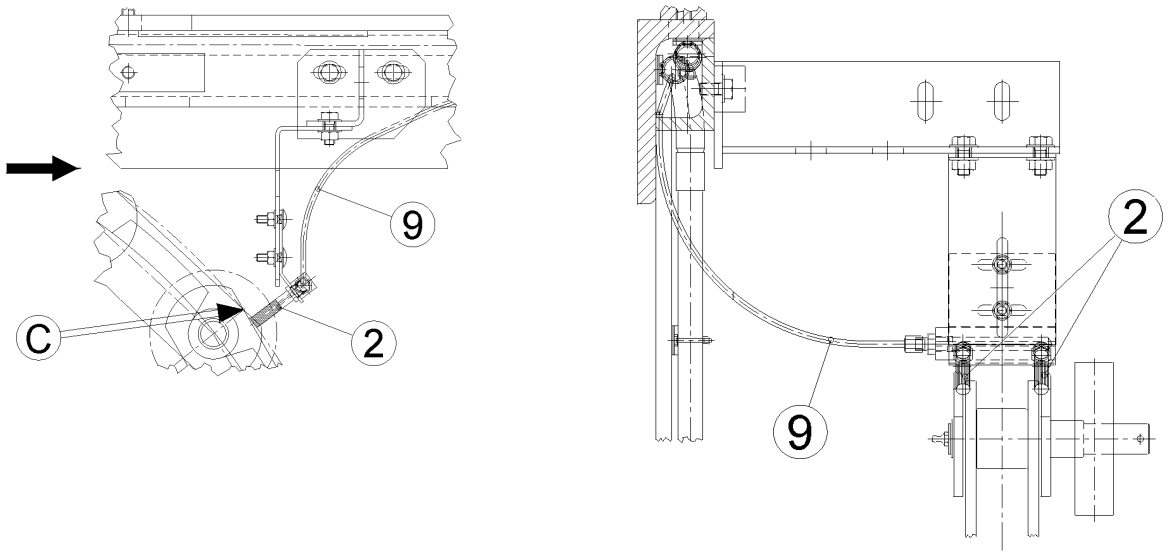


Hint!

The oil application brushes should touch the chains with **gentle** pressure.

- At the step chains

Fig. 924-05



– Adjust the oil application brushes (2) to the intersecting point of the link plates.

2.1.4 Readjusting the Oil Application Brushes

- Loosen the fastening screws.
- Adjust the height of the support plate so that it is positioned according to the figure.

Hint!
If readjustment is no longer possible, replace the oil application brushes.

2.2 Lubricants

Use the following lubricants:

Warning: Outdoor installation & ambient temperature!

With automatic lubrication system, covered outdoor installaton and ambient temperatures < 10 °C, only oils indicated below may be used!

	Lubrication Method	BP	ESSO	KLÜBER	MOBIL	SHELL	ZEPF
1	Automatic lubrication system			Mineral oil			Synthetic oil
		–	–	Klüberoil GEM 1-46N	–	–	Ultrafit-Synthex
		Only use these particular, water-repellent oils. These oils are **not** suited for manual lubrication.					

2.3 Troubleshooting

- The respective warning messages are displayed on the OIT screen.

Fault	Causes	Solution
Level switch signals malfunction	• Fill level below minimum value	• Fill the lubricant container (automatic error reset).
	• Oil level OK	• Check cable and level switch.
Pressure does not build up within 100 strokes	• Leak in main line	• Seal or replace main line.
	• Large air pockets in main line	• Purge main line. • Check hoses for leaks, replace hoses in case of leaks.
	• Pump does not transport lubricant	• Check the relay. • Check the fuse. • Check the pump.
	• Solenoid valve does not close	• Replace the solenoid valve.
Individual grease points (chains) are not lubricated	• Solenoid valve does not open	• Check the relay. • Check the fuse. • Check the solenoid valve. • Check the cable to the solenoid valve.
	• Grease point counterpressure at dosing elements too high	• Check the grease point counterpressure (bore of brushes clogged). • Check the hoses from the valve to the brushes.
Pulse from pressure switch does not arrive, even though pressure is building up in main line	• Cable break between pressure switch and controller	• Repair or replace cable.
	• Pressure switch defective	• Replace the pressure switch.

10.9 Guide Pad Lubrication (Lubrication Step) – Q 409 598

1 Description and Mode of Operation

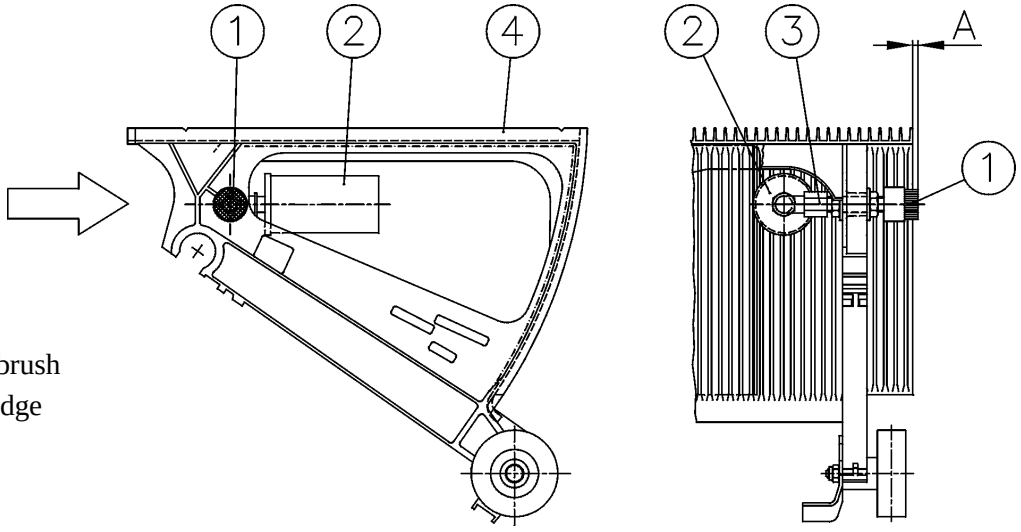
Hint!
Standard with: • Automatic lubrication system • Stainless-steel skirt panels

- Lubricating units each consisting of an application brush (1), a grease cartridge (2) and tubing (3) are attached to the left and right sides of one step (4) instead of guide pads..
- By means of a propellant, the lubricant is gradually pressed from the grease cartridge (2) onto the application brush (1) which applies lubricant to the gliding surface of the guide pads along the skirt panels.

Hint!
This prevents the guide pads from squeaking as they run along the skirt panels.

- With the standard setting, the grease cartridge must be replaced every 9 months.
- The oil cartridge is filled with regular lubricating oil. Upon request, oil cartridges with biologically degradable oil confirming to water hazard class 0 are provided.

Fig. 598-01



1) Application brush
2) Grease cartridge
3) Tubing
4) Step

A: $4.5^{+0.5}$ mm with standard steps

2 Maintenance

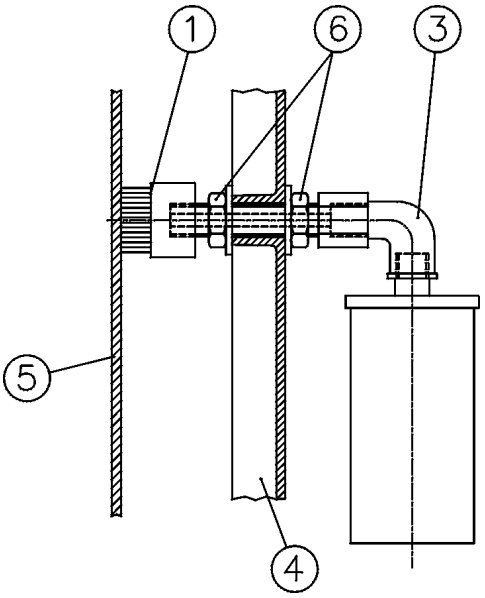
2.1 Adjusting the Application Brushes

Hint!

The application brushes should abut the skirt panels with an overlap of min. 1 mm and max. 2 mm.

- Readjusting the application brushes:

Fig. 598-02



1) Application brush
3) Tubing
4) Step
5) Skirt panel
6) 1/4" pipe nuts

– Loosen the pipe nuts (6) and shift the entire lubrication unit towards the skirt panel.
– Application brush (1) and skirt panel (5) overlap: min. 1 mm / max. 2 mm

Hint!

Replace the application brushes (1) as soon as the bristles have reached their minimum permissible length (8 mm) or the lubricating unit cannot be shifted farther outward!

Warning: Lubricate before initial start-up!

Lubricating brushes (1) must be lubricated manually before initial start-up.

This applies both to initial start-up of the escalator during commissioning and to initial start-up upon replacing the lubricating brushes.

2.2 Condition of the Application Brushes

- Length of bristles:
  - New brush: approx. 15 mm
  - Minimum length: 8 mm

Hint!
Replace the application brushes when the minimum bristle length is reached.

- Soiled application brushes

  Clean badly soiled brushes with a rag to remove sand, dust or abrasive matter.

2.3 Replacing the Grease Cartridge

- Remove the empty grease cartridge.
- Cut off the tip of the yellow plug of the new grease cartridge with a knife.

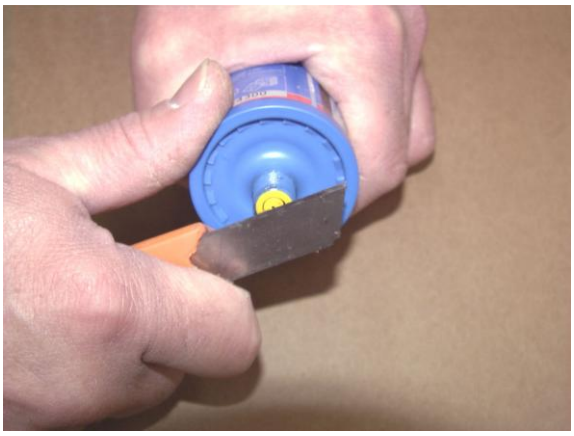


Fig. 598-03

- Use a 3-mm Allen wrench to set the activation screw to position "9".

Fig. 598-04

- Screw in the new grease cartridge and tighten it by hand.

Fig. 598-05

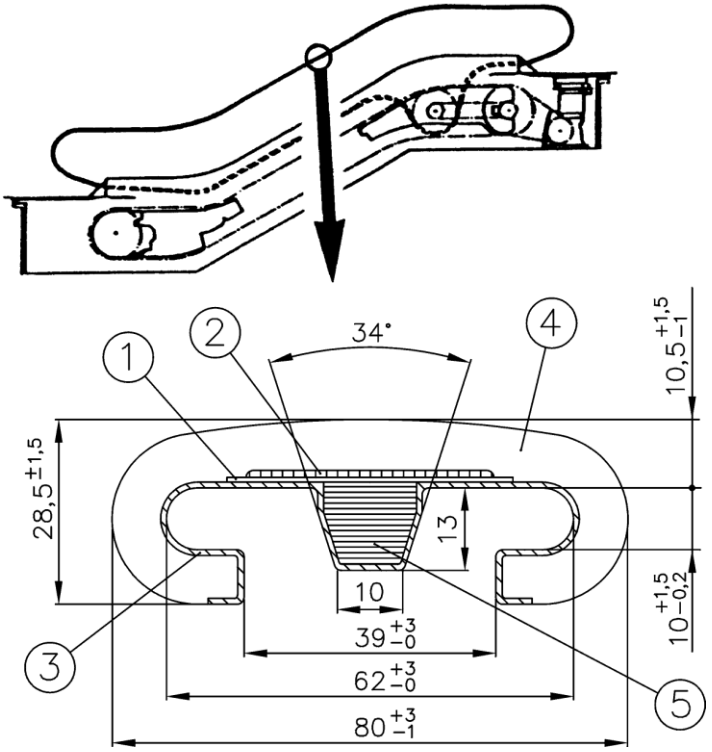
11 Maintenance of Handrail Section

11.1 V-Type Handrail – Q 409 603

1 Description and Mode of Operation

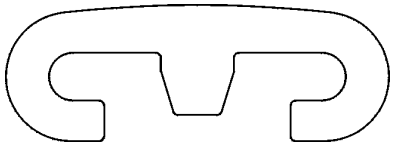
- The handrail is provided with a multilayered, prestretched fabric lining (1). The tensile forces are absorbed by the steel cord reinforcement (2) embedded between the fabric linings.
- The gliding layer (3) is made of synthetic material.
- The outer layer (4) of **black** handrails is made of rubber with embedded white dots.

Fig. 603-01



1) Fabric linings (cord)
2) Steel cord reinforcement
3) Gliding layer
4) Outer layer
5) V-shape

- Breaking load of the handrail: min. 28,000 N
- V-shape design



EHC Handrail, Type 78 VWNQSF

2 Maintenance

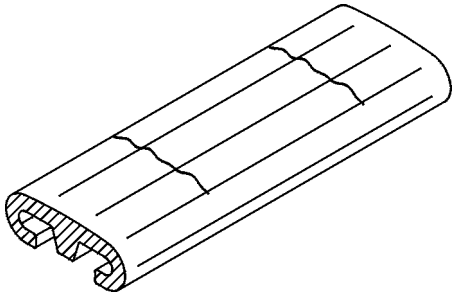
2.1 Condition Check

2.1.1 Condition of Outer Layer

- Check for cracks in outer layer

Hint!
Due to aging of handrail

Fig. 603-02

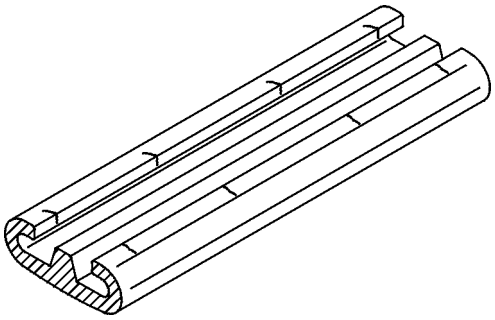


2.1.2 Condition of Lips

- Check for lip cracks

Hint!
Due to overtensioned or aged handrail

Fig. 603-03

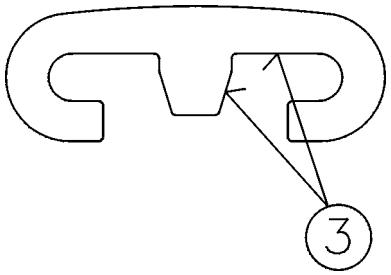


2.2 Cleaning

2.2.1 Cleaning the Gliding Layer

- Clean the gliding layer (3) with a vacuum cleaner.

Fig. 603-04



3) Gliding layer

2.2.2 Cleaning the Outer Layer

- Clean dirty or dingy handrails as follows:
  - Soak a rag in water with diluted dishwashing soap (not dishwasher detergent).
  - Vigorously rub the outer layer of the handrail.
  - Polish it with a soft, dry rag.
- If the handrail is extremely dirty and/or the surface is extremely mat, use the care set including cleanser and preserver.

Observe the instructions which come with the care set!

Warning: No benzene!

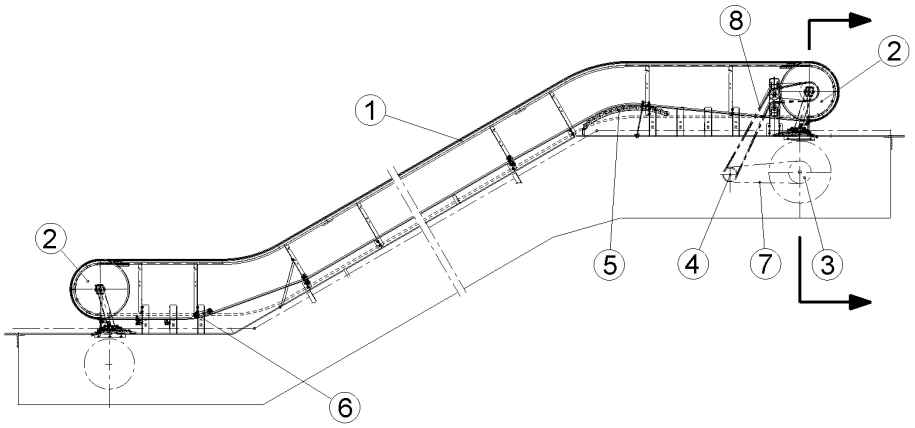
Do not use benzene, benzene-containing solvents, or aggressive cleansers! If these are used, the outer layer will age and crack prematurely!

11.2 Handrail Drive, Handrail Guide Profiles – Q 409 639

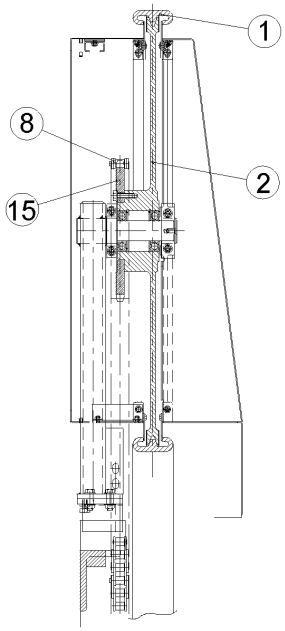
1 Description and Mode of Operation

- The handrail drive is located in the balustrade newel of the drive station. The handrail (1) is driven by the diverter sheave (2) designed as a V-belt pulley.
- The V-type belt pulley made of cast iron and mounted on the diverter sheave drives the handrail. The handrail is guided via handrail guide profiles and plastic rollers (guide and support rollers) which are located in the escalator's incline and in the transition curves. The tension roller bow is composed of a steel base plate with mounted plastic rollers and is vertically movable.

Fig. 639-01



1) Handrail
2) Diverter sheave
3) Main shaft
4) Handrail drive shaft
5) Tension roller bow
6) Deflection roller assembly
7) Main chain
8) Drive chain
15) Sprocket (diverter sheave)



- The handrail (1) is guided via the tension roller bow (5) into the incline and then via the deflection roller assembly (6) onto the diverter sheave (2) of the tension station.
- The handrail is tensioned by the pivoted tension roller bow (5).

2 Maintenance

2.1 Handrail Tension

Hint!

The handrail is propelled solely by the engagement of the handrail's V-shaped part in the diverter sheave (= handrail drive wheel) located in the balustrade newel of the drive station.

Warning: Excessively high handrail tension!

An excessively high handrail tension improves propulsion for a short time, but damages the handrail in the long run:

- Contraction of the handrail → increased friction in the guiding system
- Increased flexing when running over the rollers of the tension roller bow (5)

Warning: Shrinkage of handrails!

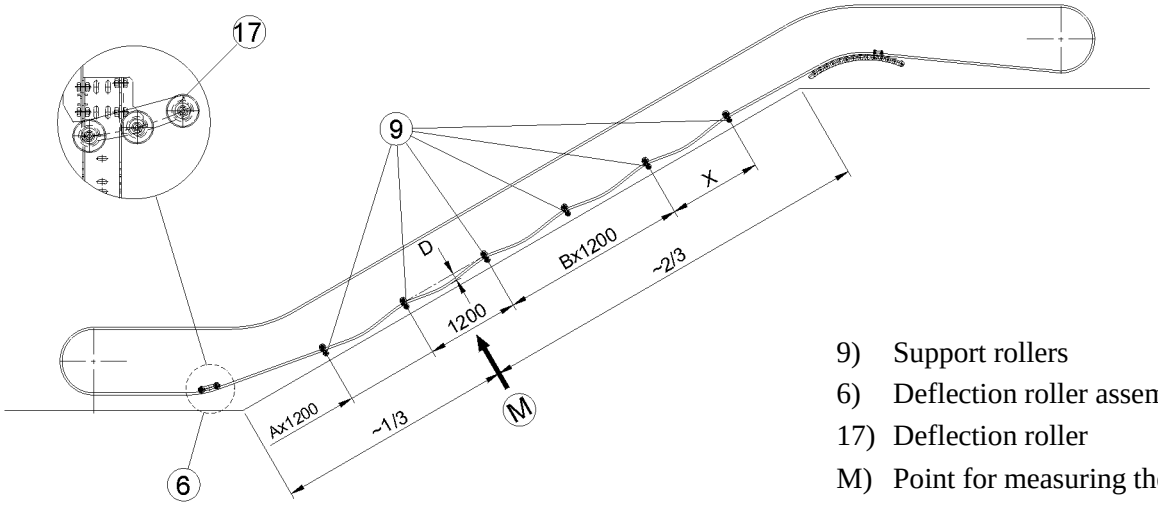
Due to the pretensioned steel cord reinforcement, handrails may shrink in length by max. 0.05%.

2.1.1 Checking the Handrail Tension

Hint!

To perform the check, remove the one inner cladding panel of the transition curve (for the position of the panel Fig. 639-02).

Fig. 639-02



9) Support rollers
6) Deflection roller assembly
17) Deflection roller
M) Point for measuring the sag

- Check the sag of the handrail.
  - Run the escalator for a complete cycle in the **upward** direction.
  - Measure the sag "D" between two support rollers (12) spaced 1200 mm apart.
  - "D" should measure 8-12 mm.

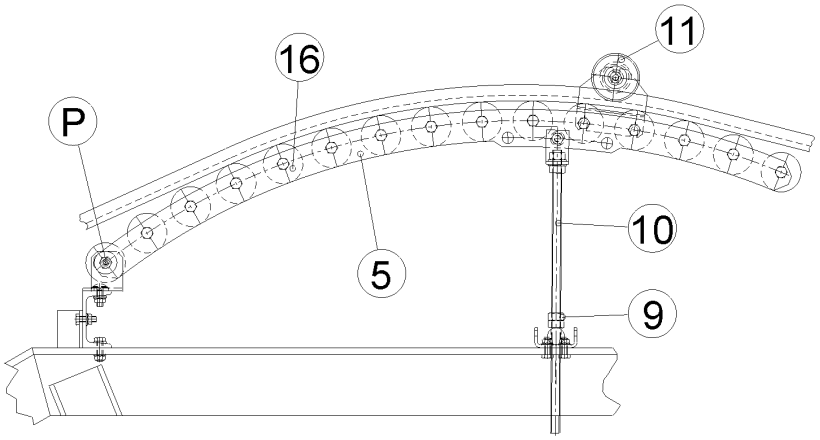
2.1.2 Tensioning the Handrail

Hint!

Due to the handrail's **tendency to shrink**, it may also be required to **relieve** the tension.

- Run the escalator for a complete cycle in the **upward** direction.

Fig. 639-03



5) Tension roller bow
9) Nut/counternut
10) Push rod
11) Lateral guide roller
16) Roller
P) Pivot

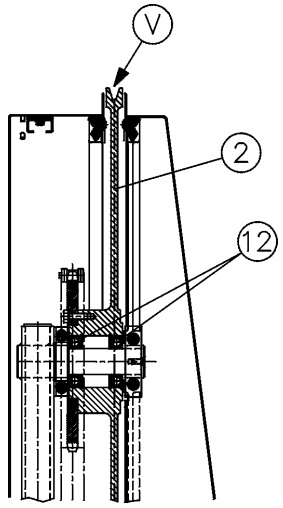
- Loosen the counternut (9) and raise or lower the tension roller bow (5) by means of the second nut so that the sag "D" measures approx. 10 mm (see Fig. 639-02).

2.2 Diverter Sheave

Hint!

In the tension station, the diverter sheave also acts as the handrail drive wheel.

Fig. 639-04



2) Diverter sheave
V) V-shaped groove
12) Ball bearings

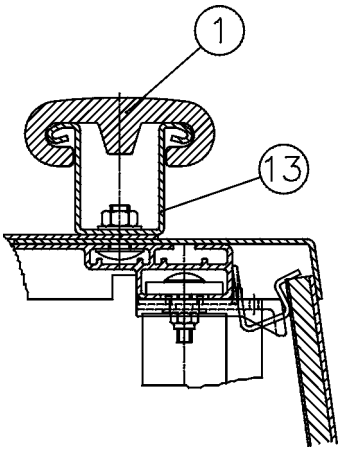
- Clean the V-shaped groove (V) of the diverter sheave (25).
- Check whether the ball bearings (26) produce noise.

Hint!

The ball bearings themselves are sealed and lubricated for their entire service life.

2.3 Handrail Guide Profiles

Fig. 639-05



1) Handrail
13) Handrail guide profile

2.3.1 Checking the Handrail Guide Profiles

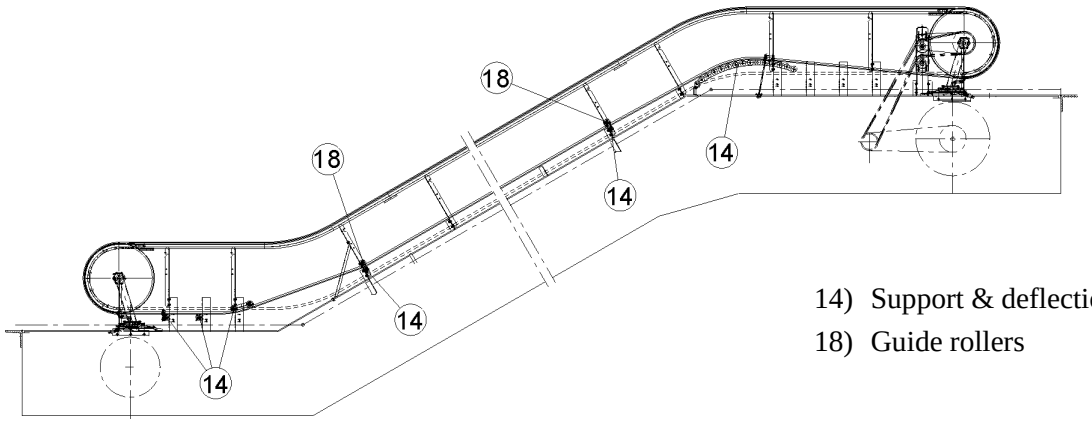
- Check the guide profiles for abrasion: especially at the transition curves at the drive and tension stations.
- Check the joints for true alignment.

2.3.2 Cleaning the Handrail Guide Profiles

- Vacuum clean the profiles to remove dust and abrasive matter.

2.4 Support Rollers, Deflection Rollers

Fig. 639-06



14) Support & deflection rollers
18) Guide rollers

2.4.1 Checking the Rollers for Free Movement

Hint!

The ball bearings are sealed and lubricated for their entire service life.

Warning: Squeaking noise!

Blocked rollers damage the handrail and produce squeaking noises.

2.4.2 Cleaning the Rollers

- Dust/abrasive matter may accumulate on the surface of the rollers.

Warning: Soiling!

Dirt may get onto the handrail.

11.3 Handrail Drive Chains – Q 409 604

1 Description and Mode of Operation

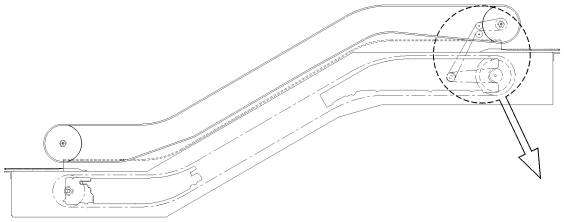
1.1 Description

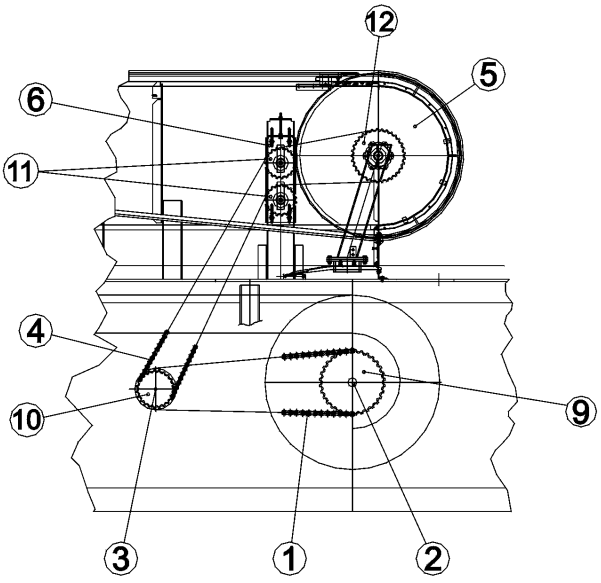
One chain on each side of the handrail drive shaft transmits the movement from the handrail drive shaft to the handrail wheels (diverter sheaves), situated at the upper end of the escalator.

1.2 Mode of Operation

- The main handrail drive chain (1) runs from the main shaft (2) driving the steps to the handrail drive shaft (3). Secondary handrail drive chains (4) run from each side of the handrail drive shaft to the handrail drive wheels (diverter sheaves) (5) in the newels.
- After disassembling the 3 maintenance steps, run the gap thus formed in front of the upper combplate. This makes the main handrail drive chain (1) accessible.
- After disassembling the inner cladding newel panels as well as one of the adjacent panels, the secondary handrail drive chains (4), the tensioning devices (6) and the handrail drive wheels (diverter sheaves) (5) are accessible.

Fig. 604-01





1) Main handrail drive chain (duplex chain)
2) Main shaft
3) Handrail drive shaft
4) Secondary handrail drive chain (simplex chain)
5) Handrail drive wheel (diverter sheave)
6) Tensioning device
9) Divided pinion of main shaft
10) Sprocket
11) Sprockets for secondary handrail drive chain tensioning
12) Sprocket of diverter sheave

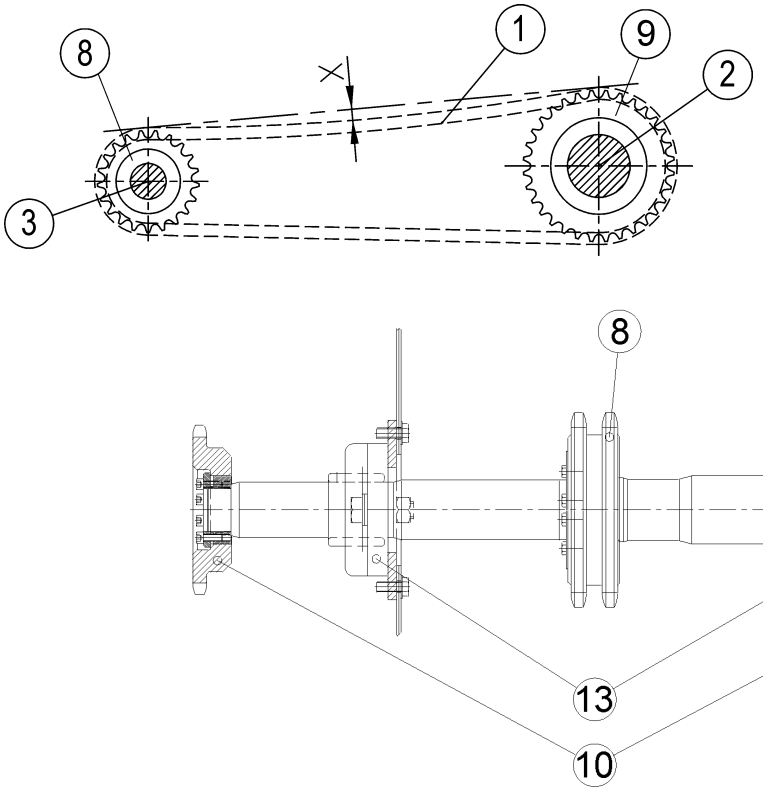
2 Maintenance

2.1 Chain Tension of the Main Handrail Drive Chain

2.1.1 Checking the Tension

- For an optimum chain tension, the unstressed chain strand should have a sag of 10-15 mm.
- Retension the chain in the case of a sag of X ≥ 30 mm.

Fig. 604-02



X) Sag
1) Main handrail drive chain
2) Main shaft
3) Handrail drive shaft
8) Divided pinion of handrail drive shaft
10) Sprockets
13) Flanged bearings

2.1.2 Retensioning

Hint!

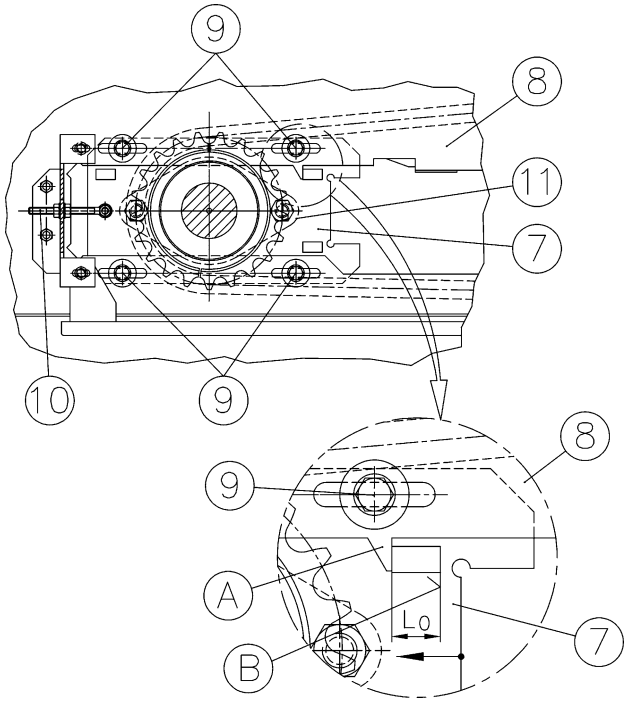
To tension the main handrail drive chain (1), the entire handrail drive shaft (3) is shifted towards the tension station.

- Turn the drive by means of the hand-winding device to distribute the sag X to **both** chain strands.

Warning: Overtensioning!

Otherwise, one of the chain strands might be overtensioned.

Fig. 604-03



7) Bearing plate
8) Side plate
9) Fastening screws
10) Tension spindle
11) Flanged bearing
A) Pointer
B) Measuring edge
L_0: Displacement value
← Direction of movement of the bearing plate during tensioning

- Loosen the fastening screws (9) of the bearing plate (7).
- Loosen the counternut of the tension spindle (10).
- Alternately tighten the tension spindles (10) until the sag X = 10-15 mm.

Hint!

To check the tension, strain one chain strand and check the sag at the unstressed chain strand (see Fig. 604-02).

- Check whether the displacement value L_0 is identical on both sides.

Hint!

Factory setting: L_0 = 25 mm (theoretical)

- Tighten the fastening screws (9) and the counternut of the tensioning spindle (10).

Warning: Max. permissible displacement!

Max. permissible displacement of the handrail drive shaft from its initial position (factory setting): 19 mm; displacement value L_0 = 6 mm is reached

With this displacement, the chain has reached the maximum permissible elongation of 2 %!

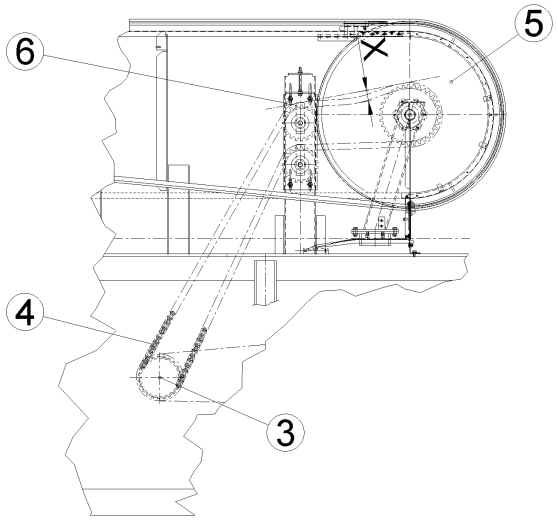
For how to replace the main handrail drive chain, see Repair Instructions Q 409 688, Main Handrail Drive Chain

2.2 Chain Tension of the Secondary Handrail Drive Chains

2.2.1 Checking the Tension

- For an optimum chain tension, the unstressed chain strand should have a sag of 10-15 mm.
- Retension the chain in the case of a sag of X ≥ 30 mm.

Fig. 604-04



3) Handrail drive shaft
4) Secondary handrail drive chain
5) Handrail drive wheel (diverter sheave)
6) Tensioning device
X) Sag

2.2.2 Retensioning

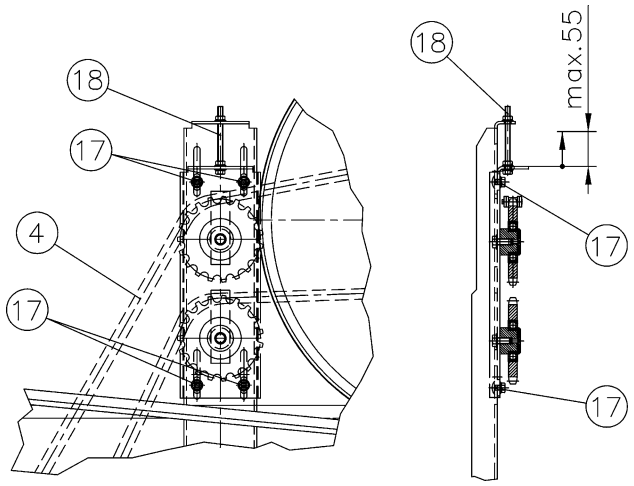
- Turn the drive by means of the hand-winding device to distribute the sag X to **both** chain strands.

Warning: Overtensioning!

Otherwise, one of the chain strands might be overtensioned.

Fig. 604-05

4) Secondary handrail drive chain
17) Fastening screws
18) Tension spindle



- Slightly loosen the nuts of the clamping screws (17).
- Tighten the tension spindles (18) until the sag X = 10-15 mm.

Hint!

To check the tension, strain one chain strand and check the sag at the unstressed chain strand (see Fig. 604-04).

- Tighten the fastening screws (17).

Warning: Max. permissible displacement!

Max. permissible displacement of the tensioning device from its initial position (factory setting): 55 mm

With this displacement, the chain has reached the maximum permissible elongation of 2 %!

For how to replace secondary handrail drive chains, see Repair Instructions Q 409 695, Secondary Handrail Drive Chains

2.3 Lubrication

Use the following lubricants to lubricate the handrail drive chain:

Warning: Outdoor installation & ambient temperature!

With automatic lubrication system, outdoor installaton and ambient temperatures < 10 °C, only oils indicated below may be used!

	Lubrication Method	BP	ESSO	KLÜBER	MOBIL	SHELL	ZEPF
1	**Automatic lubrication system**			Mineral oil			Synthetic oil
		–	–	Klüberoil GEM 1-46N	–	–	Ultrafit-Synthex
		Only use these particular, water-repellent oils. These oils are **not** suited for manual lubrication.					

Warning: Do not use synthetic oils!

On escalators with steps equipped with yellow plastic edges, step chains **must not** be lubricated with synthetic oils.

For more detailed information, see Maintenance Instructions Q 409 924, Automatic Lubrication System

11.4 Handrail Monitor, Handrail Rupture Contact, Antistatic Brushes – Q 409 650

1 Description and Mode of Operation

1.1 Handrail Monitor and Handrail Rupture Contact

1.1.1 Description

One handrail monitor per handrail is located next to the first balustrade support in the central incline.

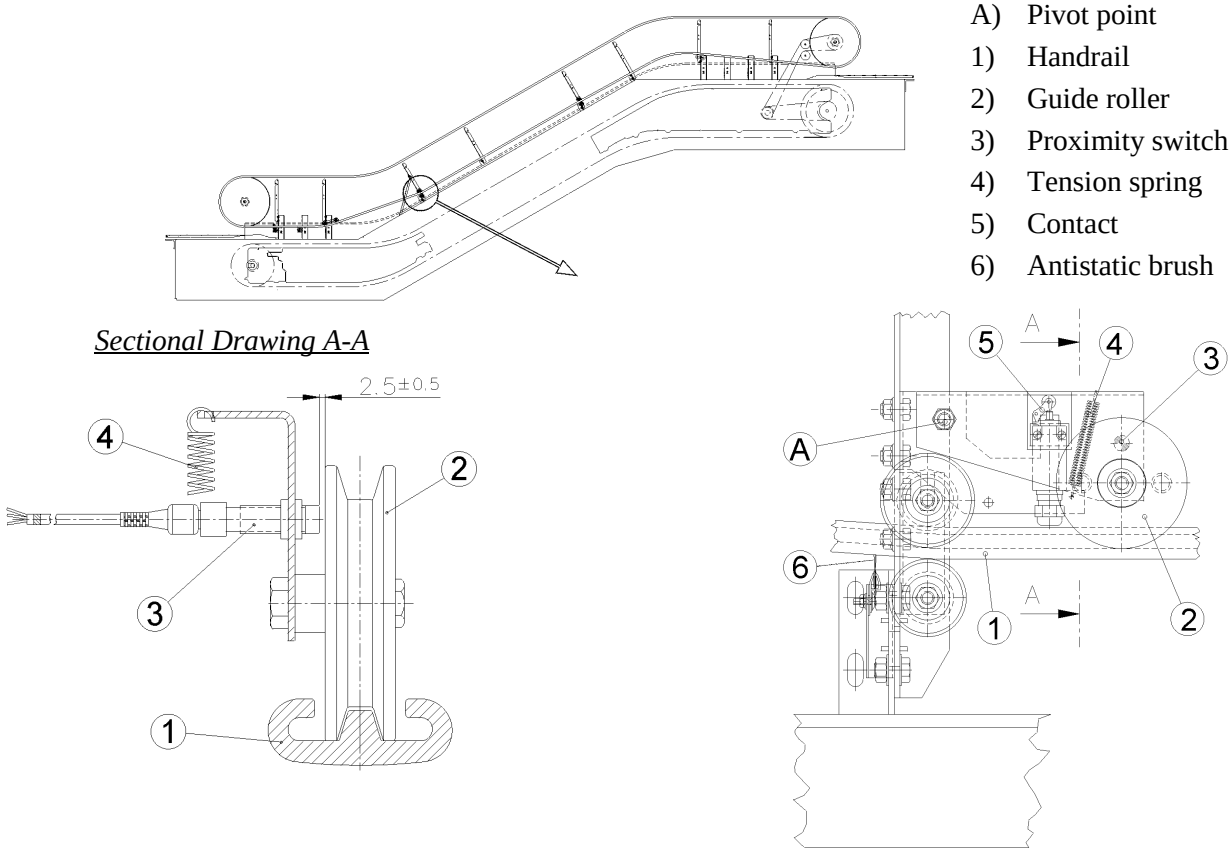
A guide roller (steel roller, galvanized) is mounted onto a steel angle and pressed against the handrail by spring tension. In the case of excessive elongation or breakage of the handrail, the pivoted steel angle releases the handrail rupture contact and shuts the unit down. A proximity switch monitors the speed of the handrail via two bores in the guide rollers.

1.1.2 Mode of Operation

- The following states are monitored:
  - excessive elongation or breakage of the handrail (1) via the guide roller (2) pressed against the handrail (1) by spring tension;
  - the handrail speed by means of a proximity switch (3) monitoring the guide roller (2). If the speed of the handrail is reduced by more than 15% as compared to the speed of the step band, the escalator is shut down with a time delay.

Hint!
With the standard design, the shutdown is **not** electronically interlocked.

Fig. 650-01



1.2 Antistatic Brushes

One antistatic brush (6) per handrail is installed at the rib beneath the handrail monitor (see Fig. 650-01)

The antistatic brush touches the outer layer in the return track thus preventing the handrail from becoming electrostatically charged.

2 Maintenance

2.1 Checking the Setting of the Handrail Monitor

Hint!
Only required during commissioning

- Distance between proximity switch and guide roller: $2.5^{\pm 0.5}$ mm

2.2 Checking the Operation of the Handrail Rupture Contact

Hint!
Also possible with maintenance operating panel.

- Activate the contact (5) by hand

  Error codes:

  "E_2B" for left handrail
  "E_E5" for right handrail

2.3 Checking the Operation of the Handrail Monitor

Hint!
Only possible with key switch

- For the **left** handrail
  - Disconnect the initiator input.
  - Start the escalator. Upon start-up delay (10 sec.) and the time delay (5 sec), the escalator is shut down. Error code: "E_32" PLC-M, "E_82" PLC-S
- For the **right** handrail
  - Disconnect the initiator input.
  - Start the escalator. Upon start-up delay (10 sec.) and the time delay (5 sec), the escalator is shut down. Error code: "E_33" PLC-M, "E_83" PLC-S

2.4 Checking the Setting of the Antistatic Brushes

Hint!

The antistatic brushes (6) must touch the outer layer of the handrail in its return track.

- Readjust the antistatic brushes (6), if required.

Warning: Electrostatic discharge!

Damaged, heavily soiled or poorly adjusted brushes result in unpleasant electrostatic discharge when touching the escalator.

- Replace damaged or heavily soiled brushes.

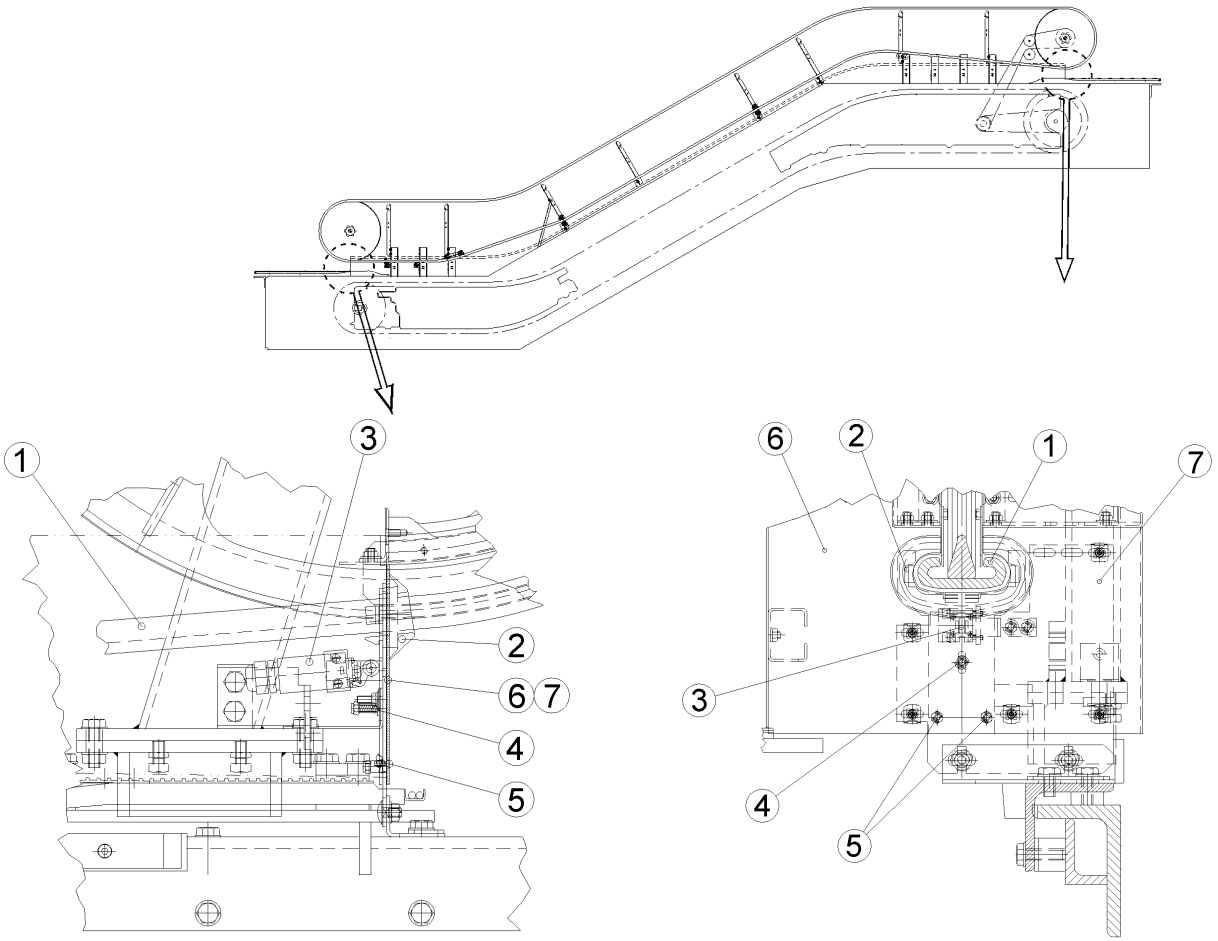
12 Maintenance of Balustrade

12.1 Handrail Entry Contacts – Q 409 653

1 Description and Mode of Operation

If an object gets jammed between the handrail (1) and the safety rubber collar (2), the rubber collar tilts back and interrupts the safety circuit via the contact (3).

Fig. 653-01



1) Handrail
2) Rubber collar
3) Contact
4) Spring
5) Pivots (rubber cushion)
6) Inner front plate
7) Outer front plate

2 Maintenance

2.1 Functional Check

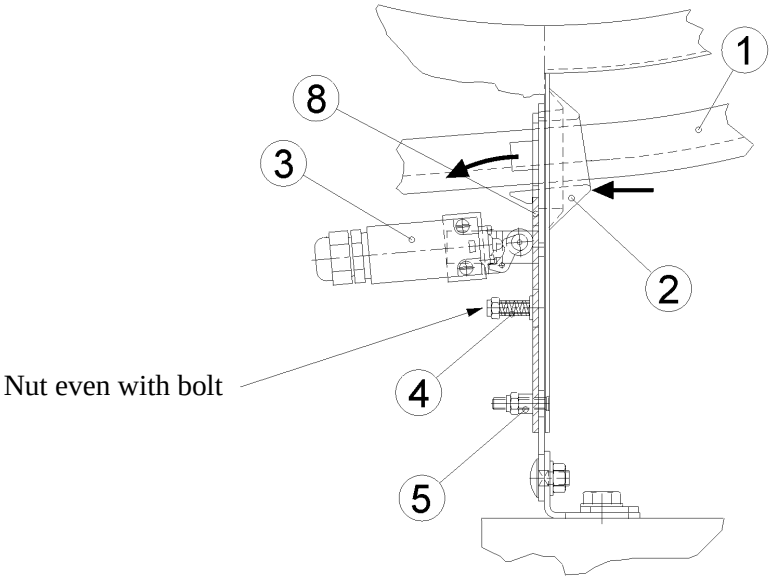
- When pressing against the rubber collar (2), the rubber collar must tilt back and actuate the contact (3). The escalator must shut down.

  Error codes:

  "E_11" for contact, drive station, left
  "E_48" for contact, drive station, right
  "E_16" for contact, tension station, left
  "E_49" for contact, tension station, right

Fig. 653-02

1) Handrail
2) Rubber collar
3) Contact
4) Spring
5) Pivot (rubber cushion)
8) Upper part of release lever



- The triggering force is adjusted via the spring (4) (nut even with bolt).

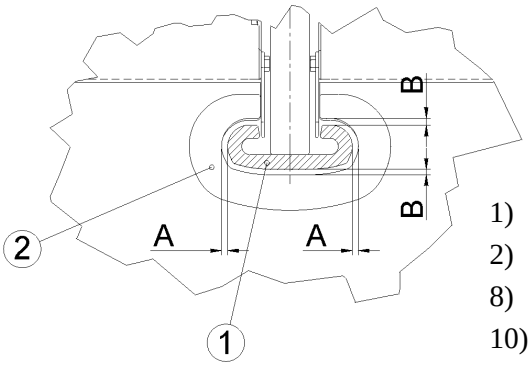
Hint!
The handrail entry contact is a self-resetting contact.

2.2 Adjusting the Rubber Collar

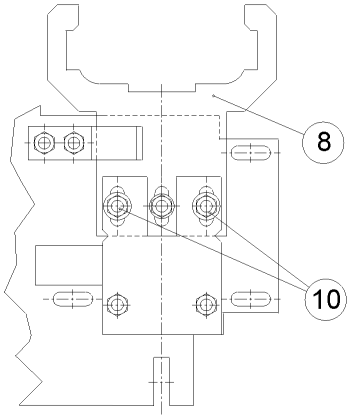
Hint!
Setting check required during commissioning and when the handrail runs off center

- If readjustment is necessary:
  - Remove the inner front plate (6).
  - Slightly loosen the nuts (10).
  - Use the upper part of the release lever (8) to adjust the rubber collar (2) so that it is centered to the handrail.

Fig. 653-03



1) Handrail
2) Rubber collar
8) Upper part of release lever
10) Nuts

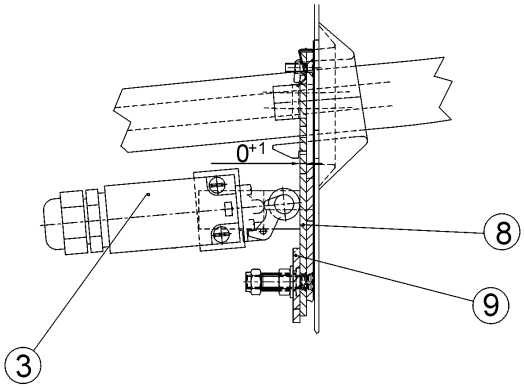


2.3 Adjusting the Contact

Hint!
Setting check only required during commissioning

- Clearance between the contact (3) and the upper part of the release lever (8): 0^{+1} mm

Fig. 653-04



3) Contact
8) Upper part of release lever
9) Lower part of release lever

13 Maintenance of Electrical Equipment

13.1 Control Cabinet and Boxes – Q 409 478

1 Description and Mode of Operation

- The entire electrical equipment is accommodated in closed stainless steel cabinets, i.e., the external main control cabinet, boxes in the drive station and in the tension station.
- The drive & controller hardware is accommodated in the external control cabinet comprising a main disconnect switch, the transformers, the fuses and circuit breakers, the auxiliary control and signaling contactors and relays, the service hour meter, the safety brake delay, the frequency converter, and the OIT as well as the main PLC modules and the multiport Ethernet switch.
- One junction box and one heater box are installed in the drive station's escalator pit.
- A second junction box as well as a second heater box are accommodated in the tension station's escalator pit.
- The control cabinet and all boxes are designed according to the degree of protection NEMA 4X (= IP 66).

1.1 Drive & Control Cabinet ASA

This external control cabinet accommodates a main disconnect switch, the transformers, the fuses and circuit breakers, the control and signaling auxiliary contactors and relays, the service hour meter, the safety brake delay, the frequency converter, and the OIT as well as the main PLC modules and the multiport Ethernet switch (see Fig. 478-01 for details).

Fig. 478-01: *Interior View*

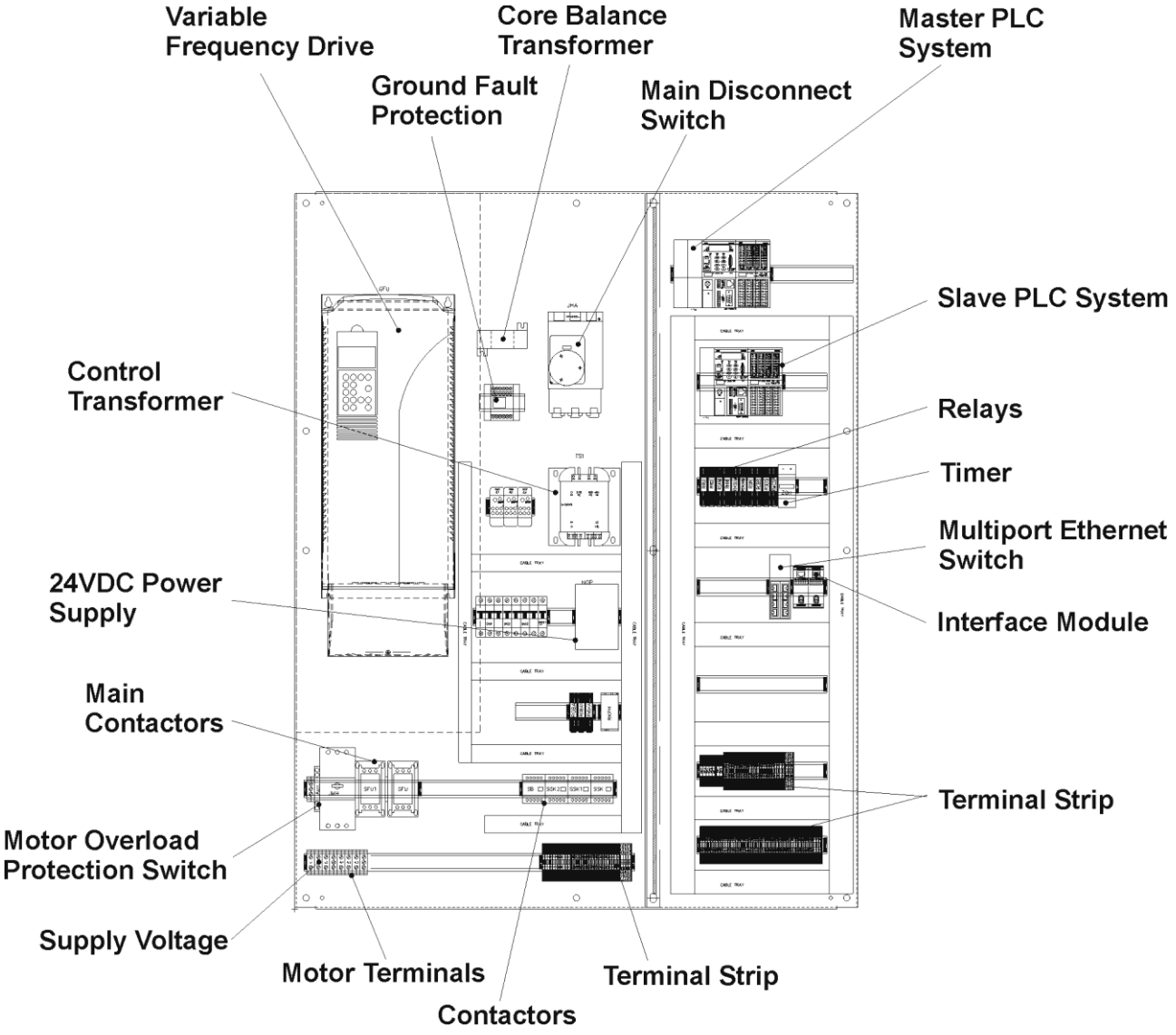
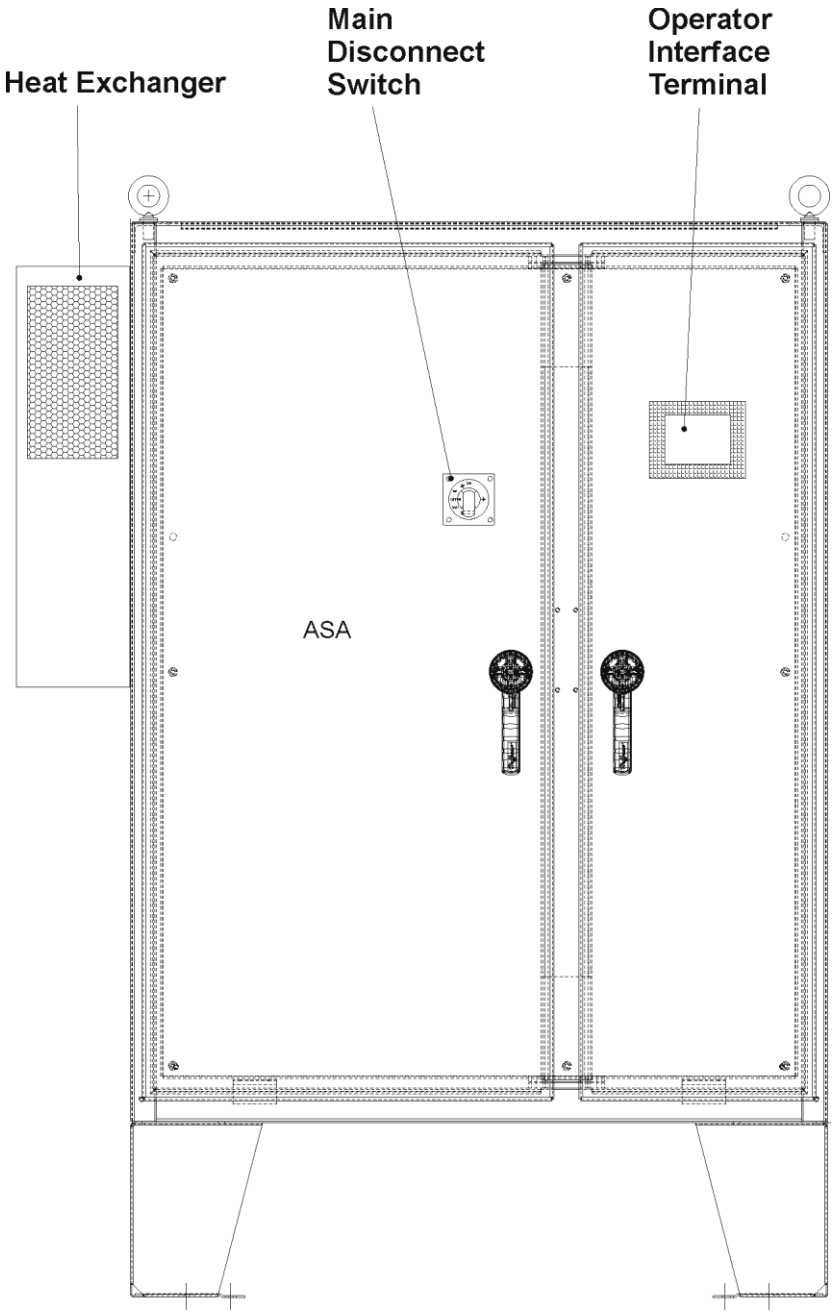


Fig. 478-01a: *Legend*

LEGEND	
ABBREVIATION	**DESCRIPTION**
ASA	External Drive & Control Enclosure
GFU	Variable Frequency Drive
JHA	Main Disconnect Switch
JMH	Motor Overload Protection Switch
NGP	480VAC/24VDC 10A Power Supply
PLCM	PLC Master
PLCS	PLC Slave
RCBS	Customer Stop Relay
RGBA/RGBA1	Safety Brake Relays
RHM	Relay Emergency Stop
RHSUM	Relay Buzzer E- Stop
RON	Relay Escalator Running
RRD	Relay Direction Down
RRU	Relay Direction Up
RSKM	Relay Safety Circuit
RSKSUM	Relay Safety Circuit Buzzer
RVEK- A	Heat Exchanger Relay
SB	Service Brake Converter Contactor
SFU	Frequency Converter Contactor
SFU1	Frequency Converter Contactor
SIF1	Fuse 24VAC 4A GMA Escalator Lights
SIF2	Fuse 24VDC 4A GMA ASA Enclosure
SIF4	Fuse 24VDC 4A GMA Junction Box Top
SIF5	Fuse 24VDC 4A GMA Junction Box Bottom
SIF6	Fuse 24VDC 4A GMA Piston Pump System
SIS1	MCB 4A to Primary Control Transformer
SIS2	MCB 4A/110VAC Brakes and Controls
SIS3	MCB 2A to Primary Power Supply
SIMVEK- A	MCB 2A Heat Exchanger
SSK	Saftey Circuit Contactor
SSK1	Saftey Circuit Contactor 1
SSK2	Saftey Circuit Contactor 2
TS	Control Transformer 480VAC/110VAC/24VAC
ZQH	Run Hour Meter
RHM- T	Relay Signalling Stop Top
RHM- B	Relay Signalling Stop Bottom
RKHLE- T	Relay Handrail Entry Switch Top (left/right)
RKHLE- B	Relay Handrail Entry Switch Bottom (left/right)
RKSL- T	Relay Skirting Panel Switch Top (left/right)
RKSL- B	Relay Skirting Panel Switch Bottom (left/right)
RKKP- T	Relay Combplate Switch Top (left/right)
RKKP- B	Relay Combplate Switch Bottom (left/right)
RINVK- T	Relay Inductive Switch Speed Monitoring Top
RINVK- B	Relay Inductive Switch Speed Monitoring Bottom
RKKA- T	Relay Broken Step Switch Top
RKKA- B	Relay Broken Step Switch Bottom
RKUS- T	Relay Upthrust Switch Top
RKUS- B	Relay Upthrust Switch Bottom
RSTRT- FLT	Relay Starting Fault
RMGB	Relay Magnet Brake
RMGBA	Relay Magnet Safety Brake Active
RCOMM- FLT	Relay Communication Fault
RMISC- FLT	Relay Miscellaneous Fault
RKSS- B	Relay chain tension Switch Bottom (left/right)
RINHL- B	Relay Inductive Switch Handrail Speed Mon. (L/R)
RKBF	Relay Contact in case of fire by customer
RJRE- A	Relay Key Switch Direvtion (top/bottom)
RDC24	Relay 24 Volt DC Fault

The Operator Interface Terminal (OIT) as well as a main disconnect switch are installed in the front doors of the external control cabinet.

Fig. 478-02



1.2 Top Junction Box TJ/Bottom Junction Box BJ

These boxes accommodate the Ethernet bus coupler, the vibration monitor, WAGO I/O modules, terminals and relays for piston pump and lighting as well as the inspection plug connection and an emergency stop button (see Fig. 478-04a and Fig. 478-04b for details).

Fig. 478-04a: *Top Junction Box*

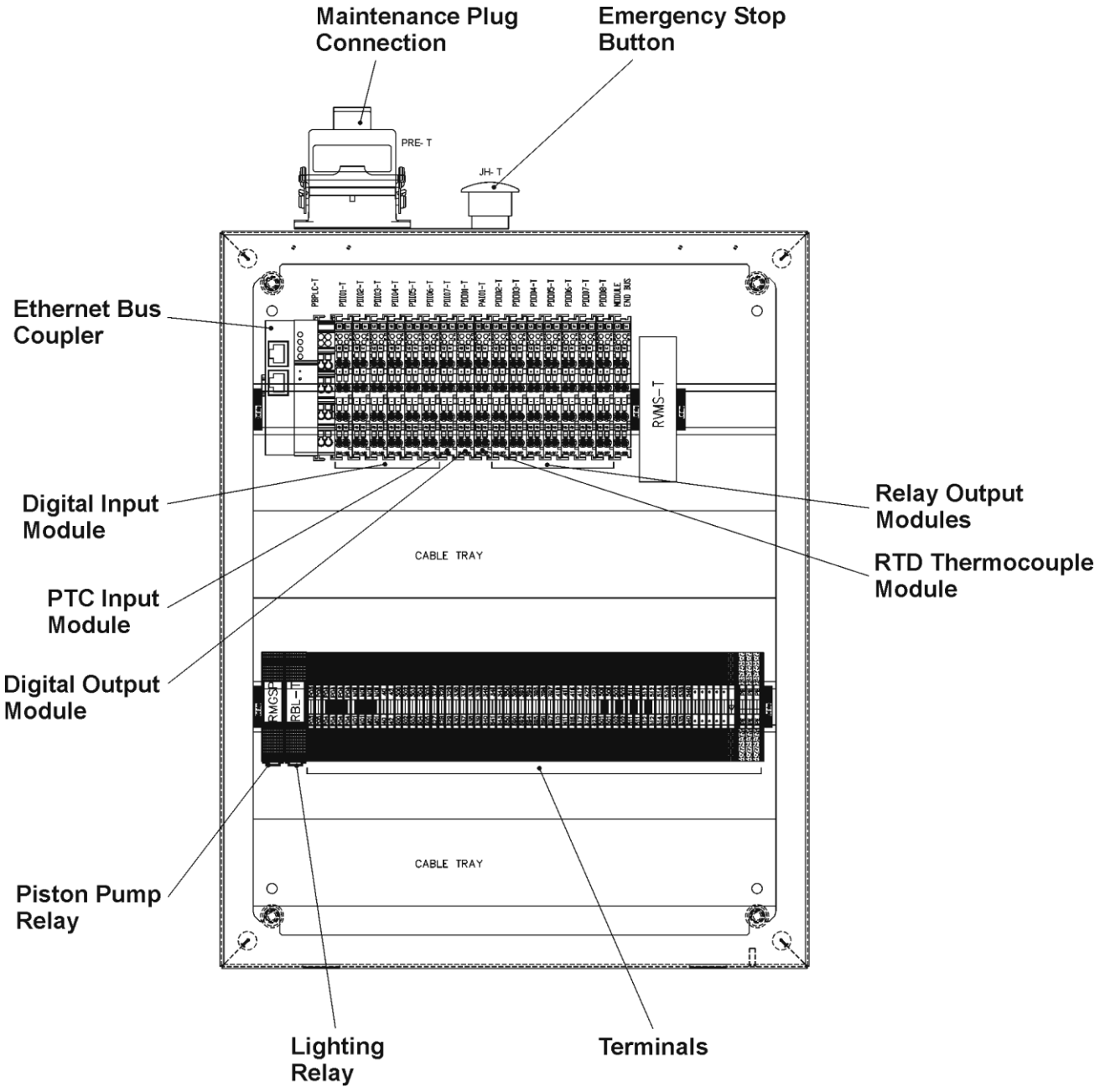
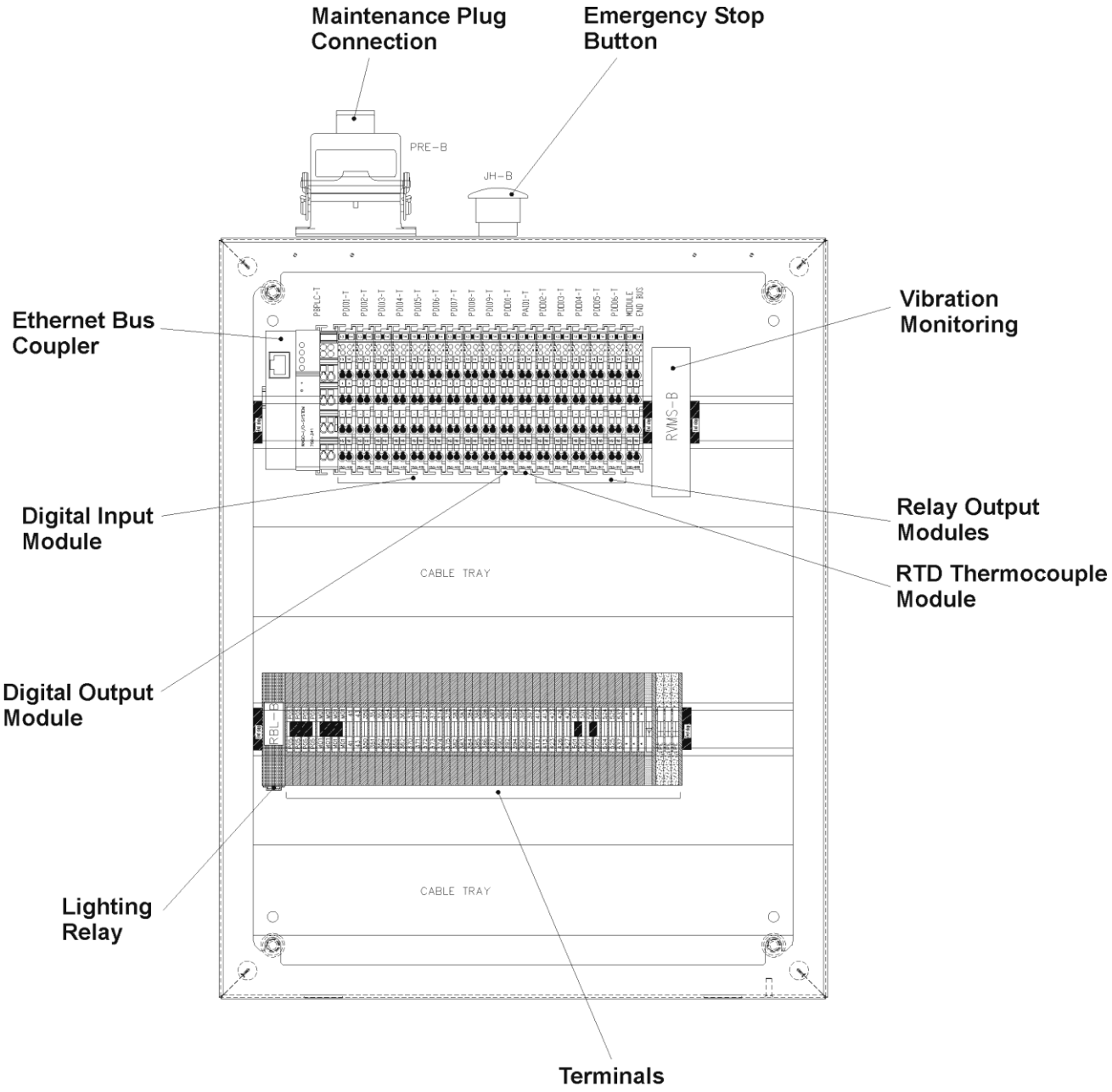


Fig. 478-04b: *Bottom Junction Box*



1.3 Top Heater Box SH-T/Bottom Heater Box SH-B

These boxes accommodate the main circuit breaker, additional circuit breakers, control contactors, terminals as well as the residual current device (see Fig. 478-06a and Fig. 478-06b for details). The top heater box accomodates the heating disconnect switch in the front door.

Fig. 478-06a: *Top Heater Box*

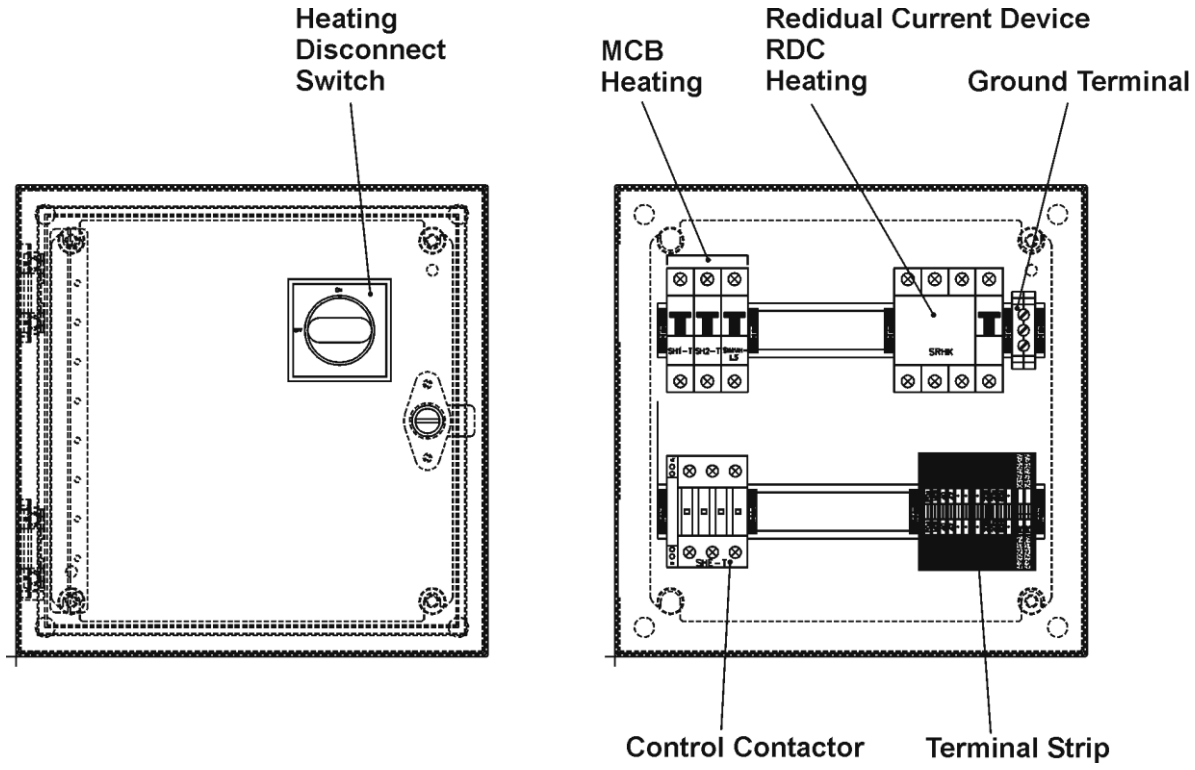
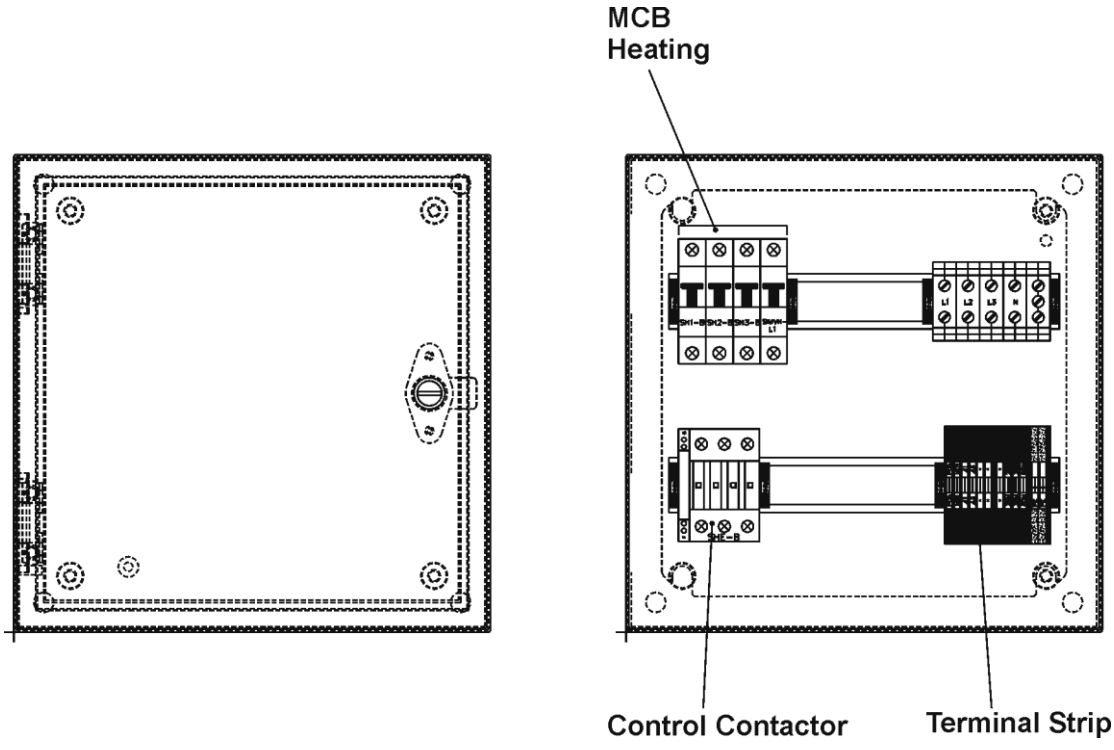


Fig. 478-06b: *Bottom Heater Box*

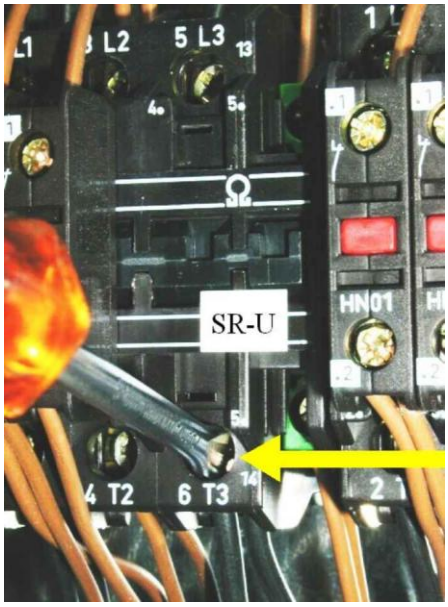


2 Maintenance

2.1 Standard Maintenance Routines

- Clean the control cabinets with a vacuum cleaner.
- Check and, if required, re-tighten all internal connections.
- Check and, if required, re-tighten the terminals of the contactors to avoid arcing or defects due to loose terminals. (**Risk of fire!**)

Fig. 478-07



Retightening of Terminals

Defective Contactor

- Check the disconnect switches and circuit breakers.
- Check and clean all cooling fans and heat exchangers.

13.2 Displays – Q 409 479

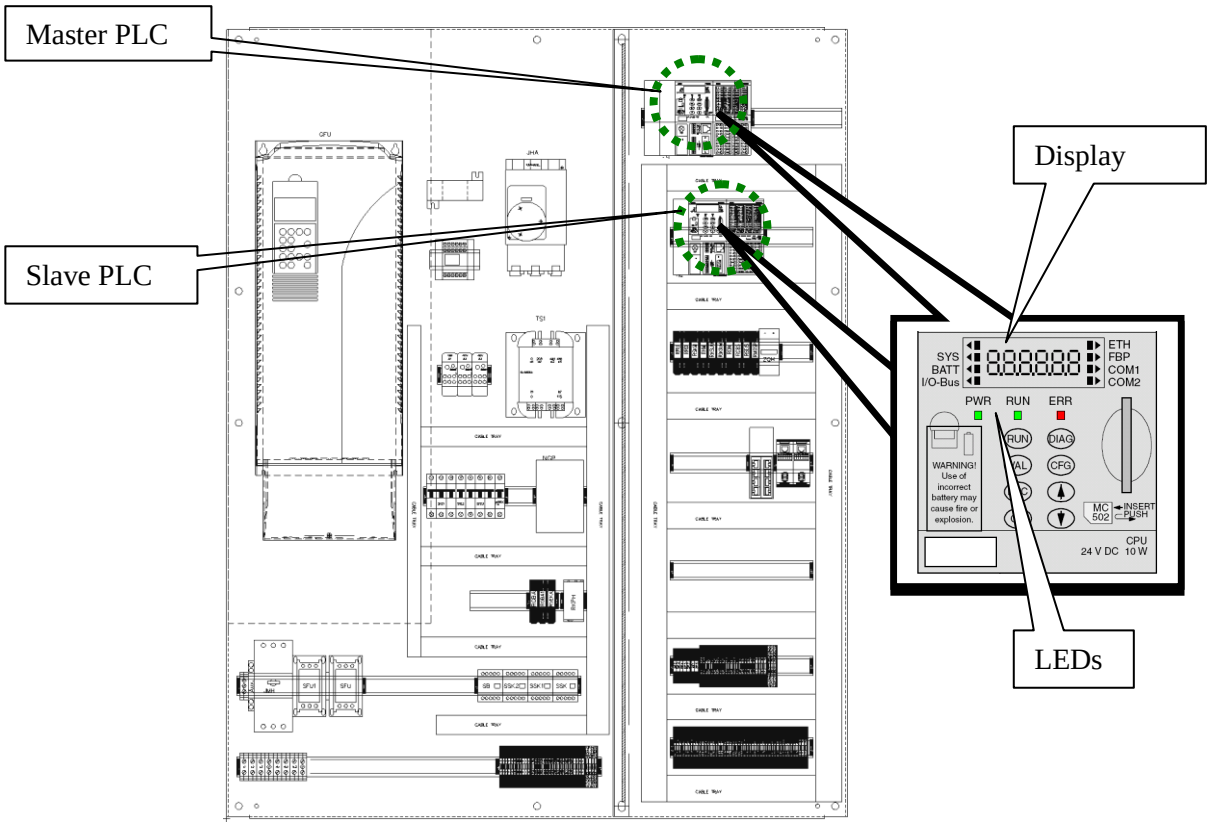
1 Description and Mode of Operation

1.1 Digital Displays on the Main PLC Module

- The 6-digit 7-segment status display shows:
  - the CPU status (e.g., RUN or STOP)
  - error codes and error classes
  - address modifications and parameters of the integrated couplers (Ethernet)
  - values at the channels of I/O modules
- The triangle displays show:
  - what is currently selected (active)
- The square displays show:
  - that the CPU and the bus are communicating
- The status LEDs show:
  - the status of the power supply
  - the status of the CPU
  - the occurrence of an error

For more detailed information about this module, see AC500 System Description 2CDC125016M0201.pdf

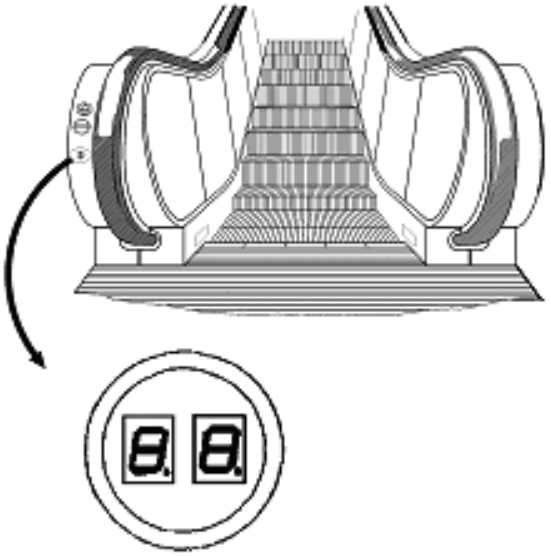
Fig. 479-01



1.2 Digital Display at Newel End

- The 2-digit display only displays operating states and error messages.
- 2-digit displays are installed in the right balustrade newel at the drive station and in the left balustrade newel at the tension station (see Fig. 479-02).

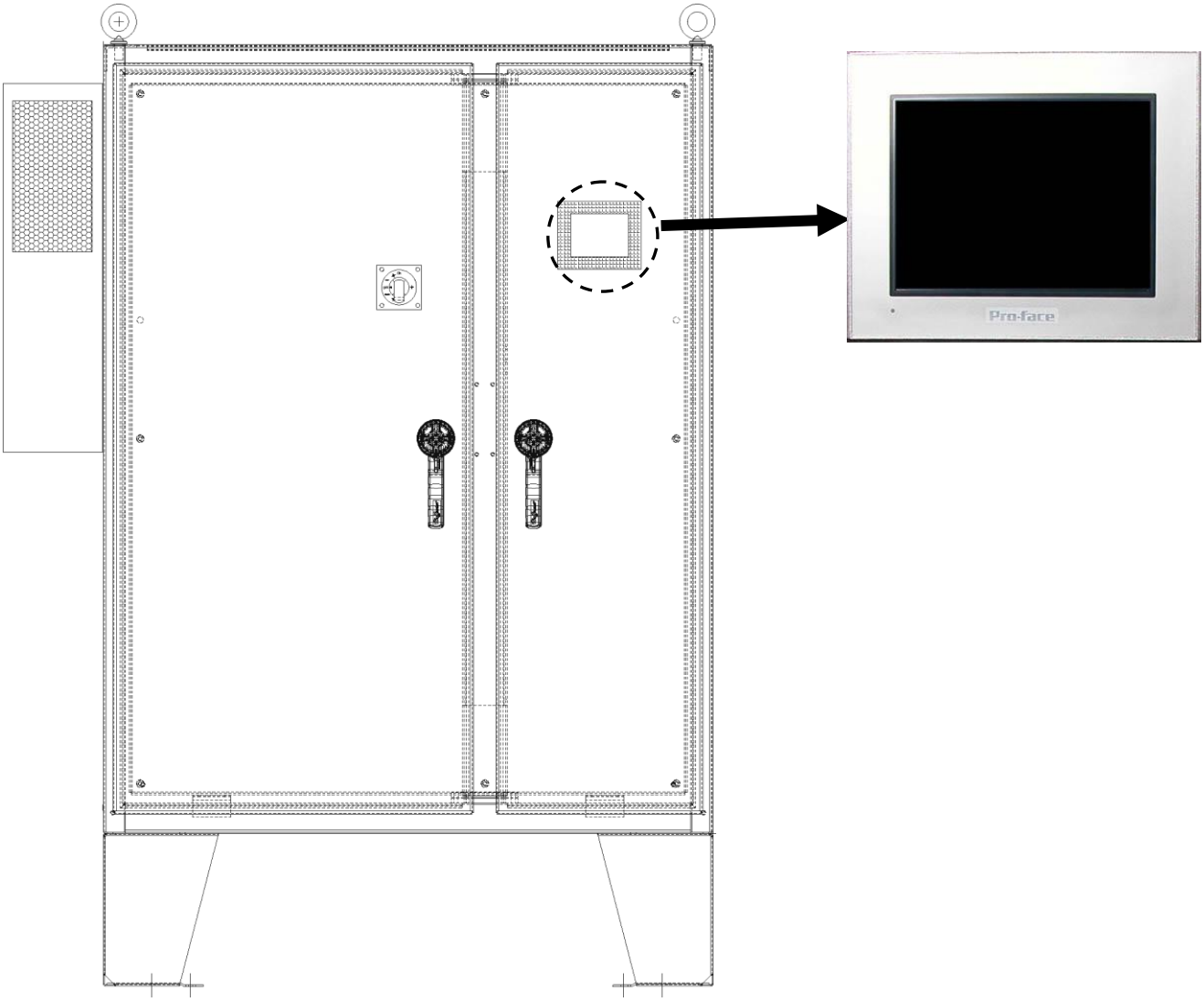
Fig. 479-02



1.3 Operator Interface Terminal (OIT) in the Control Cabinet Door

- This touch panel terminal allows the technician to troubleshoot the escalator via full text messages, run various technical tests, observe statistical information, etc.

Fig. 479-03: *Front View, Main Control Cabinet*



2 Maintenance

2.1 Functional Check

- Check whether the display works properly.

Warning: Defective displays!

Replace defective displays.

13.3 Operating Panels – Q 409 661

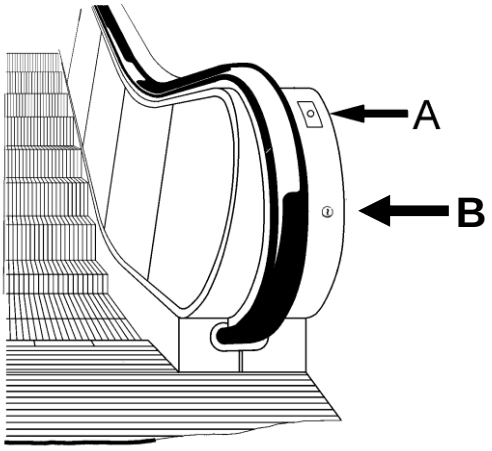
1 Description and Mode of Operation

The operating panels comprise all operating devices required for normal operation and are installed in one of the newel ends at the drive and tension station respectively.

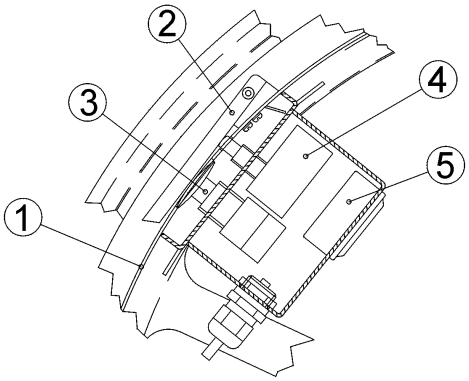
The operating panels comprise

- the key switch (6) to start and stop the escalator (see Fig. 661-01, View B);
- the emergency stop button (3) (see Fig. 661-01, View A), which is covered by a hinged lid (2). When lifting the lid (2), a microswitch (4) activates a buzzer (5).

Fig. 661-01



View A: Emergency Stop Button



View B: Key Switch

1) Newel end
2) Hinged lid
3) Stop button (DHSUM-T, DHSUM-B)
4) Microswitch (DHSUM-T, DHSUM-B)
5) Buzzer (DHSUM-T, DHSUM-B)

2 Maintenance

2.1 Functional Check

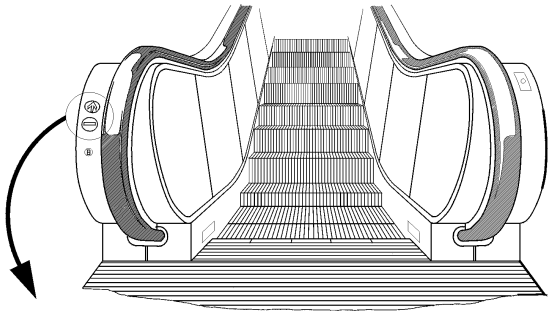
- Key switch:
  - Check the correct start function by turning the key switch in the desired position. Upon turning the key switch, the escalator must start runnig in the desired direction of travel.
  - Check the correct stop function by turning the key switch against the direction of travel. Upon turning the key switch, the escalator must stop (soft stop).
- Emergency stop button:
  - Check the correct function of the emergency stop button. Upon opening the hinged lid, the buzzer must sound. Upon pushing the stop button, the escalator must stop (emergency stop).

13.4 Direction Indicators – Q 409 716

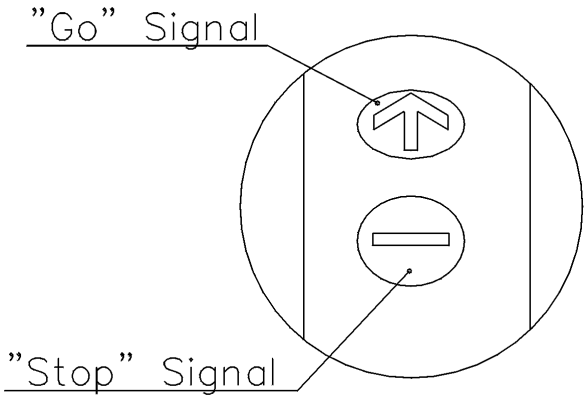
1 Description and Mode of Operation

- Direction indicators are mounted in the right balustrade newel at the drive station and in the left balustrade newel at the tension station (left newel end).
- The indicators consist of two signal LEDs, which indicate the respective direction of travel to passengers by means of a red "stop" signal and a green "go" signal.

Fig. 716-01: *Access, Bottom Landing*



Signal LEDs



2 Maintenance

2.1 Functional Check

Hints!

- Only possible with key switch
- During inspection operation all signaling devices are disconnected.

- When traveling in the **upward** direction:
  - green "go" signal at tension station
  - red "stop" signal at drive station
- In the **downward** direction the other way round
- Check the luminous power of the signal LEDs.

Warning: Defective LEDs!

Replace defective signal LEDs.

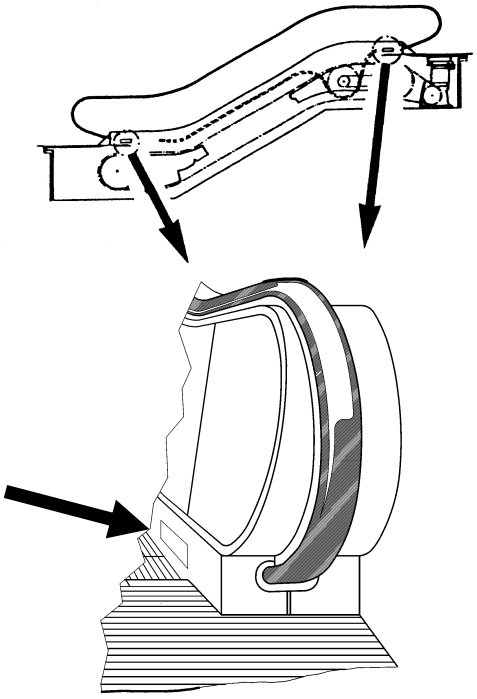
13.5 Combplate Lighting – Q 409 476

1 Description and Mode of Operation

Lamps are mounted in both balustrade skirtings at the drive and tension stations. These lamps illuminate the entry or access area between step and combplate. This makes it easier to step onto and off the escalator.

The lighting is designed with permanent LEDs.

Fig. 476-01



2 Maintenance

2.1 Functional Check

Hints!
• Only possible with key switch • During inspection operation all signaling devices are disconnected.

- All 4 lamps must give proper light.

Warning: Defective lamps!
Replace defective lamps.

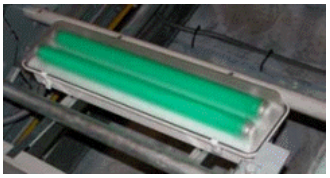
13.6 Step Gap Lighting – Q 409 477

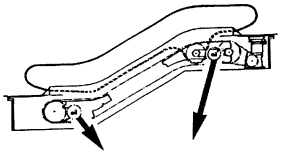
1 Description and Mode of Operation

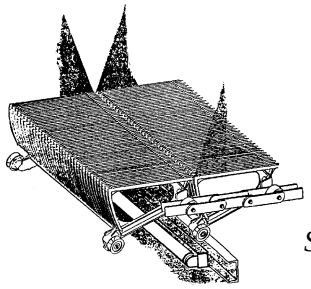
At the drive and tension stations, special green lamps (fluorescent tubes) are mounted within the step band in front of the tips of the combs. These lamps demarcate the individual steps optically.

This makes it easier to step onto the escalator.

Fig. 477-01







Symbolic drawing

2 Maintenance

2.1 Functional Check

Hint!
Only possible with key switch.

Warning: Defective tubes!
Replace fluorescent tubes.

2.2 Cleaning

- Thoroughly clean the tubes.

Warning: Soiling!
Dirt falling down between the steps covers the tubes!

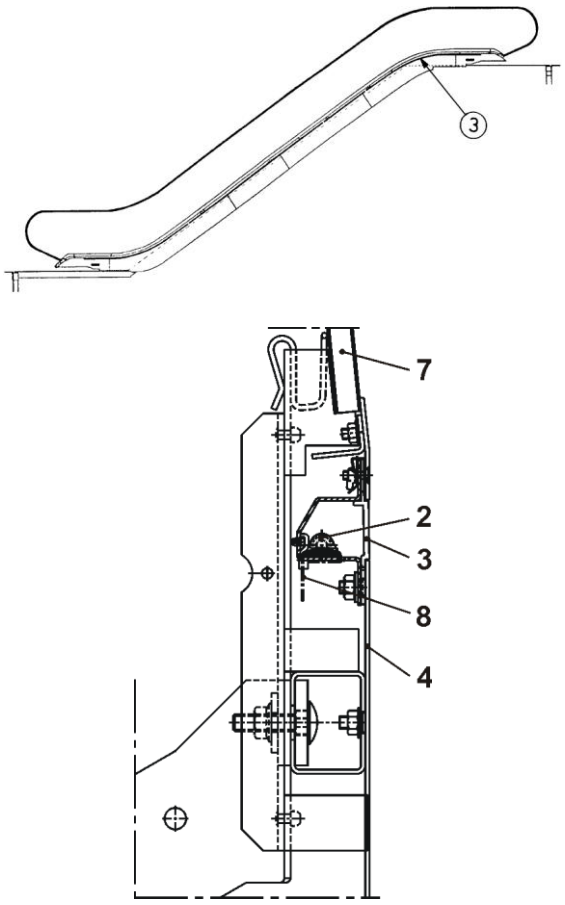
13.7 Skirt Lighting – Q 409 475

1 Description and Mode of Operation

Upon request, inclined balustrades can be equipped with a lighting. 24-volt LED light strips are fitted into the skirt panel profile. The LED light strips are protected against accidental contact over their entire lengths by means of a transparent plastic profile.

LED light strips (up to a max. of 14 m in total) are connected in series. Each LED light strip consists of several 400-mm segments. For lengths of more than 14 m additional feed lines are required.

Fig. 475-01



2) LED light strips
3) Plastic profile
4) Skirt panel
7) Inner cladding
8) Cable binder

2 Maintenance

2.1 Functional Check

Hint!
Only possible with key switch; during inspection operation, the lighting is disconnected.

- Check whether all LED segments (2) give a perfect light.

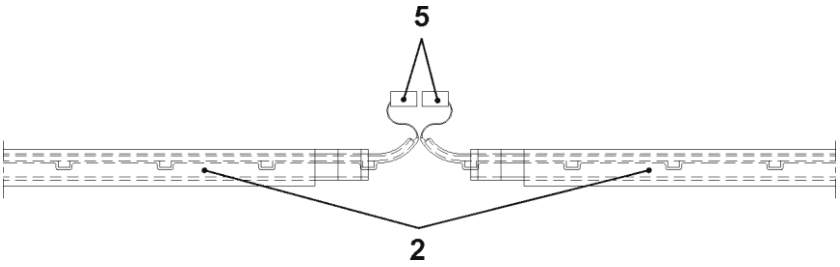
Hint!
In case of a damage a whole 400-mm LED segment drops out. The remaining segments are still lighting up.

– If one of the LED segments is defective (or if a wire is broken), the respective LED light strip has to be replaced.

See Repair Instructions Q 409 849, Skirt Lighting

- LED light strip supply

Fig. 475-02



2) LED light strip
5) Connection plugs

13.8 Water Level Monitor – Q 409 484

1 Description and Mode of Operation

If there is a risk that the escalator's tension station pit may fill with water, a water level monitor can be installed. The water level monitor is located below the truss in the tension station. When a predefined water level is reached, the water level monitor activates an alarm.

The water level is monitored via a level monitor implemented in the form of an ultrasonic sensor.

When the water level rises to the tip of the ultrasonic sensor between the forks, the signal registers in the bottom I/O.

The output of the level monitor (1), which is implemented in the form of a dry changeover contact, is directly connected to the controller.

If the output of the level monitor is activated, the escalator is shut down and the associated relay is triggered and can be used as a dry contact to activate a pump, an alarm device, etc.

For more detailed information about this module, refer to the following publications:

Refer to this document	LVU Publication
LVU-A700 Series	LVU-A700.pdf

Fig. 484-01

1) Level monitor

2 Maintenance

2.1 Functional Check

- Place the tip of the level monitor (1) in a container with water.
- Error code: "E_DB"

Fig. 484-02

1) Level monitor

13.9 Maintenance Operating Panel – Q 409 480

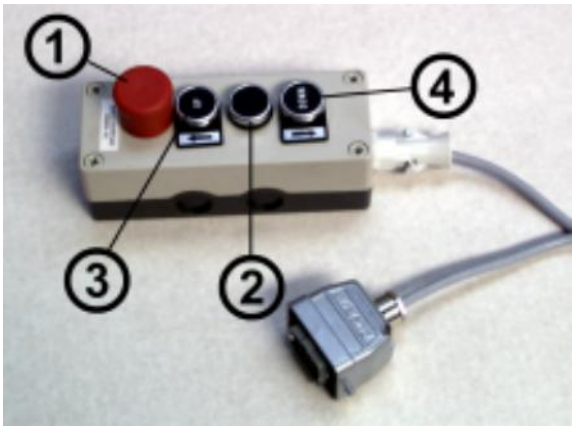
1 Description and Mode of Operation

The maintenance operating panel consists of a manual control device, an approx. 8 m long cable (option: 18 m long cable) with a plug, which can be connected to a socket on the top of the control cabinet in the drive or tension stations.

Hint!
When connecting the maintenance operating panel, the key switches and other starting devices are **deactivated**.

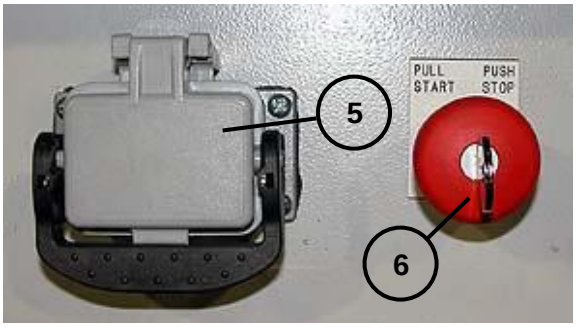
Danger: Trial runs only with maintenance operating panel!
In the course of work performed at or within the escalator, trial runs should only be carried out with the maintenance operating panel.

Fig. 480-01



1) Stop button
2) Start pushbutton
3) UP direction button
4) DOWN direction button

Fig. 480-02



5) Dummy plug
6) Stop button (JH-T, JH-B)

2 Maintenance

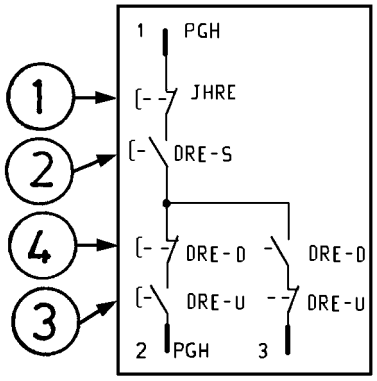
- Connecting the maintenance operating panel:
  - Open the lock and remove the dummy plug (5).
  - Connect and lock the plug of the maintenance operating panel.
- Select "MANUAL MODE" on the OIT main screen.

Hint!

When the escalator is in manual mode, the step level and the step upthrust contacts are bypassed.

- Functional check:
  - With the start pushbutton (2) and **one** of the direction pushbuttons (3, 4) pressed, the escalator should only move into the desired direction as long as both pushbuttons are activated.
  - With the stop button (1) pressed (and locked), the escalator must not start up.

Fig. 480-03: *Wiring Diagram of the Maintenance Operating Panel*



1) Stop button
2) Start pushbutton
3) UP direction button
4) DOWN direction button

VOLUME III

Repair

14 Repair of Drive & Brakes

14.1 Drive Chain – Q 409 504

1 Preparation Work

- Remove all floor covers at the drive station.

See Maintenance Instructions Q 409 457, Floor Covers

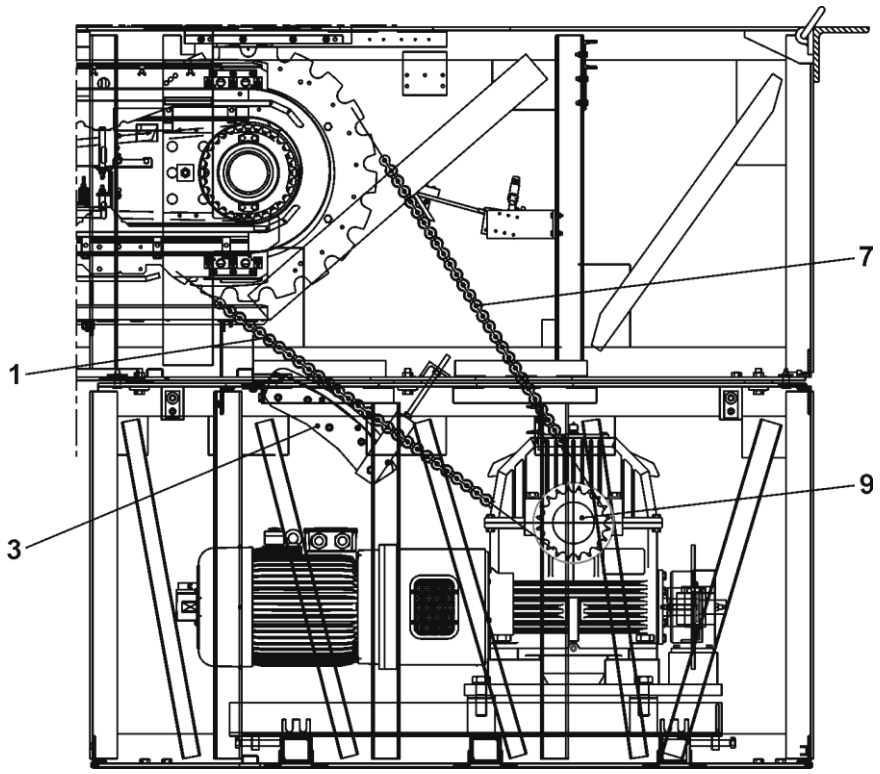
- Remove the guard plate at the drive station.

See Maintenance Instructions Q 409 487, Guard Plates

2 Replacing the Drive Chain

- The master link (7) should be easily accessible on the upper chain strand. Run the escalator with the maintenance operating panel until the master link (7) is at the correct position (see Fig. 504-01).

Fig. 504-01



1) Drive chain
3) Chain deflector
7) Master link
9) Pinion

- Release the tension of the drive chain by shifting the drive longitudinally by means of the threaded spindles.

See Maintenance Instructions Q 409 452, Drive Chain

- Open the master link (7).

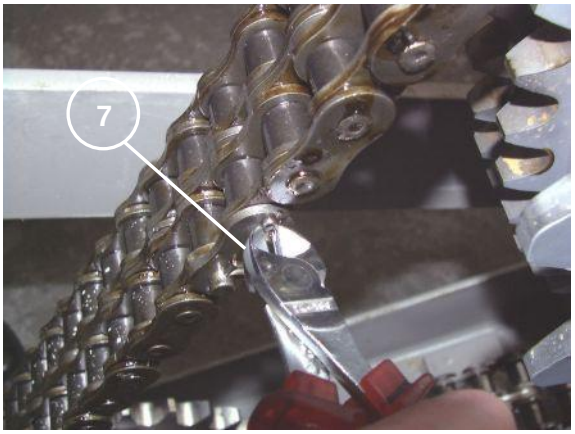


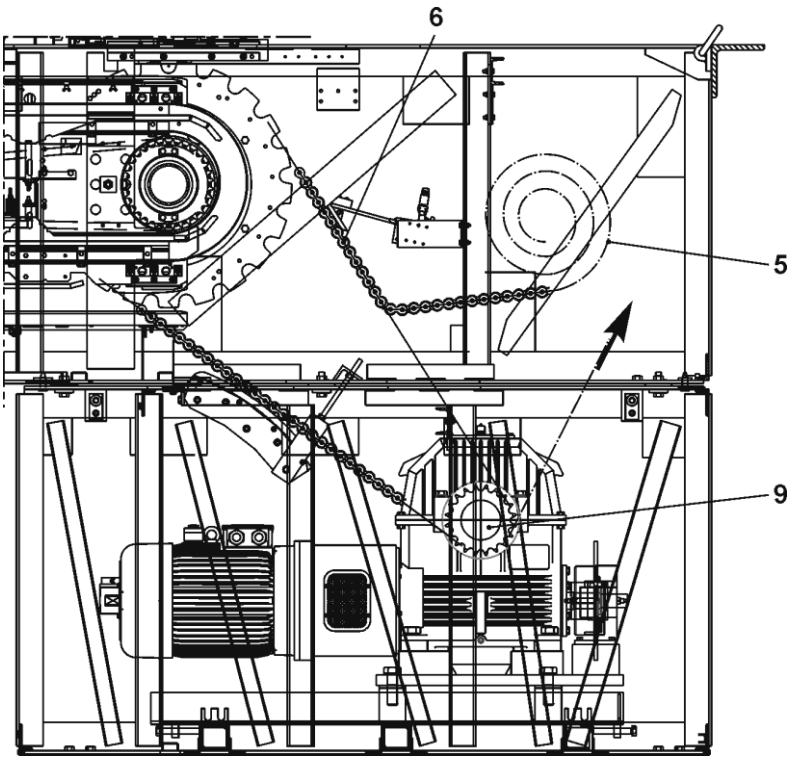
Fig. 504-02

- Attach the new chain (5) to the old chain (6).
- Carefully run the escalator with the maintenance operating panel in the downward direction to pull in the new chain (5). Support the old chain (6) at the pinion (9) by hand (see Fig. 504-03).

Hint!

Take care to maintain the tension. Otherwise, the old chain (6) will fall off the pinion (9).

Fig. 504-03



5) New chain
6) Old chain
9) Pinion

- Close the master link (7) of the new chain (5).

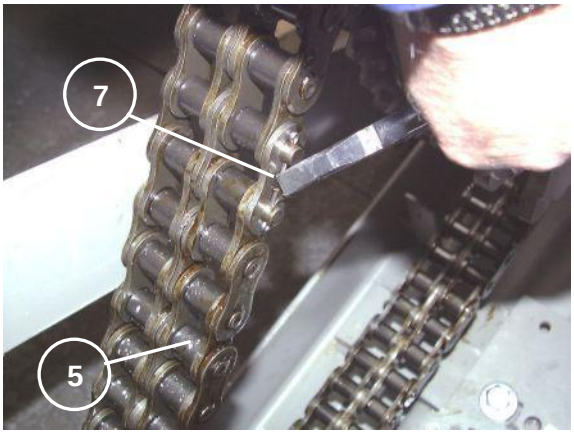


Fig. 504-04

- Tension the drive chain (1).

  The sag X should measure 10-15 mm.

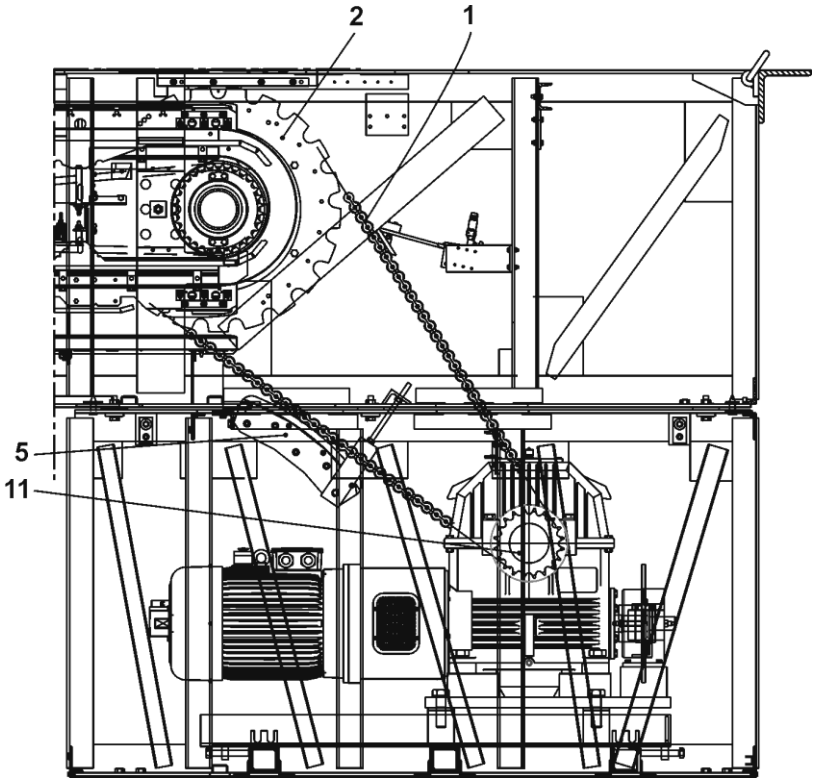


Fig. 504-05

For how to tension the drive chain, see Maintenance Instructions Q 409 452, Drive Chain

3 Checks, Lubrication

- Check the tension of the chain.

See Maintenance Instructions Q 409 452, Drive Chain

- Thoroughly lubricate the drive chain (initial lubrication).

For the appropriate lubricant, see Maintenance Instructions Q 409 452, Drive Chain

4 Reassembly

Reassemble the parts disassembled under Section 1 analogously in the reverse order.

14.2 Brake Pads – Service Brake – Q 409 503

1 Preparation Work

- Remove all floor covers at the drive station.

See Maintenance Instructions Q 409 457, Floor Covers

- Turn off and padlock the main switch.
- Engage the step chain locking device.

See Maintenance Instructions Q 409 926, Step Chain Locking Device

2 Replacing the Brake Pads

For more detailed information, see Volume VJ, Renold_O&M_Manual.pdf

3 Checks

- Measure the braking distance.

See Maintenance Instructions Q 409 447, Drive

4 Reassembly

Reassemble the parts disassembled under Section 1 analogously in the reverse order.

14.3 Main Shaft – Bearing Replacement – Q 409 858

1 Preparation Work

- Remove the inner cladding panels from the endpiece to the curved inner cladding panel at the drive station.

See Repair Instructions Q 409 702, Inner Cladding Disassembly

- Remove all floor covers at the drive station.

See Maintenance Instructions Q 409 457, Floor Covers

- Remove the guard plate at the drive station.

See Maintenance Instructions Q 409 487, Guard Plates

- Remove all floor covers at the tension station.

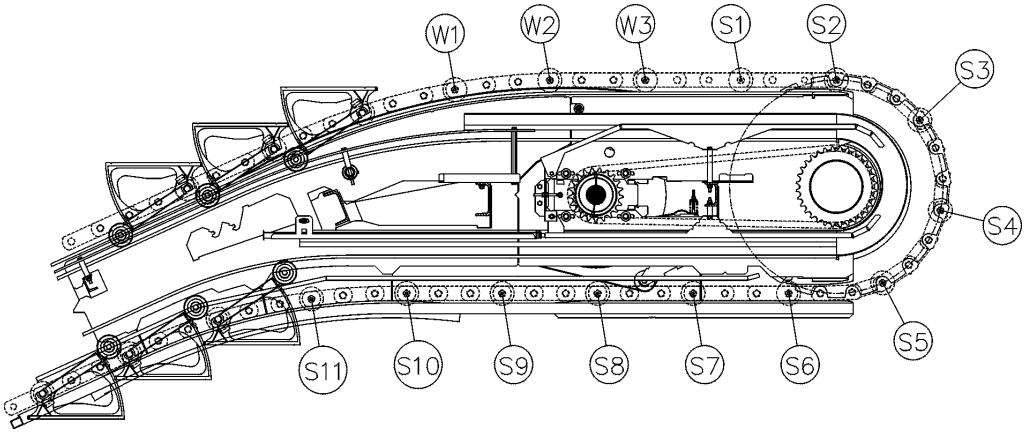
See Maintenance Instructions Q 409 457, Floor Covers

- Remove the guard plate at the tension station.

See Maintenance Instructions Q 409 487, Guard Plates

- Disassemble 14 steps in the following order (see Fig. 858-01):
  - the 3 maintenance steps (W1, W2, W3)
  - 11 steps after the 3 maintenance steps (S1 to S11).

Fig. 858-01



For how to disassemble steps, see Maintenance Instructions Q 409 461, Steps, Step Disassembly, Guide Pads, Step Rollers, Bushings

- Disassemble the divided step axles of the steps W1, W2, W3, S1 and S2.

See Repair Instructions Q 409 692, Step Chain Rollers

- Run the gap in the step band to the main shaft so that one half of the gap lies in the advance track, whereas the other half lies in the return track (see Fig. 858-01).

Hint!

The master links of the drive and handrail drive chains should be readily accessible. If required, run the step band for full cycles until the master links are accessible.

- Remove the control cabinet (if necessary) and put it aside on the floor.
- Remove the step chain locking device by removing the fastening screws to the truss.

See Maintenance Instructions Q 409 926, Step Chain Locking Device

- Turn off and padlock the main switch.

- Disassemble the inner and outer front plates at the drive station.

See Repair Instructions Q 409 616, Handrail

- Disassemble the handrail entry contacts at the drive station.

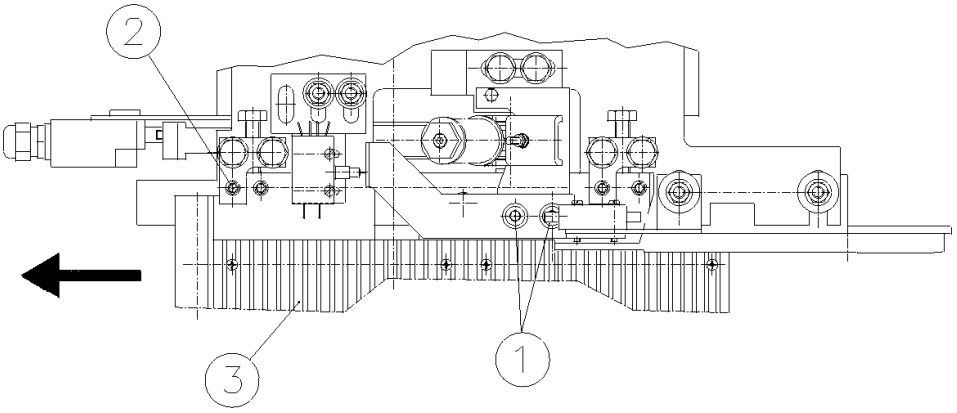
See Repair Instructions Q 409 616, Handrail

- Remove the skirt endpiece at the drive station.

See Repair Instructions Q 409 704, Skirt Panel Disassembly

- Removing the combplate (see Fig. 858-02):
  - Remove the screws (1).
  - Loosen the pin (2).
  - Pull the combplate (3) off backward.

Fig. 858-02



1) Screws
2) Pin
3) Combplate

Hint!

When reassembling the combplate (3), set the pin (2) to a distance of 0.3 to 0.5 mm.

See Maintenance Instructions Q 409 460, Combplates, Combplate Contacts, Combs, Lateral Guides

- Loosen the screws (4) of the cover (5) of the handrail drive chain (6) and remove the chain cover (5).

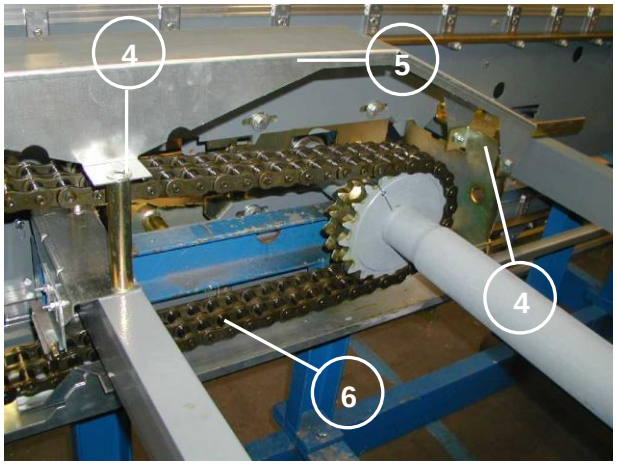


Fig. 858-03

- Loosen the screws (7) and remove them together with the oil drain channel (8).

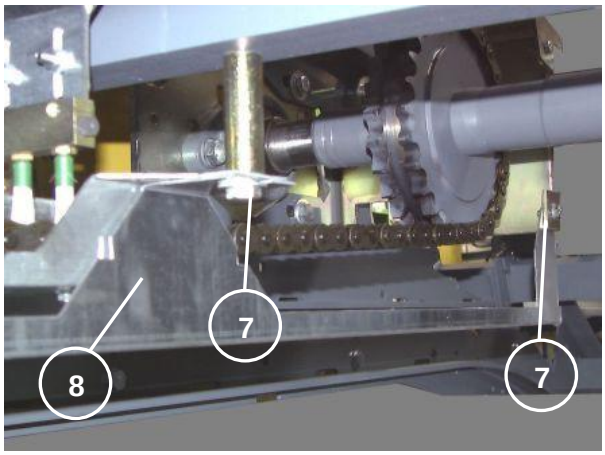
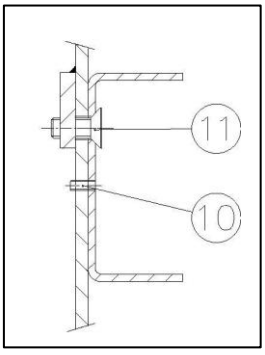


Fig. 858-04

- Disassembling the chain turn-around (9):
  - Drive out the clamping sleeves (10).
  - Remove the flat-head screws (11).
  - Remove the turn-around (9).



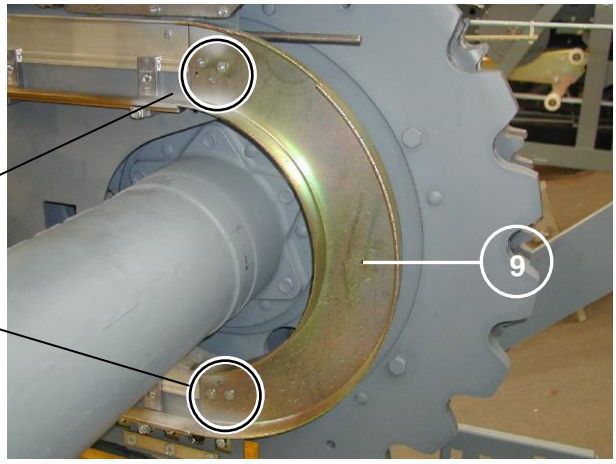


Fig. 858-05

- Completely release the tension of the handrail drive chain, open it and remove it from the divided pinion of the main shaft.

See Repair Instructions Q 409 688, Main Handrail Drive Chain

- Completely release the tension of the step chain and push the tension carriage back.

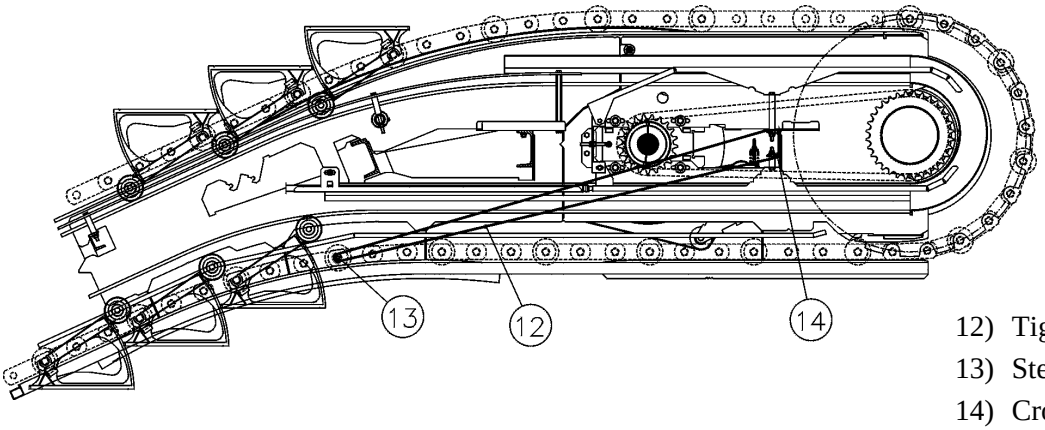
See Maintenance Instructions Q 409 602, Step Chain Tensioning Device, Chain Tension Contacts

- Firmly anchor the step chain in the return track, i.e., use two tightening straps (12) (e.g., ratchet tensioning belts) to fasten the step axle (13) to the cross member (14) of the upper track block (see Fig. 858-06).

Hints!

- Place the tightening straps (12) at the outside, next to the step chains over the step axle.
- Minimum breaking load of a tightening strap: 1000 kg

Fig. 858-06

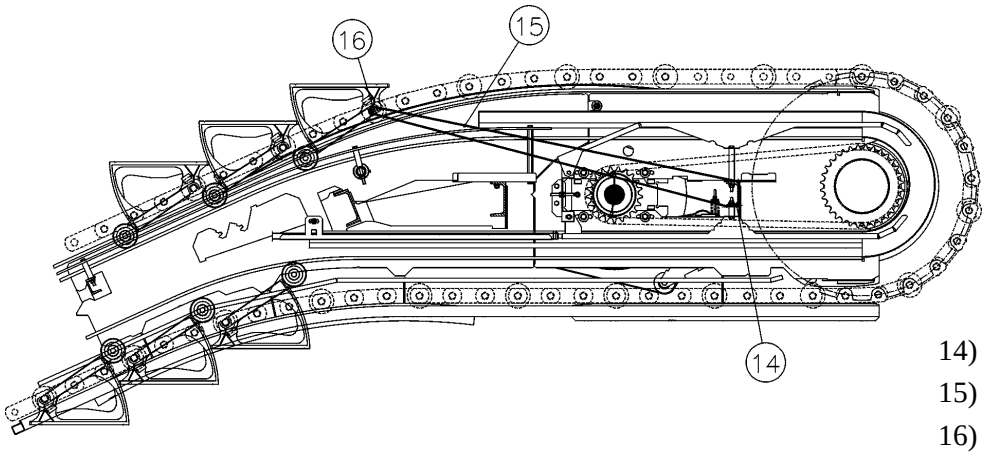


12) Tightening strap
13) Step axle
14) Cross member

- Release the brake manually and turn the flywheel in the upward direction to run the step chain as many millimeters as possible into the advance track.

- Fasten the step axle (16) by means of two additional tightening straps (15) to the cross member (14) (see Fig. 858-07).

Fig. 858-07



14) Cross member
15) Tightening strap
16) Step axle

Hint!

Since you ran the step chain into the advance track, it is slackened between the two anchored step axles (13) and (16) (see Fig. 858-06 and Fig. 858-07).

- Completely release the tension of the drive chain, open it, and remove it from the pinion of the drive unit (do not remove it from the drive sprocket of the main shaft until the latter is disassembled).

See Repair Instructions Q 409 504, Drive Chain

- Opening the step chain:

Hint!

The step chain must be opened in the advance track just before the main shaft – at the step axle (S1) (see Fig. 858-01).

– Remove the circlip (17).

Fig. 858-08

– Drive the chain pin (18) out toward the middle of the escalator.

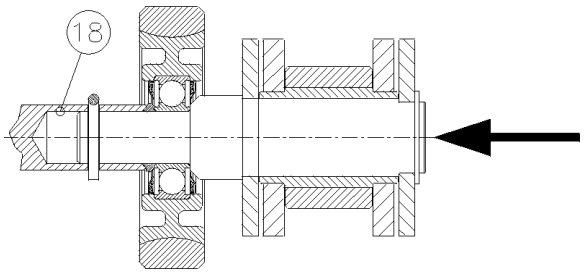


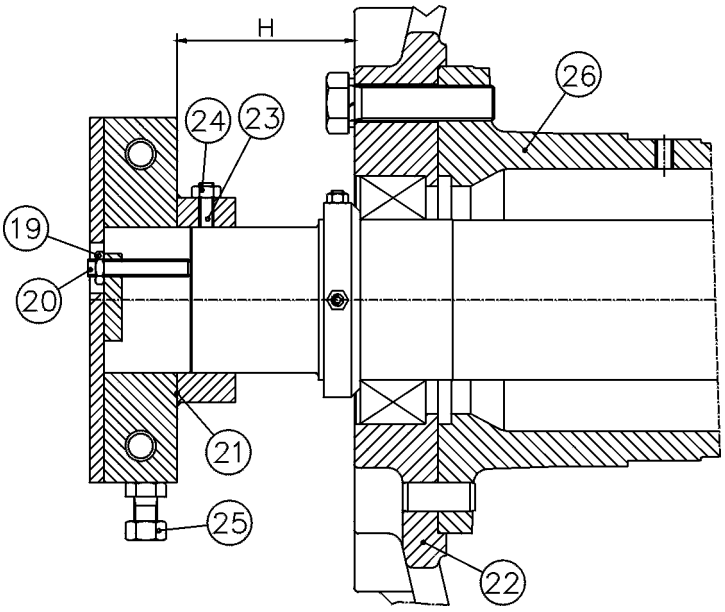
Fig. 858-09

Hint!

Do not strike the chain pin directly with a hammer.

2 Disassembling the Main Shaft

Fig. 858-10



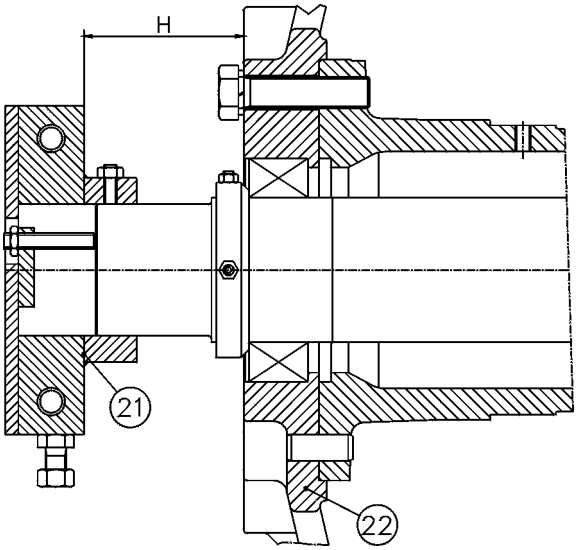
19) Counternut
20) Side adjusting screw
21) Flanged bearing
22) Step chain sprocket
23) Parallel pin
24) Counternut
25) Height adjusting screw
26) Main shaft
H) Distance

- Measure and note down the distance H between the flanged bearing (21) and the step chain sprocket (22) on both sides (see Fig. 858-11).

Hint!

For proper positioning of the main shaft during reassembly

Fig. 858-11



21) Flanged bearing
22) Step chain sprocket

- Secure the main shaft with a round sling.

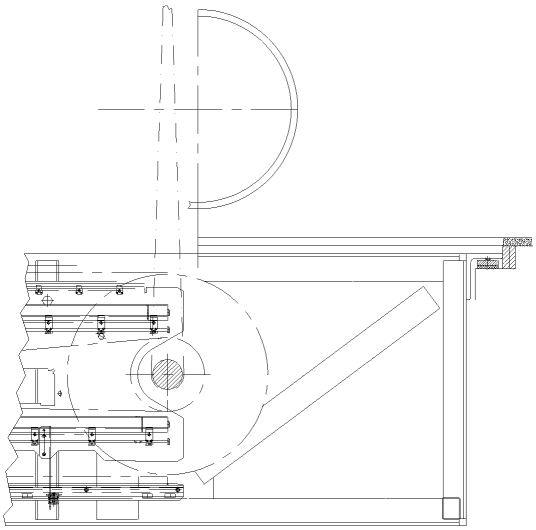


Fig. 858-12

- Attach the main shaft to the hoisting gear (carrying force: min. 1000 kg) and slightly tension the lifting cable.
- Loosen the fastening screws (27) of the flanged bearing.

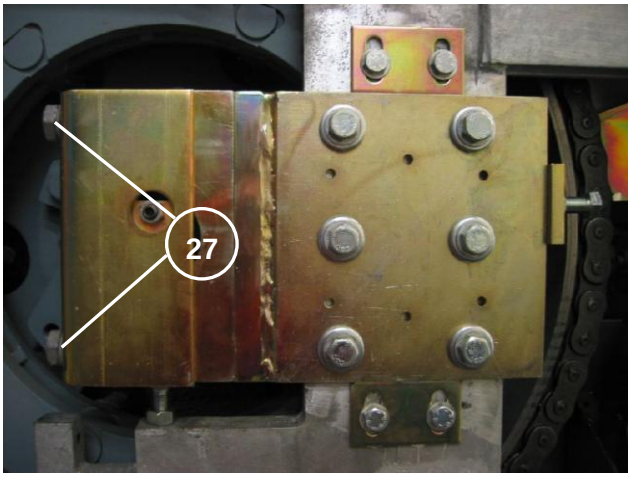


Fig. 858-13

- Swivel the main shaft (28) forward – in the direction of the support angle – and turn the step chain sprockets to pull the step chain out.

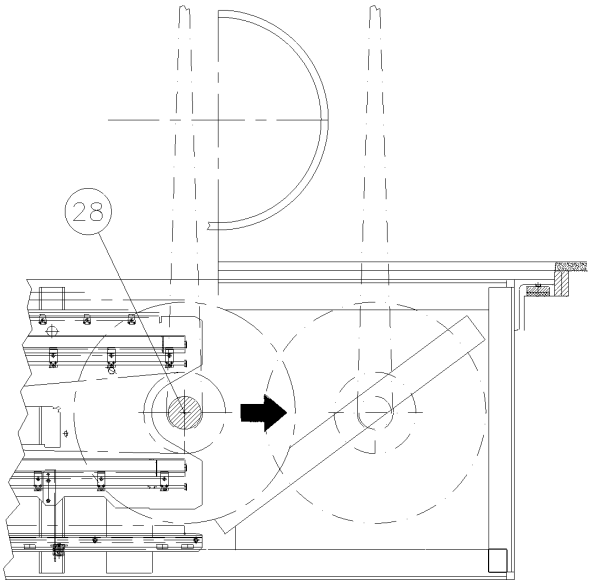


Fig. 858-14

- Pull off the flanged bearings (21).

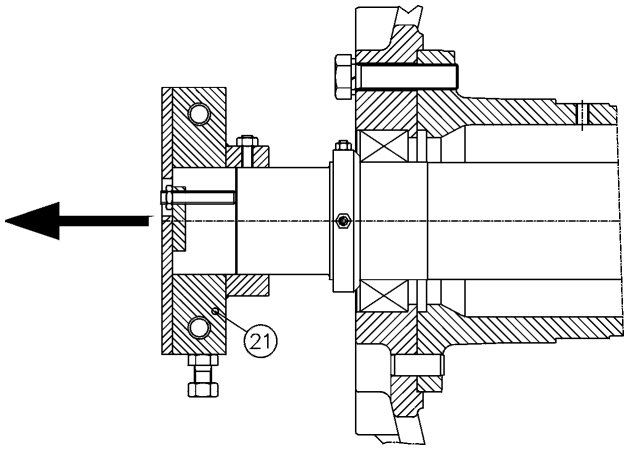
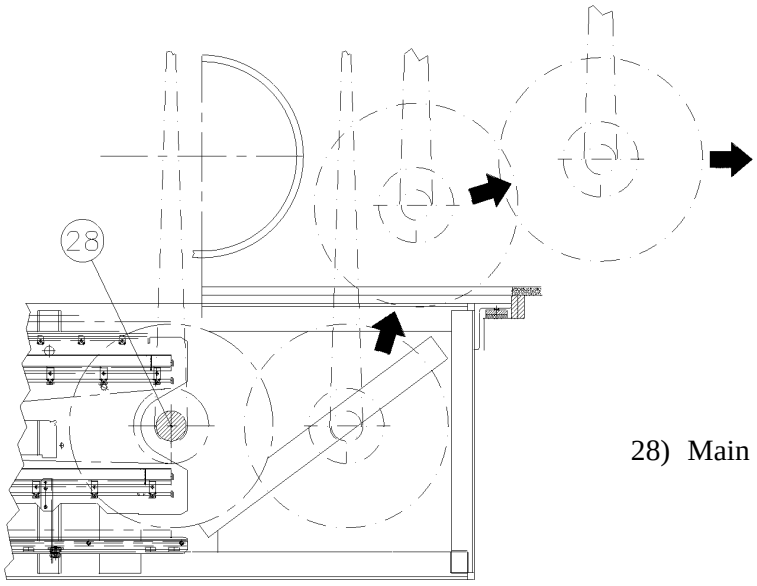


Fig. 858-15

- Lift the main shaft (28) out and swivel it forward over the support angle (see Fig. 858-16).

Fig. 858-16



28) Main shaft

3 Replacing the Bearings

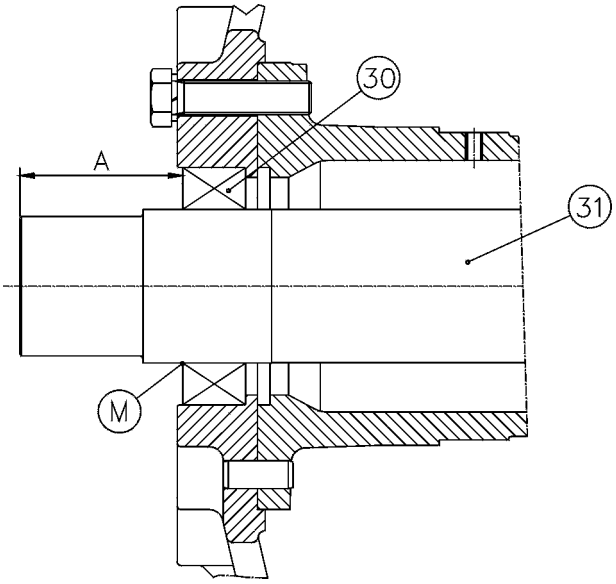
Hint!
Bearings should only be replaced in properly equipped workshops.

- Remove the adjusting rings (29) on both sides.

Fig. 858-17

- Mark the position (M) of the bearings (30) on the main-shaft axle (see Fig. 858-18).
  - Distance A = $114^{\pm 0.5}$ mm for self-aligning roller bearings

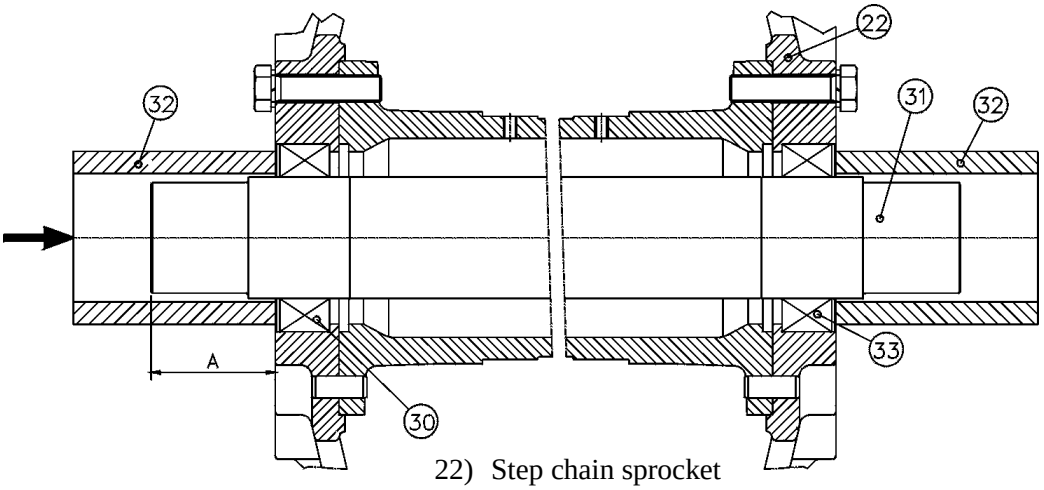
Fig. 858-18



30) Bearing
31) Main shaft axle

- Press the main-shaft axle (31) out according to the figure (countersupport (32)) and remove the bearings (30) and (33) from the step chain sprocket (22) (see Fig. 858-19).

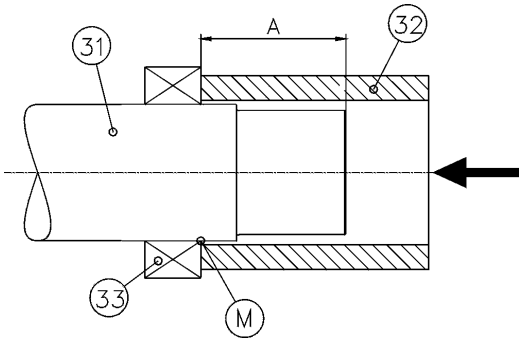
Fig. 858-19



22) Step chain sprocket
30) Bearing
31) Main-shaft axle
32) Countersupport
33) Bearing

- Use a sleeve (32) to press a new bearing (33) onto the main-shaft axle (31) up to the marking M and with the distance A from the edge (see Fig. 858-20).

Fig. 858-20



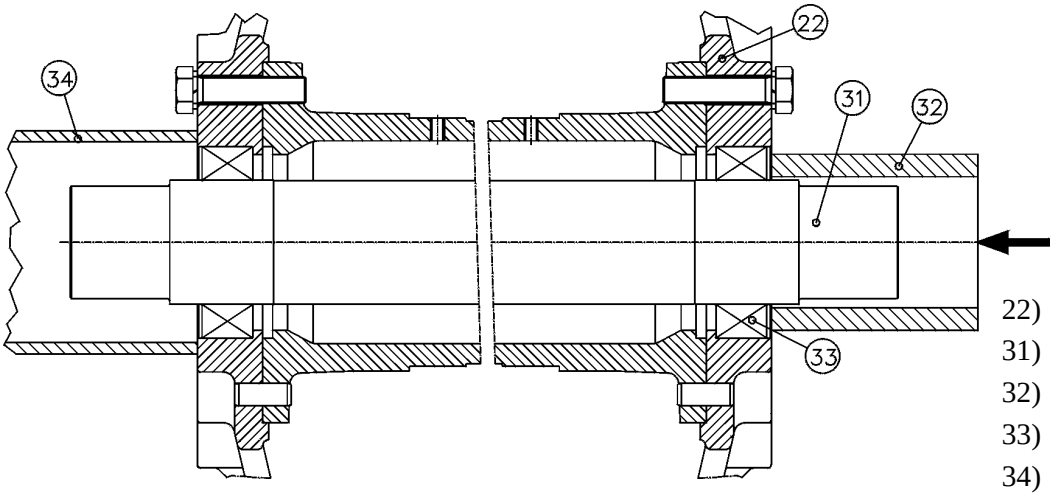
31) Main-shaft axle
32) Sleeve
33) Bearing

- Use a countersupport (34) and a sleeve (32) to press the main-shaft axle (31) – containing the pressed-on bearing (33) – into one side of the hollow shaft of the step chain sprocket (22) (see Fig. 858-21).

Hint!

The sleeve (32) should abut both the inner **and** the outer ring of the bearing.

Fig. 858-21



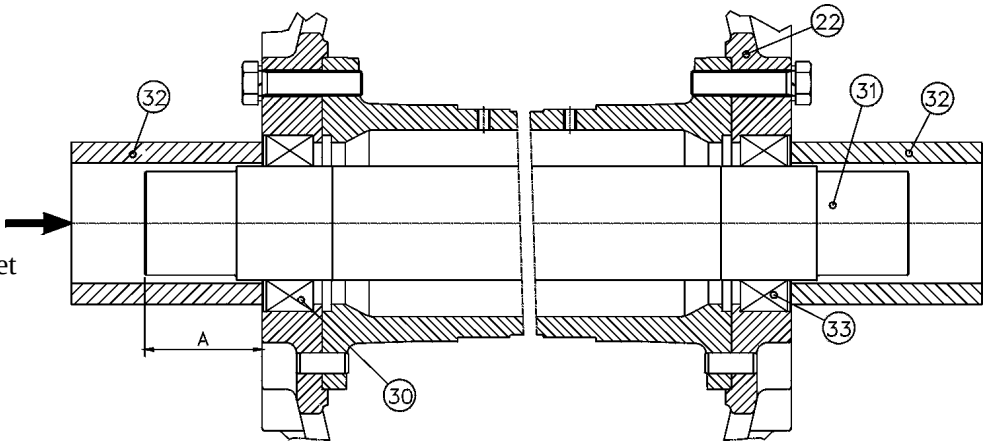
22) Step chain sprocket
31) Main-shaft axle
32) Sleeve
33) Bearing
34) Countersupport

- Use a second sleeve (32) to press the second bearing (30) onto the main-shaft axle (31) and into the step chain sprocket (22) (see Fig. 858-22).

Hint!

The first sleeve (32) serves as a countersupport when pressing the bearing (30) onto the axle and into the sprocket.

Fig. 858-22



22) Step chain sprocket
31) Main-shaft axle
32) Sleeve
33) Bearing

- Check on both sides whether the bearings (30) and (33) are properly positioned at the markings on the main-shaft axle (31) and with the distance A from the edge of the main-shaft axle (31) (see Fig. 858-18).

- Slide the adjusting rings (29) onto the main-shaft axle and firmly press them against the bearings (30) and (33); tighten the screws and counternuts.

Fig. 858-23

4 Reassembly

- Reassemble the main shaft analogously in the reverse order as described under Section 2.
- Reassemble the parts disassembled under Section 1 analogously in the reverse order.

5 Checks

- Check the entry of the step chains into the step chain sprockets.

Hint!

The step chains should enter the sprockets as close to centered as possible and must not press against the step chain sprockets on one side.

- If required, readjust the main shaft by means of the side adjusting screws.
- Check whether the pinion of the gearbox and the drive chain sprocket on the main shaft are properly aligned.

14.4 Divided Pinion on Main Shaft – Q 409 699

1 Preparation Work

- Remove all floor covers at the tension station.

See Maintenance Instructions Q 409 457, Floor Covers

- Remove the guard plate at the tension station.

See Maintenance Instructions Q 409 487, Guard Plates

- Disassemble the 3 maintenance steps and 2 additional steps.

See Maintenance Instructions Q 409 461, Steps, Step Disassembly, Guide Pads, Step Rollers, Bushings

- Remove all floor covers at the drive station.

See Maintenance Instructions Q 409 457, Floor Covers

- Remove the guard plate at the drive station.

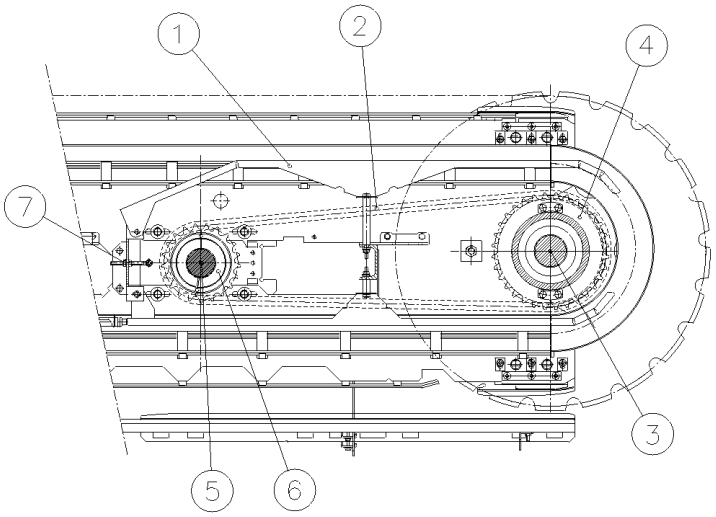
See Maintenance Instructions Q 409 487, Guard Plates

- Use the maintenance operating panel to run the gap in the step band to the drive station so that the gap starts just before the handrail drive chain and the divided pinion on the main shaft is readily accessible from the escalator pit.
- If the master link is not accessible (i.e., in the return track, beneath the pinion, etc.), use the maintenance operating panel to run the step band for full cycles until the master link is readily accessible.
- Turn off and padlock the main switch.
- Engage the step chain locking device.

See Maintenance Instructions Q 409 926, Step Chain Locking Device

2 Replacing the Divided Pinion

Fig. 699-01



1) Chain cover
2) Handrail drive chain
3) Main shaft
4) Divided pinion on main shaft
5) Handrail drive shaft
6) Divided pinion on handrail drive shaft
7) Tensioning device

- Loosen the screws (1A) of the chain cover (1) of the handrail drive chain (2) and remove the chain cover (1).

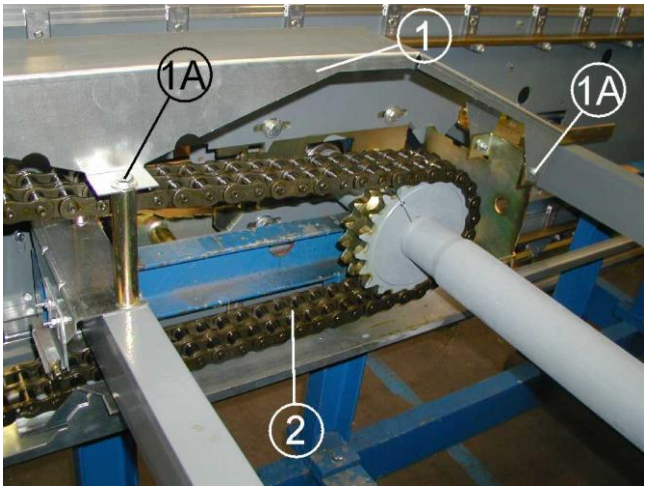


Fig. 699-02

- Loosen the fastening screws (5A) of the handrail drive shaft (5).

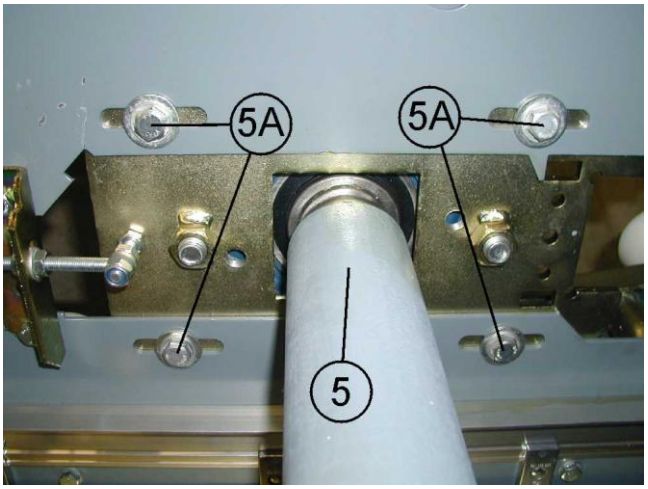


Fig. 699-03

- Completely release the tension of the handrail drive chain by means of the tensioning device (7) and push the handrail drive shaft (5) back to the stop.

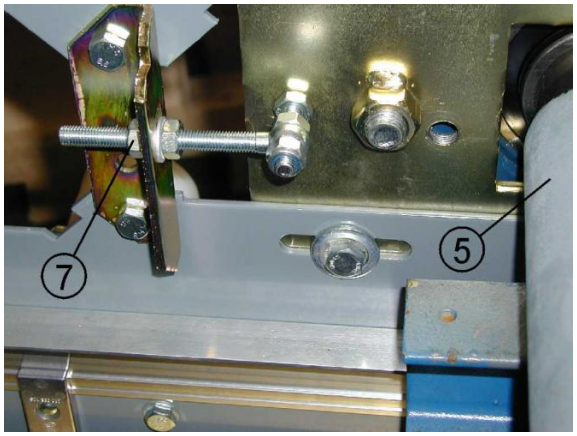


Fig. 699-04

For how to release the chain tension, see Maintenance Instructions Q 409 604, Handrail Drive Chains

- Open the master link (2A) and remove the handrail drive chain (2) from the divided pinion (6).

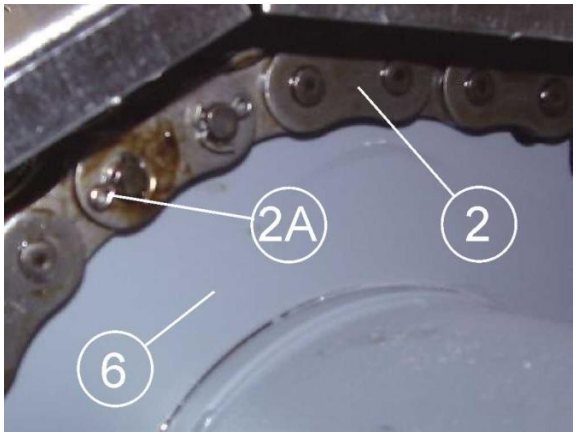


Fig. 699-05

- Remove the fillister head screws (15).

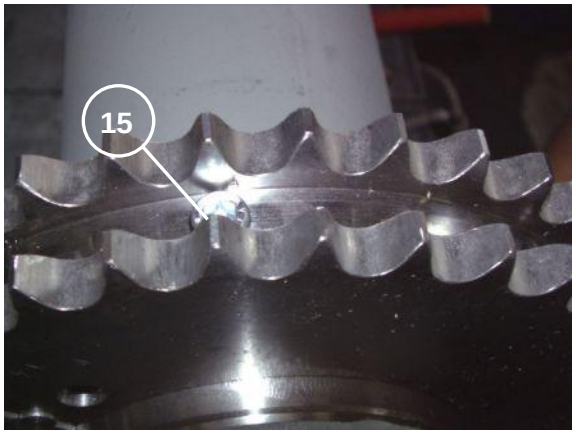


Fig. 699-06

- Remove the hex head cap screws (10) together with the washers (11), the nuts (12), the locking washers (17) and the straps (13) (see Fig. 699-07 and Fig. 699-08).

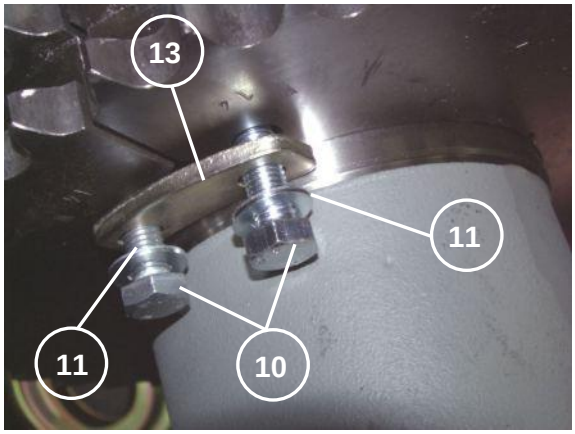


Fig. 699-07

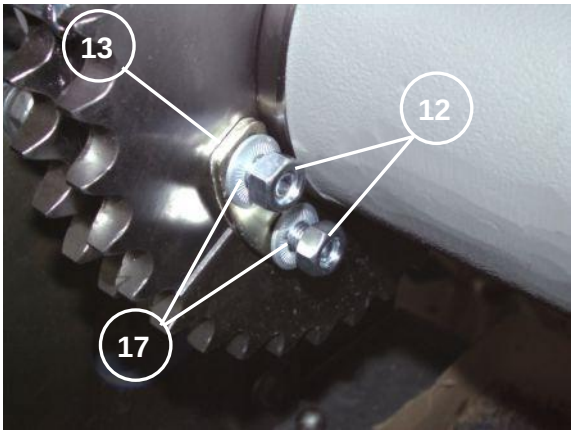


Fig. 699-08

- Remove the divided pinion (4) and the cylindrical pin (16) from the main shaft.

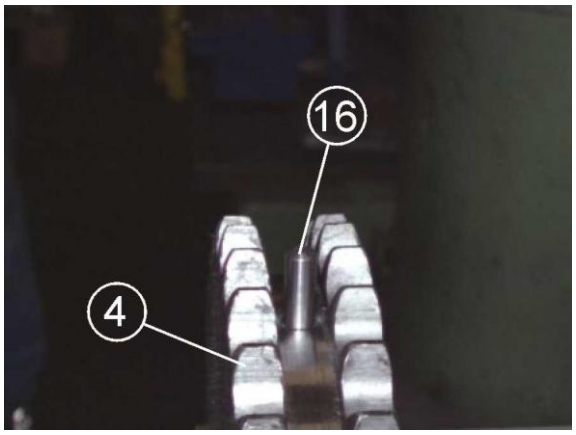


Fig. 699-09

- Remove the cylindrical pin (14).

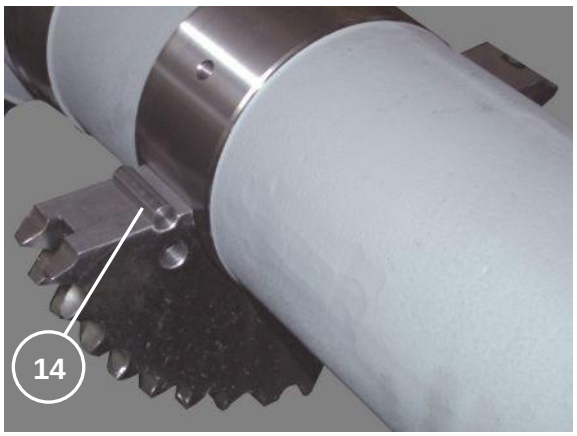


Fig. 699-10

- Install a new pinion analogously in the reverse order.
- Tension the handrail drive chain.

See Maintenance Instructions Q 409 604, Handrail Drive Chains

3 Checks

- Check the chain tension.

See Maintenance Instructions Q 409 604, Handrail Drive Chains

4 Reassembly

Reassemble the parts disassembled under Section 1 analogously in the reverse order.

15 Repair of Tracks & Skirt Panels

15.1 Skirt Panel Disassembly – Q 409 704

1 Skirt Panel Disassembly

1.1 Preparation Work

1.1.1 Curved Skirt Panel & Skirt Endpiece, Drive Station

- Turn off and padlock the main switch.
- Engage the step chain locking device.

See Maintenance Instructions Q 409 926, Step Chain Locking Device

- Remove the inner cladding panels along the length of the curved skirt panel and the skirt endpiece.

See Repair Instructions Q 409 702, Inner Cladding Disassembly

- Remove all floor covers at the drive station.

See Maintenance Instructions Q 409 457, Floor Covers

- Remove the guard plate at the drive station.

See Maintenance Instructions Q 409 487, Guard Plates

- Remove the inner front plate.

See Repair Instructions Q 409 616, Handrail

1.1.2 Curved Skirt Panel, Tension Station

- Turn off and padlock the main switch.
- Engage the step chain locking device.

See Maintenance Instructions Q 409 926, Step Chain Locking Device

- Remove the inner cladding panels up to beyond the joint with the second straight skirt panel.

See Repair Instructions Q 409 702, Inner Cladding Disassembly

- Remove all floor covers at the tension station.

See Maintenance Instructions Q 409 457, Floor Covers

- Remove the guard plate at the tension station.

See Maintenance Instructions Q 409 487, Guard Plates

- Remove the inner front plate.

See Repair Instructions Q 409 616, Handrail

1.1.3 Middle Section

- Turn off and padlock the main switch.
- Engage the step chain locking device.

See Maintenance Instructions Q 409 926, Step Chain Locking Device

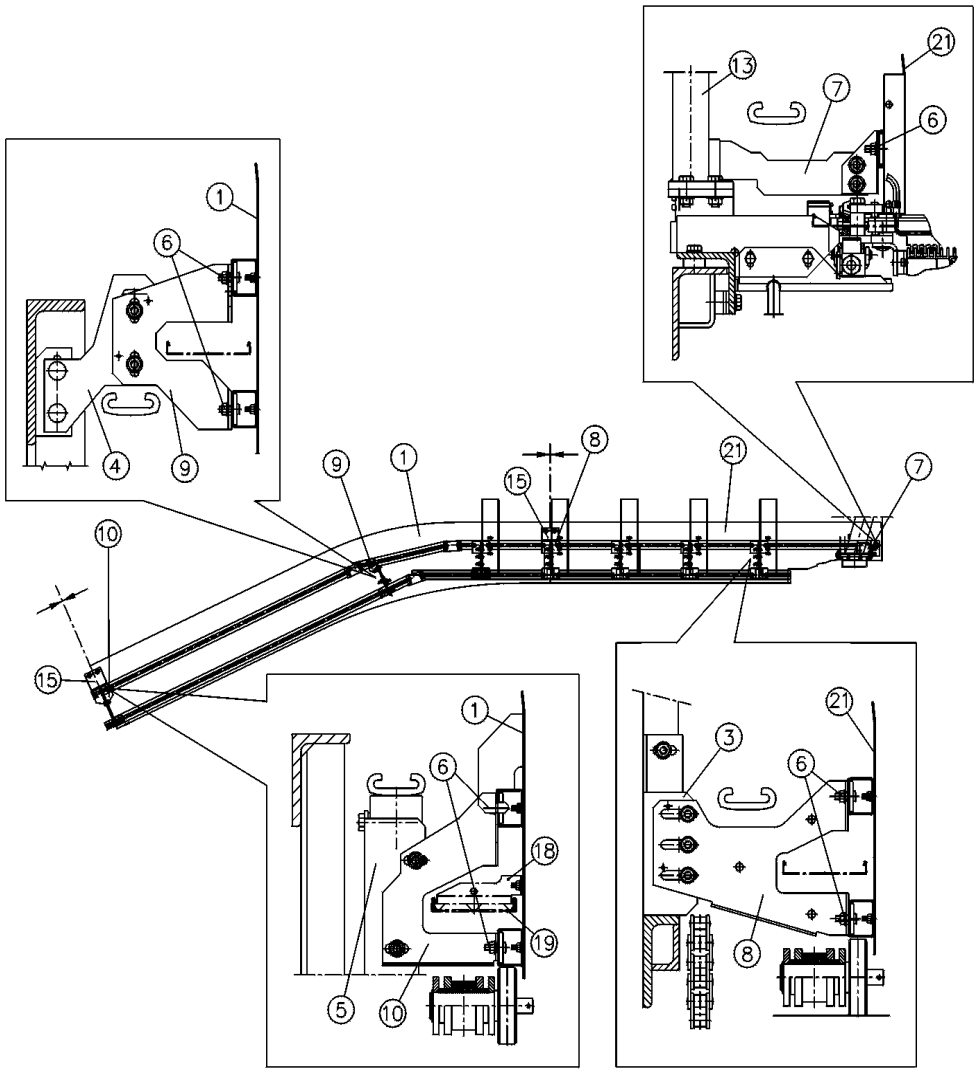
- Remove the inner cladding panels along the length of the skirt panels to be removed.

See Repair Instructions Q 409 702, Inner Cladding Disassembly

1.2 Disassembling the Skirt Panels

1.2.1 Curved Skirt Panel & Skirt Endpiece, Drive Station

Fig. 704-01



1) Curved skirt panel
3) Center support
4) Cantilever beam
5) Rib
6) Clamping screws
7)-10) Fastening angles
13) Reversing stand
15) Splice plate
18) Angle
19) Step chain cover
21) Skirt endpiece, top
→I← Skirt joint

- Removing the step chain cover (19) (see Fig. 704-01):
  - Remove the sealing tape at the joint of the step chain cover.
  - Detach the step chain cover (19) from the angles (18) and shift it aside.
- Remove the splice plate (15) at the skirt joint by unscrewing the nuts (14).

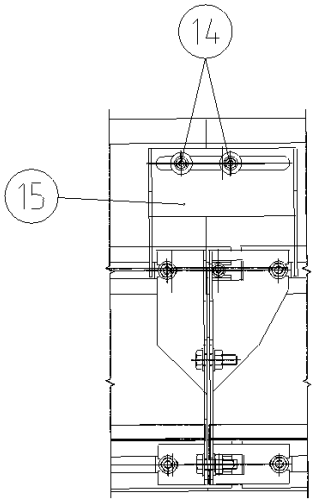


Fig. 704-02

- Remove the mounting bracket (20) by means of which the curved skirt panel is mounted to the gusset.

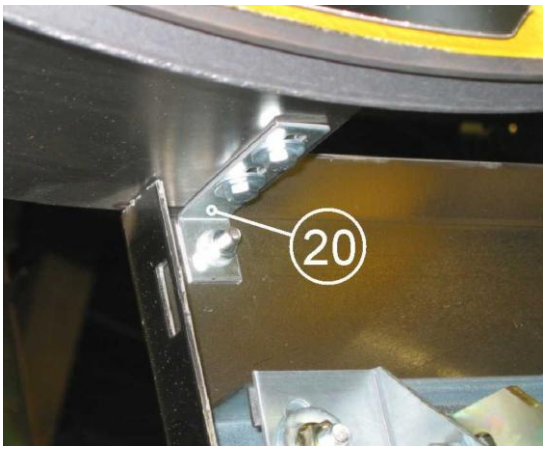


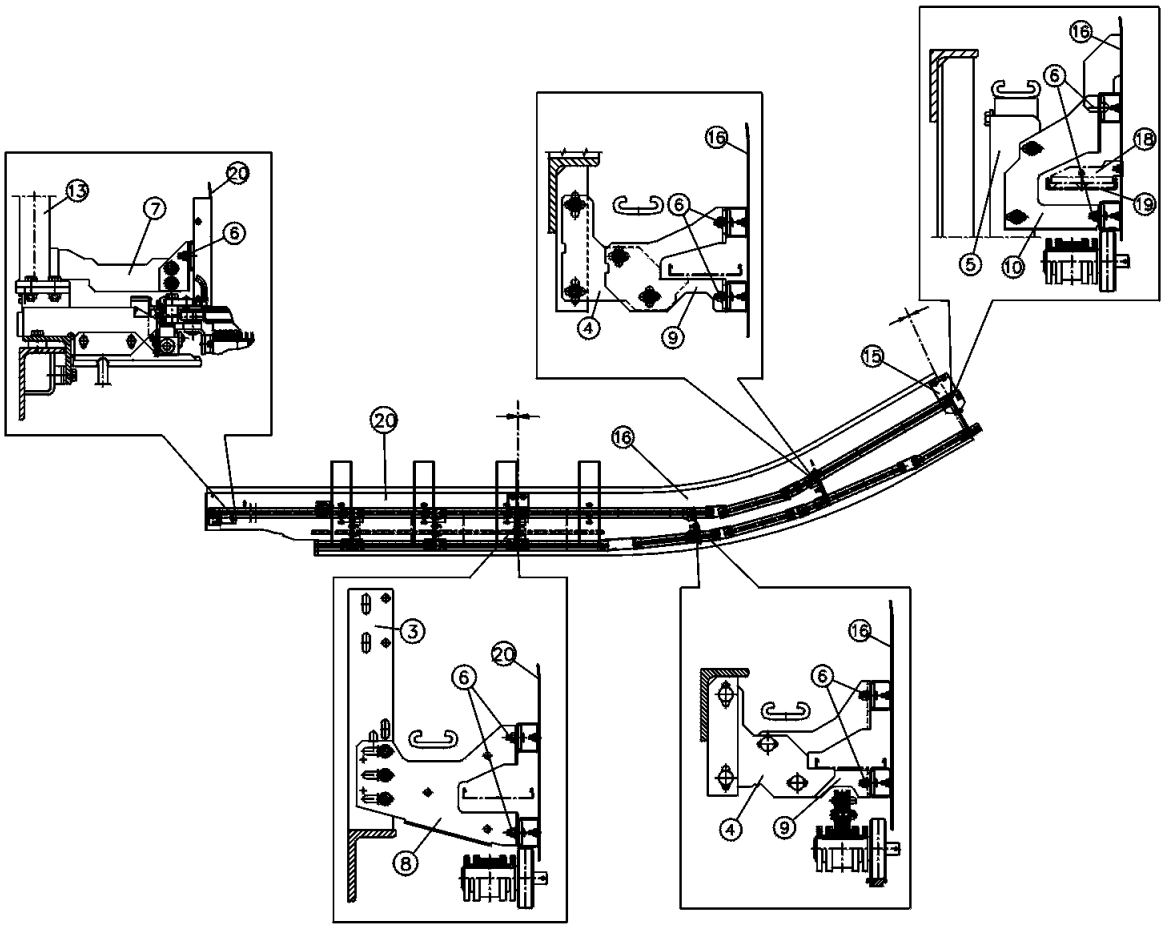
Fig. 704-03

- Loosen the nuts of the clamping screws (6) of the fastening angles (7)-(10) (see Fig. 704-01).
- Pull the clamping screws (6) out of the slots of the fastening angles (7)-(10) and retighten the clamping screws (6) manually at a distance of at least 10 mm from the fastening angles (7)-(10) (see Fig. 704-01).
- Vertically lift out the curved skirt panel (1) and put it aside.
- Shift the skirt endpiece (2) by approx. 50 mm towards the truss bend and lift it out vertically.
- Reinstallation is done analogously in the reverse order.

For the required setting checks, see Section 1.3

1.2.2 Curved Skirt Panel, Tension Station

Fig. 704-06



3) Center support
4) Cantilever beam
5) Rib
6) Clamping screws
7)-10) Fastening angles
13) Reversing stand
15) Splice plates
16) Curved skirt panel
18) Angle
19) Step chain cover
20) Skirt endpiece, bottom
→I← Skirt joint

- Remove the step chain cover (19) along the skirt panels to be removed.

See Section 1.2.1, Curved Skirt Panel & Skirt Endpiece, Drive Station

- Remove the splice plates (15) at the joint between the curved skirt panel and the first straight skirt panel as well as the joint between the first and the second straight skirt panel (see Fig. 704-02).
- Remove the mounting bracket (20) at the gusset (see Fig. 704-03).
- Loosen the nuts of the clamping screws (6) of the fastening angles (7)-(10).
- Pull the clamping screws (6) out of the slots of the fastening angles (7)-(10) and retighten the clamping screws (6) manually at a distance of at least 10 mm from the fastening angles (7)-(10).
- Vertically lift out the first skirt panel in the incline (17) and put it aside.

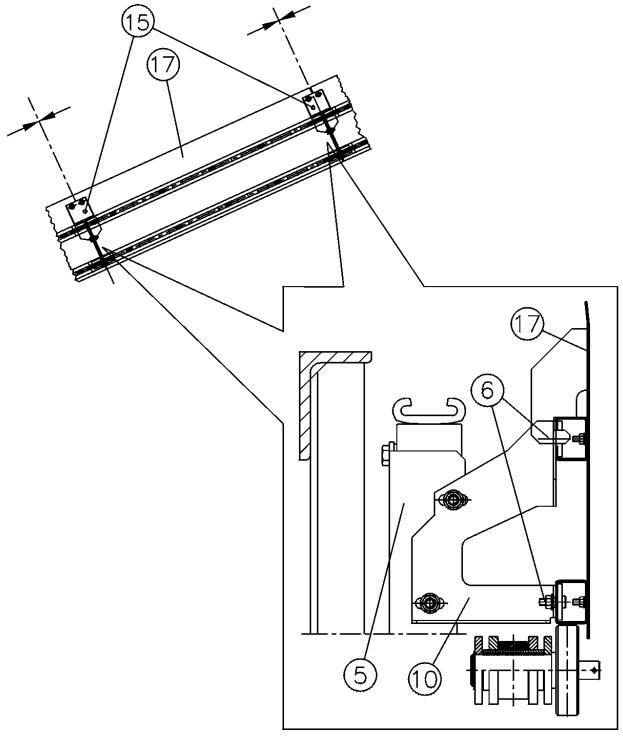
See Section 1.2.3, Skirt Panels in the Middle Section

- Shift the curved skirt panel (16) by approx. 50 mm towards the upper end and lift it out vertically.
- Reinstallation is done analogously in the reverse order.

For the required setting checks, see Section 1.3

1.2.3 Skirt Panels in the Middle Section

Fig. 704-08



5) Center support
6) Clamping screws
15) Splice plates
10) Fastening angle
17) Skirt panel in the incline
→I← Skirt joints

- Remove the step chain cover (19).

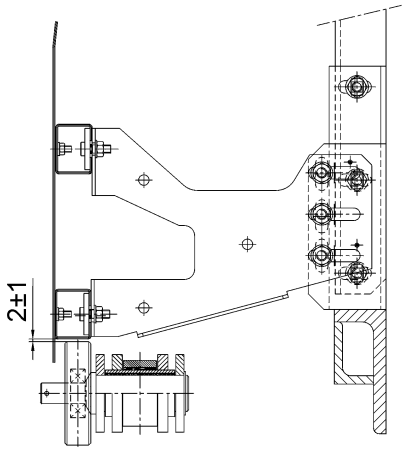
See Section 1.2.1, Curved Skirt Panel & Skirt Endpiece, Drive Station

- Remove the splice plates (15) at the skirt joints (see Fig. 704-02).
- Loosen the nuts of the clamping screws (6) of the fastening angle (10).
- Pull the clamping screws (6) out of the slots of the fastening angle (10) and retighten the clamping screws (6) manually at a distance of at least 10 mm from the fastening angle (10).
- Vertically lift out the skirt panel (17).
- Reinstallation is done analogously in the reverse order.

1.3 Checks

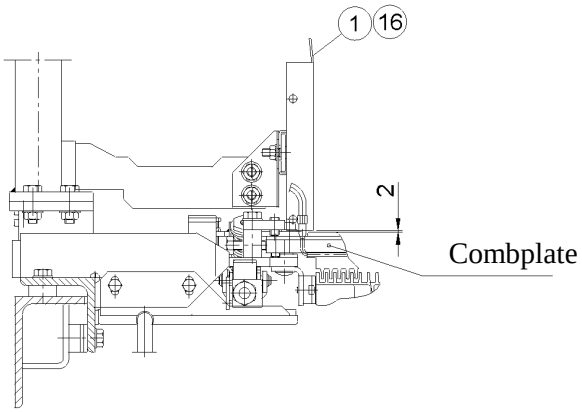
- Check whether the skirt joints are flush and even.
- Check whether the distance between the bottom C-profile and the chain roller measures $2^{\pm 1}$ mm

Fig. 704-09



- Check whether the distance between the bottom edge of the skirt panel and the rear edge of the combplate measures 2 mm.

Fig. 704-10



1.4 Reassembly

Reassemble the parts disassembled under Section 1.1 analogously in the reverse order.

2 Repair of the Skirt Surface

The skirt panels are provided with a black antifriction coating, which is applied by powder-coating.
It is possible to repair minor surface damages on site by means of a special antifriction spray:
IGP-REPLACK Spray (No. PES8005B 91390 A00 SPR).

Hints!

- Please note, that there is no 100% color equality.
- We recommend to disassemble the skirt panels to be repaired before applying the antifriction coating.
- For application, use and processing of the repair spray, observe the instructions of the spray supplier.

15.2 Diverter Sprocket – Bearing Replacement – Q 409 577

1 Preparation Work

- Remove all floor covers at the tension station.

See Maintenance Instructions Q 409 457, Floor Covers

- Remove the guard plate at the tension station.

See Maintenance Instructions Q 409 487, Guard Plates

- Disassemble the 3 maintenance steps as well as one additional step each before and after the maintenance steps.

See Maintenance Instructions Q 409 461, Steps, Step Disassembly, Guide Pads, Step Rollers, Bushings

- Disassemble the divided axles of the maintenance steps.

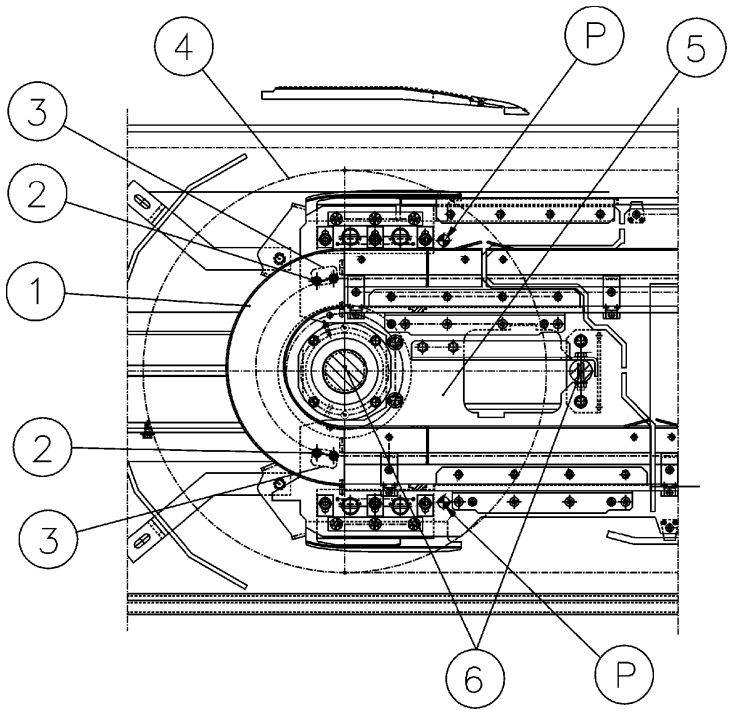
See Repair Instructions Q 409 692, Step Chain Rollers

- Turn off and padlock the main switch.
- Engage the step chain locking device.

See Maintenance Instructions Q 409 926, Step Chain Locking Device

- Disassembling the step roller turn-around (1) (see Fig. 577-01):
  - Unscrew the flat-head screws (2) from the threaded plate (3).
  - Remove the step roller turn-around (1).

Fig. 577-01



1) Step roller turn-around
2) Flat-head screws
3) Threaded plates
5) Side plate
6) Tension carriage
P) Hole for fastening screw (8)

- Disassemble the inner and outer front plates at the tension station.

See Repair Instructions Q 409 616, Handrail

- Disassemble the handrail entry contacts at the tension station.

See Repair Instructions Q 409 616, Handrail

- Remove the inner cladding panels from the endpiece to the curved inner cladding panel at the tension station.

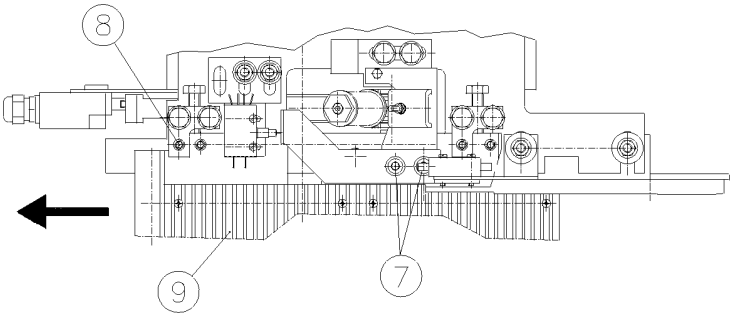
See Repair Instructions Q 409 702, Inner Cladding Disassembly

- Remove the skirt panel endpiece at the tension station.

See Repair Instructions Q 409 704, Skirt Panel Disassembly

- Removing the combplate (see Fig. 577-02):
  - Remove the screws (7).
  - Loosen the pin (8).
  - Pull the combplate (9) off backward.

Fig. 577-02



7) Screws
8) Pin
9) Combplate

- Completely release the tension of the step chain and push the tension carriage back.

See Maintenance Instructions Q 409 602, Step Chain Tensioning Device, Chain Tension Contacts

- Opening the step chain:

Hint!

The step chain must be opened in the advance track just before the diverter shaft.

- Remove the circlip (10).

Fig. 577-03

- Drive the chain pin (11) out toward the middle of the escalator.

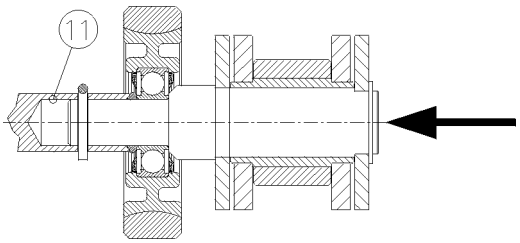


Fig. 577-04

Hint!

Do not strike the chain pin directly with a hammer.

2 Disassembling the Diverter Shaft

- Disassembling the support plate (12):
  - Remove the M10 x 20 hex head cap screws.
  - Push the support plate towards the drive station and remove it.

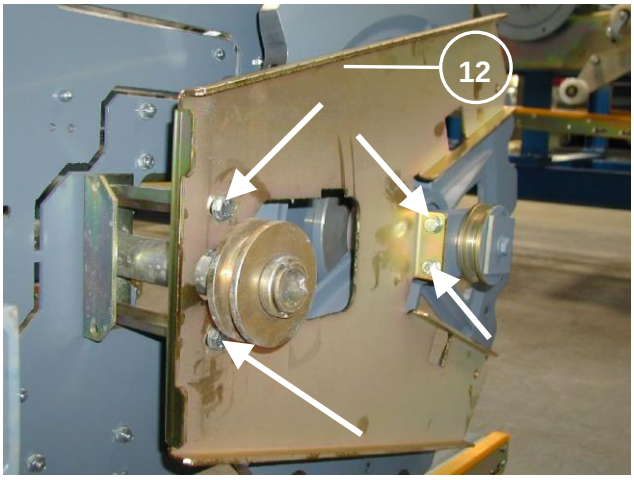


Fig. 577-05

- Secure the diverter shaft with a round sling.

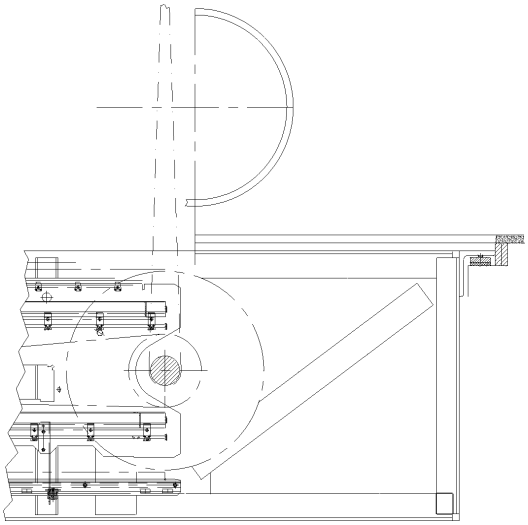


Fig. 577-06

- Remove the M12 x 25 hex head cap screws.

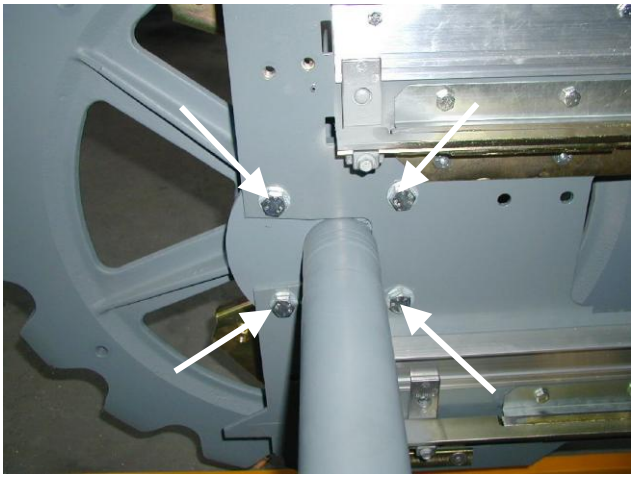


Fig. 577-07

- Move the diverter shaft from the tension station track block towards the support and remove it.

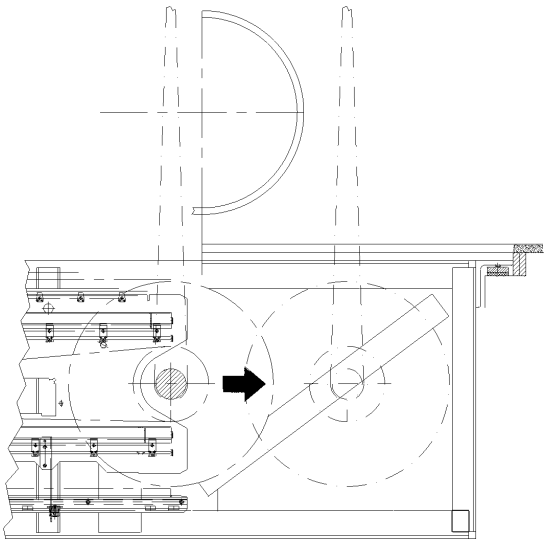


Fig. 577-08

- Remove the M12 x 30 hex head cap screw.

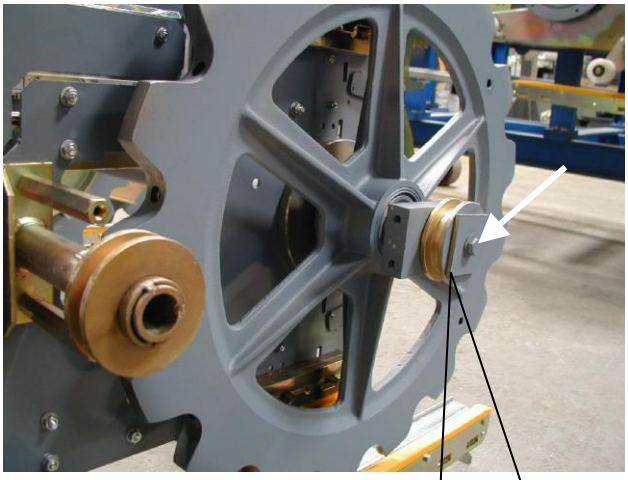
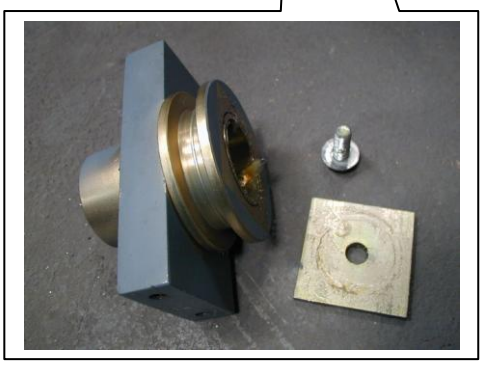


Fig. 577-09

- Remove the sleeve incl. connecting block, guide roller, and washer.



3 Replacing the Bearings

- Remove the diverter sprocket with the bearings (11, 12) and the spacer ring (9).

9) Spacer ring
10) Flange
11), 12) Bearings

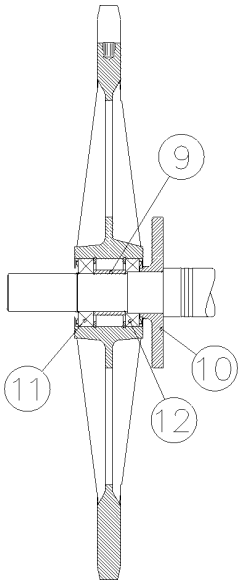


Fig. 577-10

- Reassemble the diverter sprocket with the new bearings (11, 12) and the spacer ring (9).

9) Spacer ring
10) Flange
11), 12) Bearings

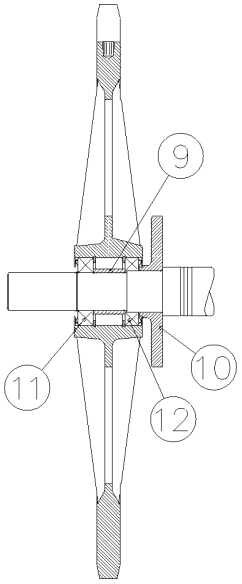


Fig. 577-11

4 Reassembly

- Reassemble the diverter shaft analogously in the reverse order as described under Section 2.
- Reassemble the parts disassembled under Section 1 analogously in the reverse order.

15.3 Replacement of Tangential Tracks & Relieving Curves – Q 409 691

1 Tangential Tracks

1.1 Preparation Work

- Remove all floor covers at the tension station.

See Maintenance Instructions Q 409 457, Floor Covers

- Remove the guard plate at the tension station.

See Maintenance Instructions Q 409 487, Guard Plates

- Disassemble the 3 maintenance steps.

See Maintenance Instructions Q 409 461, Steps, Step Disassembly, Guide Pads, Step Rollers, Bushings

- To replace the tangential tracks at the drive station, remove the floor covers and the guard plate at the drive station.

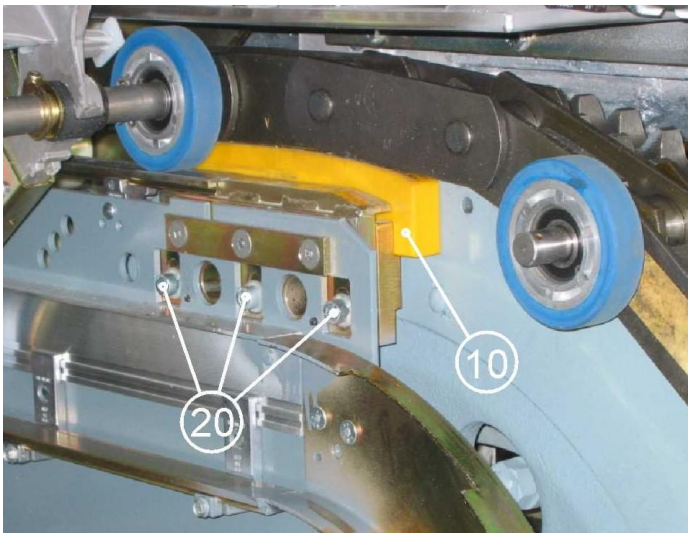
See Maintenance Instructions Q 409 457, Floor Covers, and Q 409 487, Guard Plates

- Use the maintenance operating panel to run the gap in the step band to the drive or tension station so that the tangential tracks to be replaced are readily accessible from the escalator pit.
- Turn off and padlock the main switch.
- Engage the step chain locking device.

See Maintenance Instructions Q 409 926, Step Chain Locking Device

1.2 Replacing the Tangential Tracks

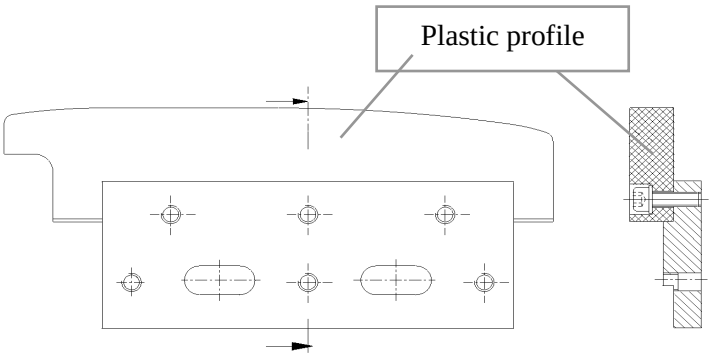
Fig. 691-01



10) Tangential track
20) Clamping screws

- Remove the clamping screws (20) (see Fig. 691-01).
- Pull out the tangential track (10) between the sprocket of the step chain and the step turn-around.
- Replace the plastic profile of the tangential track (see Fig. 691-02).

Fig. 691-02



- Reinstall the tangential track (10) analogously in the reverse order.
- Readjust the tangential tracks (10) by means of the eccentrics.

See Maintenance Instructions Q 409 619, Tracks – Tangential Tracks, Relieving Curves

1.3 Checks

- Check the setting of the tangential tracks.

See Maintenance Instructions Q 409 619, Tracks – Tangential Tracks, Relieving Curves

1.4 Reassembly

Reassemble the parts disassembled under Section 1.1 analogously in the reverse order.

2 Relieving Curve, Drive Station/Top – Wearing Band

2.1 Preparation Work

- Remove all floor covers at the tension station.

See Maintenance Instructions Q 409 457, Floor Covers

- Remove the guard plate at the tension station.

See Maintenance Instructions Q 409 487, Guard Plates

- Disassemble the 3 maintenance steps.

See Maintenance Instructions Q 409 461, Steps, Step Disassembly, Guide Pads, Step Rollers, Bushings

- Remove the inner cladding panels along the length of the upper relieving curve at the drive station.

See Repair Instructions Q 409 702, Inner Cladding Disassembly

- Use the maintenance operating panel to run the gap in the step band to the drive station so that the upper relieving curve at the drive station is readily accessible.
- Completely release the tension of the step chain.

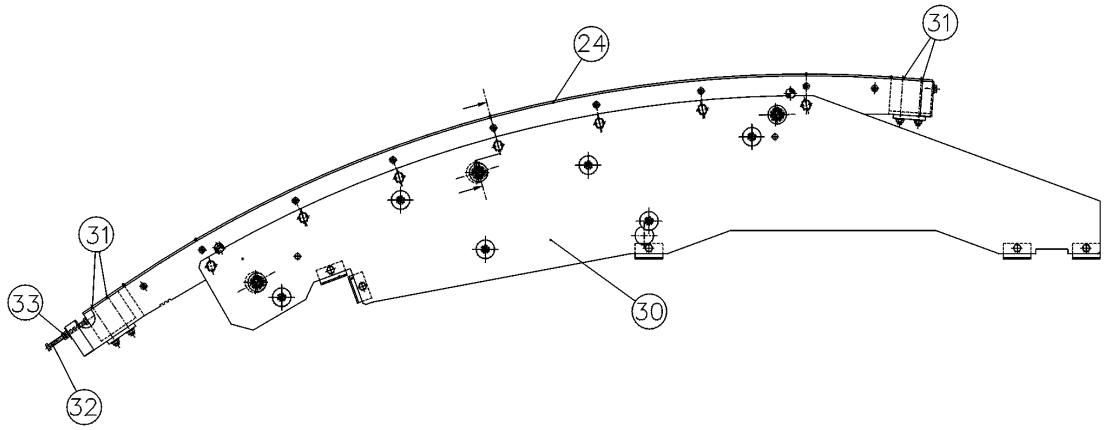
See Maintenance Instructions Q 409 602, Step Chain Tensioning Device, Chain Tension Contacts

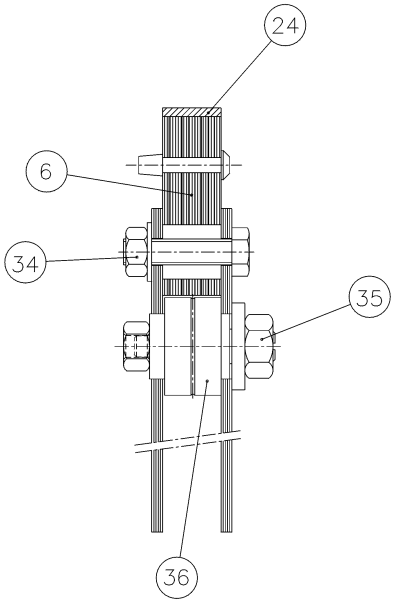
- Turn off and padlock the main switch.
- Engage the step chain locking device.

See Maintenance Instructions Q 409 926, Step Chain Locking Device

2.2 Replacing the Wearing Band

Fig. 691-03





6) Relieving curve, drive station/top
24) Wearing band
30) Mounting plate
31) Fastening screws
32) Tensioning screw
33) Nut of the tensioning screw
34) Nut of the clamping screw
35) Clamping screw of the eccentric
36) Eccentric

- Loosen the nuts (34) of the clamping screws.

Hint!

The heads of the clamping screws are welded to the base plate of the relieving curve.

- Loosen the clamping nuts (35) of the eccentrics (36).
- Turn the eccentrics (36) to lower the relieving curve (6).
- Release the tension of the wearing band (24) by means of the tensioning screw (32).
- Remove the fastening screws (31) of the wearing band (24).
- Pull out the wearing band (24) (if necessary, move the step chain carefully to pull out the wearing band).
- Install the new wearing band (24) analogously in the reverse order.
- Readjust the upper relieving curve at the drive station by means of the eccentrics (36).

2.3 Checks

- Check the setting of the upper relieving curve at the drive station.

See Maintenance Instructions Q 409 619, Tracks – Tangential Tracks, Relieving Curves

2.4 Reassembly

Reassemble the parts disassembled under Section 2.1 analogously in the reverse order.

3 Relieving Curve, Drive Station/Bottom

3.1 Preparation Work

- Remove all floor covers at the tension station.

See Maintenance Instructions Q 409 457, Floor Covers

- Remove the guard plate at the tension station.

See Maintenance Instructions Q 409 487, Guard Plates

- Disassemble the 3 maintenance steps.

See Maintenance Instructions Q 409 461, Steps, Step Disassembly, Guide Pads, Step Rollers, Bushings

- Disassemble two step axles.

See Repair Instructions Q 409 692, Step Chain Rollers

- Use the maintenance operating panel to run the gap in the step band to the drive station. Mark the steps located along the length of the lower relieving curve at the drive station. Disassemble them as well so that the gap reaches down to the bottom of the truss and the relieving curve is readily accessible.
- Completely release the tension of the step chain.

See Maintenance Instructions Q 409 602, Step Chain Tensioning Device, Chain Tension Contacts

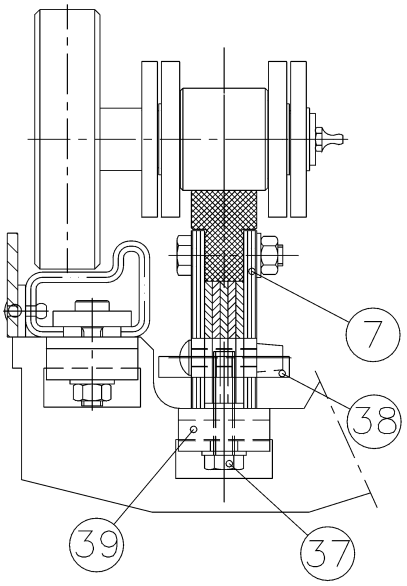
- Turn off and padlock the main switch.

- Engage the step chain locking device.

See Maintenance Instructions Q 409 926, Step Chain Locking Device

3.2 Replacing the Relieving Curve, Drive Station/Bottom

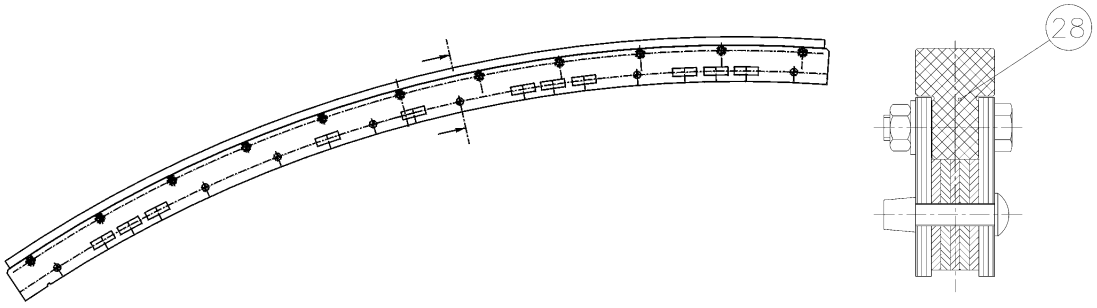
Fig. 691-04



7) Relieving curve, drive station/bottom
37) Fastening screw
38) Threaded plate
39) Clamping plate

- Unscrew the fastening screw with the locking washer (37) and remove the threaded plate (38) and the clamping plate (39) (see Fig. 691-04).
- Lift the chain and pull out the relieving curve (7).

Fig. 691-05



- Replace the plastic profile (28) (see Fig. 691-05).
- Reinstall the relieving curve (7) analogously in the reverse order.

3.3 Checks

- Check the setting of the lower relieving curve at the drive station.

See Maintenance Instructions Q 409 619, Tracks – Tangential Tracks, Relieving Curves

3.4 Reassembly

Reassemble the parts disassembled under Section 3.1 analogously in the reverse order.

16 Repair of Step Band

16.1 Step Guide Pads – Q 409 505

Hints!

- Replacing guide pads is significantly easier with disassembled steps. This necessitates disassembly and reassembly of the steps as well as readjusting them laterally.
- Since replacing **all** guide pads involves a lot of work, we recommend to perform this task in the course of major repair work, if possible (e.g., when replacing the step chains).

1 Preparation Work

- Remove all floor covers at the tension station.

See Maintenance Instructions Q 409 457, Floor Covers

- Remove the guard plate at the tension station.

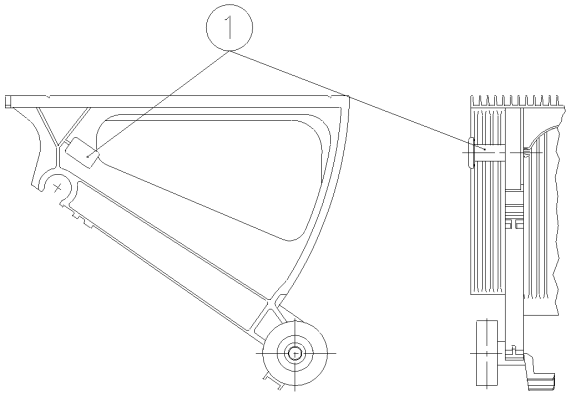
See Maintenance Instructions Q 409 487, Guard Plates

2 Replacing Guide Pads

- Remove the step.

See Maintenance Instructions Q 409 461, Steps, Step Disassembly, Guide Pads, Step Rollers, Bushings

Fig. 505-01



1) Guide pad

- Disassemble the worn guide pad (1):
  - Squeeze the snap-in connection, at the same time pushing it outward (only recommended for the replacement of individual guide pads);

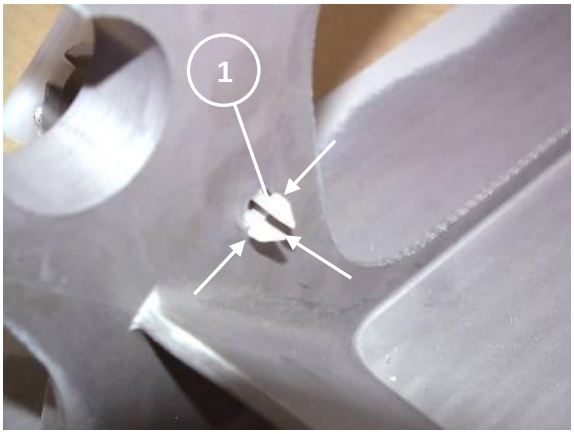


Fig. 505-02

- Insert a new guide pad (1) and lightly tap it (with a mallet) into position (the mushroom head of the guide pad (1) must abut the mounting).

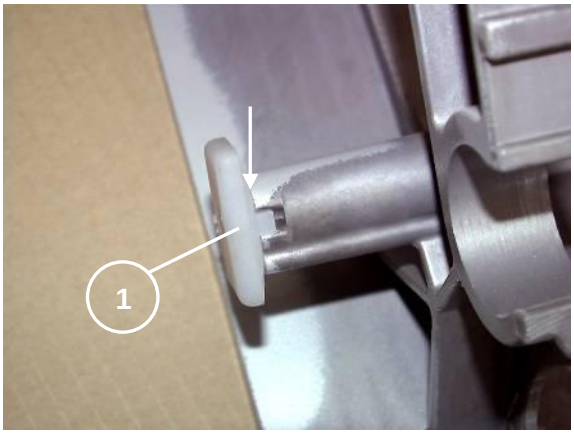


Fig. 505-03

- Reassemble the step and adjust it.

For how to reassemble the step, see Maintenance Instructions Q 409 461, Steps, Step Disassembly, Guide Pads, Step Rollers, Bushings

3 Checks, Lubrication

- Check the setting of the step (alignment).
- Check the step entry into the guide rollers.

Hint!

This check is only required when having disassembled all steps.

- Check whether the combplate is centered (lateral setting).

Hint!

This check is only required when having disassembled all steps.

- Lubrication:

For manual lubrication, see Maintenance Instructions Q 409 455, Skirt Panels

For guide pad lubrication, see Maintenance Instructions Q 409 598, Guide Pad Lubrication (Lubrication Step)

4 Reassembly

Reassemble the parts disassembled under Section 1 analogously in the reverse order.

16.2 Step Rollers – Q 409 506

Hint!

Rollers can be fastened to the full tightening torque up to two times with the same step roller pin. Afterwards the entire step must be replaced.

1 Preparation Work

- Remove all floor covers at the tension station.

See Maintenance Instructions Q 409 457, Floor Covers

- Remove the guard plate at the tension station.

See Maintenance Instructions Q 409 487, Guard Plates

2 Replacing Step Rollers

- Disassemble the step(s).

See Maintenance Instructions Q 409 461, Steps, Step Disassembly, Guide Pads, Step Rollers, Bushings

- Remove the oval-head countersunk tapping screw (1) and the washer (2).

  Tightening torque of the screw: 15-20 Nm

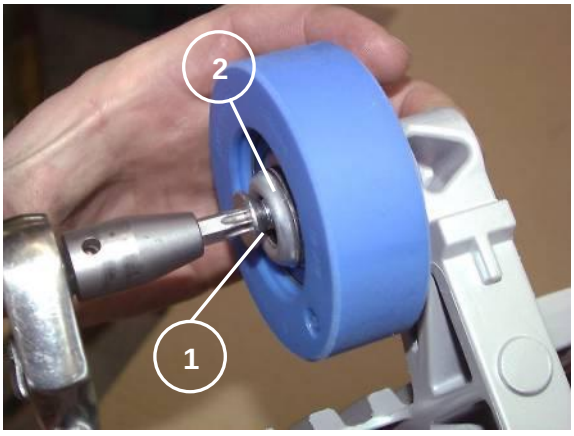


Fig. 506-01

- Pull off the defective step roller (3).

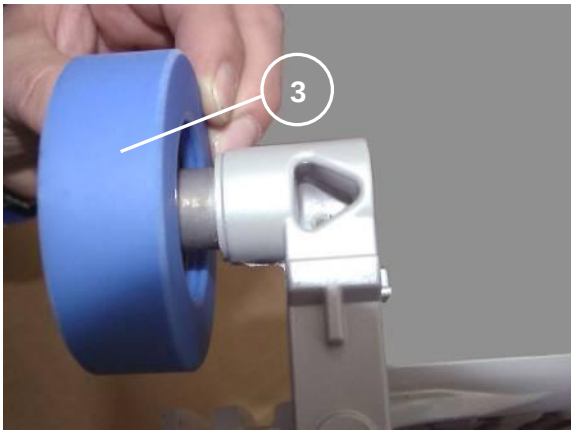


Fig. 506-02

- Reassembly is done analogously in the reverse order.
- Reassemble the step(s).

See Maintenance Instructions Q 409 461, Steps, Step Disassembly, Guide Pads, Step Rollers, Bushings

3 Checks

- Check the setting of the step (alignment).

4 Reassembly

Reassemble the parts disassembled under Section 1 analogously in the reverse order.

16.3 Step Hooks – Q 409 508

Hint!

Only the additionally mounted steel hooks can be replaced. In case of broken die-cast aluminum step hook, the entire step must be replaced.

1 Preparation Work

- Remove all floor covers at the tension station.

See Maintenance Instructions Q 409 457, Floor Covers

- Remove the guard plate at the tension station.

See Maintenance Instructions Q 409 487, Guard Plates

2 Replacing Step Hooks

- Disassemble the defective step(s).

See Maintenance Instructions Q 409 461, Steps, Step Disassembly, Guide Pads, Step Rollers, Bushings

- Remove the self-locking nut (1), the washer (2) and the defective hook (3).

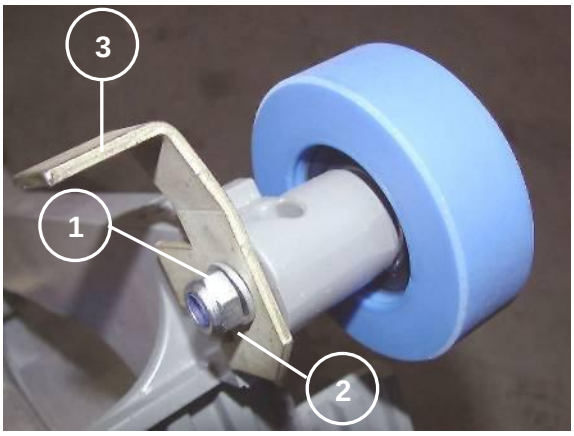


Fig. 508-01

- Align the replacement step hook (3) with the positioning stop and fasten it with the mounting screw (4), washer (5) and (2) and self-locking nut (1).

  Use a new self-locking nut (1)!

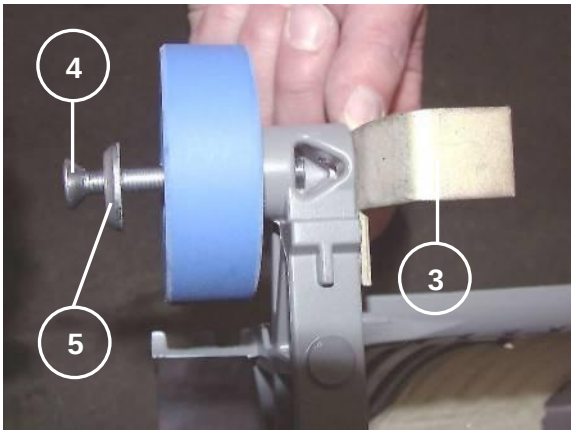


Fig. 508-02

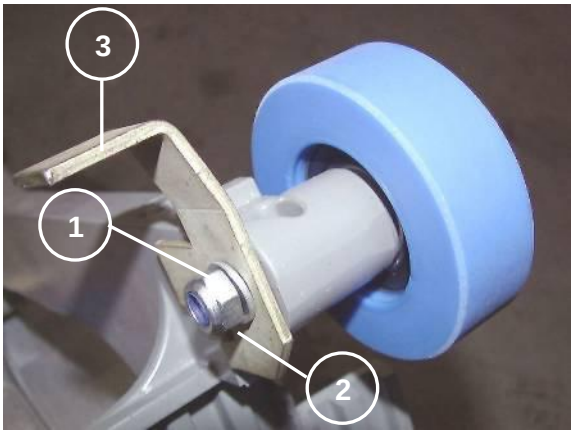


Fig. 508-03

- Reassemble the step(s).

See Maintenance Instructions Q 409 461, Steps, Step Disassembly, Guide Pads, Step Rollers, Bushings

3 Checks

- Check the setting of the step(s) (alignment).
- Check for an unimpeded, smooth run (the step hook must not bump against other parts).

4 Reassembly

Reassemble the parts disassembled under Section 1 analogously in the reverse order.

16.4 Step Chain Rollers – Q 409 692

1 Preparation Work

- Remove all floor covers at the tension station.

See Maintenance Instructions Q 409 457, Floor Covers

- Remove the guard plate at the tension station.

See Maintenance Instructions Q 409 487, Guard Plates

- Turn off and padlock the main switch.
- Engage the step chain locking device.

See Maintenance Instructions Q 409 926, Step Chain Locking Device

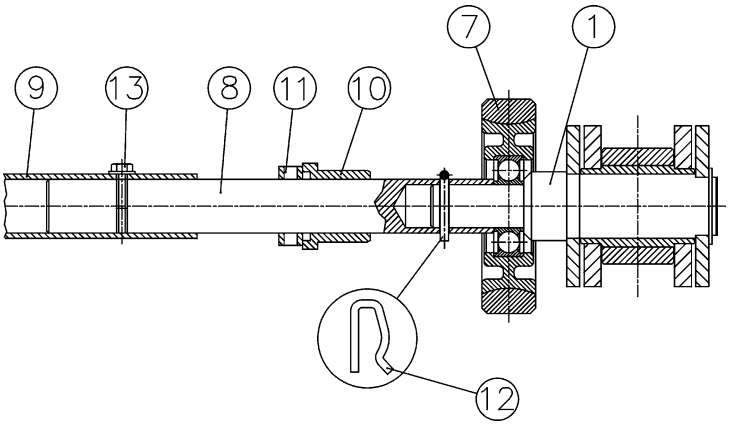
2 Replacing Step Chain Rollers

- Disassemble the step on the axle with the defective step chain roller.

See Maintenance Instructions Q 409 461, Steps, Step Disassembly, Guide Pads, Step Rollers, Bushings

- Disassemble the divided axle.

Fig. 692-01



1) Chain pin
7) Step chain roller
8) Step axle
9) Connecting pipe
10) Step bushing
11) Strap
12) Spring clip
13) Screw with locking washer

- Remove the spring clip (12), remove the hex head cap screw (13) and the locking washer, and disassemble the step axle (8) and the connecting pipe (9).
- Pull the step chain roller (7) off the chain pin (1) by means of a pull-off device.
- Clean the chain pin (1).
- Install a new step chain roller.

Hint!
Before installation, treat the contact surface with an anti-corrosive agent (Hatec slip and mounting paste).

- Reassemble the divided axle.
- Reassemble the step.

See Maintenance Instructions Q 409 461, Steps, Step Disassembly, Guide Pads, Step Rollers, Bushings

3 Checks

- Check the setting of the step (alignment).

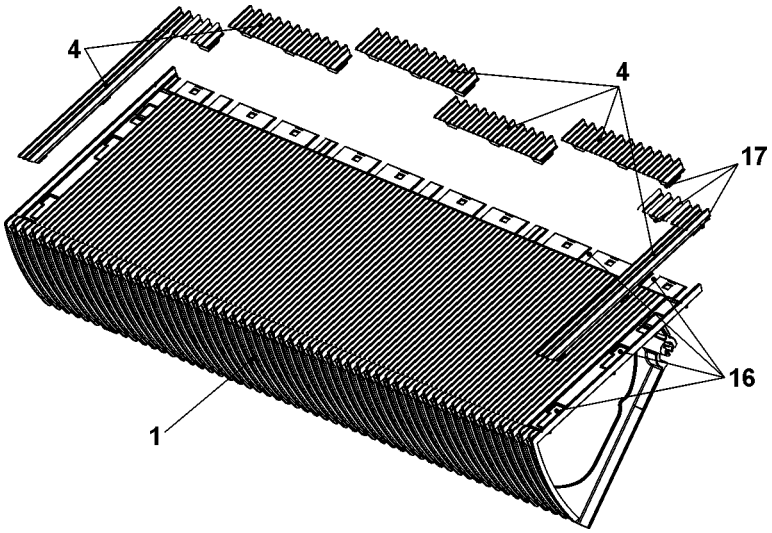
See Maintenance Instructions Q 409 461, Steps, Step Disassembly, Guide Pads, Step Rollers, Bushings

4 Reassembly

Reassemble the parts disassembled under Section 1 analogously in the reverse order.

16.5 Replacement of Yellow Plastic Step Edges – Q 409 891

Fig. 891-01



1) Step
4) Plastic edges
16) Recesses
17) Catches

Illustration without step roller and guide pad

1 Characteristics of Yellow Plastic Edges

Hint!

Take care that no benzene or oil-dissolving agents get in contact with the plastic inserts, since they would damage them in the area of the fastening screws within a relatively short time. The material would break prematurely.

Characteristics of defective plastic:

- light-yellow discoloration
- cracks
- brittleness

See also Cleaning Instructions Q 409 193

2 Replacing the Plastic Edges

Warning: Damage to the step!

When removing the catches (17), hold the chisel (18) so as not to damage the aluminum step (see Fig. 891-02).

- Remove the catches (17) of the plastic inserts with a chisel (18).

  Proceed with the lateral inserts analogously!

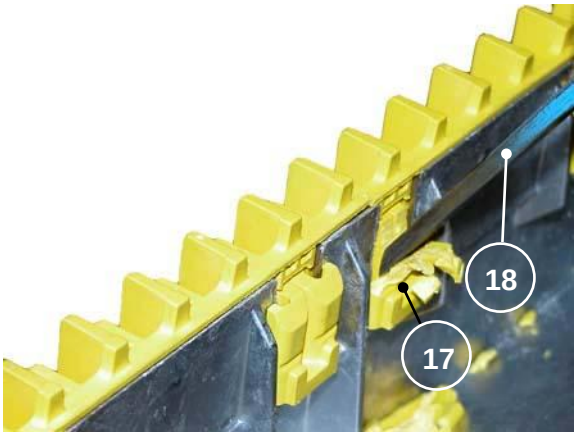


Fig. 891-02

- Remove the old plastic edges (4).
- Clean the support surfaces on the step.

Warning: Damage to the step inserts!

In order not to damage the new step inserts (4), it is absolutely necessary to place a piece of wood on the new inserts when tapping them in (see Fig. 891-03).

- Position the new plastic inserts (4) and use a piece of wood (19) to carefully tap them in up to the stops!

  Proceed with the lateral inserts analogously!

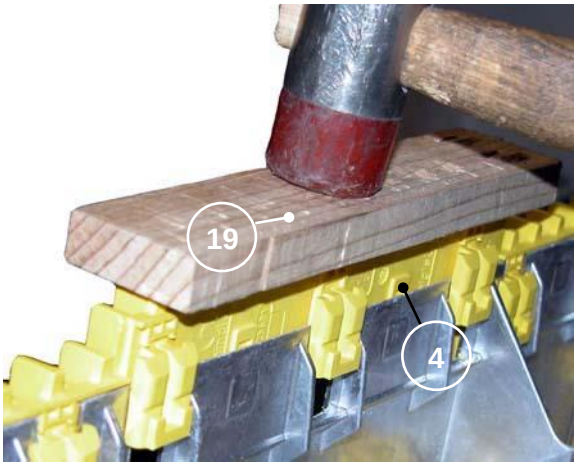


Fig. 891-03

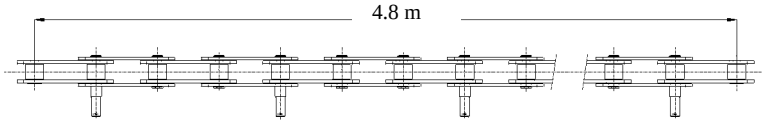
16.6 Complete Replacement of Step Chains – Q 409 700

1 General

1.1 Condition of the Step Chains at Time of Supply

- Rolled chain strands on a standard-size pallet, shrink-wrapped.
- The step chains are divided in:
  - Standard strands, each with 35 links plus a loose master link (= total length: 4.8 m) (see Fig. 700-01)

Fig. 700-01

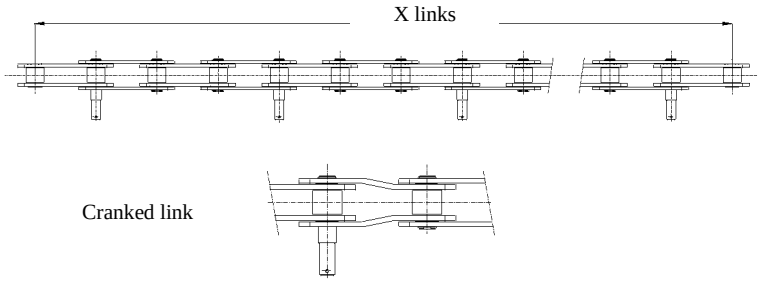


  - 2 additional strands, each with X links plus a loose master link (see Fig. 700-02)

Hint!

Cranked chain link only with uneven number of steps.

Fig. 700-02



- A loose master link consists of
  - four Seeger circlip rings (21),
  - two link plates (22) and
  - two pins (23).

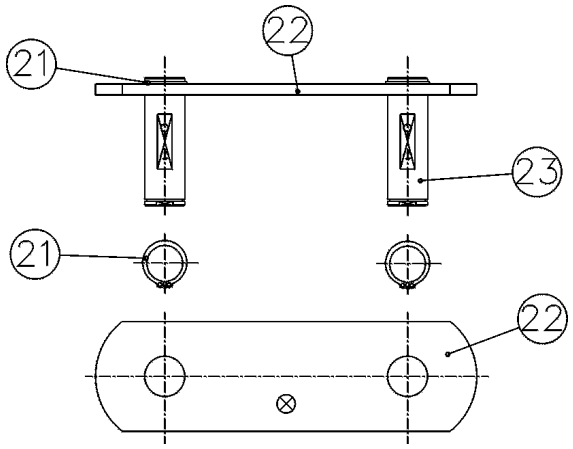


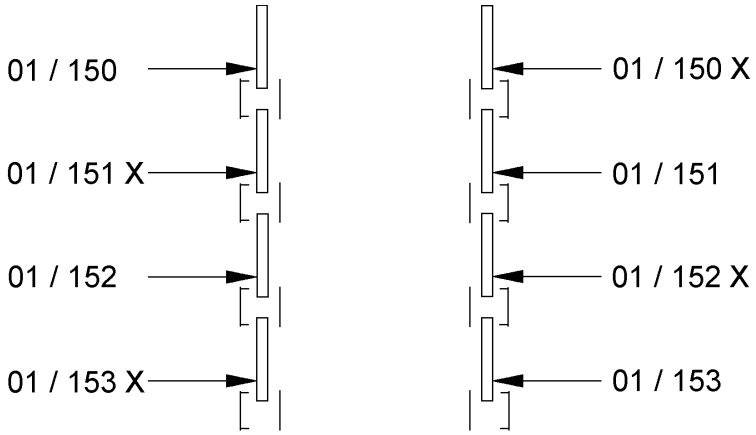
Fig. 700-03

- Identification of the chain strands:
  - The strand number (e.g., 01/150) is written on one of the link plates at one end of each strand.
  - Strands come in pairs. Paired strands have the same strand number. The two strands of a pair differ in length by a max. of 0.2 mm.
  - In addition to the strand number, the longer strand of a pair is identified by an "X" (e.g., 01/150X).

1.2 Installation Sequence of the Strand Pairs

- One strand each with the same strand number must be installed on the left and on the right side.
- To compensate for the minimal length tolerances, the strands identified by an "X" must be alternately installed on the left and on the right side (see Fig. 700-04).

Fig. 700-04



2 Scope of Work

2.1 Preparation Work

- Remove all floor covers at the tension station.

See Maintenance Instructions Q 409 457, Floor Covers

- Remove the guard plate at the tension station.

See Maintenance Instructions Q 409 487, Guard Plates

- Remove the countertrack.
- Disassemble all steps.

See Maintenance Instructions Q 409 461, Steps, Step Disassembly, Guide Pads, Step Rollers, Bushings

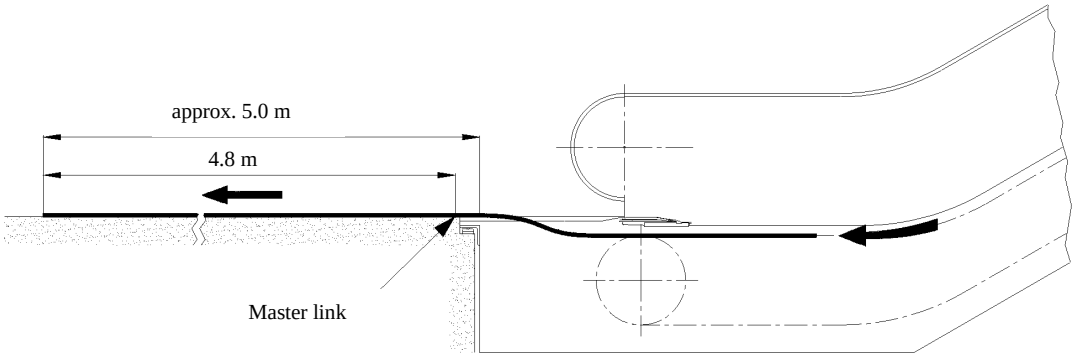
2.2 Replacing Step Chains

- Completely release the tension of the step chain and push the tension carriage back.

See Maintenance Instructions Q 409 602, Step Chain Tensioning Device, Chain Tension Contacts

- Open the master link in the area of the 3 maintenance steps.
- Use the maintenance operating panel to carefully run the step chain band in the downward direction until approx. 5 m of the chain are outside the escalator (see Fig. 700-05).

Fig. 700-05



- Remove the master link at the end of the chain strand (4.8 m).

- Remove the clamping springs (12) on one side.

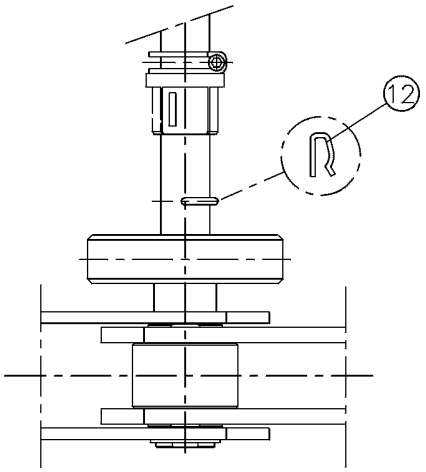


Fig. 700-06

- Tap the step chain (6) out of the step axles (8).

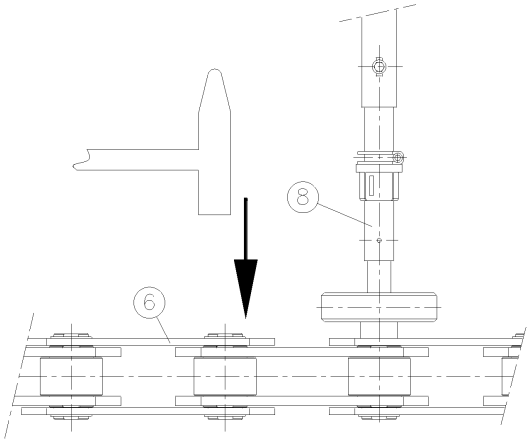


Fig. 700-07

- Remove the clamping springs (12) on the other side.

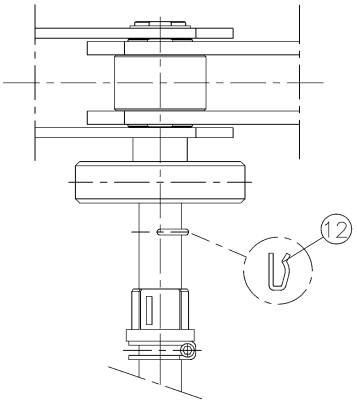


Fig. 700-08

- Pull the step axles (8) off the chain pins (1).

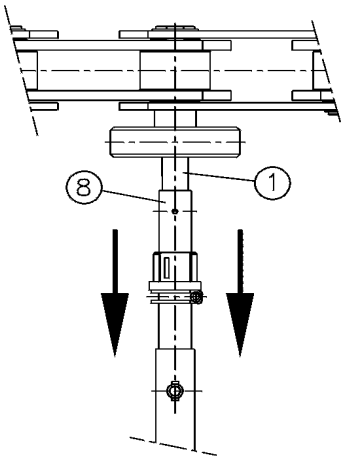


Fig. 700-09

- If you want to reuse the step chain rollers (7), pull them off the chain pin (1) by means of a pull-off device.

- Disassemble the removed step axles if you want to reuse the following parts:
  - Clamping springs (12)
  - Connecting pipes (9)
  - Bushings (10)
  - Straps (11)
  - Hex head cap screws with locking washers (13)
  - Axles (8)

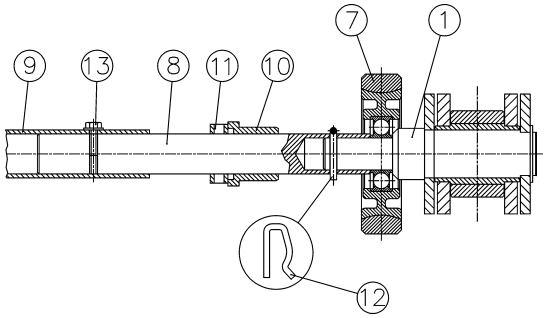


Fig. 700-10

  - O-rings (16)
  - V-sealing rings (17)

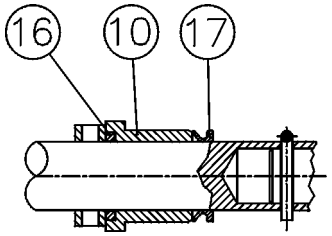


Fig. 700-11

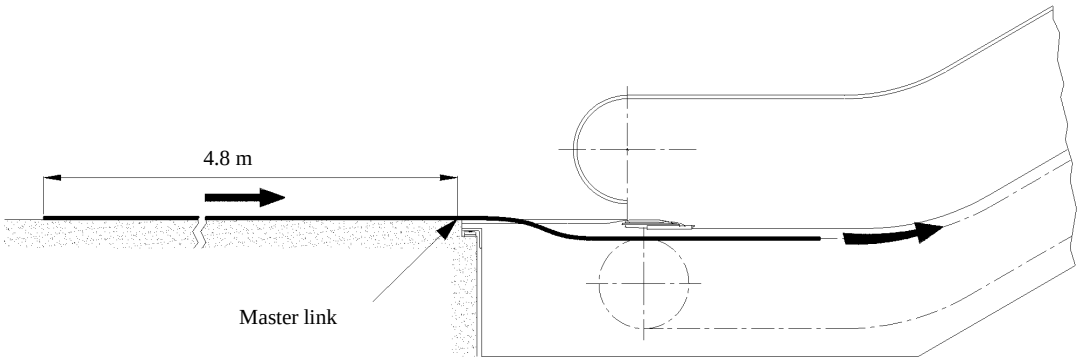
- Assemble a new strand pair analogously in the reverse order as described for Fig. 700-06 to Fig. 700-09.

Hints!

- Check whether the two chain strands have the same strand number.
- Pay attention to the position of the straps:
  All strap bolts must point in the same direction as the strap bolts still mounted in the remainder of the old step chain.

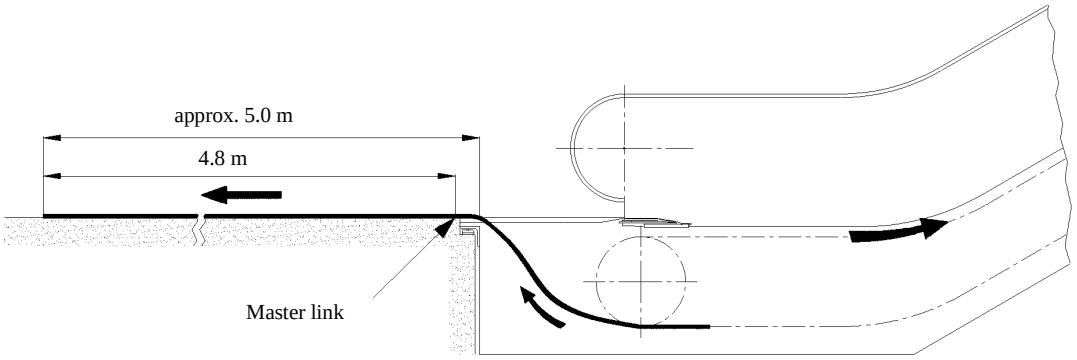
- Attach the new chain strand by means of a master link to the old step chain. Use the maintenance operating panel to run the unit in the upward direction until the new chain strand is completely inserted in the track (see Fig. 700-12).

Fig. 700-12



- Continue to run the unit in the upward direction until approx. 5 m of the old step chain are outside the return track (see Fig. 700-13).

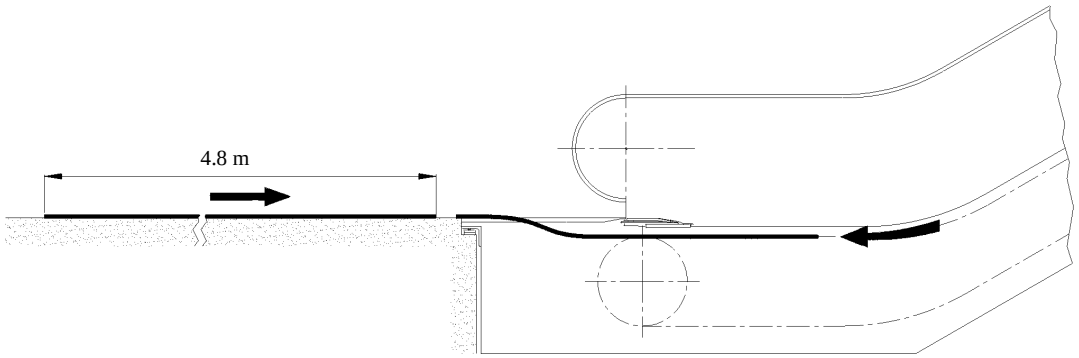
Fig. 700-13



- Remove the master link at the end of the chain strand (4.8 m).
- Disassemble the removed strand pair (see Fig. 700-10 and Fig. 700-11).
- Assemble a new strand pair analogously in the reverse order as described for Fig. 700-06 to Fig. 700-09.

- Run the unit in the downward direction until the previously installed new chain strand is again outside the escalator, and attach the new chain strand by means of a master link (see Fig. 700-14).

Fig. 700-14



- Run the unit in the upward direction until the new chain strand is completely inserted in the track. Continue to run the unit in the upward direction until approx. 5 m of the old step chain are outside the return track (see Fig. 700-13).
- Remove the master link at the end of the chain strand (4.8 m).
- Disassemble the removed strand pair (see Fig. 700-10 and Fig. 700-11).
- Assemble a new strand pair analogously in the reverse order as described for Fig. 700-06 to Fig. 700-09.
- Run the unit in the downward direction until the previously installed new chain strand is again outside the escalator, and attach the new chain strand by means of a master link (see Fig. 700-14).
- Run the unit in the upward direction until the new chain strand is completely inserted in the track. Continue to run the unit in the upward direction until approx. 5 m of the old step chain are outside the return track (see Fig. 700-13).
- Repeat these steps until all new chain strands are inserted in the track.
- Close the step chain by means of a master link.
- Tension the step chain.

See Maintenance Instructions Q 409 602, Step Chain Tensioning Device, Chain Tension Contacts

- Adjust the chain tension contacts.

See Maintenance Instructions Q 409 602, Step Chain Tensioning Device, Chain Tension Contacts

2.3 Installing Steps

- Install all steps.

See Maintenance Instructions Q 409 461, Steps, Step Disassembly, Guide Pads, Step Rollers, Bushings

- Check and, if required, correct the lateral setting of the steps.

Hint!

Individual, laterally displaced steps can cause problems at the following positions:

- Points of entry into the lateral guides:
  The steps "knock" ➔ noise, vibrations
- Points of entry into the combs:
  The steps brush or "knock" against the comb teeth ➔ noise, vibrations, broken teeth
- Lateral guidance along the skirt panels:
  Strong lateral pressure ➔ squeaking noise

- Perform a trial run.

3 Checks, Lubrication

- Check the tension of the step chains.

See Maintenance Instructions Q 409 602, Step Chain Tensioning Device, Chain Tension Contacts

- Check the setting of the step chain tension contacts.

See Maintenance Instructions Q 409 602, Step Chain Tensioning Device, Chain Tension Contacts

- Check the entry of the steps into the lateral guides.

See Maintenance Instructions Q 409 460, Combplates, Combplate Contacts, Combs, Lateral Guides

- Check the entry of the steps into the combs.

See Maintenance Instructions Q 409 460, Combplates, Combplate Contacts, Combs, Lateral Guides

- Check the gap between the steps and the skirt panels.

Hint!

Max. 4 mm on one side; < 7 mm total of both sides

- Thoroughly lubricate the step chains by hand.

See Maintenance Instructions Q 409 600, Step Chains

Hint!

The initial lubrication must be done by hand even if the unit is equipped with an automatic lubrication system. Use the same oil as for the lubrication unit.

4 Reassembly

Reassemble the parts disassembled under Section 2.1 analogously in the reverse order.

17 Repair of Handrail Section

17.1 Main Handrail Drive Chain – Q 409 688

1 Preparation Work

- Remove all floor covers at the tension station.

See Maintenance Instructions Q 409 457, Floor Covers

- Remove the guard plate at the tension station.

See Maintenance Instructions Q 409 487, Guard Plates

- Disassemble the 3 maintenance steps and 2 additional steps.

See Maintenance Instructions Q 409 461, Steps, Step Disassembly, Guide Pads, Step Rollers, Bushings

- Remove all floor covers at the drive station.

See Maintenance Instructions Q 409 457, Floor Covers

- Remove the guard plate at the drive station.

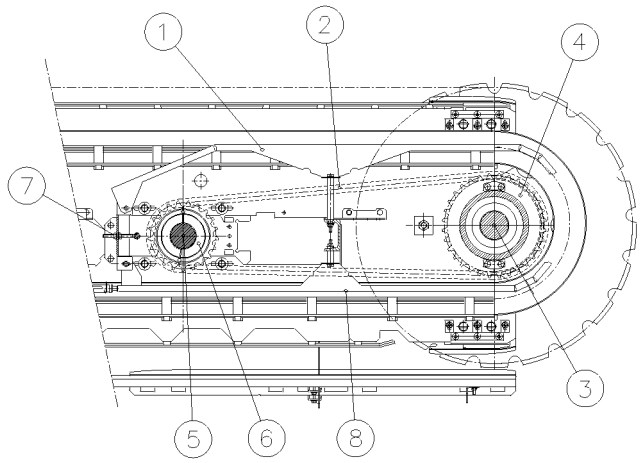
See Maintenance Instructions Q 409 487, Guard Plates

- Use the maintenance operating panel to run the gap in the step band to the drive station so that the gap starts just before the handrail drive shaft and the divided pinion on the main shaft is readily accessible from the escalator pit.
- If the master link is not accessible (i.e., in the return track, beneath a pinion, etc.), use the maintenance operating panel to run the step band for full cycles until the master link is readily accessible.
- Turn off and padlock the main switch.
- Engage the step chain locking device.

See Maintenance Instructions Q 409 926, Step Chain Locking Device

2 Replacing the Main Handrail Drive Chain

Fig. 688-01



1) Chain cover
2) Handrail drive chain
3) Main shaft
4) Divided pinion on main shaft
5) Handrail drive shaft
6) Divided pinion on handrail drive shaft
7) Tensioning device
8) Oil drain channel

- Loosen the screws (1A) of the chain cover (1) of the handrail drive chain (2) and remove the chain cover (1).

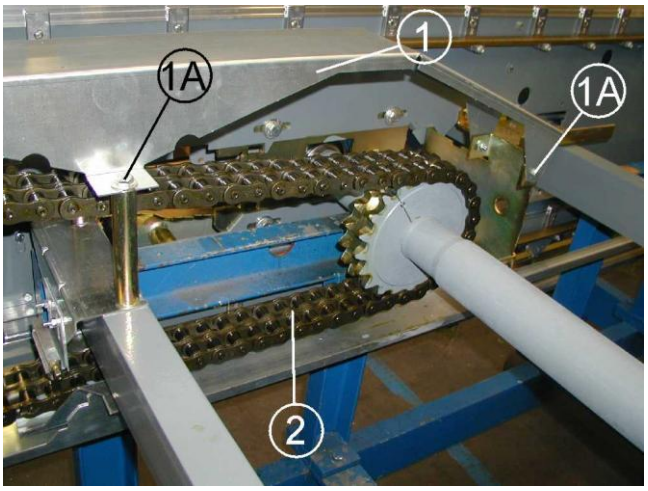


Fig. 688-02

- Loosen the fastening screws (5A) of the handrail drive shaft (5).

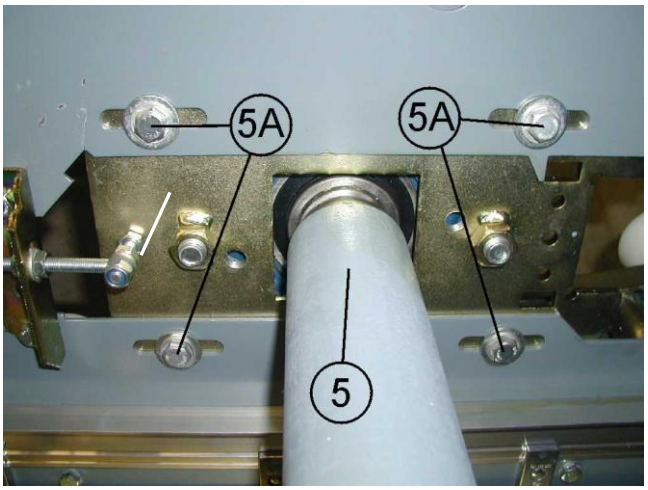


Fig. 688-03

- Completely release the tension of the handrail drive chain by means of the tensioning device (7) and push the handrail drive shaft (5) back to the stop.

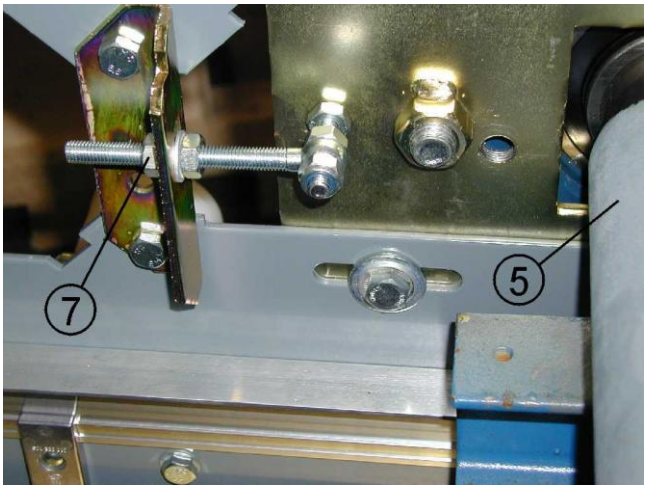


Fig. 688-04

See Maintenance Instructions Q 409 604, Handrail Drive Chains

- Open the master link (2A).

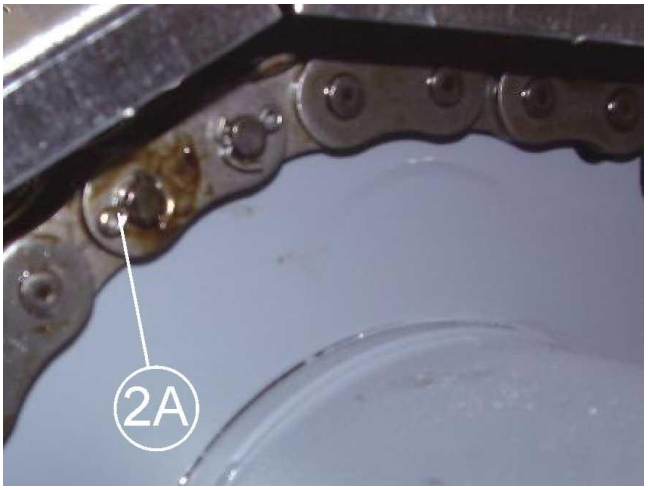


Fig. 688-05

- Pull the old handrail drive chain (2) out around both pinions.
- Clean the oil drain channel (8).

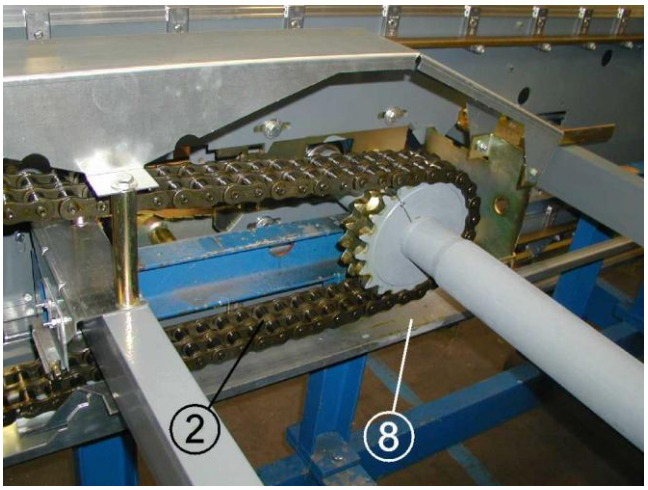


Fig. 688-06

- Insert the new handrail drive chain and close the master link (2A).

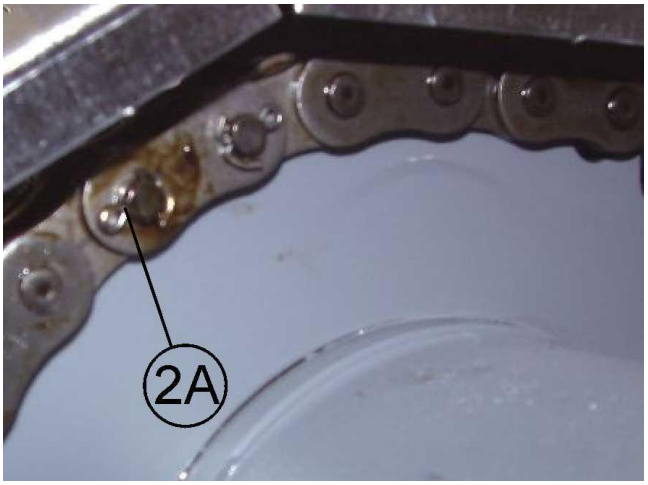


Fig. 688-07

- Tension the handrail drive chain (2).

See Maintenance Instructions Q 409 604, Handrail Drive Chains

3 Checks, Lubrication

- Check the chain tension.

See Maintenance Instructions Q 409 604, Handrail Drive Chains

- Thoroughly lubricate the chain by hand (initial lubrication).

Use an adequate lubricant according to the lubrication chart in Maintenance Instructions Q 409 604, Handrail Drive Chains

4 Reassembly

Reassemble the parts disassembled under Section 1 analogously in the reverse order.

17.2 Secondary Handrail Drive Chains – Q 409 695

1 Preparation Work

- Remove the first and second inner cladding panels.

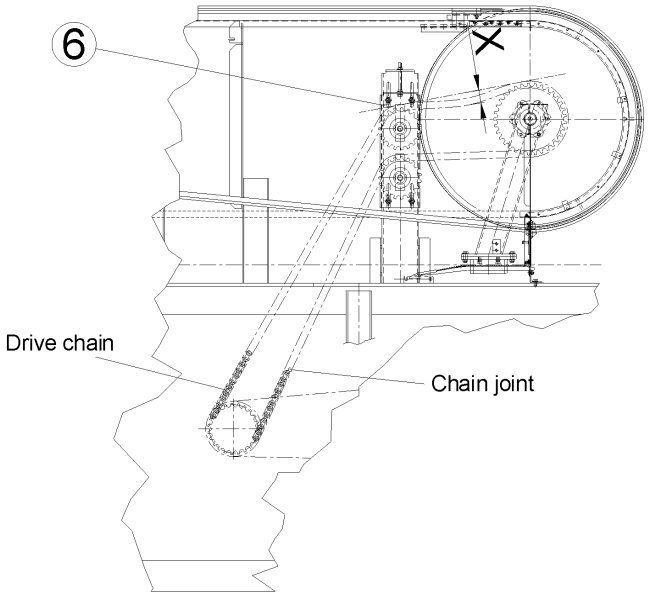
See Repair Instructions Q 409 702, Inner Cladding Disassembly

- Use the maintenance operating panel to run the escalator until the chain joint is readily accessible (see Fig. 695-01).
- Turn off and padlock the main switch.
- Engage the step chain locking device.

See Maintenance Instructions Q 409 926, Step Chain Locking Device

2 Replacing the Secondary Handrail Drive Chain

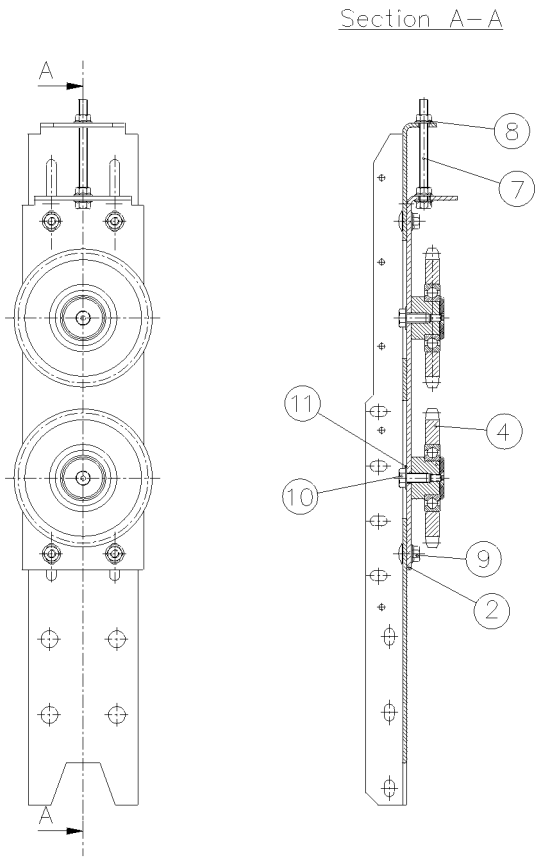
Fig. 695-01



6) Tensioning device
X) Sag of chain

- Completely release the tension of the secondary handrail drive chain by means of the tensioning device (6) (see Fig. 695-01):
  - Loosen the hex toothed flanged nuts (9) (= 4 pcs.) of the tension carriage (2) (see Fig. 695-02).
  - Lower the tension carriage (2) by means of the threaded bolt (7) and the hexagon nut (8) (see 695-02).

Fig. 695-02



2) Tension carriage
4) Sprocket
7) Threaded bolt
8) Hexagon nut
9) Hex toothed flanged nut
Cup square neck bolt
10) Hex toothed flanged nut
11) Plain washer

- Open the master link.
- Pull the handrail drive chain out around the pinions.
- Install a new handrail drive chain analogously in the reverse order.
- Tension the handrail drive chain by means of the tensioning device (6) (see Fig. 695-01).
  - Lift the tension carriage (2) by means of the threaded bolt (7) and the hex nut (8) (see Fig. 695-02).
  - Tighten the hex toothed flanged nuts (9) (= 4 pcs.) of the tension carriage (2) (see Fig. 695-02).

See Maintenance Instructions Q 409 604, Handrail Drive Chains

3 Checks, Lubrication

- Check the chain tension.

See Maintenance Instructions Q 409 604, Handrail Drive Chains

- Thoroughly lubricate the chain by hand (initial lubrication).

Use an adequate lubricant according to the lubrication chart in Maintenance Instructions Q 409 604, Handrail Drive Chains

4 Reassembly

Reassemble the parts disassembled under Section 1 analogously in the reverse order.

17.3 Divided Pinion on Handrail Drive Shaft – Q 409 697

1 Preparation Work

- Remove all floor covers at the tension station.

See Maintenance Instructions Q 409 457, Floor Covers

- Remove the guard plate at the tension station.

See Maintenance Instructions Q 409 487, Guard Plates

- Disassemble the 3 maintenance steps.

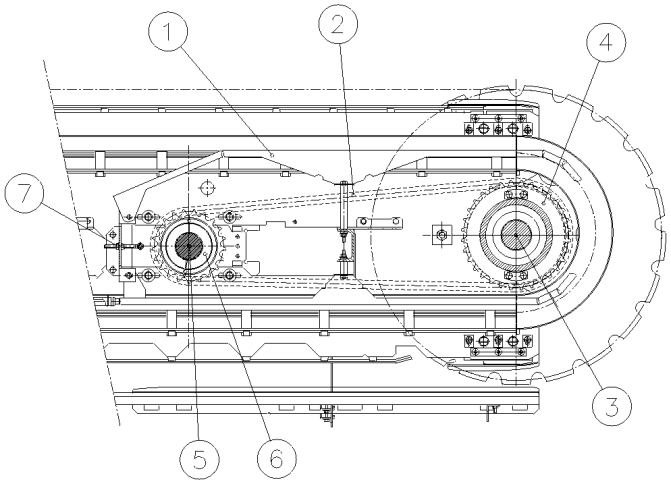
See Maintenance Instructions Q 409 461, Steps, Step Disassembly, Guide Pads, Step Rollers, Bushings

- Use the maintenance operating panel to run the gap in the step band to the drive station so that the divided pinion on the handrail drive shaft is readily accessible.
- If the master link is not accessible (i.e., in the return track, beneath the pinion, etc.), use the maintenance operating panel to run the step band for full cycles until the master link is readily accessible.
- Turn off and padlock the main switch.
- Engage the step chain locking device.

See Maintenance Instructions Q 409 926, Step Chain Locking Device

2 Replacing the Divided Pinion

Fig. 697-01



1) Chain cover
2) Handrail drive chain
3) Main shaft
4) Divided pinion on main shaft
5) Handrail drive shaft
6) Divided pinion on handrail drive shaft
7) Tensioning device

- Loosen the screws (1A) of the chain cover (1) of the handrail drive chain (2) and remove the chain cover (1).

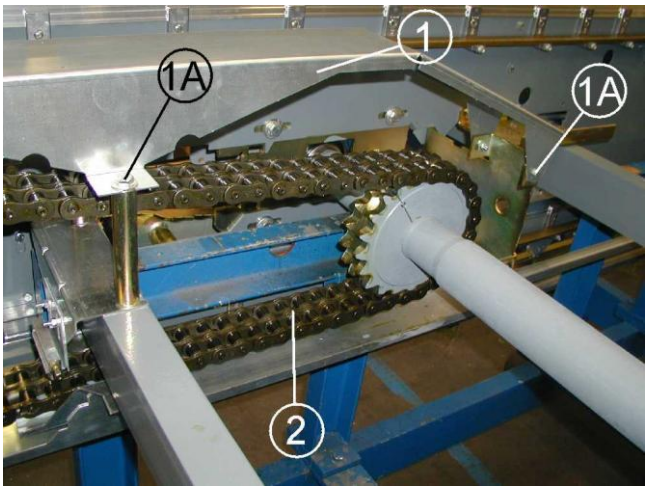


Fig. 697-02

- Loosen the fastening screws (5A) of the handrail drive shaft (5).

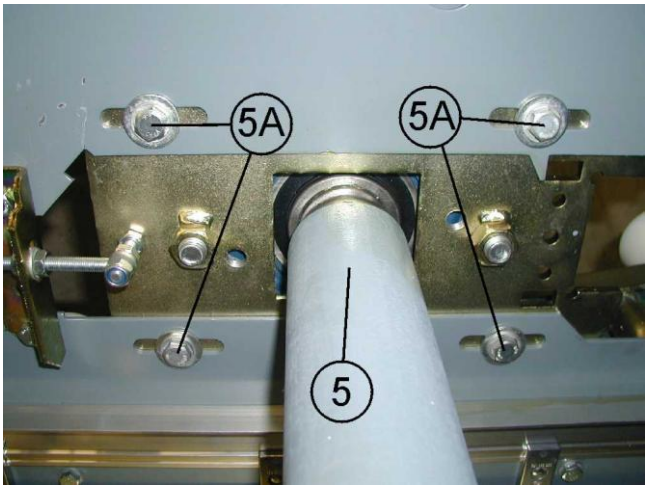


Fig. 697-03

- Completely release the tension of the handrail drive chain by means of the tensioning device (7) and push the handrail drive shaft (5) back to the stop.

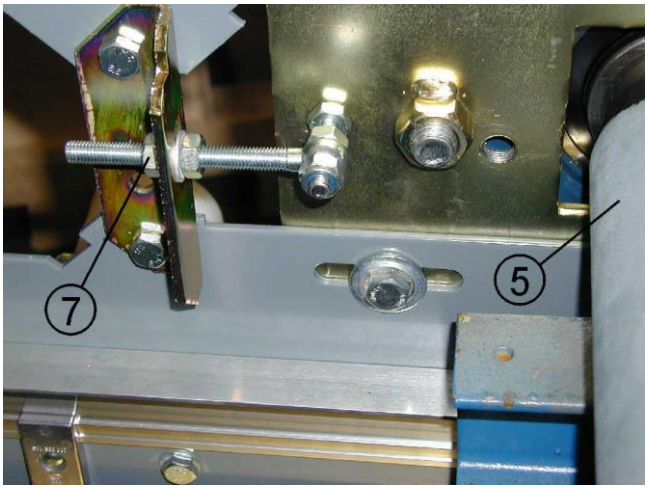


Fig. 697-04

See Maintenance Instructions Q 409 604, Handrail Drive Chains

- Open the master link (2A) and remove the handrail drive chain (2) from the divided pinion (6) of the handrail drive shaft.

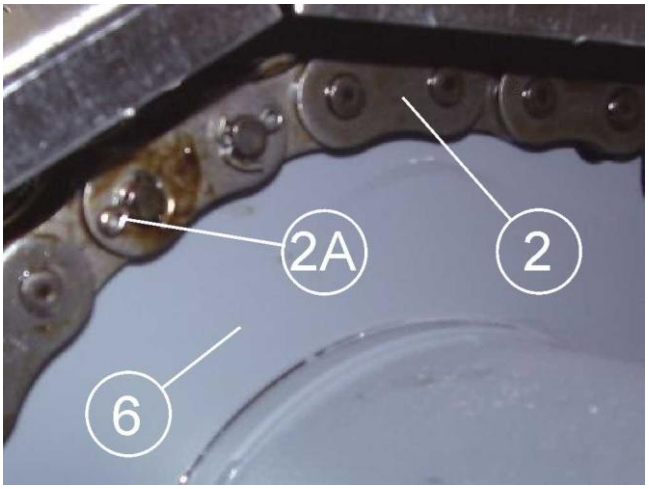


Fig. 697-05

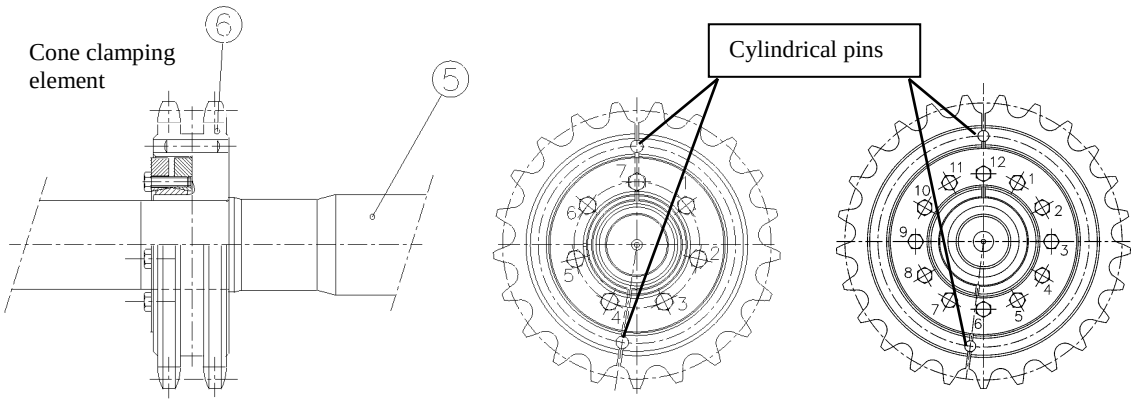
- Removing the cone clamping element (see Fig. 697-06):
  - Loosen all screws.
  - Pull out the cone clamping element.

Hint!

If the cone clamping element does not move (this may be due to frictional corrosion between the cone clamping element rings, between the inner ring and the shaft or the outer ring and the sprocket):

- Knock out both cylindrical pins.
- Knock with a hammer laterally against the sprocket until the cone clamping element loosens.
- Pull out the cone clamping element.

Fig. 697-06

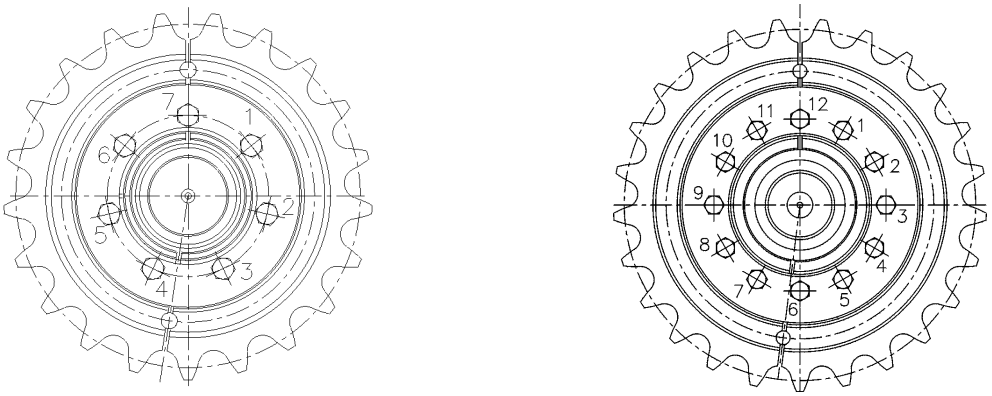


- Remove the divided pinion (6) (see Fig. 697-06).
- Remove the cylindrical pins (see Fig. 697-06).
- Install a new pinion analogously in the reverse order.

  Assembly of the cone clamping element (see Fig. 697-07):

  1. Tighten the screws in the indicated numerical order:
     #1-7 with 12 Nm, #1-12 with 15 Nm
  2. Tighten the screws in the indicated numerical order:
     #1-7 with 25 Nm, #1-12 with 30 Nm
  3. Tighten the screws once more in the indicated numerical order
     #1-7 with 25 Nm, #1-12 with 30 Nm

Fig. 697-07



- Tension the handrail drive chain.

See Maintenance Instructions Q 409 604, Handrail Drive Chains

3 Checks

- Check the chain tension.

See Maintenance Instructions Q 409 604, Handrail Drive Chains

4 Reassembly

Reassemble the parts disassembled under Section 1 analogously in the reverse order.

17.4 Sprockets of Handrail Drive Shaft – Q 409 698

1 Preparation Work

- Remove all floor covers at the tension station.

See Maintenance Instructions Q 409 457, Floor Covers

- Remove the guard plate at the tension station.

See Maintenance Instructions Q 409 487, Guard Plates

- Disassemble the 3 maintenance steps and 2 additional steps.

See Maintenance Instructions Q 409 461, Steps, Step Disassembly, Guide Pads, Step Rollers, Bushings

- Disassemble 2 divided step axles.

See Repair Instructions Q 409 692, Step Chain Rollers

- Remove the inner cladding panels along the length of the skirt panel endpiece at the drive station.

See Repair Instructions Q 409 702, Inner Cladding Disassembly

- Remove all floor covers at the drive station.

See Maintenance Instructions Q 409 457, Floor Covers

- Remove the guard plate at the drive station.

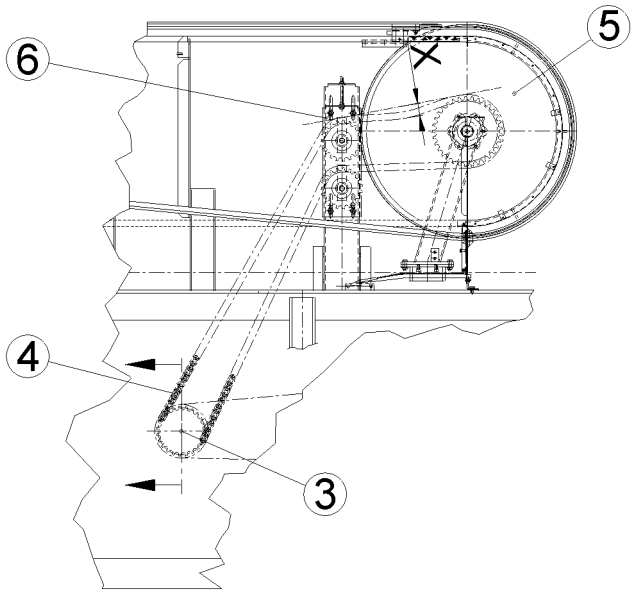
See Maintenance Instructions Q 409 487, Guard Plates

- Use the maintenance operating panel to run the gap in the step band to the drive station, mark the steps located directly beneath the gap in the step band and disassemble them as well, so that the gap reaches down to the bottom of the truss.
- If the master link of the handrail drive chain is not accessible (i.e., in the return track, beneath a pinion, etc.), use the maintenance operating panel to run the step band for full cycles until the master link is readily accessible.
- Turn off and padlock the main switch.
- Engage the step chain locking device.

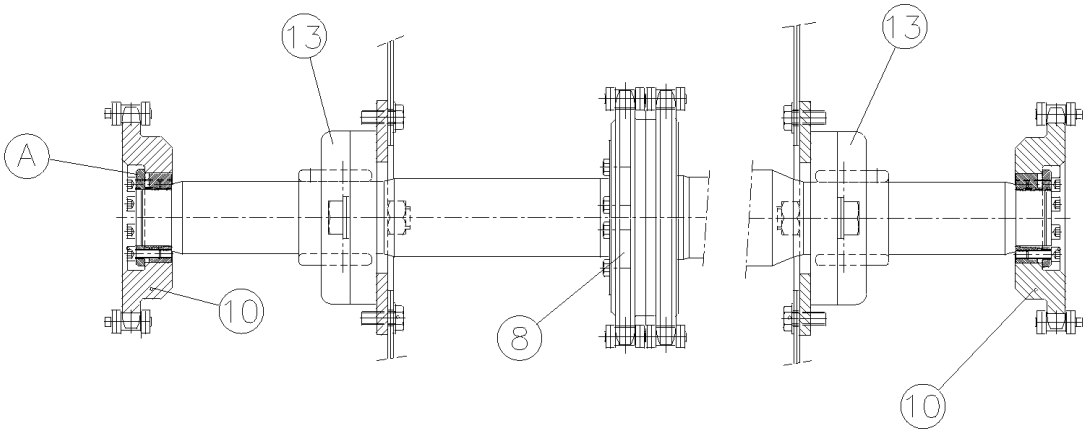
See Maintenance Instructions Q 409 926, Step Chain Locking Device

2 Replacing the Sprockets

Fig. 698-01



3) Handrail drive shaft
4) Secondary handrail drive chain
5) Handrail drive wheel (diverter sheave)
6) Tensioning device
8) Divided pinion on handrail drive shaft
10) Sprockets
13) Flanged bearings
A) Cone clamping element
X) Sag of chain



- Release the tension of the secondary handrail drive chains (4) by means of the tensioning devices (6).

See Repair Instructions Q 409 695, Secondary Handrail Drive Chains

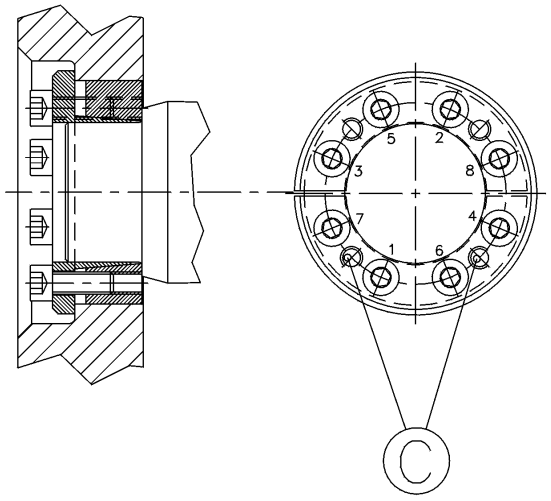
- Pull the secondary handrail drive chains (4) off the sprockets (10).
- Remove the cone clamping elements (A):
  - Loosen all screws.
  - Pull out the cone clamping elements (A).

Hint!

If the cone clamping element doesn't move (this may be due to frictional corrosion between the cone clamping element-rings, between the inner ring and the shaft or the outer ring and the sprocket):

- Insert 4 screws into the core holes (C) so that they abut the outer ring of the cone clamping element.
- Pull the inner ring off the outer ring by alternately tightening the 4 screws.

Fig. 698-02



C) Core holes

- Replace the sprockets (10):
  - Insert the cone clamping element (A) into the sprocket (10) until the outer ring is flush with the sprocket.
  - Slide the cone clamping element (A) and the sprocket (10) onto the shaft (3) and press the outer ring against the shaft collar.
  - Tighten the screws in the following order:

    1 to 8 to a tightening torque of 20 Nm

    1 to 8 to a tightening torque of 41 Nm

    2 times clockwise starting with screw 4 to a tightening torque of 41 Nm
- Place the secondary handrail drive chains (4) onto the sprockets (10).
- Tension the secondary handrail drive chains (4).

See Maintenance Instructions Q 409 604, Handrail Drive Chains

3 Checks

- Check the tension of the secondary handrail drive chains.

See Maintenance Instructions Q 409 604, Handrail Drive Chains

4 Reassembly

Reassemble the parts disassembled under Section 1 analogously in the reverse order.

17.5 Flanged Bearing on Handrail Drive Shaft – Q 409 721

1 Preparation Work

- Remove all floor covers at the tension station.

See Maintenance Instructions Q 409 457, Floor Covers

- Remove the guard plate at the tension station.

See Maintenance Instructions Q 409 487, Guard Plates

- Disassemble the 3 maintenance steps and 2 additional steps.

See Maintenance Instructions Q 409 461, Steps, Step Disassembly, Guide Pads, Step Rollers, Bushings

- Disassemble 2 divided step axles.

See Repair Instructions Q 409 692, Step Chain Rollers

- Remove the inner cladding panels along the length of the skirt panel endpiece at the drive station.

See Repair Instructions Q 409 702, Inner Cladding Disassembly

- Remove all floor covers at the drive station.

See Maintenance Instructions Q 409 457, Floor Covers

- Remove the guard plate at the drive station.

See Maintenance Instructions Q 409 487, Guard Plates

- Use the maintenance operating panel to run the gap in the step band to the drive station, mark the steps located directly beneath the gap in the step band and disassemble them as well, so that the gap reaches down to the bottom of the truss.
- If the master link of the handrail drive chain is not accessible (i.e., in the return track, beneath a pinion, etc.), use the maintenance operating panel to run the step band for full cycles until the master link is readily accessible.
- Turn off and padlock the main switch.
- Engage the step chain locking device.

See Maintenance Instructions Q 409 926, Step Chain Locking Device

- Remove the chain cover (14) and completely release the tension of the main handrail drive chain (1) by means of the tensioning device (see Fig. 721-01).

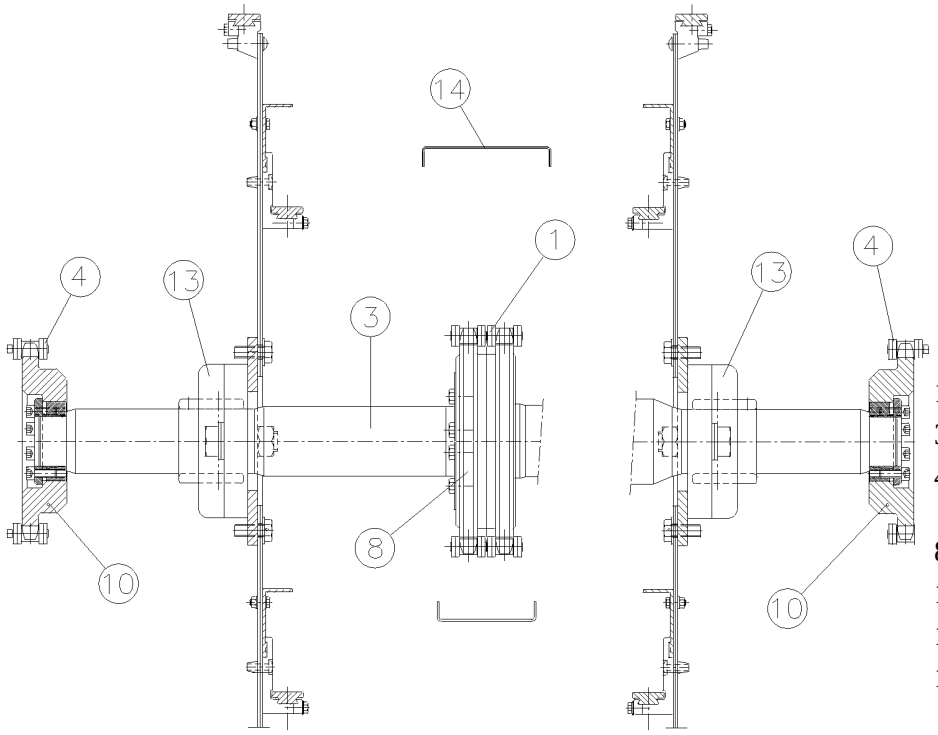
See Repair Instructions Q 409 688, Main Handrail Drive Chain

- Completely release the tension of the secondary handrail drive chains (4) and pull the chains off the sprockets (10) (see Fig. 721-01).

See Repair Instructions Q 409 695, Secondary Handrail Drive Chains

2 Replacing the Flanged Bearing

Fig. 721-01



1) Main handrail drive chain
3) Handrail drive shaft
4) Secondary handrail drive chains
8) Divided pinion
10) Sprockets
13) Flanged bearings
14) Chain cover

- Remove the sprockets (10) from the handrail drive shaft (3).

See Repair Instructions Q 409 698, Sprockets of Handrail Drive Shaft

- Measure the distance from the end of the handrail drive shaft (3) to the flanged bearing (13).
- Mark the exact position of the flanged bearing (13).

- Loosen the two setscrews (15).
- Remove the hex head cap screws M20 x 60 (16) with the spring lock washers and the washers (see also Fig. 721-03).

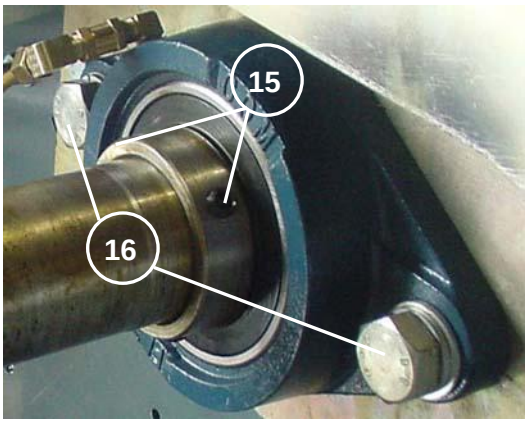
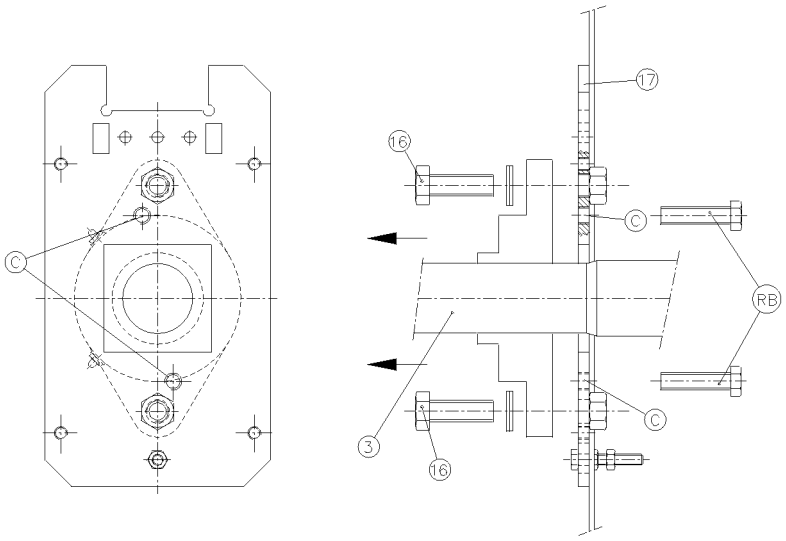


Fig. 721-02

- Screw M16 x 100 screws (RB) (screw class at least 8.8) into the core holes (C) so that they abut the flanged bearing (see Fig. 721-03).
- Pull the flanged bearing off the handrail drive shaft (3) by alternately tightening the M16 x 100 screws (RB). Finally, pull the bearing off the handrail drive shaft (3) by hand.

Fig. 721-03

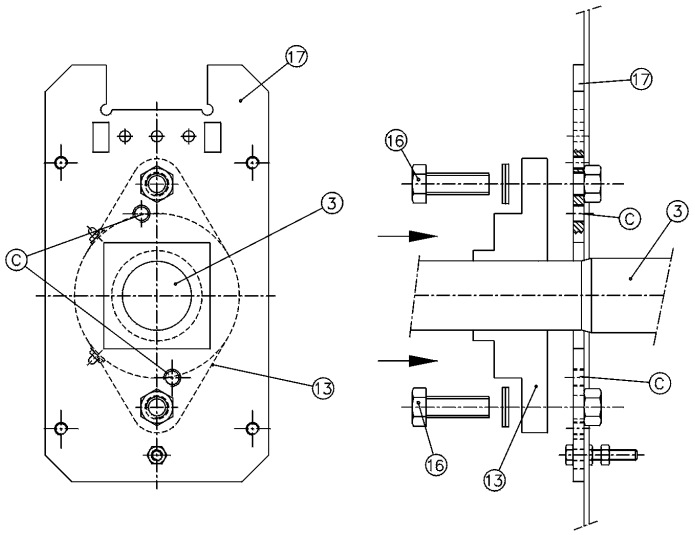


3) Handrail drive shaft
16) Hex head cap screws
17) Bearing plate
RB) M16 x 100 screws
C) Core holes

- Unscrew the M16 x 100 screws (RB) from the core holes.

- Slip the new flanged bearing (13) onto the handrail drive shaft (3) and fasten it to the bearing plate (17) by hand by means of M20 x 60 hex head cap screws with spring lock washers and washers (16) (see Fig. 721-04).

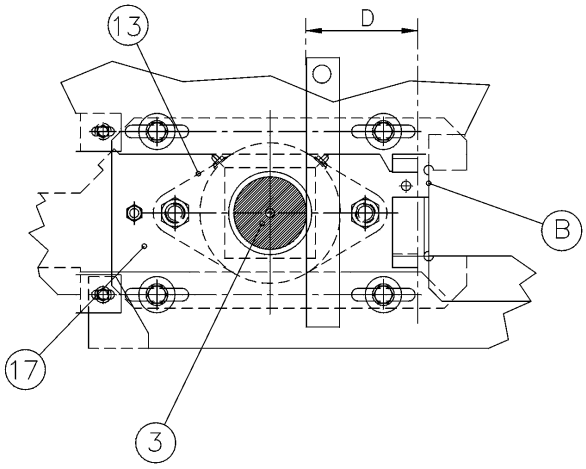
Fig. 721-04



3) Handrail drive shaft
13) Flanged bearing
16) Hex head cap screws M20 x 60
17) Bearing plate
C) Core holes

- Adjust the flanged bearing (13) on the bearing plate (17) so that the distance D between the handrail drive shaft (2) and the measuring edge (B) is identical on both sides (see Fig. 721-09).

Fig. 721-05



13) Flanged bearing
3) Handrail drive shaft
17) Bearing plate
B) Measuring edge

Hint!

You can do this, for example, by placing a level against the handrail drive shaft (3) and measuring the distance D.

- Install the remaining parts analogously in the reverse order.

Warning: No lateral forces on the bearings!

To avoid lateral forces on the bearings, DO NOT tighten the setscrews (15) – see Fig. 721-02 – before the flanged bearing (13) – see Fig. 721-05 – has been fixed.

- Adjust the end of the handrail drive shaft (3) to the previously measured distance to the flanged bearing (13).
- Tighten the two setcrews (15) (see Fig. 721-02) to a torque of 22 Nm.
- When reinstalling the cone clamping elements, make sure to tighten the screws in the proper order.

See Repair Instructions Q 409 698, Sprockets of Handrail Drive Shaft

- Tension the main and secondary handrail drive chains.

See Maintenance Instructions Q 409 604, Handrail Drive Chains

3 Checks, Lubrication

- Lubricate the bearings.

Hint!

Use a grease gun to press the lubricant into the lubricator nipple.

See Maintenance Instructions Q 594 036, Lubrication System, Lubrication Schedule

- Check the tension of the main and secondary handrail drive chains.

See Maintenance Instructions Q 409 604, Handrail Drive Chains

4 Reassembly

Reassemble the parts disassembled under Section 1 analogously in the reverse order.

17.6 Sprockets or Bearings of Secondary Handrail Drive Chain Tensioning Device – Q 409 696

1 Preparation Work

- Remove the first and second inner cladding panels at the drive station.

See Repair Instructions Q 409 702, Inner Cladding Disassembly

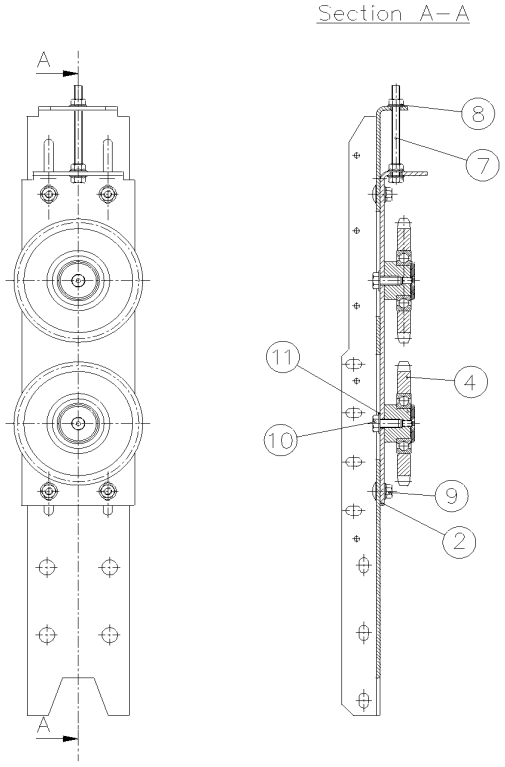
- Turn off and padlock the main switch.
- Engage the step chain locking device.

See Maintenance Instructions Q 409 926, Step Chain Locking Device

2 Replacing the Sprockets

- Replace the sprockets:

Fig. 696-01



2) Tension carriage
4) Sprocket
7) Threaded bolt
8) Hexagon nut
9) Hex toothed flanged nut
Cup square neck bolt
10) Hex toothed flanged nut
11) Plain washer

– Release the tension of the handrail drive chain by shifting the tension carriage (2).

See Repair Instructions Q 409 695, Secondary Handrail Drive Chains

– Pull the handrail drive chain off the sprockets (4) of the chain tensioning device (see Fig. 696-01).
– Remove the hex socket countersunk screw (6) and the mounting washer (5).
– Pull the sprocket (4) off the mounting (3).

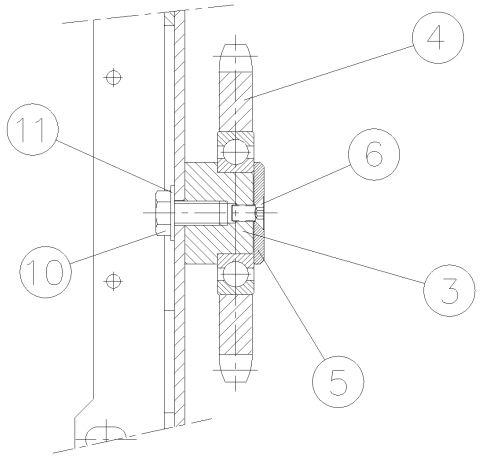


Fig. 696-02

– Install a new sprocket (entire unit incl. bearing) analogously in the reverse order.
– Tension the secondary handrail drive chain by shifting the tension carriage.

See Maintenance Instructions Q 409 604, Handrail Drive Chains

3 Replacing the Bearings

- Replace the bearings of the sprockets:
  – Disassemble the sprocket (4) as described above.
  – Press out the bearing and press in a new one.
  – Reinstall the sprocket (4) as described above.

4 Checks

- Check the alignment of the two sprockets.
- Check the tension of the secondary handrail drive chains.

See Maintenance Instructions Q 409 604, Handrail Drive Chains

5 Reassembly

Reassemble the parts disassembled under Section 1 analogously in the reverse order.

17.7 Bearings or Sprockets of Handrail Diverter Sheave – Q 409 693

1 Preparation Work

- Remove the newel panel of the inner cladding at the tension and/or drive station.

See Repair Instructions Q 409 702, Inner Cladding Disassembly

- Remove all floor covers at the tension and/or drive station.

See Maintenance Instructions Q 409 457, Floor Covers

- Release the tension of the secondary handrail drive chain and open the master link.

See Repair Instructions Q 409 695, Secondary Handrail Drive Chains

- Pull the secondary handrail drive chain off the sprocket of the diverter sheave.
- Disassemble the handrail entry contact.

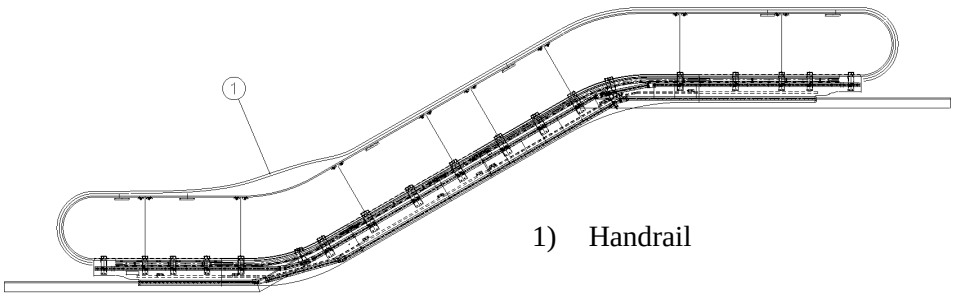
See Repair Instructions Q 409 616, Handrail

- Lift the handrail (1) out of the guide profiles at the lower transition curve.

Hint!

Instead of releasing the tension of the handrail.

Fig. 693-01



1) Handrail

- Turn off and padlock the main switch.
- Engage the step chain locking device.

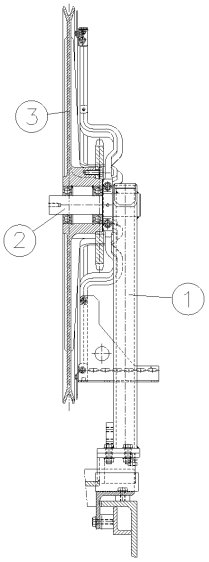
See Maintenance Instructions Q 409 926, Step Chain Locking Device

2 Replacing the Bearings

- Pull the handrail off the diverter sheave.
- Disassemble the gusset of the reversing stand.

See Repair Instructions Q 409 616, Handrail

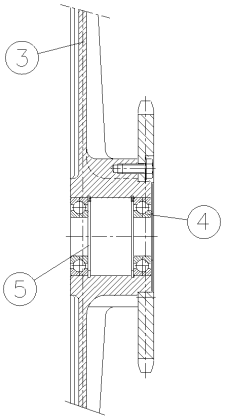
- Pull the diverter sheave (3) off the reversing stand pin (2) by means of a pull-off device.



1) Reversing stand
2) Reversing stand pin
3) Diverter sheave

Fig. 693-02

- Clean the V-shaped groove of the diverter sheave (2).
- Replace the bearings (4).



3) Diverter sheave
4) Bearing
5) Retaining ring for bores

Fig. 693-03

- Press the diverter sheave (3) on the reversing stand pin (2).

1) Reversing stand
2) Reversing stand pin
3) Diverter sheave

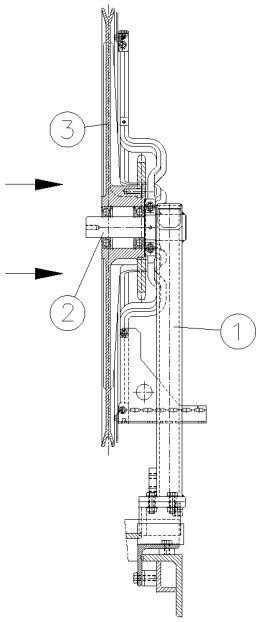


Fig. 693-04

- Reassemble the gusset.

See Repair Instructions Q 409 616, Handrail

- Check the alignment of the diverter sheave.
- Remount the handrail.

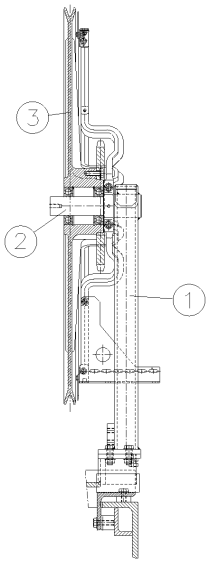
See Repair Instructions Q 409 616, Handrail

3 Replacing the Sprockets

- Pull the handrail off the diverter sheave.
- Disassemble the gusset of the reversing stand.

See Repair Instructions Q 409 616, Handrail

- Pull the diverter sheave (3) off the reversing stand pin (2) by means of a pull-off-device.
- Clean the V-shaped groove of the diverter sheave (2).



1) Reversing stand
2) Reversing stand pin
3) Diverter sheave

Fig. 693-05

- Remove the hex head cap screws M10 x 25 (6) and pull the sprocket (7) off the diverter sheave.
- Install a new sprocket and tighten the hex head cap screws M10 x 25 (6) in the order indicated in Fig. 693-06.

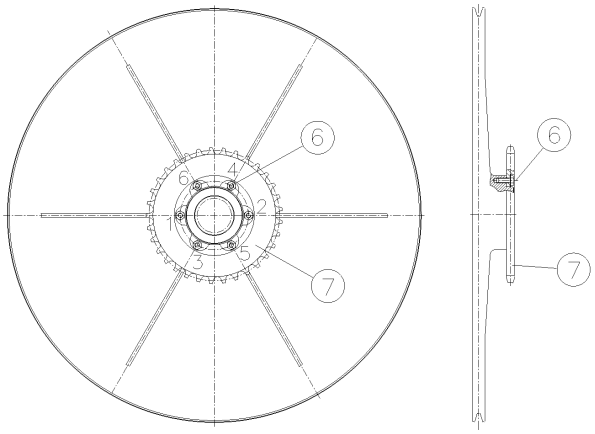
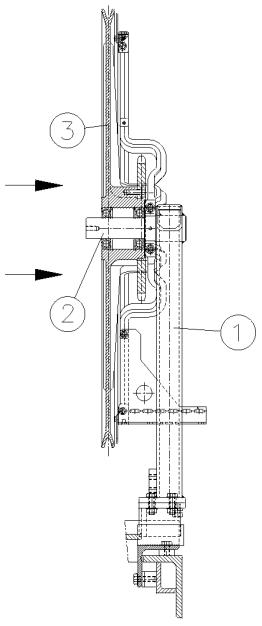


Fig. 693-06

- Press the diverter sheave (3) on the reversing stand pin (2).



1) Reversing stand
2) Reversing stand pin
3) Diverter sheave

Fig. 693-07

- Reassemble the gusset.

See Repair Instructions Q 409 616, Handrail

- Check the alignment of the diverter sheave.
- Remount the handrail.

See Repair Instructions Q 409 616, Handrail

4 Checks

- Check the tension of the secondary handrail drive chains.

See Maintenance Instructions Q 409 604, Handrail Drive Chains

- Check the handrail tension.

See Maintenance Instructions Q 409 639, Handrail Drive, Handrail Guide Profiles

5 Reassembly

Reassemble the parts disassembled under Section 1 analogously in the reverse order.

17.8 Handrail – Q 409 616

Hint!

Due to the high requirements on escalators in public transport areas it is strictly recommended to install factory-spliced closed handrails only.

Therefore, the following instructions only describe the disassembly and installation of factory-spliced closed handrails for design I balustrades.

1 Preparation Work

- Remove all floor covers at the tension station.

See Maintenance Instructions Q 409 457, Floor Covers

- Remove the guard plate at the tension station.

See Maintenance Instructions Q 409 487, Guard Plates

- Remove all floor covers at the drive station.

See Maintenance Instructions Q 409 457, Floor Covers

- Remove the guard plate at the drive station.

See Maintenance Instructions Q 409 487, Guard Plates

- Turn off and padlock the main switch.
- Engage the step chain locking device.

See Maintenance Instructions Q 409 926, Step Chain Locking Device

- At the drive and tension stations:
  - Loosen the flat-head screws (4) and remove them together with the inner front plate (1) and the outer front plate (2).

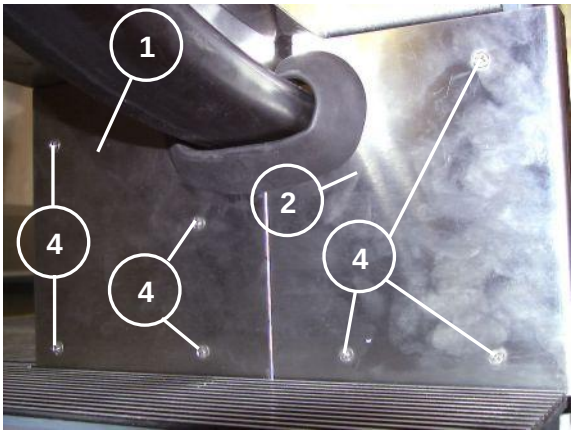


Fig. 616-01

  - Remove the rubber collar (3).

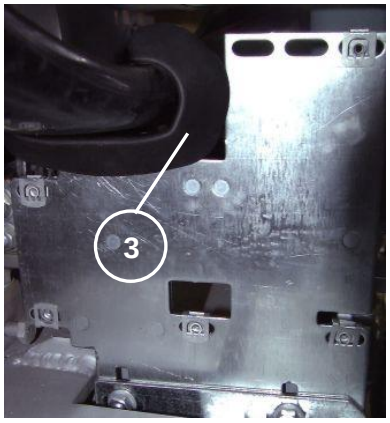


Fig. 616-02

  - Loosen the hex head cap screws (5) and remove them together with the handrail entry contact (entire assembly (6)).

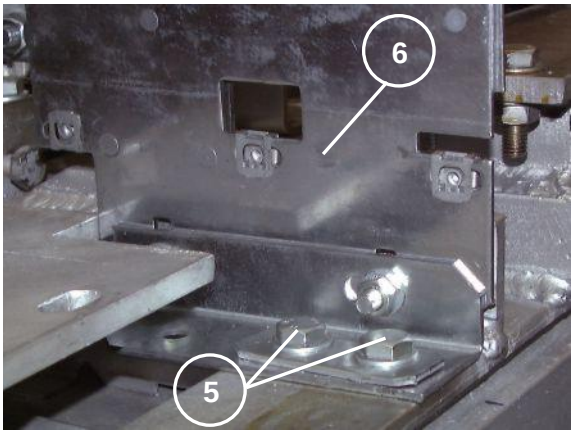


Fig. 616-03

Hint!

Before removing the assembly, mark the lateral and longitudinal positions.

- Disassemble all inner cladding panels.

See Repair Instructions Q 409 702, Inner Cladding Disassembly

- Disassemble the gusset of the reversing stands at the drive and tension station.
  - Unscrew the hex head cap screw (12) from the guide block of the splice plate, loosen the clamping screws (13), and shift the splice plate (14) from the newel profile to the curved transition profile.

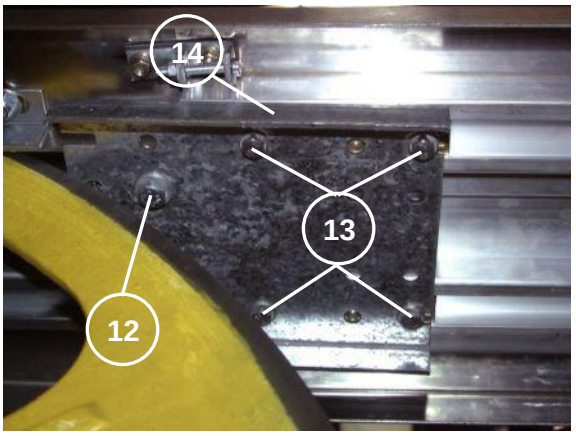


Fig. 616-04

  - Remove the fillister head screw (15) from the butt joint and unscrew the hex head cap screw (16) from the guide block of the curved piece.

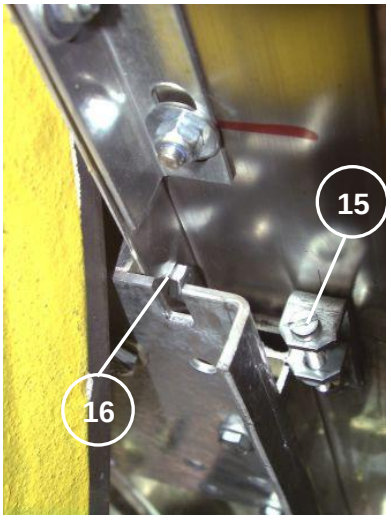


Fig. 616-05

– Unscrew the fastening screw (17) incl. the washer (18).

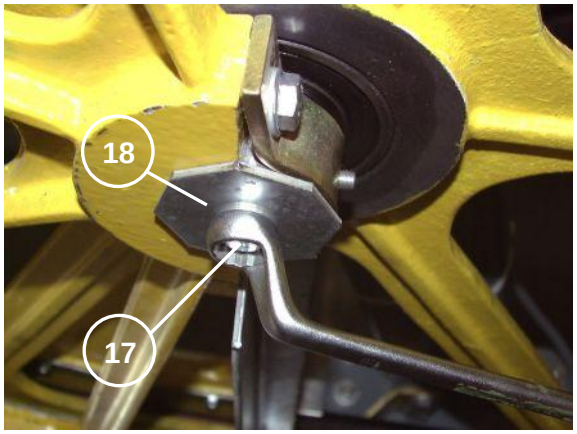


Fig. 616-06

– Unscrew the set screw (19).
– Unscrew the hex head cap screws (20) incl. the locking washers and remove the clamp (21).
– Lift the newel support incl. the gusset completely off the reversing stand and set it aside.

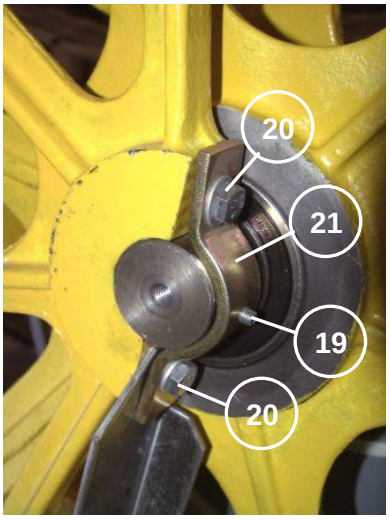


Fig. 616-07

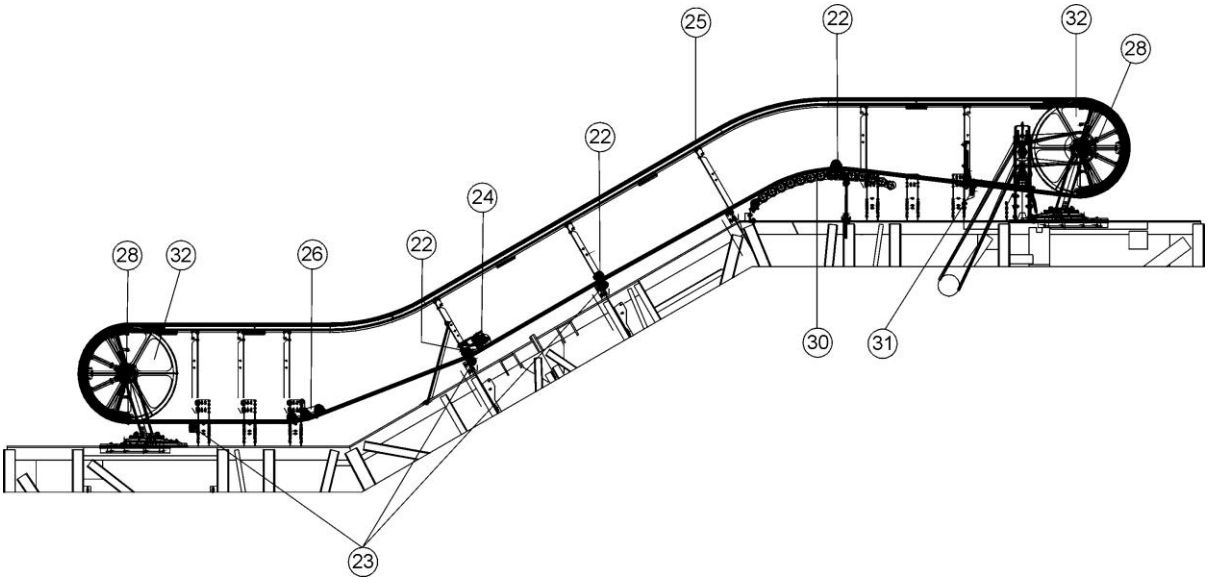
Hint!

When reinstalling the newel support, adjust the profiles to each other and to the edge of the newel profile.

2 Replacing the Handrail

2.1 Disassembling the Old Handrail

Fig. 616-08



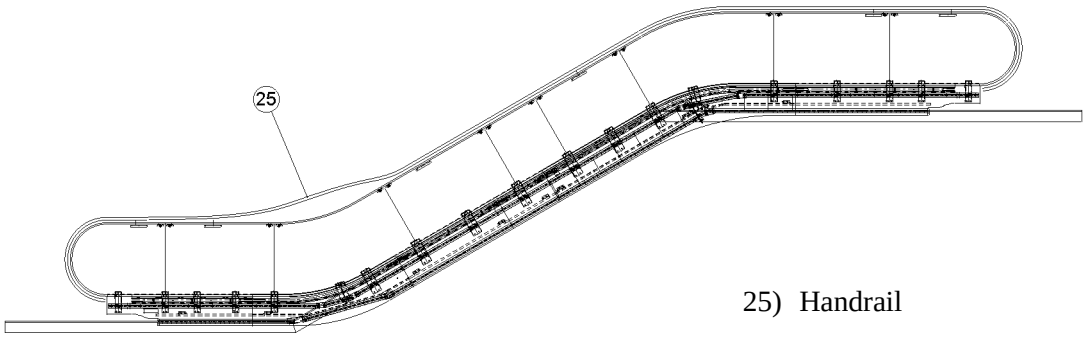
22) Guide rollers
23) Support rollers
24) Handrail elongation contact
25) Handrail
26) Roller assembly
28) Newel supports
30) Tension roller bow
31) Lateral guide
32) Handrail diverter sheaves

- Completely release the tension of the handrail.

See Maintenance Instructions Q 409 639, Handrail Drive, Handrail Guide Profiles

- Lift the handrail (25) out of the guide profiles of the balustrade starting at the diverter sheave (32) at the tension station (see Fig. 616-09).

Fig. 616-09



25) Handrail

- Remove all lateral guide rollers (22) in the incline and from the tension roller bow (30) (see Fig. 616-08).

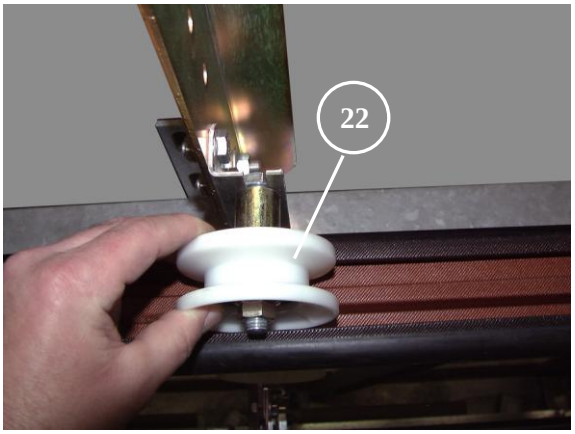


Fig. 616-10

- Lift the handrail off the support rollers (23) in the incline and remove it past the edge of the skirt panels.

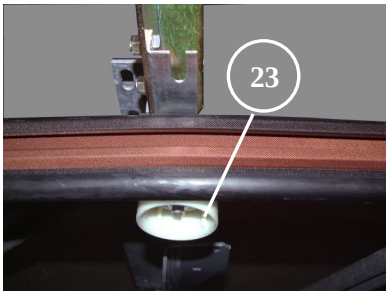


Fig. 616-11

- Pull the handrail out from above past the guide roller assembly (26).

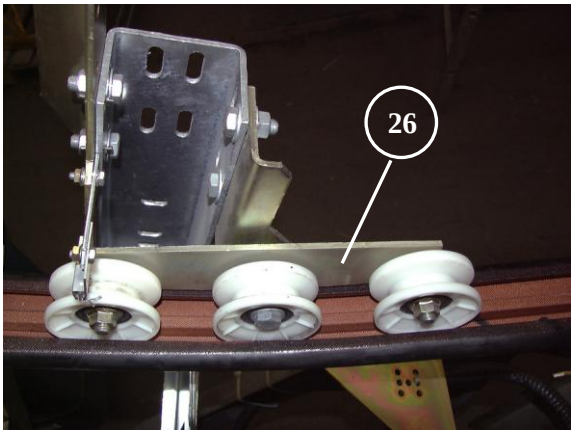


Fig. 616-12

2.2 Installing the New Handrail

- Unroll the handrail starting at the balustrade end at the drive station and continuing down to the balustrade end at the tension station and lay it down on the steps.

Hint!
Be careful when laying the handrail down on the steps; if available, put cardboard between the handrail and the steps → protection against possible damage to the handrail.

- Lay the handrail over the diverter sheave (32) at the drive station and mount it on the handrail guide profile over a length of approx. 1 m.

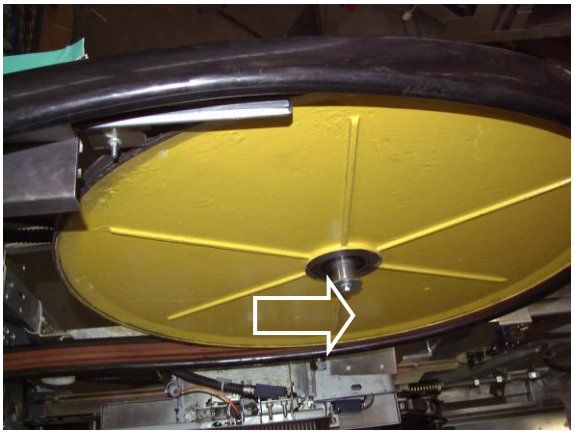


Fig. 616-13

Hint!
To secure the handrail against slipping off

- Lay the handrail over the tension roller bow assembly (30) towards the tensioning station.

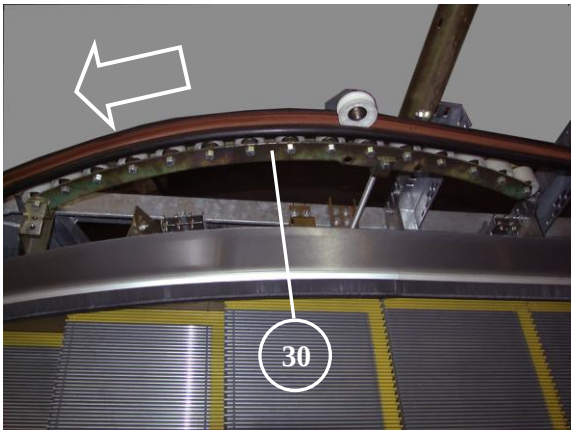


Fig. 616-14

- Lift the handrail over the edge of the skirt panel and lay it over the support rollers (23).

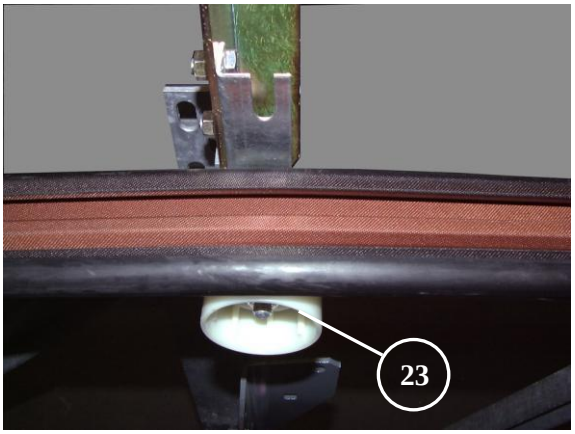


Fig. 616-15

Warning: Damage of the handrail by skirt panels!

When inserting the handrail between the edge of the skirt panel and the balustrade clamp, take care that the handrail does not get damaged by the edge of the skirt panel!

- Insert the handrail in the handrail elongation contact (24) (see Fig. 616-08) and the roller assembly (26).

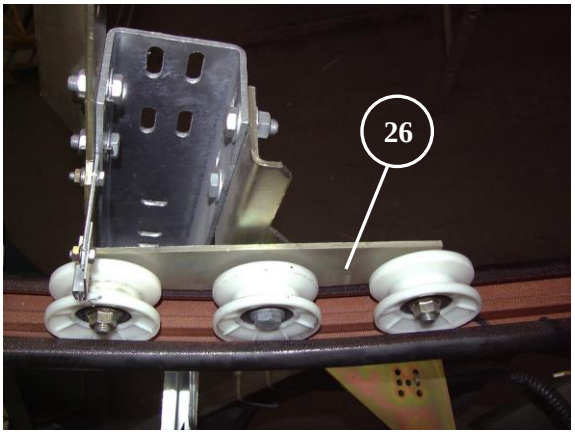


Fig. 616-16

- Lay the handrail over the diverter sheave at the tension station.

- Mount the handrail on the handrail guide profile starting from the balustrade end at the drive station and continuing down to the diverter sheave at the tension station:
  - Insert one side of the handrail into the handrail guide profile and mount the other side with the assembly tool.

Fig. 616-17

- Install the lateral guide rollers (22) in the incline and at the tension roller bow (30) (see Fig. 616-18).
- Check the alignment of the guide rollers:
  - The guide rollers must abut the V-shape of the handrail (without blocking) and it must be possible to turn them by hand.

    Setting dimension = $0.5^{\pm 0.5}$ mm

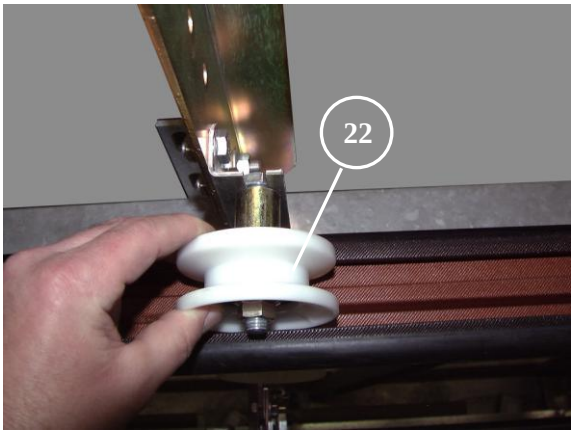


Fig. 616-18

  - Insert a **0.5 mm shim** (21) between the support roller and the handrail
  - Push the guide roller down and tighten it.
  - Remove the shim (21).

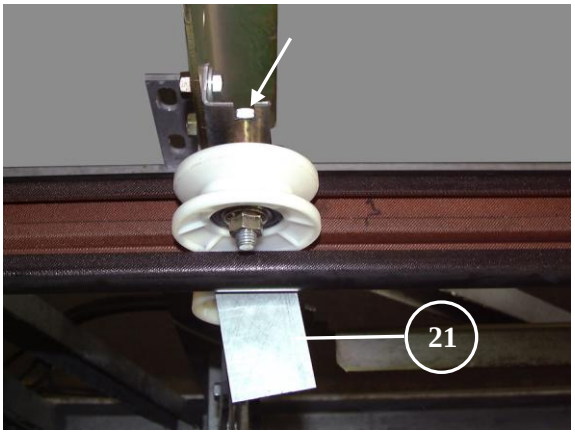


Fig. 616-19

- Tension the handrail.

Hint!

At this stage of installation, it is only possible to tension the handrail provisionally; the final tensioning will take place in the course of the handrail test run.

- Basic adjustment of the tension roller bow:

  Use the two hexagon nuts (20) (adjusting nut and counternut) on the threaded rod to set the distance between the bracket and the edge of the shackle to approx. 300 mm.

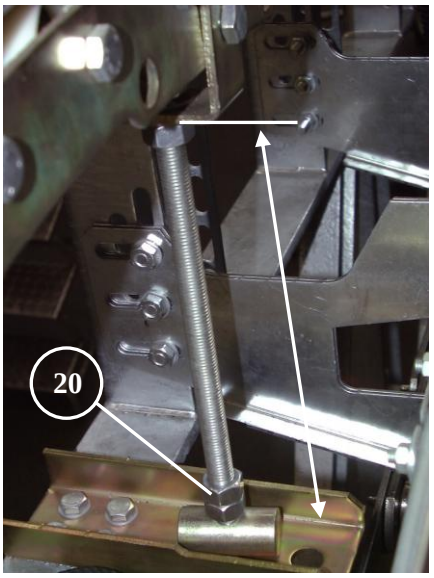


Fig. 616-20

See Maintenance Instructions Q 409 639, Handrail Drive, Handrail Guide Profiles

3 Checks

3.1 Checking the Handrail Tension

- Check the handrail tension.

See Maintenance Instructions Q 409 639, Handrail Drive, Handrail Guide Profiles

3.2 Checking the Running Behavior in the Return Track

- In the area of the drive station:

Hint!

Move the handrail only in the **upward** direction.

– The handrail must run via the diverter sheave (32) and the lateral guide (31) and enter and exit the tension roller bow (30) centered and without lateral pressure.
– Use the adjusting nuts (33) to adjust the guide roller to the inside or outside so that the handrail enters and exits the tension roller bow centered.

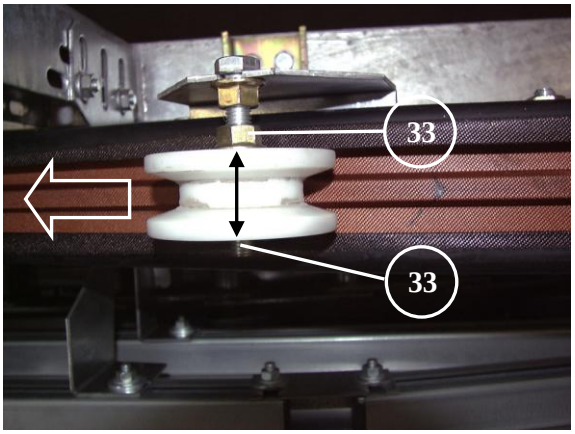


Fig. 616-21

Hint!

Move the handrail only in the **downward** direction.

– The handrail must run via the tension roller bow centered and in the same position as during upward travel and with no guiding force from the guide roller.

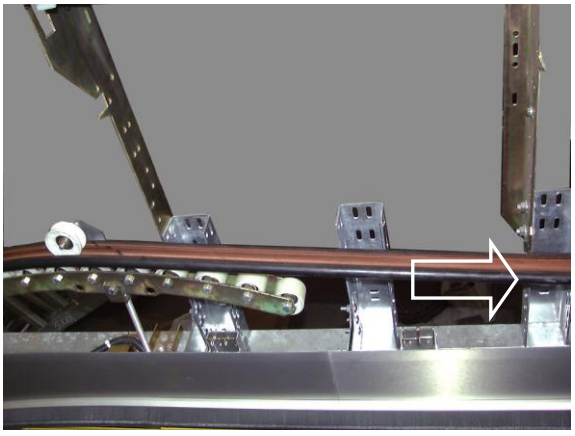


Fig. 616-22

- In the area of the tension station:

Hint!

Move the handrail only in the **downward** direction.

– The handrail must run via the diverter sheave (32) and the roller assembly (26) and enter the first lateral guide roller (22) in the incline centered and without lateral pressure.
– Loosen the mounting bolts (34), displace the roller carrier (26) parallel to the inside or outside so that the handrail runs centered over them.

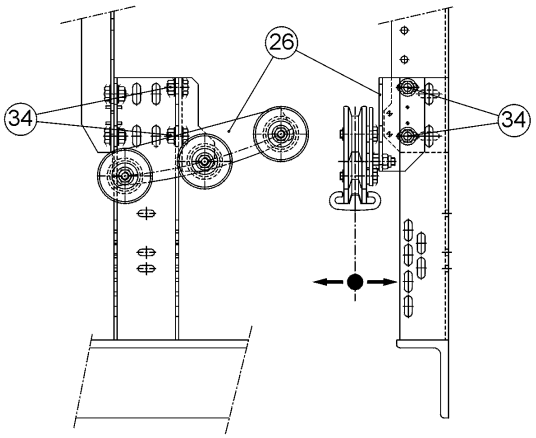


Fig. 616-23

Hint!

Move the handrail only in the **upward** direction.

– The handrail must run via the roller carrier (26) centered and in the same position as during downward travel and with no guiding force from the rollers (see Fig. 616-23).

Warning: Damage of the handrail by lateral pressure!

Since the handrail is not 100 % straight, it may run slightly off center and even brush against the guide rollers. In this case, however, the handrail **must not exert any lateral pressure** on these components!

- Check whether the handrail enters the handrail entry contacts properly.

4 Reassembly

- Reassemble the parts disassembled under Section 1 analogously in the reverse order.
- Clean the handrail.

See Maintenance Instructions Q 409 639, Handrail Drive, Handrail Guide Profiles

18 Repair of Balustrade

18.1 Inner Cladding Disassembly – Q 409 702

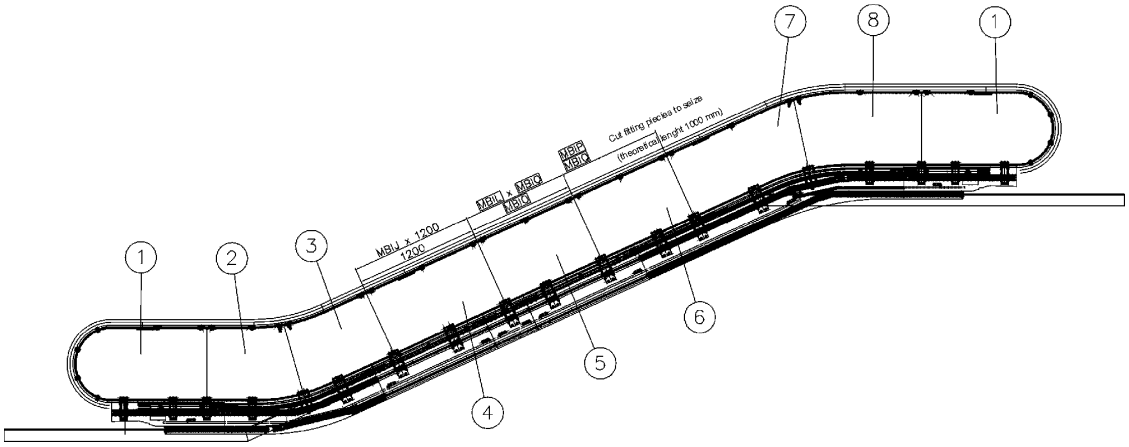
1 Preparation Work

- Turn off and padlock the main switch.
- Engage the step chain locking device.

See Maintenance Instructions Q 409 926, Step Chain Locking Device

2 Disassembling and Reassembling the Inner Cladding

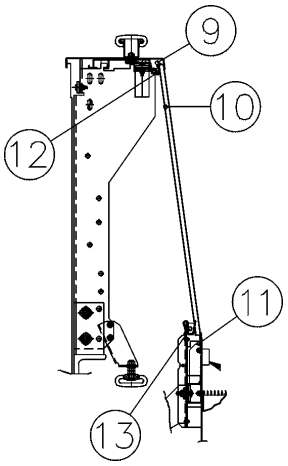
Fig. 702-01



1) Newel panels
2) Transition panel, tension station
3) Transition panel, tension station
4) MBIJ x 1200 (number accord. to rise)
5) MBIL x MBIO (number and dimension accord. to rise)
6) 1000-mm fitting piece
7) Transition panel, drive station
8) Transition panel, drive station

2.1 Disassembling Cladding Panels (Except for Newel Panel)

Fig. 702-02



9) Balustrade profile
10) Cladding panel
11) Skirt panel
12) Countersupport
13) Support

Hint!

The panels can be disassembled in any order – except for the newel panels (1) and the lower transition panels (2) and (3). To be able to disassemble these panels, the adjoining panels (4) and (8) must first be removed.

- Lift the cladding panel with suction pick-ups, pull it inward over the skirt panel, pull it out of the countersupport and put the cladding panel down.
- Disassemble all inner cladding panels in this way.

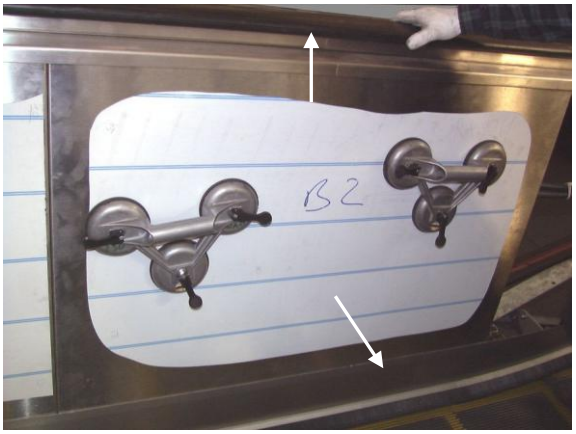


Fig. 702-03

2.2 Disassembling the Newel Panel

- Disassemble the panels (4), (3), (2) and (8) according to Section 2.1 and Fig. 702-01.
- Shift the newel panel horizontally about 30 mm toward the step band.
- Remove the newel panel according to Section 2.1.

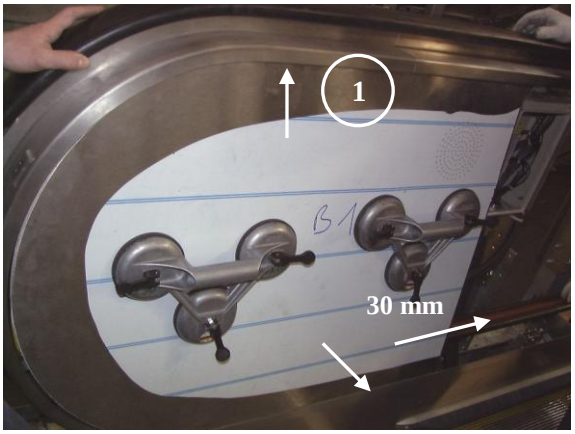


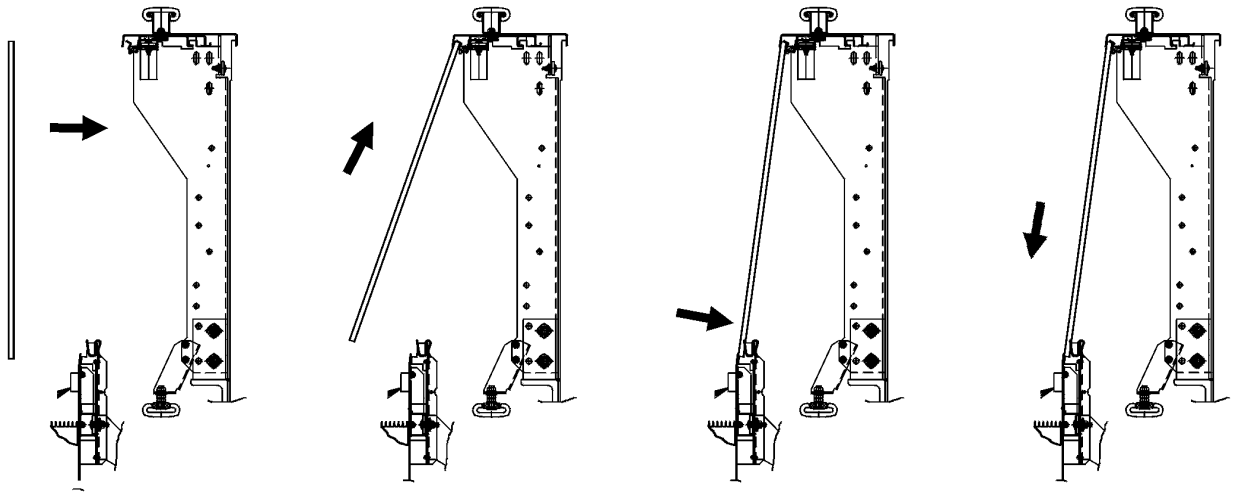
Fig. 702-04

2.3 Reassembling Cladding Panels

Hint!
Reassembly is done analogously in the reverse order.

- Lift the panel with suction pick-ups, insert it at a slight upward angle into the countersupport, press it outward over the skirt panel, and lower it into the support (see Fig. 702-05).

Fig. 702-05



– Overlap between inner cladding panel and balustrade profile: **approx. 9 mm**

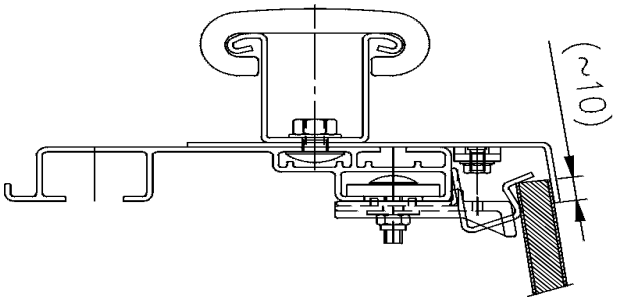


Fig. 702-06

– Overlap between inner cladding panel and skirt panel: **approx. 6 mm**

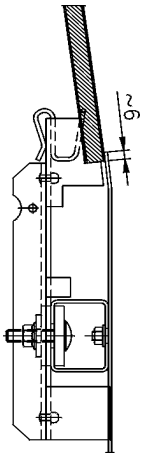


Fig. 702-07

3 Checks

- Check the vertical adjustment of the abutting edges.

4 Finishing Work

- Turn on the main switch.

19 Repair of Electrical Equipment

19.1 Replacement of PLC Components – Q 409 689

Electric Voltage!

The control cabinet is equipped with electronic components. Therefore, make sure to avoid static discharge when replacing a componenet.

Protective measure:

- Discharge static by grounding yourself to the control cabinet (e.g., by touching the mounting plate in the control cabinet).

1 Procedure for the Replacement of a PLC Component

1.1 Replacing PLC components

- Turn off the main switch before replacing a component.
- When replacing the CPU, always pay attention to matching software.

Hint!

Contact the supplying factory for support

- Pull out all plugs of the component you want to change.
- Now, you can pull out the module and replace it.
- Install all items in the reverse order.

1.2 Software Update

For a software update, the required SD card containing the updated software, as well as related instructions are available from Schindler Elevator Corp, Clinton, NC, Tel. 1-800-804-4001.

See also Maintenance Instruction Q 409 478, Control Cabinet and Boxes

19.2 Skirt Lighting – Q 409 849

1 Preparation Work

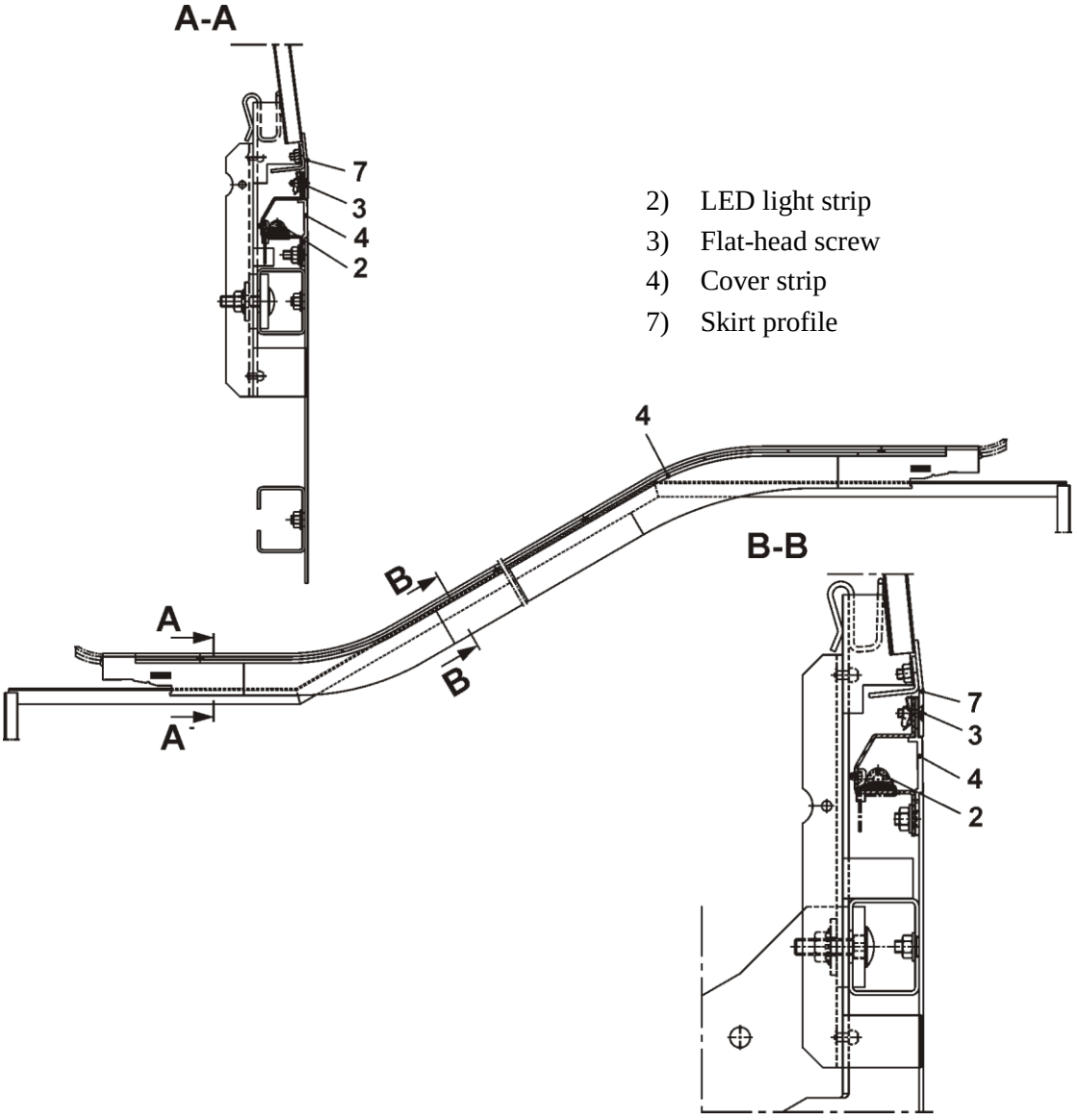
- Remove the last floor cover next to the support angle at the drive or tension station.

See Maintenance Instructions Q 409 457, Floor Covers

- Turn off and padlock the main lighting switch.

2 Replacing LED Light Strips

Fig. 849-01



2) LED light strip
3) Flat-head screw
4) Cover strip
7) Skirt profile

- Disassemble the required number of inner cladding panels (11) so that the skirt profile (7) to be removed is readily accessible over its entire length (see Fig. 849-02).

- Remove the required number of skirt profiles (7) so that the LED light strip (2) to be replaced is readily accessible.
  - Loosen the flat-head screws (3) and remove them together with the skirt profile (7).
  - Pull the cover strip(s) (4) out from above.

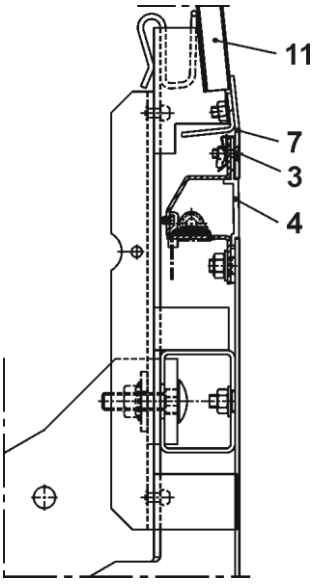


Fig. 849-02

- Unplug the connection plug (8) on both ends of the affected LED light strip (2).

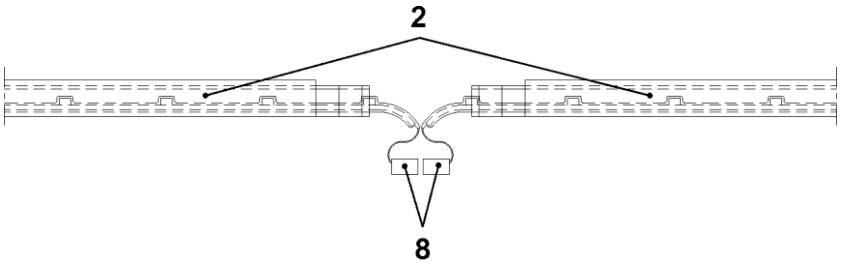


Fig. 849-03

- Cut and remove the cable binders (9)
- Remove the LED light strip (2) from the holding clips (10).

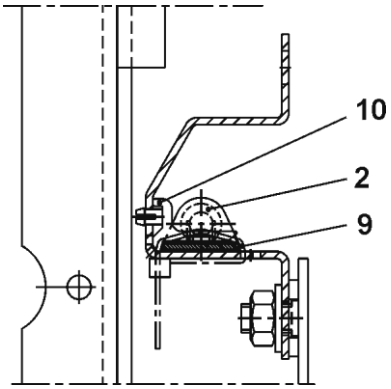


Fig. 849-04

- Install a new LED light strip in the reverse order.

Hint!

Upon installation of the new LED light strip (2), make sure that the LED light strip is secured by the clips (10) and the cable binders (9) again.

- Reinstall the removed skirt profiles (7)
  - Insert the cover strip(s) (4) out from above.
  - Reinstall the skirt profile (7) and tighten the flat-head screws (3).

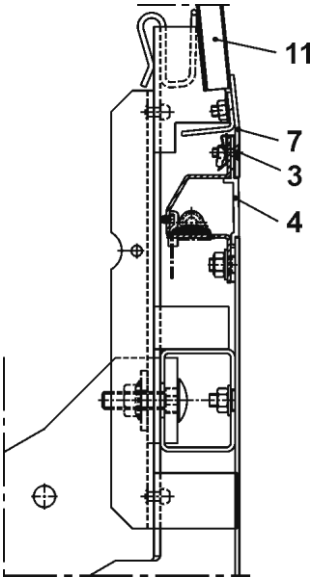


Fig. 849-05

- Reinstall the removed inner cladding panels (11) (see Fig. 849-05).

3 Checks

- Check the lighting.

See Maintenance Instructions Q 409 475, Skirt Lighting

- Check the cover strips for proper seating and flush joints.

4 Reassembly

Reassemble the parts disassembled under Section 1 in the reverse order.

19.3 Safety Contacts, Initiators, Solenoids – Q 409 690

1 Safety Contacts

1.1 Limit Switch With Roller

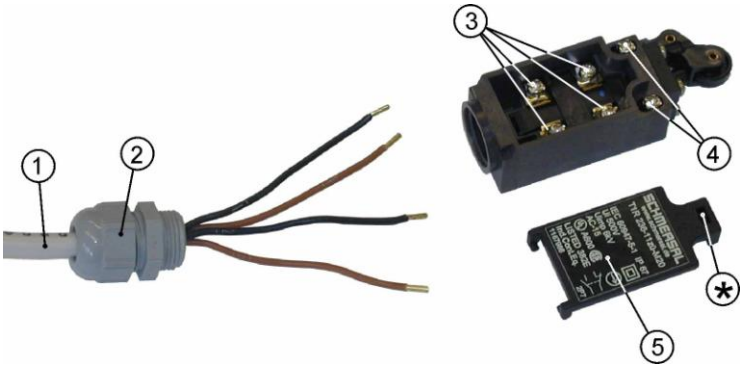
This limit switch is used for the following contacts:

- Step chain tension contact
- Combplate contact
- Drive chain contact, mechanical
- Handrail entry contact
- Handrail rupture contact
- Step level contact
- Step chain locking device contact

1.1.1 Replacing the Contact

Fig. 690-01

1) Cable
2) Cable gland
3) Electrical screw terminals
4) Fastening screws
5) Cover



- Loosen the fastening screws (4) and remove the limit switch.
- Disconnect the wiring:
  - Remove the cover (5) by means of a screwdriver (*).
  - Disconnect the electrical screw terminals (3).
  - Remove the cable gland (2) and pull out the cable (1).
- Install the new limit switch analogously in the reverse order.

Wiring acc. to wiring diagram

1.1.2 Checks

- Setting
- Functional check

For the step chain tension contact, see Maintenance Instructions Q 409 602

For the combplate contact, see Maintenance Instructions Q 409 460

For the drive chain contact, see Maintenance Instructions Q 409 453

For the handrail entry contact, see Maintenance Instructions Q 409 653

For the handrail rupture contact, see Maintenance Instructions Q 409 650

For the step level contact, see Maintenance Instructions Q 409 601

For the step chain locking device contact, see Maintenance Instructions Q 409 926

1.2 Limit Switch Without Roller

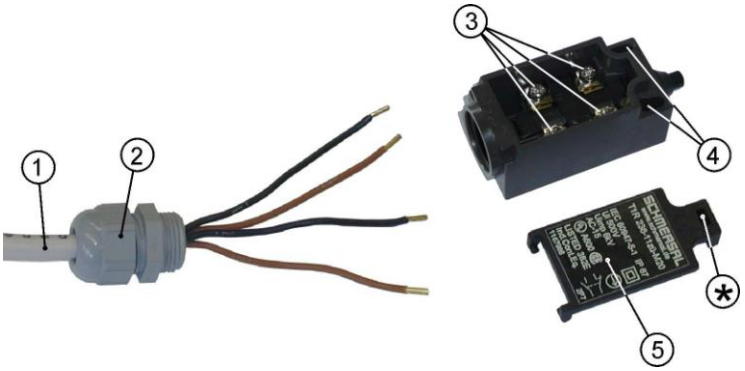
This limit switch is used for the following contact:

- Step upthrust contact

1.2.1 Replacing the Contact

Fig. 690-02

1) Cable
2) Cable gland
3) Electrical screw terminals
4) Fastening screws
5) Cover



- Loosen the fastening screws (4) and remove the limit switch.
- Disconnect the wiring:
  - Remove the cover (5) by means of a screwdriver (*).
  - Disconnect the electrical screw terminals (3).
  - Remove the cable gland (2) and pull out the cable (1).
- Install the new limit switch analogously in the reverse order.

Wiring acc. to wiring diagram

1.2.2 Checks

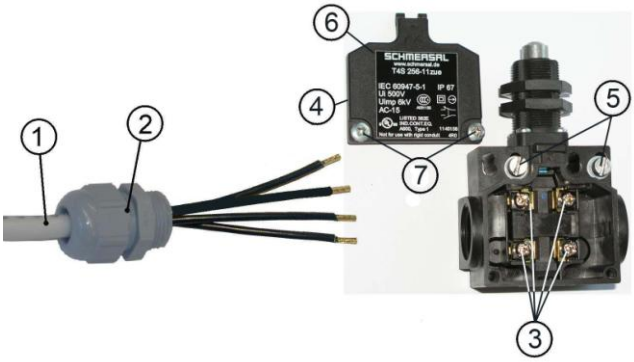
- Setting
- Functional check

For the step upthrust contact, see Maintenance Instructions Q 409 709

1.3 Skirt Contact

1.3.1 Replacing the Contact

Fig. 690-03



1) Cable
2) Cable gland
3) Electrical screw terminals
4) Sealing
5) Fastening screws
6) Cover
7) Cover screws

- Loosen the fastening screws (5) and remove the limit switch.
- Disconnect the wiring:
  - Loosen the cover screws (7) of the cover and remove the cover (6).
  - Disconnect the electrical screw terminals (3).
  - Remove the cable gland (2) and pull out the cable (1).
- Install the new limit switch analogously in the reverse order.

Wiring acc. to wiring diagram

1.3.2 Checks

- Setting
- Functional check

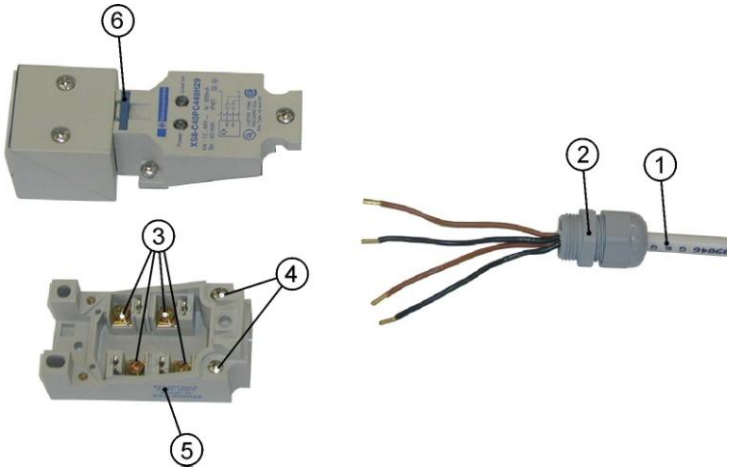
See Maintenance Instructions Q 409 648, Skirt Contacts

2 Initiators

2.1 Step Band Monitor

2.1.1 Replacing the Proximity Switch

Fig. 690-04



1) Cable
2) Cable gland
3) Electrical screw terminals
4) Fastening screws
5) Base plate
6) Switch lock

- Loosen the fastening screws (4) and remove the proximity switch.
- Disconnect the wiring:
  - Open the cover of the proximity switch.
  - Pull out the switch lock (6).
  - Remove the upper part of the proximity switch.
  - Disconnect the electrical screw terminals (3).
  - Remove the cable gland (2) and pull out the cable (1).
- Install the new proximity switch analogously in the reverse order.

Wiring acc. to wiring diagram

2.1.2 Checks

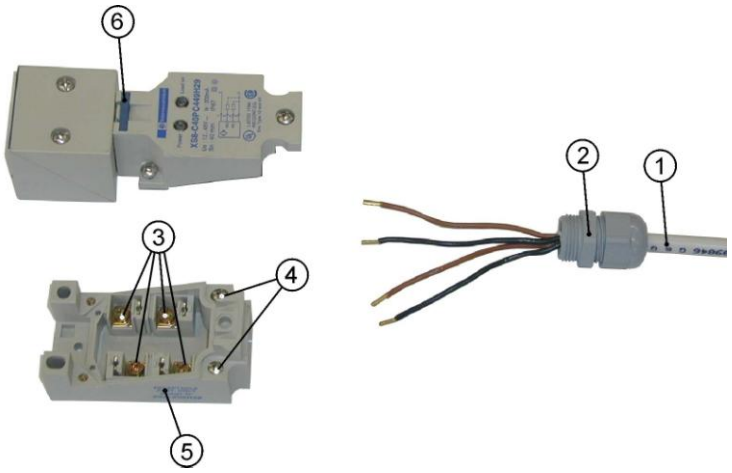
- Setting
- Functional check

See Maintenance Instructions Q 409 465, Step Band Monitor

2.2 Step/Chain Roller Monitor

2.2.1 Replacing the Proximity Switch

Fig. 690-04a



1) Cable
2) Cable gland
3) Electrical screw terminals
4) Fastening screws
5) Base plate
6) Switch lock

- Loosen the fastening screws (4) and remove the proximity switch.
- Disconnect the wiring:
  - Open the cover of the proximity switch.
  - Pull out the switch lock (6).
  - Remove the upper part of the proximity switch.
  - Disconnect the electrical screw terminals (3).
  - Remove the cable gland (2) and pull out the cable (1).
- Set the active face of the sensor head to downward direction.
- Install the new proximity switch analogously in the reverse order.

Wiring acc. to wiring diagram

2.2.2 Checks

- Setting
- Functional check

See Maintenance Instructions Q 409 465A, Step/Chain Roller Monitor

2.3 Speed Monitor

2.3.1 Replacing the Proximity Switch

Fig. 690-05

1) Cable
2) Cable gland
3) Proximity switch
4) Fastening nuts

- Loosen the fastening nuts (4) and remove the proximity switch (3).
- Disconnect the cable (1).
- Install a new proximity switch (3) in the reverse order.

2.3.2 Checks

- Setting
- Functional check

See Volume VJ, Renold_O&M_Manual.pdf

2.4 Handrail Monitor

2.4.1 Replacing the Proximity Switch

See Section 2.3, Speed Monitor

2.4.2 Checks

- Setting
- Functional check

See Maintenance Instructions Q 409 650, Handrail Monitor, Handrail Rupture Contact, Antistatic Brushes

3 Solenoids

3.1 Service Brake

3.1.1 Replacing the Solenoid

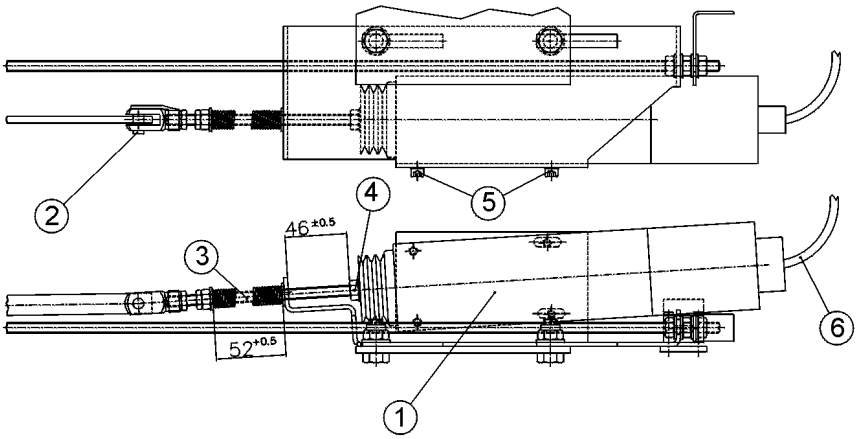
For more detailed information, see Volume VJ, Renold_O&M_Manual.pdf

3.2 Safety Brake

3.2.1 Replacing the Solenoid

Fig. 690-06

1) Solenoid
2) ES pin
3) Threaded rod
4) Nut
5) Hex socket screw
6) Cable

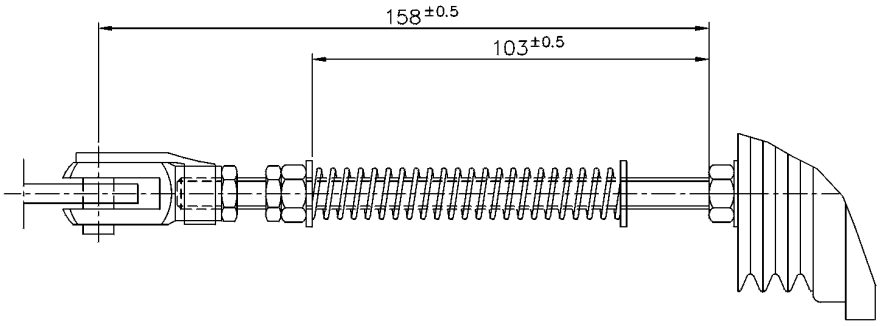


- Pull the cable (6) off the solenoid (1).
- Remove the ES pin (2).
- Loosen the nut (4) and remove the threaded rod (3).
- Loosen the hex socket screws (= 4 pcs.) with the locking washers (5) and remove the solenoid (1).
- Install a new solenoid analogously in the reverse order.

3.2.2 Checks

- Check the setting of the threaded rod (3) (see Fig. 690-07).

Fig. 690-07



- Check the longitudinal adjustment of the solenoid.

Hint!
The indicated distances apply to picked-up solenoids.

- Functional check

See Maintenance Instructions Q 409 710, Safety Brake

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Illustrated Parts Catalog

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