

SIEMENS

Operating and Service Manual

Switchguard S 700 K Point Machine

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Document history

Version	Release date	Sections changed	Reason
B	2012-12-22	All	Restructuring, modularization and revision of the safety notices in accordance with the SAFE principle
C	2014-10-22	4 6	Mounting steps and torque values added Block diagrams corrected

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1 Information for the user

About this document

Scope

This document refers to the Switchguard® S 700 K point machine with its more than 200 variants.

Purpose

The contents of this document cover handling, installation, commissioning, preventive and corrective maintenance as well as checking of the functional integrity of the point machine. In addition, this document contains further useful information, in particular concerning the safety of staff. The information is presented as text and figures.

This document also contains the technical data of the point machine, the tools to be used for preventive and corrective maintenance as well as information required for its proper use.

The document has been compiled to enable qualified staff to perform the necessary work.

Note on illustrations

All illustrations in this document are examples. Due to ongoing product development, the illustrations shown in this document may not correspond to the supplied product version in all cases.

Where a risk of injury or damage during the work cannot be totally excluded, attention is drawn to the hazards by pictograms.

Target group

This document is directed at installation and maintenance staff.

Suggestions

Contact us direct if you have any suggestions concerning this document. Your ideas and requests would be gratefully received.

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2 Safety

Representation of safety information

Where a risk of injury or damage cannot be ruled out in the work described, attention is drawn to the relevant hazards by means of specially highlighted safety notices. The safety notices used are classified according to the severity of the hazard and have the following meanings:



DANGER

Death or serious injury **will** occur if you do not take the precautions described.



WARNING

Death or serious injury **may** occur if you do not take the precautions described.



CAUTION

Slight injury may occur if you do not take the precautions described.

NOTICE

Damage or an undesirable result or state may occur if you do not take the precautions described.

Qualified staff

Definition

As qualified staff as defined in this document, you must meet the following conditions:

- Due to your technical education, know-how and experience as well as knowledge of the relevant regulations, you are able to perform the assigned tasks independently and identify potential risks.
- You have been specially trained and examined for the assigned work on the described equipment.
- You have been authorized by the operator to perform work on the described equipment in accordance with the standards governing railway signaling and safety systems.

Work to be performed by qualified staff only

Work on the described equipment may only be performed by qualified staff.

Safety-minded work



DANGER

Dangerous operating conditions and risk of accidents due to improper work!

Improper work may result in serious injury. As qualified staff, you are responsible for job safety.

Observe all regulations and work rules to avoid any risk of injury or damage.

Observance of regulations

- Observe all safety regulations for your personal safety and for protection of the equipment described.
- Also observe the operator's regulations and the statutory regulations for the prevention of accidents.

Work rules

- Only operate the equipment described if it is in perfect working order. Report any faults detected to the authority or person responsible.
- Carry out the work in such a way that human safety is not affected nor operation of the equipment described impaired.
- Refrain from any work not described in this document.
- Protect yourself. Watch out for hazards in the track area. Wear protective clothing when performing work that may result in injury. Observe the applicable regulations of the railway operator.

- Before performing any work, carry out the necessary operational measures in accordance with the operator's regulations. Only then deactivate the safety equipment.
- Fully re-activate the safety equipment once the work has been completed. Check the safety equipment for correct operation.
- Inform staff of any incorrect actions.
- Ensure that no unauthorized persons enter the danger zone.

Prohibited modifications

- The equipment described may only be used with third-party equipment and components recommended or approved by Siemens. Refrain from any modifications not described in this document.
- Only replace faulty components by appropriately correctly stored spare components. Do not attempt to repair components. Return faulty components to Siemens.
- Only use the maintenance materials, lubricants and original spare parts prescribed by Siemens.

Safety regulations

Avoidance of injury and damage

This section tells you what safety regulations need to be observed for handling, installation and maintenance of the point machine.

To avoid injury or damage, you must carefully observe the safety regulations below. Familiarize yourself with the contents of this Operating and Service Manual to ensure safe and correct work on the point machine.



WARNING

Dangerous operating conditions and risk of accidents!

Preventive and corrective maintenance is performed during normal operations.

Before beginning work on the track, apply the appropriate safety measures in accordance with the applicable railway regulations.



WARNING

Danger of electric shock!

If you remove the cover of the point machine, take into account the fact that the parts bearing a lightning symbol are carrying a current. The point machine can start to move and the set of points be thrown.

Disconnect the point machine.

**WARNING****Dangerous operating conditions and risk of accidents!**

Modifications to the point machine impair its function and may result in personal injury and/or damage.

Do not carry out any unauthorized modifications to the point machine. Perform all work using only the tools, specialist equipment, test facilities and materials intended for maintenance.

**CAUTION****Irritation of the skin!**

Grease can irritate the skin or cause other allergic reactions.

Prevent your skin from coming into contact with grease. Only apply grease using gloves and appropriate tools (e.g. a brush).

Usage of prescribed agents

Only use the stated agents for cleaning, greasing, lubricating, oiling and sealing.

Designation	Application
Molub-Alloy 243 Arctic grease	Point machine components
Molykote paste (type G-N)	Gear wheels
SAE 10 W/40 oil (do not use spray oils containing turpentine or silicone)	Oiling of components
Flake graphite	Cover lock
De-icing agent	Cover lock
Plastic sealing compound (e.g. Fluid D from Teroson GmbH Heidelberg)	Sealing at flanges

Table 1 Agents

Tools

The following tools are required:

- plastic hammer
- slotted-head and Phillips screwdrivers
- set of Allen keys
- set of Torx keys
- set of socket wrenches with extender
- set of open-ended or ring wrenches
- torque wrench for an adjustment range of 2 to 40 Nm
- metal folding rule or similar measuring tool
- torque wrench for 200 Nm (fastening of the point machine)

Earthing of point machine housing

The point machine housing must be connected to earth potential or – on electrified lines – to the railway earthing system. Use insulated copper cable with the cross-section specified by the railway operator. Connect the earthing cable to one of the two M16 earthing screws of the housing using a cable lug.

Transport of point machine



Risk of pinching and rupture!

The point machine weighs approx. 120 kg.

Observe the applicable regulations for the prevention of accidents when transporting the point machine. Wear protective clothing (e.g. protective gloves, safety footwear) and use appropriate hoisting gear.

The point machine must be handled with care when being transported. Check all parts for any damage in transit and completeness.

For transport, round slings can be run around the flanges of the housing, for example.

Storage of point machine

The point machine can be stored briefly (< 1 month) in the manufacturer's packaging outdoors on a clean, dry surface. If the point machine is to be stored for a longer time, remove the foil and store the closed point machine in its mounting position at a weather-protected location. Do not stack point machines.

3 Constructional details and mode of operation

Product overview

Overview of functions

The S 700 K point machine is used to operate points with external locking and, under certain conditions, also points without a locking mechanism. It has the following functions:

- throwing of points
- retention of point blades in the end (home) positions
- (electrical) detection of the blade end position

Versions

The point machine is available in different versions which are distinguished by the following:

- trailability or non-trailability
- right-hand or left-hand mounting
- with or without point detector
- type of motor current
- throwing stroke, throwing force, and throwing time
- different internal wiring

The point machine is available as a trailable or non-trailable version. The typical trailing resistance is 9000 N +500 N. The retention force of the non-trailable machine is greater than 90 kN.

Trailable point machines should only be used up to a max. train speed of 160 km/h. At higher train speeds of up to 350 km/h, in the event of movable frogs or points with more than one point machine, the non-trailable version is to be used.

A throwing movement already initiated can be reversed at any time and from any position.

In the event of a power failure, the point machine can be reversed locally using a crank handle.

Product advantages

- good overall efficiency
due to a four-pole three-phase AC motor (standard), antifriction bearings, and a ball spindle drive. Under normal conditions, feeder cables having a core diameter of less than 1.8 mm (at 400 V AC) can be used. Alternatively, a greater control range is possible.
- good accessibility
since all the components are neatly arranged in a point machine housing. Parts which need to be checked during interlocking inspections and maintenance work are easily accessible.

Constructional details of point machine

Point machine housing

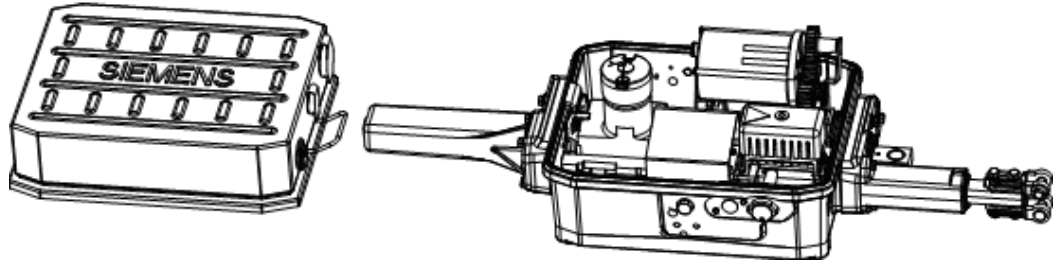


Figure 1 S 700 K point machine

The point machine housing conforms to IP rating IP54 as per EN 60529.

The inside is ventilated and any water which may have collected can be drained off by removing a drainage stopper. The outlets for the throw bar and detector slides, the lock cover and the opening for the crank handle are well sealed. The efficiency of the point machine is not impaired by the entry of moisture.

The housing cover has a built-in lock.

Cable gland

The cables enter the point machine housing in an insulated manner through one or more cable glands on the point machine sides.

The cable cores are connected to a terminal strip with eight terminals. A maximum of eight cores can be connected depending on the voltage cut-off switch used.

Earthing screws

One M16 earthing screw is provided on each of the two long sides of the point machine housing.

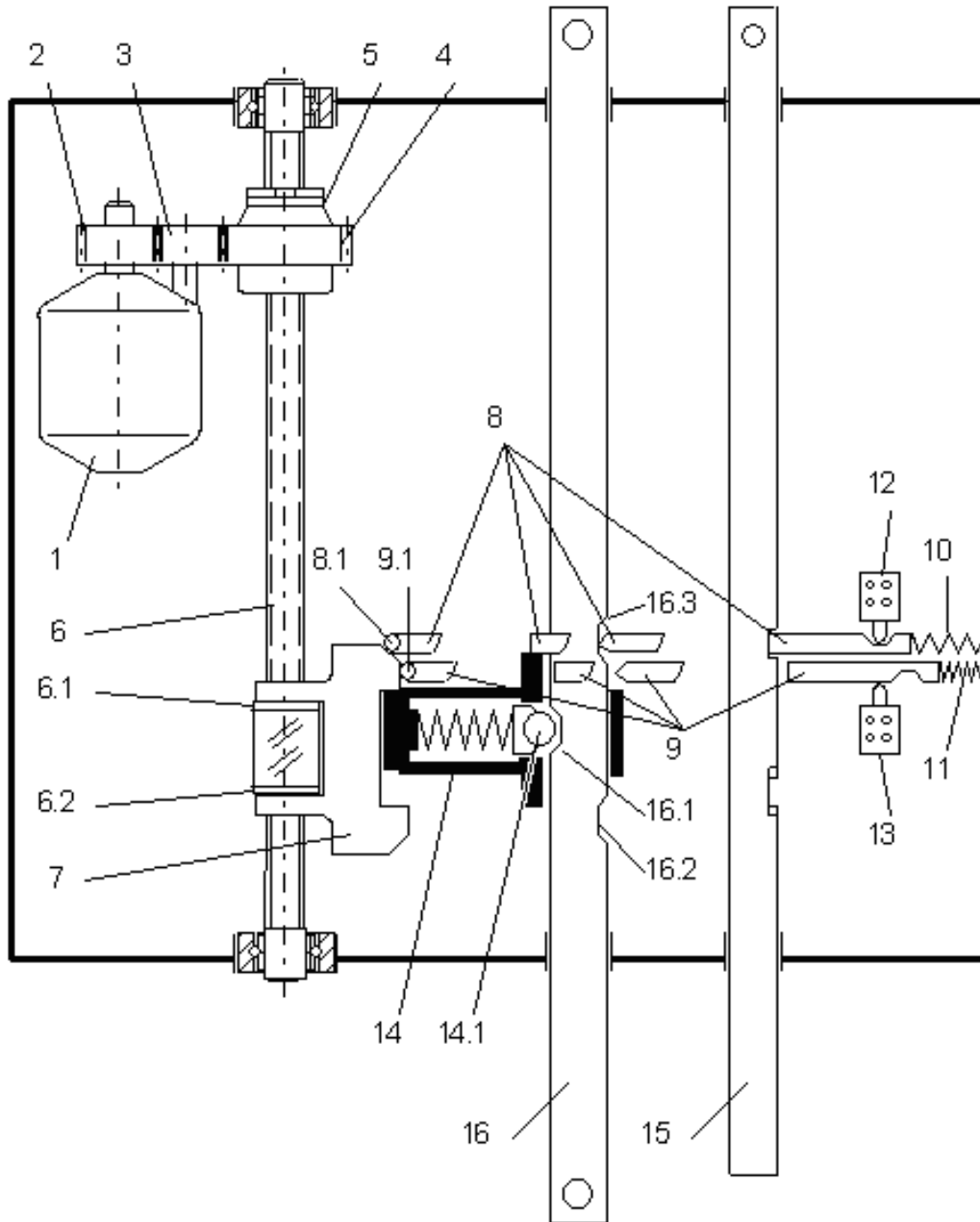
Internal wiring

For the internal wiring, flexible conductors are used which are bundled together. Contact areas subject to particular stress are covered with a flexible tube.

The dielectric strength of all voltage-carrying parts with respect to ground is 2500 V, 50 Hz (VDE 0831). A diagram of the internal circuitry is affixed to the housing cover of the point machine.

Function chart

The illustration is a function chart of the point machine with index numbers which are explained in the text below. The chart is intended as a guide; mechanical details have therefore been omitted.



1	Motor
2	Pinion
3	Intermediate gear wheel
4	Gear wheel
5	Transmission clutch
6	Ball spindle drive

6.1 and 6.2	Carrier
7	Shifting plate
8 and 9	Keep-and-detect slide
8.1 and 9.1 and 14.1	Roller
10 and 11	Compression spring
12 and 13	Limit switch
14	Retention clutch
15	Detector slide
16	Throw bar
16.1 and 16.2 and 16.3	Notch of throw bar

Figure 2 Function chart of the S 700 K point machine

Motor

The encased (built-in) motor (1), an asynchronous short-circuit three-phase AC motor for standard applications, has been specially adapted to the constructional requirements of the point machine. The motor is designed for short-time duty and has a high starting torque. The starting current is damped to permit operation with different line resistances.

The rotor shaft, resting on ball bearings, supports the motor pinion (2). A crank handle gear wheel is available for insertion of the crank handle. An intermediate gear wheel (3) mounted on a pin of the motor engages with the pinion. This intermediate gear wheel bridges the axial clearance to the gear wheel of the transmission clutch (5). An operating lever also mounted on the pin acts as a latch which only permits crank handle operation when the voltage cut-off switch is operated. Different transmission ratios and thus different throwing speeds or times are possible.

A suitable tolerance combination between the motor attachment and gear wheels ensures a perfect engagement with the transmission clutch gear wheel (4) even if the motor is exchanged.

Other motors are available. They comply with the German VDE specifications.

Transmission clutch

A multiple-disc clutch (5) limits the throwing force. Torque is transmitted by two steel discs to a sintered friction disc. The throwing force remains constant throughout the entire service life. This is due to the long useful life of the clutch, the flat characteristics of the spiral springs by means of which the pressure force is produced, and the relatively low surface pressure.

The transmission clutch is mounted as a complete unit. The housing parts are made of light metal alloy. The clutch hub attached to the output end remains stationary when the clutch slips. The slipping clutch part at the motor end, incorporating the clutch housing with the gear wheel, forms the actual flywheel mass and rests on the hub.

The throwing force is adjusted ex works to 5000 N +/-500 N for standard applications (German Railways (DB AG)). The adjusting screw is secured by means of two form-fit locking pins and sealed.

A throwing movement already initiated can be reversed at any time and from any position.

Gearing

The torque of the motor (1) has to be transformed into the necessary throwing force. The rotary movement is converted into the straight movement of the throw bar (16) by a ball spindle drive (6) via reduction gearing (2, 3, 4) and the transmission clutch (5).

The ball spindle drive permits a high transmission ratio and produces linear motion. The spindle and spindle nut intermesh via rolling balls. The rotary motion of the spindle is transmitted to the spindle nut and transformed into linear motion by rolling friction. A guide prevents coupled rotation of the spindle nut, resulting in the required longitudinal motion. The spindle nut passes on the longitudinal motion to the secondary components via carriers (6.1 and 6.2).

Retention clutch with throw bar

The retention clutch (14) is a notched clutch. It is attached direct to the throw bar (16), which is thus completely enclosed by the clutch housing. The retention clutch comprises a pretensioned spiral spring which presses a guided roller (14.1) into the hardened notch (16.1) of the throw bar. The pretensioning of the spring determines the retention force. It is adjusted by means of a nut, which is then form-locked and sealed.

- Trailable points are held in the two end positions with a retention force of 7000 N \pm 500 N. When points are trailed, the notch of the throw bar lifts out the roller, thereby compressing the retention spring. The trailing resistance is 9000 N +500 N. It is produced by the spring pressure and the friction between the throw bar and the guides in the clutch housing as well as the guide flanges in the point machine housing.
- In non-trailable point machines, the latching bolt of the retention clutch is blocked.

On the clutch housing, there is also a shifting plate (7) supported by a guide. The plate engages a keep-and-detect slide (8 or 9) at the beginning of the throwing process and unblocks the clutch housing.

Point detector

The point machine can be equipped with a point detector consisting of a pair of detector slides and a guide sleeve. The detector slides prove the two end positions of the point blades. An end position is only indicated if the prescribed distance between the point blades and the stock rail is maintained.

If the connection between the points and point machine is interrupted, e.g. due to a fractured operating rod, the point detector retains the points in the end position (alternative locking). This alternative locking is performed with a force of 35 kN.

The point fault becomes apparent the next time the points are operated and no "end position reached" indication is issued. A fractured detector rod can be detected in the same way.

The detector slides (15) have notches enabling them to lock the relevant end position. The joints on the detector slides are insulated.

Contact assembly

Limit switches (12 and 13) are used as the switching elements. For a four-wire three-phase AC point circuit, changeover contacts are required. These are operated by the quick-switch mechanism of the limit switch, making a mid-way position of the contacts impossible.

The contacts are arranged in such a way that an end position of the points cannot be indicated until the throw bar and detector slides have reached their end positions. The end position of the throw bar must correspond to the position of the points.

Mode of operation

Throwing of points (point machine without point detector)

1. The motor (1) starts up. The torque is transmitted by the pinion (2) via the intermediate gear wheel (3) to the gear wheel (4), and via the transmission clutch (5) to the ball spindle drive with the spindle nut (6). The clutch limits the torque,
2. which is converted into a longitudinal force by the axial travel of the spindle nut. The carriers (6.1 and 6.2) on the spindle nut move the shifting plate (7) in the direction of thrust.
3. When the sloping edge of the shifting plate moves against the roller (8.1) of the keep-and-detect slide (8), it pushes the slide back against the force of the compression spring (10), causing the limit switch (12) to operate. The detection current contact is broken and the throwing current contact made. The retention clutch (14) and the detector slides (15) are released.
4. The actual throwing process begins. Up to this point, the spindle nut has only carried the shifting plate; it now also transports the retention clutch (14), a notched clutch linked to the throw bar (16). The retention clutch transfers the movement of the spindle nut to the throw bar.
The retention force (setting of the retention clutch) must always exceed the throwing force in order to prevent disengagement in the event of a large throwing resistance.
5. At the end of the throwing movement, a compression spring (11) is released, pushing forward the keep-and-detect slide (9) assigned to this end position. The keep-and-detect slide engages with the end position notch (16.2) of the throw bar and locks the retention clutch.

Throwing of points (point machine with point detector)

For point machines with a point detector, the keep-and-detect slide (9) must also engage with the notches of the detector slides (15). The keep-and-detect slide can, therefore, only reach the locking end position if the detector slides have also reached the correct end position. Only under these conditions is it possible for the keep-and-detect slide to operate the limit switch (13), thereby breaking the throwing current contact and making the detection current contact.

The detector slides (15) are locked in the end position by the keep-and-detect slide (9).

Trailing process

1. In the end position shown (see the “Function chart” figure), the keep-and-detect slide (8) retains the throw bar (16) via the retention clutch (14).
2. The throw bar can only be moved if the set trailing resistance is overcome. The sloping edge of the notch (16.1) in the throw bar lifts the roller (14.1) of the retention clutch against the force of the retention spring. A second notch (16.3) of the throw bar for the relevant end position shifts the engaged keep-and-detect slide (8). The keep-and-detect slide operates the limit switch (12) and breaks the detection current contact. At the same time, the locking of the detector slides (15) by the keep-and-detect slide (8) is canceled. The retention clutch (14) remains locked by the split keep-and-detect slide (8).
3. As the trailing process progresses, the throw bar (16) is shifted with respect to the retention clutch (14) after the trailing resistance has been overcome. The point machine is indicated as being trailed as soon as the throw bar is moved, even if the locking of the point machine is still effective.

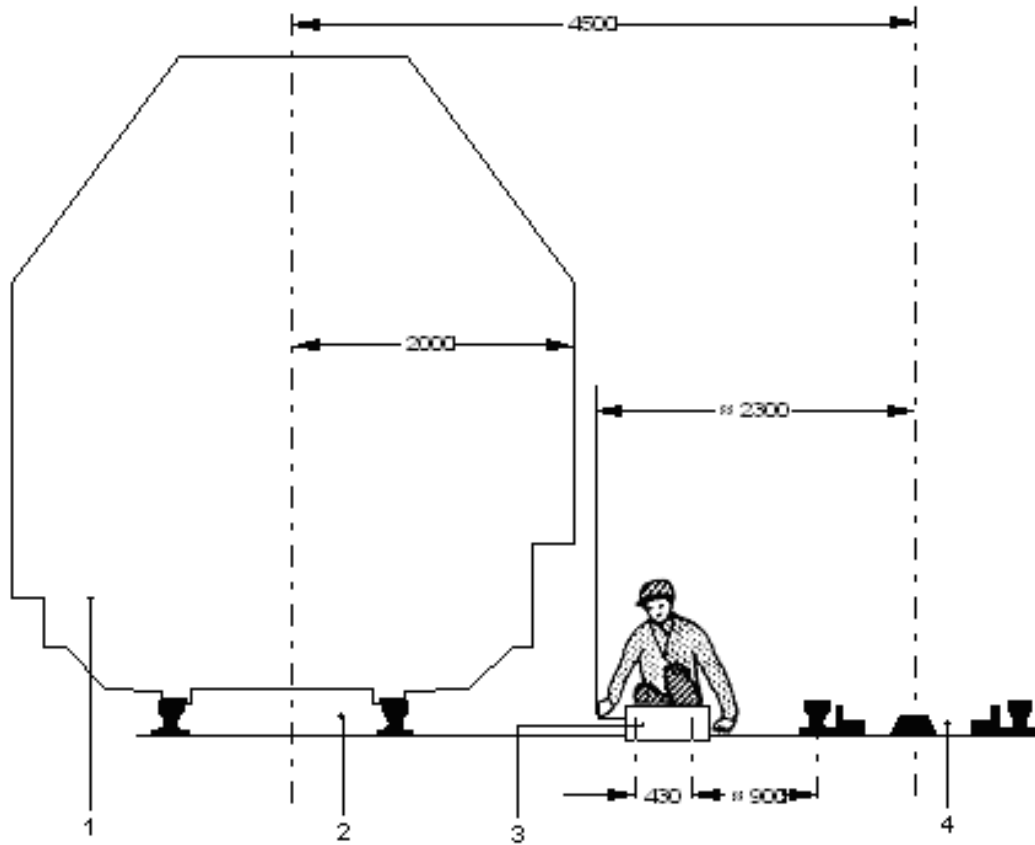
After trailing, the point machine must be made operational again. This is done by a point reversal which allows the retention clutch to catch up with the throw bar until it engages. If non-trailable point machines are trailed, safety-related components are destroyed in most cases so that proper operation is no longer ensured.

Non-trailable point machines which have been trailed must be checked and repaired by qualified staff. We recommend returning them to the manufacturer for inspection and repair.

Throwing of points with crank handle

The point machine can be reversed locally using a crank handle. Depending on the point machine version, the crank handle is inserted on the right-hand or left-hand side of the point machine housing. The crank handle is inserted through a covered opening in the housing and engaged with the crank handle gear wheel. Hence, on double-track lines, staff do not need to turn their back to either of the tracks.

The position of the crank handle opening is such that cranking is not hindered by ballast or the like. A crank handle latch prevents the crank handle from engaging with the crank handle gear wheel as long as the throwing current is on. The voltage cut-off switch is operated by means of a key and the crank handle gear wheel released.



1	Clearance gage
2	Adjacent track
3	Point machine
4	Blocked track
*	The dimensions in the illustration are given in mm.

Figure 3 Throwing of points with a crank handle

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4 Installation and commissioning of point machine

Installation of point machine

WARNING

Dangerous operating conditions and risk of accidents!

Hazards by passing trains are encountered when working on the point machine in the track area.

Before you start working on the track, inform the signaller responsible in order that he/she blocks the points. Continually observe the traffic on the adjacent track during the work.

NOTICE

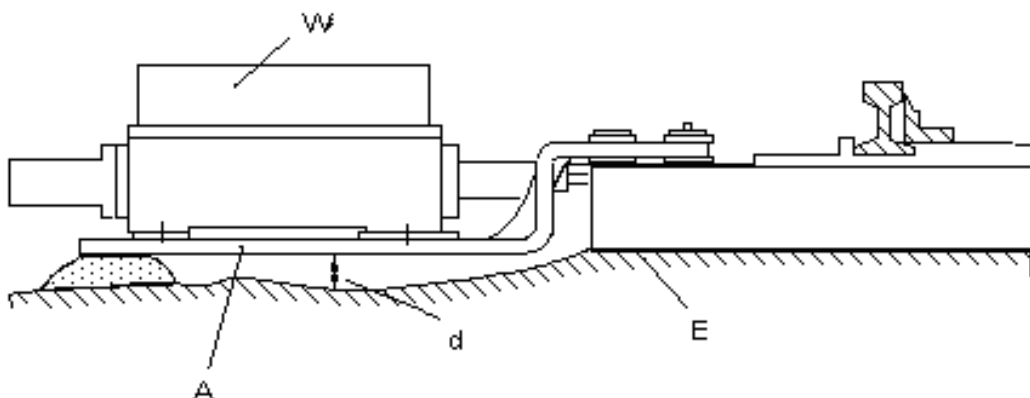
Damage to point machine

The point machine has an IP rating of IP54, i.e. it is only protected against the ingress of dust and spray water. The electrical and mechanical components of the point machine can be damaged or destroyed by standing or splashing water.

Install the point machine in such a way that it cannot be impaired by standing or splashing water.

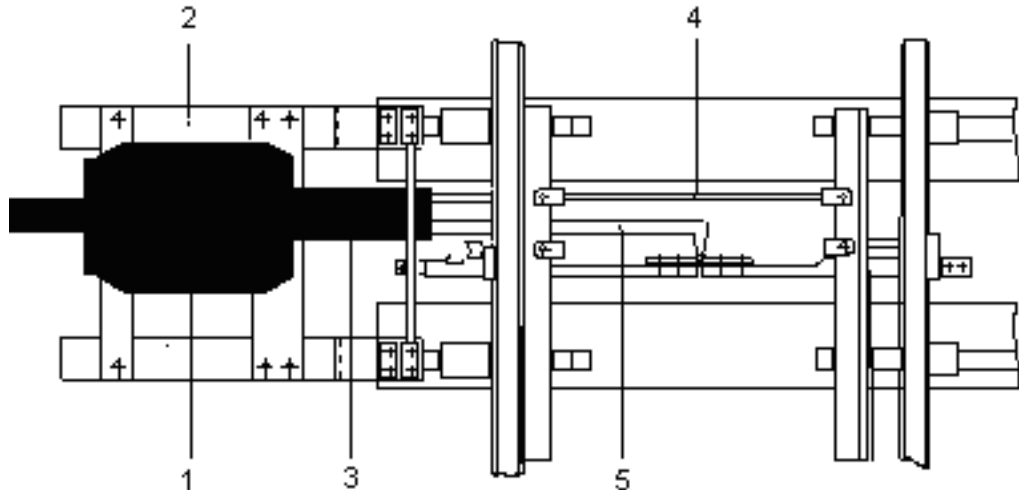
Drain off any water which collects by removing the drainage stopper. For this purpose, remove the stoppers from the four fastening holes and the cable entry hole(s).

Seating



W	Point machine
A	Base plate
d	At least 3 cm of air
E	Soil or ballast

Figure 4 Installation on a base plate (side view)



1	Point machine
2	Base plate
3	Rodding cover
4	Detector rod
5	Operating rod

Figure 5 Trackside installation (top view, on a base plate)

Preparation of point machine installation

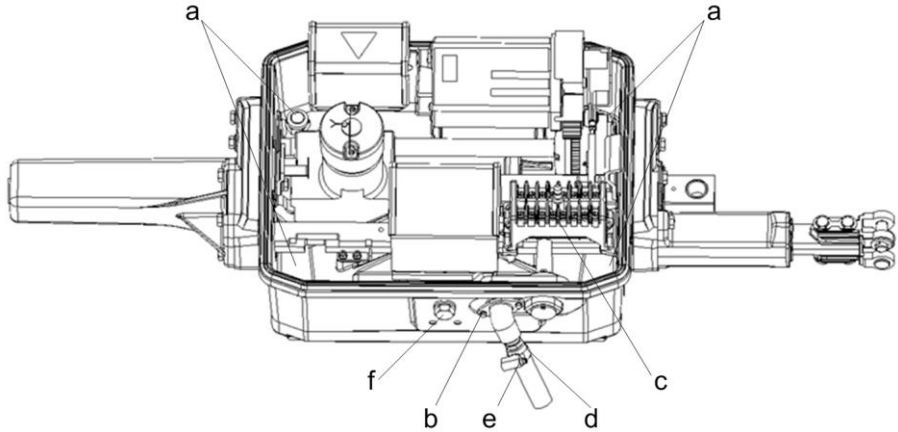
Step	Action
1	For seating the base plate and point machine, prepare a 30 to 40 cm ballast layer so that rain or water from melting snow can drain off and seep away well. Alternatively, use small concrete slabs or bricks as a seat.
2	Install the point machine so that the base plate is horizontal and the point machine cannot be impaired by standing or splashing water.
3	To achieve this, pack ballast under the base plate on the side facing away from the track.
4	Stamp the ballast firm.
5	Thoroughly stamp the seating surface of the point machine flat.
6	Check whether sufficient space has been left free of ballast on the side of the crank handle to be able to operate it without any difficulty.

Mounting of point machine


Step	Action
1	Fix the base plate on ribbed sole-plates or sleepers (see the "Trackside installation" figure).
2	Place the point machine on the base plate.
3	Hook in the detector rods in the case of point machines with a point detector.
4	Laterally shift the point machine until the detector rods are in alignment with the detector slides and vertically to the stock rail.

Step	Action
5	Put on the rodding cover.
6	Check whether there is sufficient play between the slide forks and the cover, taking into account a lateral play of the rodding cover. Shift the point machine, if required. Laterally crank the detector rods so that they cannot become jammed in the slide forks. Provisionally secure the point machine in this position on the base plate using clamps.
7	Connect the upper detector slide with the short detector rod and the lower detector slide with the long detector rod (see the "Trackside installation" figure).

Adjustment of point machine

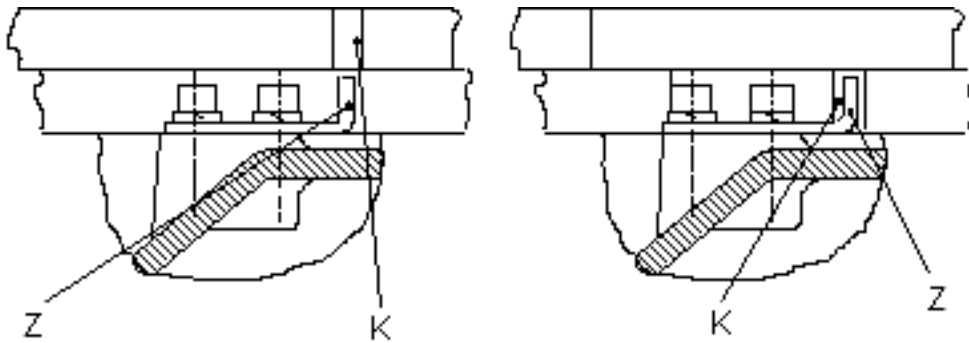
Step	Action
1	Hook in the operating rod and align it so that it is in alignment with the throw bar and in parallel with the detector rod and both bolts can be easily inserted.
2	Adjust the locking device overlap in both end positions by changing the length of the operating rod or shifting the point machine.
3	Make sure that the point machine is slightly inclined towards the track so that no water can enter the point machine housing via the detector slides or the throw bar.
4	Fix the point machine to the base plate using the fastening bolts.  Insert the connecting cable through the cable gland (b), (e) and (d) into the housing.
5	Connect the cable cores to the voltage cut-off switch in the point machine using pin cable lugs.
6	Connect the earthing cable to the earthing screw (f) using a cable lug.

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Step	Action																					
7	<p>Tighten the screws/bolts with the following torques:</p> <table border="1"> <thead> <tr> <th>Mounting point</th> <th>Screw/bolt</th> <th>Torque [Nm]</th> </tr> </thead> <tbody> <tr> <td>Fastening of the point machine (a)</td> <td>M20</td> <td>200</td> </tr> <tr> <td>Cable gland (b)</td> <td>M5</td> <td>2</td> </tr> <tr> <td>Connecting cable on voltage cut-off switch (c)</td> <td>M4</td> <td>3.8</td> </tr> <tr> <td>Connecting sleeve</td> <td>PG16</td> <td>10</td> </tr> <tr> <td>Tube clip (e)</td> <td>-</td> <td>5</td> </tr> <tr> <td>Earthing screw (f)</td> <td>M16</td> <td>150</td> </tr> </tbody> </table> <p>The stated torques apply with a tolerance of +/-15%, corresponding to installation with a torque wrench.</p>	Mounting point	Screw/bolt	Torque [Nm]	Fastening of the point machine (a)	M20	200	Cable gland (b)	M5	2	Connecting cable on voltage cut-off switch (c)	M4	3.8	Connecting sleeve	PG16	10	Tube clip (e)	-	5	Earthing screw (f)	M16	150
Mounting point	Screw/bolt	Torque [Nm]																				
Fastening of the point machine (a)	M20	200																				
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Connecting cable on voltage cut-off switch (c)	M4	3.8																				
Connecting sleeve	PG16	10																				
Tube clip (e)	-	5																				
Earthing screw (f)	M16	150																				
8	Check that the point opening at the operating rod is in the admissible range (see also data recording sheet of points).																					
9	<div style="border: 1px solid black; padding: 10px; text-align: center;">  <p>WARNING</p> <p>Dangerous operating conditions! The point machine only functions properly if it has not been manipulated. Do not perform any unauthorized modifications!</p> </div> <p>Run in the point machine and adjust the upper (short) detector rod. The wide notches automatically adopt the correct position in the range of the permissible point opening of, for example, 149 to 169 mm (standard version). In this position, the relevant edge of the control notch must visually coincide with the edge of the pointer (see the "Pointer position with detector slide stroke" figures).</p>																					
10	<div style="border: 1px solid black; padding: 10px; text-align: center;"> <p>NOTICE</p> <p>Points fail to reverse! The transmission clutch may slip. Keep the point blades and point lock in perfect condition.</p> </div> <p>If the points fail to reverse (slipping of the transmission clutch), first check the condition of the point blades and point lock. If necessary, measure the throwing resistance of the points and the throwing force of the point machine using an appropriate measuring instrument.</p>																					

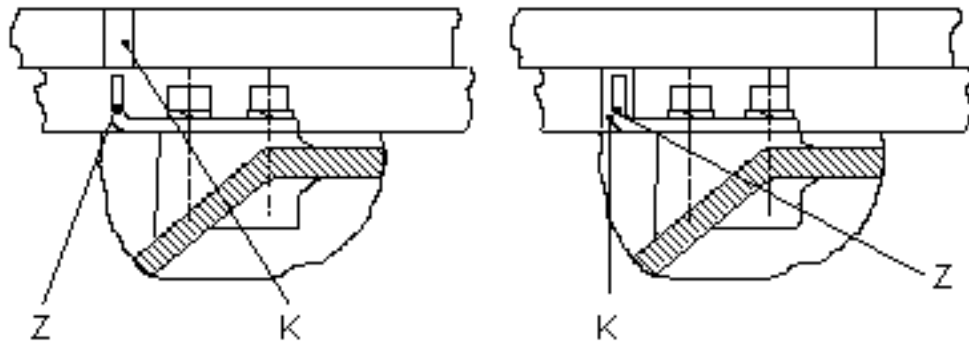
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Pointer position with detector slide stroke



K	Control notch
Z	Pointer

Figure 6 Pointer position with detector slide stroke, e.g. 160 mm



K	Control notch
Z	Pointer

Figure 7 Pointer position with detector slide stroke, 68 to 90 mm and 98 to 120 mm

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Commissioning of point machine

Re-tightening of fastening bolts

Step	Action
1	<div style="border: 1px solid black; padding: 10px; text-align: center;"> <p>NOTICE</p> <p>Point machine has become loose! The fastening bolts of the point machine may become loose after first-time installation. Re-tighten them at least twice after installation.</p> </div> <p>Re-tighten the fastening bolts of the point machine after installation after approx. three weeks at a torque of 200 Nm.</p>
2	Re-tighten the fastening bolts of the point machine after installation after approx. six weeks at a torque of 200 Nm.

Checking of correct operation

The components of the point machine must not be greased or oiled when putting it into service.

Step	Action
1	After installation of the point machine, check that it functions properly by throwing the points several times.
2	Perform a correspondence check in which you check correspondence of the point position with the detection indication at the interlocking.
3	Check whether the applicable regulations of the railway operator are observed.

5 Maintenance of point machine

Inspection and preventive maintenance

Inspection measures

Inspection comprises functional checking of the point machine and its components.

Preventive maintenance measures

Preventive maintenance comprises greasing and oiling of the point machine components. Use the prescribed lubricants.

The point machine requires little maintenance. All bearing surfaces remain fully functional even if they have not been greased over an extended period of time. Most of the maintenance work required to ensure that the point machine is in perfect working order can be carried out, for example, during inspection of the point locking components by qualified staff.

The throwing force values of the point machine can only be checked on a point machine test bench by measurement. When the point machine is installed, only the slipping force of the transmission clutch can be established using a force-sensing device upon electrical or manual point operation.

Various factors are possible during slipping-force measurement which may result in measuring errors and incorrect evaluations. Especially when the throwing movement is blocked suddenly, an irrelevant force peak is produced which has no effect on the points.

Inspection and preventive maintenance intervals

Intervals for inspection and preventive maintenance measures

Component	Activity
Point machine	Remove cover and and check interior
Point machine components	Check whether any parts are damaged
Wiring module	Check condition
Point machine housing – running rail connection (earthing)	Check connection

Table 2 Inspection interval: 6 months

Component	Activity
Crank handle latch	Check operation
Voltage cut-off switch	Check operation
Point machine	Check secure fit and installation conditions

Component	Activity
Throw bar	Grease
Ball spindle	Grease
Gear wheels	Grease
Detector slides	Grease and oil
Keep-and-detect slides	Oil
Shifting plate	Oil
Cover lock	Check easy movement

Table 3 Inspection/maintenance interval: 1 year

Component	Activity
Shaft of intermediate and crank handle gear wheels	Grease
Ball bearings at ends of ball spindle	Grease
Grease chambers in throw bar and detector slide guide	Top up

Table 4 Inspection/maintenance interval: 2 years

Inspection work

Checking of point machine interior

Grease and oil inside the point machine housing do not affect operation of the point machine.

Step	Action
1	Check the following on the point machine: <ul style="list-style-type: none"> Is the interior of the point machine clean and dry? Are the ventilation and drainage holes unblocked? Are the throw bar and detector slides free of rust and lubricated? Are the control notches of the detector slides in a center position over the pointer in both end positions?
2	Check the following on the housing cover: <ul style="list-style-type: none"> Does the housing cover fit without play? Is the rubber seal on the housing cover present and undamaged? Are the cover lock and lock cover in proper condition?

Checking of components

Step	Action
1	Perform a visual inspection.
2	Examine the components of the point machine to see if they are damaged.

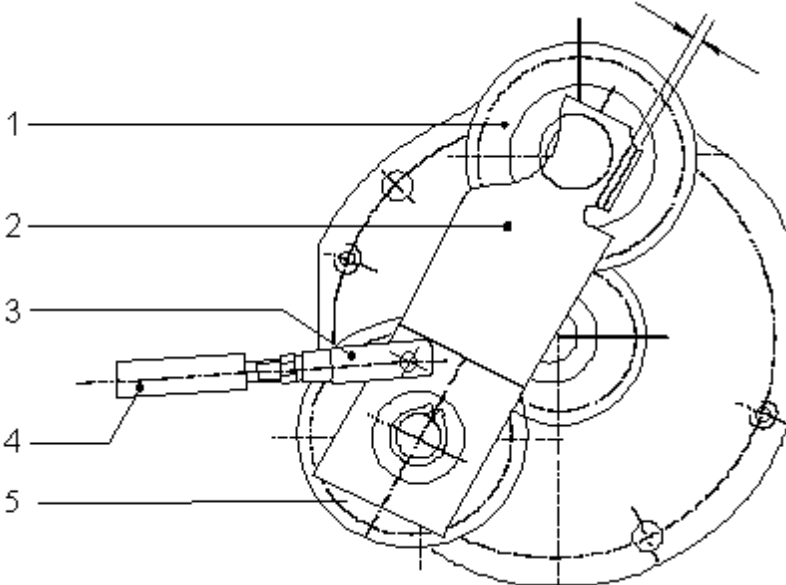
Checking of cable harness

Step	Action
1	Check whether the cable harness is held firmly in the cable clamp provided and does not touch any moving parts.
2	If the insulation of the cables is damaged: <ul style="list-style-type: none"> • Check whether any of the copper conductors have been damaged. • If only the insulation is damaged, wrap the relevant copper conductor with suitable insulating tape.
3	If a copper conductor is damaged, the cable harness must be exchanged by qualified staff.
4	Check whether the limit switches are damaged, i.e. show signs of mechanical or electrical wear and/or ingressed moisture. If so, replace the contact assembly.
5	Check whether the protective covers of the limit switches are present and undamaged.
6	Check whether the protective cover of the voltage cut-off switch is present and undamaged.

Checking of point machine housing – running rail connection (earthing)

Step	Action
1	Observe the regulations and guidelines of the relevant railway operator.
2	Check whether the cable is securely connected to the earthing screw of the point machine.

Checking of crank handle latch and voltage cut-off switch

Step	Action										
1	<div style="border: 1px solid black; padding: 10px; text-align: center;"> <p>NOTICE</p> <p>Damage to crank handle latch and voltage cut-off switch! The crank handle latch and voltage cut-off switch may be damaged when using force. Do not use force when checking.</p> </div> <p>Check whether the slit pins on the transmission components for the crank handle latch are present.</p>										
2	<p>Check whether the latch lever prevents the insertion of the crank handle on the crank handle gear wheel when the voltage cut-off switch is on.</p>  <table border="1" data-bbox="486 1384 1372 1624"> <tbody> <tr> <td>1</td> <td>Crank handle gear wheel</td> </tr> <tr> <td>2</td> <td>Latch lever</td> </tr> <tr> <td>3</td> <td>Fork head</td> </tr> <tr> <td>4</td> <td>Connecting rod</td> </tr> <tr> <td>5</td> <td>Intermediate gear wheel</td> </tr> </tbody> </table> <ul style="list-style-type: none"> • There must be a lateral play of 2 mm to 3 mm between the crank handle gear wheel and the latch lever. • When the voltage cut-off switch is off, it must be possible to insert the crank handle without any difficulty. • When the crank handle is inserted, the point machine must not switch on. • No limit switch in the voltage cut-off switch must switch. 	1	Crank handle gear wheel	2	Latch lever	3	Fork head	4	Connecting rod	5	Intermediate gear wheel
1	Crank handle gear wheel										
2	Latch lever										
3	Fork head										
4	Connecting rod										
5	Intermediate gear wheel										
3	<p>Necessary corrections can be performed by adjusting the length of the connecting rod. Adjust the length of the connecting rod using the nut on the fork head.</p>										

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Checking of secure fit and installation conditions

Step	Action
1	Check whether the point machine and base plate are securely connected.
2	Check whether the base plate is securely connected to the ribbed sole-plate.
3	Check whether split pins are present, except for the prevailing torque type hexagon nut.
4	Check the following: <ul style="list-style-type: none"> • Is the throw bar cover free of ballast? • Is a point identification plate present in accordance with the layout diagram and can it be read? • Is the point machine in alignment with the track and the operating rod? • Can the cover not be removed after it has been key-locked?

Preventive maintenance work**WARNING****Dangerous operating conditions!**

Point machines may fail.

In order to detect any failures, operate rarely thrown point machines at least once a day within the failure detection time.

**WARNING****Dangerous operating conditions!**

Reliable operation of the point machine is no longer ensured if you detach any cables or conductors during preventive maintenance work.

Perform normal position proving.

**CAUTION****Irritation of the skin!**

Grease can irritate the skin or cause other allergic reactions.

Prevent your skin from coming into contact with grease. Only apply grease using gloves and appropriate tools (e.g. a brush).

Checking of point machine after actions

Check the point machine whenever work has been done on it by throwing the points several times.

Admissible grease and oil

Use the following lubricants for greasing and oiling the point machine components:

- Molub-Alloy 243 Arctic grease
- standard motor oil

Other lubricants are not permissible.

Greasing of throw bar

Step	Action
1	Grease the part of the throw bar projecting from the point machine housing in the fully extended position.
2	Grease the part which remains inside the housing in the two end positions of the point machine.

Greasing of ball spindle

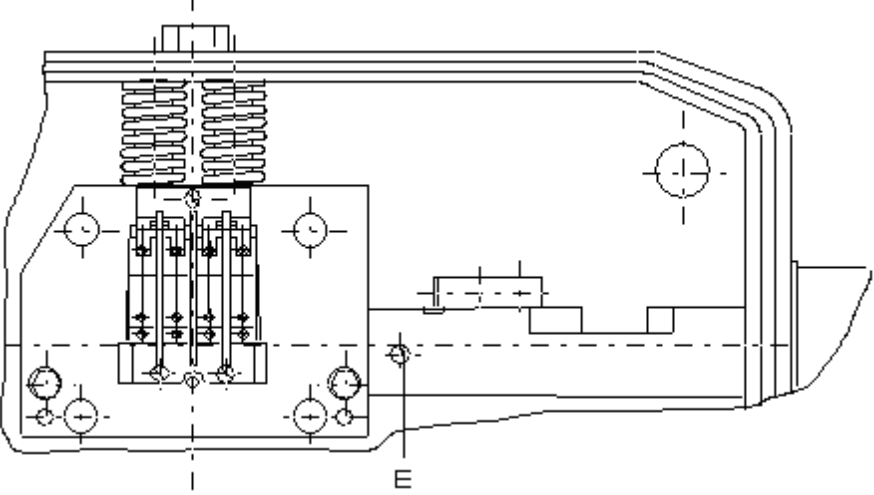
Step	Action
1	Grease the ball spindle in the two end positions of the point machine,
2	reversing the point machine a number of times as you do so.

Greasing of gear wheels

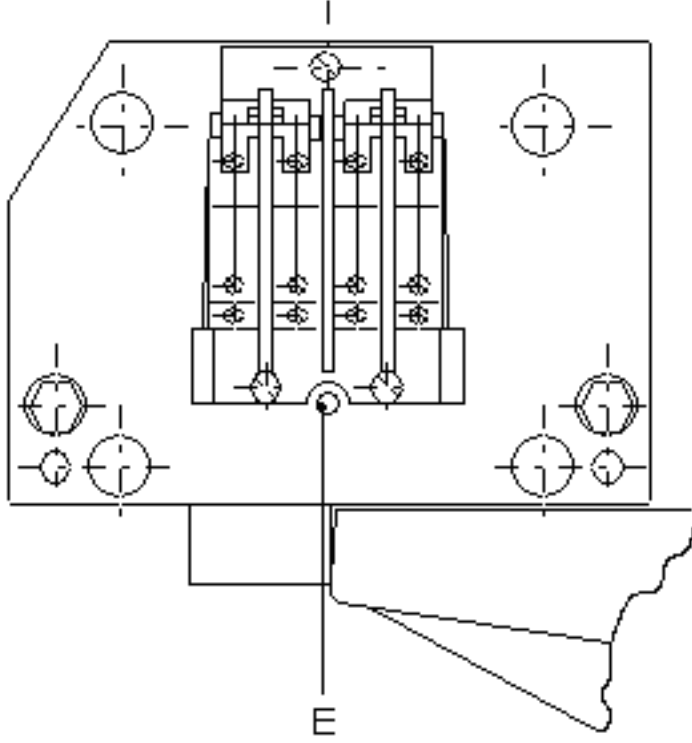
Step	Action
1	Grease all four gear wheels with the motor stopped.
2	Grease the bearings of the crank handle coupling unit and the intermediate gear wheel in the event of running noise.

Greasing and oiling of detector slides

Step	Action
1	Grease all accessible surfaces of the two detector slides with the slides "out".
2	Grease all accessible surfaces of the two detector slides with the slides "in".
3	Oil the contact surface between the detector slides

Step	Action
4	<p>through the hole (E) in the upper detector slide in accordance with the point machine version.</p> <ul style="list-style-type: none"> • Left-hand version: with the detector slides "in" • Right-hand version: with the detector slides "out" 

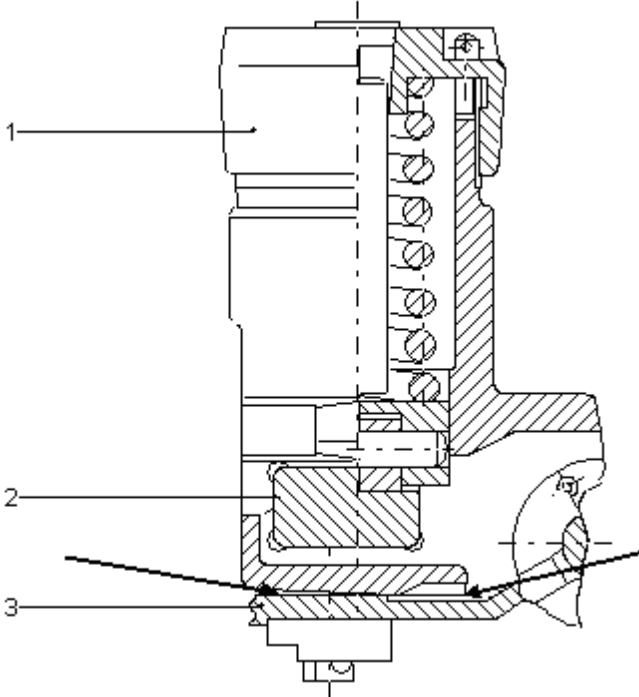
Oiling of keep-and-detect slides

Step	Action
1	<p>Oil the keep-and-detect slides through the hole (E) for oiling the keep-and-detect slides,</p> 
2	<p>reversing the point machine a number of times as you do so.</p>

Oiling of shifting plate

The sliding surfaces of the shifting plate are accessible from above.

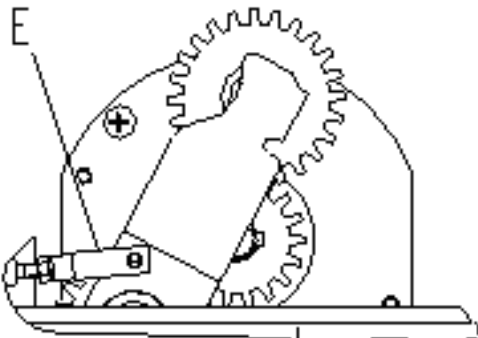
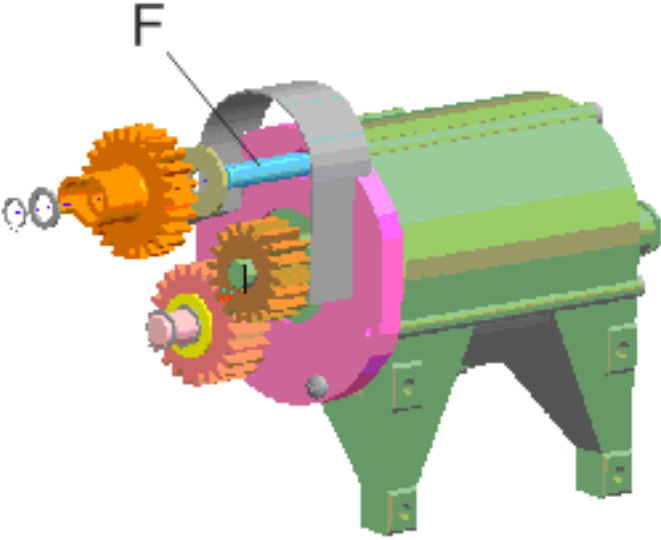
Step	Action
1	Move the point machine to the end position in which the distance between the retention clutch (1) and the transmission clutch is the greatest. The retention clutch is then at one end of the point machine and the transmission clutch at the other.
2	Oil the two surfaces for oiling the shifting plate (3) marked with arrows underneath the throw bar (2).



Checking of cover lock for ease of movement

Step	Action
1	Check whether the point machine housing can be opened and closed by applying slight pressure on the cover.
2	Check the bolt hook if the cover lock moves sluggishly.
3	Apply flake graphite to the lock if it moves sluggishly.
4	Use a de-icing agent if the lock is frozen.

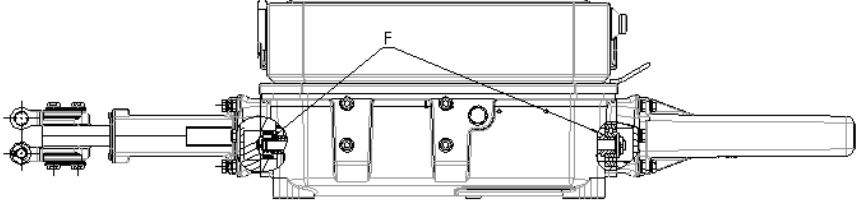
Greasing of shaft of intermediate and crank handle gear wheels

Step	Action
1	Undo the bolt (E) of the connecting rod on the reduction gearing. 
2	Fold away the latch lever of the crank handle gear wheel.
3	<div style="border: 1px solid black; padding: 10px; text-align: center;"> <p>NOTICE</p> <p>Damage to point machine! The shaft retaining clips may be damaged when removing them. Do not overstretch the shaft retaining clips.</p> </div> <p>Remove the shaft retaining clips using circlip pliers.</p>
4	Remove the thrust ring with crank handle gear wheel or latch lever and intermediate gear wheel.
5	Apply grease (F) to the cavities in the gear wheels and the shaft. 
6	Mount all parts in reverse order.

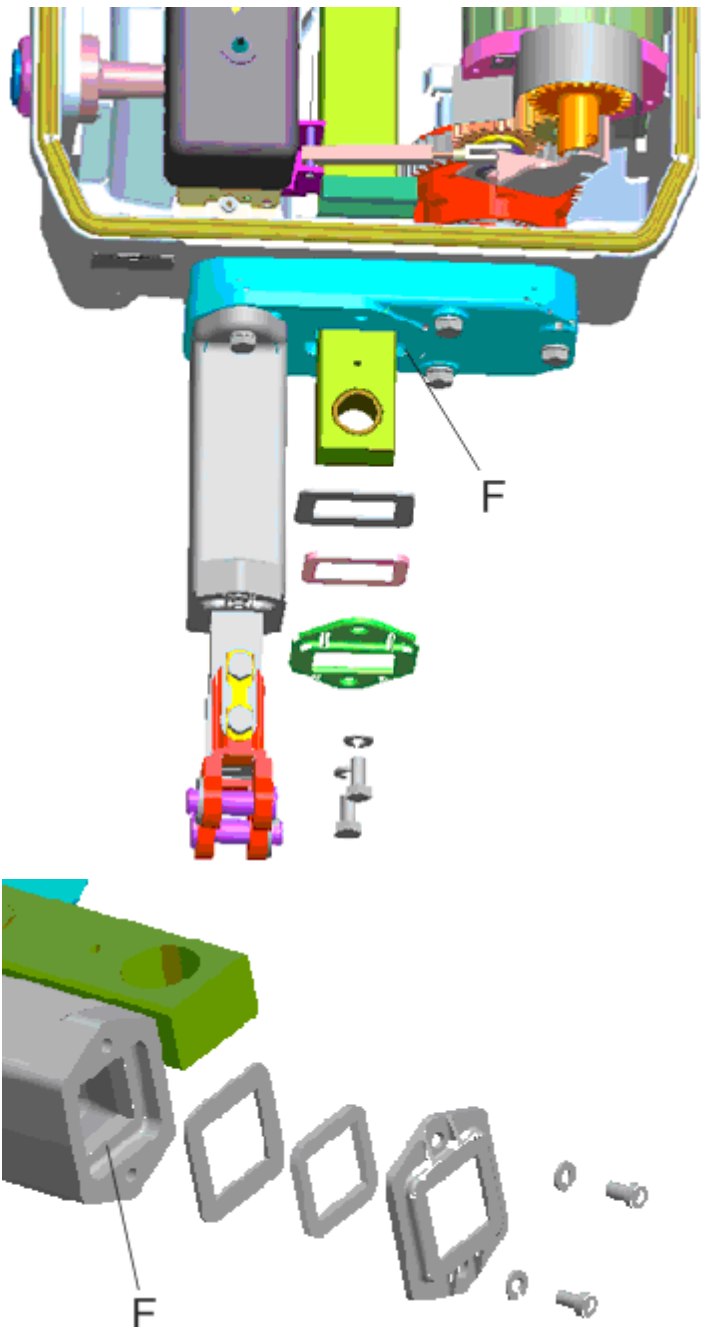
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Greasing of ball bearings at ends of ball spindle

Step	Action
1	Grease (F) the accessible surfaces of the ball bearings at the ends of the ball spindle.


Topping-up of grease chambers in throw bar and detector slide guide

Step	Action
1	Move the point machine to its fully extended position.
2	Remove any covers.
3	Undo the fastening screws of the throw bar and detector slide cover plate.
4	Remove the cover plate, seal and sealing flange on the throw bar and detector slides from the flanges.

Step	Action
5	<p>Top up the grease chamber (F) in the flanges with grease.</p> 
6	<p style="text-align: center;">NOTICE</p> <p>Damage to point machine! The seal and sealing flange must be correctly inserted in the cover plate in order not to damage them. Insert the seal and sealing flange flush and not canted into the cover plate.</p> <p>Mount all parts in reverse order.</p>

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Special preventive maintenance work

Maintenance of point machine after long out-of-service periods

Step	Action
1	After long out-of-service periods, have the point machine slipped three times in each end position.
2	Drain off any water which may have collected in the point machine by removing the drainage stopper (see the "Components of the point machine" figure).

Checking of point machine after actions

Check the point machine whenever work has been done on it.

Step	Action
1	Check the point machine by throwing the points several times.
2	Perform normal position proving if you have detached any cables or conductors during preventive maintenance work.

Corrective maintenance of point machine

Who is to perform corrective maintenance?

Corrective maintenance of the point machine may only be performed by the manufacturer or a service center appointed by the manufacturer. If you have any questions, contact the manufacturer.

When is corrective maintenance to be performed?

To ensure a high level of availability, the point machine should be maintained after an operating time of ten years or 10^6 throwing operations.

Corrective maintenance is necessary in the event of the following:

- The point machine has been waterlogged.
- The point machine has been damaged (e.g. a non-trailable point machine has been trailed).
- The point machine is in a severely neglected state.
- The point machine is showing signs of excessive wear.

Components to be replaced

Replace the following components whenever corrective maintenance is performed on the point machine, irrespective of their outer appearance:

- ball spindle drive with transmission clutch
- contact assembly
- limit switches

6 Data and components of point machine

Technical data

Technical data of point machine

Weight	Approx. 120 kg
Temperature range	–30°C to +70°C
Service life	$\geq 1 \times 10^6$ throwing operations or ten years
Type of current	Three-phase AC, single-phase AC, DC
Rated voltage	3 x 400/230 V AC, 50 Hz \pm 2%; 110 to 136 V DC Special versions on request
Throwing stroke	Standard version 220 mm, 150 mm Special versions on request
Point opening	160 mm Further versions on request
Throwing force	5000 N \pm 500 N Special versions on request
Restoring force of point blade	\leq 1400 N
Retention force	7000 N \pm 500 N or 90 kN for non-trailable point machines
Alternative locking force of detector slides	35 kN
Trailing resistance	9000 N +500 N (static)
Throwing time (depending on version)	Approx. 3 to 8 s
IP rating	IP54 as per EN 60529
Protection class	1 as per VDE 0100
Test voltage	2500 V, 50 Hz as per VDE 0831

Table 5 Technical data of the point machine (typical values)

Versions

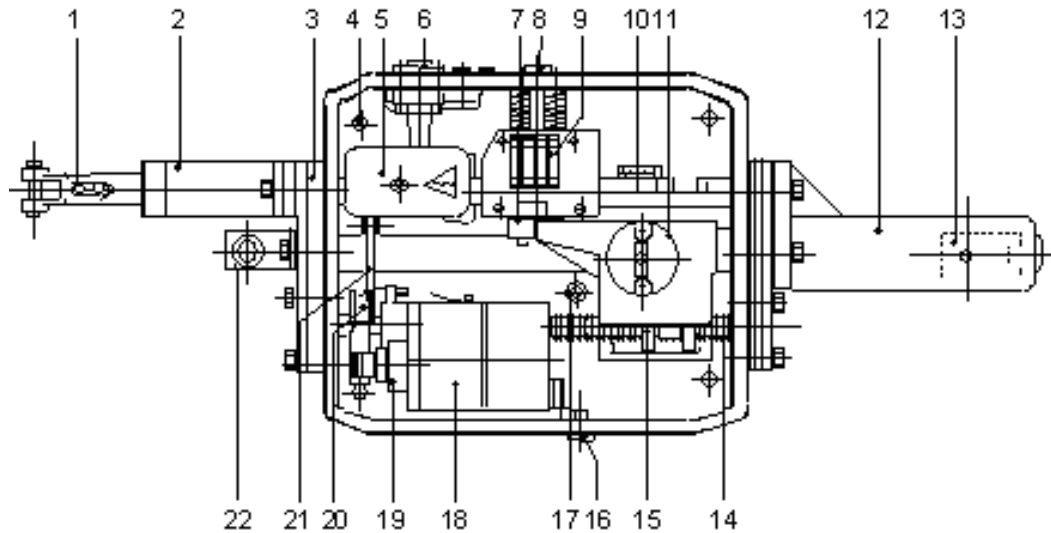
The point machine is available in different versions which are distinguished by the following:

- trailability or non-trailability
- right-hand or left-hand mounting
- with or without point detector
- type of motor current
- throwing stroke, throwing force, and throwing time
- pitch of ball spindle drive
- modification option from right-hand to left-hand version or vice versa

Overview of variants: C25106-A141-A1-* -47

Components

Components of point machine



1	Detector slide
2	Guide sleeve
3	Guide flange
4	Fastening hole (four)
5	Voltage cut-off switch
6	Disconnection lock
7	Keep-and-detect slide
8	Earthing screw
9	Contact assembly (shown without cover)
10	Adjusting device for the detector slides
11	Retention clutch
12	Cover
13	Stop
14	Ball spindle
15	Ball spindle nut
16	Earthing screw
17	Drainage stopper
18	Motor
19	Gear wheels
20	Transmission clutch
21	Crank handle latch
22	Throw bar

Figure 8 Components of the point machine

Dimension drawings and circuit diagrams

Dimension drawings of point machine

The illustration below shows the dimensions in the side view (above) and top view (below) by way of an example.

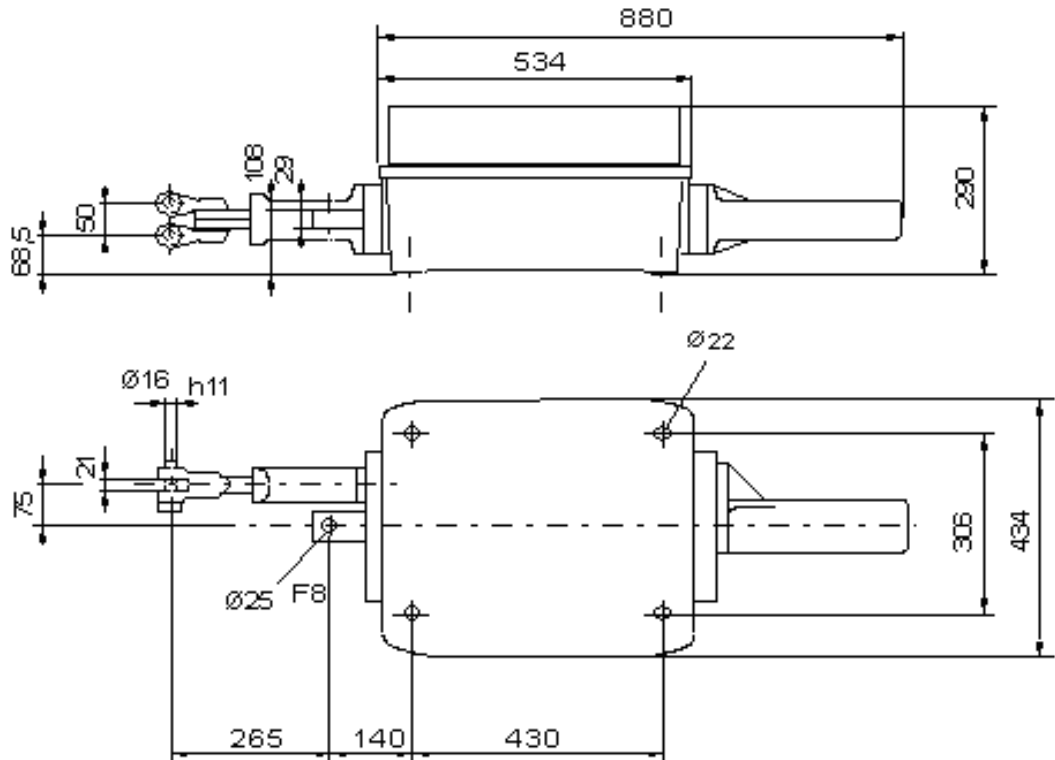


Figure 9 Dimension drawings (side view, top view)

Circuit diagrams of point machine

The figures below show typical circuits of the point machine (CS = cut-off switch, point machine above in each case).

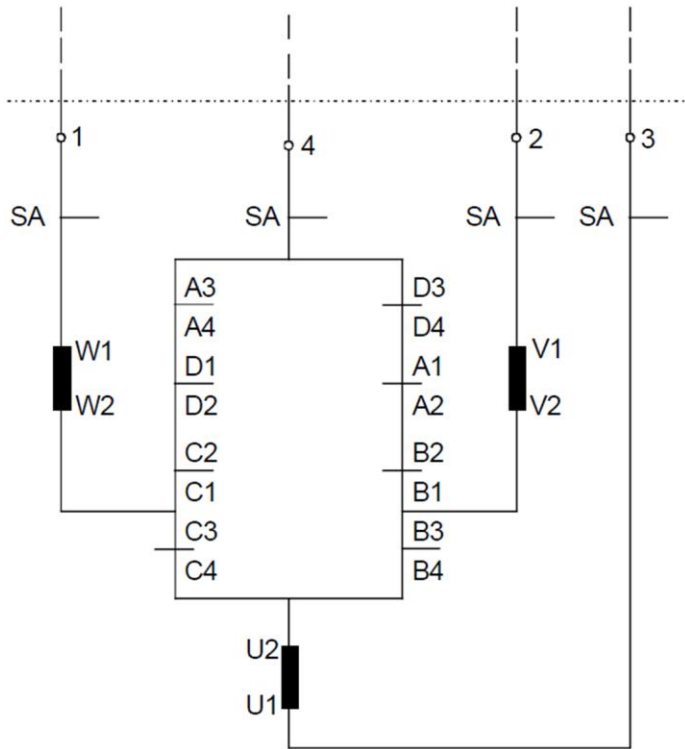


Figure 10 Four-wire three-phase AC circuit

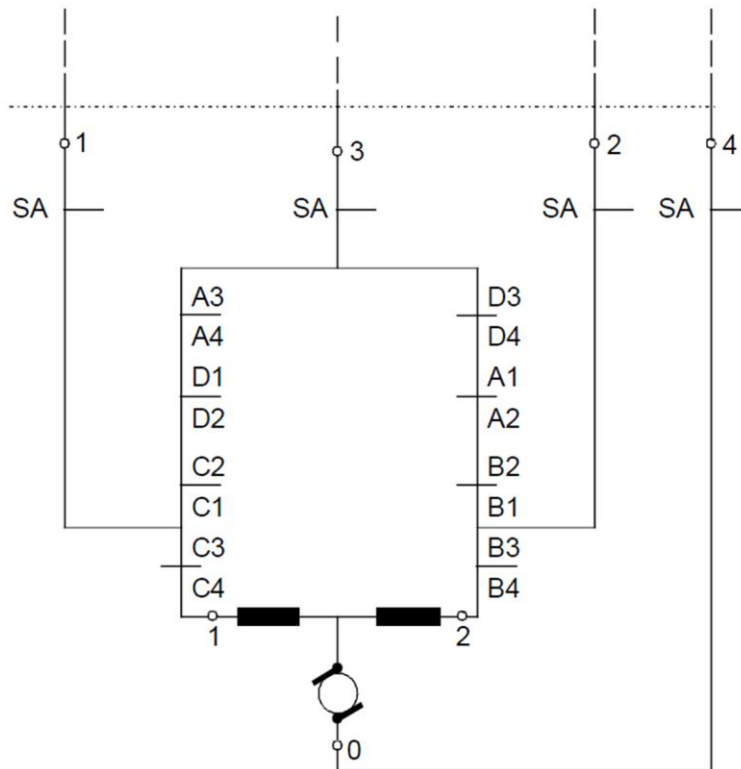


Figure 11 Four-wire DC and single-phase AC circuit

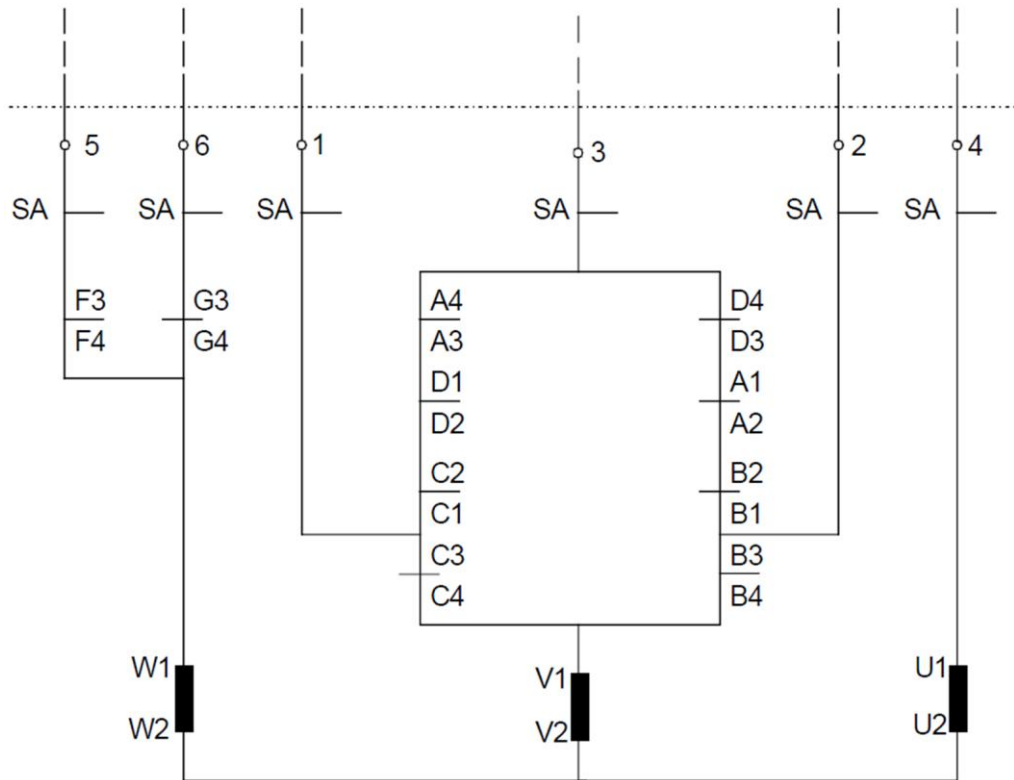


Figure 12 Six-wire three-phase AC circuit

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7 Indices

List of abbreviations

Abbreviation	Meaning
AC	alternating current
DB AG	(Deutsche Bahn Aktiengesellschaft) German Railways
EN	European standard
IP	ingress protection
SAE	oil specification of Society of Automotive Engineers
SCN	Siemens code number
VDE	(Verband Deutscher Elektrotechniker) Association of German Electrical Engineers

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