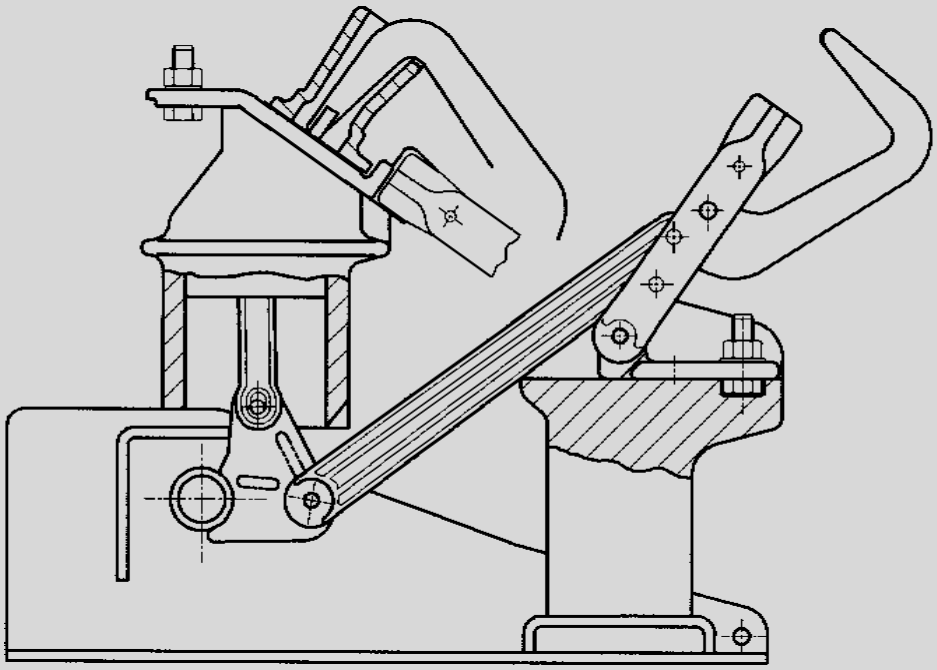
Power^{IT} Indoor Air Switch Disconnector, NAL
Power^{IT} Indoor Air Switch Disconnector, NALF

Rated voltage: 12, 17.5, 24 and 36 kV
Rated current: 400/630, 800 and 1250 V

Mounting and Operation Manual 1YMR602171-en



Industrial^{IT} enabled™

ABB

Triple-pole switch disconnector type NAL and fuse switch disconnector type NALF For indoor installation

CONTENTS

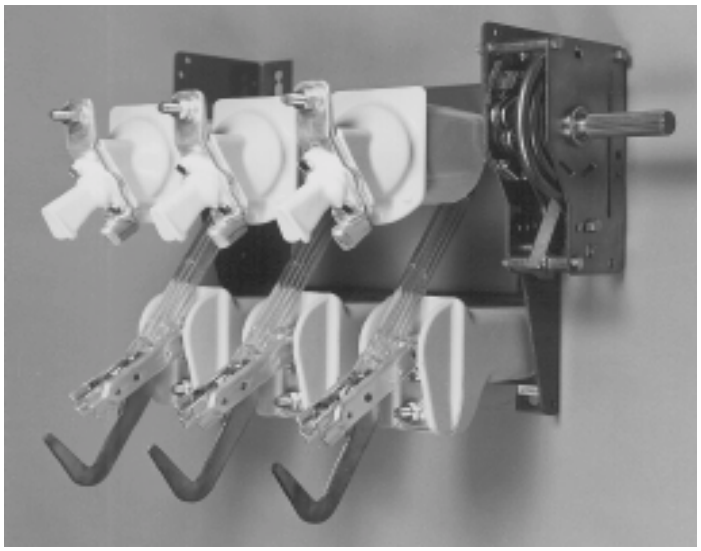


Fig. 1 R 558 B

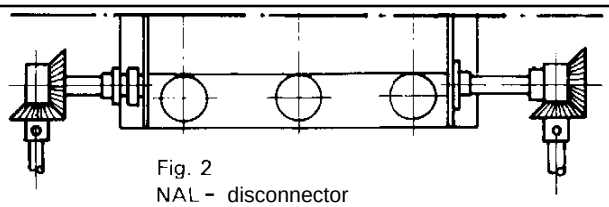


Fig. 2
NAL - disconnector

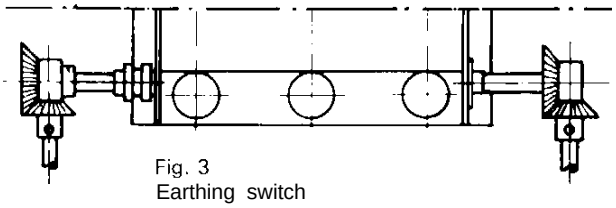


Fig. 3
Earthing switch

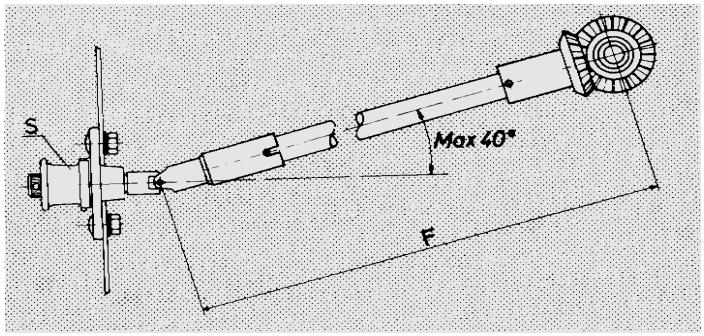


Fig. 3a NHP 240979

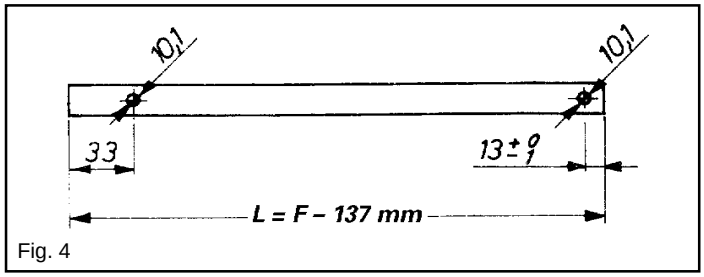


Fig. 4

1.0 SWITCH DISCONNECTOR TYPE NAL, ALTERNATIVE ASSEMBLIES

The switch disconnector NAL is supplied ex works as follows:
1.1 Fully assembled with mechanism and auxiliaries. See item 2.0
1.2 Switch main frame, mechanism and auxiliaries as separate components, see item 4.0

2.0 INSTALLATION

2.1 Preparation of the switch for installation. Fig. 1
For switches with A-mechanisms, the contact knives must be fully opened by hand and the draw bars connected to the cranks. Before the switch is test operated, one has to check that the surfaces of the main contact are covered by contact grease
(Recommended grease: ISOFLEX TOPAS NCA 52)

Test operations
Switches with K-mechanism will close when the operating shaft is turned anti-clockwise. The switch open when the operation shaft is turned clockwise.
(Clockwise/anti-clockwise as seen from the mechanism side of the switch)
When operating switches with A-mechanism the opening spring is first charged and latched by turning the operating shaft clockwise. Turning the shaft anti-clockwise charges the closing spring and the switch closes.
The switches open when the operating shaft is turned clockwise.
For KS-mechanism, see items 3.2

CAUTION:
Keep well clear of contact knives when operating the switches.

2.2 Mounting the hand operating mechanism type HE
The bevel gears are mounted with the switch in open posistion as shown in Fig. 2 and 3.

Fig. 4a R 555 A

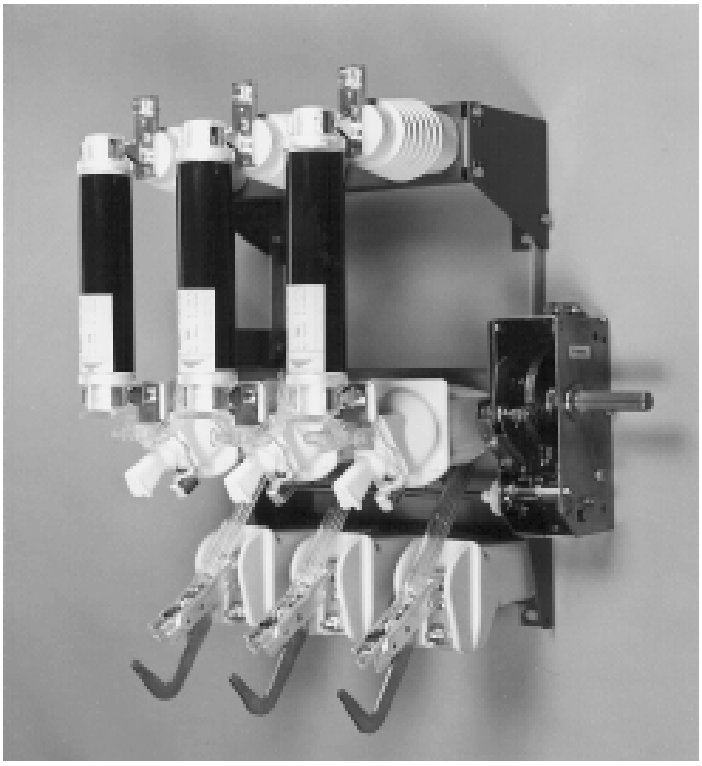


Fig. 4b R 563 A

The inclination of the operating tube must not exeed 40°. Fig. 3a
Drilling of the operating tube. Fig. 4.

2.3 Mounting of fuse base

2.3.1 The switch must be open and the main springs not charged. When mounting a fuse base with three post insulators, one set of fuse contacts and possibly fuse trip accessories are mounted directly on the switch terminals. Fig. 4a or 4b

2.3.2 Mounting of fuse tripping. Fig. 5

a) Lower part of bearing (8) is fixed to terminal (10) by one schrew(9)
b) The lever(13) together with the fuse trip flap (15) are placed in the lower bearing(8) and locked by means of upper part of bearing(14)
c) The released rod(11) is mounted in the lever (13)
d) The drive ring (2) is mounted to the release shaft(1) on the RHS
e) The bearing(5) and washer(6) is mounted on the release shaft(1) on the LHS and secured by split-pin(7)
f) Disc.(3) is mounted to the release shaft(4) of the mechanism
g) The release rods(11) are mounted onto the hooks(12) on the release shaft(1)

2.3.3 Ajustment of the fuse tripping 5a

- The ajustment apply to switch disconnectors with fuse links and fuse tripping

- The ajustment must be made with both operating spring in the mechanism in uncharged position, but the releasing spring in the mechanism has to be charged as mentioned under control point 2.3.4 point a

1) The split pin(7) is removed and the release shaft(1) together with the drive ring(2) is pushed in the direction of the arrow until the tapped connection is free from disc.(3)
2) The release rod(1) with the drive ring(2) is turned and ajusted to a hole in the disc(3), while the ajustment of the fuse trip flap(15) and its distance to the strike pin of the fuse link must be checked(Fig. 5).

Remark:

- Ajusted according to above the fuse switch disconnector must open

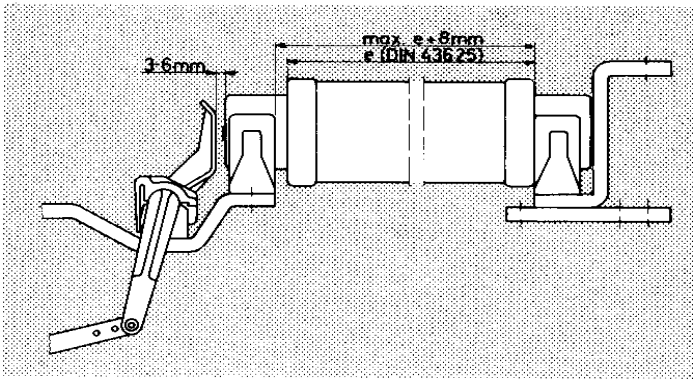
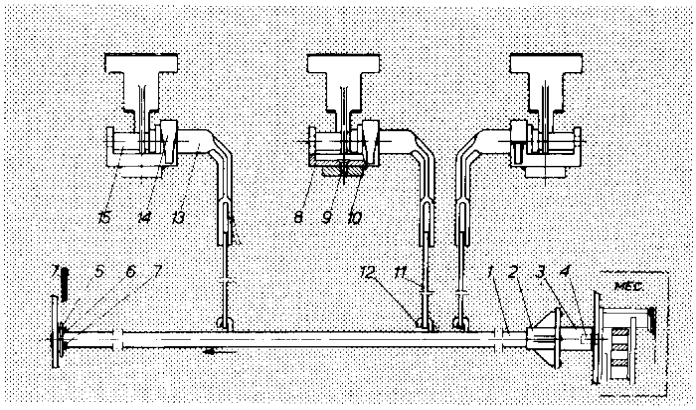


Fig. 5 NHP 300025



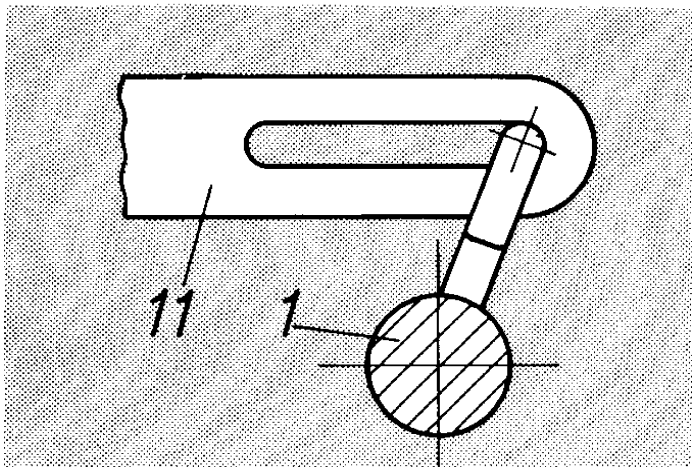


Fig. 5a NHP 241427
NHP 401625

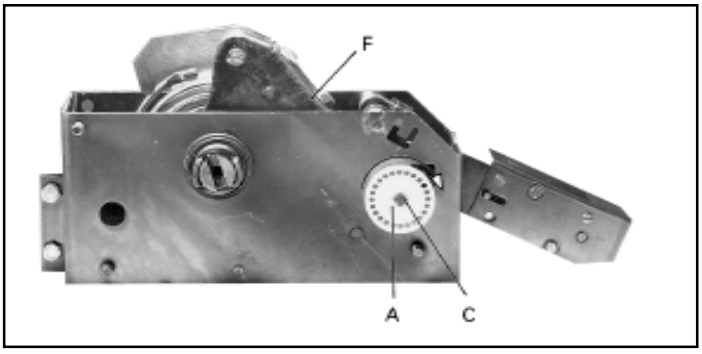


Fig. 6 R-249 B

by tests in all phases
- After fuse interruption the mechanism shall be blocked against another operation until the fuse link has been replaced.

2.3.4 Fuse tripping. Control

a) Turn the operating shaft E- Fig. 4a clockwise, max 60°, and return the operating handle back to the neutral position(Opening spring housing F, Fig. 6, must not be latched)

b) Mount a new fuse-link, or a test fuse which is in acc. with DIN 43625, in one of the phases. Dimetionally the fuse link then will have the same dimetions as ABB-CEF fuse-links

c) If the distance between the fuse clips is longer than described - max e + 8mm, the ajustment(point 2.3.3) must be made with the fuse link resting on the fuse clips on the fuse base

d) The distance between the striker pin and the fuse trip flag (15) must be from 3-6 mm. By this adjustment the fuse link is allowed to sag, but the distance between the striker pin and the fuse trip flag must not exceed 12 mm

e) If the fuse switch disconnector does not open when adjusted as mentioned above, the adjustment has to be checked and repeated

f) Remark:
The hooks (12) on the release rod (1) ought to have the same position

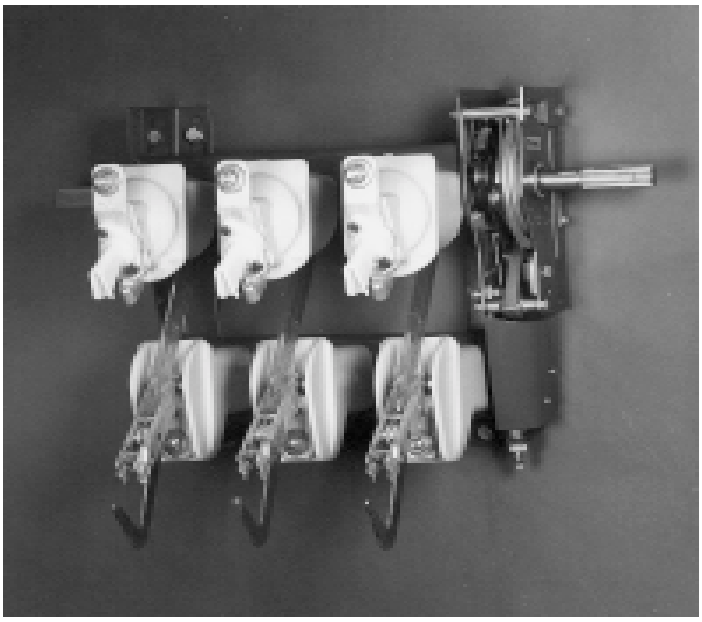


Fig. 7 R-384 A

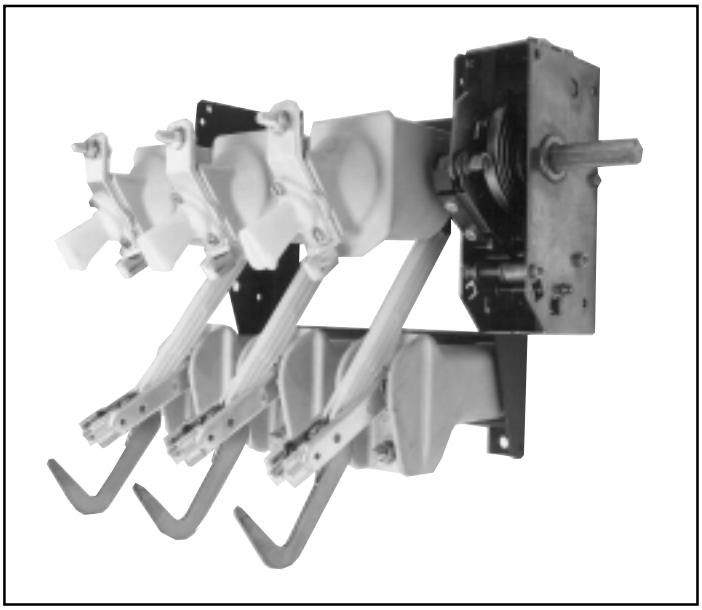


fig. 8 R-160 A

as shown on Fig. 5a - when the fuse switch disconnector is in open position with both operating springs uncharged, but with the releasing spring charged. (Ref. point a)

3.0 ADJUSTING THE HAND OPERATING, MECHANISM TYPE HE

3.1 K-mechanism. Fig.1

(Switch in the open position.)

Closing

Arrester ring, S, on the front shaft of the HE-mechanism is removed. Fig. 3 The operating handle is turned clockwise until the switch closes. Mount the arrester ring

Opening

Turn the handle clockwise and the switch opens. Test the arrester ring for correct functioning.

3.2 KS-mechanism. Fig. 7

Closing

The arrester rings on the front shaft of the HE-mechanism is removed and the operating handle is turned clockwise until it reaches the stop. The switch is now prepared for closing by means of an operating coil or a pneumatic cylinder. Mount the arrester ring

Opening

The operating handle is turned clockwise until it reaches the stop. The switch is now prepared for opening by means of an operating coil or a pneumatic cylinder. Test the arrester ring for correct functioning. Discharging the operating spring must be done by operating the switch and not by returning the operating handle

Caution:

The hand operating mechanism must be adjusted not to press on the latch on the KS-mechanism after charging the operating spring.

3.3 A-mechanism. Fig. 8

Closing

Remove the arrester rings on the front shaft of the hand operating mechanism. Fig. 3. Turn the operating handle anti-clockwise until the opening spring is charged and latched. Mount the arrester ring. Turn the operating handle clockwise until the switch closes. Test the arrester ring for correct functioning

Opening

After having pulled out the arrester ring, turn the operating handle anti-clockwise. The switch opens after approx. 20° rotation.

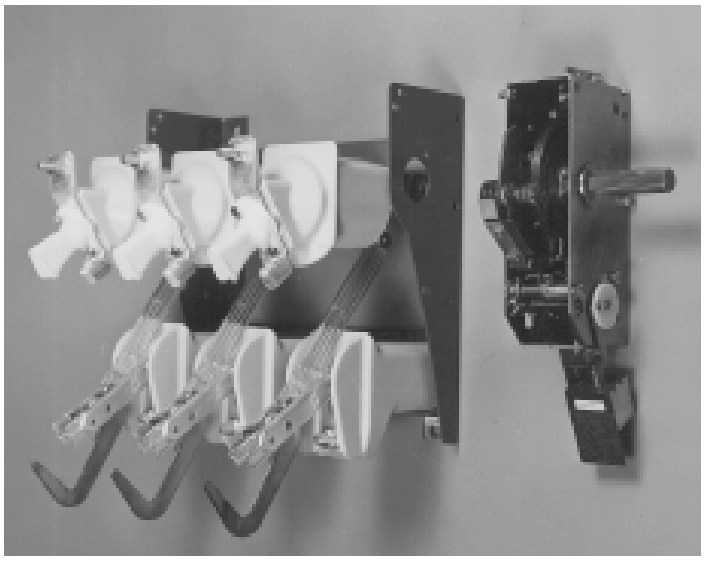


fig. 9 R-559 A

4.0 MOUNTING THE MECHANISM ON THE SWITCH. FIG. 9

The mechanisms are mounted on the right hand side of the switch main frame and the switch is normally operated from the same side. (Mechanism-side). When the switches have to be operated from the opposite side, an operating shaft must be connected. See Fig. 9b.
The mechanism clutch is brought together with the clutch of the hollow main shaft and the mechanism is fixed to the switch frame.

Note: Contact knives in open position.

Normally the switch disconnector is delivered without shaft extension for left hand side operation.

4.1. Test operation of A-mechanism.

After having mounted the mechanism to the switch frame, check that the latch H is in correct position by pulling it back to the outhermost position.

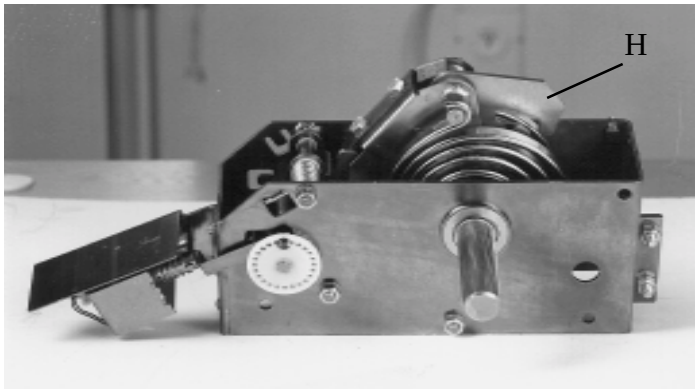


fig. 9 a R-250 B

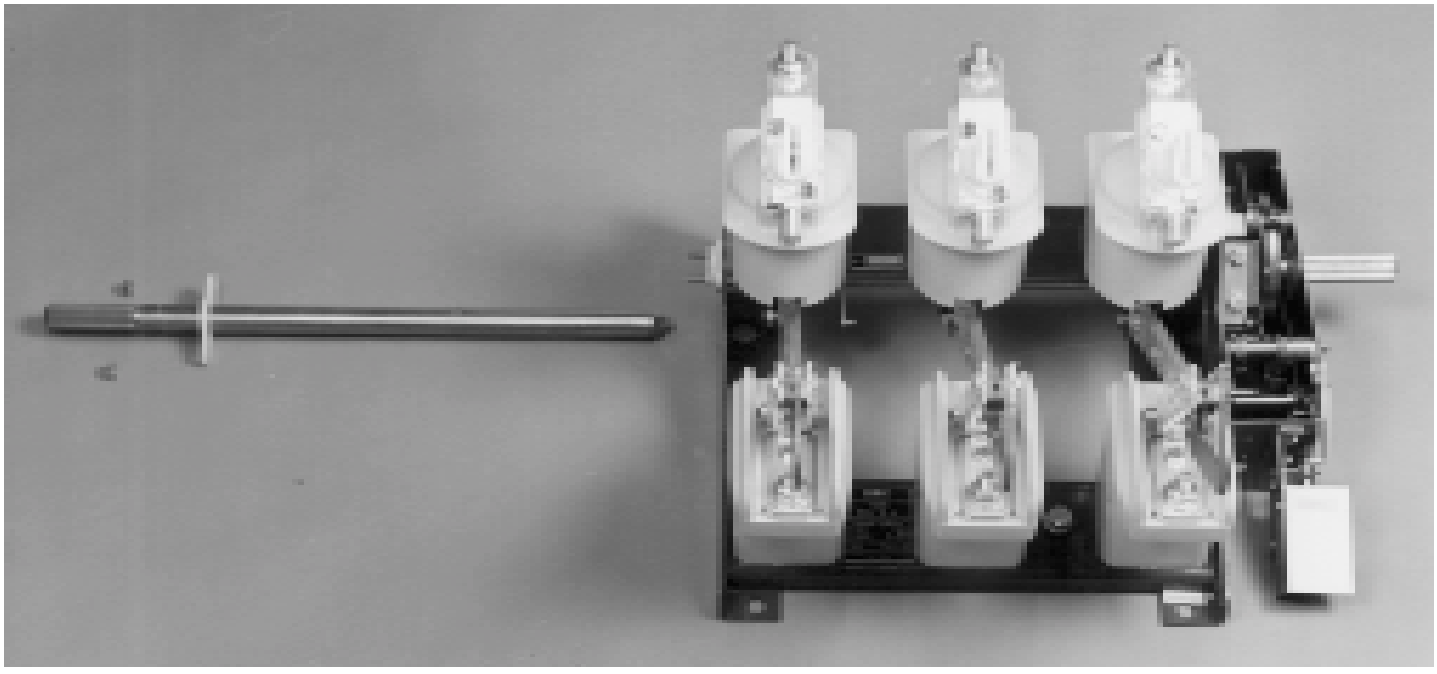


fig. 9b R-564 A

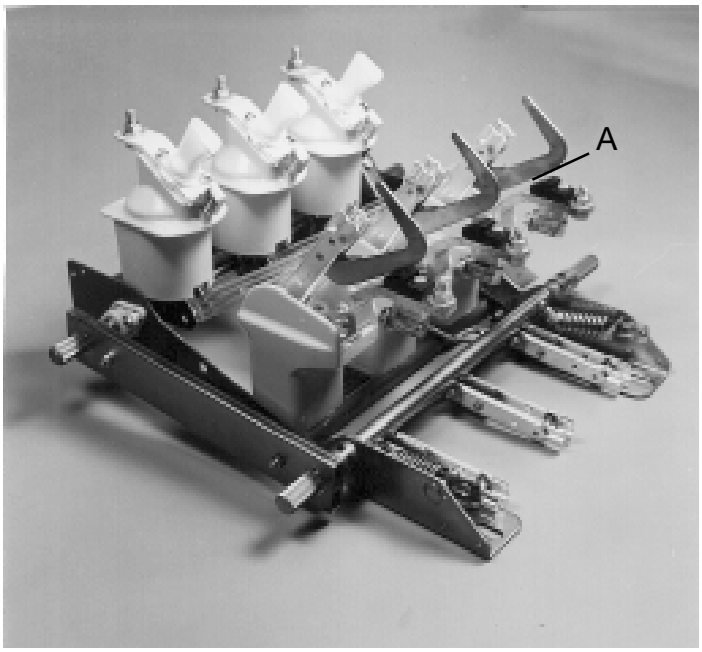


fig. 10 R-561 B

See Fig. 9a.
Test operation see item 2.1.

5.0 MOUNTING OF QUICK-MAKE EARTH SWITCH TYPE E

The switch will normally be delivered for connection of the hand operating mechanism on the right hand side and any mechanical interlook on the left side. The splined extension intended for connection to the hand operating mechanism will have free travel.
The extension for the interlook will be bolted to the shaft. See Fig. 10.

5.1. Mounting the quick-make earth switch to the switch **disconnector type NAL**

The contacts A are mounted on the terminals of the switch disconnector, and the surfaces of the main contacts are then covered by contact grease.
(Recommended grease: ISOFLEX TOPAS NCA 52)
Close the earth switch slowly and adjust the fixed contacts to line up correctly with moving contacts.
Tighten the contacts screws.

5.2 Mounting the quick-make earth switch to the fuse-switch disconnector type NALF

Proceed as under item 5.1.
The contacts A must be mounted on the terminals of the fuse base, and secure the position with tension bushes.

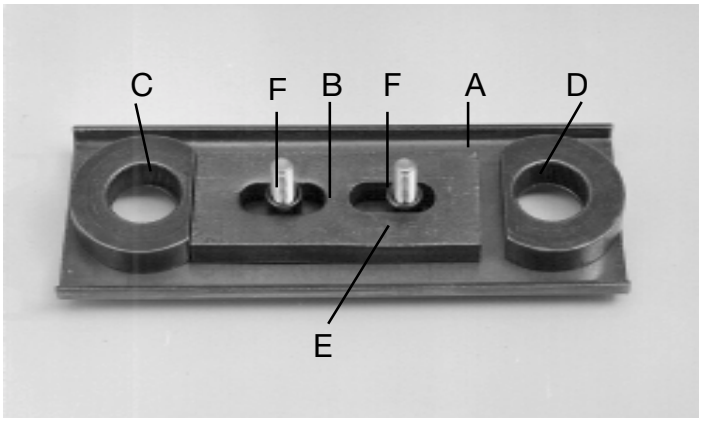


fig. 11 R-148 B

6.0 MOUNTING THE MECHANICAL INTERLOCK BETWEEN SWITCH DISCONNECTOR AND QUICK-MAKE EARTH SWITCH. Fig. 10-11

The switch disconnector must be in the open position. (for NAL-A the opening spring must be charged before assembly of the interlock. See item 2.1.)
The quick-make earth switch must also be in the open position.
Put one half of the guide A (side plate) on the operating shafts of the switches. Mount the interlock connection B.Mount the interlock rings C and D on the shafts with the flat part of the ring facing towards the interlock connection B. Fig. 11.
Do not forget mounting the two distance rings E on the two screws F.

Testing the interlock.

It shall not be possible to close the switch disconnector when the earth switch is closed.

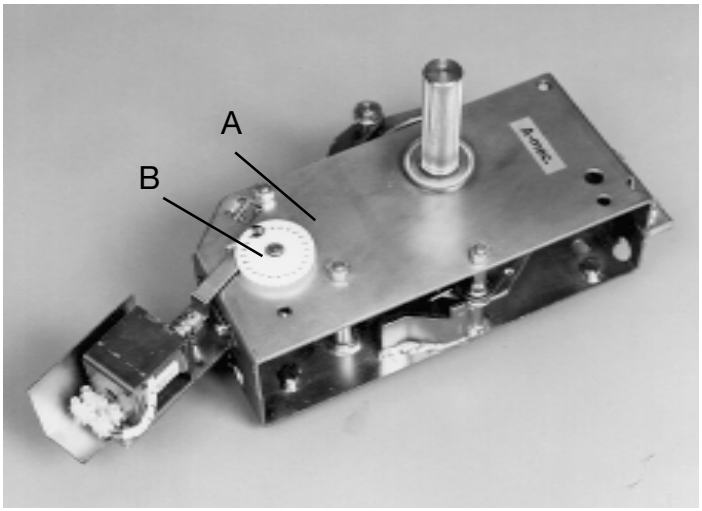


fig. 12 R 562 C

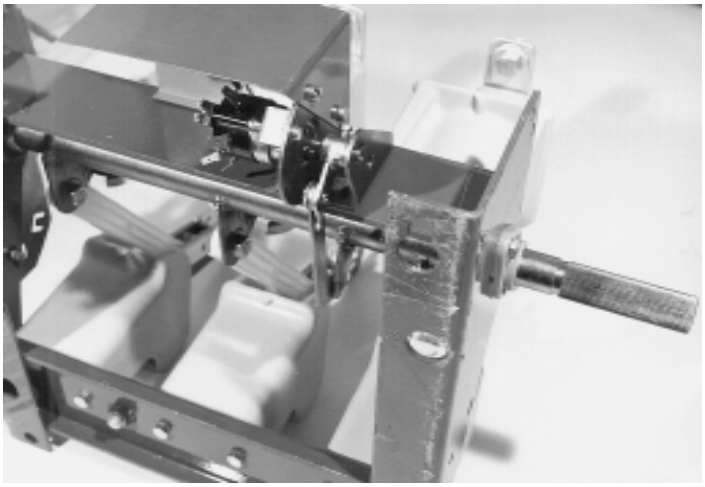
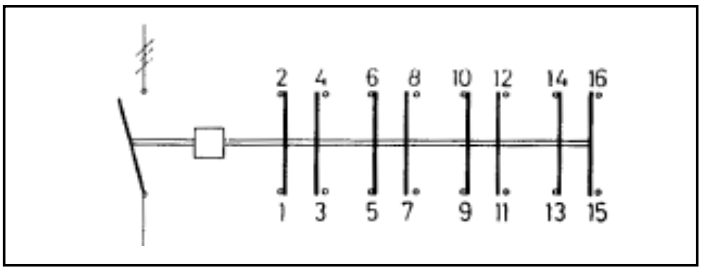
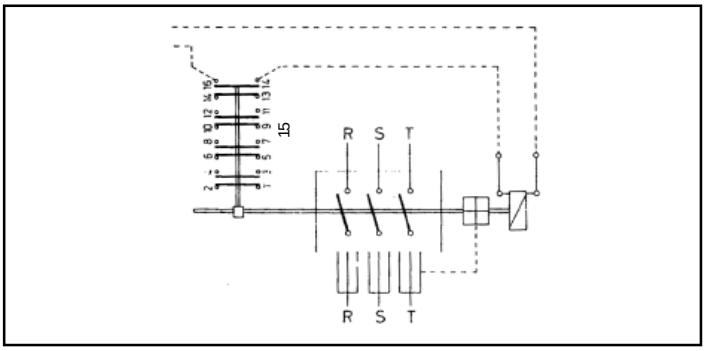


fig. 13 R-157 A



Wiring diagram auxiliary switch NHP 343651



Wiring diagram tripping coil NHP 343650

It shall not be possible to close the earth switch disconnector when the switch is closed.

7.0 MOUNTING THE SHUNT RELEASE. Fig. 12.

Turn the operating shaft E (Fig. 4a) a maximum of 60° clockwise. Opening spring housing F, Fig. 6, must not be latched. Return the shaft to its neutral position. Connect the bar B to the perforated disc A. Fig. 12.

8.0 MOUNTING THE AUXILIARY SWITCH. Fig. 13.

The auxiliary switch is mounted to the frame on the opening side of the switch disconnector and the bar connected to the crank on the hollow shaft.

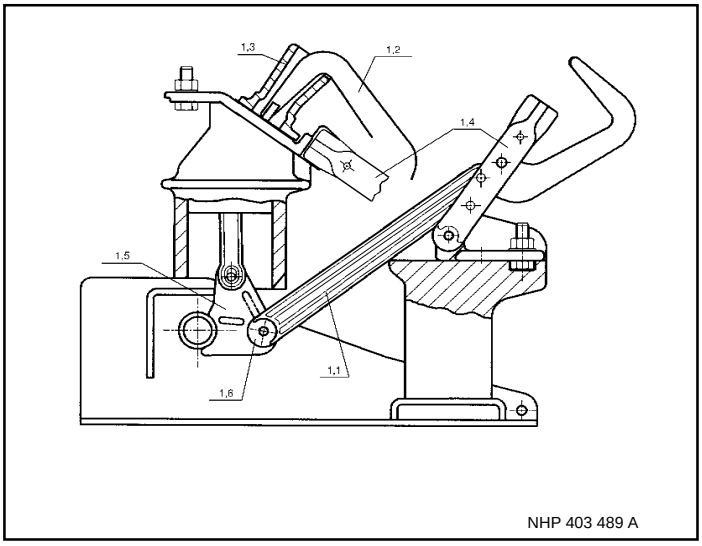


fig. 14

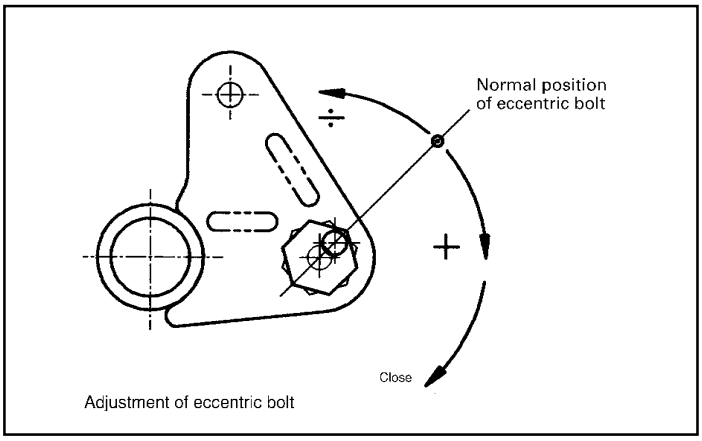


fig. 15 NHP 403 489 B

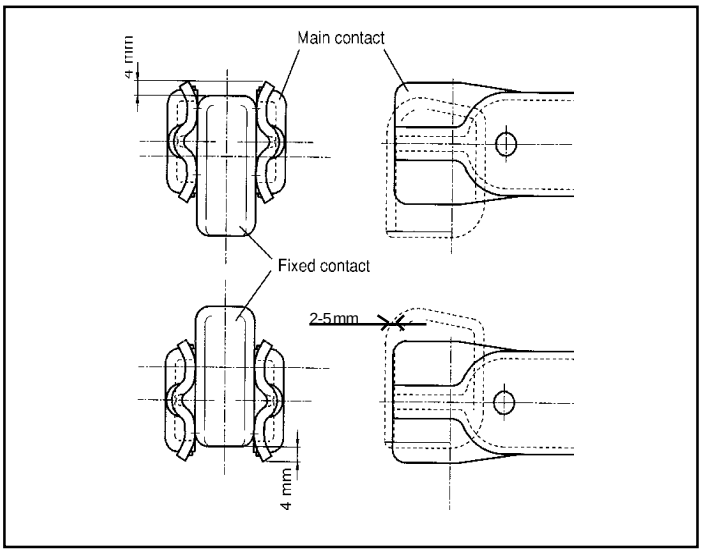


fig. 16

9.0 SERVICE AND MAINTENANCE

Cleaning

*After maintenance the switch disconnector **must** be cleaned before being put into service. Strong solvents and alcoholic fluids must **not** be used.*

After cleaning, the contact area of the main blades and the fixed contacts must be greased, Type Isoflex Topas NCA 52. If the switch disconnector is placed in a very humid and poluted area which will reduce the tracking resistance, we recomend to polish the insulators and insulated components with Silikon Type HS4.

Switch disconnectors in service

The switch disconnector should be checked at least once a year by conducting a number of operations to check all the functions.

The frequency of maintenance depends on the service and enviromental conditions.

– Moving- and fixed contacts are greased with – Isoflex Topas NCA 52.
– Mechanisms do not need any greasing under normal conditions.
– Note: Arcing knives, piston and cylinder **must not be greased.**

Mechanical overhaul

After 1000 operations or 5 years in service a complete overhaul of the switch disconnector should be carried out, preferably by ABB-personal.

Electrical overhaul

The frequency of overhaul depends also on the number of operations and the magnitude of the breaking current.

After about 100 operations at rated current or about 500 operations at half the rated current the main contacts, the arcing contacts and the arc extinguishing chamber should be inspected and eventually replaced.

Replacement should take place when

– The tip of the arcing contact knives has diminished approx. 3 mm. (By minor damages the arcing tip might only be polished)
– The fixed arcing fingers are burned or do not give any contact
– The width of the slot in the arcing chamber is more than 8 mm.

Control of NAL knives after mounting Fig. 14, 15, 16.

Due to difference in wall and support frame straightness, it is necessary to check the position of the main knives on the fixed contact.

1. Switch with A-mechanism.By delivery the draw bars (1.1) are detached.

a) Test by hand that each arcing knife (1.2) moves freely in the arc chamber (1.3)

b) Pull the main contacts by hand (1.4) to open position.
See fig. 14. Attach the draw bars to the main shaft (1.5) by the eccentric bolt (1.6), and secure with washer and circlip.

2. Switch with K-mechanism
By delivery the draw bars are connected.
3. Before operating the switch, check that the surfaces of the main contacts are covered by contact grease in the contact area. The grease type Isoflex Topas NCA 52 must be used if additional grease is required.
4. Close the switch by operating the mechanism.
Check the engagement and the contact overlap. All four contact points on the main contacts must be in touch with the fixed contacts.
The depth between the fixed and the moving contacts must be adjusted by the eccentric bolt (fig. 15) if the moving contact is outside the limit of 4 mm! See fig 16.

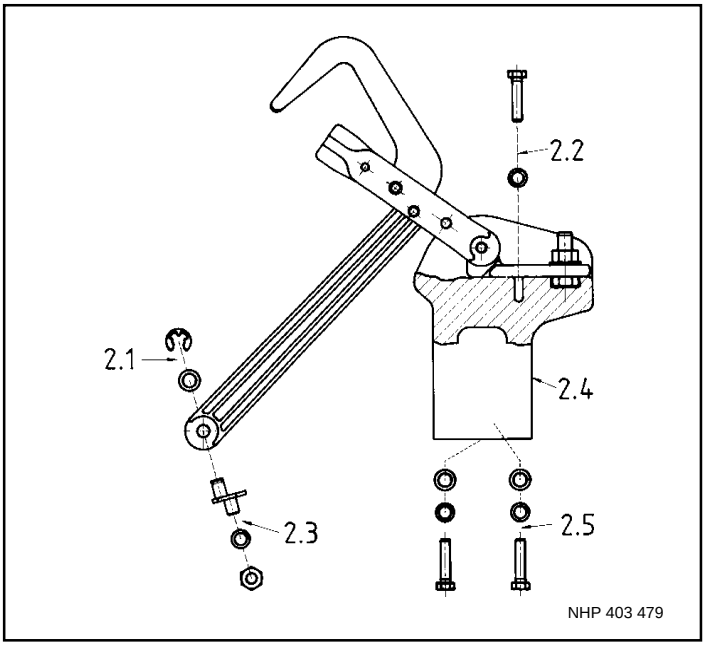


fig. 17

10.0 REPLACEMENTS OF PARTS

The switch disconnector type NAL is equipped with DMC insulators (Glassfibre-reinforced polyester) with selftaping screws for fixing of insulators and contacts.
If the same insulator and screws are to be used after exchange of parts, the following procedure must be followed:
– Unscrew the selftapping screws carefully and brush them clean, and blow out the small particles in the threaded hole. (Protect the eyes.)
When mounting, the screws must be entered carefully into the threads in the insulator and tightened with care.
– Correct torque, see page 15.
If new insulator shall be mounted, the holes in the insulator should be threaded about 10 mm deep by the selftapping screw before mounting. Remove the screw and blow the holes clean.
The mounting takes place acc. to the following procedures.

10.1 Replacement of contact knife with draw bar Fig. 17.
Switch disconnector in open position with both the operating springs uncharged.
a) Remove the circlips 2.1 attaching the draw bar to the main shaft. (Eccentric bolt not to be loosened.)
b) Unscrew the screw(s) 2.2 attaching the main contact to the insulator. Remove the fixed contact with the contact knife and draw bar. (1 pc screw on 12 kV and 2 pcs screws on 24 kV).
c) Attach the new main contact with the contact knife and draw bar to the insulator.
d) Grease the new contact knife with ISOFLEX NCA 52, and check carefully that it enters the fixed main contact correctly, and also that the arcing knife moves freely in the arcing chamber when closing and opening. (The arcing knife does not have the same position related to the contact knife during the closing and opening movement.) The contact knive must rotate firmly at the pivot point, but without jerking.
e) Attach the draw bar to the main shaft by the eccentric bolt 2.3 and secure with washer and circlips 2.1
f) The depth of the engagement between the fixed and the moving contact can be adjusted by the eccentric bolt 2.3 or by moving the insulator 2.4 back or forth.

10.2 Replacement of fixed contact on the pivot side
Normally the main contact with contact knife and draw bar is delivered as one unit.
Procedure as under 10.1

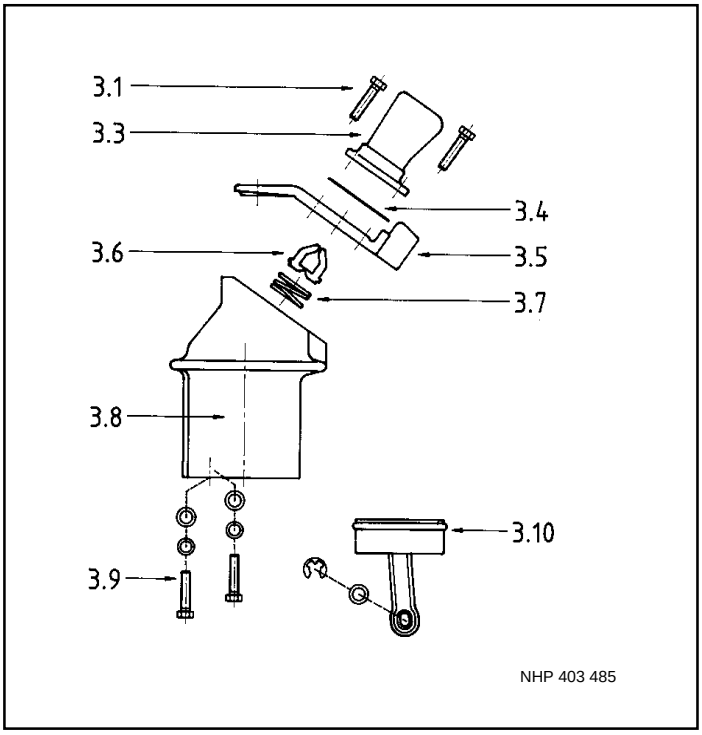


fig. 18

10.3 Replacements of fixed contact on the opening side
Fig. 18.
Switch disconnector in open position.

a) Unscrew the two screws 3.1 and lift up the arcing chamber and the thermal disc 3.4 (for 630 A) while pressing the main contact 3.5 firmly against the hollow insulator 3.8.

b) Lift up the main contact 3.5 by the arcing contacts 3.6 which penetrate the main contact.
Remove the pressure spring 3.7 and clean the top of the insulator and the hole, and blow out the threaded holes. (Protect the eyes.)

c) Attach the new main contact in reverse order as described above.
Demaged parts must be replaced.
– Take care that the arcing contacts 3.6 are correctly placed in the pressure spring 3.7.
– By mounting the termal disc 3.4 and the arcing chamber 3.3, the main contact 3.5 must be pressed firmly against the hollow insulator 3.8. Attach the whole assembly by the screws 3.1. For correct torque see page 15.
Check correct position of the arcing contact and test correct funktion.
Grease the contact area with ISOFLEX TOPAS NCA 52.

11.0 REPLACEMENT OF THE ARCING CHAMBER

Fig. 18.

Follow instructions under item 10.3

12.0 REPLACEMENT OF INSULATORS

12.1 Hollow insulators with arcing chamber
Fig. 18.

a) Unscrew 3.9 and detach the insulator.

b) The new insulator has to be increased inside with a film of silicone, type DOWN CORNING (DC4).

c) Attach the new insulator to the frame by the two selftapping screws. Remember to mount the piston with piston rod 3.10. For correct torque see page 15.
Note the washer and spring washer for the screws.

12.2 Pivot side support insulator
Fig. 17.
Detach the main contact with contact knives according to item 10.1 b.

a) Unscrew 2.5 and detach the insulator.

b) Attach the new insulator to the frame by the two selftapping screws 2.5. For correct torque see page 15.
Note the washer and spring washer for the screws.

c) Attach the main contact with the contact knife to the top of the insulator and adjust according to item 10.1, page 11.

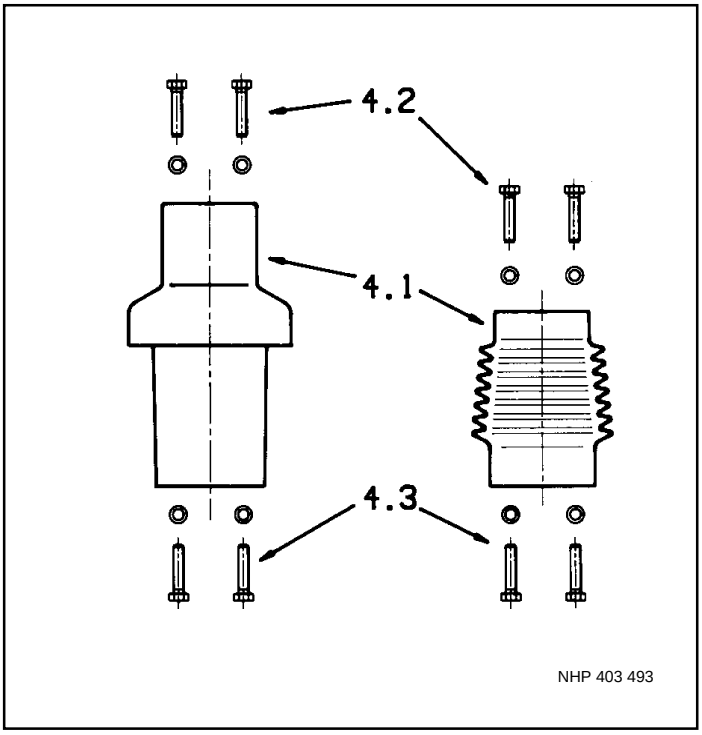


fig. 19

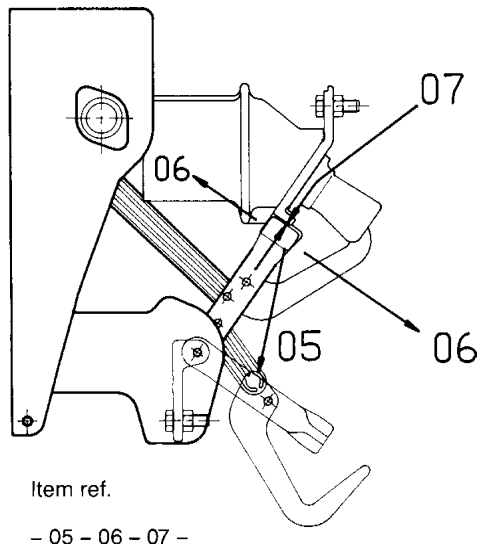
13.0 INSULATOR FOR FUSEBASE AND QUICK MAKE EARTHING SWITCH

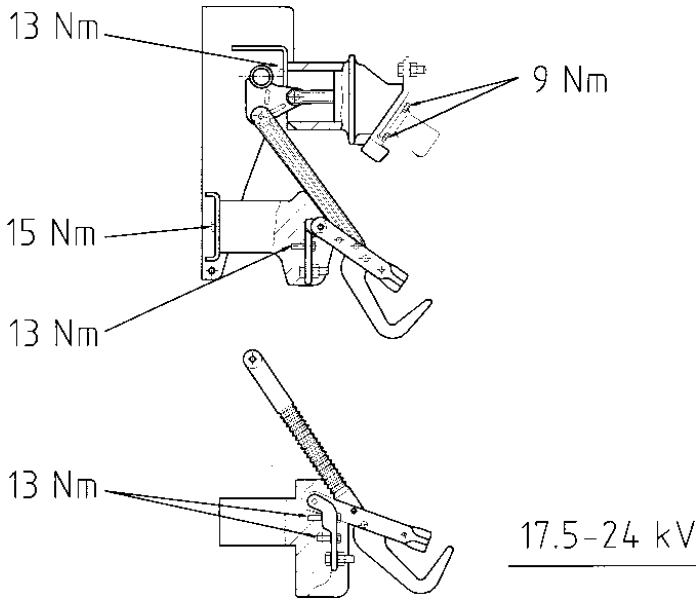
Fig. 19.

a) Unscrew 4.2 and detach the fuse clips and contact block respectively.
b) Unscrew 4.3 at the base of the insulator and detach the insulator.
c) Attach the new insulator to the frame by the two selftapping screws 4.3. For correct torque see page 15.
Note the washer and spring washer for the screws.
d) Attach the fuse clips and contact block respectively to the top of the insulator by the screws 4.2.
For correct torque see page 15.

14.0 TECHNICAL SPECIFICATION FOR NAL/NALF SWITCH DISCONNECTORS

NAL 12 – 17,5 – 24 – 36/6 – 12,5 A–K–KS
Main functions

Item	Function	Mechanism type		Function limits 12 kV	17,5/24 kV	36 kV	Reference control
01	Closing speed of contact knifes	m/sec		5,5 – 5,8	6,5 – 6,8	4,7 – 6,3	Verified by manufacturer
02	Opening speed of contact knifes	m/sec		4,5 – 4,8	5,5 – 5,8	5 – 7	
03	Maximum operating torque	Type K	Closing [Nm]	70	90	100	Verified by manufacturer
			Opening [Nm]	80	100	120	
		Type A	Closing [Nm]	90	110	120	
			Opening [Nm]	5	5	5	
		Type KS	Closing [Nm]	90	90	120	
			Opening [Nm]	90	90	120	
05	Minimum distance between fixed contact and contact knife of open switch	05		120 mm	212 mm	360 mm	Verified by manufacturer
06 07 08	Contact knife penetration Contact knife penetration Contact knife alignment	06		Both contact spots on each side MUST make contact. Contact area = 26 mm			Control 100 % by sight
	 Item ref. – 05 – 06 – 07 – NHP 403 491	07		Tolerance of contact engagement 2-5 mm (see fig. 16)			Control 100 % by sight
		08		The alignment is controlled by: The main contact knife must be aligned with the main contact.			Control 100 % by sight
				The arcing knife runs straight and move freely in the arcing chamber, and makes full engagement with the fixed arcing contact.			Must be adjusted



NAL 12 – 17,5 – 24 kV. Switch Disconnector.

Tightening torque for self tapping screws.

fig. 20

NHP 403 492

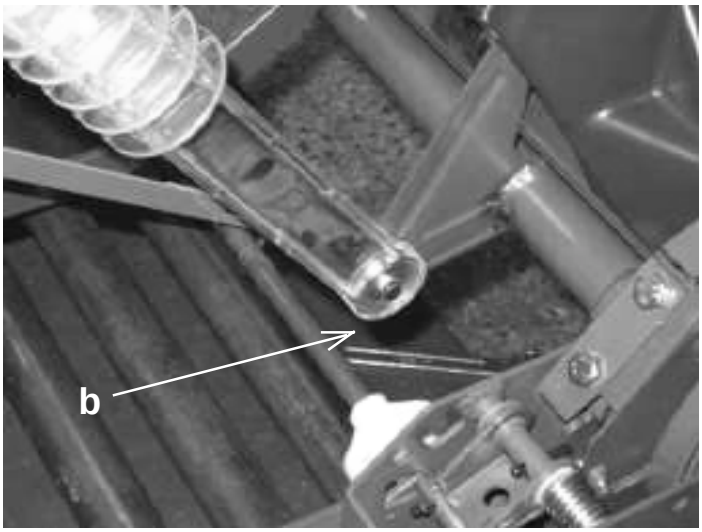


Fig. 21

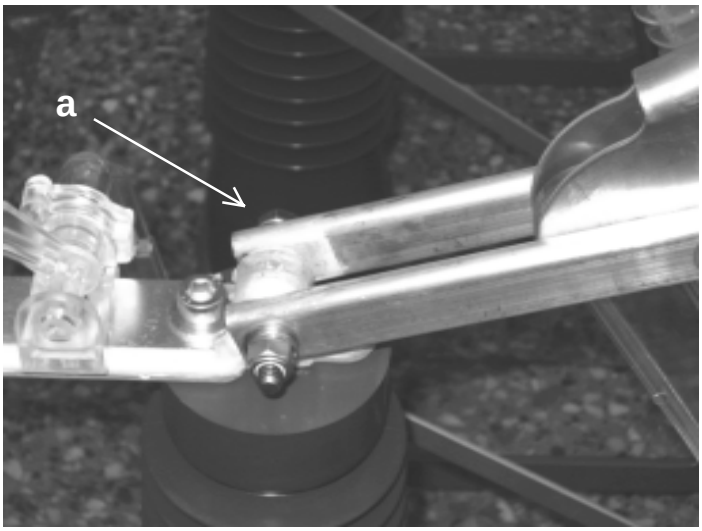


Fig. 22

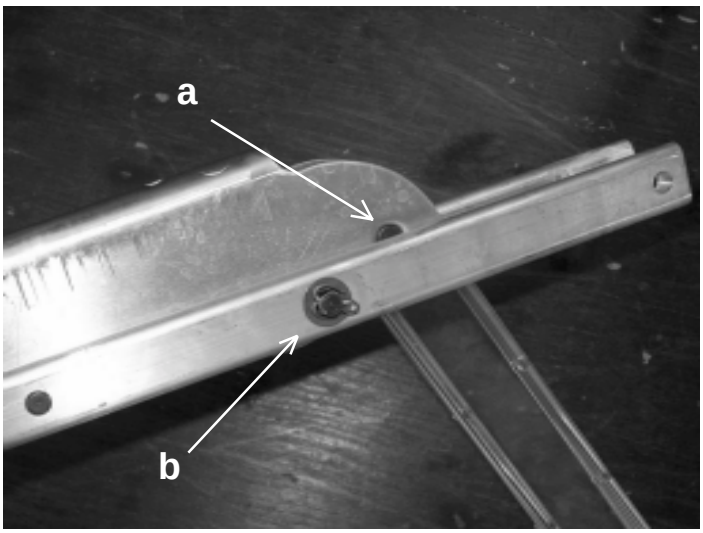


Fig. 23

15. CHANGING PARTS IN NAL 36kV

15.1 Changing contact knives

Disconnect the switch disconnector. When A-mechanism is fitted, the opening spring must NOT be charged.

a) The draw bar is detached from the crank arm of the operating shaft. (fig. 21)
b) The contact screw is detached and the contact knives are removed (fig. 22)
c) Replacement contact knifes are lubricated with ISOFLEX TOPAS NB 52 and fited to the contact block with the contact screw (a).
d) Check that the contact knives can move easily and operate correctly over the opposite contacts.
e) Before the drawbar is connected to the crank arm of the operating shaft (fig. 21) ensure that the auxiliary knives run easily in the individual arc extinguishing chambers, and that the main knives make properly.
f) Put contact grease on the main contacts before the first test operation. The contact position is adjusted by the eccentric bolt on the operating shaft. It can also be adjusted by adjusting the support insulator.

15.2 Changing draw bar (fig. 23)

a) Disconnect the switch disconnector.
b) Pull out the bolt b.
c) Pull down the auxiliary knife such that the drawbar bolt (a) can be pushed out and upper hold for the drawbar is free.
d) The lower hold for the drawbar is freed by removing circlips on eccentric bolt (fig. 21)
e) New drawbar to be fitted in sequence a-b (fig. 23)

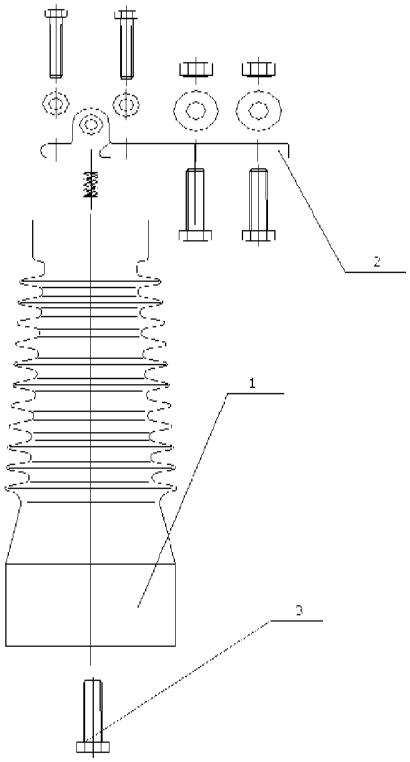


Fig. 24

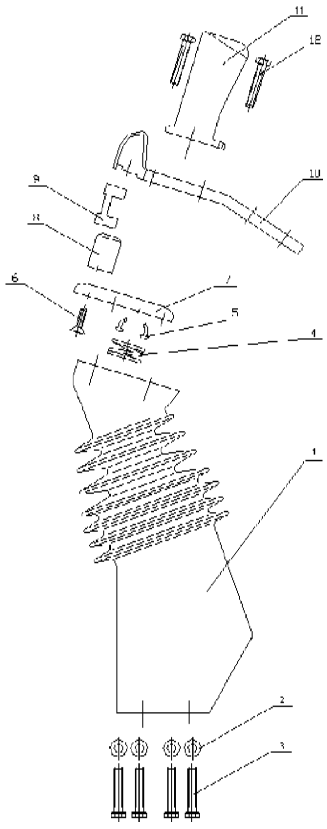


Fig. 25

15.3 Changing the supporting insulator (fig. 24)

a) disconnect the switch disconnector.
b) Contact block with contact knives is dismounted. (use spannergap17)
c) The insulators are attached to the switch frame by a screw M12 (spannergap 19)
The insulator is dismounted and a new insulator is fitted to the switch frame.
d) Contact block with contact knives is fitted to the insulator and adjusted as described in paragraph 15.1

15.4 Changing the hollow insulator (fig. 25)

a) Disconnect the switch disconnector.
b) The spring mechanism is dismounted from the frame.
c) All draw bars are detached from the crank arm of the operating shaft. (fig. 21)
d) Turn the operating shaft to one side.
e) Disconnect the piston rod from the operating shaft and piston can be taken out
f) Undo the fixing screws on insulator.
g) The hollow insulator is attached to the frame by 4 screws M10 (spannergap 17). New Insulator is fitted. If contact blocks and arcextingusing chambers are to be used again, these must be fitted to the insulator BEFORE the insulator is fitted to the switch frame.
h) Add spring mechanism and connect all draw bars to the crank arms as described in paragraph 15.1
i) The position of the insulator is checked and adjusted as described in paragraph 15.5. (NB! A certain degree of adjustment can be made by moving the hollow insulator.)

15.5 Changing the piston with piston rod (fig. 26)

NB! Remove spring mechanism before starting, if you have A-Mechanism installed.

a) Close the switch disconnector.
b) Disconnect the lower part of draw bar from the main shaft.
c) Disconnect the piston rod from the operating shaft and piston can be taken out.
d) New piston is fitted the same way.
NB! Piston and cylinder MUST NOT be greased or lubricated.
e) Conect the drawbar to the eccentric bolt on the main shaft.

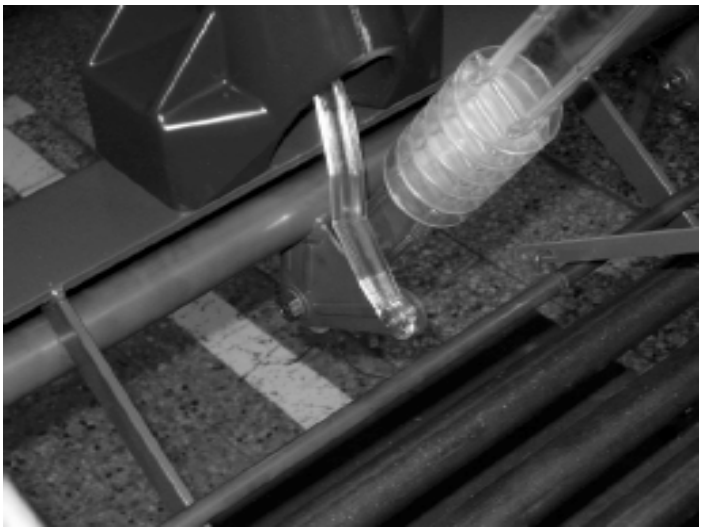
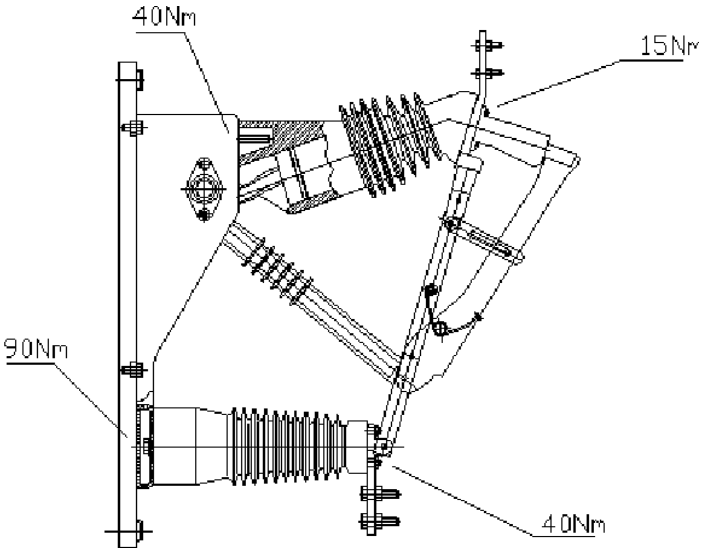


Fig. 26

15.5 Changing the piston with piston rod (fig. 26)
NB! Remove spring mechanism before starting, if you have A-Mechanism installed.

a) Close the switch disconnector.
b) Disconnect the lower part of draw bar from the main shaft.
c) Disconnect the piston rod from the operating shaft and piston can be taken out.
d) New piston is fitted the same way.
NB! Piston and cylinder MUST NOT be greased or lubricated.
e) Conect the drawbar to the eccentric bolt on the main shaft.



Tightening torque for screws.

Fig. 27

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