TRADE TRAINING
ATC PROGRAMME

ELECTRICIAN GENERAL

TEVTA

GOVERNMENT OF THE PUNJAB
TECHNICAL EDUCATION & VOCATIONAL TRAINING AUTHORITY
PUNJAB BOARD OF TECHNICAL EDUCATION
TRADE TESTING CELL, LAHORE.

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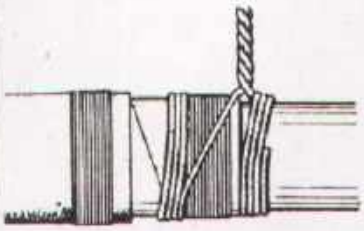
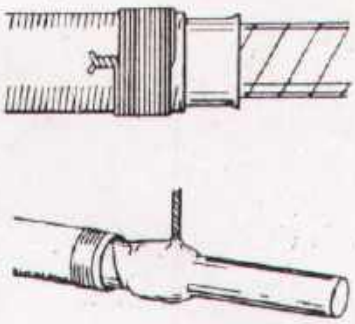
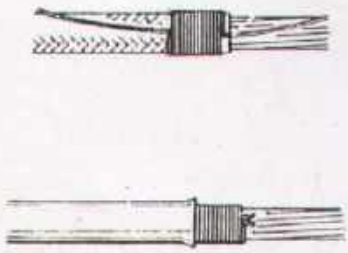


1 STRIPPING

2 STRIPPING



3 INSTRUCTION SHEET



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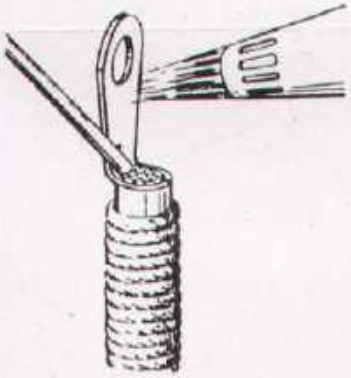
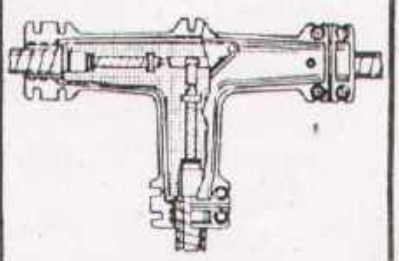


5 SOLDERING

6 WELDING

7 TERMINAL BOX

8 CABLE BOX



9 CABLE DISTR. PLUG

LAYOUT

EP 2.1/3.5.5/
Cable jointing

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

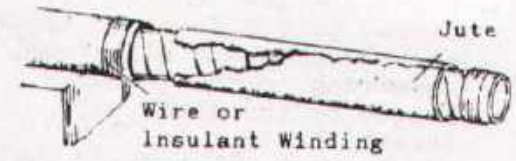
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

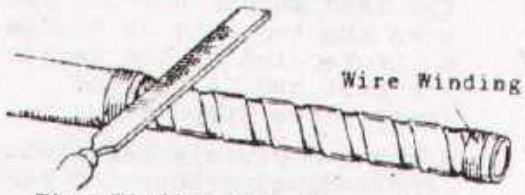
ELECTRICIAN-
GENERAL

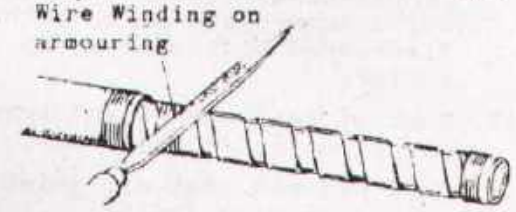
1

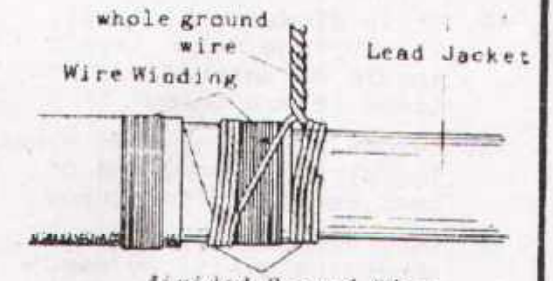
SEQUENCE OF OPERATION

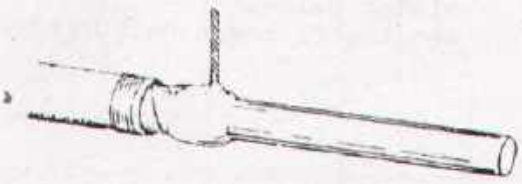
1. In order to ease working and ensure greater reliability, place end of cable on some suitable support (e.g. trestle), and mark the length to be off-set.
2. Secure jute with wire or insulant winding.
   See instr. sheet No. EP/2.3/3.5.5/3
3. Incise and peel jute sheathing.
4. File steel-tape armouring bare for 20 to 30 mm and tin.
5. Place wire winding on tinned steel-tape armouring (some 10 windings).
6. Incise armouring in front of winding by filing all around with triangular file and remove by knicking.
   Note: Saw must not be used.
7. Heat with blow-lamp and peel-off the impregnated and well-adhesive paper sheath.
   (e.g. with petroleum)
8. Scrape bare and tin lead jacket for some 20 to 30 mm next to wire winding.
9. Loop one half of ground wire in 2 windings around armouring and lead jacket.
10. Join the three windings by bead soldering.
    See instr. sheet No. EP/2.3/3.5.5/3







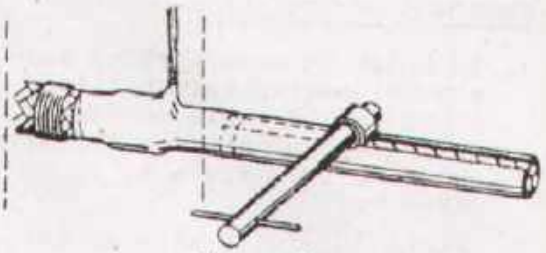




	STRIPPING OF ARMOURED CABLES	EP 2.3/3.5.5/1 Cable jointing
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL 3

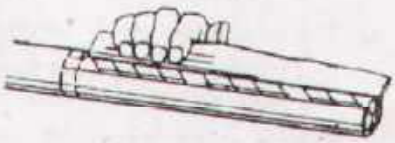
SEQUENCE OF OPERATION

11. Notch the lead sheath all around to the required length, then notch again all around according to the set-off length of the joint wire sheath (belt).
The lead sheath section between the two notches serves as protection of the remaining belt and is removed later. (see Step 18)



Strip reeler

12. Crack two closely parallel longitudinal cracks and reel off intermediate strip with flat-nosed pliers or strip reeler.

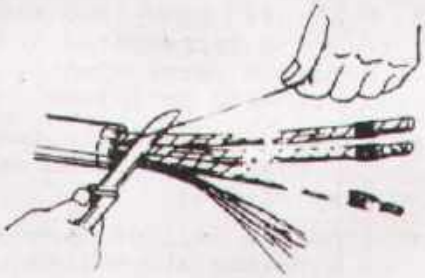


13. Turn up lead sheath and tear off at notch (do not cut).

14. Reel off and tear off joint wire sheathing (belt).

15. Cut off filler with knife from inside to outside.
Do not cut against wires.

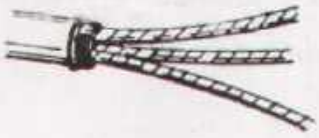
16. Lace wires with (impregnated) twine according to connecting length.
See instr. sheet No.2.3/3.5.5/4



17. Strip wires to windings, whereby the outer layers should be notched and the inner layers torn.

18. Remove remaining lead sheath (belt) and expand end of lead sheathing to funnel.

19. Lace exposed joint wire sheathing (belt) by winding with (impregnated) binder twine.
See instr. sheet No.2.3/3.5.5/4

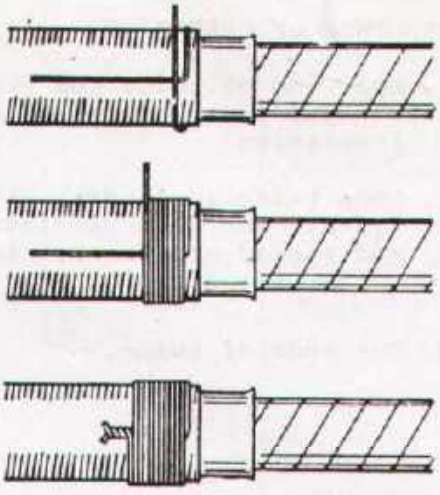


	STRIPPING OF ARMOURED CABLES	EP 2.3/3.5.5/2 Cable jointing
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL 4

WIRE WINDINGS

SEQUENCE OF OPERATION

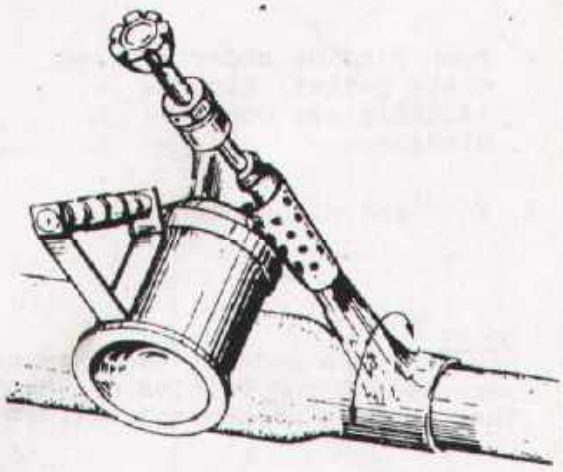
1. Bend wire right angularly and loop around the cable.
2. Wind several layers tightly and securely over loop.
3. Twist and cut wire ends.



TINNING OF LEADEN WORK-PIECES

SEQUENCE OF OPERATION

1. Clean and scrape work-pieces bare.
2. Spread flux on work-piece.
3. Heat carefully while moving flame back and forth (simultaneously).
4. Melt solder (rod tin).
5. Heat the applied solder only to a pasty condition (it must not flow) and spread with flux-soaked cloth.



Note
The back and forth movement of the flame during the heating of the work-piece is necessary for preventing localized over-heating (melting of the lead).

TWINE WINDING WITH THREADED END

SEQUENCE OF OPERATION

1. Loop end of twine and start winding just before end of insulation.

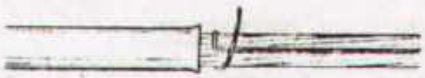
2. Loop twine in several closely adjacent firm windings and thread end through loop.

3. Cut ends of twine.

TWINE WINDING WITH KNOTTED END

SEQUENCE OF OPERATION

1. Crease end of twine and wind some three layers around crease.



2. Push winding under knurled cable jacket, tighten slightly and continue winding.

3. Knot and cut ends.

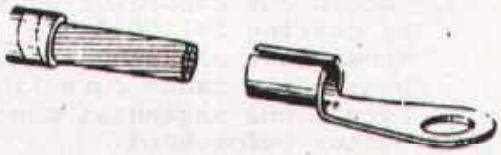
Note:
Windings are made of tape, twine or wire, depending on the purpose and composition of the line to be laced.
They must be smooth and uniform, firm and unshiftable.

SEQUENCE OF OPERATION

1. Strip line to required length (= length of sleeve + 10 mm).
   Clean conductor if necessary.

2. Push stripped end into the sleeve.

3. Protect insulation from soldering heat, e.g. by lacing with asbestos yarn.

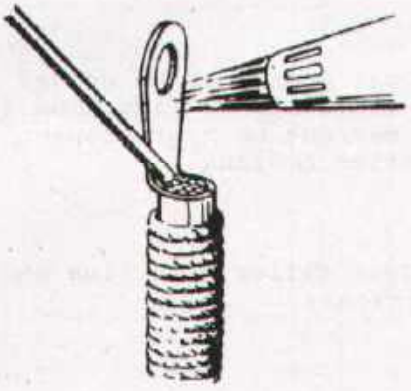


4. Put cable and cable-lug in vertical position.

5. Coat soldering point with paste flux.

6. Solder, heat cable-lug above the soldering point, permit solder to penetrate into sleeve by knocking.

7. Insulate and secure and protect by lacing, if this should be required.



Note:
The solder must fill the sleeve of the cable-lug completely, but must not penetrate any further.

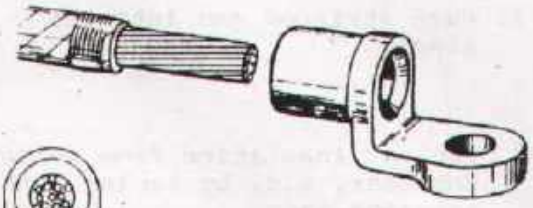
Only solders containing a minimum of 40% tin should be used.

	MOUNTING LARGE CABLE-LUGS BY SOLDERING	EP 2.3/3.5.5/5 Cable jointing
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL 7

The Preliminaries for welding cable-lugs on aluminium conductors require particularly meticulous execution, so as to ensure that the actual welding be rapid and reliable.

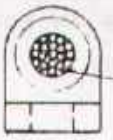
Working Steps

1. Set-off and strip cables to required length and form out the conductors.



2. Smooth cut conductor ends by cutting followed by subsequent cleaning (use benzine on cable cores). Form round segmental conductor beforehand.

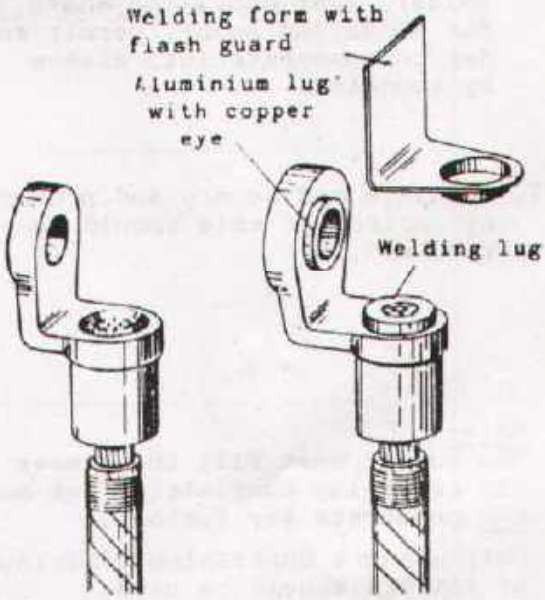
improperly filled hole



Hole well filled with wires

pointed wire

4. Place conductor and cable-lug in vertical position, and attach welding form with flash guard if this is required.



5. Coat points to be welded with suitable flux. The flux must not be hygroscopic after cooling.

6. Coat filler with flux and prepare.

Note
The fillers used should preferably be waste ends of the cable core to be welded.

	WELDING CABLE-LUGS ON ALUMINIUM CONDUCTORS	EP 2.3/3.5.5/6 Cable jointing
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL 8

SEQUENCE OF OPERATION

1. Set welding flame pointedly and at low-oxygen (excess of gas).

2. Heat conductor end with pointed flame circulatingly until lugs are formed on the faces of the individual wires.

3. Spread lugs together with filler. Heat rim of cable-lug until its surface bulges.

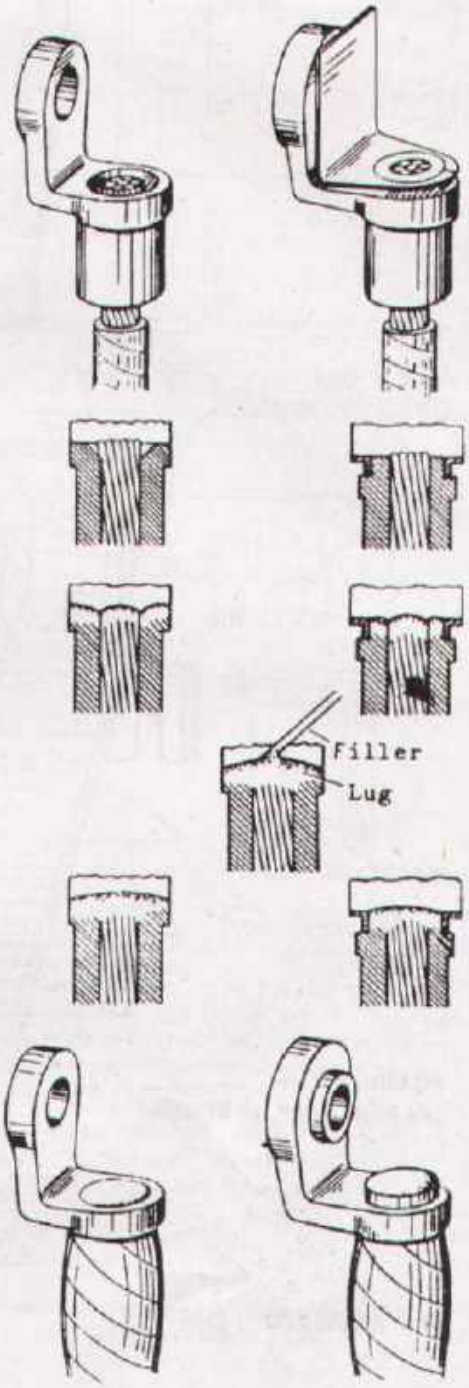
4. Spread the conductor and lug melts together. Build up filler until a lug is formed.

   In building up the lug feed filler to the melt and continue to feed while stirring.

   Take off filler before removing flame.

5. Permit melt to harden and clean cable-lug.

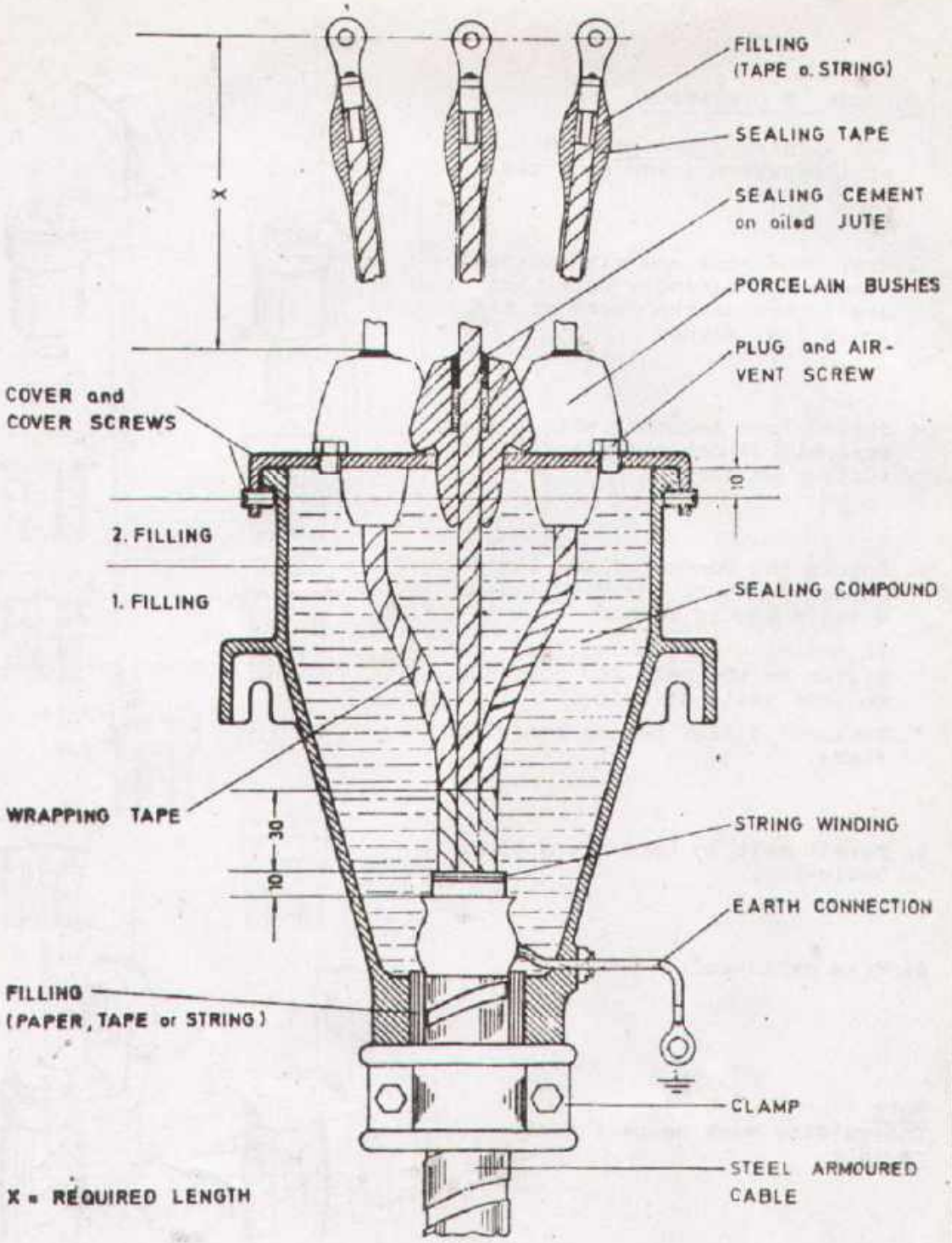
6. Wrap cable end.



Note
The welding must be performed rapidly.

WELDING CABLE-LUGS ON ALUMINIUM CONDUCTORS

EP 2.3/3.5.5/7
Cable jointing



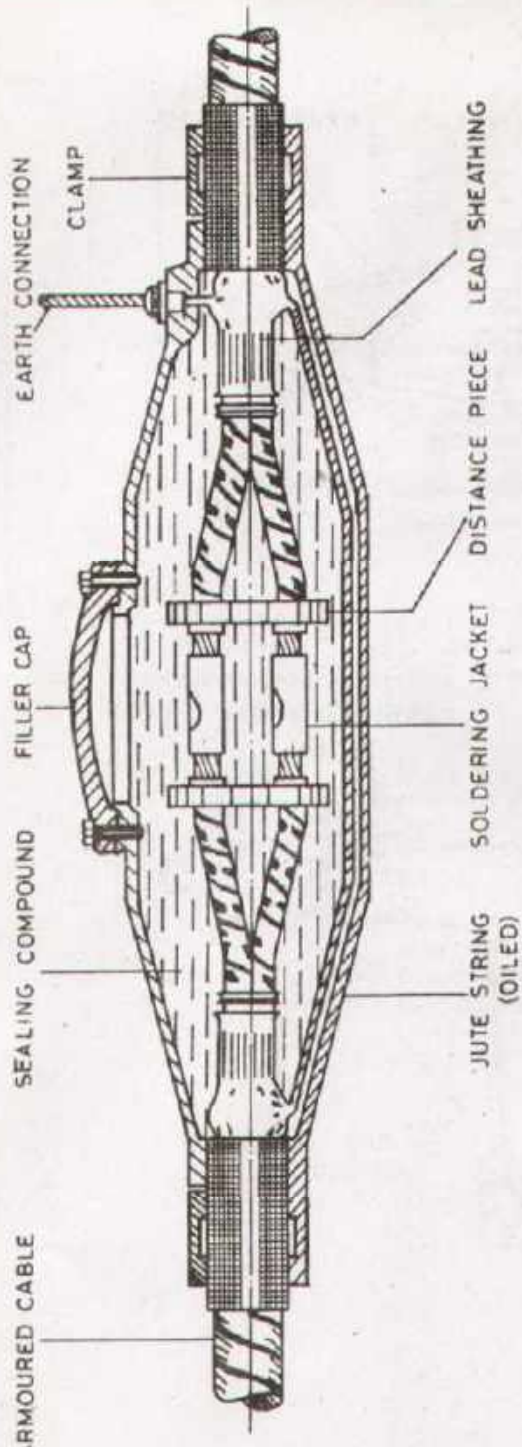
TERMINAL BOX

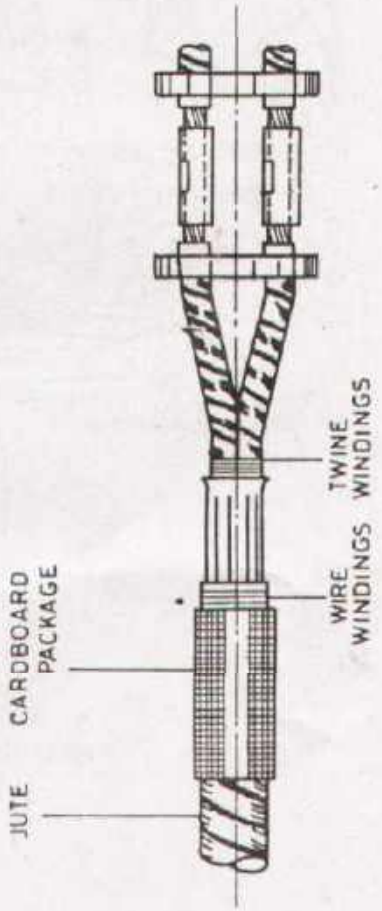
EP 2.3/3.5.5/8
Cable jointing

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

ELECTRICIAN
GENERAL 10





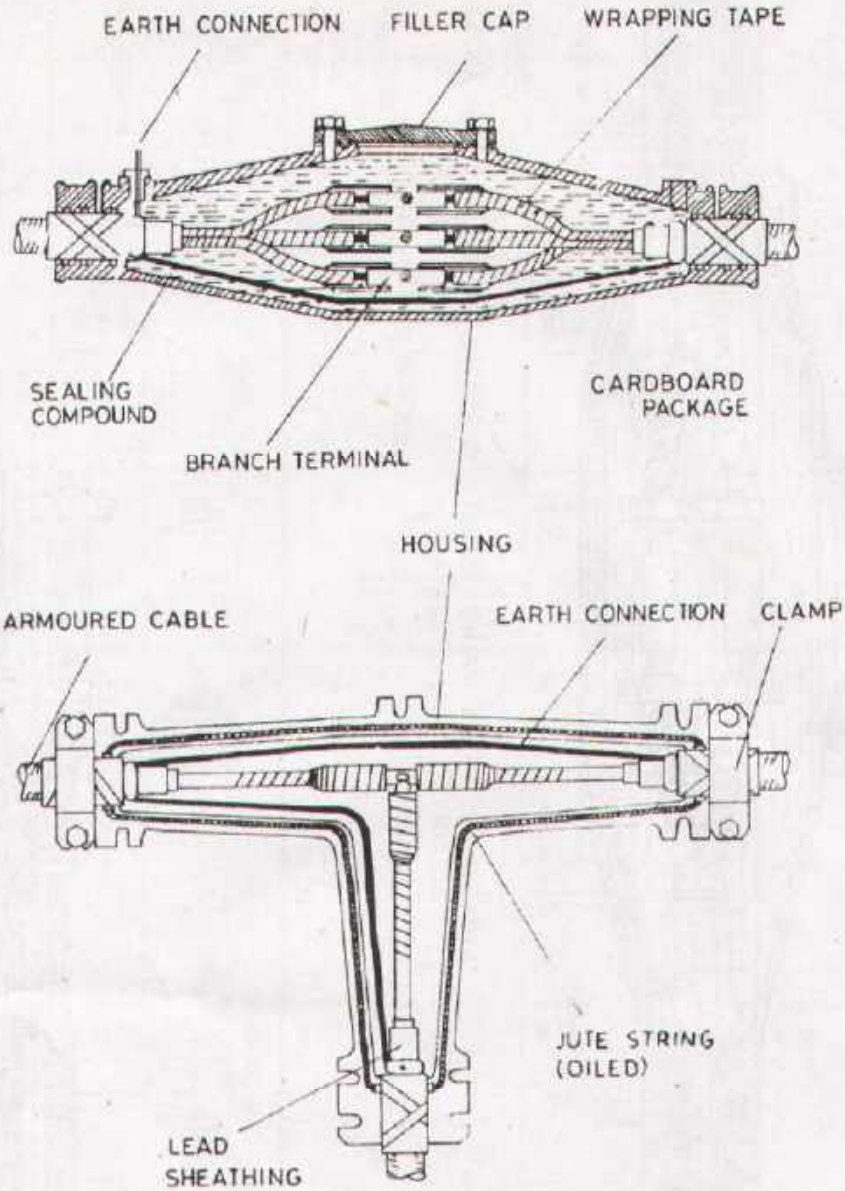
CABLE-CONNECTING BOX

EP 2 3/3.5.5/9
Cable jointing

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

ELECTRICIAN
GENERAL



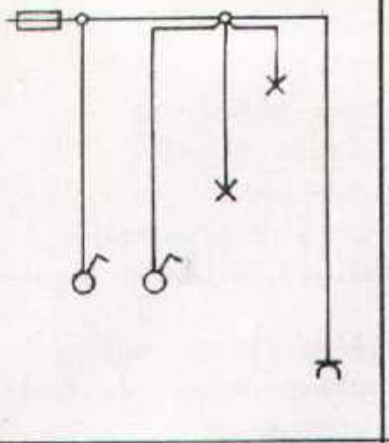
CABLE DISTRIBUTION PLUG

EP 2.3/3.5.5/10

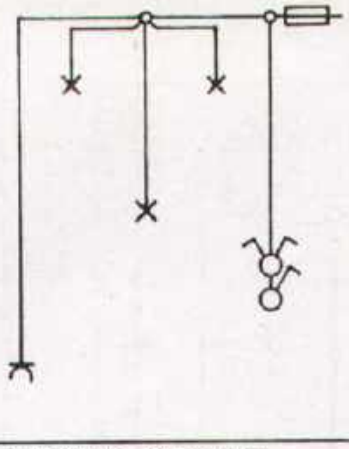
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

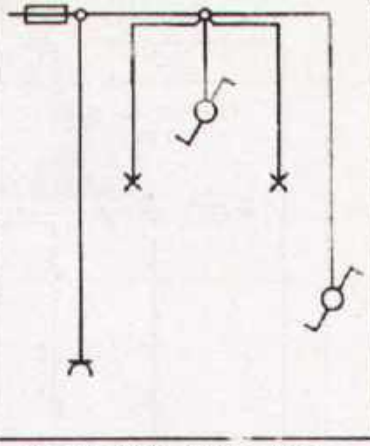
ELECTRICIAN GENERAL



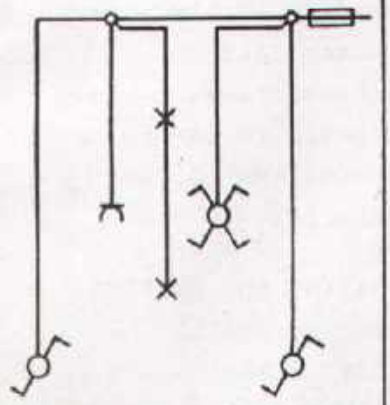
1 KITCHEN INSTALLATION



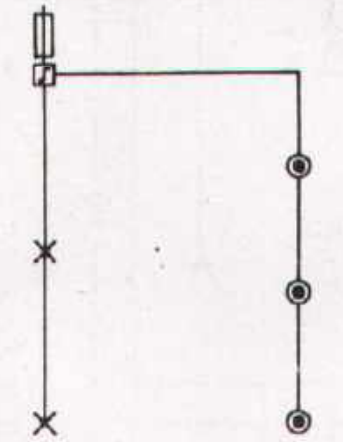
2 DRAWING ROOM INST.



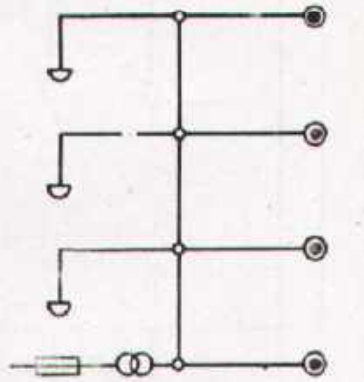
3 SLEEPING ROOM INST.



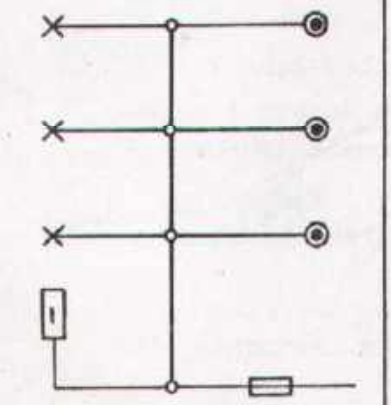
4 HALL INSTALLATION



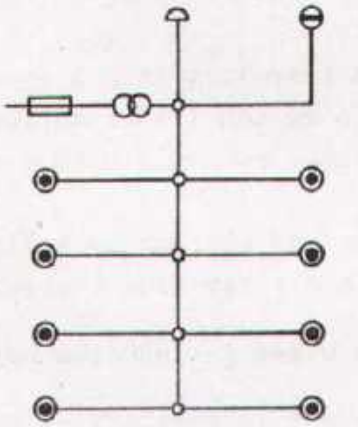
5 IMPULSE SWITCH INST.



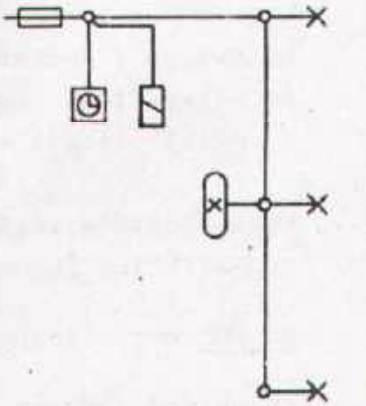
6 TREMBLER BELL INST.



7 TIME SWITCH INST.



8 INDICATOR BELL INST.



9 TIMING SWITCH INST.

LAYOUT

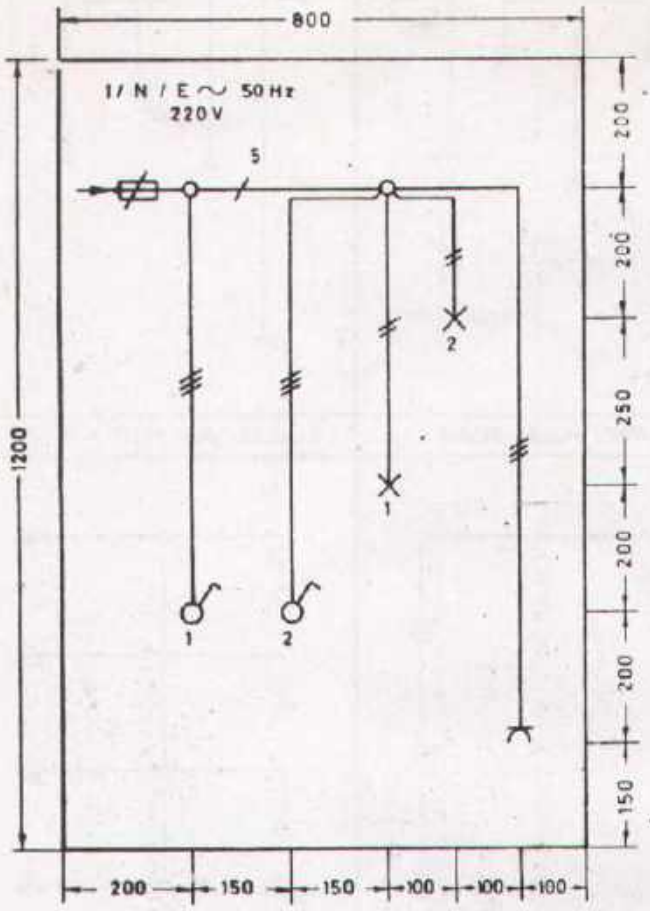
EP 2.1/3.5.4/

Installation II

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

ELECTRICIAN GENERAL



Material:

1 Fuse, (complete)
2 Junction boxes
2 Lampholders
2 Single pole switches
1 Socket (Schuko or 3-pin)

For Alteration:

2 Sockets (Schuko or 3-pin)
Use instead of
2 Single pole switches
1 Multicircuit switch
According to the type of installation
Screws, clamps, cables, pipes, wire, batten or casing and capping material

a) CASING and CAPPING
b) BATTEN WIRING
c) PIPE WIRING
d) CABLE WIRING

Estimate the material required for the installation

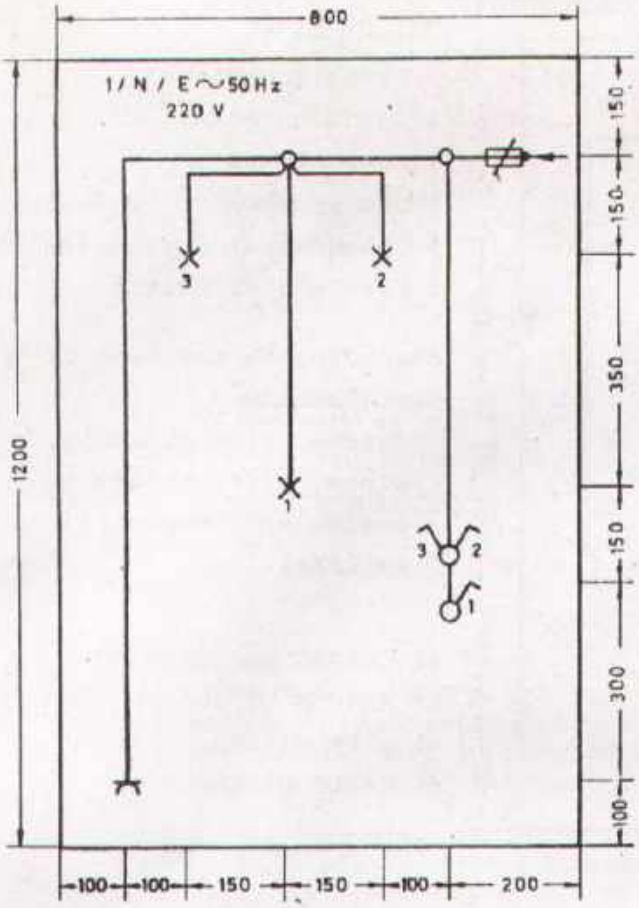
a) **Switch 1 operates lamp 1, switch 2 operates lamp 2**
b) **Alteration, remove switch 1 + 2, replace number 1 with a multi-circuit switch, number 2 with a socket (Schuko or 3-pin)**

Draw complete wiring- and current path diagrams of above shown installation layout and alteration thereof.

DO NOT cut off spare wires in junction boxes, switches etc.

Check and connect SUPPLY in PRESENCE of your INSTRUCTOR.

	KITCHEN	EP 2.3/3.54/1 Installation II



MATERIAL:

1 Fuse, (complete)
2 Junction boxes
3 Lampholders
1 Socket (Schuko or 3-pin)
1 Single pole switch
1 Multicircuit switch
According to the type of installation
Screws, clamps, cable, pipes, wire, batten or casing and capping material

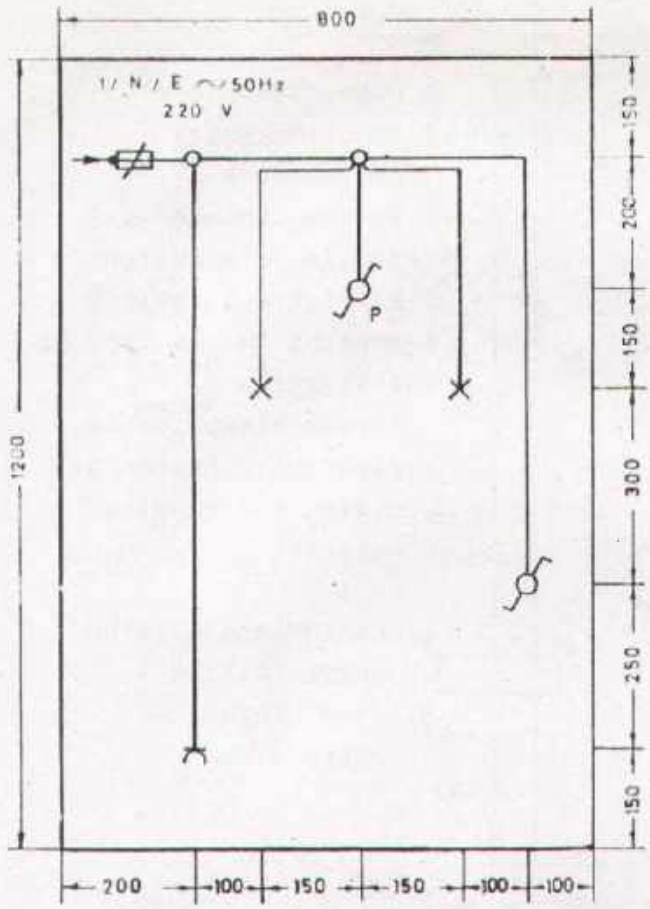
a) CASING and CAPPING
b) BATTEN WIRING
c) PIPE WIRING
d) CABLE WIRING

Indicate number of wires in above given installation layout.

Estimate the material required for the installation.

Draw complete wiring- and current path diagrams of above shown installation layout.

Check and connect SUPPLY in PRESENCE of your INSTRUCTOR.



MATERIAL:

1 Fuse, (complete)
2 Junction boxes
2 Lampholders
1 Socket (Schuko or 3-pin)
1 Change-over switch (pull)
1 Change-over switch

According to the type of installation
Screws, clamps, cable, pipes, wire, batten or casing and capping material

a) CASING and CAPPING
b) BATTEN WIRING
c) PIPE WIRING
d) CABLE WIRING

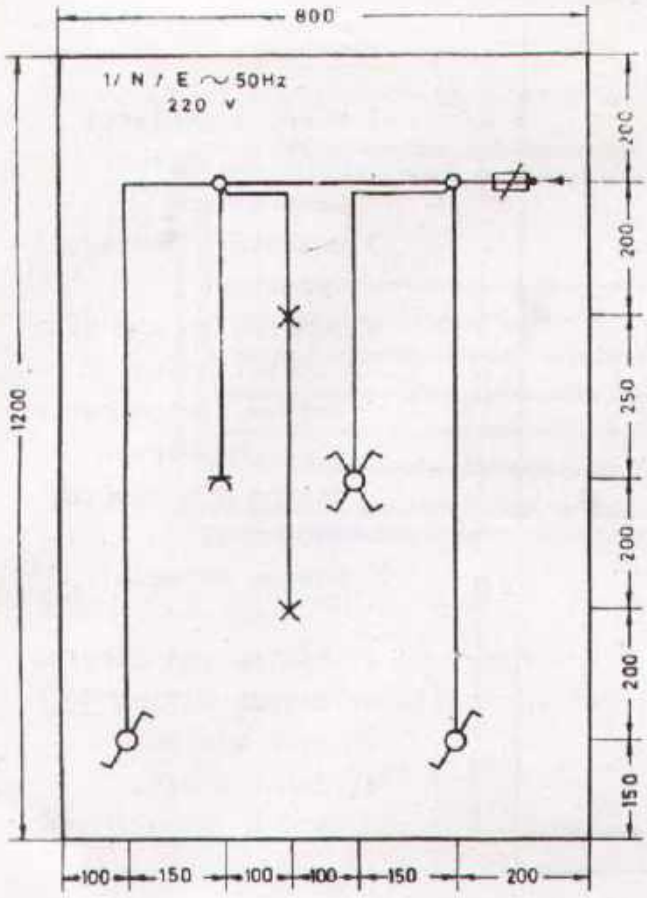
Indicate number of wires in above given installation layout.

Estimate the material required for the installation.

Draw complete wiring- and current path diagrams of above shown installation layout.

Check and connect SUPPLY in PRESENCE of your INSTRUCTOR.

	SLEEPING ROOM	EP 2.3/3.5.4/3 Installation II
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL 16



MATERIAL:

1 Fuse, (complete)
2 Junction boxes
2 Lampholders
2 Change-over switches
1 Intermediate switch
1 Socket (Schuko or 3-pin)
According to the type of installation
Screws, clamps, cables, pipes, wire, batten or casing and capping material

a) CASING and CAPPING
b) BATTEN WIRING
c) PIPE WIRING
d) CABLE WIRING

Indicate number of wires (conductors) in above given installation layout.

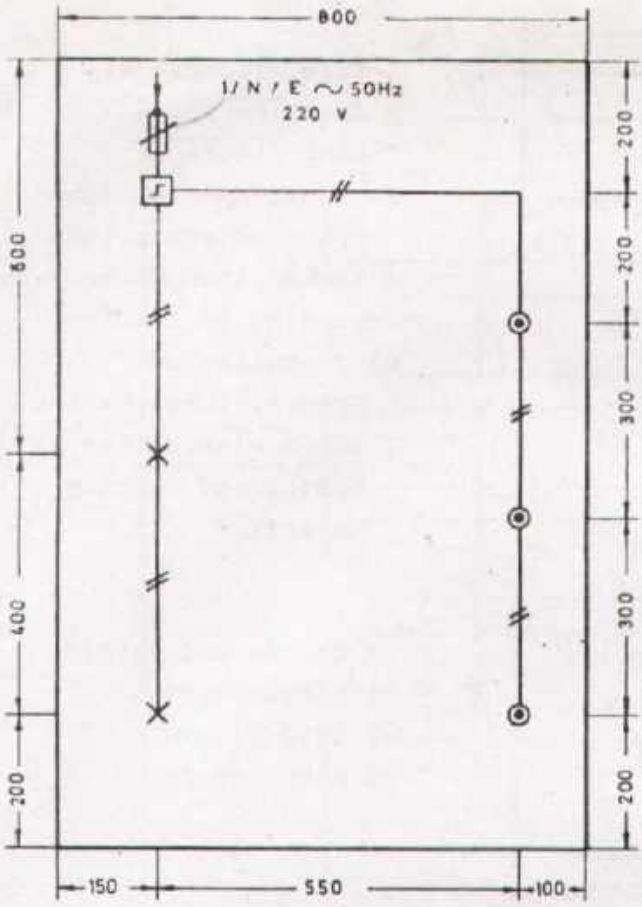
Estimate the material required for the installation.

Draw complete wiring- and current path diagrams of above shown installation layout.

Check and connect SUPPLY in PRESENCE of your INSTRUCTOR.

If intermediate switch is not available then perform practical exercise of Drg.No. EP/2 3/3 5.4/10

	HALL	EP 2.3/3.5.4/4 Installation II
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL



MATERIAL:

1 Fuse, (complete)
1 Impulse switch
2 Lampholders
3 Momentary contact switches
According to the kind of installation
Screws, clamps, cable, pipe and wires, casing and capping material, batten material

a) CASING and CAPPING
b) BATTEN WIRING
c) PIPE WIRING
d) CABLE WIRING

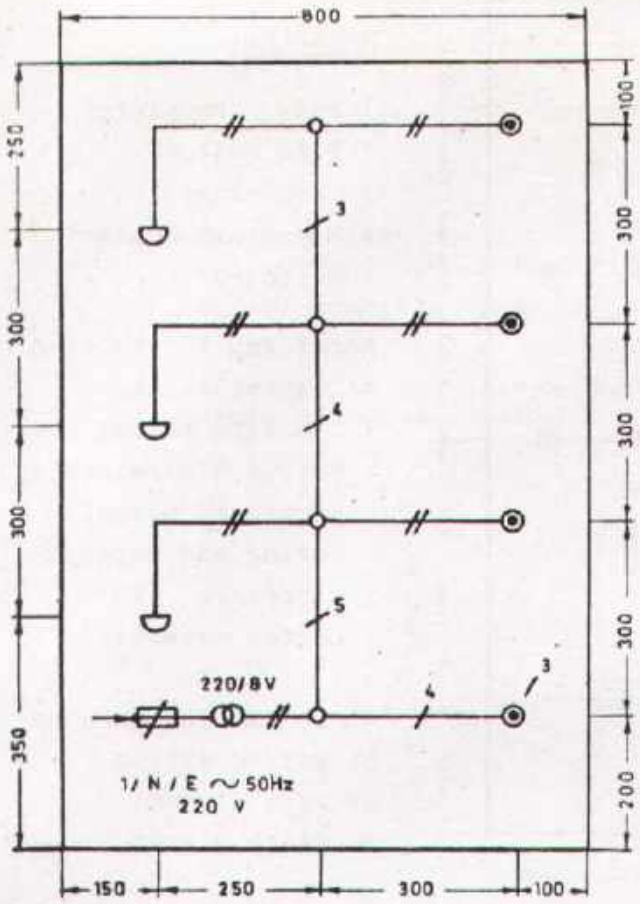
Estimate the material required for the installation to be made.

Draw complete wiring and current path diagrams of above shown installation layout.

Check and connect in PRESENCE of your INSTRUCTOR.

If impulse switch is not available then perform practical exercise of Drg.No. EP/2.3/3.5.4/11

	IMPULSE SWITCH	EP 2.3/3.5.4/5 Installation II
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL 18



MATERIAL:

1 Fuse, (complete)
1 Transformer 220/8 V
3 Trembler bells
3 Momentary contact switches, single
3 Momentary contact switches with name plate
According to the kind of installation
4 Junction boxes, screws,clamps,cable, pipes and wire, casing and capping material.

a) CASING and CAPPING
b) BATTEN WIRING
c) PIPE WIRING
d) CABLE WIRING

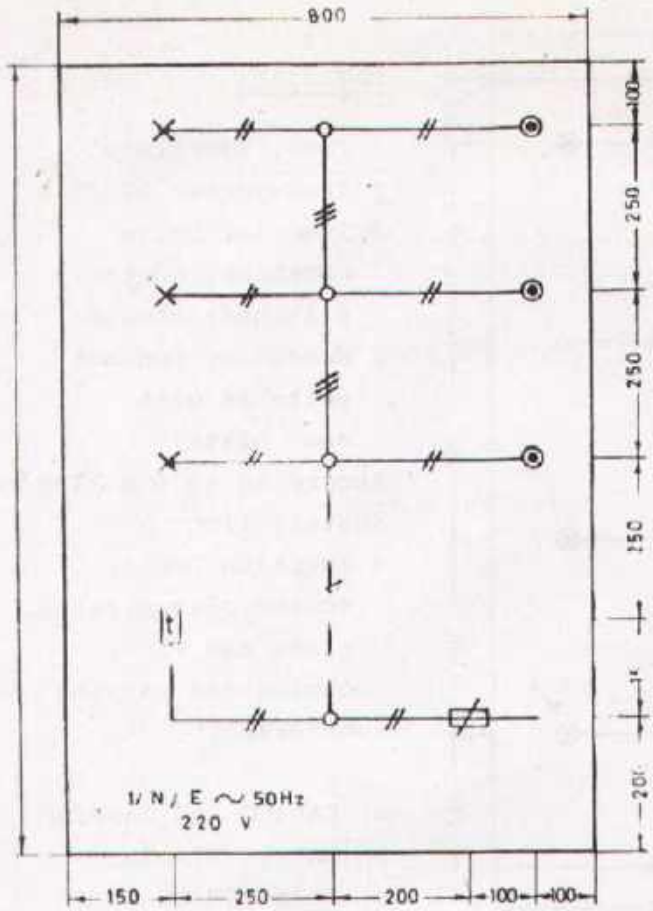
Estimate the material required for the installation to be made.

Draw complete wiring- and current path diagrams of above shown installation layout.

Check and connect SUPPLY in PRESENCE of your INSTRUCTOR.

If 8V bell is not available then perform this exercise without Transformer at 220V

	TREMBLER BELL	EP 2.3/3.5.4/6 Installation II
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL 19



MATERIAL:

1 Fuse, (complete)
1 Time switch
3 Lampholders
3 Momentary contact switches

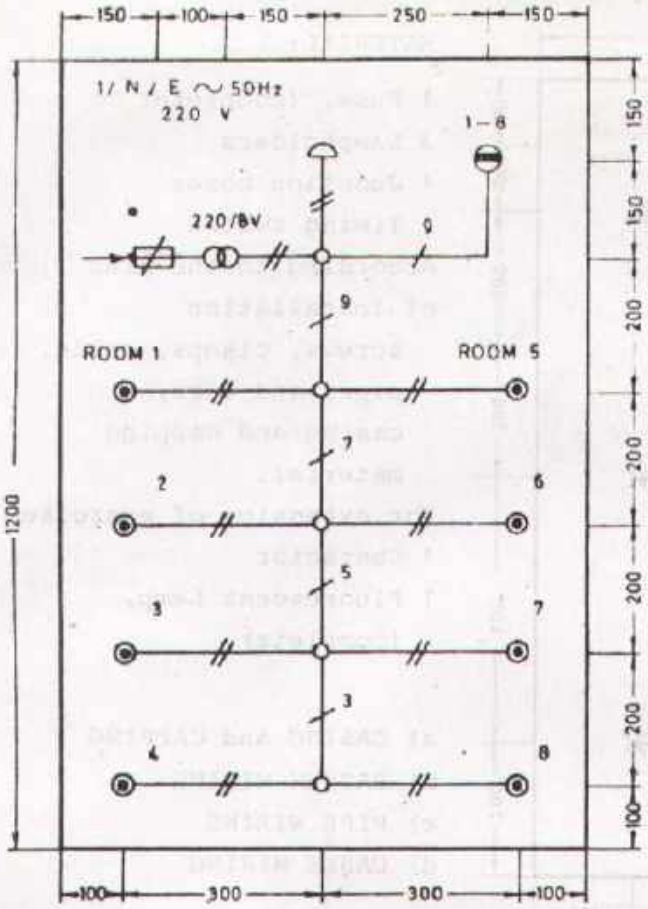
According to the kind of installation
4 Junction boxes, screws, clamps, cable, pipes and wires, casing and capping material, batten material.

a) CASING and CAPPING
b) BATTEN WIRING
c) PIPE WIRING
d) CABLE WIRING

Estimate the material required for the installation to be made.

Draw complete wiring- and current path diagrams of above shown installation layout.

Check and connect SUPPLY in PRESENCE of your INSTRUCTOR.



MATERIAL:

1 Fuse, (complete)
1 Transformer 220/8 V
1 Number-Indicator 8 Nos.
1 Trembler bell
8 Momentary contact switches
According to the kind of installation
5 Junction boxes, screws, clamps, cable, pipes and wires, casing and capping material, batten material.

a) CASING and CAPPING
b) BATTEN WIRING
c) PIPE WIRING

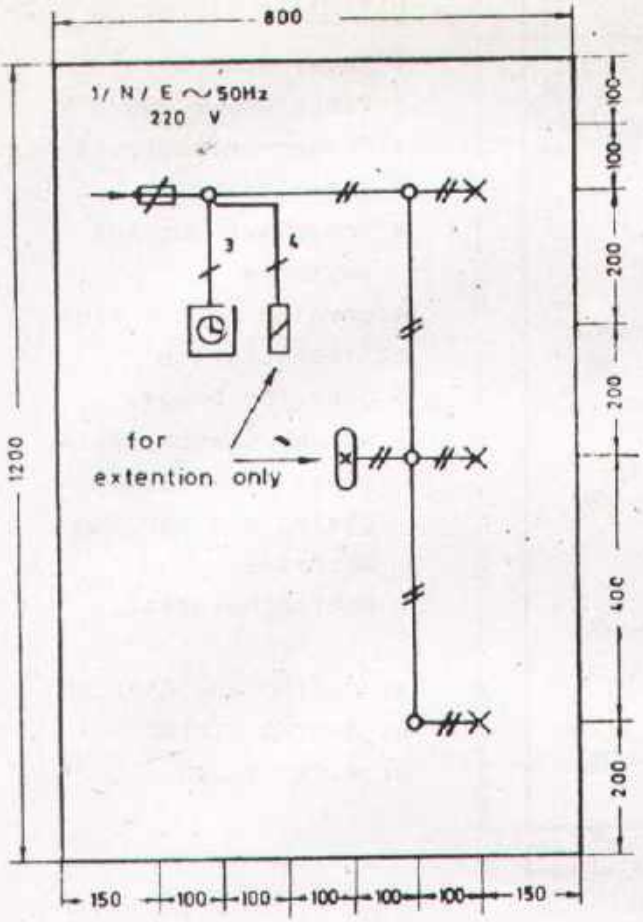
Estimate the material required for the installation to be made.

Draw complete wiring-and current path diagrams of above shown installation layout.

Check and connect SUPPLY in PRESENCE of your INSTRUCTOR.

If 8V bell indicator is not available then perform this exercise without Transformer at 220V.

	INDICATOR BELL	EP 2.3/3.5.4/8
		Installation II



MATERIAL:

1 Fuse, (complete)
3 Lampholders
4 Junction boxes
1 Timing switch
According to the kind of installation
screws, clamps, cable, pipes and wire, casing and capping material.
For extension of exercise
1 Contactor
1 Fluorescent Lamp, (complete)

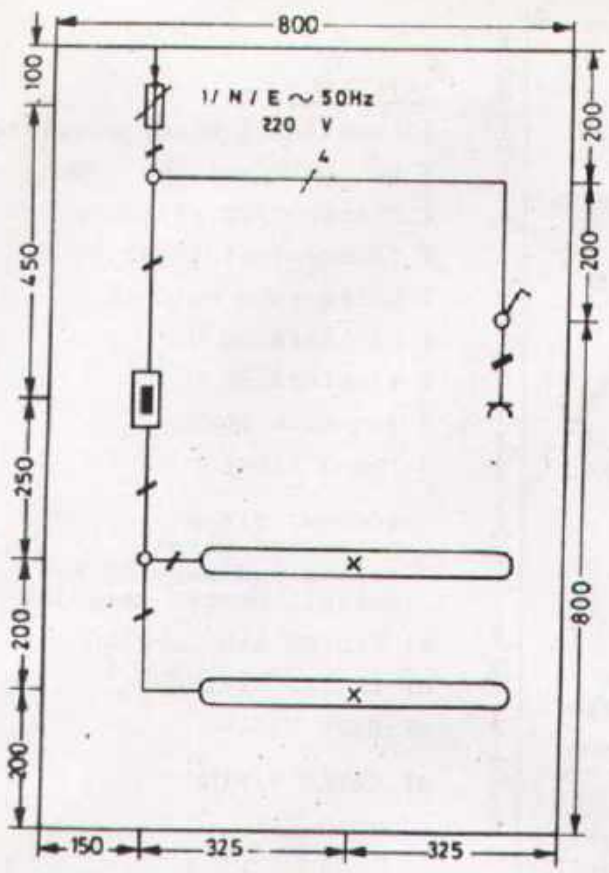
a) CASING and CAPPING
b) BATTEN WIRING
c) PIPE WIRING
d) CABLE WIRING

Estimate the material required for the installation to be made.

Draw complete wiring- and current path diagrams of above shown installation layout.
a) without extension
b) with extension

Check and connect SUPPLY in PRESENCE of your INSTRUCTOR.

	TIMING SWITCH	EP 2.3/3.5.4/9 Installation II



MATERIAL:

1 fuse (with base) complete
1 single pole switch
2 fluorescent tubes 20 W
2 pairs tube holders
1 ballast 40 W
2 starters 20 W
2 junction boxes
1 3-pin socket
2 round blocks

According to the type of installation

screws, clamps, cable, pipes and wires, casing and capping material, batten material

a) CASING AND CAPPING
b) BATTEN WIRING
c) PIPE WIRING
d) CABLE WIRING

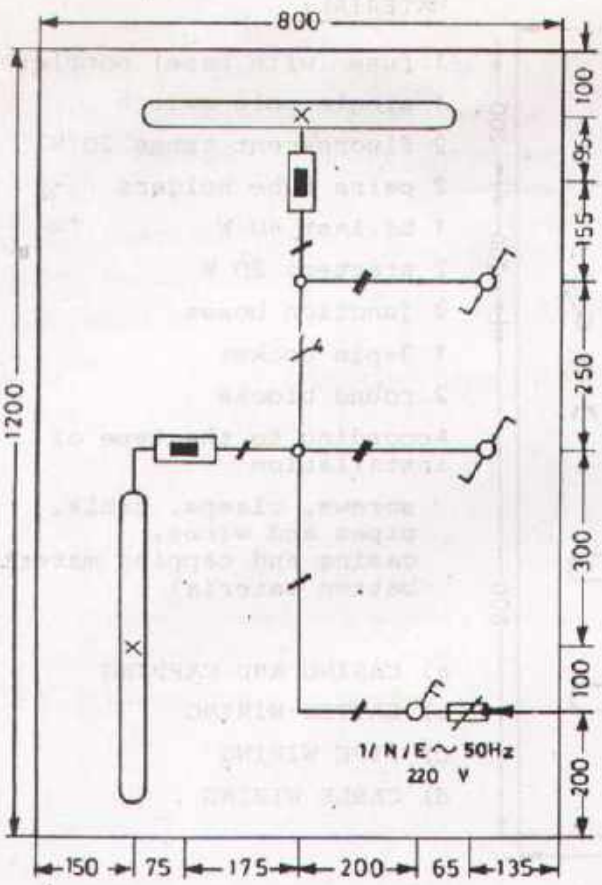
Estimate the material required for the installation to be made

a)
b)
c)
d)

Draw complete WIRING- and CURRENT PATH DIAGRAM of above shown INSTALLATION-LAYOUT.

CHECK AND CONNECT SUPPLY IN PRESENCE OF YOUR INSTRUCTOR.

	FLUORESCENT LAMPS WITH ONE BALLAST	EP 2.3/3.5.4/10 Installation II
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL 23



MATERIAL:

1 fuse (with base) complete
1 two pole switch
2 change over switches
2 fluorescent tubes 20 W
2 pairs tube holders
2 ballasts 20 W
2 starters 20 W
2 junction boxes
3 round blocks

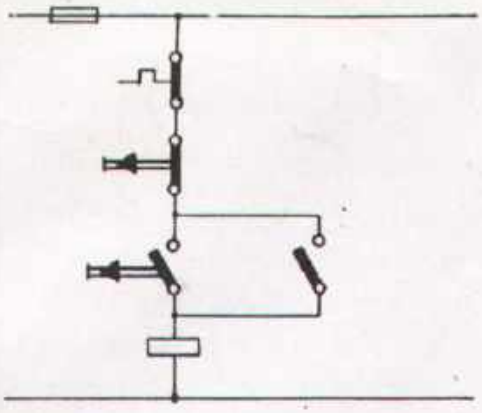
screws, clamps, pipes and wires, casing and capping material, batten material

a) CASING AND CAPPING
b) BATTEN WIRING
c) PIPE WIRING
d) CABLE WIRING

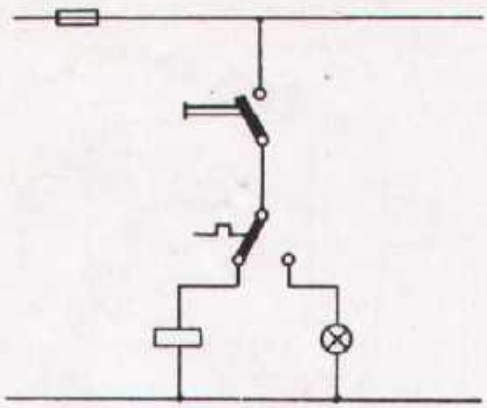
Estimate the material required for the installation to be made

a)
b)
c)
d)

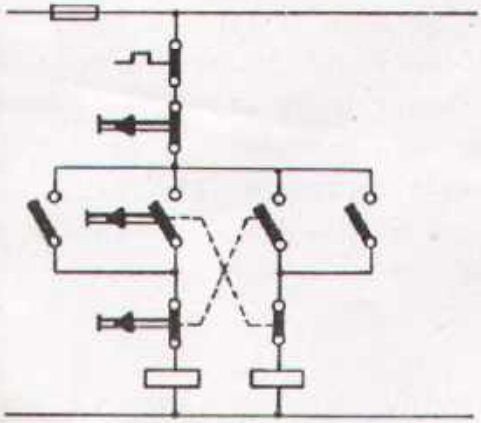
CHECK AND CONNECT SUPPLY IN PRESENCE OF YOUR INSTRUCTOR.



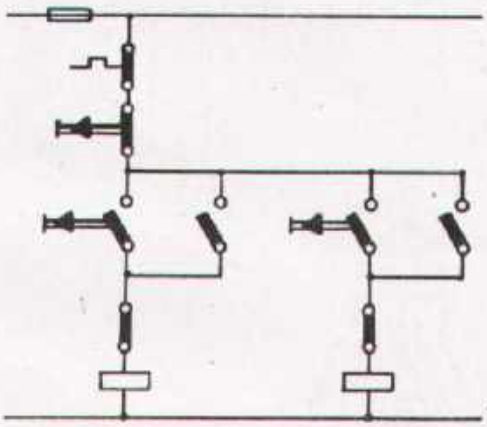
1 ON AND OFF CIRCUIT



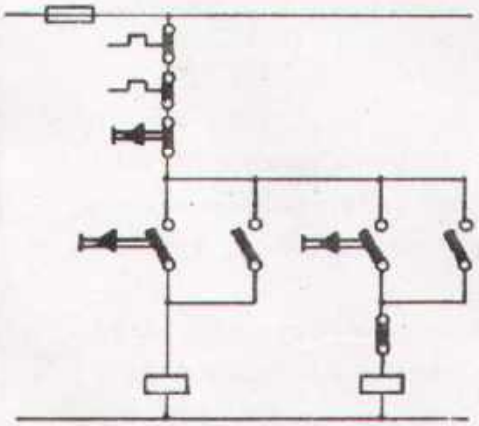
2 OVER CURRENT PROTECTION



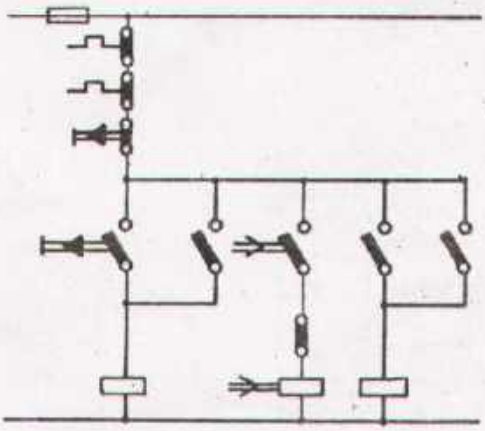
3 INTERLOCKING BY SWITCHES



4 INTERLOCKING BY CONTACTORS



5 SEQUENCE CONTROL HAND DRIVEN



6 SEQUENCE CONTROL TIME RELAY DRIVEN

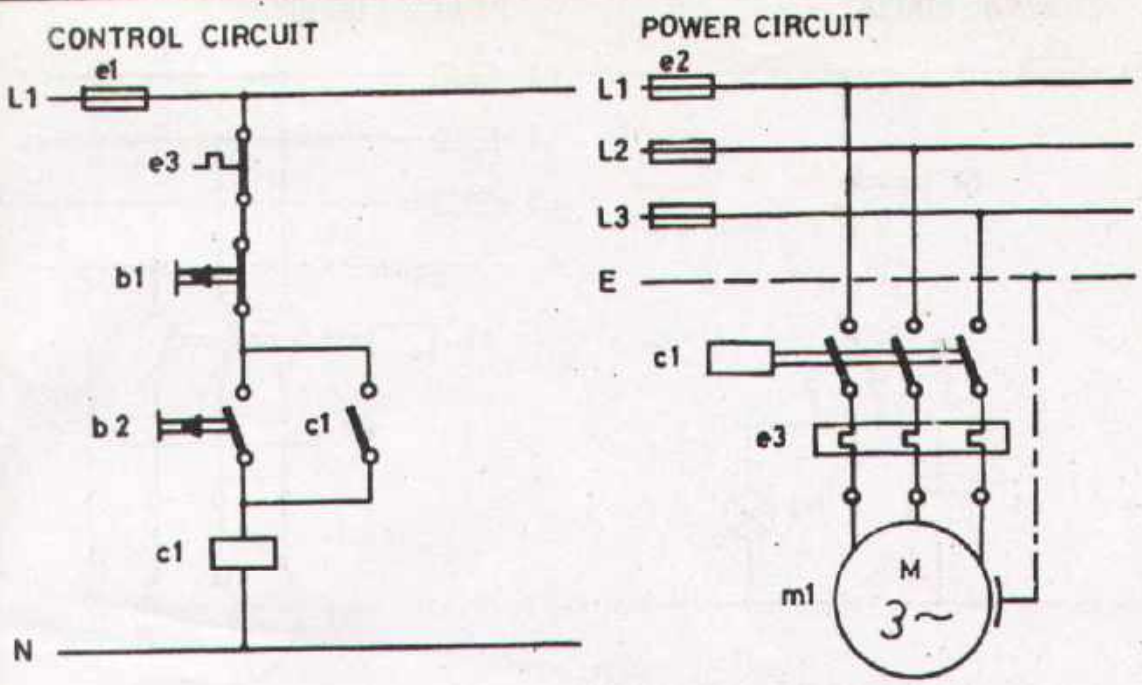
LAYOUT

EP 1.1/2.5.3/
Circuits

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

ELECTRICIAN
GENERAL



Implementation of a control- and power circuit

Implement the control- and power circuit on the switch panel of the exercise table.

Check the circuit thoroughly.

Voltage is to be applied by the instructor.

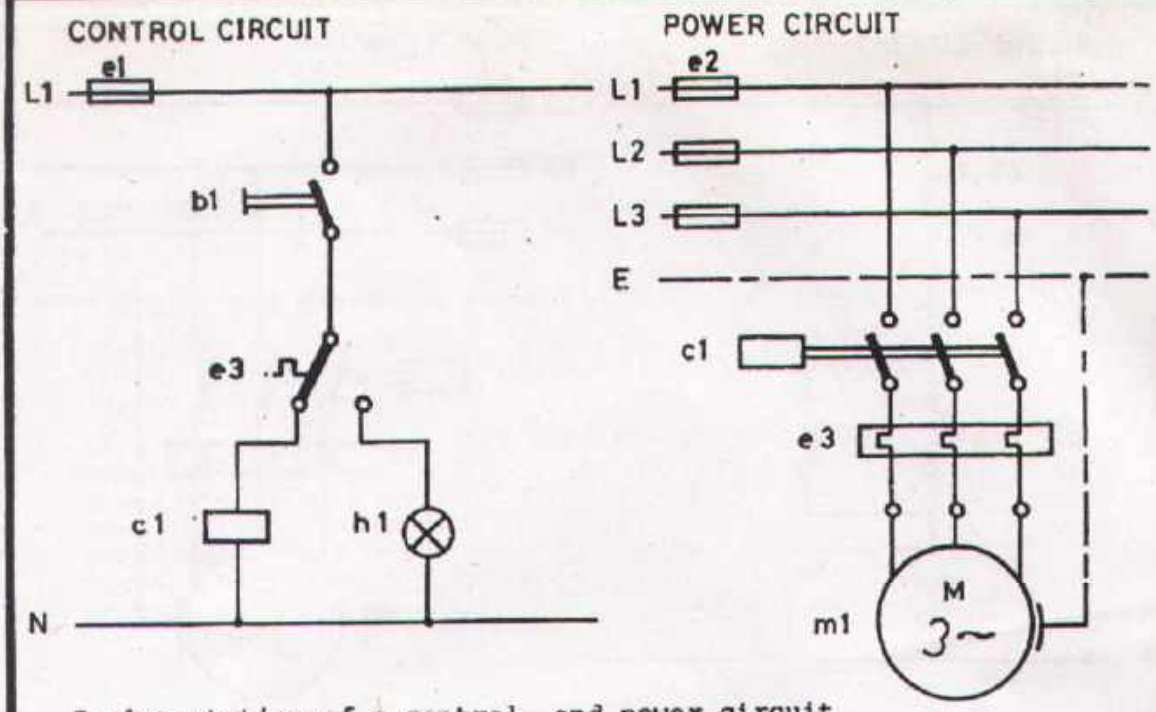
Sequence of testing the functions:

1. Press momentary switch b 2
2. Release momentary switch b 2
3. Press momentary switch b 1
4. Release momentary switch b 1

Describe your observations in brief with your own words.

Note: Auxiliary contact c1, that is no-contact of contactor c1, has to be parallel to the closer contact of momentary switch b2.

	ON-AND OFF CIRCUIT WITH CONTACTOR	EP 1.3/2.5.3/1
		Circuits



Implementation of a control- and power circuit

Implement the control- and power circuit on the switch panel of the exercise table.

Check the circuit thoroughly.

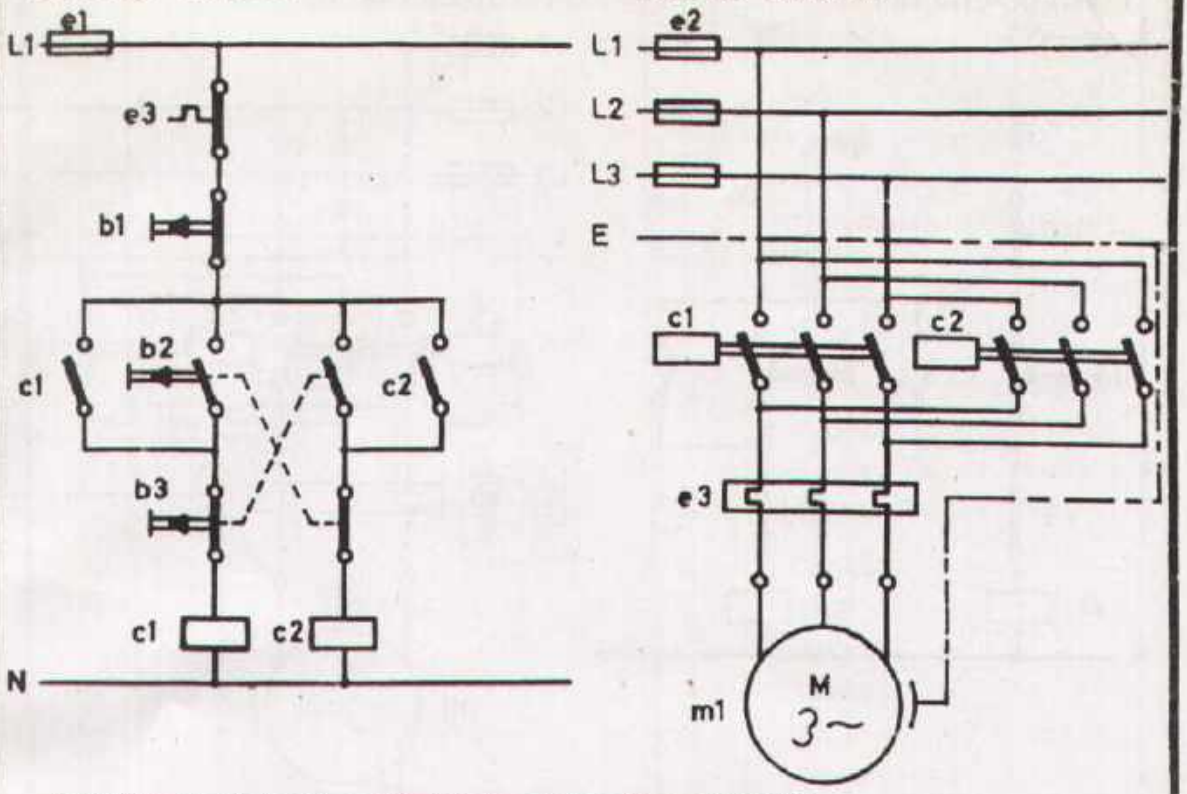
Voltage is to be applied by the instructor.

Test the functions as follows:

1. Adjust the electrothermic overcurrent release to the rated current of the motor.
2. Remove one connection to the three phase motor and operate single pole switch b1.
3. Measure the time until the overcurrent release works, that means until control-lamp h1 lights up.
4. Switch off b1.
5. Establish the proper connection to the three phase motor . and unlock the thermic overload protection.
6. Switch on b1 and after some time switch off.

Describe your operations in brief.

Note: Contacts of the electro-thermic overload protection have to be in series with the off-switch.



Implementation of a control- and power circuit

Implement the control- and power circuit on the switch panel of the exercise table.

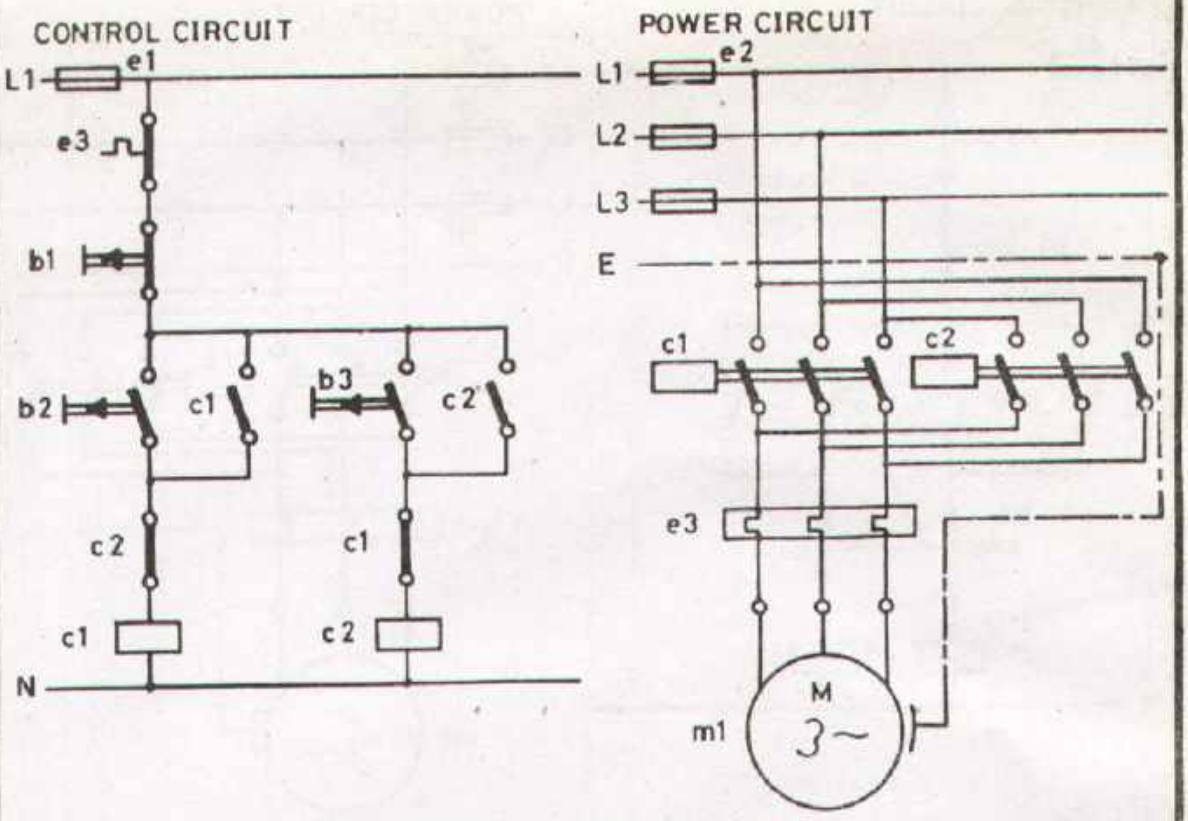
Check the circuit.

Voltage is to be applied by the instructor.

1. Press momentary switch b2 and release it.
2. Press momentary switch b1 and release it.
3. Press momentary switch b3 and release it.
4. Press momentary switch b1 and release it.
5. Press momentary switch b3 and release it.
6. Press momentary switch b2 and release it.
7. Press momentary switch b1 and release it.
8. Press momentary switches b2 and b3 simultaneously.
9. Switch off by momentary switch b1.

Describe your observations in brief.

Note: Momentary switches with opener and closer contacts connected in opposite branches are used to allow only one contactor at the same time to work.



Implementation of a control- and power circuit

Implement the control- and power circuit on the switch panel of the exercise table.
Check the circuit thoroughly.
Voltage is to be applied by the instructor.

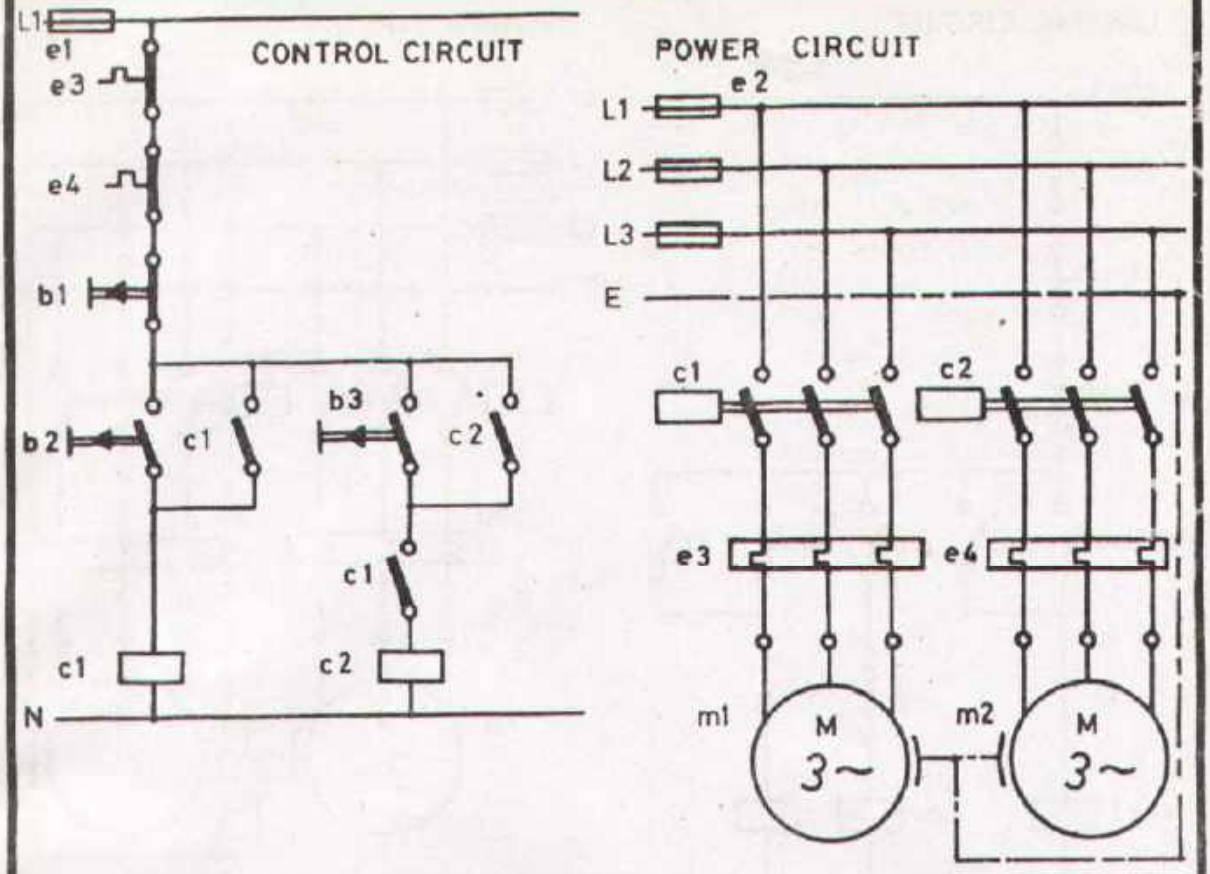
Sequence of testing the functions:

1. Press momentary switch b2 and release it.
2. Press momentary switch b3 and release it.
3. Press momentary switch b1 and release it.
4. Press momentary switch b3 and release it.
5. Press momentary switch b2 and release it.
6. Press momentary switch b1 and release it.
7. Press momentary switch b2 and release it.

Describe your observations in brief.

Note: If it is demanded that only one contactor can work at the moment then there has to be a nc-auxiliary-contact in series with each opposite contactor.

A combination of both interlocking systems (exercises 4 and 5) will increase the function.



Implementation of a control- and power circuit

Implement the control- and power diagram on the switch panel of the exercise table.

Check the circuit thoroughly.

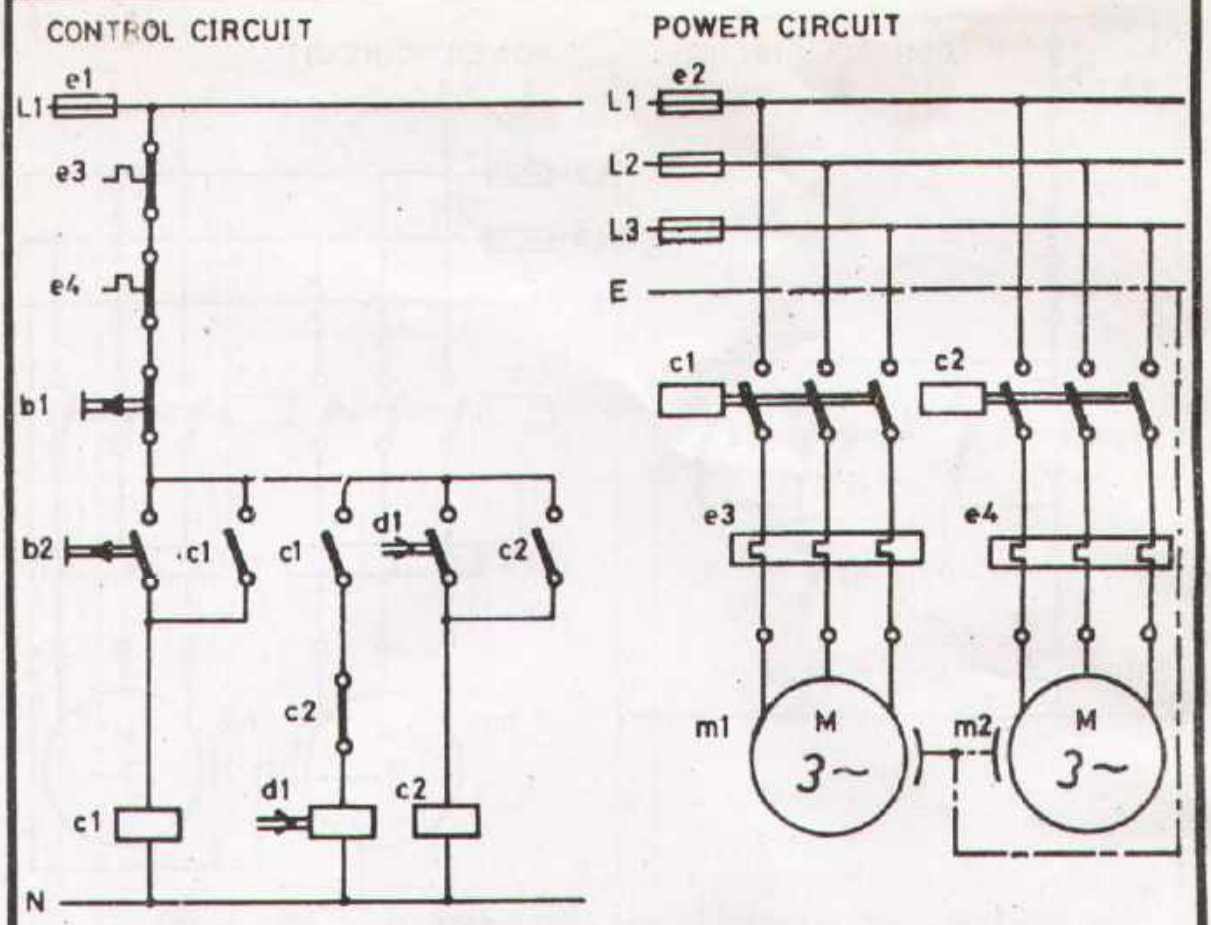
Voltage is to be applied by the instructor.

Sequence of testing the functions:

1. Press momentary switch b3 and release it.
2. Press momentary switch b2 and release it.
3. Press momentary switch b3 and release it.
4. Press momentary switch b1 and release it.

Describe your observations in brief.

Note: A no-auxiliary-contact of contactor c1 before contactor c2 means that contactor c2 only can be driven after contactor c1 has been operated.



Implementation of a control- and power circuit

Implement the control- and power circuit on the switch panel.

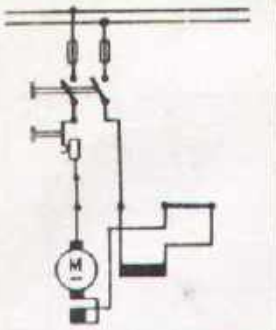
Check the circuit.

Voltage is to be applied by the instructor.

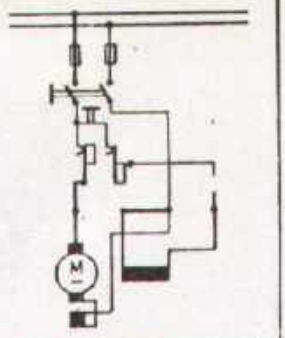
Sequence of testing the functions:

1. Press momentary switch b2 and release it.
2. Observe the sequence of starting of the motors.
3. Press momentary switch b1 and release it.
4. Adjust another time of the time relay and start again with momentary switch b2.

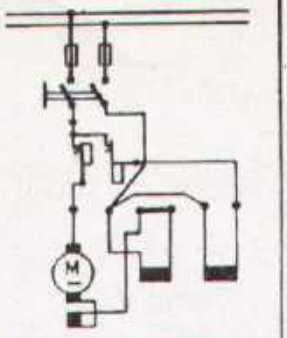
Note: This given circuit is similar to the circuit of exercise 5, but it is working automatically due to auxiliary contactor d1.



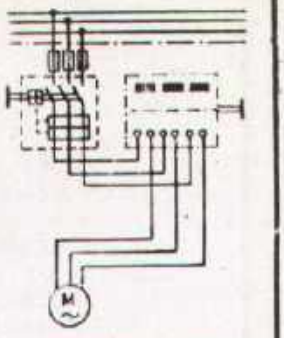
1 DC - SERIES MOTOR



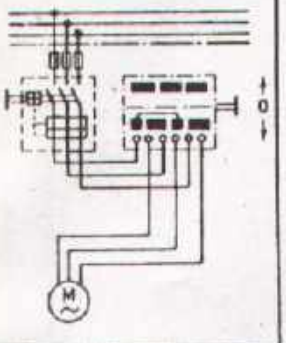
2 DC - SHUNT MOTOR



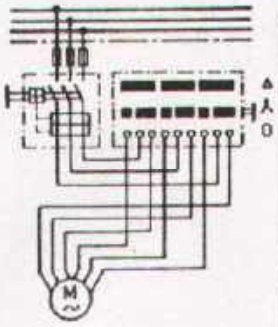
3 DC - COMPOUND MOTOR



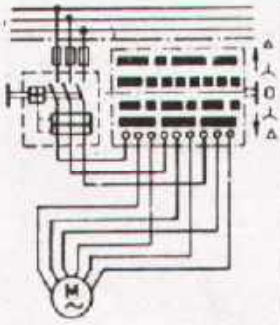
4 SWITCH, ON-OFF



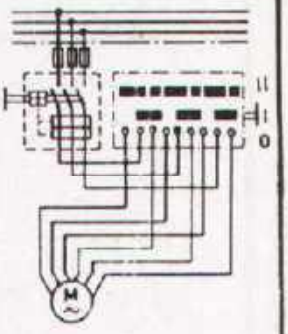
5 SWITCH, REVERSING



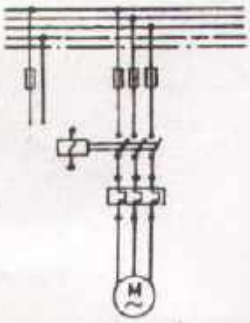
6 SWITCH, ⅄Δ



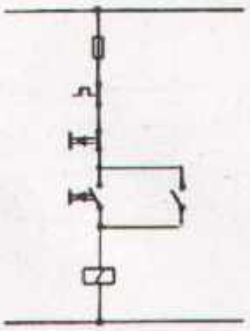
7 SWITCH, ⅄Δ REVERSING



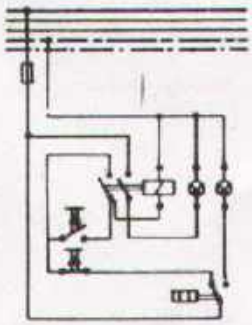
8 SWITCH, MULTI SPEED



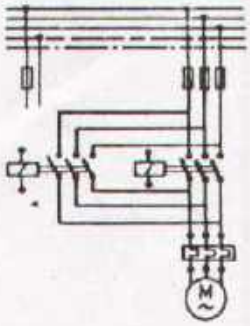
9 CONTACTOR ON-OFF



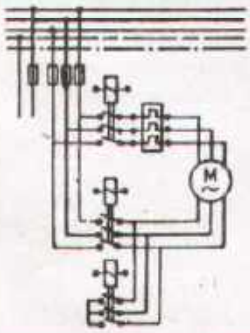
10 CONTACTOR ON-OFF



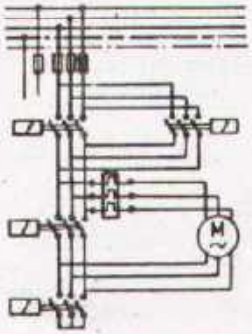
11 CONTACTOR ON-OFF



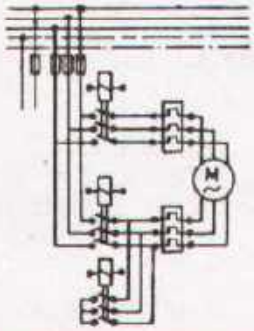
12-13-14 CONTACTOR REV-



15-16-17 CONTACTOR ⅄Δ



18-19-20 CONTACTOR ⅄Δ REV.



21-22-23 CONT. MULTI SPEED

FOR POWER CIRCUITS 12, 15, 18, 21, THERE ARE SEPARATE CURRENT PATH AND WIRING DIAGRAMS (13-14, 16-17, 19-20, 22-23.) ALL EXERCISE SHEETS MAY BE USED FOR INSTALLATION AS WELL AS FOR PLUG WIRING EXERCISES.

LAYOUT

EP 1.1/3.5.1/
Motors & Switches
Contactors, Circuits

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

ELECTRICIAN
GENERAL

STEP NO.	"CLOSER" OR MAKE	"OPENER" OR BREAK	IN CURRENT PATH	SWITCHES		MAIN-TAINS	INTER-LOCKS	IN CURRENT PATH
				ON	OFF			

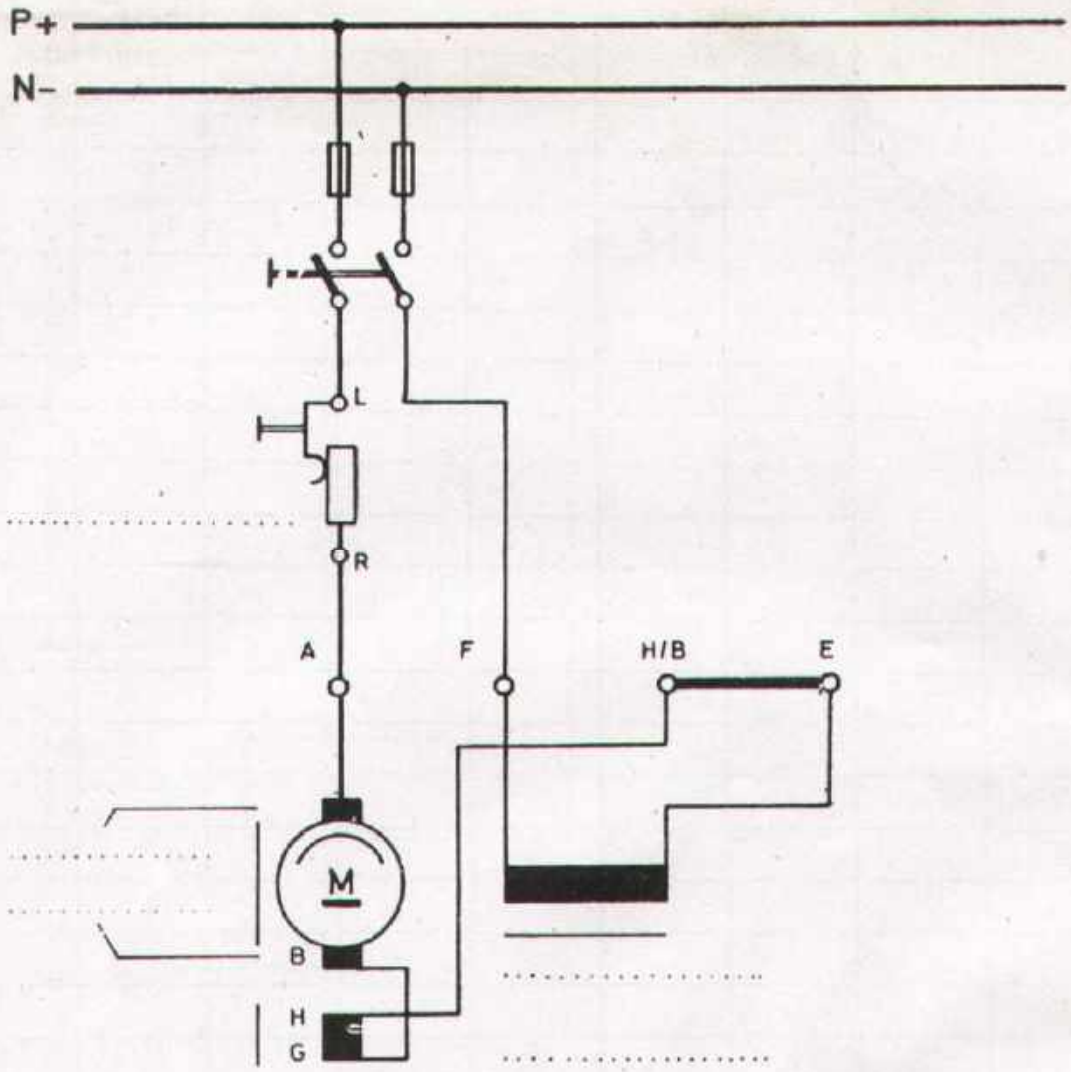
NAME :

ROLL No.:

FOR EXERCISE: DESCRIPTION OF CONTROL CIRCUIT

EP 1.3/3.5.1/0

Contactors



CLOCKWISE

A	F	H/B	E
O	O	O	O

DRAW CONNECTIONS AND LINKS FOR CLOCKWISE AND ANTI-CLOCKWISE DRIVE

ANTI-CLOCKWISE

A	F	H/B	E
O	O	O	O

a.) MARK FLOW OF CURRENT AND DIRECTION OF MOTOR ROTATION (arrow head)

b.) GIVE NAME OF COMPONENTS ON DOTTED LINES

c.) WHAT MEASURES CAN BE TAKEN TO INCREASE OR DECREASE THE SPEED/POWER

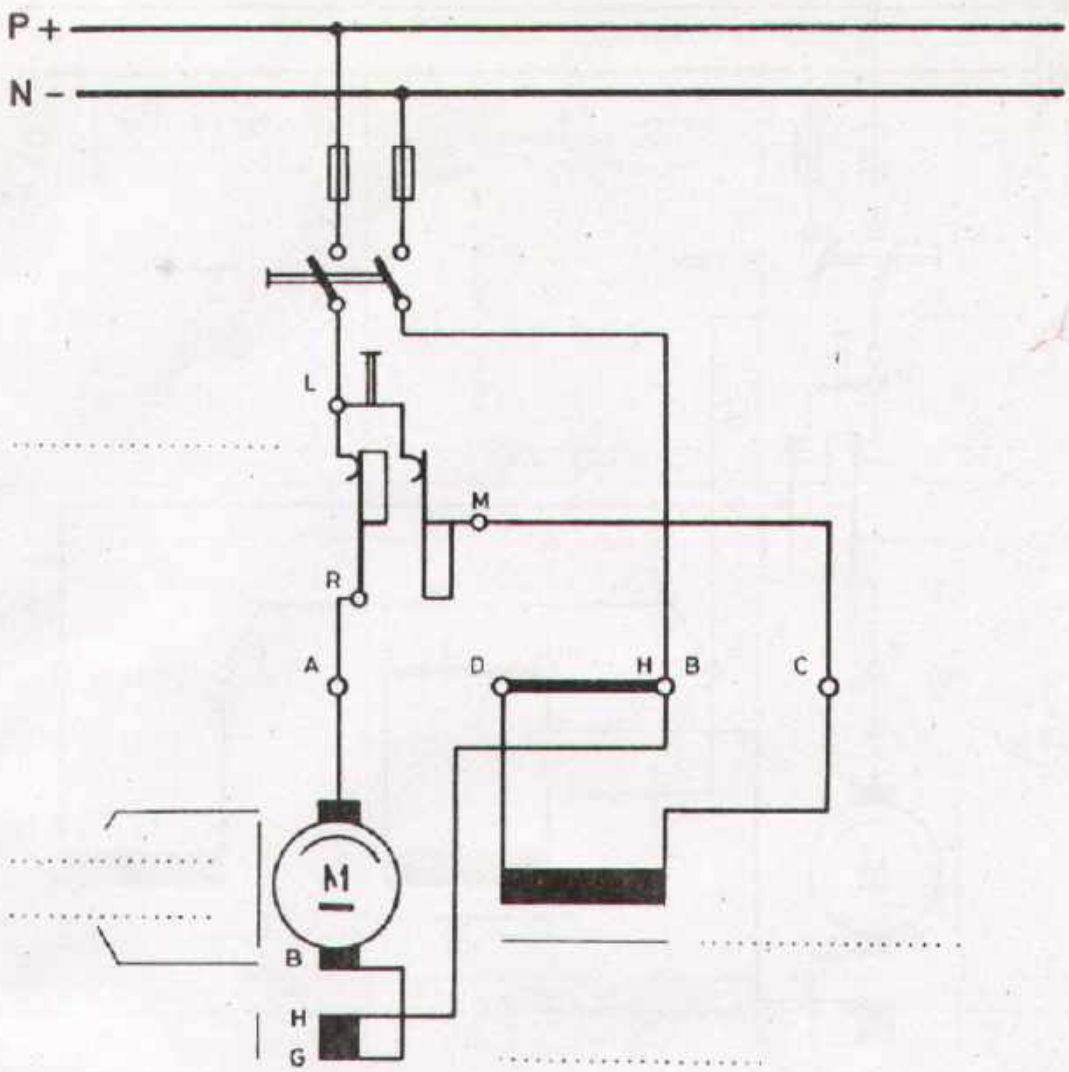
d.) TAKE SUITABLE MATERIAL AND DO YOUR PRACTICAL JOB.

e.) WHAT RULES CAN YOU APPLY TO DETERMINE THE FLOW (Direction) OF CURRENT?

SERIES WOUND D.C MOTOR

EP 1.3/3.5.W1

Motors&Switches



CLOCKWISE

A	D	H/B	C
O	O	O	O

DRAW CONNECTIONS AND LINKS FOR CLOCKWISE AND ANTI-CLOCKWISE DRIVE

ANTI-CLOCKWISE

A	D	H/B	C
O	O	O	O

a.) MARK FLOW OF CURRENT AND DIRECTION OF MOTOR ROTATION (arrow head)

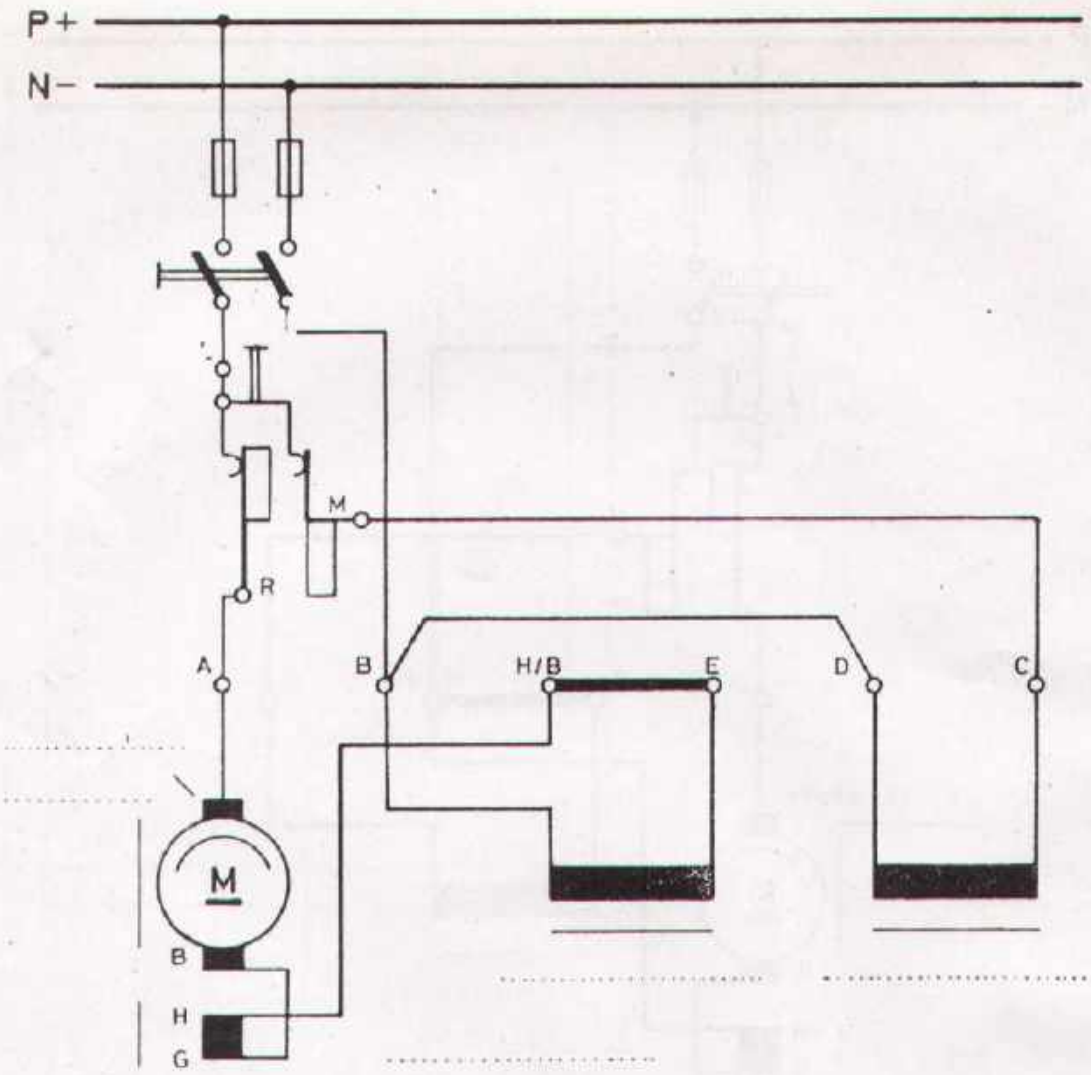
b.) GIVE NAME OF COMPONENTS ON DOTTED LINES.

c.) WHAT MEASURES CAN BE TAKEN TO INCREASE OR DECREASE THE SPEED/POWER

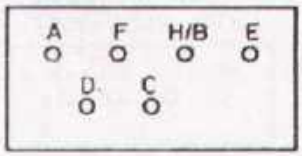
d.) TAKE SUITABLE MATERIAL AND DO YOUR PRACTICAL JOB.

e.) WHAT RULES CAN YOU APPLY TO DETERMINE THE FLOW(Direction) OF CURRENT?

	SHUNT WOUND D.C. MOTOR	EP 1.3/3.5.1/2
		Motors&Switches

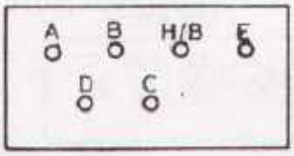


CLOCKWISE



DRAW CONNECTIONS AND LINKS FOR CLOCKWISE AND ANTI-CLOCKWISE DRIVE

ANTI-CLOCKWISE



a.) MARK FLOW OF CURRENT AND DIRECTION OF MOTOR ROTATION (arrow head)

b.) GIVE NAME OF COMPONENTS ON DOTTED LINES.

c.) WHAT MEASURES CAN BE TAKEN TO INCREASE OR DECREASE THE SPEED/POWER.

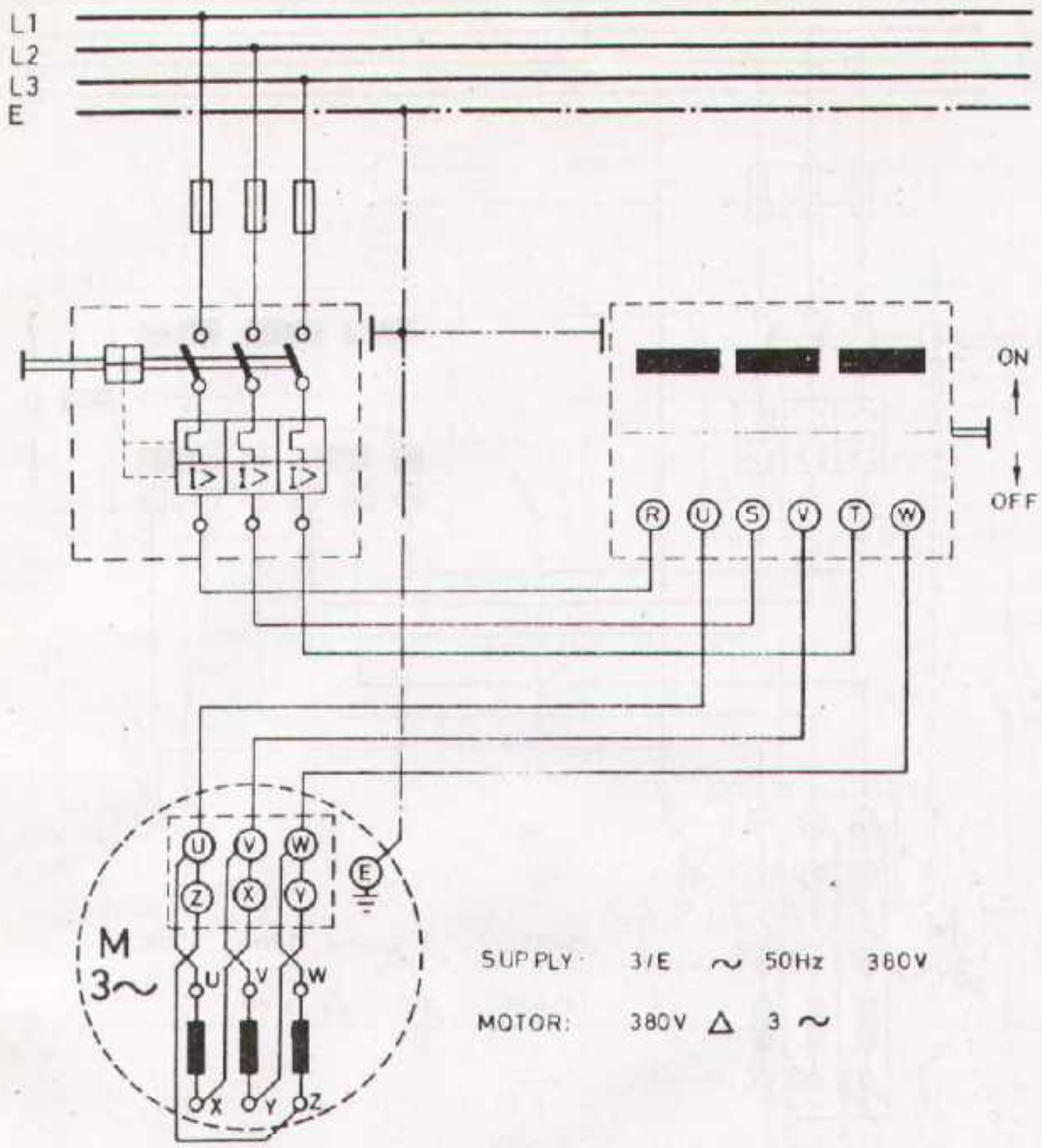
d.) TAKE SUITABLE MATERIAL AND DO YOUR PRACTICAL JOB.

e.) WHAT RULES CAN YOU APPLY TO DETERMINE THE FLOW (Direction) OF CURRENT?

COMPOUND WOUND D C MOTOR

EP 1.3/3.5.1/3

Motors&Switches

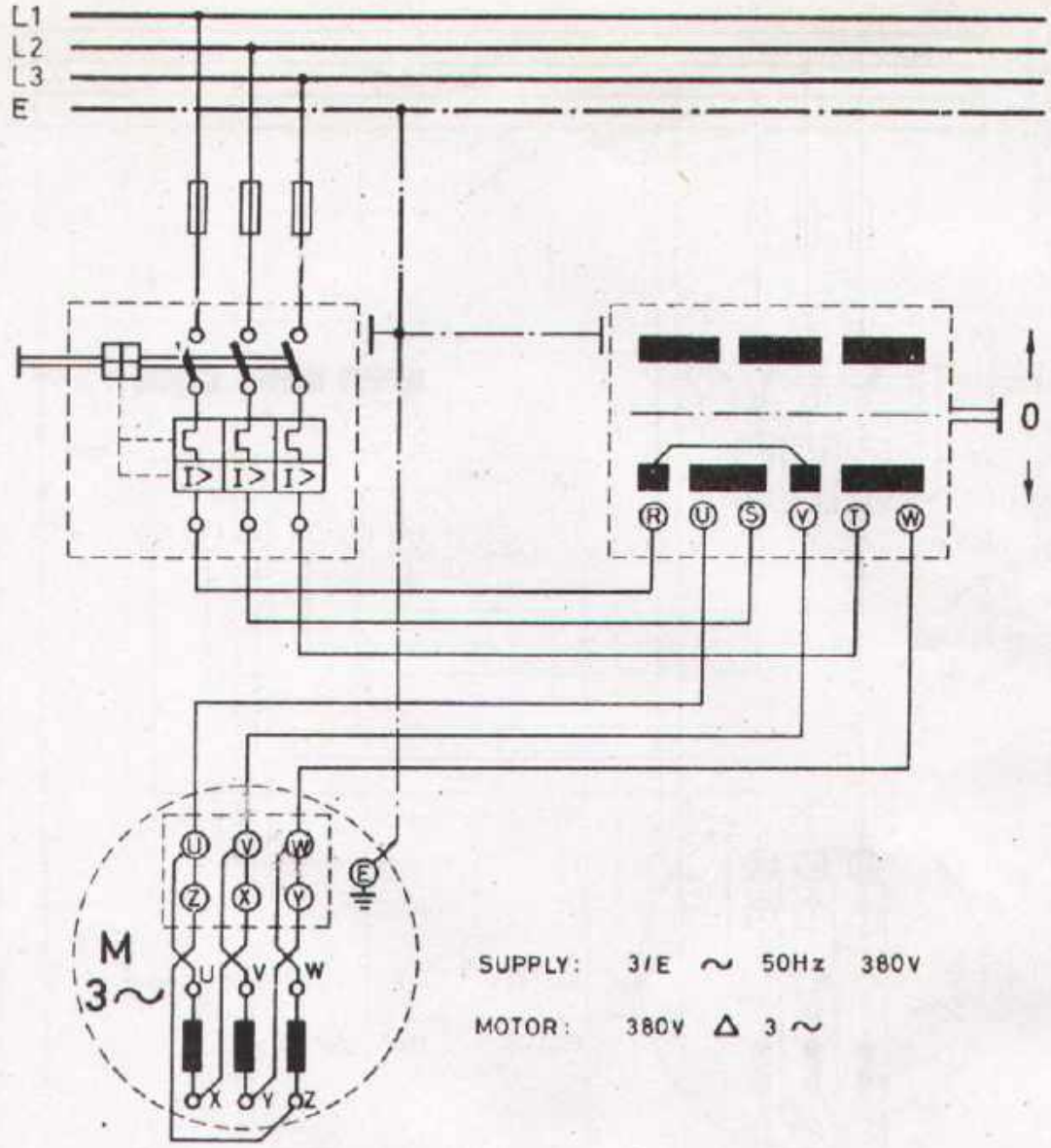


TAKE SUITABLE MATERIAL AND DO YOUR PRACTICAL JOB.

ACCORDING TO INSTRUCTORS DECISION PLUG WIRING OR BOARD INSTALLATION EXERCISE.

CONNECT **SUPPLY** IN PRESENCE OF YOUR **INSTRUCTOR**.

	ON-OFF DRUM SWITCH	EP 1.3/3.5.1/4
		Motors&Switches
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL



SUPPLY: 3/E ~ 50Hz 380V

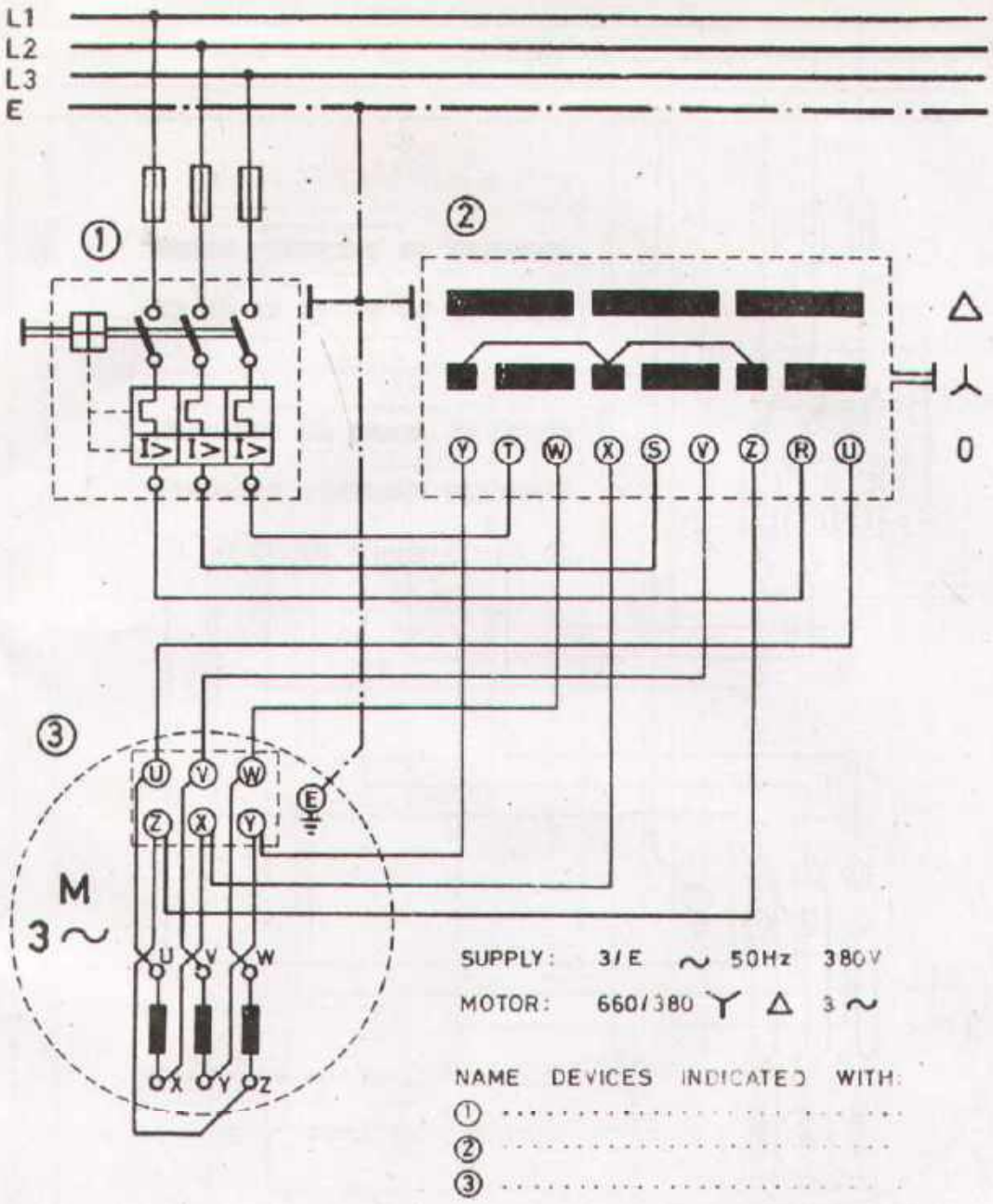
MOTOR: 380V Δ 3 ~

TAKE SUITABLE MATERIAL AND DO YOUR PRACTICAL JOB.

ACCORDING TO INSTRUCTORS DECISION PLUG WIRING OR BOARD INSTALLATION EXERCISE.

CONNECT SUPPLY IN PRESENCE OF YOUR INSTRUCTOR.

	REVERSING DRUM SWITCH	EP 1.3/3.5.1/5
		Motors & Switches
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL



SUPPLY: 3/E ~ 50Hz 380V

MOTOR: 660/380 Y △ 3 ~

NAME DEVICES INDICATED WITH:

① .....

② .....

③ .....

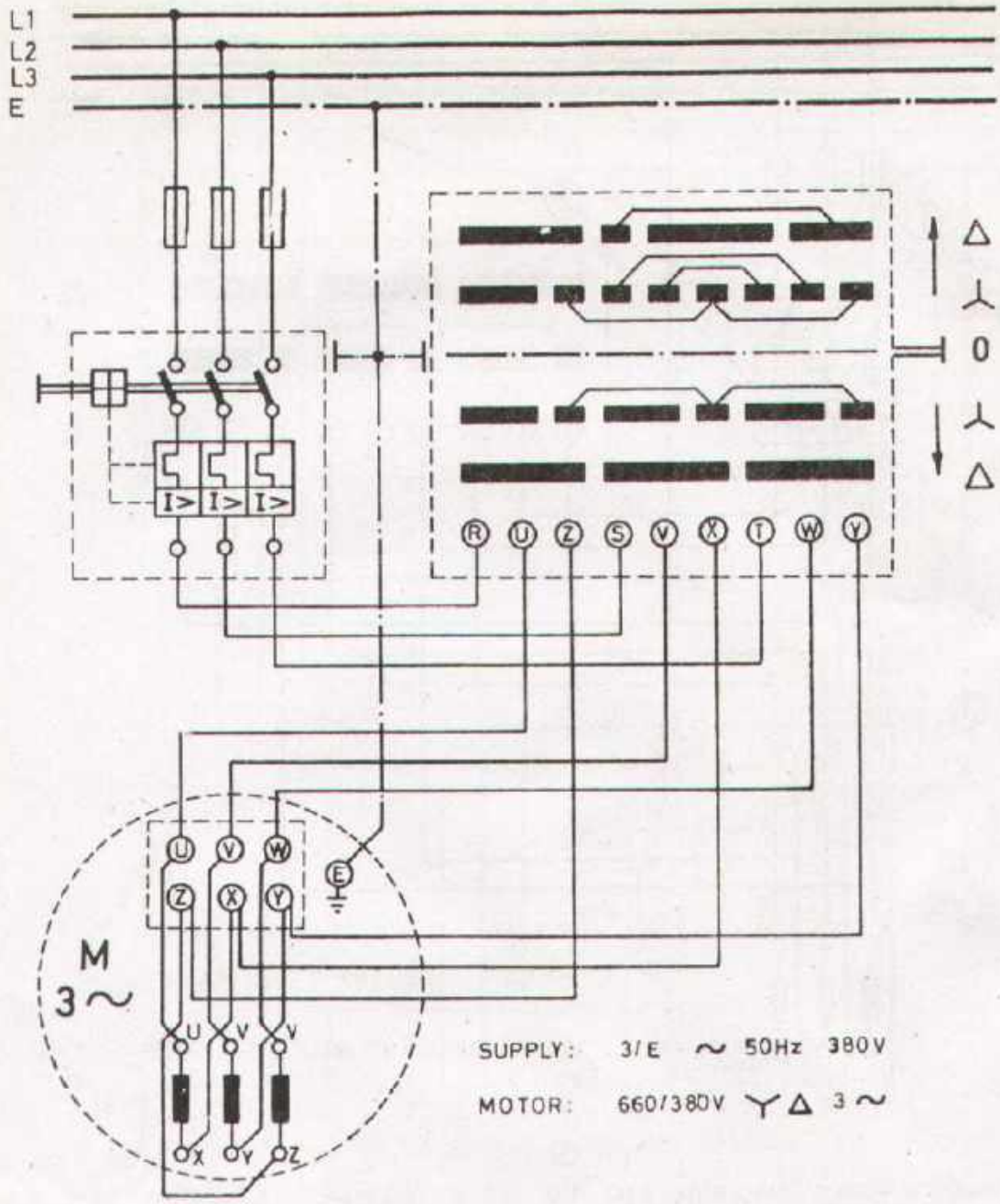
TAKE SUITABLE MATERIAL AND DO YOUR PRACTICAL EXERCISE

ACCORDING TO INSTRUCTORS DECISION WIRING ON BOARD

INSTALLATION EXERCISE.

CONNECT SUPPLY IN PRESENCE OF YOUR INSTRUCTOR.

	STAR-DELTA DRUM SWITCH	EP 1.3/3.5.1/6 Motors&Switches
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL 41

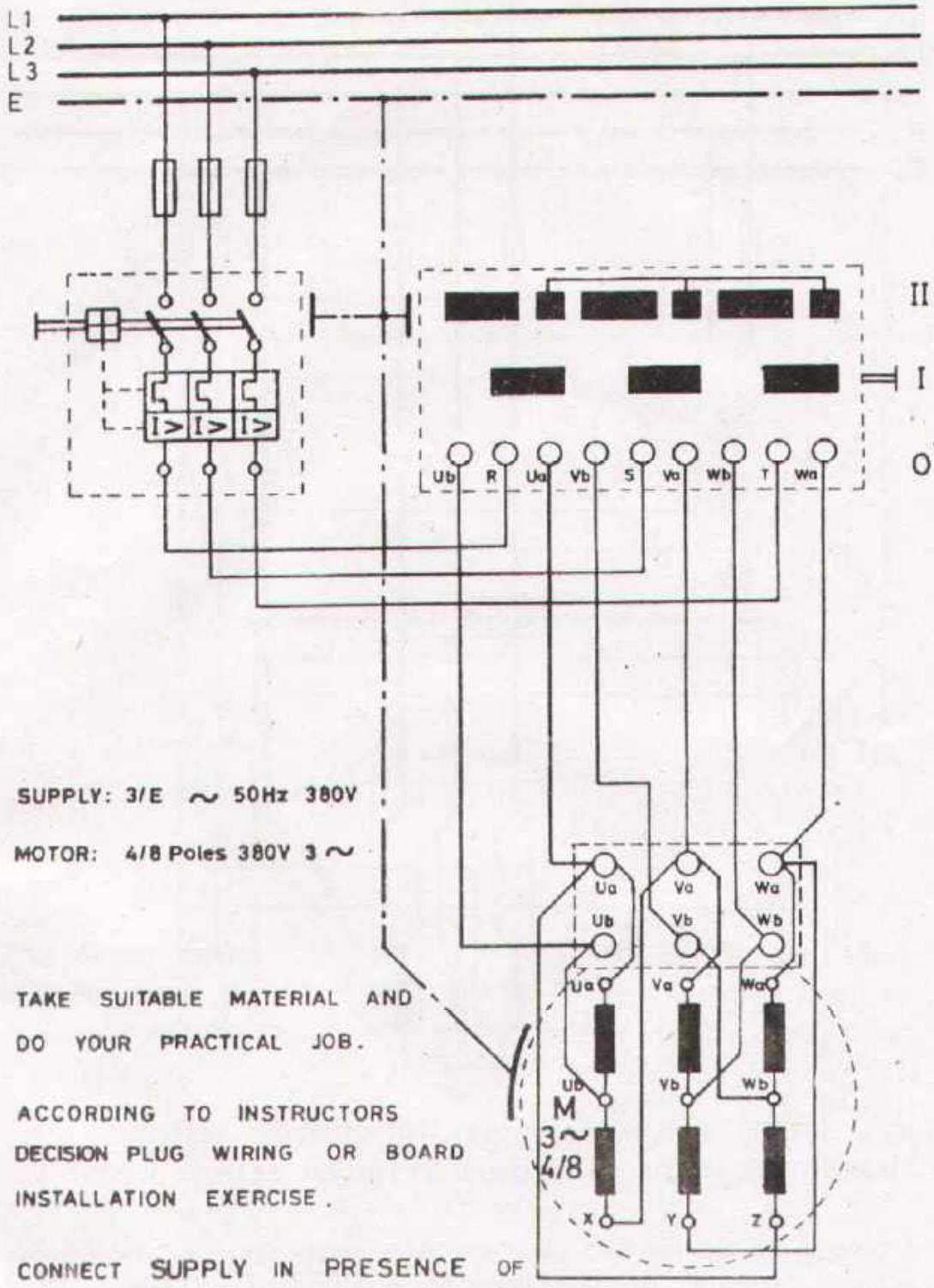


TAKE SUITABLE MATERIAL AND DO YOUR PRACTICAL JOB.

ACCORDING TO INSTRUCTORS DECISION PLUG WIRING OR BOARD INSTALLATION EXERCISE.

CONNECT SUPPLY IN PRESENCE OR YOUR INSTRUCTOR.

	STAR-DELTA REVERSING DRUM SWITCH	EP 1.3/3.5.1/7
		Motors&Switches
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL 42



SUPPLY: 3/E ~ 50Hz 380V

MOTOR: 4/8 Poles 380V 3 ~

TAKE SUITABLE MATERIAL AND DO YOUR PRACTICAL JOB.

ACCORDING TO INSTRUCTORS DECISION PLUG WIRING OR BOARD INSTALLATION EXERCISE.

CONNECT SUPPLY IN PRESENCE OF YOUR INSTRUCTOR.

MULTI SPEED DRUM SWITCH

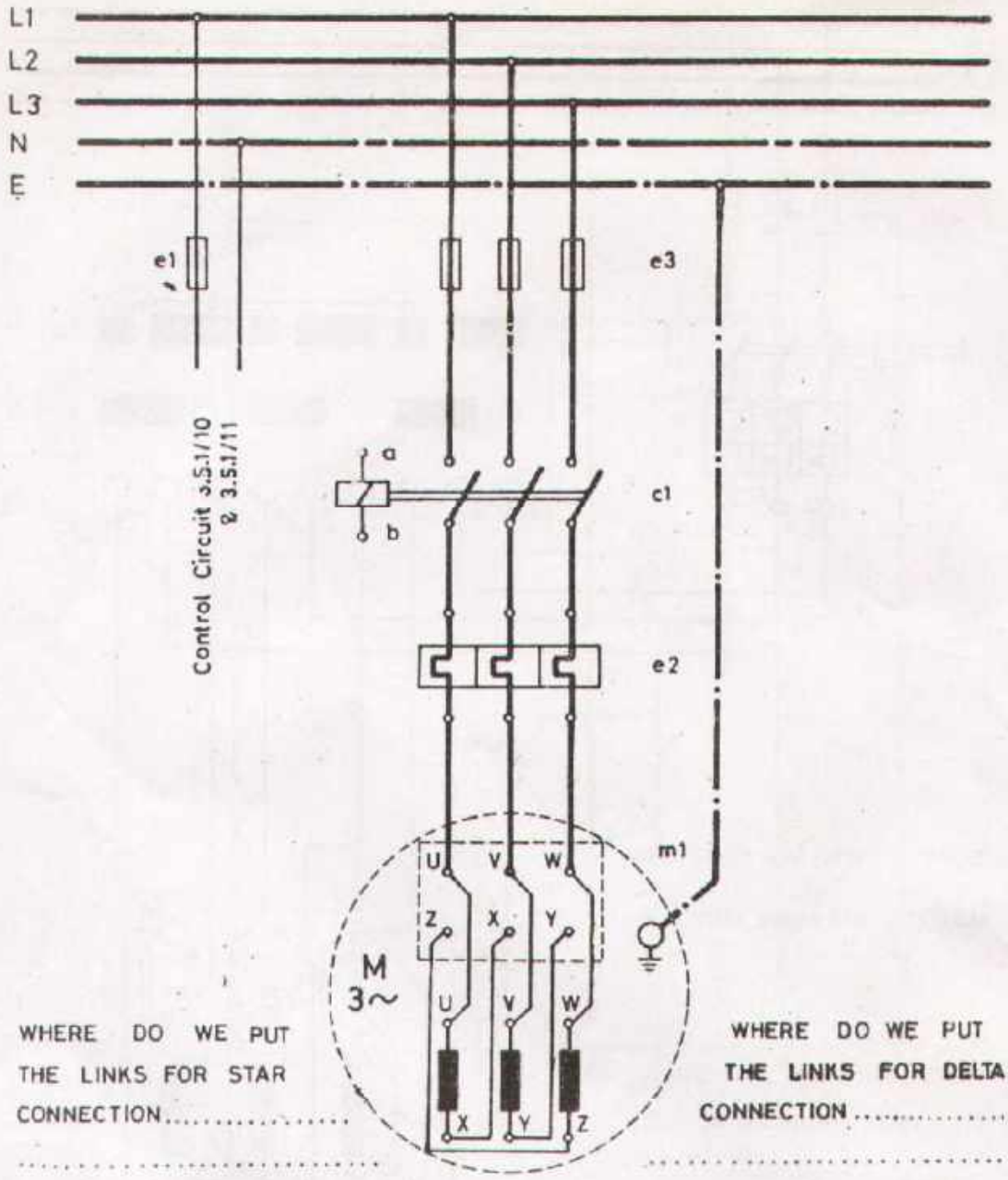
EP 1.3/3.5.1/8

Motors&Switches

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

ELECTRICIAN GENERAL



WHERE DO WE PUT THE LINKS FOR STAR CONNECTION.....

.....

WHERE DO WE PUT THE LINKS FOR DELTA CONNECTION.....

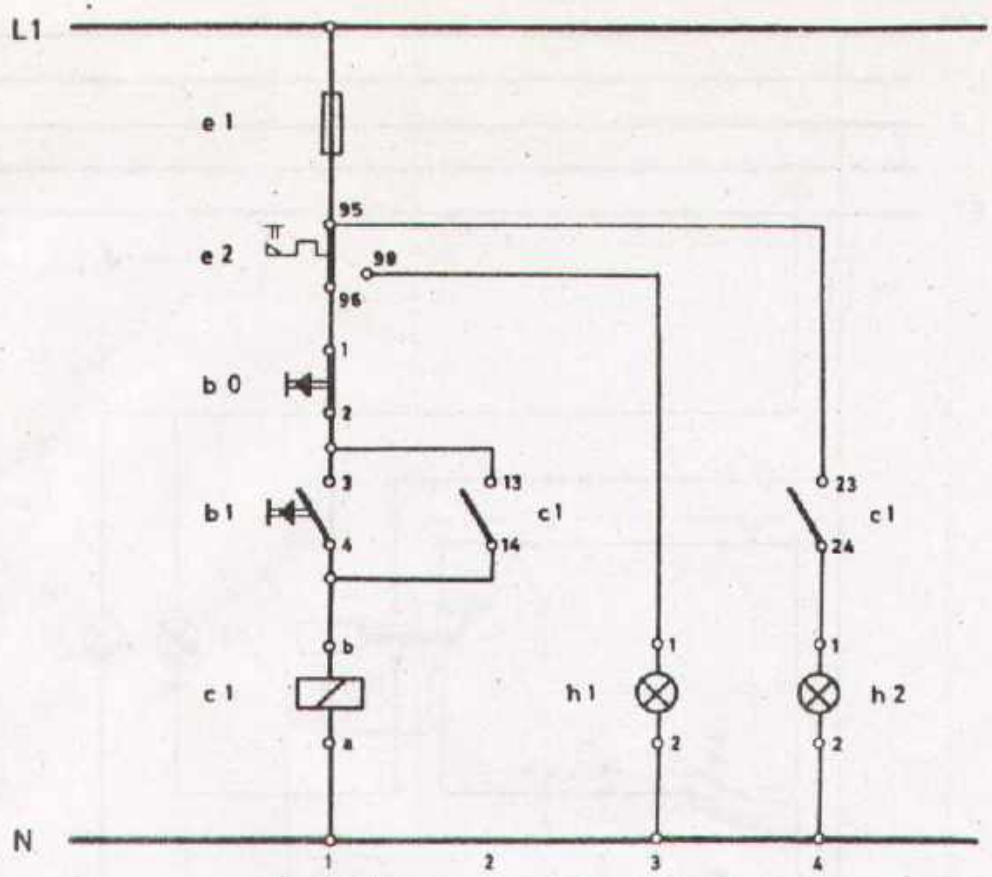
.....

TAKE SUITABLE MATERIAL (MOTOR) AND DO YOUR PRACTICAL JOB. EXERCISE SHEET NO. 3.5.1/10 AND 3.5.1/11 MAY BE USED IN ADDITION.

ACCORDING TO INSTRUCTORS DECISION PLUG WIRING OR BOARD INSTALLATION CONNECT SUPPLY IN PRESENCE OF YOUR INSTRUCTOR.

DRAWING IS ALSO USED FOR EXERCISE EP 2.3/4.5.1/5

	MOTOR CONNECTION, 3~ ON-OFF	EP 1.3/3.5.1/9 Contactors
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL 44



M c o
— 2 —
— 4 —
—

IF THIS IS GIVEN IN A DRAWING IT HAS TO BE BELOW THE CONTACTOR CONCERNED WITH.

DESCRIPTION OF PARTS:

b0 PUSH BUTTON-OFF MOMENTARY CONTACT
b1 PUSH BUTTON-ON " "
c 1 AUTOMATIC CONTACTOR (COIL)
e 1 CONTROL CIRCUIT FUSE
e 2 THERMAL OVERLOAD SWITCH with LOCK
h 1 WARNING LAMP (OVERLOAD)
h 2 CONTROL LAMP (MOTOR RUNNING)

M c o
— 2 —
— 4 —
1 1

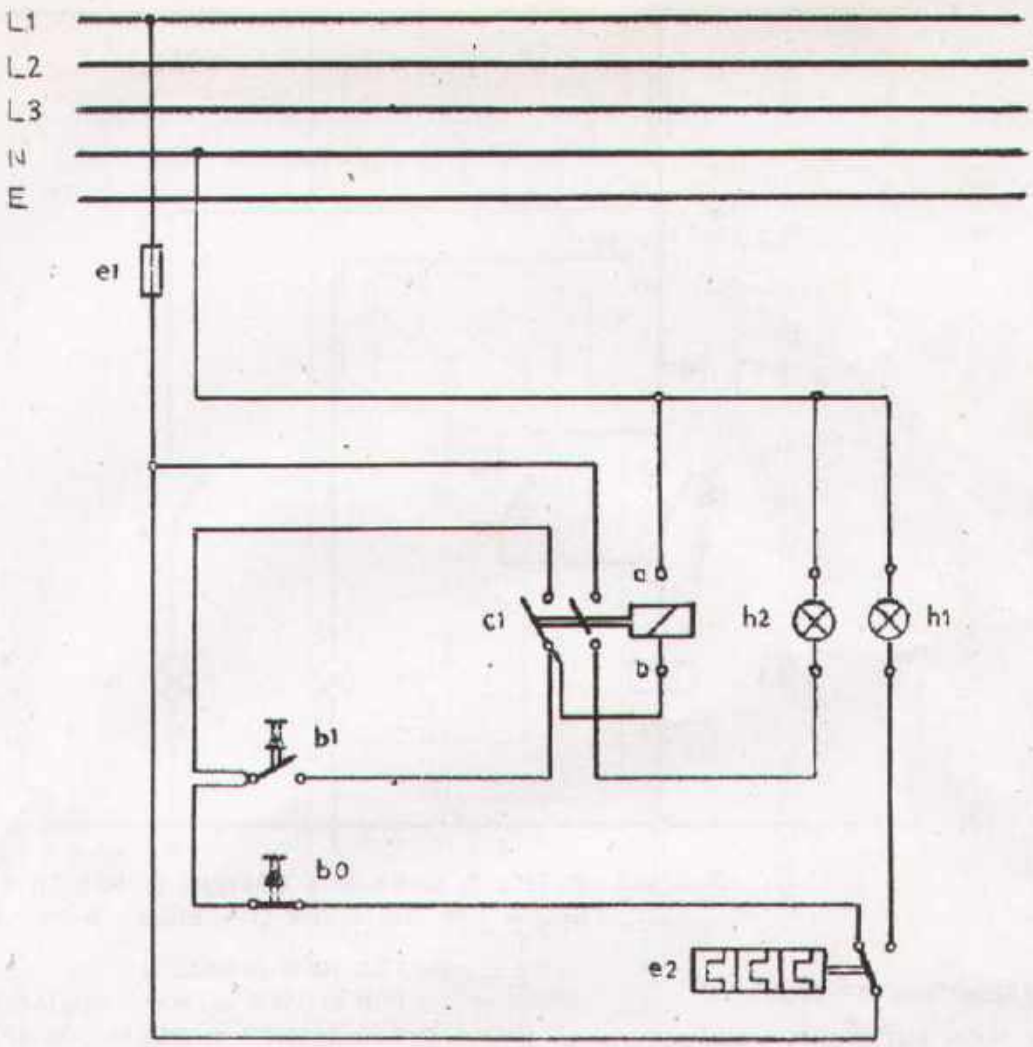
FOR MAIN CONTACTS
FOR "CLOSER" or MAKE CONTACTS
FOR "OPENER" or BREAK CONTACTS
PATH WHERE YOU WILL FIND THE CONTACTS IN THE DRAWING

ALL CONTACTS CONTROLLED OF e.g. CONTACTOR c1 ARE ALSO MARKED WITH c1

a) WORK OUT YOUR DESCRIPTION OF CONTROL CIRCUITS 3.5.1/0
b) TAKE SUITABLE MATERIAL AND DO YOUR PRACTICAL JOB.
EXERCISE SHEET No. 3.5.1/09 AND 3 5 1/11 MAY BE USED IN ADDITION.
ACCORDING TO INSTRUCTORS DECISION PLUG WIRING OR BOARD INSTALLATION EXER.
CONNECT SUPPLY IN PRESENCE OF YOUR INSTRUCTOR.

DRAWING IS ALSO USED FOR EXERCISE EP 2.3/4.5.1/5

	MOTOR CONNECTION, ON–OFF	EP 1.3/3.5.1/10 Contactors
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL 45



TAKE SUITABLE MATERIAL AND DO YOUR PRACTICAL JOB. EXERCISE SHEET No. 3.5.1/09 AND 3.5.1/10 MAY BE USED IN ADDITION.

RECORD MOTOR DATA

MOTOR NAME PLATE

.....V .....A

.....

CHECK WITH A.-METER AND

RECORD STARTING AMPS. .....A RUNNING AMPS. .....A

SAME MOTOR SHOULD BE USED FOR STAR-DELTA CONNECTION EXERCISE.

3 PHASE ON-OFF WITH CONTROL LAMPS

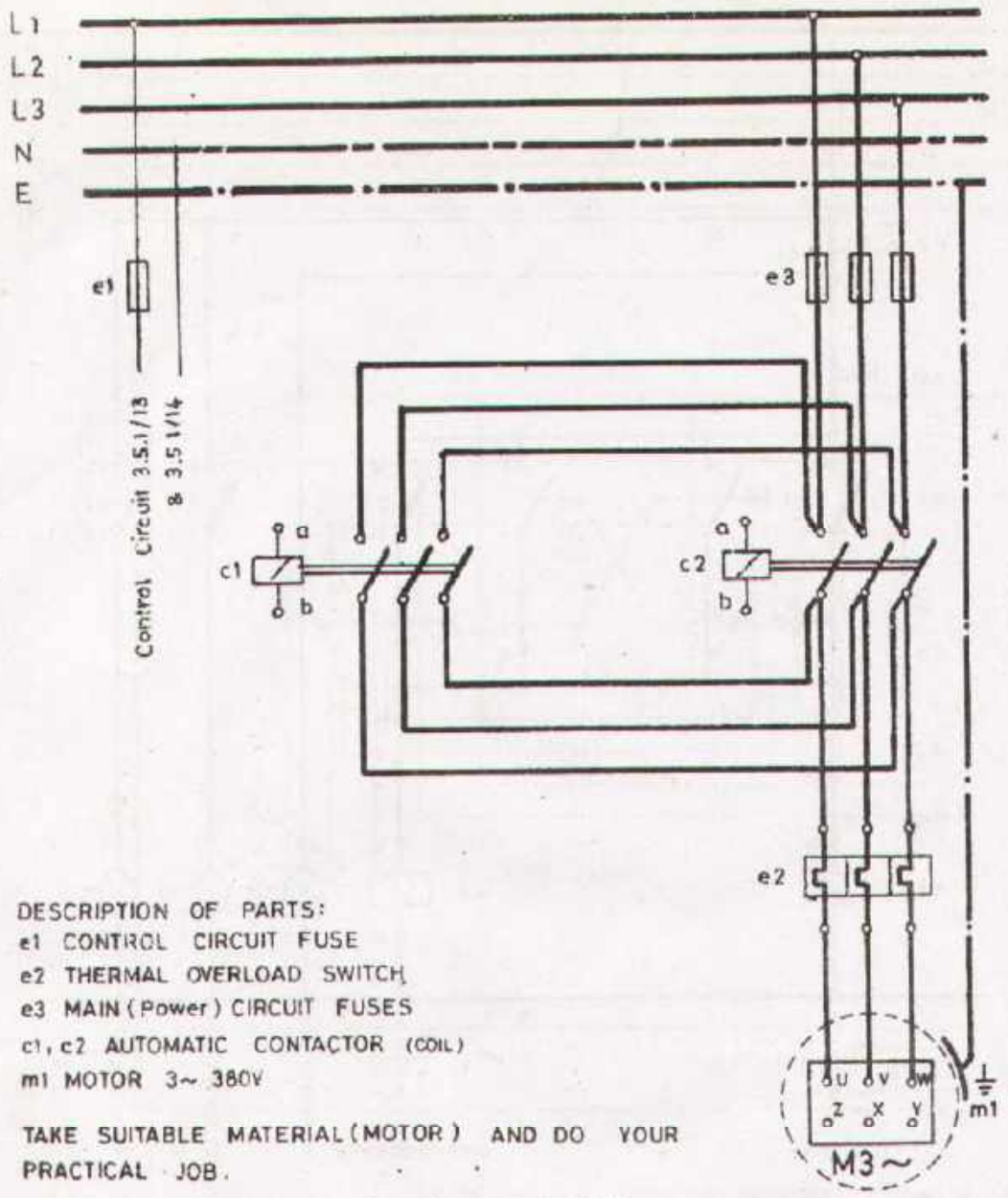
EP 1.3/3.5.1/11

Circuits III

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

ELECTRICIAN GENERAL



DESCRIPTION OF PARTS:
e1 CONTROL CIRCUIT FUSE
e2 THERMAL OVERLOAD SWITCH
e3 MAIN (Power) CIRCUIT FUSES
c1, c2 AUTOMATIC CONTACTOR (COIL)
m1 MOTOR 3~ 380V

TAKE SUITABLE MATERIAL (MOTOR) AND DO YOUR PRACTICAL JOB.

EXERCISE SHEET NO. 3.5.1/13 AND 3.5.1/14 MAY BE USED IN ADDITION.

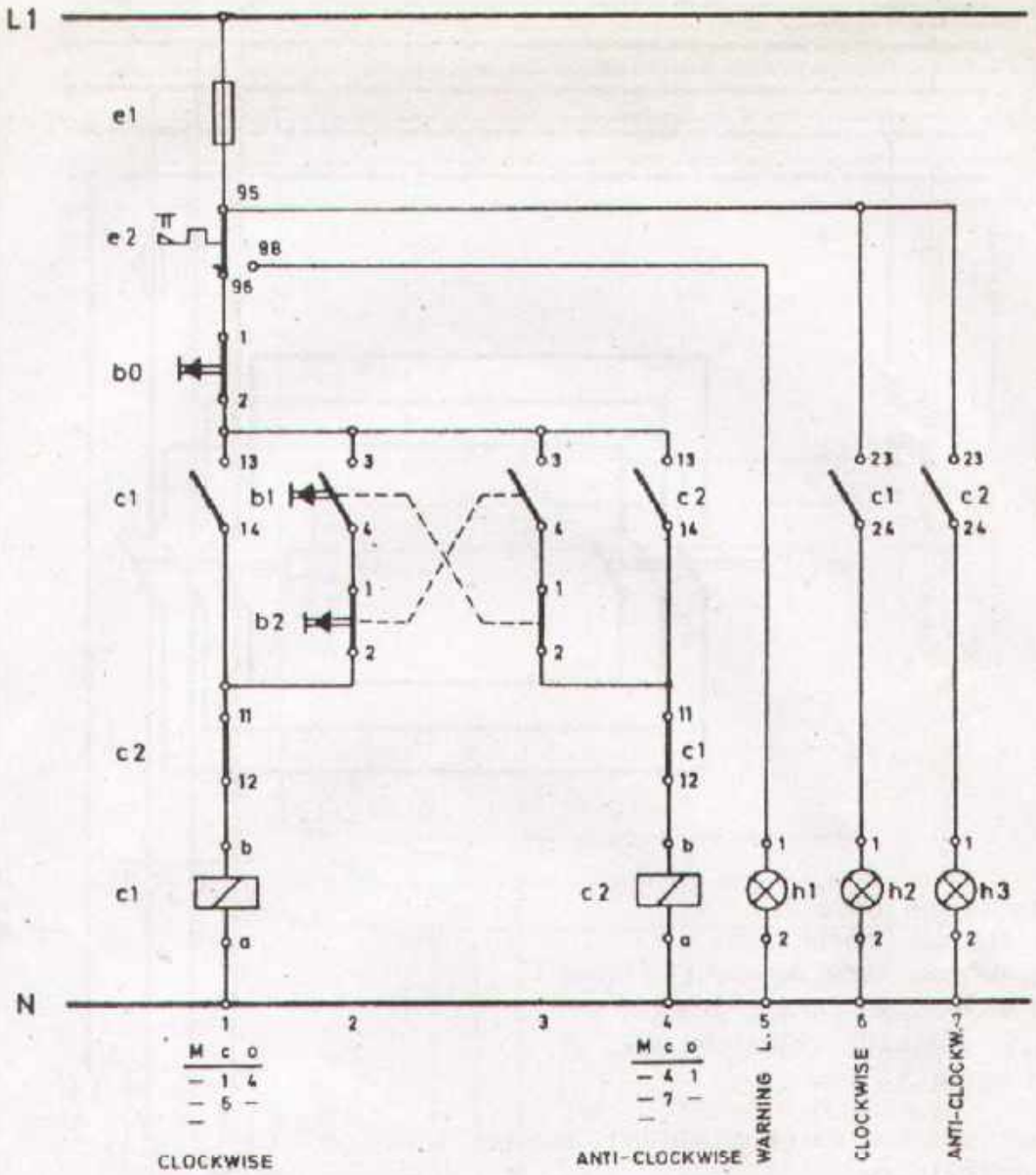
ACCORDING TO INSTRUCTORS DECISION PLUG WIRING OR BOARD INSTALLATION.

CONNECT SUPPLY IN PRESENCE OF YOUR INSTRUCTORS

NOTE: DO NOT SWITCH DIRECTLY FROM ONE DIRECTION TO THE OTHER, ALLOW MOTOR TO STOP.

DRAWING IS ALSO USED FOR EXERCISE EP 2.3/4.5.1/6

	MOTOR CONNECTION, 3~ REVERSING	EP 1.3/3.5.1/12 Contactors
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL 47



a.) GIVE DESCRIPTION OF:

e1 .....

e2 .....

c1, c2 .....

b0, b1, b2 .....

h1, h2, h3 .....

b.) WORK OUT YOUR DESCRIPTION OF CONTROL CIRCUITS 3.5.1/0

c.) TAKE SUITABLE MATERIAL AND DO YOUR PRACTICAL JOB.

EXERCISE SHEET NO. 3.5.1/12 AND 3.5.1/14 MAY BE USED IN ADDITION.

ACCORDING TO INSTRUCTORS DECISION PLUG WIRING OR BOARD INSTALLATION.

CONNECT **SUPPLY** IN **PRESENCE** OF YOUR **INSTRUCTOR.**

NOTE: DO NOT SWITCH DIRECTLY FROM ONE DIRECTION TO THE OTHER, ALLOW MOTOR TO STOP

DRAWING IS ALSO USED FOR EXERCISE EP 2.3/4.5.1/6

MOTOR CONNECTION 3~ REVERSING

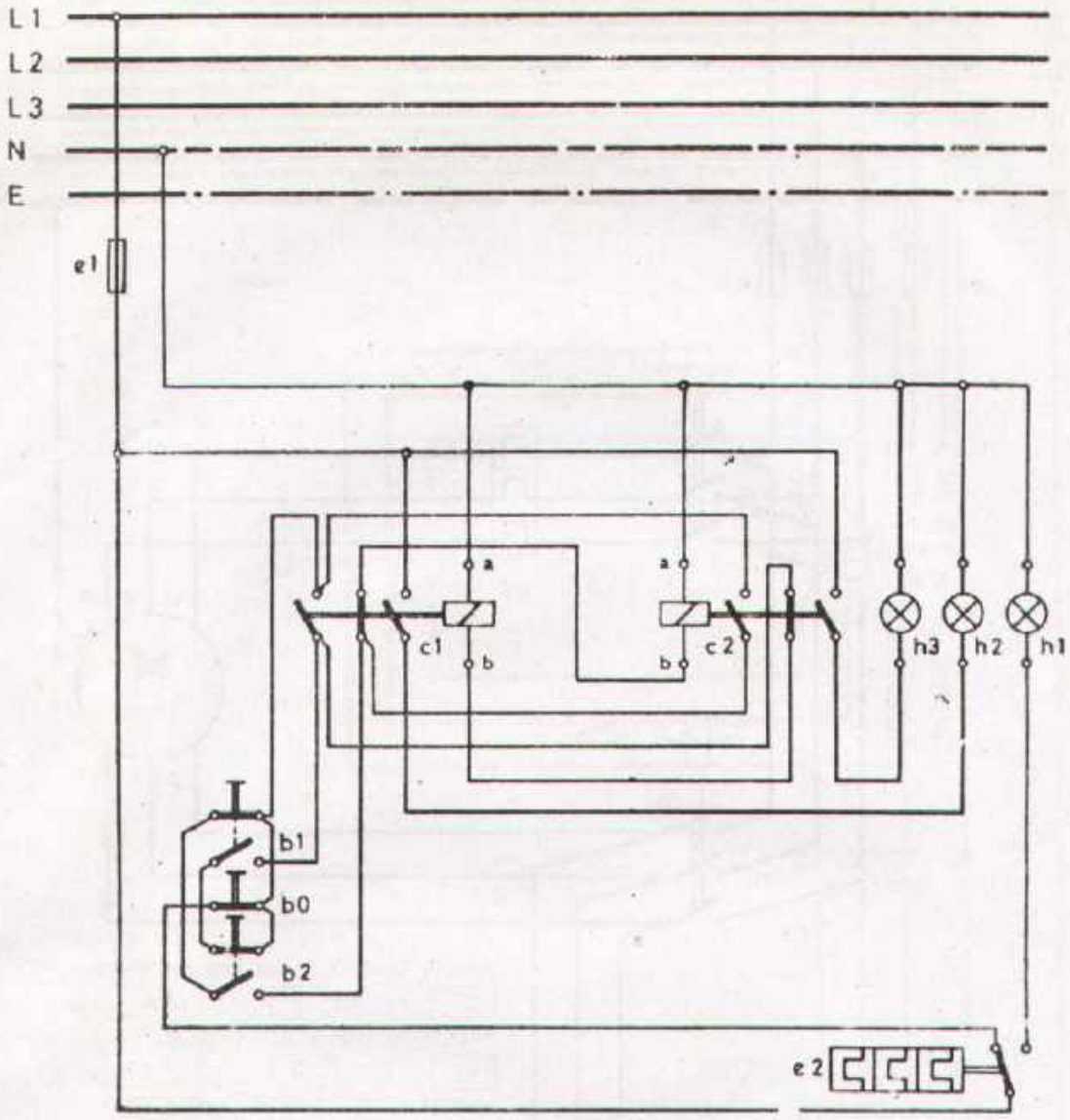
EP 1.3/3.5.1/13

Contactors

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

ELECTRICIAN GENERAL



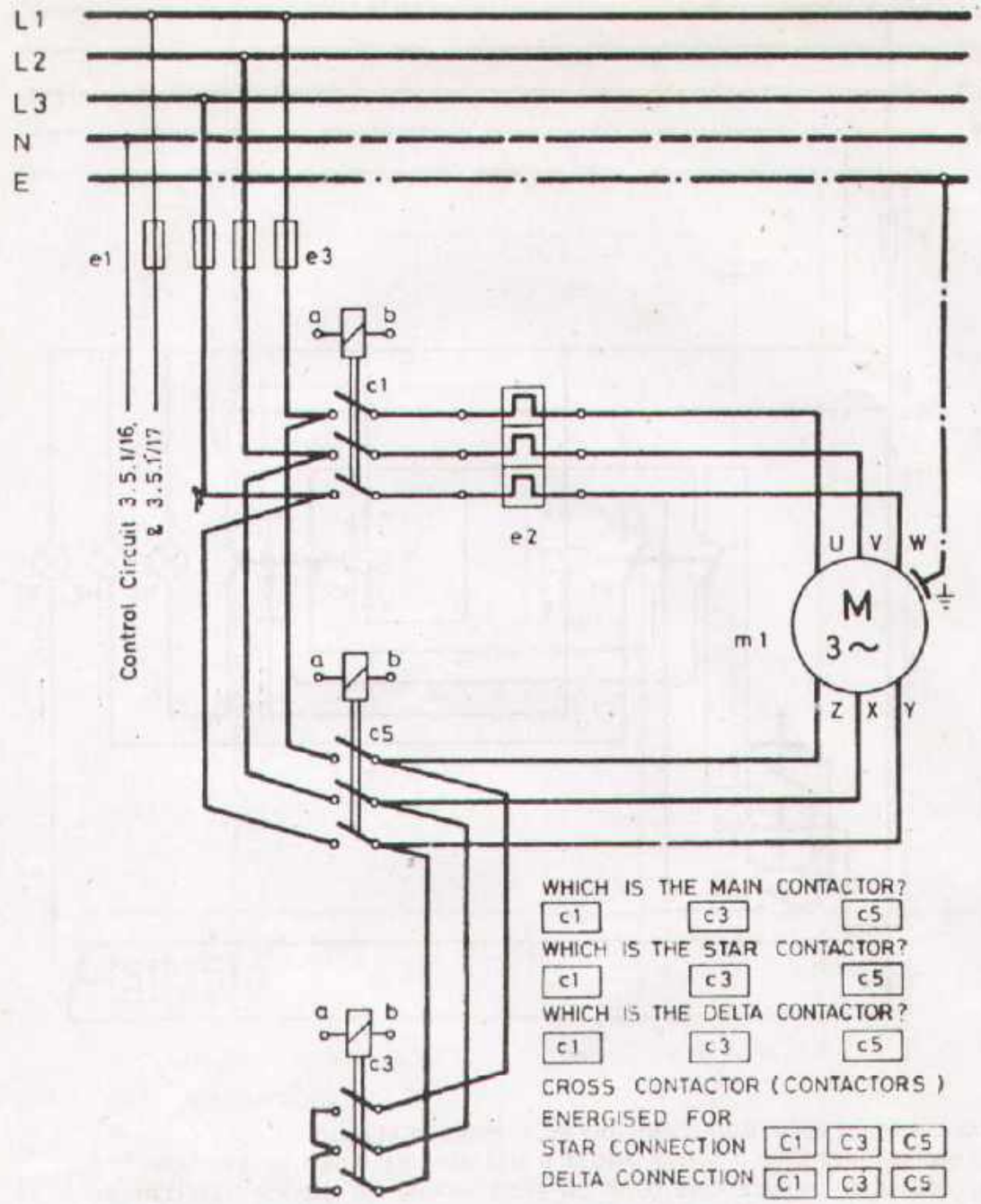
TAKE SUITABLE MATERIAL AND DO YOUR PRACTICAL JOB.
EXERCISE SHEET No. 3.5.1/12 AND 3.5.1/13 MAY BE USED IN ADDITION ACCORDING TO INSTRUCTORS DECISION PLUG WIRING OR BOARD INSTALLATION.

CONNECT SUPPLY IN PRESENCE OF YOUR INSTRUCTOR.

NOTE : DO NOT SWITCH DIRECTLY FROM ONE DIRECTION TO THE OTHER, ALLOW MOTOR TO STOP.

DRAWING IS ALSO USED FOR EXERCISE EP 2.3/4.5.1/6

	3 PHASE REVERSING WITH CONTROL LAMPS	EP 1.3/3.5.1/14
		Circuits III
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL



WHICH IS THE MAIN CONTACTOR?

c1 c3 c5

WHICH IS THE STAR CONTACTOR?

c1 c3 c5

WHICH IS THE DELTA CONTACTOR?

c1 c3 c5

CROSS CONTACTOR (CONTACTORS)

ENERGISED FOR

STAR CONNECTION C1 C3 C5

DELTA CONNECTION C1 C3 C5

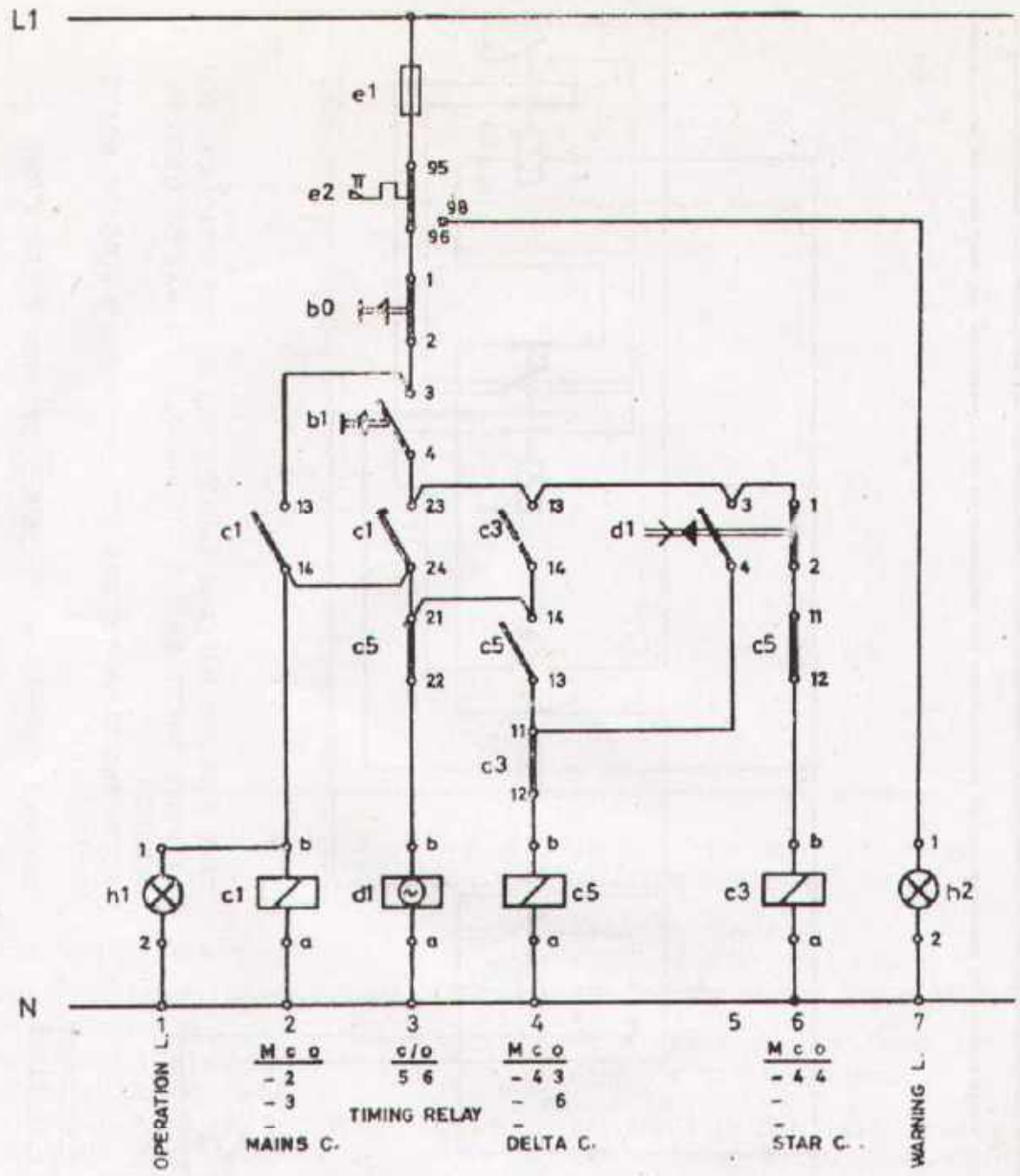
TAKE SUITABLE MATERIAL (MOTOR) AND DO YOUR PRACTICAL JOB.
EXERCISE SHEET No. 3.5.1/16 AND 3.5.1/17 MAY BE USED IN ADDITION.
ACCORDING TO INSTRUCTORS DECISION PLUG WIRING OR BOARD INSTALLATION.
CONNECT SUPPLY IN PRESENCE OF YOUR INSTRUCTOR.

DRAWING IS ALSO USED FOR EXERCISE EP 2.3/4.5.1/7

MOTOR CONNECTION, 3~ STAR-DELTA

EP 1.3/3.5.1/15

Contactors



a.) WORK OUT YOUR DESCRIPTION OF CONTROL CIRCUITS 3.5.1/0

b.) TAKE SUITABLE MATERIAL (MOTOR) AND DO YOUR PRACTICAL JOB. EXERCISE SHEET NO. 3.5.1/15 AND 3.5.1/17 MAY BE USED IN ADDITION. ACCORDING TO INSTRUCTORS DECISION PLUG WIRING OR BOARD INSTALLATION.

CONNECT SUPPLY IN PRESENCE OF YOUR INSTRUCTOR.

DRAWING IS ALSO USED FOR EXERCISE EP 2.3/4.5.1/7

	MOTOR CONNECTION, 3~ STAR-DELTA	EP 1.3/3.5.1/16 Contactors
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL 51

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

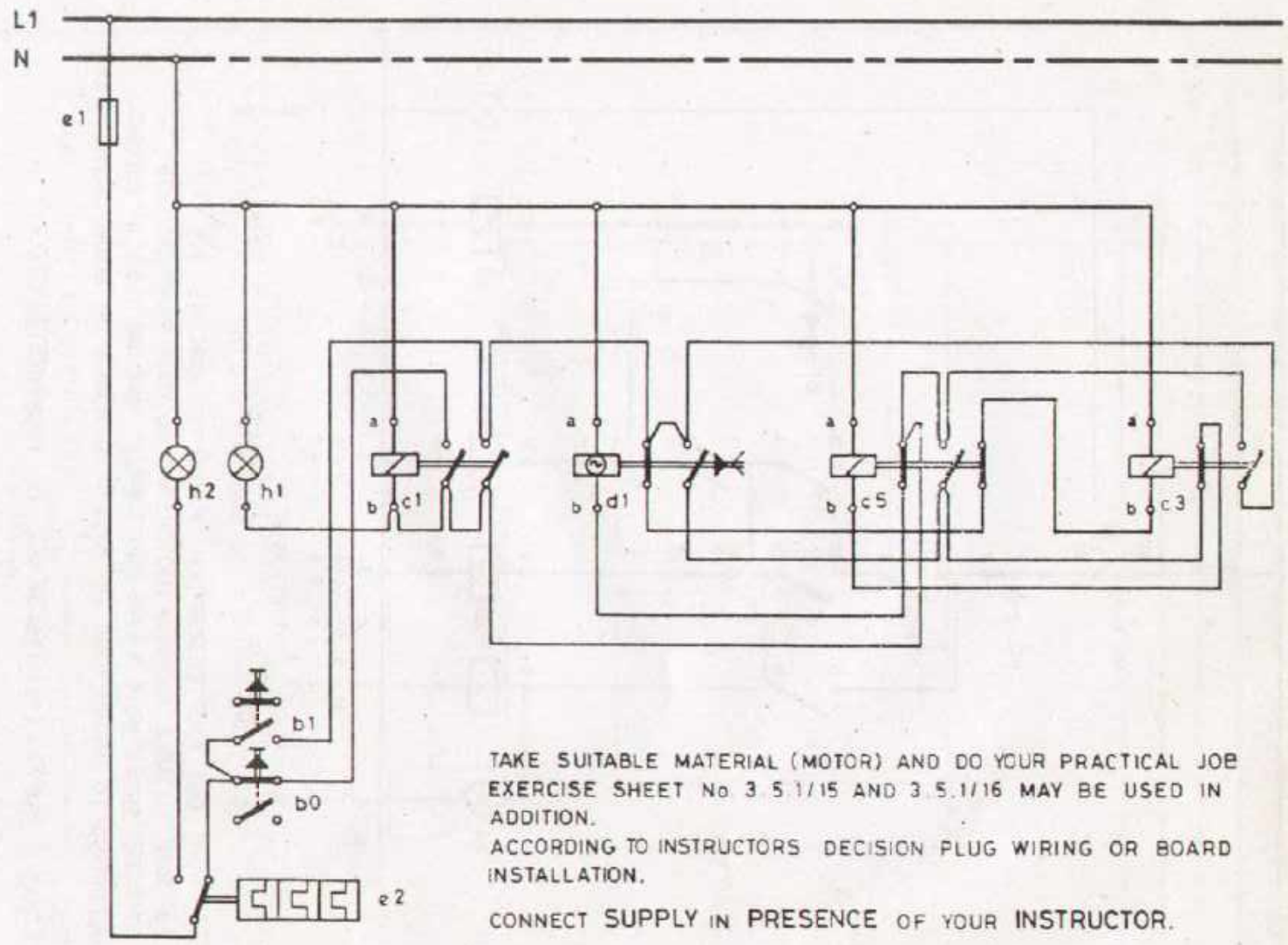
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

ELECTRICIAN GENERAL

EP 1.3/3.5.1/17

Circuits III

STAR-DELTA WITH CONTROL LAMPS

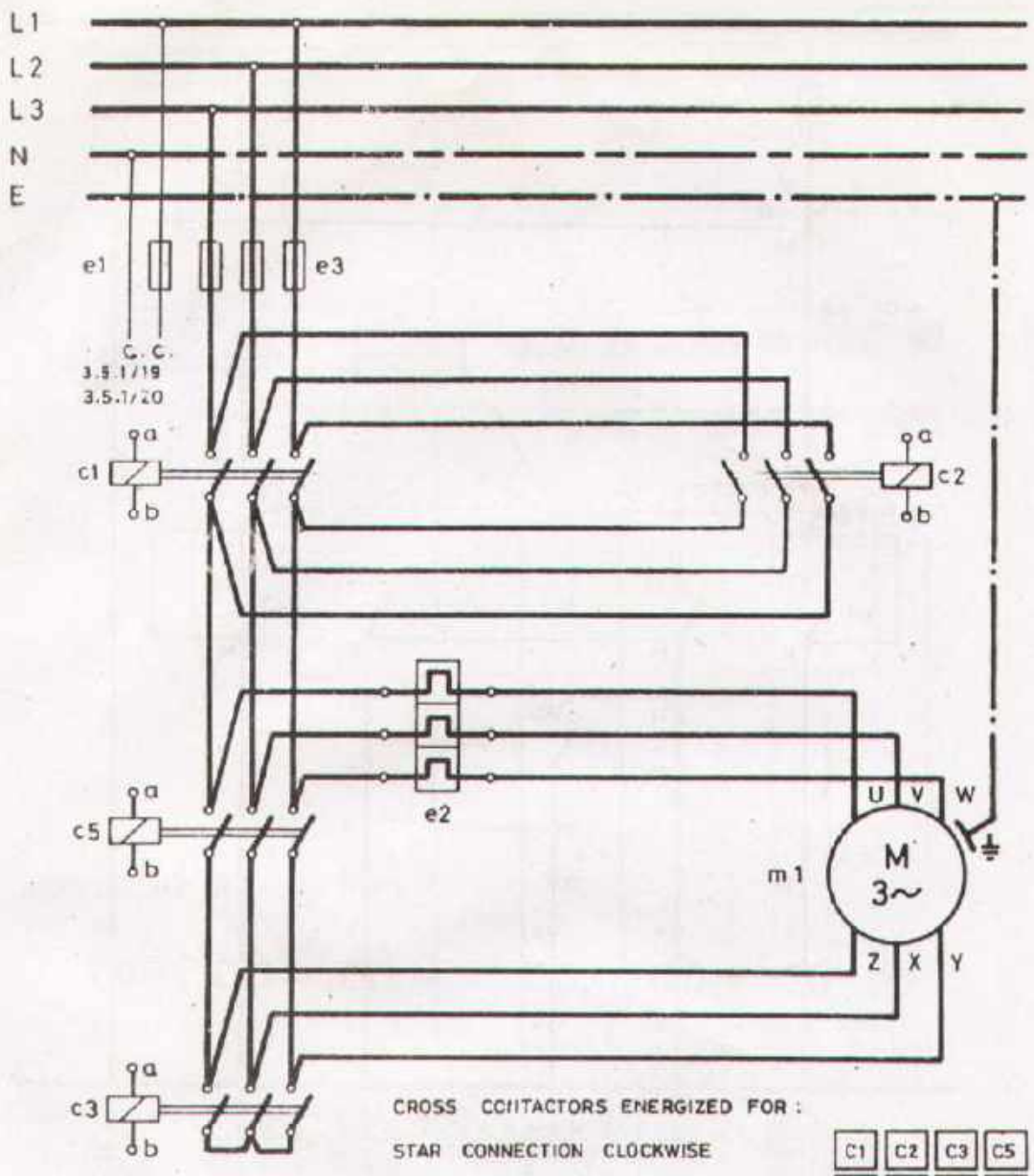


TAKE SUITABLE MATERIAL (MOTOR) AND DO YOUR PRACTICAL JOB EXERCISE SHEET No 3.5.1/15 AND 3.5.1/16 MAY BE USED IN ADDITION.

ACCORDING TO INSTRUCTORS DECISION PLUG WIRING OR BOARD INSTALLATION.

CONNECT SUPPLY IN PRESENCE OF YOUR INSTRUCTOR.

DRAWING IS ALSO USED FOR EXERCISE EP 2.3/4.5.1/7

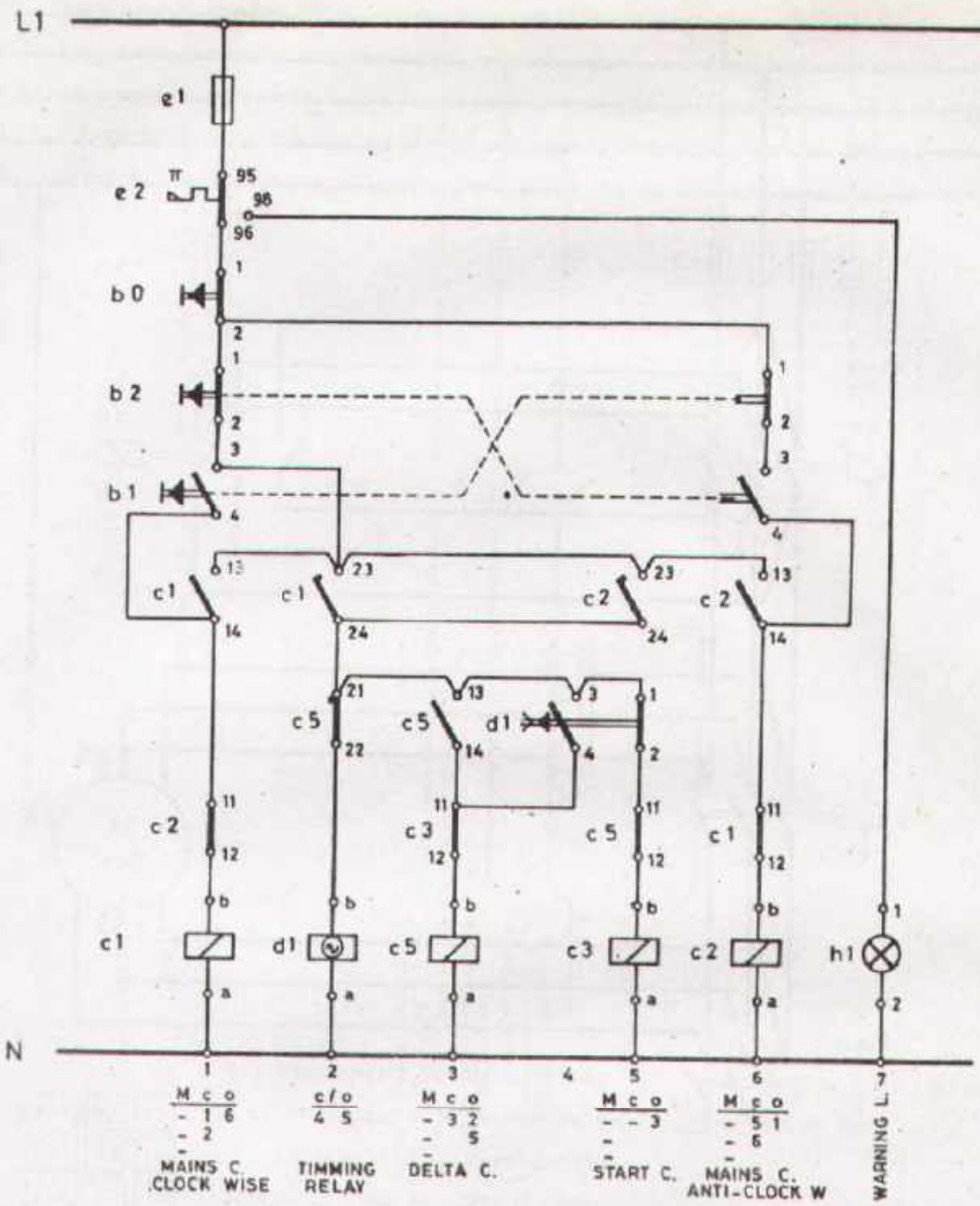


CROSS CONTACTORS ENERGIZED FOR :

STAR CONNECTION CLOCKWISE	C1	C2	C3	C5
DELTA CONNECTION CLOCKWISE	C1	C2	C3	C5
STAR CONNECTION ANTI-CLOCKWISE	C1	C2	C3	C5
DELTA CONNECTION ANTI-CLOCKWISE	C1	C2	C3	C5

TAKE SUITABLE MATERIAL (MOTOR) AND DO YOUR PRACTICAL JOB.
EXERCISE SHEET NO. 3.5.1/19 AND 3.5.1/20 MAY BE USED IN ADDITION.
ACCORDING TO INSTRUCTORS DECISION PLUG WIRING OR BOARD INSTALLATION.
CONNECT SUPPLY IN PRESENCE OF YOUR INSTRUCTOR
DRAWING IS ALSO USED FOR EXERCISE EP 2.3/4.5.1/8

	MOTOR CONNECTION, 3~ STAR DELTA REVERSING	EP 1.3/3.5.1/18 Contactors

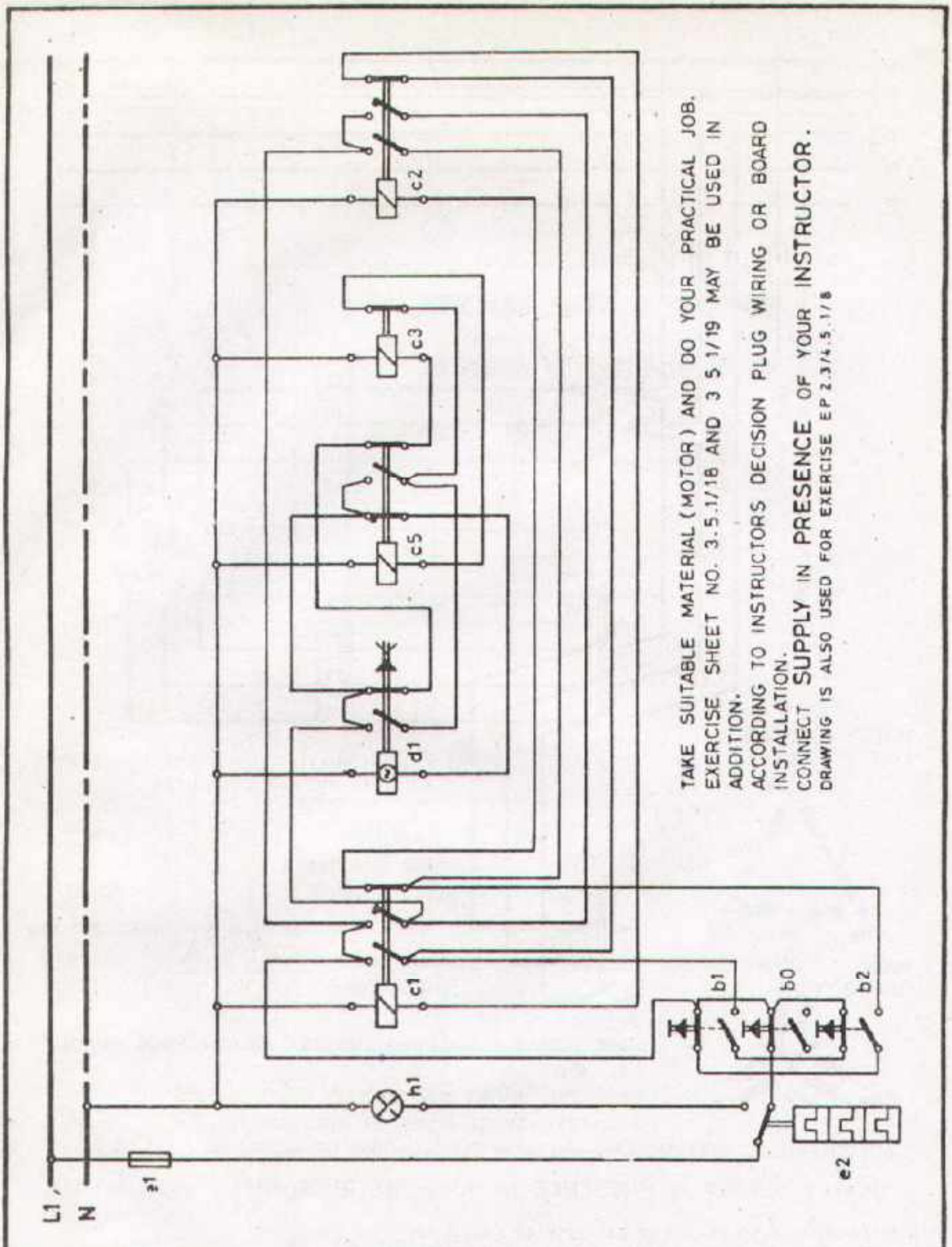


a) WORK OUT YOUR DESCRIPTION OF CONTROL CIRCUITS 3.5.1/0
b) EXPLAIN WHY DOES THE CONTROL CIRCUIT CROSS THE DIFFERENT CONTACTS.
c) TAKE SUITABLE MATERIAL AND DO YOUR PRACTICAL JOB.
EXERCISE SHEET No. 3.5.1/18 AND 3.5.1/20 MAY BE USED IN ADDITION.
ACCORDING TO INSTRUCTORS DECISION PLUG WIRING OR BOARD INSTALLATION.

CONNECT SUPPLY IN PRESENCE OF YOUR INSTRUCTOR.

DRAWING IS ALSO USED FOR EXERCISE EP 2.3/4.5.1/8

	MOTOR CONNECTION, 3~ STAR-DELTA REVERSING	EP 1.3/3.5.1/19
		Contactors
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL



TAKE SUITABLE MATERIAL (MOTOR) AND DO YOUR PRACTICAL JOB. EXERCISE SHEET NO. 3.5.1/18 AND 3 5 1/19 MAY BE USED IN ADDITION.
ACCORDING TO INSTRUCTORS DECISION PLUG WIRING OR BOARD INSTALLATION.
CONNECT SUPPLY IN PRESENCE OF YOUR INSTRUCTOR.
DRAWING IS ALSO USED FOR EXERCISE EP 2.3/4.5.1/8

STAR-DELTA REVERSING WITH CONTROL LAMP

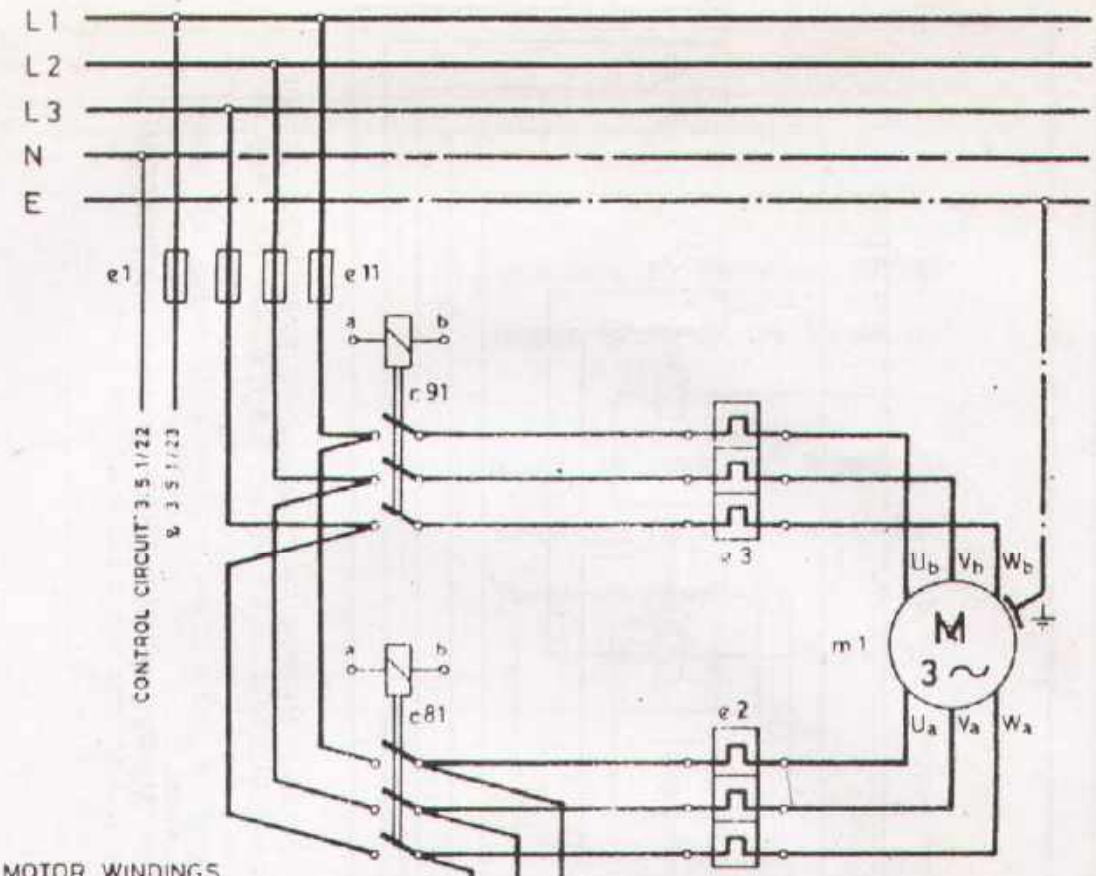
EP 1.3/3.5.1/20

Circuits III

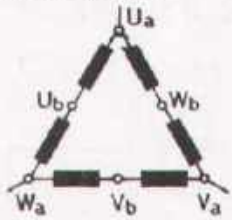
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

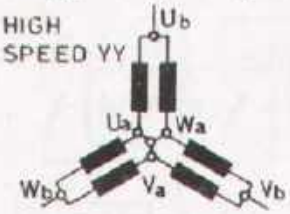
ELECTRICIAN GENERAL



MOTOR WINDINGS
LOW SPEED △



HIGH SPEED YY



CROSS CONTACTOR (CONTACTORS) CONCERNED
WHICH IS THE MAIN CONTACTOR
FOR LOW SPEED

[c81] [c91] [c93]

FOR HIGH SPEED

[c81] [c91] [c93]

WHICH CONTACTOR (S) IS (ARE) ENERGIZED FOR

LOW SPEED	c81	c91	c93
HIGH SPEED	c81	c91	c93

TAKE SUITABLE MATERIAL (MOTOR) AND DO YOUR PRACTICAL JOB.
EXERCISE SHEET No. 3.5.1/22 AND 3.5.1/23 MAY BE USED IN ADDITION.

ACCORDING TO INSTRUCTORS DECISION PLUG WIRING OR BOARD INSTALLATION.

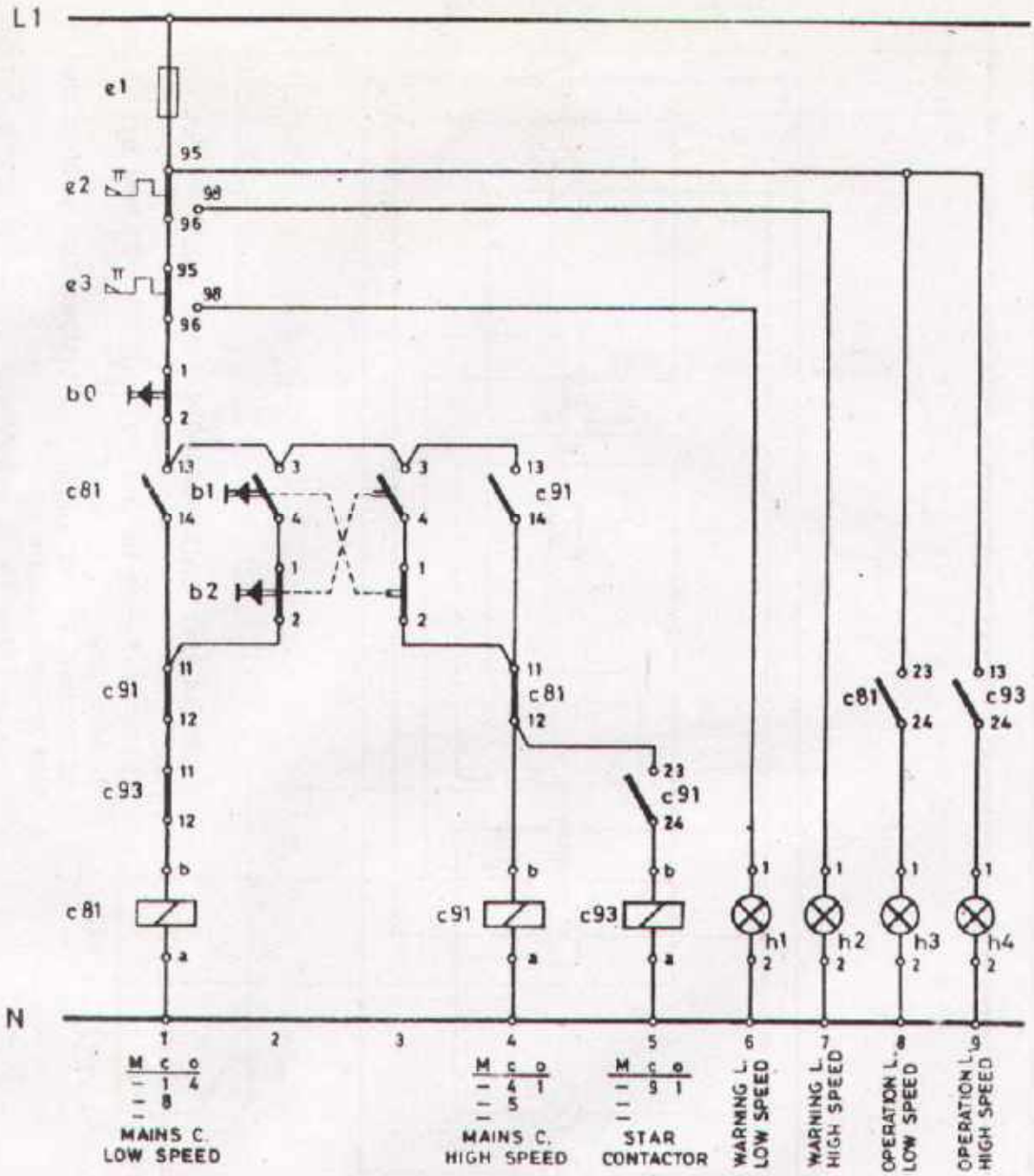
CONNECT SUPPLY IN PRESENCE OF YOUR INSTRUCTOR.

DRAWING IS ALSO USED FOR EXERCISE EP 2.3/4 5.1/9

MOTOR CONNECTION, 3~ 2 SPEEDS TAPPED WOUND, 1 DIRECTION

EP 1.3/3.5.1/21

Contactors



a) WORK OUT YOUR DESCRIPTION OF CONTROL CIRCUITS 3.5.1/0
b) TAKE SUITABLE MATERIAL AND DO YOUR PRACTICAL JOB.
EXERCISE SHEET No. 3.5.1/21 AND 3.5.1/23 MAY BE USED IN ADDITION.
WHY ARE TWO OVERLOAD PROTECTION SWITCHES INSTALLED ?
WHAT FOR IS THE INTERLINK SYSTEM PRACTISED ON SWITCHES AND CONTACTORS?
ACCORDING TO INSTRUCTORS DECISION PLUG WIRING OR BOARD INSTALLATION.

CONNECT SUPPLY IN PRESENCE OF YOUR INSTRUCTOR.

DRAWING IS ALSO USED FOR EXERCISE EP 2.3/4.5.1/9

MOTOR CONNECTION, 3~ 2 SPEEDS TAPPED WOUND, 1 DIRECTION

EP 1.3/3.5.1/22

Contactors

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

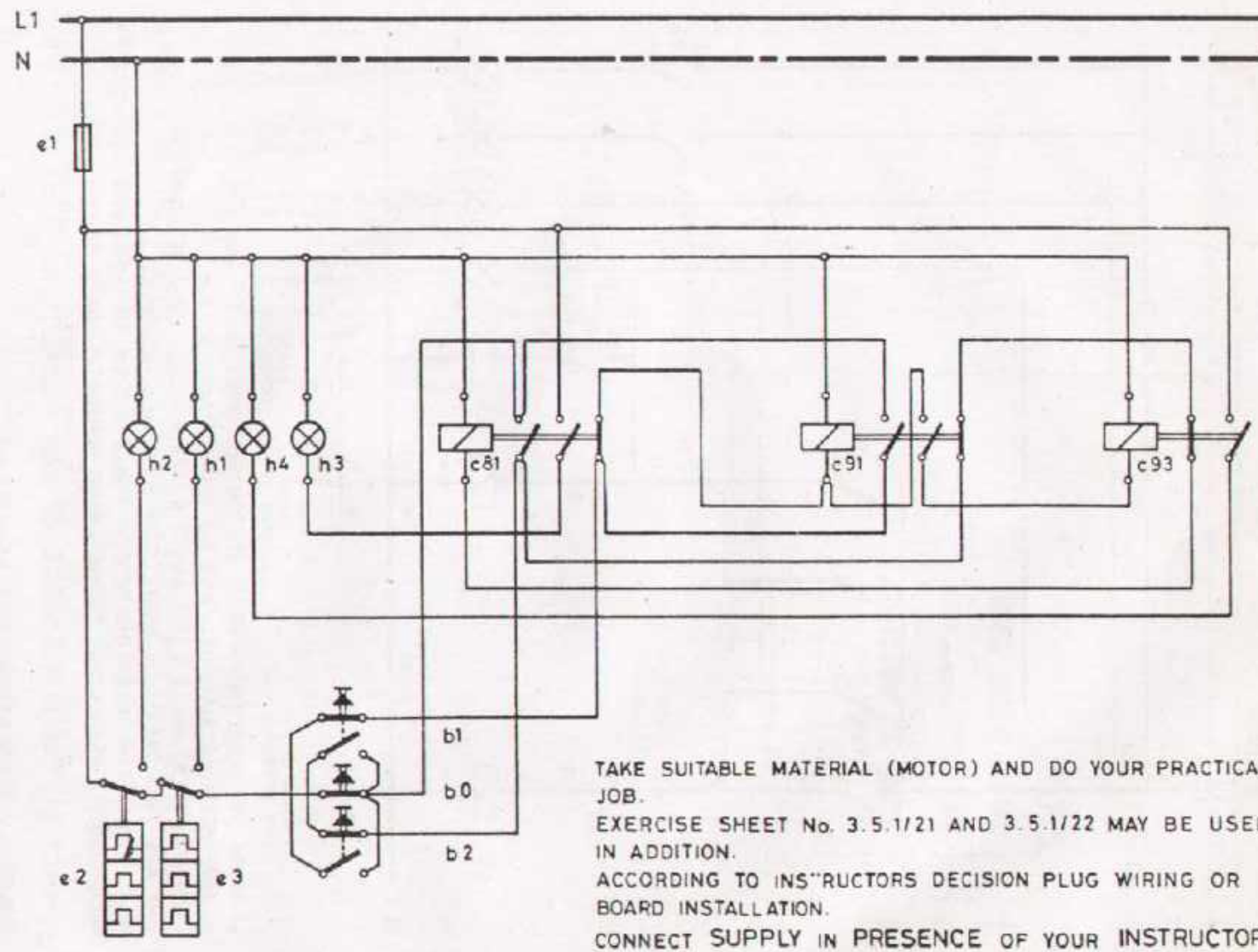
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

ELECTRICIAN GENERAL

MULTI-SPEED, 1 DIRECTION, 2 SPEEDS

Circuits III

EP 1.3/3.5.1/23



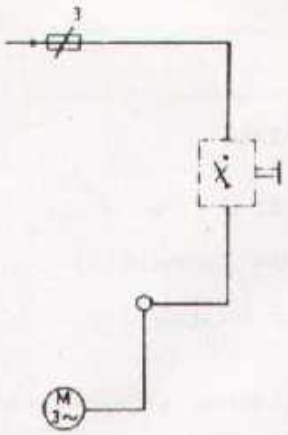
TAKE SUITABLE MATERIAL (MOTOR) AND DO YOUR PRACTICAL JOB.

EXERCISE SHEET No. 3.5.1/21 AND 3.5.1/22 MAY BE USED IN ADDITION.

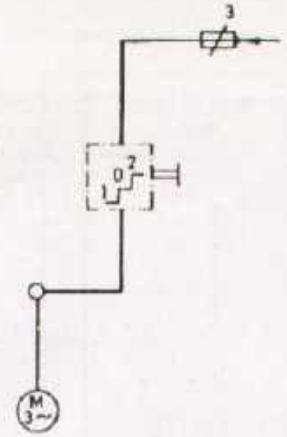
ACCORDING TO INS"RUCTORS DECISION PLUG WIRING OR BOARD INSTALLATION.

CONNECT SUPPLY IN PRESENCE OF YOUR INSTRUCTOR.

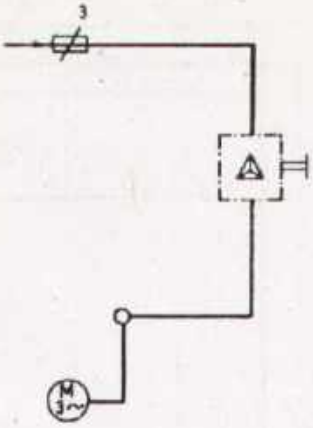
DRAWING IS ALSO USED FOR EXERCISE EP 2.3/4.5.1/9



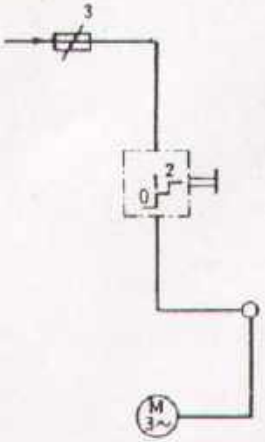
1 SWITCH, ON-OFF



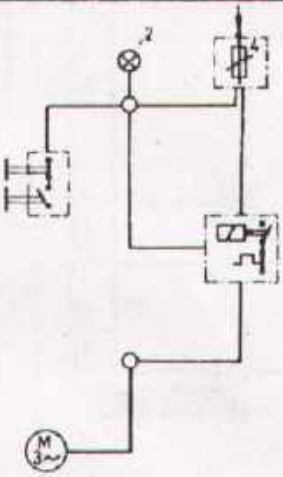
2 SWITCH, REVERSING



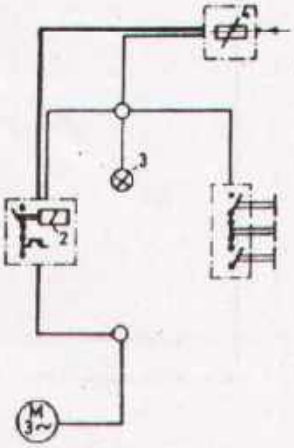
3 SWITCH, STAR-DELTA



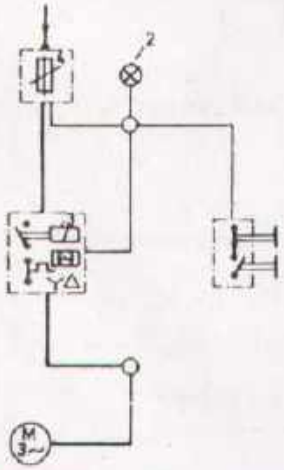
4 SWITCH, MULTI SPEED



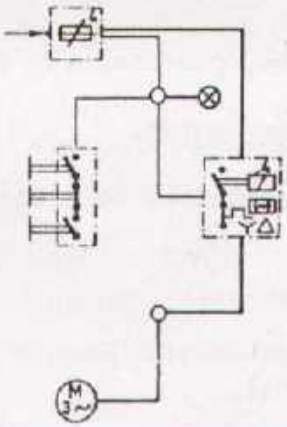
5 CONTACTOR, ON-OFF



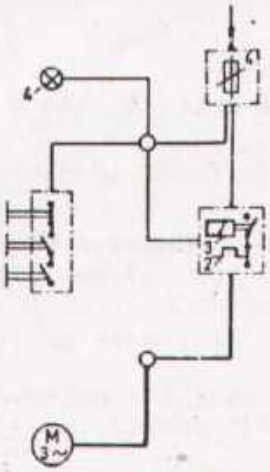
6 CONTACTOR, REVERSING



7 CONTACTOR, STAR-DELTA



8 CONTACTOR, YΔ-REVERSING



9 CONTACTOR, MULTI SPEED

LAYOUT

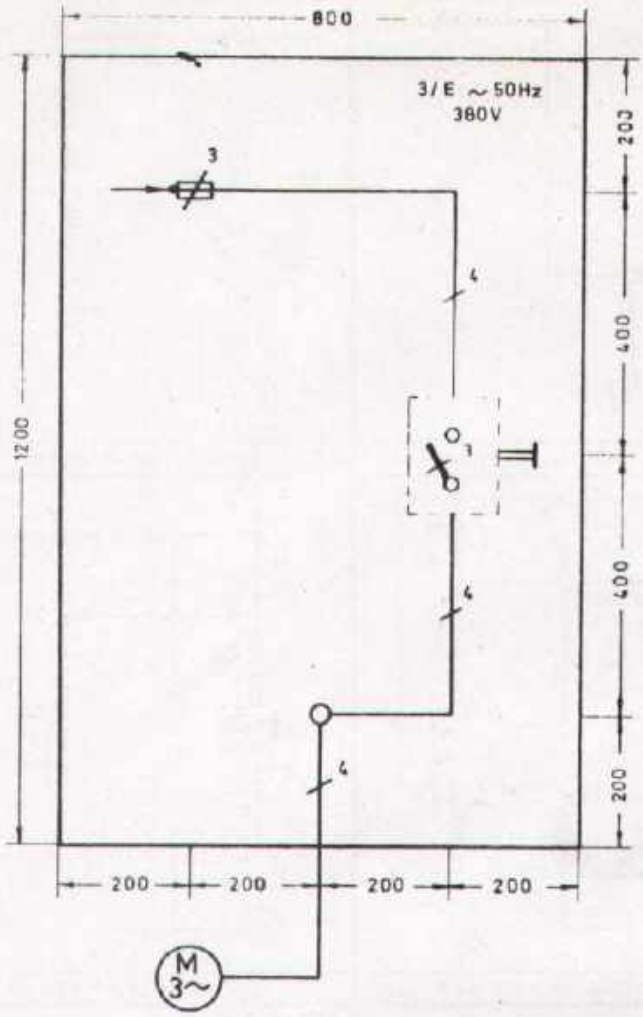
EP 2.1/4.5.1/

Installation III

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

ELECTRICIAN GENERAL



MATERIAL:

1 Motor 3~ 380 V

3 Fuses (complete)

1 Drum Switch 3~
ON - OFF

1 Appliance Connection Box

Cable

Pipe

Wire

Clamps

Screws

Connectors

The motor 3~ 380 V is to be connected via fuses and sw tch.

Take fuses suitable for your motor.

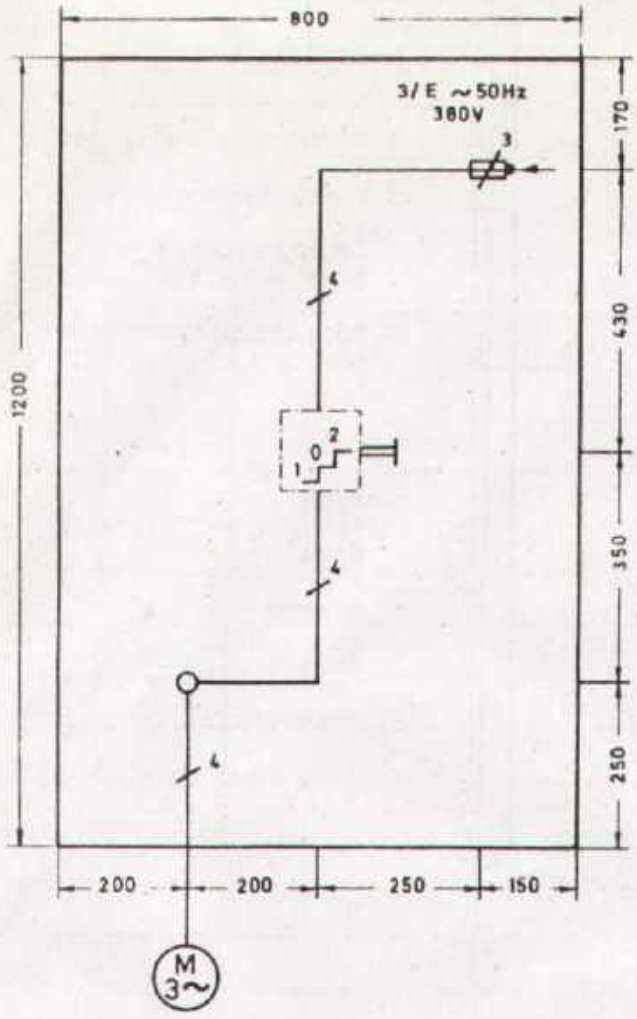
All components are to be installed according to the given drawing and measurements.

Give estimate for the material.

(A suitable motor protection switch should be provided additionally, if available.)

CONNECT SUPPLY IN PRESENCE OF YOUR INSTRUCTOR.

Exercise sheet. No. 4.5.2/7 may be used in addition	MOTOR CONNECTION, ON-OFF	EP 2.3/4.5.1/1 Installation III



MATERIAL:

1 Motor 3~ 380 V

3 Fuses (complete)

1 Drum Switch 3~ Reversing

1 Appliance Connection Box

Cable

Pipe

Wire

Clamps

Screws

Connectors

The Motor 3~ 380 V is to be connected via fuses and reversing switch.

Take fuses suitable for your motor.

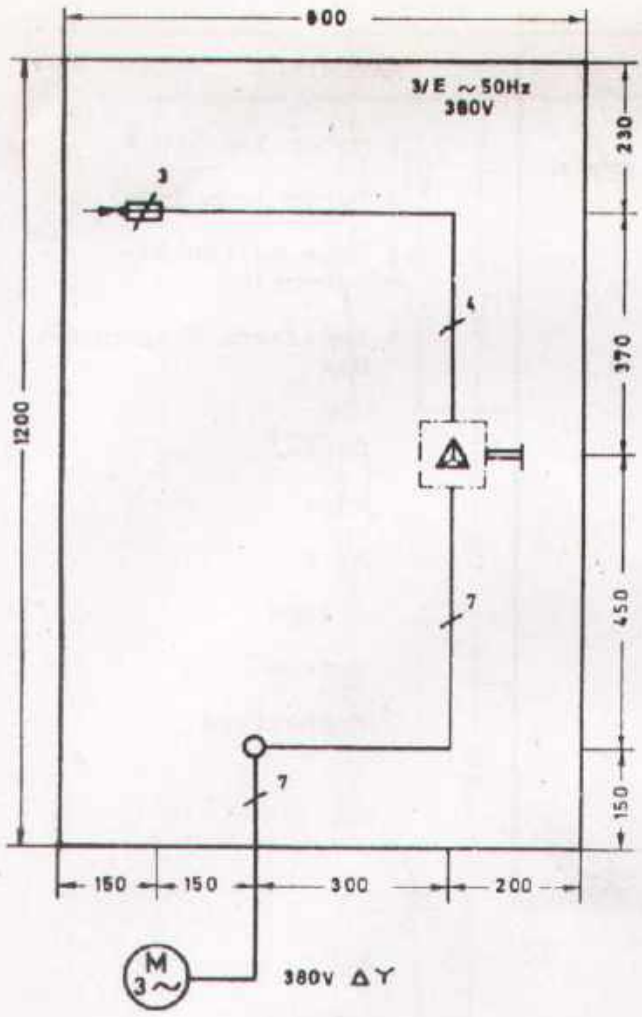
All components are to be installed according to the given drawing and measurements.

Give estimate for the material.

(A suitable motor protection switch should be provided additionally, if available.)

CONNECT SUPPLY IN PRESENCE OF YOUR INSTRUCTOR.

Exercise sheet No. 4.5.2/8 may be used in addition	MOTOR CONNECTION, REVERSING	EP 2.3/4.5.1/2 Installation III



MATERIAL:

1 Motor 3 ~ 660 / 380 V

3 Fuses (complete)

1 Drum Switch 3 ~
Star - Delta

1 Appliance Connection
Box

Cable

Pipe

Wire

Clamps

Screws

Connectors

The three-phase motor 660 / 380 V is to be connected via fuses and star - delta switch.

Take fuses suitable for your motor.

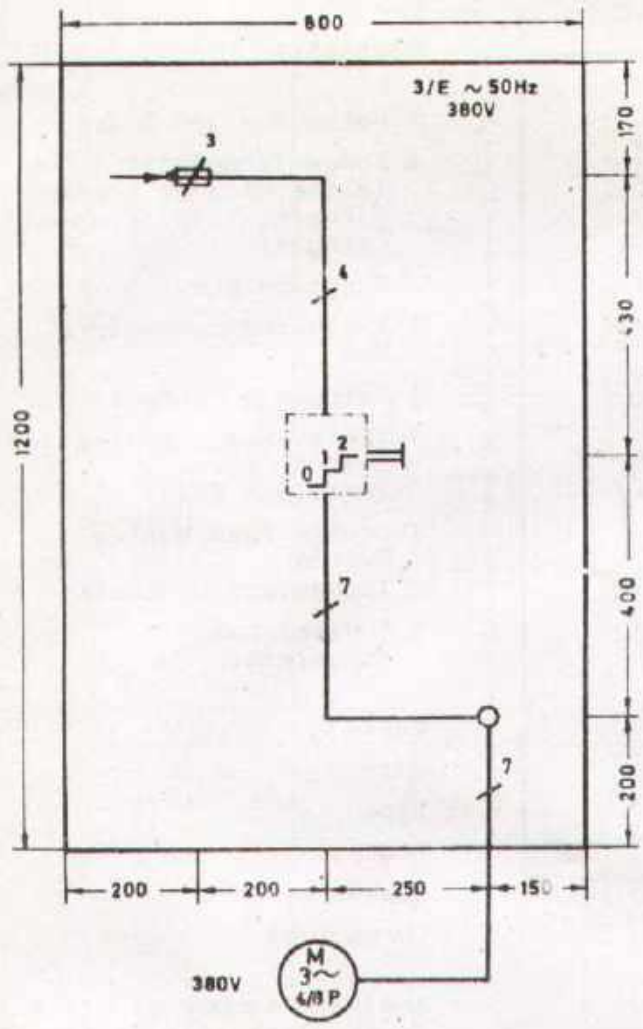
All components are to be installed according to the given drawing and measurements.

Give estimate for the material.

(A suitable motor protection switch should be provided additionally, if available.)

CONNECT SUPPLY IN PRESENCE OF YOUR INSTRUCTOR.

Exercise sheet No. 4.5.2/9 may be used in addition	MOTOR CONNECTION, STAR-DELTA	EP 2.3/4.5.1/3 Installation III



MATERIAL:

1 Motor 3~ 380 V
(Double Speed 4/8 P)

3 Fuses (complete)

1 Drum Switch 3~
Double Speed
(suitable for your motor)

1 Appliance Connection Box

Cable

Wire

Clamps

Screws

Connectors

Pipe

The three-phase double speed motor 380 V is to be connected via fuses and double speed switch.

Take fuses suitable for your motor.

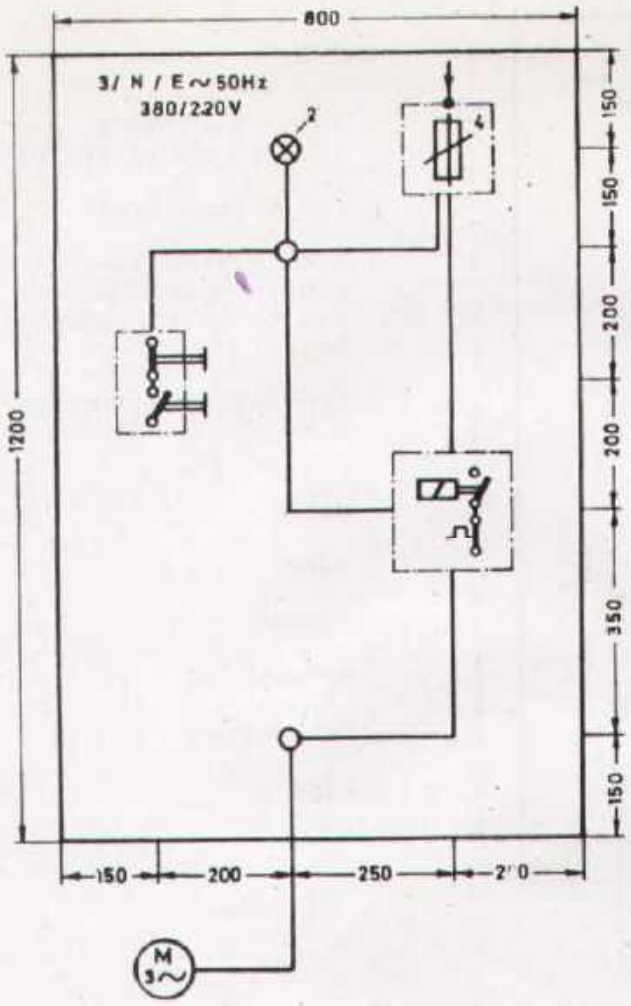
All components are to be installed according to the given drawing and measurements.

Give estimate for material.

(A suitable motor protection switch should be provided additionally, if available.)

CONNECT SUPPLY IN PRESENCE OF YOUR INSTRUCTOR.

Exercise sheet No. 4.5.2/11 may be used in addition	MOTOR CONNECTION, DOUBLE SPEED	EP 2.3/4.5.1/4 Installation III



MATERIAL:

1 Motor 3~ 380 V Δ

4 Fuses (complete)
(3 for main or power circuit, 1 for control circuit)

1 Junction Box

1 Appliance Connection Box

1 Automatic Contactor

1 Therm. Motor Protection Switch
(Overload Relay)

1 Double Push Button Switch
(momentary contact)

2 Control Lamps
(complete)

Cable

Wire

Pipe

Clamps

Screws

Connectors

Indicate number of wires in the installation layout

The motor 3~ 380 V is to be connected via fuses, automatic contactor and therm. motor protection switch.

The control circuit consisting of fuse, double push button (momentary contact), control lamps, automatic contactor coil as well as auxiliary contacts and therm. motor protection switch has to be installed as a separate circuit to the power (main) circuit.

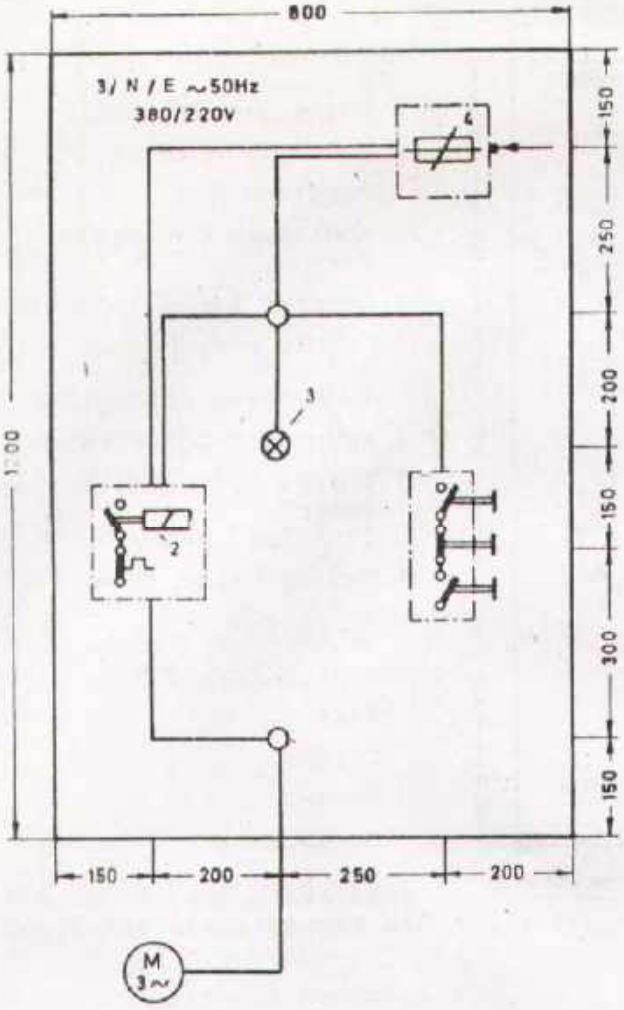
All components are to be installed according to the given drawing and measurements.

Take fuses suitable for your motor.

Adjust also therm. motor protection switch.

CONNECT SUPPLY IN PRESENCE OF YOUR INSTRUCTOR.

Exercise sheet No. 4.5.3/8.9+10 may be used in addition	MOTOR CONNECTION, CONTACTOR ON–OFF	EP 2.3/4.5.1/5 Installation III
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL



MATERIAL:

1 Motor 3~ 380 V
4 Fuses (complete)
1 Junction Box
1 Appliance Connection Box
3 Control Lamps (compl.)
1 Triple Push Button Switch (momentary contact)
2 Automatic Contactors
1 Therm. Motor Protection Switch (Overload Relay)

Cable
Pipe
Wire
Clamps
Screws
Connectors

Indicate number of wires in the installation layout.

The three-phase motor 380 V is to be connected via fuses, automatic contactor and therm. motor protection switch.

The control circuit consisting of fuse, triple push button switch, control lamps, automatic contactor coils as well as auxiliary contacts and therm. motor protection switch has to be installed as a separate circuit to the power (main) circuit.

All components are to be installed according to the given drawing and measurements.

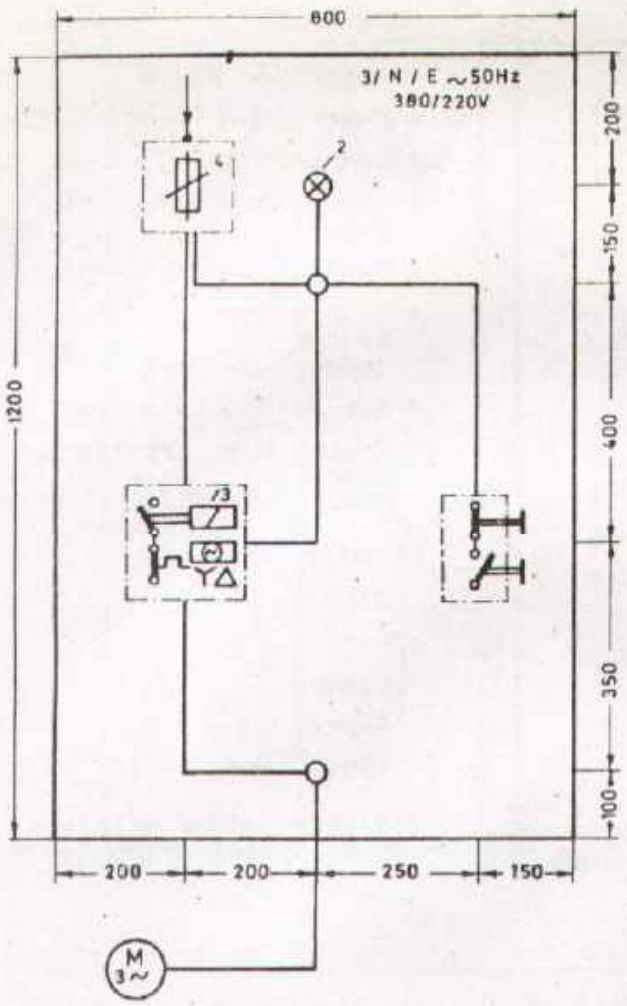
Take fuses suitable for your motor.

Adjust also therm. protection switch.

Give estimate for material.

CONNECT SUPPLY IN PRESENCE OF YOUR INSTRUCTOR.

Exercise sheet No. 4.5.3/11,12+13 may be used in addition	MOTOR CONNECTION, CONTACTOR REVERSING	EP 2.3/4.5.1/6 Installation III



MATERIAL:

1 Motor 3~ 660/380 V
4 Fuses (complete)
1 Junction Box
1 Appliance Connection Box
2 Control Lamps (compl.)
1 Double Push Button Switch (momentary contact)
3 Automatic Contactors
1 Therm. Motor Protection Switch (Overload Relay)
1 Timing Relay (Timer)

Cable
Pipe
Wire
Clamps
Screws
Connectors

Indicate number of wires in the installation layout.

The three-phase motor 660/380 V is to be connected via fuses, automatic contactors and therm. motor protection switch.

The control circuit consisting of fuse, double push button switch, control lamps, timer, automatic contactor coils as well as auxiliary contacts and therm. motor protection switch has to be installed as a separate circuit to the power (main) circuit.

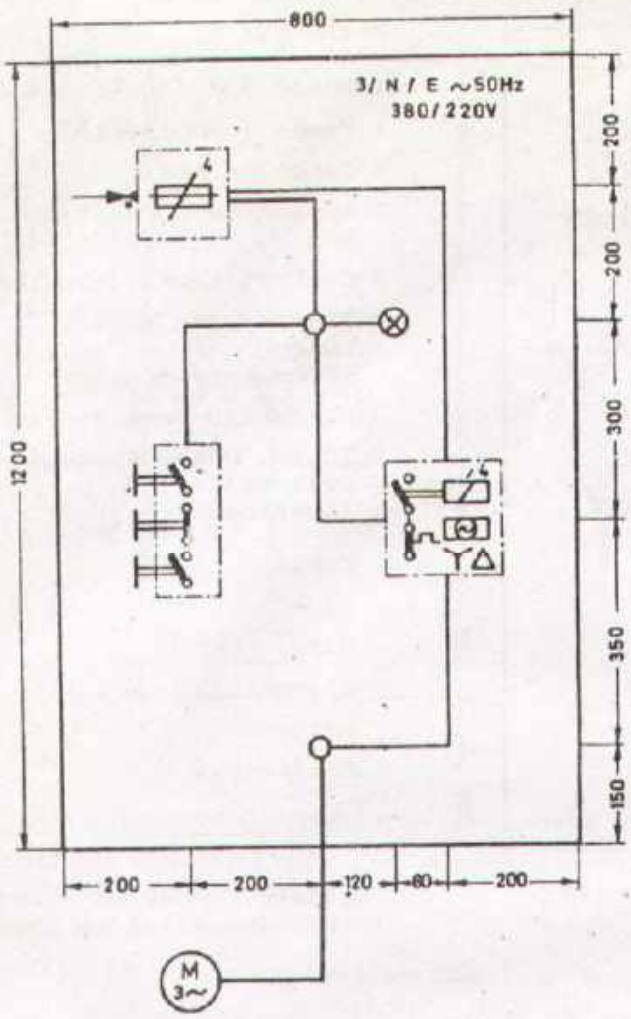
All components are to be installed according to the given drawing and measurements.

Take fuses suitable for your motor.

Adjust also therm. motor protection switch.

CONNECT SUPPLY IN PRESENCE OF YOUR INSTRUCTOR.

Exercise sheet No. 4.5.3/14, 15+18 may be used in addition	MOTOR CONNECTION CONTACTOR STAR DELTA	EP 2.3/4.5.1/7
		Installation III



MATERIAL:

1 Motor 3~ 660/380 V
4 Fuses (complete)
1 Junction Box
1 Appliance Connection Box
1 Control Lamp (complete)
1 Triple Push Button Switch (momentary contact)
4 Automatic Contactors
1 Therm. Motor Protection
1 Timing Relay (Timer)

Cable
Pipe
Wire
Clamps
Screws
Connectors

Indicate number of wires in the installation layout.

The three-phase motor 660/380 V is to be connected via fuses, ·utomatic contactors and motor protection switch.

The control circuit consisting of fuse, triple push button switch, control lamp, timer, automatic contactor coils as well as auxiliary contacts and therm. motor protection switch has to be installed as a separate circuit to the power (main) circuit.

All components are to be installed according to the given drawing and measurements.

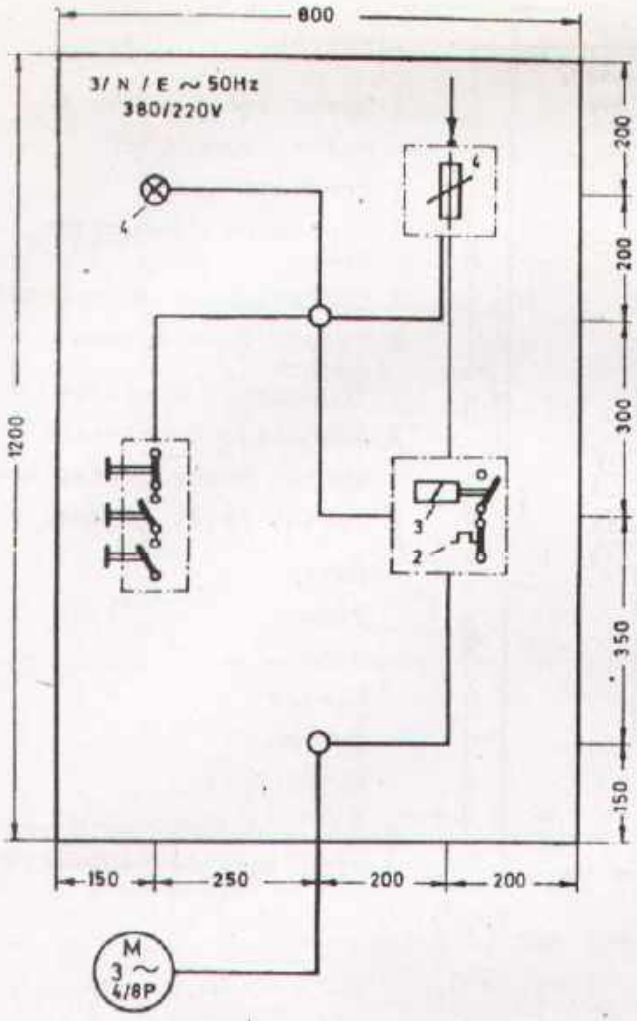
Take fuses suitable for your motor.

Adjust also therm. motor protection switch.

Give estimate for material.

CONNECT SUPPLY IN PRESENCE OF YOUR INSTRUCTOR.

Exercise sheet No. 4.5.3/17,18+19 may be used in addition	MOTOR CONNECTION, CONTACTOR STAR-DELTA REV.	EP 2.3/4.5.1/8 Installation III



MATERIAL:

1 Motor 3~ 380 V 4/8 P
4 Fuses (complete)
1 Junction Box
1 Appliance Connection Box
4 Control Lamps (complete)
1 Triple Push Button Switch (momentary contact)
3 Automatic Contactors
2 Therm. Motor Protection Switches (Overload Relay)

Cable
Pipe
Wire
Clamps
Screws
Connectors

Indicate number of wires in the installation layout.

The three-phase double speed motor 380 V is to be connected via fuses, automatic contactors and therm. motor protection switches.

The control circuit consisting of fuse, triple push button switch, control lamps, automatic contactor coils as well as auxiliary contacts and therm. motor protection switches has to be installed as a separate circuit to the power (main) circuit.

All components to be installed according to the given drawing and measurements.

Take fuses suitable for your motor.

Adjust also therm. motor protection switch.

Give estimate for material.

CONNECT SUPPLY IN PRESENCE OF YOUR INSTRUCTOR.

Exercise sheet No. 4.5.3/20.21+22 may be used in addition	MOTOR CONNECTION, CONTACTOR MULTI-SPEED	EP 2.3/4.5.1/9
		Installation III

SERVICING ELECTRICAL MOTORS

DISMANTLING ELECTRICAL MOTORS

REMOVAL OF BALL BEARINGS

INSTALLING OF BEARINGS (2)

REMOVAL OF BUSHES AND SLEEVE BEARINGS

CLEANING OF BALL BEARINGS / TRANSPORTATION

SKIMMING OF ARMATURE

ASSEMBLING OF ELECTRICAL MOTORS

TEST SHEET (MECHANICAL)

TEST SHEET (ELECTRICAL)

CHECK LIST

TYPES OF BEARINGS

TYPES OF LUBRICATION NIPPLES

OIL SEALS

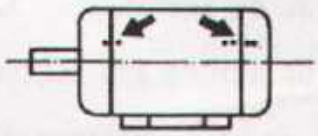
BEARINGS

PARTS OF ELECTRICAL MOTORS

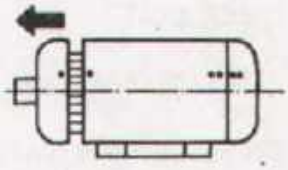
CONSTRUCTION TYPES OF ELECTRICAL MOTORS

SEQUENCE OF OPERATION

1. Place all motor parts in a box !
2. Work very carefully to avoid damage.
3. Place motor on a clean, level and solid surface, e.g. work bench, concrete floor. Do not open the motor on dirt floor for dirt and dust will enter the motor and cause damage.
4. Clean the outside to remove all dirt and grease with a dry rag, cloth, duster or a brush and some petrol or kerosene oil. DO NOT USE WATER.
5. Mark the exact position of both the ENDSHIELDS and the MOTOR FRAME with a sharp centre punch, scriber or a file. This will help maintain the true bearing alignment when reassembling the motor and prevent mixing up the parts.



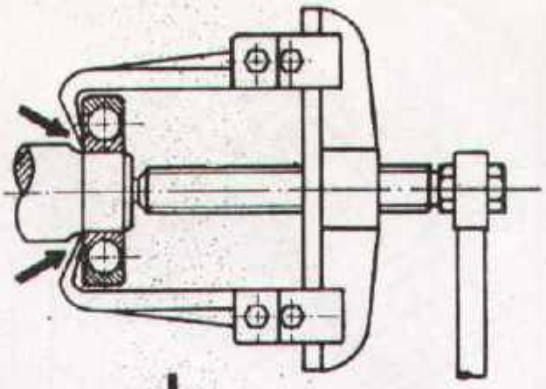
6. Take out carbon BRUSHES, if the motor has any, to avoid damaging them.
7. Open nuts or screws with the PROPER SPANNER, or correct size SCREWDRIVER. DO NOT USE PLIERS.
   If the screws or nuts are very tight, apply light hammer blows and soften with petrol or kerosene.
   ATTENTION: If the nuts or screws are firmly rusted the stud is likely to be twisted off.
8. Open ENDSHIELD on shaft extension side first. On the opposite side very often the motor lead wires are attached or the centrifugal switch is mounted. Be careful not to tear off the wires from the motor windings or damage the centrifugal switch.



9. Clean inside of the motor carefully with compressed air, rags etc. or a small paint brush with some petrol or kerosene oil. DO NOT USE WATER and do not use too much cleaning fluid directly on the windings as it may damage the insulation.

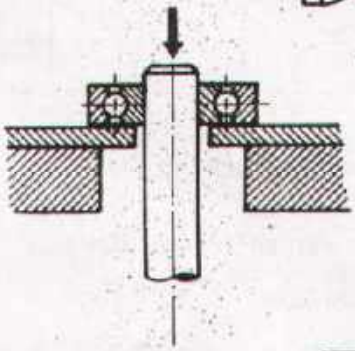
   The use of sharp edged tools, e.g. screwdriver, scraper, knives, inside the motor is NOT permitted. For scratching use small pieces of wood or plastic only.
10. Place all parts of the motor in one box. Do not mix parts from other motors or tools with it.
    If parts are not kept in a box they will get lost resulting in an irrepairable motor.

The ballbearing is removed from the shaft with a "puller".

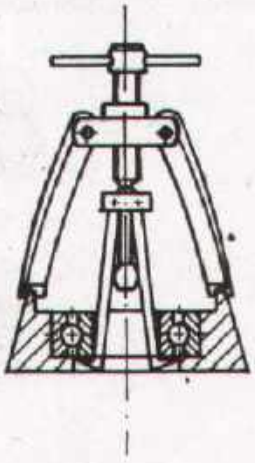


Note: It is very important that only the ring which sits on the shaft is pressed by the puller.

Two strips of flat iron across a vice may be used to remove the bearing. Drive out the shaft with light hammer blows using protective pieces such as wood, copper or aluminium on the shaft end in order to prevent damage to the shaft.

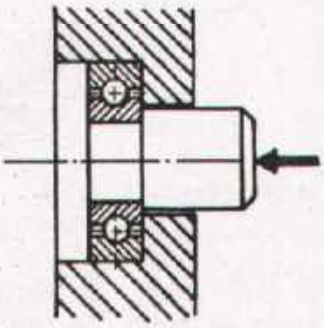


Puller for removing ballbearings from bores.

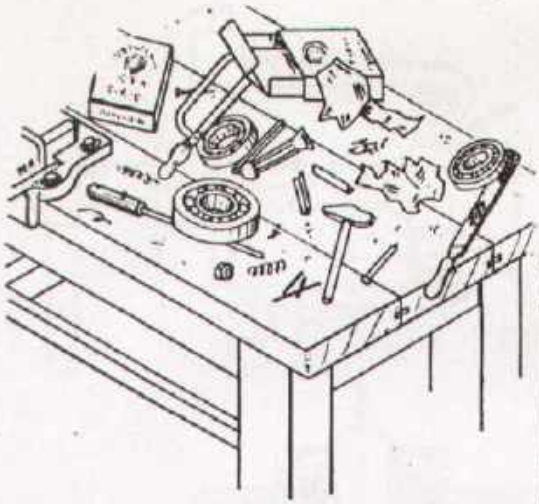


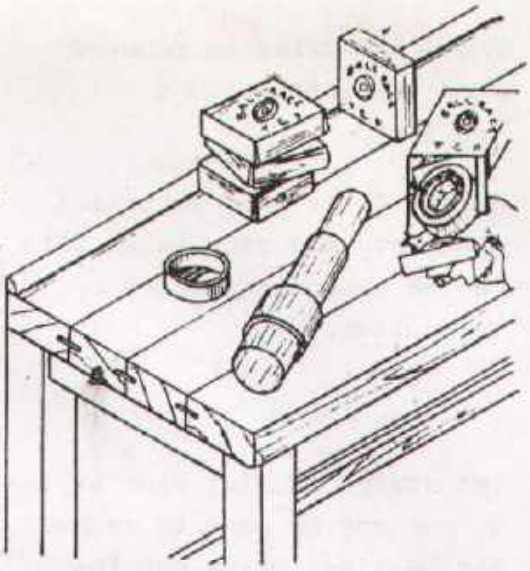
Careful hammerblows on a piece of soft material, alu, wood etc., may be used to drive the bearing out.

Avoid excessive pressure on the inside ring for it may damage the bearing.



	REMOVAL OF BALL BAERINGS	EP 2.3/4.5.6/2
		Serv. E.Motors





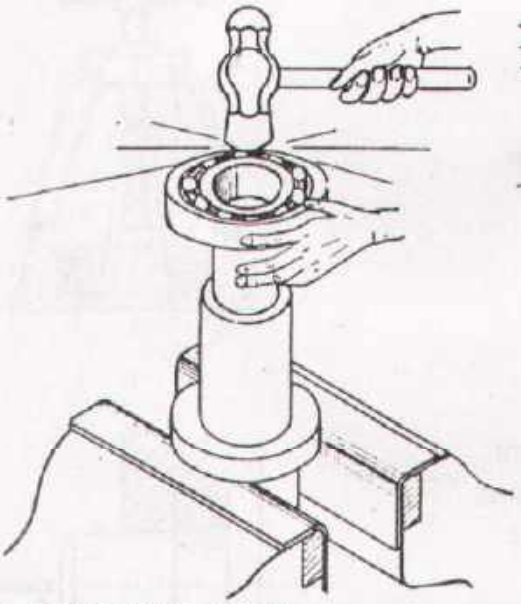
KEEP YOUR WORK-BENCH CLEAN.

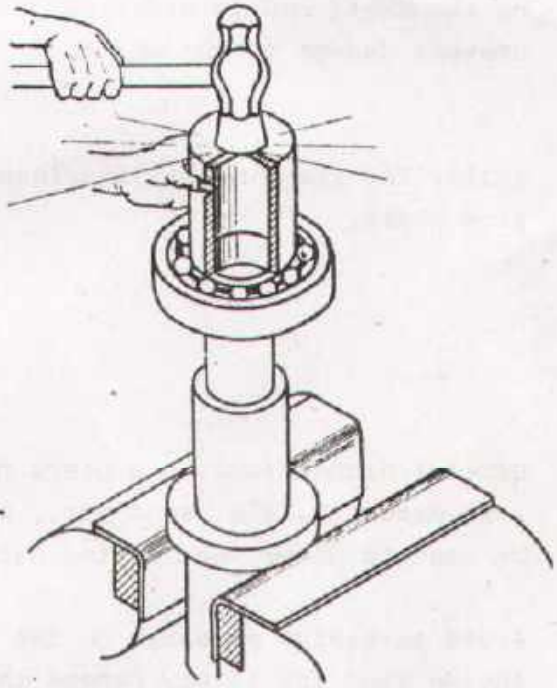
WRONG

PACKAGE SHOULD NOT BE OPENED AND NEW BEARING EXPOSED TO DIRT BEFORE BEING INSTALLED.

RIGHT

PACKAGE SHOULD BE KEPT CLEAN, AND BEARING SHOULD NOT BE REMOVED UNTIL NEEDED.





KEEP BEARINGS CLEAN

INSTALL BEARING PROPERLY

WRONG

BEARING SHOULD NOT BE DRIVEN ONTO SHAFT BY BLOWS ON OUTER CASE.

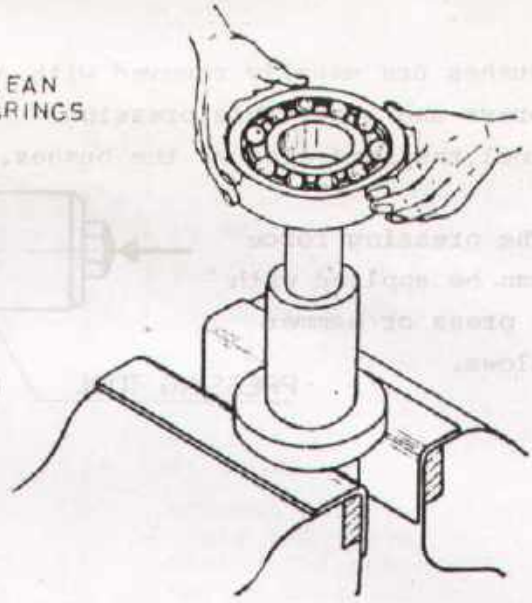
RIGHT

BEARING SHOULD BE LIGHTLY TAPPED ONTO SHAFT BY BLOWS ON TUBE WHICH FITS AGAINST INNER SLEEVE.

INSTALLING OF BEARINGS

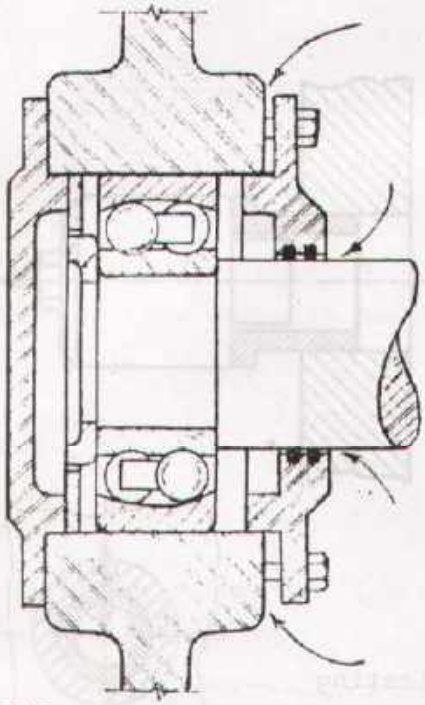
EP 2.3/4 5.6/3

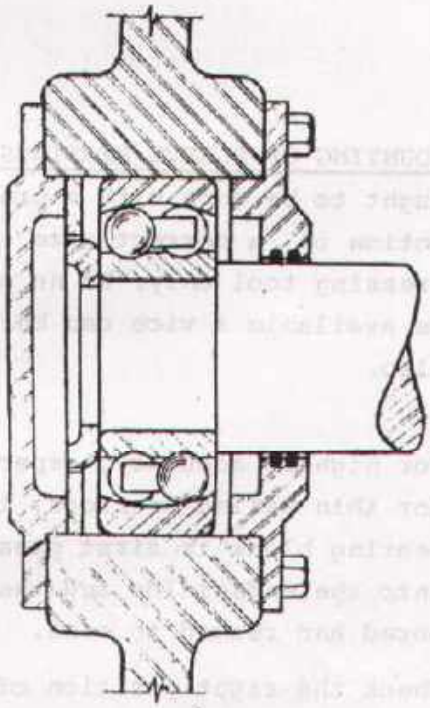
Serv. E. Motors



WRONG
THE OIL ON NEW BEARINGS MUST NOT BE REMOVED.

RIGHT
THE NEW BEARINGS SHOULD BE FITTED IMMEDIATELY AFTER ITS REMOVAL FROM THE PACKAGE.





WRONG
LOOSE COVER-PLATES PERMIT DIRT TO ENTER HOUSINGS, CAUSING RAPID BEARING FAILURE.

RIGHT
COVER-PLATES PROPERLY INSTALLED, PREVENTING THE ENTRANCE OF DIRT.

PROTECT OPERATING BEARINGS

INSTALLING OF BEARINGS

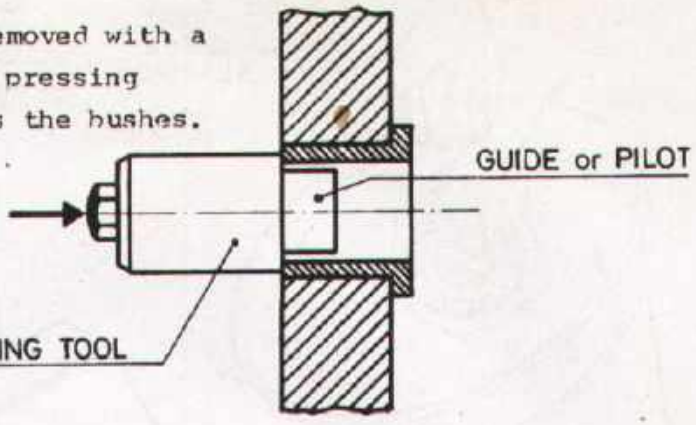
EP 2.3/4.5.6/4
Serv. E. Motors

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

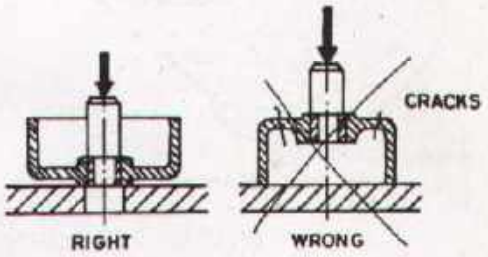
ELECTRICIAN GENERAL

Bushes are usually removed with a press and a suitable pressing tool, the same size as the bushes.

The pressing force can be applied with a press or hammer blows.

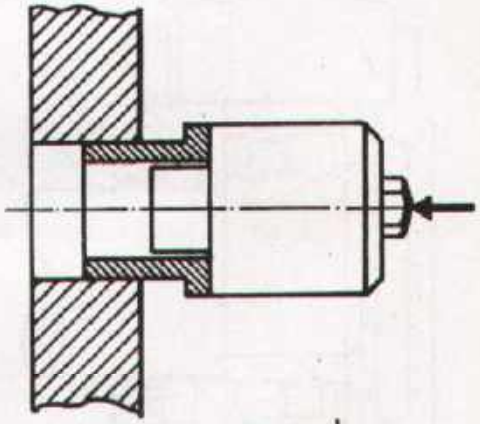


To press in and out bushes place endshields on firm support to avoid cracking or damage.



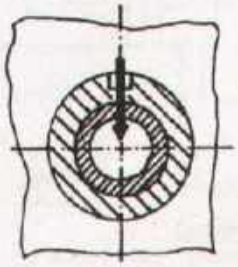
MOUNTING OF SLEEVE BEARINGS

ought to be done with a pressing motion of a correct size pressing tool only. If no press is available a vice can be used also.



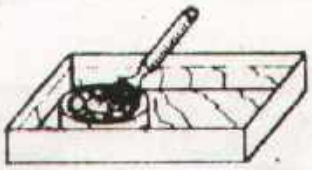
For highest accuracy, especially for thin walled bearings, the bearing blank is first pressed into the endshields and then bored and reamed to size.

Check the right position of the lubricating hole. If necessary drill the hole after assembling the bearing.

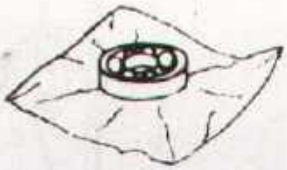


	REMOVAL OF BUSHES AND SLEEVE BEARINGS	EP 2.3/4.5.6/5
		Serv. E. Motors

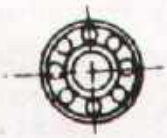
Cleaning a ball bearing (not applicable for new bearings)



Clean with brush and kerosene or petrol.



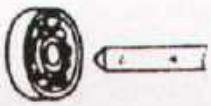
Dry with a clean cloth.



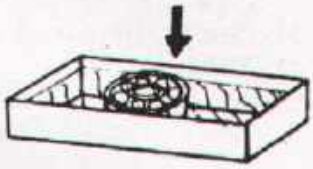
Check if clean.

Apply protective oil film and wrap in clean cloth or paper till further use.

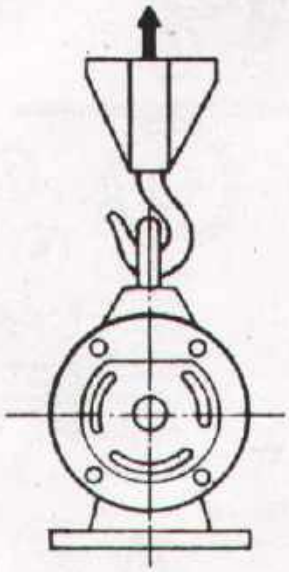
Check if clean.

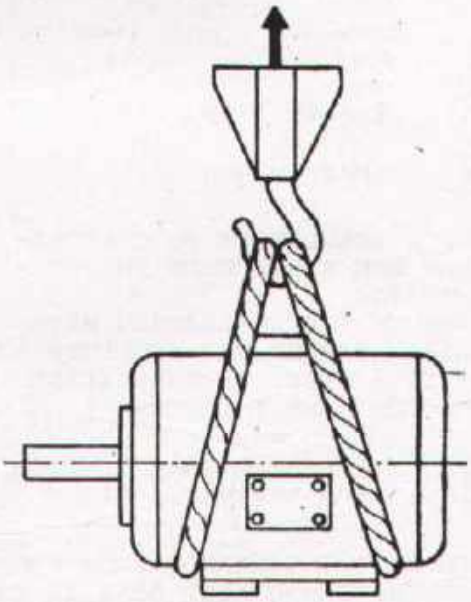


Dry with compressed air.



Rinse with fresh petrol or kerosene.





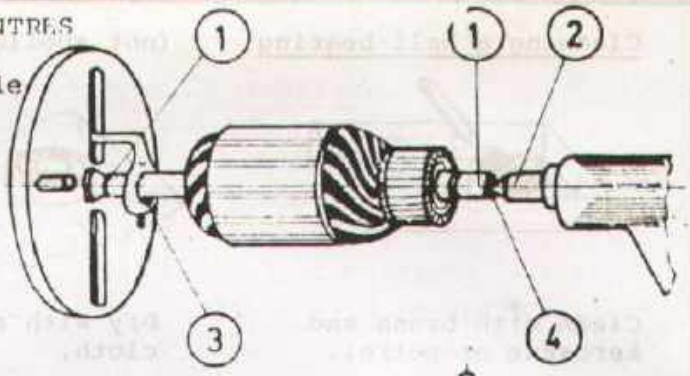
Transportation of heavy motors (lifting)

Attention: Prevent accidents.
Always secure load. Do not stand under lifted load.

	CLEANING OF BALL BEARINGS TRANSPORTATION	EP 2.3/4.56/6 Serv.El.Motors
	DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME	ELECTRICIAN GENERAL 75

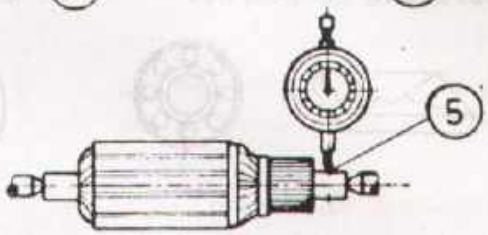
1) MOUNT ROTOR BETWEEN CENTRES

(1) shaft w. centre hole
(2) dead centre
(3) lathe dog
(4) lubricant



2) CHECK TRUENESS WITH DIAL INDICATOR

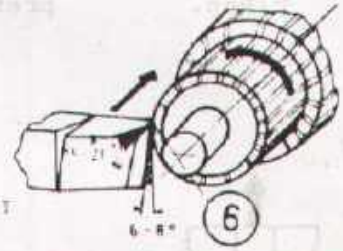
(5)



3) CAREFULLY TURN LIGHT CUT

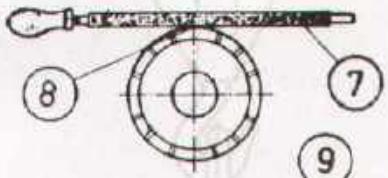
(6)

▽	= 35 m/min	115 ft/min
▽▽	= 30 m/min	165 ft/min
▽	= 0·3 – 0·5 mm/Rev.	0.012 – 0.020"
▽▽	= 0·05 – 0·1 mm/Rev.	0.002 – 0.004"



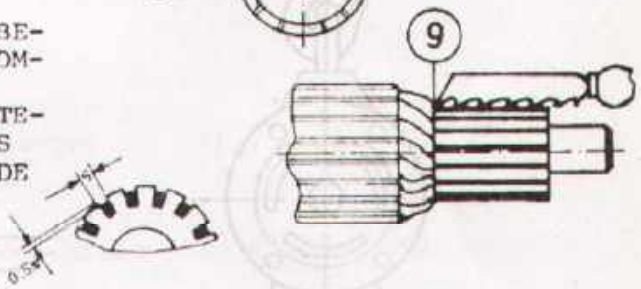
4) SMOOTHEN WITH EMERY SHEET AND REMOVE BURRS

(7) smooth file
(8) emery cloth



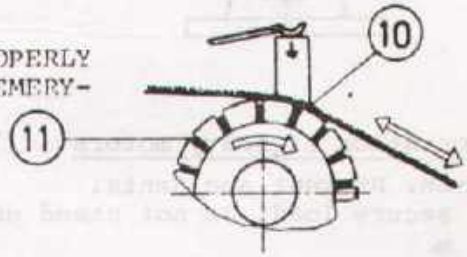
5) MICA INSULATION MUST BE BELOW THE SURFACE OF THE COMMUTATOR.
REMOVE THE INSULATING MATERIAL BETWEEN THE SEGMENTS WITH A SPEC. HACKSAW BLADE OF THE SAME THICKNESS !

(9) hacksaw blade
mind the winding!



6) TO SEAT THE CARBONBRUSH PROPERLY ON THE COMMUTATOR DRAW AN EMERY-SHEET BETWEEN BRUSH AND COMMUTATOR !

(10) emery cloth
(11) undercut mica



	SKIMMING OF ARMATURE	EP 2.3/4, 5.6/7 Serv.El.Motors

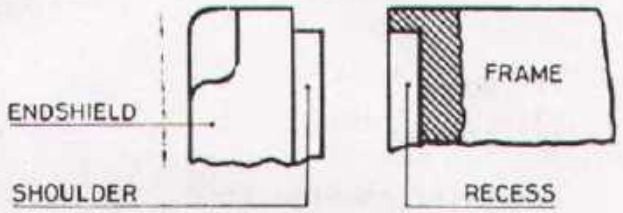
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

ELECTRICIAN GENERAL

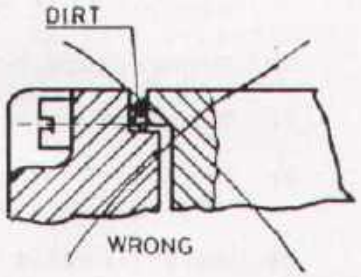
In general the assembling of an E-motor is in the reversed order of the disassembling sequence.

NOTE:

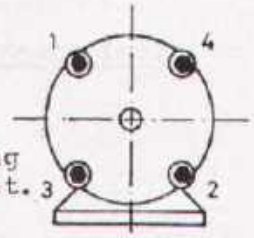
- Make sure that every part of the motor is clean and in good working order.
- Fit the centrifugal switch carefully, if any.
- Do not damage any motor windings.
- Apply grease to ballbearings only immediately before final assembling.
- The recess on the frame and the shoulder on the endshields MUST be clean and free from any deposit.



- Dirt will cause misalignment.



- Tighten bolts or nuts crosswise.
- Use wooden hammer to tap endshields with light hammer blows while turning the shaft to obtain maximum alignment.



QUALITY CONTROL

All serviced and repaired motors are to be checked thoroughly both mechanically and electrically.

ONLY MOTORS IN PERFECT CONDITION ARE TO BE RELEASED!

Checklist: (mechanical)

		correct	tight too low (small)	loose too high (big)
1)	Noise	☐	☐	☐
2)	End play	☐	☐	☐
3)	Rotor running free	☐	☐	☐
4)	Bearing fits	☐	☐	☐
5)	Lubrication, grease nipples, oil supply	☐	☐	☐
6)	Temperature bearings	☐	☐	☐
7)	Temperature motor frame	☐	☐ (fair)	☐ (unusable)
8)	Condition of shaft, key way, pulley, bearing seals	☐	☐	☐
9)	Bolts, nuts tightened	☐	☐	☐
10)	Test run 30 min.	☐	☐	☐

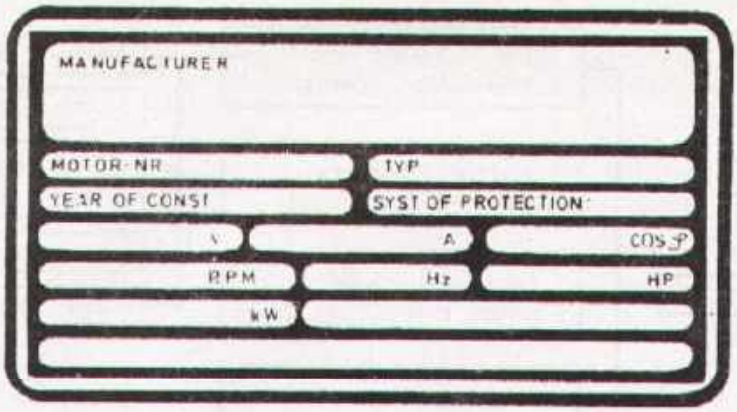
Final remarks:

Signature/Date

QUALITY CONTROL

All serviced and repaired motors are to be checked thoroughly both mechanically and electrically.

ONLY MOTORS IN PERFECT CONDITION ARE TO BE RELEASED !



Type of motor: A.C. D.C. single phase polyphase

Checklist (electrical)

1) Fill in above type plate:

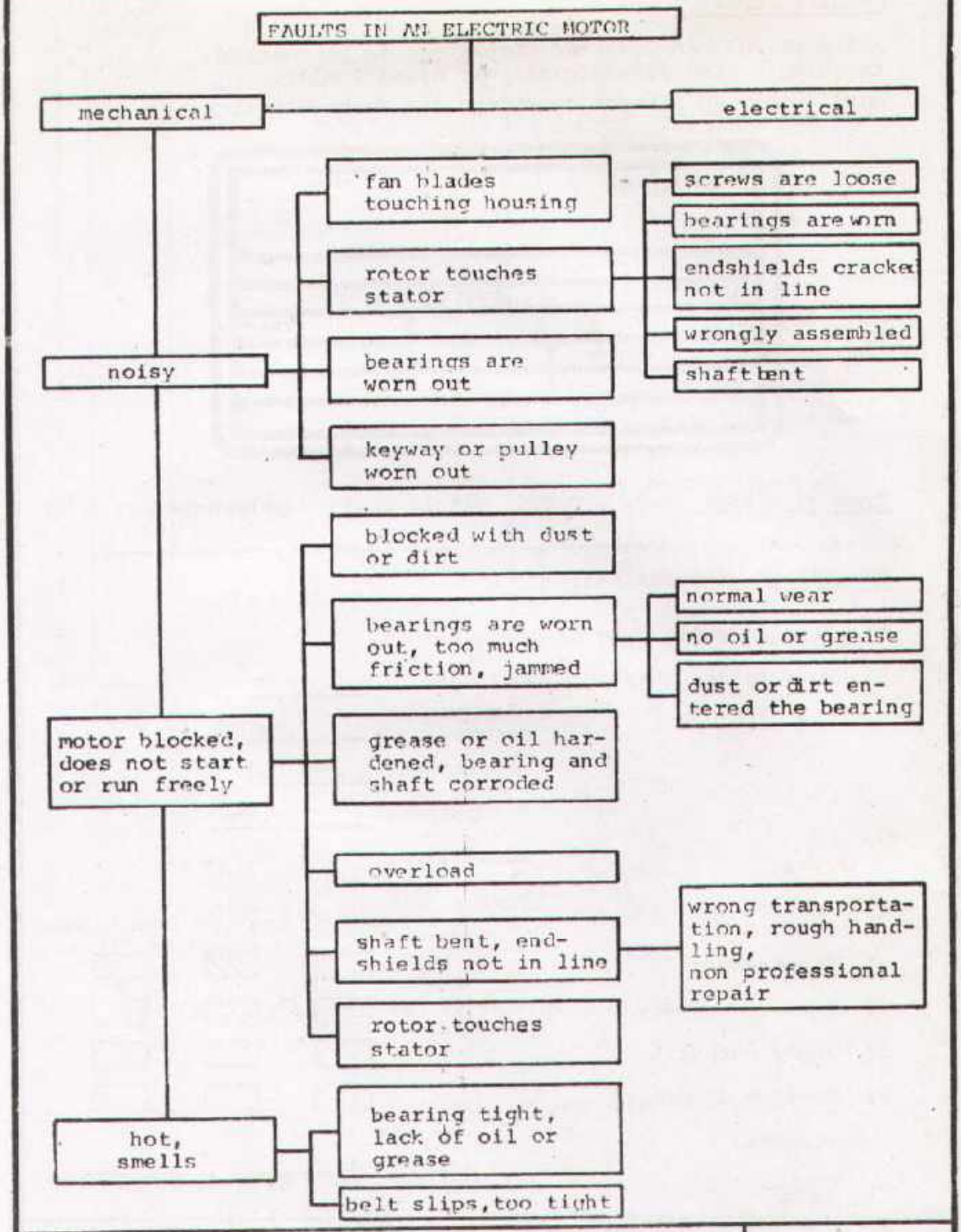
2) Measure and check:
- Voltage: _____ V
- Current _____ A
- Resistance: _____ Ω
- Revolution: _____ RPM
- Insulation:
- Earth:

	good	too low	too high
3) Temperature:	☐	▨	☐
4) Noise:	☐	▨	☐
5) Power output:	☐	☐	☐
6) Testrun 30 min.:	☐	☐	☐

Remarks:

_____ _____
Signature / Date

	TEST SHEET (ELECTRICAL)	EP 2.3/4.5.6/10 Serv.El.Motors



CHECKLIST

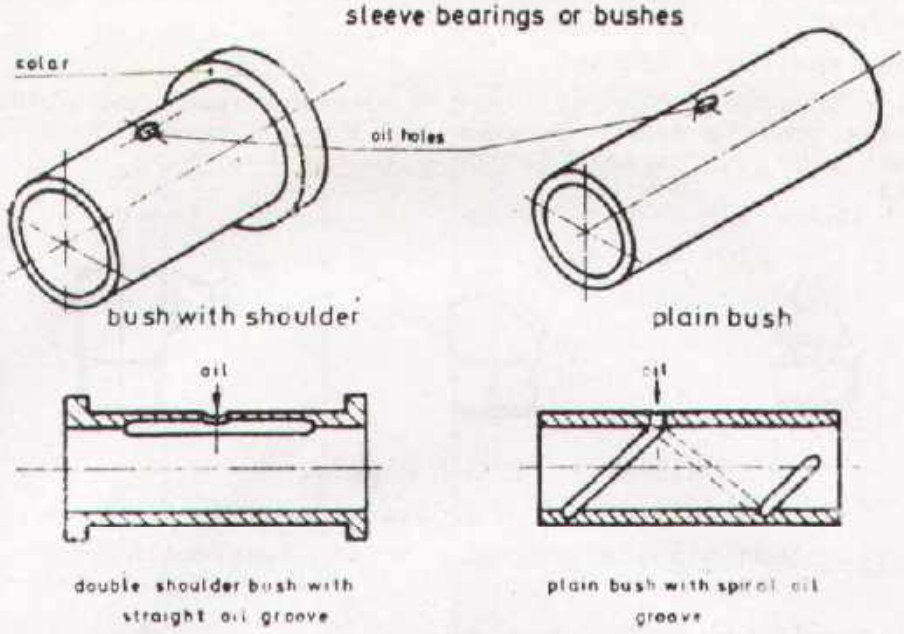
EP 2.3/4.5.6/11
Serv.El.Motors

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

ELECTRICIAN
GENERAL

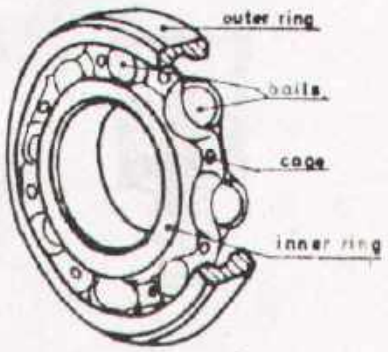
sleeve bearings or bushes



SLEEVE BEARINGS or BUSHES are turned from brass, gun metal bronze or special bearing metals. Sleeve bearing motors are usually oil lubricated and are generally used in horizontal position.

"OIL LESS" bushes are considered as permanently lubricated. In this arrangement the shaft passes through a sintered (powdered metal which is pressed and baked in an oven) bushing which has been impregnated with oil. No lubrication is needed. Used in fans etc.

ball bearing



BALL BEARINGS are manufactured from special steel and are precisely machined and ultra precisely ground. The balls and the actual running faces are highly polished.

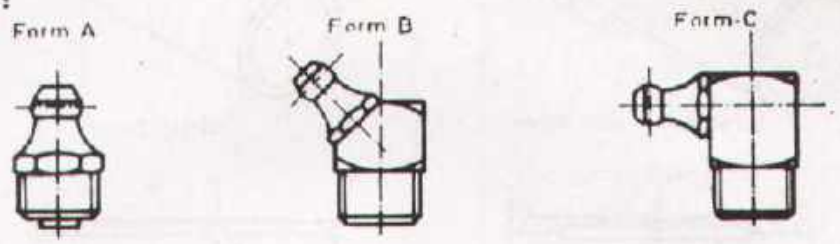
SEALED BEARINGS contain lifetime lubrication and should not be opened.

LUBRICATION OF ELECTRIC MOTORS

Moving parts need to be lubricated to reduce friction which causes heat.

Heat may spoil the bearing.

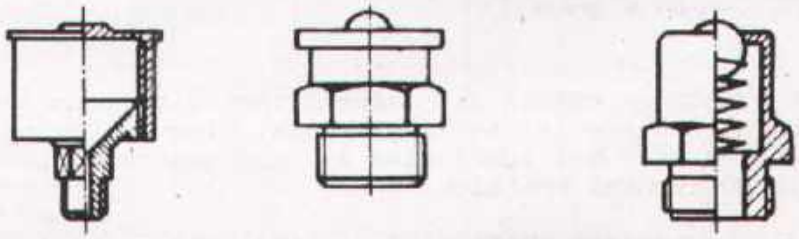
Bearings in electric motors need a constant supply of clean oil or grease. The lubricant is supplied through specially designed oil supply holes commonly fitted with the following oil or grease nipples:



ball-valve grease nipples

To be served with a grease gun only.

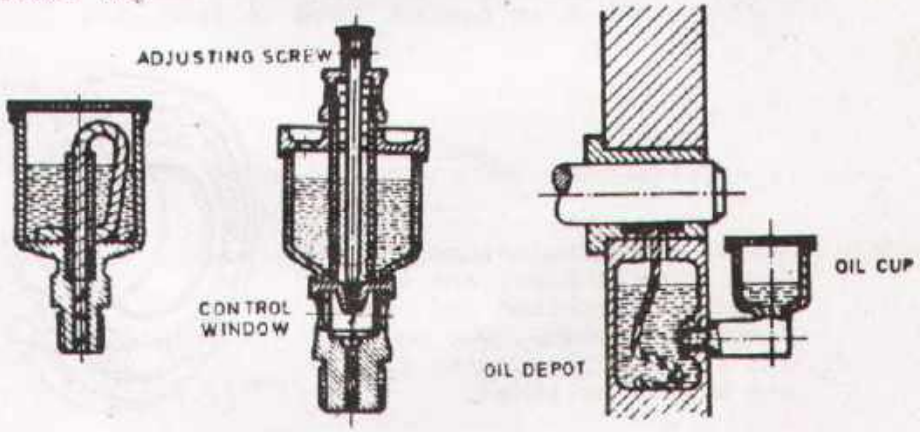
NOTE: clean nipples carefully before lubricating.



stauffer type grease cup

oil nipple

oil nipple



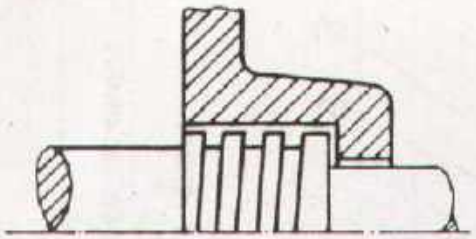
wick oiler (lubricater)

sight feed lubricator

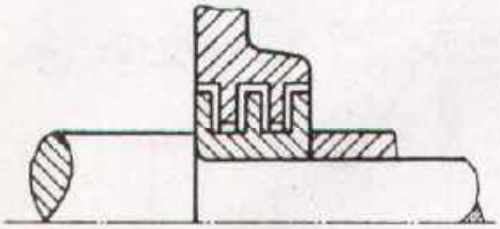
wick oiler (lubricator)

	TYPES OF LUBRICATION NIPPLES	EP 2.3/4.5.6/13 Serv.El.Motors
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL 82

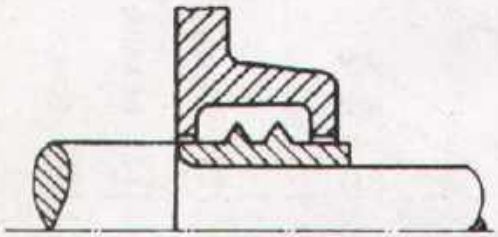
NON CONTACTING OIL SEAL



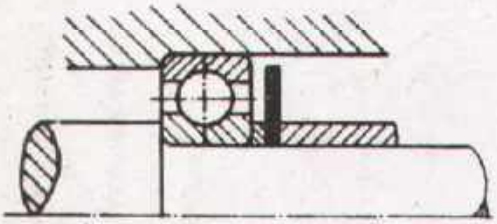
CONVEYOR SPIRAL



LABYRINTH BOX

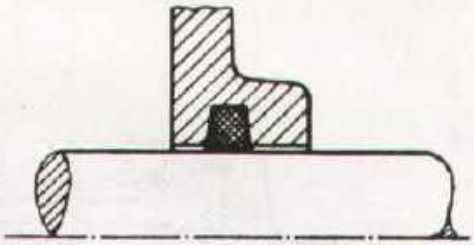


OIL THROWER

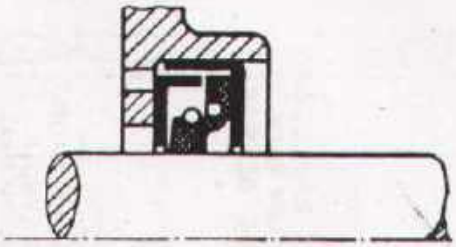


RETAINING RING

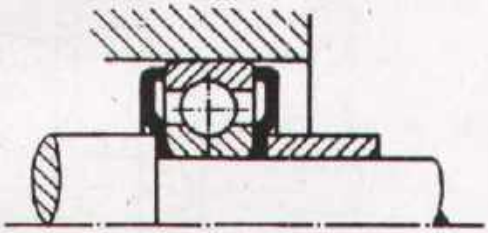
CONTACTING OIL SEAL



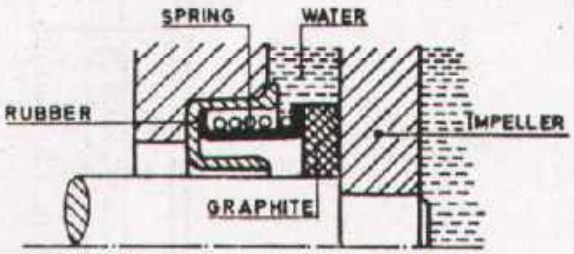
FELT RING SEAL



ELASTIC OIL SEAL



SEALED BALL BEARING



WATER PUMP SEAL

	ELECTRIC MOTORS OIL SEALS	EP 2.3/4.5.6/14 Serv.El.Motors
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL 83

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

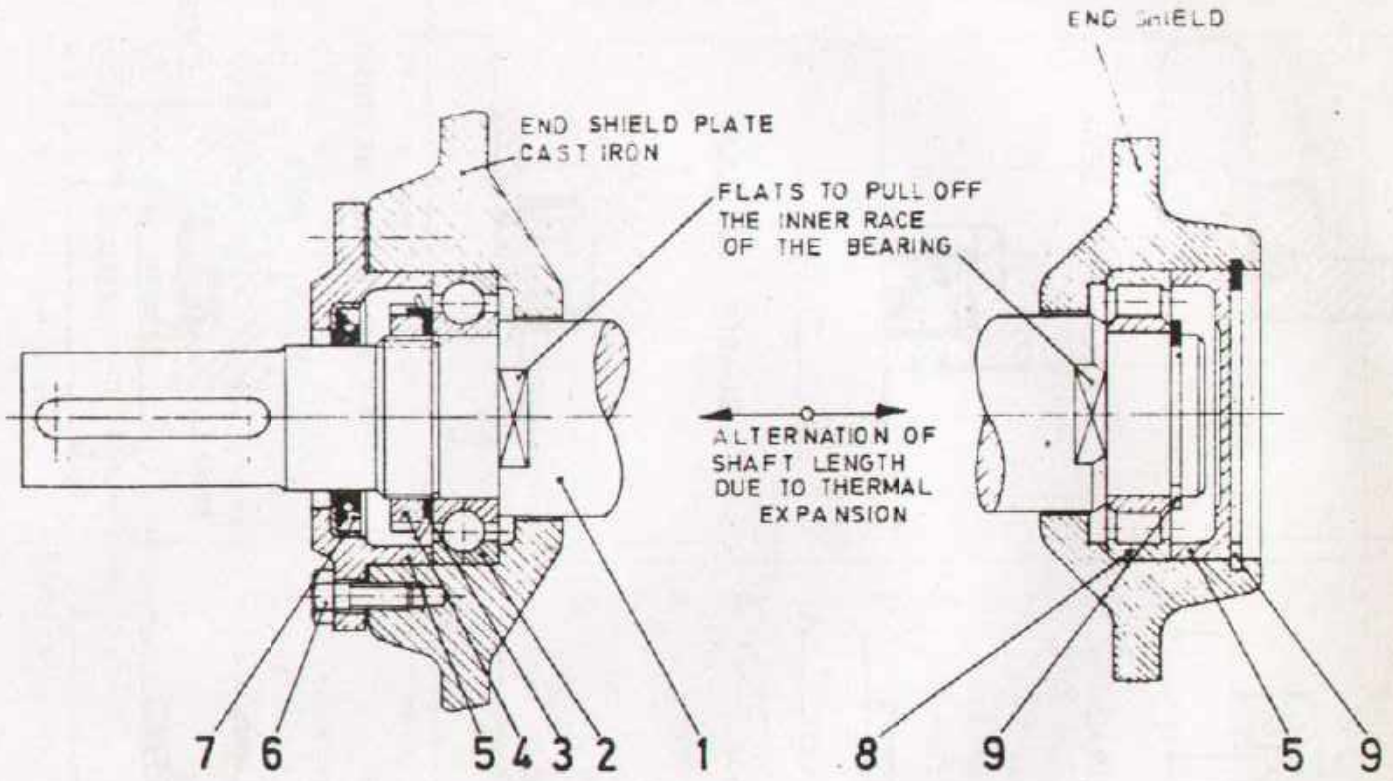
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

ELECTRICIAN GENERAL

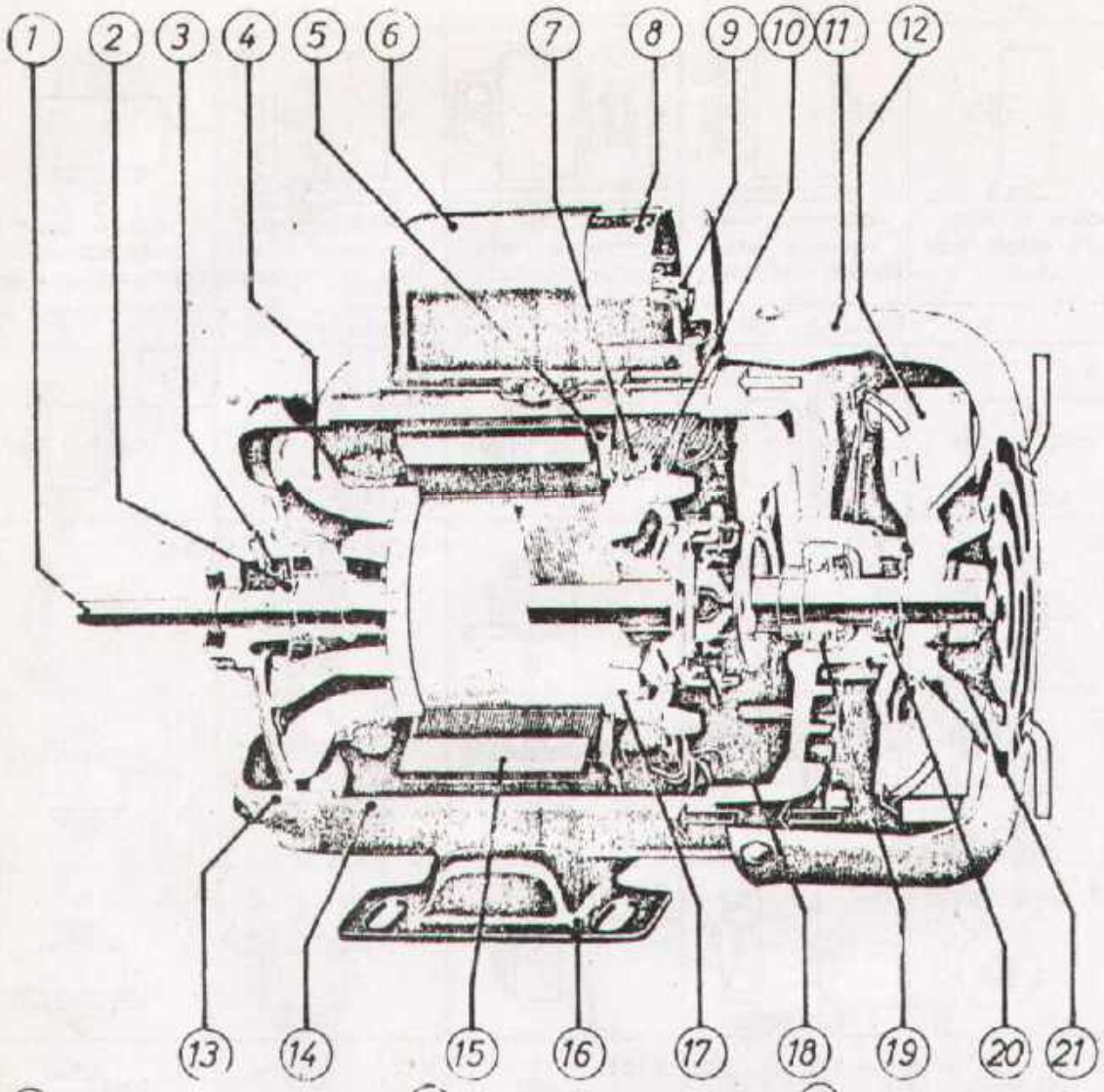
BEARINGS

EP 2.3/4.5.6/15

Serv. E. Motors



(1) SHAFT	(4) GROOVED NUT	(7) SEAL - FELT / FIBRE
(2) BALL BEARING	(5) BEARING COVER	(8) CYL. ROLLER BEARINGS
(3) LOCK WASHER	(6) COVER BOLT	(9) LOCK RING



(1) _____	(8) _____	(15) _____
(2) _____	(9) _____	(16) _____
(3) _____	(10) _____	(17) _____
(4) _____	(11) _____	(18) _____
(5) _____	(12) _____	(19) _____
(6) _____	(13) _____	(20) _____
(7) _____	(14) _____	(21) _____

PARTS OF ELECTRIC-MOTOR

EP 2.3/4.5.6/16
Serv.El.Motors

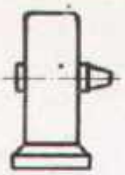
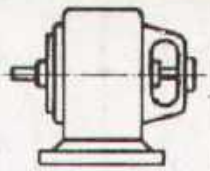
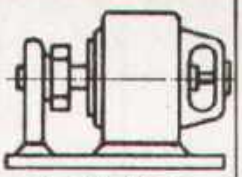
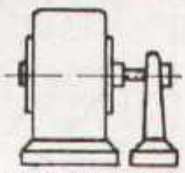
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK GERMAN TECHNICAL TRAINING PROGRAMME

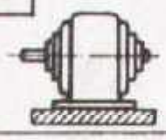
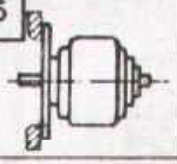
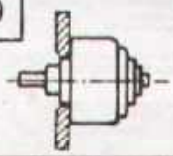
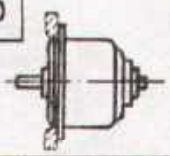
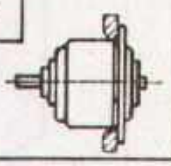
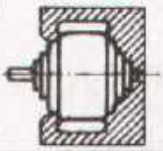
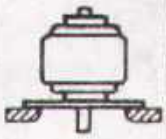
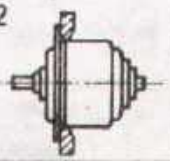
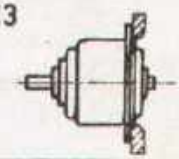
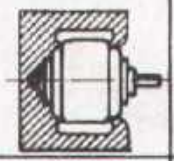
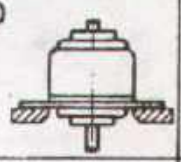
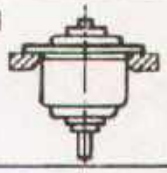
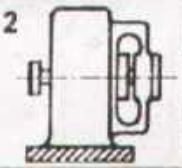
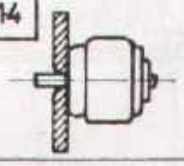
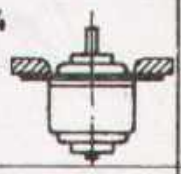
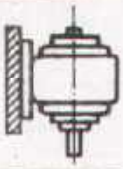
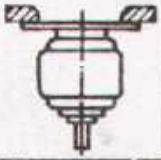
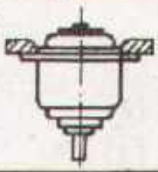
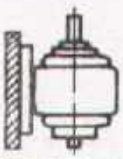
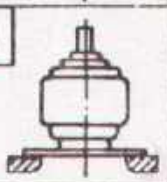
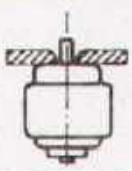
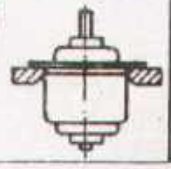
ELECTRICIAN
GENERAL

THE VARIOUS TYPES OF CONSTRUCTION ARE DISTINGUISHED BY SYMBOLS, LETTER AND NUMBER.

CLASS

A	B	C	D	V
				
MACHINE WITHOUT SHAFT, FRAME WITH LEGS.	HORIZONTAL-SHAFT MACHINES WITH ENDSHIELD-BEARINGS.	AS "B" BUT ADDITIONAL WITH PEDESTAL-BEARINGS.	HORIZONTAL-SHAFT MACHINES WITH PEDESTAL-BEARINGS.	VERTICAL-SHAFT MACHINES WITH GUIDE & RADIAL BEAR.

EXAMPLES OF THE MOST IMPORTENT MOTOR FORMS

B 3 	B5 	B9 	B10 	B11 
B 6 	V 1 	V 8 	V12 	V13 
B 7 	V 3 	V 9 	V10 	V11 
B 8 	B 2 	B 14 	V14 	V15 
V 5 	V 4 	V 18 	V 12 	V 13 
V 6 	V 2 	V 19 	V 16 	V 17 

EXAMPLE:
B 3 MOTOR WITH 2 ENDSHIELD BEARINGS, FRAME WITH LEGS, FREE SHAFT END - FREE SHAFT END SUITABLE FOR THE ATTACHMENT OF A PULLEY, PINION OR COUPLING. MOUNTING ON FOUNDATION, ETC.

CONSTRUCTION TYPES OF ELECTRICAL MACHINES

EP 2.3/4. 5.6/17

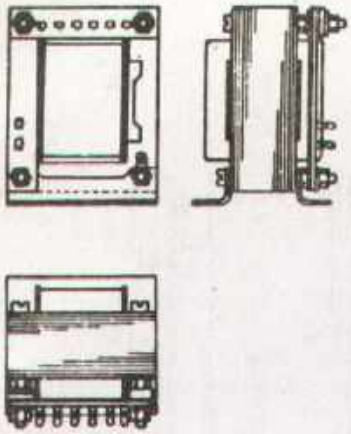
Serv. E. Motors

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

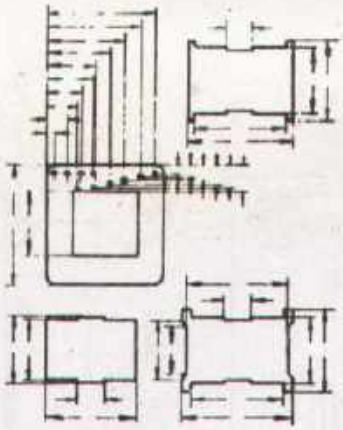
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

ELECTRICIAN GENERAL

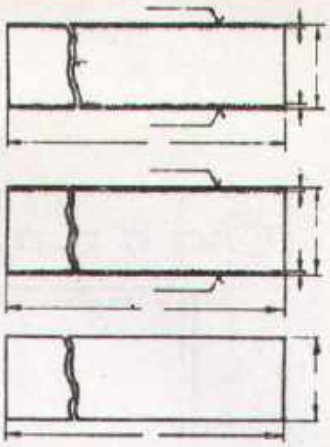
86



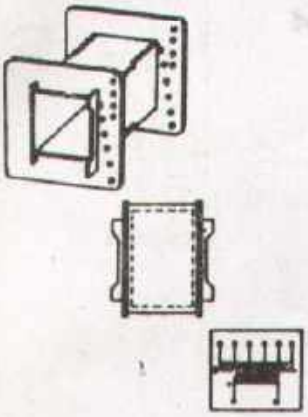
1 ASSEMBLY



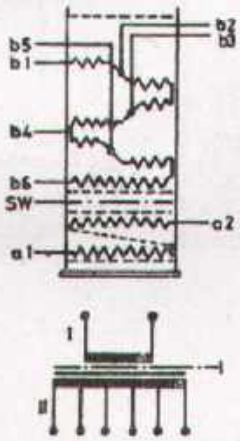
2 SPOOL-PARTS



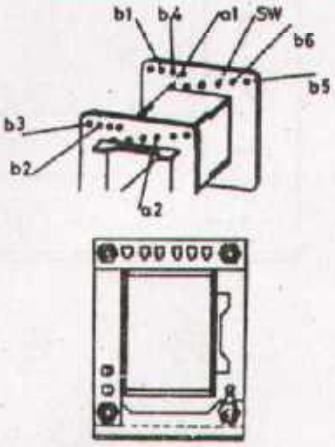
3 PAPER INSULATION



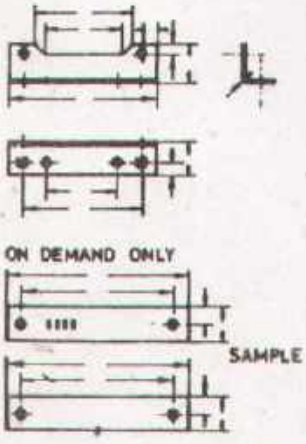
4 SPOOL ASSEMBLY



5 WINDINGS



6 CONNECTIONS



7 LEGS/TERMINALS

The course "Repair of Windings" should actually consist of motor and transformer repairs as the need may arise for the Training Centre. In case no such work is available timely, the transformer shown on this layout is to be made. The following main skills are trained in this exercise :

1) preparing spool body out of laminated paper
2) cutting insulation paper for different layers
3) winding coils, tapped and with different wire diameters
4) packing of iron core
5) fixing and connecting terminal plate
6) testing insulation and function

Parallel to the practical work all necessary informations (incl. calculations) are given in the theory lessons.

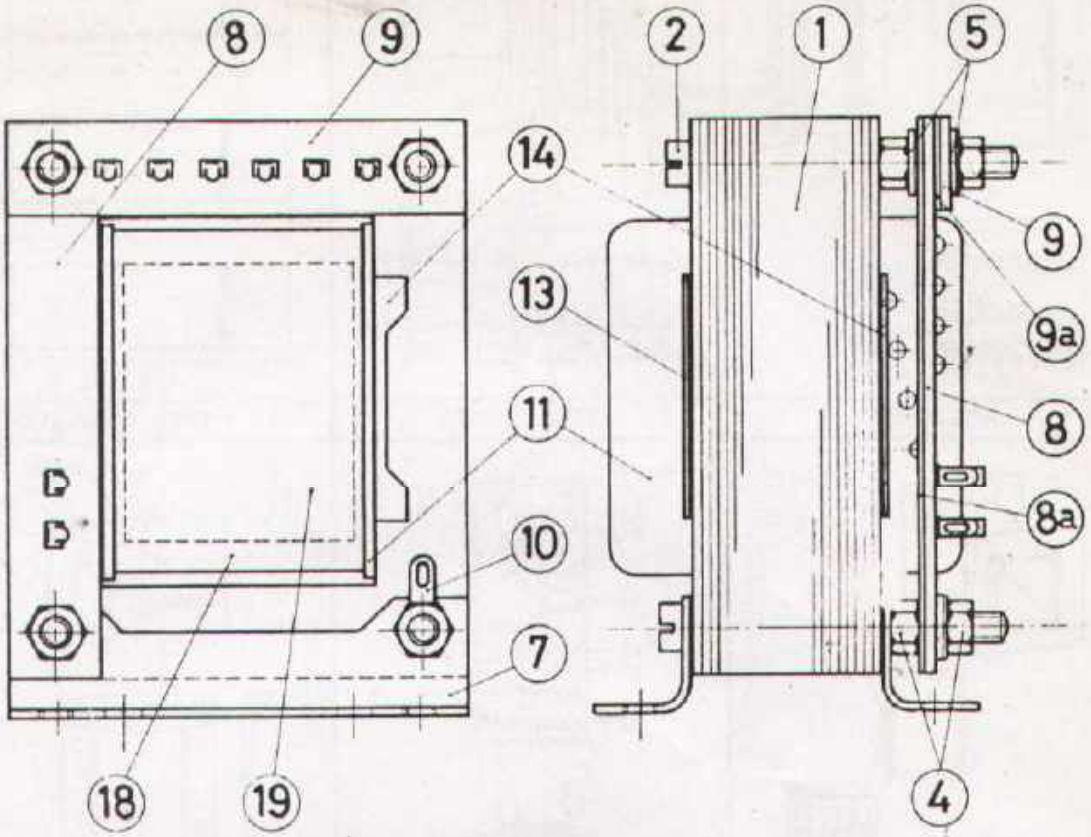
LAYOUT

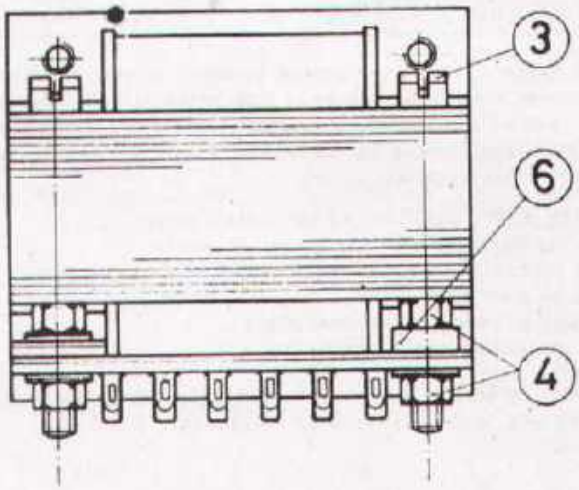
EP 2.1/4.5.5/
Repair of Winding

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

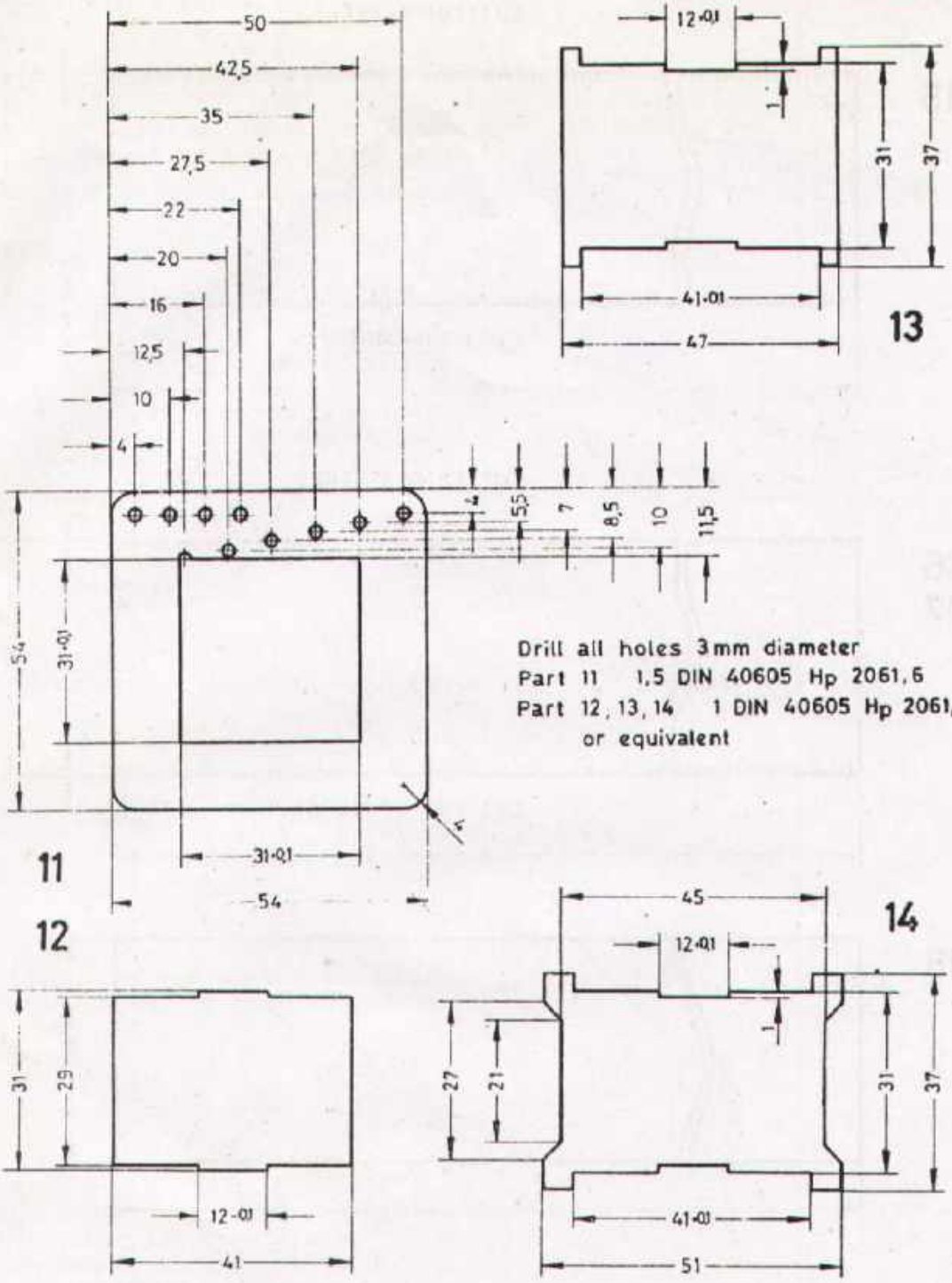
ELECTRICIAN GENERAL





SCALE 1:1	TRANSFORMER-ASSEMBLY	EP 2.3/4.5.5/1 Repair of Winding
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL 38

Tolerance ± 0,1
unless otherwise stated

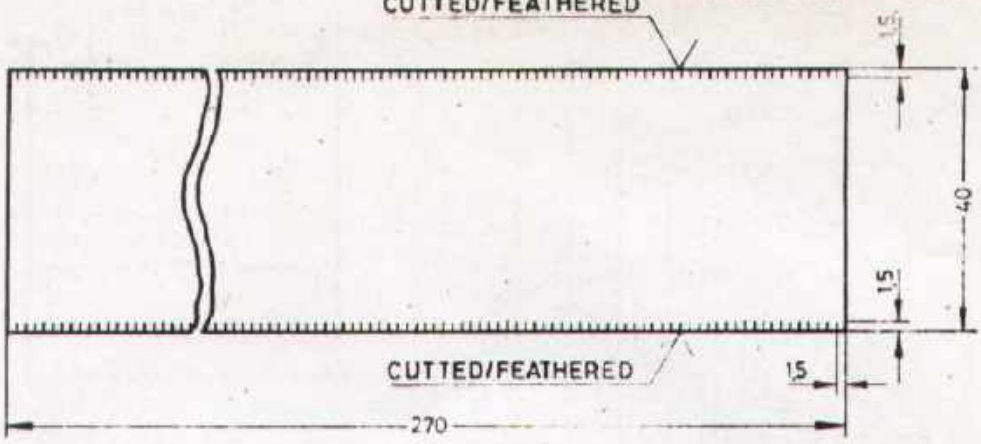


Drill all holes 3mm diameter
Part 11 1,5 DIN 40605 Hp 2061,6
Part 12, 13, 14 1 DIN 40605 Hp 2061,6
or equivalent

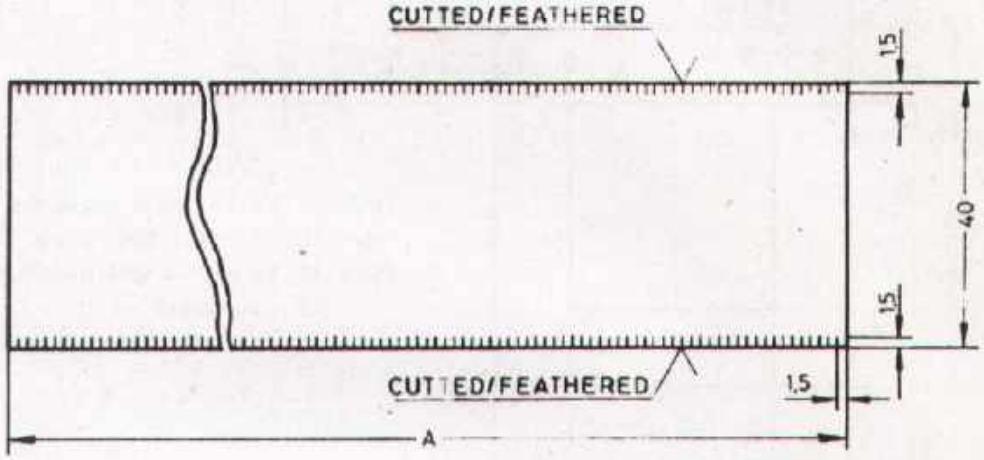
SCALE 1:1	TRANSFORMER,SPOOL PARTS	EP 2.3/4.5.5/2 Repair of Winding
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL 89

Tolerance ± 0,2
unless otherwise stated

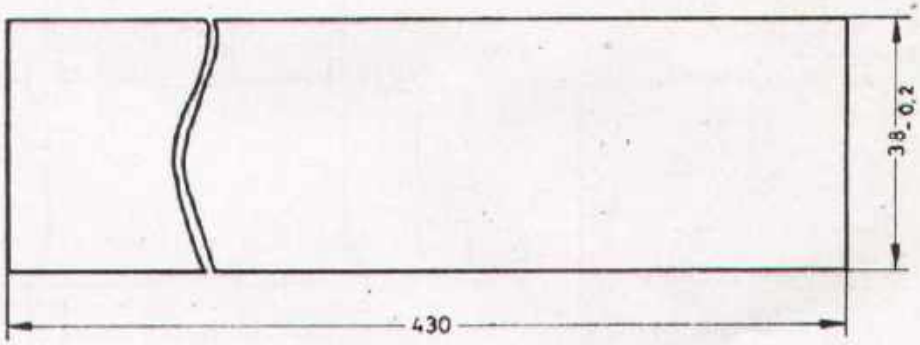
15



16
17

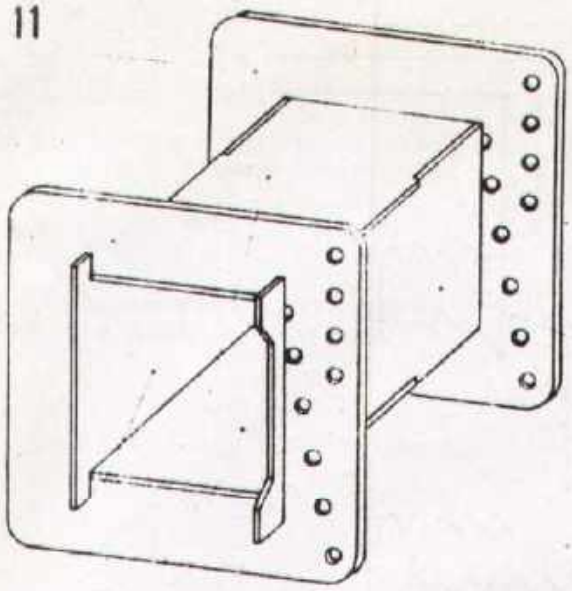


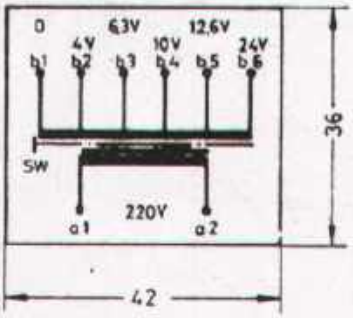
18



PART 16 MEASUREMENT "A" = 330 MATERIAL: Bd 0,06 DIN 40622 Lp
17 "A" = 350 or EQUIVALENT

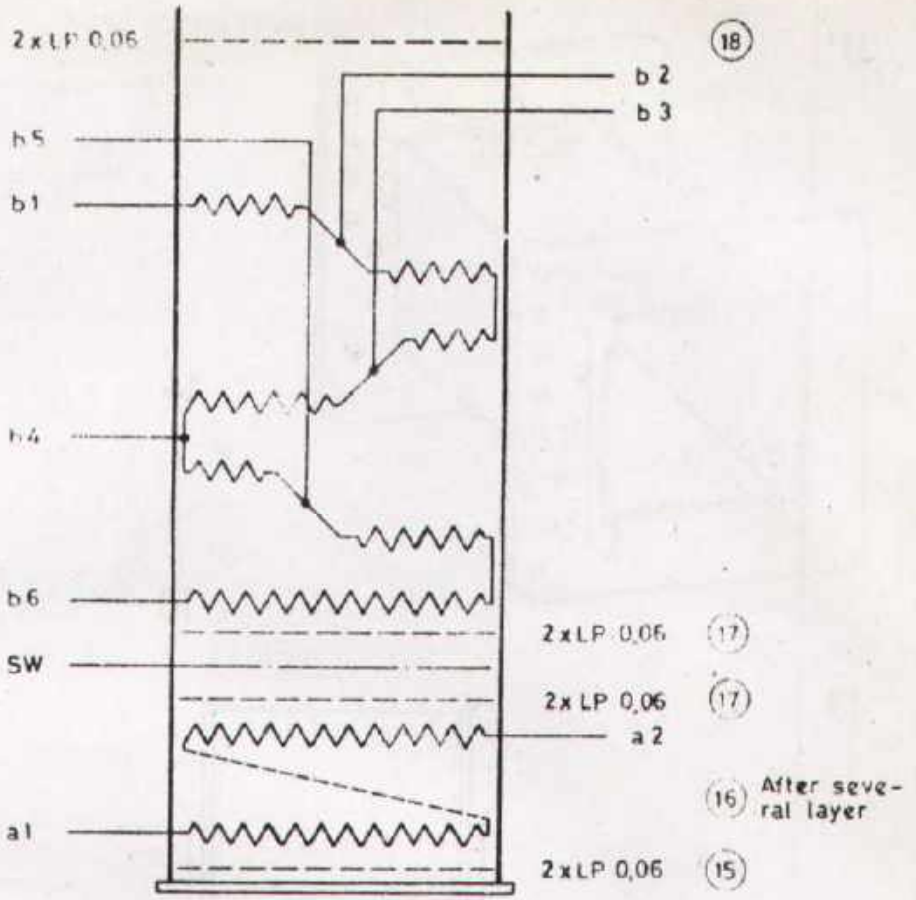
SCALE 1 :	TRANSFORMER PAPER INSULATIONS	EP 2.3/4 55/3 Repair of Winding
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL 9a





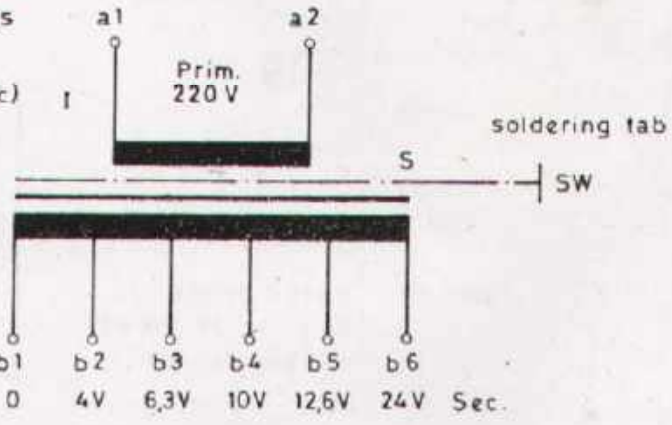
PART 19 PAPER, WHITE
80 gr / m² 86 DIN 827
OR EQUIVALENT

SCALE 1:1	TRANSFORMER SPOOL ASSEMBLY	EP 2.3/4.5.5/4 Repair of Winding
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL 91



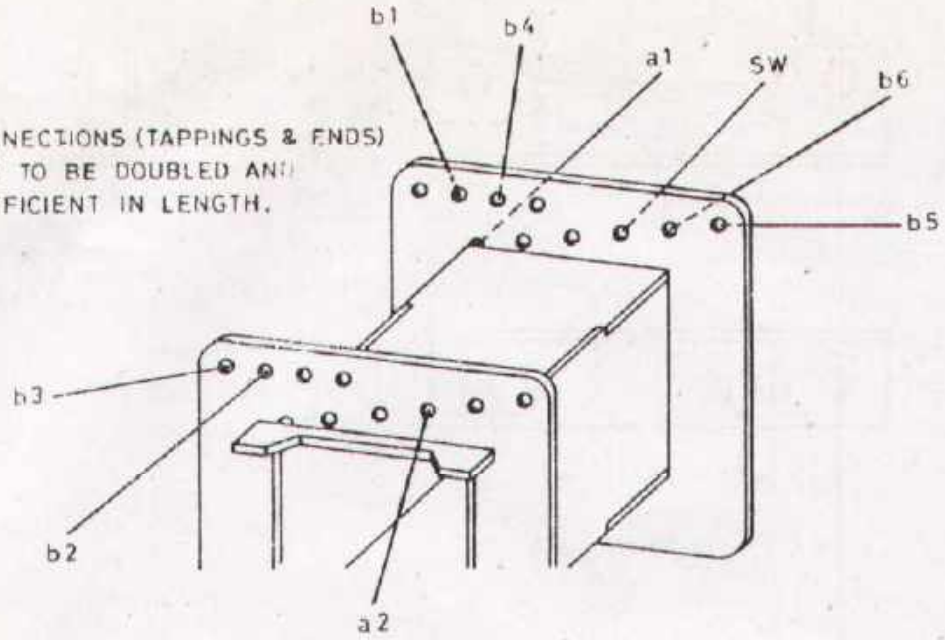
Mark the winding-tappings and ends properly

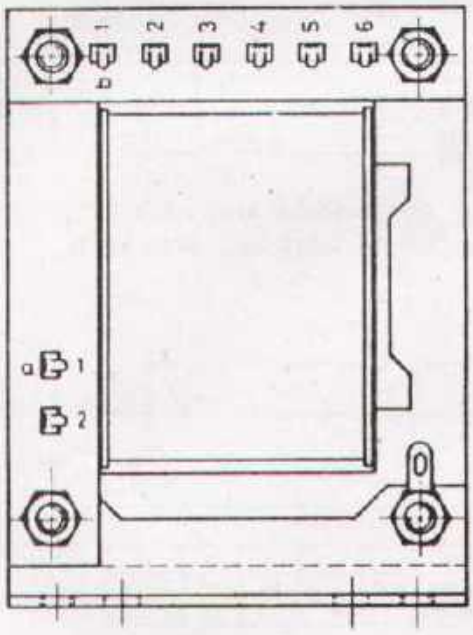
(diff. colours, numbers etc)



	TRANSFORMER WINDINGS	EP 2.3/4. 5.5/5 Repair of Winding
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		ELECTRICIAN GENERAL 92

CONNECTIONS (TAPPINGS & ENDS) ARE TO BE DOUBLED AND SUFFICIENT IN LENGTH.





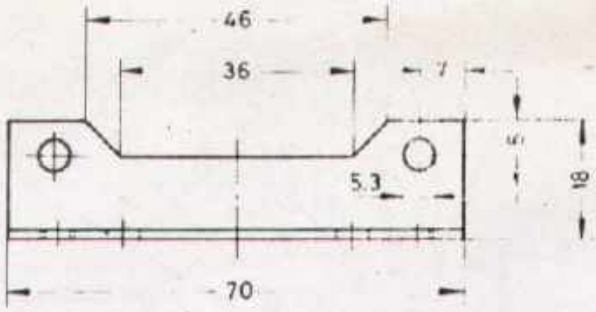
TRANSFORMER CONNECTIONS

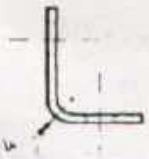
EP 2.3/4.5.5/6

Repair of Winding

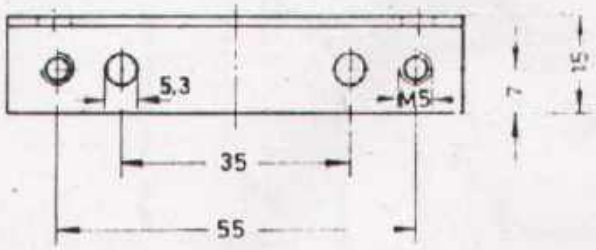
Tolerance ± 0,1
unless otherwise stated

7



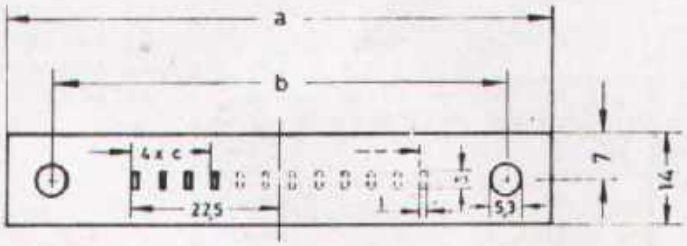


Thickness 1,5
or SWG ~16

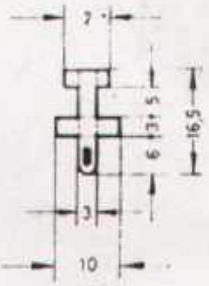


ON DEMAND ONLY

8
9



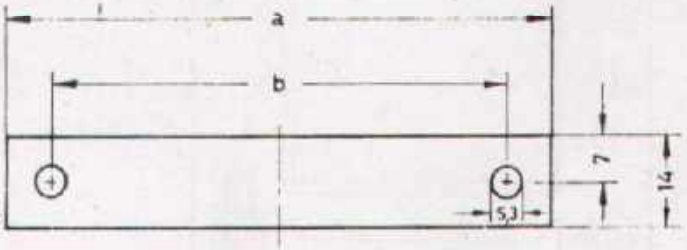
2mm thick



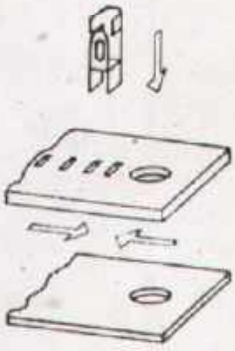
SOLDERING TAB

SAMPLE, IF NOT READY-MADE AVAILABLE. SIZE OF SLOTS DEPENDENT ON MATERIAL AVAILABLE.

8a
9a



1mm thick



No.	DENOMINATION	a	b	c
	LONG TERMINAL PLATE	84	70	3 x 4
	SHORT TERMINAL PLATE	70	56	11 x 4

SCALE 1 : 1	TRANSFORMER LEGS & TERMINALS	EP 2.3/4.5.5/7 Repair of Winding

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

ELECTRICIAN GENERAL