GOVERNMENT POLYTECHNIC KENDRAPARA

LECTURES NOTE

TESTING AND MAINTENANCE OF ELECTRICAL MACHINE

6th Sem Electrical

Prepared By
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CHAPTER - 1

(1) → Installation, Commissioning and Testing of Machine.

Inspection of Arrival of Machine and Inspection procedure before its Installation :-

→ Inspection is the examination of certain machine may be motors or generators or their parts to inspect bore their damage or missing.

→ The main aim of the inspection is to check that machine received is in good condition.

→ This inspection work should be carried out by some competent persons who have got through knowledge Regarding the Inspection of particular machine.

What to inspect and how to inspect.

JANUARY • WEDNESDAY

05

JANUARY - 2022

M	T	W	T	F	S	S
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3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

WK 02 (005-360)

following procedure :-

9 am

→ The wooden crates containing motor should be unloaded by using cranes, sliding the motor down an inclinded blank, using pipe are barg

11 am

should be avoided.

→ 12 noon Handling of electrical Machine (motor)

1 pm Motor should be handeled be-carefully to increase life and service of the motors.

2 pm

Following precautions should be followed during

3 pm Handeling :-

4 pm

Always using lifting hook to lift the motor

5 pm

except in very small frame, where no lifting

6 pm

hook is provided.

7 pm

→ Don't use any other part of the motor for lifting purposes.

→ Don't use shaft projection for dragging the motor.

→ 2022 Don't roll or drag the motor on floor.

FEBRUARY - 2022

M	T	W	T	F	S	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28						

THURSDAY • JANUARY

06

WK 02 (006-359)

Procedure for inspection of an Electrical Motor

9 am Before its installation :-

10 am → The inspection of motor should be carried out as follows.

11 am

(1) External inspection of motor for conditions

12 noon

(2) inspection of terminals by opening the terminal lid.

1 pm

(3) Blowing of motor with clean, dry air to

2 pm remove dust.

3 pm (4) Checking of the rotor for easy rotation when

4 pm turned by hand.

5 pm (5) Rectification of defects observed during inspection.

6 pm (6) Particular attention should be given towards

7 pm antifriction bearings of the motor.

(7) Insulation Resistance are tested between winding and frame tested by means of a megger.

2022

JANUARY • FRIDAY

07

JANUARY - 2022

M	T	W	T	F	S	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

WK 02 (007-358)

Step in Drying out of a Motor or a Generator

9 am

→ Preliminary preparation of the machine, Source of

10 am heat measurement etc.

→ Arrange the Set up.

11 am

→ Apply heat by one of suitable means gradually.

12 noon

→ Take periodic reading at Lock time.

1 pm

→ Measure periodically of insulation resistance.

2 pm

→ Intermidiate Stage.

3 pm

→ Rising Stage.

4 pm

By radiating lamp :-

5 pm

This is the most Simple method used for medium

6 pm

and Small motors.

7 pm

→ The lamp are located in the chamber opposite to the motor winding.

→ The heating Should be continuous and carefully Controlled So that it doesnot too high thus damaging the insulation.

2022

FEBRUARY - 2022

M	T	W	T	F	S	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28						

SATURDAY • JANUARY

08

WK 02 (008-357)

9 am → In order to ascertain how drying out is

10 am Preceding 'Megger' reading Should be taken every 12 hours

11 am By circulating Short - circuit current :-

12 noon

This is most convinent method of drying any

1 pm

electrical machine Such as generators, Synchronous

2 pm

Motors, field winding etc.

3 pm

→ The machine is connected low voltage Source.

4 pm

→ The I/p Voltage current Power the temperature of

5 pm

body, temperature of air are periodically measured.

6 pm

→ The Increase in temperature Should be very

7 pm

Gradually upto the value of not exceeding

SUNDAY 09

2022

JANUARY • MONDAY

10

WK 03 (010-355)

JANUARY - 2022

M	T	W	T	F	S	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

Generalized procedure of installation of Electrical machine :-

Installation procedure of an electric motor involves a series of activities like :-

(a) Location and Layout
(b) Positioning of Machine
(c) Concrete foundation
(d) Levelling and Alignment
(e) Grouting
(f) Fitting of other parts, accessories, piping etc.
(g) → final levelling and Alignment.

Location and Layout :-

→ The location of an electrical machine depends on its purpose of installation, definite type and size.

⇒ The location plan should permit to have required wide space all around bore continuing the erection work and should facilitate regular inspection, repairing etc.

2022

FEBRUARY - 2022

M	T	W	T	F	S	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28						

TUESDAY • JANUARY

11

WK 03 (011-354)

→ The location should be finalized in such a fashion that it will not disturb the operation and maintance work of other machines.

→ Laying out means marking of the foundation plan with the help of chalk on a concrete floor and by a string with number of pegs.

(b) Positioning of Machines :-

→ positioning of machine at the location is an important job which deserves care, skill and an efficient team work.

→ An equipment may have the weight of few tons but it is to be loaded or unloaded to be moved vertically or horizontally to bring it at the site and to place it on the foundation as well.

→ Different types of lifting devices like pulley blocks, chain hoists overhead cranes etc.

2022

JANUARY • WEDNESDAY

12

JANUARY - 2022

M	T	W	T	F	S	S
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4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

WK 02 (012-353)

Concrete foundation:-

9 am

The part of a structure which provides a base or

10 am

support for the machinary is called foundation.

11 am

→ This size and strength of foundation depends upon

12 noon

the size and nature of supported machine.

1 pm

→ foundation serves the purpose to protect the

2 pm

machine from external vibrating and to lower down

3 pm

the frequency of natural vibration.

4 pm

(d) Levelling And Alignment :-

5 pm

After having the machine on the foudation, the

6 pm

important job is to level and align it with other

7 pm

accessories. → The levelling is performed with levelling

wedge, shoe etc.

→ The horizontal and slight vertical movement of

the heavy mass of machine is performed by

2022 pipes, rollers.

FEBRUARY - 2022

M	T	W	T	F	S	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28						

THURSDAY • JANUARY

13

WK 03 (013-352)

→ When the levelling is completed the foundation

9 am

bolt, cavity along with the bolt may be made of

10 am

concrete, pouring of the cement concrete is generally

11 am

made through the gap provided at the top of the

12 noon

foundation.

1 pm

(e) Grounting :-

2 pm

Grounting is a procedure of connecting the machine

3 pm

with the foundation by a concrete mixture of

4 pm

plastic consistency.

5 pm

→ Generally a quick setting cement is used to

6 pm

perform grounting.

7 pm

→ The top of the foundation block is made roughened

made moistened with water and wooden partitions

are placed all around the machine.

2022

9am → Quick Setting cement is then poured with in the boundary with care to eliminate any air gap within it.

10am

11am → once started the pouring should be completed

12 noon continously the machine must be left undisturbed

1pm for a few days after grouting to provide it time to set.

(F) 3pm fitting of other parts, Accessories, Piping etc.

4pm When the machine erected, the other accessories may be joined accordingly.

5pm → While laying out the foundation plan, overall

6pm requirement should be kept in mind. thus minimise the

7pm problem arising later on.

9am (A) - Final Levelling and Alignment :-

After grouting has set in properly accurate

10am levelling can be carried out such levelling involves

11am minor adjustment.

12noon Procedure :-

1pm Align the motor and the driven machine on

2pm bed-plates in their final position with shims under

3pm their feet.

4pm → Mark both half coupling by means of chalk line.

5pm Make accurate measurement between the faces

6pm of the vertical surfaces.

7pm Turn the motor shaft through 90°, 180°, 270° and 360°

and not reading of gap.

SUNDAY 16

JANUARY • MONDAY

17

WK 04 (017-348)

JANUARY - 2022

M	T	W	T	F	S	S
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3	4	5	6	7	8	9
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24	25	26	27	28	29	30
31						

9 am **Electric wiring for motors:-**

10 am Every manufacture sends out a terminal diagram with his motors this generally shows how the internal windings are arranged and how the terminals lettered.

Size of cable:-

3 pm All cable should be large enough size to carry the current which is stamped on the motor name plate. and size of the cable should be followed from the table-

→ The size of cables used should be capable of carrying full load current corresponding to the rating of motor.

FEBRUARY - 2022

M	T	W	T	F	S	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28						

TUESDAY • JANUARY

18

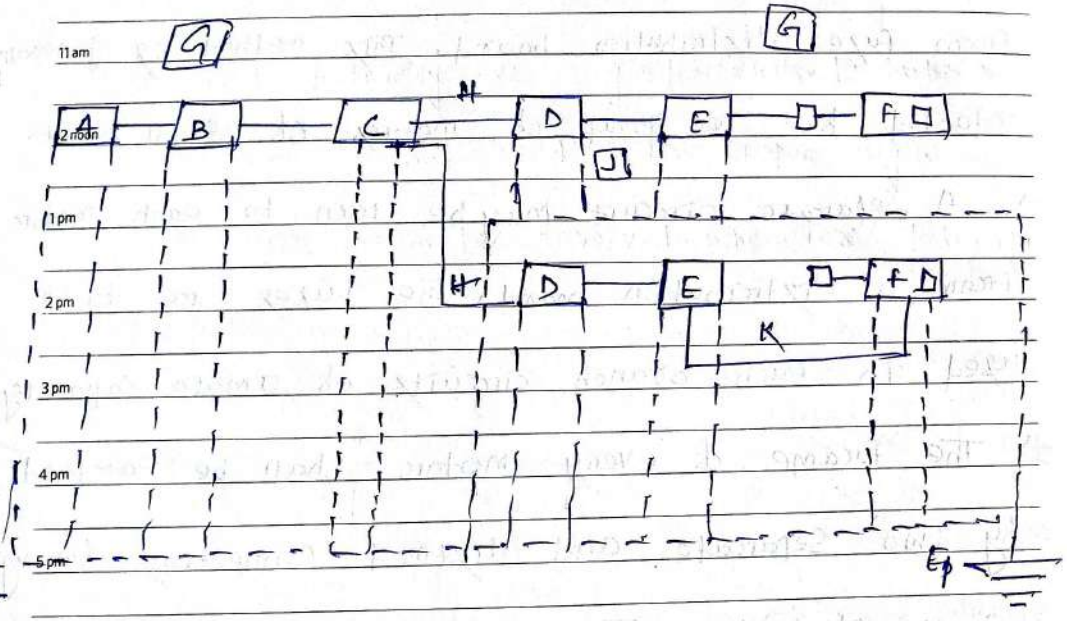
WK 04 (018-347)

Methods for Installation of wiring for Two or more motors :-

9 am A separate circuit may be run to each motor from fuse distribution board. This method is generally adopted for a group of motors of small sizes.

1 pm A separate circuit may be run to each motor from a distribution board. The fuses are to be used in each branch circuits of ample capacity.

4 pm The frame of every motor shall be earthed by two separate and distinct connections through 6 pm earth electrodes. The earth connection should be 7 pm visible for periodical inspection.



(Arrangement of wiring circuit bore motor)

A = Supply company's metering panel.

B = Iron clad main switch with overload Release.

C = Power panel.

D = Triple pole Iron clad switch near motor

E = Motor Stater fitted with over current and no-volt protective devices.

F = Motor.

G = Danger Note plate.

H = All cables to be steel Armoured.

J = Card with instructions bore Resuscitating Persons Subfering from electric shock.

K = Earth metalic tubing protecting cables from Starter to motor.

Ep = Earthing.

JANUARY • FRIDAY

21

WK 04 (021-344)

JANUARY - 2022

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4	5	6	7	8	9	10
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18	19	20	21	22	23	24
25	26	27	28	29	30	31

General Requirement for electric Installation

9 am

Acording to Indian Electricity Rule:-

10 am

Introduction :-

11 am

Like fire electricity is a good servant but a

12 noon

bad master if not handled in proper way.

1 pm

The two main hazards involved, whenever electricity

2 pm

is employed, are

3 pm

① Danger of shock.

4 pm

② Danger of fire

5 pm

→ 6 pm Right from generating station to consumer premises

and then to appliances certain requirement, regulation

Code of practice have laid down in our country which

are well known as Indian Electricity Rule (IER).

The abstract of few important IER as given

2022 below.

FEBRUARY - 2022

M	T	W	T	F	S	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28						

SATURDAY • JANUARY

22

WK 04 (022-343)

Rule 30 -

9 am

① Service line and apparatus on consumer's premises :-

10 am

The Supplier shall ensure that all electric supply

11 am

lines, wires, fittings and apparatus belonging to him

12 noon

which are on a consumer premises are in safe

1 pm

condition and in all respect fit for supplying energy.

2 pm

→ Service line placed by the supplier on the premises

3 pm

of a consumer which are underground shall be

4 pm

so insulated and protected by supplier.

5 pm

Rule - 31 cut-out consumer's premises :-

6 pm

→ pm The Supplier shall provide a suitable cut-out in

SUNDAY 23

each conductor of every line other than an

earthed neutral conductor.

→ When more than one consumer is supplied

through a common service line, each such

2022

Consumer shall be provided with an independent cut out at the point of junction to the common service.

→ The owner of every electric supply line, other than earthed or neutral conductors of concentric cable, shall protect it by suitable cutout.

Rule-33 Identification of Earthed and Earthed Neutral Conductors and position of Switches and Cut-outs therein :-

→ Where the conductors include an earthed conductor of two wire system or an earthed neutral conductor of a multi-wire system or a conductor which is to be connected thereto.

→ An indication of permanent nature shall be provided by the owner of the earthed or earthed neutral conductor.

→ Where the earthed or earthed neutral conductor is the property of the supplier, at or near point of commencement of supply.

→ Where a conductor forming part of consumer's system is to be connected to the supplier's earthed neutral conductor at the point where such connection is to be made.

→ In all other cases, at the point corresponding to the point of commencement of supply as may be approved by an inspector.

(2) No cut out link or switch other than a linked switch arranged to operate simultaneously on the earthed neutral conductor and conductor shall be inserted in any or near main inserted may earthed neutral conductor in a two wire system.

There to with following exceptions:-

① A link for Testing purpose.

② A switch for use in controlling a generator or T/F.

Rule-33:- Earthed Terminal on Consumer's Premises:-

The Supplier shall provide and maintain on consumers premises or the consumers use a suitable earthed terminal in an accessible position at or near point commencement of supply as defined under Rule 58.

→ Provided that in case of medium, high or extra high voltage installation the consumer shall, in addition to the aforementioned earthing arrangement.

→ The consumer shall take all reasonable precautions to prevent mechanical damage to the earthed terminal and its lead belonging to the Supplier.

Rule 34:- Accessibility of Bare conductor:-

Where bare conductors are used in a building the owner of such conductors shall

① ensure that they are inaccessible.

② Provide in readily accessible position switches for rendering them dead whenever necessary.

③ Take such other safety measures as are considered necessary by the Inspector.

Rule 35:- Caution Notices:-

Every motor, Generator, transformers and other electrical plant and equipment together with apparatus used for controlling regulating same.

→ All Supports of high and extra high voltage overhead lines.

JANUARY • SATURDAY

29

WK 05 (029-336)

JANUARY - 2022

M	T	W	T	F	S	S
				1	2	3
4	5	6	7	8	9	10
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18	19	20	21	22	23	24
25	26	27	28	29	30	31

Provided further that where the generators, motors, transformers or other apparatus is within an enclosure, one notice affixed to the said enclosure shall be sufficient for the purposes of this rule.

Rule-36

Handling of electric supply lines apparatus:-

Before any conductor or apparatus is handled, adequate precaution shall be taken by earthing or other suitable means to discharge electricity such conductor and any adjacent conductor.

→ No person shall work on any live electric supply line and no person shall assist such person on such work unless he is authorised in that behalf and takes the safety measures approved by Inspector.

30 SUNDAY

2022

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31

WK 06 (031-334)

Rule-37

Supply of vehicle cranes etc:-

Every person using a vehicle, travelling crane or like to which energy is supplied from an external source shall ensure that it is effectively controlled by a suitable switch enabling all voltage to be cut-off in one operation and where such vehicles, travelling crane or the line runs on metal rails the owner shall ensure that the rails are electrically continuous and earthed.

Rule-38 :-

Cables for Portable Apparatus:

Flexible cables shall not be used for portable motors, generators, transformers, rectifiers, electric bills, electric sprays welding sets.

They are heavily insulated and adequately protected from mechanical injury.

2022

FEBRUARY • TUESDAY

01

WK 06 (032-333)

The Protection is by means of metalic covering it shall be in metalic connection with the frame of any such apparatus and earth.

Rule. 39 Cables protected by Bituminous Materials

→ Where the Supplier has brought into use an electric Supply line which is not completely enclosed in a continuous metalic covering / connected with earth.

→ Any pipe, conduit or the like into which such electric Supply line may, have been drawn, unless other arrangements are approved by Inspector.

9am **Necessity of Starters for Both DC & AC Machine or Motor.**

10am

11am

→ When a motor is at rest back emf is zero armature Resistance is very small. Therefore it is dangerous to start the motor of ratings above 5 H.P directly from the line.

12noon

1pm

2pm

3pm

→ The starting current is very high and this heavy current may damage the armature and also cause a flash over across commutator.

4pm

5pm

6pm

→ In series with armature at the time of starting which is gradually cutout as the motor gains speed and develops back emf which regulated the speed.

7pm

So the starters are used for limiting the starting current to safe value.

05

WK 06
(036-329)

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9 am So Apart from Reducing the Starting current
10 am at Start, Suitable arrangements are made
11 fore protecting the Motore from overloading by
disconnecting it automatically from supply.
→ 1 pm Heree the Starter is an electrically operated
Switch designed fore accelerating a Motore from rest
to 3 pm normal speed in predetermined direction of rotation.
4 pm
Types of Starteres fore DC Motores
5 pm
6 pm fore DC Shunt and compound Motore.
7 pm (i) Threee points Starter
(ii) foure points starter. DC Series motor.
(i) Two point Starter.

06 SUNDAY

2022

MONDAY • FEBRUARY

07

WK 07
(038-327)

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Overload Relays :-

9 am
10 am A Relay is a device that opens or closes an
11 am auxiliary circuit under some predetermined Condition
12 noon in the main circuit.
1 pm → A Relay is also an electro-magnetically operated
2 pm Switch. The main parts of Relay are Armature, Contacts
3 pm and coil.
→ When the current flows through the coil, the
4 pm
aremature is attracted and operates the contacts.
5 pm
Relay can be designed to operate with very
6 pm
small current in the coil.
7 pm

2022

Testing of protective Relays :-

9 am

Various tests of Relays

10 am

① Acceptance Test.

11 am

② - Installation Test.

12 noon

③ Manufacturer's Test.

1 pm

Testing Before Given Supply & Testing Report :-

2 pm

3 pm

Testing before given supply are.

4 pm

① Electrical check.

Meehanical check.

5 pm

Electrical check :-

6 pm

→ Insulation Resistance Test between Installation

7 pm

and earth.

→ Insulation Resistance between Conductors.

→ Testing of earth continuity.

→ Earth Resistance test.

2022

Earth Resistance Test :-

9 am

Test of polarity Whether ϕ'

10 am

① Before performing insulation Resistance test between Installation and earth.

11 am

→ 1 pm The position of main switch, fuses and switches will be checked.

→ 3 pm Before making test with the help of meggar the position of main switch, fuses, switches etc.

4 pm

5 pm ① Main switch to be off position

6 pm The fuses beyond the main switch should be in

7 pm position.

→ All switches in ON position.

→ The lamps and other equipments in their position.

→ The phase and neutral terminals are connected to each other and connected to the line terminal of the meggar.

→ Starting devices should be properly installed to save the motor from being damaged.

→ Double earthing should be provided for protecting the motor in case of leakage.

→ The protective devices installed should be of proper Rating to save motor. / being damaged.

Mechanical checks :-

Before closing the main switch the installation should be carefully inspected to ensure that

→ The motor is well bolted down.

The motor should be checked for proper lubrication.

→ The belt or other driving equipment is tight

→ All covers, guards, terminal lids etc. are in place.

→ All wiring is tight and correctly connected.

→ All starter, switches, controller, brush gear handles and in off position.

→ The bearing should be free from moisture contents and metalic particle.

→ After conducting the above mentioned checking the motor should be run to load for finding possible faults such as noise, overheating and vibration etc.

12

WK 07 (043-322)

Testing Report :-

Before the electrical Machine is put into service its installation should be got passed by the Electrical Inspector.

① Getting testing Report of installation from govt. approved Electrical Contractor.

→ Submission of Report along with application to H.S.E.B authority.

Motor No	KW	RPM	Location	Insulation Resistance	Resistance of earth circuit	Remark

Signature of contractor

Contractor's License No

Basic idea on dispatch of transformer :-

Basic idea on dispatch of transformer :-

Transformers are generally dispatch by manufacturer in one of following methods depending upon size and local condition.

① Dried out, filled with oil, ready for service (small transformer).

② With oil covering the core and coil colding (Medium transformer).

③ With out in the tank filled with nitrogen at pressure (large T/F).

Transformers may be packed in a strong wooden packing case for dispatch or it can also be sent without any packing case depending

FEBRUARY • THURSDAY

17

WK 08 (048-317)

FEBRUARY - 2022

M	T	W	T	F	S	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
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9 am upon the conditions of transformers.

10 am

Delivery of Transformers at the site :-

11 am

12 noon → low power Transformers are transported to the sites completely assembled, medium power transformers either completely assembled and packed in boxes.

3 pm → 4 pm Low and medium power transformers are taken to their sites on trucks and high power transformers are transported on rail wagons or road trailors.

Handeling on Arrival of site :-

The simplest and most convinent way to unload the transformers is with the help of cranes.

2022

MARCH - 2022

M	T	W	T	F	S	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

FRIDAY • FEBRUARY

18

WK 08 (049-316)

9 am → Where cranes are not available in such cases

10 am a trench is to be dug to a depth equal to the

11 am height of trailore plateforem and the transformer

12 noon is sured in position on rails.

1 pm Inspection of site :-

2 pm On Arrival at site the packing cases should

3 pm be checked against the dispatch particulars.

4 pm → Any loss of packages in the transit should be

5 pm communicated to the manufacturer and insurance company.

6 pm → The transformer should be unpacked and inspected

7 pm fore any signs, fitting, bushings etc.

→ Oil leakage should be checked.

2022

FEBRUARY • SATURDAY

19

WK 08 (050-315)

FEBRUARY - 2022

M	T	W	T	F	S	S	M	T	W	T	F	S	S
	1	2	3	4	5	6	7	8	9	10	11	12	13
14	15	16	17	18	19	20	21	22	23	24	25	26	27
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9 am The following checks are.

10 am Checking oil :- The samples of oil should be

11 am drawn from near the top and bottom and tested

12 noon as per I.S 1866 - 1961. code of practice for

maintance of insulating oil.

1 pm A lower than 30 KV dielectric strength for a 4mm

2 pm gap would indicate presence of moisture.

3 pm Checking insulation Resistance of winding :-

4 pm

5 pm Insulation resistance of winding should be checked

6 pm with 1000V megger. Voltage is being applied

7 pm for a period of one minute. All the winding

except the winding under test should be earthed

Storage during this test.

The transformers arrived at site and likely to

be installed immediately donot need long storage.

2022

MARCH - 2022

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	1	2	3	4	5	6	7	8	9	10	11	12	13
14	15	16	17	18	19	20	21	22	23	24	25	26	27
28	29	30	31										

MONDAY • FEBRUARY

21

but the transformers which are moisture ~~absorbed~~

9 am & rains are dust etc.

10 am It is predereable to store the transformers

11 am which are not to be installed immediatley need proper

12 noon Storage indoors with proper covering and Flooring.

1 pm The oil should not be drained unless there is a

2 pm provision for filling inert gas.

3 pm Civil works Associated with Transformer foundation:-

4 pm

5 pm civil construction features Regarding Installation:-

6 pm For indore installation the following factors

7 pm should be considered :-

① Ventilation :-

Noise level.

Space Required for movement maintenance.

2022

FEBRUARY • TUESDAY

22

WK 09 (053-312)

FEBRUARY - 2022

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		1	2	3	4	5	6	7	8	9	10	11	12	13
14	15	16	17	18	19	20	21	22	23	24	25	26	27
28													

9 am (4) Trenches for cable. minimum clearances between

10 am the transformer and walls should be as.

11 am Walls on all four sides = 1.25m

12 noon " " three " = 1.1 m

" " back side only = 0.51 m.

1 pm Wall on two sides = clearance from each side

2 pm must be 0.75m.

3 pm The clearance of 0.5m should be provided between

4 pm the top most point of the conservator and the

5 pm roof.

6 pm Outdoor installation :-

Foundation :-

7 pm It must be strong enough to beare the load of transformer without any vibration and must be made with proper floor level and plinth level.

2022

MARCH - 2022

M	T	W	T	F	S	S	M	T	W	T	F	S	S
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28	29	30	31										

WEDNESDAY • FEBRUARY

23

WK 09 (054-311)

facility for Drainage of oil :-

9 am Outdoor Transformer having oil capacity of more

10 am than 9000 liters should be provided with Soak pit.

11 am + ~~Ground~~ Gravel should be Spread all arround.

12 noon Proper Slope should be maintained and Soak pit

1 pm filled with Sand and gravel should be provided

2 pm manholes.

3 pm Cabling :-

4 pm Power cable and Control cable should

5 pm never be placed in same conduit DC control cable.

6 pm AC protection circuit cables and AC power cable

7 pm should be separated from each other.

Cable Boxes :- At the transformer is fitted with cable boxes and be connected by paper insulated Power Cables. Cable ends should be sealed and cable boxes should be filled with oil.

2022

FEBRUARY • THURSDAY

24

FEBRUARY - 2022

M	T	W	T	F	S	S
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28						

WK 09 (055-310)

9 am

Main Power connection :-

fore medium voltage, cable connected bare

10 am

conductors, connecting T's used fore indoor and

11 am

outdoor installation respectively.

12 noon

Noise Reduction :-

1 pm

The transformers must be

2 pm mounted on a non reflecting resistance pad

3 pm on a solid and non vibrating surface to reduce

4 pm the noise level considerably.

5 pm Fire protecting :-

6 pm Carbon - tetra chloride (CCl_4) and foam type

7 pm fire extinguishers and buckets filled with

Sand and Water should be kept ready for

this purpose.

2022

MARCH - 2022

M	T	W	T	F	S	S
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7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
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FRIDAY • FEBRUARY

25

WK 09 (056-309)

Provision of Supports of Bushings :-

9 am

LT cable should be supported on wooden support

10 am

along with angle iron to avoid bending of cables

11 am

coming out of the transformers otherwise the

12 noon

bushing will be cracked.

1 pm

Location of Switch gear :-

2 pm

Switch gears should be installed in a separate

3 pm

room and power and control cables should be run

4 pm

in separate conduit pipes.

5 pm

Steps to be taken before commissioning of a

6 pm

Power Transformer :-

7 pm

2022

FEBRUARY • SATURDAY

26

WK 09 (057-308)

FEBRUARY - 2022

M	T	W	T	F	S	S
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21	22	23	24	25	26	27
28						

9 am

(1) Fitment of Accessories

(2) Filling of oil

10 am

(3) Drying out.

(4) Charging of breather with fresh Silica gel.

11 am

12 noon

(5) Cleaning of Porcelain of bushings with tri-chloro ethalene and then by dry cloth.

1 pm

(6) Conductors and Cables.

2 pm

(7) Earthing of tank and cover.

3 pm

(8) Neutral earthing as per Schematic diagram.

4 pm

(9) Connection of protecting circuits and alarm circuits with CTs.

5 pm

(10) - Setting of relays in the control room.

6 pm

7 pm

27 SUNDAY

2022

MARCH - 2022

M	T	W	T	F	S	S
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MONDAY • FEBRUARY

28

WK 10 (059-306)

9 am

(1) Fitment of Accessories :-

Transformers are dispatched with some accessories

10 am

removed and packed in separate packings to avoid

11 am

damage during transportation.

12 noon

Accessories are fitted after the transformer

1 pm

has been put in position. The Accessories fitted

2 pm

are (a) oil conservator.

3 pm

(b) Silica gel dehydrating breather.

4 pm

(c) Buchholz Relay.

5 pm

(d) Explosion Vent.

6 pm

(e) Temperature Indicators for oil and winding

7 pm

(f) Bushings.

(g) Magnetic oil gauge

(h) Tap changing

(i) Cooling Equipment.

2022

MARCH • TUESDAY

01

MARCH - 2022

M	T	W	T	F	S	S
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WK 10 (060-305)

Oil conservatore :-

9 am

Oil conservatore is a part of a drum,

10 am

mounted on the top of the transformer.

11 am

→ A level indicator is fixed to it. Which

12 noon

gives alarm at low level.

1 pm

→ Conservatore is connected through a pipe to the

2 pm

transformer tank containing oil. This oil expands

3 pm

and contracts depending upon the heat produced.

4 pm

And so the oil level in the conservatore rises and

5 pm

Falls.

6 pm

→ Pipe connected to the conservatore is left

7 pm

open to the atmosphere through a breather so

that the extra air may go out or come in

2022

APRIL - 2022

M	T	W	T	F	S	S
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WEDNESDAY • MARCH

02

WK 10 (061-304)

(2) Breather :-

9 am

When oil level in the oil conservatore changes, air

10 am

moves in and out of the conservator. This action

11 am

is known as breathing.

12 noon

→ It contains Silica gel or some other drying

1 pm

agent such as calcium chloride.

2 pm

→ The breather is a box containing calcium

3 pm

chloride or silica gel to absorb moisture of

4 pm

air entering the conservatore.

5 pm

→ The insulating property of transformer oil

6 pm

is lost if a small amount of moisture enters

7 pm

in it. So dry air is allowed to pass through

this breather.

MARCH

2022

MARCH • THURSDAY

03

MARCH - 2022

M	T	W	T	F	S	S
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WK 10 (062-303)

Buchholz Relay :-

9 am

10 am The Relay is a gas actuated Relay which

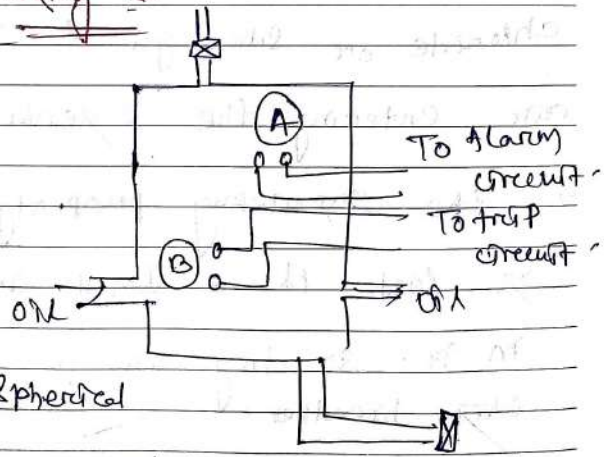
11 am is meant for the protection of oil immersed transformer from insulation failure.

→ 1 pm The Relay is situated in the pipe connected between the transformer and conservator.

Construction and working :-

3 pm

4 pm



5 pm

6 pm

7 pm

→ It consist of Spherical floats A and B are provided.

→ Each Assembly of floats is arranged

2022 in such a way that when the transformer

APRIL - 2022

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FRIDAY • MARCH

04

WK 10

oil is completely filled and ready for service.

9 am The contacts of both the switches are open.

10 am

11 am ### following precautions :-

12 noon It should be seen that piping and relay oil free

1 pm From any matter that may be disturb relay

2 pm operation.

3 pm → The distance of relay from conservator should not

4 pm be less than 3 times the diameter of the pipe.

5 pm → The pipe should slope up from the tank to

6 pm the conservator at an angle 3° to 7°.

7 pm

Advantages :-

It is the simplest form of transformer protection.

→ It is detects the faults at a stage much earlier than is possible with other forms of protection.

MARCH • SATURDAY

05

WK 10 (064-301)

MARCH - 2022

M	T	W	T	F	S	S	M	T	W	T	F	S	S
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9 am Disadvantages:-

10 am It can only be used with oil immersed

11 equipped with conservatore tanks.

→ 12 This device can detect faults only below oil level

pm the transformer.

Maintenance:- It should be critically inspected

and subjected to operational test at least once in

4 pm year.

→ while performing operational tests, dry air

or 6 pm Nitrogen should be injected through lower pet

cock and its behaviour should be recorded.

→ Oil level along mechanical inspection oil level

should be brought down and buckets should be

checked for free movement.

→ 2022 The breather is sealed at the top with a

plug.

APRIL - 2022

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MONDAY • MARCH

07

WK 11 (066-299)

Explosion Vent :-

9 am It is also a safety device of transformer

10 am which protects the transformere tank from gases

11 am induced by any type of short circuit in the

12 noon transformer.

1 pm → This consists of a vertical pipe closed by a

2 pm diaphram made of thin bakelite sheet.

3 pm Temperature Indicator :-

4 pm It is also a protecting device fitted to a

5 pm transformere to indicate the temperature of

6 pm transformer oil.

7 pm → for measuring the temperature of oil, bulb of

vapour pressure type thermometer is placed in

the hot oil and dial of the thermometer

is mounted outside of the tank.

2022

MARCH • TUESDAY

08

WK 11 (067-298)

MARCH - 2022

M	T	W	T	F	S	S	M	T	W	T	F	S	S
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9am The two indicating pointers black and red are provided. → Black pointer indicates the temperature of oil and it also drives red pointer.

Bushing :- The bushing serve as supports and insulation of busbars and transformer terminals.

→ The bushing consist of procelain shell body, upper and lower locating washers used for fixing the position of busbar.

→ The winding of a transformer is connected to the lines through the copper rods which are insulated from the tank cover. These are known as bushing.

→ Oil bushing is used for 33KV application.

for current Rating above 2000A.

2022

APRIL - 2022

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25	26	27	28	29	30								

WEDNESDAY • MARCH

09

WK 11 (068-297)

Types of bushing.

9am ① HV Bushing ② LV Bushing.

10am Important tests on HV Bushing.

11am ⓐ Type Tests ⓑ Routine test.

12noon

Type Tests :-

1pm → measurement of dc Resistance between

2pm terminals of conductors.

3pm → Temp. rise Test.

4pm → Short circuit Test.

5pm Routine Test:

6pm → measurement of Insulation Resistance.

7pm → measurement of Resistance.

→ Power frequency voltage withstand test for 1 minute.

2022

9 am Maintance of Bushing :—

10 am The Bushings after unpacking are cleaned.

11 am the protective cover is to be removed and

12 noon then it is washed with hot transformer oil.

1 pm Following checks are carried out if the bushing

2 pm is stored indoors.

3 pm → oil strength of bushing oil must be able

4 pm to withstand 40KV at 4 mm gap.

5 pm → The Insulation Resistance value between line

6 pm terminals and flange should be more than

7 pm 10,000 MΩ in case of healthy bushings.

→ If the bushing have been stored for more than

5 years, its capacitance should be measured

and compared with standard values.

2022

→ The bushing should be installed at an correct angle

9 am It should be fixed properly on the turret setting.

10 am

(g) Magnetic oil Gauge :—

11 am → The magnetic oil level gauge supervises the

12 noon level of oil in the conservator tank.

1 pm → The oil level gauge as provided on the transformer

2 pm are the dial type with minimum and maximum level

3 pm markings and a pointer which indicates the level

4 pm of oil in the conservator.

5 pm

(h) Tap changing :—

6 pm The voltage control of transmission and distribution

7 pm system is obtained by Tap changing.

Tap changers are either on load or off load

tap changers.

Tap changers is fitted with the transformer

2022

for adjusting Secondary voltage. The voltage control of the range ± 16% can be achived by tap changing transformers.

Types of Tap changer :-

① Off-Load Tap changers :- Occasional adjustment Secondary voltage can be made by off circuit tap changer.

→ The tap in changed only after opening the circuit breaker on secondary side.

→ Off circuit tap changer operation is mannually executed by substation operator.

② ON Load Tap changers :

The daily voltage variation due to changing load and short period voltage variations

are controlled by on-Load tap changer automatically.

→ The tapping of on load tap changer can be changed without interruption in load current.

→ The on-load tap changer is fitted with power transformer. The winding may be HV and LV is tapped. The taps are connected to the diverter switch of tap changer.

① Cooling Equipment :-

The radiators are generally dispatched in separate packings. Before erection, they should be cleaned properly and washed with oil and then mounted as per layout.

MARCH • TUESDAY

15

MARCH - 2022

M	T	W	T	F	S	S
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7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
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WK 12 (074-291)

Making of Leak proof Joints :-

9 am

10 am Only the material recommended by manufacturer should be used for the gasket. If no material is recommended, then a gasket of cork or Synthetic material like neoprene or neoprene bonded cork should be used.

The surface should be thoroughly cleaned by alcohol, nepthan or any other cleansing agent.

5 pm

Characteristic of Transformer oil :-

6 pm

→ The properties of transformer oil are similar gear oil are recommended in IS 335. 1963.

7 pm

→ The fresh dielectric oil has a pale yellow colour.

→ The dark colour appearance indicates deterioration.

→ The dielectric oil should never contain suspended particles, water soluble acids, active sulphur or colloidal carbon. These impurities cause oil deterioration.

2022

APRIL - 2022

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WEDNESDAY • MARCH

16

→ Highere Flash Point (145°c) is preferred WK 12 (075-290)

9 am

→ Flash point indicates the tedency to evaporate.

10 am for flash point lower than 135°c. the oil

11 am evaporates quickly and viscosity raises.

12 noon

Procedure for filling the oil in Transformer Tank

1 pm

2 pm The oil is filled in the tank after after the following steps :-

3 pm

① Drying out of transformer tank, core and coils

4 pm

5 pm ② filling of oil by means of oil filtering plant (flask).

6 pm

③ Before filling the oil, the transformer should be fitted with all the accessories such as plugs and valve gauge.

→ oil sample should be taken and tested and then filled the tank.

7 pm

2022

MARCH • THURSDAY

17

MARCH - 2022

M	T	W	T	F	S	S	M	T	W	T	F	S	S
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28	29	30	31										

WK 12 (076-288)

→ It should be ensured in oil filling operation that no air pockets are left in the tank and no dust or moisture enters the tank.

→ All the air vents should be opened.

→ Oil should be filled through metal hoses from the oil filtering plant.

Equipment Required for oil filling :-

→ High Vacuum filterating plant.

Oil storage tank with Silica gel breather.

Vacuum Gauge.

Oil dielectric strength tester.

Moisture content meter.

Vacuum tank.

Oil Sampling cans or bottles

Thermometer.

Valves filling and hoses.

Dry air or Dry nitrogen cylinders.

Manometer.

2022

APRIL - 2022

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25	26	27	28	29	30								

FRIDAY • MARCH

18

WK 12 (077-288)

Characteristics of insulating oil :-

→ It should have a high dielectric strength not less than 40 KV (rms) in drums and 30KV (rms) in transformer tank

→ It should be free from moisture contents and water vapour.

→ The oil should be perfectly clear and pale in color transparent and free from suspended matter of sediments.

→ Acidity contents should be very low in the oil.

→ It should have high flash points 140°C and lower Point.

→ The oil should be chemically stable.

→ It should posses low viscosity.

→ Density of oil at 20°C should be 0.89 gm/cm³.

→ Mineral oil grade B should be used.

2022

MARCH • SATURDAY

19

WK 12 (078-287)

MARCH - 2022

M	T	W	T	F	S	S
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21	22	23	24	25	26	27
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Charging of Breather with Silica gel :-

9 am

10 am → Remove the wing nuts supporting the body.

11 am → Glass container should be squarely fitted on its gasket ; then pour reactivated or fresh silical gel into the container upto level 1/4 inch from the top.

12 noon

1 pm

2 pm

3 pm → fixed the Assembly to the top plate with inspection window facing outward from the T/f.

4 pm → Transformer oil should be poured into the oil cup until it overflowes through the screw hole.

5 pm

6 pm

7 pm → Silica gel is reactivated by applying heat to it or heating it in oven until its colour is restored to blue.

20 SUNDAY

→ While baking silicon gel temperature should not exceed 150°C.

2022

APRIL - 2022

M	T	W	T	F	S	S
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MONDAY • MARCH

21

WK 13 (080-285)

Testing of Transformer oil :-

9 am

10 am (1) Breakdown Test (BDV Test). or Flash point Test.

11 am (2) crackle Test.

12 noon (3) Sight Test.

1 pm (4) Acidity Test.

2 pm **Breakdown Test :-**

3 pm → It is performed to check the dielectric strength

4 pm transformer oil.

5 pm → The test performed in the oil testing set.

6 pm → The sample of oil is drawn from near the top

7 pm and bottom of the transformer and tested.

→ A lower than 30KV dielectric strength for a 4mm gap of electrode could indicate the presence of moisture.

2022

9 am Cracked Test :-

10 am It is performed to check presence of moisture in the insulating oil, to perform this test a sample of oil is taken in a beaker and the oil is heated.

2 pm One iron rod of 1.5 mm is made red hot and dipped in sample oil if there is any hissing sound coming through the oil in beaker, it indicates the presence of moisture content in the oil which will be considered not suitable for the use.

Sight Test :-

The test can be performed by taking water in a beaker and test tube is filled with oil. The level of oil in the tube should not less than 35mm by level in the beaker.

Close the end of the tube and fix it on the stand by dipping into water. If the bubbles appear at first, then it will indicate the presence of moisture contents in the oil.

This test is rarely used because the oil testing set is not easily available in the laboratory.

10 am Acidity Test :-

11 am This test is done to measure the free organic and inorganic compound present in the oil.

12 noon It is expressed in terms of the number of milligrams of potassium hydroxide required to neutralize the total free acid in one gram of material.

1 pm

4 pm

5 pm

6 pm

7 pm

MARCH • THURSDAY

24

WK 13 (083-282)

MARCH - 2022

M	T	W	T	F	S	S	M	T	W	T	F	S	S
		1	2	3	4	5	6	7	8	9	10	11	12	13
14	15	16	17	18	19	20	21	22	23	24	25	26	27
28	29	30	31										

Question

9 am

(1) What is the function of conservators?

(2) What is the function of breather?

10 am

11 am

12 noon

1 pm

2 pm

3 pm

4 pm

5 pm

6 pm

7 pm

2022

APRIL - 2022

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WEDNESDAY • MARCH

30

WK 14 (089-276)

9 am

(1) Explain the procedure of inspection and storage and handeling.

10 am

(2) Explain ~~the~~ the civil work associated with transformer foundations.

11 am

12 noon

(3) Explain the procedure of filling oil of the transformer tank.

1 pm

2 pm

(4) Explain the procedure of maintance of T/F oil.

3 pm

(5) State the characteristics of T/F oil.

4 pm

(6) Explain the procedure of drying out Power T/F.

5 pm

6 pm

(7) Explain the procedure of testing the BDV of oil.

7 pm

(8) Explain how a t/f is dispatched from manufacturing work and transpored to site.

(9) Describe construction and parts of a typical Medium sized T/F.

2022

MARCH • THURSDAY

31

WK 14
(090-275)

MARCH - 2022

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APRIL - 2022

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25	26	27	28	29	30								

9 am

Name the various Accessories and fitments on a T/F.

10 am

Explain the principle and application of Buchholz Relay

Explain Maintance of Bushing.

11 am

12 noon

1 pm

2 pm

3 pm

4 pm

5 pm

6 pm

7 pm

9 am

10 am

11 am

12 noon

1 pm

2 pm

3 pm

4 pm

5 pm

6 pm

7 pm

MAY - 2022

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MONDAY • APRIL 04

WK 15 (094-271)

Substation :-

A Substation is an assembly of apparatus which is installed to control transmission or distribution of electric power.

→ Main function :- is to receive energy, ~~transmitted~~ where these are ~~to~~ at high voltage from generating Station, reduce the voltage to suitable value for local distribution

Indoor Substation :-

Indoor Distribution and Transformer Substation consists of a series of open and enclosed chambers. The main equipment of given installation is arranged in them compartments.

2022

APRIL • TUESDAY

05

APRIL - 2022

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WK 15 (095-270)

Design and Planning of Indoor Substations :-

- The type of supply required (wheather 3φ, 4 wire or 3φ, 3 wire load and earthing arrangement.
- Atmospheric conditions such as are temperature and moisture.
- Atmospheric pollution
- Reliability of substation equipment so that there is minimum power interruption.
- Continuity of service through alternative supply if the source of supply is interrupted.
- Possibility for modification or future extention.
- Noise Reduction
- Radio and telecommunication interference due to switching.

2022

MAY - 2022

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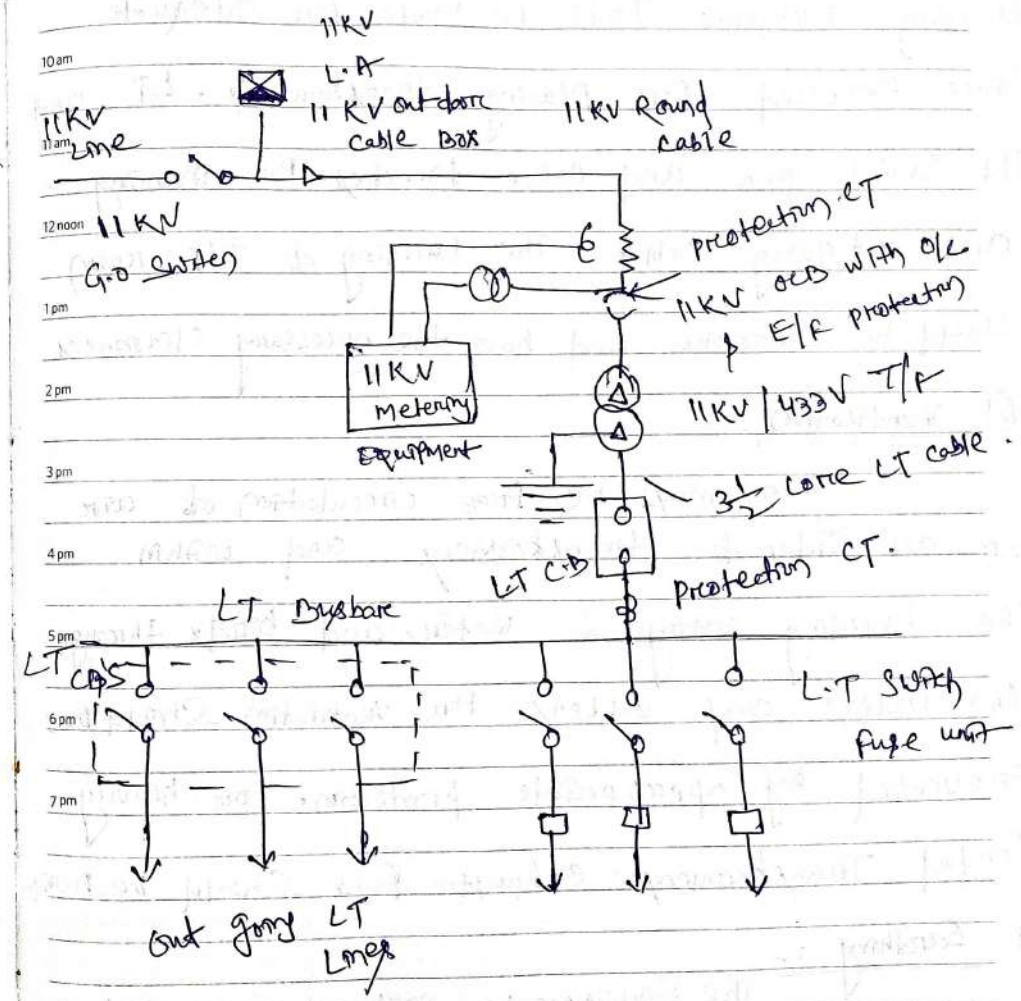
WEDNESDAY • APRIL

06

WK 15

General Requirements of Layout of Indoor Substation.



2022

APRIL • THURSDAY

07

APRIL - 2022

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25	26	27	28	29	30	

WK 15 (097-268)

① Building construction :- When constructing the building provisions should be made for adequate Space required for placing transformers, LT and HT Switch gear and cable trenches for incoming and outgoing cables. The building of T/F room should be Spacious and have the necessary clearances

② Ventilation :-

There must be free circulation of air on all sides of transformers and within the building entry of water and birds through inlets and outlets for ventilation should be prevented by appropriate protection. For heavily loaded Transformers exhaust fans should be provided.

③ Earthing :-

The Equipment installed in a medium Voltage distribution Substation should be solidly earthed.

2022

MAY - 2022

M	T	W	T	F	S	S
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FRIDAY • APRIL

08

WK 15

④ Cable Trenches :- Cable Trenches are provided for laying the cables. The cable trenches should be protected against entry of water by blocking off the openings and filled with sand and covered with mild steel or R.C.C slabs.

Key Diagram Showing Various Equipments and there connections :-

With the help of key diagram, the layout drawings and protective gear Schemes can be evolved. Layout of indoor Substation depends upon the Space available number and size of T/Fs and number and type of H.T and LT Switch gear required.

2022

APRIL • SATURDAY

09

WK 15 (099-266)

APRIL - 2022

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9 am

10 am

11 am

12 noon

1 pm

2 pm

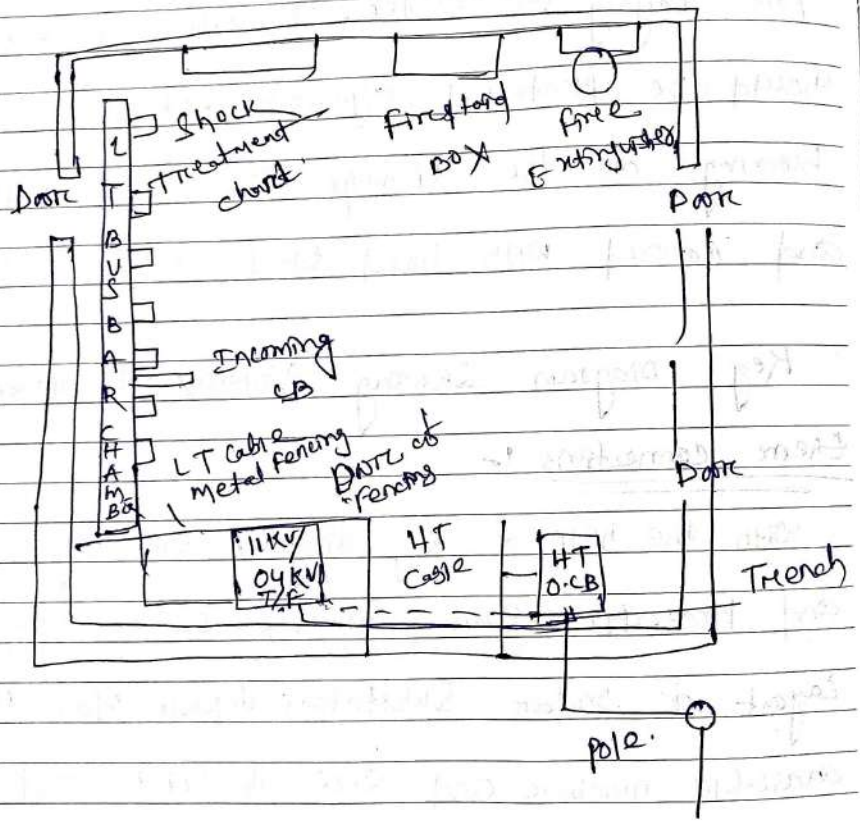
3 pm

4 pm

5 pm

6 pm

7 pm



10 SUNDAY

2022

MAY - 2022

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MONDAY • APRIL

11

WK 16 (101-264)

Layout of indoor Substation :-

9 am

The transformer should be installed in a separate

10 am

room. If this is not possible the transformer should

11 am

be installed in one corener and protected by

12 noon

Metal fencing.

1 pm

→ The position of 11KV O.C.B and transformer

2 pm

should be such that minimum possible 11KV cable is

3 pm

used.

4 pm

→ LT Switch gear should be located in such a

5 pm

position so that the operation of circuit breakers

6 pm

and switches is easy.

7 pm

2022

APRIL • TUESDAY

12

APRIL - 2022

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WK 16 (102-263)

Considerations for safe operation of substation:

9 am

(1) Fencing and Gate for transformer Enclosure:-

10 am

Expanded metal fencing supported by channel iron

11 am

supports is provided to enclose the transformer.

12 noon

A small Gate is provided with locking arrangement

1 pm

for a safety.

2 pm

(2) Fire Protection:- Coly and foam fire

3 pm

extinguishers and buckets filled with sand

4 pm

should be located in easily accessible positions

5 pm

in switch room and substation.

6 pm

(3) Precautions against dust and insects:-

7 pm

Indoor substation should be made in accessible to

birds, reptiles, rats, insects and dust. All cable

ducts and openings should be sealed as far as

possible.

2022

MAY - 2022

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30	31					

WEDNESDAY • APRIL

13

WK 16 (103-262)

(4) Effect of Atmosphere condition:-

9 am

All steel and iron parts should be given an

10 am

anti corrosive coating before final painting.

11 am

Fore installations near the chemical fumes or

12 noon

gases, rubber chlorinated point should be used.

1 pm

Earthing:-

2 pm

Non current carrying parts with

3 pm

conducting surface should be effectly earthed

4 pm

The earth connections of all equipments should

5 pm

be made duplicate. The following points:-

6 pm → Earth conductor should be earthed separately.

→ Lightning arrester should be protected against

7 pm

mechanical damage.

→ The Resistance of earth system should not exceed 2Ω.

→ All metal fencing should be earthed at two points.

→ Pipe and plate earthing should be provided

for indoor substation.

2022

APRIL • THURSDAY

14

APRIL - 2022

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WK 16 (104-261)

Installation of outdoor substation :-

9 am

The substations should be installed and

10 am

commissioned to deliver the power to the distribution networks.

11 am

Selection of site for substation :-

12 noon

Following factors are considered :-

1 pm

→ Type of substation

→ 2 pm Availability of suitable and sufficient land

→ 3 pm Communication facility

→ 4 pm Atmospheric Pollution

→ Availability of Essential Amenities to the staff.

→ 5 pm Drainage facility

CIVIL Activities :- → 6 pm Soil investigations at the allocated site.

→ 7 pm Design and Drawing, issue of drawing to site.

→ Civil foundation work, this include excavation of foundation reinforcement, concreting, curing.

→ Super structure of building, ground floor, first floor etc.

→ Civil work for earthing system

→ Road, Rail - Drainage Water supply

Fencing - Civil work for Cabling system etc.

2022

MAY - 2022

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10	11	12	13	14	15	16
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FRIDAY • APRIL

15

WK 16

Drawings :-

9 am

Plot Plans indicating area allocated to the substations, approach roads, railway line etc.

10 am

Layouts :- These include electrical layout, civil layout.

11 am

Complete substations layouts of important buildings.

12 noon

Drawing of stores :- These include indoor store, outdoor fenced stores, semi-enclosed sheds.

→ 2 pm Foundation plan for the complete substation.

→ 3 pm Foundation drawings for Ac yard, control building, transformers.

4 pm

→ Drawings of structures for equipment. Procelain

5 pm

tower and gantries.

→ 6 pm Drawing for earthing layout.

→ 7 pm Drawing for cable layout.

→ Outline general arrangement drawings of equipment.

→ Protection and control schematic drawings.

2022

APRIL • SATURDAY

16

APRIL - 2022

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WK 16 (106-259)

Transport and Receipt of transformer :-

9 am

The following modes of transport are used

10 am

① By Ship, By Road, By Rail.

11 am

→ The power transformer Shunt Reactors, long

12 noon

busbars, long bushing need special care an

1 pm

attention during transport.

2 pm

→ The transport of these equipment should be

3 pm

planned before starting the detail design of

4 pm

such equipment.

5 pm

→ The arrangement of road trailors, cranes, special

6 pm

wagon should be made in advance. The necessary

7 pm

permit from railway authorities & road authorities

17 SUNDAY

should be obtained bore transport.

2022

MAY - 2022

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MONDAY • APRIL

18

WK 17 (108-257)

Insulation Resistance Checking of winding :-

9 am

The insulation Resistance is measured by a megger

10 am

→ A megger consist of DC generator and mega-

11 am

meter.

12 noon

→ The Standard megger are of 1000V DC, 2.5kV DC

and 5kV DC.

1 pm

→ The insulation Resistance is the ratio of $\frac{V_{dc}}{I_{dc}}$

2 pm

V_{dc} = It is the applied voltage across two

3 pm

conductors separated by insulation under test.

4 pm

I_{dc} = It is the current flowing through the

5 pm

insulation.

6 pm

→ megger test gives clear indication about

7 pm

health clearness and dryness.

→ In Power T/f the insulation Resistance is

measured between each winding and earth tank.

→ Between HV winding and LV winding in case of

Others equipment the insulation Resistance is

measured b/t the terminal and earth frame.

APRIL • TUESDAY

19

APRIL - 2022

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WK 17 (109-256)

Testing of transformer Oil :-

9 am

① BDV Test.

10 am

② Crackle test.

11 am

③ Sight Test ④ Acidity test.

12 noon

~~Protection Fitting~~ :- Construction of Mounting :-

1 pm

HT fuse is used for protection of HT side and an iron clad L.T Switch is used for

2 pm

3 pm

protection of LT side.

4 pm

→ Lightning arrestors are installed over

5 pm

HT line to protect from surges.

6 pm

→ 11 KV Lightning arrestors three in number are

7 pm

erected at the top of H pole structure for the protection of transformer against lightning.

→ protection Relay panels, control cables, circuit breakers, CTs, VTs etc.

2022

MAY - 2022

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WEDNESDAY • APRIL

20

WK 17 (110-255)

Protection Fitting :-

9 am

Buchholz Relay, Explosion vent, Pressure Release

10 am

Valve, Oil temperature indicator, Breather are

11 am

fitted to the T/F for protection purpose.

12 noon

→ The foundation Plan of the complete Substation

1 pm

2 pm indicates the building foundation, yard foundation

3 pm transformer foundation etc.

→ The foundation Plan for an individual equipment

4 pm

5 pm is recommended by the manufacture.

→ Particulare attention should be paid to the

6 pm

7 pm design of t/f foundation.

→ The provision of cable trenches, earthing drainage, auxiliary supply should be taken into consideration.

2022

APRIL • THURSDAY

21

APRIL - 2022

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WK 17 (111-254)

Final Comissioning :-

9 am

These are divided in following catagories :-

10 am

11 am Equipment functional check test.

12 noon Sub system check.

1 pm Complete System.

2 pm Commissioning test.

3 pm Performance Characteristic test.

4 pm Earthing Arrangement :-

5 pm The basic purpose of earthing system is to protect the human body from electric shock and stop the current to flow in the circuit.

The main function of earthing -

→ To maintain the potential of any part of the system at definite value.

2022

MAY - 2022

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17	18	19	20	21	22	23
24	25	26	27	28	29	30
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FRIDAY • APRIL

22

WK 17 (112-253)

→ To Allow current to flow to earth

9 am

in case of fault so that the protective gear

10 am

will operate to isolate faulty circuit.

11 am

Type of earthing :-

12 noon

① Neutral earthing

1 pm

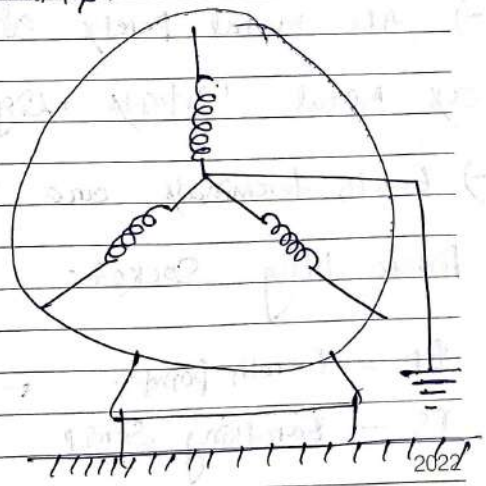
Equipment Earthing.

2 pm Neutral Earthing :-

3 pm It is the connection of ground to the neutral

4 pm point of star connected winding of generator, t/f

5 pm and other rotating machines.



6 pm

7 pm

2022

APRIL • SATURDAY

23

APRIL - 2022

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WK 17 (113-252)

Equipment Earthing :-

9 am

Connection non current carrying metal parts of equipment such as tower, motor, body, t/f core and tank etc to the ground is called equipment earthing.

10 am

11 am

12 noon

→ Parts to be connected to Earth By Equipment earthing

1 pm

→ Neutral conductor of 3p, 4 wire and Middle conductor of 2p 3 wire DC Supply System.

2 pm

3 pm

→ Metal bream of generator, motor and other Metalic parts of equipments.

4 pm

5 pm

→ All metal parts of electrical installation such as metal Conduits, Light fittings, iron clad Main switch

6 pm

→ Earth terminals are three pin lighting and

7 pm

24 SUNDAY

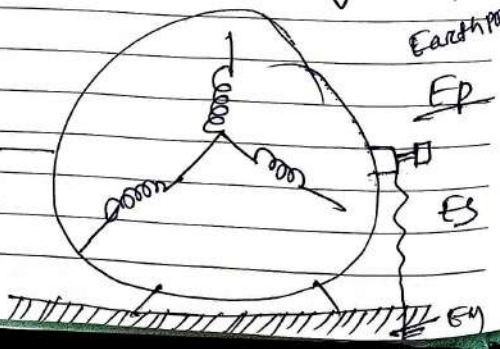
Power plug socket.

EP = Earth point.

ES — Earthing Strip

2022

EM — Earthing Mat.



MAY - 2022

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MONDAY • APRIL

25

WK 18 (115-250)

Purpose of Earthing :-

9 am

→ To save human life bream danger or shock or death.

10 am

11 am → To protect large building from atmospheric lightning.

12 noon → To protect all Machine.

1 pm → To maintain the line voltage Constant.

2 pm → To maintain potential of any part of a system at a definite value w.r.t earth.

3 pm

4 pm

5 pm

6 pm

7 pm

2022

APRIL • TUESDAY

26

APRIL - 2022

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WK 18 (116-249)

Testing and commissioning of substation :-

9 am

Before commissioning the substation following points should be checked.

10 am

11 am

→ The earth Resistance of substation should not be more than 5Ω.

12 noon

1 pm

→ It should be insured that the H.T and L.T fuses are of the appreopriate sizes.

2 pm

3 pm

→ It should be ensured that the air path of silica gel breather of the transformer is clean. If it is checked it should be cleared.

4 pm

5 pm

6 pm

→ Before commissioning the substation the operation of tap changing switch should be checked.

7 pm

→ Horn gaps are provided as a back up protection across H.T bushing terminals and body of the T/f.

→ The oil level in the T/f should be upto mark indicated on the transformer.

2022

MAY - 2022

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WEDNESDAY • APRIL

27

WK 18 (117-248)

Control and Relay panels :-

9 am

The protective Relays are automatic devices

10 am

which can sense the fault and send instructions

11 am

to the associated circuit - breaker to open.

12 noon

→ The Relay and Control panels are located

1 pm

mainly in the control room of the substation

2 pm

building from where it is possible to supervise

3 pm

and monitor the substation.

4 pm

Installation of control panels :-

5 pm

After seperate panels of control board have

6 pm

been received at the site they must be checked

7 pm

for any damaged or missing parts. The insulation

Resistance of all the control wiring should not be

less than 1 MΩ.

2022

APRIL • THURSDAY

28

APRIL - 2022

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WK 18 (118-247)

Large Installations :- When control of a large number of circuits is desired as many of generating stations, The general trend is to provide separate Panels for :- ⓐ control and indication equipment

ⓑ Relay and indication equipment, Voltage Regulare equipment.

→ The diagram of Main Connection are given on the front face of the Panel, these diagrams indicates the position of CB and Isolator.

→ The control operator gets the idea to which breaker is open or closed.

→ The control generator and Main T/F circuits are generally brought on a separate control desk. located centrally. In front of Main control board.

2022

MAY - 2022

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FRIDAY • APRIL

29

WK 18 (119-246)

Installation of Switchgeare :-

① **Preliminary preparations :-**

The preliminary preparation include study of drawings, acceptance, report checking certificates and test reports of the equipment, completion of civil engineering work, arranging the tools, lifting gears etc. organising the labour, prepare the schedule of installation, preparing Sequence cards for erection of Majore etc. Such card indicates the Sequence of operation, items involved, procedure in brief etc.

ⓐ **Sequence card for erection of Switchgear equipment :-**

S No	Operation	Tools, lifting geare etc	Drawing No	Techniques and precaution

2022

APR/MAY • SATURDAY

30

APRIL - 2022

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WK 18 (120-245)

The Drawing include

9 am

① Circuit diagram of the plant.

10 am

② Civil engineering plans, foundation Plans etc.

11 am

③ Dimension Drawings of equipment.

12 noon

Location of Switchgear :-

1 pm

Generally upto 11KV, Indoor Switch gear is

2 pm

popular.

3 pm

→ Indoor Switchgear should be located in a clean

4 pm

dry room free from Vermins, Snakes, moisture

5 pm

dust etc. Floor should be dry and levelled.

6 pm

→ The floor should withstand load about 1000 kg/m² (200lb/sq/ft). Enough space should be left in

7 pm

01 SUNDAY

front and in the rear of Switchgear as recommended by the manufacture.

2022

MAY - 2022

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MONDAY • MAY

02

WK 19 (122-243)

MAY

The following points :-

9 am

① fire proof doors, roof, ceiling etc.

10 am

② Sealing of cable ducts.

11 am

③ Subdivision of Switch gear.

12 noon

④ Installation of fire fighting apparatus.

1 pm

Unpacking :-

2 pm

The equipment is packed in crates and is

3 pm

brought to site by railway and motor truck.

4 pm → Packings are lowered on the site by means

5 pm of rope, hoist or Crane carefully.

6 pm On unpacking the items are checked against

7 pm list. Further the items are carefully inspected visually.

→ If any damage is found the matter should be informed to the manufacturer and insurance company immediately and the damaged equipment should be returned.

2022

MAY • TUESDAY

03

MAY - 2022

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WK 19 (123-242)

Foundation :-

9 am

The foundation is prepared according to the

10 am

foundation plan. Holes are provided of foundation bolts.

11 am

Trenches and passages are provided for cables and

12 noon

other piping. The floor should be correctly levelled

1 pm

and marked according to the drawing.

2 pm

Erection :-

3 pm

The Equipment is installed according

to 4 pm the procedure mentioned in the instruction

Manual.

5 pm

→ Some types of lifting devices special tools etc

6 pm

may be necessary

7 pm

→ The assembly is erected vertically. The

Vertically is checked by means of spirit level.

→ ~~If necessary~~

2022

JUNE - 2022

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WEDNESDAY • MAY

04

WK 19 (124-241)

Relay :-

9 am

It is advisable not to adjust the relay

10 am Mechanism. The faulty relay should be sent to

11 am the manufacturer since relay repair is as a

12 noon Specialized job.

1 pm → Contacts are relay should be inspected for any

2 pm sign of burning where necessary, glass paper

3 pm should be used for cleaning.

4 pm → All the terminals of relay should be checked

5 pm for tightness. The wiring should be checked for

6 pm security.

7 pm

2022

MAY • THURSDAY

05

MAY - 2022

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30	31					

WK 19 (125-240)

9 am

Busbars Earthing Connections :-

10 am The bus-bar contacts and making surfaces of connectors should be cleaned with emery paper or smooth file. The busbars are assembled as soon as they are cleaned. Special grease is applied also.

Connections of main cable :-

4 pm The cable terminal box should be clean and moisture should be removed by blow-lamps. The cable filling compound should be warmed to about 135 - 140°c.

→ The buckets used for filling should be pre-heated to about 80 before use.

→ The level of compound should be about 45mm below the top cover to allow expansion during service conditions.

JUNE - 2022

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FRIDAY • MAY

06

WK 19

→ The cable cover is bolted when the compound gets cold. No moisture should enter while filling the compound.

Earthing :-

The Earthing bar of the switchgear, the metalic non current carrying parts are connected to station earthing system.

→ The earthing bar is run through various units and the frames of each unit connected to earthing bar.

→ Earthing bar is connected to station earth by two GI flats.

2022

MAY • SATURDAY

07

WK 19 (127-238)

MAY - 2022

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9 am Installation of outdoor circuit breakers :-

10 am

outdoor - C.B are mounted on pre-fabricated

11 am

galvanised steel structures.

12 noon

Important steps :-

1 pm

① Receipt and storage :-

2 pm

3 pm The packing cases are inspected and stored

4 pm indoor/ covered store in a planned location.

5 pm Indoor equipment are stored indoor, outdoor

6 pm equipment are stored outdoor.

7 pm CIVIL WORKS :-

08 SUNDAY These are carried out as a part

of civil works. The foundation plan is

decided on the basis of requirements of

2 the clearances and the base of equipment/

JUNE - 2022

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MONDAY • MAY

09

WK 20 (129-236)

Structure.

9 am

→ Pockets are provided for grouting the foundation

10 am bolts.

11 am

→ Earthing mat is made welded with iron rod mesh

12 noon

and is buried in the yard at depth of upto 1 mtr.

1 pm

2 pm Foundations :- (Various Steps for installation)

3 pm ① Check the readiness of foundations and there

4 pm dimensioning as per the drawings. Check the

5 pm Location of holes for grouting with reference

6 pm to foundation plan.

7 pm ② Check the level of foundation surface.

③ Place the based structure of the circuit-

breaker in position. Make connection of earthing

rod/er to structure.

④ → Assemble operating mechanism in its position.

2022

MAY • TUESDAY

10

WK 20 (130-235)

MAY - 2022

M	T	W	T	F	S	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

9 am → Assemble Support Porcelany and interrupting heads.

11 am → Join the links in the mechanism with the links 12 noon the pole units as explained in manufacturer's instruction Book.

2 pm → Give auxiliary supplies to mechanism for motor fore trip circuit and closing circuit.

4 pm → Tighten all the bolts and other hardwaries. Remove packing.

5 pm → If provision available operate slow opening 6 pm and slow closing.

7 pm → Measure Insulation Resistance.

→ Fill quenching medium after draying out operation Check leakage and ensure leakage free assembly.

2022

JUNE - 2022

M	T	W	T	F	S	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

WEDNESDAY • MAY

11

WK 20 131-235

→ measure Insulating Resistance and Resistance between 9 am terminals of poles.

10 am → Make terminal connection, earthing connections.

11 am → operate breaker from local control panel.

12 noon → Operate the breaker from Control room by 1 pm operators instructions. and then by operating 2 pm relevant relays.

3 pm

4 pm **Pre commissioning checks / Tests :-**

5 pm These are performed in accordance with the 6 pm agreed field quality plan and include :-

7 pm

→ Leakage tests

→ Time / contact travel characteristics

→ Time tests

→ Insulation Resistance test on main and auxiliary circuits.

2022

MAY • THURSDAY

12

WK 20
(132-233)

MAY - 2022

M	T	W	T	F	S	S	M	T	W	T	F	S	S
						1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16	17	18	19	20	21	22
23	24	25	26	27	28	29	30	31					

9 am → Measurement of low resistance between terminals of Pole.

10 am → Checking of earthing connection.

11 am → Operation of breaker from local control cabinet

12 noon → Operation of breaker from control room by Manual command. by relay command.

1 pm

2 pm

3 pm

4 pm

5 pm

JUNE - 202

M	T	W
		1
13	14	15
27	28	29

9 am

10 am

11 am

12 noon

1 pm

2 pm

3 pm

4 pm

5 pm

JUNE - 2022

M	T	W	T	F	S	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

MONDAY • MAY

16

WK 21 (136-229)

Maintenance

Introduction :-

Maintenance is the process for maintaining any equipment or machinery in a proper and efficient condition.

→ A machine should never be allowed to run without lubrication. The periodic Inspection and Maintenance details may vary with the type of machine and its working conditions.

Fundamental of Maintenance :-

Maintenance can be defined as those activities required to keep the equipment in operating condition so that it continues to meet specifications.

→ The maintance schedule is usually in the form of log sheets on which weeks, months

2022

MAY • TUESDAY

17

MAY - 2022

M	T	W	T	F	S	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

WK 21 (137-228)

of the year are tabulated.

9 am

→ The spares are important for maintenance duty.

10 am

The spares are kept in store with proper

11 am

inventory control.

12 noon

Classification of maintenance :-

1 pm

2 pm (a) corrective are breakdown maintenance.

3 pm (b) Preventive maintenance.

4 pm (c) Contracted maintenance.

5 pm Corrective or Breakdown maintenance

6 pm Corrective maintenance is carried out when an equipment fails or doesn't work satisfactory

Preventive maintenance

It is carried out to Reduce the failure of equipment to minimum.

2022

JUNE - 2022

M	T	W	T	F	S	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

WEDNESDAY • MAY

18

WK 21 (138-227)

Contracted maintenance

9 am

In this maintenance, contract terms

10 am

are agreed upon by the supplier of the equipment

11 am

and user and may include both Preventive and

12 noon

corrective maintenance.

1 pm

Preventive Maintenance planning :-

2 pm

It is an important feature of modern

3 pm

industry and it is most commonly used in the

4 pm

maintenance department.

5 pm

→ The maintenance engineer should inspect the

6 pm

plant periodically under working conditions and

7 pm

also when it is at rest with good planning

and preparation.

→ The planning maintenance should be categorized in following ways :-

2022

MAY • THURSDAY

19

MAY - 2022

M	T	W	T	F	S	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

WK 21 (139-226)

9 am

10 am

11 am

12 noon

1 pm

2 pm

3 pm

4 pm

5 pm

6 pm

7 pm

① Routine maintenance.

② Periodical maintenance (weekly, fortnightly, Monthly, quaterly or half yearly)

③ Maintenance of fault as and when the fault occurs.

Advantages of Preventive Maintenance :-

→ It prevents un scheduled interruption to Various Machines and equipments and premature failures.

→ It makes an effective use of systematic maintenance and inspection to determine the need for minor and major repairs.

→ It Reduces breakdown to a minimum and increases the efficiency of equipments and machinery.

JUNE - 2022

M	T	W	T	F	S	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

FRIDAY • MAY

20

WK 21 (140-225)

9 am

10 am

11 am

12 noon

1 pm

2 pm

3 pm

4 pm

5 pm

6 pm

7 pm

→ It helps to plan flexibility in operation due to accurate knowledge of machinery conditions.

→ It lowers wear and tear of machine and other equipments.

→ It makes working condition better.

→ It increases the life of the machine.

→ less Standby equipment is needed.

→ Provide greater safety and protection to the workers.

→ The cost of repairing is reduced.

Classification of Preventive Maintenance :-

① Routine Maintenance :-

It should be carried out daily, if possible. It includes inspection, minor repairs such as Replacement of Small Parts and adjustment of equipment so that it remains in operation.

2022

MAY • SATURDAY

21

MAY - 2022

M	T	W	T	F	S	S
					1	2
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

WK 21 (141-224)

Routine manteranee of electric motor involves Washing and lubrication of bearings, checking of control equipment and replacement of carbon brushes etc.

② Periodic manteranee :-

It should be carried out weekly, monthly, quaterly or halfyearly depending upon the requirements and condition of the machine.

→ It includes inspection of loose parts, Ventilation, Replacement of worn parts, change of oil, checking of insulation etc.

③ Overhaul :-

22 SUNDAY

It should be carried out half-yearly or yearly.

→ It consists of replacement or renewal of main units, assemblies and parts of electrical equipment.

2022

JUNE - 2022

M	T	W	T	F	S	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

MONDAY • MAY

23

WK 22 (143-222)

① Manteranee on Fault :-

It is carried out immediately as and when a fault occurs blowing of fuse, short circuit or overloading etc.

The following factors should be taken into Consideration at the time of preparing the Schedule for Manteranee :-

(a) checking of stationary Parts.

(b) checking of movable parts

(c) Checking of working condition of equipment

(d) Checking of safety measures.

(e) checking of protective devices.

(f) Checking of facilities available.

(g) Checking of stores and spares inventory.

(h) checking of tools, trackley, jacks, and fixtures etc.

2022

MAY • TUESDAY

24

MAY - 2022

M	T	W	T	F	S	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

WK 22 (144-221)

Breakdown :-

9 am

When Industrial plants or electrical machines are running and stop incidently, it is known as breakdown.

10 am

11 am

12 noon

Causes of Breakdown :-

1 pm

The following are main causes of breakdown :-

2 pm

3 pm

(A) Faulty design construction

4 pm

(B) Incorrect Installation

5 pm

(C) Overload

6 pm

(D) Negligence

7 pm

(E) Wear and Tear

(F) Accident.

Breakdown Maintenance :-

It is carried out as and when necessary.

JUNE - 2022

M	T	W	T	F	S	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

WEDNESDAY • MAY

25

WK 22 (145-220)

The following are the main recommendations for implementation to breakdown maintenance.

9 am

10 am

(1) Engineering Records :-

11 am

12 noon

The timely fulfilment of breakdown maintenance depends to a great extent upon the way in which the work is recorded.

1 pm

2 pm

3 pm

→ The proper entry of all detected faults into repair cards of an electrical equipment is of special importance.

4 pm

5 pm

→ This card will tell us the overall condition of the equipment and kind of repairs required and helps planning time required for repairs.

6 pm

7 pm

(2) Inspection :-

The maintenance work mainly depends upon the ~~maint~~ inspection.

2022

MAY • THURSDAY

26

MAY - 2022

M	T	W	T	F	S	S
			1	2	3	4
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12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

WK 22 (146-219)

Therefore Inspection must be carried out by senior and compitent person who has got through knowledge of maintenance work. Divided into 2 type ⓐ External Inspection ⓑ Internal Inspection

External Inspection :-

The external Inspection is carried out when the equipment are in Operation. Condition like vibration, abnormal sound, wear and slackness of fit and clearance lubrication etc.

Internal Inspection :-

Internal Inspection is to be carried out during Preplanned Shut down which can be done Monthly or Quaterly or half-yearly depending upon the Operating Conditions.

JUNE - 2022

M	T	W	T	F	S	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

FRIDAY • MAY

27

WK 22 (147-218)

ⓒ **Servicing :-**

This Refers to cleaning adjustment, Lubrication and maintenance function without dismantling the equipment.

Testing :-

The testing of electrical equipments must be done very carefully because the performance of the equipments specially Protective device such as Relay etc.

→ Testing work should be done by Responsible person who has ~~three~~ thorough knowledge of use and proper handling of testing equipments.

Test entry should be made in forms available.

2022

MAY • SATURDAY

28

MAY - 2022

M	T	W	T	F	S	S
					1	2
9	10	11	12	13	14	15
23	24	25	26	27	28	29

M	T	W	T	F	S	S
3	4	5	6	7	8	
16	17	18	19	20	21	22
30	31					

WK 22 (148-217)

9 am

Engineering Analysis :-

10 am It is observed that a few equipments require more frequent repairs as compared to others. following are main reasons :-

1 pm

2 pm

3 pm

4 pm

5 pm

6 pm

7 pm

1. Defective Design.
2. Faulty Material
3. Unhealty operating conditions.
4. Misuse of equipment.
5. Poor Maintenance.
6. Low quality material used in equipment.

Tools and Tackles :-

~~29~~ SUNDAY

Proeper tools and tackles are more essential for the continously operating units.

2022

JUNE - 2022

M	T	W	T	F	S	S
		1	2	3	4	5
13	14	15	16	17	18	19
27	28	29	30			

M	T	W	T	F	S	S
6	7	8	9	10	11	12
20	21	22	23	24	25	26

MONDAY • MAY

30

WK 22 (150-215)

9 am

→ Proeper tools also Reduce the amount

10 am

Manual Labour required for handeling heavy equipments.

11 am

Manual Work can be reduced by.

12 noon

1 pm

2 pm

3 pm

4 pm

5 pm

6 pm

7 pm

1. Mechanising the lifting and handling operations
2. Employing induced heating and induction heat type method for drying out motors, transformers etc.
3. Jointing wires and Rods by welding instead of Soldering.

Inventory control of Stores and Spares :-

It is also very much necessary for maintenance section to make the inventory of all the spares required and should be made readily available for use whenever required.

2022

MAY • TUESDAY

31

MAY - 2022

M	T	W	T	F	S	S
					1	2
9	10	11	12	13	14	15
23	24	25	26	27	28	29

M	T	W	T	F	S	S
3	4	5	6	7	8	
16	17	18	19	20	21	22
30	31					

WK 23 (151-214)

List of commonly used instruments for Maintenance :-

9 am

10 am

The following instruments are generally used for

11 am

Maintenance in Industry :-

12 noon

(A) Voltmeter with Switch :- Voltmeter with switch

1 pm

is used to find out voltage between main phases

2 pm

and between phase and neutral at the supply point.

3 pm

(B) A small switch board fitted with various size

4 pm

of lamp holders and socket outlets including

5 pm

Fluorcent lighting fittings, into which other

6 pm

components such as choke coil, starter, switch

7 pm

may be connected.

(C) An oven provided with a ventilated fan and

preferably heated electrically.

→ Infra-red lamps may be used for heating

2022

JUNE - 2022

M	T	W	T	F	S	S
		1	2	3	4	5
13	14	15	16	17	18	19
27	28	29	30			

M	T	W	T	F	S	S
6	7	8	9	10	11	12
20	21	22	23	24	25	26

WEDNESDAY • JUNE

01

WK 23 (152-213)

in the place of ~~heater~~ Resistance heater or

9 am

Steam pipe heating.

10 am

→ Prawler can be used for testing the armature

11 am

of motor, repulsion type motor, series AC and universal

12 noon

Motors.

1 pm

→ A low voltage supply from a car battery

2 pm

can be used through a switch and variable

3 pm

Resistance for making voltage drop test on

4 pm

armature.

5 pm

→ A meggar for measuring earth Resistance.

6 pm

upto 100 Ω.

7 pm

→ An earth fault loop tester for impedance test

of earthing.

→ A clip on multirange ammeter, a double

range AC voltmeter, DC Voltmeter and multirange

DC ammeter also used for Maintenance work.

2022

JUNE • THURSDAY

02

JUNE - 2022

M	T	W	T	F	S	S	M	T	W	T	F	S	S
		1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24	25	26
27	28	29	30										

WK 23 (153-212)

A strong torch is used specially fitted with a terminal one socket O/P for supply continuity test and testing fuses etc.

List of commonly used Tools for maintenance

Installation and maintenance work necessitates the use of large variety of measuring tools and gauges etc.

1. Screw Drivers
2. Combination pliers
3. Side cutting pliers.
4. Cutters.
5. Hand Hammers (Ball peen hammer, cross pen hammer, Straight peen, Straight claw hammer)
6. Hack saw
7. The file.
8. The spirit level.

JULY - 2022

M	T	W	T	F	S	S	M	T	W	T	F	S	S
				1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31							

FRIDAY • JUNE

03

WK 23 (154-211)

9. chisel
10. Spanners
11. Bench vice.
- Pocket Knife.
- Warden Saw
- Blow lamp
- Hand drill
- Bearing Puller

List of Accessories maintenance Work :-

- Nuts, bolts, washers.
- Fuse wire of different rating
- Supper enamabled winding wire of copper Material.
- Rubber Gloves
- Thimbles.
- PVC / VIR cable of different sizes
- Lead of terminals
- Varnish
- Sand paper.
- Relays
- Contacts of Starters
- Electrolyte capacitors of different Rating
- Ball bearing

2022

JUNE • SATURDAY

04

JUNE - 2022

M	T	W	T	F	S	S	M	T	W	T	F	S	S
		1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24	25	26
27	28	29	30										

WK 23 (155-210)

9 am Cartridge fuse and fuse carriers of different Sizes.

10 am Double pole iron clad Switch

11 am Treple " " " "

12 noon Spare Socket outlet & plugs

1 pm Lamp holders

2 pm Solder wire

3 pm Grease.

4 pm Emery paper.

5 pm Carbon brushes of different Sizes

6 pm Pulleys

7 pm Handles for Starters

5 SUN Starter coils

Lubricating oil.

2022

JULY - 2022

M	T	W	T	F	S	S	M	T	W	T	F	S	S
				1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31							

MONDAY • JUNE

06

WK 24 (157-208)

Maintenance Schedule of Electric motor :-

9 am

SINO	Periodically	Maintenance Activity
1	Daily	→ Inspect and tighten earthing connection.
		→ check bearing.
		→ Inspect Fuses and Relay Setting.
		→ check lubricating System
		→ Watch out for excessive vibrations.
	Weekly	→ Care should be taken that amount of Unusual dust, dripping water. Acids / Fumes may not enter the motor.
		→ Bearing Should be checked for noise, oil them little cold grease in housing them.

2022

JUNE • TUESDAY

07

JUNE - 2022

M	T	W	T	F	S	S	M	T	W	T	F	S	S
		1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24	25	26
27	28	29	30										

WK 24 (158-207)

9 am
10 am
11 am
12 noon
1 pm
2 pm
3 pm
4 pm
5 pm
6 pm
7 pm

→ When there is sparking the colour and condition of commutator brushes. The brushes for loose connection should be checked.
Be smoothened with the help of The surface of commutator should be smoothened with the help of Sand paper and clean the segments of commutator with the help of cleaning stick.

Rotor & Armature → The uniformity of air gap in the motor should be checked in which sleeve bearings are used.

Mechanical condition → Sometimes there is a unusual noise is heard from motor due to metal to metal contact.

2022

JULY - 2022

M	T	W	T	F	S	S	M	T	W	T	F	S	S
				1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31							

WEDNESDAY • JUNE

08

WK 24 (159-206)

9 am
10 am
11 am
12 noon
1 pm
2 pm
3 pm
4 pm
5 pm
6 pm
7 pm

Mechanical inspection

→ Check the belt for suitable slackness and good surface condition.
The gears should be checked wear and tear.

Monthly / Quaterly

Windings

Check winding for there proper insulation. test insulation Resistance, short circuit and earth or leakage. moisture contents should also be checked.

Brushes → check the brushes for there proper fittings & free play in the brush holders. Brush spring pressure should be noticed.

Commutator → Commutator should be examined for high mica & high bar, scratches and roughness.

JUNE • THURSDAY

09

WK 24 (160-205)

JUNE - 2022

M	T	W	T	F	S	S	M	T	W	T	F	S	S
		1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24	25	26
27	28	29	30										

9 am

10 am

11 am

12 noon

1 pm

2 pm

3 pm

4 pm

5 pm

6 pm

7 pm

Coupling and other Drives :→

Sometimes the belt becomes loose, Adjust It.

Loads :→

Changing load conditions, should be observed, Controlling devices, trouble poore handlings are wrong adjustments.

Half yearly/yearly :-

Windings :→

Check the windings for insulation Resistance, dry cracks of insulation if needed.

Squirrel Cage Rotor →

Broken or Loose bars of rotor Should be observed throughly get It Soldered welded.

Wound Rotor :→

Collector, washers and connections Should be checked.

2022

JULY - 2022

M	T	W	T	F	S	S	M	T	W	T	F	S	S
				1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31							

FRIDAY • JUNE

10

WK 24 (161-204)

9 am

10 am

11 am

12 noon

1 pm

2 pm

3 pm

4 pm

5 pm

6 pm

7 pm

Armature Stator →

Check the stator for open, Short earth or Leakage fault Insulation Resistance Should also be checked. Lamination core Should be checked for Its looseness.

Air gap :→

Uniformity of air gap should be observed.

Mechanical parts :→

The inside and outside of frames and belts Should be Checked the Rotor.

Maintenance Schedule of Synchronous Motor :-

Maintenance is also essential for the longer life of electrical machinary. The following points required for the maintenance Schedule :-

2022

JUNE • SATURDAY

11

JUNE - 2022

M	T	W	T	F	S	S	M	T	W	T	F	S	S
		1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24	25	26
27	28	29	30										

WK 24 (162-203)

General :- The machines should be stopped and isolated from all supplies before any maintenance work is done.

The frequency maintenance required depends to large extent upon the site conditions.

Cleaning :- The unit should be periodically cleaned internally by blowing out with a jet of dry air and by wiping away any deposits of grease and carbon dust with a clean dry cloth.

Brushes :- The Brushes should be examined monthly after every 1000 hrs. Running to see that they are bedding properly.

→ Care must be taken to see that the brush holders are not allowed to touch the surfaces of slip rings.

JULY - 2022

M	T	W	T	F	S	S	M	T	W	T	F	S	S
				1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31							

MONDAY • JUNE

13

WK 25 (164-201)

Slip rings :-

During normal running the slip rings should have a dark burnished appearance free from grooving and uneven wear.

Bearings :- The bearings are charged with grease at works, and the bearings should be recharged after every 3000 hours of running.

Periodically clean and recharge the bearings.

Oil Leakage :-

It may be noted fore lubricating the Synchronous machine it should be neither be excessive oiling or insufficient lubrication

→ The lubrication should be appropriate and Periodic.

2022

JUNE • TUESDAY

14

WK 25 (165-200)

JUNE - 2022

M	T	W	T	F	S	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

Temperature :-

9 am

The insulation temperature and body temperature

10 am

Must be recorded frequently. It should be within

11 am

permissible limits so that machine can run

12 noon

smoothly.

1 pm

Maintenance Schedule of Transformer

2 pm

Frequency of Inspection	Inspections	Inspection Details	Action Required when conditions are unsatisfactory
Hourly →	Load, temperature, Voltage	Check against rated figure	Starts Fan
Daily	Dehydrating breather	Check that air passages are clear	If ~~check~~ colour.
Monthly	Oil level in transformers	Check transformer oil level.	

2022

JULY - 2022

M	T	W	T	F	S	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

WEDNESDAY • JUNE

15

WK 25 (165-199)

9 am

Quaterly → Bushings → Examine for cracks and dirt deposits.

10 am

Half yearly → Conservator → check for moisture cover.

11 am

Yearly → (a) Oil in T/f → Check for dielectric strength and water check acidity and sludge.

1 pm

(b) Earth Resistance

2 pm

(c) Relay, alarms and → Clean and compress there ~~circuits~~ circuits and replace contacts fuses.

3 pm

Two yearly :- Non-conservator T/f. → Filters oil regardless of condition.

4 pm

Five yearly or after Internal fault :- → Overall inspection → Wash by lifting of core and coils. hosing down with clean dry oil.

6 pm

2022

JUNE • THURSDAY

16

JUNE - 2022

M	T	W	T	F	S	S	M	T	W	T	F	S	S
		1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24	25	26
27	28	29	30										

WK 25 (167-198)

Maintenance of underground Cable :-

9 am
→ Terminals boxes should be carefully inspected
10 am
If there is any damage or leakage of insulat
11 am
→ of all types of cables inspection and insulation
12 noon
resistance test should be made regularly.
1 pm
→ check of excessive cable temperature.
2 pm
→ Check if any accumulation of water in cable duct
3 pm
→ check any dripping of water, oil, other liquid
4 pm
on cables.
5 pm
→ A check should be made for any excessive
6 pm
mechanical stress which may be causes during
7 pm
laying of cable.
→ check any indication of insulation.

2022

JULY - 2022

M	T	W	T	F	S	S	M	T	W	T	F	S	S
				1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31							

FRIDAY • JUNE

17

WK 25 (168-197)

Sf6 Circuit Breakers :-

Slot	Activity	Periodically	Activity
10 am	Checking of Sf6 pressure & density monitore	Weekly	Remote monitoring system available for alarm.
12 noon	Checking of grading	Yearly / short down period	Applicable to the EHT breaker above 220KV system.
1 pm	and its supply.		
2 pm			
3 pm	Sf6 gas pressure checking with respect to different temperature and climate condition	second checking like winter check & summer check	Comparison with other breaker system brings idea regarding gas.
5 pm			
6 pm	Sf6 gas leakage		
7 pm	test with leak detector.	Yearly.	
	measurement of Sf6 gas	2/3 yearly	Different guide lines are to be followed depending upon the Manufacturer.

2022

JUNE • SATURDAY

18

WK 25 (169-196)

JUNE - 2022

M	T	W	T	F	S	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

Maintenance of overhead Transmission line :-

9 am

All overhead lines should be inspected Regarding

10 am

Each month inspector at ground level when the

11 am

line is live.

12 noon

Supports :- (Tower).

1 pm

(a) Metal Supports :-

2 pm

The condition of the concrete foundation should

3 pm

be examined for possible damage.

4 pm

(b) Wooden poles :-

5 pm

The poles should be checked for current

6 pm

alignment and also the underground portion

7 pm

of the pole should be checked to verify

19 SUNDAY

there is any damage.

2022

JULY - 2022

M	T	W	T	F	S	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

MONDAY • JUNE

20

WK 26 (171-194)

(2) Cross Arms :-

9 am

It should be checked whether the metallic

10 am

cross arms are fitted are and wooden cross

11 am

arms may be delaying.

12 noon

(3) Insulators and fittings :-

1 pm

To check

2 pm

→ Broken and chip Porcelain

3 pm

→ Fitted Insulators

4 pm

→ Accumulation of dust, coal on insulation.

5 pm

→ Rusting of fittings.

6 pm

→ Burnt and fumed spots

7 pm

→ Damaged insulator should be Replaced.

→ Dirty insulator should be clean after

disconnecting the line from the supply.

2022

JUNE • TUESDAY

21

JUNE - 2022

M	T	W	T	F	S	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

WK 26 (172-193)

(4) Conductor & Earth wire :-

9 am

Clearance of Phase wire and Earth wire to

10 am

Ground should be checked in according to (IER)

11 am

→ In case of Sag it should be conducted

12 noon

Properly after dis connecting the line from

1 pm

the Supply.

2 pm

(5) Conductor fittings and Joints :-

3 pm

To check :-

4 pm

→ Loseness of binding or insulator and at Joints

5 pm

→ Slip of conductor from the insulator sheet.

6 pm

(6) Gang Operated Switch OR fuse :-

7 pm

To check defective switch

Burning or overheating of contacts.

Damaged arcing contact.

2022

Missing or broken earth wire.

JULY - 2022

M	T	W	T	F	S	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

WEDNESDAY • JUNE

22

WK 26 (173-192)

(7) Bird Nest :-

9 am

Bird nest coming on the overhead line should

10 am

be removed also remove the Birdnest from the cross

11 am

arm.

(8) noon

Earth electrodes should be watered from time

1 pm

to time.

(9) 2 pm

Earth Resistance should be check from time to time.

3 pm

Battery Maintenance Schedule :-

4 pm

Sl.No	Periodically	Maintance Activity
6 pm	Daily	→ Inspect the battery and room for general cleaning.
7 pm		→ Check the height of electrolyte.
		→ Record & check the Specific gravity and temperature of electrolyte of the Pilot cells.
		→ Record & check the temperature
		→ Check the voltage

2022

JUNE • THURSDAY

23

JUNE - 2022

M	T	W	T	F	S	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

SUN 0

9 am

10 am

11 am

12 noon

1 pm

2 pm

3 pm

4 pm

5 pm

6 pm

7 pm

2022

Maintenance activity

Periodically

Weekly

→ Inspect the battery very carefully.

- Remove dust on dirt if accumulated
- Keep the battery clean & dry
- Check the cells for crack and electrolyte leakage
- Record and check the specific gravity voltage and temperature of pilot cells.

→ check for the plate buckling collection of sediment at the bottom of the cells etc.

3 **Fortnightly**

Carry out inspection schedule laid down above.

4 **Quarterly**

- Check the specific gravity and temperature of each cell.
- Check the voltage of the battery and each cell.
- Check the leakage of electrolyte.

JULY - 2022

M	T	W	T	F	S	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

FRIDAY • JUNE

24

WK 26 (175-190)

9 am

10 am

11 am

12 noon

1 pm

2 pm

3 pm

4 pm

5 pm

6 pm

7 pm

2022

→ All the bolts and nuts should be checked bore tightness. Petroleum plug.

→ Test the battery load & small continuous load.

Yearly

→ In addition to the inspection schedule given above check bore the following conditions.

→ condition of individual cell.

→ Resistance that ix terminal as well as cell to cell.

→ Inspection of battery rack.

→ Label of the sediments if collected and the bottom of the cell.

→ paint of each the racks, walls the room with Resistance paint if needed.

JUNE • SATURDAY

25

WK 26 (176-189)

JUNE - 2022

M	T	W	T	F	S	S	M	T	W	T	F	S	S
		1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24	25	26
27	28	29	30										

Maintenance of Substation :-

Sr No	Periodically	Maintenance Activity
1	Half yearly	→ Visually inspection for - cleanness - for checking leakage - for cracks in porcelain - Sign for decay
2	Yearly	→ Check level of oil in different equipment → Check gas pressure → Inspection of Surge Arresters → Checking of various Switching devices for burning, for corrosion → Check operating mechanisms - Circuit breaker - Isolator. → Check as per Manufacture Instruction for Connectors. → To Provide necessary Lubrication to various Joints

9 am
10 am
11 am
12 noon
1 pm
2 pm
3 pm
4 pm
5 pm
6 pm
7 pm

26 SUNDAY

2022