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① SECTION I

5 Types of substation

- Transformer substation /1
- Switching substation /1
- Power factor Correction sub-station /1
- Frequency Changer sub-station /1
- Converting substation /1
- Industrial sub-station /1

② a) AN: Air nature Cooling /1
b) AF: Air forced Cooling /1
c) ONAN: oil nature, Air nature cooling /1.5
d) OFAF: Forced oil, forced air Cooling /1.5
} Corrected

③ a) gas cushion /1
b. High terminal voltage /1
c. magnetic core and winding inside the housing /1
d. porcelain insulator /1
e. Secondary terminal box /1

④ Advantages of Vacuum circuit breaker (4)
- Vacuum circuit breaker does not require any additional filling of oil or gas. they do not need periodic ~~oil~~ refilling. /2
- Rapid recovery of high dielectric strength on current interruptions that only a half cycle or less arcing occurs after proper contact separation /1
- Breaker unit is compact and self contained It can be installed in any required orientation /1
- because of the above reasons together with the economic advantages offered, Vacuum circuit breaker has high acceptance /1

(5) Testing instrument used for testing substation installation are. (5)

1. Field strength tester /1
2. Circuit breaker tester /1
3. protection relay tester /1
4. High Voltage detector /1
5. High voltage multimeter /1
6. Megaohmmeter /1

(6) Information (data) contained in trouble report of substation are: (5)

- Equipment type /1
- Manufacturer (name) /1
- Model number /1
- Equipment ratings /1
- Severity of system disturbance /1
- Date of manufacture /1
- Date of reported trouble /1
- problem type /1

(7) types of overcurrent relay (5)

- Instantaneous overcurrent relay /1
- Inverse time overcurrent relay /1
- Definite time overcurrent relay /1
- Inverse Definite time overcurrent relay /1
- Extremely inverse Definite time overcurrent relay /1

(8) A: potential/Voltage transformer /1
B: Voltmeter /1
C: Wattmeter /1
D: Ammeter /1
E: Current transformer /1

(9) Function of substation are: (5)
- Protection of transmission system /1
- Controlling the exchange of energy /1
- Ensure steady state and transient stability /1
- load shedding and prevention of loss of synchronism. Maintaining the system frequency within targeted limit /1
- Voltage control, reducing the reactable power flow by compansation of reactive power, tap-changing /1
- Securering the supply by providing adequate ligne capacity /1
- fault analysis and pin-pointing the cause and subsquant improvement in that area of field /1
- data transmittion via power line carrier for the purpose of network monitoring, control and protection /1
- Determining the energy transfer through transmission line /1
- Reliable supply by feeding the network at various /1
- Establishiment of economic load distribution and several associated functions /1

(10) equipment used to maintain substation (5)
- Tools
  - protective equipments /1
  - climbing equipments /1
  - Electical inspecting and testing equipment /1
  - large portable and mobile equipment /1
  - All hands and mechanically operated /1

(11) tasks to be performed when you make visual inspection of power transformer (consider 5)
- load Tap-changer check /1
- Replace silica gel /1
- cleaning /1

• bushing, check /1
• tank and associated device check /1
• Oil level check /1

(12) - Overall /05: protect dust over cloves and body /05
- gloves /05: protect hands /05
- safety shoes /05: protect feet /05
- goggles /05: protect eyes /05
- Ear muff /05 protect ears /05
- safety belt /05 protect personal for /05 falling down

SECTION II

(13) A: lightning arrester /2 / surge arrestors
B: insulator /2
C: Fuse /1
D: OCB (oil ~~circuit breaker~~) /1 Control board
E: pole /1
F: Isolator operating handle /1
G: Transformer /1
H: Isolator /1

(14) substation: is a past of an electrical generation, transmition and distribution system /3
A: bus bar /1
B: Disconnector (bus-bar isolator) /1
C: Circuit breaker /1
D: Current transformer /1
E: Voltage " /1
F: Isolator line /1
G: earthing switch /1

(15) 1. screw drivers /05: used for closing and opening screws /05
2. plier /05 used for cutting, striping, Twisting wires, Cables /05

3- Spanners /05 used for opening and closing bolts and nuts /05

4: hammer /05 used for hammering /05

5: spirit level: /05 used for indicating vertically and horizontal of the surface /05

6. Tape measure /05 : used for measuring distance /05

7. Hack saw /05 used for cutting Cables, metals /05

8. drilling machine /05 used drilling holes /05

9. grinding machine /05 used for ~~Cutting~~ Cutting metals /05

(16) Five types of maintenance are: (5)

1. corrective maintenance /1 : the set of tasks is destinated to correct the defect to be found in the different equipment and that are communicated to the maintenance departement by users of the same equipment /1

2. preventive maintenance /1 Its mission is to maintain a level of certain service on equipment, ~~proo~~ programming the intervations of their vulnerabilities in the ~~intervations of their~~ most oppotune time. It is used to be systematic character that is the equipment is inspected even if it has not given any symptoms of having a problem /1

3. Predictive maintenance /1 it is pursues constantly know and report the status and operational capacity of the installation by knowing the values of certain variables which represent such state and operational ability to apply this maintenance, It is necessary to indentify pysical variables (temperature, vibration, power consumption, ---) which variation is indicative of problems that may be appearing on the equipment /1

4. Zero hours maintenance (over hauls) /1
The set of task whose goal is to retrieve the equipment at scheduled interval before appearing any failure, either when the reliability of the equipment at scheduled interval before appearing any failure, either of the equipment has decreased considerably so it is risky to make forecast of production capacity. Thus revision is based on looking the equipment to zero hours of operation, That is as if the equipment were new. These reviews will replace or repair all items suject to wear the aims to ensure with high probability a good working time fixed in advance /1

5. periodic maintenance /1 The basic maintenance of equipment made by the users of it. It consist of series of elementary tasks (data collections, visual inspections cleaning lubricate retightening screws) for which no Extensive trainning is necessary but perhaps only a brief training. This type of maintenance is the based on TPM (Total productive maintenance) /1

(17) g)

Location	Possible Causes	Remedial action
from Screw joints	• Foreign Material Threads /1	• remove the foreign material /1
	• poor threads /1	• check the threads and replace if required /1
	• improper assembly /1	• Ensure proper Assembly /1

b) /4

Type of failure	possible cause	remedial action
H.V bushing flashover	. lightning discharge or overvoltage /1	It may a break in the turns or end leads flash marks on the end coil and Earthed part close to it /1
	Dirty bushing /1	Ensure cleaning of porcelain bushing during each inspection /1

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(18) Maintenance procedures followed while performing maintenance activity

1. Inspection /1
This a maintenance action which calls for a careful scruting of switchgear component. The inspection is carried out without dismantling component from its assembly /1.5

2. Servicing /1
serving implies work that is carried out for ensuring that the equipment is kept in acceptable condition. It does not involve any dismantling and is typical limited to the cleaning, lubricat- and adjustment as specified in the operation and maintenance instruction of the switchgear /1.5

3. Examination /1
This is an inspection carried out with partial dismentling /1.5

4. ~~Ove~~bo overhaul /1
work done with the objective of repairing or replacing parts, which are found to be below standard by examination, so as to restore a particular component or the entire equipment an acceptable condition /1.5

2. a) AN: cooling is achieved by ~~forced~~ circulating outside air and these transformers are air cooled Transformers /1

b) AF: Cooling is achieved by forced (with the help of industrial fans) Air circulation /1.5

c) ONAN: Cooling is achieved by circulation of oil and outside air acts as a heat dissipation medium /1.5

d) OFAF: Cooling is acquired by forced (or helped) circulation of synthetic oil and air /1.5