

# Cooling of transformers

- ↳ Losses in transformer-Converted in heat energy.
- ↳ Heat developed is transmitted by,
  - ↳ Conduction
  - ↳ Convection
  - ↳ Radiation
- ↳ The paths of heat flow are,
  - ↳ From internal hot spot to the outer surface(in contact with oil)
  - ↳ From outer surface to the oil
  - ↳ From the oil to the tank
  - ↳ From tank to the cooling medium-Air or water.

# Cooling of transformers

→ Methods of cooling:

- Explain different methods of cooling of transformer with neat sketches. (May 2011, Dec 2014)
- In dry type transformer
  - heat generated is conducted across the core and winding to be dissipated from the outer surface of winding to the surrounding air through convection

## In oil immersed transformer

- heat produced inside the core and the windings is conducted across them to their surface. This heat is transferred by oil to the walls of tank. Finally tank to surrounding air by radiation convection.

### \*\*Choice of method depend upon

A) size B) type C) Application D) Condition of site

Letter symbols:- A air G gas L synthetic oil O mineral oil

S solid insulation W water N natural

F Forced

Types of cooling:

\* Air Cooled (Dry type)

1. AN Air natural

2. AB air blast

\* Oil Cooled(oil immersed transformer)

1. ON oil natural

2. ONAF oil natural air forced

3. ONWF Oil Natural water forced

4. OF Forced circulation of oil

- OFAN oil forced air natural

-OFAF oil forced air forced

-OFWF oil forced water forced

## 1. AN -(Air naturals)

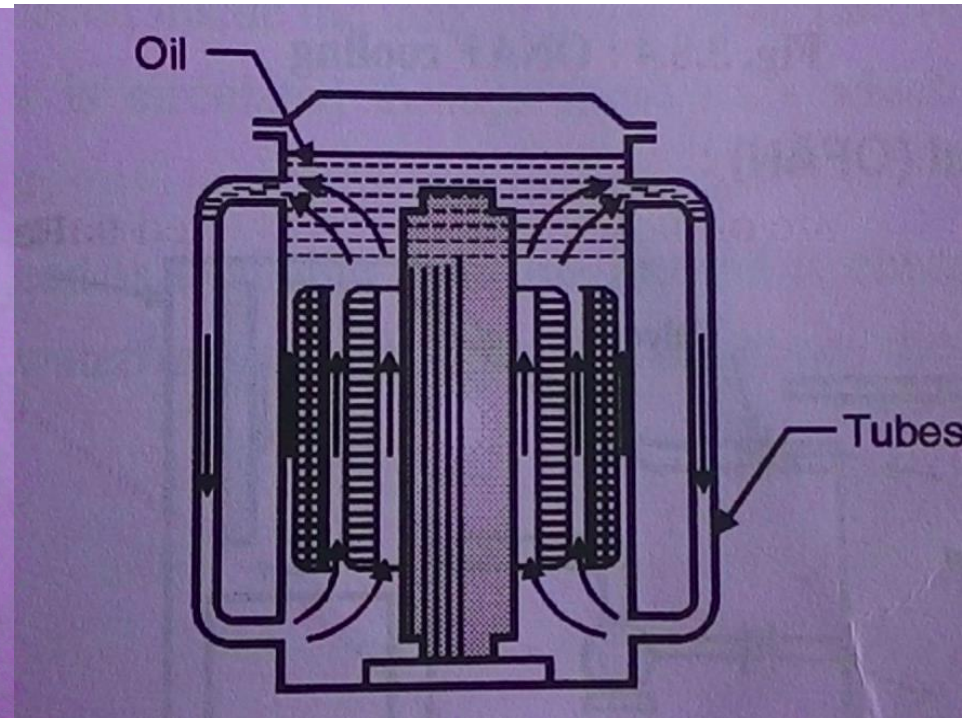
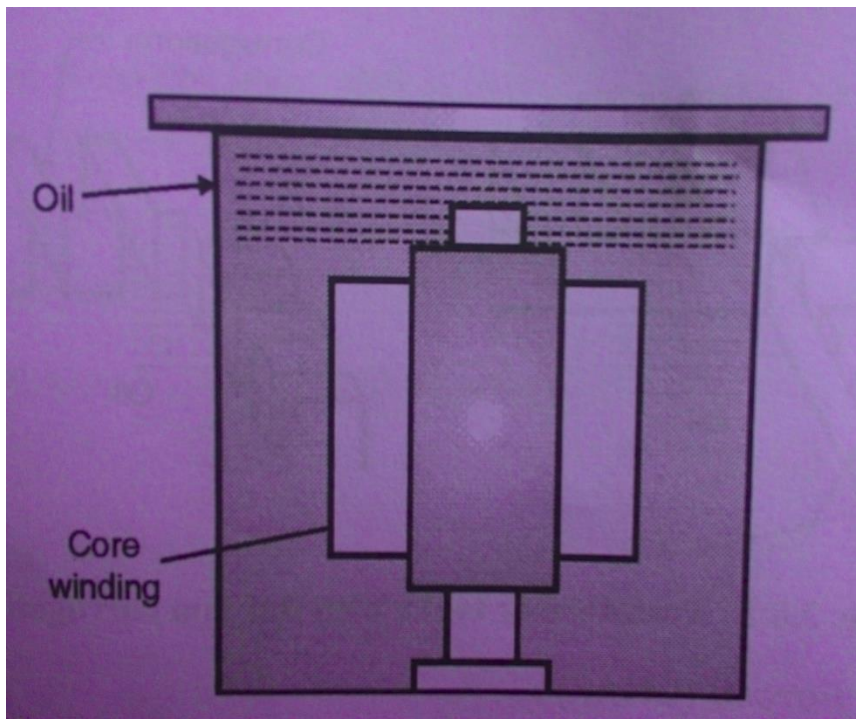
--Ambient air is used as medium of cooling the generated heat is taken away by the means of natural air circulation of surrounding air.

## 2. AB (Air blast)

--In this method also natural air is used but it is circulated forcefully in the form of continuous blast over the winding of transformer

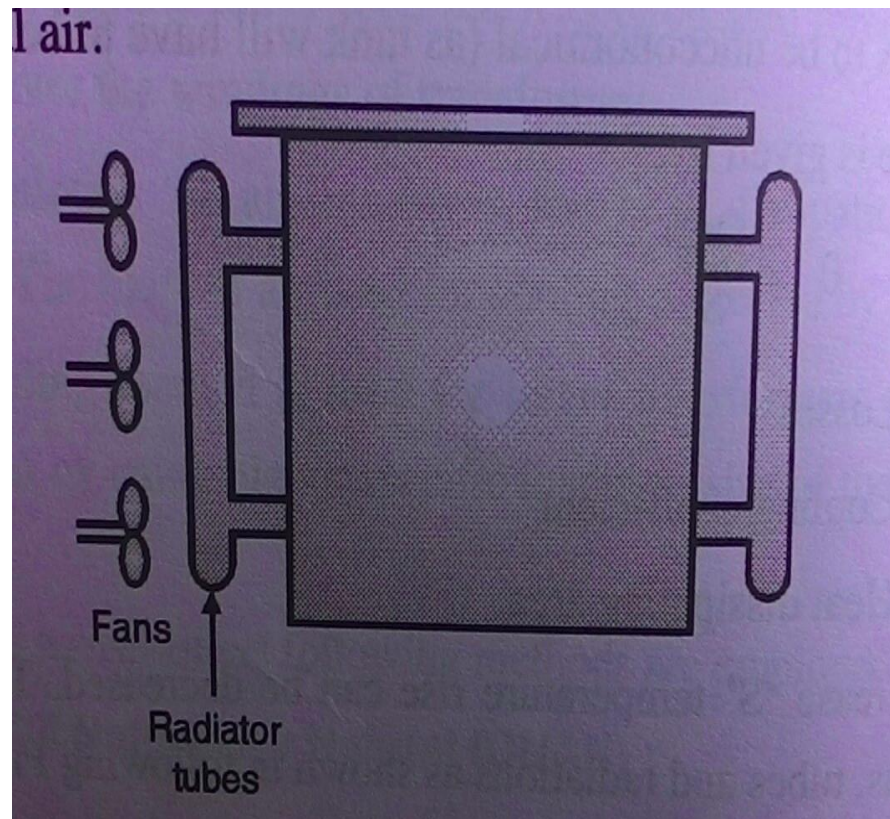
## 1. ON (oil natural)

- As rating increases , an method is not sufficient for cooling.
- Most of the transformer are oil immersed and are cooled naturally.



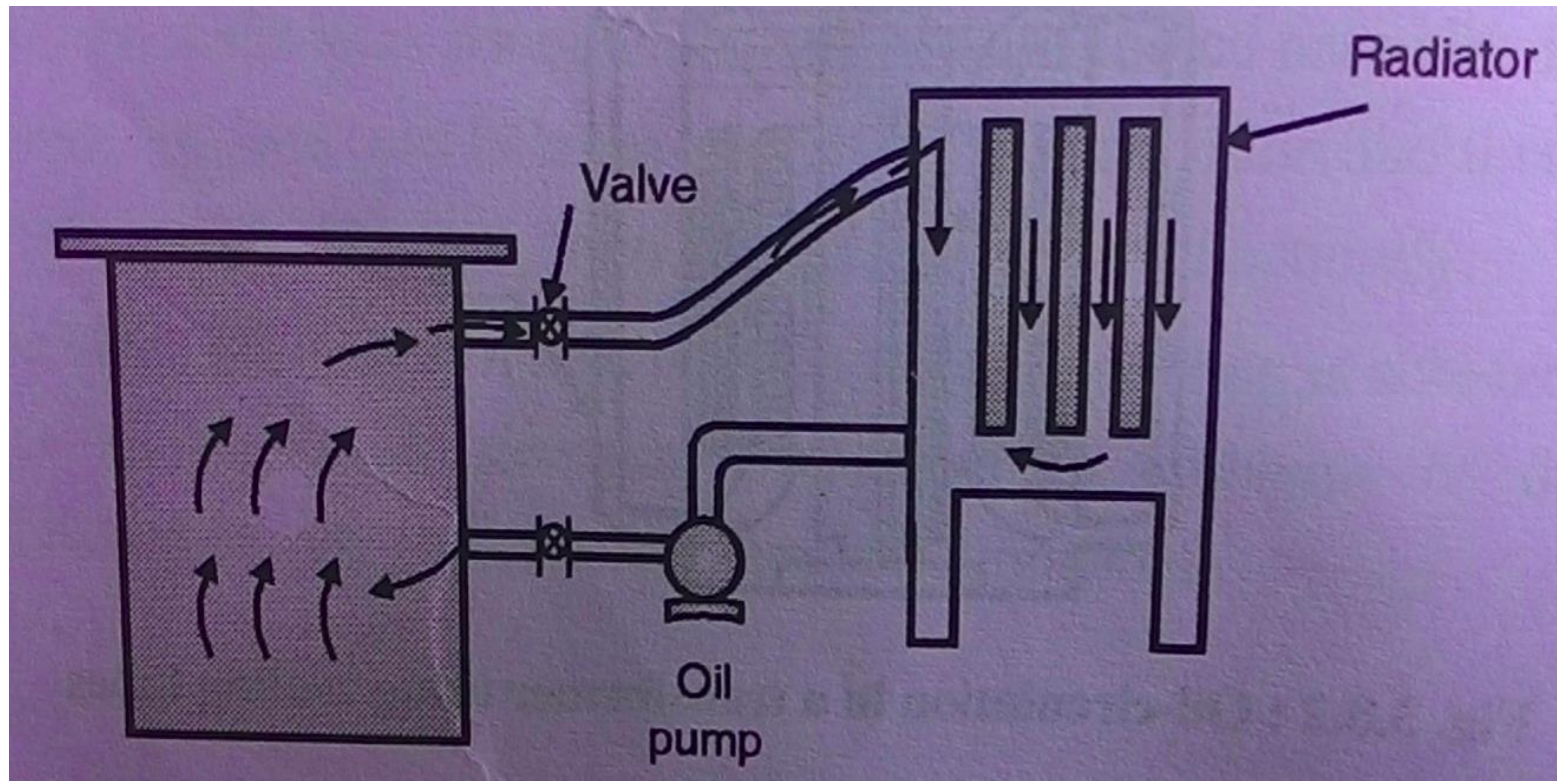
## 2. ONAF oil natural air forced

- Used for medium rating transformer
- Heat remove from the tank surface by air blast on the tank surface using fans



## OFAN oil forced air natural

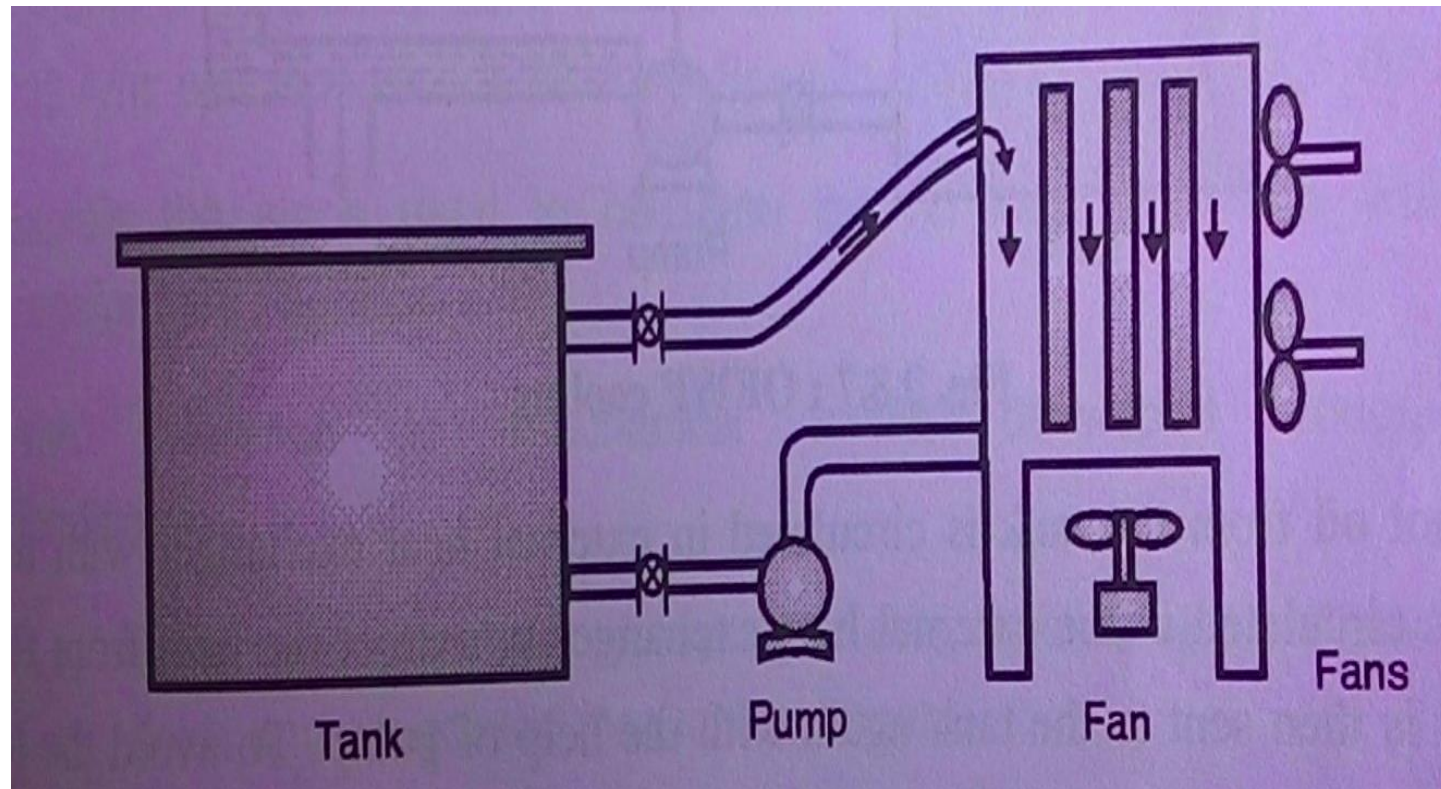
- In this hot oil is forced to circulate in to the external radiator using a pump. By using natural air oil is cooled.





## DFAF oil forced air forced

- ➔ Used for large transformer(power)
- ➔ Improvement in OFAN method
- ➔ Low load OFAN is used and at full load DFAF is used



## DFWF Oil Forced water forced

- With the help of pump hot oil from tank is circulated in external heat exchanger
- Water is circulated in the external heat exchanger.
- Cooled oil is sent to the tank by pump
- To avoid the leakage of water into the oil , the pressure of oil is kept higher.

