EXP. No. (3)

Parallel Operation of Two Three Phase Transformer

Theory:

Modern power system generation transmission and distribution usually have several transformers that are operated singly or in several parallel combination to supply a common load. There are good reasons for this practice. The efficiency of transformer is a maximum, or near full-load. Since the power system load fluctuates during 24 hours period, it is most economical to have several smaller transformers connected in parallel to share the common variable load.

Continuity of service is of course, extremely important in the operation of electrical system. It requires several transformers connected in parallel, so that break down of a transformer does not involve the complete interruption. It is a good practice to give transformer periodic inspection to still the possibility of failure of the system. So service continuity is maintained without shut down the whole system. As the future demand increases in a system it is easy to install another transformer in parallel to other rather than replacing the existing system by completely new system.

For the successful operation in parallel, the transformers must satisfy the following conditions:

1- The voltage rating of the primary winding, as well as the secondary windings must be the same, i.e. the transformers must have the same voltage ratio.
2- Secondary voltage of one transformer must be in phase with the secondary voltage of the other transformer with respect to load. Both transformers should have same phase sequence.
3- Equivalent impedances of the two transformers (ohmic values) referred to the same windings should be inversely proportional to their KVA rating.
4- The ratio of the equivalent resistance to the equivalent reactance for both the transformers should be the same.
5- The two transformers share loads according to their ratings a 3 phase transformer is connected in several ways Y-Y, Δ- Δ, Y- Δ, Δ-Y. The following combinations are possible for parallel operation.

First Transformer	Second Transformer
Y-Y	Y -Y
Y-Δ	Y -Δ
Δ- Δ	Δ - Δ

The following connections are not possible for parallel operation

First Transformer
Y-Y
Y-Y
Δ- Δ

Procedure:

1- Take Y-Y & Y-Y combination given above and complete the circuit diagram as shown in fig. (1).
2- Keep switches S1 and S2 off.
3- Be sure that the out of power supply is at its minimum value at the time of switching on.
4- Check the phase sequence indicator, by applying rated primary voltage to the transformer. If the phase sequence indicator is not available then both the voltmeters connected in secondary of the transformers are reading zero, the connection are correct in phase. If one or the voltmeters are reading same voltage instead of zero the connections are not correct in phase. In that case you should change the phases.
5- If the connection is correct in phase, switch S1 ON. Now both the transformers are in parallel.
6- Switch on load switch S2.
7- Now changing the 3 phase load, go on recording two to three readings.
8- Repeat the above procedure for other connections if it is possible.

Observation Table

NO.	First Transformer	Second Transformer	Voltage Between Phases	Load Current Share by The Transformers	
				First	Second
1					
2					

Calculation:

Determine KVA rating at different load currents.

Questions:

1- Why in some cases the voltage between the same phases is zero and some cases it is not?
2- What will happen if transformers are connected in parallel without satisfying the necessary conditions?
3- Out of the conditions for successful parallel operation listed above, state of the conditions must be strictly satisfied, and which of the condition permit deviation?

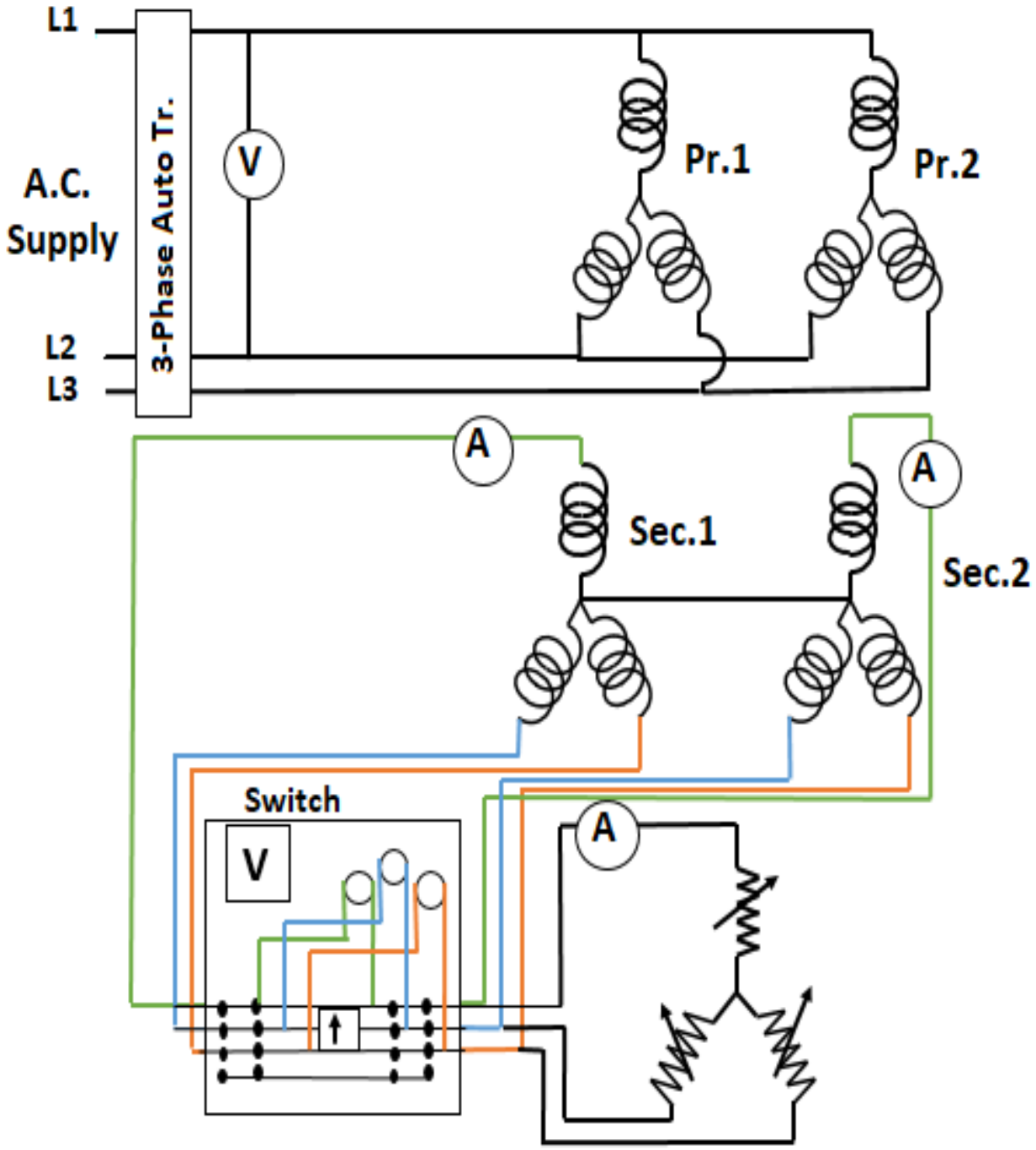
L1
A.C.
Supply
L2
L3
3-Phase Auto Tr.
V
Pr.1
Pr.2
A
Sec.1
A
Sec.2
Switch
V
A

Fig. (1)