Expt. 4

NAME → NAKUL

ENTRY NO. → 2022EEB1192

Group NO. → 1.

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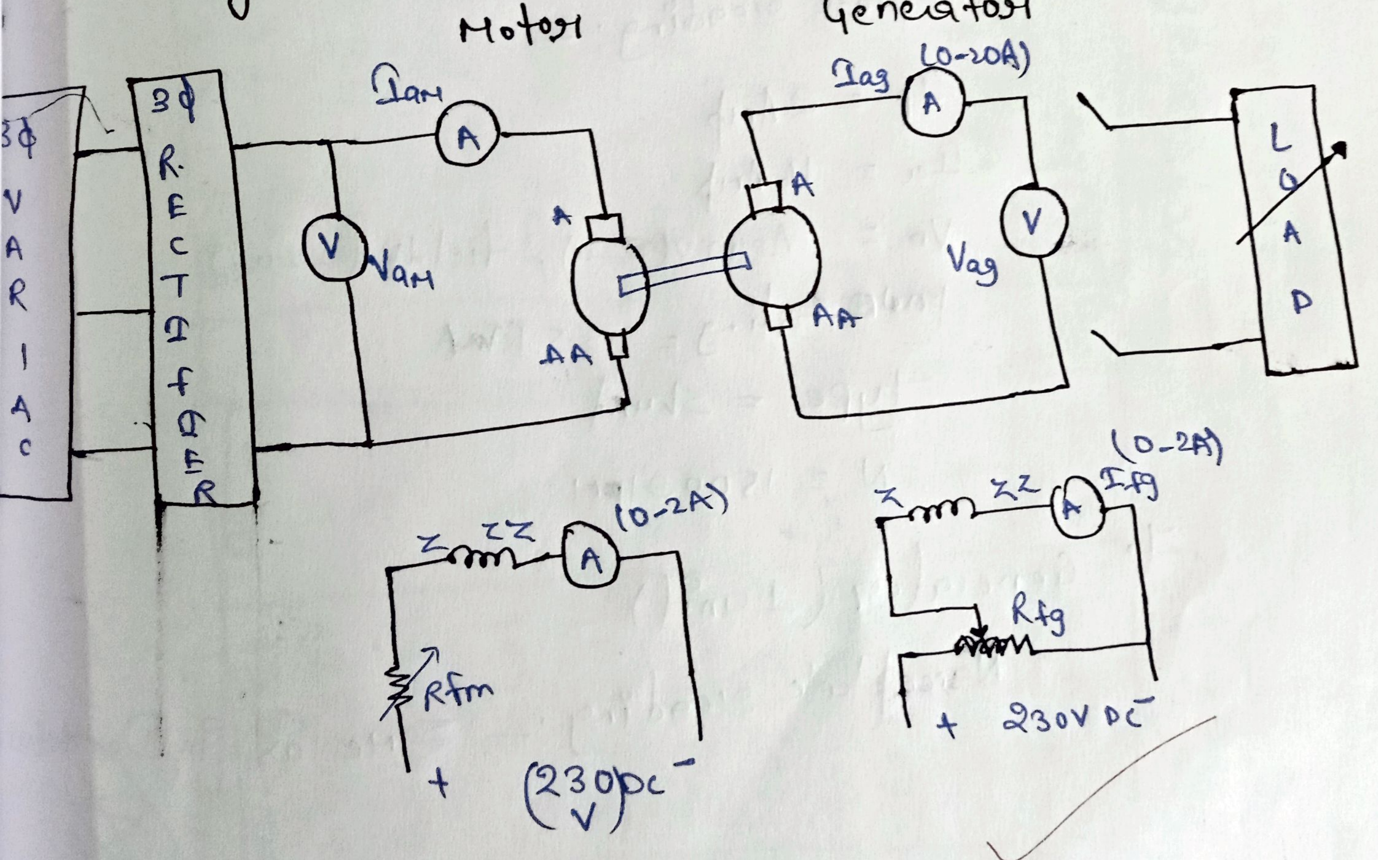
Objective:—

- To determine the magnetization characteristic of a separately excited DC generator.
- To determine the load characteristic of a separately excited DC generator.

Circuit Diagram:—



Separately Excited DC Motor Generator

List of Components:—

1. Variac
2. 3ϕ Rectifier (1unit)
3. Voltmeter (0-250V) (4units)
4. Ammerter (4units) {2 of 0-20A range, +2 of 0-2A range}
5. Rheostat (2 units)
6. DC Motor (1unit)

   Nameplate reading:—

   I_f = 2Amp

   I_a = 16Amp

   V_o = Arm v(220), field v (220V)

   ~~power~~ rating = 3.5 KWA

   type = shunt

   N = 1500 rpm

7. Generator (1unit)

   Nameplate reading:— Same as in Dc

Rated speed = 1500 rpm.

OCC of DC generator

S.No.	I_{fg} FORWARD	I_{fg} Reverse	V_{ag} (V) FORWARD	V_{ag} (V) REVERSE
1.	0		22	24
2.	0.25	0.25	62	70
3.	0.5	0.5	139	137
4.	0.75	0.75	180	179
5.	1	1	200	200
6.	1.25	1.25	214	214
7.	1.5	1.5	224	224
8.	1.75	1.75	232	232
9.	2.00	2.00	238	238

Rated I_{fg} = 2 Amp.

S.No.	N F.W	N B.W	V_{ag} F.W	V_{ag} B.W
1.	150	148	24	22
2.	300	300	48	47
3.	450	446	70	70
4.	600	600	95	95
5.	750	747	119	118
6.	900	895	142	140
7.	1050	1050	165	165
8.	1200	1198	188	187
9.	1350	134	211	210
10	1500	1500	235	235

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load test:—

Rated I_{fg} = 2 Amp   speed 1500 RPM

$K_a = 2.3\,\Omega$

S.No.	load current (I_{ag})	V_{ag}	V_{aM}	I_{aM}	$E_{ag} = (V_{ag} + I_a R_a)$
1.	2.0	230	220	3	234.6
2.	4.0	228	219	5.2	237.2
3.	6.0	224	215	7.4	237.8
4.	8.0	220	219	9.4	238.4
5.	10	218	217	12	241.0
6.	12	214	220	13.8	241.6
7.	14	210	218	16.4	242.2
8.	16	208	219	18.4	244.8

$230 + 2.0 \times 2.3 = 234.6$

$+ 16 \times 2.3 = 2$

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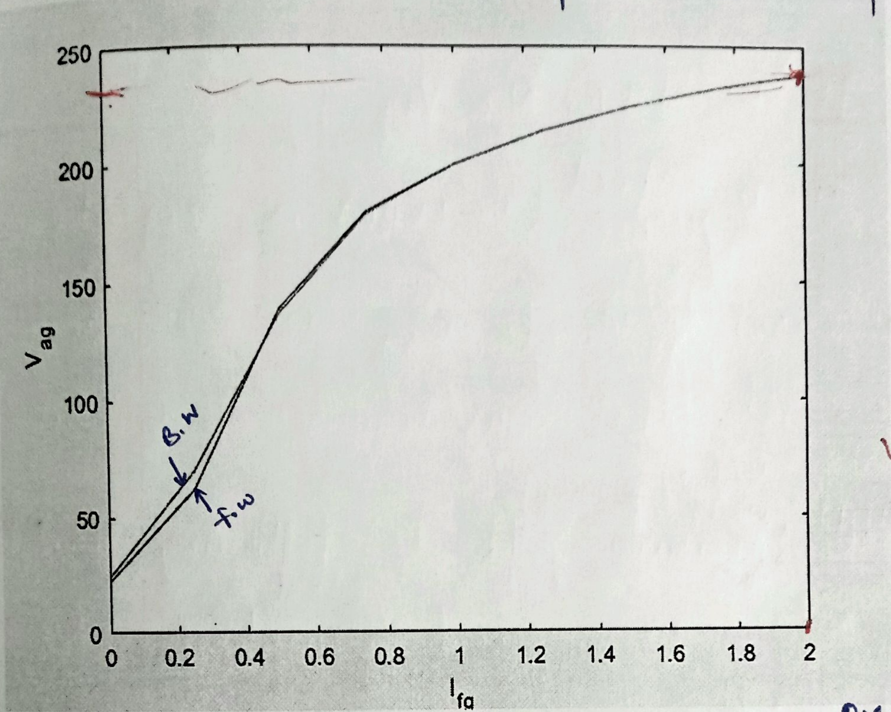
R_f (field Res.)

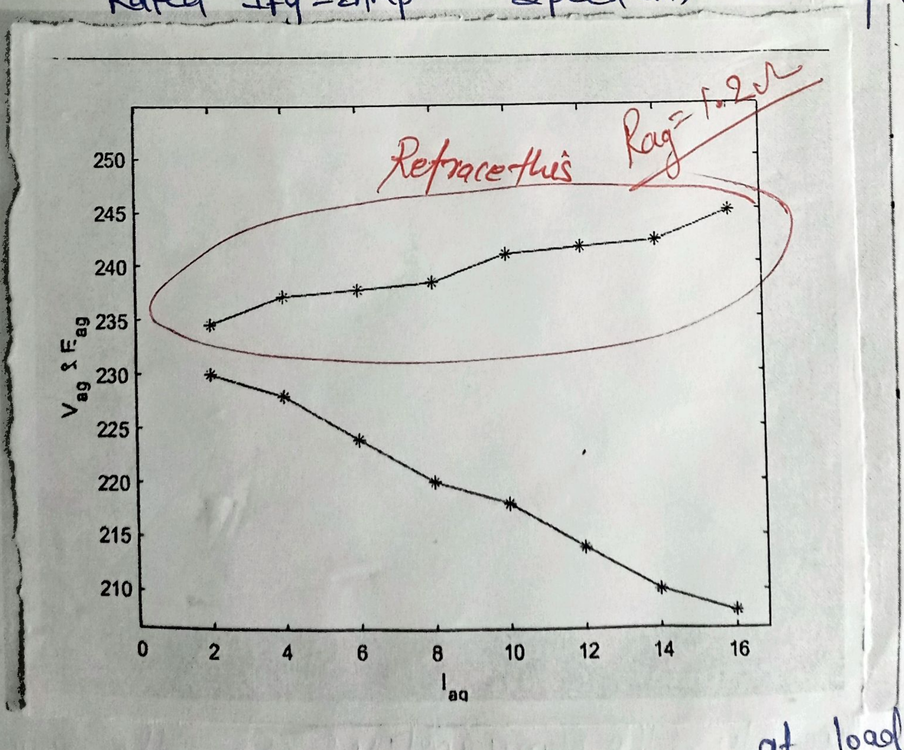
R_{arm}

Rated speed (N) = 1500 rpm.



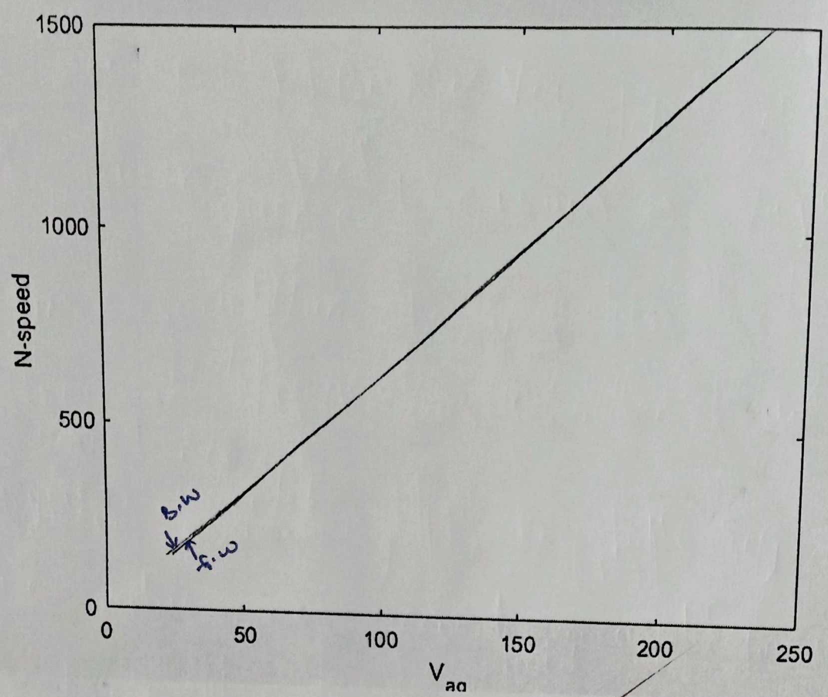
O.C.C

Rated I_{fg} = 2 Amp. speed (N) = 1500 rpm.



at load

Rated $I_{fg} = 2$ Amp.



$N \propto V_{ag}$

O.C.C.

Result / calculation:—

we got field resistance $(R_f) = 113\,\Omega$

& Armature Resistence $(R_a) = 2.3\,\Omega$

we got all these values using multimeter.

observation:—

while performing the Experiment, we notice that at $I_{fg} = 0$, there was some V_{ag} value, this was due to the magnetism in the armature at a given speed.

Precautions: —

After all connection, circuit must be verified from teacher. A wrong connection, might be cause of damage.

2. When you are goin to switch ON, you should follow the sequence
first ON Dc field than Dc armature (motor) after it Dc field of Generator and then load.

3. and to switch off first load to zero. Switch off of Dc field of generator, than Dc armature and than Dc field.

i.e. Dc field switch ON first and switch off at last.

4. Before you are going to switch on just observe that your auto transformer must be at its initial stage. i.e. 0 V.

NAME : NAKUL
ENTRY NO. : 2022EEB1192
GROUP NO. : 1.

Exp. 3

8/10

Objective:-

* To Connect the given three identical single phase Transformers in all the possible three-phase connection.
* To study the efficiency and voltage regulation of a star - star three phase transformer.

Various 3ϕ transformer connection:-

There are four types of connections:-

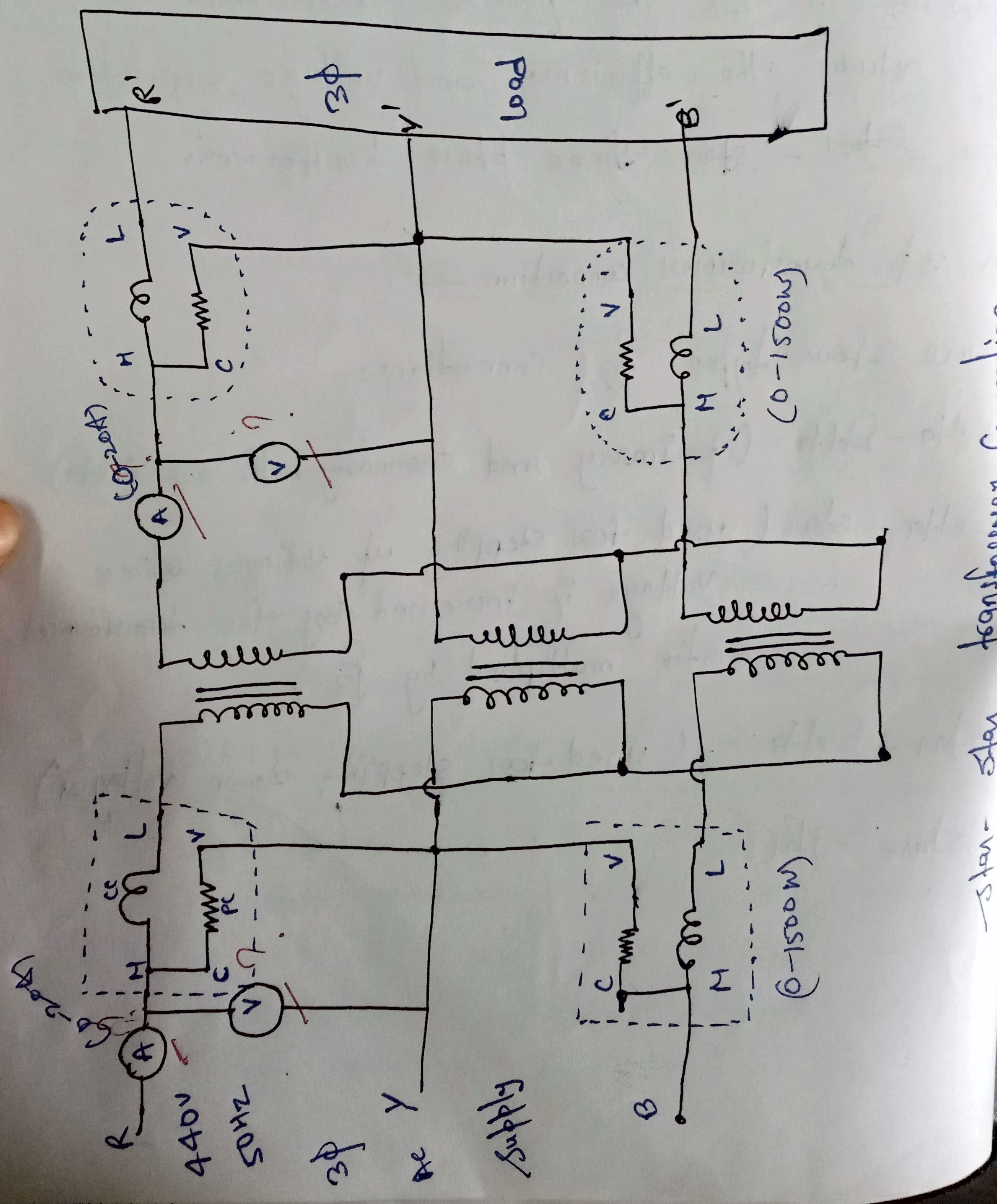
(i) Delta - Delta (primary and secondary both are delta)

(ii) Delta - star (used for stepping up voltages since voltage is increased by the transformer ratio multiplied by $\sqrt{3}$.)

(iii) Star - Delta:- (used for stepping down voltages)

(iv) Star - Star:

Circuit Diagram:—



	No load		Secondary	
	Line	Phase	Line	Phase
-Y	400V	234.5	400	234.5

Load Test

	Primary					Secondary				
	W_p	V_L	V_p	$I_c/2$	$I_p/2$	W_s	V_L	V_p	$I_c/2$	$I_p/2$
1.	1600W	400	235	0.5A	0.5A	1120	395	232	0.4	0.4
2.	2880	400	235	2A	2A	2400	390	230	1.8A	1.8A
3.	4160	400	235	2.9	2.9	3680	385	227	2.8	2.8A
4	5280	400	235	3.9	3.9	4880	380	226	3.7	3.7
5	6720	400	235	4.8	4.8	6240	380	227	4.65	4.65
6	7200	400	235	5.2A	5.2A	6560	380	223	5.1	5.1

	Primary No load		Secondary No load	
	Line	Phase	Line	Phase
Δ-Y	400V	400V	($400\sqrt{3}$) 692.82 V	400V
	200V	201V	($200\sqrt{3}$) 346.41V	201V
-Δ	400V	403V	400V	403V
	200V	201V	195V	201V

5/02/24

Group No:-06

EXP-03 : To study three-phase Transformer connectio

~~Aim~~ Material required => Voltmeter (0-250V) 3 units

Wattmeter (0-1500W) 4 units

Ammeter (0-20A) 2 units

3 single ϕ Transformers - to be connected

To gain 3ϕ Transformer (10 KVA/14.43 Amps)

Observations =>

No-load conditions

Y - Y

Y - Δ

Δ - Y

st of Equipments:—

1. 3 single phase transformer (to be connected together) (10 KVA/14.43 Amp)
2. 2 unit Ammeter (0-20A)
3. 4 unit Wattmeter (0-1500W)
4. 2 unit Voltmeter — ? } → instead we used multifunction meter
5. 3ϕ load

Calculations:—

$$\text{Efficiency} = \frac{P_{output}}{P_{input}} \times 100\%$$

$$\text{Voltage regulation} = \frac{V_{NL} - V_L}{V_L} \times 100\%$$

he voltage T/f ratio:—

(i) for Y-Y connection:—

$$\frac{V_{LP}}{V_{LS}} = \frac{\sqrt{3}V}{\frac{\sqrt{3}V}{a}} = a:1 = 1:1$$

for Δ-Y connection

$$\frac{V_{LP}}{V_{LS}} = \frac{\sqrt{3}V}{\frac{\sqrt{3}\sqrt{3}V}{a}} = a:\sqrt{3} = 1:\sqrt{3}$$

Similarly for Y-Δ connection

$$\frac{V_{LP}}{V_{LS}} = \sqrt{3}:1$$

& for Δ-Δ connection

$$\frac{V_{LP}}{V_{LS}} = 1:1$$

Efficiency (Y-Y connection) :-

$$\eta\% = \frac{W_s}{W_p} \times 100$$

i) $\frac{1120}{1600} \times 100 = 70\%$.

ii) $\frac{2400}{2880} \times 100 = 83.3\%$.

(iii) $\frac{3680}{4160} \times 100 = 88.46\%$.

(iv) $\frac{4880}{5280} \times 100 = 92.42\%$.

v) $\frac{6240}{6720} \times 100 = 92.85\%$.

vi) $\frac{6560}{7200} \times 100 =$

Voltage Regulation:-

$$VR\% = \frac{|V_{nl}| - |V_{fl}|}{|V_{fl}|} \times 100$$

$|V_{nl}| = 400V$

then.

i) $\frac{400-395}{395} \times 100 = 1.2\%$;

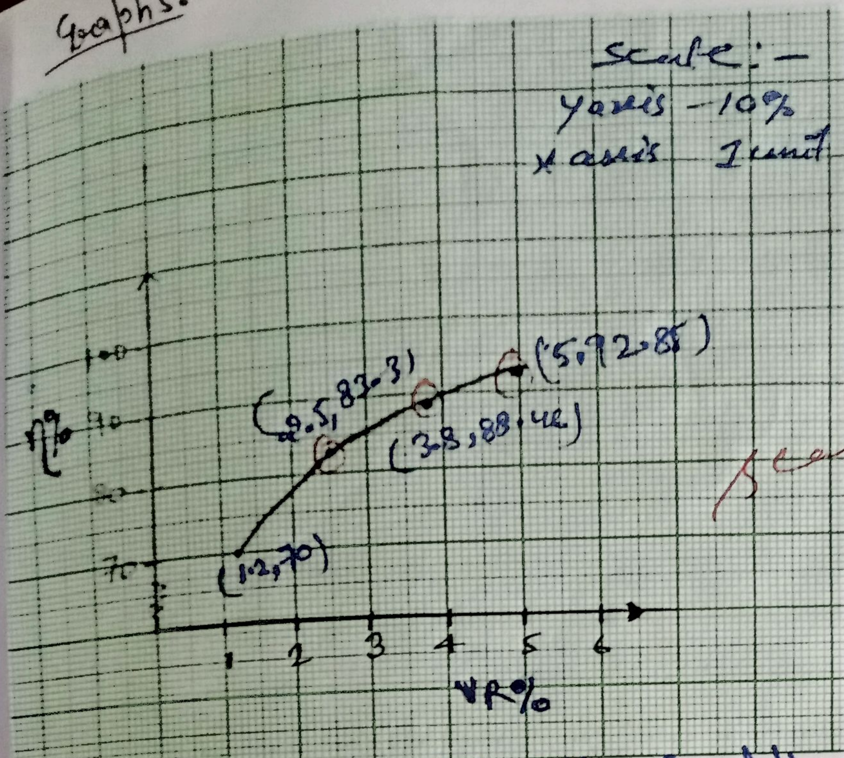
ii) $\frac{400 - 390}{390} \times 100 = 2.5\%$;

iii) $\frac{400 - 385}{385} \times 100 = 3.8\%$;

(iv) = (v) = (vi)

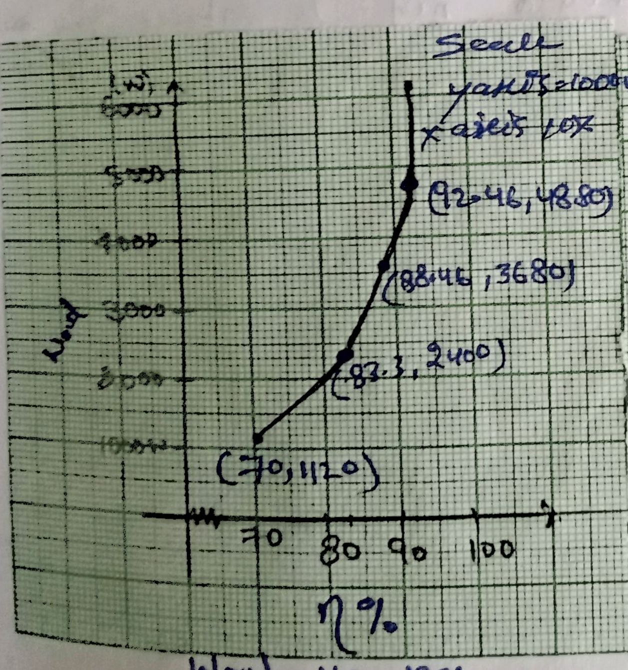
$= \frac{400-380}{380} \times 1$

Graphs:—

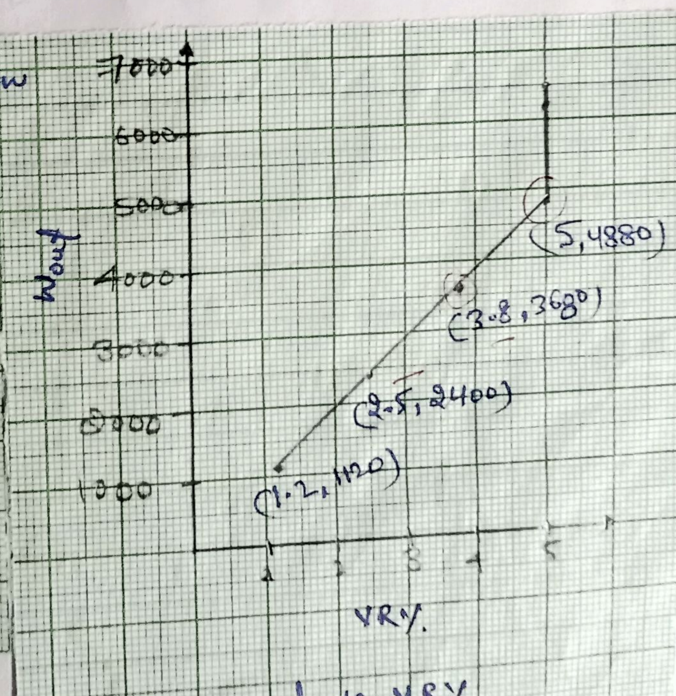


Efficiency VS Voltage Regulation

scale not mentioned?



Wout VS η%



Wout vs VR%

Graphs of result we got.

Precautions:-

1. Make sure that the winding are in the pr phase relationship.
2. power should not on untill circuit is comple verified.
3. The voltage across the terminal should no increased above than rated voltage it can destroy the insulation of the transformer.
4. also current should not be above the r current. it might ~~be~~ ~~[illegible]~~ burn up transfor windings.

Conclusion:⇒

As we performed three phase transformer connections, we got all results are with in perm limits.

Y-Y three phase transformer results of load test were noted and we compute VR and Efficieny.

We got on conclusion, after getting lab graph and ust observation that for Y-Y only 57.7% line voltage applied to get full line current

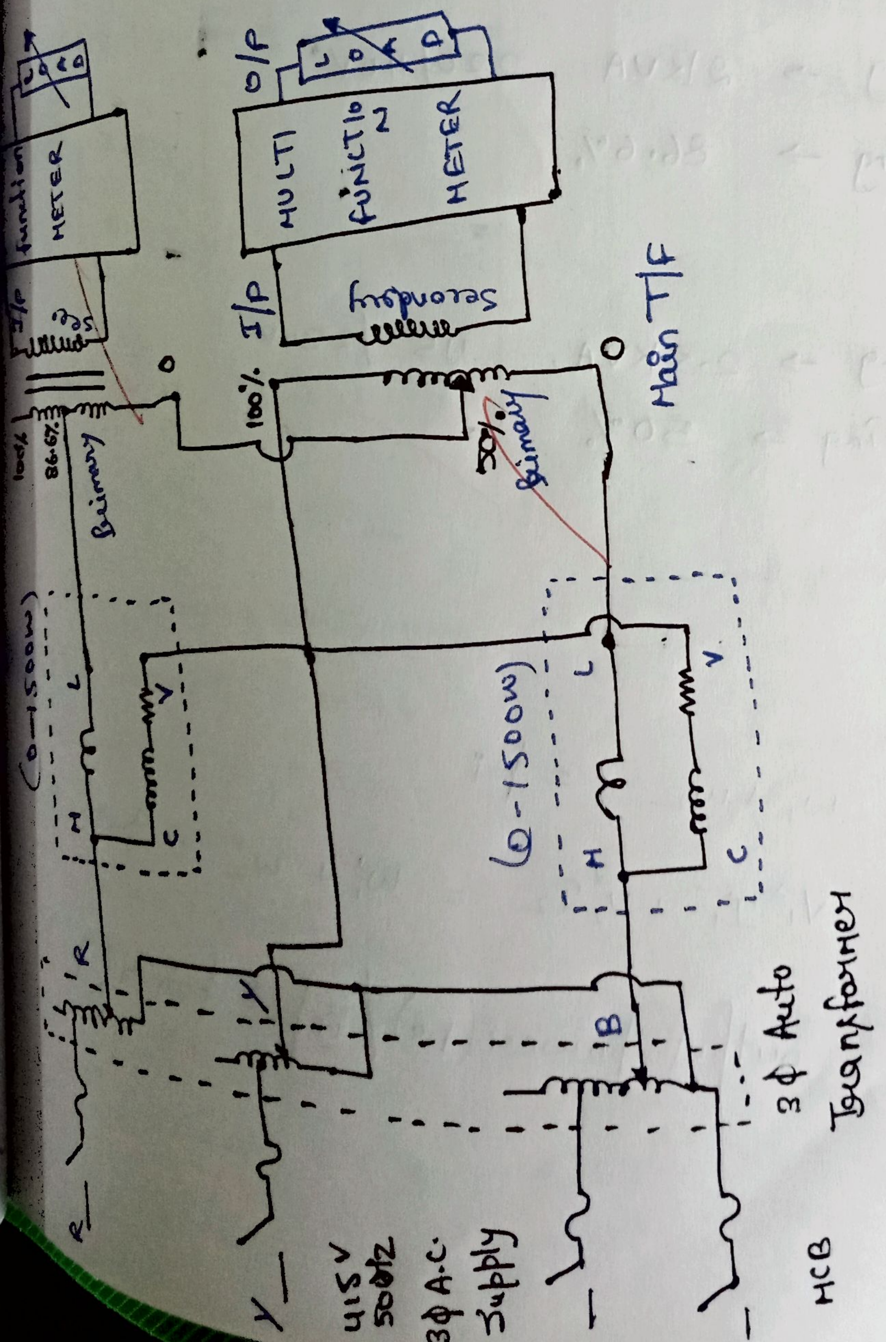
In ΔY connection voltage setsup by increased by transformer by multiply by √

ENTRY NO. - 2022EEB1192
GROUP - 1

Exp-2

jective:-
To study the performance of Scott connected transformer on no-load and full load.

cuit Diagram:-



SCOTT Connection ON 1-Phase Transformers

Equipments:—

1. Voltmeter (0 - 250V)
2. Ammeter (0 - 10A)
3. Watt meter 2 (0 - 1.5 KVA) | Multifunction Met
4. Three phase variac
5. Resistive loads
6. Transformer

a) Teaser

Rating → 2KVA 220/110V

tapping → 86.6%

b) Main

Rating → 2.5 KVA, 115 /230V

tapping → 50%

formulas:—

Input power = $W_1 + W_2 = P_i$

output power = $V_1^* I_1 + V_2^* I_2 = W_1' + W_2' = P_o$

Efficiency (η) = output power (P_o) / input power (P_i)

Primary Side						Secondary Side				
KW₁	KW₂	I/P Power	V_1	I_1	W'_1	V_2	I_2	W'_2	O/P Power	% η
0.15	0.22	0.37	107.3	1.94	0.21	110.9	0.99	0.10	0.31	83%
0.20	0.26	0.46	107	2.38	0.25	110.2	1.46	0.16	0.41	89%
0.25	0.31	0.56	105.8	2.79	0.30	109.2	1.91	0.21	0.51	91%
0.30	0.34	0.64	105.1	3.21	0.33	108.8	2.37	0.26	0.59	92%
0.45	0.48	0.93	105.6	4.58	0.46	108.2	3.74	0.41	0.87	93%
0.47	0.51	0.98	104.4	4.98	0.52	106.8	4.16	0.45	0.97	98.9%
0.64	0.65	1.29	107.8	6.09	0.66	109.3	5.19	0.57	1.23	95.3%
~~0.88~~	~~0.83~~									
1.00	0.92	1.93	107.5	8.96	0.96	107.5	8.06	0.87	1.83	94.8%
1.11	1.01	2.12	106.8	9.78	1.05	106.4	8.91	0.95	2.10	94%

I/p power (P_i) = $w_1 + w_2$

0.15 + 0.22 = 0.37 KVA

0.20 + 0.26 = 0.46

0.25 + 0.31 = 0.56

0.30 + 0.34 = 0.64

0.45 + 0.48 = 0.93

0.47 + 0.51 = 0.98

0.64 + 0.65 = 1.29

1.00 + 0.92 = 1.93

1.11 + 1.01 = 2.00

output power

$w'_1 + w'_2$

1. 0.21 + 0.10 = 0.31
2. 0.25 + 0.16 = 0.41
3. 0.30 + 0.21 = 0.51
4. 0.33 + 0.26 = 0.59
5. 0.46 + 0.41 = 0.87
6. 0.52 + 0.45 = 0.97
7. 0.66 + 0.57 = 1.23
8. 0.96 + 0.87 = 1.83
9. 1.05 + 0.95 = 2.12

Efficiency:—

$$\frac{\text{output power}}{\text{Input power}} \times 100$$

1. $\frac{0.31}{0.37} \times 100 = 83\%$.

2. $\frac{0.41}{0.46} \times 100 = 89\%$.

3. $\frac{0.51}{0.56} \times 100 = 91\%$.

4. $\frac{0.59}{0.64} \times 100 = 92\%$.

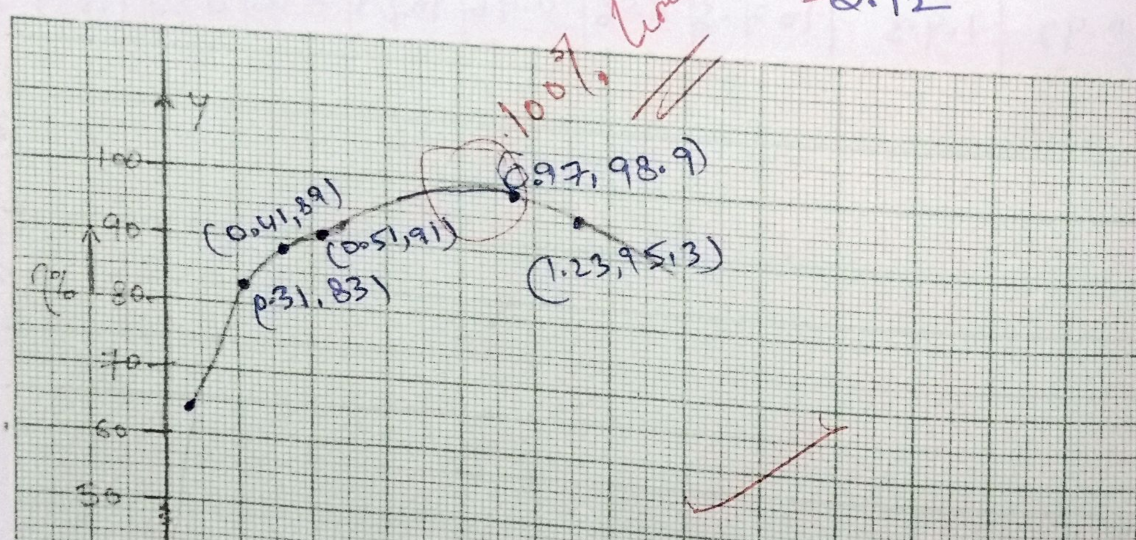
5. $\frac{0.87}{0.93} \times 100 = 93\%$.

6. $\frac{0.97}{0.98} \times 100 = 98.9\%$

7. $\frac{1.23}{1.29} \times 100 = 95.3\%$

8. $\frac{1.83}{1.93} \times 100 = 94.8\%$

9. $\frac{2.00}{2.12} \times 100 = 94\%$.



Graph Efficiency (η%) V/s output power

Conclusion:—
The scott co[...]
supply
3ϕ
The scott
significant
constant
variations
transformers
Scott con[...]
regulation
fluctuation
situations
crucial.

Precautions:—
(i) All Co[...]
(ii) Before
must [...]

Conclusion:-

The scott connection of transformers used to convert 3φ supply to 2φ supply or vice versa.

The scott connection of transformers offers significant advantages in terms of providing a constant power output to a load despite variations in input voltage. By using two identical transformers connected in a specific manner, the Scott connection allows for better voltage regulation and reduces the effects of voltage fluctuations. This is particularly useful in situations where a stable power supply is crucial.

Precautions:-

(i) All connections must be made tight.

(ii) Before making or breaking the circuit, supply must be switched off.

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NAME - NAKUL

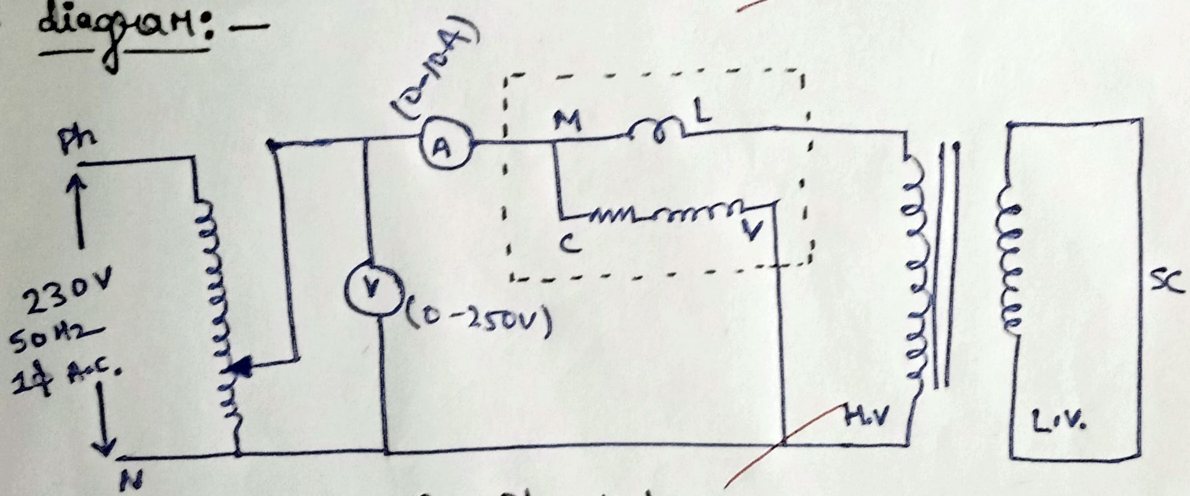
ENT. No. - 2020EE81192

Group No. 1.

objective:-

objective of the experiment is to study parallel operation of two single - phase transformers.

Circuit diagram:-



short - circuit test.

Name plate Details:-

Transformer ratings : 1.5KVA

Primary voltage : 115V-230V

Secondary Voltage : 115V - 230V

8.5/10

List of Equipment:

1. Two single phase transformers (2.5KVA, 0.575
2. Voltage Source (230V, 50Hz)
3. Ammeter (10A)
4. Voltmeter (0-250V)
5. Load Resistors
6. Auto transformer

observations:—

~~Vsc1 = 10.71V~~

Power = 81W

Voltage 1 = 8.203V

I_{sc1} = 10.47 A

Power 2 = 358 W

Voltage 2 = 34.48V

I_{sc2} = 10.56A

Rabha 18/01/24

Calculation:—

$$Z_{eq(1)} = \frac{V_{sc1}}{I_{sc1}} = \frac{8.23}{10.47} = 0.0786\,\Omega$$

$$Z_{eq(2)} = \frac{V_{sc2}}{I_{s2}} = \frac{34.48}{10.56} = 3.20\,\Omega$$

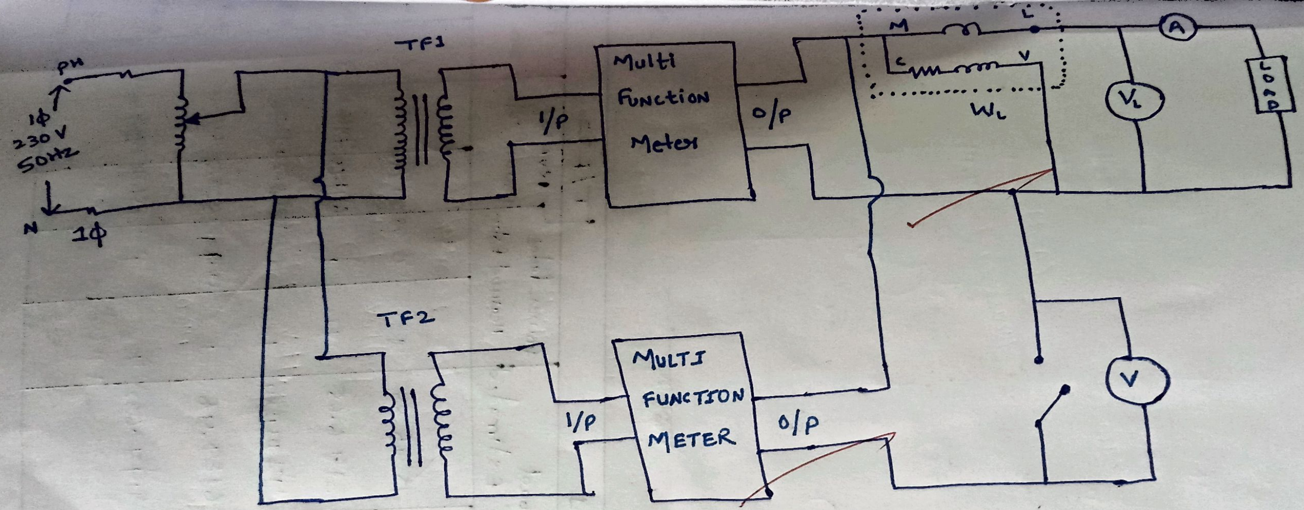
$$pf(1) = \frac{W_{sc}}{V_{sc} I_{sc}} = 0.94$$

$$pf(2) = 0.98$$

observation:—

Applied voltage = 230V

freq. = 50 Hz



Parallel operation of Single Phase Transformer

1. **Measured voltage,current and power**

Applied Voltage =

Frequency =

S.No.	Transformer 1		Transformer 2		Output				
	I_1	kW_1	I_2	kW_2	V_L	I_L A	kW_L	I_1+I_2	W_1+W_2
1.	0.45	~~0.01~~	0.31	~~0.06~~	~~213~~	~~0~~	~~0~~	~~0.76~~	
2.	~~0.85~~ 7.70	~~0.16~~ 1.65	1.38	0.28	215.1	9.25	2	9.08	1.9
3.	15.11	3.24	2.99	0.63	214.6	18.93	8.96	18.1	3.87
4.	22.46	4.79	4.68	0.98	213.3	27.57	5.89	27.14	5.77
5.	29.63	6.26	6.26	1.32	212.2	36.86	7.75	35.89	7.58
6.	44.51	9.3	9.78	2.03	209.8	54.8	11.5	54.29	11.33

S.No.	KVA O/P. $S=V_LI_L$	T/F 1 KVA load Measured	T/F 1 KVA load Estimated	T/F 1 Power factor Measured	T/F 1 Power factor Estim	T/F 2 KVA load Measured	T/F 2 KVA load esti.	P… Mea…
1	0	95.86						
2	1994.30	1660.12	1595.99	1	0.99	287.52	398.86	1
3	3955.07	3292.60	3196.65	1	1	641.65	799.01	1
4	5580.68	4890.718	4704.84	1	~~1~~	998.24	11.76	1
5	7736.81	6287.48	6189.48	1	0.99	1328.37	1547.3	1
6.	11497.04	9338.19	9197.632	1	1	2051.84	2999.46	1

Calculations: —

$R_1 = \frac{W}{(I_{sc})^2} = \frac{81}{(10.47)^2} = 0.73\,\Omega$

$X_1 = \sqrt{Z_1^2 - R_1^2} = 0.291\,\Omega$

$R_2 = \frac{356}{(10.56)^2} = 3.19\,\Omega$, $X_2 = \sqrt{Z_2^2 - R_2^2} = 0.80\,\Omega$

$S_1 = \frac{3.29}{3.29 + 0.7860} \cdot SL$

$S_2 = \frac{0.7860}{0.7860 + 3.29} \times SL$

2). 0.80×1994.30

$= 1695.44$

$= 0.2 \times 1994.30$

$= 398.04$

3). 0.80×3955.07

3196.05

$= 0.2 \times 3995.07$

$= 799.04$

4). 0.80×5880.68

$= 3832.57$

$= 0.2 \times 5880.68 = 1176.136$

5). $0.80 \times 7736.8 = 6189.44$ $= 0.2 \times 7736.8 = 1547.36$

6). $0.80 \times 11497.04 = 11497.04$ $= 0.2 \times 11497.04 = 2299.40$

P.F:-

$P.f_1 = W_1/S_1 =$ 0.99, 1, 1, 0.9957, 1.

$P.f_2 = W_2/S_2 =$ 0.94, 0.98, 0.981, 0.9937, 0.989

Conclusion:-

We conclude that:-

- parallel operation of two single-phase transformers are feasible and allows for the distribution of load among transformers acc. to their kVA rating.

Conclusion should be clear it is not showing how transformers are sharing loads ?

Precautions:-

- Handle electricity carefully to avoid electric shock
- Ensure that transformers are of the same voltage
- verify connections before applying power to it.
- while making connection ensure polarity of transformers.

Conclusion:-

- parallel operation of two transformer are feasible and allow for the distribution of load according to their kVA ratings, one with low kVA rating share more load than the other one and if both kVA ratings are equal then they will share equal load.