Chittagong University of Engineering and Technology

Department of Electrical and Electronic Engineering

Course No : **EEE 240**
Course Title : **Electrical Machine Design**

120 KVA, Three Phase, 11000/415 V Distribution Transformer Design

Submitted By,

Group No : 07

Name : **Nusrat Jahan Papri**

Student ID : **1902008**

Level : 02

Term : 02

Section : A

Date of Submission: 5th February 2023

Submitted To,

Dr. Nipu Kumar Das
Professor, Dept. of EEE, CUET

Mr. Mrinmoy Dey
Assistant Professor, Dept. of EEE, CUET

Remarks:

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. OBJECTIVE:

To design a 120 kVA, three-phase, 50 Hz, 11000/415 V, delta/star distribution transformer.

The considerations to be taken in the design:

- Tapping ± 2.5%, ± 5% on high voltage side.
- Cooling ON (self-oil cooled)
- Temperature rise over oil less than 60^0C
- Load loss not more than 3KW
- Percentage impedance %Z= 4.50%

We Calculated:

1. Efficiency at 75^0C on full load,75% load, and 50% load at unity power factor
2. Regulation on full load at 75^0C at unity power factor and 0.8 power factor lagging.

2. Solution:

3. Voltage per turn $\mathbf{E_t}$:

An empirical expression that gives voltage per turn quite accurately for transformers is

$$E_t = \frac{\sqrt{\frac{kVA \times 1000}{no.of\ legs}}}{40}$$

Here, $no.\ of\ legs$ for this three phase core type transformer is 3

$$E_t = \frac{\sqrt{\frac{120 \times 1000}{3}}}{40}$$

$$E_t = 5 \text{ V/turn}$$

4. Specific Magnetic Loading

Choose B_{max} = 1.7 Wb / m^2 ; Here, material for core is chosen as cold rolled grain oriented (CRGO) steel laminations of 0.35 mm thickness; Mitered core construction is used; mitered at 45^0

Cross Section of the core:
E_t = 4.44 $B_m\ f$ A_i volts
Where, B_m = flux density in wb/m^2 (taken as 1.7 wb/m^2)

f= 50 Hz

$A_{i=}$ net cross-sectional area of the core in the m^2

$$A_i = \frac{E_t}{4.44\, B_m\, f}$$

$$A_i = \frac{5 \times 10^6}{4.44 \times 1.7 \times 50}$$

= 13,248 mm^2

5. The diameter of the circumscribing circle for the core, d:

Here, we have chosen 7 step cores.

So, the area should be nearly circular. In the case of a 7 step core, the core space factor, K_i= 0.88 and the Stacking factor for laminations, K_i= 0.92

If, d = diameter of the core section,

$A_i = 0.88 \times 0.92 \times \frac{\pi d^2}{4}$

$$d^2 = \frac{13248 \times 4}{0.88 \times 0.92 \times \pi}$$

d = 144.342748 mm

we choose , d = 144 mm

Then, Area $A_i = 0.88 \times 0.92 \times \frac{\pi d^2}{4}$ = 13,185 mm^2

And, $B_m = \frac{E_t}{4.44\, A_i\, f}$

$$= \frac{5}{4.44 \times 50 \times 13185 \times 10^{-6}}$$

B_m= 1.708 Wb/m^2

6. Window area A_w

S = $3.33 \times A_i \times A_w \times K_w \times \delta \times B_m \times f \times 10^{-3}\ kVA$

Here, K_w = Window space factor (K_w)

$= \frac{10}{30+kv} = \frac{10}{30+11} = 0.24$

KV= voltage in kV at high tension side,

K_w is taken approximately 0.24

A_w= Window area;A_i = net cross section area of the core,m^2 δ = current density taken as 2.5 A / mm^2;

S = output in kVA (120KVA);

Therefore,

$$A_w = \frac{S}{3.33 \times A_i \times K_w \times \delta \times B_m \times f \times 10^{-3}}$$

$$A_w = \frac{120 \times 10^6}{3.33 \times 13185 \times 0.24 \times 2.5 \times 1.708 \times 50 \times 10^{-3}}$$

= 53,339 mm^2

Now, we choose, Window width = 150 mm

Then, The height of the window = 2 × width of window (approximately)

= 2 × 150

= 300 mm

Now, Height of window = $\frac{A_w}{d}$ mm

= $\frac{53,339}{150}$mm

≈ 356 mm

Checking clearance to yoke, this is later taken as **350 mm**

Now, window area, A_w = 150 × 350 = 52500 mm^2

The main dimensions of the core are therefore: Diameter, d = 144 mm;

With a 7-step core, the largest width of the core with d = 144 mm is equal 0.95× 144 ≈ 137mm

D = distance between the centers of the adjacent limbs

= 150 +137 = 287 mm;

Fig: 1 shows the core and yoke assembly dimensions.

Here,

Height of window = 350 mm

Total width = (2 × 287) + 137 = 711 mm

Total height =350 + (137×2) = 624 mm

By checking the window space factor approximately, K_w = 0.2438 which is near about 0.24 (chosen)

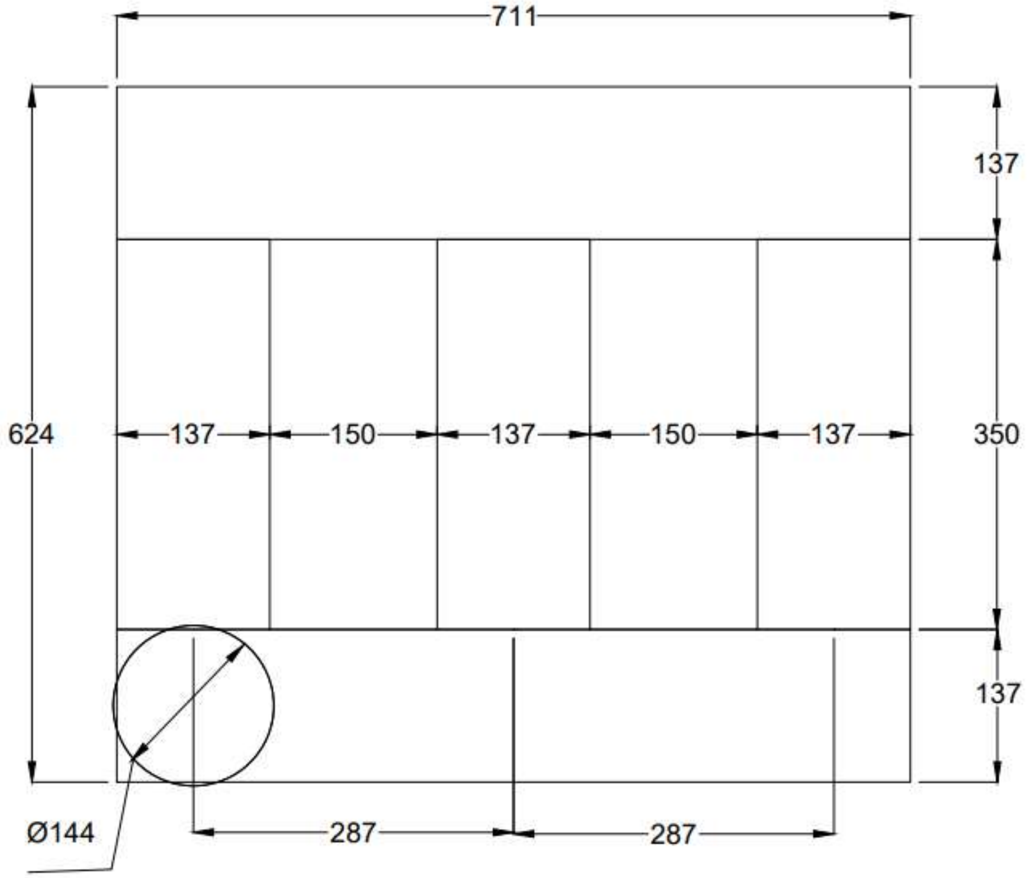

Figure 1: Core and Assembly dimensions

7. Number of turns in L.V. winding:

Voltage per phase = 415 / $\sqrt{3}$ = 239.6 V (as the winding is star connected),

Turns per phase on L.V. winding, $T_2 = \frac{239.6}{5}$ = 47.92, chosen as 48 turns.

8. Number of turns of H.V. winding

Turns per phase on HV winding = $\frac{11000}{5}$ = 2200; as the winding is delta connected;

Tapping of ± 5% and ± 2.5% are to be provided on the H.V. winding.

Turns on HV winding for normal connections = 2200;

5% more, 2200 × 1.05 = 2310

5% less, 2200 × 0.95 = 2090

2.5% more, 2200 × 1.025 = 2255

2.5% less, 2200 × 0.975 = 2145

Thus, the turns for HV winding are:

	5%	Normal	2.5%	
More	2310	2200	2255	Turn
Less	2090		2145	Turn

Table 1: Tappings

9. Low voltage winding:

Current per phase, $I_2 = \frac{120 \times 10^3}{\sqrt{3} \times 415}$ A

= 167 A

Here, we choose helical cylindrical coil.

Current density, δ = 2.5 A /mm^2; (assumed)

Area of LV conductor, $a_2 = \frac{I_2}{\delta} = \frac{167}{2.5}$ = 69 mm^2

Choosing, rectangular copper conductor from IS:6160:1977,

[For rectangular copper conductors for electrical machines, giving area near about the required one.]

Let, choose a section 4.6 mm thickness × 7.5 mm width; 2 conductor strips forming the conductor of L.V. area, $a_2 = 4.6 \times 7.5 \times 2 = 69$ mm^2

10.High voltage winding

Hence, we choose disc coils.

Current in H.V. winding per phase = $\frac{120 \times 1000}{3 \times 11000}$ (being delta connected)

= 3.63 A

Cross section of conductor for H.V. winding,

$a_1 = \frac{I_1}{\delta} = \frac{3.63}{2.5}$ = 1.45 mm^2

Choosing round conductor where, d = diameter of conductor

We know,

$a_1 = \frac{\pi d^2}{4}$

Diameter of the conductor, d = 1.36 mm

Then, area = $\frac{\pi d^2}{4} = \frac{\pi \times 1.36^2}{4}$ = 1.45 mm^2

Copper area in window = 2 $(a_1 T_1 + a_2 T_2)$ = 2 $(1.45 \times 2310 + 69 \times 48)$

= 2$\times$ 6661.5 mm^2

Now for this dimension, we get window space factor, $k_w = \frac{2 \times 6661.5}{52500}$

= 0.25 which is near about 0.24 chosen.

11.Design and layout of L.V. winding:

Number of turns 48.

Size of conductor 2 strips of $7.5 \times 4.6\ mm$, copper rectangular conductors. With paper insulator for conductors, the size of each conductor will be (7.5+0.25) mm × (4.6 + 0.25) mm;

Choose 2 layers for L.V. winding;

Turns per layer = 24;

Width of conductor 7.75 mm is taken along the winding with 2 conductor sides 4.85 + 4.85 = 9.7 mm forming conductor per layer. For two layers, the dimension of conductors width-wise is 19.4 mm and height of window-wise 7.75 mm for each conductor.

Height L.V. winding in window = 24 $\times$ 7.75 = 186 mm

Thickness of L.V. coil = 19.4 mm

Distance between core and L.V. coil = 3.5 mm

Inside diameter of L.V. coil = 144 + (2 × 3.5) = 151 mm

Outside diameter of L.V. coil = 151 + (2 × 19.4) = 189.8 mm

Mean diameter of L.V. coil = 151 + 19.4 = 170.4 mm

Mean length of turn of L.V. coil = π × 170.4 = 535.3 mm

Conductor layout of L.V. winding is shown in Figure 02

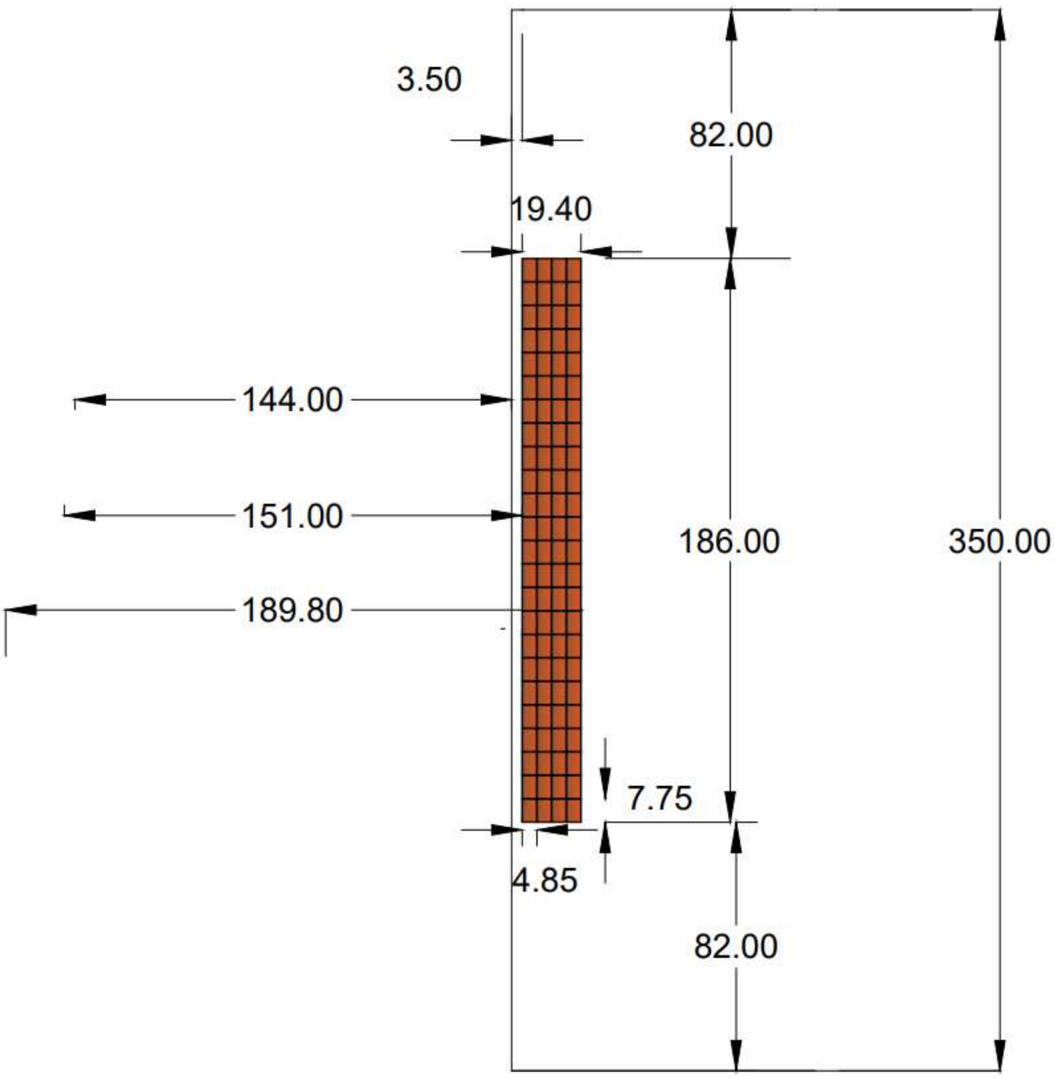

Figure 2: Layout of L.V. winding (all dimensions in mm)

12.Design and layout of H.V. winding:

The distance between L.V. and H.V. = 12 mm

Inside diameter of H.V. winding = 190 + (12× 2) = 214 mm

Now, Split H.V. winding in 4 coils each with turns = $\frac{2310}{4}$ = 578

The size of conductor = 1.36 mm diameter. With paper insulation on conductor, the diameter = 1.36 +0.25 = 1.61 mm

Chosen 14 layers; turns per layer = $\frac{578}{14}$ = 41

Height of winding in each H.V. coil = 41 × 1.61 = 66 mm

Thickness of each coil = 14 × 1.61 = 22.54 mm

Outside diameter of H.V. coil = 214 + (2× 22.54) = 259 mm

Mean diameter of H.V. coil = 214 + 22.54 = 236.54 mm

Mean length of turn = π × 236.54 = 743.11 mm

Height of H.V. coils in window = (66 × 4) + 8 + 8 +8 = 288 mm

Distance between each of four H.V. coils = 8 mm

The space required between coils and core on either side is taken as 31 mm.

The height of window required = 288 +(31 × 2) =350 mm,which is acceptable.

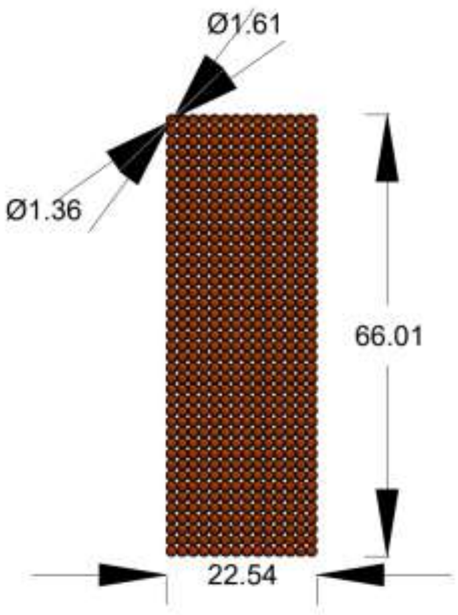

Figure 3: Layout of each H.V. coils (all dimensions in mm)

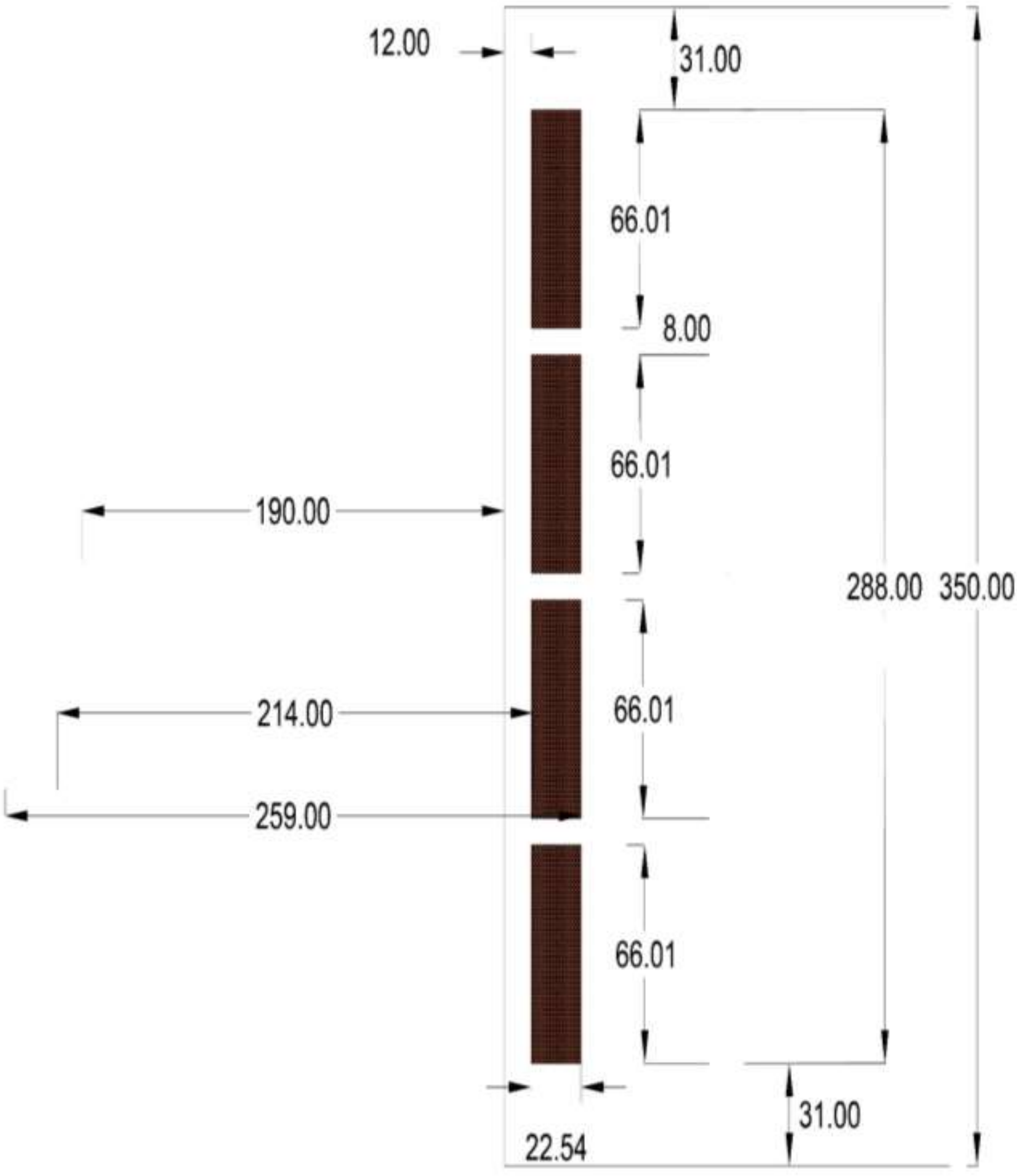

Figure 4: Layout of H.V. winding (all dimensions in mm)

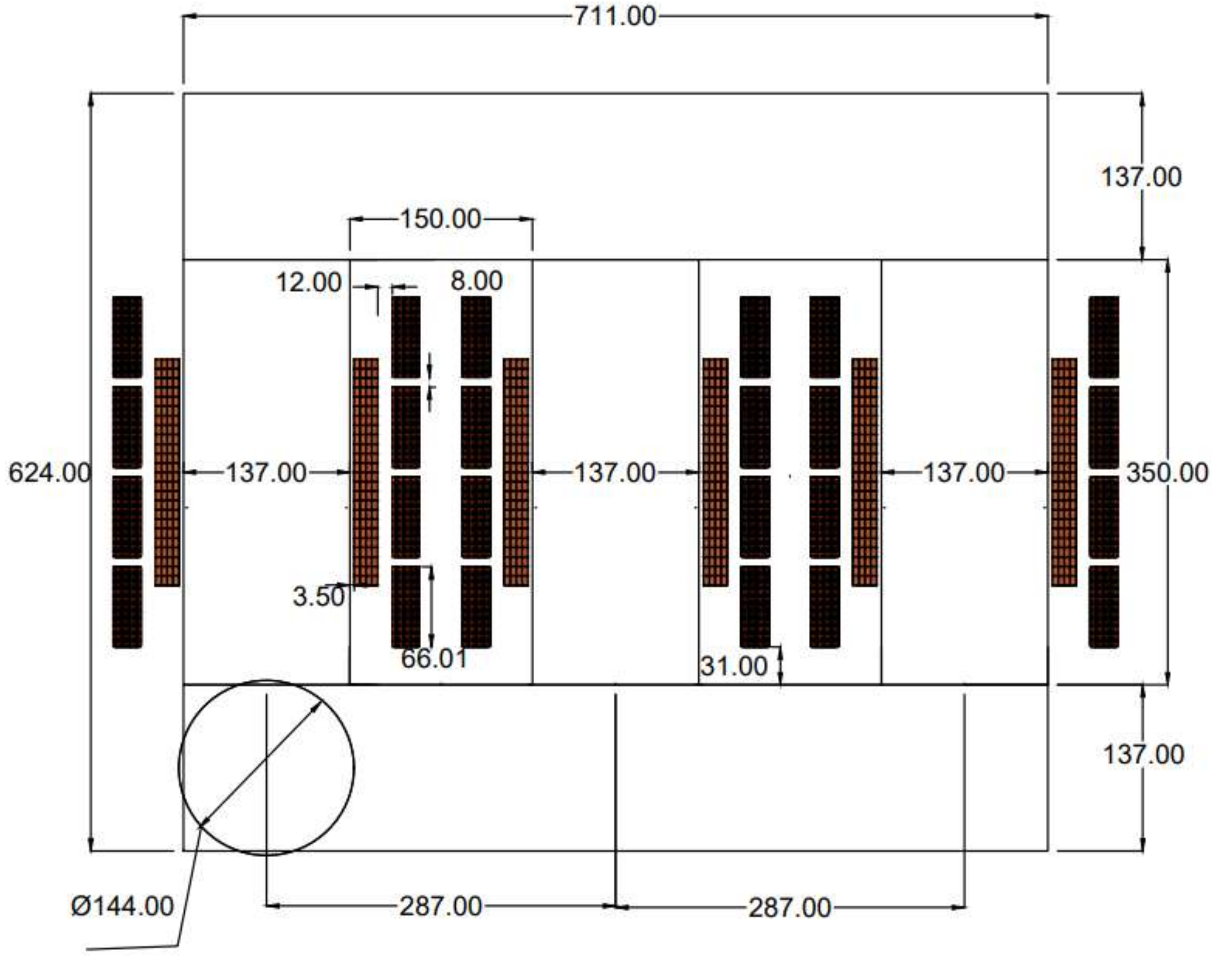

Figure 5: Overall Layout of Three phase Distribution Transformer (all dimensions in mm)

13.Percentage Reactance:

L.V. mean length of turn = 535.3 mm.

H.V. mean length of turn = 743.11 mm.

Average $L_{mt} = \frac{535.3+743.11}{2}$ = 639.2 mm

AT = $I_2 \times T_2$ = 167 × 48 =

Mean height of coils, $h_c = \frac{186+288}{2}$ = 237 mm

Hence, a =12mm; b_1= width of H.V.=22.54mm

b_2 = width of L.V. = 19.4 mm;

$a + \frac{b_1+b_2}{3} = 12+ \frac{22.54+19.4}{3}$ = 25.98 mm

% Reactance X = $\frac{2\pi f \times \mu_0 \times L_{mt} \times AT}{h_c \times E_t} \times \left(a + \frac{b_1+b_2}{3} \right)$

$= \frac{2\pi \times 50 \times 4\pi \times 10^{-7} \times 0.6392 \times 167 \times 48 \times 0.02598}{0.237 \times 5} \times 100\%$

X =4.43 %

14.Percentage Resistance:

Resistance of low voltage winding: (per phase)

Here, ρ_{20}= 0.01724 Ω/mm^2/m; α_{20}=0.00393

At 75°C, $\rho_{75} = \rho_{20}\{1+\alpha_{20}(75-20)\}$

= 0.01724(1+0.00393× 55)

= 0.021 Ω/mm^2/m

Resistance of L.V. winding = $\frac{0.021 \times 535.3 \times 48}{69 \times 10^3}$ =7.82× 10^{-3} Ω/phase

Resistance of H.V. winding = $\frac{0.021 \times 743.11 \times 2310}{1.45 \times 10^3}$ = 24.86 Ω/phase

Ratio of transformation = $\frac{T_1}{T_2} = \frac{11000}{239}$ = 46

Equivalent resistance referred to HV winding (per phase)

R = 24.86 + (7.82× $10^{-3} \times 46^2$) Ω

= 41.4 Ω

Base resistance = $\frac{H.V.\ voltage}{H.V.\ current} = \frac{11000}{3.63}$ = 3030.30 Ω

Percentage resistance, %R = $\frac{\text{equivalent resistant}}{base\ resistance}$

$= \frac{41.4}{3030.30} \times 100\%$

= 1.36 %

Hence, % X = 4.43%;   % R = 1.36%

Therefore, Percentage impedance, %Z = $\sqrt{4.43^2 + 1.36^2}$

= 4.63 %

15.Weight of iron in core and yoke assembly:

From Fig. 1 the volume of the core and yoke is given by,

$A_i\,\{2 \times \text{total width} + 3\ \times \text{total height}\}$

= 13185(711 $\times$ 2 + 350 $\times$ 3) =13185 $\times$ 2472 mm^3

Weight of iron = 7.85 × 1000 kg/ m^3

Weight of core and yoke =$\frac{13185\ \times 2472 \times 7.85}{10^3 \times 10^3}$

= 255.85 kg

Core loss at B_{max} = 1.708 wb/m^2 is 1.4 W/kg

Core loss in transformer = 1.4 × 255.85 = 358.19 W

16.Magnetizing volt-amperes:

For, B_{max} = 1.708 wb/m^2 ; VA / kg from the curve is 22 VA/kg

Magnetizing volt amperes = 255.85 × 22 = 5628.7 VA

17.Weight of L.V. winding:

We know, density of copper 8.89 g/cm^3

Number of turns (L.V. winding) =48 and a_2 = 69 mm^2

Mean length of turn = 535.3 mm

Weight of L.V. winding (per limb) = $\frac{8.89\ \times 48 \times 535.3 \times 69}{10^6}$ = 15.76 kg

18.Weight of H.V. winding (per limb):

Number of turns =2310(taping);normal = 2200; $a_1 = 1.45$ mm^2

Mean length per turn = 743.11 mm

Weight of four coils, 5% more (one limb) =$\frac{8.89\ \times 1.45 \times 743.11 \times 2310}{10^6}$

= 22.1276 kg for all turns

For normal turns,

Weight of four coils, 5% more (one limb) $=\frac{8.89 \times 1.45 \times 743.11 \times 2200}{10^6}$

= 21.07 kg

19.Total weight of copper in transformer:

We can write, 3(L.V. + H.V.) = 3 (15.76 +22.127) =113.661 kg (taping)

Normal total weight = 3(15.76 +21.07) =110.49 kg

20.Copper loss and load loss at 75^0C

H.V. current per phase = 3.63A;

Copper loss for three phase = $3\times I^2 \times r$ = $3\times 3.63^2 \times 41.4$ = 1636.57 W

Let stray load loss about 7%, then load loss at 75^0C = 1636.57×1.07 = 1751.13 W

Iron loss = 358.19 W; total loss = 358.19 + 1751.13 = 2109.32 W

21.Calculation of performance:

I. Efficiency on full load at unity power factor:

Output = 120 × 1000 watts;

Efficiency = $\frac{120 \times 1000}{(120 \times 1000)+2109.32} \times 100\%$ = 98.27%

II. Efficiency on 75% full load at unity power factor:

Core loss = 358.19 watts;

Load loss on 3/4 load = 1751.13 × $(3/4)^2$ = 985.01W

Total loss = 358.19+985.01 = 1343.2 W

Efficiency on 3/4th of full load = $\frac{120 \times 0.75 \times 1000}{(120 \times 0.75 \times 1000)+1343.2} \times 100\%$ = 98.53%

III. Efficiency on 50% full load at unity power factor:

Core loss = 358.19 watts;

Load loss on 50% load = 1751.13× $(0.5)^2$ = 437.7825 W

Total loss = (358.19+437.7825) = 796 W

Efficiency on 50% of full load = $\frac{60\times1000}{(60\times 1000\,)+796}$× 100% = 98.69 %

22.Regulation on full load at unity power factor:

%R = 1.36%; %X = 4.43%;

$(\mathrm{V} + \mathrm{IR})^2 + (IX)^2 = \mathrm{E}^2$

$(1 + 0.0136)^2 + (0.0443)^2 = \mathrm{E}^2$

E = 1.0145

Regulation = 1.0145 – 1 = 0.0145 p.u. or 1.45%

23.Regulation on full load at 0.8 power factor lagging:

= [IR cos φ + IX sin φ] %

= (1.36 × 0.8 + 4.43 × 0.6)%

= 3.746 %

24.Core loss current, magnetizing current, no-load current:

Core loss = 358.19 watts.

Core loss current, I_c = $\frac{358.19}{3\times11000}$ = 0.0108 A

Magnetizin g VA = 5628.7; magnetizing current, I_m = $\frac{5628.7}{3\times11000}$ = 0.1705 A

No load current per phase, I_0= $\sqrt{0.0108^2 + 0.1705^2} = 0.1708\ A$

Current per phase = 3.63A

No-load current = $\frac{0.1708}{3.63} \times 100\%$= 4.70% of full load.

25. Design of tank:

Outside diameter of H.V. = 259 mm.

The distance between coils on adjacent limbs = 137+150 -259 = 28 mm.

Clearance at each end is 40 mm.

Thus the length of tank = 259 × 3 + 28 × 2 +40 × 2 = 913 mm

The breadth of tank = 259 + 60 × 2 = 379 mm

Height = 624 + 50 for base +250 oil level above core +250 mm for leads

= 924 mm up to oil level + 250 mm for leads = 1174

Inside dimensions of the tank of the transformer = 913 × 380 × 1174 mm

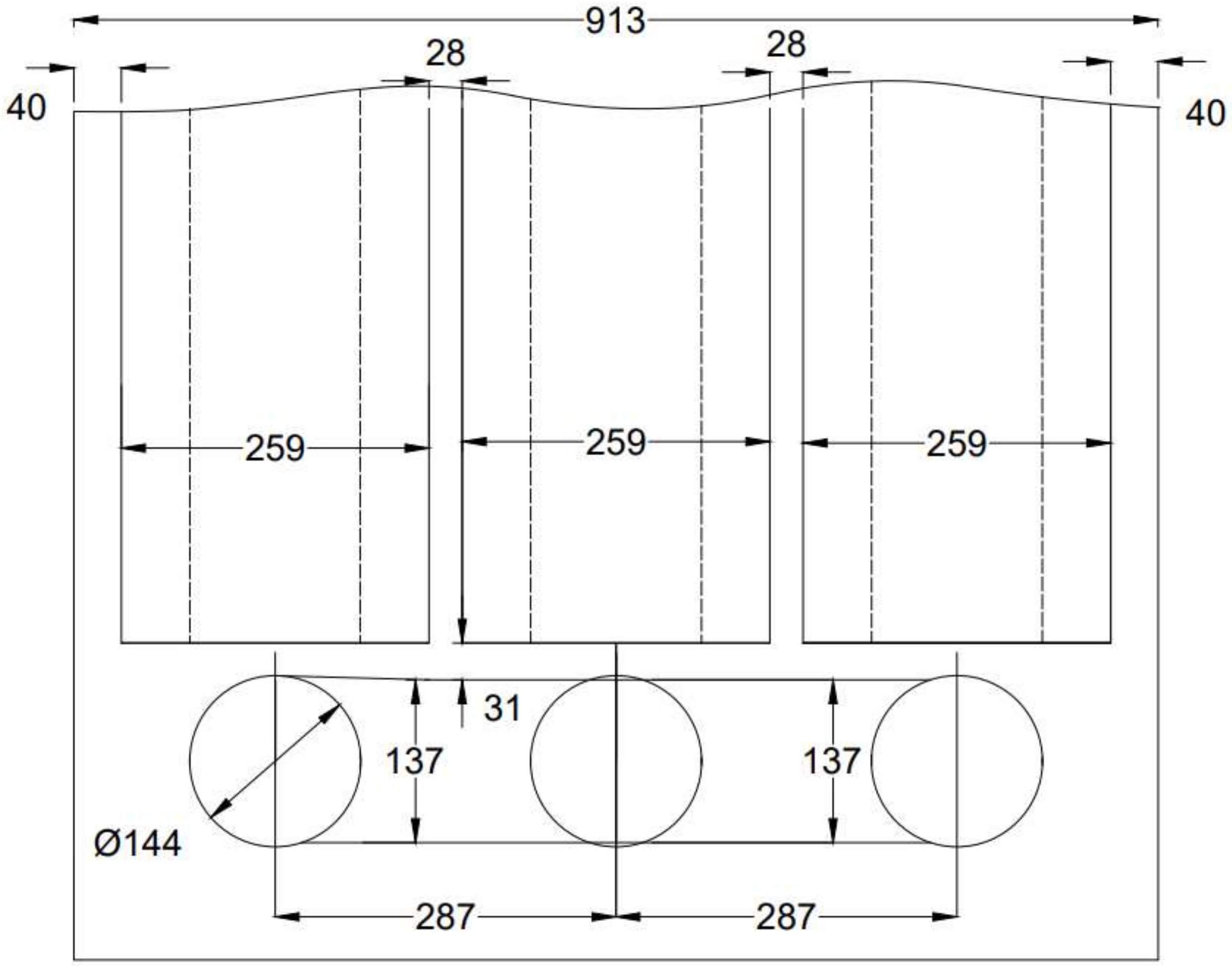

Figure 6: Tank dimensions (with all dimensions in mm)

26. Temperature rise:

Let stray load loss about 7%, then load loss at 75^0C = 1636.57 × 1.07 = 1751.13 W

Now, for dissipation of heat, only 4 surfaces of a tank are taken into consideration.

The top and the bottom are not considered.

Surface of tank = $\frac{1175}{10^3} \times \frac{380}{10^3} \times 2$ = 0.893 m^2

Again, $\frac{1175}{10^3} \times \frac{913}{10^3} \times 2$ = 0.2.145 m^2

Total S_t = 3.038 m^2

Full-load loss to be dissipated = 2109.32 W

If 12.5 watts per m^2 per ^0C temperature rise is taken as dissipation due to convection and radiation, the temperature rise = $\frac{2109.32}{12.5\times 3.038} = 55.54$ ^0C

The temperature of transformer walls may be limited to 35 ^0C instead of 55.54^0C∵.Then the temperature rise of the oil will be 50 and of coils 55^0C.

In that case the surface of the tank for cooling has to be increased either by radiators or by tubes attached to the tank. If the total surface area is considered, '***x***' times the tank surface area, then $x \times S_t = \frac{1}{8.8}\left[\frac{p_i+p_c}{\theta} - 12.5 \times S_t\right]$

$$= \frac{1}{8.8}\left[\frac{2109.32}{35} - 12.5 \times 3.038\right]$$

= 2.533 m^2

924 mm is height up to oil level; height of tube is taken as 874 mm

Surface of one tube of 50 mm diameter = $\pi \times 50 \times 874 \times 10^{-6}$ =0.13728 m^2

Number of tubes required = $\frac{2.533}{0.13728}$ = 18.45 say 19

Number of tubes required = 19.

27.Volume and weight of oil:

Volume of tank up to oil level of 924 mm = $\frac{924}{10^3} \times \frac{380}{10^3} \times \frac{913}{10^3}$ = 0.3205 m^3

Volume of transformer core and copper = $\frac{110.49}{8.89\times 10^3} + \frac{255.85}{7.85\times 10^3}$ = 0.04502 m^3

Volume of oil = Volume of tank up to oil level - Volume of core and copper

= 0.3205 – 0.04502 = 0.27548 m^3

Oil required in transformer = 0.27548×10^3 = 275.48 litres.

Therefore, weight of oil required = 275.48 ×0.89 = 245.1772 kg

28.Weight of tank:

If the thickness of the tank walls is taken as 5 mm,

Weight of tank = 0.005 [$\frac{913}{1000} \times \frac{380}{1000} \times 2 + \frac{1174}{1000} \times \frac{380}{1000} \times 2 + \frac{1174}{1000} \times \frac{913}{1000} \times 2] \times 10^3 \times 7.85$

= 146.39 kg

29.Volume and weight of oil in tubes:

Hence, 19 tube each of 50 mm diameter and 0.85 m length

Therefore, Volume = $\frac{\pi}{4} \times (\frac{50}{1000})^2 \times 0.85 \times 19$

= 0.03171m^3

Volume of oil in tubes = 0.03171×1000 = 31.71 litres

Weight of oil in tubes = 31.71 × 0.89 = 28.22 kg

Weight of tubes = $\pi Dl \times 0.005 \times 19 \times 7.85 \times 1000$ kg

= $\pi \times \frac{50}{1000} \times 0.85 \times 0.005 \times 19 \times 7.85 \times 1000$ kg

= 99.57 kg

30.Total weight of transformer:

Weight of core and yoke assembly	255.85 kg
Weight of copper in windings	113.66 kg
Weight of tank	146.39 kg
Weight of tubes	99.57kg
Weight of oil in tank	245.17 kg
Weight of oil in tubes	28.22 kg
Total weight	= 888.86 kg

31.Summary:

I. Specifications:

Transformer designed as per BIS Specifications:

kVA 120 ; Volts H.V. 11000 volts; Volts L.V. (no load) 415 volts; Amperes H.V. 6.28 A ; Amperes L.V. 166.94 A(line values); three phase, delta/star 50 H; temperature rise of oil 55.54°C; type of cooling ON ; Percentage impedance 4.63%;

± 2.5% and ± 5% tapings on High voltage side.

II. Core and yoke:

Material: CRGO (cold rolled grain oriented) steel laminations 0.35 mm thick; Mitred core construction 45° cut.

Voltage per turn ,5V;Flux density B_{max}=1.70 Wb/m^2; Net area of cross section of core 13,185 mm^2; circumscribing circle diameter 144 mm.

Size of core, yoke and frame: yoke is made of the same section as the core; 3-limb core construction. Distance between centers of adjacent limbs,287mm; width of the window,150 mm; height of window 3500mm;width of limb 137mm; overall height of the frame 624mm; overall width of core frame 711mm.

Weight of core and yoke assembly 255.85kg; core loss atB_{max} = 1.70 wb/ m^2; 1.4 W per kg; magnetizing VA = 22 VA/kg;

Windings	L.V	H.V
Type of winding	Helical	Disc
Current density	2.5 A/ mm^2	2.5 A/mm^2
Cross sectional area of conductor	69 mm^2	1.45mm^2
Number Of Layers per limb	2	4 Discs
Number of turns	48	2200 normal ;2310max tapping
Number of turns per layer	24	41
Height of winding in window	186 mm	288 mm
Thickness of coil	19.4 mm	22.54 mm
Inside diameter of coil	151 mm	214 mm
Outside diameter of coil	189.8 mm	259 mm
Mean length of turn	535.3 mm	743.11 mm
Resistance at 75^0c	0.00782 Ω	24.86 Ω
Weight of copper for winding per limb	15.76 kg	21.07 kg
Total Weight of Copper	110.49 kg	

Table 2: Windings

III. Insulation and Losses:

Insulation between core and L.V. winding: pressboard paper

Insulation for conductors: paper

Insulation between layers: Crape paper

Insulation between L.V and H.V. windings: Bakelized paper cylinder; Laminated pressed wood sticks for spacers for cooling. Class A insulation for O N type transformers.

Tank: Temperature rise of oil 55.54 ^{0}C where cooling has been applied.

Inside dimensions of tank: length 913 mm; breadth 380 mm; height 1174 mm

Tubes 19, each of 50 mm diameter with 850 mm long.

Oil in transformer tank	275.48 litres
Oil in tubes	31.71 litres
Weight of oil in tank	245.17kg
Weight of oil in tubes	28.22 kg
Weight of tank	146.39kg
Weight of tubes	99.57 kg
Weight of complete transformer	888.86 kg

Table 3: Tank properties

Performance:

Percentage resistance	1.36%
Percentage reactance	4.43%
Percentage impedance	4.63%
Iron loss	358.19 W
Copper and stray load loss, i.e. load loss at 75^0C	1751.13 W
Total loss on full load	2109.32 W
Efficiency on full load at unity power factor	98.27%
Efficiency on 75% full load at unity power factor	98.53%
Efficiency on 50% full load at unity power factor	99.69%
Regulation on full load at unity power factor	1.45%
Regulation on full load at 0.8 power factor lagging	3.746%
Core loss current per phase	0.0108A
Magnetizing current per phase	0.1705A
No load current per phase	0.1708A;4.7% of full load current

Table 4: Performance

Tappings: The tappings on H.V. winding

	5%	Normal	2.5%
More	2310 turns	2200 turns	2255 turns
Less	2090 turns		2145 turns

32.Conclusion:

A 120 KVA distribution transformer has been designed which made to be connected in delta wye and ratings of the voltages were 11KV and 415 V. There had been attempts to maintain the compact feature of the transformer. Cost efficiency had also been one of the top priorities while designing the machine.