Chapter V

CONSTRUCTIONAL DETAILS

5.1 Core Construction

Core type with five-steps cruciform section was used for this transformer. The core section was shown in Fig. 5.1

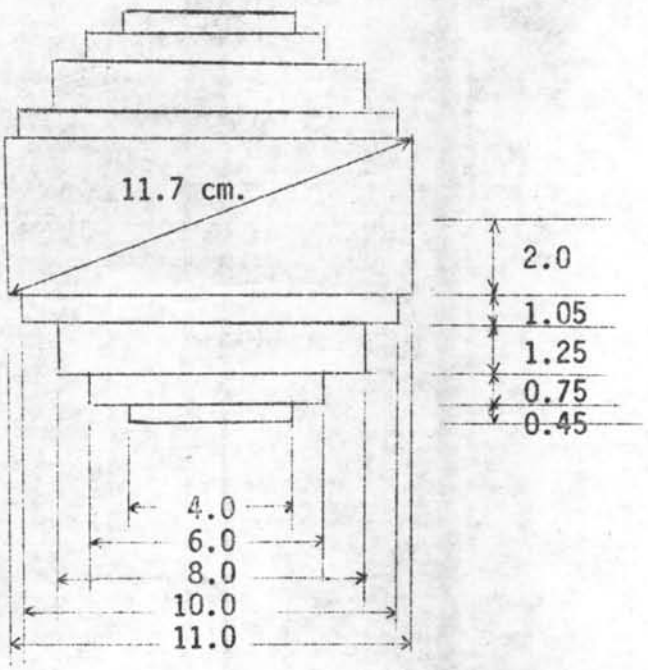


Fig. 5.1 CORE-LEG CROSS SECTION, DIMENSIONS IN CM.

The RG-8H silicon steel strip with 0.30 mm. thickness were used to form the core of seperate laminations. I-punching strips were cut from continuous strips with 45° corner cuts. The dimensions and shapes of each strip for the core's yokes and legs were shown in Fig. 5.2 . Overlapping laminations arrangement were used in order to reduce the reluctance in the joints as shown in Fig. 5.3

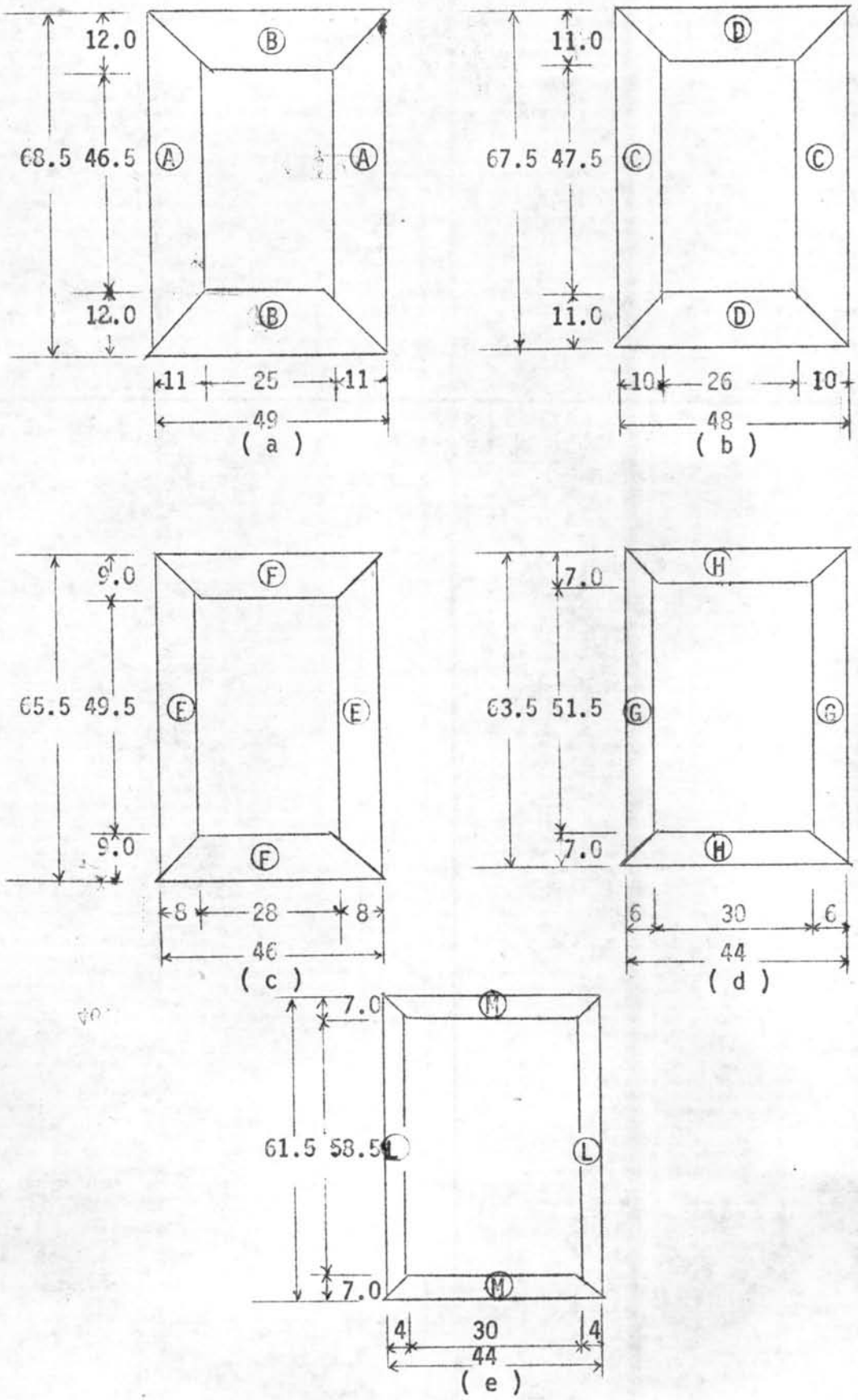


Fig. 5.2 The dimensions of each lamination of the core in centimetre.

(Letter a, b, c, d, e designate to laminations start from inner to outer respectively)

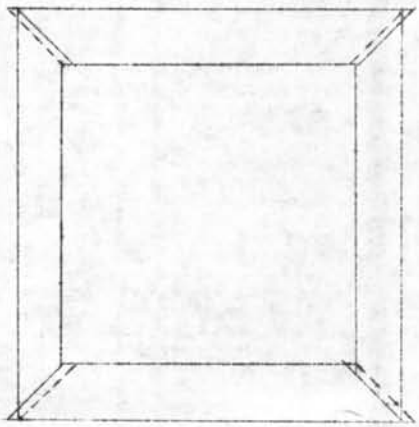


Fig. 5.3 core of laminations showing modified lap joints with corner cut diagonally

From Fig. 5.2 The number of the laminations are:

For core legs

Dimension (A) = 264 laminas (each leg 132 laminas)

Dimension (C) = 144 laminas (each leg 72 laminas)

Dimension (E) = 168 laminas (each leg 84 laminas)

Dimension (G) = 104 laminas (each leg 52 laminas)

Dimension (L) = 64 laminas (each leg 32 laminas)

For core yokes

Dimension (B) = 264 laminas (each yoke 132 laminas)

Dimension (D) = 144 laminas (each yoke 72 laminas)

Dimension (F) = 168 laminas (each yoke 84 laminas)

Dimension (H) = 84 laminas (each yoke 42 laminas)

Dimension (M) = 84 laminas (each yoke 42 laminas)

Constructional framework of U-shape iron clamps were used to clamp the top and bottom yokes of the assembled core to form a rigid

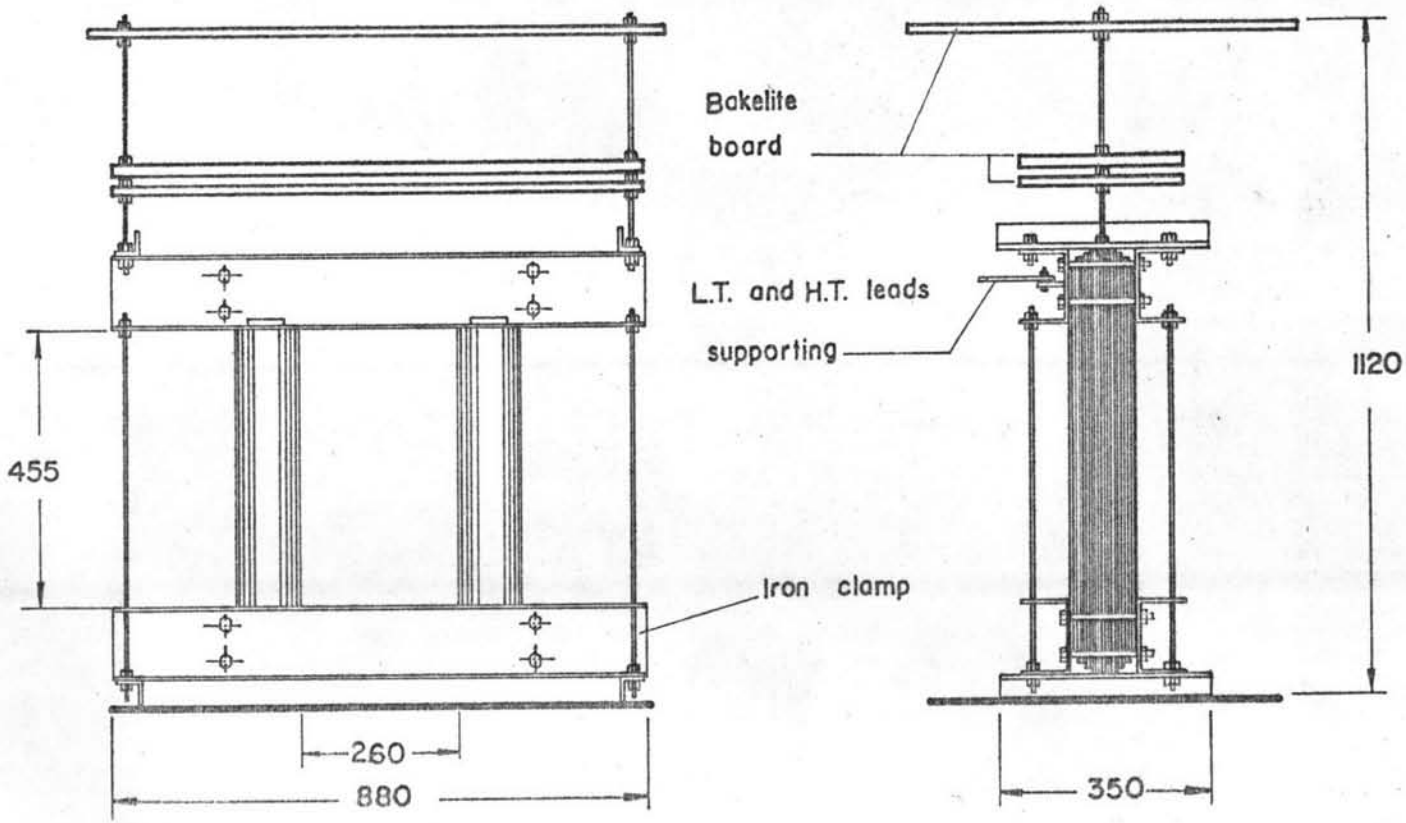


Fig 5.4 Core clamping devices (millimetres)

body. Both core and clamping devices are coated with insulating varnish. The shape and dimensions of the core clamping devices were shown in Fig. 5.4 .

5.2 Coils Construction

The low and high voltage windings of this transformer are concentric type. The low voltage coils were wound in cylindrical form. Disk type coils were used to form the high voltage windings and were placed over the low voltage coils to obtain good coupling.

5.2.1 Low voltage coils construction

The winding machine and wooden former shown in Fig. 5.5 were used to form the low voltage coils. The wooden former was shaped in cylindrical form and attached to the winding machine. The pressphane insulations of 0.50 mm. thick were wrapped around the wooden former for 6 layers to provide the insulation between core and low voltage coil. Conductors were wound on this pressphane cylinder. Each layer consisted of 19 turns. The pressphane insulation of 0.13 mm. thick was used to provide insulation between layers. The method of forming coils were shown in Fig. 5.6 .

5.2.2 High voltage coils construction

The high voltage windings were seperated from the low voltage winding by a series of ducts and insulating barriers as shown in Fig. 3.5 . The pressphane insulations were used as duct spacers. Oil ducts construction between low and high voltage windings were shown in Fig. 5.7 . The high voltage coils consisted of disk-type sections. There were 40

layers in each disk. Three sheets of pressphane insulation of 0.13 mm. thick were placed between the layers to provide insulation. The method of forming high voltage coils were shown in Fig. 5.8 .

5.3 Tank

The tank was made of plain-steel of 3.175 mm. thick and fitted with oil level, oil filler, drain valve and eye nuts for lifting. The tank lid was made of bakelite board of 20 mm. thick and coated with insulating enamel. The shape and dimensions of the tank and tank lid were shown in Fig. 5.9 . The inside surface of the tank was coated with varnished and the outside surface was painted with rustproof paint and finished with grey color paint.

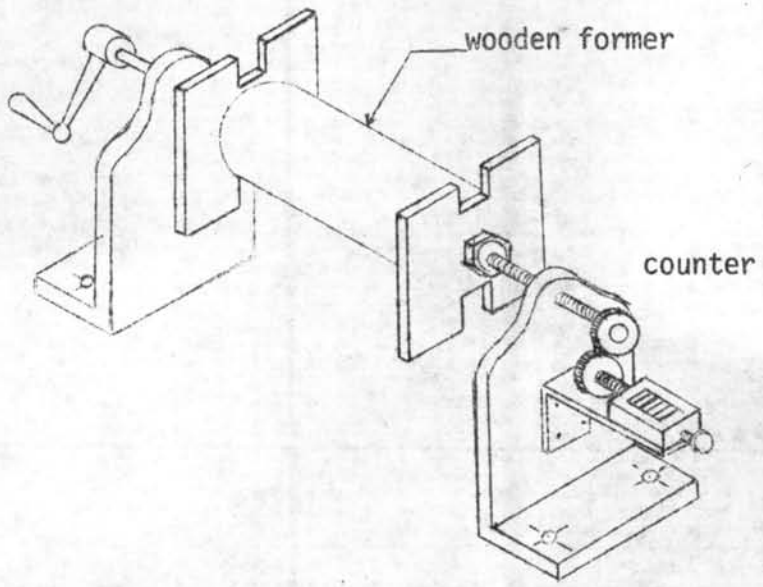
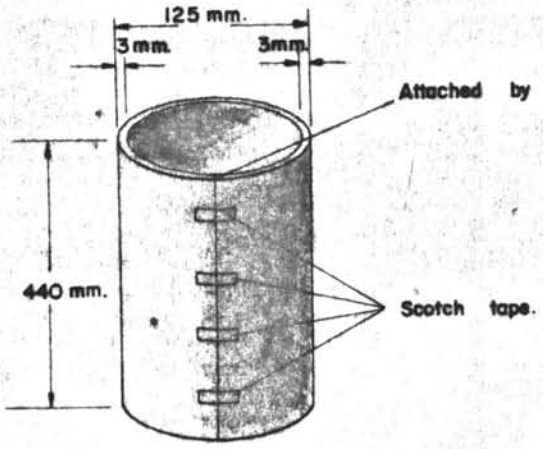
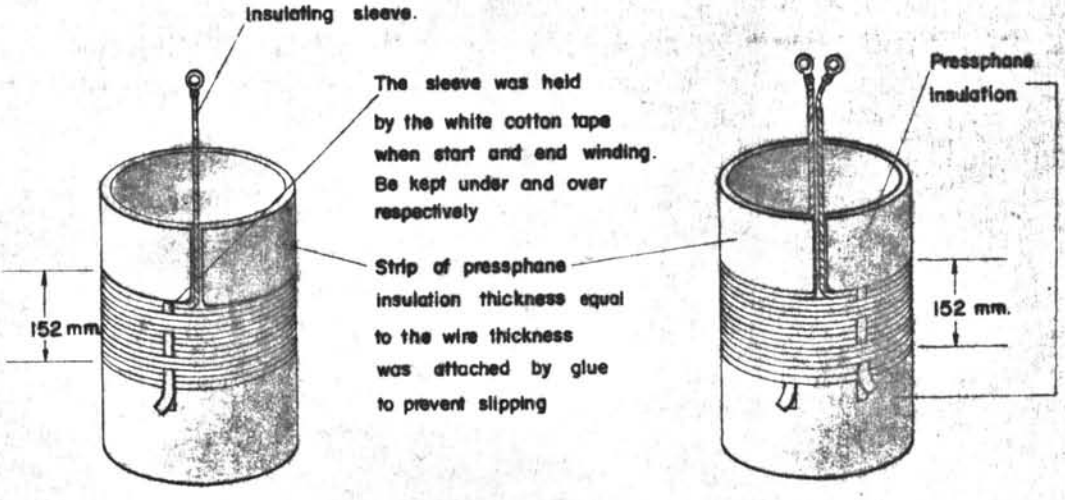


Fig. 5.5 Wooden former and winding machine



A. The insulation between core and low – voltage coil.



B. Start winding

C. End winding

Fig 5.6 The method of forming low – voltage coil

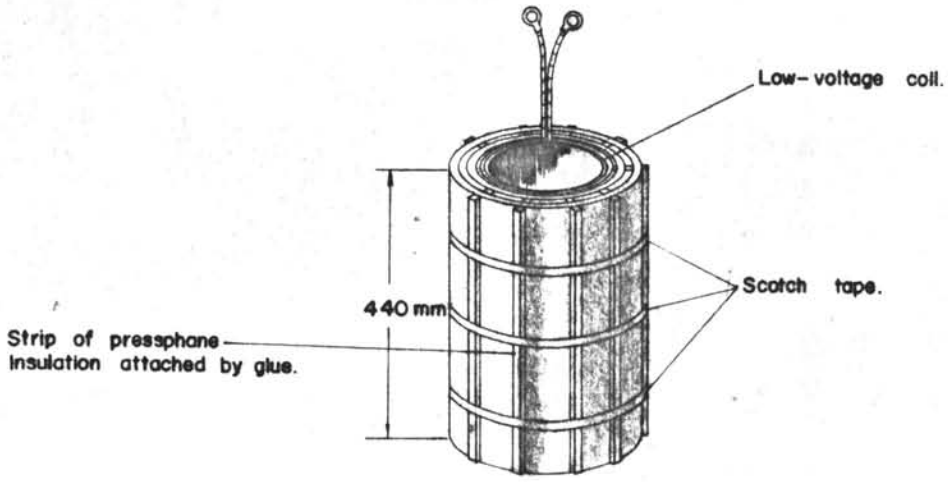
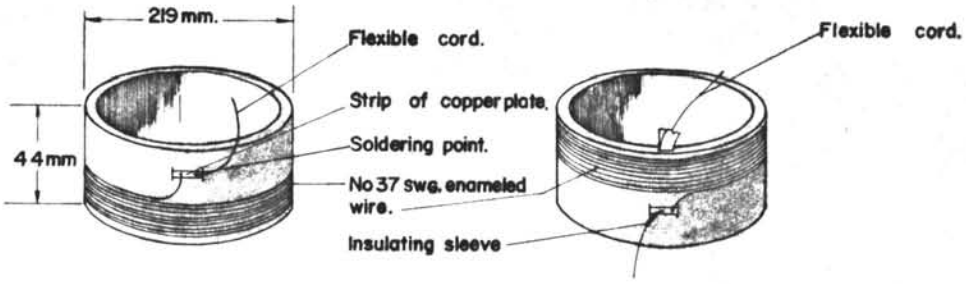


Fig 5.7 Oil ducts construction.

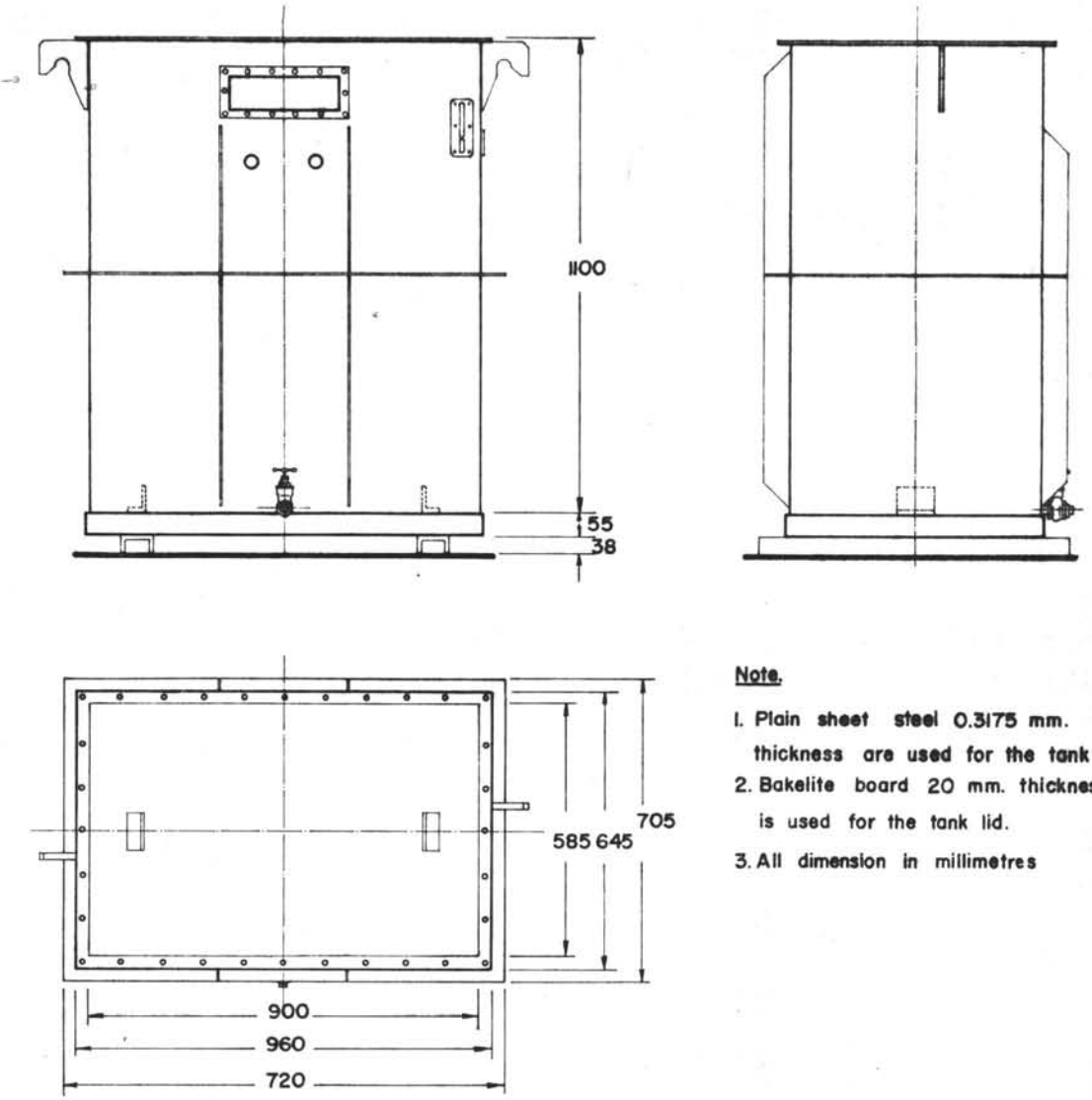
between low - voltage and high voltage winding.



A. start winding

B. End winding.

Fig 5.8 The method of forming high - voltage coils



Note.

1. Plain sheet steel 0.3175 mm. thickness are used for the tank
2. Bakelite board 20 mm. thickness is used for the tank lid.
3. All dimension in millimetres

Fig 5.9 Shape and dimension of the tank (millimetres)

5.4 Assembly

5.4.1 Coils Inserting.

At first, the upper clamping steel and the upper yoke were removed. One layer of 0.13 mm. thick pressphane insulation was wrapped around each core leg to provide fittness of the low voltage coils. The ring-type pressboards insulation and supporting collars were fixed at the bottom and head of the coils. Then, the low voltage coils were inserted into each core leg with the terminal lead wire connected in series. The terminal lead wire of the low voltage windings were insulated by the insulating sleeve.

After the low voltage coils were tightly fixed, the high voltage coils were then inserted outside around the low voltage coils. Each coil was connected in series with one end of the winding was solidly grounded onto the tank. The other end was connected to the high voltage bushing. Special insulations were also provided for the point of connection of the terminal lead wire.

The upper yoke was again assembled to form a complete core and clamped by the upper clamping steel. The bakelite transformer lid was supported by two double-arming bolts attached to the upper clamping steel. The high voltage bushing was placed on the transformer lid and was supported by the round bakelite clamp. The high voltage terminal lead insulated with paper insulation tube 10 mm. thick was connected to the high voltage bushing.

5.4.2 The vacuum process.

After assembling the coils, the unfinished transformer must

be dried in the vacuum chamber by the vacuum process. Drying process should be operated first by increasing the temperature of the vacuum chamber to about 75 C and then started the vacuum process. The temperature and vacuum pressure were controlled at 105 C and 760 mm.Hg. respectively. The process should be operated 8 hours continuously at this temperature. After the first drying process, the assembled coils should be checked to make sure that they were tightly fixed and the insulation resistance were also measured.

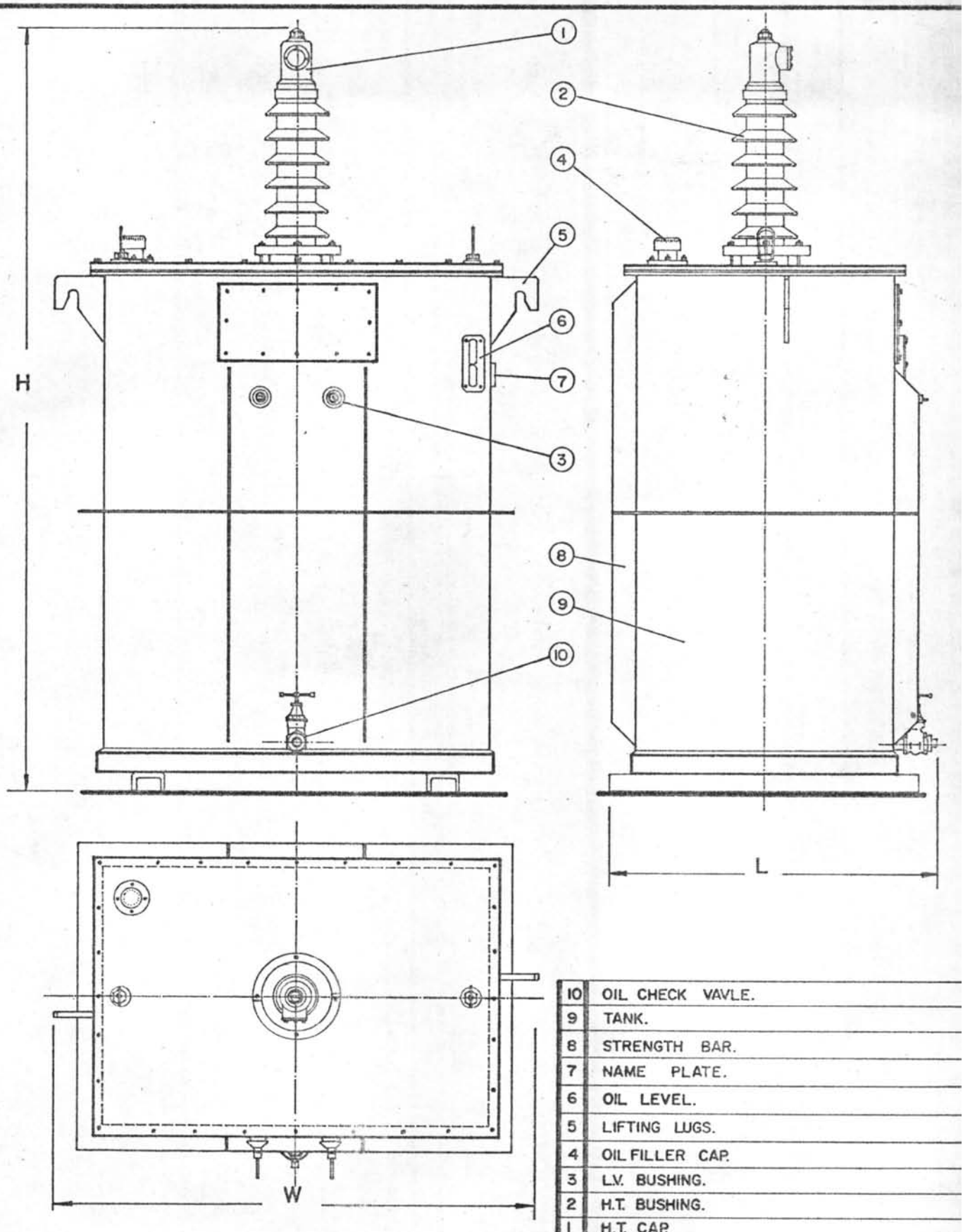
Again the second drying process was repeated by the same method as the first operation in order to make sure that the moisture were completely removed.

5.4.3 The oil-filling process.

The assembled core and coils took from the vacuum chamber after second drying were put into the tank. The low voltage bushing were placed on the tank wall. The handhole was open to allow connecting the low voltage terminal leads to bushings and the ground lead of high voltage winding to transformer tank. Then the handhole was closed and the tank lid with rubber seal were attached to the tank fastened by screws and nuts.

Before starting the third drying process, the oil-filler cap must be opened. The vacuum transformer oil fitting pipe was put to this hole, then the third drying operation was started by the same method as the first and second operation. The vacuum transformer oil were filled through the oil filling hole until the transformer core and coils were immersed. The reason for filling the vacuum transformer oil during the

vacuum process was that to prevent transformer from moisture in the air. The transformer was removed from the vacuum chamber. The oil was filled again until the level equal the level designed. The oil-filler cap was closed. Then the transformer was finished and ready for testing. The dimension and parts of the transformer were shown in Fig. 5.10.



(Approximate Dimension and Drawing.)

No	NAME OF PARTS.
10	OIL CHECK VAVLE.
9	TANK.
8	STRENGTH BAR.
7	NAME PLATE.
6	OIL LEVEL.
5	LIFTING LUGS.
4	OIL FILLER CAP.
3	L.V. BUSHING.
2	H.T. BUSHING.
1	H.T. CAP.

K V A.	Dimension in millimeters.			Weight (Kgs.)	Oil (Litres.)
	H	L	W		
5	2780	760	1120	512	460

SPECIFICATIONS OF TRANSFORMER.

Fig. 5.10