



Transformer cores can be manufactured from electrical steel of various forms. Cores could be stacked from punched laminations, or strip laminations. These electrical steel laminations are insulated with very thin but hard insulation during the steel rolling process. When stacked, this insulation helps prevent eddy current circulation between laminations.

Punched laminations are typically used on small transformers, usually less than 45 kVA. These punched laminations have holes in the corners and the core is held together with insulated bolts through the holes of the laminations.

Some 25 years ago, for strip core laminations of larger transformers, it was a common practice to punch holes in laminations and hold them together with insulated through bolts.

The punched holes reduce the area of the core locally and increase the losses slightly. Another potential issue with using through bolts for holding the core is that these bolts need to be insulated from the core and frame as these bolts must not touch the bare edges of the holes in the laminations. In the event the insulation fails, laminations will be shorted through these bolts and there would be circulating current between laminations, which would increase core losses.

In modern transformers, strip laminations of electrical strip are held together with external cross tie rods. These tie rods sandwich core laminations between core clamps. As the tie rods are external to the core, there is no need to insulate these tie rods and core clamps as there would not be any path to short the laminations. HPS does not insulate the core from the clamps.

To hold the core vertically, Hammond Power Solutions Inc. (HPS) uses vertical tie straps external to the core. These straps have grade 5 steel bolts to tie the top and bottom clamps. Thus the core laminations are tied together with cross tie rods in a horizontal direction and by tie straps in a vertical direction.

HPS uses glass resin I-Beams of high tensile and compression strength between coils and the core clamps. Thus coils are well supported against axial short circuit forces resulting from any fault in the system. HPS has used this construction very successfully on transformers up to 19 MVA. HPS has tested transformers from 300 kVA to 4000 kVA for short circuit forces using the above construction and they have passed the test.

Construction developed by HPS provides lower losses, higher strength against short circuit forces and eliminates the risk of shorting the laminations through the core bolts. Since there is no insulation used between core & core clamps, no core Megger test is required.

Dhiru Patel P. Eng., C. Eng.
Engineering Manager
Technology & Product Development
Hammond Power Solutions Inc.