

DLF (Dry Low Frequency)

ABOUT THE MACHINE

The power of the machine is distributed in different inverters, each inverter has a power line with a defined frequency set up by the user. Each power line has different heating points (one for each transformer). The heating point is made up of one power connector and 3 temperature sensors.

The machine is modular and custom-tailored on customer's productivity depending on the number of inverters and the number of heating points per inverter.

If the customer has many transformers of the same kind, few inverters and several heating points per inverter will be used.

If the customer has many transformers of different kind, more inverters and less heating points per inverter will be used.

Critical points:

- a) Each inverter can support more than one transformer, but the sum of electrical currents is defined by the capacity of inverter (Amp).
- b) Small transformers with high voltage (vg 50 KVA and 30 KV) need 690 V for working properly.

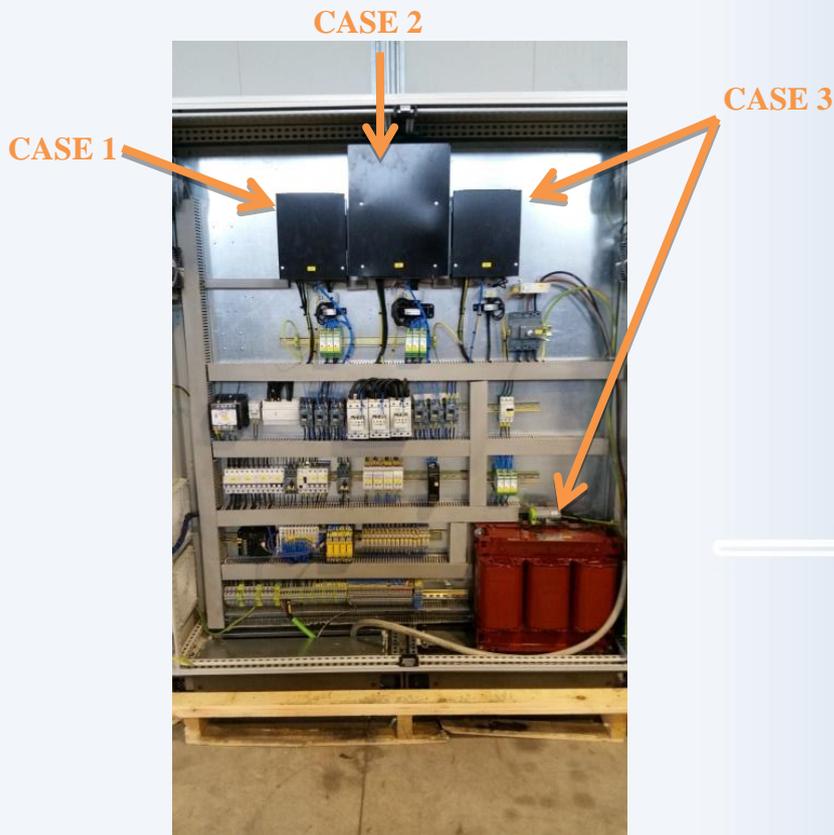
Case of inverter configurations:

CASE 1 : ORDINARY TRANSFORMERS - Medium inverter (30 A) with 400 V output and 1-50Hz. The best for the most common cases. 25-1000 KVA transformers depending on the voltage;

CASE 2 : FOR LARGE TRANSFORMERS - A large inverter (60 A or more) with 400 V output and 1-50Hz for large transformers up to 3150 KVA depending on the voltage;

CASE 3 : FOR PROBLEMATIC TRANSFORMERS - Small inverter (10 A) with transformer in order to give 690V 10-50Hz and for small transformers 25-100KVA with high primary voltages 30-36 kV

Figure 1 shows an example of the 3 cases. In this example each inverter is divided into 3 lines for 3 heating points



ABOUT THE PROCESS

The curing process can be made in 3 different ways:

1. Dry the active part out of the tank and out of the vacuum chamber, then put the active part into the tank and immediately into the vacuum. (most recommended, easiest and highest productivity)
2. Set the DLF to the active part into the tank, then put it into the vacuum chamber. (high productivity but the need of control during the ventilation of the tank makes the process not easy)
3. Put the active part into the tank and into the vacuum chamber. Use the DLF and the vacuum at the same time (best quality, but it takes longer because of the vacuum chamber, therefore lower productivity)

According to the power of the transformer and of the single coils, the DLF can treat independently an unlimited number of transformers. The heat generated inside will melt the resin on the DDP Paper and will reduce the initial humidity from 8-10% to 2-3% (standard values). Of course, the values will change according to the temperature and humidity of the plant.

In order to achieve a better result, the use a vacuum chamber is necessary.

The machine is really user friendly: all you need to do is connect the transformer properly, insert values and parameters of the process and start it. During the treatment, the process status will be shown on a touch screen.

The following images show the system composition:



SHORT
CIRCUIT
LOW
VOLTAGE

REGULATES
TAP
CHAGER TO
MAX

CONNECTS
LF LINE TO
HIGH
VOLTAGE

USE THE 3
TEMPERATURE
SENSORS

INVERTER
INFO

TRAFO INFO

4 CUSTOMER CASES

- a) Customer with OVEN ONLY: in this case it is not recommended to replace it by low-frequency system as the drying would not be efficient.
The DLF is better to be used in combination with a vacuum chamber.
Please recommend DLF + Vacuum chamber for better results.
- b) Customer with OVEN and VACUUM in the same chamber: in this case the customer can use DLF for the pre-heating and the vacuum for the final treatment (removing the rest of the humidity). This will considerably increase its functionality (reducing the time of the heating process inside the chamber) and permit to save time and money (the process will be faster and the energy consumption much lower)
- c) Customer with OVEN far from the VACUUM CHAMBER: in this case the customer can easily replace the oven with DLF. This will bring low energy consumption and economic advantages
 1. 2 years pay back – ROI
 2. The system in this configuration will be more flexible as the oven is quite inefficient with partial loads.
- d) New PLANT: in this last case the customer will use the DLF as it is the most modern technology, very eco-friendly (low gas emissions and fuel consumption), the most economic (reduction of energy consumption), the fastest and the best for ensuring the most stable production (the heating up time will be short and will not depend on coil dimension 25 to 2500KVA) and the best quality (the coil heating will be homogeneous).
Together with the DLF the customer will need the VACUUM CHAMBER, too.

INVESTMENT

The prices will change depending on the size of the Inverters (VOLTAGE). The modular concept in this case will be necessary. This means that the Sales manager needs to receive from the customers the proper questionnaire made by LAE filled in completely.