Wieffering

Measurement & engineering structure control & panel construction

RW.B.28.009

V= voltage, by volt
I= electric current, by amp.
R= resistance, by ohm O
PS= apparent power, by KVamp
PQ=interactive power, by reversed KVamp, this is a used power not consumed.
Linear voltage= 230 V (is the voltage between one phase and zero)
Voltage phase=400 V (voltage between consequent phases)
Hz= frequency by Hrz. (oscillations per second)
Cos Ph.= Cosine Phi, this is the power factor, known by 0… and Cosine Phi is the angle between the active power and the apparent, it is also known by the power factor.
Sin Ph.= Sine Phi, known by 0…and Sine Phi is the angle between the factor with the three phase installations = 1.73(the linear voltage is 1.73 times the phase voltage)

<u>The Active Power:</u>
It is also known by (the Power Watt) or Watt.
And it is the actual electrical power absorbed and need to make the system works, as to form an electrical field in the circuit of the engine to work.

<u>The apparent power</u>:
It is known by Volt Amp.
It is the product of the voltage and the apparent power.
This apparent power is the sum of the outward Watt current + the interactive current.
Also we can take the sum of the outward active power and the interactive current.
The apparent current determines the total capacity of supply conductors, such as transformers, generators, and distribution units along with feeding cables.

<u>The interactive power:</u>
It is known by the reversed volt amp. (The returned power)
This interactive power is emerged from induction or power loads such as the non-synchronous motors, generators, inductive ovens, fluorescent pillars with induction batteries remover. The interactive current is needed to generate the magnetic field.
The magnetic field accumulates it is also frequently and simultaneously strengthened with the supply frequency (50Hrz). Thus we use this power but it can't be consumed.
By this power, the main conductors will have additional charge due to the fact that additional current should be generated, therefore the cables and distribution units should be able to carry this current, also the power supply transformer and generator has to be able to supply this current

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Cosine Phi.:

It is the angle between the active and the apparent power, angle *Phi*.
The power factor is *de cosine* for this angle *Phi.* , this means that you can calculat the power factor *de* as follows; *Cos.Phi* = the active power divided by the apparent power
Through this formula you can know when the interactive and the apparent power increases, and thus the angle *Cos Phi* decreases.
This shows that the angle *Cos Phi* is not suitable enough, where it needs more apparent power despite the lack of full energy consumption.

Disadvantages of poor power factor:

The presence of unsuitable power factor is due to the presence of an increase in the apparent power at the absorbed active power.
Through this way, the apparent power reaches double the value of Watt current at the angle *Cos Phi* which is equal to 0.5 (angle 60°).
This causes an additional loss of power and voltage; in addition to an increase in temperature of the generators, transformers, energy distributors and cables.
The loss of heat is inversely proportional to the power factor square.
This means that the power factor corrections reduce the load from the main supply connections.
The power system can be loaded and become more profitable by losing the smaller voltage.
Power factor correction is in the interest of users in places that need thinner cables; also transformers and distribution units used can be appropriate for the least power.
Thus, we can add more power in present facility after correcting its power factor without adding extra power factor in the power distributors and thicker cables.
When there is a poor *Cos Phi* angle, the facility could install and charge the interactive meter.

The factor correction *Cos Phi*:

In order to improve the power factor, you can use capacitors alongside synchronous motors or non- synchronous electrical reversed motors.
While this function occurs, the front current is being absorbed from the main conductors.
Nevertheless, the capacitor has advantages as it needs no maintenance, easily installed and needs no base to be fixed on.

This is the reason for using capacitors only for this purpose.
The capacitors are installed and connected in parallel with the main connectors.
The capacitor absorbs the front electrical current and thus it decreases or marginalizes the coming current, as these apparent current decreases.
The decreased current arrives where the load and the capacitor are connected.
Thus, it is better to install the capacitors as near as possible to the load.

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Full compensation and compensation in excess:

It is better to adjust the power factor at 1, thus the apparent power equals the active power. And if the power factor is exactly 1, so we are talking about full compensation.

But if the current of the capacitor increases, the interactive current try to decrease, hence we are talking about compensation in excess. This is also a problem where the power factor may increase, and tend to the opposite direction. This could be too risky on machines as the current may cause loss of negative voltage in machines, and thus it may lead to generate an excess in capacity. In order to prevent this undesirable condition, a regulator is used for the electrical interactive power Watt to pressure or convert the brink of the capacitor as it may require.

Formulas:

V = I × R

(Single phase)

Pw = V × I × Cos Phi

Ps = V × I

PQ = V × I × Sin Phi

Cos Phi = Pw: Ps

(Three phase)

Pw = V × 1.73 × I × Cos Phi

Ps = V × 1.73 × I

PQ = V × 1.73 × I × Sin Phi

Xos Phi = Pw: Ps

We will provide graphical images associated with the measurements of the carpentry machine as follows:

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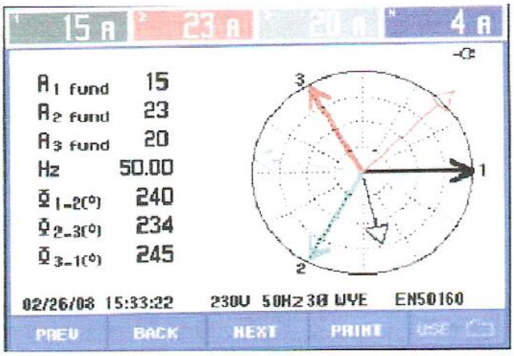
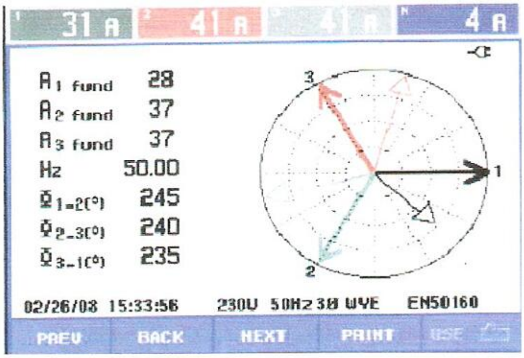
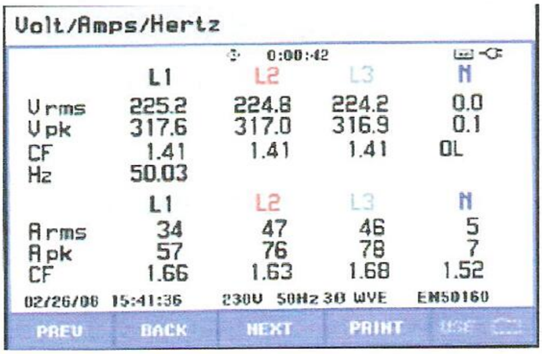


The measurement of a loaded machine with the compensation



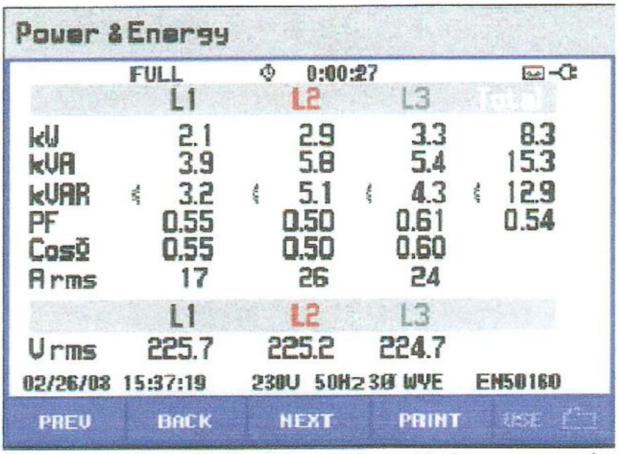
The measurement of a loaded machine without the compensation



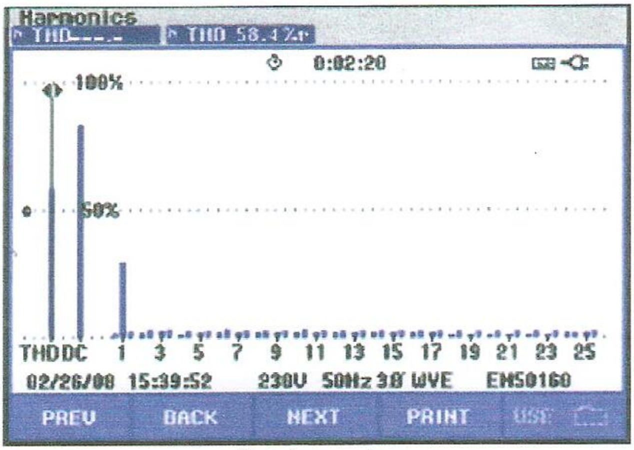
	L1	L2	L3	N
Vrms	225.2	224.8	224.2	0.0
Vpk	317.6	317.0	316.9	0.1
CF	1.41	1.41	1.41	OL
Hz	50.03			

	L1	L2	L3	N
Arms	34	47	46	5
Apk	57	76	78	7
CF	1.66	1.63	1.68	1.52

The measurement of a loaded machine without the compensation



The measurement of a loaded machine with the compensation



Zero harmonics

Harmonics are the proportionate currents or voltages at any higher frequency when compared to the main harmonics that reaches 50 Hrz, thus the third harmonic is at 150 Hrz while the fifth harmonic is at 250 Hrz.