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SOLDERABILITY TESTER

MENISCO ST78

Can be used with all kind of alloy (including lead free)

Dimensions : 650x420x420 mm (Lxwxh)
Weight : around 30 kg
Power : 220v or 110v (500w), 50Hz/60Hz
Immersion depth : 0,1 to 10 mm (step of 0,1mm)
Immersion speed: 1 to 50 mm/s

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INTRODUCTION

MENISCO ST78 is a measuring device which allows any **WETTABILITY** phenomena to be **QUANTIFIED** every time **SOLIDS** and **LIQUIDS** are involved:

- electronic components, printed circuit boards, fluxes, molten alloys,
- various materials, liquid glues,
- various materials, paints and varnishes,
- various materials, cleansers,
- various materials, lubricants,
- ...

MENISCO ST78 thus provides not only **control** but also **design** and **investigation** possibilities for the **production** and, then, the use of:

- electronic components,
- printed circuit boards,
- surface treatment metals,
- fluxes,
- solder alloys,
- cleansers,
- glues, paints, varnishes, inks,.

WETTING PHENOMENA PRINCIPLE

On soldering, three phases are present:

- the solid phase (solder parts),
- the liquid phase (molten alloy),
- the vapour phase (atmospheric air in most cases).

The molecular interactions of these three phases taken in pairs are surface tensions called:

- γ**SL** solid-liquid phase,
- γ**SV** solid-vapour phase,
- γ**LV** liquid-vapour phase.

The balance of those three forces is attained when the liquid which wets the solid forms a meniscus represented by the **YOUNG** formula:

$$\vec{\gamma SV} + \vec{\gamma SL} + \vec{\gamma LV} = \vec{0}$$

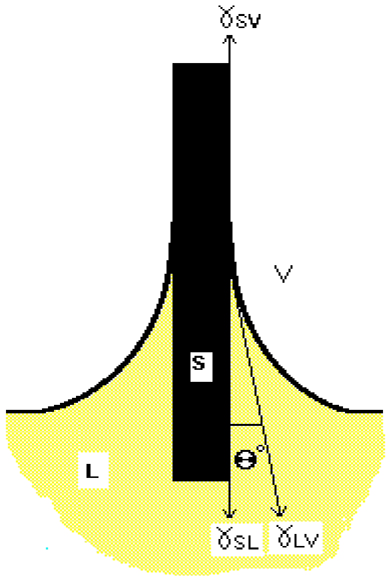

Figure 1 : meniscus

The angle Θ formed by the surface of the solid and the liquid at their extreme point of contact is the wetting angle.

The projection of the forces upon a plane is written:

$$\gamma SV - \gamma SL - \gamma LV * \cos\theta = 0 \quad \Rightarrow \quad \cos\theta = \frac{\gamma SV - \gamma SL}{\gamma LV}$$

The angle Θ directly linked to surface tensions is thus representative of the wetting quality.

The angle Θ becomes smaller when the wetting quality increases.

Note: The wetting angle (Θ) is conceivable only for alloys in the liquid state.

MENISCOGRAPHY

PRINCIPLE

When a sample is partly immersed into a molten alloy bath, it is subject to a set of forces due to the buoyancy and to surface tensions which are particularly high at the ALLOY-FLUX interface.

The measurement of the force resultant is representative of the meniscus and, consequently, of the **wetting angle** θ and of the **solderability quality**.

BASIC FORMULA

The principle set forth above enables one to write:

$$F = Fm - Fa$$

F → resultant force measured
Fm → wetting force
Fa → buoyancy

$$F = \gamma_{LV} * l * \cos\theta - \rho * v * g$$

$$\cos\theta = \frac{F + \rho * v * g}{\gamma_{LV} * l}$$

F → resultant force measured
θ → wetting angle
γ_{LV} → liquid-vapour surface tension (ALLOY/FLUX)
l → sample perimeter in the meniscus area
ρ → specific volume of the molten alloy
v → immersed sample volume
g → gravitational field (9.81)

F is a measured value from which the angle θ is deduced.

The other parameters are data fixed in accordance with the testing conditions.
If the value of the surface tension γ_{LV}**,** is unknown, one must start by determining it.

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SANCTIONS

The sanction is the value of the wetting angle obtained with the four basic parameters:
- solder alloy (composition)
- alloy temperature
- flux
- time

For checking of the component solderability by the manufacturer and by the user, the reference values of these parameters are as follows:
- solder alloy B Sn 60 Pb 183 - 190 (NF A 81-361)
- temperature 235 ℃
- flux 25 g of pure natural colophane (WW) in 75 g of propanol-2 (isopropanol) or ethyl alcohol (96,2%) and 0.39 g of diethylamine chlorohydrate which corresponds to a chlorine rate of 0.5% (CMA flux to NF French standard NF C 90550).
- time as a function of the component size being admitted that the reference time is 3 s for small components (including the CMS).

These four parameters can be jointly agreed to by the manufacturer and the user.
The number of samples to be measured shall not exceed ten.

In view of this, the solderability quality is classified into four categories according to the following table

SOLDERABILITY CLASSIFICATION	ANGLE VALUE (°)
1	$\theta \leq 30$
2	$\theta \leq 40$
3	$\theta \leq 55$
4	$\theta > 55$
θ wetting angle for each sample	

The experience gained in production and assembly workshops enables the following table to be drawn up:

SOLDERABILITY CLASSIFICATION	QUALITY
1	EXCELLENT
2	GOOD
3	ADMISSIBLE
4	UNCERTAIN

Note: if a sample in ten does not fall in the category chosen, one should measure five new samples which must all be satisfactory.

MEASURING SEQUENCE

Before starting any measurement, make sure that the apparatus has been calibrated within no more that one year.

Check as need be:
- using gauge weights, the measuring chain linearity and accuracy
- the temperature control (± 3℃)

Display the measuring parameters (temperature, time, immersion depth, amplifier sensitivity)

Put the sample in the clamp and apply the flux onto the end of the sample by immersing it into the container which contains the flux. For rosin-based fluxes only, apply the end of the sample on blotting paper to eliminate the last drop.

Suspend the sample to the sensor, reset the apparatus to zero, clean the surface layer of the molten alloy bath, and start the measuring cycle

At the end of the cycle, remove the clamp and analyze the results of the measurement on the VDU screen or any other recording means.

Note:
For samples with a high thermal inertia, it is recommended to pre-heat the sample after having deposited the flux under the appropriate conditions and with the supplier's and user's joint approval.

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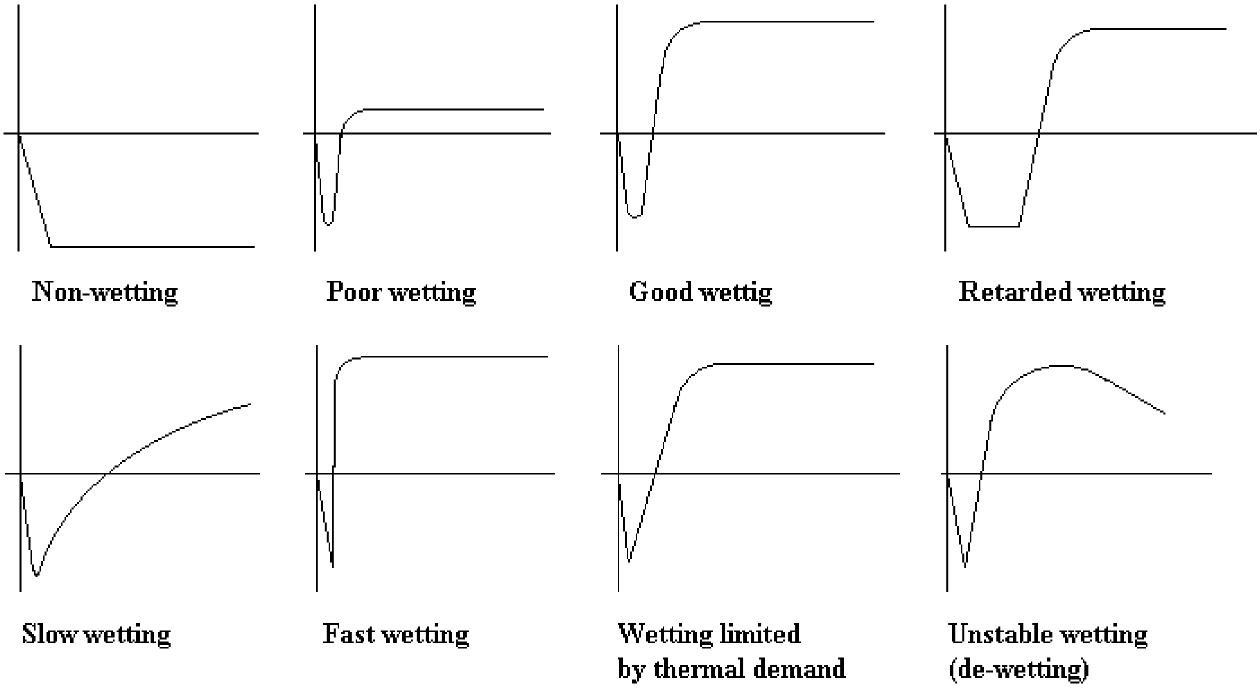
INTERPRETATION OF RECORDING

According to the conditon of materials to measure, appearance of curves different from the ideal curve may be observed, as the ones presented hereafter.
In all case, the expression of the results stays the same.

Schematic of wetting phenomena



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