I&J Fisnar Inc. - Dispensing Dynamics - Part 1 - Fluids

Dispensing Dynamics

There are five principles relevant to any dispensing application. These principles of dispensing dynamics must be understood before determining a dispensing solution. The principles are simple, but can provide an invaluable guide to recommending new equipment or in solving an existing equipment dispensing issue.

Principles:

• Air is compressible. Fluid is not compressible.

This first principle explains why a fluid can be dispensed at all; if the fluid was compressible, accurate dispensing could never be achieved. The principle also explains why there is a delay in fluid flow when using an air line – the air must first be compressed before impacting the fluid. In the case of a syringe, as fluid is used and the fluid level drops, the air chamber in the syringe increases resulting in a delay and/or smaller shot size. This phenomenon brings us to the second principle of dispensing dynamics.

• Dispensing fluid is related to: 1. Air pressure, 2. Time, 3. Tip size.

This second principle applies to any dispensing operation including syringes and valves. Changing one of these parameters will alter the dispensing result.

• A dispensed shot is equal to: ½ volume of a sphere: Volume = D^3 x 0.5236 / 2.

This principle will help calculate reservoir supply and fluid usage.

• For repeatable shot accuracy, always use a valve.

A valve has no variable air space and will therefore provide accurate and constantly repeatable shots.

• The type of fluid and its viscosity will determine the valve to be used.

Understanding this principle will ensure questions are raised about the fluid before recommending a suitable valve.

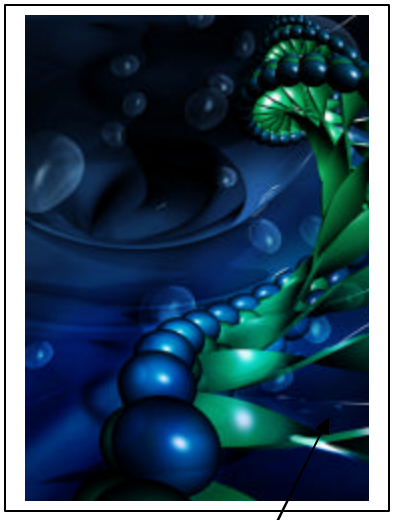
Common Fluid Characteristics

A fluid is selected for a specific application and can be a liquid or a paste.

Solvents, silicones, one-part or two-part encapsulates and various pastes have unique characteristics which are particular to each of these fluids.

Viscosity

One of the major characteristics of a fluid is its viscosity. Viscosity is usually stated in centipoise (cps). Fluids with high centipoise are thick and have no self-leveling capabilities, whereas fluids with low centipoise are thin and possess self-leveling properties.



Engine Oil

Since viscosity may change due to time or temperature, measures must be taken to either defer or compensate for a viscosity change. To determine a fluid's viscosity, the manufacturer's product information should be referenced. The following examples provide a reference of viscosity:

Water:	1 cps (centipoise)
Vegetable oil:	80 cps
Engine oil:	1,000 cps
Solder mask:	6,000 cps
Ketchup:	30,000 cps

Ketchup is a thixotropic fluid.

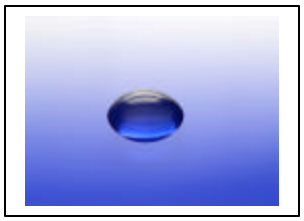
If a material is thixotropic, it means that the viscosity will change when the fluid is agitated. For example, when the bottle of ketchup is shaken, the ketchup flows easily.

Mustard:	200,000 cps
Pastes:	1,000,000 cps range

Viscosity is generally stated in centipoise (cps), poise, or millipascal which is equal to one centipoise. We will cover more on viscosity and its relationship to dispensing in chapter 4.

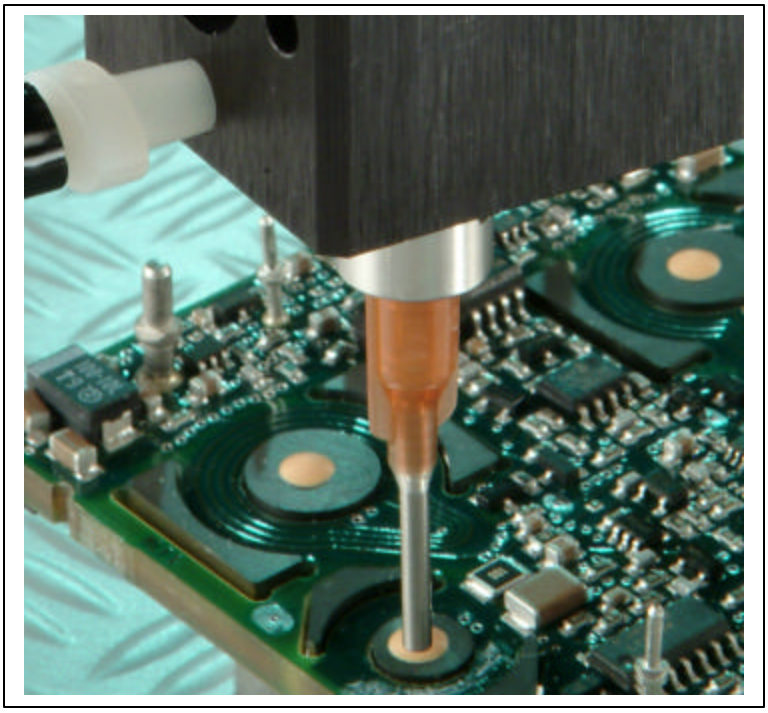
Shot Size

The “shot size” (amount being dispensed per shot) depends on several factors.
Changing these factors will affect the size:



- Tip diameter, length and style
- Dispensing time
- Dispensing pressure

Shots are dispensed in half sphere (V) as calculated by the diameter (D).
V = Shot size (ml)
D = Diameter (mm) **Example: D = 2.67mm, V = 0.005 ml**



Dispensing solder mask shots using volumetric valve:

Variables:

- Selected tip size
- Auger rotation speed
- Auger pitch size

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