When testing thickness of plastic packaging films, how do you know what specifications to use for the pressure foot and diameter of the measuring foot?

This is not an easy question.


The new method references ASTM D 6998 “Standard Guide for Determination of Thickness of Plastic Film Test Specimens” as the guide for recommending foot diameter and foot pressure.

Some terms to understand:

- **Pressure foot or upper anvil**: a metal circular upper/moving weight which exerts pressure on the film sample.
- **Lower anvil**: a circular metal base where the film sample is compressed during a test.
- **Parallelism**: the flatness of the pressure foot and lower anvil surfaces when compressed together.
- **Foot pressure**: the amount of force/dead weight of the pressure foot measured in kPa or PSI.
- **Accuracy**: the maximum error allowed in the measurement device- usually 1 micron (0.0393 mils)
- **mils**: a unit of measure for plastic films and other sheet materials- 1 mil = 0.001 inch.

Industries such as paper, tissue paper, corrugated board or textiles have well defined specifications listed in the applicable standard. However, plastic film standards such as ASTM D 6988 and ISO 4593 suggest a range for the diameter and foot pressure based on the stiffness and thickness of the material.

**Questions:**

1. **Is the material considered a thin or deformable film? What are thin films?**
   Thin films are ≤ 0.025 mm (0.001 in.). Deformable films are easily compressible and a lower contact foot pressure is recommended.

   If the requirement is to test thin films then a maximum pressure of 70 kPa (10 psi) is suggested. If the material is not classified as a thin film then a foot pressure range of 160-185 kPa (23-27 PSI).

   A pressure foot with a large area is difficult to calibrate and maintain parallelism between the pressure foot and the anvil. Also a large diameter pressure foot is difficult to keep clean (as seen in the following illustration).

   ![Diagram of pressure foot comparison](image)

   Any dust or dirt on the film will be measured during the test. During a measurement, dust can adhere to the upper and lower foot and produce a higher reading. This is a very common problem with thickness measurements.

2. **What diameter pressure foot is recommended for plastic films?**
According to ASTM D 6988, the diameter ranges from 3.2-12.7 mm (0.125-0.5 inch).
ISO 4593 recommends a diameter of 2.5-10 mm (0.098-0.393 inch).

3. **What is the recommended pressure for plastic films?**

   ASTM D 6988 has a range of 5-70 kPa (0.73-10.1 PSI) for thin films and 160-185 kPa (23-27 PSI) for stiffer films.

   ISO recommends a pressure range of 0.5-1.0 N (51-102 gram) dead weight.

**Instruments:**

TMI Model **49-56-00-0003** is configured with a 10 mm diameter/12.5 kPa (0.393 inch/1.81 PSI) pressure foot and meets both ASTM D 6988 and ISO 4593.

TMI Model **49-86-00-0006** is configured with a 6.35 mm diameter/31 kPa (0.25-inch diameter/4.5 PSI) pressure foot and meets ASTM D 6988 and ISO 4593.

The above two units feature light weight pressure suitable for testing compressible and non-compressible plastic films.
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