

1032.1.e. con't.

1. Interfaces for wafer input and output, to which more than two pieces of semiconductor processing equipment are to be connected; **and**
2. Designed to form an integrated system in a vacuum environment for sequential multiple wafer processing;

Note:

1032.1.e. does not control automatic robotic wafer handling systems not designed to operate in a vacuum environment.

- f. “Stored programme controlled” lithography equipment, as follows:

1. Align and expose step and repeat (direct step on wafer) or step and scan (scanner) equipment for wafer processing using photo-optical or X-ray methods, having any of the following:

- a. A light source wavelength shorter than 350 nm; **or**
- b. Capable of producing a pattern with a minimum resolvable feature size of 0.5 µm or less;

Technical Note:

The minimum resolvable feature size is calculated by the following formula:

$$MRF = \frac{(\text{an exposure light source wavelength in } \mu\text{m}) \times (K \text{ factor})}{\text{numerical aperture}}$$

where the K factor = 0.7.

MRF = minimum resolvable feature size.

2. Equipment specially designed for mask making or semiconductor device processing using deflected focussed electron beam, ion beam or “laser” beam, having any of the following:

- a. A spot size smaller than 0.2 µm;
- b. Being capable of producing a pattern with a feature size of less than 1 µm; **or**
- c. An overlay accuracy of better than ± 0.20 µm (3 sigma.);

- g. Masks and reticles designed for integrated circuits controlled by 1031.1.;

- h. Multi-layer masks with a phase shift layer.

2. “Stored programme controlled” test equipment, specially designed for testing finished or unfinished semiconductor devices, as follows, and specially designed components and accessories therefore:

- a. For testing S-parameters of transistor devices at frequencies exceeding 31 GHz;
- b. For testing integrated circuits capable of performing functional (truth table) testing at a pattern rate of more than 333 MHz;

Note:

1032.2.b. does not control test equipment specially designed for testing:

1. “Electronic assemblies” or a class of “electronic assemblies” for home or entertainment applications;

2. Uncontrolled electronic components, “electronic assemblies” or integrated circuits.

3. Memories

Technical Note:

For the purpose of this entry, pattern rate is defined as the maximum frequency of digital operation of a tester. It is therefore equivalent to the highest data rate that a tester can provide in non-multiplexed mode. It is also referred to as test speed, maximum digital frequency or maximum digital speed.

- c. For testing microwave integrated circuits controlled by 1032.2.b.

1033. Materials

1. Hetero-epitaxial materials consisting of a “substrate” with stacked epitaxially grown multiple layers of any of the following:
 - a. Silicon;
 - b. Germanium; **or**
 - c. Silicon Carbide;
 - d. III/V compounds of gallium or indium.

Technical Note:

III/V compounds are polycrystalline or binary or complex monocrystalline products consisting of elements of groups IIIA and VA of Mendeleev’s periodic classification table (e.g., gallium arsenide, gallium-aluminum arsenide, indium phosphide).

2. Resist materials, as follows, and “substrates” coated with controlled resists:

- a. Positive resists designed for semiconductor lithography specially adjusted (optimised) for use at wavelengths below 350 nm ;
- b. All resists, designed for use with electron beams or ion beams, with a sensitivity of 0.01 µcoulomb/mm² or better;
- c. All resists, designed for use with X-rays, with a sensitivity of 2.5 mJ/mm² or better;
- d. All resists optimised for surface imaging technologies, including silylated resists.

Technical Note:

Silylation techniques are defined as processes incorporating oxidation of the resist surface to enhance performance for both wet and dry developing.

3. Organo-inorganic compounds as follows:

- a. Organo-metallic compounds of aluminum, gallium or indium having a purity (metal basis) better than 99.999%;
- b. Organo-arsenic, organo-antimony and organo-phosphorus compounds having a purity (inorganic element basis) better than 99.999%.

Note:

1033.3. only controls compounds whose metallic, partly metallic or non-metallic element is directly linked to carbon in the organic part of the molecule.

4. Hydrides of phosphorus, arsenic or antimony, having a purity better than 99.999%, even diluted in inert gases or hydrogen.

Note:

1033.4. does not control hydrides containing 20% molar or more of inert gases or hydrogen.

1034. Software

1. “Software” specially designed for the “development” or “production” of equipment controlled by 1031.1.b. to 1031.2.g. or 1032.
2. “Software” specially designed for the “use” of “stored program controlled” equipment controlled by 1032.
3. Computer-aided-design (CAD) “software”, having all of the following:
 - a. Designed for the “development” of semiconductor devices or integrated circuits, **and**
 - b. Designed to perform or use any of the following:
 - c. Design rules or circuit verification rules;
 - d. Simulation of the physically laid out circuits; **or**
 - e. Lithographic processing simulators for design.