1091.4. con't.

Note:
1091.4. does not control payloads.

N.B.
For the control status of products contained in "spacecraft" payloads, see the appropriate Categories.

5. Liquid rocket propulsion systems containing any of the systems or components controlled by 1091.6.
6. Systems and components specially designed for liquid rocket propulsion systems, as follows:
   a. Cryogenic refrigerators, flightweight dewars, cryogenic heat pipes or cryogenic systems specially designed for use in space vehicles and capable of restricting cryogenic fluid losses to less than 30% per year;
   b. Cryogenic containers or closed-cycle refrigeration systems capable of providing temperatures of 100 K (-173°C) or less for "aircraft" capable of sustained flight at speeds exceeding Mach 3, launch vehicles or "spacecraft";
   c. Slush hydrogen storage or transfer systems;
   d. High pressure (exceeding 17.5 MPa) turbo pumps, pump components or their associated gas generator or expander cycle turbine drive systems;
   e. High-pressure (exceeding 10.6 MPa) thrust chambers and nozzles therefore;
   f. Propellant storage systems using the principle of capillary containment or positive expulsion (i.e., with flexible bladders);
   g. Liquid propellant injectors, with individual orifices of 0.381mm or smaller in diameter (an area of 1.14×10^{-3} cm^2 or smaller for non-circular orifices) specially designed for liquid rocket engines;
   h. One-piece carbon-carbon thrust chambers or one-piece carbon-carbon exit cones with densities exceeding $1.4 g/cm^3$ and tensile strengths exceeding 48 MPa.
7. Solid rocket propulsion systems with any of the following:
   a. Total impulse capacity exceeding 1.1 MNs;
   b. Specific impulse of 2.4 kNs/kg or more when the nozzle flow is expanded to ambient sea level conditions for an adjusted chamber pressure of 7 MPa;
   c. Stage mass fractions exceeding 88% and propellant solid loadings exceeding 86%;
   d. Any of the components controlled by 1091.8.; **or**
   e. Insulation and propellant bonding systems using direct-bonded motor designs to provide a strong mechanical bond or a barrier to chemical migration between the solid propellant and case insulation material.

      Technical Note:
      For the purposes of 1091.7.e., a strong mechanical bond means bond strength equal to or more than propellant strength.

8. Components, as follows, specially designed for solid rocket propulsion systems:
   a. Insulation and propellant bonding systems using liners to provide a strong mechanical bond or a barrier to chemical migration between the solid propellant and case insulation material;

      Technical Note:
      For the purposes of 1091.8.a., a strong mechanical bond means bond strength equal to or more than propellant strength.

   b. Filament-wound "composite" motor cases exceeding 0.61 m in diameter or having structural efficiency ratios (PV/W) exceeding 25 km;

      Technical Note:
      The structural efficiency ratio (PV/W) is the burst pressure (P) multiplied by the vessel volume (V) divided by the total pressure vessel weight (W).

   c. Nozzles with thrust levels exceeding 45 kN or nozzle throat erosion rates of less than 0.075 mm/s;
   d. Movable nozzle or secondary fluid injection thrust vector control systems capable of any of the following:
      1. Omni-axial movement exceeding ± 5°
      2. Angular vector rotations of 20°/s or more; or
      3. Angular vector accelerations of $40°/s^2$ or more.
9. Hybrid rocket propulsion systems with:
   a. Total impulse capacity exceeding 1.1 MNs; **or**
   b. Thrust levels exceeding 220 kN in vacuum exit conditions.
10. Specially designed components, systems and structures for launch vehicles, launch vehicle propulsion systems or "spacecraft", as follows:
   a. Components or structures exceeding 10kg, specially designed for launch vehicles manufactured using metal "matrix", "composite", organic "composite", ceramic "matrix" or intermetallic reinforced materials controlled by 1013.7. or 1013.10.;

      Note:
      The weight cut-off is not relevant for nose cones.

   b. Components and structures specially designed for launch vehicle propulsion systems controlled by 1091.5. to 1091.9. manufactured using metal matrix, composite, organic composite, ceramic matrix or intermetallic reinforced materials controlled by 1013.7. or 1013.10.;
   c. Structural components and isolation systems specially designed to control actively the dynamic response or distortion of "spacecraft" structures;
   d. Pulsed liquid rocket engines with thrust-to-weight ratios equal to or more than 1kN/kg and a response time (the time required to achieve 90% of total rated thrust from start-up) of less than 30 ms.
11. Ramjet, scramjet or combined cycle engines and specially designed components therefore.
12. Unmanned aerial vehicles having any of the following:
   a. An autonomous flight control and navigation capability (e.g. an autopilot with an Inertial Navigation System); **or**
   b. Capability of controlled-flight out of the direct vision range involving a human operator (e.g. televisual remote control).

   Note:
   1091,12, does not control model aircraft.

   N.B.:
   A model aircraft is intended for recreational and competition purposes.

1092. Test, Inspection and Production Equipment

1. Specially designed equipment, tooling and fixtures, as follows, for manufacturing or measuring gas turbine blades, vanes or tip shroud castings:
   a. Directional solidification or single crystal casting equipment;
   b. Ceramic cores or shells;
2. On-line (real time) control systems, instrumentation (including sensors) or automated data acquisition and processing equipment, specially designed for the "development" of gas turbine engines, assemblies or components incorporating technologies controlled by 1095.3.a.