

Technical Note:

For the purposes of 1091.7.d. and 1091.8.a., a strong mechanical bond means bond strength equal to or more than propellant strength.

1091. 9. Hybrid rocket propulsion systems with:
- Total impulse capacity exceeding 1.1 MNs; or
 - Thrust levels exceeding 220 kN in vacuum exit conditions;
1091. 10. Specially designed components or structures for launch vehicles or launch vehicle propulsion systems, manufactured using metal "matrix" "composite", organic "composite", ceramic "matrix" or intermetallic reinforced materials embargoed by 1013.7. or 1013.10.;
1091. 11. Ramjet, scramjet or combined cycle engines and specially designed components therefor.

1092. TEST, INSPECTION AND PRODUCTION EQUIPMENT

1092. 1. Specially designed equipment, tooling or fixtures, as follows, for manufacturing or measuring gas turbine blades, vanes or tip shroud castings:
- Automated equipment using non-mechanical methods for measuring airfoil wall thickness;
 - Tooling, fixtures or measuring equipment for the "laser", water jet or ECM/EDM hole drilling processes embargoed by 1095.3.c.;
 - Directional solidification or single crystal casting equipment;
 - Ceramic cores or shells;
 - Ceramic core manufacturing equipment or tools;
 - Ceramic core leaching equipment;
 - Ceramic shell wax pattern preparation equipment;
 - Ceramic shell burn out or firing equipment;
1092. 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 embargoed by 1095.3.a.;
1092. 3. Equipment specially designed for the production or test of gas turbine brush seals designed to operate at tip speeds exceeding 335 m/s, and specially designed parts or accessories therefor;
1092. 4. Tools, dies or fixtures for the solid state joining of gas turbine "superalloy" or titanium components;
1092. 5. On-line (real time) control systems, instrumentation (including sensors) or automated data acquisition and processing equipment, specially designed for use with the following wind tunnels or devices:
- Wind tunnels designed for speeds of Mach 1.2 or more, except those specially designed for educational purposes and having a test section size (measured laterally) of less than 250 mm;
Technical Note:
Test section size: the diameter of the circle, or the side of the square, or the longest side of the rectangle, at the largest test section location.
 - Devices for simulating flow-environments at speeds exceeding Mach 5, including hot-shot tunnels, plasma arc tunnels, shock tubes, shock tunnels, gas tunnels and light gas guns;
 - Wind tunnels or devices, other than two-dimensional sections, capable of simulating Reynolds number flows exceeding 25×10^6 ;
1092. 6. Specially designed acoustic vibration test equipment capable of producing sound pressure levels of 160 dB or more (referenced to 20 micropascals) with a rated output of 4 kW or more at a test cell temperature exceeding 1,273 K (1,000°C), and specially designed transducers, strain gauges, accelerometers, thermocouples or quartz heaters therefor;
1092. 7. Equipment specially designed for inspecting the integrity of rocket motors using non-destructive test (NDT) techniques other than planar X-ray or basic physical or chemical analysis;
1092. 8. Transducers specially designed for the direct measurement of the wall skin friction of the test flow with a stagnation temperature exceeding 833 K (560°C);
1092. 9. Tooling specially designed for producing turbine engine powder metallurgy rotor components capable of operating at stress levels of 60% of ultimate tensile strength (UTS) or more and metal temperatures of 873 K (600°C) or more.

1093. MATERIALS

None.

1094. SOFTWARE

1094. 1. "Software" required for the "development" of equipment or technology embargoed by 1091., 1092. or 1095.3.;
1094. 2. "Software" required for the "production" of equipment embargoed by 1091. or 1092.;
1094. 3. "Software" required for the "use" of full authority digital electronic engine controls (FADEC) for propulsion systems embargoed by 1091. or equipment embargoed by 1092., as follows:
- "Software" in digital electronic controls for propulsion systems, aerospace test facilities or air breathing aero-engine test facilities;
 - Fault-tolerant "software" used in FADEC systems for propulsion systems and associated test facilities;
1094. 4. Other "software", as follows:
- "Software" specially designed for vibration test equipment using real time digital controls with individual exciters (thrusters) with a maximum thrust exceeding 100 kN;
 - 2D or 3D viscous "software" validated with wind tunnel or flight test data required for detailed engine flow modelling;
 - "Software" required for the "development" or "production" of real time full authority electronic test facilities for engines or components embargoed by 1091.;
 - "Software" for testing aero gas turbine engines, assemblies or components, specially designed to collect, reduce and analyse data in real time, and capable of feedback control, including the dynamic adjustment of test articles or test conditions, as the test is in progress;
 - "Software" specially designed to control directional solidification or single crystal casting;
 - "Software" in "source code", "object code" or machine code required for the "use" of active compensating systems for rotor blade tip clearance control.

NOTE:

1094.4.f. does not embargo "software" embedded in un-embargoed equipment or required for maintenance activities associated with the calibration or repair or updates to the active compensating clearance control system.

1095. TECHNOLOGY

1095. 1. Technology according to the General Technology Note for the "development" of equipment or "software" embargoed by 1091.1.c., 1091.4. to 1091.11., 1092. or 1094.;
1095. 2. Technology according to the General Technology Note for the "production" of equipment embargoed by 1091.1.c., 1091.4. to 1091.11. or 1092.

NOTE:

"Development" or "production" technology embargoed by 1095. for gas turbine engines remains embargoed when used as "use" technology for repair, rebuild and overhaul. Excluded from embargo are: technical data, drawings or documentation for maintenance activities directly associated with calibration, removal or replacement of damaged or unserviceable line replaceable units, including replacement of whole engines or engine modules.

(For technology for the repair of embargoed structures, laminates or materials, see 1015.2.f.)

1095. 3. Other technology, as follows:
1095. 3. a. Technology "required" for the "development" or "production" of the following gas turbine engine components or systems:
- Directionally solidified gas turbine blades, vanes or tip shrouds rated to operate at gas path temperatures exceeding 1,593 K (1,320°C);
 - Single crystal blades, vanes or tip shrouds;
 - Multiple domed combustors operating at average burner outlet temperatures exceeding 1,643 K (1,370°C), or combustors incorporating thermally decoupled combustion liners, non-metallic liners or non-metallic shells;
 - Components manufactured from organic "composite" materials designed to operate above 588 K (315°C),