

1092. cont'd.

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);
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

1. "Software" required for the "development" of equipment or technology embargoed by 1091., 1092. or 1095.3.;
2. "Software" required for the "production" of equipment embargoed by 1091. or 1092.;
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:
 - a. "Software" in digital electronic controls for propulsion systems, aerospace test facilities or air breathing aero-engine test facilities;
 - b. Fault-tolerant "software" used in FADEC systems for propulsion systems and associated test facilities;
4. Other "software", as follows:
 - a. "Software" specially designed for vibration test equipment using real time digital controls with individual exciters (thrusters) with a maximum thrust exceeding 100 kN;
 - b. 2D or 3D viscous "software" validated with wind tunnel or flight test data required for detailed engine flow modelling;
 - c. "Software" required for the "development" or "production" of real time full authority electronic test facilities for engines or components embargoed by 1091.;
 - d. "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;
 - e. "Software" specially designed to control directional solidification or single crystal casting;
 - f. "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 unembargoed equipment or required for maintenance activities associated with the calibration or repair or updates to the active compensating clearance control system.

1095. Technology

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.;
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.)

3. Other technology, as follows:
 - a. Technology "required" for the "development" or "production" of the following gas turbine engine components or systems:

1. Gas turbine blades, vanes or tip shrouds made from directionally solidified (DS) or single crystal (SC) alloys having (in the 001 Miller Index Direction) a stress-rupture life exceeding 400 hours at 1,273 K (1,000°C) at a stress of 200 MPa, based on the average property values;
2. 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;
3. Components manufactured from organic "composite" materials designed to operate above 588 K (315°C), or from metal "matrix" "composite", ceramic "matrix", intermetallic or intermetallic reinforced materials embargoed by 1011.2. or 1013.7.;
4. Uncooled turbine blades, vanes, tip-shrouds or other components designed to operate at gas path temperatures of 1,323 K (1,050°C) or more;
5. Cooled turbine blades, vanes or tip-shrouds, other than those described in 1095.3.a.1., exposed to gas path temperatures of 1,643 K (1,370°C) or more;
6. Airfoil-to-disk blade combinations using solid state joining;
7. Gas turbine engine components using "diffusion bonding" technology embargoed by 1025.3.b.;
8. Damage tolerant gas turbine engine rotating components using powder metallurgy materials embargoed by 1013.2.b.;
9. FADEC for gas turbine and combined cycle engines and their related diagnostic components, sensors and specially designed components;
10. Adjustable flow path geometry and associated control systems for:
 - a. Gas generator turbines;
 - b. Fan or power turbines;
 - c. Propelling nozzles;

Notes:

1. Adjustable flow path geometry and associated control systems do not include inlet guide vanes, variable pitch fans, variable stators or bleed valves for compressors.
2. 1095.3.a.10. does not embargo "development" or "production" technology for adjustable flow path geometry for reverse thrust.

11. Rotor blade tip clearance control systems employing active compensating casing technology limited to a design and development data base;
 12. Gas bearings for gas turbine engine rotor assemblies;
 13. Wide chord hollow fan blades without part-span support;
- b. Technology "required" for the "development" or "production" of:
 1. Wind tunnel aero-models equipped with non-intrusive sensors capable of transmitting data from the sensors to the data acquisition system;
 2. "Composite" propeller blades or propfans capable of absorbing more than 2,000 kW at flight speeds exceeding Mach 0.55;
 - c. Technology "required" for the "development" or "production" of gas turbine engine components using "laser", water jet or ECM/EDM hole drilling processes to produce holes with:
 1. a. Depths more than four times their diameter;
 - b. Diameters less than 0.76 mm; and
 - c. Incidence angles equal to or less than 25° or
 2. a. Depths more than five times their diameter;
 - b. Diameters less than 0.4 mm; and
 - c. Incidence angles of more than 25°;

Technical Note:

For the purposes of 1095.3.c., incidence angle is measured from a plane tangential to the airfoil surface at the point where the hole axis enters the airfoil surface.

- d. Technology "required" for the "development" or "production" of helicopter power transfer systems or tilt rotor or tilt wing "aircraft" power transfer systems:
 1. Capable of loss-of-lubrication operation for 30 minutes or more; or
 2. Having an input power-to-weight ratio equal to or more than 8.87 kW/kg.