SCHEDULE 1

PROHIBITED GOODS–MISCELLANEOUS CONTENTS

PART II

GROUP 3A

Metal Working Machinery and Associated Equipment

IL1001	Technology for metal-working manufacturing processes and specially designed software, the following–	
	(a) Technology for the design of tools, dies and fixtures specially designed for any of the following processes–	
	(1) hot die forging	D
	(2) superplastic forming	D
	(3) diffusion bonding	D
	(4) direct-acting hydraulic pressing	D
	(b) Technology consisting of the parameters listed below in connection with the process referred to in the relevant sub-head–	
	(1) hot die forging–	
	(i) temperature	D
	(ii) strain rate	D
	(2) superplastic forming of aluminium alloys, titanium alloys and superalloys–	
	(i) surface preparation	D
	(ii) strain rate	D
	(iii) temperature	D
	(iv) pressure	D
	(3) diffusion bonding of superalloys and titanium alloys–	

(i) surface preparation	D
(ii) temperature	D
(iii) pressure	D
(4) direct-acting hydraulic pressing of aluminium alloys, and titanium alloys–	
(i) pressure	D
(ii) cycle time	D
(5) hot isostatic densification of titanium alloys, aluminium alloys and superalloys–	
(i) temperature	D
(ii) pressure	D
(iii) cycle time	D

In this entry–

(a) "hot die forging" means a deformation process where die temperatures are at the same nominal temperature as the workpiece and exceed 850 K (577°C);

(b) "superplastic forming" means a deformation process using heat for metals that are normally characterised by low values of elongation (less than 20%) at the breaking point as determined at room temperature by conventional tensile strength-testing, in order to achieve elongations during processing which are at least 2 times those values;

(c) "diffusion bonding" means a solid-state molecular joining of at least two separate metals into a single piece with a

	joint strength equivalent to that of the weakest material;	
	(d) "direct-acting hydraulic pressing" means a deformation process which uses a fluid-filled flexible bladder in direct contact with the workpiece;	
	(e) "hot isostatic densification" means a process of pressurizing a casting at temperatures exceeding 375 K (102°C) in a closed cavity through various media (gas, liquid, solid particles, etc) to create equal force in all directions to reduce or eliminate internal voids in the casting;	
PL7031	Production equipment for inert gas and vacuum atomising processes, specially designed components therefor and related technology, the following–	
	(a) Production equipment designed or modified for inert gas and vacuum atomising processes to achieve sphericity and uniform size of particles in metal powders, whatever the type of metal and whether or not the powder is specified in this Schedule, and specially designed components therefor	A
	(b) Technology for inert gas and vacuum atomising processes to achieve sphericity and uniform size of particles in metal powders, whatever the type of metal and whether or not	B

	the powder is specified in this Schedule	
PL7027	Flow forming machines and machines combining the functions of spin forming and flow forming, having both the following characteristics: and specially designed components and specially designed software therefor	A
	(a) specially designed or adapted for use with numerical or computer controls;	
	(b) having more than two axes which can be co-ordinated simultaneously for contouring control.	
IL1080	Specially designed equipment, tooling and fixtures and technology for the manufacture or measuring of gas turbine blades or vanes, the following: and specially designed components and accessories therefor and specially designed ODMA software for the equipment, components and accessories–	
	(1) Specially designed equipment, tooling, fixtures, components and accessories, the following–	
	(a) Blade or vane aerofoil or root automatic measuring equipment	C
	(b) Precision vacuum investment casting equipment, including core-making equipment	C
	(c) Small-hole drilling equipment for producing holes having depth more than four times their diameter and less than 0.76 mm (0.03 inch) in diameter	C

(d) Directional solidification casting equipment and directional recrystallization equipment	C
(e) Segmented cast blade or vane bonding equipment	C
(f) Integral blade-and-disc casting equipment	C
(g) Blade or vane coating equipment, except furnaces, molten-metal baths and ion-plating baths	C
(h) Ceramic blade or vane moulding and finishing machines	C
(i) Moulds, cores and tooling for the manufacture and finishing of–	
(1) cast hollow turbine blades or vanes	C
(2) turbine blades or vanes produced by powder compaction	C
(j) Composite metal turbine blade or vane moulding and finishing machines	C
(k) Inertial blade or vane welding machines	C
(l) Machinery and equipment for the manufacture of blades or vanes in the compressor section of aircraft or aircraft-derived gas turbine engines where the technology is the same as for the manufacture of blades or vanes in the turbine section	C
(2) Technology (except installation, operation	

	and maintenance technology) for use of the following equipment	
	(a) Blade or vane belt grinding machines	D
	(b) Blade or vane edge radiusing machines	D
	(c) Blade or vane aerofoil milling or grinding machines	D
	(d) Blade or vane blank performing machines	D
	(e) Blade or vane rolling machines	D
	(f) Blade or vane aerofoil shaping machines except metal removing types	D
	(g) Blade or vane root grinding machines	D
	(h) Blade or vane aerofoil scribing equipment	D
	(i) Machinery and equipment for the manufacture of blades or vanes in the compressor section of aircraft or aircraft-derived gas turbine engines where the technology is the same as for the manufacture of blades or vanes in the turbine section	D
	In this entry–	
	"manufacture" or	
	"making" includes refurbishing.	
IL1081	Specially designed or modified equipment, tools, dies, moulds and fixtures for the manufacture or inspection of aircraft, airframe structures or aircraft fasteners, the following: and specially designed components and accessories therefor and specially designed ODMA	

	software for the equipment, components and accessories–	
	(a) Equipment, tools, dies, moulds or fixtures for:	
	(1) hydraulic stretch forming–	
	(i) whose machine motions or forces are digitally controlled or controlled by electrical analogue devices	C
	or	
	(ii) which are capable of thermal-conditioning the workpiece	C
	(2) the milling of aircraft skins or spars, except those which do not present an improvement on machinery in production ten years preceding the year of export	C
	(b) Tools, dies, moulds or fixtures for–	
	(1) diffusion bonding	C
	(2) superplastic forming	C
	(3) hot die forging	C
	(4) direct-acting hydraulic pressing of aluminium alloys and titanium alloys	C
	(5) the manufacture, inspection, inserting or securing of specially designed high-strength aircraft fasteners	C
	The definitions in entry IL1001 of the processes and control of the metal working manufacturing technologies mentioned above, apply also for the purposes of this entry.	
IL1086	Specially designed or modified equipment, tools, dies, moulds,	

	fixtures and gauges for the manufacture or inspection of aircraft and aircraft-derived gas turbine engines, the following: and specially designed components and accessories and specially designed ODMA software for the equipment, components and accessories–	
	(a) Equipment, tools, dies, moulds, fixtures and gauges–	
	(1) for automated production inspection	C
	(2) for automated welding	C
	(b) Tools, dies, fixtures and gauges–	
	(1) for solid-state joining by inertial welding or thermal bonding	C
	(2) for manufacture and inspection of high-performance gas turbine bearings	C
	(3) for rolling specially configured rings such as nacelle rings	C
	(4) for forming and finishing turbine discs	C
	(c) Compressor or turbine disc broaching machines	C
	This head includes only broaching machines specially designed for the manufacture of aircraft or aircraft-derived gas turbine engines and not general purpose broaching machines specially adapted for that purpose.	
IL1088	Gear making or finishing machinery, the following–	
	(a) Bevel gear making machinery, the following–	

	(1) gear grinding machinery (non-generating type)	C
	(2) other machinery capable of the production of bevel gears of module finer than 0.5 mm (diametrical pitch finer than 48) and meeting a quality standard better than DIN 58405 Class 6	C
	(b) Machinery capable of producing gears in excess of AGMA quality level 13 or equivalent	C
	For the purposes of this entry DIN 3963 Class 4 shall be considered equivalent to AGMA quality level 13.	
IL1091	Numerical control units, numerically controlled machine tools, components, specially designed parts and sub-assemblies, software and technology, the following–	
	(a) Numerical control units for machine tools, having any of the following characteristics, and specially designed ODMA software and specially designed components therefor–	
	(1) more than three interpolating axes can be co-ordinated simultaneously for contouring control	W
	(2) two or three interpolating axes can be co-ordinated simultaneously for contouring control and	
	(A) the smallest programmable increment, namely the input resolution, for any linear	W

	axis is less than 0.001 mm	
	NOTE: In case of units with only two linear axes one of them may have a smallest programmable increment of less than 0.001 mm but not less than 0.0005 mm.	
	(B) interpolation of third order or higher is possible (e.g. spline or involute interpolation) W	
	(C) word size of more than 32 bit (excluding parity bits) W	
	(D) capable of real-time processing of data to modify, during the machining operation, tool path, feed rate and spindle data by either–	
	(a) automatic calculation and modification of part programme data for machining in two or more axes by means of measuring cycles and access to source data	W
	or	
	(b) adaptive control, with more than one physical variable measured and processing by means of a computing model (strategy) to change one or more machining instructions to optimize the process	W
	(E) capable of receiving directly (on-line) and processing computer aided design (CAD) data for internal preparation of machine instructions	W
except–		
numerical control units which are either:		

(a) modified for and incorporated in machines not specified in this Schedule; or

(b) specially designed for machines not specified in this Schedule;

(b) Machine tools, for removing, cutting or spark eroding metals, ceramics or composites, the following–

(1) machine tools for turning which have all the following characteristics W

(A) according to the manufacturer's technical specifications, can be equipped with numerical control units specified in head (a) above, even when not equipped with such units at delivery;

(B) have two or more axes which can be co-ordinated simultaneously for contouring control;

(C) have any of the following–

(a) two or more contouring rotary axes;

(b) run out (out-of-true running) less (better) than 0.0008 mm total indicator reading (TIR);

(c) camming (axial displacement) less (better) than 0.0008 mm total indicator reading (TIR); or

(d) the positioning accuracies, with all compensations available, are better than–

(1) overall positioning along any linear axis of–

(A) 0.006 mm for a total length of axis travel L equal to or shorter than 500 mm; or

(B) (0.006 + 0.001 × (L −500)/500) mm if L is longer than 500 mm and shorter than 5,500 mm; or

(C) 0.016 mm if L is equal to or longer than 5,500 mm; or

(2) of any rotary axis, 0.001°;

(2) machine tools for milling which have all the following characteristics W

(A) according to the manufacturer's technical specifications, can be equipped with numerical control units specified in head (a) above, even when not equipped with such units at delivery;

(B) have two or more axes which can be co-ordinated simultaneously for contouring control;

(C) have any of the following–

(a) two or more contouring rotary axes;

(b) one or more contouring tilting spindles;

(c) run out (out-of-true running) less (better) than $2 \times D \times 10^{-5}$ mm total indicator reading (TIR) where D equals the diameter of the spindle in mm;

(d) the positioning accuracies, with all compensations available, are better than–

(1) overall positioning along any linear axis of–

(A) 0.006 mm, if none of the axes exceeds a total length of axis travel L of 650 mm;

(B) if the total length of axis travel L of any axis islonger than 650 mm, 0.008 mm or (0.008 + 0.0015 × (L −500)/500) mm whichever is higher, for axes up to 5,500 mm of travel; or

(C) 0.023 mm for any axis the total length L of which is equal to or longer than 500 mm; or

(2) of any rotary axis, 0.0010 or

(e) a motor power of any spindle of more than 75 kW;

(3) machine tools for grinding which have all the following characteristics W

(A) according to the manufacturer’s technical specifications, can be equipped with numerical control units specified in head (a) above, even when not equipped with such units at delivery;

(B) have two or more axes which can be co-ordinated simultaneously for contouring control;

(C) have any of the following–

(a) two or more contouring rotary axes;

(b) one or more contouring tilting spindles;

(c) run out (out-of-true running) less (better) than 0.0008 mm total indicator reading (TIR); or

(d) the positioning accuracies, with all compensations available, are better than–

(1) overall positioning along any linear axis of–

(A) 0.004 mm, for a total length of axis travel L equal to or shorter than 300 mm;

(B) (0.004 + 0.001 × (L −300)/300) mm if L is longer than 300 mm, and shorter than 3,300 mm; or

(C) 0.014 mm if L is equal to or longer than 3,300 mm; or

(2) of any rotary axis, 0.001°;

except–
tool or cutter grinding machines having all the following characteristics–

(a) no more than four axes can be co-ordinated simultaneously for contouring control;

(b) no more than two rotary axes can be co-ordinated simultaneously for contouring control;

(c) run out (out-of-true running) more (worse) than 0.0008 mm total indicator reading (TIR);

(d) the positioning accuracies, with all compensations available, are not better than:

(1) overall positioning along any linear axis of 0.004 mm; or

(2) of any rotary axis, 0.001°; and

(e) a maximum slide travel along any axis of less than 200 mm;

(4) electrical discharge machines (EDM) of the wire feed type which have five or more contouring axes and which can be equipped with one of the following–

(A) numerical control units specified in head (a) above even when not equipped with such units at delivery	W
(B) electronic controllers specified in head (b) in entry IL1391 inGroup 3D	W

(5) electrical discharge machines (EDM) of the non-wire type which have two or more contouring rotary axes and which can be equipped with one of the following–

(A) numerical control units specified in head (a) above even when not equipped with such units at delivery	W
(B) electronic controllers specified in head (b) in entry IL1391 inGroup 3D	W
(6) machine tools for removing metals ceramics or composites, having all the following characteristics	W

(A) acting by means of–

(a) water or other liquid jets, whether or not employing abrasive additives;

(b) electron beam; or	
(c) laser beam; and	
(B) according to the manufacturer's technical specifications, can be equipped with numerical control units specified in head (a) above, even when they are not equipped with such units at delivery; and	
(C) having two or more rotary axes which–	
(a) can be co-ordinated simultaneously for contouring control; and	
(b) have a positioning accuracy of better than 0.01°;	
(c) Technology for–	
(1) the development of numerical control units for machine tools specified in head (a) above	D,I,L,Y
(2) the production of numerical control units which have either of the following characteristics:	
(A) specified in head (a) above	D,I,L,Y
(B) containing a microprocessor with both of the following	D,I,L,Y
(a) a word length of 32 bit; and	
(b) a bus architecture of 32 bit;	
(3) the development of numerically controlled machine tools for removing, cutting or spark eroding metals, ceramics or composites specified inhead (b) above	D,I,L,Y

	(4) the production of numerically controlled machine tools which have either of the following characteristics–	
	(A) specified in head (b) above	D,I,L,Y
	(B) a positioning accuracy along any linear axis of better than 0.02 mm	D,I,L,Y
	(5) the development of components specified in head (d) or (e) below	D,I,L,Y
	(6) the production of components or sub-assemblies, which have either of the following characteristics–	
	(A) specified in head (d) or sub-head (e)(2) below	D,I,L,Y
	(B) not specified in sub-head (d)(2) or (d)(3) below	D,I,L,Y
	(7) the development of interactive graphics as an integrated part in numerical control units for preparation or modification of part programmes	D,I,L,Y
	(8) the development of generators of machine tool instructions (eg part programmes) from design data residing inside numerical control units	D,I,L,Y
	(9) the incorporation of expert systems for advanced decision support of shop floor operations	D,I,L,Y
	(10) the development of flexible manufacturing units used with the software specified in sub-	D,I,L,Y

head (b)(5)(E) in entry IL1566 in Group 3G	
(d) Components and specially designed parts for machine tools specified inhead (b) above, the following–	
(1) spindle assemblies, consisting of spindles and bearings as a minimal assembly, with run-out (out-of-true running) less than–	
(A) 0.0008mm total indicator reading (TIR) for machine tools for turning or grinding	W
(B) $2 \times D \times 10^{-5}$ mm total indicator reading (TIR), where D equals the diameter of the spindle in mm, for machine tools for milling	W
(2) linear position feedback units (eg inductive type devices, graduated scales, laser or infrared systems) having, with compensation, an overall accuracy better than ± (0.0015 + L × 10−6)mm, where L equals the effective length in mm of the linear measurement	W
(3) rotary position feedback units (eg inductive type devices, graduated scales, laser or infrared systems) having, with compensation, an accuracy better than ± 0.00025°	W
(4) slide way assemblies consisting of a minimal assembly of ways, bed and slide with all of the following characteristics	W

(A) a yaw, pitch or roll of less than 2 seconds of arc, total indicator reading (TIR);	
(B) a horizontal straightness of less than 0.004mm; and	
(C) a vertical straightness of less than 0.004mm;	
(5) ball screws, having all of the following characteristics	W
(A) a sum of tolerance of mean travel deviation (e) and half the travel variation (Vu) less than $(0.0025 + 5 \times 10^{-6} \times L)$mm, where L is the useful travel in mm of the ball screw;	
(B) a tolerance of travel variation (V300) within 300mm travel of the ball screw less than 0.004mm; and	
(C) a run-out (out-of-true running) of the journal diameter related to the screw shaft outer diameter less than 0.005mm total indicator reading (TIR), at an axial distance of 3 or more times the screw shaft outer diameter from the end of the journal;	
(6) single point diamond cutting tool inserts having all of the following characteristics	W
(A) a flawless and chip-free cutting edge when magnified 400 times in any direction;	
(B) a cutting radius out-of-roundness less than 0.002mm total indicator reading (TIR); and	

(C) a cutting radius between 0.1 and 5.0mm;		
(7) linear induction motors used as drives for slides having all the following characteristics	W	
(A) a stroke longer than 200mm for linear slides;		
(B) a nominal force rating above 45 N; and		
(C) a minimal controlled incremental movement less than 0.001mm for linear motion;		
(e) Specially designed components or sub-assemblies, capable of upgrading, according to the manufacturer's specifications, numerical control units, machine tools or feed-back devices to or above the levels specified in head (a) or (b), or in sub-head (d)(2) or (d)(3) above, the following–		
(1) printed circuit boards with mounted components and softwaretherefor	W	
(2) compound rotary tables	W	

In this entry–

"accuracy", usually measured in terms of inaccuracy, means the maximum deviation, positive or negative, of an indicated value from an accepted standard or true value;		
"adaptive control" means a control system that adjusts the response from conditions detected during the operation;		(cont.)

"camming" (axial displacement) means axial displacement in one revolution of the main spindle measured in a plane perpendicular to the spindle faceplate, at a point next to the circumference of the spindle faceplate;

"compound rotary table" means a table allowing the workpiece to rotate and tilt about two non-parallel axes, which can be co-ordinated simultaneously for contouring control;

"contouring control" means two or more numerically controlled motions operating in accordance with instructions that specify the next required position and the required feed rates to that position. These feed rates are varied in relation to each other so that a desired contour is generated;

"numerical control" means the automatic control of a process performed by a device that makes use of numeric data usually introduced as the operation is in progress;

"positioning accuracy" of numerically controlled machine tools is to be determined and presented in accordance with ISO/DIS 230/2, paragraph 2.13, in conjunction with the requirements below:

(a) test conditions:–

(1) for 12 hours before and during

measurements, the machine tools and accuracy measuring equipment will be kept at the same ambient temperature. During the premeasurement time the slides of the machine will be continuously cycled in the same manner that the accuracy measurements will be taken;

(2) the machine shall be equipped with any mechanical, electronic, or software compensation to be exported with the machine;

(3) accuracy of measuring equipment for the measurements shall be at least 4 times more accurate than the expected machine tool accuracy;

(4) power supply for slide drives shall be the following:–

(A) line voltage variation shall not be greater than ± 10 per cent of nominal rated voltage;

(B) frequency variation shall not be greater than ± 2 Hz of normal frequency;

(C) lineouts or interrupted service are not permitted.

(b) test programme:–

(1) feed rate (velocity of slides) during measurement shall be the rapid traverse rate; NOTE: In case of machine tools which generate optical quality surfaces, the feed rate

shall be equal to or less than 50mm per minute;

(2) measurements shall be made in an incremental manner from one limit of the axis travel to the other without returning to the starting position for each move to the target position;

(3) axes not being measured shall be retained at mid travel during test of an axis.

(c) presentation of test results:–

the results of the measurements must include:–

(1) position accuracy (A); and

(2) the mean reversal error (B);

"run out" (out-of-true running) means radial displacement in one revolution of the main spindle measured in a plane perpendicular to the spindle axis at a point on the external or internal revolving surface to be tested;

"tilting spindle" means a tool holding spindle which alters, during the machining process, the angular position of its centre line with respect to any other axis.

"machine tools for removing, cutting or spark eroding metal, ceramics or composites" are the following:

(a) machine tools for turning, including–

(1) horizontal turning machines;

(2) vertical turning machines;

(3) turning centres, with or without milling or grinding options;

(4) machines for generating optical quality surfaces;

(b) machine tools for milling, including–

(1) boring machines;

(2) boring-milling machines;

(3) milling machines;

(4) machining centres, with or without turning or grinding options;

(5) machine tools for routing;

(c) machine tools for grinding, with or without milling or turning options, including–

(1) jig grinding machines;

(2) contour grinding machines;

(3) tool and cutter grinding machines;

(d) machine tools using electric discharge for machining;

(e) other machines tools, as follows:

(1) water and other liquid jet machines;

(2) electron beam cutting machines; or

(3) ser cutting machines.

Any term used in this entry shall bear the meaning it has in

	entry IL1565 and entry IL1566 in Group 3G.	
PL7005	Machines, internal grinding, (except hand-held drills) of the kind incorporating, or specially designed for the utilisation of, grinding heads designed or rated for operation at speeds in excess of 120,000 revolutions per minute	W
IL1099	Dimensional inspection systems or devices, the following: and specially designed components and specially designed ODMA software therefor–	
	(a) Manual dimensional inspection machines with two or more axes, and having a measurement uncertainty equal to or less (better) than (0.25 + L/1000) micrometre in any axis (L is measured length in mm)	C
	except optical comparators.	
	(b) Computer controlled or numerically controlled dimensional inspection machines having both of the following characteristics	C
	(1) two or more axes;	
	(2) a one dimensional (1D) length measurement uncertainty equal to or less (better) than (1.5 + L/1000) micrometre tested with a probe of an accuracy of less (better) than 0.2 micrometre (L is measured length in mm);	
	(c) Linear angular displacement measuring devices, the following–	
	(1) linear measuring instruments having	

any of the following characteristics–	
(A) non-contact type measuring systems with a resolution equal to or less than 0.2micrometre within a measuring range up to 0.2mm	C
(B) linear voltage differential transformer systems having both of the following characteristics	C
(a) linearity equal to or less (better) than 0.1% within a measuring range up to and including 5mm; and	
(b) drift equal to or less (better) than 0.1% per day at a standard ambient test room temperature ± 1K; or	
(C) measuring systems having both the following characteristics	C
(a) contain a laser;	
(b) maintain for at least 12 hours, over a temperature range of ± 1K around a standard temperature and at a standard pressure–	
(1) a resolution over their full scale of ± 0.1micrometre or better; and	
(2) a measurement uncertainty equal to or less (better) than (0.2 + L/2000) micrometre (L is measured length in mm);	
(2) angular measuring instruments having an angular position deviation equal to or less (better) than 0.00025°	C

except–

optical instruments, such as autocollimators, using collimated light to detect angular displacement of a mirror;

(d) Systems for simultaneous linear-angular inspection of hemishells, having both of the following characteristics C

(1) measurement uncertainty along any linear axis equal to or less (better) than 3.5micrometre per 5mm;

(2) angular position deviation equal to or less (better) than 0.02°

NOTE:
Specially designed ODMA software for the systems described in this head includes software for simultaneous measurement of wall thickness and contour.

In this entry–

"angular position deviation" means the maximum difference between angular position and the actual, very accurately measured angular position, after the workpiece mount of the table has been turned out of its initial position;

"linearity" (usually measures in terms of non-linearity) means the maximum deviation of the actual characteristic (average of upscale and downscale readings), positive or negative, from a straight line so positioned as to equalise and minimise the maximum deviations;

"measurement uncertainty" means the characteristic parameter which specifies in what range about the output value the correct value of the measurable variable lies with a confidence level of 95%. It includes the uncorrected systematic deviations, the uncorrected backlash and the random deviations;

"resolution" means the least increment of a measuring device; on digital instruments, the least significant bit.