

# CPC COOPERATIVE PATENT CLASSIFICATION

## F MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING (NOTE omitted)

### ENGINES OR PUMPS

#### F05 INDEXING SCHEMES RELATING TO ENGINES OR PUMPS IN VARIOUS SUBCLASSES OF CLASSES [F01-F04](#)

#### F05D INDEXING SCHEME FOR ASPECTS RELATING TO NON-POSITIVE- DISPLACEMENT MACHINES OR ENGINES, GAS-TURBINES OR JET- PROPULSION PLANTS

##### 2200/00 Mathematical features

- 2200/10 . Basic functions
- 2200/11 . . Sum
- 2200/12 . . Subtraction
- 2200/13 . . Product
- 2200/14 . . Division
- 2200/15 . . Inverse
- 2200/20 . Special functions
- 2200/21 . . Root
- 2200/211 . . . Square root
- 2200/212 . . . Cubic root
- 2200/22 . . Power
- 2200/221 . . . Square power
- 2200/222 . . . Cubic power
- 2200/23 . . Logarithm
- 2200/24 . . exponential
- 2200/25 . . Hyperbolic trigonometric, e.g. sinh, cosh, tanh
- 2200/26 . . trigonometric
- 2200/261 . . . Sine
- 2200/262 . . . Cosine
- 2200/263 . . . Tangent
- 2200/264 . . . Cotangent
- 2200/30 . miscellaneous
- 2200/31 . . odd
- 2200/32 . . even
- 2200/33 . . bigger or smaller
- 2200/34 . . biggest or smallest
- 2200/35 . . first
- 2200/36 . . last

##### 2210/00 Working fluids

- 2210/10 . Kind or type
- 2210/11 . . liquid, i.e. incompressible
- 2210/12 . . gaseous, i.e. compressible
- 2210/13 . . mixed, e.g. two-phase fluid
- 2210/132 . . . Pumps with means for separating and evacuating the gaseous phase
- 2210/14 . . Refrigerants with particular properties, e.g. HFC
- 2210/20 . Properties
- 2210/30 . Flow characteristics
- 2210/31 . . with Mach-number kept constant along the flow
- 2210/32 . . Pressure kept constant along the flow
- 2210/33 . . Turbulent flow
- 2210/34 . . Laminar flow

- 2210/40 . Flow geometry or direction
- 2210/41 . . upwards due to the buoyancy of compressed air
- 2210/42 . . Axial inlet and radial outlet
- 2210/43 . . Radial inlet and axial outlet
- 2210/44 . . bidirectional, i.e. in opposite, alternating directions

##### 2220/00 Application

- 2220/10 . in ram-jet engines or ram-jet driven vehicles
- 2220/20 . within closed fluid conduits, e.g. pipes
- 2220/30 . in turbines
- 2220/31 . . in steam turbines
- 2220/32 . . in gas turbines
- 2220/321 . . . for a special turbine stage
- 2220/3212 . . . . the first stage of a turbine
- 2220/3213 . . . . an intermediate stage of the turbine
- 2220/3215 . . . . the last stage of the turbine
- 2220/3216 . . . . for a special compressor stage
- 2220/3217 . . . . for the first stage of a compressor or a low pressure compressor
- 2220/3218 . . . . for an intermediate stage of a compressor
- 2220/3219 . . . . for the last stage of a compressor or a high pressure compressor
- 2220/323 . . . for aircraft propulsion, e.g. jet engines
- 2220/324 . . . to drive unshrouded, low solidity propeller
- 2220/325 . . . to drive unshrouded, high solidity propeller
- 2220/326 . . . to drive shrouded, low solidity propeller
- 2220/327 . . . to drive shrouded, high solidity propeller
- 2220/328 . . . providing direct vertical lift
- 2220/329 . . . in helicopters
- 2220/34 . . in ram-air turbines ("RATS")
- 2220/36 . . specially adapted for the fan of turbofan engines
- 2220/40 . in turbochargers
- 2220/50 . for auxiliary power units (APU's)
- 2220/60 . making use of surplus or waste energy
- 2220/62 . . with energy recovery turbines
- 2220/64 . . for domestic central heating or production of electricity
- 2220/70 . in combination with
- 2220/72 . . a steam turbine
- 2220/722 . . . as part of an integrated gasification combined cycle
- 2220/74 . . a gas turbine

- 2220/75 . . equipment using fuel having a low calorific value, e.g. low BTU fuel, waste end, syngas, biomass fuel or flare gas
- 2220/76 . . an electrical generator
- 2220/762 . . . of the direct current (D.C.) type
- 2220/764 . . . of the alternating current (A.C.) type
- 2220/7642 . . . . of the synchronous type
- 2220/7644 . . . . of the asynchronous type, i.e. induction type
- 2220/7646 . . . . . Double fed induction generators (DFIGs)
- 2220/766 . . . via a direct connection, i.e. a gearless transmission
- 2220/768 . . . equipped with permanent magnets
- 2220/77 . . . of the linear type
- 2220/80 . . in supersonic vehicles excluding hypersonic vehicles or ram, scram or rocket propulsion
- 2220/90 . . in vehicles adapted for vertical or short take off and landing (v/stol vehicles)
- 2230/00 Manufacture**
- 2230/10 . . by removing material
- 2230/11 . . . by electrochemical methods
- 2230/12 . . . by spark erosion methods
- 2230/13 . . . using lasers
- 2230/14 . . . Micromachining
- 2230/18 . . . Manufacturing tolerances
- 2230/20 . . essentially without removing material
- 2230/21 . . . by casting
- 2230/211 . . . . by precision casting, e.g. microfusing or investment casting
- 2230/22 . . . by sintering
- 2230/23 . . . by permanently joining parts together
- 2230/232 . . . . by welding
- 2230/233 . . . . . Electron beam welding
- 2230/234 . . . . . Laser welding
- 2230/235 . . . . . TIG or MIG welding
- 2230/236 . . . . . Diffusion bonding
- 2230/237 . . . . . Brazing
- 2230/238 . . . . . Soldering
- 2230/239 . . . . . Inertia or friction welding
- 2230/24 . . . by extrusion
- 2230/25 . . . by forging
- 2230/26 . . . by rolling
- 2230/30 . . with deposition of material
- 2230/31 . . . Layer deposition
- 2230/311 . . . . by torch or flame spraying
- 2230/312 . . . . by plasma spraying
- 2230/313 . . . . by physical vapour deposition
- 2230/314 . . . . by chemical vapour deposition
- 2230/40 . . Heat treatment
- 2230/41 . . . Hardening; Annealing
- 2230/411 . . . . Precipitation hardening
- 2230/42 . . . by hot isostatic pressing
- 2230/50 . . Building or constructing in particular ways
- 2230/51 . . . in a modular way, e.g. using several identical or complementary parts or features
- 2230/52 . . . using existing or "off the shelf" parts, e.g. using standardized turbocharger elements
- 2230/53 . . . by integrally manufacturing a component, e.g. by milling from a billet or one piece construction
- 2230/54 . . . by sheet metal manufacturing
- 2230/60 . . Assembly methods
- 2230/61 . . . using limited numbers of standard modules which can be adapted by machining
- 2230/64 . . . using positioning or alignment devices for aligning or centring, e.g. pins
- 2230/642 . . . . using maintaining alignment while permitting differential dilatation
- 2230/644 . . . . for adjusting the position or the alignment, e.g. wedges or eccenters
- 2230/68 . . . using auxiliary equipment for lifting or holding
- 2230/70 . . Disassembly methods
- 2230/72 . . Maintenance
- 2230/80 . . Repairing, retrofitting or upgrading methods
- 2230/90 . . Coating; Surface treatment ([manufacture with deposition of material F05D 2230/30](#))
- 2240/00 Components**
- NOTE**
- Components are the basic elements of construction
- 2240/10 . . Stators
- 2240/11 . . . Shroud seal segments
- 2240/12 . . . Fluid guiding means, e.g. vanes
- 2240/121 . . . . related to the leading edge of a stator vane
- 2240/122 . . . . related to the trailing edge of a stator vane
- 2240/123 . . . . related to the pressure side of a stator vane
- 2240/124 . . . . related to the suction side of a stator vane
- 2240/125 . . . . related to the tip of a stator vane
- 2240/126 . . . . Baffles or ribs
- 2240/127 . . . . Vortex generators, turbulators, or the like, for mixing ([by creating turbulence F05D 2260/2212](#))
- 2240/128 . . . . Nozzles
- 2240/1281 . . . . . Plug nozzles
- 2240/129 . . . . Cascades, i.e. assemblies of similar profiles acting in parallel
- 2240/14 . . Casings or housings protecting or supporting assemblies within
- 2240/15 . . Heat shield
- 2240/20 . . Rotors
- 2240/24 . . . for turbines
- 2240/241 . . . . of impulse type
- 2240/242 . . . . of reaction type
- 2240/243 . . . . of the Archimedes screw type
- 2240/30 . . Characteristics of rotor blades, i.e. of any element transforming dynamic fluid energy to or from rotational energy and being attached to a rotor
- 2240/301 . . . . Cross-sectional characteristics
- 2240/302 . . . . characteristics related to shock waves, transonic or supersonic flow
- 2240/303 . . . . related to the leading edge of a rotor blade
- 2240/304 . . . . related to the trailing edge of a rotor blade
- 2240/305 . . . . related to the pressure side of a rotor blade
- 2240/306 . . . . related to the suction side of a rotor blade
- 2240/307 . . . . related to the tip of a rotor blade
- 2240/31 . . . . with roughened surfaces
- 2240/35 . . Combustors or associated equipment
- 2240/36 . . Fuel vaporizer
- 2240/40 . . Use of a multiplicity of similar components
- 2240/50 . . Bearings
- 2240/51 . . . Magnetic
- 2240/511 . . . . with permanent magnets
- 2240/515 . . . . Electromagnetic
- 2240/52 . . . Axial thrust bearings
- 2240/53 . . . Hydrodynamic or hydrostatic bearings

- 2240/54 . . Radial bearings
- 2240/55 . Seals
- 2240/56 . . Brush seals
- 2240/57 . . Leaf seals
- 2240/58 . . Piston ring seals
- 2240/581 . . . Double or plural piston ring arrangements, i.e. two or more piston rings
- 2240/59 . . Lamellar seals
- 2240/60 . Shafts
- 2240/61 . . Hollow
- 2240/62 . . Flexible
- 2240/63 . . Glands for admission or removal of fluids from shafts
- 2240/70 . Slinger plates or washers
- 2240/80 . Platforms for stationary or moving blades
- 2240/81 . . Cooled platforms
- 2240/90 . Mounting on supporting structures or systems
- 2240/91 . . on a stationary structure
- 2250/00** **Geometry**
- NOTE**
- Geometry indicates the shape or form of a component or the configuration or arrangement of components in a machine or in a plant
- 2250/10 . Two-dimensional
- 2250/11 . . triangular
- 2250/12 . . rectangular
- 2250/121 . . . square
- 2250/13 . . trapezoidal
- 2250/131 . . . polygonal
- 2250/132 . . . hexagonal
- 2250/14 . . elliptical
- 2250/141 . . . circular
- 2250/15 . . spiral
- 2250/16 . . parabolic
- 2250/17 . . hyperbolic
- 2250/18 . . patterned
- 2250/181 . . . ridged
- 2250/182 . . . crenellated, notched
- 2250/183 . . . zigzag
- 2250/184 . . . sinusoidal
- 2250/185 . . . serpentine-like
- 2250/19 . . machined; miscellaneous
- 2250/191 . . . perforated
- 2250/192 . . . bevelled
- 2250/193 . . . milled
- 2250/20 . Three-dimensional
- 2250/21 . . pyramidal
- 2250/22 . . parallelepipedal
- 2250/221 . . . cubic
- 2250/23 . . prismatic
- 2250/231 . . . cylindrical
- 2250/232 . . . conical
- 2250/24 . . ellipsoidal
- 2250/241 . . . spherical
- 2250/25 . . helical
- 2250/26 . . paraboloid
- 2250/27 . . hyperboloid
- 2250/28 . . patterned
- 2250/281 . . . threaded
- 2250/282 . . . cubic pattern
- 2250/283 . . . honeycomb
- 2250/29 . . machined; miscellaneous
- 2250/291 . . . hollowed
- 2250/292 . . . tapered
- 2250/293 . . . lathed, e.g. rotation symmetrical
- 2250/294 . . . grooved
- 2250/30 . Arrangement of components
- 2250/31 . . according to the direction of their main axis or their axis of rotation
- 2250/311 . . . the axes being in line
- 2250/312 . . . the axes being parallel to each other
- 2250/313 . . . the axes being perpendicular to each other
- 2250/314 . . . the axes being inclined in relation to each other
- 2250/315 . . . the main axis being substantially vertical
- 2250/32 . . according to their shape
- 2250/321 . . . asymptotic
- 2250/322 . . . tangential
- 2250/323 . . . convergent
- 2250/324 . . . divergent
- 2250/33 . . symmetrical
- 2250/34 . . translated
- 2250/35 . . rotated
- 2250/36 . . in inner-outer relationship, e.g. shaft-bearing arrangements
- 2250/37 . . circumferential
- 2250/38 . . angled, e.g. sweep angle
- 2250/40 . Movement of components
- 2250/41 . . with one degree of freedom
- 2250/411 . . . in rotation
- 2250/42 . . with two degrees of freedom
- 2250/43 . . with three degrees of freedom
- 2250/44 . . by counter rotation
- 2250/50 . Inlet or outlet
- 2250/51 . . Inlet
- 2250/511 . . . augmenting, i.e. with intercepting fluid flow cross sectional area greater than the rest of the machine behind the inlet
- 2250/512 . . . concentrating only, i.e. with intercepting fluid flow cross sectional area not greater than the rest of the machine behind the inlet
- 2250/52 . . Outlet
- 2250/53 . . of regenerative pumps
- 2250/60 . Structure; Surface texture
- 2250/61 . . corrugated
- 2250/611 . . . undulated
- 2250/62 . . smooth or fine
- 2250/621 . . . polished
- 2250/63 . . coarse
- 2250/70 . Shape
- 2250/71 . . curved
- 2250/711 . . . convex
- 2250/712 . . . concave
- 2250/713 . . . inflexed
- 2250/72 . . symmetric
- 2250/73 . . asymmetric
- 2250/74 . . given by a set or table of xyz-coordinates
- 2250/75 . . given by its similarity to a letter, e.g. T-shaped
- 2250/80 . Size or power range of the machines
- 2250/82 . . Micromachines
- 2250/84 . . Nanomachines
- 2250/90 . Variable geometry

<b>2260/00</b>	<b>Function</b>
2260/02	. Transport and handling during maintenance and repair
2260/10	. Particular cycles
2260/12	. Testing on a test bench
2260/14	. Preswirling
2260/15	. Load balancing
2260/16	. Fluid modulation at a certain frequency
2260/20	. Heat transfer, e.g. cooling
2260/201	. . by impingement of a fluid
2260/202	. . by film cooling
2260/203	. . by transpiration cooling
2260/204	. . by the use of microcircuits
2260/205	. . Cooling fluid recirculation, i.e. after cooling one or more components is the cooling fluid recovered and used elsewhere for other purposes
2260/207	. . using a phase changing mass, e.g. heat absorbing by melting or boiling
2260/208	. . using heat pipes
2260/209	. . using vortex tubes
2260/211	. . by intercooling, e.g. during a compression cycle
2260/212	. . by water injection
2260/213	. . by the provision of a heat exchanger within the cooling circuit
2260/221	. . Improvement of heat transfer
2260/2212	. . . by creating turbulence ( <a href="#">vortex generators</a> , <a href="#">turbulators or the like for mixing</a> <a href="#">F05D 2240/127</a> )
2260/2214	. . . by increasing the heat transfer surface
2260/22141	. . . . using fins or ribs
2260/231	. . Preventing heat transfer
2260/232	. . characterized by the cooling medium
2260/2322	. . . steam
2260/234	. . of the generator by compressor inlet air
2260/24	. . for draft enhancement in chimneys, using solar or other heat sources
2260/30	. Retaining components in desired mutual position
2260/31	. . Retaining bolts or nuts
2260/311	. . . of the frangible or shear type
2260/32	. . by means of magnetic or electromagnetic forces
2260/33	. . with a bayonet coupling
2260/34	. . Balancing of radial or axial forces on regenerative rotors
2260/35	. . Reducing friction between regenerative impeller discs and casing walls
2260/36	. . by a form fit connection, e.g. by interlocking
2260/37	. . by a press fit connection
2260/38	. . by a spring, i.e. spring loaded or biased towards a certain position
2260/39	. . by a V-shaped ring to join the flanges of two cylindrical sections, e.g. casing sections of a turbocharger
2260/40	. Transmission of power
2260/402	. . through friction drives
2260/4021	. . . through belt drives
2260/4022	. . . through endless chains
2260/4023	. . . through a friction clutch
2260/403	. . through the shape of the drive components
2260/4031	. . . as in toothed gearing
2260/40311	. . . . of the epicyclical, planetary or differential type
2260/404	. . through magnetic drive coupling
2260/4041	. . . the driven magnets encircling the driver magnets
2260/406	. . through hydraulic systems
2260/407	. . through piezoelectric conversion
2260/408	. . through magnetohydrodynamic conversion
2260/42	. Storage of energy
2260/43	. . in the form of rotational kinetic energy, e.g. in flywheels
2260/50	. Kinematic linkage, i.e. transmission of position
2260/52	. . involving springs
2260/53	. . using gears
2260/532	. . . of the bevelled or angled type
2260/54	. . using flat or V-belts and pulleys
2260/55	. . using chains and sprockets; using toothed belts
2260/56	. . using cams or eccentrics
2260/57	. . using servos, independent actuators, etc.
2260/60	. Fluid transfer
2260/601	. . using an ejector or a jet pump
2260/602	. . Drainage
2260/6022	. . . of leakage having past a seal ( <a href="#">seals</a> <a href="#">F05D 2240/57</a> ; <a href="#">glands</a> <a href="#">F05D 2240/63</a> )
2260/604	. . Vortex non-clogging type pumps
2260/605	. . Venting into the ambient atmosphere or the like
2260/606	. . Bypassing the fluid
2260/607	. . Preventing clogging or obstruction of flow paths by dirt, dust, or foreign particles
2260/608	. . Aeration, ventilation, dehumidification or moisture removal of closed spaces
2260/609	. . Deoiling or demisting
2260/61	. . Removal of CO <sub>2</sub> ( <a href="#">removal of CO<sub>2</sub> from waste gases</a> <a href="#">B01D 53/62</a> )
2260/611	. . Sequestration of CO <sub>2</sub>
2260/70	. Adjusting of angle of incidence or attack of rotating blades
2260/71	. . as a function of flow velocity
2260/72	. . by turning around an axis parallel to the rotor centre line
2260/74	. . by turning around an axis perpendicular the rotor centre line
2260/75	. . the adjusting mechanism not using auxiliary power sources, e.g. by "servos"
2260/76	. . the adjusting mechanism using auxiliary power sources
2260/77	. . the adjusting mechanism driven or triggered by centrifugal forces
2260/78	. . the adjusting mechanism driven or triggered by aerodynamic forces
2260/79	. . Bearing, support or actuation arrangements therefor
2260/80	. Diagnostics
2260/81	. Modelling or simulation
2260/82	. Forecasts
2260/821	. . Parameter estimation or prediction
2260/83	. Testing, e.g. methods, components or tools therefor
2260/84	. Redundancy
2260/85	. Starting
2260/90	. Braking
2260/901	. . using aerodynamic forces, i.e. lift or drag
2260/902	. . using frictional mechanical forces
2260/903	. . using electrical or magnetic forces
2260/904	. . using hydrodynamic forces

**F05D**

- 2260/94 . . . . . Functionality given by mechanical stress related aspects such as low cycle fatigue [LCF] of high cycle fatigue [HCF]
- 2260/941 . . . . . particularly aimed at mechanical or thermal stress reduction
- 2260/95 . . . . . Preventing corrosion ([coating or surface treatment F05D 2230/90](#))
- 2260/96 . . . . . Preventing, counteracting or reducing vibration or noise
- 2260/961 . . . . . by mistuning rotor blades or stator vanes with irregular interblade spacing, airfoil shape
- 2260/962 . . . . . by means of "anti-noise"
- 2260/963 . . . . . by Helmholtz resonators
- 2260/964 . . . . . counteracting thermoacoustic noise
- 2260/97 . . . . . Reducing windage losses
- 2260/972 . . . . . in radial flow machines
- 2260/98 . . . . . Lubrication
- 2260/99 . . . . . Ignition, e.g. ignition by warming up of fuel or oxidizer in a resonant acoustic cavity
  
- 2270/00 Control**
- 2270/01 . . . . . Purpose of the control system
- 2270/02 . . . . . to control rotational speed (n)
- 2270/021 . . . . . to prevent overspeed
- 2270/022 . . . . . to prevent underspeed
- 2270/023 . . . . . of different spools or shafts
- 2270/024 . . . . . to keep rotational speed constant
- 2270/03 . . . . . in variable speed operation
- 2270/04 . . . . . to control acceleration (u)
- 2270/042 . . . . . by keeping it below damagingly high values
- 2270/044 . . . . . by making it as high as possible
- 2270/05 . . . . . to affect the output of the engine
- 2270/051 . . . . . Thrust
- 2270/052 . . . . . Torque
- 2270/053 . . . . . Explicitly mentioned power
- 2270/06 . . . . . to match engine to driven device
- 2270/061 . . . . . in particular the electrical frequency of driven generator
- 2270/07 . . . . . to improve fuel economy
- 2270/071 . . . . . in particular at idling speed
- 2270/08 . . . . . to produce clean exhaust gases
- 2270/081 . . . . . with as little smoke as possible
- 2270/082 . . . . . with as little NOx as possible
- 2270/083 . . . . . by monitoring combustion conditions
- 2270/0831 . . . . . indirectly, at the exhaust
- 2270/09 . . . . . to cope with emergencies
- 2270/091 . . . . . in particular sudden load loss
- 2270/092 . . . . . in particular blow-out and relight
- 2270/093 . . . . . of one engine in a multi-engine system
- 2270/094 . . . . . by using back-up controls
- 2270/095 . . . . . by temporary overriding set control limits
- 2270/096 . . . . . caused by water or hail ingestion
- 2270/10 . . . . . to cope with, or avoid, compressor flow instabilities
- 2270/101 . . . . . Compressor surge or stall
- 2270/102 . . . . . caused by working fluid flow velocity profile distortion
- 2270/1022 . . . . . due to high angle of attack of aircraft
- 2270/1024 . . . . . due to compressor degradation
- 2270/11 . . . . . to prolong engine life
- 2270/112 . . . . . by limiting temperatures
- 2270/114 . . . . . by limiting mechanical stresses
- 2270/116 . . . . . by preventing reverse rotation
- 2270/12 . . . . . to maintain desired vehicle trajectory parameters
- 2270/121 . . . . . Altitude
- 2270/122 . . . . . Speed or Mach number
- 2270/13 . . . . . to control two or more engines simultaneously
- 2270/14 . . . . . to control thermoacoustic behaviour in the combustion chambers ([counteracting noise or vibration F05D 2260/96](#))
- 2270/16 . . . . . to control water or steam injection
- 2270/17 . . . . . to control boundary layer
- 2270/172 . . . . . by a plasma generator, e.g. control of ignition
- 2270/173 . . . . . by the Coanda effect
- 2270/18 . . . . . using fluidic amplifiers or actuators
- 2270/20 . . . . . to optimize the performance of a machine
- 2270/30 . . . . . Control parameters, e.g. input parameters
- 2270/301 . . . . . Pressure
- 2270/3011 . . . . . Inlet pressure
- 2270/3013 . . . . . Outlet pressure
- 2270/3015 . . . . . differential pressure
- 2270/303 . . . . . Temperature
- 2270/3032 . . . . . excessive temperatures, e.g. caused by overheating
- 2270/304 . . . . . Spool rotational speed
- 2270/305 . . . . . Tolerances
- 2270/306 . . . . . Mass flow
- 2270/3061 . . . . . of the working fluid
- 2270/3062 . . . . . of the auxiliary fluid for heating or cooling purposes
- 2270/309 . . . . . Rate of change of parameters
- 2270/31 . . . . . Fuel schedule for stage combustors
- 2270/311 . . . . . Air humidity
- 2270/312 . . . . . Air pressure
- 2270/313 . . . . . Air temperature
- 2270/331 . . . . . Mechanical loads
- 2270/332 . . . . . Maximum loads or fatigue criteria
- 2270/333 . . . . . Noise or sound levels
- 2270/334 . . . . . Vibration measurements
- 2270/335 . . . . . Output power or torque
- 2270/336 . . . . . Blade lift measurements
- 2270/40 . . . . . Type of control system
- 2270/42 . . . . . passive or reactive, e.g. using large wind vanes
- 2270/44 . . . . . active, predictive, or anticipative
- 2270/46 . . . . . redundant, i.e. failsafe operation
- 2270/50 . . . . . Control logic embodiments
- 2270/52 . . . . . by electrical means, e.g. relays or switches
- 2270/54 . . . . . by electronic means, e.g. electronic tubes, transistors or IC's within an electronic circuit
- 2270/56 . . . . . by hydraulic means, e.g. hydraulic valves within a hydraulic circuit
- 2270/58 . . . . . by mechanical means, e.g. levers, gears or cams
- 2270/60 . . . . . Control system actuates means
- 2270/62 . . . . . Electrical actuators
- 2270/64 . . . . . Hydraulic actuators
- 2270/65 . . . . . Pneumatic actuators
- 2270/66 . . . . . Mechanical actuators ([F05D 2270/62 takes precedence](#))
- 2270/70 . . . . . Type of control algorithm
- 2270/701 . . . . . proportional
- 2270/702 . . . . . differential
- 2270/703 . . . . . integral
- 2270/704 . . . . . proportional-differential
- 2270/705 . . . . . proportional-integral
- 2270/706 . . . . . proportional-integral-differential



**F05D**

- 2270/707 . . fuzzy logic
- 2270/708 . . with comparison tables
- 2270/709 . . with neural networks
- 2270/71 . . synthesized, i.e. parameter computed by a mathematical model
- 2270/80 . Devices generating input signals, e.g. transducers, sensors, cameras or strain gauges
- 2270/802 . . Calibration thereof
- 2270/803 . . Sampling thereof
- 2270/804 . . Optical devices
- 2270/8041 . . . Cameras
- 2270/805 . . Radars
- 2270/806 . . Sonars
- 2270/807 . . Accelerometers
- 2270/808 . . Strain gauges; Load cells
- 2270/809 . . Encoders
- 2270/81 . . Microphones
- 2270/821 . . Displacement measuring means, e.g. inductive
- 2300/00 Materials; Properties thereof**
- 2300/10 . Metals, alloys or intermetallic compounds
- 2300/11 . . Iron
- 2300/111 . . . Cast iron
- 2300/12 . . Light metals
- 2300/121 . . . Aluminium
- 2300/122 . . . Beryllium
- 2300/123 . . . Boron
- 2300/124 . . . Lithium
- 2300/125 . . . Magnesium
- 2300/13 . . Refractory metals, i.e. Ti, V, Cr, Zr, Nb, Mo, Hf, Ta, W
- 2300/131 . . . Molybdenum
- 2300/132 . . . Chromium
- 2300/133 . . . Titanium
- 2300/134 . . . Zirconium
- 2300/135 . . . Hafnium
- 2300/14 . . Noble metals, i.e. Ag, Au, platinum group metals
- 2300/141 . . . Silver
- 2300/142 . . . Gold
- 2300/143 . . . Platinum group metals, i.e. Os, Ir, Pt, Ru, Rh, Pd
- 2300/1431 . . . . Palladium
- 2300/1432 . . . . Ruthenium
- 2300/1433 . . . . Osmium
- 2300/1434 . . . . Iridium
- 2300/1435 . . . . Rhodium
- 2300/15 . . Rare earth metals, i.e. Sc, Y, lanthanides
- 2300/16 . . Other metals not provided for in groups [F05D 2300/11](#) - [F05D 2300/15](#)
- 2300/1602 . . . Arsenic
- 2300/1604 . . . Antimony
- 2300/1606 . . . Bismuth
- 2300/1608 . . . Barium
- 2300/161 . . . Manganese
- 2300/1612 . . . Lead
- 2300/1614 . . . Tin
- 2300/1616 . . . Zinc
- 2300/1618 . . . Mercury
- 2300/17 . . Alloys
- 2300/171 . . . Steel alloys
- 2300/172 . . . Copper alloys
- 2300/1721 . . . . Bronze
- 2300/1722 . . . . Phosphor-bronze alloy
- 2300/1723 . . . . Nickel-Copper alloy, e.g. Monel
- 2300/173 . . . Aluminium alloys, e.g. AlCuMgPb
- 2300/174 . . . Titanium alloys, e.g. TiAl
- 2300/175 . . . Superalloys
- 2300/176 . . . Heat-stable alloys
- 2300/177 . . . Ni - Si alloys
- 2300/18 . . Intermetallic compounds
- 2300/182 . . . Metal-aluminide intermetallic compounds
- 2300/20 . . Oxide or non-oxide ceramics
- 2300/21 . . Oxide ceramics
- 2300/2102 . . . Glass
- 2300/2104 . . . MIBA
- 2300/2106 . . . Quartz
- 2300/2108 . . . Phosphor
- 2300/211 . . . Silica
- 2300/2112 . . . Aluminium oxides
- 2300/2114 . . . Sapphire
- 2300/2116 . . . Zinc oxide
- 2300/2118 . . . Zirconium oxides
- 2300/212 . . . Aluminium titanate
- 2300/22 . . Non-oxide ceramics
- 2300/222 . . . Silicon
- 2300/224 . . . Carbon, e.g. graphite
- 2300/226 . . . Carbides
- 2300/2261 . . . . of silicon
- 2300/2262 . . . . of titanium, e.g. TiC
- 2300/2263 . . . . of tungsten, e.g. WC
- 2300/228 . . . Nitrides
- 2300/2281 . . . . of aluminium
- 2300/2282 . . . . of boron
- 2300/2283 . . . . of silicon
- 2300/2284 . . . . of titanium
- 2300/2285 . . . . of zirconium
- 2300/229 . . . Sulfides
- 2300/2291 . . . . of molybdenum
- 2300/30 . . Inorganic materials other than provided for in groups [F05D 2300/10](#) - [F05D 2300/2291](#)
- 2300/40 . . Organic materials
- 2300/41 . . Leather
- 2300/42 . . Cellulosic materials, e.g. wood
- 2300/43 . . Synthetic polymers, e.g. plastics; Rubber
- 2300/431 . . . Rubber
- 2300/432 . . . PTFE [PolyTetraFluorEthylene]
- 2300/433 . . . Polyamides, e.g. NYLON
- 2300/434 . . . Polyimides, e.g. AURUM
- 2300/436 . . . Polyetherketones, e.g. PEEK
- 2300/437 . . . Silicon polymers
- 2300/44 . . Resins
- 2300/48 . . other organic materials
- 2300/50 . . Intrinsic material properties or characteristics
- 2300/501 . . Elasticity
- 2300/502 . . Thermal properties
- 2300/5021 . . . Expansivity
- 2300/50211 . . . . similar
- 2300/50212 . . . . dissimilar
- 2300/5023 . . . Thermal capacity
- 2300/5024 . . . Heat conductivity
- 2300/504 . . Reflective properties
- 2300/505 . . Shape memory behaviour
- 2300/506 . . Hardness

## F05D

- 2300/507 . . Magnetic properties
- 2300/509 . . Self lubricating materials; Solid lubricants
- 2300/51 . . Hydrophilic, i.e. being or having wettable properties
- 2300/512 . . Hydrophobic, i.e. being or having non-wettable properties
- 2300/514 . . Porosity
- 2300/516 . . Surface roughness
- 2300/518 . . Ductility
- 2300/52 . . Translucence
- 2300/522 . . Density
- 2300/60 . Properties or characteristics given to material by treatment or manufacturing
- 2300/601 . . Fabrics
- 2300/6012 . . . Woven fabrics
- 2300/603 . . Composites; e.g. fibre-reinforced
- 2300/6031 . . . Functionally graded composites
- 2300/6032 . . . Metal matrix composites [MMC]
- 2300/6033 . . . Ceramic matrix composites [CMC]
- 2300/6034 . . . Orientation of fibres, weaving, ply angle
- 2300/604 . . Amorphous
- 2300/605 . . Crystalline
- 2300/606 . . Directionally-solidified crystalline structures
- 2300/607 . . Monocrystallinity
- 2300/608 . . Microstructure
- 2300/609 . . Grain size
- 2300/61 . . Syntactic materials, i.e. hollow spheres embedded in a matrix
- 2300/611 . . Coating
- 2300/6111 . . functionally graded coating
- 2300/612 . . Foam
- 2300/613 . . Felt
- 2300/614 . . Fibres or filaments
- 2300/615 . . Filler
- 2300/70 . Treatment or modification of materials
- 2300/701 . . Heat treatment
- 2300/702 . . Reinforcement