

**CPC****COOPERATIVE PATENT CLASSIFICATION****F05D****INDEXING SCHEME FOR ASPECTS RELATING TO  
NON-POSITIVE-DISPLACEMENT MACHINES OR ENGINES,  
GAS-TURBINES OR JET-PROPULSION PLANTS****F05D 2200/00****Mathematical features**

- F05D 2200/10 . Basic functions
- F05D 2200/11 . . Sum
- F05D 2200/12 . . Subtraction
- F05D 2200/13 . . Product
- F05D 2200/14 . . Division
- F05D 2200/15 . . Inverse
- F05D 2200/20 . Special functions
- F05D 2200/21 . . Root
- F05D 2200/211 . . . Square root
- F05D 2200/212 . . . Cubic root
- F05D 2200/22 . . Power
- F05D 2200/221 . . . Square power
- F05D 2200/222 . . . Cubic power
- F05D 2200/23 . . Logarithm
- F05D 2200/24 . . exponential
- F05D 2200/25 . . Hyperbolic trigonometric, e.g. sinh, cosh, tanh
- F05D 2200/26 . . trigonometric
- F05D 2200/261 . . . Sine
- F05D 2200/262 . . . Cosine
- F05D 2200/263 . . . Tangent
- F05D 2200/264 . . . Cotangent
- F05D 2200/30 . miscellaneous
- F05D 2200/31 . . odd
- F05D 2200/32 . . even
- F05D 2200/33 . . bigger or smaller
- F05D 2200/34 . . biggest or smallest
- F05D 2200/35 . . first
- F05D 2200/36 . . last

**F05D 2210/00****Working fluids**

- F05D 2210/10 . Kind or type

- F05D 2210/11      . .      liquid, i.e. incompressible
- F05D 2210/12      . .      gaseous, i.e. compressible
- F05D 2210/13      . .      mixed, e.g. two-phase fluid
- F05D 2210/132      . . .      Pumps with means for separating and evacuating the gaseous phase
- F05D 2210/14      . .      Refrigerants with particular properties, e.g. HFC

#### F05D 2210/20      .      Properties

- F05D 2210/30      .      Flow characteristics
  - F05D 2210/31      . .      with Mach-number kept constant along the flow
  - F05D 2210/32      . .      Pressure kept constant along the flow
  - F05D 2210/33      . .      Turbulent flow
  - F05D 2210/34      . .      Laminar flow
- F05D 2210/40      .      Flow geometry or direction
  - F05D 2210/41      . .      upwards due to the buoyancy of compressed air
  - F05D 2210/42      . .      Axial inlet and radial outlet
  - F05D 2210/43      . .      Radial inlet and axial outlet
  - F05D 2210/44      . .      bidirectional, i.e. in opposite, alternating directions

### **F05D 2220/00      Application**

- F05D 2220/10      .      in ram-jet engines or ram-jet driven vehicles
- F05D 2220/20      .      within closed fluid conduits, e.g. pipes
- F05D 2220/30      .      in turbines
  - F05D 2220/31      . .      in steam turbines
  - F05D 2220/32      . .      in gas turbines
    - F05D 2220/321      . . .      for a special turbine stage
      - F05D 2220/3212      . . . .      the first stage of a turbine
      - F05D 2220/3213      . . . .      an intermediate stage of the turbine
      - F05D 2220/3215      . . . .      the last stage of the turbine
    - F05D 2220/3216      . . . .      for a special compressor stage
      - F05D 2220/3217      . . . . .      for the first stage of a compressor or a low pressure compressor
      - F05D 2220/3218      . . . . .      for an intermediate stage of a compressor
      - F05D 2220/3219      . . . . .      for the last stage of a compressor or a high pressure compressor
  - F05D 2220/323      . . .      for aircraft propulsion, e.g. jet engines
    - F05D 2220/324      . . .      to drive unshrouded, low solidity propeller
    - F05D 2220/325      . . .      to drive unshrouded, high solidity propeller
    - F05D 2220/326      . . .      to drive shrouded, low solidity propeller
    - F05D 2220/327      . . .      to drive shrouded, high solidity propeller
    - F05D 2220/328      . . .      providing direct vertical lift
    - F05D 2220/329      . . .      in helicopters

- F05D 2220/34 . . in ram-air turbines ("RATS")
- F05D 2220/36 . . specially adapted for the fan of turbofan engines
- F05D 2220/40 . in turbochargers
- F05D 2220/50 . for auxiliary power units (APU's)
- F05D 2220/60 . making use of surplus or waste energy
- F05D 2220/62 . . with energy recovery turbines
- F05D 2220/64 . . for domestic central heating or production of electricity
- F05D 2220/70 . in combination with
- F05D 2220/72 . . a steam turbine
- F05D 2220/722 . . . as part of an integrated gasification combined cycle
- F05D 2220/74 . . a gas turbine
- F05D 2220/75 . . equipment using fuel having a low calorific value, e.g. low BTU fuel, waste end, syngas, biomass fuel or flare gas
- F05D 2220/76 . . an electrical generator
- F05D 2220/762 . . . of the direct current (D.C.) type
- F05D 2220/764 . . . of the alternating current (A.C.) type
- F05D 2220/7642 . . . . of the synchronous type
- F05D 2220/7644 . . . . of the asynchronous type, i.e. induction type
- F05D 2220/7646 . . . . . Double fed induction generators (DFIGs)
- F05D 2220/766 . . . via a direct connection, i.e. a gearless transmission
- F05D 2220/768 . . . equipped with permanent magnets
- F05D 2220/77 . . . of the linear type
- F05D 2220/80 . in supersonic vehicles excluding hypersonic vehicles or ram, scram or rocket propulsion
- F05D 2220/90 . in vehicles adapted for vertical or short take off and landing ( [v/stol vehicles](#) ), ( [gas turbines providing direct vertical lift](#) [R05D 220/38](#) )

## **F05D 2230/00      Manufacture**

- F05D 2230/10 . by removing material
- F05D 2230/11 . . by electrochemical methods
- F05D 2230/12 . . by spark erosion methods
- F05D 2230/13 . . using lasers
- F05D 2230/14 . . Micromachining
- F05D 2230/18 . . Manufacturing tolerances
- F05D 2230/20 . essentially without removing material
- F05D 2230/21 . . by casting
- F05D 2230/211 . . . by precision casting, e.g. microfusing or investment casting
- F05D 2230/22 . . by sintering

F05D 2230/23	..	by permanently joining parts together
F05D 2230/232	...	by welding
F05D 2230/233	....	Electron beam welding
F05D 2230/234	....	Laser welding
F05D 2230/235	....	TIG or MIG welding
F05D 2230/236	....	Diffusion bonding
F05D 2230/237	....	Brazing
F05D 2230/238	....	Soldering
F05D 2230/239	....	Inertia or friction welding
F05D 2230/24	..	by extrusion
F05D 2230/25	..	by forging
F05D 2230/26	..	by rolling
F05D 2230/30	.	with deposition of material
F05D 2230/31	..	Layer deposition
F05D 2230/311	...	by torch or flame spraying
F05D 2230/312	...	by plasma spraying
F05D 2230/313	...	by physical vapour deposition
F05D 2230/314	...	by chemical vapour deposition
F05D 2230/40	.	Heat treatment
F05D 2230/41	..	Hardening; Annealing
F05D 2230/411	...	Precipitation hardening
F05D 2230/42	..	by hot isostatic pressing
F05D 2230/50	.	Building or constructing in particular ways
F05D 2230/51	..	in a modular way, e.g. using several identical or complementary parts or features
F05D 2230/52	..	using existing or "off the shelf" parts, e.g. using standardized turbocharger elements
F05D 2230/53	..	by integrally manufacturing a component, e.g. by milling from a billet or one piece construction
F05D 2230/54	..	by sheet metal manufacturing
F05D 2230/60	.	Assembly methods
F05D 2230/61	..	using limited numbers of standard modules which can be adapted by machining
F05D 2230/64	..	using positioning or alignment devices for aligning or centring, e.g. pins
F05D 2230/642	...	using maintaining alignment while permitting differential dilatation
F05D 2230/644	...	for adjusting the position or the alignment, e.g. wedges or eccenters
F05D 2230/68	..	using auxiliary equipment for lifting or holding
F05D 2230/70	.	Disassembly methods
F05D 2230/72	.	Maintenance
F05D 2230/80	.	Repairing, retrofitting or upgrading methods

F05D 2230/90 . Coating; Surface treatment ( [manufacture with deposition of material F05D 2230/30](#) )

## **F05D 2240/00 Components**

### **NOTE**

Components are the basic elements of construction

- F05D 2240/10 . Stators
- F05D 2240/11 .. Shroud seal segments
- F05D 2240/12 .. Fluid guiding means, e.g. vanes
  - F05D 2240/121 ... related to the leading edge of a stator vane
  - F05D 2240/122 ... related to the trailing edge of a stator vane
  - F05D 2240/123 ... related to the pressure side of a stator vane
  - F05D 2240/124 ... related to the suction side of a stator vane
  - F05D 2240/125 ... related to the tip of a stator vane
  - F05D 2240/126 ... Baffles or ribs
  - F05D 2240/127 ... Vortex generators, turbulators, or the like, for mixing ( [by creating turbulence F05D 2260/2212](#) )
  - F05D 2240/128 ... Nozzles
    - F05D 2240/1281 .... Plug nozzles
  - F05D 2240/129 ... Cascades, i.e. assemblies of similar profiles acting in parallel
- F05D 2240/14 .. Casings or housings protecting or supporting assemblies within
- F05D 2240/15 .. Heat shield
- F05D 2240/20 . Rotors
  - F05D 2240/24 .. for turbines
    - F05D 2240/241 ... of impulse type
    - F05D 2240/242 ... of reaction type
    - F05D 2240/243 ... of the Archimedes screw type
  - F05D 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
    - F05D 2240/301 ... Cross-sectional characteristics
    - F05D 2240/302 ... characteristics related to shock waves, transonic or supersonic flow
    - F05D 2240/303 ... related to the leading edge of a rotor blade
    - F05D 2240/304 ... related to the trailing edge of a rotor blade
    - F05D 2240/305 ... related to the pressure side of a rotor blade
    - F05D 2240/306 ... related to the suction side of a rotor blade
    - F05D 2240/307 ... related to the tip of a rotor blade
    - F05D 2240/31 ... with roughened surfaces
- F05D 2240/35 . Combustors or associated equipment
- F05D 2240/36 .. Fuel vaporizer

- F05D 2240/40 . Use of a multiplicity of similar components
- F05D 2240/50 . Bearings
  - F05D 2240/51 .. Magnetic
    - F05D 2240/511 ... with permanent magnets
    - F05D 2240/515 ... Electromagnetic
  - F05D 2240/52 .. Axial thrust bearings
  - F05D 2240/53 .. Hydrodynamic or hydrostatic bearings
  - F05D 2240/54 .. Radial bearings
- F05D 2240/55 . Seals
  - F05D 2240/56 .. Brush seals
  - F05D 2240/57 .. Leaf seals
  - F05D 2240/58 .. Piston ring seals
    - F05D 2240/581 ... Double or plural piston ring arrangements, i.e. two or more piston rings
  - F05D 2240/59 .. Lamellar seals
- F05D 2240/60 . Shafts
  - F05D 2240/61 .. Hollow
  - F05D 2240/62 .. Flexible
  - F05D 2240/63 .. Glands for admission or removal of fluids from shafts
- F05D 2240/70 . Slinger plates or washers
- F05D 2240/80 . Platforms for stationary or moving blades
  - F05D 2240/81 .. Cooled platforms
- F05D 2240/90 . Mounting on supporting structures or systems
  - F05D 2240/91 .. on a stationary structure

**F05D 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

- F05D 2250/10 . Two-dimensional
  - F05D 2250/11 .. triangular
  - F05D 2250/12 .. rectangular
    - F05D 2250/121 ... square
    - F05D 2250/13 .. trapezoidal
      - F05D 2250/131 ... polygonal
        - F05D 2250/132 ... hexagonal
      - F05D 2250/14 .. elliptical

F05D 2250/141	...	circular
F05D 2250/15	..	spiral
F05D 2250/16	..	parabolic
F05D 2250/17	..	hyperbolic
F05D 2250/18	..	patterned
F05D 2250/181	...	ridged
F05D 2250/182	...	crenellated, notched
F05D 2250/183	...	zigzag
F05D 2250/184	...	sinusoidal
F05D 2250/185	...	serpentine-like
F05D 2250/19	..	machined; miscellaneous
F05D 2250/191	...	perforated
F05D 2250/192	...	bevelled
F05D 2250/193	...	milled
F05D 2250/20	.	Three-dimensional
F05D 2250/21	..	pyramidal
F05D 2250/22	..	parallelepipedal
F05D 2250/221	...	cubic
F05D 2250/23	..	prismatic
F05D 2250/231	...	cylindrical
F05D 2250/232	...	conical
F05D 2250/24	..	ellipsoidal
F05D 2250/241	...	spherical
F05D 2250/25	..	helical
F05D 2250/26	..	paraboloid
F05D 2250/27	..	hyperboloid
F05D 2250/28	..	patterned
F05D 2250/281	...	threaded
F05D 2250/282	...	cubic pattern
F05D 2250/283	...	honeycomb
F05D 2250/29	..	machined; miscellaneous
F05D 2250/291	...	hollowed
F05D 2250/292	...	tapered
F05D 2250/293	...	lathed, e.g. rotation symmetrical
F05D 2250/294	...	grooved
F05D 2250/30	.	Arrangement of components
F05D 2250/31	..	according to the direction of their main axis or their axis of rotation
F05D 2250/311	...	the axes being in line
F05D 2250/312	...	the axes being parallel to each other
F05D 2250/313	...	the axes being perpendicular to each other
F05D 2250/314	...	the axes being inclined in relation to each other

F05D 2250/315	...	the main axis being substantially vertical
F05D 2250/32	..	according to their shape
F05D 2250/321	...	asymptotic
F05D 2250/322	...	tangential
F05D 2250/323	...	convergent
F05D 2250/324	...	divergent
F05D 2250/33	..	symmetrical
F05D 2250/34	..	translated
F05D 2250/35	..	rotated
F05D 2250/36	..	in inner-outer relationship, e.g. shaft-bearing arrangements
F05D 2250/37	..	circumferential
F05D 2250/38	..	angled, e.g. sweep angle
F05D 2250/40	.	Movement of components
F05D 2250/41	..	with one degree of freedom
F05D 2250/411	...	in rotation
F05D 2250/42	..	with two degrees of freedom
F05D 2250/43	..	with three degrees of freedom
F05D 2250/44	..	by counter rotation
F05D 2250/50	.	Inlet or outlet
F05D 2250/51	..	Inlet
F05D 2250/511	...	augmenting, i.e. with intercepting fluid flow cross sectional area greater than the rest of the machine behind the inlet
F05D 2250/512	...	concentrating only, i.e. with intercepting fluid flow cross sectional area not greater than the rest of the machine behind the inlet
F05D 2250/52	..	Outlet
F05D 2250/53	..	of regenerative pumps
F05D 2250/60	.	Structure; Surface texture
F05D 2250/61	..	corrugated
F05D 2250/611	...	undulated
F05D 2250/62	..	smooth or fine
F05D 2250/621	...	polished
F05D 2250/63	..	coarse
F05D 2250/70	.	Shape
F05D 2250/71	..	curved
F05D 2250/711	...	convex
F05D 2250/712	...	concave
F05D 2250/713	...	inflexed
F05D 2250/72	..	symmetric
F05D 2250/73	..	asymmetric
F05D 2250/74	..	given by a set or table of xyz-coordinates

- F05D 2250/75 . . given by its similarity to a letter, e.g. T-shaped
- F05D 2250/80 . Size or power range of the machines
- F05D 2250/82 . . Micromachines
- F05D 2250/84 . . Nanomachines ( [Nanotechnology for interacting, sensing or actuating Y01N 8/00](#) )
- F05D 2250/90 . Variable geometry
- F05D 2260/00      Function**
- F05D 2260/02 . Transport and handling during maintenance and repair
- F05D 2260/10 . Particular cycles
- F05D 2260/12 . Testing on a test bench
- F05D 2260/14 . Preswirling
- F05D 2260/15 . Load balancing
- F05D 2260/16 . Fluid modulation at a certain frequency
- F05D 2260/20 . Heat transfer, e.g. cooling
- F05D 2260/201 . . by impingement of a fluid
- F05D 2260/202 . . by film cooling
- F05D 2260/203 . . by transpiration cooling
- F05D 2260/204 . . by the use of microcircuits
- F05D 2260/205 . . Cooling fluid recirculation, i.e. after cooling one or more components is the cooling fluid recovered and used elsewhere for other purposes
- F05D 2260/207 . . using a phase changing mass, e.g. heat absorbing by melting or boiling
- F05D 2260/208 . . using heat pipes
- F05D 2260/209 . . using vortex tubes
- F05D 2260/211 . . by intercooling, e.g. during a compression cycle
- F05D 2260/212 . . by water injection
- F05D 2260/213 . . by the provision of a heat exchanger within the cooling circuit
- F05D 2260/221 . . Improvement of heat transfer
- F05D 2260/2212 . . . by creating turbulence ( [vortex generators, turbulators or the like for mixing F05D 2240/127](#) )
- F05D 2260/2214 . . . by increasing the heat transfer surface
- F05D 2260/22141 . . . . using fins or ribs
- F05D 2260/231 . . Preventing heat transfer
- F05D 2260/232 . . characterized by the cooling medium
- F05D 2260/2322 . . . steam
- F05D 2260/234 . . of the generator by compressor inlet air
- F05D 2260/24 . . for draft enhancement in chimneys, using solar or other heat sources
- F05D 2260/30 . Retaining components in desired mutual position

- F05D 2260/31 . Retaining bolts or nuts
- F05D 2260/311 . of the frangible or shear type
- F05D 2260/32 . . by means of magnetic or electromagnetic forces
- F05D 2260/33 . . with a bayonet coupling
- F05D 2260/34 . . Balancing of radial or axial forces on regenerative rotors
- F05D 2260/35 . . Reducing friction between regenerative impeller discs and casing walls
- F05D 2260/36 . . by a form fit connection, e.g. by interlocking
- F05D 2260/37 . . by a press fit connection
- F05D 2260/38 . . by a spring, i.e. spring loaded or biased towards a certain position
- F05D 2260/39 . . by a V-shaped ring to join the flanges of two cylindrical sections, e.g. casing sections of a turbocharger
- F05D 2260/40 . Transmission of power
- F05D 2260/402 . . through friction drives
- F05D 2260/4021 . . . through belt drives
- F05D 2260/4022 . . . through endless chains
- F05D 2260/4023 . . . through a friction clutch
- F05D 2260/403 . . through the shape of the drive components
- F05D 2260/4031 . . . as in toothed gearing
- F05D 2260/40311 . . . . of the epicyclical, planetary or differential type
- F05D 2260/404 . . through magnetic drive coupling
- F05D 2260/4041 . . . the driven magnets encircling the driver magnets
- F05D 2260/406 . . through hydraulic systems
- F05D 2260/407 . . through piezoelectric conversion
- F05D 2260/408 . . through magnetohydrodynamic conversion
- F05D 2260/42 . Storage of energy
- F05D 2260/43 . . in the form of rotational kinetic energy, e.g. in flywheels
- F05D 2260/50 . Kinematic linkage, i.e. transmission of position
- F05D 2260/52 . . involving springs
- F05D 2260/53 . . using gears
- F05D 2260/532 . . . of the bevelled or angled type
- F05D 2260/54 . . using flat or V-belts and pulleys
- F05D 2260/55 . . using chains and sprockets; using toothed belts
- F05D 2260/56 . . using cams or eccentrics
- F05D 2260/57 . . using servos, independent actuators, etc.
- F05D 2260/60 . Fluid transfer
- F05D 2260/601 . . using an ejector or a jet pump
- F05D 2260/602 . . Drainage
- F05D 2260/6022 . . . of leakage having past a seal ( seals [F05D 2240/57](#); glands [F05D 2240/63](#) )
- F05D 2260/604 . . Vortex non-clogging type pumps

- F05D 2260/605 . . Venting into the ambient atmosphere or the like
- F05D 2260/606 . . Bypassing the fluid
- F05D 2260/607 . . Preventing clogging or obstruction of flow paths by dirt, dust, or foreign particles
- F05D 2260/608 . . Aeration, ventilation, dehumidification or moisture removal of closed spaces
- F05D 2260/609 . . Deoiling or demisting
- F05D 2260/61 . . Removal of CO<sub>2</sub> ( [removal of CO<sub>2</sub> from waste gases B01D 53/62](#) )
- F05D 2260/611 . . Sequestration of CO<sub>2</sub>
  
- F05D 2260/70 . Adjusting of angle of incidence or attack of rotating blades
- F05D 2260/71 . . as a function of flow velocity
- F05D 2260/72 . . by turning around an axis parallel to the rotor centre line
- F05D 2260/74 . . by turning around an axis perpendicular the rotor centre line
- F05D 2260/75 . . the adjusting mechanism not using auxiliary power sources, e.g. by "servos"
- F05D 2260/76 . . the adjusting mechanism using auxiliary power sources
- F05D 2260/77 . . the adjusting mechanism driven or triggered by centrifugal forces
- F05D 2260/78 . . the adjusting mechanism driven or triggered by aerodynamic forces
- F05D 2260/79 . . Bearing, support or actuation arrangements therefor
  
- F05D 2260/80 . Diagnostics
  
- F05D 2260/81 . Modelling or simulation
  
- F05D 2260/82 . Forecasts
- F05D 2260/821 . . Parameter estimation or prediction
  
- F05D 2260/83 . Testing, e.g. methods, components or tools therefor
  
- F05D 2260/84 . Redundancy
  
- F05D 2260/85 . Starting
  
- F05D 2260/90 . Braking
- F05D 2260/901 . . using aerodynamic forces, i.e. lift or drag
- F05D 2260/902 . . using frictional mechanical forces
- F05D 2260/903 . . using electrical or magnetic forces
- F05D 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)
- F05D 2260/941 . . particularly aimed at mechanical or thermal stress reduction
  
- F05D 2260/95 . Preventing corrosion ( [coating or surface treatment F05D 2230/90](#) )
  
- F05D 2260/96 . Preventing, counteracting or reducing vibration or noise
- F05D 2260/961 . . by mistuning rotor blades or stator vanes with irregular interblade spacing, airfoil shape
- F05D 2260/962 . . by means of "anti-noise"

- F05D 2260/963 . . by Helmholtz resonators
- F05D 2260/964 . . counteracting thermoacoustic noise
- F05D 2260/97 . Reducing windage losses
- F05D 2260/972 . . in radial flow machines
- F05D 2260/98 . Lubrication
- F05D 2260/99 . Ignition, e.g. ignition by warming up of fuel or oxidizer in a resonant acoustic cavity

## **F05D 2270/00 Control**

- F05D 2270/01 . Purpose of the control system
- F05D 2270/02 . . to control rotational speed (n)
- F05D 2270/021 . . . to prevent overspeed
- F05D 2270/022 . . . to prevent underspeed
- F05D 2270/023 . . . of different spools or shafts
- F05D 2270/024 . . . to keep rotational speed constant
- F05D 2270/03 . . in variable speed operation
- F05D 2270/04 . . to control acceleration (u)
- F05D 2270/042 . . . by keeping it below damagingly high values
- F05D 2270/044 . . . by making it as high as possible
- F05D 2270/05 . . to affect the output of the engine
- F05D 2270/051 . . . Thrust
- F05D 2270/052 . . . Torque
- F05D 2270/053 . . . Explicitly mentioned power
- F05D 2270/06 . . to match engine to driven device
- F05D 2270/061 . . . in particular the electrical frequency of driven generator
- F05D 2270/07 . . to improve fuel economy
- F05D 2270/071 . . . in particular at idling speed
- F05D 2270/08 . . to produce clean exhaust gases
- F05D 2270/081 . . . with as little smoke as possible
- F05D 2270/082 . . . with as little NOx as possible
- F05D 2270/083 . . . by monitoring combustion conditions
- F05D 2270/0831 . . . . indirectly, at the exhaust
- F05D 2270/09 . . to cope with emergencies
- F05D 2270/091 . . . in particular sudden load loss
- F05D 2270/092 . . . in particular blow-out and relight
- F05D 2270/093 . . . of one engine in a multi-engine system
- F05D 2270/094 . . . by using back-up controls
- F05D 2270/095 . . . by temporary overriding set control limits
- F05D 2270/096 . . . caused by water or hail ingestion
- F05D 2270/10 . . to cope with, or avoid, compressor flow instabilities

F05D 2270/101	...	Compressor surge or stall
F05D 2270/102	....	caused by working fluid flow velocity profile distortion
F05D 2270/1022	.....	due to high angle of attack of aircraft
F05D 2270/1024	.....	due to compressor degradation
F05D 2270/11	..	to prolong engine life
F05D 2270/112	...	by limiting temperatures
F05D 2270/114	...	by limiting mechanical stresses
F05D 2270/116	...	by preventing reverse rotation
F05D 2270/12	..	to maintain desired vehicle trajectory parameters
F05D 2270/121	...	Altitude
F05D 2270/122	...	Speed or Mach number
F05D 2270/13	..	to control two or more engines simultaneously
F05D 2270/14	..	to control thermoacoustic behaviour in the combustion chambers ( <a href="#">counteracting noise or vibration F05D 260/96</a> )
F05D 2270/16	..	to control water or steam injection
F05D 2270/17	..	to control boundary layer
F05D 2270/172	...	by a plasma generator, e.g. control of ignition
F05D 2270/173	...	by the Coanda effect
F05D 2270/18	..	using fluidic amplifiers or actuators
F05D 2270/20	..	to optimize the performance of a machine
F05D 2270/30	.	Control parameters, e.g. input parameters
F05D 2270/301	..	Pressure
F05D 2270/3011	...	Inlet pressure
F05D 2270/3013	...	Outlet pressure
F05D 2270/3015	...	differential pressure
F05D 2270/303	..	Temperature
F05D 2270/3032	...	excessive temperatures, e.g. caused by overheating
F05D 2270/304	..	Spool rotational speed
F05D 2270/305	..	Tolerances
F05D 2270/306	..	Mass flow
F05D 2270/3061	...	of the working fluid
F05D 2270/3062	...	of the auxiliary fluid for heating or cooling purposes
F05D 2270/309	..	Rate of change of parameters
F05D 2270/31	..	Fuel schedule for stage combustors
F05D 2270/311	..	Air humidity
F05D 2270/312	..	Air pressure
F05D 2270/313	..	Air temperature
F05D 2270/331	..	Mechanical loads
F05D 2270/332	..	Maximum loads or fatigue criteria
F05D 2270/333	..	Noise or sound levels
F05D 2270/334	..	Vibration measurements
F05D 2270/335	..	Output power or torque

- F05D 2270/336 . . Blade lift measurements
- F05D 2270/40 . Type of control system
  - F05D 2270/42 . . passive or reactive, e.g. using large wind vanes
  - F05D 2270/44 . . active, predictive, or anticipative
  - F05D 2270/46 . . redundant, i.e. failsafe operation
- F05D 2270/50 . Control logic embodiments
  - F05D 2270/52 . . by electrical means, e.g. relays or switches
  - F05D 2270/54 . . by electronic means, e.g. electronic tubes, transistors or IC's within an electronic circuit
  - F05D 2270/56 . . by hydraulic means, e.g. hydraulic valves within a hydraulic circuit
  - F05D 2270/58 . . by mechanical means, e.g. levers, gears or cams
- F05D 2270/60 . Control system actuates means
  - F05D 2270/62 . . Electrical actuators
  - F05D 2270/64 . . Hydraulic actuators
  - F05D 2270/65 . . Pneumatic actuators
  - F05D 2270/66 . . Mechanical actuators ( [F05D 2270/62](#) takes precedence )
- F05D 2270/70 . Type of control algorithm
  - F05D 2270/701 . . proportional
  - F05D 2270/702 . . differential
  - F05D 2270/703 . . integral
  - F05D 2270/704 . . proportional-differential
  - F05D 2270/705 . . proportional-integral
  - F05D 2270/706 . . proportional-integral-differential
  - F05D 2270/707 . . fuzzy logic
  - F05D 2270/708 . . with comparison tables
  - F05D 2270/709 . . with neural networks
  - F05D 2270/71 . . synthesized, i.e. parameter computed by a mathematical model
- F05D 2270/80 . Devices generating input signals, e.g. transducers, sensors, cameras or strain gauges
  - F05D 2270/802 . . Calibration thereof
  - F05D 2270/803 . . Sampling thereof
  - F05D 2270/804 . . Optical devices
    - F05D 2270/8041 . . . Cameras
  - F05D 2270/805 . . Radars
  - F05D 2270/806 . . Sonars
  - F05D 2270/807 . . Accelerometers
  - F05D 2270/808 . . Strain gauges; Load cells
  - F05D 2270/809 . . Encoders
  - F05D 2270/81 . . Microphones
  - F05D 2270/821 . . Displacement measuring means, e.g. inductive

**F05D 2280/00****F05D 2290/00****F05D 2300/00****Materials; Properties thereof**

F05D 2300/10	. Metals, alloys or intermetallic compounds
F05D 2300/11	.. Iron
F05D 2300/111	... Cast iron
F05D 2300/12	.. Light metals
F05D 2300/121	... Aluminium
F05D 2300/122	... Beryllium
F05D 2300/123	... Boron
F05D 2300/124	... Lithium
F05D 2300/125	... Magnesium
F05D 2300/13	.. Refractory metals, i.e. Ti, V, Cr, Zr, Nb, Mo, Hf, Ta, W
F05D 2300/131	... Molybdenum
F05D 2300/132	... Chromium
F05D 2300/133	... Titanium
F05D 2300/134	... Zirconium
F05D 2300/135	... Hafnium
F05D 2300/14	.. Noble metals, i.e. Ag, Au, platinum group metals
F05D 2300/141	... Silver
F05D 2300/142	... Gold
F05D 2300/143	... Platinum group metals, i.e. Os, Ir, Pt, Ru, Rh, Pd
F05D 2300/1431	.... Palladium
F05D 2300/1432	.... Ruthenium
F05D 2300/1433	.... Osmium
F05D 2300/1434	.... Iridium
F05D 2300/1435	.... Rhodium
F05D 2300/15	.. Rare earth metals, i.e. Sc, Y, lanthanides
F05D 2300/16	.. Other metals not provided for in groups <a href="#">F05D 2300/11</a> to <a href="#">F05D 2300/15</a>
F05D 2300/1602	... Arsenic
F05D 2300/1604	... Antimony
F05D 2300/1606	... Bismuth
F05D 2300/1608	... Barium
F05D 2300/161	... Manganese
F05D 2300/1612	... Lead
F05D 2300/1614	... Tin
F05D 2300/1616	... Zinc
F05D 2300/1618	... Mercury

F05D 2300/17	..	Alloys
F05D 2300/171	...	Steel alloys
F05D 2300/172	...	Copper alloys
F05D 2300/1721	....	Bronze
F05D 2300/1722	....	Phosphor-bronze alloy
F05D 2300/1723	....	Nickel-Copper alloy, e.g. Monel
F05D 2300/173	...	Aluminium alloys, e.g. AlCuMgPb
F05D 2300/174	...	Titanium alloys, e.g. TiAl
F05D 2300/175	...	Superalloys
F05D 2300/176	...	Heat-stable alloys
F05D 2300/177	...	Ni - Si alloys
F05D 2300/18	..	Intermetallic compounds
F05D 2300/182	...	Metal-aluminide intermetallic compounds
F05D 2300/20	.	Oxide or non-oxide ceramics
F05D 2300/21	..	Oxide ceramics
F05D 2300/2102	...	Glass
F05D 2300/2104	...	MIBA
F05D 2300/2106	...	Quartz
F05D 2300/2108	...	Phosphor
F05D 2300/211	...	Silica
F05D 2300/2112	...	Aluminium oxides
F05D 2300/2114	...	Sapphire
F05D 2300/2116	...	Zinc oxide
F05D 2300/2118	...	Zirconium oxides
F05D 2300/212	...	Aluminium titanate
F05D 2300/22	..	Non-oxide ceramics
F05D 2300/222	...	Silicon
F05D 2300/224	...	Carbon, e.g. graphite
F05D 2300/226	...	Carbides
F05D 2300/2261	....	of silicon
F05D 2300/2262	....	of titanium, e.g. TiC
F05D 2300/2263	....	of tungsten, e.g. WC
F05D 2300/228	...	Nitrides
F05D 2300/2281	....	of aluminium
F05D 2300/2282	....	of boron
F05D 2300/2283	....	of silicon
F05D 2300/2284	....	of titanium
F05D 2300/2285	....	of zirconium
F05D 2300/229	...	Sulfides
F05D 2300/2291	....	of molybdenum
F05D 2300/30	.	Inorganic materials other than provided for in groups <b>F05D 300/10</b> to <b>F05D 300/2291</b>

F05D 2300/40	. Organic materials
F05D 2300/41	.. Leather
F05D 2300/42	.. Cellulosic materials, e.g. wood
F05D 2300/43	.. Synthetic polymers, e.g. plastics; Rubber
F05D 2300/431	... Rubber
F05D 2300/432	... PTFE (PolyTetraFluorEthylene)
F05D 2300/433	... Polyamides, e.g. NYLON
F05D 2300/434	... Polyimides, e.g. AURUM
F05D 2300/436	... Polyetherketones, e.g. PEEK
F05D 2300/437	... Silicon polymers
F05D 2300/44	.. Resins
F05D 2300/48	.. other organic materials
F05D 2300/50	. Intrinsic material properties or characteristics
F05D 2300/501	.. Elasticity
F05D 2300/502	.. Thermal properties
F05D 2300/5021	... Expansivity
F05D 2300/50211	.... similar
F05D 2300/50212	.... dissimilar
F05D 2300/5023	... Thermal capacity
F05D 2300/5024	... Heat conductivity
F05D 2300/504	.. Reflective properties
F05D 2300/505	.. Shape memory behaviour
F05D 2300/506	.. Hardness
F05D 2300/507	.. Magnetic properties
F05D 2300/509	.. Self lubricating materials; Solid lubricants
F05D 2300/51	.. Hydrophilic, i.e. being or having wettable properties
F05D 2300/512	.. Hydrophobic, i.e. being or having non-wettable properties
F05D 2300/514	.. Porosity
F05D 2300/516	.. Surface roughness
F05D 2300/518	.. Ductility
F05D 2300/52	.. Translucence
F05D 2300/522	.. Density
F05D 2300/60	. Properties or characteristics given to material by treatment or manufacturing
F05D 2300/601	.. Fabrics
F05D 2300/6012	... Woven fabrics
F05D 2300/603	.. Composites; e.g. fibre-reinforced
F05D 2300/6031	... Functionally graded composites
F05D 2300/6032	... Metal matrix composites (MMC)
F05D 2300/6033	... Ceramic matrix composites (CMC)
F05D 2300/6034	... Orientation of fibres, weaving, ply angle

F05D 2300/604	..	Amorphous
F05D 2300/605	..	Crystalline
F05D 2300/606	..	Directionally-solidified crystalline structures
F05D 2300/607	..	Monocrystallinity
F05D 2300/608	..	Microstructure
F05D 2300/609	..	Grain size
F05D 2300/61	..	Syntactic materials, i.e. hollow spheres embedded in a matrix
F05D 2300/611	..	Coating
F05D 2300/6111	..	functionally graded coating
F05D 2300/612	..	Foam
F05D 2300/613	..	Felt
F05D 2300/614	..	Fibres or filaments
F05D 2300/615	..	Filler
F05D 2300/70	.	Treatment or modification of materials
F05D 2300/701	..	Heat treatment
F05D 2300/702	..	Reinforcement