CPC COOPERATIVE PATENT CLASSIFICATION

F01P COOLING OF MACHINES OR ENGINES IN GENERAL; COOLING OF INTERNAL-COMBUSTION ENGINES (arrangements in connection with cooling of propulsion units in vehicles B60K 11/00; heat-transfer, heat-exchange or heat-storage materials C09K 5/00; {cooling of gas-turbine engines F02C 7/12 }; heat exchange in general, radiators F28)

NOTE

In this subclass, the following terms or expressions are used with the meanings indicated:

- "air" also includes other gaseous cooling fluids;
- "liquid cooling" also includes cooling where liquid is used as the heat transferring fluid between parts to be cooled and the air, e.g. using radiators;
- "air cooling" means direct air cooling and thus excludes indirect air cooling occurring in liquid cooling systems as explained herefore;
- "cooling-air" includes directly or indirectly acting cooling-air.

Attention is drawn to the notes preceding class F01 , especially as regards Note (3).

Cooling by lubricant is classified in subclass F01M when the lubrication aspect predominates and in subclass F01P when the cooling aspect predominates.

Guidance heading: **Air cooling; Liquid cooling** (propelling cooling-air or liquid coolants F01P 5/00; controlling supply or circulation of coolants F01P 7/00; cylinders, pistons, valves, fuel injectors, sparking-plugs, or other engine or machine parts, modified to facilitate cooling, see the relevant classes for such parts)

F01P 1/00 **Air cooling**

F01P 2001/005 . Cooling engine rooms

F01P 1/02 . Arrangements for cooling cylinders or cylinder heads, e.g. ducting cooling-air from its pressure source to cylinders or along cylinders

F01P 2001/023 . . Cooling cylinders (F01P 2003/022 takes precedence)

F01P 2001/026 . . Cooling cylinder heads (F01P 2003/025 takes precedence)

F01P 1/04 . Arrangements for cooling pistons

F01P 1/06 . Arrangements for cooling other engine or machine parts

F01P 1/08 . . for cooling intake or exhaust valves

F01P 1/10 . . for cooling fuel injectors or sparking-plugs

F01P 3/00 **Liquid cooling**

F01P 2003/001 . Cooling liquid

F01P 2003/003 .. having boiling-point higher than 100°C

F01P 2003/005 . the liquid being fuel

F01P 2003/006 . the liquid being oil

F01P 2003/008 . the liquid being water and oil

F01P 3/02 . Arrangements for cooling cylinders or cylinder heads

F01P 2003/021 .. Cooling cylinders

F01P 2003/022 ... combined with air cooling

F01P 2003/024 .. Cooling cylinder heads

F01P 2003/025 ... combined with air cooling

F01P 2003/027 .. Cooling cylinders and cylinder heads in parallel

F01P 2003/028 .. Cooling cylinders and cylinder heads in series

F01P 3/04 .. Liquid-to-air heat-exchangers combined with, or arranged on, cylinders or cylinder heads

F01P 3/06 . Arrangements for cooling pistons

F01P 3/08 .. Cooling of piston exterior only, e.g. by jets

F01P 3/10 .. Cooling by flow of coolant through pistons

F01P 3/12 . Arrangements for cooling other engine or machine parts

F01P 3/14 .. for cooling intake or exhaust valves

F01P 3/16 .. for cooling fuel injectors or sparking-plugs

F01P 3/18 . Arrangements or mounting of liquid-to-air heat-exchangers (such arrangements on cylinders or cylinder heads F01P 3/04; relative to vehicles B60K 11/04)

F01P 2003/182 .. with multiple heat-exchangers

F01P 2003/185 .. arranged in parallel

F01P 2003/187 .. arranged in series

F01P 3/20 . Cooling circuits not specific to a single part of engine or machine (F01P 3/22 takes precedence)

F01P 3/202 .. {for outboard marine engines }

F01P 3/205 ... {Flushing }

F01P 3/207 .. {liquid-to-liquid heat-exchanging relative to marine vessels }

F01P 3/22 . characterised by evaporation and condensation of coolant in closed cycles (other cooling by evaporation F01P 9/02) ; characterised by the coolant reaching higher temperatures than normal atmospheric boiling-point

F01P 3/2207 .. {characterised by the coolant reaching temperatures higher than the normal atmospheric boiling point }

F01P 2003/2214 .. Condensers

F01P 2003/2221 ... of the horizontal type

F01P 2003/2228 ... of the upflow type

F01P 2003/2235 ... of the downflow type

F01P 2003/2242 . . . Steam-to-steam condensers
F01P 2003/225 . . . Steam-to-liquid condensers
F01P 2003/2257 . . . Rotating condensers
F01P 2003/2264 . . . Separators
F01P 3/2271 . . {Closed cycles with separator and liquid return }
F01P 2003/2278 . . Heat pipes
F01P 3/2285 . . {Closed cycles with condenser and feed pump }
F01P 2003/2292 . . with thermostatically controlled by-pass

Guidance heading: **Pumping cooling-air or liquid coolants; Controlling circulation or supply of coolants**

F01P 5/00 **Pumping cooling-air or liquid coolants** (controlling circulation or supply of coolants by influencing drive of pumps F01P 7/00)

F01P 5/02 . Pumping cooling-air; Arrangements of cooling-air pumps, e.g. fans or blowers
F01P 2005/025 . . using two or more air pumps
F01P 5/04 . . Pump-driving arrangements
F01P 5/043 . . . {Pump reversing arrangements }
F01P 2005/046 . . . with electrical pump drive
F01P 5/06 . . Guiding or ducting air to, or from, ducted fans
F01P 5/08 . . Use of engine exhaust gases for pumping cooling-air

F01P 5/10 . Pumping liquid coolant; Arrangements of coolant pumps
F01P 2005/105 . . Using two or more pumps
F01P 5/12 . . Pump-driving arrangements
F01P 2005/125 . . . Driving auxiliary pumps electrically

F01P 5/14 . Safety means against, or active at, failure of coolant-pump drives, e.g. shutting engine down; Means for indicating functioning of coolant pump

F01P 7/00 **Controlling of coolant flow**

F01P 7/02 . the coolant being cooling-air
F01P 7/023 . . {Cowlings for airplane engines }
F01P 7/026 . . {Thermostatic control }
F01P 7/04 . . by varying pump speed, e.g. by changing pump-drive gear ratio
F01P 7/042 . . . {using fluid couplings (couplings or clutches of this type per se F16D 35/00) }
F01P 7/044 . . . {using hydraulic drives }
F01P 7/046 . . . {using mechanical drives }
F01P 7/048 . . . {using electrical drives }
F01P 7/06 . . by varying blade pitch
F01P 7/08 . . by cutting in or out of pumps
F01P 7/081 . . . {using clutches, e.g. electro-magnetic or induction clutches }

F01P 7/082 . . . . {using friction clutches }
F01P 7/084 . . . . . {actuated electromagnetically }
F01P 7/085 . . . . . {actuated by fluid pressure }
F01P 7/087 . . . . . {actuated directly by deformation of a thermostatic device }
F01P 7/088 . . . . . {actuated in response to driving speed, e.g. by centrifugal devices }
F01P 7/10 . . by throttling amount of air flowing through liquid-to-air heat exchangers
F01P 7/12 . . . by thermostatic control

F01P 7/14 . the coolant being liquid
F01P 2007/143 . . using restrictions
F01P 2007/146 . . using valves
F01P 7/16 . . by thermostatic control
F01P 7/161 . . . {by bypassing pumps }
F01P 7/162 . . . {by cutting in and out of pumps }
F01P 7/164 . . . {by varying pump speed }
F01P 7/165 . . . {characterised by systems with two or more loops }
F01P 7/167 . . . {by adjusting the pre-set temperature according to engine parameters, e.g. engine load, engine speed }
F01P 2007/168 . . . By varying the cooling capacity of a liquid-to-air heat-exchanger

F01P 9/00 **Cooling having pertinent characteristics not provided for in, or of interest apart from, groups F01P 1/00 to F01P 7/00** (profiting from waste heat of combustion-engine cooling F02G 5/00)

F01P 2009/005 . Cooling with melting solids

F01P 9/02 . Cooling by evaporation, e.g. by spraying water on to cylinders (evaporation and condensation of liquid coolant in closed cycles F01P 3/22; {evaporation or evaporation apparatus for physical or chemical purposes, e.g. evaporation of liquids for gas phase reactions B01B 1/005 })

F01P 9/04 . by simultaneous or alternative use of direct air-cooling and liquid cooling (F01P 9/02 takes precedence)

F01P 9/06 . by use of refrigerating apparatus, e.g. of compressor or absorber type

F01P 11/00 **Component parts, details, or accessories not provided for in, or of interest apart from, groups F01P 1/00 to F01P 9/00**

F01P 11/02 . Liquid-coolant {filling }, overflow, venting, or draining devices (automatic draining during freezing conditions F01P 11/20)
F01P 11/0204 . . {Filling }
F01P 11/0209 . . . {Closure caps }
F01P 11/0214 . . . . {Mounting }
F01P 2011/0219 . . . . . using bayonet connections
F01P 2011/0223 . . . . . Decoration
F01P 2011/0228 . . . . . Sealing

F01P 2011/0233 . . . . . Venting
F01P 11/0238 . . . . {with overpressure valves or vent valves }
F01P 2011/0242 . . . . . setting the pressure valve
F01P 11/0247 . . . . {Safety; Locking against opening }
F01P 2011/0252 . . . . . Venting before opening
F01P 2011/0257 . . . . . with theft preventing means
F01P 2011/0261 . . . . . activated by temperature
F01P 2011/0266 . . . . . activated by pressure
F01P 2011/0271 . . . . Semi-permeable, e.g. using Gore-Tex c fibres
F01P 11/0276 . . {Draining or purging }
F01P 11/028 . . {Deaeration devices }
F01P 11/0285 . . {Venting devices }
F01P 11/029 . . {Expansion reservoirs }
F01P 11/0295 . . {Condensers for radiators }

F01P 11/04 . Arrangements of liquid pipes or hoses

F01P 11/06 . Cleaning (in general B08B) ; Combating corrosion (in general C23F)
F01P 2011/061 . . Cleaning or combatting corrosion using filters
F01P 2011/063 . . Cleaning (F01P 2011/061 takes precedence)
F01P 2011/065 . . Flushing
F01P 2011/066 . . Combatting corrosion (F01P 2011/061 takes precedence)
F01P 2011/068 . . . chemically

F01P 11/08 . Arrangements of lubricant coolers (in lubrication apparatus F01M)

F01P 11/10 . Guiding or ducting cooling-air, to, or from, liquid-to-air heat exchangers

F01P 11/12 . Filtering, cooling, or silencing cooling-air

F01P 11/14 . Indicating devices; Other safety devices
F01P 11/16 . . concerning coolant temperature (F01P 11/20 takes precedence)
F01P 11/18 . . concerning coolant pressure, coolant flow, or liquid-coolant level
F01P 11/20 . . concerning atmospheric freezing conditions, e.g. automatically draining or heating during frosty weather
F01P 2011/205 . . using heat-accumulators

Guidance heading:

F01P 2023/00 Signal processing; Details thereof

F01P 2023/08 . Microprocessor; Microcomputer

Guidance heading: **Air cooling; Liquid cooling** (propelling cooling-air or liquid coolants F01P 5/00; controlling supply or circulation of coolants F01P 7/00; cylinders, pistons, valves, fuel injectors, sparking-plugs, or other engine or machine parts, modified to facilitate cooling,

see the relevant classes for such parts)

F01P 2025/00 **Measuring**

F01P 2025/04 . Pressure
F01P 2025/06 . . for determining flow

F01P 2025/08 . Temperature
F01P 2025/12 . . Cabin temperature
F01P 2025/13 . . Ambient temperature
F01P 2025/30 . . Engine incoming fluid temperature
F01P 2025/31 . . Cylinder temperature
F01P 2025/32 . . Engine outcoming fluid temperature
F01P 2025/33 . . Cylinder head temperature
F01P 2025/34 . . Heat exchanger incoming fluid temperature
F01P 2025/36 . . Heat exchanger mixed fluid temperature
F01P 2025/40 . . Oil temperature
F01P 2025/42 . . Intake manifold temperature
F01P 2025/44 . . Outlet manifold temperature
F01P 2025/46 . . Engine parts temperature
F01P 2025/48 . . Engine room temperature
F01P 2025/50 . . using two or more temperature sensors
F01P 2025/52 . . Heat exchanger temperature

F01P 2025/60 . Operating parameters
F01P 2025/62 . . Load
F01P 2025/64 . . Number of revolutions
F01P 2025/66 . . Vehicle speed

F01P 2025/70 . Level

F01P 2025/80 . Concentration anti-freeze

F01P 2031/00 **Fail safe**

F01P 2031/16 . using melting materials

F01P 2031/18 . Detecting fluid leaks

F01P 2031/20 . Warning devices

F01P 2031/22 . using warning lamps

F01P 2031/24 . for freezing

F01P 2031/30 . Cooling after the engine is stopped

F01P 2031/32 . Deblocking of damaged thermostat

F01P 2031/34 . Limping home

F01P 2031/36 . Failure of coolant pump

F01P 2037/00 Controlling

F01P 2037/02 . starting

F01P 2050/00 Applications

F01P 2050/02 . Marine engines
F01P 2050/04 . . using direct cooling
F01P 2050/06 . . using liquid-to-liquid heat exchangers
F01P 2050/08 . . Engine room
F01P 2050/10 . . Z-type engine
F01P 2050/12 . . Outboard engine

F01P 2050/16 . Motor-cycles

F01P 2050/20 . Aircraft engines

F01P 2050/22 . Motor-cars

F01P 2050/24 . Hybrid vehicles

F01P 2050/30 . Circuit boards

F01P 2060/00 Cooling circuits using auxiliaries

F01P 2060/02 . Intercooler

F01P 2060/04 . Lubricant cooler
F01P 2060/045 . . for transmissions

F01P 2060/06 . Retarder

F01P 2060/08 . Cabin heater

F01P 2060/10 . Fuel manifold

F01P 2060/12 . Turbo charger

F01P 2060/14 . Condenser

F01P 2060/16 . Outlet manifold

F01P 2060/18 . Heater
F01P 2060/185 . . for alternators or generators

F01P 2070/00 Details

F01P 2070/02 . using shape memory alloys

F01P 2070/04 . using electrical heating elements

F01P 2070/06 . Using intake pressure as actuating fluid

F01P 2070/08 . Using lubricant pressure as actuating fluid

F01P 2070/10 . using electrical or electromechanical means

F01P 2070/30 . Rotating radiators

F01P 2070/32 . Ring-shaped heat exchangers

F01P 2070/50 . mounting fans to heat-exchangers

F01P 2070/52 . mounting heat-exchangers