

CPC COOPERATIVE PATENT CLASSIFICATION

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

ENGINES OR PUMPS

F01 MACHINES OR ENGINES IN GENERAL; ENGINE PLANTS IN GENERAL; STEAM ENGINES

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](#))

NOTES

1. 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.
2. Attention is drawn to the notes preceding class [F01](#), especially as regards Note (3).
3. Cooling by lubricant is classified in subclass [F01M](#) when the lubrication aspect predominates and in subclass [F01P](#) when the cooling aspect predominates.

WARNING

In this subclass non-limiting references (in the sense of paragraph 39 of the Guide to the IPC) may still be displayed in the scheme.

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](#))

<p>1/00 Air cooling</p> <p>2001/005 . {Cooling engine rooms}</p> <p>1/02 . Arrangements for cooling cylinders or cylinder heads, e.g. ducting cooling-air from its pressure source to cylinders or along cylinders</p> <p>2001/023 . . {Cooling cylinders (F01P 2003/022 takes precedence)}</p> <p>2001/026 . . {Cooling cylinder heads (F01P 2003/025 takes precedence)}</p> <p>1/04 . Arrangements for cooling pistons</p> <p>1/06 . Arrangements for cooling other engine or machine parts</p> <p>1/08 . . for cooling intake or exhaust valves</p> <p>1/10 . . for cooling fuel injectors or sparking-plugs</p> <p>3/00 Liquid cooling</p> <p>2003/001 . {Cooling liquid}</p> <p>2003/003 . . {having boiling-point higher than 100°C}</p> <p>2003/005 . {the liquid being fuel}</p> <p>2003/006 . {the liquid being oil}</p> <p>2003/008 . {the liquid being water and oil}</p> <p>3/02 . Arrangements for cooling cylinders or cylinder heads</p>	<p>2003/021 . . {Cooling cylinders}</p> <p>2003/022 . . . {combined with air cooling}</p> <p>2003/024 . . {Cooling cylinder heads}</p> <p>2003/025 . . . {combined with air cooling}</p> <p>2003/027 . . {Cooling cylinders and cylinder heads in parallel}</p> <p>2003/028 . . {Cooling cylinders and cylinder heads in series}</p> <p>3/04 . . Liquid-to-air heat-exchangers combined with, or arranged on, cylinders or cylinder heads</p> <p>3/06 . Arrangements for cooling pistons</p> <p>3/08 . . Cooling of piston exterior only, e.g. by jets</p> <p>3/10 . . Cooling by flow of coolant through pistons</p> <p>3/12 . Arrangements for cooling other engine or machine parts</p> <p>3/14 . . for cooling intake or exhaust valves</p> <p>3/16 . . for cooling fuel injectors or sparking-plugs</p> <p>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)</p> <p>2003/182 . . {with multiple heat-exchangers}</p> <p>2003/185 . . {arranged in parallel}</p> <p>2003/187 . . {arranged in series}</p> <p>3/20 . Cooling circuits not specific to a single part of engine or machine (F01P 3/22 takes precedence)</p> <p>3/202 . . {for outboard marine engines}</p> <p>3/205 . . . {Flushing}</p> <p>3/207 . . {liquid-to-liquid heat-exchanging relative to marine vessels}</p>
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- 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
- 3/2207 . . {characterised by the coolant reaching temperatures higher than the normal atmospheric boiling point}
- 2003/2214 . . {Condensers}
- 2003/2221 . . . {of the horizontal type}
- 2003/2228 . . . {of the upflow type}
- 2003/2235 . . . {of the downflow type}
- 2003/2242 . . . {Steam-to-steam condensers}
- 2003/225 . . . {Steam-to-liquid condensers}
- 2003/2257 . . . {Rotating condensers}
- 2003/2264 . . . {Separators}
- 3/2271 . . {Closed cycles with separator and liquid return}
- 2003/2278 . . {Heat pipes}
- 3/2285 . . {Closed cycles with condenser and feed pump}
- 2003/2292 . . {with thermostatically controlled by-pass}
- Pumping cooling-air or liquid coolants; Controlling circulation or supply of coolants**
- 5/00 Pumping cooling-air or liquid coolants (controlling circulation or supply of coolants by influencing drive of pumps [F01P 7/00](#))**
- 5/02 . . Pumping cooling-air; Arrangements of cooling-air pumps, e.g. fans or blowers
- 2005/025 . . {using two or more air pumps}
- 5/04 . . Pump-driving arrangements
- 5/043 . . . {Pump reversing arrangements}
- 2005/046 . . . {with electrical pump drive}
- 5/06 . . Guiding or ducting air to, or from, ducted fans
- 5/08 . . Use of engine exhaust gases for pumping cooling-air
- 5/10 . . Pumping liquid coolant; Arrangements of coolant pumps
- 2005/105 . . {Using two or more pumps}
- 5/12 . . Pump-driving arrangements
- 2005/125 . . . {Driving auxiliary pumps electrically}
- 5/14 . . Safety means against, or active at, failure of coolant-pumps drives, e.g. shutting engine down; Means for indicating functioning of coolant pumps
- 7/00 Controlling of coolant flow**
- 7/02 . . the coolant being cooling-air
- 7/023 . . {Cowlings for airplane engines}
- 7/026 . . {Thermostatic control}
- 7/04 . . by varying pump speed, e.g. by changing pump-drive gear ratio
- 7/042 . . . {using fluid couplings ([couplings or clutches of this type per se F16D 35/00](#))}
- 7/044 . . . {using hydraulic drives}
- 7/046 . . . {using mechanical drives}
- 7/048 . . . {using electrical drives}
- 7/06 . . by varying blade pitch
- 7/08 . . by cutting in or out of pumps
- 7/081 . . . {using clutches, e.g. electro-magnetic or induction clutches}
- 7/082 {using friction clutches}
- 7/084 {actuated electromagnetically}
- 7/085 {actuated by fluid pressure}
- 7/087 {actuated directly by deformation of a thermostatic device}
- 7/088 {actuated in response to driving speed, e.g. by centrifugal devices}
- 7/10 . . by throttling amount of air flowing through liquid-to-air heat exchangers
- 7/12 . . . by thermostatic control
- 7/14 . . the coolant being liquid
- 2007/143 . . {using restrictions}
- 2007/146 . . {using valves}
- 7/16 . . by thermostatic control
- 7/161 . . . {by bypassing pumps}
- 7/162 . . . {by cutting in and out of pumps}
- 7/164 . . . {by varying pump speed}
- 7/165 . . . {characterised by systems with two or more loops}
- 7/167 . . . {by adjusting the pre-set temperature according to engine parameters, e.g. engine load, engine speed}
- 2007/168 . . . {By varying the cooling capacity of a liquid-to-air heat-exchanger}
- 9/00 Cooling having pertinent characteristics not provided for in, or of interest apart from, groups [F01P 1/00](#) - [F01P 7/00](#) (profiting from waste heat of combustion-engine cooling [F02G 5/00](#))**
- 2009/005 . . {Cooling with melting solids}
- 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](#)})
- 9/04 . . by simultaneous or alternative use of direct air-cooling and liquid cooling ([F01P 9/02](#) takes precedence)
- 9/06 . . by use of refrigerating apparatus, e.g. of compressor or absorber type
- 11/00 Component parts, details, or accessories not provided for in, or of interest apart from, groups [F01P 1/00](#) - [F01P 9/00](#)**
- 11/02 . . Liquid-coolant {filling}, overflow, venting, or draining devices ([automatic draining during freezing conditions F01P 11/20](#))
- 11/0204 . . {Filling}
- 11/0209 . . . {Closure caps}
- 11/0214 {Mounting}
- 2011/0219 {using bayonet connections}
- 2011/0223 {Decoration}
- 2011/0228 {Sealing}
- 2011/0233 {Venting}
- 11/0238 {with overpressure valves or vent valves}
- 2011/0242 {setting the pressure valve}
- 11/0247 {Safety; Locking against opening}
- 2011/0252 {Venting before opening}
- 2011/0257 {with theft preventing means}
- 2011/0261 {activated by temperature}
- 2011/0266 {activated by pressure}
- 2011/0271 {Semi-permeable, e.g. using Gore-Tex c fibres}
- 11/0276 . . {Draining or purging}
- 11/028 . . {Deaeration devices}
- 11/0285 . . {Venting devices}

- 11/029 . . {Expansion reservoirs}
- 11/0295 . . {Condensers for radiators}
- 11/04 . Arrangements of liquid pipes or hoses
- 11/06 . Cleaning (in general [B08B](#)); Combating corrosion (in general [C23F](#))
- 2011/061 . . {Cleaning or combating corrosion using filters}
- 2011/063 . . {Cleaning ([F01P 2011/061](#) takes precedence)}
- 2011/065 . . {Flushing}
- 2011/066 . . {Combating corrosion ([F01P 2011/061](#) takes precedence)}
- 2011/068 . . . {chemically}
- 11/08 . Arrangements of lubricant coolers (in lubrication apparatus [F01M](#))
- 11/10 . Guiding or ducting cooling-air, to, or from, liquid-to-air heat exchangers
- 11/12 . Filtering, cooling, or silencing cooling-air
- 11/14 . Indicating devices; Other safety devices
- 11/16 . . concerning coolant temperature ([F01P 11/20](#) takes precedence)
- 11/18 . . concerning coolant pressure, coolant flow, or liquid-coolant level
- 11/20 . . concerning atmospheric freezing conditions, e.g. automatically draining or heating during frosty weather
- 2011/205 . . {using heat-accumulators}

2023/00 Signal processing; Details thereof

- 2023/08 . Microprocessor; Microcomputer

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2025/00 Measuring

- 2025/04 . Pressure
- 2025/06 . . for determining flow
- 2025/08 . Temperature
- 2025/12 . . Cabin temperature
- 2025/13 . . Ambient temperature
- 2025/30 . . Engine incoming fluid temperature
- 2025/31 . . Cylinder temperature
- 2025/32 . . Engine outgoing fluid temperature
- 2025/33 . . Cylinder head temperature
- 2025/34 . . Heat exchanger incoming fluid temperature
- 2025/36 . . Heat exchanger mixed fluid temperature
- 2025/40 . . Oil temperature
- 2025/42 . . Intake manifold temperature
- 2025/44 . . Outlet manifold temperature
- 2025/46 . . Engine parts temperature
- 2025/48 . . Engine room temperature
- 2025/50 . . using two or more temperature sensors
- 2025/52 . . Heat exchanger temperature
- 2025/60 . Operating parameters
- 2025/62 . . Load
- 2025/64 . . Number of revolutions
- 2025/66 . . Vehicle speed
- 2025/70 . Level
- 2025/80 . Concentration anti-freeze

2031/00 Fail safe

- 2031/16 . using melting materials
- 2031/18 . Detecting fluid leaks
- 2031/20 . Warning devices
- 2031/22 . using warning lamps
- 2031/24 . for freezing
- 2031/30 . Cooling after the engine is stopped
- 2031/32 . Deblocking of damaged thermostat
- 2031/34 . Limping home
- 2031/36 . Failure of coolant pump

2037/00 Controlling

- 2037/02 . starting

2050/00 Applications

- 2050/02 . Marine engines
- 2050/04 . . using direct cooling
- 2050/06 . . using liquid-to-liquid heat exchangers
- 2050/08 . . Engine room
- 2050/10 . . Z-type engine
- 2050/12 . . Outboard engine
- 2050/16 . Motor-cycles
- 2050/20 . Aircraft engines
- 2050/22 . Motor-cars
- 2050/24 . Hybrid vehicles
- 2050/30 . Circuit boards

2060/00 Cooling circuits using auxiliaries

- 2060/02 . Intercooler
- 2060/04 . Lubricant cooler
- 2060/045 . . for transmissions
- 2060/06 . Retarder
- 2060/08 . Cabin heater
- 2060/10 . Fuel manifold
- 2060/12 . Turbo charger
- 2060/14 . Condenser
- 2060/16 . Outlet manifold
- 2060/18 . Heater
- 2060/185 . . for alternators or generators

2070/00 Details

- 2070/02 . using shape memory alloys
- 2070/04 . using electrical heating elements
- 2070/06 . Using intake pressure as actuating fluid
- 2070/08 . Using lubricant pressure as actuating fluid
- 2070/10 . using electrical or electromechanical means
- 2070/30 . Rotating radiators
- 2070/32 . Ring-shaped heat exchangers
- 2070/50 . mounting fans to heat-exchangers
- 2070/52 . mounting heat-exchangers