

F04 POSITIVE-DISPLACEMENT MACHINES FOR LIQUIDS; PUMPS FOR LIQUIDS OR ELASTIC FLUIDS (portable fire extinguishers with manually-operated pumps A62C 11/00, with power-driven pumps A62C 25/00; charging or scavenging combustion engines by pumps F02B; engine fuel-injection pumps F02M; ion pumps H01J 41/12; electrodynamic pumps H02K 44/02)

Note

Combinations of positive-displacement and non-positive-displacement pumps are classified in subclass F04B as a general subclass for pumps, and in subclasses F04C, F04D in respect of matter specific to those subclasses.

F04B POSITIVE-DISPLACEMENT MACHINES FOR LIQUIDS; PUMPS (machines for liquids, or pumps, of rotary-piston or oscillating-piston type F04C; non-positive-displacement pumps F04D; pumping of fluid by direct contact of another fluid or by using inertia of fluid to be pumped F04F; crankshafts, crossheads, connecting-rods F16C; flywheels F16F; gears for interconverting rotary motion and reciprocating motion in general F16H; pistons, piston-rods, cylinders, in general F16J)

- (1) In this subclass, the following term is used with the meaning indicated:
– “piston” also covers a plunger.
- (2) Attention is drawn to the Notes following the titles of class B81 and subclass B81B relating to “micro-structural devices” and “micro-structural systems”. [7]
- (3) Attention is drawn to the Notes preceding class F01, especially as regards the definitions of “machines”, “pumps”, and “positive-displacement”.
- (4) Machines, pumps or pumping installations having flexible working members are classified in groups F04B 43/00 or F04B 45/00. [2009.01]

Subclass index

POSITIVE-DISPLACEMENT MACHINES FOR LIQUIDS, PUMPS IN GENERAL

General characteristics of machines and pumps

multiple cylinders; single
cylinders, pistons coacting in
cylinder; differential-surface
pistons; flexible working
members 1/00; 3/00;
5/00; 43/00

positively-driven distribution
members; driving or driven
means to or from working
members 7/00; 9/00

equalization of pulses,
counteracting cavitation 11/00
other characteristics 19/00

Characteristics peculiar to pumps, their adaptations or combinations

delivering measured quantities;
handling specific fluids;
pumping from great depths 13/00; 15/00;
47/00

associated with specific driving
engines 17/00

Other characteristics 19/00
Pumping installations or systems 23/00, 43/00,
47/00

Component parts, details or
accessories 53/00

PUMPS FOR ELASTIC FLUIDS

General characteristics

multiple stages; multiple
cylinders 25/00; 27/00

free piston; flexible working
member; actuation by muscle
power 31/00; 45/00;
33/00

driving means 35/00

For pumping from great depths 47/00

Other characteristics; other details
or accessories 37/00; 39/00

Pumping installations or systems 41/00, 45/00,
47/00

CONTROL, SAFETY MEASURES;
TESTING 49/00; 51/00

COMPONENT PARTS, DETAILS OR
ACCESSORIES 53/00

Pumps for liquids or for liquid and elastic fluids; Positive-displacement machines for liquids

1/00 Multi-cylinder machines or pumps characterised by number or arrangement of cylinders (F04B 3/00 takes precedence; fluid-driven pumps F04B 9/08; control of reciprocating machines or pumps in general F04B 49/00)

1/02 . having two cylinders (in V-arrangement F04B 1/04)

1/04 . having cylinders in star- or fan-arrangement [6]

1/047 . . with an actuating or actuated element at the outer ends of the cylinders [6]

1/053 . . with an actuating or actuated element at the inner ends of the cylinders [6]

1/06 . . Control

1/07 . . . by varying the relative eccentricity between two members, e.g. a cam and a drive shaft [6]

1/08 . . . regulated by delivery pressure

1/10 . . the cylinders being movable, e.g. rotary [6]

- 1/107 . . . with an actuating or actuated element at the outer ends of the cylinders [6]
- 1/113 . . . with an actuating or actuated element at the inner ends of the cylinders [6]
- 1/12 . . having cylinder axes coaxial with, or parallel or inclined to, main shaft axis
- 1/14 . . having stationary cylinders
- 1/16 . . . having two or more sets of cylinders or pistons
- 1/18 . . . having self-acting distribution members, i.e. actuated by working fluid
- 1/20 . . having rotary cylinder block
- 1/22 . . . having two or more sets of cylinders or pistons
- 1/24 inclined to main shaft axis
- 1/26 . . Control
- 1/28 . . . for machines or pumps with stationary cylinders
- 1/29 by varying the relative positions of a swash plate and a cylinder block [6]
- 1/30 . . . for machines or pumps with rotary cylinder block
- 1/32 by varying the relative positions of a swash plate and a cylinder block [6]
- 1/34 . Control not provided for in a single group of groups F04B 1/02 to F04B 1/32 [6]
- 3/00 Machines or pumps with pistons coacting within one cylinder, e.g. multi-stage**
- 5/00 Machines or pumps with differential-surface pistons**
- 5/02 . with double-acting pistons [6]
- 7/00 Piston machines or pumps characterised by having positively-driven valving** (with cylinders in star- or fan-arrangement F04B 1/04; with cylinder axes coaxial with, or parallel or inclined to, main shaft axis F04B 1/12)
- 7/02 . the valving being fluid-actuated
- 7/04 . in which the valving is performed by pistons and cylinders coacting to open and close intake or outlet ports [3]
- 7/06 . . the pistons and cylinders being relatively reciprocated and rotated [3]
- 9/00 Piston machines or pumps characterised by the driving or driven means to or from their working members**
- 9/02 . the means being mechanical
- 9/04 . . the means being cams, eccentrics, or pin-and-slot mechanisms (with cylinder axes coaxial with, or parallel or inclined to, main shaft axis F04B 1/12)
- 9/06 . . the means including spring- or weight-loaded lost-motion devices
- 9/08 . the means being fluid
- 9/10 . . the fluid being liquid
- 9/103 . . . having only one pumping chamber [6]
- 9/105 reciprocating movement of the pumping member being obtained by a double-acting liquid motor [6]
- 9/107 rectilinear movement of the pumping member in the working direction being obtained by a single-acting liquid motor, e.g. actuated in the other direction by gravity or a spring [6]
- 9/109 . . . having plural pumping chambers [6]
- 9/111 with two mechanically connected pumping members [6]
- 9/113 reciprocating movement of the pumping members being obtained by a double-acting liquid motor [6]
- 9/115 reciprocating movement of the pumping members being obtained by two single-acting liquid motors, each acting in one direction [6]
- 9/117 the pumping members not being mechanically connected to each other [6]
- 9/12 . . the fluid being elastic, e.g. steam or air
- 9/123 . . . having only one pumping chamber [6]
- 9/125 reciprocating movement of the pumping member being obtained by a double-acting elastic-fluid motor [6]
- 9/127 rectilinear movement of the pumping member in the working direction being obtained by a single-acting elastic-fluid motor, e.g. actuated in the other direction by gravity or a spring [6]
- 9/129 . . . having plural pumping chambers [6]
- 9/131 with two mechanically connected pumping members [6]
- 9/133 reciprocating movement of the pumping members being obtained by a double-acting elastic-fluid motor [6]
- 9/135 reciprocating movement of the pumping members being obtained by two single-acting elastic-fluid motors, each acting in one direction [6]
- 9/137 the pumping members not being mechanically connected to each other [6]
- 9/14 . Pumps characterised by muscle-power operation
- 11/00 Equalisation of pulses, e.g. by use of air vessels; Counteracting cavitation**
- 13/00 Pumps specially modified to deliver fixed or variable measured quantities** (for transferring liquid from bulk storage containers or reservoirs into vehicles or into portable containers B67D 7/58)
- 13/02 . of two or more fluids at the same time
- 15/00 Pumps adapted to handle specific fluids, e.g. by selection of specific materials for pumps or pump parts**
- 15/02 . the fluids being viscous or non-homogeneous
- 15/04 . the fluids being hot or corrosive (F04B 15/06 takes precedence)
- 15/06 . for liquids near their boiling point, e.g. under subnormal pressure
- 15/08 . . the liquids having low boiling points
- 17/00 Pumps characterised by combination with, or adaptation to, specific driving engines or motors**
- 17/02 . driven by wind motors
- 17/03 . driven by electric motors [6]
- 17/04 . . using solenoids [6]
- 17/05 . driven by internal-combustion engines [6]
- 17/06 . Mobile combinations
- 19/00 Machines or pumps having pertinent characteristics not provided for in, or of interest apart from, groups F04B 1/00 to F04B 17/00**
- 19/02 . having movable cylinders
- 19/04 . Pumps for special use (for transferring liquids from bulk storage containers or reservoirs into vehicles or into portable containers B67D 7/58)
- 19/06 . . Pumps for delivery of both liquid and elastic fluids at the same time (wet gas pumps F04B 37/20) [6]

- 19/08 . Scoop devices
- 19/10 . . of wheel type
- 19/12 . . of helical or screw type
- 19/14 . . of endless-chain type, e.g. with the chains carrying pistons co-operating with open-ended cylinders
- 19/16 . Adhesion-type liquid-lifting devices
- 19/18 . . Adhesion members therefor
- 19/20 . Other positive-displacement pumps
- 19/22 . . of reciprocating-piston type
- 19/24 . . Pumping by heat expansion of pumped fluid
- 23/00 Pumping installations or systems** (F04B 17/00 takes precedence)
 - 23/02 . having reservoirs
 - 23/04 . Combinations of two or more pumps
 - 23/06 . . the pumps being all of reciprocating positive-displacement type
 - 23/08 . . the pumps being of different types
 - 23/10 . . . at least one pump being of the reciprocating positive-displacement type
 - 23/12 . . . at least one pump being of the rotary-piston positive-displacement type (F04B 23/10 takes precedence)
 - 23/14 . . . at least one pump being of the non-positive-displacement type (F04B 23/10, F04B 23/12 take precedence)

Pumps specially adapted for elastic fluids

- 25/00 Multi-stage pumps specially adapted for elastic fluids**
 - 25/02 . of stepped-piston type
 - 25/04 . having cylinders coaxial with, or parallel or inclined to, main shaft axis
- 27/00 Multi-cylinder pumps specially adapted for elastic fluids and characterised by number or arrangement of cylinders** (F04B 25/00 takes precedence; control of reciprocating machines or pumps in general F04B 49/00)
 - 27/02 . having cylinders arranged oppositely relative to main shaft
 - 27/04 . having cylinders in star- or fan-arrangement [6]
 - 27/047 . . with an actuating element at the outer ends of the cylinders [6]
 - 27/053 . . with an actuating element at the inner ends of the cylinders [6]
 - 27/06 . . the cylinders being movable, e.g. rotary
 - 27/067 . . Control [6]
 - 27/073 . . . by varying the relative eccentricity between two members, e.g. a cam and a drive shaft [6]
 - 27/08 . having cylinders coaxial with, or parallel or inclined to, main shaft axis
 - 27/10 . . having stationary cylinders [6]
 - 27/12 . . . having plural sets of cylinders or pistons [6]
 - 27/14 . . Control [6]
 - 27/16 . . . of pumps with stationary cylinders [6]
 - 27/18 . . . by varying the relative positions of a swash plate and a cylinder block [6]
 - 27/20 . . . of pumps with rotary cylinder block [6]
 - 27/22 . . . by varying the relative positions of a swash plate and a cylinder block [6]
 - 27/24 . Control not provided for in a single group of groups F04B 27/02 to F04B 27/22 [6]

- 31/00 Free-piston pumps specially adapted for elastic fluids; Systems incorporating such pumps** (muscle-driven pumps in which the stroke is not defined by gearing F04B 33/00; free-piston combustion engines, free-piston gas generators F02B 71/00; systems predominated by prime mover aspects, see the relevant class for the prime mover)

- 33/00 Pumps specially adapted for elastic fluids actuated by muscle power, e.g. for inflating**

- 33/02 . with intermediate gearing

- 35/00 Piston pumps specially adapted for elastic fluids and characterised by the driving means to their working members, or by combination with, or adaptation to, specific driving engines or motors, not otherwise provided for** (predominant aspects of the engines or motors, see the relevant classes)

- 35/01 . the means being mechanical [6]
- 35/02 . the means being fluid
- 35/04 . the means being electric
- 35/06 . Mobile combinations

- 37/00 Pumps specially adapted for elastic fluids and having pertinent characteristics not provided for in, or of interest apart from, groups F04B 25/00 to F04B 35/00**

- 37/02 . for evacuating by absorption or adsorption (absorption or adsorption in general B01J)
- 37/04 . . Selection of specific absorption or adsorption materials
- 37/06 . for evacuating by thermal means
- 37/08 . . by condensing or freezing, e.g. cryogenic pumps (cold traps B01D 8/00)
- 37/10 . for special use (F04B 37/02, F04B 37/06 take precedence)
- 37/12 . . to obtain high pressure
- 37/14 . . to obtain high vacuum
- 37/16 . . . Means for nullifying unswept space
- 37/18 . . for specific elastic fluids
- 37/20 . . . for wet gases, e.g. wet air

- 39/00 Component parts, details, or accessories, of pumps or pumping systems specially adapted for elastic fluids, not otherwise provided for in, or of interest apart from, groups F04B 25/00 to F04B 37/00** (for controlling F04B 49/00)

- 39/02 . Lubrication (of machines or engines in general F01M)
- 39/04 . Measures to avoid lubricant contaminating the pumped fluid
- 39/06 . Cooling (of machines or engines in general F01P); Heating; Prevention of freezing
- 39/08 . Actuation of distribution members
- 39/10 . Adaptation or arrangement of distribution members
- 39/12 . Casings (casings for machines or engines in general F16M); Cylinders; Cylinder heads; Fluid connections
- 39/14 . Provisions for readily assembling or disassembling
- 39/16 . Filtration; Moisture separation

- 41/00 Pumping installations or systems specially adapted for elastic fluids** (F04B 31/00, F04B 35/00 take precedence)

- 41/02 . having reservoirs
- 41/04 . Conversion of internal-combustion engine cylinder units to pumps
- 41/06 . Combinations of two or more pumps

Machines or pumps having flexible working members

- 43/00 Machines, pumps, or pumping installations having flexible working members** (pumps or pumping installations specially adapted for elastic fluids F04B 45/00)
- 43/02 . having plate-like flexible members, e.g. diaphragms (F04B 43/14 takes precedence) [3]
 - 43/04 . . Pumps having electric drive
 - 43/06 . . Pumps having fluid drive
 - 43/067 . . . the fluid being actuated directly by a piston [6]
 - 43/073 . . . the actuating fluid being controlled by at least one valve [6]
 - 43/08 . having tubular flexible members (F04B 43/12 takes precedence)
 - 43/09 . . Pumps having electric drive [6]
 - 43/10 . . Pumps having fluid drive
 - 43/107 . . . the fluid being actuated directly by a piston [6]
 - 43/113 . . . the actuating fluid being controlled by at least one valve [6]
 - 43/12 . having peristaltic action
 - 43/14 . . having plate-like flexible members [3]
 - 45/00 Pumps or pumping installations having flexible working members and specially adapted for elastic fluids**
 - 45/02 . having bellows
 - 45/027 . . having electric drive [6]
 - 45/033 . . having fluid drive [6]
 - 45/04 . having plate-like flexible members, e.g. diaphragms (F04B 45/10 takes precedence) [3]
 - 45/047 . . Pumps having electric drive [6]
 - 45/053 . . Pumps having fluid drive [6]
 - 45/06 . having tubular flexible members (F04B 45/02, F04B 45/08 take precedence) [3]
 - 45/067 . . Pumps having electric drive [6]
 - 45/073 . . Pumps having fluid drive [6]
 - 45/08 . having peristaltic action [3]
 - 45/10 . . having plate-like flexible members [3]
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- 47/00 Pumps or pumping installations specially adapted for raising fluids from great depths, e.g. well pumps** (by using positive or negative pressurised fluid medium acting directly on the liquid to be pumped F04F 1/00)
- 47/02 . the driving mechanisms being situated at ground level (F04B 47/12 takes precedence)
 - 47/04 . . the driving means incorporating fluid means
 - 47/06 . having motor-pump units situated at great depth
 - 47/08 . . the motors being actuated by fluid
 - 47/10 . . . the units or parts thereof being liftable to ground level by fluid pressure

- 47/12 . having free plunger lifting the fluid to the surface
- 47/14 . Counterbalancing
- 49/00 Control of, or safety measures for, machines, pumps, or pumping installations, not otherwise provided for in, or of interest apart from, groups F04B 1/00 to F04B 47/00**
- 49/02 . Stopping, starting, unloading, or idling control (controlled electrically F04B 49/06) [6]
- 49/025 . . by means of floats [6]
- 49/03 . . by means of valves [6]
- 49/035 . . . Bypassing [6]
- 49/04 . Regulating by means of floats (F04B 49/025 takes precedence) [6]
- 49/06 . Control using electricity (regulating by means of floats actuating electric switches F04B 49/04)
- 49/08 . Regulating by delivery pressure
- 49/10 . Other safety measures
- 49/12 . by varying the length of stroke of the working members [6]
- 49/14 . . Adjusting abutments located in the path of reciprocation [6]
- 49/16 . by adjusting the capacity of dead spaces of working chambers [6]
- 49/18 . by changing the effective cross-section of the working surface of the piston [6]
- 49/20 . by changing the driving speed (controlled electrically F04B 49/06) [6]
- 49/22 . by means of valves (F04B 49/03 takes precedence) [6]
- 49/24 . . Bypassing [6]
- 51/00 Testing machines, pumps, or pumping installations**
- 53/00 Component parts, details or accessories not provided for in, or of interest apart from, groups F04B 1/00 to F04B 23/00 or F04B 39/00 to F04B 47/00 [6]**
- 53/02 . Packing the free space between cylinders and pistons [6]
- 53/04 . Draining [6]
- 53/06 . Venting [6]
- 53/08 . Cooling (of machines or engines in general F01P); Heating; Preventing freezing [6]
- 53/10 . Valves; Arrangement of valves [6]
- 53/12 . . arranged in or on pistons [6]
- 53/14 . Pistons, piston-rods or piston-rod connections [6]
- 53/16 . Casings; Cylinders; Cylinder liners or heads; Fluid connections [6]
- 53/18 . Lubricating (of machines or engines in general F01M) [6]
- 53/20 . Filtering [6]
- 53/22 . Arrangements for enabling ready assembly or disassembly [6]

F04C ROTARY-PISTON, OR OSCILLATING-PISTON, POSITIVE-DISPLACEMENT MACHINES FOR LIQUIDS (engines F03C); **ROTARY-PISTON, OR OSCILLATING-PISTON, POSITIVE-DISPLACEMENT PUMPS**
Note

Attention is drawn to the Notes preceding class F01, especially as regards the definitions of “machines”, “pumps”, “positive displacement”, “rotary-piston machines”, “oscillating-piston machines”, “rotary piston”, “co-operating members”, “movement of co-operating members”, “teeth or tooth-equivalents”, and “internal axis”.

Subclass index
MACHINES OR PUMPS

Rotary-piston	
general characteristics; non-parallel axes of movement of co-operating members.....	2/00; 3/00
resiliently-deformable chamber walls; fluid ring	5/00; 7/00
Oscillating-piston.....	9/00
Combinations or adaptations	11/00, 13/00
Pump installations.....	11/00
Control; monitoring; safety arrangements	14/00
Other details or accessories	15/00

PUMPS SPECIALLY ADAPTED FOR ELASTIC FLUIDS

Rotary-piston pumps.....	18/00
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Rotary-piston pumps with fluid ring or the like	19/00
Oscillating-piston pumps	21/00
Combinations of two or more pumps, each being of rotary-piston or oscillating-piston type; Pumping installations; Multi-stage pumps	23/00
Adaptations of pumps for special use	25/00
Sealing arrangements in rotary-piston pumps	27/00
Control; monitoring; safety arrangements	28/00
Other components parts, details or accessories	29/00

2/00 Rotary-piston machines or pumps (with non-parallel axes of co-operating members F04C 3/00; with the working-chamber walls at least partly resiliently deformable F04C 5/00; with fluid ring or the like F04C 7/00; rotary-piston pumps specially adapted for elastic fluids F04C 18/00, F04C 19/00; rotary-piston machines or pumps in which the working-fluid is exclusively displaced by, or exclusively displaces, one or more reciprocating pistons F04B) [3]

Note

Group F04C 2/30 takes precedence over groups F04C 2/02 to F04C 2/24. [3]

2/02	. of arcuate-engagement type, i.e. with circular translatory movement of co-operating members, each member having the same number of teeth or tooth-equivalents [3]	2/107	. . . with helical teeth [3]
2/04	. . of internal-axis type [3]	2/113	. . . the inner member carrying rollers intermeshing with the outer member [3]
2/06	. . of other than internal-axis type (F04C 2/063 takes precedence) [3]	2/12	. . of other than internal-axis type [3]
2/063	. . with coaxially-mounted members having continuously-changing circumferential spacing between them [3]	2/14	. . . with toothed rotary pistons [3]
2/067	. . . having cam-and-follower type drive [3]	2/16	. . . with helical teeth, e.g. chevron-shaped, screw type [3]
2/07	. . . having crankshaft-and-connecting-rod type drive [3]	2/18	. . . with similar tooth forms (F04C 2/16 takes precedence) [3]
2/073	. . . having pawl-and-ratchet type drive [3]	2/20	. . . with dissimilar tooth forms (F04C 2/16 takes precedence) [3]
2/077	. . . having toothed-gearing type drive [3]	2/22	. of internal-axis type with equidirectional movement of co-operating members at the points of engagement, or with one of the co-operating members being stationary, the inner member having more teeth or tooth-equivalents than the outer member [3]
2/08	. of intermeshing-engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing [3]	2/24	. of counter-engagement type, i.e. the movement of co-operating members at the points of engagement being in opposite directions [3]
2/10	. . of internal-axis type with the outer member having more teeth or tooth-equivalents, e.g. rollers, than the inner member [3]	2/26	. . of internal-axis type [3]
		2/28	. . of other than internal-axis type [3]
		2/30	. having the characteristics covered by two or more of groups F04C 2/02, F04C 2/08, F04C 2/22, F04C 2/24 or having the characteristics covered by one of these groups together with some other type of movement between co-operating members [3]
		2/32	. . having both the movement defined in group F04C 2/02 and relative reciprocation between the co-operating members [3]
		2/324	. . . with vanes hinged to the inner member and reciprocating with respect to the outer member [3]
		2/328	. . . and hinged to the outer member [3]

2/332	. . . with vanes hinged to the outer member and reciprocating with respect to the inner member [3]	14/00	Control of, monitoring of, or safety arrangements for, machines, pumps or pumping installations (of pumps or pumping installations specially adapted for elastic fluids F04C 28/00) [8]
2/336 and hinged to the inner member [3]	14/02	. specially adapted for several machines or pumps connected in series or in parallel [8]
2/34	. . having the movement defined in group F04C 2/08 or F04C 2/22 and relative reciprocation between the co-operating members [3]	14/04	. specially adapted for reversible machines or pumps [8]
2/344	. . . with vanes reciprocating with respect to the inner member [3]	14/06	. specially adapted for stopping, starting, idling or no-load operation [8]
2/348 the vanes positively engaging, with circumferential play, an outer rotatable member [3]	14/08	. characterised by varying the rotational speed [8]
2/352 the vanes being pivoted on the axis of the outer member [3]	14/10	. characterised by changing the positions of the inlet or outlet openings with respect to the working chamber [8]
2/356	. . . with vanes reciprocating with respect to the outer member [3]	14/12	. . using sliding valves [8]
2/36	. . having both the movements defined in groups F04C 2/22 and F04C 2/24 [3]	14/14	. . using rotating valves [8]
2/38	. . having the movement defined in group F04C 2/02 and having a hinged member (F04C 2/32 takes precedence) [3]	14/16	. . using lift valves [8]
2/39	. . . with vanes hinged to the inner as well as to the outer member [3]	14/18	. characterised by varying the volume of the working chamber (by changing the positions of inlet or outlet openings F04C 14/10) [8]
2/40	. . having the movement defined in group F04C 2/08 or F04C 2/22 and having a hinged member [3]	14/20	. . by changing the form of the inner or outer contour of the working chamber [8]
2/44	. . . with vanes hinged to the inner member [3]	14/22	. . by changing the eccentricity between cooperating members [8]
2/46	. . . with vanes hinged to the outer member [3]	14/24	. characterised by using valves regulating pressure or flow rate, e.g. discharge valves (F04C 14/10 takes precedence) [8]
3/00	Rotary-piston machines or pumps, with non-parallel axes of movement of co-operating members, e.g. of screw type (with the working-chamber walls at least partly resiliently deformable F04C 5/00; rotary-piston pumps with non-parallel axes of movement of co-operating members specially adapted for elastic fluids F04C 18/48)	14/26	. . using bypass channels [8]
3/02	. the axes being arranged at an angle of 90 degrees [5]	14/28	. Safety arrangements; Monitoring [8]
3/04	. . of intermeshing engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing [5]	15/00	Component parts, details or accessories of machines, pumps or pumping installations, not provided for in groups F04C 2/00 to F04C 14/00 (of pumps specially adapted for elastic fluids F04C 18/00 to F04C 29/00) [1,8]
3/06	. the axes being arranged otherwise than at an angle of 90 degrees [5]	15/06	. Arrangements for admission or discharge of the working fluid, e.g. constructional features of the inlet or outlet [8]
3/08	. . of intermeshing engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing [5]		
5/00	Rotary-piston machines or pumps with the working-chamber walls at least partly resiliently deformable (such pumps specially adapted for elastic fluids F04C 18/00)		
7/00	Rotary-piston machines or pumps with fluid ring or the like (such pumps specially adapted for elastic fluids F04C 19/00)		
9/00	Oscillating-piston machines or pumps (such pumps specially adapted for elastic fluids F04C 21/00)		
11/00	Combinations of two or more machines or pumps, each being of rotary-piston or oscillating-piston type (combinations of such pumps specially adapted for elastic fluids F04C 23/00); Pumping installations (F04C 13/00 takes precedence; specially adapted for elastic fluids F04C 23/00; fluid gearing F16H)		
13/00	Adaptations of machines or pumps for special use, e.g. for extremely high pressures (of pumps specially adapted for elastic fluids F04C 25/00)		
		Pumps specially adapted for elastic fluids	
		18/00	Rotary-piston pumps specially adapted for elastic fluids (with fluid ring or the like F04C 19/00; rotary-piston pumps in which the working-fluid is exclusively displaced by one or more reciprocating pistons F04B) [3]
		Note	
			Group F04C 18/30 takes precedence over groups F04C 18/02 to F04C 18/24. [3,5]
		18/02	. of arcuate-engagement type, i.e. with circular translatory movement of co-operating members, each member having the same number of teeth or tooth-equivalents [3]
		18/04	. . of internal-axis type [3]
		18/06	. . of other than internal-axis type (F04C 18/063 takes precedence) [3]
		18/063	. . with coaxially-mounted members having continuously-changing circumferential spacing between them [3]
		18/067	. . . having cam-and-follower type drive [3]
		18/07	. . . having crankshaft-and-connecting-rod type drive [3]
		18/073	. . . having pawl-and-ratchet type drive [3]
		18/077	. . . having toothed-gearing type drive [3]

- 18/08 . . of intermeshing-engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing [3]
 - 18/10 . . . of internal-axis type with the outer member having more teeth or tooth-equivalents, e.g. rollers, than the inner member [3]
 - 18/107 . . . with helical teeth [3]
 - 18/113 . . . the inner member carrying rollers intermeshing with the outer member [3]
 - 18/12 . . of other than internal-axis type [3]
 - 18/14 . . . with toothed rotary pistons [3]
 - 18/16 with helical teeth, e.g. chevron-shaped, screw type [3]
 - 18/18 with similar tooth forms (F04C 18/16 takes precedence) [3]
 - 18/20 with dissimilar tooth forms (F04C 18/16 takes precedence) [3]
 - 18/22 . . of internal-axis type with equidirectional movement of co-operating members at the points of engagement, or with one of the co-operating members being stationary, the inner member having more teeth or tooth-equivalents than the outer member [3]
 - 18/24 . . of counter-engagement type, i.e. the movement of co-operating members at the points of engagement being in opposite directions [3]
 - 18/26 . . . of internal-axis type [3]
 - 18/28 . . . of other than internal-axis type [3]
 - 18/30 . . having the characteristics covered by two or more of groups F04C 18/02, F04C 18/08, F04C 18/22, F04C 18/24, F04C 18/48, or having the characteristics covered by one of these groups together with some other type of movement between co-operating members [3]
 - 18/32 . . . having both the movement defined in group F04C 18/02 and relative reciprocation between the co-operating members [3]
 - 18/324 . . . with vanes hinged to the inner member and reciprocating with respect to the outer member [3]
 - 18/328 and hinged to the outer member [3]
 - 18/332 . . . with vanes hinged to the outer member and reciprocating with respect to the inner member [3]
 - 18/336 and hinged to the inner member [3]
 - 18/34 . . . having the movement defined in group F04C 18/08 or F04C 18/22 and relative reciprocation between the co-operating members [3]
 - 18/344 . . . with vanes reciprocating with respect to the inner member [3]
 - 18/348 the vanes positively engaging, with circumferential play, an outer rotatable member [3]
 - 18/352 the vanes being pivoted on the axis of the outer member [3]
 - 18/356 . . . with vanes reciprocating with respect to the outer member [3]
 - 18/36 . . having both the movements defined in groups F04C 18/22 and F04C 18/24 [3]
 - 18/38 . . having the movement defined in group F04C 18/02 and having a hinged member (F04C 18/32 takes precedence) [3]
 - 18/39 . . . with vanes hinged to the inner as well as to the outer member [3]
 - 18/40 . . . having the movement defined in group F04C 18/08 or F04C 18/22 and having a hinged member [3]
 - 18/44 . . . with vanes hinged to the inner member [3]
 - 18/46 . . . with vanes hinged to the outer member [3]
 - 18/48 . . Rotary-piston pumps with non-parallel axes of movement of co-operating members [5]
- Note**
- Group F04C 18/30 takes precedence over group F04C 18/48. [8]
- 18/50 . . . the axes being arranged at an angle of 90 degrees [5]
 - 18/52 . . . of intermeshing engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing [5]
 - 18/54 . . . the axes being arranged otherwise than at an angle of 90 degrees [5]
 - 18/56 . . . of intermeshing engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing [5]
 - 19/00 **Rotary-piston pumps with fluid ring or the like, specially adapted for elastic fluids**
 - 21/00 **Oscillating-piston pumps specially adapted for elastic fluids**
 - 23/00 **Combinations of two or more pumps, each being of rotary-piston or oscillating-piston type, specially adapted for elastic fluids; Pumping installations specially adapted for elastic fluids; Multi-stage pumps specially adapted for elastic fluids** (F04C 25/00 takes precedence)
 - 23/02 . . Pumps characterised by combination with, or adaptation to, specific driving engines or motors (predominant aspects of the engines or motors, *see* the relevant classes)
 - 25/00 **Adaptations for special use of pumps for elastic fluids**
 - 25/02 . . for producing high vacuum (sealing arrangements F04C 27/00; silencing F04C 29/06)
 - 27/00 **Sealing arrangements in rotary-piston pumps specially adapted for elastic fluids**
 - 27/02 . . Liquid sealing for high-vacuum pumps
 - 28/00 **Control of, monitoring of, or safety arrangements for, pumps or pumping installations specially adapted for elastic fluids [8]**
 - 28/02 . . specially adapted for several pumps connected in series or in parallel [8]
 - 28/04 . . specially adapted for reversible pumps [8]
 - 28/06 . . specially adapted for stopping, starting, idling or no-load operation [8]
 - 28/08 . . characterised by varying the rotational speed [8]
 - 28/10 . . characterised by changing the positions of the inlet or outlet openings with respect to the working chamber [8]
 - 28/12 . . using sliding valves [8]
 - 28/14 . . using rotating valves [8]
 - 28/16 . . using lift valves [8]
 - 28/18 . . characterised by varying the volume of the working chamber (by changing the positions of inlet or outlet openings F04C 28/10) [8]
 - 28/20 . . by changing the form of the inner or outer contour of the working chamber [8]

F04C – F04D

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| <p>28/22 . . by changing the eccentricity between cooperating members [8]</p> <p>28/24 . characterised by using valves regulating pressure or flow rate, e.g. discharge valves (F04C 28/10 takes precedence) [8]</p> <p>28/26 . . using bypass channels [8]</p> <p>28/28 . Safety arrangements; Monitoring [8]</p> <p>29/00 Component parts, details, or accessories, of pumps or pumping installations specially adapted for elastic fluids, not provided for in groups F04C 18/00 to F04C 28/00</p> <p>29/02 . Lubrication (of machines or engines in general F01M); Lubricant separation (separation in general B01D)</p> | <p>29/04 . Heating; Cooling (of machines or engines in general F01P); Heat insulation (heat insulation in general F16L 59/00)</p> <p>29/06 . Silencing (gas-flow silencers or exhaust apparatus for machines or engines in general F01N)</p> <p>29/12 . Arrangements for admission or discharge of the working fluid, e.g. constructional features of the inlet or outlet [8]</p> |
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F04D NON-POSITIVE-DISPLACEMENT PUMPS

- (1) This subclass covers non-positive-displacement pumps for liquids, for elastic fluids, or for liquids and elastic fluids whether rotary or not having pure rotation.
- (2) This subclass does not cover combinations of non-positive-displacement pumps with other pumps, which are covered by subclass F04B, except that the use of such other pumps for priming or boosting non-positive-displacement is covered by this subclass.
- (3) Attention is drawn to the Notes preceding class F01, especially as regards the definition of “pump”.

Subclass index

ROTARY PUMPS FOR LIQUID AND ELASTIC FLUID OR LIQUID ALONE

Kind of flow: radial or helico-centrifugal; axial; circumferential or transverse; other 1/00; 3/00; 5/00; 11/00

For handling specific fluids.....7/00

Priming, preventing vapour lock.....9/00

Pumping installations or systems; control..... 13/00; 15/00

ROTARY PUMPS FOR ELASTIC FLUID

Kind of flow: radial or helico-centrifugal; axial; other..... 17/00; 19/00; 23/00

Involving supersonic speed of fluid 21/00

Pumping installations; control 25/00; 27/00

DETAILS OR ACCESSORIES 29/00

OTHER KINDS OF PUMPS

Pumping liquid and elastic fluid at the same time 31/00

With other than pure rotation..... 33/00

Wave producers..... 35/00

1/00 Radial-flow pumps, e.g. centrifugal pumps; Helico-centrifugal pumps (adapted for pumping specific fluids F04D 7/00; priming or boosting F04D 9/00; pumping liquids and elastic fluids at the same time F04D 31/00)

- 1/02 . having non-centrifugal stages, e.g. centripetal
- 1/04 . Helico-centrifugal pumps
- 1/06 . Multi-stage pumps (F04D 1/02 takes precedence)
- 1/08 . . the stages being situated concentrically
- 1/10 . . with means for changing the flow-path through the stages, e.g. series/parallel
- 1/12 . Pumps with scoops or like paring members protruding in the fluid circulating in a bowl
- 1/14 . Pumps raising fluids by centrifugal force within a conical rotary bowl with vertical axis

3/00 Axial-flow pumps (priming or boosting F04D 9/00; pumping liquids and elastic fluids at the same time F04D 31/00)

- 3/02 . of screw type

5/00 Pumps with circumferential or transverse flow (pumping liquids and elastic fluids at the same time F04D 31/00)

7/00 Pumps adapted for handling specific fluids, e.g. by selection of specific materials for pumps or pump parts (pumping liquids and elastic fluids at the same time F04D 31/00)

- 7/02 . of centrifugal type
- 7/04 . . the fluids being viscous or non-homogeneous
- 7/06 . . the fluids being hot or corrosive, e.g. liquid metal
- 7/08 . . the fluids being radioactive

9/00 Priming; Preventing vapour lock

- 9/02 . Self-priming pumps
- 9/04 . using priming pumps; using booster pumps to prevent vapour lock
- 9/06 . . of jet type

11/00 Other rotary non-positive-displacement pumps (pumping installations or systems F04D 13/00; pumping liquids and elastic fluids at the same time F04D 31/00)

13/00 Pumping installations or systems (controlling F04D 15/00; pumping liquids and elastic fluids at the same time F04D 31/00)

13/02 . Units comprising pumps and their driving means (predominant aspects of the driving means, see the relevant classes for such means)

13/04 . . the pump being fluid-driven

13/06 . . the pump being electrically driven

13/08 . . . for submerged use

13/10 adapted for use in mining bore holes

13/12 . Combinations of two or more pumps (combinations with priming pumps or booster pumps to counter-act vapour lock F04D 9/04)

13/14 . . the pumps being all of centrifugal type

13/16 . with storage reservoirs

15/00 Control, e.g. regulation, of pumps, pumping installations, or systems

15/02 . Stopping of pumps, or operating valves, on occurrence of unwanted conditions

Rotary pumps specially adapted for elastic fluids

17/00 Radial-flow pumps specially adapted for elastic fluids, e.g. centrifugal pumps; Helico-centrifugal pumps specially adapted for elastic fluids (F04D 21/00 takes precedence)

17/02 . having non-centrifugal stages, e.g. centripetal

17/04 . . of transverse-flow type

17/06 . Helico-centrifugal pumps

17/08 . Centrifugal pumps

17/10 . . for compressing or evacuating

17/12 . . . Multi-stage pumps

17/14 with means for changing the flow-path through the stages, e.g. series/parallel (surge control F04D 27/02)

17/16 . . for displacing without appreciable compression

17/18 . . characterised by use of centrifugal force of liquids entrained in pumps

19/00 Axial-flow pumps specially adapted for elastic fluids (F04D 21/00 takes precedence)

19/02 . Multi-stage pumps

19/04 . . specially adapted to the production of a high vacuum, e.g. molecular pumps

21/00 Pumps specially adapted for elastic fluids involving supersonic speed of pumped fluids

23/00 Other rotary non-positive-displacement pumps specially adapted for elastic fluids (pumping installations or systems F04D 25/00)

25/00 Pumping installations or systems specially adapted for elastic fluids (controlling F04D 27/00)

25/02 . Units comprising pumps and their driving means (predominant aspects of the driving means, see the relevant classes for such means)

25/04 . . the pump being fluid-driven

25/06 . . the pump being electrically driven (F04D 25/08 takes precedence)

25/08 . . the working fluid being air, e.g. for ventilation

25/10 . . . the unit having provisions for automatically changing the direction of output air

25/12 . . . the unit being adapted for mounting in apertures

25/14 and having shutters, e.g. automatically closed when not in use

25/16 . Combinations of two or more pumps

27/00 Control, e.g. regulation, of pumps, pumping installations or pumping systems specially adapted for elastic fluids

27/02 . Surge control

29/00 Details, component parts, or accessories (machine elements in general F16)

29/02 . Selection of particular materials (for handling specific liquids F04D 7/00)

29/04 . Shafts or bearings, or assemblies thereof (specially adapted for elastic fluid pumps F04D 29/05) [1,8]

29/041 . . Axial thrust balancing [8]

29/042 . . Axially shiftable rotors (F04D 29/041 takes precedence) [8]

29/043 . . Shafts [8]

29/044 . . . Arrangements for joining or assembling shafts [8]

29/046 . . Bearings [8]

29/047 . . . hydrostatic; hydrodynamic [8]

29/048 . . . magnetic; electromagnetic [8]

29/049 . . . Roller bearings [8]

29/05 . Shafts or bearings, or assemblies thereof, specially adapted for elastic fluid pumps [8]

29/051 . . Axial thrust balancing [8]

29/052 . . Axially shiftable rotors (F04D 29/051 takes precedence) [8]

29/053 . . Shafts [8]

29/054 . . . Arrangements for joining or assembling shafts [8]

29/056 . . Bearings [8]

29/057 . . . hydrostatic; hydrodynamic [8]

29/058 . . . magnetic; electromagnetic [8]

29/059 . . . Roller bearings [8]

29/06 . Lubrication [1,8]

29/063 . . specially adapted for elastic fluid pumps [8]

29/08 . Sealings

29/10 . . Shaft sealings

29/12 . . . using sealing-rings

29/14 . . . operative only when pump is inoperative

29/16 . . between pressure and suction sides

29/18 . Rotors (specially adapted for elastic fluids F04D 29/26)

29/20 . . Mounting rotors on shafts

29/22 . . specially for centrifugal pumps

29/24 . . . Vanes

29/26 . Rotors specially adapted for elastic fluids

29/28 . . for centrifugal or helico-centrifugal pumps

29/30 . . . Vanes

29/32 . . for axial-flow pumps

29/34 . . . Blade mountings

29/36 adjustable

29/38 . . . Blades

29/40 . Casings; Connections for working fluid

29/42 . . for radial or helico-centrifugal pumps

29/44 . . . Fluid-guiding means, e.g. diffusers

29/46 adjustable

29/48 for unidirectional fluid flow in reversible pumps

29/50 for reversing fluid flow

29/52 . . for axial pumps

29/54 . . . Fluid-guiding means, e.g. diffusers

29/56 adjustable

29/58 . Cooling (of machines or engines in general F01P); Heating; Diminishing heat transfer

F04D – F04F

29/60	• Mounting; Assembling; Disassembling
29/62	• • of radial or helico-centrifugal pumps
29/64	• • of axial pumps
29/66	• Combating cavitation, whirls, noise, vibration, or the like (gas-flow silencers for machines or engines in general F01N); Balancing (surge control F04D 27/02)
29/68	• • by influencing boundary layers
29/70	• Suction grids; Strainers; Dust separation; Cleaning

Other non-positive-displacement pumps

31/00	Pumping liquids and elastic fluids at the same time
33/00	Non-positive-displacement pumps with other than pure rotation, e.g. of oscillating type (F04D 35/00 takes precedence; hand-held fans A45B) [2]
35/00	Pumps producing waves in liquids, i.e. wave-producers (for bath tubs A47K 3/10) [2]

F04F PUMPING OF FLUID BY DIRECT CONTACT OF ANOTHER FLUID OR BY USING INERTIA OF FLUID TO BE PUMPED (containers or packages with special means for dispensing liquid or semi-liquid contents by internal gaseous pressure B65D 83/14); **SIPHONS** [2]

- (1) Attention is drawn to the Notes preceding class F01.
 (2) Combinations of pumps covered by this subclass with other pumps are only classified in this subclass if such other pumps are intended for preliminary pumping for diffusion pumps.

Subclass index

PUMPS USING PRESSURE OR FLOW OF ANOTHER FLUID.....	1/00, 5/00
PUMPS USING NEGATIVE PRESSURE;	
PUMPS USING INERTIA OF THE FLUID.....	1/00, 3/00; 7/00

DIFFUSION PUMPS, e.g. WITH FORE PUMPS	9/00
SIPHONS; OTHER PUMPS.....	10/00; 99/00
JET-PUMP INSTALLATIONS	5/54

1/00	Pumps using positively or negatively pressurised fluid medium acting directly on the liquid to be pumped (using only negative pressure F04F 3/00; jet pumps F04F 5/00; siphons F04F 10/00)
1/02	• using both positively and negatively pressurised fluid medium, e.g. alternating
1/04	• • generated by vaporising and condensing
1/06	• the fluid medium acting on the surface of the liquid to be pumped (F04F 1/02 takes precedence)
1/08	• • specially adapted for raising liquids from great depths, e.g. in wells
1/10	• • of multiple type, e.g. with two or more units in parallel (F04F 1/08 takes precedence)
1/12	• • • in series
1/14	• • adapted to pump specific liquids, e.g. corrosive or hot liquids
1/16	• • characterised by the fluid medium being suddenly pressurised, e.g. by explosion
1/18	• the fluid medium being mixed with, or generated from, the liquid to be pumped
1/20	• • specially adapted for raising liquids from great depths, e.g. in wells
3/00	Pumps using negative pressure acting directly on the liquid to be pumped (siphons F04F 10/00)
5/00	Jet pumps, i.e. devices in which fluid flow is induced by pressure drop caused by velocity of another fluid flow (diffusion pumps F04F 9/00; combination of jet pumps with pumps of other than jet type F04B; use of jet pumps for priming or boosting non-positive-displacement pumps F04D)
5/02	• the inducing fluid being liquid
5/04	• • displacing elastic fluids
5/06	• • • of rotary type
5/08	• • • the elastic fluid being entrained in a free-falling column of liquid

5/10	• • displacing liquids, e.g. containing solids, or liquids and elastic fluids
5/12	• • • of multi-stage type
5/14	• the inducing fluid being elastic fluid
5/16	• • displacing elastic fluids
5/18	• • • for compressing
5/20	• • • for evacuating
5/22	• • • • of multi-stage type
5/24	• • displacing liquids, e.g. containing solids, or liquids and elastic fluids
5/26	• • • of multi-stage type (F04F 5/28 takes precedence)
5/28	• • • Restarting of inducing action
5/30	• • • • with axially-slidable combining nozzle
5/32	• • • • with hinged flap in combining nozzle
5/34	• • characterised by means for changing inducing-fluid source
5/36	• • characterised by using specific inducing fluid
5/38	• • • the inducing fluid being mercury vapour
5/40	• • • the inducing fluid being oil vapour
5/42	• characterised by the input flow of inducing fluid medium being radial or tangential to output flow (cyclones B04C)
5/44	• Component parts, details, or accessories not provided for in, or of interest apart from, groups F04F 5/02 to F04F 5/42
5/46	• • Arrangements of nozzles
5/48	• • Control
5/50	• • • of compressing pumps
5/52	• • • of evacuating pumps
5/54	• Installations characterised by use of jet pumps, e.g. combinations of two or more jet pumps of different type

7/00	Pumps displacing fluids by using inertia thereof, e.g. by generating vibrations therein	9/06	. Arrangement of vapour traps
7/02	. Hydraulic rams	9/08	. Control
9/00	Diffusion pumps	10/00	Siphons
9/02	. of multi-stage type	10/02	. Gravity-actuated siphons
9/04	. in combination with fore pumps, e.g. use of isolating valves	13/00	Pressure exchangers [2009.01]
		99/00	Subject matter not provided for in other groups of this subclass [2009.01]