

**ECLA****EUROPEAN CLASSIFICATION****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; gearings for interconverting rotary motion and reciprocating motion in general F16H; pistons, piston-rods, cylinders, in general F16J)

[N: **WARNING**  
 [C1010]

- The following IPC groups are not used in the internal ECLA classification scheme. Subject matter covered by these groups is classified in the following ECLA groups:

[F04B35/02](#) covered by [F04B9/08](#)

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**Notes**

- In this subclass, the following term is used with the meaning indicated:
  - "piston" also covers a plunger.
- Attention is drawn to the notes preceding class F01, especially as regards the definitions of "machines", "pumps", and "positive-displacement".

**Guide heading:**

**Pumps for liquids or for liquid and elastic fluids; Positive-displacement machines for liquids** (pumps for raising fluids from great depths F04B47/00; having flexible working members F04B43/00)

**F04B1/00**

**Multi-cylinder machines or pumps characterised by number or arrangements of cylinders** ([F04B3/00](#) takes precedence; fluid-driven pumps [F04B9/08](#); control of reciprocating machines or pumps in general [F04B49/00](#))

## F04B1/00D

- . [N: Pumps with cylinder axis arranged substantially tangentially to a circle centred on main shaft axis]

## F04B1/02

- . having two cylinders (in V-arrangement [F04B1/04](#))

## F04B1/04

- . having cylinders in star- or fan-arrangement

## F04B1/04K

- . . [N: Details, component parts specially adapted for such pumps]

## F04B1/04K2

- . . . [N: Pistons]

## F04B1/04K3

- . . . [N: Cams]

## F04B1/04K3B

- . . . . [N: consisting of several cylindrical elements, e.g. rollers]

F04B1/04K4	. . .	[N: Cylinders]
F04B1/04K5	. . .	[N: Arrangements for pressing or connecting the pistons against the actuated cam]
F04B1/04K5B	. . . .	[N: hydraulically]
F04B1/04K6	. . .	[N: Disconnecting the pistons from the actuated cam (in general <a href="#">F01B31/24</a> )]
F04B1/04K7	. . .	[N: Supporting and guiding means for the pistons]
F04B1/04K10	. . .	[N: Draining of the engine housing; arrangements dealing with leakage fluid]
F04B1/04K12	. . .	[N: Sealing, e.g. seals for shafts or housings ( <a href="#">F04B1/04K2</a> , <a href="#">F04B53/16C2</a> take precedence)] [N9901]
F04B1/04K15	. . .	[N: Particularities relating to the distribution members ( <a href="#">F04B1/047A</a> , <a href="#">F04B1/053A</a> and <a href="#">F04B1/053C</a> take precedence)]
F04B1/04K15C	. . . .	[N: to cylindrical distribution members]
F04B1/04K15K	. . . .	[N: to conical distribution members]
F04B1/04K15V	. . . .	[N: to plate-like distribution members]
F04B1/047	. .	with an actuating or actuated element at the outer ends of the cylinders [N9410]
F04B1/047A	. . .	[N: with cam-actuated distribution members] [N9410]
F04B1/047C	. . .	[N: with two or more series radial piston-cylinder units] [N9410]
F04B1/047C2	. . . .	[N: directly located side-by-side] [N9410]
F04B1/047C4	. . . .	[N: Coupling of several cylinder-barrels] [N9410]
F04B1/053	. .	with an actuating or actuated element at the inner ends of the cylinders [N9410]
F04B1/053A	. . .	[N: with cam-actuated distribution members] [N9410]
F04B1/053A2	. . . .	[N: each machine piston being provided with channels which are coacting with the cylinder and are used as a distribution member for another piston-cylinder unit] [N9410]
F04B1/053C	. . .	[N: the piston-driving cam being provided with an inlet and an outlet] [N9410]
F04B1/053E	. . .	[N: with two or more series radial piston-cylinder units] [N9410]
F04B1/053E2	. . . .	[N: directly located side-by-side] [N9410]
F04B1/06	. .	Control [N: ( <a href="#">F04B49/12</a> , <a href="#">F04B49/18</a> take precedence)]
F04B1/06B	. . .	[N: by using a valve in a system with several pumping chambers wherein the flow-path through the chambers can be changed, e.g. series-parallel]
F04B1/06K	. . .	[N: by changing the phase relationship between the actuating cam and the distributing means]
F04B1/07	. . .	by varying the relative eccentricity between two members, e.g. a cam and a drive shaft [N9410]
F04B1/08	. . .	regulated by delivery pressure
F04B1/10	. .	the cylinders being movable, e.g. rotary [N: ( <a href="#">F04B1/20</a> and <a href="#">F04B3/00B2</a> take precedence)]
F04B1/107	. . .	with an actuating or actuated element at the outer ends of the cylinders [N9410]
F04B1/107A	. . . .	[N: with rotary cylinder block] [N9410]
F04B1/107A2	. . . . .	[N: with cylinder block and actuating cam rotating together ( <a href="#">F04B1/107A4B</a> and <a href="#">F04B1/107A4D2</a> take precedence)] [N9410]
F04B1/107A4	. . . . .	[N: with two or more series radial piston-cylinder units] [N9410]
F04B1/107A4B	. . . . .	[N: with cylinder block and actuating cam both rotating ( <a href="#">F04B1/107A4D2</a> takes precedence)] [N9410]
F04B1/107A4D	. . . . .	[N: directly located side-by-side] [N9410]

F04B1/107A4D2	. . . . .	{7 dots} [N: with cylinder block and actuating cam both rotating] [N9410]
F04B1/113	. . .	with an actuating or actuated element at the inner ends of the cylinders [N9410]
F04B1/113A	. . . .	[N: with rotary cylinder block] [N9410]
F04B1/113A2	. . . . .	[N: the rotary cylinder being provided with only one piston, reciprocating within the cylinder] [N9410]
F04B1/12	. . . . .	having cylinder axes coaxial with, or parallel or inclined to main shaft axis
F04B1/12C	. . .	[N: Component parts, details, e.g. valves, sealing, lubrication ( <a href="#">F04B1/20C</a> takes precedence)]
F04B1/12C2	. . . .	[N: Pistons]
F04B1/12C2B	. . . . .	[N: Piston shoe retaining means]
F04B1/12F	. . .	[N: Driving means]
F04B1/14	. . .	[N: having stationary cylinders]
F04B1/14C	. . . .	[N: Component parts]
F04B1/14C2	. . . . .	[N: Cylinders]
F04B1/14C5	. . . . .	[N: Housings]
F04B1/14C7	. . . . .	[N: Swash plates or actuating elements]
F04B1/14C7B	. . . . .	[N: Swash plate or actuating element bearing means or driving axis bearing means]
F04B1/16	. . . . .	having two or more sets of cylinders or pistons
F04B1/18	. . . . .	having self-acting distribution members, i.e. actuated by working fluid
F04B1/18A	. . . . .	[N: Check valves] [N0107]
F04B1/18C	. . . . .	[N: Cylindrical distribution members]
F04B1/18K	. . . . .	[N: Conical distribution members]
F04B1/18V	. . . . .	[N: Plate-like distribution members] [N0107]
F04B1/20	. . . . .	having rotary cylinder block
F04B1/20B	. . . . .	[N: Arrangements for pressing the cylinder barrel against the valve plate, e.g. by fluid pressure]
F04B1/20C	. . . . .	[N: Component parts]
F04B1/20C1	. . . . .	[N: Particularities in the contacting area between cylinder barrel or valve plate]
F04B1/20C1B	. . . . .	[N: Bearing means]
F04B1/20C2	. . . . .	[N: Cylinder barrel]
F04B1/20C3	. . . . .	[N: Valve means]
F04B1/20C3C	. . . . .	[N: Cylindrical valve means]
F04B1/20C3K	. . . . .	[N: Conical valve means]
F04B1/20C5	. . . . .	[N: Pumphousing]
F04B1/20C5B	. . . . .	[N: Cylinder barrel bearing means]
F04B1/20C7	. . . . .	[N: Swash plate]
F04B1/20C7B	. . . . .	[N: Swash plate bearing means or driving axis bearing means]
F04B1/20D	. . . . .	[N: Connection between rotating cylinder barrel and rotating inclined swash plate]
F04B1/22	. . . . .	having two or more sets of cylinders or pistons
F04B1/24	. . . . .	inclined to main shaft axis

- F04B1/26 . . Control
- F04B1/28 . . . for machines or pumps with stationary cylinders
- F04B1/29 . . . . by varying the relative positions of a swash plate and a cylinder block [N0401]
- F04B1/29A . . . . . [N: by changing the inclination of the swash plate] [N0401]
- F04B1/30 . . . for machines or pumps with rotary cylinder block
- F04B1/30A . . . . [N: by turning the valve plate]
- F04B1/30D . . . . [N: by turning the swash plate (with fixed inclination)]
- F04B1/32 . . . . by varying the relative positions of a swash plate and a cylinder block [N9608]
- F04B1/32B . . . . . [N: by moving the swash plate in a direction perpendicular to the axis of rotation of the cylinder barrel] [N9608]
- F04B1/32C . . . . . [N: by changing the inclination of the swash plate] [N9608]
- F04B1/32C3 . . . . . [N: using wedges] [N9608]
- F04B1/32D . . . . . [N: by changing the inclination of the axis of the cylinder barrel relative to the swash plate ([F04B1/30](#) takes precedence)] [N9608]
- F04B1/34 . Control not provided for in a single group of groups [F04B1/02](#) to [F04B1/32](#) [N9410]

#### **F04B3/00 Machines or pumps with pistons coaxing within one cylinder e.g. multi-stage**

- F04B3/00B . [N: with two or more pistons reciprocating one within another, e.g. one piston forming cylinder of the other]
- F04B3/00B2 . . [N: with rotating cylinder block]

#### **F04B5/00 Machines or pumps with differential surface pistons**

- F04B5/02 . with double-acting pistons [N9410]

#### **F04B7/00 Piston machines or pumps characterised by having positively-driven valving (with cylinders in star- or fan-arrangement [F04B1/04](#); with cylinder axes coaxial with, or parallel or inclined to, main shaft axis [F04B1/12](#))**

- F04B7/00A . [N: the distribution member forming both the inlet and discharge distributor for one single pumping chamber ([F04B7/02A](#) takes precedence)]
- F04B7/00A2 . . [N: and having a rotating movement]
- F04B7/00A4 . . [N: and having an oscillating movement]
- F04B7/00A6 . . [N: and having a slidable movement]
- F04B7/00C . [N: a common distribution member forming a single discharge distributor for a plurality of pumping chambers ([F04B7/02C](#) takes precedence)]
- F04B7/00C2 . . [N: and having a rotating movement]
- F04B7/00C4 . . [N: and having an oscillating movement]
- F04B7/00C6 . . [N: and having a slidable movement]
- F04B7/00C8 . . [N: and having an orbital movement, e.g. elbow-pipe type members]
- F04B7/00E . [N: the distribution member forming a single inlet for a plurality of pumping chambers]

or a multiple discharge for one single pumping chamber]

- F04B7/00G . [N: with specific kinematics of the distribution member ([F04B7/00A](#), [F04B7/00C](#) take precedence)] [N9812]
- F04B7/00G2 . . [N: for rotating distribution members] [N9812]
- F04B7/00G4 . . [N: for oscillating distribution members] [N9812]
- F04B7/00G6 . . [N: for reciprocating distribution members] [N9812]
- [N: **WARNING**  
Groups [F04B7/00K](#) to [F04B7/00K4](#) are not used for classification. The documents are in the process of being reclassified to subclass [F01L](#)  
]
- F04B7/00K . [N: Mechanical driving means therefor, e.g. cams]
- F04B7/00K2 . . [N: for a rotating member]
- F04B7/00K2A . . . [N: being mounted on the main shaft]
- F04B7/00K4 . . [N: for a sliding member]
- F04B7/00L . [N: the member being of the lost-motion type, e.g. friction-actuated members, or having means for pushing it against or pulling it from its seat]
- F04B7/00M . [N: the members being actuated by electro-magnetic means]
- F04B7/00P . [N: the distribution being realised by moving the cylinder itself, e.g. by sliding or swinging ([F04B7/02P](#) takes precedence)]
- F04B7/00T . [N: Component parts or details specially adapted therefor]
- F04B7/00T2 . . [N: Sealing arrangements between the distribution members and the housing]
- F04B7/00T2B . . . [N: for oscillating distribution members]
- F04B7/00T2D . . . [N: for pipe-type distribution members]
- F04B7/02 . the valving being fluid-actuated
- F04B7/02A . . [N: the distribution member forming both the inlet and discharge distributor for one single pumping chamber]
- F04B7/02A4 . . . [N: and having an oscillating movement]
- F04B7/02A6 . . . [N: and having a slidable movement]
- F04B7/02C . . [N: a common distribution member forming a single discharge distributor for a plurality of pumping chambers]
- F04B7/02C4 . . . [N: and having an oscillating movement]
- F04B7/02C6 . . . [N: and having a slidable movement]
- F04B7/02C8 . . . [N: and having an orbital movement, e.g. elbow-pipe type members]
- F04B7/02F . . [N: the inlet and discharge means being separate members]
- F04B7/02F2 . . . [N: and being deformable, e.g. membranes]
- F04B7/02F4 . . . [N: and having a rotating movement]
- F04B7/02P . . [N: the distribution being realised by moving the cylinder itself, e.g. by sliding or swinging]
- F04B7/04 . in which the valving is performed by pistons and cylinders coacting to open and close intake or outlet ports

- F04B7/04B . . [N: Two pistons coacting within one cylinder]
  - F04B7/06 . . the pistons and cylinders being relatively reciprocated and rotated
- F04B9/00           Piston machines or pumps characterised by the driving or driven means to or from their working members**
- F04B9/02 . the means being mechanical
  - F04B9/02D . . [N: Driving of pistons coacting within one cylinder]
  - F04B9/04 . . the means being cams, eccentrics, or pin-and-slot mechanisms (with cylinder axes coaxial with, or parallel or inclined to, main shaft axis [F04B1/12](#))
  - F04B9/04C . . . [N: the means being cams]
  - F04B9/04E . . . [N: the means being eccentrics]
  - F04B9/04P . . . [N: the means being pin-and-slot mechanisms]
  - F04B9/06 . . the means including spring- or weight-loaded lost-motion devices
  - F04B9/08 . the means being fluid
  - F04B9/10 . . the fluid being liquid
  - F04B9/103 . . . having only one pumping chamber [N9410]
  - F04B9/103A . . . . [N: the movement of the pump piston in the two directions being obtained by two single-acting liquid motors each acting in one direction] [N9410]
  - F04B9/105 . . . . reciprocating movement of the pumping member being obtained by a double-acting liquid motor [N9410]
  - F04B9/105A . . . . . [N: one side of the double-acting liquid motor being always under the influence of the liquid under pressure] [N9410]
  - F04B9/105C . . . . . [N: with fluid-actuated inlet or outlet valve (mechanically controlled [F04B7/00](#))] [N9410]
  - F04B9/107 . . . . 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 [N9410]
  - F04B9/107A . . . . . [N: with actuation in the other direction by gravity] [N9410]
  - F04B9/107C . . . . . [N: with fluid-actuated inlet or outlet valve (mechanically controlled [F04B7/00](#))] [N9410]
  - F04B9/109 . . . having plural pumping chambers [N9410]
  - F04B9/109A . . . . [N: having two or more pumping chambers in series] [N9410]
  - F04B9/111 . . . . with two mechanically connected pumping members [N9410]
  - F04B9/111A . . . . . [N: the movement of the pumping pistons in only one direction being obtained by a single-acting piston liquid motor, e.g. actuation in the other direction by spring means] [N9410]
  - F04B9/113 . . . . . reciprocating movement of the pumping members being obtained by a double-acting liquid motor [N9410]
  - F04B9/115 . . . . . reciprocating movement of the pumping members being obtained by two single-acting liquid motors, each acting in one direction [N9410]
  - F04B9/117 . . . . the pumping members not being mechanically connected to each other [N9410]
  - F04B9/117A . . . . . [N: the movement of each pump piston in the two directions being obtained by a double-acting piston liquid motor] [N9410]

- F04B9/117A2 . . . . . [N: with fluid-actuated inlet or outlet valve (mechanically controlled [F04B7/00](#))] [N9410]
- F04B9/117C . . . . . [N: the movement of each piston in one direction being obtained by a single-acting piston liquid motor] [N9410]
- F04B9/117C2 . . . . . [N: the movement in the other direction being obtained by a hydraulic connection between the liquid motor cylinders] [N9410]
- F04B9/12 . . . . . the fluid being elastic, e.g. steam or air
- F04B9/12V . . . . . [N: using a source of partial vacuum or sub-atmospheric pressure]
- F04B9/12V4 . . . . . [N: the return stroke being obtained by a spring]
- F04B9/12V5 . . . . . [N: the return stroke being obtained by an elastic fluid under pressure]
- F04B9/123 . . . . . having only one pumping chamber [N9410]
- F04B9/123A . . . . . [N: the movement of the pump piston in the two directions being obtained by two single-acting piston fluid motors, each acting in one direction] [N9410]
- F04B9/125 . . . . . reciprocating movement of the pumping member being obtained by a double-acting elastic-fluid motor [N9410]
- F04B9/125A . . . . . [N: one side of the double-acting piston fluid motor being always under the influence of the fluid under pressure] [N9410]
- F04B9/125C . . . . . [N: with fluid-actuated inlet or outlet valve (mechanically controlled [F04B7/00](#))] [N9410]
- F04B9/127 . . . . . 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 [N9410]
- F04B9/127A . . . . . [N: with actuation in the other direction by gravity] [N9410]
- F04B9/127C . . . . . [N: with fluid-actuated inlet or outlet valve (mechanically controlled [F04B7/00](#))] [N9410]
- F04B9/129 . . . . . having plural pumping chambers [N9410]
- F04B9/129A . . . . . [N: having two or more pumping chambers in series] [N9410]
- F04B9/131 . . . . . with two mechanically connected pumping members [N9410]
- F04B9/131A . . . . . [N: the movement of the pumping pistons in only one direction being obtained by a single-acting piston fluid motor, e.g. actuation in the other direction by spring means] [N9410]
- F04B9/133 . . . . . reciprocating movement of the pumping members being obtained by a double-acting elastic-fluid motor [N9410]
- F04B9/135 . . . . . reciprocating movement of the pumping members being obtained by two single-acting elastic-fluid motors, each acting in one direction [N9410]
- F04B9/137 . . . . . the pumping members not being mechanically connected to each other [N9410]
- F04B9/137A . . . . . [N: the movement of each pump piston in the two directions is obtained by a double-acting piston fluid motor] [N9410]
- F04B9/137A2 . . . . . [N: with fluid-actuated inlet or outlet valve (mechanically controlled [F04B7/00](#))] [N9410]
- F04B9/137C . . . . . [N: the movement of each piston in one direction being obtained by a single-acting piston fluid motor] [N9410]
- F04B9/137C2 . . . . . [N: the movement in the other direction being obtained by an hydraulic connection between the fluid motor cylinders] [N9410]
- F04B9/14 . . . . . Pumps characterised by muscle-power operation [N: hand-held spraying or dispensing apparatus using pumps or bulbs [B05B11/00](#)]

**F04B11/00**      **Equalisation of pulses, e.g. by use of air vessels; Counteracting cavitation**

- F04B11/00A . [N: using accumulators]
- F04B11/00A2 . . [N: with a fluid spring]
- F04B11/00A2C . . . [N: the spring fluid being in direct contact with the pumped fluid]
- F04B11/00A4 . . [N: with a mechanical spring]
  
- F04B11/00C . [N: by piston speed control ([F04B11/00P2](#) takes precedence)]
  
- F04B11/00P . [N: using two or more pumping pistons]
- F04B11/00P2 . . [N: with piston speed control]
- F04B11/00P2C . . . [N: with special shape of the actuating element]
- F04B11/00P4 . . [N: connected in series]
- F04B11/00P4D . . . [N: the pistons having different cross-sections]
  
- F04B11/00R . [N: using a special shape of fluid pass, e.g. throttles, ducts]
  
- F04B13/00** **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 [B67D5/40](#))**
  
- F04B13/02 . of two or more fluids at the same time
  
- F04B15/00** **Pumps adapted to handle specific fluids, e.g. by selection of specific materials for pumps or pump parts**
  
- F04B15/02 . the fluids being viscous or non-homogeneous
- F04B15/02B . . [N: supply of fluid to the pump by gravity through a hopper, e.g. without intake valve]
  
- F04B15/04 . the fluids being hot or corrosive ([F04B15/06](#) takes precedence)
  
- F04B15/06 . for liquids near their boiling point, e.g. under subnormal pressure
- F04B15/08 . . the liquids having low boiling points
  
- F04B17/00** **Pumps characterised by combination with, or adaptation to, specific driving engines or motors**
  
- F04B17/00P . [N: driven by piezo-electric means ([F04B43/04M2](#) and [F04B43/09P](#) take precedence)]
  
- F04B17/00S . [N: Solar operated]
  
- F04B17/02 . driven by wind motors
  
- F04B17/03 . driven by electric motors [N9410]
- F04B17/04 . . using solenoids
- F04B17/04B . . . [N: the solenoid motor being separated from the fluid flow] [N9908]
- F04B17/04B2 . . . . [N: using solenoids directly actuating the piston] [N9908]

- F04B17/04D . . . [N: the fluid flowing through the moving part of the motor] [N9908]
- F04B17/04F . . . [N: the fluid flowing around the moving part of the motor] [N9908]
- F04B17/05 . driven by internal-combustion engines [N9410]
- F04B17/06 . Mobile combinations
- F04B19/00** **Machines or pumps having pertinent characteristics not provided for in, or of interest apart from, groups [F04B1/00](#) to [F04B17/00](#)**
- F04B19/00F . [N: free-piston type pumps]
- F04B19/00M . [N: Micro pumps ([F04B43/04M](#) and [F04B43/09P](#) take precedence)]
- F04B19/02 . having movable cylinders
- F04B19/02H . . [N: reciprocating cylinders]
- F04B19/02R . . [N: cylinders rotating around their own axis]
- F04B19/02S . . [N: cylinders oscillating around an axis perpendicular to their own axis]
- F04B19/04 . Pumps for special use (for transferring liquids from bulk storage containers or reservoirs into vehicles or into portable containers [B67D5/40](#))
- F04B19/06 . . Pumps for delivery of both liquid and elastic fluid at the same time (wet gas pumps [F04B37/20](#))
- F04B19/08 . Scoop devices
- F04B19/10 . . of wheel type
- F04B19/12 . . of helical or screw-type
- F04B19/14 . . of endless-chain type, e.g. with the chains carrying pistons co-operating with open-ended cylinders
- F04B19/16 . Adhesion-type liquid-lifting devices
- F04B19/18 . . Adhesion members therefor
- F04B19/20 . Other positive-displacement pumps
- F04B19/22 . . of reciprocating-piston type
- F04B19/24 . . Pumping by heat expansion of pumped fluid
- F04B23/00** **Pumping installations or systems ([F04B17/00](#) takes precedence)**
- F04B23/02 . having reservoirs
- F04B23/02B . . [N: the pump being immersed in the reservoir] [N9507]
- F04B23/02B2 . . . [N: only the pump-part being immersed, the driving-part being outside the reservoir] [N9507]
- F04B23/02C . . [N: the pump being located directly adjacent the reservoir] [N9507]
- F04B23/02C2 . . . [N: a pump-side forming a wall of the reservoir] [N9507]
- F04B23/02C4 . . . [N: the pump being mounted on top of the reservoir] [N9507]
- F04B23/04 . Combinations of two or more pumps

- F04B23/06 . . . the pumps being all of reciprocating positive-displacement type
- F04B23/08 . . . the pumps being of different types
- F04B23/10 . . . . at least one pump being of the reciprocating positive-displacement type
- F04B23/10B . . . . . [N: being a radial piston pump]
- F04B23/10D . . . . . [N: being an axial piston pump]
- F04B23/12 . . . . at least one pump being of the rotary-piston positive-displacement type ([F04B23/10](#) takes precedence)
- F04B23/14 . . . . at least one pump being of the non-positive-displacement type ([F04B23/10](#), [F04B23/12](#) take precedence)

**Guide heading:** **Pumps specially adapted for elastic fluids (having a flexible working member F04B45/00; for raising fluid from great depths F04B47/00)**

#### **F04B25/00 Multi-stage pumps**

- F04B25/00P . [N: with two cylinders]
- F04B25/02 . of stepped piston type
- F04B25/04 . having cylinders coaxial with, or parallel or inclined to, main shaft axis

#### **F04B27/00 Multi-cylinder pumps characterised by number or arrangement of cylinders ([F04B25/00](#) takes precedence; control of reciprocating machines or pumps in general [F04B49/00](#))**

- F04B27/00P . [N: with two cylinders]
- F04B27/02 . having cylinders arranged oppositely relative to main shaft
- F04B27/04 . having cylinders in star- or fan-arrangement
- F04B27/04K . . [N: Details, component parts specially adapted for such pumps]
- F04B27/04K2 . . . [N: Pistons]
- F04B27/04K3 . . . [N: Cams]
- F04B27/04K3B . . . . [N: consisting of several cylindrical elements, e.g. rollers]
- F04B27/04K4 . . . [N: Cylinders]
- F04B27/04K5 . . . [N: Arrangements for pressing or connecting the pistons against the actuated cam]
- F04B27/04K5B . . . . [N: hydraulically]
- F04B27/04K6 . . . [N: Disconnecting the pistons from the actuated cam (in general [F01B31/24](#))]
- F04B27/04K7 . . . [N: Supporting and guiding means for the pistons]
- F04B27/04K10 . . . [N: Draining of the engine housing; Arrangements dealing with leakage fluid]
- F04B27/04K15 . . . [N: Particularities relating to the distribution members ([F04B27/047A](#), [F04B27/053A](#) and [F04B27/053C](#) take precedence)]
- F04B27/04K15C . . . . [N: to cylindrical distribution members]
- F04B27/04K15K . . . . [N: to conical distribution members]
- F04B27/04K15V . . . . [N: to plate like distribution members]

- F04B27/047 . . with an actuating element at the outer ends of the cylinders [N9410]
- F04B27/047A . . . [N: with cam-actuated distribution members] [N9410]
- F04B27/047C . . . [N: with two or more series radial piston-cylinder units] [N9410]
- F04B27/047C2 . . . . [N: directly located side-by-side] [N9410]
- F04B27/047C4 . . . . [N: Coupling of several cylinder-barrels] [N9410]
- F04B27/053 . . with an actuating element at the inner ends of the cylinders [N9410]
- F04B27/053A . . . [N: with cam-actuated distribution members] [N9410]
- F04B27/053A2 . . . . [N: each machine piston being provided with channels, which are coaxing with the cylinder and are used as a distribution member for another piston-cylinder unit] [N9410]
- F04B27/053C . . . [N: the piston-driving cam being provided with an inlet or an outlet] [N9410]
- F04B27/053E . . . [N: with two or more series radial piston-cylinder units] [N9410]
- F04B27/053E2 . . . . [N: directly located side-by-side] [N9410]
- F04B27/06 . . the cylinders being movable, e.g. rotary [N: ([F04B27/08](#) takes precedence)]
- F04B27/06A . . . [N: having cylinders in star- or fan-arrangement, the connection of the pistons with an actuating element being at the outer ends of the cylinders]
- F04B27/06A2 . . . . [N: rotary cylinder block]
- F04B27/06A2A . . . . . [N: cylinder block and actuating cam rotating together ([F04B27/06A2B2](#) and [F04B27/06A2B3A](#) take precedence)]
- F04B27/06A2B . . . . . [N: with two or more series radial piston cylinder units]
- F04B27/06A2B2 . . . . . [N: cylinder block and actuating cam both rotating ([F04B27/06A2B3A](#) takes precedence)]
- F04B27/06A2B3 . . . . . [N: directly located side by side]
- F04B27/06A2B3A . . . . . {7 dots} [N: cylinder block and actuating cam both rotating]
- F04B27/06B . . . [N: having cylinders in star- or fan-arrangement, the connection of the pistons with an actuating element being at the inner ends of the cylinders]
- F04B27/06B2 . . . . [N: rotary cylinder block]
- F04B27/06B2D . . . . . [N: the rotary cylinder being provided with only one piston, reciprocating within this cylinder]
- F04B27/067 . . Control [N9410]
- F04B27/067B . . . [N: by using a valve in a system with several pumping chambers, wherein the flow-path through the chambers can be changed, e.g. series-parallel] [N9410]
- F04B27/067K . . . [N: by changing the phase relationship between the actuating cam and the distribution means] [N9410]
- F04B27/073 . . . by varying the relative eccentricity between two members, e.g. a cam and a drive shaft [N9410]
- F04B27/08 . . having cylinders coaxial with, or parallel or inclined to, main shaft axis
- F04B27/08B . . [N: having rotary cylinder block (see [F01B3/00B](#), [F03C1/06E](#), [F03C1/20](#))]
- F04B27/08B2 . . . [N: having two or more sets of cylinders or pistons]
- F04B27/08B2B . . . . [N: inclined to main shaft axis]
- F04B27/08B3 . . . [N: arrangements for pressing the cylinder barrel against the valve plate e.g. by fluid pressure]
- F04B27/08B4 . . . [N: component parts, details, e.g. valves, sealings, lubrication]
- F04B27/08B4B . . . . [N: particularities in the contacting area between cylinder barrel and valve plate]

- F04B27/08B4B2 . . . . . [N: bearing means]
- F04B27/08B4C . . . . . [N: cylinder barrel]
- F04B27/08B4D . . . . . [N: valve means, e.g. valve plate]
- F04B27/08B4D3 . . . . . [N: cylindrical valve means]
- F04B27/08B4D5 . . . . . [N: conical valve means]
- F04B27/08B4F . . . . . [N: machine housing]
- F04B27/08B4F2 . . . . . [N: cylinder barrel bearing means]
- F04B27/08B4G . . . . . [N: swash plate]
- F04B27/08B4G2 . . . . . [N: swash plate bearing means or driving axis bearing means]
- F04B27/08B6 . . . . . [N: connection between rotating cylinder barrel and rotating inclined swash plate]
- F04B27/08D . . . . . [N: Component parts, e.g. sealings; Manufacturing or assembly thereof] [C9908]
- F04B27/08D3 . . . . . [N: Pistons] [C9908]
- F04B27/08D3R . . . . . [N: piston shoe retaining means]
- F04B27/08D3S . . . . . [N: Piston shoes] [N9908]
- F04B27/08D5 . . . . . [N: casings, housings]
- F04B27/08D7 . . . . . [N: driving means]
- F04B27/10 . . . . . having stationary cylinders [N9410]
- F04B27/10A . . . . . [N: Distribution members] [N9410]
- F04B27/10A2 . . . . . [N: Cylindrical distribution members] [N9410]
- F04B27/10A4 . . . . . [N: Conical distribution members] [N9410]
- F04B27/10C . . . . . [N: Component parts, details, e.g. sealings, lubrication] [N9410]
- F04B27/10C2 . . . . . [N: Cylinders] [N9410]
- F04B27/10C4 . . . . . [N: Actuating elements] [N9410]
- F04B27/10C4A . . . . . [N: Actuating-element bearing means or driving-axis bearing means] [N9410]
- F04B27/10C4P . . . . . [N: Pivot mechanisms] [N9811]
- F04B27/10C6 . . . . . [N: Casings, housings] [N9410]
- F04B27/10C8 . . . . . [N: Lubrication] [N9906]
- F04B27/12 . . . . . having plural sets of cylinders or pistons [N9410]
- F04B27/14 . . . . . Control [N9410]
- F04B27/16 . . . . . of pumps with stationary cylinders [N9410]
- F04B27/18 . . . . . by varying the relative positions of a swash plate and a cylinder block [N9410]
- F04B27/18B . . . . . [N: Controlled by crankcase pressure] [N9410]
- F04B27/20 . . . . . of pumps with rotary cylinder block [N9410]
- F04B27/22 . . . . . by varying the relative positions of a swash plate and a cylinder block [N9410]
- F04B27/24 . . . . . Control not provided for in a single group of groups [F04B27/02](#) to [F04B27/22](#) [N9410]

**F04B29/00** [N: IPC5] **Other pumps with movable, e.g. rotatable cylinders**

**F04B31/00** **Free-piston pumps; Systems incorporating such pumps** (muscle-driven pumps in which the stroke is not defined by gearing [F04B33/00](#); free-piston combustion engines,

free-piston gas generators [F02B71/00](#); systems predominated by prime mover aspects, see the relevant classes for the prime mover)

- F04B33/00**                    **Pumps actuated by muscle power, e.g. for inflating**
- F04B33/00D                . [N: specially adapted for inflating tyres of non-motorised vehicles, e.g. cycles, tricycles]
- F04B33/02                . with intermediate gearing
- F04B35/00**                    **Piston pumps 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)**
- F04B35/00C                . [N: driven by internal combustion engines]
- F04B35/00F                . [N: driven by floating elements]
- F04B35/00S                . [N: driven by steam engines]
- F04B35/00T                . [N: the means being a fluid transmission link]
- F04B35/01                . the means being mechanical
- F04B35/04                . the means being electric
- F04B35/04S                . . [N: using solenoids]
- F04B35/06                . Mobile combinations
- F04B37/00**                    **Pumps having pertinent characteristics not provided for in, or of interest apart from, groups [F04B25/00](#) to [F04B35/00](#)**
- F04B37/02                . for evacuating by absorption or adsorption ([absorption or adsorption in general B01J](#); [N: for gas-filled discharge tubes see [H01J17/24](#)])
- F04B37/04                . . Selection of specific absorption or adsorption materials
- F04B37/06                . for evacuating by thermal means
- F04B37/08                . . by condensing or freezing, e.g. cryogenic pumps ([cold traps B01D8/00](#))
- F04B37/08R                . . . [N: Regeneration of cyro-pumps] [N9611]
- F04B37/10                . for special use ([F04B37/02](#), [F04B37/06](#) take precedence)
- F04B37/12                . . to obtain high pressure
- F04B37/14                . . to obtain high vacuum
- F04B37/16                . . . Means for nullifying unswept space
- F04B37/18                . . for specific elastic fluid
- F04B37/20                . . . for wet gases, e.g. wet air

**F04B39/00**

**Component parts, details, or accessories, of pumps or pumping systems, not otherwise provided for in, or of interest apart from, groups [F04B25/00](#) to [F04B37/00](#) (for controlling [F04B49/00](#))**

- F04B39/00B . [N: adaptations of pistons]
- F04B39/00B2 . . [N: liquid pistons]
- F04B39/00B4 . . [N: with valve arranged in the piston]
- F04B39/00B6 . . [N: piston rods]
  
- F04B39/00D . [N: Pulsation and noise damping means]
- F04B39/00D2 . . [N: with encapsulations] [N9908]
- F04B39/00D2B . . . [N: of inlet or outlet channels] [N9908]
- F04B39/00D4 . . [N: with vibration damping supports] [N9908]
- F04B39/00D6 . . [N: with direct action on the fluid flow using absorptive materials] [N9908]
- F04B39/00D8 . . [N: with a special shape of fluid passage, e.g. bends, throttles, diameter changes, pipes] [N9908]
- F04B39/00D8A . . . [N: using muffler volumes] [N0008]
- F04B39/00D8H . . . [N: using sidebranch resonators, e.g. Helmholtz resonators] [N0008]
- F04B39/00D8M . . . [N: characterised by assembly or mounting] [N0008]
- F04B39/00D12 . . [N: by generating oil foam] [N0008]
- F04B39/00D14 . . [N: using blow off silencers] [N0008]
- F04B39/00D16 . . [N: using mechanical tuned resonators] [N0008]
  
- F04B39/00K . [N: crankshaft]
  
- F04B39/02 . Lubrication (of machines or engines in general [F01M](#))
- F04B39/02C . . [N: with lubrication control systems] [N9906]
- F04B39/02M . . [N: characterised by the use of a special lubricant] [N9906]
- F04B39/02T . . [N: characterised by the compressor type (swash-plate compressors [F04B27/10C8](#))] [N9906]
- F04B39/02T1 . . . [N: Hermetic compressors] [N9906]
- F04B39/02T1D . . . . [N: with oil distribution channels] [N9906]
- F04B39/02T1D1 . . . . . [N: in the rotating shaft] [N9906]
- F04B39/02T1D1C . . . . . [N: using centrifugal force for transporting the oil] [N9906]
- F04B39/02T1P . . . . [N: with an auxiliary oil pump] [N9906]
- F04B39/02T1S . . . . [N: with device for spraying lubricant or with mist lubrication] [N9906]
- F04B39/02T5 . . . [N: the pump being of the reciprocating piston type, e.g. oscillating, free-piston compressors] [N9906]
- F04B39/02V . . [N: Constructional details, e.g. reservoirs in the casing (swash-plate compressors [F04B27/08D3](#), [F04B27/10C8](#))] [N9906]
- F04B39/02V5 . . . [N: Lubrication of pistons or cylinders] [N9906]
  
- F04B39/04 . Measures to avoid lubricant contaminating the pumped fluid
- F04B39/04B . . [N: sealing for a reciprocating rod (sealing in general [F16J](#))]
- F04B39/04B2 . . . [N: sealing being provided on the piston]

- F04B39/04B4 . . . [N: sealing with a rolling diaphragm between piston and cylinder]
- F04B39/04B6 . . . [N: Labyrinth-sealing between piston and cylinder]
- F04B39/04B8 . . . [N: Sealing between piston and carter being provided by a bellow]
- F04B39/04B10 . . . [N: Sealing between piston and carter being provided by a diaphragm]
  
- F04B39/06 . Cooling (of machines or engines in general [F01P](#)); Heating; Prevention of freezing
- F04B39/06B . . [N: Cooling by injecting a liquid in the gas to be compressed]
- F04B39/06C . . [N: Cooling by a cooling jacket in the pump casing]
- F04B39/06D . . [N: Cooling by ventilation]
- F04B39/06P . . [N: prevention of freezing]
  
- F04B39/08 . Actuation of distribution members
  
- F04B39/10 . Adaptations or arrangements of distribution members
- F04B39/10B . . [N: the members being ball valves]
- F04B39/10C . . [N: the members being of the poppet valve type]
- F04B39/10D . . [N: the members being disc valves]
- F04B39/10D2 . . . [N: without spring ([F04B39/10D3](#) takes precedence)]
- F04B39/10D3 . . . [N: annular disc valves]
- F04B39/10F . . [N: the members being parallel flexible strips]
- F04B39/10G . . [N: Combination of in- and outlet valve]
- F04B39/10H . . [N: the members being Hoerbigen valves]
- F04B39/10N . . [N: the members being parallel non-flexible strips]
- F04B39/10P . . [N: Valve plates]
- F04B39/10R . . [N: the members being reed valves]
- F04B39/10R2 . . . [N: circular reed valves]
- F04B39/10R3 . . . [N: flat annular reed valves]
- F04B39/10W . . [N: the members being low-resistance valves allowing free streaming]
  
- F04B39/12 . Casings (casings for machines or engines in general [F16M](#)); Cylinders; Cylinders heads; Fluid connections
- F04B39/12C . . [N: Casings]
- F04B39/12D . . [N: Cylinder block]
- F04B39/12F . . [N: Fluid connections]
- F04B39/12H . . [N: Cylinder heads]
- F04B39/12L . . [N: Cylinder liners]
- F04B39/12M . . [N: Mounting of a cylinder block in a casing]
- F04B39/12V . . [N: Crankcases] [C9908]
  
- F04B39/14 . Provisions for readily assembling or disassembling
  
- F04B39/16 . Filtration; Moisture separation
  
- F04B41/00** . **Pumping installations or systems** ([F04B31/00](#), [F04B35/00](#) take precedence)

- F04B41/02 . having reservoirs
- F04B41/04 . Conversion of internal-combustion engine cylinder units to pumps
- F04B41/06 . Combinations of two or more pumps

**Guide heading:** **Machines or pumps having flexible working members**

**F04B43/00** **Machines, pumps, or pumping installations having flexible working members**  
(pumps or pumping installations specially adapted for elastic fluids [F04B45/00](#))

- F04B43/00D . [N: Special features]
- F04B43/00D2 . . [N: the periphery of the flexible member being not fixed to the pump-casing, but acting as a valve]
- F04B43/00D3 . . [N: without valves]
- F04B43/00D5 . . [N: the flexible member being formed as an O-ring]
- F04B43/00D7 . . [N: with a number of independent working chambers which are actuated successively by one mechanism]
- F04B43/00D8 . . [N: particularities of the flexible members]
- F04B43/00D8B . . . [N: bell-shaped flexible members]
- F04B43/00D8T . . . [N: of tubular flexible members]
- F04B43/00D9 . . [N: systems, control, safety measures]
- F04B43/00D9B . . . [N: leakage control; pump systems with two flexible members; between the actuating element and the pumped fluid]
- F04B43/02 . having plate-like flexible members, e.g. diaphragms
- F04B43/02B . . [N: the plate-like flexible member is pressed against a wall by a number of elements, each having an alternating movement in a direction perpendicular to the plane of the plate-like flexible member and each having its own driving mechanism]
- F04B43/02D . . [N: double acting plate-like flexible member]
- F04B43/02P . . [N: two or more plate-like pumping members in parallel]
- F04B43/02P3 . . . [N: each plate-like pumping flexible member working in its own pumping chamber]
- F04B43/02V . . [N: with in- or outlet valve arranged in the plate-like flexible member (valve arranged in the piston [F04B53/12](#))]
- F04B43/04 . . Pumps having electric drive
- F04B43/04M . . . [N: Micro pumps]
- F04B43/04M2 . . . . [N: with piezo-electric drive]
- F04B43/06 . . Pumps having fluid drive
- F04B43/067 . . . the fluid being actuated directly by a piston [N9410]
- F04B43/073 . . . the actuating fluid being controlled by at least one valve [N9410]
- F04B43/073A . . . . [N: with fluid-actuated pump inlet or outlet valves; with two or more pumping chambers in series] [N9410]
- F04B43/073C . . . . [N: with two or more pumping chambers in parallel] [N9410]
- F04B43/08 . having tubular flexible members ([F04B43/12](#) takes precedence)

- F04B43/08B . . [N: the tubular flexible member being pressed against a wall by a number of elements, each having an alternating movement in a direction perpendicular to the axes of the tubular member and each having its own driving mechanism]
- F04B43/08D . . [N: the tubular member being deformed by stretching ou distersion]
- F04B43/08P . . [N: with two or more tubular flexible members in parallel ([F04B43/113C](#) takes precedence)]
- F04B43/08S . . [N: with two or more tubular flexible members in series ([F04B43/113A](#) takes precedence)]
- F04B43/09 . . Pumps having electric drive [N9410]
- F04B43/09P . . . [N: Piezo-electric drive] [N9410]
- F04B43/10 . . Pumps having fluid drive
- F04B43/107 . . . the fluid being actuated directly by a piston [N9410]
- F04B43/113 . . . the actuating fluid being controlled by at least one valve [N9410]
- F04B43/113A . . . . [N: with fluid-actuated pump inlet or outlet valves; with two or more pumping chambers in series] [N9410]
- F04B43/113C . . . . [N: with two or more pumping chambers in parallel] [N9410]
- F04B43/12 . . having peristaltic action
- F04B43/12B . . [N: the actuating element being a swash plate]
- F04B43/12C . . [N: having no backing plate (deforming of the tube only by rollers)]
- F04B43/12D . . [N: the actuating elements, e.g. rollers, moving in a straight line during squeezing]
- F04B43/12E . . [N: using an excenter as the squeezing element]
- F04B43/12F . . [N: using only one roller as the squeezing element, the roller moving on an arc of a circle during squeezing]
- F04B43/12F2 . . . [N: the roller being placed at the outside of the tubular flexible member]
- F04B43/12G . . [N: by using two or more rollers as squeezing elements, the rollers moving on an arc of a circle during squeezing]
- F04B43/12G2 . . . [N: the rollers being placed at the outside of the tubular flexible member]
- F04B43/12G4 . . . [N: the rotary axes of the rollers lying in a plane perpendicular to the rotary axis of the driving motor]
- F04B43/12G6 . . . [N: Means for pushing the rollers against the tubular flexible member]
- F04B43/12G8 . . . [N: Means for pushing the backing-plate against the tubular flexible member]
- F04B43/12G10 . . . [N: Pumps specially adapted for several tubular flexible members]
- F04B43/14 . . having plate-like flexible members

**F04B45/00 Pumps or pumping installations having flexible working members and specially adapted for elastic fluids**

- F04B45/02 . . having bellows
- F04B45/02P . . [N: with two or more bellows in parallel]
- F04B45/02S . . [N: with two or more bellows in series]
- F04B45/027 . . having electric drive [N9410]
- F04B45/033 . . having fluid drive [N9410]
- F04B45/033A . . . [N: the fluid being actuated directly by a piston] [N9410]
- F04B45/033C . . . [N: the actuating fluid being controlled by one or more valves] [N9410]

- F04B45/04 . having plate-like flexible members, e.g. diaphragms
- F04B45/04D . . [N: double acting plate-like flexible pumping member]
- F04B45/04P . . [N: two or more plate-like pumping flexible members in parallel]
- F04B45/04V . . [N: with in- or outlet valve arranged in the plate-like pumping flexible members]
- F04B45/047 . . Pumps having electric drive [N9410]
- F04B45/053 . . Pumps having fluid drive [N9410]
- F04B45/053A . . . [N: the fluid being actuated directly by a piston] [N9410]
- F04B45/053C . . . [N: the actuating fluid being controlled by one or more valves] [N9410]
  
- F04B45/06 . having tubular flexible members ([F04B45/02](#) takes precedence)
- F04B45/06F . . [N: with fluid drive]
- F04B45/06F3 . . . [N: the fluid being actuated directly by a piston]
- F04B45/06F4 . . . [N: the actuating fluid being controlled by one or more valves]
- F04B45/06G . . [N: with electric drive]
- F04B45/067 . . Pumps having electric drive [N9410]
- F04B45/073 . . Pumps having fluid drive [N9410]
- F04B45/073A . . . [N: the fluid being actuated directly by a piston] [N9410]
- F04B45/073C . . . [N: the actuating fluid being controlled by one or more valves] [N9410]
- F04B45/08 . . having peristaltic action
- F04B45/08B . . . [N: the actuating element being a swash plate]
- F04B45/10 . . having plate-like flexible members
  
- F04B47/00** **Pumps or pumping installation 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 [F04F1/00](#))
  
- F04B47/00K . [N: Sand trap arrangements]
  
- F04B47/02 . the driving mechanisms being situated at ground level ([F04B47/12](#) takes precedence)
- F04B47/02D . . [N: driving of the walking beam]
- F04B47/02M . . [N: actuated by muscle power]
- F04B47/02P . . [N: Pull rods, full rod component parts]
- F04B47/02V . . [N: details of the walking beam]
- F04B47/04 . . the driving means incorporating fluid means
  
- F04B47/06 . having motor-pump units situated at great depth
- F04B47/08 . . the motor being actuated by fluid
- F04B47/10 . . . the units or parts thereof being liftable to ground level by fluid pressure
  
- F04B47/12 . having free plunger lifting the fluid to the surface
  
- F04B47/14 . Counterbalancing
- F04B47/14F . . with fluid means
  
- F04B49/00** **Control** [N: e.g. of pump delivery, or pump pressure] **of, or safety measures for,**

**machines, pumps, or pumping installations, not otherwise provided for, or of interest apart from, groups [F04B1/00](#) to [F04B47/00](#)**

**[N: Note**

The classification symbols in group [F04B49/00](#) and subgroups can be followed by additional symbols preceded by the sign "+". The symbols are applied in subgroups [F04B49/06](#), [F04B49/08](#), [F04B49/16](#) and [F04B49/22A](#). The symbols have the meanings as listed below:

+C specially adapted for pumps for elastic fluids,  
e.g. compressors  
+P specially adapted for pumps for liquids  
]

- [F04B49/00A](#) . [N: Hydraulic systems to change the pump delivery]
- [F04B49/00F](#) . [N: changing the phase relationship of two working pistons in one working chamber or the phase-relationship of a piston and a driven distribution member]
- [F04B49/00H](#) . [N: Installations or systems with two or more pumps or pump cylinders, wherein the flow-path through the stages can be changed, e.g. from series to parallel (**centrifugal pumps [F04D15/00H](#)**)]
- [F04B49/02](#) . Stopping, starting, unloading or idling control (**controlled electrically [F04B49/06](#)**) [C9410]
- [F04B49/02C](#) . . [N: by means of pressure]
- [F04B49/025](#) . . by means of floats [N9410]
- [F04B49/03](#) . . by means of valves [N9410]
- [F04B49/035](#) . . . Bypassing [N9410]
- [F04B49/04](#) . Regulating by means of floats (**[F04B49/025](#) takes precedence**) [C9410]
- [F04B49/06](#) . Control using electricity (**regulating by means of floats actuating electric switches [F04B49/04](#)**)
- [F04B49/06C](#) . . [N: and making use of computers]
- [F04B49/08](#) . Regulating by delivery pressure
- [F04B49/10](#) . Other safety measures
- [F04B49/10S](#) . . [N: Responsive to speed]
- [F04B49/10V](#) . . [N: Responsive to pumped volume]
- [F04B49/12](#) . by varying the length of stroke of the working members [N9410]
- [F04B49/12A](#) . . [N: Lost-motion device in the driving mechanism] [N9410]
- [F04B49/12C](#) . . [N: by changing the eccentricity of one element relative to another element] [N9410]
- [F04B49/12C2](#) . . . [N: by changing the eccentricity of the actuation means, e.g. cams or cranks, relative to the driving means, e.g. driving shafts (**[F04B49/12C4](#) takes precedence**)] [N9810]
- [F04B49/12C2B](#) . . . . [N: with a double eccenter mechanism] [N9810]

- F04B49/12C4 . . . [N: by changing the eccentricity of the cylinders, e.g. by moving a cylinder block] [N9810]
- F04B49/14 . . Adjusting abutments located in the path of reciprocation [N9410]
- F04B49/16 . by adjusting the capacity of dead spaces of working chambers [N9410]
- F04B49/18 . by changing the effective cross-section of the working surface of the piston [N9410]
- F04B49/20 . by changing the driving speed (controlled electrically [F04B49/06](#)) [N9410]
- F04B49/22 . by means of valves ([F04B49/03](#) takes precedence) [N9410]
- F04B49/22A . . [N: with throttling valves or valves varying the pump inlet opening or the outlet opening] [N9410]
- F04B49/24 . . Bypassing [N9410]
- F04B49/24B . . . [N: by keeping open the inlet valve] [N9410]
- F04B49/24C . . . [N: by keeping open the outlet valve] [N9410]

#### **F04B51/00 Testing machines, pumps, or pumping installations**

#### **F04B53/00 Component parts, details or accessories not provided for in, or of interest apart from, groups [F04B1/00](#) to [F04B23/00](#) or [F04B39/00](#) to [F04B47/00](#) [C9410]**

- F04B53/00D . [N: Noise damping] [N0102]  
[N: **WARNING**  
Group [F04B53/00D](#) and subgroups are not complete, see [F04B11/00](#), [F04B53/16](#)  
]
- F04B53/00D2 . . [N: by encapsulation] [N0102]
- F04B53/00D4 . . [N: by damping supports] [N0102]
- F04B53/00D6 . . [N: by mechanical resonators] [N0102]
- F04B53/00F . [N: Adaptations or arrangements of valves used as foot valves, of suction strainers, or of mud-boxes] [N9410]
- F04B53/00K . [N: Crankshafts] [N9410]
- F04B53/00P . [N: Cylinder heads] [N9410]
- F04B53/00S . [N: Spacing or clearance between cylinder and piston] [N9410]
- F04B53/02 . Packing the free space between cylinders and pistons [N9410]
- F04B53/04 . Draining [N9410]
- F04B53/06 . Venting [N9410]
- F04B53/08 . Cooling (of machines or engines in general [F01P](#)); Heating; Preventing freezing [N9410]
- F04B53/10 . Valves; Arrangement of valves [C9410]

F04B53/10B	. .	[N: Ball valves]
F04B53/10B4	. . .	[N: being formed by two closure members working in series]
F04B53/10B6	. . .	[N: having means for guiding the closure member]
F04B53/10B8	. . .	[N: having means for limiting the opening height]
F04B53/10B8B	. . . .	[N: and means for controlling the opening height]
F04B53/10B12	. . .	[N: Combinations of ball valves working in parallel]
F04B53/10B14	. . .	[N: Semi-spherical ball valves]
F04B53/10D	. .	[N: Disc valves]
F04B53/10D4	. . .	[N: having means for guiding the closure member axially]
F04B53/10D4B	. . . .	[N: the guiding means being provided within the valve opening]
F04B53/10D4D	. . . .	[N: the guiding means being provided at both sides of the disc]
F04B53/10D6	. . .	[N: Flat-annular type disc valves]
F04B53/10D8	. . .	[N: Spring-actuated disc valves ( <a href="#">F04B53/10D4</a> , <a href="#">F04B53/10D6</a> take precedence)]
F04B53/10D10	. . .	[N: with means for limiting the opening height]
F04B53/10F	. .	[N: Flap valves]
F04B53/10F2	. . .	[N: the closure member being a rigid element oscillating around a fixed point]
F04B53/10F2B	. . . .	[N: by means of a flexible connection]
F04B53/10F2D	. . . .	[N: the valve being formed by two elements]
F04B53/10F4	. . .	[N: the valve being formed by one or more flexible elements]
F04B53/10F4B	. . . .	[N: one flexible element oscillating around a fixed point]
F04B53/10F4C	. . . .	[N: two flexible elements oscillating around a fixed point]
F04B53/10F4D	. . . .	[N: more than two flexible elements oscillating around a fixed point]
F04B53/10F4E	. . . .	[N: the valve being a tube, e.g. normally closed at one end]
F04B53/10F4F	. . . .	[N: the valve being a membrane]
F04B53/10F4F2	. . . . .	[N: fixed at two or more points at its periphery]
F04B53/10F4F4	. . . . .	[N: fixed at its centre]
F04B53/10F4F6	. . . . .	[N: fixed at its whole periphery and with an opening at its centre]
F04B53/10F4F6A	. . . . .	[N: the opening normally being closed by a fixed element]
F04B53/10G	. .	[N: the valve being an elastic body, the length thereof changing in the opening direction]
F04B53/10H	. .	[N: the valve being a flexible annular ring]
F04B53/10K	. .	[N: Flow resistance valves, e.g. without moving parts]
F04B53/10M	. .	[N: Valves characterised by the material]
F04B53/10M2	. . .	[N: magnetic]
F04B53/10P	. .	[N: having means for limiting the opening height ( <a href="#">F04B53/10B8</a> and <a href="#">F04B53/10D10</a> take precedence)]
F04B53/10S	. .	[N: Valve seats]
F04B53/10T	. .	[N: inlet and outlet valve forming one unit]
F04B53/10T2	. . .	[N: and one single element forming both the inlet and outlet closure member]
F04B53/10W	. .	[N: Valves linked to another valve of another pumping chamber]
F04B53/10Z	. .	[N: with means for lifting the closure member for pump cleaning purposes]
F04B53/12	. .	arranged in or on pistons [N9410]

- F04B53/12A . . . [N: the valve being an annular ring surrounding the piston, e.g. an O-ring] [N9410]
- F04B53/12C . . . [N: the piston being free-floating, e.g. the valve being formed between the actuating rod and the piston] [N9410]
- F04B53/12F . . . [N: Flexible valves] [N9410]
- F04B53/12H . . . [N: Oscillating valves] [N9410]
- F04B53/12R . . . [N: Reciprocating valves] [N9410]
- F04B53/12R2 . . . . [N: Ball valves] [N9410]
- F04B53/12R4 . . . . [N: Disc valves] [N9410]
- F04B53/12R4A . . . . . [N: Annular disc valves] [N9410]
- F04B53/12R6 . . . . [N: Poppet valves] [N9410]
  
- F04B53/14 . . . Pistons, piston-rods or piston-rod connections [N9410]
- F04B53/14B . . . [N: Intermediate liquid piston between the driving piston and the pumped liquid ([F04B43/06](#) and [F04B43/10](#) take precedence)] [N9410]
- F04B53/14C . . . [N: Intermediate liquid-piston between a driving piston and a driven piston ([F04B9/10](#), [F04B43/06](#), [F04B43/10](#) and [F04B53/14B](#) take precedence)] [N9410]
- F04B53/14P . . . [N: Sealing provided on the piston] [N9410]
- F04B53/14R . . . [N: Adaptation of piston-rods] [N9410]
- F04B53/14R4 . . . . [N: Rod shock absorber] [N9410]
- F04B53/14R5 . . . . [N: Piston-rod guiding arrangements] [N9410]
- F04B53/14R7 . . . . [N: Mounting or detaching of piston rod] [N9410]
- F04B53/14V . . . [N: the piston being provided with channels which are coacting with the cylinder and are used as a distribution member for another piston-cylinder unit] [N9410]
  
- F04B53/16 . . . Casings; Cylinders; Cylinder liners or heads; Fluid connections [N9410]
- F04B53/16C . . . [N: Adaptations of cylinders] [N9410]
- F04B53/16C2 . . . . [N: Stuffing boxes] [N9410]
- F04B53/16C4 . . . . [N: Cylinder liners] [N9410]
- F04B53/16C4A . . . . . [N: Mounting of cylinder liners in cylinders] [N9410]
  
- F04B53/18 . . . Lubricating (of machines or engines in general [F01M](#)) [N9410]
- F04B53/20 . . . Filtering [N9410]
- F04B53/22 . . . Arrangements for enabling ready assembly or disassembly [N9410]