

## SECTION F — MECHANICAL ENGINEERING; LIGHTING; HEATING; WEAPONS; BLASTING

### F04 POSITIVE-DISPLACEMENT MACHINES FOR LIQUIDS; PUMPS FOR LIQUIDS OR ELASTIC FLUIDS

**F04C ROTARY-PISTON, OR OSCILLATING-PISTON, POSITIVE-DISPLACEMENT MACHINES FOR LIQUIDS** (engines driven by liquids F03C); **ROTARY-PISTON, OR OSCILLATING-PISTON, POSITIVE-DISPLACEMENT PUMPS** (engine fuel-injection pumps F02M)

#### Note(s)

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 FOR LIQUIDS; PUMPS FOR LIQUIDS OR FOR LIQUIDS AND ELASTIC FLUIDS

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
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

#### Machines for liquids; Pumps for liquids or for liquids and elastic fluids [2011.01]

- 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, 2006.01]**

#### Note(s) [3]

Group F04C 2/30 takes precedence over groups F04C 2/02-F04C 2/24.

- 2/02** • of arcuate-engagement type, i.e. with circular translatable movement of co-operating members, each member having the same number of teeth or tooth-equivalents **[3, 2006.01]**

- 2/04 • • of internal-axis type **[3, 2006.01]**  
 2/06 • • of other than internal-axis type (F04C 2/063 takes precedence) **[3, 2006.01]**  
 2/063 • • with coaxially-mounted members having continuously-changing circumferential spacing between them **[3, 2006.01]**  
 2/067 • • • having cam-and-follower type drive **[3, 2006.01]**  
 2/07 • • • having crankshaft-and-connecting-rod type drive **[3, 2006.01]**  
 2/073 • • • having pawl-and-ratchet type drive **[3, 2006.01]**  
 2/077 • • • having toothed-gearing type drive **[3, 2006.01]**  
 2/08 • of intermeshing-engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing **[3, 2006.01]**  
 2/10 • • of internal-axis type with the outer member having more teeth or tooth-equivalents, e.g. rollers, than the inner member **[3, 2006.01]**  
 2/107 • • • with helical teeth **[3, 2006.01]**

- 2/113 • • • the inner member carrying rollers intermeshing with the outer member [3, 2006.01]
- 2/12 • • of other than internal-axis type [3, 2006.01]
- 2/14 • • • with toothed rotary pistons [3, 2006.01]
- 2/16 • • • • with helical teeth, e.g. chevron-shaped, screw type [3, 2006.01]
- 2/18 • • • • with similar tooth forms (F04C 2/16 takes precedence) [3, 2006.01]
- 2/20 • • • • with dissimilar tooth forms (F04C 2/16 takes precedence) [3, 2006.01]
- 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, 2006.01]
- 2/24 • of counter-engagement type, i.e. the movement of co-operating members at the points of engagement being in opposite directions [3, 2006.01]
- 2/26 • • of internal-axis type [3, 2006.01]
- 2/28 • • of other than internal-axis type [3, 2006.01]
- 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, 2006.01]
- 2/32 • • having both the movement defined in group F04C 2/02 and relative reciprocation between the co-operating members [3, 2006.01]
- 2/324 • • • with vanes hinged to the inner member and reciprocating with respect to the outer member [3, 2006.01]
- 2/328 • • • • and hinged to the outer member [3, 2006.01]
- 2/332 • • • with vanes hinged to the outer member and reciprocating with respect to the inner member [3, 2006.01]
- 2/336 • • • • and hinged to the inner member [3, 2006.01]
- 2/34 • • having the movement defined in group F04C 2/08 or F04C 2/22 and relative reciprocation between the co-operating members [3, 2006.01]
- 2/344 • • • with vanes reciprocating with respect to the inner member [3, 2006.01]
- 2/348 • • • • the vanes positively engaging, with circumferential play, an outer rotatable member [3, 2006.01]
- 2/352 • • • • the vanes being pivoted on the axis of the outer member [3, 2006.01]
- 2/356 • • • with vanes reciprocating with respect to the outer member [3, 2006.01]
- 2/36 • • having both the movements defined in groups F04C 2/22 and F04C 2/24 [3, 2006.01]
- 2/38 • • having the movement defined in group F04C 2/02 and having a hinged member (F04C 2/32 takes precedence) [3, 2006.01]
- 2/39 • • • with vanes hinged to the inner as well as to the outer member [3, 2006.01]
- 2/40 • • having the movement defined in group F04C 2/08 or F04C 2/22 and having a hinged member [3, 2006.01]
- 2/44 • • • with vanes hinged to the inner member [3, 2006.01]
- 2/46 • • • with vanes hinged to the outer member [3, 2006.01]

- 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) [1, 2006.01]
- 3/02 • the axes being arranged at an angle of 90 degrees [5, 2006.01]
- 3/04 • • of intermeshing engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing [5, 2006.01]
- 3/06 • the axes being arranged otherwise than at an angle of 90 degrees [5, 2006.01]
- 3/08 • • of intermeshing engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing [5, 2006.01]
- 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) [1, 2006.01]
- 7/00 **Rotary-piston machines or pumps with fluid ring or the like** (such pumps specially adapted for elastic fluids F04C 19/00) [1, 2006.01]
- 9/00 **Oscillating-piston machines or pumps** (such pumps specially adapted for elastic fluids F04C 21/00) [1, 2006.01]
- 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 39/00-F16H 47/00) [1, 2006.01]
- 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) [1, 2006.01]
- 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) [2006.01]
- 14/02 • specially adapted for several machines or pumps connected in series or in parallel [2006.01]
- 14/04 • specially adapted for reversible machines or pumps [2006.01]
- 14/06 • specially adapted for stopping, starting, idling or no-load operation [2006.01]
- 14/08 • characterised by varying the rotational speed [2006.01]
- 14/10 • characterised by changing the positions of the inlet or outlet openings with respect to the working chamber [2006.01]
- 14/12 • • using sliding valves [2006.01]
- 14/14 • • using rotating valves [2006.01]
- 14/16 • • using lift valves [2006.01]
- 14/18 • characterised by varying the volume of the working chamber (by changing the positions of inlet or outlet openings F04C 14/10) [2006.01]
- 14/20 • • by changing the form of the inner or outer contour of the working chamber [2006.01]
- 14/22 • • by changing the eccentricity between cooperating members [2006.01]

- 14/24 • characterised by using valves controlling pressure or flow rate, e.g. discharge valves (F04C 14/10 takes precedence) [2006.01]
- 14/26 • • using bypass channels [2006.01]
- 14/28 • Safety arrangements; Monitoring [2006.01]
- 15/00 **Component parts, details or accessories of machines, pumps or pumping installations, not provided for in groups F04C 2/00-F04C 14/00** (of pumps specially adapted for elastic fluids F04C 18/00-F04C 29/00) [1, 2006.01]
- 15/06 • Arrangements for admission or discharge of the working fluid, e.g. constructional features of the inlet or outlet [2006.01]

#### **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, 2006.01]
- Note(s) [3, 5]**  
Group F04C 18/30 takes precedence over groups F04C 18/02-F04C 18/24.
- 18/02 • of arcuate-engagement type, i.e. with circular transitory movement of co-operating members, each member having the same number of teeth or tooth-equivalents [3, 2006.01]
- 18/04 • • of internal-axis type [3, 2006.01]
- 18/06 • • of other than internal-axis type (F04C 18/063 takes precedence) [3, 2006.01]
- 18/063 • • with coaxially-mounted members having continuously-changing circumferential spacing between them [3, 2006.01]
- 18/067 • • • having cam-and-follower type drive [3, 2006.01]
- 18/07 • • • having crankshaft-and-connecting-rod type drive [3, 2006.01]
- 18/073 • • • having pawl-and-ratchet type drive [3, 2006.01]
- 18/077 • • • having toothed-gearing type drive [3, 2006.01]
- 18/08 • of intermeshing-engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing [3, 2006.01]
- 18/10 • • of internal-axis type with the outer member having more teeth or tooth-equivalents, e.g. rollers, than the inner member [3, 2006.01]
- 18/107 • • • with helical teeth [3, 2006.01]
- 18/113 • • • the inner member carrying rollers intermeshing with the outer member [3, 2006.01]
- 18/12 • • of other than internal-axis type [3, 2006.01]
- 18/14 • • • with toothed rotary pistons [3, 2006.01]
- 18/16 • • • • with helical teeth, e.g. chevron-shaped, screw type [3, 2006.01]
- 18/18 • • • • with similar tooth forms (F04C 18/16 takes precedence) [3, 2006.01]
- 18/20 • • • • with dissimilar tooth forms (F04C 18/16 takes precedence) [3, 2006.01]
- 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, 2006.01]

- 18/24 • of counter-engagement type, i.e. the movement of co-operating members at the points of engagement being in opposite directions [3, 2006.01]
- 18/26 • • of internal-axis type [3, 2006.01]
- 18/28 • • of other than internal-axis type [3, 2006.01]
- 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, 2006.01]
- 18/32 • • having both the movement defined in group F04C 18/02 and relative reciprocation between the co-operating members [3, 2006.01]
- 18/324 • • • with vanes hinged to the inner member and reciprocating with respect to the outer member [3, 2006.01]
- 18/328 • • • • and hinged to the outer member [3, 2006.01]
- 18/332 • • • with vanes hinged to the outer member and reciprocating with respect to the inner member [3, 2006.01]
- 18/336 • • • • and hinged to the inner member [3, 2006.01]
- 18/34 • • having the movement defined in group F04C 18/08 or F04C 18/22 and relative reciprocation between the co-operating members [3, 2006.01]
- 18/344 • • • with vanes reciprocating with respect to the inner member [3, 2006.01]
- 18/348 • • • • the vanes positively engaging, with circumferential play, an outer rotatable member [3, 2006.01]
- 18/352 • • • • the vanes being pivoted on the axis of the outer member [3, 2006.01]
- 18/356 • • • with vanes reciprocating with respect to the outer member [3, 2006.01]
- 18/36 • • having both the movements defined in groups F04C 18/22 and F04C 18/24 [3, 2006.01]
- 18/38 • • having the movement defined in group F04C 18/02 and having a hinged member (F04C 18/32 takes precedence) [3, 2006.01]
- 18/39 • • • with vanes hinged to the inner as well as to the outer member [3, 2006.01]
- 18/40 • • having the movement defined in group F04C 18/08 or F04C 18/22 and having a hinged member [3, 2006.01]
- 18/44 • • • with vanes hinged to the inner member [3, 2006.01]
- 18/46 • • • with vanes hinged to the outer member [3, 2006.01]
- 18/48 • Rotary-piston pumps with non-parallel axes of movement of co-operating members [5, 2006.01]

#### **Note(s) [2006.01]**

Group F04C 18/30 takes precedence over group F04C 18/48.

- 18/50 • • the axes being arranged at an angle of 90 degrees [5, 2006.01]
- 18/52 • • • of intermeshing engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing [5, 2006.01]
- 18/54 • • the axes being arranged otherwise than at an angle of 90 degrees [5, 2006.01]
- 18/56 • • • of intermeshing engagement type, i.e. with engagement of co-operating members similar to that of toothed gearing [5, 2006.01]
- 19/00 **Rotary-piston pumps with fluid ring or the like, specially adapted for elastic fluids [1, 2006.01]**

## F04C

- |       |   |       |  |
|-------|---|-------|--|
| 21/00 | <b>Oscillating-piston pumps specially adapted for elastic fluids [1, 2006.01]</b>   | 28/08 | <ul style="list-style-type: none"> <li>• characterised by varying the rotational speed <b>[2006.01]</b></li> </ul>   |
| 23/00 | <b>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) [1, 2006.01]</b> | 28/10 | <ul style="list-style-type: none"> <li>• characterised by changing the positions of the inlet or outlet openings with respect to the working chamber <b>[2006.01]</b></li> </ul>                   |
| 23/02 | <ul style="list-style-type: none"> <li>• Pumps characterised by combination with, or adaptation to, specific driving engines or motors (predominant aspects of the engines or motors, <u>see</u> the relevant classes) <b>[1, 2006.01]</b></li> </ul>   | 28/12 | <ul style="list-style-type: none"> <li>• • using sliding valves <b>[2006.01]</b></li> </ul>  |
| 25/00 | <b>Adaptations for special use of pumps for elastic fluids [1, 2006.01]</b>   | 28/14 | <ul style="list-style-type: none"> <li>• • using rotating valves <b>[2006.01]</b></li> </ul>   |
| 25/02 | <ul style="list-style-type: none"> <li>• for producing high vacuum (sealing arrangements F04C 27/00; silencing F04C 29/06) <b>[1, 2006.01]</b></li> </ul>   | 28/16 | <ul style="list-style-type: none"> <li>• • using lift valves <b>[2006.01]</b></li> </ul>   |
| 27/00 | <b>Sealing arrangements in rotary-piston pumps specially adapted for elastic fluids [1, 2006.01]</b>  | 28/18 | <ul style="list-style-type: none"> <li>• characterised by varying the volume of the working chamber (by changing the positions of inlet or outlet openings F04C 28/10) <b>[2006.01]</b></li> </ul> |
| 27/02 | <ul style="list-style-type: none"> <li>• Liquid sealing for high-vacuum pumps <b>[1, 2006.01]</b></li> </ul>  | 28/20 | <ul style="list-style-type: none"> <li>• • by changing the form of the inner or outer contour of the working chamber <b>[2006.01]</b></li> </ul>   |
| 28/00 | <b>Control of, monitoring of, or safety arrangements for, pumps or pumping installations specially adapted for elastic fluids [2006.01]</b>   | 28/22 | <ul style="list-style-type: none"> <li>• • by changing the eccentricity between cooperating members <b>[2006.01]</b></li> </ul>  |
| 28/02 | <ul style="list-style-type: none"> <li>• specially adapted for several pumps connected in series or in parallel <b>[2006.01]</b></li> </ul>   | 28/24 | <ul style="list-style-type: none"> <li>• characterised by using valves controlling pressure or flow rate, e.g. discharge valves (F04C 28/10 takes precedence) <b>[2006.01]</b></li> </ul>          |
| 28/04 | <ul style="list-style-type: none"> <li>• specially adapted for reversible pumps <b>[2006.01]</b></li> </ul>   | 28/26 | <ul style="list-style-type: none"> <li>• • using bypass channels <b>[2006.01]</b></li> </ul>   |
| 28/06 | <ul style="list-style-type: none"> <li>• specially adapted for stopping, starting, idling or no-load operation <b>[2006.01]</b></li> </ul>  | 28/28 | <ul style="list-style-type: none"> <li>• Safety arrangements; Monitoring <b>[2006.01]</b></li> </ul>   |
|       |   | 29/00 | <b>Component parts, details, or accessories, of pumps or pumping installations specially adapted for elastic fluids, not provided for in groups F04C 18/00-F04C 28/00 [1, 2006.01]</b>             |
|       |   | 29/02 | <ul style="list-style-type: none"> <li>• Lubrication; Lubricant separation <b>[1, 2006.01]</b></li> </ul>  |
|       |   | 29/04 | <ul style="list-style-type: none"> <li>• Heating; Cooling; Heat insulation <b>[1, 2006.01]</b></li> </ul>  |
|       |   | 29/06 | <ul style="list-style-type: none"> <li>• Silencing <b>[1, 2006.01]</b></li> </ul>  |
|       |   | 29/12 | <ul style="list-style-type: none"> <li>• Arrangements for admission or discharge of the working fluid, e.g. constructional features of the inlet or outlet <b>[2006.01]</b></li> </ul>             |