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

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

### F04D NON-POSITIVE-DISPLACEMENT PUMPS (engine fuel-injection pumps F02M; ion pumps H01J 41/12; electrodynamic pumps H02K 44/02)

**Note(s)**

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


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**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, 2006.01]**

1/02 • having non-centrifugal stages, e.g. centripetal **[1, 2006.01]**

1/04 • Helico-centrifugal pumps **[1, 2006.01]**

1/06 • Multi-stage pumps (F04D 1/02 takes precedence) **[1, 2006.01]**

1/08 • • the stages being situated concentrically **[1, 2006.01]**

1/10 • • with means for changing the flow-path through the stages, e.g. series/parallel **[1, 2006.01]**

1/12 • Pumps with scoops or like paring members protruding in the fluid circulating in a bowl **[1, 2006.01]**

1/14 • Pumps raising fluids by centrifugal force within a conical rotary bowl with vertical axis **[1, 2006.01]**

**3/00 Axial-flow pumps** (priming or boosting F04D 9/00; pumping liquids and elastic fluids at the same time F04D 31/00) **[1, 2006.01]**

3/02 • of screw type **[1, 2006.01]**

**5/00 Pumps with circumferential or transverse flow** (pumping liquids and elastic fluids at the same time F04D 31/00) **[1, 2006.01]**

**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) **[1, 2006.01]**

7/02 • of centrifugal type **[1, 2006.01]**

7/04 • • the fluids being viscous or non-homogeneous **[1, 2006.01]**

7/06 • • the fluids being hot or corrosive, e.g. liquid metal **[1, 2006.01]**

7/08 • • the fluids being radioactive **[1, 2006.01]**

**9/00 Priming; Preventing vapour lock [1, 2006.01]**

9/02 • Self-priming pumps **[1, 2006.01]**

9/04 • using priming pumps; using booster pumps to prevent vapour lock **[1, 2006.01]**

9/06 • • of jet type **[1, 2006.01]**

**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) **[1, 2006.01]**

**13/00** **Pumping installations or systems** (controlling F04D 15/00; pumping liquids and elastic fluids at the same time F04D 31/00) **[1, 2006.01]**
13/02 • Units comprising pumps and their driving means (predominant aspects of the driving means, see the relevant classes for such means) **[1, 2006.01]**
13/04 • • the pump being fluid-driven **[1, 2006.01]**
13/06 • • the pump being electrically driven **[1, 2006.01]**
13/08 • • • for submerged use **[1, 2006.01]**
13/10 • • • • adapted for use in mining bore holes **[1, 2006.01]**
13/12 • Combinations of two or more pumps (combinations with priming pumps or booster pumps to counter-act vapour lock F04D 9/04) **[1, 2006.01]**
13/14 • • the pumps being all of centrifugal type **[1, 2006.01]**
13/16 • with storage reservoirs **[1, 2006.01]**

**15/00** **Control, e.g. regulation, of pumps, pumping installations, or systems [1, 2006.01]**
15/02 • Stopping of pumps, or operating valves, on occurrence of unwanted conditions **[1, 2006.01]**

**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) **[1, 2006.01]**
17/02 • having non-centrifugal stages, e.g. centripetal **[1, 2006.01]**
17/04 • • of transverse-flow type **[1, 2006.01]**
17/06 • Helico-centrifugal pumps **[1, 2006.01]**
17/08 • Centrifugal pumps **[1, 2006.01]**
17/10 • • for compressing or evacuating **[1, 2006.01]**
17/12 • • • Multi-stage pumps **[1, 2006.01]**
17/14 • • • • with means for changing the flow-path through the stages, e.g. series/parallel (surge control F04D 27/02) **[1, 2006.01]**
17/16 • • for displacing without appreciable compression **[1, 2006.01]**
17/18 • • characterised by use of centrifugal force of liquids entrained in pumps **[1, 2006.01]**

**19/00** **Axial-flow pumps specially adapted for elastic fluids** (F04D 21/00 takes precedence) **[1, 2006.01]**
19/02 • Multi-stage pumps **[1, 2006.01]**
19/04 • • specially adapted to the production of a high vacuum, e.g. molecular pumps **[1, 2006.01]**

**21/00** **Pumps specially adapted for elastic fluids involving supersonic speed of pumped fluids [1, 2006.01]**

**23/00** **Other rotary non-positive-displacement pumps specially adapted for elastic fluids** (pumping installations or systems F04D 25/00) **[1, 2006.01]**

**25/00** **Pumping installations or systems specially adapted for elastic fluids** (controlling F04D 27/00) **[1, 2006.01]**
25/02 • Units comprising pumps and their driving means (predominant aspects of the driving means, see the relevant classes for such means) **[1, 2006.01]**
25/04 • • the pump being fluid-driven **[1, 2006.01]**
25/06 • • the pump being electrically driven (F04D 25/08 takes precedence) **[1, 2006.01]**
25/08 • • the working fluid being air, e.g. for ventilation **[1, 2006.01]**
25/10 • • • the unit having provisions for automatically changing the direction of output air **[1, 2006.01]**
25/12 • • • the unit being adapted for mounting in apertures **[1, 2006.01]**
25/14 • • • • and having shutters, e.g. automatically closed when not in use **[1, 2006.01]**
25/16 • Combinations of two or more pumps **[1, 2006.01]**

**27/00** **Control, e.g. regulation, of pumps, pumping nstallations or pumping systems specially adapted for elastic fluids [1, 2006.01]**
27/02 • Surge control **[1, 2006.01]**

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**29/00** **Details, component parts, or accessories** (machine elements in general F16) **[1, 2006.01]**
29/02 • Selection of particular materials (for handling specific liquids F04D 7/00) **[1, 2006.01]**
29/04 • Shafts or bearings, or assemblies thereof (specially adapted for elastic fluid pumps F04D 29/05) **[1, 2006.01]**
29/041 • • Axial thrust balancing **[2006.01]**
29/042 • • Axially shiftable rotors (F04D 29/041 takes precedence) **[2006.01]**
29/043 • • Shafts **[2006.01]**
29/044 • • • Arrangements for joining or assembling shafts **[2006.01]**
29/046 • • Bearings **[2006.01]**
29/047 • • • hydrostatic; hydrodynamic **[2006.01]**
29/048 • • • magnetic; electromagnetic **[2006.01]**
29/049 • • • Roller bearings **[2006.01]**
29/05 • Shafts or bearings, or assemblies thereof, specially adapted for elastic fluid pumps **[2006.01]**
29/051 • • Axial thrust balancing **[2006.01]**
29/052 • • Axially shiftable rotors (F04D 29/051 takes precedence) **[2006.01]**
29/053 • • Shafts **[2006.01]**
29/054 • • • Arrangements for joining or assembling shafts **[2006.01]**
29/056 • • Bearings **[2006.01]**
29/057 • • • hydrostatic; hydrodynamic **[2006.01]**
29/058 • • • magnetic; electromagnetic **[2006.01]**
29/059 • • • Roller bearings **[2006.01]**
29/06 • Lubrication **[1, 2006.01]**
29/063 • • specially adapted for elastic fluid pumps **[2006.01]**
29/08 • Sealings **[1, 2006.01]**
29/10 • • Shaft sealings **[1, 2006.01]**
29/12 • • • using sealing-rings **[1, 2006.01]**
29/14 • • • operative only when pump is inoperative **[1, 2006.01]**
29/16 • • between pressure and suction sides **[1, 2006.01]**
29/18 • Rotors (specially adapted for elastic fluids F04D 29/26) **[1, 2006.01]**
29/20 • • Mounting rotors on shafts **[1, 2006.01]**
29/22 • • specially for centrifugal pumps **[1, 2006.01]**
29/24 • • • Vanes **[1, 2006.01]**
29/26 • Rotors specially adapted for elastic fluids **[1, 2006.01]**
29/28 • • for centrifugal or helico-centrifugal pumps **[1, 2006.01]**
29/30 • • • Vanes **[1, 2006.01]**
29/32 • • for axial-flow pumps **[1, 2006.01]**
29/34 • • • Blade mountings **[1, 2006.01]**
29/36 • • • • adjustable **[1, 2006.01]**

29/38 • • • Blades **[1, 2006.01]**
29/40 • Casings; Connections for working fluid **[1, 2006.01]**
29/42 • • for radial or helico-centrifugal pumps **[1, 2006.01]**
29/44 • • • Fluid-guiding means, e.g. diffusers **[1, 2006.01]**
29/46 • • • • adjustable **[1, 2006.01]**
29/48 • • • • • for unidirectional fluid flow in reversible pumps **[1, 2006.01]**
29/50 • • • • • for reversing fluid flow **[1, 2006.01]**
29/52 • • for axial pumps **[1, 2006.01]**
29/54 • • • Fluid-guiding means, e.g. diffusers **[1, 2006.01]**
29/56 • • • • adjustable **[1, 2006.01]**
29/58 • Cooling (of machines or engines in general F01P); Heating; Diminishing heat transfer **[1, 2006.01]**
29/60 • Mounting; Assembling; Disassembling **[1, 2006.01]**
29/62 • • of radial or helico-centrifugal pumps **[1, 2006.01]**
29/64 • • of axial pumps **[1, 2006.01]**
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) **[1, 2006.01]**
29/68 • • by influencing boundary layers **[1, 2006.01]**
29/70 • Suction grids; Strainers; Dust separation; Cleaning **[1, 2006.01]**

**Other non-positive-displacement pumps**

**31/00 Pumping liquids and elastic fluids at the same time [1, 2006.01]**

**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) **[1, 2, 2006.01]**

**35/00 Pumps producing waves in liquids, i.e. wave-producers** (for bath tubs A47K 3/10) **[2, 2006.01]**