

## 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

**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]**

## F04D

13/00	<b>Pumping installations or systems</b> (controlling F04D 15/00; pumping liquids and elastic fluids at the same time F04D 31/00) [1, 2006.01]	25/10	• • • the unit having provisions for automatically changing the direction of output air [1, 2006.01]
13/02	• Units comprising pumps and their driving means (predominant aspects of the driving means, <i>see</i> the relevant classes for such means) [1, 2006.01]	25/12	• • • the unit being adapted for mounting in apertures [1, 2006.01]
13/04	• • the pump being fluid-driven [1, 2006.01]	25/14	• • • • and having shutters, e.g. automatically closed when not in use [1, 2006.01]
13/06	• • the pump being electrically driven [1, 2006.01]	25/16	• Combinations of two or more pumps [1, 2006.01]
13/08	• • • for submerged use [1, 2006.01]	27/00	<b>Control, e.g. regulation, of pumps, pumping installations or pumping systems specially adapted for elastic fluids</b> [1, 2006.01]
13/10	• • • • adapted for use in mining bore holes [1, 2006.01]	27/02	• Surge control [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]	29/00	<b>Details, component parts, or accessories</b> (machine elements in general F16) [1, 2006.01]
13/16	• with storage reservoirs [1, 2006.01]	29/02	• Selection of particular materials (for handling specific liquids F04D 7/00) [1, 2006.01]
15/00	<b>Control, e.g. regulation, of pumps, pumping installations, or systems</b> [1, 2006.01]	29/04	• Shafts or bearings, or assemblies thereof (specially adapted for elastic fluid pumps F04D 29/05) [1, 2006.01]
15/02	• Stopping of pumps, or operating valves, on occurrence of unwanted conditions [1, 2006.01]	29/041	• • Axial thrust balancing [2006.01]
<b>Rotary pumps specially adapted for elastic fluids</b>		29/042	• • Axially shiftable rotors (F04D 29/041 takes precedence) [2006.01]
17/00	<b>Radial-flow pumps specially adapted for elastic fluids, e.g. centrifugal pumps; Helico-centrifugal pumps specially adapted for elastic fluids</b> (F04D 21/00 takes precedence) [1, 2006.01]	29/043	• • Shafts [2006.01]
17/02	• having non-centrifugal stages, e.g. centripetal [1, 2006.01]	29/044	• • • Arrangements for joining or assembling shafts [2006.01]
17/04	• • of transverse-flow type [1, 2006.01]	29/046	• • Bearings [2006.01]
17/06	• Helico-centrifugal pumps [1, 2006.01]	29/047	• • • hydrostatic; hydrodynamic [2006.01]
17/08	• Centrifugal pumps [1, 2006.01]	29/048	• • • magnetic; electromagnetic [2006.01]
17/10	• • for compressing or evacuating [1, 2006.01]	29/049	• • • Roller bearings [2006.01]
17/12	• • • Multi-stage pumps [1, 2006.01]	29/05	• Shafts or bearings, or assemblies thereof, specially adapted for elastic fluid pumps [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]	29/051	• • Axial thrust balancing [2006.01]
17/16	• • for displacing without appreciable compression [1, 2006.01]	29/052	• • Axially shiftable rotors (F04D 29/051 takes precedence) [2006.01]
17/18	• • characterised by use of centrifugal force of liquids entrained in pumps [1, 2006.01]	29/053	• • Shafts [2006.01]
19/00	<b>Axial-flow pumps specially adapted for elastic fluids</b> (F04D 21/00 takes precedence) [1, 2006.01]	29/054	• • • Arrangements for joining or assembling shafts [2006.01]
19/02	• Multi-stage pumps [1, 2006.01]	29/056	• • Bearings [2006.01]
19/04	• • specially adapted to the production of a high vacuum, e.g. molecular pumps [1, 2006.01]	29/057	• • • hydrostatic; hydrodynamic [2006.01]
21/00	<b>Pumps specially adapted for elastic fluids involving supersonic speed of pumped fluids</b> [1, 2006.01]	29/058	• • • magnetic; electromagnetic [2006.01]
23/00	<b>Other rotary non-positive-displacement pumps specially adapted for elastic fluids</b> (pumping installations or systems F04D 25/00) [1, 2006.01]	29/059	• • • Roller bearings [2006.01]
25/00	<b>Pumping installations or systems specially adapted for elastic fluids</b> (controlling F04D 27/00) [1, 2006.01]	29/06	• Lubrication [1, 2006.01]
25/02	• Units comprising pumps and their driving means (predominant aspects of the driving means, <i>see</i> the relevant classes for such means) [1, 2006.01]	29/063	• • specially adapted for elastic fluid pumps [2006.01]
25/04	• • the pump being fluid-driven [1, 2006.01]	29/08	• Sealings [1, 2006.01]
25/06	• • the pump being electrically driven (F04D 25/08 takes precedence) [1, 2006.01]	29/10	• • Shaft sealings [1, 2006.01]
25/08	• • the working fluid being air, e.g. for ventilation [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]**