

## 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)

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

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

- 3/02 • of screw type

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

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

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

**9/00 Priming; Preventing vapour lock**

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

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

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

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

## F04D

- 13/04 • • the pump being fluid-driven
- 13/06 • • the pump being electrically driven
- 13/08 • • • for submerged use
- 13/10 • • • • adapted for use in mining bore holes
- 13/12 • Combinations of two or more pumps (combinations with priming pumps or booster pumps to counter-act vapour lock F04D 9/04)
- 13/14 • • the pumps being all of centrifugal type
- 13/16 • with storage reservoirs
- 15/00 Control, e.g. regulation, of pumps, pumping installations, or systems**
- 15/02 • Stopping of pumps, or operating valves, on occurrence of unwanted conditions

### Rotary pumps specially adapted for elastic fluids

- 17/00 Radial-flow pumps specially adapted for elastic fluids, e.g. centrifugal pumps; Helico-centrifugal pumps specially adapted for elastic fluids** (F04D 21/00 takes precedence)
  - 17/02 • having non-centrifugal stages, e.g. centripetal
  - 17/04 • • of transverse-flow type
  - 17/06 • Helico-centrifugal pumps
  - 17/08 • Centrifugal pumps
  - 17/10 • • for compressing or evacuating
  - 17/12 • • • Multi-stage pumps
  - 17/14 • • • • with means for changing the flow-path through the stages, e.g. series/parallel (surge control F04D 27/02)
  - 17/16 • • for displacing without appreciable compression
  - 17/18 • • characterised by use of centrifugal force of liquids entrained in pumps
- 19/00 Axial-flow pumps specially adapted for elastic fluids** (F04D 21/00 takes precedence)
  - 19/02 • Multi-stage pumps
  - 19/04 • • specially adapted to the production of a high vacuum, e.g. molecular pumps
- 21/00 Pumps specially adapted for elastic fluids involving supersonic speed of pumped fluids**
- 23/00 Other rotary non-positive-displacement pumps specially adapted for elastic fluids** (pumping installations or systems F04D 25/00)
- 25/00 Pumping installations or systems specially adapted for elastic fluids** (controlling F04D 27/00)
  - 25/02 • Units comprising pumps and their driving means (predominant aspects of the driving means, see the relevant classes for such means)
  - 25/04 • • the pump being fluid-driven
  - 25/06 • • the pump being electrically driven (F04D 25/08 takes precedence)
  - 25/08 • • the working fluid being air, e.g. for ventilation
  - 25/10 • • • the unit having provisions for automatically changing the direction of output air
  - 25/12 • • • the unit being adapted for mounting in apertures
  - 25/14 • • • • and having shutters, e.g. automatically closed when not in use
  - 25/16 • Combinations of two or more pumps
- 27/00 Control, e.g. regulation, of pumps, pumping installations or pumping systems specially adapted for elastic fluids**

- 27/02 • Surge control

- 29/00 Details, component parts, or accessories** (machine elements in general F16)
- 29/02 • Selection of particular materials (for handling specific liquids F04D 7/00)
- 29/04 • Shafts or bearings, or assemblies thereof (specially adapted for elastic fluid pumps F04D 29/05) [**1, 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
- 29/10 • • Shaft sealings
- 29/12 • • • using sealing-rings
- 29/14 • • • operative only when pump is inoperative
- 29/16 • • between pressure and suction sides
- 29/18 • Rotors (specially adapted for elastic fluids F04D 29/26)
- 29/20 • • Mounting rotors on shafts
- 29/22 • • specially for centrifugal pumps
- 29/24 • • • Vanes
- 29/26 • Rotors specially adapted for elastic fluids
- 29/28 • • for centrifugal or helico-centrifugal pumps
- 29/30 • • • Vanes
- 29/32 • • for axial-flow pumps
- 29/34 • • • Blade mountings
- 29/36 • • • • adjustable
- 29/38 • • • Blades
- 29/40 • Casings; Connections for working fluid
- 29/42 • • for radial or helico-centrifugal pumps
- 29/44 • • • Fluid-guiding means, e.g. diffusers
- 29/46 • • • • adjustable
- 29/48 • • • • • for unidirectional fluid flow in reversible pumps
- 29/50 • • • • • for reversing fluid flow
- 29/52 • • for axial pumps
- 29/54 • • • Fluid-guiding means, e.g. diffusers
- 29/56 • • • • adjustable
- 29/58 • Cooling (of machines or engines in general F01P); Heating; Diminishing heat transfer
- 29/60 • Mounting; Assembling; Disassembling

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

#### Other non-positive-displacement pumps

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