

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)	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)
1/02 • having non-centrifugal stages, e.g. centripetal	7/02 • of centrifugal type
1/04 • Helico-centrifugal pumps	7/04 • • the fluids being viscous or non-homogeneous
1/06 • Multi-stage pumps (F04D 1/02 takes precedence)	7/06 • • the fluids being hot or corrosive, e.g. liquid metal
1/08 • • the stages being situated concentrically	7/08 • • the fluids being radioactive
1/10 • • with means for changing the flow-path through the stages, e.g. series/parallel	9/00 Priming; Preventing vapour lock
1/12 • Pumps with scoops or like paring members protruding in the fluid circulating in a bowl	9/02 • Self-priming pumps
1/14 • Pumps raising fluids by centrifugal force within a conical rotary bowl with vertical axis	9/04 • using priming pumps; using booster pumps to prevent vapour lock
3/00 Axial-flow pumps (priming or boosting F04D 9/00; pumping liquids and elastic fluids at the same time F04D 31/00)	9/06 • • of jet type
3/02 • of screw 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)
5/00 Pumps with circumferential or transverse flow (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, <u>see</u> 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

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- 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]