

## F04D

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

### Definition statement

*This place covers:*

Non positive displacement pumps for liquids, for elastic fluids, or for liquids and elastic fluids, whether rotary or not having pure rotation.

### References

#### Limiting references

*This place does not cover:*

Engine fuel-injection pumps	<a href="#">F02M</a>
Ion pumps	<a href="#">H01J 41/12</a>
Electrodynamic pumps	<a href="#">H02K 44/02</a>

#### Application-oriented references

*Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:*

Aeroplane propellers	<a href="#">B64C 11/00</a>
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#### Informative references

*Attention is drawn to the following places, which may be of interest for search:*

Blood pumps	<a href="#">A61M 1/00</a>
Obtaining oil, gas, water from deep wells	<a href="#">E21B</a>
Non positive displacement machines or engines	<a href="#">F01D</a>
Pumping cooling air or liquid coolants	<a href="#">F01P 5/00</a>
Machines or engines for liquids	<a href="#">F03B</a>
Wind motors	<a href="#">F03D</a>
Combinations of non-positive displacement pumps with other pumps; Positive displacement machines for fluids; Pumps	<a href="#">F04B</a>
Rotary-piston, or oscillating piston, positive displacement machines for fluids	<a href="#">F04C</a>
Bearings	<a href="#">F16C</a>
Sealings	<a href="#">F16J 15/00</a>
Central heating systems	<a href="#">F24D</a>
Air conditioning, Ventilation	<a href="#">F24F</a>

## Special rules of classification

As a general rule a complete classification will contain at least one class out of the 2 first main parts which would specify the type of pump concerned, combined with at least one class out of the main group [F04D 29/00](#).

In cases where a "Details, component, parts, or accessories" has to be classified which can be used in a number of different types of pumps which would be covered by different sub groups, only the relevant [F04D 29/00](#) sub group class should be given.

Care should be taken when classifying compressors used in combination with gas turbines. Classification in [F04D](#) when compressor details are predominant. Classification in [F01D](#) when the integration or the fluid connection to the turbine or its combustion chamber are involved

This subclass is generally subdivided in 3 main parts:

- Non-positive displacement pumps for non-elastic fluids: [F04D 1/00](#) - [F04D 15/029](#)
- Non positive displacement pumps for elastic fluids: [F04D 17/00](#)-[F04D 27/0292](#)
- Details, component, parts, or accessories: [F04D 29/00](#) - [F04D 29/708](#)

In the part related to "Details, component, parts, or accessories" i.e. main group [F04D 29/00](#) each sub group is subdivided in two further subgroups, one for elastic fluids and another one for non elastic fluids. By way of example: [F04D 29/02](#) has a subgroup [F04D 29/023](#) covering the elastic fluids, and another subgroup [F04D 29/026](#) covering the non elastic fluids.

## Glossary of terms

*In this place, the following terms or expressions are used with the meaning indicated:*

Engine	means a device for continuously converting fluid energy into mechanical power. Thus, this term includes, for example, steam piston engines or steam turbines, per se, or internal-combustion piston engines, but it excludes single-stroke devices
Pump	means a device for continuously raising, forcing, compressing, or exhausting fluid by mechanical or other means. Thus, this term includes fans or blowers
Machine	means a device which could equally be an engine and a pump, and not a device which is restricted to an engine or one which is restricted to a pump
Positive displacement	means the way the energy of a working fluid is transformed into mechanical energy, in which variations of volume created by the working fluid in a working chamber produce equivalent displacements of the mechanical member transmitting the energy
Non-positive displacement	means the way the energy of a working fluid is transformed into mechanical energy, by transformation of the energy of the working fluid into kinetic energy, and vice versa
Rotary-piston machine	means a positive-displacement machine in which a fluid-engaging work-transmitting member rotates about a fixed axis or about an axis moving along a circular or similar orbit. This definition applies also to engines and pumps

**F04D 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](#))

**Definition statement**

*This place covers:*

Radial and mixed flow type pumps for non elastic fluids

**References****Limiting references**

*This place does not cover:*

Shear force pumps	<a href="#">F04D 5/001</a>
Adaptation to specific liquids	<a href="#">F04D 7/00</a>
Priming of pumps	<a href="#">F04D 9/00</a>

**Synonyms and Keywords**

*In patent documents the following expressions/words "helico centrifugal flow", "mixed flow" and "diagonal flow" are often used.*

**F04D 3/00**

Axial-flow pumps (priming or boosting [F04D 9/00](#))

**Definition statement**

*This place covers:*

Axial flow type pumps for non elastic fluids.

**References****Limiting references**

*This place does not cover:*

Adaptation to specific liquids	<a href="#">F04D 7/00</a>
Priming of pumps	<a href="#">F04D 9/00</a>

**Informative references**

*Attention is drawn to the following places, which may be of interest for search:*

Conveyors	<a href="#">B65G 33/00</a>
Archimedes screw pumps	<a href="#">F04B 19/12</a>

## F04D 5/00

**Pumps with circumferential or transverse flow {(control thereof [F04D 15/005](#))}**

### Definition statement

*This place covers:*

Shear force pumps and pumps with circumferential or transverse flow, also shear force pumps, although they are generally of radial type.

### Glossary of terms

*In this place, the following terms or expressions are used with the meaning indicated:*

Shear force pump	a pump where the energy is transferred to the liquid by friction forces
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### Synonyms and Keywords

*In patent documents the following expressions/words "circumferential flow pump", "side channel pump", "regenerative pump", "peripheral flow pump" and "vortex flow pump" are often used.*

## F04D 7/00

**Pumps adapted for handling specific fluids, e.g. by selection of specific materials for pumps or pump parts ([F04D 11/005](#), [F04D 29/22](#) take precedence)**

### Definition statement

*This place covers:*

Adaptations which make a pump suitable for a specific liquid.

### References

#### Informative references

*Attention is drawn to the following places, which may be of interest for search:*

Pumping specific fluids in general	<a href="#">F04B 15/00</a>
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### Special rules of classification

In general classification is combined with a sub group in the [F04D 29/00](#) group

## F04D 9/00

**Priming; Preventing vapour lock**

### Definition statement

*This place covers:*

All adaptations of a pump in order to prime the pump, to avoid vapor lock or to avoid loss of prime

## F04D 11/00

**Other rotary non-positive-displacement pumps (pumping installations or systems [F04D 13/00](#))**

### Definition statement

*This place covers:*

Any rotary non-positive displacement which does not have radial, axial or helico centrifugal flow.

## F04D 13/00

**Pumping installations or systems (controlling [F04D 15/00](#))**

### Definition statement

*This place covers:*

The combination of a pump with its drive system or its integration into a system either comprising several pumps or comprising storage systems

### References

#### Limiting references

*This place does not cover:*

Control of pumps	<a href="#">F04D 15/00</a>
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#### Informative references

*Attention is drawn to the following places, which may be of interest for search:*

Electrical machines	<a href="#">H02K</a>
Magnetic couplings	<a href="#">H02K 49/102</a>

## F04D 15/00

**Control, e.g. regulation, of pumps, pumping installations or systems**

### Definition statement

*This place covers:*

Systems and schemes for controlling a pump, either matching the pump to the requirements of the system or avoiding harmful conditions for the pump

### References

#### Informative references

*Attention is drawn to the following places, which may be of interest for search:*

Actuators for control action	<a href="#">F04D 29/00</a>
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## F04D 17/00

**Radial-flow pumps, e.g. centrifugal pumps; Helico-centrifugal pumps (F04D 21/00 takes precedence)**

### Definition statement

*This place covers:*

Radial and mixed-flow type pumps for elastic fluids.

### Special rules of classification

The centrifugal pumps for elastic fluids are subdivided into 2 main parts; in the "compressing or evacuating" sub group [F04D 17/10](#) the compression ratio should be significant, while in the "for displacing without appreciable compression" sub group [F04D 17/16](#) the generation of flow is predominant

### Synonyms and Keywords

*In patent documents the following expressions/words "helico centrifugal flow", "mixed flow" and "diagonal flow" are often used.*

## F04D 19/00

**Axial-flow pumps (F04D 21/00 takes precedence; {pump comprising axial flow and radial flow stages [F04D 17/025](#)})**

### Definition statement

*This place covers:*

Axial flow type pumps for elastic fluids.

### References

#### Limiting references

*This place does not cover:*

Combined axial-flow and radial-flow stages	<a href="#">F04D 17/025</a>
Pumps involving supersonic speeds in the pumped fluid	<a href="#">F04D 21/00</a>

### Special rules of classification

The axial pumps for elastic fluids are subdivided into 2 main parts; in the "multistage pumps" sub group [F04D 19/02](#) the compression ratio should be significant, while in the "fan" sub groups [F04D 19/002](#) and [F04D 19/007](#) the generation of flow is predominant

## F04D 21/00

**Pump involving supersonic speed of pumped fluids**

### Definition statement

*This place covers:*

All pump for elastic fluids involving supersonic speed of pumped fluids.

## F04D 23/00

**Other rotary non-positive-displacement pumps (pumping installations or systems [F04D 25/00](#))**

### Definition statement

*This place covers:*

Any rotary non positive displacement which does not have radial, axial or helico centrifugal flow, pumps adapted for conveying or for handling specific elastic fluid, and pumps with circumferential or transverse flow.

## F04D 25/00

**Pumping installations or systems (controlling [F04D 27/00](#))**

### Definition statement

*This place covers:*

The combination of a pump for elastic fluids with its drive system or its integration into a system either comprising several pumps or comprising storage systems.

### References

#### Limiting references

*This place does not cover:*

Pump installation control	<a href="#">F04D 27/00</a>
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#### Informative references

*Attention is drawn to the following places, which may be of interest for search:*

Hand held fans	<a href="#">A45B</a>
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### Special rules of classification

[F04D 25/06](#) and [F04D 25/08](#) are both used in parallel . [F04D 25/06](#) focusses on the motor design, or the combination of motor and pump. [F04D 25/08](#) focusses on specific design for special purposes. Both subgroups can be used in combination (e.g. a computer fan with an inside out motor and details on how the motor is cooled will get both [F04D 25/0613](#) and [F04D 25/082](#) classification

## F04D 27/00

**Control, e.g. regulation, of pumps, pumping installations or pumping systems specially adapted for elastic fluids**

### Definition statement

*This place covers:*

Systems and schemes for controlling a pump for elastic fluids, either matching the pump to the requirements of the system or avoiding harmful conditions for the pump, e.g. surge or stall conditions.

## References

### Informative references

Attention is drawn to the following places, which may be of interest for search:

Control of flow	<a href="#">G05D 7/00</a>
Control of pressure	<a href="#">G05D 16/00</a>

## Special rules of classification

[F04D 27/02](#) subgroup is used for ANY type of control and is thus not limited to surge or stall control

[F04D 27/001](#) is used when the detection of pump condition is predominant (e.g. determining of surge margin, without immediate control action; mapping of pump characteristics for later use)

## F04D 29/00

Details, component parts, or accessories (machine elements in general [F16](#))

### Definition statement

This place covers:

Details, component parts, or accessories of any type of pump for elastic or non elastic fluids.

## References

### Informative references

Attention is drawn to the following places, which may be of interest for search:

Making blades for propellers or turbines	<a href="#">B21D 53/78</a>
Making specific metal objects	<a href="#">B23P 15/00</a>
Machine elements in general	<a href="#">F16</a>

## Special rules of classification

In main group [F04D 29/00](#) each sub group is subdivided in two further subgroups, one for elastic fluids and another on for non elastic fluids. By way of example: [F04D 29/02](#) has a subgroup [F04D 29/023](#) covering the elastic fluids, and another subgroup [F04D 29/026](#) covering the non elastic fluids.

However for the subgroups relating to bearing and shafts ([F04D 29/04](#) and [F04D 29/05](#)) and rotors ([F04D 29/18](#) and [F04D 29/26](#)) specific subgroups are provided for elastic fluids and non-elastic fluids.

## F04D 29/32

for axial flow pumps

## References

### Informative references

Attention is drawn to the following places, which may be of interest for search:

Blades for multistage rotors of machines or engines	<a href="#">F01D 5/00</a>
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**F04D 29/322****{Blade mountings}****References****Informative references***Attention is drawn to the following places, which may be of interest for search:*

Fixing blades to rotors; Blade roots	<a href="#">F01D 5/30</a>
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**F04D 29/324****{Blades}****References****Informative references***Attention is drawn to the following places, which may be of interest for search:*

Selecting composite materials, e.g. blades with reinforcing filaments	<a href="#">F01D 5/282</a>
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**F04D 31/00****Pumping liquids and elastic fluids at the same time****Definition statement***This place covers:*

Pumping liquids and elastic fluids at the same time, i.e. one pump handles both elastic and non elastic fluids together.

**References****Informative references***Attention is drawn to the following places, which may be of interest for search:*

Obtaining oil, gas, water from deep wells	<a href="#">E21B</a>
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**F04D 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](#))****Definition statement***This place covers:*

Non-positive-displacement pumps with other than pure rotation. Some examples are mechanisms imitating the movement of a bird wing or a fish tale, or the movement produced by humans when using a hand fan.

**References****Limiting references**

*This place does not cover:*

Wave generators	<a href="#">F04D 35/00</a>
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**F04D 35/00**

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

**Definition statement**

*This place covers:*

Non-positive-displacement pumps for the generation of waves.

**References****Limiting references**

*This place does not cover:*

Wave generators for baths and tubs	<a href="#">A47K 3/10</a>
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**Informative references**

*Attention is drawn to the following places, which may be of interest for search:*

Swimming pools	<a href="#">E04H 4/00</a>
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