

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

### F01 MACHINES OR ENGINES IN GENERAL; ENGINE PLANTS IN GENERAL; STEAM ENGINES

**F01D NON-POSITIVE-DISPLACEMENT MACHINES OR ENGINES, e.g. STEAM TURBINES** (combustion engines F02; machines or engines for liquids F03, F04; non-positive-displacement pumps F04D)

#### Note(s)

- This subclass covers:
  - non-positive-displacement engines for elastic fluids, e.g. steam turbines;
  - non-positive-displacement engines for liquids and elastic fluids;
  - non-positive-displacement machines for elastic fluids;
  - non-positive-displacement machines for liquids and elastic fluids.
- Attention is drawn to the Notes preceding class F01, especially as regards the definitions of "reaction type", e.g. with airfoil-like blades, and "impulse type", e.g. bucket turbines.

#### Subclass index

##### NON-POSITIVE-DISPLACEMENT MACHINES OR ENGINES

General characteristics; with axial-thrust balancing; with other than pure rotation.....1/00, 3/00, 23/00

Component parts

blades and carrying members, protection thereof; rotors with adjustable blades; stators.....5/00, 7/00, 9/00

means against internal leakage.....11/00

COMBINATIONS OR ADAPTATIONS OF MACHINES OR ENGINES.....13/00, 15/00

REGULATION, CONTROLLING, SAFETY MEANS.....17/00, 19/00, 21/00

STARTING; SHUTTING-DOWN.....19/00, 21/00

OTHER DETAILS AND ACCESSORIES.....25/00

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|--|---|
| <p><b>1/00 Non-positive-displacement machines or engines, e.g. steam turbines</b> (with working-fluid flows in opposite axial directions for balancing axial thrust F01D 3/02; with other than pure rotation F01D 23/00; turbines characterised by their use in special steam systems, cycles, or processes, regulating devices therefor F01K) <b>[1, 2006.01]</b></p> | <p>1/18 • without working-fluid guiding means (F01D 1/24, F01D 1/32, F01D 1/34 take precedence) <b>[1, 5, 2006.01]</b></p>  |
| <p>1/02 • with stationary working-fluid guiding means and bladed or like rotor (F01D 1/24 takes precedence; without working-fluid guiding means F01D 1/18) <b>[1, 5, 2006.01]</b></p>  | <p>1/20 • • traversed by the working-fluid substantially axially <b>[1, 2006.01]</b></p>  |
| <p>1/04 • • traversed by the working-fluid substantially axially <b>[1, 2006.01]</b></p>   | <p>1/22 • • traversed by the working-fluid substantially radially <b>[1, 2006.01]</b></p>   |
| <p>1/06 • • traversed by the working-fluid substantially radially <b>[1, 2006.01]</b></p>  | <p>1/24 • characterised by counter-rotating rotors subjected to same working-fluid stream without intermediate stator blades or the like <b>[1, 2006.01]</b></p>                                |
| <p>1/08 • • • having inward flow <b>[1, 2006.01]</b></p>   | <p>1/26 • • traversed by the working-fluid substantially axially <b>[1, 2006.01]</b></p>  |
| <p>1/10 • • having two or more stages subjected to working-fluid flow without essential intermediate pressure change, i.e. with velocity stages (F01D 1/12 takes precedence) <b>[1, 2006.01]</b></p>   | <p>1/28 • • traversed by the working-fluid substantially radially <b>[1, 2006.01]</b></p>   |
| <p>1/12 • • with repeated action on same blade ring <b>[1, 2006.01]</b></p>  | <p>1/30 • characterised by having a single rotor operable in either direction of rotation, e.g. by reversing of blades (combinations of machines or engines F01D 13/00) <b>[1, 2006.01]</b></p> |
| <p>1/14 • • • traversed by the working-fluid substantially radially <b>[1, 2006.01]</b></p>  | <p>1/32 • with pressure/velocity transformation exclusively in rotor, e.g. the rotor rotating under the influence of jets issuing from the rotor <b>[1, 2006.01]</b></p>                        |
| <p>1/16 • • characterised by having both reaction stages and impulse stages <b>[1, 2006.01]</b></p>  | <p>1/34 • characterised by non-bladed rotor, e.g. with drilled holes (F01D 1/32 takes precedence; sirens G10K 7/00) <b>[1, 5, 2006.01]</b></p>  |
|  | <p>1/36 • • using fluid friction <b>[1, 2006.01]</b></p>  |
|  | <p>1/38 • • of the screw type <b>[5, 2006.01]</b></p>   |

- 3/00 Machines or engines with axial-thrust balancing effected by working fluid [1, 2006.01]**
- 3/02 • characterised by having one fluid flow in one axial direction and another fluid flow in the opposite direction [1, 2006.01]
- 3/04 • axial thrust being compensated by thrust-balancing dummy piston or the like [1, 2006.01]
- 5/00 Blades; Blade-carrying members** (nozzle boxes F01D 9/02); **Heating, heat-insulating, cooling, or antivibration means on the blades or the members [1, 2006.01]**
- 5/02 • Blade-carrying members, e.g. rotors (rotors of non-bladed type F01D 1/34; stators F01D 9/00) [1, 2006.01]
- 5/03 • • Annular blade-carrying members having blades on the inner periphery of the annulus and extending inwardly radially, i.e. inverted rotors [6, 2006.01]
- 5/04 • • for radial-flow machines or engines [1, 2006.01]
- 5/06 • • Rotors for more than one axial stage, e.g. of drum or multiple-disc type; Details thereof, e.g. shafts, shaft connections [1, 2006.01]
- 5/08 • • Heating, heat-insulating, or cooling means [1, 2006.01]
- 5/10 • • Antivibration means [1, 2006.01]
- 5/12 • Blades (blade roots F01D 5/30; rotors with blades adjustable in operation F01D 7/00; stator blades F01D 9/02) [1, 2006.01]
- 5/14 • • Form or construction (selecting particular materials, measures against erosion or corrosion F01D 5/28) [1, 2006.01]
- 5/16 • • • for counteracting blade vibration [1, 2006.01]
- 5/18 • • • Hollow blades; Heating, heat-insulating, or cooling means on blades [1, 2006.01]
- 5/20 • • • Specially-shaped blade tips to seal space between tips and stator [1, 2006.01]
- 5/22 • • Blade-to-blade connections, e.g. by shrouding [1, 2006.01]
- 5/24 • • • using wire or the like [1, 2006.01]
- 5/26 • • Antivibration means not restricted to blade form or construction or to blade-to-blade connections [1, 2006.01]
- 5/28 • • Selecting particular materials; Measures against erosion or corrosion [1, 2006.01]
- 5/30 • Fixing blades to rotors; Blade roots [1, 2006.01]
- 5/32 • • Locking, e.g. by final locking-blades or keys [1, 2006.01]
- 5/34 • Rotor-blade aggregates of unitary construction [1, 2006.01]
- 7/00 Rotors with blades adjustable in operation; Control thereof** (for reversing F01D 1/30) [1, 2006.01]
- 7/02 • having adjustment responsive to speed [1, 2006.01]
- 9/00 Stators [1, 2006.01]**
- 9/02 • Nozzles; Nozzle boxes; Stator blades; Guide conduits [1, 2006.01]
- 9/04 • • forming ring or sector [1, 2006.01]
- 9/06 • Fluid supply conduits to nozzles or the like [1, 2006.01]
- 11/00 Preventing or minimising internal leakage of working fluid, e.g. between stages** (sealings in general F16J) [1, 2006.01]
- 11/02 • by non-contact sealings, e.g. of labyrinth type (for sealing space between rotor blade tips and stator F01D 11/08) [1, 2006.01]
- 11/04 • • using sealing fluid, e.g. steam [1, 2006.01]
- 11/06 • • • Control thereof [1, 2006.01]
- 11/08 • for sealing space between rotor blade tips and stator (specially-shaped blade tips therefor F01D 5/20) [1, 2006.01]
- 11/10 • • using sealing fluid, e.g. steam [1, 2006.01]
- 11/12 • • using a rubstrip, e.g. erodible, deformable or resiliently biased part [6, 2006.01]
- 11/14 • • Adjusting or regulating tip-clearance, i.e. distance between rotor-blade tips and stator casing (rotors with blades adjustable in operation F01D 7/00) [6, 2006.01]
- 11/16 • • • by self-adjusting means (F01D 11/12 takes precedence) [6, 2006.01]
- 11/18 • • • using stator or rotor components with predetermined thermal response, e.g. selective insulation, thermal inertia, differential expansion [6, 2006.01]
- 11/20 • • • Actively adjusting tip-clearance [6, 2006.01]
- 11/22 • • • by mechanically actuating the stator or rotor components, e.g. moving shroud sections relative to the rotor [6, 2006.01]
- 11/24 • • • by selectively cooling or heating stator or rotor components [6, 2006.01]
- 13/00 Combinations of two or more machines or engines** (F01D 15/00 takes precedence; combinations of two or more pumps F04; fluid gearing F16H) [1, 2006.01]
- 13/02 • Working-fluid interconnection of machines or engines [1, 2006.01]
- 15/00 Adaptations of machines or engines for special use; Combinations of engines with devices driven thereby [1, 2006.01]**
- 15/02 • Adaptations for driving vehicles, e.g. locomotives [1, 2006.01]
- 15/04 • • the vehicles being waterborne vessels [1, 2006.01]
- 15/06 • Adaptations for driving, or combinations with, hand-held tools or the like [1, 2006.01]
- 15/08 • Adaptations for driving, or combinations with, pumps [1, 2006.01]
- 15/10 • Adaptations for driving, or combinations with, electric generators [1, 2006.01]
- 15/12 • Combinations with mechanical gearing (driven by multiple engines F01D 13/00) [1, 2006.01]
- 17/00 Regulating or controlling by varying flow** (for reversing F01D 1/30; by varying rotor blade position F01D 7/00; specially for starting F01D 19/00; shutting-down F01D 21/00; regulating or controlling in general G05) [1, 2006.01]
- 17/02 • Arrangement of sensing elements [1, 2006.01]
- 17/04 • • responsive to load [1, 2006.01]
- 17/06 • • responsive to speed [1, 2006.01]
- 17/08 • • responsive to condition of working fluid, e.g. pressure [1, 2006.01]
- 17/10 • Final actuators (valves in general F16K) [1, 2006.01]
- 17/12 • • arranged in stator parts [1, 2006.01]
- 17/14 • • • varying effective cross-sectional area of nozzles or guide conduits [1, 2006.01]
- 17/16 • • • by means of nozzle vanes [1, 2006.01]
- 17/18 • • • varying effective number of nozzles or guide conduits [1, 2006.01]
- 17/20 • Devices dealing with sensing elements or final actuators or transmitting means between them, e.g. power-assisted (sensing elements alone F01D 17/02; final actuators alone F01D 17/10) [1, 2006.01]
- 17/22 • • the operation or power assistance being predominantly non-mechanical [1, 2006.01]

17/24	• • • electrical [1, 2006.01]	25/02	• De-icing means for engines having icing phenomena [1, 2006.01]
17/26	• • • fluid, e.g. hydraulic [1, 2006.01]	25/04	• Antivibration arrangements [1, 2006.01]
<b>19/00</b>	<b>Starting of machines or engines; Regulating, controlling, or safety means in connection therewith</b> (warming-up before starting F01D 25/10; turning or inching gear F01D 25/34) [1, 2006.01]	25/06	• • for preventing blade vibration (means on blade-carrying members or blades F01D 5/00) [1, 2006.01]
19/02	• dependent on temperature of component parts, e.g. of turbine casing [1, 2006.01]	25/08	• Cooling (of machines or engines in general F01P); Heating; Heat insulation (of blade-carrying members, of blades F01D 5/00) [1, 2006.01]
<b>21/00</b>	<b>Shutting-down of machines or engines, e.g. in emergency; Regulating, controlling, or safety means not otherwise provided for [1, 2006.01]</b>	25/10	• • Heating, e.g. warming-up before starting [1, 2006.01]
21/02	• Shutting-down responsive to overspeed [1, 2006.01]	25/12	• • Cooling [1, 2006.01]
21/04	• responsive to undesired position of rotor relative to stator, e.g. indicating such position [1, 2006.01]	25/14	• • Casings modified therefor (double casings F01D 25/26) [1, 2006.01]
21/06	• • Shutting-down [1, 2006.01]	25/16	• Arrangement of bearings; Supporting or mounting bearings in casings (bearings <u>per se</u> F16C) [1, 2006.01]
21/08	• • Restoring position [1, 2006.01]	25/18	• Lubricating arrangements (of machines or engines in general F01M) [1, 2006.01]
21/10	• responsive to unwanted deposits on blades, in working-fluid conduits, or the like [1, 2006.01]	25/20	• • using lubrication pumps [1, 2006.01]
21/12	• responsive to temperature [1, 2006.01]	25/22	• • using working fluid or other gaseous fluid as lubricant [1, 2006.01]
21/14	• responsive to other specific conditions [1, 2006.01]	25/24	• Casings (modified for heating or cooling F01D 25/14); Casing parts, e.g. diaphragms, casing fastenings (casings for rotary machines or engines in general F16M) [1, 2006.01]
21/16	• Trip gear [1, 2006.01]	25/26	• • Double casings; Measures against temperature strain in casings [1, 2006.01]
21/18	• • involving hydraulic means [1, 2006.01]	25/28	• Supporting or mounting arrangements, e.g. for turbine casing [1, 2006.01]
21/20	• Checking operation of shut-down devices [1, 2006.01]	25/30	• Exhaust heads, chambers, or the like [1, 2006.01]
<b>23/00</b>	<b>Non-positive-displacement machines or engines with movement other than pure rotation, e.g. of endless-chain type [1, 2006.01]</b>	25/32	• Collecting of condensation water; Drainage [1, 2006.01]
<b>25/00</b>	<b>Component parts, details, or accessories, not provided for in, or of interest apart from, other groups [1, 2006.01]</b>	25/34	• Turning or inching gear [1, 2006.01]
		25/36	• • using electric motors [1, 2006.01]