

ECLA**EUROPEAN CLASSIFICATION****F****MECHANICAL ENGINEERING; LIGHTING;
HEATING; WEAPONS; BLASTING ENGINES OR
PUMPS****Notes**

Guide to the use of this subsection (classes F01 to F04) The following notes are meant to assist in the use of this part of the classification scheme.

1. In this subsection, subclasses or groups designating "engines" or "pumps" cover methods of operating the same, unless otherwise specifically provided for.
2. In this subsection, the following terms or expressions are used with the meanings 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. "Engine" also includes the fluid-motive portion of a meter unless such portion is particularly adapted for use in a meter;
 - "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, the dynamic effect of the fluid being of minor importance; and VICE-VERSA;
 - "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;
 - "oscillating-piston machine" means a positive-displacement machine in which a fluid-engaging work-transmitting member oscillates. This definition applies also to engines and pumps;
 - "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;
 - "rotary piston" means the work-transmitting member of a rotary-piston machine and may be of any suitable form, e.g. like a toothed gear;
 - "co-operating members" means the "oscillating piston" or "rotary piston" and another member, e.g. the working-chamber wall, which assists in the driving or pumping action;
 - "movement of the co-operating members" is to be interpreted as relative, so that one of the "co-operating members" may be stationary, even though reference may be made to its rotational axis, or both may move;
 - "teeth or tooth-equivalents", include lobes, projections or

abutments;

- "internal-axis type" means that the rotational axes of the inner and outer co-operating members remain at all times within the outer member, e.g. in a similar manner to that of a pinion meshing with the internal teeth of a ring gear;
- "free-piston" means a piston of which the length of stroke is not defined by any member driven thereby;
- "cylinders" means positive-displacement working chambers in general and thus this term is not restricted to cylinders of circular cross-section;
- "main shaft" means the shaft which converts reciprocating piston motion into rotary motion or VICE-VERSA;
- "plant" means an engine together with such additional apparatus as is necessary to run the engine. For example, a steam engine plant includes a steam engine and means for generating the steam;
- "working fluid" means the driven fluid in a pump and the driving fluid in an engine. The working fluid may be in a gaseous state, i.e. compressible, or liquid. In the former case coexistence of two states is possible;
- "steam" includes condensable vapours in general, and "special vapour" is used when steam is excluded;
- "reaction type" as applied to non-positive-displacement machines or engines means machines or engines in which pressure/velocity transformation takes place wholly or partly in the rotor; machines or engines with no, or only slight, pressure/velocity transformation in the rotor are called "impulse type".

3. In this subsection:

- cyclically operating valves, lubricating, gas-flow silencers or exhaust apparatus, or cooling should be classified in subclasses F01L, F01M, F01N, F01P irrespective of their stated application, unless their classifying features are peculiar to their application, in which case they should be classified only in the relevant subclass of classes F01 to F04;
- lubricating, gas-flow silencers or exhaust apparatus, or cooling of machines or engines should be classified in subclasses F01M, F01N, F01P except for those peculiar to steam engines which should be classified in subclass F01B.

4. For use of this subsection with a good understanding, it is essential to remember, so far as subclasses F01B, F01C, F01D, F03B, F04B, F04C and F04D, which form its skeleton, are concerned:

- the principle which resides in their elaboration
- the classifying characteristics which they call for, and
- their complementarity

- a. Principle This concerns essentially the subclasses listed above. Other subclasses, notably those of class F02, which cover better-defined matter, are not considered here. Each subclass covers fundamentally a genus of apparatus (engine or pump) and by extension covers equally "machines" of the same kind. Two different subjects, one having a more general character than the other, are thus covered by in the same subclass Subclasses F01B, F03B, F04B, beyond

the two subjects which they cover, have further a character of generality in relation to other subclasses concerning the different species of apparatus in the genus concerned. This generality applies as well for the two subjects dealt with, without these always being in relation to the same subclasses. Thus, subclass F03B, in its part dealing with "machines" should be considered as being the general class relating to subclasses F04B, F04C and in its part dealing with "engines" as being general in relation to subclass F03C.

- b. CharacteristicsThe principal classifying characteristic of the subclass is that of genera of apparatus, of which there are three possible:

Machines; engines; pumps.

As stated above, "machines" are always associated with one of the other two genera. These main genera are subdivided according to the general principles of operation of the apparatus:

Positive displacement; non-positive displacement.

The positive displacement apparatus are further subdivided according to the ways of putting into effect the principle of operation, that is, to the kind of apparatus:

Simple reciprocating piston; rotary or oscillating piston; other kind.

Another classifying characteristic is that of the working fluid, in respect of which three kinds of apparatus are possible, namely:

Liquid and elastic fluid; elastic fluid; liquid.

- c. Complementarity This resides in association of pairs of the subclasses listed above, according to the characteristics under consideration in respect of kind of apparatus or working fluid.
- d. The subclasses concerned with the various principles, characteristics and complementarity are shown in the following table:

Kind	positive		non-	Working fluid					
Relations of			posi-					of	
gene- dis-	rotary		tive					rality	
in									
place-	reci-	or os-				liquid			
respect	pro-	cillat-				and		of	
ment	cating ing					elastic elastic		of	
kind									
dis-	piston	piston	other			fluid fluid liquid			
placement									
<hr/>									
MACHINES									

	X		X		X	X		F01B
		X			X	X		F01C
				X	X	X		F01D
				X			X	F03B
	X		X				X	F04B
ENGINES		X					X	F04C
	X		X		X	X		F01B
		X			X	X		F01C
				X	X	X		F01D
				X			X	F03B
	X	X	X				X	F03C
PUMPS								
	X		X		X	X	X	F04B
		X			X	X	X	F04C
				X	X	X	X	F04D

It is seen from the table that :

- For the same kind of apparatus in a given genus, the characteristic of "working fluid" associates:
F01B and F04B)
F01C and F04C) Machines
F01D and F03B)
F01B and F03C)
F01C and F03C) Engines
F01D and F03B)
- For the same kind of working fluid, the "apparatus" characteristic relates subclasses in the same way as considerations of relative generality.

SUBSECTION: Engines or pumps

F01 **MACHINES OR ENGINES IN GENERAL** (combustion engines [F02](#); machines for liquids [F03](#), [F04](#)); **ENGINE PLANTS IN GENERAL; STEAM ENGINES**

F01B **MACHINES OR ENGINES, IN GENERAL OR OF POSITIVE-DISPLACEMENT TYPE, e.g. STEAM ENGINES** (of rotary-piston or oscillating-piston type [F01C](#); of non-positive-displacement type [F01D](#); internal-combustion aspects of reciprocating-piston engines [F02B57/00](#), [F02B59/00](#); crankshafts, crossheads, connecting-rods [F16C](#); flywheels [F16F](#); gearings for interconverting rotary motion and reciprocating motion in general [F16H](#); pistons, piston rods, cylinders, for engines in general [F16J](#)) [**M1204**]

F01C **ROTARY-PISTON OR OSCILLATING-PISTON MACHINES OR ENGINES** (internal-combustion aspects [F02B 53/00](#), [55/00](#))

F01D **NON-POSITIVE DISPLACEMENT MACHINES OR ENGINES, e.g. STEAM TURBINES** (machines or engines for liquids [F03](#);

non-positive displacement pumps F04D)

- F01K** STEAM ENGINE PLANTS; STEAM ACCUMULATORS; ENGINE PLANTS NOT OTHERWISE PROVIDED FOR; ENGINES USING SPECIAL WORKING FLUIDS OR CYCLES (gas-turbine or jet-propulsion plants F02; nuclear power plants, engine arrangements therein G21D)
- F01L** CYCLICALLY OPERATING VALVES FOR MACHINES OR ENGINES (valves in general F16K)
- F01M** LUBRICATING OF MACHINES OR ENGINES IN GENERAL (lubricating in general [F16N](#)); LUBRICATING INTERNAL COMBUSTION ENGINES; CRANKCASE VENTILATING
- F01N** GAS-FLOW SILENCERS OR EXHAUST APPARATUS FOR MACHINES OR ENGINES IN GENERAL; GAS-FLOW SILENCERS OR EXHAUST APPARATUS FOR INTERNAL COMBUSTION ENGINES ([N: evacuation of fumes from the area where they are produced [B08B15/00](#); arrangement of exhaust or silencing apparatus on percussive tools [B25D17/12](#); arrangements in connection with gas exhaust of propulsion units in vehicles [B60K13/00](#), [N: on ships or other waterborne vessels [B63H21/32](#), on aircraft [B64D33/04](#); arrangement of exhaust or silencing apparatus on firearms [F41A21/30](#); ground installations for reducing aircraft engine or jet noise [B64F 1/26](#); silencers specially adapted for steam engines [F01B31/16](#); air-intake silencers for gas turbine or jet propulsion plants [F02C7/045](#); jet pipe or nozzles for jet propulsion plants [F02K](#); combustion-air intake silencers specially adapted for, or arranged on, internal-combustion engines [F02M35/00](#); [N: combating noise or silencing in positive displacement machines or pumps [F04B39/00D](#), in rotary-piston machines or pumps [F04C29/06](#), in non-positive displacement pumps [F04D29/66](#); means in valves for absorbing noise [F16K47/02](#); noise absorbers in pipe system [F16L55/02](#); conducting smoke or fumes from various locations to the outside [F23J11/00](#); means for preventing or suppressing noise in air-conditioning or ventilation systems [F24F13/24](#); protecting against, or damping, noise in general [G10K11/16](#))
- F01P** COOLING OF MACHINES OR ENGINES IN GENERAL; COOLING OF INTERNAL-COMBUSTION ENGINES (arrangements in connection with cooling of propulsion units in vehicles [B60K11/00](#); heat-transfer, heat-exchange or heat-storage materials [C09K5/00](#); [N: cooling of gas-turbine engines [F02C7/12](#); heat exchange in general, radiators [F28](#))
- F02** COMBUSTION ENGINES (cyclically operating valves therefor, lubricating, exhausting, or silencing engines [F01](#)); HOT-GAS OR COMBUSTION-PRODUCT ENGINE PLANTS

- F02B** **INTERNAL-COMBUSTION PISTON ENGINES; COMBUSTION ENGINES IN GENERAL** (plants in which engines use combustion products F02C, F02G; internal-combustion turbines F02C) [M1204]
- F02C** **GAS-TURBINE PLANTS; AIR INTAKES FOR JET-PROPULSION PLANTS; CONTROLLING FUEL SUPPLY IN AIR-BREATHING JET-PROPULSION PLANTS** (construction of turbines F01D; jet-propulsion plants F02K; construction of compressors or fans F04; gas-turbine combustion chambers F23R; using gas turbines in compression refrigeration plants [F25B11/00](#); using gas-turbine plants in vehicles, see the relevant vehicle classes)
- F02D** **CONTROLLING COMBUSTION ENGINES** (cyclically operating valves for combustion engines F01L; controlling combustion engine lubrication F01M; cooling internal combustion engines F01P; supplying combustion engines with combustible mixtures or constituents thereof, e.g. carburettors, injection pumps F02M; starting of combustion engines F02N; controlling of ignition F02P; controlling gas-turbine plants, jet-propulsion plants, or combustion-product engine plants, see the relevant subclasses for these plants) [M1204]
- F02F** **CYLINDERS, PISTONS OR CASINGS, FOR COMBUSTION ENGINES; ARRANGEMENTS OF SEALINGS IN COMBUSTION ENGINES** (specially adapted for rotary-piston or oscillating-piston internal-combustion engines [F02B](#); specially adapted for gas-turbine plants [F02C](#); specially adapted for jet-propulsion plants [F02K](#))
- F02G** **HOT GAS OR COMBUSTION-PRODUCT POSITIVE-DISPLACEMENT ENGINE PLANTS** (steam engine plants, special vapour plants, plants operating on either hot gas or combustion-product gases together with other fluid [F01K](#); gas-turbine plants [F02C](#); jet-propulsion plants [F02K](#)); **USE OF WASTE HEAT OF COMBUSTION ENGINES; NOT OTHERWISE PROVIDED FOR**
- F02K** **JET-PROPULSION PLANTS** (arrangement or mounting of jet-propulsion plants in land vehicles or vehicles in general B60K; arrangement or mounting of jet-propulsion plants in waterborne vessels B63H; controlling aircraft attitude, flight direction or altitude by jet reaction B64C; arrangement or mounting of jet-propulsion plants in aircraft B64D; plants characterised by the power of the working fluid being divided between jet-propulsion and another form of propulsion, e.g. propeller, F02B, C; features of jet-propulsion plants common to gas-turbine plants, air intakes or fuel supply control of air-breathing jet-propulsion plants F02C) [C9410]
- F02M** **SUPPLYING COMBUSTION ENGINES IN GENERAL, WITH COMBUSTIBLE MIXTURES OR CONSTITUENTS THEREOF** (charging

such engines F02B)

- F02N** **STARTING OF COMBUSTION ENGINES** (starting of free-piston combustion engines [F02B71/02](#); starting of gas-turbine plants [F02C7/26](#)); **STARTING AIDS FOR SUCH ENGINES, NOT OTHERWISE PROVIDED FOR**
- F02P** **IGNITION, OTHER THAN COMPRESSION IGNITION, FOR INTERNAL-COMBUSTION ENGINES; TESTING OF IGNITION TIMING IN COMPRESSION-IGNITION ENGINES** ([N: anti-pollution means for internal-combustion engines [F02B17/00](#)]; specially adapted for rotary-piston or oscillating-piston engines F02B 53/12; [N: ignition of gas turbine plants [F02C7/26](#); ignition of jet propulsion plants [F02K9/95](#); starting of combustion engines [F02N9/00](#)]; ignition of combustion apparatus in general, glowing plugs F23Q; measuring of physical variables in general G01; controlling in general G05; data processing in general G06; electrical components in general see Section H; [N: ignition coils [H01F38/12](#); sparking plugs [H01T13/00](#)] [C9604]
- F03** **MACHINES OR ENGINES FOR LIQUIDS** (for liquid and gases [F01](#); positive-displacement machines for liquids [F04](#)); **WIND, SPRING WEIGHT AND MISCELLANEOUS MOTORS; PRODUCING MECHANICAL POWER; OR A REACTIVE PROPULSIVE THRUST, NOT OTHERWISE PROVIDED FOR**
- F03B** **MACHINES OR ENGINES FOR LIQUIDS** (positive-displacement engines for liquid F03C; machines for liquids and gases F01; positive-displacement machines for liquids F04 , rotary fluid gearing of the hydrokinetic type [F16H41/00](#))
- F03C** **POSITIVE-DISPLACEMENT ENGINES DRIVEN BY LIQUIDS** (positive-displacement engines for liquids and elastic fluids F01; positive-displacement machines for liquids F04; fluid-pressure actuators F15B; fluid gearing F16H)
- F03D** **WIND MOTORS**
- F03G** **SPRING, WEIGHT, INERTIA OR LIKE MOTORS; MECHANICAL-POWER PRODUCING DEVICES OR MECHANISMS, NOT OTHERWISE PROVIDED FOR OR USING ENERGY SOURCES NOT OTHERWISE PROVIDED FOR** (arrangements in connection with power supply in vehicles from force of nature [B60K16/00](#); electric propulsion with power supply in vehicles from force of nature [B60L8/00](#))
- F03H** **PRODUCING A REACTIVE PROPULSIVE THRUST, NOT OTHERWISE PROVIDED FOR** (from combustion products F02K)

- F04** **POSITIVE DISPLACEMENT MACHINES FOR LIQUIDS; PUMPS FOR LIQUIDS OR ELASTIC FLUIDS** (portable fire-extinguishers with manually-operated pumps [A62C11/00](#), with power-driven pumps [A62C25/00](#); charging or scavenging combustion engines by pumps [F02B](#); engines fuel-injection pumps [F02M](#); ion pumps [H01J41/00](#); electro-dynamic pumps [H02K44/02](#))
- Note**
Combinations of positive-displacement and non-positive displacement pumps are classified in subclass [F04B](#) as a general subclass for pumps and in subclasses [F04C](#), [F04D](#) in respect of matter specific to these subclasses.
- F04B** **POSITIVE DISPLACEMENT MACHINES FOR LIQUIDS; PUMPS** (machines for liquids, or pumps, of rotary piston or oscillating piston type [F04C](#); non-positive displacement pumps [F04D](#); pumping of fluid by direct contact of another fluid or by using inertia of fluid to be pumped [F04F](#); crankshafts, crossheads, connecting-rods [F16C](#); flywheels [F16F](#); gearings for interconverting rotary motion and reciprocating motion in general [F16H](#); pistons, piston-rods, cylinders, in general [F16J](#))
- F04C** **ROTARY-PISTON, OR OSCILLATING-PISTON, POSITIVE-DISPLACEMENT MACHINES FOR LIQUIDS** (engines [F03C](#)); **ROTARY-PISTON, OR OSCILLATING-PISTON, POSITIVE-DISPLACEMENT PUMPS**
- F04D** **NON-POSITIVE DISPLACEMENT PUMPS**
- F04F** **PUMPING OF FLUID BY DIRECT CONTACT OF ANOTHER FLUID OR BY USING INERTIA OF FLUID TO BE PUMPED** [[N](#): (evacuating by sorption [F04B](#))]; **SIPHONS** [[N](#): Conveying materials in bulk by flows of gas, liquid or foam [B65G53/00](#)]
- SUBSECTION: Engineering in general**
- F15** **FLUID-PRESSURE ACTUATORS; HYDRAULICS OR PNEUMATICS IN GENERAL**
- F15B** **SYSTEMS ACTING BY MEANS OF FLUIDS IN GENERAL; FLUID-PRESSURE ACTUATORS, e.g. SERVO-MOTORS; DETAILS OF FLUID-PRESSURE SYSTEMS, NOT OTHERWISE PROVIDED FOR** ([[N](#): hydraulically or pneumatically operated lifting devices for soil-working machines [A01B63/10](#); hydraulic drawing presses [B21D](#); hydraulic or pneumatic manipulators [B25J](#); hydraulic or pneumatic tipping devices for vehicles [B60P1/00](#); hydraulic or pneumatic remote control for railway signals [B61L7/04](#); hydraulic or pneumatic mine supports

[E21D15/44](#)]; motors, turbines, compressors, blowers, pumps F01 to F04; [N: fluid signal amplifiers, relays [F15C](#)]; fluid dynamics [F15D](#); fluid clutches or brakes [F16D](#); fluid springs [F16F](#); fluid gearing [F16H](#); pistons, cylinders packing [F16J](#); valves, taps, cocks, actuating-floats [F16K](#); safety valves with auxiliary fluid operation of the main valve [F16K17/10](#); fluid-operating means for valves [F16K31/12](#); pipes, pipe joints [F16L](#); lubricating [F16N](#))

- F15C** **FLUID-CIRCUIT ELEMENTS PREDOMINANTLY USED FOR COMPUTING OR CONTROL PURPOSES** (transducers [F15B5/00](#), [N: [F15B21/00](#)]; fluid dynamics in general [F15D](#); computer comprising fluid elements [G06D](#), [G06G](#); [N: electric control by means of electro-hydraulic or electro-pneumatic amplifiers [G05B7/02](#)])
- F15D** **FLUID DYNAMICS, i.e. METHODS OR MEANS FOR INFLUENCING THE FLOW OF GASES OR LIQUIDS** ([N: nozzles, spray heads [B05B](#); devices to decrease friction or resistance or to increase speed of ships [B63B](#); ship rudders [B63H25/38](#); influencing the flow or the viscosity of fluids with chemical additives [C09K3/00](#), [C10M](#); hydraulic engineering [E02B](#)]; fluid circuit elements [F15C](#); [N: one-way check valves [F16K15/00](#)])
- F16** **ENGINEERING ELEMENTS AND UNITS; GENERAL MEASURES FOR PRODUCING AND MAINTAINING EFFECTIVE FUNCTIONING OF MACHINES OR INSTALLATIONS; THERMAL INSULATION IN GENERAL**
- F16B** **DEVICES FOR FASTENING OR SECURING CONSTRUCTIONAL ELEMENTS OR MACHINE PARTS TOGETHER, e.g. NAILS, BOLTS, CIRCLIPS, CLAMPS, CLIPS, WEDGES, JOINTS OR JOINTING**
- F16C** **SHAFTS; FLEXIBLE SHAFTS; ELEMENTS OR CRANKSHAFT MECHANISMS; ROTARY BODIES OTHER THAN GEARING ELEMENTS; BEARINGS**
- F16D** **COUPLINGS FOR TRANSMITTING ROTATION; CLUTCHES; BRAKES**
- F16F** **SPRINGS; SHOCK-ABSORBERS; MEANS FOR DAMPING VIBRATION**
- F16G** **BELTS, CABLES, OR ROPES, PREDOMINANTLY USED FOR DRIVING PURPOSES; CHAINS; FITTINGS PREDOMINANTLY USED THEREFOR**
- F16H** **GEARING** [N: (steering of motor vehicles by differentially driving ground-engaging elements on opposite vehicle sides [B62D11/02](#))]

- F16J** **PISTONS** [N: (specially adapted for dampers [F16F9/32](#))]; **CYLINDERS;**
SEALINGS [[C9410](#)]
- F16K** **VALVES; TAPS; COCKS; ACTUATING-FLOATS; DEVICES FOR**
VENTING OR AERATING [N: (devices for emptying and evacuating the excess
liquid in valves or conduits [F16L55/07](#))]
- F16L** **PIPES; JOINTS OR FITTINGS FOR PIPES; SUPPORTS FOR PIPES,**
CABLES OR PROTECTIVE TUBING; MEANS FOR THERMAL
INSULATION IN GENERAL
- F16M** **FRAMES, CASINGS, OR BEDS OF ENGINES OR OTHER MACHINES**
OR APPARATUS NOT SPECIFIC TO AN ENGINE, MACHINE, OR
APPARATUS PROVIDED FOR ELSEWHERE; STANDS OR SUPPORTS
- F16N** **LUBRICATING**
- F16P** **SAFETY DEVICES IN GENERAL;** [N: [SAFETY DEVICES FOR PRESSES](#)]
- F16S** **CONSTRUCTIONAL ELEMENTS IN GENERAL; STRUCTURES**
BUILT-UP FROM SUCH ELEMENTS, IN GENERAL
- F16T** **STEAM TRAPS OR LIKE APPARATUS FOR DRAINING-OFF LIQUIDS**
FROM ENCLOSURES PREDOMINANTLY CONTAINING GASES OR
VAPOURS
- F17** **STORING OF DISTRIBUTING GASES OR LIQUIDS** (water supply
[E03B](#))
- F17B** **GAS-HOLDERS OF VARIABLE CAPACITY** (self-acting gas cut-off devices
[A47J27/62](#), [G05D](#); flame traps [A62C4/00](#); gas mixers [B01E](#), [F16K11/00](#), [G05D11/00](#);
construction or assembling of bulk storage containers employing civil-engineering
techniques [E04H7/00](#), gas compressors [F04](#); valves [F16K](#); damping pulsations in valves
or pipes [F16K](#), [F16L](#); pipes [F16L](#); stopping devices for gas mains [F16L55/10](#); vessels
adapted for storing compressed, liquefied, or solidified gases [F17C](#); gas distribution
systems [F17D1/04](#); detecting leakage [F17D5/02](#), [G01M](#); supervising or alarm devices
[F17D5/02](#), [G08B](#); control of combustion in burners [F23N](#); gas flow or pressure regulators
[G05D](#))
- F17C** **VESSELS FOR CONTAINING OR STORING COMPRESSED,**
LIQUEFIED OR SOLIDIFIED GASES; FIXED-CAPACITY

GAS-HOLDERS; FILLING VESSELS WITH, OR DISCHARGING FROM VESSELS, COMPRESSED, LIQUEFIED, OR SOLIDIFIED GASES (storing fluids in natural or artificial cavities or chambers in the earth [B65G5/00](#); construction or assembling of bulk storage containers employing civil-engineering techniques [E04H7/00](#); variable-capacity gas-holders [F17B](#); liquefaction or refrigeration machines, plants, or systems [F25](#))

F17D PIPE-LINE SYSTEMS; PIPE-LINES (pumps or compressors [F04](#); fluid dynamics [F15D](#); valves or the like [F16K](#); pipes, laying pipes, supports, joints, branches, repairing, work on the entire line, accessories [F16L](#); steam traps or the like [F16T](#); fluid-pressure electric cables [H01B9/06](#))

SUBSECTION: Lighting; heating

F21 LIGHTING (electric aspects or elements, see section H, e.g. electric light sources [H01J](#), [H01K](#), [H05B](#)) [[C0102](#)]

[N: **Note**

In this class, the following terms are used with the meanings indicated:

- "Portable" means "intended to be carried personally"
 - "Non-portable" means "not intended to be carried personally, even if capable of being moved from place to place"
-]

F21H MANTLES; OTHER INCANDESCENT BODIES HEATED BY COMBUSTION (arrangements thereof [F21V36/00](#); burners [F23D](#))

F21K LIGHT SOURCES NOT OTHERWISE PROVIDED FOR

F21L LIGHTING DEVICES OR SYSTEMS THEREOF, BEING PORTABLE OR SPECIALLY ADAPTED FOR TRANSPORTATION

F21S NON-PORTABLE LIGHTING DEVICES OR SYSTEMS THEREOF (burners [F23D](#)) [[C0904](#)]

F21V DETAILS OF LIGHTING DEVICES, OF GENERAL APPLICATION

F22 STEAM GENERATION (chemical or physical apparatus for generating gases [B01J](#); chemical generation of gas, e.g. under pressure, Section C; removal of combustion products or residues, e.g. cleaning of the combustion contaminated surfaces of tubes of boilers, [F23J](#); generating combustion products of high pressure or high velocity [F23R](#);

water heaters not for steam generation [F24H](#), [F28](#); cleaning of internal or external surfaces of heat-transfer conduits, e.g. water tubes of boilers, [F28G](#))

Note

In this class the following term is used with the meaning indicated:

- "steam" covers also other condensable vapours, e.g. mercury, diphenyl, diphenyl oxide.

F22B

METHODS OF STEAM GENERATION; STEAM BOILERS (steam engine plants where engine aspects predominate [F01K](#); domestic central-heating systems using steam [F24D](#); heat exchange or heat transfer in general [F28](#); generation of vapour in the cores of nuclear reactors [G21](#))

F22D

PREHEATING, OR ACCUMULATING PREHEATED, FEED-WATER ; FEED-WATER SUPPLY ; CONTROLLING WATER LEVEL ; AUXILIARY DEVICES FOR PROMOTING WATER CIRCULATION WITHIN BOILERS (chemical treatment of water, e.g. purification, [C02F](#) ; enclosed heat-exchange apparatus in general [F28D](#) ; controlling in general [G05](#))

F22G

SUPERHEATING OF STEAM (steam separating arrangements in boilers [F22B37/26](#))

F23

COMBUSTION APPARATUS; COMBUSTION PROCESSES

Note

In this class, the following terms are used with the meanings indicated:

- "combustion" means a heat-producing sequence of chemical reactions between a burnable substance and molecular oxygen, e.g. in air, in most cases generating light in the form of flames or a glow;
- "combustion chamber" means a chamber in which fuel is burned to establish a self-supporting fire or flame and which surrounds that fire or flame;
- "burner" means a device by which fluent fuel is passed to a combustion space where it burns to produce a self-supporting flame;
- "air" means a mixture of gases containing free oxygen and able to promote or support combustion.

F23B

METHODS OR APPARATUS FOR COMBUSTION USING ONLY SOLID FUEL (for combustion of fuels that are solid at room temperatures, but burned in melted form, e.g. candle wax, [C11C5/00](#), [F23C](#), [F23D](#) ; using solid fuel suspended in air [F23C](#), [F23D 1/00](#) ; using solid fuel suspended in liquids [F23C](#), [F23D11/00](#); using solid fuel and fluent fuel simultaneously or alternately [F23C](#), [F23D 17/00](#); [N: burning of low grade fuel [F23G](#); grates [F23H](#); feeding solid fuel to combustion apparatus [F23K](#); combustion chambers, not otherwise provided for [F23M](#); domestic apparatus [F24](#); central heating

boilers F24D; package boilers F24H)

- F23C** **COMBUSTION APPARATUS USING FLUENT FUEL** (combustion apparatus for solid fuel only F23B; burners F23D; constructional details of combustion chambers not otherwise provided for F23M; combustion chambers for generating combustion products of high pressure or high velocity F23R)
- F23D** **BURNERS** (generating combustion products of high pressure or high velocity F23R)
- F23G** **CREMATION FURNACES; CONSUMING WASTE PRODUCTS BY COMBUSTION**
- F23H** **GRATES** (inlets for fluidisation air for fluidised bed combustion apparatus [F23C10/20](#)); **CLEANING OR RAKING GRATES**
- F23J** **REMOVAL OR TREATMENT OF COMBUSTION PRODUCTS OR COMBUSTION RESIDUES** [N: (from fluidised-bed combustion apparatus [F23C11/02T5](#))]; **FLUES** (precipitating dust from flue gases B01D; composition of fuel C10; combustion apparatus for consuming smoke or fumes, e.g. exhaust gases, [F23G7/06](#))
- F23K** **FEEDING FUEL TO COMBUSTION APPARATUS** (fuel feeders specially adapted for fluidised-bed combustion apparatus [F23C10/22](#); regulating or controlling combustion [F23N](#))
- F23L** **AIR SUPPLY; DRAUGHT-INDUCING; SUPPLYING NON-COMBUSTIBLE LIQUID OR GAS** (air-supply arrangements for fluent fuels F23C; dampers and throat restrictors for open fire-places F24; air inlet valves for open fire fronts F24)
- F23M** **CONSTRUCTIONAL DETAILS OF COMBUSTION CHAMBERS, NOT OTHERWISE PROVIDED FOR** (construction or support of tube walls for steam boilers F22B; generating combustion products of high pressure or high velocity F23R)
- F23N** **REGULATING OR CONTROLLING COMBUSTION** (control devices specially adapted for fluidised-bed combustion apparatus [F23C10/28](#); condition responsive controls for regulating combustion in domestic stoves with open fires for solid fuel [F24B1/187](#))
- F23Q** **IGNITION** (devices or installations peculiar to internal-combustion engines [F02P](#); of

cigarettes or tobacco [A24F](#); compositions therefor, chemical igniters [C06C](#));
Extinguishing-devices [\[C0002\]](#)

F23R

GENERATING COMBUSTION PRODUCTS OF HIGH PRESSURE OR HIGH VELOCITY, e.g. GAS-TURBINE COMBUSTION CHAMBERS (using such products for specific purposes, see the relevant classes for the purposes; chemical aspects of gas production [C06D5/00](#); gas-turbine plants characterised by the arrangement of the combustion chamber in the plant [F02C3/14](#); arrangement of afterburners in jet-propulsion plants [F02K3/10](#); combustion chambers of rocket-engine plants [F02K9/00](#))

F24

HEATING; RANGES; VENTILATING (protecting plants by heating in gardens, orchards, or forests [A01G13/06](#); baking ovens and apparatus [A21B](#); cooking devices other than ranges [A47J](#); forging [B21J](#), [B21K](#); specially adapted for vehicles, see the relevant subclasses of [B60](#) to [B64](#); combustion apparatus in general [F23](#); drying [F26B](#); ovens in general [F27](#); electric heating elements and arrangements [H05B](#))

Note

In this class, the following terms are used with the meanings indicated:

- "stove" includes apparatus which may have an open fire, e.g. fireplace;
- "range" means an apparatus for cooking having elements that perform different cooking operations or cooking and heating operations.

F24B

DOMESTIC STOVES OR RANGES FOR SOLID FUELS

F24C

OTHER DOMESTIC STOVES OR RANGES; DETAILS OF DOMESTIC STOVES OR RANGES, OF GENERAL APPLICATION (radiator stoves of the fluid-circulating type F24H)

F24D

DOMESTIC- OR SPACE-HEATING SYSTEMS, e.g. CENTRAL HEATING SYSTEMS; DOMESTIC HOT-WATER SUPPLY SYSTEMS; ELEMENTS OR COMPONENTS THEREFOR (preventing corrosion [C23F](#); water supply in general [E03](#); using steam or condensate extracted or exhausted from steam engine plants for heating purposes [F01K17/02](#); steam traps [F16T](#); domestic stoves or ranges [F24B](#), C; water or air heaters having heat generating means [F24H](#); combined heating and refrigeration systems [F25B](#); heat exchange apparatus or elements [F28](#); removing furring [F28G](#))

F24F

AIR-CONDITIONING, AIR-HUMIDIFICATION, VENTILATION, USE OF AIR CURRENTS FOR SCREENING (devices for ventilating greenhouses [A01G](#) [N: [F24F9/24](#); air-conditioning systems for greenhouses [A01G9/24E](#)]; animal husbandry [A01K](#), e.g. controlling humidity in incubators [A01K41/04](#); disinfecting or sterilising of air

A61L; devices for reconditioning breathing air in sealed rooms or for ventilating gas-proof shelters A62B; filtering, washing or drying of gases B01D; mixing gases with vapours or liquids in general [B01F3/00](#); spraying B05B, B05D; removing dirt or fumes from areas where they are produced [B08B15/00](#); ventilation, air-conditioning or cooling, specially adapted for vehicles, see the relevant vehicle places, e.g. B60H, [B61D27/00](#), [N: [B64D13/00](#)]; production of ozone [C01B13/10](#); chimneys or flues [E04F17/02](#), [E04H12/28](#), [F23J11/00](#), [F23L17/02](#); air ducts or conduits [E0417/04](#), F16L; ventilation in doors or windows [E06B7/02](#); fans, blowers F04; noise-absorbing in pipes or pipe systems F16L; tops for chimneys and ventilating shafts F23L; cooling F25; details of heat-exchange or heat-transfer apparatus, of general application F28F; apparatus for generating ions to be introduced into non-enclosed gases, e.g. the atmosphere [H01T23/00](#))

F24H

FLUID HEATERS, e.g. WATER OR AIR HEATERS, HAVING HEAT GENERATING MEANS, IN GENERAL (heat-transfer, heat-exchange or heat-storage materials [C09K5/00](#); tube furnaces for thermal non-catalytic cracking [C10G9/20](#); devices, e.g. valves, for venting and aerating enclosures [F16K24/00](#); steam traps or like apparatus [F16T](#); steam generation [F22](#); combustion apparatus [F23](#); domestic stoves or ranges [F24B](#), [F24C](#); domestic- or space-heating systems [F24D](#); furnaces, kilns, ovens, retorts [F27](#); heat-exchangers [F28](#); electric heating elements or arrangements [H05B](#))

F24J

PRODUCING OR USE OF HEAT NOT OTHERWISE PROVIDED FOR (materials therefor [C09K5/00](#); engines or other mechanisms for producing mechanical power from heat, see the relevant classes, e.g. F03G for using natural heat)

F25

REFRIGERATION OR COOLING; COMBINED HEATING AND REFRIGERATION SYSTEMS; HEAT PUMP SYSTEMS; MANUFACTURE OR STORAGE OF ICE; LIQUEFACTION SOLIDIFICATION OF GASES

F25B

REFRIGERATION MACHINES, PLANTS OR SYSTEMS; COMBINED HEATING AND REFRIGERATION SYSTEMS; HEAT-PUMP SYSTEMS ([N: evaporation or evaporation apparatus for physical or chemical purposes, e.g. evaporation of liquids for gas phase reactions [B01B1/00B](#)]; heat-transfer, heat-exchange or heat-storage materials, e.g. refrigerants, or materials for the production of heat or cold by chemical reactions other than by combustion [C09K5/00](#); pumps, compressors F04; use of heat-pumps for domestic- or space-heating or for domestic hot-water supply F24D; air-conditioning, air-humidification F24F; fluid heaters using heat pumps F24H) [[C0311](#)]

F25C

PRODUCTION, WORKING, STORING OR DISTRIBUTION OF ICE (frozen sweets, including ice-cream, their production [A23G9/00](#); concentrating solutions by removing frozen solvents [B01D9/04](#); purification of water by freezing [C02F1/22](#); refrigeration machines, plants or systems [F25B](#); solidification of gases or gaseous mixtures [F25J](#); freeze drying [F26B](#))

F25D**REFRIGERATORS; COLD ROOMS; ICE-BOXES; COOLING OR FREEZING APPARATUS NOT COVERED BY ANY OTHER SUBCLASS**

(refrigerated show cases [A47F3/04](#); thermally-insulated vessels for domestic use [A47J41/00](#); refrigerated vehicles, see the appropriate subclasses of classes [B60](#) to [B64](#); containers with thermal insulation in general [B65D81/38](#); heat-transfer, heat-exchange or heat-storage materials, e.g. refrigerants, or materials for the production of heat or cold by chemical reactions other than by combustion [C09K5/00](#); thermally-insulated vessels for liquefied or solidified gases [F17C](#); air-conditioning or air-humidification [F24F](#); refrigeration machines, plants or systems [F25B](#); cooling of instruments and comparable apparatus without refrigeration [G12B](#); cooling of engines or pumps, see the relevant classes)

F25J**LIQUEFACTION, SOLIDIFICATION OR SEPARATION OF GASES OR GASEOUS [N: or liquefied gaseous] MIXTURES BY PRESSURE AND COLD TREATMENT [N: or by bringing them into the supercritical state (cryogenic pumps**

[F04B37/08](#); gas storage vessels, gas holders [F17](#); filling vessels with, or discharging from vessels, compressed, liquefied or solidified gases [F17C](#); refrigeration machines, plants, or systems [F25B](#))] [[C1203](#)]

F26**DRYING****F26B****DRYING SOLID MATERIALS OR OBJECTS BY REMOVING LIQUID THEREFROM**

(racks for drying fruit and vegetables [A01F25/12](#); drying foodstuffs [A23](#); drying hair [A45D20/00](#); body-drying implements [A47K10/00](#); drying household articles [A47L](#), [N: e.g. drying footwear [A47L23/20](#)]; drying gases and vapours [B01D](#); chemical and physical processes for dewatering or like separating liquids from solids [B01D43/00](#); centrifugal apparatus [B04](#); drying ceramics [C04B33/30](#); drying yarns and fabrics in association with some other form of treatment [D06C](#); drying frames for laundry without heating or positive air circulation, domestic and like spin-dryers, wringing and hot pressing laundry [D06F](#); furnaces, kilns, ovens [F27](#); [N: treatment including a drying step of semiconductor substrates, e.g. wafers, [H01L21/00S2D4](#))] [[C9805](#)]

F27

FURNACES; KILNS; OVENS; RETORTS (specially adapted for a purpose covered by a single other class and specifically mentioned in that class, see the class in question, e.g. bakery ovens [A21B](#), glass melting furnaces [C03B](#), coke or gas-making apparatus [C10B](#), [C10J](#), apparatus for cracking hydrocarbons [C10G](#), blast furnaces [C21B](#), converters for making steel [C21C](#), furnaces for heat treatment of metal [C21D](#); furnaces for electroslag or arc remelting of metals [C22B9/00](#); enamelling ovens [C23D](#); combustion apparatus [F23](#); electric heating [H05B](#))

Notes

1. This class deals with furnaces, kilns, ovens, retorts, open sintering apparatus, and details or accessories therefor, in general. It includes the arrangement of electrical heating elements in or on furnaces, but not the elements themselves. It is not concerned with the processes carried on within the furnaces.

2. In this class, where appropriate, the term "furnaces" is to be understood as covering kilns, ovens, or retorts.

F27B **FURNACES, KILNS, OVENS, OR RETORTS IN GENERAL; OPEN SINTERING OR LIKE APPARATUS**

F27D **DETAILS OR ACCESSORIES OF FURNACES, KILNS, OVENS, OR RETORTS, IN SO FAR AS THEY ARE OF KINDS OCCURRING IN MORE THAN ONE KIND OF FURNACE (combustion apparatus F23)**

F28 **HEAT EXCHANGE IN GENERAL**

Notes on scope

1. Apparatus using heat exchange or heat transfer (as defined below) for specific purposes is classified either in subclass [F28B](#) or in the appropriate subclasses of, for example, classes [F22](#), [F24](#), [F25](#), [F26](#); if no such other subclass is appropriate, such apparatus is to be classified in [F28C](#) or [F28D](#).
2. In this class the following terms are used with the meanings indicated:
 - "Heat exchange" means the heating or cooling of a fluid or fluent solid by direct or indirect contact with a heated or cooled fluid or fluent solid;
 - "Heat transfer" means the heating or cooling of a fluid or fluent solid by direct contact with a heated or cooled surface or body.

F28B **STEAM OR VAPOUR CONDENSERS** (condensation of vapours [B01D5/00](#); steam engine plants having condensers [F01K](#); liquefaction of gases [F25J](#); details of heat-exchange and heat-transfer arrangements of general application [F28F](#))

F28C **HEAT-EXCHANGE APPARATUS, NOT PROVIDED FOR IN ANOTHER SUBCLASS, IN WHICH THE HEAT-EXCHANGE MEDIA COME INTO DIRECT CONTACT WITHOUT CHEMICAL INTERACTION** (safety devices in general [F16P](#); fluid heaters having heat generating means [F24H](#); with an intermediate heat-transfer medium coming into direct contact with heat-exchange media [F28D15/00](#) to [F28D19/00](#); details of heat-exchange apparatus of general application [F28F](#))

F28D **HEAT-EXCHANGE APPARATUS, NOT PROVIDED FOR IN ANOTHER SUBCLASS, IN WHICH THE HEAT-EXCHANGE MEDIA DO NOT COME INTO DIRECT CONTACT** (fluid heaters having heat generating means and heat transferring means [F24H](#); furnaces [F27](#); details of heat-exchange apparatus of general)

F28F **DETAILS OF HEAT-EXCHANGE AND HEAT-TRANSFER APPARATUS, OF GENERAL APPLICATION (water and air traps, air venting F16)**

F28G **CLEANING OF INTERNAL OR EXTERNAL SURFACES OF HEAT-EXCHANGE OR HEAT-TRANSFER CONDUITS, e.g. WATER TUBES OR BOILERS** (cleaning pipes or tubes in general [B08B9/02](#); devices or arrangements for removing water, minerals, or sludge from boilers while the boiler is in operation, or which remain in position while the boiler is in operation, or are specifically adapted to boilers without any other utility [F22B37/48](#); removal or treatment of combustion products or combustion residues F23J; removing ice from heat-exchange apparatus [F28F17/00](#))

SUBSECTION: Weapons; Blasting

F41 **WEAPONS**

Notes

1. This class covers also means for practice and training which may cover also means for practice and training which may have aspects of simulation, e.g. in apparatus for so-called "military games", although simulators are generally covered by class [G09](#).
2. In this class, the following terms or expressions are used with the meanings indicated:
 - "smallarm" means a firearm which is generally held with one or both hands for firing, but this term also includes a light machine-gun which may be supported on a tripod or the like during firing;
 - "gun" means any weapon having a barrel and a trigger or firing mechanism for projecting a missile; it may be a piece of ordnance or a smallarm. It may use combustible or explosive propellant charges, air pressure, electromagnetism or other propulsive forces;
 - "revolver-type gun" means a gun having a revolving drum magazine, the chambers of which are used successively as firing chamber;
 - "revolver" means a revolver-type pistol;
 - "semi-automatic firearm" means a firearm from which one shot is fired after actuation of the trigger and which then returns to a condition for firing a subsequent shot upon renewed actuation of the trigger;
 - "automatic gun" means a gun which will continue firing so long as the initial firing pressure is maintained on the trigger;
 - "sighting" means bringing into visual coincidence a direction of a target;
 - "aiming" means bringing a weapon to a direction differing from the sighting direction by corrections in order that the projectile may hit the target;
 - "laying" means setting a weapon in the correct position for hitting a mark.
3. Attention is drawn to the definitions of "projectile", "missile" and "rocket" given in

Note 2 following the title of class [F42](#).

- F41A** **FUNCTIONAL FEATURES OR DETAILS COMMON TO BOTH SMALLARMS AND ORDNANCE, e.g. CANNONS; MOUNTINGS FOR SMALLARMS OR ORDNANCE**
- F41B** **WEAPONS FOR PROJECTING MISSILES WITHOUT USE OF EXPLOSIVE OR COMBUSTIBLE PROPELLANT CHARGE; WEAPONS NOT OTHERWISE PROVIDED FOR** (projectiles for fishing, e.g. fish-spears, [A01K81/00](#); sports implements for throwing [A63B65/00](#), e.g. boomerangs [A63B65/08](#); stationary apparatus for projecting sports balls, e.g. tennis balls, [A63B69/40](#); throwing or slinging toys [A63H33/18](#); knives, axes [B26B](#); projectiles or missiles other than those incorporating springs as projecting means [F42B6/00](#))
- F41C** **SMALLARMS, e.g. PISTOLS, RIFLES** (functional features or details common to both smallarms and ordnance, mountings therefor [F41A](#); projecting missiles without use of explosive or combustible propellant charge [F41B](#)); **ACCESSORIES THEREFOR**
- F41F** **APPARATUS FOR LAUNCHING PROJECTILES OR MISSILES FROM BARRELS, e.g. CANNONS** (smallarms [F41C](#)); **LAUNCHERS FOR ROCKETS OR TORPEDOES; HARPOON GUNS** (functional features or details common to both smallarms and ordnance, mountings therefor [F41A](#); projecting missiles without use of explosive or combustible propellant charge [F41B](#))
- F41G** **WEAPON SIGHTS; AIMING** (optical aspects thereof [G02B](#))
- F41H** **ARMOUR; ARMoured TURRETS; ARMoured OR ARMED VEHICLES; MEANS OF ATTACK OR DEFENCE, e.g. CAMOUFLAGE, IN GENERAL**
- F41J** **TARGETS; TARGET RANGES; BULLET CATCHERS** [**N**: (targets for shooting or hurling games [A63F9/02B](#))]
- F42** **AMMUNITION; BLASTING**

Notes

1. This class covers also means for practice or training which may have aspects of simulation, although simulators are generally covered by class [G09](#).

2. In this class, the following terms or expressions are used with the meanings indicated:

- "primer" effects the first explosive step in the sequence of explosion;
- "percussion cap" means a primer which is struck to explode;
- "igniter" effects the first spark-producing or heat-producing step but may not be explosive;
- "firing-means" or "initiator" (used respectively in the arts of weaponry and blasting) means a device acting directly on the primer, which device may or may not form part of the fuze;
- "detonator" or "detonator charge" means a charge used to amplify the explosion of the primer;
- "fuze" means an assembly or mechanism which incorporates safety and arming means in order that the explosion can only take place under certain conditions; this assembly or mechanism determines also the moment (instantaneous or delayed) or the manner, e.g. impact, proximity, hydrostatic pressure, of the firing;
- "ammunition" covers propulsive charge and projectile whether or not forming a single body, unless otherwise made clear;
- "projectile", "missile" or "projectile or missile" means any body which is projected or propelled;
- "guided missile" means projectile or missile which is guided during at least part of its trajectory;
- "rocket" means projectile or missile which is self-propelled, during at least part of its trajectory, by a rocket engine, i.e. by a jet-propulsion engine carrying both fuel and oxidant therefor;
- "fuse" or "fuse cord" means a continuous train of explosive enclosed in a usually flexible cord or cable for setting-off an explosive charge in the art of blasting.

F42B **EXPLOSIVE CHARGES, e.g. FOR BLASTING, FIREWORKS, AMMUNITION (explosive compositions C06B; fuzes F42C; blasting F42D)**

F42C **AMMUNITION FUZES** (blasting cartridge initiators [F42B3/10](#); chemical aspects [C06C](#)); **ARMING OR SAFETY MEANS THEREFOR** (filling fuzes [F42B33/02](#); fitting or extracting primers in or from fuzes [F42B33/04](#); containers for fuzes [F42B39/30](#))

F42D **BLASTING** (fuses, e.g. fuse cords, [C06C5/00](#); [N: for obtaining fluid from wells [E21B43/00](#); for mining or quarrying [E21C37/00](#); for making tunnels or galleries [E21D9/00F](#); cartridges [F42B3/00](#))]