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

F25 REFRIGERATION OR COOLING; COMBINED HEATING AND REFRIGERATION SYSTEMS; HEAT PUMP SYSTEMS; MANUFACTURE OR STORAGE OF ICE; LIQUEFACTION OR SOLIDIFICATION OF GASES

F25B REFRIGERATION MACHINES, PLANTS, OR SYSTEMS; COMBINED HEATING AND REFRIGERATION SYSTEMS; HEAT PUMP SYSTEMS (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 C09K 5/00; 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)

Note(s) [5]

Attention is drawn to Note (2) following the title of subclass F24F.

Subclass index

MODE OF OPERATION
- Compression type
  - characterised by the cycle 1/00, 13/00
  - characterised by the arrangement
    - self-contained rotary; with several evaporation circuits; with several condenser circuits; with cascade operation 3/00, 5/00, 6/00, 7/00
  - characterised by the refrigerant 9/00
  - using turbines 11/00
- Sorption type 15/00, 17/00
- Other types having a single mode of operation, using: evaporation without recovery; electric or magnetic effects; other effect 19/00, 21/00, 23/00
- Combinations: of above modes of operation; of heating and refrigerating 25/00, 29/00
- Heat pumps 30/00
- Using special energy source 27/00

DETAILS, ARRANGEMENTS, OR COMPONENTS
- Components: boilers, analysers, rectifiers; boiler-absorbers; absorbers, adsorbers; evaporators, condensers; subcoolers, desuper- heaters, superheaters 33/00, 35/00, 37/00, 39/00, 40/00
- Arrangements
  - compressor arrangement; fluid circulation; separating or purifying gases 31/00, 41/00, 43/00
  - for charging or discharging refrigerant; for combating corrosion or deposits 45/00, 47/00
- Mounting of control and safety devices 49/00

Compression machines, plant, or systems

1/00 Compression machines, plant or systems with non-reversible cycle (F25B 3/00, F25B 5/00, F25B 6/00, F25B 7/00, F25B 9/00 take precedence) **[1, 5, 2006.01]**

1/02 • with compressor of reciprocating-piston type (F25B 1/10 takes precedence) **[1, 2006.01]**

1/04 • with compressor of rotary type (F25B 1/10 takes precedence) **[1, 2006.01]**

1/047 • • of screw type **[5, 2006.01]**

1/053 • • of turbine type **[5, 2006.01]**

1/06 • with compressor of jet type, e.g. using liquid under pressure (F25B 1/10 takes precedence) **[1, 2006.01]**

1/08 • • using vapour under pressure **[1, 2006.01]**

1/10 • with multi-stage compression (with cascade operation F25B 7/00) **[1, 2006.01]**

3/00 Self-contained rotary compression machines, i.e. with compressor, condenser, and evaporator rotating as a single unit [1, 2006.01]

5/00 Compression machines, plant, or systems, with several evaporator circuits, e.g. for varying refrigerating capacity (with cascade operation F25B 7/00) **[1, 2006.01]**

5/02 • arranged in parallel **[5, 2006.01]**

5/04 • arranged in series **[5, 2006.01]**

6/00 Compression machines, plant, or systems, with several condenser circuits [5, 2006.01]

6/02 • arranged in parallel **[5, 2006.01]**
6/04 • arranged in series **[5, 2006.01]**

7/00 Compression machines, plant, or systems, with cascade operation, i.e. with two or more circuits, the heat from the condenser of one circuit being absorbed by the evaporator of the next circuit (F25B 9/00 takes precedence) **[1, 2006.01]**

9/00 Compression machines, plant, or systems, in which the refrigerant is air or other gas of low boiling point [1, 2006.01]
9/02 • using Joule-Thompson effect; using vortex effect **[1, 2006.01]**
9/04 • • using vortex effect **[5, 2006.01]**
9/06 • using expanders (F25B 9/10 takes precedence) **[5, 2006.01]**
9/08 • using ejectors (F25B 9/10 takes precedence) **[5, 2006.01]**
9/10 • with several cooling stages **[5, 2006.01]**
9/12 • using 3He-4He dilution **[5, 2006.01]**
9/14 • characterised by the cycle used, e.g. Stirling cycle **[5, 2006.01]**

11/00 Compression machines, plant, or systems, using turbines, e.g. gas turbines [1, 2006.01]
11/02 • as expanders (F25B 9/06 takes precedence) **[5, 2006.01]**
11/04 • • centrifugal type **[5, 2006.01]**

13/00 Compression machines, plant, or systems, with reversible cycle (defrosting cycles F25B 47/02) **[1, 2006.01]**

Sorption machines, plant, or systems

15/00 Sorption machines, plant, or systems, operating continuously, e.g. absorption type [1, 2006.01]
15/02 • without inert gas (F25B 15/12, F25B 15/14, F25B 15/16 take precedence) **[1, 2006.01]**
15/04 • • the refrigerant being ammonia evaporated from aqueous solution **[1, 2006.01]**
15/06 • • the refrigerant being water vapour evaporated from a salt solution, e.g. lithium bromide **[1, 2006.01]**
15/08 • • the refrigerant being sulfuric acid **[1, 2006.01]**
15/09 • • the refrigerant being hydrogen desorbed from a hydride **[5, 2006.01]**
15/10 • with inert gas (F25B 15/12, F25B 15/14, F25B 15/16 take precedence) **[1, 2006.01]**
15/12 • with resorber (F25B 15/14 takes precedence) **[1, 2006.01]**
15/14 • using osmosis **[1, 2006.01]**
15/16 • using desorption cycle **[1, 2006.01]**

17/00 Sorption machines, plant, or systems, operating intermittently, e.g. absorption or adsorption type [1, 2006.01]
17/02 • the absorbent or adsorbent being a liquid, e.g. brine (F25B 17/10 takes precedence) **[1, 2006.01]**
17/04 • • with two or more boilers operating alternately **[1, 2006.01]**
17/06 • • with the boiler and evaporator built-up as a unit in a tiltable or revolving arrangement **[1, 2006.01]**
17/08 • the absorbent or adsorbent being a solid, e.g. salt (F25B 17/12 takes precedence) **[1, 5, 2006.01]**
17/10 • using the endothermic solution of salt **[1, 2006.01]**
17/12 • using desorption of hydrogen from a hydride **[5, 2006.01]**

Machines, plant, or systems, with a single mode of operation, not covered by groups F25B 1/00-F25B 17/00

19/00 Machines, plant, or systems, using evaporation of a refrigerant but without recovery of the vapour [1, 2006.01]
19/02 • using fluid jet, e.g. of steam **[1, 2006.01]**
19/04 • • using liquid jet, e.g. of water **[1, 2006.01]**

21/00 Machines, plant, or systems, using electric or magnetic effects [1, 2006.01]
21/02 • using Peltier effect; using Nernst-Ettinghausen effect (thermoelectric elements H01L 35/00, H01L 37/00) **[1, 2006.01]**
21/04 • • reversible **[5, 2006.01]**

23/00 Machines, plant, or systems, with a single mode of operation not covered by groups F25B 1/00-F25B 21/00, e.g. using selective radiation effect [1, 2006.01]

25/00 Machines, plant, or systems, using a combination of modes of operation covered by two or more of the groups F25B 1/00-F25B 23/00 (combinations of two or more modes of operation covered by a single main group, see the relevant group) **[1, 2006.01]**
25/02 • Compression-sorption machines, plants, or systems **[1, 2006.01]**

27/00 Machines, plant, or systems, using particular sources of energy (F25B 30/06 takes precedence) **[1, 2006.01]**
27/02 • using waste heat, e.g. from internal-combustion engines **[1, 2006.01]**

29/00 Combined heating and refrigeration systems, e.g. operating alternately or simultaneously [1, 5, 2006.01]

30/00 Heat pumps [5, 2006.01]

Note(s) [5]

When classifying heat pump circuits or systems, groups F25B 1/00-F25B 25/00 and F25B 29/00 take precedence over group F25B 30/00.
30/02 • of the compression type **[5, 2006.01]**
30/04 • of the sorption type **[5, 2006.01]**
30/06 • characterised by the source of low potential heat **[5, 2006.01]**

Component parts or details

31/00 Compressor arrangements (compressors per se F04) **[1, 2006.01]**
31/02 • of motor-compressor units **[1, 2006.01]**

33/00 Boilers; Analysers; Rectifiers (boiler-absorbers F25B 35/00) **[1, 2006.01]**

35/00 Boiler-absorbers, i.e. boilers usable for absorption or adsorption [1, 2006.01]
35/02 • using a liquid as sorbent, e.g. brine **[1, 2006.01]**
35/04 • using a solid as sorbent **[1, 2006.01]**

37/00 **Absorbers; Adsorbers** (boiler-absorbers F25B 35/00; separating processes involving the treatment of liquids with solid sorbents B01D 15/00; separation of gases or vapours by adsorption B01D 53/02; separation of gases or vapours by absorption B01D 53/14; investigating using adsorption or absorption G01N 30/00) **[1, 2006.01]**

39/00 **Evaporators; Condensers [1, 2006.01]**
39/02 • Evaporators **[1, 2006.01]**
39/04 • Condensers **[1, 2006.01]**

40/00 **Subcoolers, desuperheaters or superheaters [5, 2006.01]**
40/02 • Subcoolers **[5, 2006.01]**
40/04 • Desuperheaters **[5, 2006.01]**
40/06 • Superheaters **[5, 2006.01]**

41/00 **Fluid-circulation arrangements, e.g. for transferring liquid from evaporator to boiler** (pumps per se, sealings therefor F04) **[1, 2006.01]**
41/02 • using electro-osmosis **[1, 2006.01]**
41/04 • Disposition of valves (valves per se F16K) **[1, 2006.01]**
41/06 • Flow restrictors, e.g. capillary tubes; Disposition thereof **[1, 2006.01]**

43/00 **Arrangements for separating or purifying gases or liquids** (in analysers or rectifiers F25B 33/00)**; Arrangements for vaporising the residuum of liquid refrigerant, e.g. by heat** (F25B 40/00 takes precedence) **[1, 5, 2006.01]**
43/02 • for separating lubricants from the refrigerant **[1, 2006.01]**
43/04 • for withdrawing non-condensible gases **[1, 2006.01]**

45/00 **Arrangements for charging or discharging refrigerant [1, 2006.01]**

47/00 **Arrangements for preventing or removing deposits or corrosion, not provided for in another subclass [1, 2006.01]**
47/02 • Defrosting cycles **[5, 2006.01]**

49/00 **Arrangement or mounting of control or safety devices** (testing refrigerators G01M; control in general G05) **[1, 2006.01]**
49/02 • for compression type machines, plant or systems **[5, 2006.01]**
49/04 • for sorption type machines, plant or systems **[5, 2006.01]**

F25C **PRODUCTION, WORKING, STORING OR DISTRIBUTION OF ICE** (frozen sweets, including ice-cream, their production A23G 9/00; concentrating solutions by removing frozen solvents B01D 9/04; purification of water by freezing C02F 1/22; refrigeration machines, plants, or systems F25B; solidification of gases or gaseous mixtures F25J; freeze-drying F26B) **[2]**

Note(s) [2]

In this subclass, the following term is used with the meaning indicated:
- "ice" means any frozen liquid and also covers frozen semiliquids or pasty substances.

1/00 **Production of ice** (F25C 3/00 takes precedence) **[1, 2006.01]**
1/02 • Production of natural ice, i.e. without refrigeration **[1, 2006.01]**
1/04 • by using stationary moulds **[1, 2006.01]**
1/06 • • open or openable at both ends **[1, 2006.01]**
1/08 • by immersing freezing chambers or plates into water **[1, 2006.01]**
1/10 • by using rotating or otherwise moving moulds (F25C 1/08 takes precedence) **[1, 2006.01]**
1/12 • by freezing water on cooled surfaces, e.g. to form slabs **[1, 2006.01]**
1/14 • • to form thin sheets which are removed by scraping or wedging, e.g. in the form of flakes **[1, 2006.01]**
1/16 • by partially evaporating water in a vacuum **[1, 2006.01]**
1/18 • of a particular transparency or translucency, e.g. by injecting air **[1, 2006.01]**
1/20 • • by agitation **[1, 2006.01]**
1/22 • Construction of moulds; Filling devices therefor (metering by volume in general G01F) **[1, 2006.01]**
1/24 • • for refrigerators, e.g. freezing trays **[1, 2006.01]**

3/00 **Methods or apparatus specially adapted for the production of ice or snow for winter sports or similar recreational purposes, e.g. for sporting installations; Production of artificial snow** (foundations or pavings for artificial surfaces for outdoor or indoor practice of snow or ice sports E01C 13/10; working on surfaces of snow or ice in order to make them suitable for traffic or sporting purposes E01H 4/00) **[1, 2006.01]**
3/02 • for ice rinks **[1, 2006.01]**
3/04 • for sledging trails or ski trails; Production of artificial snow **[1, 2006.01]**

5/00 **Working, storing or distribution of ice [1, 2006.01]**
5/02 • Tools or machines for disintegrating, removing, or harvesting ice **[1, 2006.01]**
5/04 • • without the use of saws **[1, 2006.01]**
5/06 • • • by deforming bodies with which the ice is in contact, e.g. by inflatable members **[1, 2006.01]**
5/08 • • • by heating bodies in contact with the ice **[1, 2006.01]**
5/10 • • • • using hot refrigerant; using fluid heated by refrigerant **[1, 2006.01]**
5/12 • • • Ice-shaving machines **[1, 2006.01]**
5/14 • Tools or machines for shaping or finishing ice pieces, e.g. ice presses **[1, 2006.01]**
5/16 • Tools or devices for ice handling not covered by any other subclass **[1, 2006.01]**
5/18 • Storing ice **[1, 2006.01]**

F25D **REFRIGERATORS; COLD ROOMS; ICE-BOXES; COOLING OR FREEZING APPARATUS NOT COVERED BY ANY OTHER SUBCLASS** (refrigerated showcases A47F 3/04; thermally-insulated vessels for domestic use A47J 41/00; refrigerated vehicles, see the appropriate subclasses of classes B60-B64; containers with thermal insulation in general B65D 81/38; 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 C09K 5/00; thermally-insulated vessels for liquefied or solidified gases F17C; air-conditioning or air-humidification F24F; refrigeration machines, plants, or systems F25B; cooling of instruments or comparable apparatus without refrigeration G12B; cooling of engines or pumps, see the relevant classes)

Note(s) [5, 2009.01]

1. Devices associated with refrigerating machinery are classified in groups F25D 11/00-F25D 16/00.
2. In this subclass, the following term is used with the meaning indicated:
   - "device" means an enclosed space to be cooled; such devices being associated either with refrigerating machinery, e.g. in a refrigerator, or with other cold sources, e.g. in an ice-box.
3. Attention is drawn to Note (2) following the title of subclass F24F.

Subclass index

DEVICES NOT ASSOCIATED WITH REFRIGERATING MACHINERY
Using cold air or water; other cold materials or bodies.....1/00, 3/00
Using endothermic chemical reactions, or evaporation without recovery.....5/00, 7/00
Other devices, combinations.....9/00
DEVICES ASSOCIATED WITH REFRIGERATING MACHINERY: SELF-CONTAINED MOVABLE; STATIONARY; OTHER.....11/00, 13/00, 15/00
In combination with a cooling mode not associated with refrigerating machinery.....16/00
STRUCTURAL PARTS OR ARRANGEMENTS, OF GENERAL APPLICATION: DEFROSTING; GENERAL FEATURES; HANDLING OF ARTICLES TO BE COOLED.....21/00, 23/00, 25/00
CIRCULATING COOLING FLUID OR GAS; LIGHTING.....17/00, 27/00
ARRANGEMENT OR MOUNTING: OF REFRIGERATION UNITS; OF CONTROL OR SAFETY DEVICES.....19/00, 29/00
OTHER APPARATUS.....31/00

Devices not associated with refrigerating machinery

1/00 **Devices using naturally-cold air or water [1, 2006.01]**
1/02 • using naturally-cold water, e.g. household-tap water **[1, 2006.01]**

3/00 **Devices using other cold materials; Devices using cold-storage bodies [1, 2006.01]**
3/02 • using ice, e.g. ice-boxes **[1, 2006.01]**
3/04 • • Stationary cabinets **[1, 2006.01]**
3/06 • • Movable containers **[1, 2006.01]**
3/08 • • • portable, i.e. adapted to be carried personally **[1, 2006.01]**
3/10 • using liquefied gases, e.g. liquid air **[1, 2006.01]**
3/11 • • with conveyors carrying articles to be cooled through the cooling space **[4, 2006.01]**
3/12 • using solidified gases, e.g. carbon-dioxide snow **[1, 2006.01]**
3/14 • • portable, i.e. adapted to be carried personally **[1, 2006.01]**

5/00 **Devices using endothermic chemical reactions, e.g. using frigorific mixtures [1, 2006.01]**
5/02 • portable, i.e. adapted to be carried personally **[1, 2006.01]**

7/00 **Devices using evaporation effects without recovery of the vapour** (butter or cheese dishes with cooling devices A47G 19/26) **[1, 2006.01]**

9/00 **Devices not associated with refrigerating machinery and not covered by groups F25D 1/00-F25D 7/00; Combinations of devices covered by two or more of the groups F25D 1/00-F25D 7/00 [1, 2006.01]**

Devices associated with refrigerating machinery

11/00 **Self-contained movable devices associated with refrigerating machinery, e.g. domestic refrigerators [1, 2006.01]**
11/02 • with cooling compartments at different temperatures **[1, 2006.01]**
11/04 • specially adapted for storing deep-frozen articles (F25D 11/02 takes precedence) **[1, 2006.01]**

13/00 **Stationary devices associated with refrigerating machinery, e.g. cold rooms [1, 2006.01]**
13/02 • with several cooling compartments, e.g. refrigerated locker systems **[1, 2006.01]**
13/04 • • the compartments being at different temperatures **[1, 2006.01]**
13/06 • with conveyors carrying articles to be cooled through the cooling space **[1, 2006.01]**

15/00 **Devices associated with refrigerating machinery not covered by group F25D 11/00 or F25D 13/00, e.g. non-self-contained movable devices [1, 2006.01]**

16/00 **Devices using a combination of a cooling mode associated with refrigerating machinery with a cooling mode not associated with refrigerating machinery [5, 2006.01]**

Details or features of the devices covered by groups F25D 1/00-F25D 16/00 [5]

17/00 **Arrangements for circulating cooling fluids; Arrangements for circulating gas, e.g. air, within refrigerated spaces [1, 3, 2006.01]**

17/02 • for circulating liquids, e.g. brine **[1, 2006.01]**

17/04 • for circulating gas, e.g. by natural convection **[1, 3, 2006.01]**

17/06 • • by forced circulation **[1, 2006.01]**

17/08 • • • using ducts **[1, 2006.01]**

19/00 **Arrangement or mounting of refrigeration units with respect to devices [1, 2006.01]**

19/02 • plug-in type **[1, 2006.01]**

19/04 • with more than one refrigeration unit **[1, 2006.01]**

21/00 **Defrosting; Preventing frosting; Removing condensed or defrost water** (removing ice or water from heat-exchange apparatus in general F28F 17/00; heating arrangements specially adapted for transparent or reflecting areas H05B 3/84) **[1, 2006.01]**

21/02 • Detecting the presence of frost or condensate **[1, 2006.01]**

21/04 • Preventing the formation of frost or condensate **[1, 2006.01]**

21/06 • Removing frost (defrosting cycles F25B 47/02) **[1, 2006.01]**

21/08 • • by electric heating **[1, 2006.01]**

21/10 • • by spraying with fluid **[1, 2006.01]**

21/12 • • by hot-fluid circulating system separate from the refrigerant system **[1, 2006.01]**

21/14 • Collecting or removing condensed and defrost water; Drip trays **[1, 2006.01]**

23/00 **General constructional features** (F25D 21/00 takes precedence) **[1, 2006.01]**

23/02 • Doors; Covers (F25D 23/08 takes precedence) **[1, 2006.01]**

23/04 • • with special compartments, e.g. butter conditioners **[1, 2006.01]**

23/06 • Walls (F25D 23/08 takes precedence; containers with thermal insulation B65D 81/38) **[1, 4, 2006.01]**

23/08 • Parts formed wholly or mainly of plastics materials **[1, 2006.01]**

23/10 • Arrangements for mounting in particular locations, e.g. for built-in type, for corner type **[1, 2006.01]**

23/12 • Arrangements of compartments additional to cooling compartments; Combinations of refrigerators with other equipment, e.g. stove **[1, 2006.01]**

25/00 **Charging, supporting, or discharging the articles to be cooled [1, 2006.01]**

25/02 • by shelves **[1, 2006.01]**

25/04 • by conveyors (in general B65G) **[1, 2006.01]**

27/00 **Lighting arrangements** (in general F21) **[1, 2006.01]**

29/00 **Arrangement or mounting of control or safety devices [1, 2006.01]**

31/00 **Other cooling or freezing apparatus [1, 2006.01]**

F25J **LIQUEFACTION, SOLIDIFICATION, OR SEPARATION OF GASES OR GASEOUS MIXTURES BY PRESSURE AND COLD TREATMENT** (cryogenic pumps F04B 37/08; 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)

1/00 **Processes or apparatus for liquefying or solidifying gases or gaseous mixtures [1, 2006.01]**

1/02 • requiring the use of refrigeration, e.g. of helium or hydrogen **[1, 2006.01]**

3/00 **Processes or apparatus for separating the constituents of gaseous mixtures involving the use of liquefaction or solidification [1, 2006.01]**

3/02 • by rectification, i.e. by continuous interchange of heat and material between a vapour stream and a liquid stream (F25J 3/08 takes precedence) **[1, 2006.01]**

3/04 • • for air **[1, 2006.01]**

3/06 • by partial condensation (F25J 3/08 takes precedence; by rectification F25J 3/02) **[1, 2006.01]**

3/08 • Separating gaseous impurities from gases or gaseous mixtures (cold traps B01D 8/00) **[1, 2006.01]**

5/00 **Arrangements of cold-exchangers or cold-accumulators in separation or liquefaction plants** (heat-exchangers F28C, F28D, F28F) **[1, 2006.01]**