**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; PUMPS, COMPRESSORS; USE OF HEAT-PU NTS FOR DOMESTIC-OR SPACE-HEATING OR FOR DOMESTIC HOT-WATER SUPPLY; AIR-CONDITIONING, AIR-HUMIDIFICATION; FLUID HEATERS USING HEAT PUMPS**

**NOTES**

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

**WARNING**

In this subclass non-limiting references (in the sense of paragraph 39 of the Guide to the IPC) may still be displayed in the scheme.

<table>
<thead>
<tr>
<th>Compression machines, plant, or systems</th>
<th>6/00 Compression machines, plant, or systems, with several condenser circuits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/00</td>
<td>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)</td>
</tr>
<tr>
<td>1/005</td>
<td>[of the single unit type ( (F25B 1/10 ) takes precedence) ]</td>
</tr>
<tr>
<td>1/02</td>
<td>with compressor of reciprocating-piston type ( (F25B 1/005, F25B 1/10 ) take precedence)</td>
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<tr>
<td>1/04</td>
<td>with compressor of rotary type ( (F25B 1/005, F25B 1/10 ) take precedence)</td>
</tr>
<tr>
<td>1/047</td>
<td>of screw type</td>
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<tr>
<td>1/053</td>
<td>of turbine type</td>
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<tr>
<td>1/06</td>
<td>with compressor of jet type, e.g. using liquid under pressure ( (F25B 1/005, F25B 1/10 ) take precedence)</td>
</tr>
<tr>
<td>1/08</td>
<td>using vapour under pressure</td>
</tr>
<tr>
<td>1/10</td>
<td>with multi-stage compression (with cascade operation ( F25B 7/00 ) )</td>
</tr>
<tr>
<td>3/00</td>
<td>Self-contained rotary compression machines, i.e. with compressor, condenser, and evaporator rotating as a single unit</td>
</tr>
<tr>
<td>5/00</td>
<td>Compression machines, plant, or systems, with several evaporator circuits, e.g. for varying refrigerating capacity (with cascade operation ( F25B 7/00 ) )</td>
</tr>
<tr>
<td>5/02</td>
<td>arranged in parallel</td>
</tr>
<tr>
<td>5/04</td>
<td>arranged in series</td>
</tr>
</tbody>
</table>
Compression machines, plant, or systems

9/14.
9/145.
11/00. Compression machines, plant, or systems, using turbines, e.g. gas turbines
11/02.
11/04.
13/00. Compression machines, plant or systems with reversible cycle (defrosting cycles F25B 47/02)

Sorption machines, plant, or systems

15/00. Sorption machines, plant, or systems, operating continuously, e.g. absorption type
15/002.
15/004.
15/006.
15/008.
15/02.
15/025.
15/04.
15/06.
15/08.
15/09.
15/10.
15/12.
15/14.
15/16.
17/00. Sorption machines, plant, or systems, operating intermittently, e.g. absorption or adsorption type
17/02.
17/04.
17/06.
17/08.
17/083.
17/086.
17/10.
17/12.

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
19/005.
19/02.
19/04.
21/00. Machines, plant, or systems, using electric or magnetic effects (magnetic refrigerating material H01F 1/012 and H01F 1/017)
21/02.

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
23/003.
23/006.

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)
25/005.
25/02.

27/00. Machines, plant, or systems, using particular sources of energy (F25B 30/06 takes precedence)
27/002.
27/005.
27/007.

29/00. Combined heating and refrigeration systems, e.g. operating alternately or simultaneously
29/003.
29/006.

30/00. Heat pumps
30/02.
30/04.
30/06.

Component parts or details

31/00. Compressor arrangements (compressors per se F04)
31/002.
31/004.
31/006.
31/008.
31/02.
31/023.
31/026.

33/00. Boilers; Analysers; Rectifiers (boiler-absorbers F25B 35/00)
35/00. Boiler-absorbers, i.e. boilers usable for absorption or adsorption
35/02.
35/04.
Component parts or details

47/00 Arrangements for preventing or removing deposits or corrosion, not provided for in another subclass
47/003 for preventing corrosion
47/006 for preventing frost
47/02 Defrosting cycles
47/022 for hot gas defrosting
47/025 by reversing the cycle
47/027 for defrosting sorption type systems

49/00 Arrangement or mounting of control or safety devices (testing refrigerators G01M; control in general G05)
49/005 of safety devices (F25B 49/02 and F25B 49/04 take precedence)
49/02 for compression type machines, plant or systems
49/022 Compressor control arrangements (in general F04B)
49/025 Motor control arrangements (motors per se H02K)
49/027 Condenser control arrangements
49/04 for sorption type machines, plant or systems
49/043 Operating continuously
49/046 Operating intermittently

2300/00 Special arrangements or features for refrigeration machines, plants or systems, combined heating and refrigeration systems or heat-pump systems

2309/00 Gas cycle refrigeration machines
2309/001 with a linear configuration or a linear motor
2309/002 with parallel working cold producing expansion devices in one circuit
2309/003 characterised by construction or composition of the regenerator
2309/004 using a compressor of the rotary type
2309/005 using an expander of the rotary type
2309/006 using a distributing valve of the rotary type
2309/007 using the Joule-Thompson effect
2309/021 with a cryosurgical probe tip having a specific construction
2309/022 characterised by the expansion element
2309/023 with two stage expansion
2309/026 Compression machines, plant or systems characterised by the refrigerant being carbon dioxide
2309/027 with cycle highest pressure above the supercritical pressure
2309/03 Compression machines, plant or systems characterised by the cycle used
2309/14 Ericsson or Ericcson cycles
2309/1401 Pulse-tube cycles with acoustic driver
2309/1402 Pulse-tube cycles with heat input into acoustic driver
2309/1403 Pulse-tube cycles with heat input into acoustic driver
2309/1404 Pulse-tube cycles with loudspeaker driven acoustic driver
2309/1405 Pulse-tube cycles with travelling waves
2309/1406 Pulse-tube cycles with pulse tube in co-axial or concentric geometrical arrangements
2309/1407 Pulse-tube cycles with pulse tube having in-line geometrical arrangements
2309/1408 Pulse-tube cycles with pulse tube having U-turn or L-turn type geometrical arrangements
2309/1409 Pulse-tube cycles with pulse tube having special type of geometrical arrangements not being a coaxial, in-line or U-turn type
2309/1411 Pulse-tube cycles characterised by control details, e.g. tuning, phase shifting or general control
2309/1412 Pulse-tube cycles characterised by heat exchanger details
2309/1413 Pulse-tube cycles characterised by performance, geometry or theory
2309/1414 . . . Pulse-tube cycles characterised by pulse tube details
2309/1415 . . . Pulse-tube cycles characterised by regenerator details
2309/1416 . . . Pulse-tube cycles characterised by regenerator stack details
2309/1417 . . . Pulse-tube cycles without any valves in gas supply and return lines
2309/1418 . . . Pulse-tube cycles with valves in gas supply and return lines
2309/14181 . . . the valves being of the rotary type
2309/1419 . . . Pulse-tube cycles with pulse tube having a basic pulse tube refrigerator [PTR], i.e. comprising a tube with basic schematic
2309/1421 . . . Pulse-tube cycles characterised by details not otherwise provided for
2309/1422 . . . Pulse tubes with basic schematic including a counter flow heat exchanger instead of a regenerative heat exchanger
2309/1423 . . . Pulse tubes with basic schematic including an inerterance tube
2309/1424 . . . Pulse tubes with basic schematic including an orifice and a reservoir
2309/14241 . . . Pulse tubes with basic schematic including an orifice reservoir multiple inlet pulse tube
2309/1425 . . . Pulse tubes with basic schematic including several pulse tubes
2309/1426 . . . Pulse tubes with basic schematic including at the pulse tube warm end a so called warm end expander
2309/1427 . . . Control of a pulse tube
2309/1428 . . . Control of a Stirling refrigeration machine

2313/00 Compression machines, plant, or systems with reversible cycle not otherwise provided for

2313/001 . . . with two or more accumulators
2313/002 . . . geothermal
2313/003 . . . Indoor unit with water as a heat sink or heat source
2313/004 . . . Outdoor unit with water as a heat sink or heat source
2313/005 . . . Outdoor unit expansion valves
2313/006 . . . two pipes connecting the outdoor side to the indoor side with multiple indoor units
2313/007 . . . three pipes connecting the outdoor side to the indoor side with multiple indoor units
2313/008 . . . Refrigerant heaters
2313/009 . . . indoor unit in circulation with outdoor unit in first operation mode, indoor unit in circulation with an other heat exchanger in second operation mode or outdoor unit in circulation with an other heat exchanger in third operation mode
2313/021 . . . Indoor unit or outdoor unit with auxiliary heat exchanger not forming part of the indoor or outdoor unit
2313/0211 . . . the auxiliary heat exchanger being only used during defrosting
2313/0212 . . . the auxiliary heat exchanger being only used during dehumidifying
2313/0213 . . . the auxiliary heat exchanger being only used during heating
2313/0214 . . . the auxiliary heat exchanger being used parallel to the indoor unit during heating operation
2313/0215 . . . the auxiliary heat exchanger being used parallel to the outdoor heat exchanger during heating operation
2313/023 . . . using multiple indoor units
2313/0231 . . . with simultaneous cooling and heating
2313/0232 . . . with bypasses
2313/02321 . . . during cooling
2313/02322 . . . during defrosting
2313/02323 . . . during heating
2313/0233 . . . in parallel arrangements
2313/02331 . . . during cooling
2313/02332 . . . during defrosting
2313/02333 . . . during dehumidification
2313/02334 . . . during heating
2313/0234 . . . in series arrangements
2313/02341 . . . during cooling
2313/02342 . . . during defrosting
2313/02343 . . . during dehumidification
2313/02344 . . . during heating
2313/0235 . . . using multiple outdoor units
2313/02351 . . . being defrosted alternately
2313/02352 . . . with bypasses
2313/023521 . . . during cooling
2313/023522 . . . during defrosting
2313/023523 . . . during heating
2313/02353 . . . in parallel arrangements
2313/023531 . . . during cooling
2313/023532 . . . during defrosting
2313/023533 . . . during heating
2313/02354 . . . in series arrangements
2313/023541 . . . during cooling
2313/023542 . . . during defrosting
2313/023543 . . . during heating
2313/0237 . . . characterised by the reversing means
2313/0271 . . . the compressor allows rotation in reverse direction
2313/0272 . . . using bridge circuits of one-way valves
2313/02731 . . . using one three-way valve
2313/02732 . . . using two three-way valves
2313/02741 . . . using one four-way valve
2313/02742 . . . using two four-way valves
2313/02743 . . . using three four-way valves
2313/0276 . . . using six-way valves
2313/0279 . . . using nine-way valves
2313/02791 . . . using shut-off valves
2313/02792 . . . using reversing valve changing the refrigerant flow direction due to pressure differences of the refrigerant and not by external actuation
2313/029 . . . Control issues
2313/0291 . . . related to the pressure of the indoor unit
2313/0292 . . . related to reversing valves
2313/0293 . . . related to the indoor fan, e.g. controlling speed
2313/0294 . . . related to the outdoor fan, e.g. controlling speed
2313/031 . . . Sensor arrangements
2313/0311 . . . Pressure sensors near the expansion valve
2313/0312 . . . Pressure sensors near the indoor heat exchanger
2313/0313 . . . Pressure sensors near the outdoor heat exchanger
2313/0314 . . . Temperature sensors near the indoor heat exchanger
2313/0315 . . . Temperature sensors near the outdoor heat exchanger
Details of evaporators; Details of condensers

Details of evaporators; Details of condensers

Details of evaporators; Details of condensers
Details for charging or discharging refrigerants; Service stations therefor

Charging refrigerant to a cycle
Collecting refrigerant from a cycle
Control issues for charging or collecting refrigerant to or from a cycle
with several tanks to collect or charge a cycle
Service stations therefor
having a carrying handle
having wheels
characterised by charging or discharging valves
characterised by the weighing of refrigerant or oil

Details for preventing or removing deposits or corrosion

Details of defrosting cycles
Alternate defrosting
Cool gas defrosting
Set point defrosting

General features or devices for refrigeration machines, plants or systems, combined heating and refrigeration systems or heat-pump systems, i.e. not limited to a particular subgroup of F25B

Heaters
Centrifugal separation of gas, liquid or oil
Suction accumulators with deflectors
Refrigeration circuit bypassing means
for the compressor
for the condenser
for the desuperheater
for the ejector
for the evaporator
for the expansion valve or capillary tube
for the filter or drier
for the receiver
for the subcooler
for the superheater
Compression system with heat exchange between particular parts of the system
between the accumulator and another part of the cycle
between the capillary tube and another part of the refrigeration cycle
between the storage receiver and another part of the system
between the suction tube of the compressor and another part of the cycle
Several compression cycles arranged in parallel
the capacity of the first system being different from the second
Details of compressors or related parts
Compressor mounted in a housing in which a condenser is integrated
Intercoolers therefor
Linear compressors
with multiple cylinders
with parallel compressors
the compressors having different capacities
having multiple cylinders driven by a rotating swash plate

Compressor control units, e.g. terminal boxes, mounted on the compressor casing wall containing for example starter, protection switches or connector contacts

Refrigeration machines, plants and systems having means for detecting the concentration of a refrigerant
Refrigeration machines, plants and systems having means for detecting the concentration of a sorbent solution
Drop catchers
Inflammable refrigerants
using R1234
Economisers
Power generation using energy from the expansion of the refrigerant
the extracted power is not recycled back in the refrigerant circuit
Refrigerant conversion
Pumping down refrigerant from one part of the cycle to another part of the cycle, e.g. when the cycle is changed from cooling to heating, or before a defrost cycle is started
Modules for refrigeration systems
Refrigeration systems for supermarkets
Separators
Storage receiver heat

Problems to be solved

Geometry problems, e.g. for reducing size
Increasing the heating capacity of a reversible cycle during cold outdoor conditions
Cavitations
Clogging
Cost reduction
Damage
Exceeding a certain pressure value in a refrigeration component or cycle
Exceeding a certain temperature value in a refrigeration component or cycle
Improving heat transfers
Reducing heat transfers
Sound
Vibrations
the presence of moisture in a refrigeration component or cycle
Hunting, i.e. oscillation of controlled refrigeration variables reaching undesirable values
Lubrication
Size reduction
Optimization, e.g. high integration of refrigeration components
Calculation of parameters
Reduction of parts
Preventing, detecting or repairing leaks of refrigeration fluids
Preventing leaks from developing
Detecting refrigerant leaks
### 2600/00: Control issues

- **Timing**
  - 2600/02: Compressor control
  - 2600/021: Inverters therefor
  - 2600/022: for multi-stage operation
  - 2600/023: controlling swash plate angles
  - 2600/024: by controlling the electric parameters, e.g. current or voltage
  - 2600/025: by controlling speed
  - 2600/0251: with on-off operation
  - 2600/0252: with two speeds
  - 2600/0253: with variable speed
  - 2600/026: by controlling unloaders
  - 2600/0261: external to the compressor
  - 2600/0262: internal to the compressor
  - 2600/027: by controlling pressure
  - 2600/0271: the discharge pressure
  - 2600/0272: the suction pressure
  - 2600/05: Refrigerant levels
  - 2600/07: Remote controls
  - 2600/11: Fan speed control
  - 2600/111: of condenser fans
  - 2600/112: of evaporator fans
  - 2600/13: Pump speed control
  - 2600/15: during shut down
  - 2600/17: by controlling the pressure of the condenser
  - 2600/19: Refrigerant outlet condenser temperature
  - 2600/21: Refrigerant outlet evaporator temperature
  - 2600/23: Time delays
  - 2600/25: Control of valves
  - 2600/250: Bypass valves
  - 2600/2503: Condenser exit valves
  - 2600/2505: Fixed-differential control valves
  - 2600/2507: Flow-diverting valves
  - 2600/2509: Economiser valves
  - 2600/251: Evaporator distribution valves
  - 2600/2513: Expansion valves
  - 2600/2515: Flow valves
  - 2600/2517: Head-pressure valves
  - 2600/2519: On-off valves
  - 2600/252: On-off valves controlled by pulse signals
  - 2600/2523: Receiver valves
  - 2600/2525: Pressure relief valves

### 2700/00: Sensing or detecting of parameters; Sensors therefor

- **Sensors determining characteristics of the burner for a generator**
- **Humidity**
- **Oil level**
- **Refrigerant level**

- **Load shedding of a compressor**
- **Piston positions of a compressor**
- **Sensor to detect if defrost is necessary**
- **using an emitter and receiver, e.g. sensing by emitting light or other radiation and receiving reflection by a sensor**
- **Mass flow of refrigerants**
- **at the outlet of a subcooler**
- **through the condenser**
- **at the inlet**
- **at the outlet**
- **through the evaporator**
- **of the cooled fluid upstream or downstream of the evaporator**
- **at the inlet**
- **at the outlet**
- **Power, e.g. by voltage or current**
- **of the compressor motor**
- **Speeds**
- **of the compressor**
- **of the condenser fan**
- **of the evaporator fan**
- **Pressures**
- **near an expansion valve**
- **of the condenser**
- **Oil pressures**
- **Suction pressures**
- **of the condenser**
- **of the evaporator**
- **Temperatures**
- **in a bypass**
- **at the outlet of the gas cooler**
- **near a heat exchanger**
- **of an indoor room or compartment**
- **Oil temperatures**
- **of fresh outdoor air**
- **of a Peltier element**
- **of a receiver**
- **of a separator**
- **of a heat storage receiver**
- **of a suction accumulator**
- **of a compressor or the drive means therefor**
- **at the suction side of the compressor**
- **at the discharge side of the compressor**
- **of electronic components**
- **of an inverter**
- **of the oil**
- **of the motor**
- **at the coil or rotor**
- **of a condenser**
- **the fluid cooled by the condenser**
- **of the refrigerant at the inlet of the condenser**
- **of the refrigerant at the outlet of the condenser**
- **of an evaporator**
- **of the fluid cooled by the evaporator**
- **at the inlet**
- **at the outlet**
- **of the refrigerant at the inlet of the evaporator**
- **of the refrigerant at the outlet of the evaporator**