

**CPC****COOPERATIVE PATENT CLASSIFICATION****F25B****REFRIGERATION MACHINES, PLANTS OR SYSTEMS;  
COMBINED HEATING AND REFRIGERATION SYSTEMS; HEAT-  
PUMP SYSTEMS**

({evaporation or evaporation apparatus for physical or chemical purposes, e.g. evaporation of liquids for gas phase reactions [B01B 1/005](#)}; 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](#))

**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](#) to [F25B 25/00](#) and [F25B 29/00](#) take precedence over group [F25B 30/00](#).

**Compression machines, plant, or systems****F25B 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)

## F25B 1/005

- {of the single unit type ([F25B 1/10](#) takes precedence)}

## F25B 1/02

- with compressor of reciprocating-piston type ({[F25B 1/005](#),} [F25B 1/10](#) take precedence)

## F25B 1/04

- with compressor of rotary type ({[F25B 1/005](#),} [F25B 1/10](#) take precedence)

## F25B 1/047

- . of screw type

## F25B 1/053

- . of turbine type

## F25B 1/06

- with compressor of jet type, e.g. using liquid under pressure ({[F25B 1/005](#),} [F25B 1/10](#) take precedence)

## F25B 1/08

- . using vapour under pressure

## F25B 1/10

- with multi-stage compression (with cascade operation [F25B 7/00](#))

**F25B 3/00**

**Self-contained rotary compression machines, i.e. with compressor, condenser, and evaporator rotating as a single unit**

**F25B 5/00**

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

## F25B 5/02

- arranged in parallel

## F25B 5/04

- arranged in series

**F25B 6/00**

**Compression machines, plant, or systems, with several condenser circuits**

## F25B 6/02

- arranged in parallel

## F25B 6/04

- arranged in series

- F25B 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)**
- F25B 9/00**      **Compression machines, plant, or systems, in which the refrigerant is air or other gas of low boiling point**
- F25B 9/002      . {characterised by the refrigerant}
- F25B 9/004      . . {the refrigerant being air ([air conditioning F24F](#))}
- F25B 9/006      . . {the refrigerant containing more than one component ([F25B 9/004](#) takes precedence; refrigerant materials per se [C09K 5/00](#))}
- F25B 9/008      . . {the refrigerant being carbon dioxide}
- F25B 9/02      . using Joule-Thompson effect; using vortex effect
- F25B 9/04      . . using vortex effect
- F25B 9/06      . using expanders ([F25B 9/10](#) takes precedence)
- F25B 9/065      . . {using pressurised gas jets}
- F25B 9/08      . using ejectors ([F25B 9/10](#) takes precedence)
- F25B 9/10      . with several cooling stages
- F25B 9/12      . using  $^3\text{He}$ - $^4\text{He}$  dilution
- F25B 9/14      . characterised by the cycle used, e.g. Stirling cycle {([engine plants with Vuilleumier-type cycles F02G 1/0445](#))}
- F25B 9/145      . . {pulse-tube cycle}
- F25B 11/00**      **Compression machines, plant, or systems, using turbines, e.g. gas turbines**
- F25B 11/02      . as expanders ([F25B 9/06](#) takes precedence)
- F25B 11/04      . . centrifugal type
- F25B 13/00**      **Compression machines, plant or systems with reversible cycle ([defrosting cycles F25B 47/02](#))**

### **Sorption machines, plant, or systems**

- F25B 15/00**      **Sorption machines, plant, or systems, operating continuously, e.g. absorption type**
- F25B 15/002      . {using the endothermic solution of salt}
- F25B 15/004      . {of rotary type}
- F25B 15/006      . {with cascade operation}
- F25B 15/008      . {with multi-stage operation ([F25B 15/006](#) takes precedence)}
- F25B 15/02      . without inert gas ({[F25B 15/004](#), [F25B 15/006](#), [F25B 15/008](#)}, [F25B 15/12](#), [F25B 15/14](#), [F25B 15/16](#) take precedence)
- F25B 15/025      . . {Liquid transfer means}
- F25B 15/04      . . the refrigerant being ammonia evaporated from aqueous solution ({[F25B 15/025](#) takes precedence})
- F25B 15/06      . . the refrigerant being water vapour evaporated from a salt solution, e.g. lithium bromide ({[F25B 15/025](#) takes precedence})

- F25B 15/08 . . the refrigerant being sulfuric acid {(F25B 15/025 takes precedence)}
- F25B 15/09 . . the refrigerant being hydrogen desorbed from a hydride {(F25B 15/025 takes precedence)}
- F25B 15/10 . with inert gas {(F25B 15/004, F25B 15/006, F25B 15/008}, F25B 15/12, F25B 15/14, F25B 15/16 take precedence)
- F25B 15/12 . with resorber {(F25B 15/004, F25B 15/006, F25B 15/008}, F25B 15/14 take precedence)
- F25B 15/14 . using osmosis {(F25B 15/004, F25B 15/006, F25B 15/008 take precedence)}
- F25B 15/16 . using desorption cycle {(F25B 15/004, F25B 15/006, F25B 15/008 take precedence)}

**F25B 17/00 Sorption machines, plant, or systems, operating intermittently, e.g. absorption or adsorption type**

- F25B 17/02 . the absorbent or adsorbent being a liquid, e.g. brine (F25B 17/10 takes precedence)
- F25B 17/04 . . with two or more boilers operating alternately
- F25B 17/06 . . with the boiler and evaporator built-up as a unit in a tiltable or revolving arrangement
- F25B 17/08 . the absorbent or adsorbent being a solid, e.g. salt (F25B 17/12 takes precedence)
- F25B 17/083 . . {with two or more boiler-sorbers operating alternately}
- F25B 17/086 . . {with two or more boiler-sorber/evaporator units}
- F25B 17/10 . using the endothermic solution of salt
- F25B 17/12 . using desorption of hydrogen from a hydride

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

**F25B 19/00 Machines, plant, or systems, using evaporation of a refrigerant but without recovery of the vapour**

- F25B 19/005 . {the refrigerant being a liquefied gas}
- F25B 19/02 . using fluid jet, e.g. of steam {(F25B 19/005 takes precedence)}
- F25B 19/04 . . using liquid jet, e.g. of water

**F25B 21/00 Machines, plant, or systems, using electric or magnetic effects {(magnetic refrigerating material H01F 1/012 and H01F 1/017)}**

- F25B 21/02 . using Peltier effect; using Nernst-Ettinghausen effect (thermo-electric elements H01L 35/00, H01L 37/00)
- F25B 21/04 . . reversible

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

- F25B 23/003 . {using selective radiation effect}
- F25B 23/006 . {boiling cooling systems}

**F25B 25/00**                    **Machines, plant, or systems, using a combination of modes of operation covered by two or more of the groups [F25B 1/00](#) to [F25B 23/00](#) (combinations of two or more modes of operation covered by a single main group, see the relevant group)**

- F25B 25/005                    . {using primary and secondary systems}
- F25B 25/02                    . Compression-sorption machines, plants, or systems

**F25B 27/00**                    **Machines, plant, or systems, using particular sources of energy ([F25B 30/06](#) takes precedence)**

- F25B 27/002                    . {using solar energy (use of solar heat not otherwise provided for [F24J 2/00](#))}
- F25B 27/005                    . . {in compression type systems}
- F25B 27/007                    . . {in sorption type systems}
- F25B 27/02                    . using waste heat, e.g. from internal-combustion engines

**F25B 29/00**                    **Combined heating and refrigeration systems, e.g. operating alternately or simultaneously**

- F25B 29/003                    . {of the compression type system}
- F25B 29/006                    . {of the sorption type system}

**F25B 30/00**                    **Heat pumps**

- F25B 30/02                    . of the compression type
- F25B 30/04                    . of the sorption type
- F25B 30/06                    . characterised by the source of low potential heat

#### **Component parts or details**

**F25B 31/00**                    **Compressor arrangements ([compressors per se F04](#))**

- F25B 31/002                    . {[lubrication \(of compressors per se F04B, of machines or engines in general F01M\)](#)}
- F25B 31/004                    . . {oil recirculating arrangements}
- F25B 31/006                    . {cooling of compressor or motor ([of compressors per se F04B 39/06](#))}
- F25B 31/008                    . . {by injecting a liquid ([for compressors in general F04B 39/062](#))}
- F25B 31/02                    . of motor-compressor units
- F25B 31/023                    . . {with compressor of reciprocating-piston type}
- F25B 31/026                    . . {with compressor of rotary type}

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

**F25B 35/00**                    **Boiler-absorbers, i.e. boilers usable for absorption or adsorption**

- F25B 35/02                    . using a liquid as sorbent, e.g. brine
- F25B 35/04                    . using a solid as sorbent

<b>F25B 37/00</b>	<b>Absorbers; Adsorbers</b> (boiler-absorbers <a href="#">F25B 35/00</a> ; separating processes involving the treatment of liquids with adsorbents <a href="#">B01D 15/00</a> ; separation of gases or vapours by adsorption <a href="#">B01D 53/02</a> ; separation of gases or vapours by absorption <a href="#">B01D 53/14</a> ; investigating using adsorption or absorption <a href="#">G01N 30/00</a> ); {(absorption or adsorption in general <a href="#">B01J 20/00</a> )}
<b>F25B 39/00</b>	<b>Evaporators; Condensers</b>
<a href="#">F25B 39/02</a>	. Evaporators
<a href="#">F25B 39/022</a>	. . {with plate-like or laminated elements}
<a href="#">F25B 39/024</a>	. . . {with elements constructed in the shape of a hollow panel (for heat exchange in general <a href="#">F28F 3/12</a> )}
<a href="#">F25B 39/026</a>	. . {specially adapted for sorption type systems}
<a href="#">F25B 39/028</a>	. . {having distributing means}
<a href="#">F25B 39/04</a>	. Condensers
<b>F25B 40/00</b>	<b>Subcoolers, desuperheaters or superheaters</b>
<a href="#">F25B 40/02</a>	. Subcoolers
<a href="#">F25B 40/04</a>	. Desuperheaters
<a href="#">F25B 40/06</a>	. Superheaters
<b>F25B 41/00</b>	<b>Fluid-circulation arrangements, e.g. for transferring liquid from evaporator to boiler</b> (pumps per se, sealings therefor <a href="#">F04</a> )
<a href="#">F25B 41/003</a>	. {fluid line arrangements}
<a href="#">F25B 41/006</a>	. {optical fluid control arrangements}
<a href="#">F25B 41/02</a>	. using electro-osmosis
<a href="#">F25B 41/04</a>	. Disposition of valves (valves per se <a href="#">F16K</a> )
<a href="#">F25B 41/043</a>	. . {in the circuit between evaporator and compressor}
<a href="#">F25B 41/046</a>	. . {of fluid flow reversing valves}
<a href="#">F25B 41/06</a>	. Flow restrictors, e.g. capillary tubes; Disposition thereof
<a href="#">F25B 41/062</a>	. . {Expansion valves (regulating valves per se <a href="#">G05D</a> )}
<a href="#">F25B 41/065</a>	. . . {Float control valves}
<a href="#">F25B 41/067</a>	. . {capillary tubes}
<b>F25B 43/00</b>	<b>Arrangements for separating or purifying gases or liquids</b> (in analysers or rectifiers <a href="#">F25B 33/00</a> ); <b>Arrangements for vaporising the residuum of liquid refrigerant, e.g. by heat</b> ( <a href="#">F25B 40/00</a> takes precedence)
<a href="#">F25B 43/003</a>	. {filters (in general <a href="#">B01D</a> )}
<a href="#">F25B 43/006</a>	. {accumulators}
<a href="#">F25B 43/02</a>	. for separating lubricants from the refrigerant
<a href="#">F25B 43/04</a>	. for withdrawing non-condensable gases
<a href="#">F25B 43/043</a>	. . {for compression type systems}
<a href="#">F25B 43/046</a>	. . {for sorption type systems}
<b>F25B 45/00</b>	<b>Arrangements for charging or discharging refrigerant</b>

**F25B 47/00**      **Arrangements for preventing or removing deposits or corrosion, not provided for in another subclass**

- F25B 47/003      .    {for preventing corrosion}
- F25B 47/006      .    {for preventing frost}
- F25B 47/02       .    Defrosting cycles
- F25B 47/022      .    .    {hot gas defrosting}
- F25B 47/025      .    .    .    {by reversing the cycle}
- F25B 47/027      .    .    {for defrosting sorption type systems}

**F25B 49/00**      **Arrangement or mounting of control or safety devices (testing refrigerators [G01M](#); control in general [G05](#))**

- F25B 49/005      .    {of safety devices ([F25B 49/02](#) and [F25B 49/04](#) take precedence)}
- F25B 49/02       .    for compression type machines, plant or systems
- F25B 49/022      .    .    {Compressor control arrangements (in general [F04B](#))}
- F25B 49/025      .    .    {Motor control arrangements (motors per se [H02K](#))}
- F25B 49/027      .    .    {Condenser control arrangements}
- F25B 49/04       .    for sorption type machines, plant or systems
- F25B 49/043      .    .    {Operating continuously}
- F25B 49/046      .    .    {Operating intermittently}

**F25B 2300/00**      **Special arrangements or features for refrigeration machines, plants or systems, combined heating and refrigeration systems or heat-pump systems**
**F25B 2309/00**      **Gas cycle refrigeration machines**

- F25B 2309/001      .    with a linear configuration or a linear motor
- F25B 2309/002      .    with parallel working cold producing expansion devices in one circuit
- F25B 2309/003      .    characterised by construction or composition of the regenerator
- F25B 2309/004      .    using a compressor of the rotary type
- F25B 2309/005      .    using an expander of the rotary type
- F25B 2309/006      .    using a distributing valve of the rotary type
- F25B 2309/02       .    using the Joule-Thompson effect
- F25B 2309/021      .    .    with a cryosurgical probe tip having a specific construction
- F25B 2309/022      .    .    characterised by the expansion element
- F25B 2309/023      .    .    with two stage expansion
- F25B 2309/06       .    Compression machines, plant or systems characterised by the refrigerant being carbon dioxide
- F25B 2309/061      .    .    with cycle highest pressure above the supercritical pressure
- F25B 2309/14       .    Compression machines, plant or systems characterised by the cycle used
- F25B 2309/1401     .    .    Ericsson or Ericcson cycles
- F25B 2309/1402     .    .    Pulse-tube cycles with acoustic driver
- F25B 2309/1403     .    .    Pulse-tube cycles with heat input into acoustic driver
- F25B 2309/1404     .    .    Pulse-tube cycles with loudspeaker driven acoustic driver

- F25B 2309/1405 . . Pulse-tube cycles with travelling waves
- F25B 2309/1406 . . Pulse-tube cycles with pulse tube in co-axial or concentric geometrical arrangements
- F25B 2309/1407 . . Pulse-tube cycles with pulse tube having in-line geometrical arrangements
- F25B 2309/1408 . . Pulse-tube cycles with pulse tube having U-turn or L-turn type geometrical arrangements
- F25B 2309/1409 . . Pulse-tube cycles with pulse tube having special type of geometrical arrangements not being a coaxial, in-line or U-turn type
- F25B 2309/1411 . . Pulse-tube cycles characterised by control details, e.g. tuning, phase shifting or general control
- F25B 2309/1412 . . Pulse-tube cycles characterised by heat exchanger details
- F25B 2309/1413 . . Pulse-tube cycles characterised by performance, geometry or theory
- F25B 2309/1414 . . Pulse-tube cycles characterised by pulse tube details
- F25B 2309/1415 . . Pulse-tube cycles characterised by regenerator details
- F25B 2309/1416 . . Pulse-tube cycles characterised by regenerator stack details
- F25B 2309/1417 . . Pulse-tube cycles without any valves in gas supply and return lines
- F25B 2309/1418 . . Pulse-tube cycles with valves in gas supply and return lines
- F25B 2309/14181 . . . the valves being of the rotary type
- F25B 2309/1419 . . Pulse-tube cycles with pulse tube having a basic pulse tube refrigerator [PTR], i.e. comprising a tube with basic schematic
- F25B 2309/1421 . . Pulse-tube cycles characterised by details not otherwise provided for
- F25B 2309/1422 . . Pulse tubes with basic schematic including a counter flow heat exchanger instead of a regenerative heat exchanger
- F25B 2309/1423 . . Pulse tubes with basic schematic including an inertance tube
- F25B 2309/1424 . . Pulse tubes with basic schematic including an orifice and a reservoir
- F25B 2309/14241 . . . Pulse tubes with basic schematic including an orifice reservoir multiple inlet pulse tube
- F25B 2309/1425 . . Pulse tubes with basic schematic including several pulse tubes
- F25B 2309/1426 . . Pulse tubes with basic schematic including at the pulse tube warm end a so called warm end expander
- F25B 2309/1427 . . Control of a pulse tube
- F25B 2309/1428 . . Control of a Stirling refrigeration machine

**F25B 2313/00****Compression machines, plant, or systems with reversible cycle not otherwise provided for**

- F25B 2313/001 . with two or more accumulators
- F25B 2313/002 . geothermal
- F25B 2313/003 . Indoor unit with water as a heat sink or heat source
- F25B 2313/004 . Outdoor unit with water as a heat sink or heat source
- F25B 2313/005 . Outdoor unit expansion valves
- F25B 2313/006 . two pipes connecting the outdoor side to the indoor side with multiple indoor units

- F25B 2313/007 . three pipes connecting the outdoor side to the indoor side with multiple indoor units
- F25B 2313/008 . Refrigerant heaters
- F25B 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
- F25B 2313/021 . Indoor unit or outdoor unit with auxiliary heat exchanger not forming part of the indoor or outdoor unit
  - F25B 2313/0211 . . the auxiliary heat exchanger being only used during defrosting
  - F25B 2313/0212 . . the auxiliary heat exchanger being only used during dehumidifying
  - F25B 2313/0213 . . the auxiliary heat exchanger being only used during heating
  - F25B 2313/0214 . . the auxiliary heat exchanger being used parallel to the indoor unit during heating operation
  - F25B 2313/0215 . . the auxiliary heat exchanger being used parallel to the outdoor heat exchanger during heating operation
- F25B 2313/023 . using multiple indoor units
  - F25B 2313/0231 . . with simultaneous cooling and heating
  - F25B 2313/0232 . . with bypasses
    - F25B 2313/02321 . . . during cooling
    - F25B 2313/02322 . . . during defrosting
    - F25B 2313/02323 . . . during heating
  - F25B 2313/0233 . . in parallel arrangements
    - F25B 2313/02331 . . . during cooling
    - F25B 2313/02332 . . . during defrosting
    - F25B 2313/02333 . . . during dehumidification
    - F25B 2313/02334 . . . during heating
  - F25B 2313/0234 . . in series arrangements
    - F25B 2313/02341 . . . during cooling
    - F25B 2313/02342 . . . during defrosting
    - F25B 2313/02343 . . . during dehumidification
    - F25B 2313/02344 . . . during heating
- F25B 2313/025 . using multiple outdoor units
  - F25B 2313/0251 . . being defrosted alternately
  - F25B 2313/0252 . . with bypasses
    - F25B 2313/02521 . . . during cooling
    - F25B 2313/02522 . . . during defrosting
    - F25B 2313/02523 . . . during heating
  - F25B 2313/0253 . . in parallel arrangements
    - F25B 2313/02531 . . . during cooling
    - F25B 2313/02532 . . . during defrosting
    - F25B 2313/02533 . . . during heating
  - F25B 2313/0254 . . in series arrangements



- F25B 2313/02541 . . . during cooling
- F25B 2313/02542 . . . during defrosting
- F25B 2313/02543 . . . during heating
- F25B 2313/027 . . characterised by the reversing means
- F25B 2313/0271 . . the compressor allows rotation in reverse direction
- F25B 2313/0272 . . using bridge circuits of one-way valves
- F25B 2313/02731 . . using one three-way valve
- F25B 2313/02732 . . using two three-way valves
- F25B 2313/02741 . . using one four-way valve
- F25B 2313/02742 . . using two four-way valves
- F25B 2313/02743 . . using three four-way valves
- F25B 2313/0276 . . using six-way valves
- F25B 2313/0279 . . using nine-way valves
- F25B 2313/02791 . . using shut-off valves
- F25B 2313/02792 . . using reversing valve changing the refrigerant flow direction due to pressure differences of the refrigerant and not by external actuation
- F25B 2313/029 . . Control issues
- F25B 2313/0291 . . related to the pressure of the indoor unit
- F25B 2313/0292 . . related to reversing valves
- F25B 2313/0293 . . related to the indoor fan, e.g. controlling speed
- F25B 2313/0294 . . related to the outdoor fan, e.g. controlling speed
- F25B 2313/031 . . Sensor arrangements
- F25B 2313/0311 . . Pressure sensors near the expansion valve
- F25B 2313/0312 . . Pressure sensors near the indoor heat exchanger
- F25B 2313/0313 . . Pressure sensors near the outdoor heat exchanger
- F25B 2313/0314 . . Temperature sensors near the indoor heat exchanger
- F25B 2313/0315 . . Temperature sensors near the outdoor heat exchanger
- F25B 2313/0316 . . Temperature sensors near the refrigerant heater
- F25B 2315/00 Sorption refrigeration cycles or details thereof**
- F25B 2315/001 . Crystallization prevention
- F25B 2315/002 . Generator absorber heat exchanger [GAX]
- F25B 2315/003 . Hydrates for sorption cycles
- F25B 2315/004 . Inert heat-exchangers
- F25B 2315/005 . Regeneration
- F25B 2315/006 . Reversible sorption cycles
- F25B 2315/007 . Parallel systems therefor
- F25B 2321/00 Details of machines, plants, or systems, using electric or magnetic effects**
- F25B 2321/001 . by using electro-caloric effects
- F25B 2321/002 . by using magneto-caloric effects

- F25B 2321/0021 . . with a static fixed magnet
- F25B 2321/0022 . . with a rotating or otherwise moving magnet
- F25B 2321/0023 . . with modulation, influencing or enhancing an existing magnetic field
- F25B 2321/003 . by using thermionic electron cooling effects
- F25B 2321/02 . using Peltier effects; using Nernst-Ettinghausen effects
- F25B 2321/021 . . Control thereof
- F25B 2321/0211 . . . of fans
- F25B 2321/0212 . . . of electric power, current or voltage
- F25B 2321/023 . . Mounting details thereof
- F25B 2321/025 . . Removal of heat
- F25B 2321/0251 . . . by a gas
- F25B 2321/0252 . . . by liquids or two-phase fluids

#### **F25B 2327/00 Refrigeration system using an engine for driving a compressor**

- F25B 2327/001 . of the internal combustion type

#### **F25B 2333/00 Details of boilers; Analysers; Rectifiers**

- F25B 2333/001 . the generator or boiler having an analyser
- F25B 2333/002 . the generator or boiler is heated electrically
- F25B 2333/003 . the generator or boiler is heated by combustion gas
- F25B 2333/004 . the generator or boiler uses an inert gas as pressure equalizing medium
- F25B 2333/005 . the generator or boiler uses electromagnetic energy in the form of microwaves for desorbing the sorbate from the sorbate/sorbent compound
- F25B 2333/0051 . . the energy is used for heating an auxiliary medium which is used as heating source for desorbing the sorbate from the sorbate/sorbent compound
- F25B 2333/006 . the generator or boiler having a rectifier
- F25B 2333/007 . the generator or boiler heated by heat exchangers with steam or hot water as heating fluid or by a secondary boiling-condensing heater

#### **F25B 2339/00 Details of evaporators; Details of condensers**

- F25B 2339/02 . Details of evaporators
- F25B 2339/021 . . Evaporators in which refrigerant is sprayed on a surface to be cooled
- F25B 2339/022 . . Evaporators constructed from a pair of plates forming a space in which is located a refrigerant carrying coil
- F25B 2339/023 . . Evaporators consisting of one or several sheets on one face of which is fixed a refrigerant carrying coil
- F25B 2339/024 . . Evaporators with refrigerant in a vessel in which is situated a heat exchanger
- F25B 2339/0241 . . . having plate-like elements
- F25B 2339/0242 . . . having tubular elements
- F25B 2339/04 . Details of condensers
- F25B 2339/041 . . of evaporative condensers
- F25B 2339/042 . . of pcm condensers
- F25B 2339/043 . . Condensers made by assembling plate-like or laminated elements

- F25B 2339/044 . . Condensers with an integrated receiver
- F25B 2339/0441 . . . containing a drier or a filter
- F25B 2339/0442 . . . characterised by the mechanical fixation of the receiver to the header
- F25B 2339/0443 . . . the receiver being positioned horizontally
- F25B 2339/0444 . . . where the flow of refrigerant through the condenser receiver is split into two or more flows, each flow following a different path through the condenser receiver
- F25B 2339/0445 . . . with throttle portions
- F25B 2339/0446 . . . characterised by the refrigerant tubes connecting the header of the condenser to the receiver; Inlet or outlet connections to receiver
- F25B 2339/045 . . Condensers made by assembling a tube on a plate-like element or between plate-like elements
- F25B 2339/046 . . Condensers with refrigerant heat exchange tubes positioned inside or around a vessel containing water or pcm to cool the refrigerant gas
- F25B 2339/047 . . Water-cooled condensers

**F25B 2341/00 Details of ejectors not being used as compression device; Details of flow restrictors or expansion valves**

- F25B 2341/001 . Ejectors not being used as compression device
- F25B 2341/0011 . . Ejectors with the cooled primary flow at reduced or low pressure
- F25B 2341/0012 . . Ejectors with the cooled primary flow at high pressure
- F25B 2341/0013 . . Ejector control arrangements
- F25B 2341/0014 . . Ejectors with a high pressure hot primary flow from a compressor discharge
- F25B 2341/0015 . . using two or more ejectors
- F25B 2341/0016 . . Ejectors for creating an oil recirculation
- F25B 2341/06 . Details of flow restrictors or expansion valves
- F25B 2341/061 . . Bidirectional expansion restrictors
- F25B 2341/062 . . Capillary expansion valves
- F25B 2341/063 . . Feed forward expansion valves
- F25B 2341/064 . . Superheater expansion valves
- F25B 2341/065 . . Electric expansion valves
- F25B 2341/0651 . . . actuated by electric heating means, e.g. a heated bimetallic element
- F25B 2341/0652 . . . being opened and closed cyclically, e. g. with pulse width modulation
- F25B 2341/0653 . . . actuated by an electric motor
- F25B 2341/066 . . Refrigeration circuits using more than one expansion valve
- F25B 2341/0661 . . . arranged in parallel
- F25B 2341/0662 . . . arranged in series
- F25B 2341/067 . . Expansion valves having a pilot valve
- F25B 2341/0671 . . . the pilot valve is electrically actuated
- F25B 2341/068 . . Expansion valves combined with a sensor
- F25B 2341/0681 . . . the sensor is heated
- F25B 2341/0682 . . . the sensor contains sorbent materials

- F25B 2341/0683 . . . the sensor is disposed in the suction line and influenced by the temperature or the pressure of the suction gas

## **F25B 2345/00**

### **Details for charging or discharging refrigerants; Service stations therefor**

- F25B 2345/001 . Charging refrigerant to a cycle
- F25B 2345/002 . Collecting refrigerant from a cycle
- F25B 2345/003 . Control issues for charging or collecting refrigerant to or from a cycle
- F25B 2345/004 . with several tanks to collect or charge a cycle
- F25B 2345/005 . Service stations therefor
- F25B 2345/0051 . . having a carrying handle
- F25B 2345/0052 . . having wheels
- F25B 2345/006 . characterised by charging or discharging valves
- F25B 2345/007 . characterised by the weighing of refrigerant or oil

## **F25B 2347/00**

### **Details for preventing or removing deposits or corrosion**

- F25B 2347/02 . Details of defrosting cycles
- F25B 2347/021 . . Alternate defrosting
- F25B 2347/022 . . Cool gas defrosting
- F25B 2347/023 . . Set point defrosting

## **F25B 2400/00**

### **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](#)**

- F25B 2400/01 . Heaters
- F25B 2400/02 . Centrifugal separation of gas, liquid or oil
- F25B 2400/03 . Suction accumulators with deflectors
- F25B 2400/04 . Refrigeration circuit bypassing means
- F25B 2400/0401 . . for the compressor
- F25B 2400/0403 . . for the condenser
- F25B 2400/0405 . . for the desuperheater
- F25B 2400/0407 . . for the ejector
- F25B 2400/0409 . . for the evaporator
- F25B 2400/0411 . . for the expansion valve or capillary tube
- F25B 2400/0413 . . for the filter or drier
- F25B 2400/0415 . . for the receiver
- F25B 2400/0417 . . for the subcooler
- F25B 2400/0419 . . for the superheater
- F25B 2400/05 . Compression system with heat exchange between particular parts of the system
- F25B 2400/051 . . between the accumulator and another part of the cycle
- F25B 2400/052 . . between the capillary tube and another part of the refrigeration cycle
- F25B 2400/053 . . between the storage receiver and another part of the system
- F25B 2400/054 . . between the suction tube of the compressor and another part of the cycle

- F25B 2400/06 . Several compression cycles arranged in parallel
- F25B 2400/061 . . the capacity of the first system being different from the second
- F25B 2400/07 . Details of compressors or related parts
- F25B 2400/071 . . Compressor mounted in a housing in which a condenser is integrated
- F25B 2400/072 . . Intercoolers therefor
- F25B 2400/073 . . Linear compressors
- F25B 2400/074 . . with multiple cylinders
- F25B 2400/075 . . with parallel compressors
- F25B 2400/0751 . . . the compressors having different capacities
- F25B 2400/076 . . having multiple cylinders driven by a rotating swash plate
- F25B 2400/077 . . Compressor control units, e.g. terminal boxes, mounted on the compressor casing wall containing for example starter, protection switches or connector contacts
- F25B 2400/08 . Refrigeration machines, plants and systems having means for detecting the concentration of a refrigerant
- F25B 2400/09 . Refrigeration machines, plants and systems having means for detecting the concentration of a sorbent solution
- F25B 2400/11 . Drop catchers
- F25B 2400/12 . Inflammable refrigerants
- F25B 2400/121 . . using R1234
- F25B 2400/13 . Economisers
- F25B 2400/14 . Power generation using energy from the expansion of the refrigerant
- F25B 2400/141 . . the extracted power is not recycled back in the refrigerant circuit
- F25B 2400/15 . Micro-electro-mechanical devices
- F25B 2400/16 . Receivers
- F25B 2400/161 . . arranged in parallel
- F25B 2400/162 . . characterised by the plug or stop
- F25B 2400/17 . Re-condensers
- F25B 2400/18 . Refrigerant conversion
- F25B 2400/19 . 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
- F25B 2400/21 . Modules for refrigeration systems
- F25B 2400/22 . Refrigeration systems for supermarkets
- F25B 2400/23 . Separators
- F25B 2400/24 . Storage receiver heat
- F25B 2500/00 Problems to be solved**
- F25B 2500/01 . Geometry problems, e.g. for reducing size
- F25B 2500/02 . Increasing the heating capacity of a reversible cycle during cold outdoor conditions
- F25B 2500/03 . Cavitations

F25B 2500/04	. Clogging
F25B 2500/05	. Cost reduction
F25B 2500/06	. Damage
F25B 2500/07	. Exceeding a certain pressure value in a refrigeration component or cycle
F25B 2500/08	. Exceeding a certain temperature value in a refrigeration component or cycle
F25B 2500/09	. Improving heat transfers
F25B 2500/11	. Reducing heat transfers
F25B 2500/12	. Sound
F25B 2500/13	. Vibrations
F25B 2500/14	. the presence of moisture in a refrigeration component or cycle
F25B 2500/15	. Hunting, i.e. oscillation of controlled refrigeration variables reaching undesirable values
F25B 2500/16	. Lubrication
F25B 2500/17	. Size reduction
F25B 2500/18	. Optimization, e.g. high integration of refrigeration components
F25B 2500/19	. Calculation of parameters
F25B 2500/21	. Reduction of parts
F25B 2500/22	. Preventing, detecting or repairing leaks of refrigeration fluids
F25B 2500/221	. . Preventing leaks from developing
F25B 2500/222	. . Detecting refrigerant leaks
F25B 2500/23	. High amount of refrigerant in the system
F25B 2500/24	. Low amount of refrigerant in the system
F25B 2500/25	. Standardisation of apparatus or parts
F25B 2500/26	. characterised by the startup of the refrigeration cycle
F25B 2500/27	. characterised by the stop of the refrigeration cycle
F25B 2500/28	. Means for preventing liquid refrigerant entering into the compressor
F25B 2500/29	. High ambient temperatures
F25B 2500/31	. Low ambient temperatures
F25B 2500/32	. Weight

**F25B 2600/00****Control issues**

F25B 2600/01	. Timing
F25B 2600/02	. Compressor control
F25B 2600/021	. . Inverters therefor
F25B 2600/022	. . for multi-stage operation
F25B 2600/023	. . controlling swash plate angles
F25B 2600/024	. . by controlling the electric parameters, e.g. current or voltage
F25B 2600/025	. . by controlling speed
F25B 2600/0251	. . . with on-off operation
F25B 2600/0252	. . . with two speeds
F25B 2600/0253	. . . with variable speed

- F25B 2600/026 . . by controlling unloaders
- F25B 2600/0261 . . . external to the compressor
- F25B 2600/0262 . . . internal to the compressor
- F25B 2600/027 . . by controlling pressure
- F25B 2600/0271 . . . the discharge pressure
- F25B 2600/0272 . . . the suction pressure
- F25B 2600/05 . Refrigerant levels
- F25B 2600/07 . Remote controls
- F25B 2600/11 . Fan speed control
- F25B 2600/111 . . of condenser fans
- F25B 2600/112 . . of evaporator fans
- F25B 2600/13 . Pump speed control
- F25B 2600/15 . during shut down
- F25B 2600/17 . by controlling the pressure of the condenser
- F25B 2600/19 . Refrigerant outlet condenser temperature
- F25B 2600/21 . Refrigerant outlet evaporator temperature
- F25B 2600/23 . Time delays
- F25B 2600/25 . Control of valves
- F25B 2600/2501 . . Bypass valves
- F25B 2600/2503 . . Condenser exit valves
- F25B 2600/2505 . . Fixed-differential control valves
- F25B 2600/2507 . . Flow-diverting valves
- F25B 2600/2509 . . Economiser valves
- F25B 2600/2511 . . Evaporator distribution valves
- F25B 2600/2513 . . Expansion valves
- F25B 2600/2515 . . Flow valves
- F25B 2600/2517 . . Head-pressure valves
- F25B 2600/2519 . . On-off valves
- F25B 2600/2521 . . On-off valves controlled by pulse signals
- F25B 2600/2523 . . Receiver valves
- F25B 2600/2525 . . Pressure relief valves

**F25B 2700/00****Sensing or detecting of parameters; Sensors therefor**

- F25B 2700/01 . Sensors determining characteristics of the burner for a generator
- F25B 2700/02 . Humidity
- F25B 2700/03 . Oil level
- F25B 2700/04 . Refrigerant level
- F25B 2700/05 . Load shedding of a compressor
- F25B 2700/06 . Piston positions of a compressor
- F25B 2700/11 . Sensor to detect if defrost is necessary

- F25B 2700/111 . . . using an emitter and receiver , e.g. sensing by emitting light or other radiation and receiving reflection by a sensor
- F25B 2700/13 . Mass flow of refrigerants
- F25B 2700/131 . . . at the outlet of a subcooler
- F25B 2700/133 . . . through the condenser
- F25B 2700/1331 . . . . at the inlet
- F25B 2700/1332 . . . . at the outlet
- F25B 2700/135 . . . through the evaporator
- F25B 2700/1351 . . . . of the cooled fluid upstream or downstream of the evaporator
- F25B 2700/1352 . . . . at the inlet
- F25B 2700/1353 . . . . at the outlet
- F25B 2700/15 . Power, e.g. by voltage or current
- F25B 2700/151 . . . of the compressor motor
- F25B 2700/17 . Speeds
- F25B 2700/171 . . . of the compressor
- F25B 2700/172 . . . of the condenser fan
- F25B 2700/173 . . . of the evaporator fan
- F25B 2700/19 . Pressures
- F25B 2700/191 . . . near an expansion valve
- F25B 2700/193 . . . of the compressor
- F25B 2700/1931 . . . . Discharge pressures
- F25B 2700/1932 . . . . Oil pressures
- F25B 2700/1933 . . . . Suction pressures
- F25B 2700/195 . . . of the condenser
- F25B 2700/197 . . . of the evaporator
- F25B 2700/21 . Temperatures
- F25B 2700/2101 . . . in a bypass
- F25B 2700/2102 . . . at the outlet of the gas cooler
- F25B 2700/2103 . . . near a heat exchanger
- F25B 2700/2104 . . . of an indoor room or compartment
- F25B 2700/2105 . . . Oil temperatures
- F25B 2700/2106 . . . of fresh outdoor air
- F25B 2700/2107 . . . of a Peltier element
- F25B 2700/2108 . . . of a receiver
- F25B 2700/2109 . . . of a separator
- F25B 2700/2111 . . . of a heat storage receiver
- F25B 2700/2113 . . . of a suction accumulator
- F25B 2700/2115 . . . of a compressor or the drive means therefor
- F25B 2700/21151 . . . . at the suction side of the compressor
- F25B 2700/21152 . . . . at the discharge side of the compressor



F25B 2700/21153	. . .	of electronic components
F25B 2700/21154	. . .	of an inverter
F25B 2700/21155	. . .	of the oil
F25B 2700/21156	. . .	of the motor
F25B 2700/21157	. . . .	at the coil or rotor
F25B 2700/2116	. .	of a condenser
F25B 2700/21161	. . .	the fluid cooled by the condenser
F25B 2700/21162	. . .	of the refrigerant at the inlet of the condenser
F25B 2700/21163	. . .	of the refrigerant at the outlet of the condenser
F25B 2700/2117	. .	of an evaporator
F25B 2700/21171	. . .	of the fluid cooled by the evaporator
F25B 2700/21172	. . . .	at the inlet
F25B 2700/21173	. . . .	at the outlet
F25B 2700/21174	. . .	of the refrigerant at the inlet of the evaporator
F25B 2700/21175	. . .	of the refrigerant at the outlet of the evaporator