17 Refrigeration and ice-making, ice-storage, heat exchange, mechanical liquefaction of not easily condensable gases and gaseous mixtures

17a Refrigerating machines
17b Preparation and production of ice
17c Ice cellars, ice boxes and refrigerators, freezing equipment, refrigeration cars
17d Steam condensers
17e Open heat-exchange devices, in which the heat-exchange media come into direct contact
17f Enclosed heat-exchange devices, in which the heat exchange media are separated by a solid wall
17g Liquefaction and separation of not easily condensable gases and gaseous mixtures by mechanical means, decantation and vaporisation of liquefied gases; pressure containers and insulated containers for compressed and liquefied gases

17a Refrigerating machines

Compression refrigerating machines
17a-1/01 General
17a-1/02 with liquid working agent
17a-1/03 with circulating steam as working agent
17a-1/04 Cooling of the compressor, also in conjunction with the motor and condenser
17a-1/05 Multistage compression-refrigerating machines
17a-2 Rotary compression-refrigerating machines
17a-3/01 Compressors, general, and their valve regulation (compressors 27; compressor valve structure 47g)
17a-3/02 Special kinds of compressors, e.g. compression effected by means of a liquid
17a-3/03 Rotary compressors
17a-3/04 Electrically driven compressors, and liquid driven by electrodynamic means
17a-4/01 Regulating devices for compression-refrigerating machines, general
17a-4/02 Electric regulation of compression-refrigerating machines
17a-4/03 Measurements applied to compression-refrigerating machines
17a-4/04 Float-regulation for compression-refrigerating machines
17a-5 Air refrigerating machines
17a-6 Vacuum refrigerating machines without circulation of the working agent
17a-7 Compression-absorption refrigerating machines
Absorption-refrigerating machines, continuous operation
17a-8/01 General
17a-8/02 with inert gases
17a-8/03 Liquid driven by phenomena occurring in the process itself
Absorption-refrigerating machines, discontinuous operation
17a-9/01 General
17a-9/02 Liquid seals
17a-9/03 Water separation
Use of multiple generators
Rotary periodic absorption-refrigerating machines
Regulating and control devices for absorption-refrigerating machines
Absorbers for absorption-refrigerating machines
Still: generators, generator-absorbers for absorption-refrigerating machines
Evaporators, general
Evaporators for ice making
Condensers
Regulating valves (valves 47g)
Packings, general
Diaphragm packings
Lubrication and oil separators
Liquid separators
Deaerators
Iceboxes in conjunction with compression-refrigerating machines (iceboxes 17c)
Iceboxes in conjunction with absorption-refrigerating machines
Special details
Special refrigerating machines, also those using the Peltier effect
Simultaneous production of cold and power, or of cold and heat

Preparation and production of ice (refrigerating machines 17a)

Ice making without the use of freezing cans, also preparation of natural ice
Ice making in freezing moulds
General
Filling devices for ice moulds
Ice moulds structures
Obtaining ice by means of freezing plates completely immersed in water
Ice making in rotating ice moulds
Continuous ice making
Blowing air into ice cells
Stirring mechanisms
Preparation of water for freezing (85b)
Ice saws, ice cutting and harvesting machines
Ice crushing without sawing (34b-5)
Ice cleaning machines
Ice tongs
Transporting devices for ice blocks
Ice shaving machines
Ice presses
Artificial skating rinks (39b-26; 77b-19/10; 77b-20)
Vacuum ice machines
Miscellaneous ice-making processes
Ice cream manufacture (53l-13)
Non-rotating containers without stirring devices, ice-cream storage
Rotating and oscillating containers without stirring devices
Containers with stirring devices, with rotating container or stirring devices
Continuous ice-cream making; ice cream in the cooling drum
Continuous ice-cream making: ice cream outside the cooling drum or on a moving, endless, cooled conveyor belt
Making ice cream by means of carbon dioxide
17b-6/07 Devices for dispensing ice cream portions, packing of ice cream

17c Ice cellars, ice boxes and refrigerators, freezing equipment, refrigeration cars

17c-1/01 Ice storage chambers
17c-1/02 Ice cellars, ice houses (structural section 37f-2/03, 37f-5/10)
17c-2/01 Ice cabinets
17c-2/02 Ice boxes
17c-2/03 Special ice-cooled containers (insulating containers 34l-11/02)

Refrigerators, cooling containers and freezing equipment, especially for foodstuffs, with refrigeration (ice-cream manufacture 17b-6; cooling of margarine and edible fats during manufacture 53h-2; decomposition of solutions or fluid mixtures by cooling and crystallisation of constituents 12c-2)

17c-3/01 by means of cold water, e.g. domestic tap water (85d-2 – 85d-4)
17c-3/02 by means of refrigerating mixtures (refrigerating mixtures as such 12a-7)
17c-3/03 by means of liquefied gases (ice boxes in conjunction with refrigerating machines 17a-18/01 – 17a-18/02)
17c-3/04 by liquid evaporation (34f-20; 36d-1/01 – 36d-1/13)
17c-3/05 by means of standing or circulating brine
17c-3/06 by means of cold air, e.g. from the ground
17c-3/07 by means of carbon dioxide snow and ice: dry ice (carbon dioxide as such 12i-35, 12i-31/20)
17c-3/08 by means of other refrigerants or of several refrigerants simultaneously
17c-3/10 Air cooling and circulation in cold rooms (36d-1/01 – 36d-1/02; 36d-1/20; 36d-1/40)
17c-3/11 Cold accumulating
17c-3/12 Cold transfer by condensing and evaporating heat transfer media (17a, 1801)

Refrigerator structural elements

17c-4/01 Charging and discharging devices for cooling agents and goods
17c-4/02 Movable goods supports and containers
17c-4/03 Ice containers, ice and goods grids
17c-4/04 Refrigerator cabinet lids, doors and their locks (37d-18 – 37d-24)
17c-4/05 Refrigerator cabinet walls (insulated walls 37a, 37b; insulating materials 39b, 80b)
17c-4/06 Collapsible refrigerator cabinets
17c-4/07 Regulating devices for refrigerators (42i)
17c-4/10 Miscellaneous structural elements, e.g. coils and fittings

Refrigeration cars (20c-10; 20c-24; 63a-37; 63c-43)

17c-5/01 Ice-cooled
17c-5/02 Brine-cooled
17c-5/03 with evaporation cooling
17c-5/04 with air circulation
17c-5/05 with gas cooling

17d Steam condensers (12a-6; 14e-13; 14g-12; 17a-13/03; 89e-5)

Surface condensers

17d-1/01 with water as a coolant
17d-1/02 with air as a coolant
17d-1/03 with other coolants, e.g. cooling liquids or several refrigerants simultaneously
17d-1/04 Form of the cooling surfaces (17f)
17d-1/05 Cooling tube fastening, packing and support, tube flexibility (17f-5/03; 17f-5/04)
17d-1/06 Double-walled tubes
Mixing condensers
17d-2/01 Injector condensers
17d-2/02 Water jet condensers
17d-2/03 Steam jet condensers
17d-3/01 Trickle condensers (17e-1 – 17e-3; 17f-3)
17d-3/02 Evaporation trickle condensers (17e-6/03; 17f-3/07)
17d-4/01 Rotary surface condensers (17f-10)
17d-4/02 Rotary mixing condensers (17e-5)
17d-4/03 Rotary open-surface and evaporation condensers

Components of condensers
17d-5/01 Feed, conveyance and distribution of steam
17d-5/02 Conveyance, distribution and collection or accumulation of the cooling water
17d-5/03 Re-cooling of the cooling water (17e-1 – 17e-3)
17d-5/04 Collection and discharge of the condensate, e.g. by means of piston and moist-air pumps, fractional discharge
17d-5/05 Evacuation and cooling of the non-condensable gases, e.g. by means of piston, centrifugal or jet pumps, with or without after-condensers
17d-5/10 Auxiliary condensers
17d-5/11 Cleaning and anticorrosive protection of condensers

Regulation by acting upon
17d-5/12 the cooling water, also injector and trickle water
17d-5/13 the condensate
17d-5/14 the steam
17d-5/15 the vacuum, e.g. vacuum breakers
17d-5/16 Condenser starting procedures and connections
17d-5/17 Connection and drive of the pump sets for water, condensate, air
17d-5/20 Special condenser structures and arrangements
17d-6 Condensers for cold steam machines (14h-6)
17d-7/01 Combination of several of the aforementioned condensation systems
17d-7/02 Special condensation systems

17e Open heat-exchange devices, in which the heat-exchange media come into direct contact

Open trickle coolers for liquids and gases
17e-1 Cooling towers

Cooling towers as counter-current trickle coolers, general structure
17e-2/01 with natural ventilation
17e-2/02 with artificial ventilation, also fans driven by circulating water
17e-2/03 with natural and artificial ventilation

Cooling towers as cross-current trickle coolers, general structure
17e-2/05 with natural ventilation
17e-2/06 with artificial ventilation, also with air circulation
17e-2/07 with natural and artificial ventilation
17e-2/10 Cross-current-counter-current cooling towers
17e-2/11 Compartmented cooling towers, combined counter-and cross-current coolers

Components of cooling towers
17e-2/20 Water distribution and accumulation, distributing channels and accumulator troughs
17e-2/21 Air feed, guiding devices
17e-2/22 Structural trickle systems and filler elements
17e-2/23 Core ventilation media for structural elements
17e-2/24 Media to prevent icing and soiling of the elements
17e-2/25 Tower linings
17e-2/26 Special draft-increasing media, e.g. by warming the outgoing air
17e-2/27 Water circulation and conveyance, also replacement water supply

Regulation by acting upon
17e-2/30 the water
17e-2/31 the air: change to artificial or natural ventilation
17e-2/32 Heat recovery from the exhaust steam
17e-3 Special trickle coolers with natural and artificial air draft
17e-4/01 Spray coolers, general structure inclusive of air filtration devices
17e-4/02 Spray nozzles, spray tubes
17e-4/03 Splash plates baffle plates

Moveable open coolers (17d-4/02; 17f-10)
17e-5/01 with movable distributor, general structure
17e-5/02 with rotating disks or drums, ventilation coolers
17e-5/03 with endless belts or chains
17e-5/04 with reciprocating distributors

Coolers for air cooling (36d-1/01)
17e-6/01 by direct contact with ice and ice water (17c-3/10)
17e-6/02 by direct contact with liquid refrigerant and liquefied gases
17e-6/03 Evaporation coolers (17d-3/02; 17f-3/07)
17e-7 Special open heat-exchange devices for liquids and gases, e.g. parallel-flow coolers
17e-8 Open coolers for solid substances in general

17f Enclosed heat-exchange devices, in which the heat exchange media are separated by a solid wall

Beverage and liquid coolers (6b-15; 6b-18; 53e; 64c-14)
17f-2/01 as simple tubular coolers
17f-2/02 as cooling containers, tanks, vats, also with circulation of liquid
17f-2/03 as double-tube and multi-tubular coolers

Trickle coolers
17f-3/01 with trickle tubes and tubular elements
17f-3/03 with smooth and corrugated trickle bells and terraced trickle surfaces
17f-3/05 Dismantling of trickle elements for cleaning
17f-3/06 Devices for the distribution of the trickling liquid and decrease of the rate of flow
17f-3/07 Evaporation trickle coolers (17e-6/03; 17d-3/02)

Spiral and helical coolers
17f-4/01 with spiral and helical tubular coils
17f-4/02 with spiral-shaped bent plates
17f-4/03 Plates with spiral-shaped channels
17f-4/04 Containers with helical channels

Counter current tubular coolers
17f-5/01 with vertical and horizontal tube nests arranged between tube sheets
17f-5/02 with tube bundles of special design and arrangement
17f-5/03 Arrangement and packing of the tubes, support for tubes and tube nests (17d-1/05)
17f-5/04 Movable arrangement of tubes and tube sheets to compensate for changes in length
17f-5/05 Special tube shapes and sections, e.g. flat rectangular, square tubes
17f-5/06  Guides for the heat-exchange media in and outside of the tubes, e.g. displacement bodies, intermediate walls
17f-5/07  Tubes with longitudinal fins
17f-5/08  Coolers with concentrically arranged shells
17f-5/09  Circulating and distributing devices for the heat exchange media
17f-5/10  Coolers with tubes fixed laterally to the tube sheet, e.g. U-shaped and tubes closed on one side
17f-5/11  Cleaning of tubular coolers, e.g. by dismantling the tubes or tube bundles, cleaning covers

Cross-current tubular coolers (46c4-8 – 46c4-11)

17f-5/20  General structure, tube mounting and packing
17f-5/21  Special arrangement of tubes and tube elements, e.g. staggered or in line
17f-5/22  Special tube shapes and sections, e.g. oval or elliptical
17f-5/23  Tubes with transverse fins
17f-5/24  Guiding surfaces and structural arrangements between the tubes
17f-5/30  Plate coolers (24k-4)
17f-5/31  Laminated coolers (46c4-9)
17f-5/32  Multi-element coolers made of sheet metal (36c-9)
17f-5/33  Plate elements with ribs
17f-5/34  Cooling element assemblies: group or columns
17f-6/01  Air and gas coolers (36d-1/01)
17f-6/02  Cooling air purifiers (36d-1/20)
17f-6/03  Circulation coolers with re-coolers

Coolers with defrosters
17f-7/01  by mechanical, chemical, electrical means
17f-7/02  by connecting the cooling tubes to a heated agent
17f-7/03  by reversing the refrigerant current or the air current, or both
17f-8  Pocket coolers (24k-4)
17f-9  Coolers moved through cooling water (6b-15; 6b-18)

Mechanically driven coolers (17b-6; 17d-4; 17e-5; 53h-2)
17f-10/01  with centrifugal disks and rotating drums and containers, fan coolers
17f-10/02  with movable or rotating distributors or agitators
17f-10/03  with reciprocating or rotating tubes
17f-11  Miscellaneous enclosed heat-exchange devices (13a; 13b; 17c-2 – 17c-4; 36e)

Special equipment for enclosed heat-exchange devices
17f-12/01  Regulation of heat exchange, e.g. according to quantity, temperature, pressure (36c-11; 42q; 42e)
17f-12/02  Distribution and change of flow of the heat-exchange agent, fixed and variable connections (17d-5/02)
17f-12/03  Means for producing turbulence in, and dispersion of the heat-exchange agent, especially on the heat-exchange wall, destruction of the boundary layer
17f-12/04  Coolers with variable flow section
17f-12/05  Welded coolers
17f-12/06  Special construction materials for coolers
17f-12/07  Coolers with accumulation (13g-2/03; 24c-5; 24k-4; 36b-4)
17f-12/08  Corrosion protection for coolers (17d-5/11)
17f-12/09  Special arrangement and design of the ribs on heat-exchange surfaces, e.g. as grids
17f-12/10  Special processes for increasing the heat exchange
17f-13  Direct-fired heaters for liquid or gaseous media of general applicability (heaters for special purposes, see the special classes; combustion apparatus in general 24)
17g Liquefaction and separation of not easily condensable gases and gaseous mixtures by mechanical means, decantation and vaporisation of liquefied gases; pressure containers and insulated containers for compressed and liquefied gases

17g-1 Liquefaction of not easily condensable gases and gaseous mixtures (12i; compressed illuminating gas 26a-18/10)
Separation of liquefied gas mixtures (12i; 26a-18/11)

17g-2/01 by rectification
17g-2/02 by partial condensation
17g-2/03 Cold exchangers and accumulators for liquefaction and decomposition apparatus
17g-2/04 De-icing of liquefaction and decomposition apparatus

17g-3 Pressure containers for compressed and liquefied gases (4c-34, 20c-9; containers and fillers for acetylene solution holders 26b-44, 47f-21; gas bottle valves 47g-3; safety valves and devices 47g-47; pressure-reducing valves for gas bottles 47g-48, 64c-7, 85a-4)

17g-4 Insulated containers for liquefied gases (81c-27; containers with heat insulation, general, and as domestic appliances 34l-11; industrial glass manufacturing processes 32a-8, 32a-15, 32a-27, 32a-9/00, 32a-11/00, 32a-23/00, 32b-10, 32b-17/00; ceramics manufacturing processes 80a-46; containers for blasting cartridges 78e-5)

17g-5/01 Decantation, general
17g-5/02 Decantation and vaporisation of liquefied gases