

ECLA**EUROPEAN CLASSIFICATION****F25J**

LIQUEFACTION, SOLIDIFICATION OR SEPARATION OF GASES OR GASEOUS [N: or liquefied gaseous] MIXTURES BY PRESSURE AND COLD TREATMENT [N: or by bringing them into the supercritical state (cryogenic pumps [F04B37/08](#); gas storage vessels, gas holders F17; filling vessels with, or discharging from vessels, compressed, liquefied or solidified gases F17C; refrigeration machines, plants, or systems F25B)] [C1203]

F25J1/00

Processes or apparatus for liquefying or solidifying gases or gaseous mixtures [N: (for ammonia in general [C01C1/00](#); solidification of carbonic acid [C01B31/22](#); recovering volatile solvents by condensation [B01D5/00](#); vapor recovery systems combined with filling nozzles [B67D7/54](#)) (not used)]

- F25J1/00A
 - [N: characterised by the fluid to be liquefied (not used)] [N1203]
- F25J1/00A2
 - • [N: Light or noble gases ([F25J1/00A4](#) takes precedence)] [N1203]
- F25J1/00A2H
 - • • [N: Helium] [N1203]
- F25J1/00A2W
 - • • [N: Hydrogen] [N1203]
- F25J1/00A4
 - • [N: Primary atmospheric gases, e.g. air] [N1203]
- F25J1/00A4N
 - • • [N: Nitrogen] [N1203]
- F25J1/00A4O
 - • • [N: Oxygen] [N1203]
- F25J1/00A4R
 - • • [N: Argon] [N1203]
- F25J1/00A6
 - • [N: Hydrocarbons, e.g. natural gas] [N1203]
- F25J1/00A6B
 - • • [N: Boil-off gases "BOG" from storages] [N1203]
- F25J1/00A8
 - • [N: Oxides of carbon e.g. CO₂] [N1203]
- F25J1/00C
 - [N: characterised by the kind of cold generation within the liquefaction unit for compensating heat leaks and liquid production (not used)] [N1203]
- F25J1/00C2
 - • [N: using the feed stream itself or separated fractions from it, i.e. "internal refrigeration" (not used)] [N1203]
- F25J1/00C2E
 - • • [N: by gas expansion with extraction of work] [N1203]
- F25J1/00C2E2
 - • • • [N: of a return stream] [N1203]
- F25J1/00C2F
 - • • [N: by flash gas recovery ([F25J1/02Z4H4R2](#) takes precedence)] [N1203]
- F25J1/00C2L
 - • • [N: by liquid expansion with extraction of work] [N1203]
- F25J1/00C2V
 - • • [N: by vaporising a liquid return stream] [N1203]
- F25J1/00C4
 - • [N: using an "external" refrigerant stream in a closed vapor compression cycle ([F25J1/02F](#), [F25J1/02H](#) take precedence) (not used)] [N1203]
- F25J1/00C4E
 - • • [N: by expansion of a gaseous refrigerant stream with extraction of work] [N1203]
- F25J1/00C4V
 - • • [N: by vaporising a liquid refrigerant stream] [N1203]
- F25J1/00C4V2
 - • • • [N: originating from an incorporated cascade] [N1203]
- F25J1/00C4V4
 - • • • [N: after expansion of the liquid refrigerant stream with extraction of work] [N1203]
- F25J1/00R
 - [N: characterised by the refrigerant fluid used (refrigerants in vapor compression cycles [F25B9/00B](#), refrigerant materials per se [C09K5/00](#)) (not used)] [N1203]

- F25J1/00R2 . . [N: Light or noble gases, mixtures thereof ([F25J1/00R4](#) takes precedence)] [N1203]
- F25J1/00R2H . . . [N: Helium] [N1203]
- F25J1/00R2W . . . [N: Hydrogen] [N1203]
- F25J1/00R4 . . [N: Primary atmospheric gases, mixtures thereof] [N1203]
- F25J1/00R4N . . . [N: Nitrogen] [N1203]
- F25J1/00R4O . . . [N: Oxygen] [N1203]
- F25J1/00R4R . . . [N: Argon] [N1203]
- F25J1/00R6 . . [N: Hydrocarbons (not used)] [N1203]
- F25J1/00R6A . . . [N: Methane] [N1203]
- F25J1/00R6E . . . [N: Ethane; Ethylene] [N1203]
- F25J1/00R6P . . . [N: Propane; Propylene] [N1203]
- F25J1/00R6U . . . [N: Hydrocarbons with four or more carbon atoms] [N1203]
- F25J1/00R6Z . . . [N: Mixtures of hydrocarbons comprising possibly also minor amounts of nitrogen] [N1203]
- F25J1/00R8 . . [N: Oxides of carbon, e.g. CO₂] [N1203]
- F25J1/00R10 . . [N: Others, e.g. F-, Cl-, HF-, HClF-, HCl-hydrocarbons etc. or mixtures thereof] [N1203]

- F25J1/02 . . requiring the use of refrigeration, e.g. of helium or hydrogen [N: Details and kind of the refrigeration system used; Integration with other units or processes; Controlling aspects of the process (not used)] [C1203]
- F25J1/02A . . [N: using only internal refrigeration means, i.e. without external refrigeration] [N1203]
- F25J1/02A2 . . . [N: in a quasi-closed internal refrigeration loop ([F25J1/02B10](#), [F25J1/02D10](#), [F25J1/02F10](#) take precedence)] [N1203]
- F25J1/02B . . [N: using a single-component refrigerant (SCR) fluid in a closed vapor compression cycle ([F25J1/02D](#) takes precedence) (not used)] [N1203]
- F25J1/02B2 . . . [N: as a single flow SCR cycle] [N1203]
- F25J1/02B4 . . . [N: as a dual level SCR refrigeration cascade] [N1203]
- F25J1/02B6 . . . [N: as at least a three level SCR refrigeration cascade] [N1203]
- F25J1/02B10 . . . [N: in combination with an internal quasi-closed refrigeration loop e.g. with deep flash recycle loop ([F25J1/02B10C3](#) takes precedence)] [N1203]
- F25J1/02B10C [N: as at least a three level refrigeration cascade] [N1203]
- F25J1/02B10C3 [N: using a deep flash recycle loop] [N1203]
- F25J1/02D . . [N: using a multi-component refrigerant (MCR) fluid in a closed vapor compression cycle (not used)] [C1203]
- F25J1/02D2 . . . [N: as a single flow MCR cycle] [N1203]
- F25J1/02D4 . . . [N: as a dual level refrigeration cascade with at least one MCR cycle] [N1203]
- F25J1/02D4P [N: with one SCR cycle] [N1203]
- F25J1/02D4P2 [N: using a C3 pre-cooling cycle] [N1203]
- F25J1/02D6 . . . [N: as at least a three level refrigeration cascade with at least one MCR cycle] [N1203]
- F25J1/02D6P [N: with one or more SCR cycles e.g. with a C3 pre-cooling cycle] [N1203]
- F25J1/02D10 . . . [N: in combination with an internal quasi-closed refrigeration loop, e.g. using a deep flash recycle loop] [N1203]

F25J1/02F	. .	[N: using the cold stored in an external cryogenic component in an open refrigeration loop] [N1203]
F25J1/02F2	. . .	[N: in combination with an intermediate heat exchange fluid between the cryogenic component and the fluid to be liquefied (F25J1/02F10 takes precedence)] [N1203]
F25J1/02F6	. . .	[N: in combination with the subsequent re-vaporisation of the originally liquefied gas at a second location to produce the external cryogenic component] [N1203]
F25J1/02F10	. . .	[N: in combination with an internal quasi-closed refrigeration loop (F25J1/02B10 , F25J1/02D10 take precedence)] [N1203]
F25J1/02H	. .	[N: using other external refrigeration means not provided before, e.g. heat driven absorption chillers] [N1203]
F25J1/02H2	. . .	[N: within a refrigeration cascade] [N1203]
F25J1/02K	. .	[N: Coupling of the liquefaction unit to other units or processes, so-called integrated processes (combined plants, e.g. engine plant combined with an industrial process F01K23/06C ; gas turbine plants in combination with other processes F02C6/00)] [N1203]
F25J1/02K2	. . .	[N: Integration with a unit for using hydrocarbons, e.g. consuming hydrocarbons as feed stock] [N1203]
F25J1/02K2C	. . . .	[N: for the combustion as fuels, i.e. integration with the fuel gas system] [N1203]
F25J1/02K2R	. . . .	[N: for the working-up of the hydrocarbon feed, e.g. reinjection of heavier hydrocarbons into the liquefied gas] [N1203]
F25J1/02K4	. . .	[N: integration within a pressure letdown station of a high pressure pipeline system] [N1203]
F25J1/02K6	. . .	[N: Integration with a cryogenic air separation unit (cryogenic separation of air F25J3/04)] [N1203]
F25J1/02K8	. . .	[N: Heat exchange integration] [N1203]
F25J1/02K8B	. . . .	[N: providing refrigeration for different processes treating not the same feed stream] [N1203]
F25J1/02K8D	. . . .	[N: integrating refrigeration provided for liquefaction and purification/treatment of the gas to be liquefied, e.g. heavy hydrocarbon removal from natural gas (details related to rectification F25J3/02 ; details related to partial condensation F25J3/06 ; working-up natural gas C10L3/10)] [N1203]
F25J1/02K8D2	. . . . .	[N: Purification/treatment step is integrated within one refrigeration cycle only, i.e. the same or single refrigeration cycle provides feed or overhead gas cooling] [N1203]
F25J1/02K8D4	. . . . .	[N: Purification or treatment step being integrated between two refrigeration cycles of a refrigeration cascade, i.e. first cycle providing feed gas cooling and second cycle providing overhead gas cooling] [N1203]
F25J1/02K8D4R	. . . . .	[N: wherein the overhead cooling comprises providing reflux for a fractionation step] [N1203]
F25J1/02K8W	. . . .	[N: Waste heat recovery, e.g. from heat of compression] [N1203]
F25J1/02Z	. .	[N: Start-up or control of the process; Details of the apparatus used; Details of the refrigerant compression system used (not used)] [N1203]
F25J1/02Z2	. . .	[N: Operation; Control and regulation; Instrumentation (F25J1/02Z6 takes precedence)] [N1203]
F25J1/02Z2M	. . . .	[N: Different modes, i.e. 'runs', of operation; Process control] [N1203]
F25J1/02Z2M2	. . . . .	[N: start-up of the process] [N1203]

F25J1/02Z2M4	. . . . .	[N: Stopping of the process, e.g. defrosting or deriming, maintenance; Back-up mode or systems] [N1203]
F25J1/02Z2M8	. . . . .	[N: Controlling refrigerant inventory, i.e. composition or quantity (charging or discharging refrigerants in cooling systems F25B45/00)] [N1203]
F25J1/02Z2M8P	. . . . .	[N: Details related to the refrigerant production or treatment, e.g. make-up supply from feed gas itself] [N1203]
F25J1/02Z2M10	. . . . .	[N: Intermittent or alternating process, so-called batch process, e.g. "peak-shaving"] [N1203]
F25J1/02Z2P	. . . . .	[N: Control strategy, e.g. advanced process control or dynamic modeling] [N1203]
F25J1/02Z2T	. . . . .	[N: controlling particular process parameter, e.g. pressure, temperature] [N1203]
F25J1/02Z2T8	. . . . .	[N: controlling the composition of the feed or liquefied gas, e.g. to achieve a particular heating value of natural gas] [N1203]
F25J1/02Z2Z	. . . . .	[N: Safety aspects of operation (F25J1/02Z6Z takes precedence)] [N1203]
F25J1/02Z4	. . . . .	[N: Construction and layout of liquefaction equipments, e.g. valves, machines (F25J1/02Z6 takes precedence)] [N1203]
F25J1/02Z4A	. . . . .	[N: vertical layout of the equipments within in the cold box] [N1203]
F25J1/02Z4B	. . . . .	[N: Modularity and arrangement of parts of the liquefaction unit and in particular of the cold box e.g. pre-fabrication, assembling and erection, dimensions, horizontal layout "plot"] [N1203]
F25J1/02Z4E	. . . . .	[N: Details of cold box insulation, housing and internal structure (buildings forming parts of cooling plants E04H5/10)] [N1203]
F25J1/02Z4H	. . . . .	[N: Details of the cold heat exchange system (constructional details F25J5/00, construction of cold-exchangers in general F28)] [N1203]
F25J1/02Z4H2	. . . . .	[N: using different types of heat exchangers] [N1203]
F25J1/02Z4H4	. . . . .	[N: Arrangement of heat exchanger cores in parallel with different functions, e.g. different cooling streams (F25J1/02Z4N4H takes precedence)] [N1203]
F25J1/02Z4H4R	. . . . .	[N: comprising cores associated exclusively with the cooling of a refrigerant stream, e.g. for auto-refrigeration or economizer] [N1203]
F25J1/02Z4H4R2	. . . . .	{7 dots} [N: using flash gas as heat sink] [N1203]
F25J1/02Z4H4R4	. . . . .	{7 dots} [N: using a dedicated refrigeration means (F25J1/02Z6U takes precedence)] [N1203]
F25J1/02Z4N	. . . . .	[N: Arrangement of liquefaction units or equipments fulfilling the same process step, e.g. multiple "trains" concept (F25J1/02Z6N takes precedence)] [N1203]
F25J1/02Z4N2	. . . . .	[N: Inter-connecting multiple hot equipments upstream of the cold box] [N1203]
F25J1/02Z4N4	. . . . .	[N: Inter-connecting multiple cold equipments within or downstream of the cold box] [N1203]
F25J1/02Z4N4H	. . . . .	[N: Multiple identical heat exchangers in parallel] [N1203]
F25J1/02Z4R	. . . . .	[N: Retrofitting or revamping of an existing liquefaction unit] [N1203]
F25J1/02Z4U	. . . . .	[N: adapted for special use of the liquefaction unit, e.g. portable or transportable devices] [N1203]
F25J1/02Z4U2	. . . . .	[N: Laboratory or other miniature devices] [N1203]
F25J1/02Z4U4	. . . . .	[N: Offshore use, e.g. during shipping] [N1203]
F25J1/02Z4U4F	. . . . .	[N: Unit being stationary, e.g. on floating barge or fixed platform] [N1203]

F25J1/02Z6	. . .	[N: Compression of refrigerant or internal recycle fluid, e.g. kind of compressor, accumulator, suction drum etc.] [N1203]
F25J1/02Z6A	. . . .	[N: characterised by the type of prime driver, e.g. hot gas expander] [N1203]
F25J1/02Z6A2	. . . . .	[N: Steam turbine as the prime mechanical driver] [N1203]
F25J1/02Z6A4	. . . . .	[N: Gas turbine as the prime mechanical driver] [N1203]
F25J1/02Z6A6	. . . . .	[N: Electrical motor as the prime mechanical driver] [N1203]
F25J1/02Z6C	. . . .	[N: Combination of different types of drivers mechanically coupled to the same refrigerant compressor, possibly split on multiple compressor casings] [N1203]
F25J1/02Z6C2	. . . . .	[N: including an electrical motor] [N1203]
F25J1/02Z6C4	. . . . .	[N: using work extraction by mechanical coupling of compression and expansion of the refrigerant, so-called companders] [N1203]
F25J1/02Z6E	. . . .	[N: Use of different types of prime drivers of at least two refrigerant compressors in a cascade refrigeration system] [N1203]
F25J1/02Z6G	. . . .	[N: Mechanically coupling of different refrigerant compressors in a cascade refrigeration system to a common driver] [N1203]
F25J1/02Z6J	. . . .	[N: Refrigerant compression by combined gas compression and liquid pumping] [N1203]
F25J1/02Z6L	. . . .	[N: Refrigerant compression by cold or cryogenic suction of the refrigerant gas] [N1203]
F25J1/02Z6N	. . . .	[N: Multiple compressor casings/strings in parallel, e.g. split arrangement] [N1203]
F25J1/02Z6S	. . . .	[N: Shifting of the compression load between different cooling stages within a refrigerant cycle or within a cascade refrigeration system] [N1203]
F25J1/02Z6U	. . . .	[N: Removal of the heat of compression, e.g. within an inter- or afterstage-cooler against an ambient heat sink] [N1203]
F25J1/02Z6U2	. . . . .	[N: using an externally chilled fluid, e.g. chilled water] [N1203]
F25J1/02Z6Z	. . . .	[N: Safety aspects and control of the refrigerant compression system, e.g. anti-surge control] [N1203]

F25J3/00 **Processes or apparatus for separating the constituents of gaseous [N: or liquefied gaseous] mixtures involving the use of liquefaction or solidification [N: (not used)] [N1204]**

F25J3/02	. . .	by rectification, i.e. by continuous interchange of heat and material between a vapour stream and a liquid stream (F25J3/08 takes precedence; [N: purification of hydrocarbons in general C07C7/00; (not used)]) [N1204]
F25J3/02A	. . .	[N: characterised by the feed stream (for air F25J3/04) (not used)] [N0303] [C1104]
F25J3/02A2	. . . .	[N: Natural gas or substitute natural gas] [N0303]
F25J3/02A2L	. . . . .	[N: Liquefied natural gas] [N1104]
F25J3/02A4	. . . .	[N: Refinery gas, cracking gas, coke oven gas, gaseous mixtures containing aliphatic unsaturated C _n H _m or gaseous mixtures of undefined nature] [N0303] [C1104]
F25J3/02A6	. . . .	[N: H ₂ /CO mixtures, i.e. synthesis gas; Water gas or shifted synthesis gas (production of carbon monoxide containing gas in general C01B31/18, C10J, C10K; production of hydrogen containing gas C01B3/00)] [N0303] [C1104]
F25J3/02C	. . .	[N: characterised by the separated product stream (not used)] [N0303] [C1104]
F25J3/02C2	. . . .	[N: separation of C _n H _m with 1 carbon atom or more] [N0303]

F25J3/02C4	. . .	[N: separation of CnHm with 2 carbon atoms or more] [N0303]
F25J3/02C6	. . .	[N: separation of CnHm with 3 carbon atoms or more] [N0303]
F25J3/02C8	. . .	[N: separation of CnHm with 4 carbon atoms or more] [N0303]
F25J3/02C10	. . .	[N: separation of hydrogen (production of hydrogen containing gas in general C01B3/00 , e.g. separation of hydrogen or hydrogen containing gases from gaseous mixtures at low temperatures C01B3/50D)] [N0303]
F25J3/02C12	. . .	[N: separation of nitrogen (from air F25J3/04 , production of nitrogen in general C01B21/00)] [N0303]
F25J3/02C14	. . .	[N: separation of carbon monoxide (production of carbon monoxide containing gas in general C01B31/18 , C10J , C10K)] [N0303]
F25J3/02C16	. . .	[N: separation of carbon dioxide (production of carbon dioxide in general C01B31/00)] [N0303]
F25J3/02C18	. . .	[N: separation of H2/CO mixtures, i.e. of synthesis gas (production of carbon monoxide containing gas in general C01B31/18 , C10J , C10K , production of hydrogen containing gas C01B3/00)] [N0303]
F25J3/02C20	. . .	[N: separation of H2/N2 mixtures, i.e. of ammonia synthesis gas (in general C01B3/00)] [N0303]
F25J3/02C30	. . .	[N: separation of noble gases (from air F25J3/04N ; in general C01B23/00)] [N0303]
F25J3/02C30A	. . . .	[N: of argon] [N0303]
F25J3/02C30H	. . . .	[N: of helium] [N0303]
F25J3/02Z	. .	[N: Start-up or control of the process; Details of the apparatus used, e.g. sieve plates, packings] [N9907]
F25J3/04	. .	for air [N: (not used)] [M1207]
		[N: WARNING The reclassification has, for the moment, been carried out only down to January 1, 1960.]
F25J3/04A	. . .	[N: Providing pressurised feed air or process streams within or from the air fractionation unit (not used)] [N1204]
F25J3/04A2	. . . .	[N: by compression of warm gaseous streams; details of intake or interstage cooling (F25J3/04A4 takes precedence; operation of compressors F25J3/04Z2C; particular layout of compressors used in air fractionation units F25J3/04Z4)] [N1204]
F25J3/04A2A	. . . . .	[N: of main feed air] [N1204]
F25J3/04A2B	. . . . .	[N: of purified feed air, so-called boosted air] [N1204]
F25J3/04A2N	. . . . .	[N: of nitrogen] [N1204]
F25J3/04A2O	. . . . .	[N: of oxygen] [N1204]
F25J3/04A2R	. . . . .	[N: of argon or argon enriched stream] [N1204]
F25J3/04A4	. . . .	[N: by compression of cold gaseous streams, e.g. intermediate or oxygen enriched (waste) streams)] [N1204]
F25J3/04A4A	. . . . .	[N: of air] [N1204]
F25J3/04A4N	. . . . .	[N: of nitrogen] [N1204]
F25J3/04A4O	. . . . .	[N: of oxygen] [N1204]
F25J3/04A4R	. . . . .	[N: of argon or argon enriched stream] [N1204]
F25J3/04A6	. . . .	[N: providing pressurized products by liquid compression and vaporisation with cold recovery, i.e. so-called internal compression (operation of pumps F25J3/04Z2C; particular layout of pumps used in air fractionation units

				F25J3/04Z4)] [N1204]
F25J3/04A6N	.	.	.	[N: of nitrogen] [N1204]
F25J3/04A6O	.	.	.	[N: of oxygen] [N1204]
F25J3/04A6R	.	.	.	[N: of argon or argon enriched stream] [N1204]
F25J3/04A6U	.	.	.	[N: using solely hydrostatic liquid head] [N1204]
F25J3/04A8	.	.	.	[N: Arrangements of compressors and /or their drivers (using work extraction by mechanical coupling of compression and cold expansion F25J3/04C10E)] [N1204]
F25J3/04A8A	.	.	.	[N: characterised by the type of prime driver e.g. hot gas expander] [N1204]
F25J3/04A8A2	.	.	.	[N: Steam turbine as the prime mechanical driver] [N1204]
F25J3/04A8A4	.	.	.	[N: Gas turbine as the prime mechanical driver] [N1204]
F25J3/04A8A6	.	.	.	[N: Electrical motor as the prime mechanical driver] [N1204]
F25J3/04A8C	.	.	.	[N: Combination of different types of drivers mechanically coupled to the same compressor, possibly split on multiple compressor casings] [N1204]
F25J3/04A8G	.	.	.	[N: Mechanically coupling of different compressors of the air fractionation process to the same driver(s)] [N1204]
F25J3/04B	.	.	.	[N: Purification and (pre-)cooling of the feed air; recuperative heat-exchange with product streams (not used)] [N1204]
F25J3/04B2	.	.	.	[N: Afterstage cooling and so-called "pre-cooling" of the feed air upstream the air purification unit and main heat exchange line (F25J3/04K8A takes precedence)] [N1204]
F25J3/04B4	.	.	.	[N: Hot end purification of the feed air (arrangements of cold regenerators F25J5/00)] [N1204]
F25J3/04B4A	.	.	.	[N: by adsorption of the impurities (adsorption in general B01D53/02)] [N1204]
F25J3/04B4A2	.	.	.	[N: at a pressure of substantially more than the highest pressure column] [N1204]
F25J3/04B4A8	.	.	.	[N: Regenerating the adsorbents] [N1204]
F25J3/04B6	.	.	.	[N: Cooling of the purified feed air by recuperative heat-exchange; Heat-exchange with product streams (arrangements of cold exchangers F25J5/00B)] [N1204]
F25J3/04B6C	.	.	.	[N: Division of the main heat exchange line in consecutive sections having different functions] [N1204]
F25J3/04B6C2	.	.	.	[N: having an intermediate feed connection]
F25J3/04B6C4	.	.	.	[N: including a so-called "auxiliary vaporiser" for vaporising and producing a gaseous product] [N1204]
F25J3/04B6C4R	.	.	.	{7 dots} [N: and simultaneously condensing vapor from a column serving as reflux within the or another column] [N1204]
F25J3/04B6P	.	.	.	[N: Parallel arrangement of the main heat exchange line in cores having different functions e.g. in low pressure and high pressure cores (F25J3/04J4B takes precedence)] [N1204]
F25J3/04B6P2	.	.	.	[N: Cores associated with a liquefaction or refrigeration cycle] [N1204]
F25J3/04B6S	.	.	.	[N: Subcooling of liquid process streams] [N1204]
F25J3/04B6X	.	.	.	[N: Integration of different exchangers in a single core, so-called integrated cores (F25J3/04L takes precedence)] [N1204]
F25J3/04B8	.	.	.	[N: Cold end purification of the feed air] [N1204]
F25J3/04C	.	.	.	[N: Generation of cold for compensating heat leaks or liquid production, e.g. by

				Joule-Thompson expansion] [N1204]
F25J3/04C2	.	.	.	[N: using the cold stored in external cryogenic fluids (closed loop F25J3/04C4)] [N1204]
F25J3/04C2N	.	.	.	[N: The cryogenic component does not participate in the fractionation] [N1204]
F25J3/04C2N2	.	.	.	[N: and being liquefied hydrocarbons] [N1204]
F25J3/04C2N2P	.	.	.	{7 dots} [N: and comprising means for reducing the risk of pollution of hydrocarbons into the air fractionation] [N1204]
F25J3/04C4	.	.	.	[N: using external refrigeration units, e.g. closed mechanical or regenerative refrigeration units] [N1204]
F25J3/04C6	.	.	.	[N: using internal refrigeration by open-loop gas work expansion, e.g. of intermediate or oxygen enriched (waste-)streams (F25J3/04C8 takes precedence)] [N1204]
F25J3/04C6A	.	.	.	[N: of feed air, e.g. used as waste or product air or expanded into an auxiliary column] [N1204]
F25J3/04C6A2	.	.	.	[N: Claude expansion, i.e. expanded into the main or high pressure column] [N1204]
F25J3/04C6A4	.	.	.	[N: Lachmann expansion, i.e. expanded into oxygen producing or low pressure column] [N1204]
F25J3/04C6N	.	.	.	[N: of nitrogen] [N1204]
F25J3/04C6N2	.	.	.	[N: Lowest pressure or impure nitrogen, so-called waste nitrogen expansion] [N1204]
F25J3/04C6O	.	.	.	[N: of oxygen] [N1204]
F25J3/04C6R	.	.	.	[N: of argon or argon enriched stream] [N1204]
F25J3/04C8	.	.	.	[N: using quasi-closed loop internal vapor compression refrigeration cycles, e.g. of intermediate or oxygen enriched (waste-)streams] [N1204]
F25J3/04C8A	.	.	.	[N: of air] [N1204]
F25J3/04C8A2	.	.	.	[N: and comprising a gas work expansion loop] [N1204]
F25J3/04C8N	.	.	.	[N: of nitrogen] [N1204]
F25J3/04C8N2	.	.	.	[N: and comprising a gas work expansion loop] [N1204]
F25J3/04C8O	.	.	.	[N: of oxygen] [N1204]
F25J3/04C8R	.	.	.	[N: of argon or argon enriched stream] [N1204]
F25J3/04C10	.	.	.	[N: Details relating to the work expansion, e.g. process parameter etc.] [N1204]
F25J3/04C10E	.	.	.	[N: using work extraction by mechanical coupling of compression and expansion so-called companders] [N1204]
F25J3/04C10L	.	.	.	[N: using liquid or hydraulic turbine expansion] [N1204]
F25J3/04C10M	.	.	.	[N: using multiple or multistage gas work expansion] [N1204]
F25J3/04D	.	.	.	[N: using a single pressure main column system only (F25J3/04H, F25J3/04L, F25J3/04M take precedence)] [N1204]
F25J3/04F	.	.	.	[N: using a dual pressure main column system (F25J3/04H, F25J3/04L, F25J3/04M and F25J3/04N2C6O take precedence) (not used)] [N1204]
F25J3/04F2	.	.	.	[N: in a classical double column flowsheet, i.e. with thermal coupling by a main reboiler-condenser in the bottom of low pressure respectively top of high pressure column] [N1204]
F25J3/04F4	.	.	.	[N: with thermally overlapping high and low pressure columns] [N1204]
F25J3/04F6	.	.	.	[N: without thermally coupled high and low pressure columns, i.e. a so-called split columns] [N1204]

F25J3/04F8	. . . .	[N: A main column system not otherwise provided, e.g. a modified double column flowsheet] [N1204]
F25J3/04G	. . .	[N: using at least a triple pressure main column system (F25J3/04H, F25J3/04L, F25J3/04M and F25J3/04N2C6O take precedence) (not used)] [N1204]
F25J3/04G2	. . . .	[N: in a double column flowsheet with a high pressure pre-rectifier] [N1204]
F25J3/04G4	. . . .	[N: in a double column flowsheet with an intermediate pressure column] [N1204]
F25J3/04G8	. . . .	[N: a main column system not otherwise provided, e.g. serially coupling of columns or more than three pressure levels] [N1204]
F25J3/04H	. . .	[N: using the heat generated by mixing two different phases] [C9510]
F25J3/04H2	. . . .	[N: for producing oxygen as a mixing column overhead gas by mixing gaseous air feed and liquid oxygen] [N1204]
F25J3/04J	. . .	[N: using the cold from cryogenic liquids produced within the air fractionation unit and stored in internal or intermediate storages (not used)] [N1204]
F25J3/04J2	. . . .	[N: for controlling purposes, e.g. start-up or back-up procedures (F25J3/04J4 takes precedence)] [N1204]
F25J3/04J2P	. . . . .	[N: for purity control during steady state operation] [N1204]
F25J3/04J2R	. . . . .	[N: for rapid load change of the air fractionation unit]
F25J3/04J4	. . . .	[N: for compensating variable air feed or variable product demand by alternating between periods of liquid storage and liquid assist] [N1204]
F25J3/04J4B	. . . . .	[N: by exchanging "cold" between at least two different cryogenic liquids, e.g. independently from the main heat exchange line of the air fractionation and/or by using external alternating storage systems] [N1204]
F25J3/04J4B2	. . . . .	[N: within the cold part of the air fractionation, i.e. exchanging "cold" within the fractionation and/or main heat exchange line] [N1204]
F25J3/04J4B2V	. . . . .	{7 dots} [N: Simultaneously changing air feed and products output] [N1204]
F25J3/04K	. . .	[N: Coupling of the air fractionation unit to an air gas-consuming unit, so-called integrated processes (combined plants, e.g. engine plant combined with an industrial process F01K23/06C; gas-turbine plants supplying working fluid to a chemical process F02C6/10) (not used)] [N1204]
F25J3/04K2	. . . .	[N: Integration with an oxygen consuming unit, e.g. glass facility, waste incineration or oxygen based processes in general] [N1204]
F25J3/04K2C	. . . . .	[N: for the direct combustion of fuels in a power plant, so-called "oxyfuel combustion"] [N1204]
F25J3/04K2H	. . . . .	[N: for the H ₂ /CO synthesis by partial oxidation or oxygen consuming reforming processes of fuels] [N1204]
F25J3/04K2H2	. . . . .	[N: for the gasification of solid or heavy liquid fuels, e.g. integrated gasification combined cycle (IGCC)] [N1204]
F25J3/04K2M	. . . . .	[N: for the metal production] [N1204]
F25J3/04K2M2	. . . . .	[N: for pig iron or steel making e.g. blast furnace, Corex] [N1204]
F25J3/04K4	. . . .	[N: Integration with an nitrogen consuming unit, e.g. for purging, inerting, cooling or heating] [N1204]
F25J3/04K4E	. . . . .	[N: for enhanced or tertiary oil recovery] [N1204]
F25J3/04K4G	. . . . .	[N: for a gas expansion plant e.g. dilution of the combustion gas in a gas turbine] [N1204]
F25J3/04K4G2	. . . . .	[N: Hot gas expansion of indirect heated nitrogen] [N1204]
F25J3/04K4N	. . . . .	[N: for the NH ₃ synthesis e.g. for adjusting the H ₂ /N ₂ ratio] [N1204]

F25J3/04K6	. . . .	[N: The air gas consuming unit is also fed by an air stream] [N1204]
F25J3/04K6C	. . . . .	[N: Completely integrated air feed compression, i.e. common MAC] [N1204]
F25J3/04K6P	. . . . .	[N: Partially integrated air feed compression, i.e. independent MAC for the air fractionation unit plus additional air feed from the air gas consuming unit] [N1204]
F25J3/04K8	. . . .	[N: Heat exchange integration with process streams, e.g. from the air gas consuming unit] [N1204]
F25J3/04K8A	. . . . .	[N: for cooling an air stream fed to the air fractionation unit] [N1204]
F25J3/04L	. . .	[N: using integrated mass and heat exchange, so-called non-adiabatic rectification, e.g. dephlegmator, reflux exchanger] [N1204]
F25J3/04L2	. . . .	[N: Simultaneously between rectifying and stripping sections, i.e. double dephlegmator] [N1204]
F25J3/04M	. . .	[N: using a hybrid air separation unit, e.g. combined process by cryogenic separation and non-cryogenic separation techniques (F25J3/04N2P4 and F25J3/04N4P4 take precedence)] [N1204]
F25J3/04N	. . .	[N: Recovering noble gases from air (from gas mixtures other than air F25J3/02C30 or F25J3/06C30)] [N1204]
F25J3/04N2	. . . .	[argon (not used)] [N1204]
F25J3/04N2C	. . . . .	[N: Producing crude argon in a crude argon column] [N1204]
F25J3/04N2C2	. . . . .	[N: as a parallel working rectification column or auxiliary column system in a single pressure main column system] [N1204]
F25J3/04N2C4	. . . . .	[N: as a parallel working rectification column of the low pressure column in a dual pressure main column system] [N1204]
F25J3/04N2C4T	. . . . .	{7 dots} [N: having a top condenser] [N1204]
F25J3/04N2C4T2	. . . . .	{8 dots} [N: cooled by oxygen enriched liquid from high pressure column bottoms] [N1204]
F25J3/04N2C4T4	. . . . .	{8 dots} [N: and a bottom re-boiler (F25J3/04N2C4T8 takes precedence)] [N1204]
F25J3/04N2C4T6	. . . . .	{8 dots} [N: and an intermediate re-boiler/condenser (F25J3/04N2C4T8 takes precedence)] [N1204]
F25J3/04N2C4T8	. . . . .	{8 dots} [N: a bottom re-boiler and an intermediate re-boiler/condenser] [N1204]
F25J3/04N2C4T10	. . . . .	{8 dots} [N: being arranged in more than one vessel] [N1204]
F25J3/04N2C6	. . . . .	[N: as an auxiliary column system in at least a dual pressure main column system] [N1204]
F25J3/04N2C6O	. . . . .	{7 dots} [N: The auxiliary column system simultaneously produces oxygen] [N1204]
F25J3/04N2P	. . . . .	[N: Producing pure argon, e.g. recovered from a crude argon column] [N1204]
F25J3/04N2P2	. . . . .	[N: using an auxiliary pure argon column for nitrogen rejection (F25J3/04N2P4A takes precedence)] [N1204]
F25J3/04N2P4	. . . . .	[N: using a hybrid system, e.g. using adsorption, permeation or catalytic reaction] [N1204]
F25J3/04N2P4A	. . . . .	{7 dots} [N: in combination with an auxiliary pure argon column] [N1204]
F25J3/04N4	. . . .	[N: Krypton and/or Xenon] [N1204]
F25J3/04N4P	. . . . .	[N: Producing pure krypton and/or xenon recovered from a crude krypton/xenon mixture] [N1204]

F25J3/04N4P4	. . . . .	[N: using a hybrid system, e.g. using adsorption, permeation or catalytic reaction] [N1204]
F25J3/04Z	. . .	[N: Start-up or control of the process; Details of the apparatus used (not used)] [N1204]
F25J3/04Z2	. . . .	[N: Operation, control and regulation of the process; Instrumentation within the process] [N1204]
F25J3/04Z2A	. . . . .	[N: Air purification and pre-cooling] [N1204]
F25J3/04Z2C	. . . . .	[N: Pressure changing devices, e.g. for compression, expansion, liquid pumping] [N1204]
F25J3/04Z2E	. . . . .	[N: Heat exchange, e.g. main heat exchange line; Subcooler, external reboiler-condenser (F25J3/04Z2G and F25j3/04Z2Z2 take precedence)] [N1204]
F25J3/04Z2G	. . . . .	[N: Rectification, e.g. columns; Reboiler-condenser (F25j3/04Z2Z2 takes precedence)] [N1204]
F25J3/04Z2G2	. . . . .	[N: Argon recovery] [N1204]
F25J3/04Z2G2P	. . . . .	{7 dots} [N: High purity argon purification] [N1204]
F25J3/04Z2M	. . . . .	[N: Different modes, i.e. "runs" of operation (F25J3/04J takes precedence)] [N1204]
F25J3/04Z2M2	. . . . .	[N: Start-up of the process] [N1204]
F25J3/04Z2M4	. . . . .	[N: Stopping of the process, e.g. defrosting or deriming; Back-up procedures] [N1204]
F25J3/04Z2M6	. . . . .	[N: Rapid load change of the air fractionation unit] [N1204]
F25J3/04Z2M8	. . . . .	[N: Variable air feed, i.e. "load" or product demand during specified periods e.g. during periods with high respectively low power costs (F25J3/04Z2M6 takes precedence)] [N1204]
F25J3/04Z2M10	. . . . .	[N: Intermittent process, so-called batch process] [N1204]
F25J3/04Z2P	. . . . .	[N: Control strategy, e.g. advanced process control or dynamic modeling] [N1204]
F25J3/04Z2Z	. . . . .	[N: Safety aspects of operation] [N1204]
F25J3/04Z2Z2	. . . . .	[N: of vaporisers for oxygen enriched liquids, e.g. purging of liquids] [N1204]
F25J3/04Z4	. . . .	[N: Construction and layout of air fractionation equipments, e.g. valves, machines (F25J5/00 takes precedence)] [N1204]
F25J3/04Z4A	. . . . .	[N: Vertical layout of cold equipments within in the cold box, e.g. columns, heat exchangers etc.] [N1204]
F25J3/04Z4A2	. . . . .	[N: Side by side arrangement of multiple vessels in a main column system, wherein the vessels are normally mounted one upon the other or forming different sections of the same column (multiple vessels of a crude argon column F25J3/04N2C4T10)] [N1204]
F25J3/04Z4A4	. . . . .	[N: Arrangement of reboiler-condensers] [N1204]
F25J3/04Z4B	. . . . .	[N: Modularity and arrangement of parts of the air fractionation unit, in particular of the cold box, e.g. pre-fabrication, assembling and erection, dimensions, horizontal layout "plot" (F25J3/04Z4A takes precedence)] [N1204]
F25J3/04Z4C	. . . . .	[N: Details of columns, e.g. internals, inlet/outlet devices] [N1204]
F25J3/04Z4C2	. . . . .	[N: Plates or trays] [N1204]
F25J3/04Z4C4	. . . . .	[N: Structured packings] [N1204]
F25J3/04Z4C6	. . . . .	[N: Combinations of different material exchange elements, e.g. within different columns] [N1204]

F25J3/04Z4C6S	. . . . .	{7 dots} [N: within the same column] [N1204]
F25J3/04Z4C8	. . . . .	[N: Liquid or gas distribution devices] [N1204]
F25J3/04Z4C10	. . . . .	[N: Partitioning walls or sheets] [N1204]
F25J3/04Z4C10V	. . . . .	{7 dots} [N: Vertical, e.g. dividing wall columns (details of dephlegmators F25J5/00B4)] [N1204]
F25J3/04Z4E	. . . . .	[N: Details of internal structure; insulation and housing of the cold box] [N1204]
F25J3/04Z4N	. . . . .	[N: Arrangements of multiple air fractionation units or multiple equipments fulfilling the same process step, e.g. multiple trains in a network (F25J3/04M takes precedence)] [N1204]
F25J3/04Z4N2	. . . . .	[N: and inter-connecting equipments upstream of the fractionation unit (s), i.e. at the "front-end"] [N1204]
F25J3/04Z4N4	. . . . .	[N: and inter-connecting equipment within or downstream of the fractionation unit(s) (F25J3/04C10M takes precedence)] [N1204]
F25J3/04Z4R	. . . . .	[N: Retrofitting or revamping of an existing air fractionation unit] [N1204]
F25J3/04Z4U	. . . . .	[N: adapted for special use of the air fractionation unit, e.g. transportable devices by truck or small scale use] [N1204]
F25J3/04Z4U2	. . . . .	[N: for portable medical or home use] [N1204]
F25J3/04Z4U4	. . . . .	[N: for offshore use] [N1204]
F25J3/04Z4U6	. . . . .	[N: for space applications, e.g. for rocket use] [N1204]
F25J3/06	. . . . .	by partial condensation (F25J3/08 takes precedence; by rectification F25J3/02; [N: purification of hydrocarbons in general C07C7/00; (not used)]) [N1204]
F25J3/06A	. . . . .	[N: characterised by the feed stream (for air F25J3/04) (not used)] [N0303] [C1104]
F25J3/06A2	. . . . .	[N: Natural gas or substitute natural gas] [N0303]
F25J3/06A2L	. . . . .	[N: Liquefied natural gas] [N1104]
F25J3/06A4	. . . . .	[N: Refinery gas, cracking gas, coke oven gas, gaseous mixtures containing aliphatic unsaturated CnHm or gaseous mixtures of undefined nature] [N0303] [C1104]
F25J3/06A6	. . . . .	[N: H2/CO mixtures, i.e. synthesis gas; Water gas or shifted synthesis gas (production of carbon monoxide containing gas in general C01B31/18, C10J, C10K; production of hydrogen containing gas C01B3/00)] [N0303] [C1104]
F25J3/06C	. . . . .	[N: characterised by the separated product stream (not used)] [N0303] [C1104]
F25J3/06C2	. . . . .	[N: separation of CnHm with 1 carbon atom or more] [N0303]
F25J3/06C4	. . . . .	[N: separation of CnHm with 2 carbon atoms or more] [N0303]
F25J3/06C6	. . . . .	[N: separation of CnHm with 3 carbon atoms or more] [N0303]
F25J3/06C8	. . . . .	[N: separation of CnHm with 4 carbon atoms or more] [N0303]
F25J3/06C10	. . . . .	[N: separation of hydrogen (production of hydrogen containing gas in general C01B3/00, e.g. separation of hydrogen or hydrogen containing gases form gaseous mixtures at low temperatures C01B3/50D)] [N0303]
F25J3/06C12	. . . . .	[N: separation of nitrogen (from air F25J3/04, production of nitrogen in general C01B21/00)] [N0303]
F25J3/06C14	. . . . .	[N: separation of carbon monoxide (production of carbon monoxide containing gas in general C01B31/18, C10J, C10K)] [N0303]
F25J3/06C16	. . . . .	[N: separation of carbon dioxide (production of carbon dioxide in general C01B31/00)] [N0303]
F25J3/06C18	. . . . .	[N: separation of H2/CO mixtures, i.e. of synthesis gas (production of carbon monoxide containing gas in general C01B31/18, C10J, C10K, production of

- hydrogen containing gas [C01B3/00](#)] [N0303]
- F25J3/06C20 . . . [N: separation of H₂/N₂ mixtures, i.e. of ammonia synthesis gas (in general [C01B3/00](#))] [N0303]
- F25J3/06C30 . . . [N: separation of noble gases (from air [F25J3/04N](#); in general [C01B23/00](#))] [N1104]
- F25J3/06C30H [N: of helium] [N1104]
- F25J3/06Z . . [N: Start-up or control of the process; Details of the apparatus used] [N1104]
- F25J3/08 . Separating gaseous impurities from gases or gaseous mixtures [N: or from liquefied gases or liquefied gaseous mixtures] (cold traps [B01D8/00](#)) [C1104]
- F25J5/00** **Arrangements of cold exchangers or cold accumulators in separation or liquefaction plants** (heat exchangers [F28C](#), [F28D](#), [F28F](#))
- F25J5/00B . [N: for continuously recuperating cold, i.e. in a so-called recuperative heat exchanger] [N1204]
- F25J5/00B2 . . [N: in a reboiler-condenser e.g. within a column] [N1204]
- F25J5/00B4 . . [N: combined with mass exchange, i.e. in a so-called dephlegmator] [N1204]