<table>
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<th>Class</th>
<th>Description</th>
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<td>F25J</td>
<td>LIQUEFACTION, SOLIDIFICATION OR SEPARATION OF GASES OR GASEOUS MIXTURES BY PRESSURE AND COLD TREATMENT</td>
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</table>
gas turbine plants in combination with other (combined plants, e.g. engine plant combined or processes, so-called integrated processes; Coupling of the liquefaction unit to other units [F25J 1/0211 takes precedence])

provided before, e.g. heat driven absorption (using other external refrigeration means not using the cold stored in an external cryogenic fluid in a closed vapor compression cycle)

{Heat exchange integration (cryogenic separation of air [F25J 3/04])}

{Integrated between two refrigeration cycles of a refrigeration cascade, i.e. first cycle providing feed gas cooling and second cycle providing overhead gas cooling}

{wherein the overhead cooling comprises providing reflux for a fractionation step}

{Waste heat recovery, e.g. from heat of compression}

{Start-up or control of the process; Details of the apparatus used; Details of the refrigerant compression system used}

{Operation; Control and regulation; Instrumentation ([F25J 1/0279 takes precedence])}

{Different modes, i.e. ‘runs’, of operation; Process control}

{start-up of the process}

{Stopping of the process, e.g. defrosting or derimming, maintenance; Back-up mode or systems}

{Controlling refrigerant inventory, i.e. composition or quantity (charging or discharging refrigerants in cooling systems [F25B 45/00])}

{Details related to the refrigerant production or treatment, e.g. make-up supply from feed gas itself}

{Intermittent or alternating process, so-called integrated processes (combined plants, e.g. engine plant combined with an industrial process [F01K 23/06]; gas turbine plants in combination with other processes [F02C 6/00])}

{Integration with a unit for using hydrocarbons, e.g. consuming hydrocarbons as feed stock}

{for the combustion as fuels, i.e. integration with the fuel gas system}

{for the working-up of the hydrocarbon feed, e.g. reinjection of heavier hydrocarbons into the liquefied gas}

{integration within a pressure letdown station of a high pressure pipeline system}

{Integration with a cryogenic air separation unit (cryogenic separation of air [F25J 3/04])}

{Heat exchange integration}

{providing refrigeration for different processes treating not the same feed stream}

{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 [F25J 3/02]; details related to partial condensation [F25J 3/06]; working-up natural gas [C10L 3/10])}

{Purification or treatment step is integrated within one refrigeration cycle only, i.e. the same or single refrigeration cycle provides feed gas cooling (if present) and overhead gas cooling}

{Purification or treatment step being integrated between two refrigeration cycles of a refrigeration cascade, e.g. first cycle providing feed gas cooling and second cycle providing overhead gas cooling}

{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”}
 Fluid, e.g., kind of compressor, accumulator, refrigeration system to a common driver

Mechanically coupling of different cascade refrigeration system at least two refrigerant compressors in a refrigeration system, possibly split on multiple mechanically coupled to the same refrigerant unit, e.g., portable or transportable devices adapted for special use of the liquefaction unit or equipments fulfilling the same process step, e.g., multiple "trains" concept (F25J 1/0294 takes precedence)

[3/00] Processes or apparatus for separating the constituents of gaseous (or liquefied gaseous) mixtures involving the use of liquefaction or solidification

3/02 by rectification, i.e., by continuous interchange of heat and material between a vapour stream and a liquid stream (F25J 3/08 takes precedence; purification of hydrocarbons in general C07C 7/00)

3/0204 [characterised by the feed stream (for air F25J 3/04)]

3/0209 [Natural gas or substitute natural gas]

3/0214 [Liquefied natural gas]

3/0219 [Refinery gas, cracking gas, coke oven gas, gaseous mixtures containing aliphatic unsaturated CnHm or gaseous mixtures of undefined nature]

3/0223 [H2/CO mixtures, i.e., synthesis gas; Water gas or shifted synthesis gas (production of carbon monoxide containing gas in general C01B 32/40, C10J, C10K; production of hydrogen containing gas C01B 3/00)]

3/0228 [characterised by the separated product stream]

3/0233 [separation of CnHm with 1 carbon atom or more]

3/0238 [separation of CnHm with 2 carbon atoms or more]

3/0242 [separation of CnHm with 3 carbon atoms or more]

3/0247 [separation of CnHm with 4 carbon atoms or more]

3/0252 [separation of hydrogen (production of hydrogen containing gas in general C01B 3/00, e.g., separation of hydrogen or hydrogen containing gases form gaseous mixtures at low temperatures C01B 3/006)]

3/0257 [separation of nitrogen (from air F25J 3/04, production of nitrogen in general C01B 21/00)]

3/0261 [separation of carbon monoxide (production of carbon monoxide containing gas in general C01B 32/40, C10J, C10K)]

3/0266 [separation of carbon dioxide (production of carbon dioxide in general C01B 32/00)]

3/0271 [separation of H2/CO mixtures, i.e., of synthesis gas (production of carbon monoxide containing gas in general C01B 32/40, C10J, C10K; production of hydrogen containing gas C01B 3/00)]

3/0291 [Refrigerant compression by combined gas compression and liquid pumping]

3/0292 [Refrigerant compression by cold or cryogenic suction of the refrigerant gas]

3/0294 [Multiple compressor casings/strings in parallel, e.g., split arrangement]

3/0295 [Shifting of the compression load between different cooling stages within a refrigerant cycle or within a cascade refrigeration system]

3/0296 [Removal of the heat of compression, e.g., within an inter- or after-stage-cooler against an ambient heat sink]

3/0297 [using an externally chilled fluid, e.g., chilled water]

3/0298 [Safety aspects and control of the refrigerant compression system, e.g., anti-surge control]
3/0276 . . . {separation of H₂/N₂ mixtures, i.e. of ammonia synthesis gas (in general C01B 3/00)}
3/028 . . . {separation of noble gases (from air F25J 3/04642; in general C01B 23/00)}
3/0285 . . . {of argon}
3/029 . . . {of helium}
3/0295 . . . {Start-up or control of the process; Details of the apparatus used, e.g. sieve plates, packings}
3/04 . . . {for air}
3/04006 . . . {Providing pressurised feed air or process streams within or from the air fractionation unit}
3/04012 . . . {by compression of warm gaseous streams; details of intake or interstage cooling (F25J 3/04048 takes precedence; operation of compressors F25J 3/04781; particular layout of compressors used in air fractionation units F25J 3/04866)}
3/04018 . . . {of main feed air}
3/04024 . . . {of purified feed air, so-called boosted air}
3/0403 . . . {of nitrogen}
3/04036 . . . {of oxygen}
3/04042 . . . {of argon or argon enriched stream}
3/04048 . . . {by compression of cold gaseous streams, e.g. intermediate or oxygen enriched (waste) streams}
3/04054 . . . {of air}
3/0406 . . . {of nitrogen}
3/04066 . . . {of oxygen}
3/04072 . . . {of argon or argon enriched stream}
3/04078 . . . {providing pressurized products by liquid compression and vaporisation with cold recovery, i.e. so-called internal compression (operation of pumps F25J 3/04781; particular layout of pumps used in air fractionation units F25J 3/04866)}
3/04084 . . . {of nitrogen}
3/0409 . . . {of oxygen}
3/04096 . . . {of argon or argon enriched stream}
3/04103 . . . {using solely hydrostatic liquid head}
3/04109 . . . {Arrangements of compressors and/or their drivers (using work extraction by mechanical coupling of compression and cold expansion F25J 3/04381)}
3/04115 . . . {characterised by the type of prime driver, e.g. hot gas expander}
3/04121 . . . {Steam turbine as the prime mechanical driver}
3/04127 . . . {Gas turbine as the prime mechanical driver}
3/04133 . . . {Electrical motor as the prime mechanical driver}
3/04139 . . . {Combination of different types of drivers mechanically coupled to the same compressor, possibly split on multiple compressor casings}
3/04145 . . . {Mechanically coupling of different compressors of the air fractionation process to the same driver(s)}
3/04151 . . . {Purification and (pre-)cooling of the feed air; recuperative heat-exchange with product streams}
3/04157 . . . {Afterstage cooling and so-called "pre-cooling" of the feed air upstream the air purification unit and main heat exchange line (F25J 3/04618 takes precedence)}
3/04163 . . . {Hot end purification of the feed air (arrangements of cold regenerators F25J 5/00)}
3/04169 . . . {by adsorption of the impurities (adsorption in general B01D 53/02)}
3/04175 . . . {at a pressure of substantially more than the highest pressure column}
3/04181 . . . {Regenerating the adsorbents}
3/04187 . . . {Cooling of the purified feed air by recuperative heat-exchange; Heat-exchange with product streams (arrangements of cold exchangers F25J 5/002)}
3/04193 . . . {Division of the main heat exchange line in consecutive sections having different functions}
3/042 . . . {having an intermediate feed connection}
3/04206 . . . {including a so-called "auxiliary vapouriser" for vapourising and producing a gaseous product}
3/04212 . . . {and simultaneously condensing vapor from a column serving as reflux within the or another column}
3/04218 . . . {Parallel arrangement of the main heat exchange line in cores having different functions, e.g. in low pressure and high pressure cores (F25J 3/04503 takes precedence)}
3/04224 . . . {Cores associated with a liquefaction or refrigeration cycle}
3/0423 . . . {Subcooling of liquid process streams}
3/04236 . . . {Integration of different exchangers in a single core, so-called integrated cores (F25J 3/04624 takes precedence)}
3/04242 . . . {Cold end purification of the feed air}
3/04248 . . . {Generation of cold for compensating heat leaks or liquid production, e.g. by Joule-Thompson expansion}
3/04254 . . . {using the cold stored in external cryogenic fluids (closed loop F25J 3/04278)}
3/0426 . . . {The cryogenic component does not participate in the fractionation}
3/04266 . . . {and being liquefied hydrocarbons}
3/04272 . . . {and comprising means for reducing the risk of pollution of hydrocarbons into the air fractionation}
3/04278 . . . {using external refrigeration units, e.g. closed mechanical or regenerative refrigeration units}
3/04284 . . . {using internal refrigeration by open-loop gas work expansion, e.g. of intermediate or oxygen enriched (waste-)streams (F25J 3/04332 takes precedence)}
3/0429 . . . {of feed air, e.g. used as waste or product air or expanded into an auxiliary column}
3/04296 . . . {Claude expansion, i.e. expanded into the main or high pressure column}
3/04303 . . . {Lachmann expansion, i.e. expanded into oxygen producing or low pressure column}
3/04309 . . . {of nitrogen}
\[ \text{Details relating to the work expansion, e.g. process parameter etc.} \]

\[ \text{using work extraction by mechanical coupling of compression and expansion so-called campanders} \]

\[ \text{using liquid or hydraulic turbine} \]

\[ \text{using multiple or multistage gas work expansion} \]

\[ \text{using a single pressure main column system only (F25J 3/0446, F25J 3/04624, F25J 3/04636 take precedence)} \]


\[ \text{in a classical double column flowsheet, i.e. with thermal coupling by a main reboiler-condenser in the bottom of low pressure respectively top of high pressure column} \]

\[ \text{with thermally overlapping high and low pressure columns} \]

\[ \text{without thermally coupled high and low pressure columns, i.e. a so-called split columns} \]

\[ \text{A main column system not otherwise provided, e.g. a modified double column flowsheet} \]


\[ \text{in a double column flowsheet with a high pressure pre-rectifier} \]

\[ \text{in a double column flowsheet with an intermediate pressure column} \]

\[ \text{a main column system not otherwise provided, e.g. serially coupling of columns or more than three pressure levels} \]

\[ \text{using the heat generated by mixing two different phases} \]

\[ \text{for producing oxygen as a mixing column overhead gas by mixing gaseous air feed and liquid oxygen} \]

\[ \text{using the cold from cryogenic liquids produced within the air fractionation unit and stored in internal or intermediate storages} \]

\[ \text{for controlling purposes, e.g. start-up or back-up procedures (F25J 3/04496 takes precedence)} \]

\[ \text{for purity control during steady state operation} \]

\[ \text{for rapid load change of the air fractionation unit} \]

\[ \text{for compensating variable air feed or variable product demand by alternating between periods of liquid storage and liquid assist} \]

\[ \text{by exchanging "cold" between at least two different cryogenic liquids, e.g. independently from the main heat exchange line of the air fractionation and/or by using external alternating storage systems} \]

\[ \text{within the cold part of the air fractionation, i.e. exchanging "cold" within the fractionation and/or main heat exchange line} \]

\[ \text{Simultaneously changing air feed and products output} \]

\[ \text{Coupling of the air fractionation unit to an air gas-consuming unit, so-called integrated processes (combined plants, e.g. engine plant combined with an industrial process F01K 23/06: gas-turbine plants supplying working fluid to a chemical process F02C 6/10)} \]

\[ \text{Integration with an oxygen consuming unit, e.g. glass facility, waste incineration or oxygen based processes in general} \]

\[ \text{for the direct combustion of fuels in a power plant, so-called "oxyfuel combustion"} \]

\[ \text{for the H_2/CO synthesis by partial oxidation or oxygen consuming reforming processes of fuels} \]

\[ \text{for the gasification of solid or heavy liquid fuels, e.g. integrated gasification combined cycle [IGCC]} \]

\[ \text{for the metal production} \]

\[ \text{for pig iron or steel making, e.g. blast furnace, Corex} \]

\[ \text{Integration with a nitrogen consuming unit, e.g. for purging, inerting, cooling or heating} \]

\[ \text{for enhanced or tertiary oil recovery} \]

\[ \text{for a gas expansion plant, e.g. dilution of the combustion gas in a gas turbine} \]

\[ \text{for the direct combustion of fuels for enhanced or tertiary oil recovery} \]

\[ \text{for the H_2/CO synthesis by partial oxidation or oxygen consuming reforming processes of fuels} \]

\[ \text{for the gasification of solid or heavy liquid fuels, e.g. integrated gasification combined cycle [IGCC]} \]

\[ \text{for the metal production} \]

\[ \text{for pig iron or steel making, e.g. blast furnace, Corex} \]

\[ \text{Integration with a nitrogen consuming unit, e.g. for purging, inerting, cooling or heating} \]

\[ \text{for enhanced or tertiary oil recovery} \]

\[ \text{for a gas expansion plant, e.g. dilution of the combustion gas in a gas turbine} \]

\[ \text{Hot gas expansion of indirect heated nitrogen} \]

\[ \text{for the NH_3 synthesis, e.g. for adjusting the H_2/N_2 ratio} \]

\[ \text{The air gas consuming unit is also fed by an air stream} \]

\[ \text{Completely integrated air feed compression, i.e. common MAC} \]

\[ \text{Partially integrated air feed compression, i.e. independent MAC for the air fractionation unit plus additional air feed from the air gas consuming unit} \]

\[ \text{Heat exchange integration with process streams, e.g. from the air gas consuming unit} \]
3/04618 . . . . . [for cooling an air stream fed to the air fractionation unit]
3/04624 . . . . . [using integrated mass and heat exchange, so-called non-adiabatic rectification, e.g. dephlegmator, reflux exchanger]
3/0463 . . . . . [Simultaneously between rectifying and stripping sections, i.e. double dephlegmator]
3/04636 . . . . . [using a hybrid air separation unit, e.g. combined process by cryogenic separation and non-cryogenic separation techniques (F25J 3/04733 and F25J 3/04757 take precedence)]
3/04642 . . . . . [Recovering noble gases from air (from gas mixtures other than air F25J 3/028 or F25J 3/0685)]
3/04648 . . . . . [argon]
3/04654 . . . . . [Producing crude argon in a crude argon column]
3/0466 . . . . . [as a parallel working rectification column or auxiliary column system in a single pressure main column system]
3/04666 . . . . . [as a parallel working rectification column of the low pressure column in a dual pressure main column system]
3/04672 . . . . . [having a top condenser]
3/04678 . . . . . [cooled by oxygen enriched liquid from high pressure column bottoms]
3/04684 . . . . . [and a bottom re-boiler (F25J 3/04696 takes precedence)]
3/0469 . . . . . [and an intermediate re-boiler/condenser (F25J 3/04696 takes precedence)]
3/04696 . . . . . [a bottom re-boiler and an intermediate re-boiler/condenser]
3/04703 . . . . . [being arranged in more than one vessel]
3/04709 . . . . . [as an auxiliary column system in at least a dual pressure main column system]
3/04715 . . . . . [The auxiliary column system simultaneously produces oxygen]
3/04721 . . . . . [Producing pure argon, e.g. recovered from a crude argon column]
3/04727 . . . . . [using an auxiliary pure argon column for nitrogen rejection (F25J 3/04739 takes precedence)]
3/04733 . . . . . [using a hybrid system, e.g. using adsorption, permeation or catalytic reaction]
3/04739 . . . . . [in combination with an auxiliary pure argon column]
3/04745 . . . . . [Krypton and/or Xenon]
3/04751 . . . . . [Producing pure krypton and/or xenon recovered from a crude krypton/xenon mixture]
3/04757 . . . . . [using a hybrid system, e.g. using adsorption, permeation or catalytic reaction]
3/04763 . . . . . [Start-up or control of the process; Details of the apparatus used]
3/04769 . . . . . [Operation, control and regulation of the process; Instrumentation within the process]
3/04775 . . . . . [Air purification and pre-cooling]
3/04781 . . . . . [Pressure changing devices, e.g. for compression, expansion, liquid pumping]
3/04787 . . . . . [Heat exchange, e.g. main heat exchange line; Subcooler, external reboiler-condenser (F25J 3/04793 and F25J 3/0486 take precedence)]
3/04793 . . . . . [Rectification, e.g. columns; Reboiler-condenser (F25J 3/0486 takes precedence)]
3/048 . . . . . [Argon recovery]
3/04806 . . . . . [High purity argon purification]
3/04812 . . . . . [Different modes, i.e. "runs" of operation (F25J 3/04472 takes precedence)]
3/04818 . . . . . [Start-up of the process]
3/04824 . . . . . [Stopping of the process, e.g. defrosting or deriming; Back-up procedures]
3/0483 . . . . . [Rapid load change of the air fractionation unit]
3/04836 . . . . . [Variable air feed, i.e. "load" or product demand during specified periods, e.g. during periods with high respectively low power costs (F25J 3/0483 takes precedence)]
3/04842 . . . . . [Intermittent process, so-called batch process]
3/04848 . . . . . [Control strategy, e.g. advanced process control or dynamic modeling]
3/04854 . . . . . [Safety aspects of operation]
3/0486 . . . . . [of vaporisers for oxygen enriched liquids, e.g. purging of liquids]
3/04866 . . . . . [Construction and layout of air fractionation equipments, e.g. valves, machines (F25J 5/00 takes precedence)]
3/04872 . . . . . [Vertical layout of cold equipments within in the cold box, e.g. columns, heat exchangers etc.]
3/04878 . . . . . [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 F25J 3/04703)]
3/04884 . . . . . [Arrangement of reboiler-condensers]
3/0489 . . . . . [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” (F25J 3/04872 takes precedence)]
3/04896 . . . . . [Details of columns, e.g. internals, inlet/outlet devices]
3/04903 . . . . . [Plates or trays]
3/04909 . . . . . [Structured packings]
3/04915 . . . . . [Combinations of different material exchange elements, e.g. within different columns]
3/04921 . . . . . [within the same column]
3/04927 . . . . . [Liquid or gas distribution devices]
3/04933 . . . . . [Partitioning walls or sheets]
3/04939 . . . . . [Vertical, e.g. dividing wall columns (details of dephlegmators F25J 5/007)]
3/0495 . . . . . . . . . . (Details of internal structure; insulation and housing of the cold box)
3/04951 . . . . . . . . . . (Arrangements of multiple air fractionation units or multiple equipments fulfilling the same process step, e.g. multiple trains in a network (F25J 3/04636 takes precedence))
3/04957 . . . . . . . . . . (and inter-connecting equipments upstream of the fractionation unit (s), i.e. at the “front-end”) 
3/04963 . . . . . . . . . . (and inter-connecting equipment within or downstream of the fractionation unit(s) (F25J 3/04393 takes precedence) 
3/04969 . . . . . . . . . . (Retrofitting or revamping of an existing air fractionation unit)
3/04975 . . . . . . . . . . (adapted for special use of the air fractionation unit, e.g. transportable devices by truck or small scale use)
3/04981 . . . . . . . . . . (for portable medical or home use)
3/04987 . . . . . . . . . . (for offshore use)
3/04993 . . . . . . . . . . (for space applications, e.g. for rocket use)
3/06 . . by partial condensation (F25J 3/08 takes precedence; by rectification F25J 3/02 (i.e. purification of hydrocarbons in general C07C 7/00))
3/0605 . . . . . . . . . . (characterised by the feed stream (for air F25J 3/04))
3/061 . . . . . . . . . . [Natural gas or substitute natural gas]
3/0615 . . . . . . . . . . [Liquefied natural gas]
3/062 . . . . . . . . . . [Refinery gas, cracking gas, coke oven gas, gaseous mixtures containing aliphatic unsaturated CnHm or gaseous mixtures of undefined nature]
3/0625 . . . . . . . . . . [H2/CO mixtures, i.e. synthesis gas; Water gas or shifted synthesis gas (production of carbon monoxide containing gas in general C01B 32/40, C10J, C10K; production of hydrogen containing gas C01B 3/00)]
3/063 . . . . . . . . . . (characterised by the separated product stream)
3/0635 . . . . . . . . . . (separation of CnHm with 1 carbon atom or more)
3/064 . . . . . . . . . . (separation of CnHm with 2 carbon atoms or more)
3/0645 . . . . . . . . . . (separation of CnHm with 3 carbon atoms or more)
3/065 . . . . . . . . . . (separation of CnHm with 4 carbon atoms or more)
3/0655 . . . . . . . . . . (separation of hydrogen (production of hydrogen containing gas in general C01B 3/00, e.g. separation of hydrogen or hydrogen containing gases form gaseous mixtures at low temperatures C01B 3/06))
3/066 . . . . . . . . . . (separation of nitrogen (from air F25J 3/04, production of nitrogen in general C01B 21/00))
3/0665 . . . . . . . . . . (separation of carbon monoxide (production of carbon monoxide containing gas in general C01B 32/40, C10J, C10K))
3/067 . . . . . . . . . . (separation of carbon dioxide (production of carbon dioxide in general C01B 32/00))
3/0675 . . . . . . . . . . (separation of H2/CO mixtures, i.e. of synthesis gas (production of carbon monoxide containing gas in general C01B 32/40, C10J, C10K, production of hydrogen containing gas C01B 3/00))
3/068 . . . . . . . . . . (separation of H2/N2 mixtures, i.e. of ammonia synthesis gas (in general C01B 3/00))
3/0685 . . . . . . . . . . (separation of noble gases (from air F25J 3/04642; in general C01B 23/00))
3/069 . . . . . . . . . . (of helium)
3/0695 . . . . . . . . . . (Start-up or control of the process; Details of the apparatus used)
3/08 . . Separating gaseous impurities from gases or gaseous mixtures (or from liquefied gases or liquefied gaseous mixtures) (cold traps B01D 8/00)
5/00 Arrangements of cold exchangers or cold accumulators in separation or liquefaction plants (heat exchangers F28C, F28D, F28F)
5/002 . . . . . . . . . . (for continuously recuperating cold, i.e. in a so-called recuperative heat exchanger)
5/005 . . . . . . . . . . (in a reboiler-condenser, e.g. within a column)
5/007 . . . . . . . . . . (combined with mass exchange, i.e. in a so-called dephlegmator)

2200/00 Processes or apparatus using separation by rectification
2200/02 . . . . . . . . . . in a single pressure main column system
2200/04 . . . . . . . . . . in a dual pressure main column system
2200/06 . . . . . . . . . . in a classical double column flow-sheet, i.e. with thermal coupling by a main reboiler-condenser in the bottom of low pressure respectively top of high pressure column
2200/08 . . . . . . . . . . in a triple pressure main column system
2200/10 . . . . . . . . . . in a quadruple, or more, column or pressure system
2200/20 . . . . . . . . . . in an elevated pressure multiple column system wherein the lowest pressure column is at a pressure well above the minimum pressure needed to overcome pressure drop to reject the products to atmosphere
2200/30 . . . . . . . . . . using a side column in a single pressure column system
2200/32 . . . . . . . . . . using a side column fed by a stream from the high pressure column
2200/34 . . . . . . . . . . using a side column fed by a stream from the low pressure column
2200/38 . . . . . . . . . . using pre-separation or distributed distillation before a main column system, e.g. in a at least a double column system
2200/40 . . . . . . . . . . Features relating to the provision of boil-up in the bottom of a column
2200/50 . . . . . . . . . . using multiple (re-)boiler-condensers at different heights of the column
2200/52 . . . . . . . . . . in the high pressure column of a double pressure main column system
2200/54 . . . . . . . . . . in the low pressure column of a double pressure main column system
2200/70 . . . . . . . . . . Refluxing the column with a condensed part of the feed stream, i.e. fractionator top is stripped or self-rectified
2200/72 . . . . . . . . . . Refluxing the column with at least a part of the totally condensed overhead gas
2200/74 . . . . . . . . . . Refluxing the column with at least a part of the partially condensed overhead gas
2200/76 . . . . . . . . . . Refluxing the column with condensed overhead gas being cycled in a quasi-closed loop refrigeration cycle
2200/78 . . . . . . . . . . Refluxing the column with a liquid stream originating from an upstream or downstream fractionator column
Processes or apparatus using other separation and/or processing means

Processes characterised by the type or other details of the product stream

Processes or apparatus involving steps for the removal of impurities
Processes or apparatus involving steps for increasing the pressure of gaseous process streams

Processes or apparatus involving steps for recycling of process streams

Processes or apparatus involving steps for separating low boiling, i.e. more volatile components from oxygen, e.g. N₂, Ar

Processes or apparatus involving steps for separating high boiling, i.e. less volatile components from oxygen, e.g. Kr, Xe, Hydrocarbons, Nitrous oxides, O₃

Processes or apparatus involving steps for separating impurities from natural gas, e.g. mercury, cyclical hydrocarbons

Processes or apparatus involving steps for separating low boiling components, e.g. He, H₂, N₂, Air

Processes or apparatus involving steps for separating heavy hydrocarbons, e.g. NGL, LPG, C₄⁺ hydrocarbons or heavy condensates in general

Processes or apparatus involving steps for separating acid gases, e.g. CO₂, SO₂, H₂S or RSH

Processes or apparatus involving steps for separating impurities from carbon dioxide, e.g. H₂O or water-soluble contaminants

Processes or apparatus involving steps for separating low boiling, i.e. more volatile components, e.g. He, H₂, CO, Air gases, CH₄

Processes or apparatus involving steps for separating high boiling, i.e. less volatile components, e.g. NOₓ, SOₓ, H₂S

Processes or apparatus involving steps for separating isotopes of a component, e.g. H₂, O₂

Processes or apparatus involving steps for separating low boiling components, e.g. NOₓ, SOₓ, H₂S

Processes or apparatus involving steps for separating high boiling, i.e. less volatile components, e.g. He, H₂, CO, Air gases, CH₄

Processes or apparatus involving steps for separating low boiling components, e.g. NOₓ, SOₓ, H₂S

Processes or apparatus involving steps for separating low boiling, i.e. more volatile components from oxygen, e.g. N₂, Ar

Processes or apparatus involving steps for separating high boiling, i.e. less volatile components from oxygen, e.g. Kr, Xe, Hydrocarbons, Nitrous oxides, O₃
Coupling of processes or apparatus to other units; Integrated schemes

Integration in an installation for exchanging heat, e.g. for waste heat recovery
Integration in a gas transmission system at a pressure reduction, e.g. "let down" station
Integration in an installation for liquefying oil or solidifying a fluid stream
Integration in an installation using renewable energy
Integration in an installation using nitrogen, e.g. as utility gas, for inerting or purging purposes in IGCC, POX, GTL, PSA, float glass forming, incineration processes, for heat recovery or for enhanced oil recovery
Integration in an installation using nitrogen for cooling purposes
Integration in an installation using oxygen, e.g. in the burner of a glass facility, waste incineration or oxygen based process [OBP] in general
Integration in an installation using argon
Integration in an installation using hydrocarbons, e.g. for fuel purposes
Integration in an installation using carbon dioxide, e.g. for EOR, sequestration, refrigeration etc.

Refrigeration techniques used
Internal refrigeration with work-producing gas expansion loop
Internal refrigeration with liquid vaporising loop
Internal refrigeration with working gas expansion loop
with multiple gas expansion loops
Internal refrigeration by flash gas recovery loop
External refrigeration with liquid vaporising loop
External refrigeration with working gas expansion loop
with multiple gas expansion loops of the same refrigerant
External refrigeration with incorporated cascade loop
Quasi-closed internal or closed external hydrogen refrigeration cycle
Quasi-closed internal or closed external carbon monoxide refrigeration cycle
Quasi-closed internal or closed external helium refrigeration cycle
Quasi-closed internal or closed external air refrigeration cycle
Quasi-closed internal or closed external nitrogen refrigeration cycle
Quasi-closed internal or closed external oxygen refrigeration cycle
Quasi-closed internal or closed external argon refrigeration cycle
Closed external refrigeration cycle with single component refrigerant [SCR], e.g. C1-, C2- or C3-hydrocarbons
Closed external refrigeration cycle with multi component refrigerant [MCR], e.g. mixture of hydrocarbons
Quasi-closed internal or closed external carbon dioxide refrigeration cycle
Quasi-closed internal refrigeration or heat pump cycle, if not otherwise provided
External refrigeration, e.g. conventional closed-loop mechanical refrigeration unit using Freon or NH3, unspecified external refrigeration

Details about the refrigeration cycle used, e.g. composition of refrigerant, arrangement of compressors or cascade, make up sources, use of reflux exchangers etc.
by liquid or gaseous cryogen in an open loop
by heat driven absorption chillers
by regenerative chillers, i.e. oscillating or dynamic systems, e.g. Stirling refrigerator, thermo-electric ("Peltier") or magnetic refrigeration
. . . using pulse tube refrigeration
Liquefaction cycle of a low-boiling (feed) gas in a cryocooler, i.e. in a closed-loop refrigerator

Control of the process or apparatus
Control in general, load changes, different modes ("runs"), measurements
Control for or during start-up and cooling down of the installation
Control for stopping, derating or defrosting after an emergency shut-down of the installation or for back up system
Control of a discontinuous or intermittent ("batch") process
Control of freezing of components
Advanced process control, e.g. adaptive or multivariable control

Other details not covered by groups F25J 2200/00 - F25J 2280/00
Comparison of processes or apparatus
Mathematical formulae, modeling, plot or curves; Design methods
Particular process parameters like pressure, temperature, ratios
Particular dimensions; Small scale or microdevices
Details about heat insulation or cold insulation
Details on header or distribution passages of heat exchangers, e.g. of reboiler-condenser or plate heat exchangers
Details about subcooling of liquids
Vertical layout or arrangement of cold equipments within in the cold box, e.g. columns, condensers, heat exchangers etc.
Modularity, pre-fabrication of modules, assembling and erection, horizontal layout, i.e. plot plan, and vertical arrangement of parts of the cryogenic unit, e.g. of the cold box
Materials used, e.g. copper, steel or alloys thereof or surface treatments used, e.g. enhanced surface
Arrangement of multiple equipments fulfilling the same process step in parallel
Details about pipelines, i.e. network, for feed or product distribution
Details of storing a fluid in a tank
Processing device is mobile or transportable, e.g. by hand, car, ship, rocket engine etc.
Processing device is used off-shore, e.g. on a ship, rocket engine etc.
Details of storing a fluid in a tank
Processing device is used off-shore, e.g. on a ship, rocket engine etc.
Details about safety operation of the installation