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(54) HEAT TRANSFER COMPOSITIONS

(57) This invention provides a heat transfer composition comprising from about 5 to about 40 % by weight of *trans*-1,3,3,3-tetrafluoropropene (R-1234ze(E)), from about 20 to about 35 % by weight difluoromethane (R-32), from about 15 to about 30 % by weight R-125 pentafluoroethane (R-125), and from about 12 to about 50 % by weight 1,1,1,2-tetrafluoroethane (R-134a).

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Description

[0001] The invention relates to heat transfer compositions, and in particular to heat transfer compositions which may be suitable as replacements for existing refrigerants such as R-134a, R-152a, R-1234yf, R-22, R-410A, R-407A, R-407B, R-407C, R507 and R-404a.

[0002] The listing or discussion of a prior-published document or any background in the specification should not necessarily be taken as an acknowledgement that a document or background is part of the state of the art or is common general knowledge.

[0003] Mechanical refrigeration systems and related heat transfer devices such as heat pumps and air-conditioning systems are well known. In such systems, a refrigerant liquid evaporates at low pressure taking heat from the surrounding zone. The resulting vapour is then compressed and passed to a condenser where it condenses and gives off heat to a second zone, the condensate being returned through an expansion valve to the evaporator, so completing the cycle. Mechanical energy required for compressing the vapour and pumping the liquid is provided by, for example, an electric motor or an internal combustion engine.

[0004] In addition to having a suitable boiling point and a high latent heat of vaporisation, the properties preferred in a refrigerant include low toxicity, non-flammability, non-corrosivity, high stability and freedom from objectionable odour. Other desirable properties are ready compressibility at pressures below 25 bars, low discharge temperature on compression, high refrigeration capacity, high efficiency (high coefficient of performance) and an evaporator pressure in excess of 1 bar at the desired evaporation temperature.

[0005] Dichlorodifluoromethane (refrigerant R-12) possesses a suitable combination of properties and was for many years the most widely used refrigerant. Due to international concern that fully and partially halogenated chlorofluorocarbons were damaging the earth's protective ozone layer, there was general agreement that their manufacture and use should be severely restricted and eventually phased out completely. The use of dichlorodifluoromethane was phased out in the 1990's.

[0006] Chlorodifluoromethane (R-22) was introduced as a replacement for R-12 because of its lower ozone depletion potential. Following concerns that R-22 is a potent greenhouse gas, its use is also being phased out.

[0007] Whilst heat transfer devices of the type to which the present invention relates are essentially closed systems, loss of refrigerant to the atmosphere can occur due to leakage during operation of the equipment or during maintenance procedures. It is important, therefore, to replace fully and partially halogenated chlorofluorocarbon refrigerants by materials having zero ozone depletion potentials.

[0008] In addition to the possibility of ozone depletion, it has been suggested that significant concentrations of halocarbon refrigerants in the atmosphere might contribute to global warming (the so-called greenhouse effect). It is desirable, therefore, to use refrigerants which have relatively short atmospheric lifetimes as a result of their ability to react with other atmospheric constituents such as hydroxyl radicals or as a result of ready degradation through photolytic processes.

[0009] R-410A and R-407 refrigerants (including R-407A, R-407B and R-407C) have been introduced as a replacement refrigerant for R-22. However, R-22, R-410A and the R-407 refrigerants all have a high global warming potential (GWP, also known as greenhouse warming potential).

[0010] 1,1,1,2-tetrafluoroethane (refrigerant R-134a) was introduced as a replacement refrigerant for R-12. However, despite having no significant ozone depletion potential, R-134a has a GWP of 1300. It would be desirable to find replacements for R-134a that have a lower GWP.

[0011] R-152a (1,1-difluoroethane) has been identified as an alternative to R-134a. It is somewhat more efficient than R-134a and has a greenhouse warming potential of 120. However the flammability of R-152a is judged too high, for example to permit its safe use in mobile air conditioning systems. In particular it is believed that its lower flammable limit in air is too low, its flame speeds are too high, and its ignition energy is too low.

[0012] Thus there is a need to provide alternative refrigerants having improved properties such as low flammability. Fluorocarbon combustion chemistry is complex and unpredictable. It is not always the case that mixing a non-flammable fluorocarbon with a flammable fluorocarbon reduces the flammability of the fluid or reduces the range of flammable compositions in air. For example, the inventors have found that if non-flammable R-134a is mixed with flammable R-152a, the lower flammable limit of the mixture alters in a manner which is not predictable. The situation is rendered even more complex and less predictable if ternary or quaternary compositions are considered.

[0013] There is also a need to provide alternative refrigerants that may be used in existing devices such as refrigeration devices with little or no modification.

[0014] R-1234yf (2,3,3,3-tetrafluoropropene) has been identified as a candidate alternative refrigerant to replace R-134a in certain applications, notably the mobile air conditioning or heat pumping applications. Its GWP is about 4. R-1234yf is flammable but its flammability characteristics are generally regarded as acceptable for some applications including mobile air conditioning or heat pumping. In particular, when compared with R-152a, its lower flammable limit is higher, its minimum ignition energy is higher and the flame speed in air is significantly lower than that of R-152a.

[0015] The environmental impact of operating an air conditioning or refrigeration system, in terms of the emissions of greenhouse gases, should be considered with reference not only to the so-called "direct" GWP of the refrigerant, but also with reference to the so-called "indirect" emissions, meaning those emissions of carbon dioxide resulting from consumption of electricity or fuel to operate the system. Several metrics of this total GWP impact have been developed, including those known as Total Equivalent Warming Impact (TEWI) analysis, or Life-Cycle Carbon Production (LCCP) analysis. Both of these measures include estimation of the effect of refrigerant GWP and energy efficiency on overall warming impact.

[0016] The energy efficiency and refrigeration capacity of R-1234yf have been found to be significantly lower than those of R-134a and in addition the fluid has been found to exhibit increased pressure drop in system pipework and heat exchangers. A consequence of this is that to use R-1234yf and achieve energy efficiency and cooling performance equivalent to R-134a, increased complexity of equipment and increased size of pipework is required, leading to an increase in indirect emissions associated with equipment. Furthermore, the production of R-1234yf is thought to be more complex and less efficient in its use of raw materials (fluorinated and chlorinated) than R-134a. So the adoption of R-1234yf to replace R-134a will consume more raw materials and result in more indirect emissions of greenhouse gases than does R-134a.

[0017] Some existing technologies designed for R-134a may not be able to accept even the reduced flammability of some heat transfer compositions (any composition having a GWP of less than 150 is believed to be flammable to some extent).

[0018] A principal object of the present invention is therefore to provide a heat transfer composition which is usable in its own right or suitable as a replacement for existing refrigeration usages which should have a reduced GWP, yet have a capacity and energy efficiency (which may be conveniently expressed as the "Coefficient of Performance") ideally within 10% of the values, for example of those attained using existing refrigerants (e.g. R-134a, R-152a, R-1234yf, R-22, R-410A, R-407A, R-407B, R-407C, R507 and R-404a), and preferably within less than 10% (e.g. about 5%) of these values. It is known in the art that differences of this order between fluids are usually resolvable by redesign of equipment and system operational features. The composition should also ideally have reduced toxicity and acceptable flammability.

[0019] The subject invention addresses the above deficiencies by the provision of a heat transfer composition comprising:

(i) *trans*-1,3,3,3-tetrafluoropropene (R-1234ze(E));

(ii) a second component selected from difluoromethane (R-32), propene (R-1270), propane (R290) and mixtures thereof;

(iii) a third component selected from pentafluoroethane (R-125), 1,1,1,2-tetrafluoroethane (R-134a), and mixtures thereof; and optionally

(iv) a fourth component selected from fluoroethane (R-161), 1,1-difluoroethane (R-152a) and mixtures thereof

[0020] These will be referred to hereinafter as the compositions of the invention, unless otherwise stated.

[0021] All of the chemicals herein described are commercially available. For example, the fluorochemicals may be obtained from Apollo Scientific (UK).

[0022] Typically, the compositions of the invention comprise up to about 60 or 70 % by weight R-1234ze(E), such as from about 5 to about 50 %, for example from about 10 to about 40 %. Conveniently, the compositions of the invention comprise up to about 50 % by weight of the second component, such as from about 10 to about 40 %, for example from about 15 to about 35 %.

[0023] Typically, the compositions of the invention contain from about 10 to about 80 % by weight of the third component, preferably from about 15 to about 70 %, such as from about 20 to about 60 %.

[0024] Conveniently, the compositions of the invention comprise from about 0 to about 15 % (e.g. about 5 to about 15 %) by weight of the fourth component.

[0025] In one embodiment, the compositions of the invention comprise from about 5 to about 60 % by weight of the fourth component.

[0026] As used herein, all % amounts mentioned in compositions herein, including in the paragraphs, are by weight based on the total weight of the compositions, unless otherwise stated.

[0027] The components and the amounts of the components of the compositions of the invention typically are chosen such that the flammability of both liquid and vapour phases is reduced relative to the pure flammable component, or rendered completely non-flammable.

[0028] In an embodiment, the second component is R-32.

[0029] In one aspect, the third component comprises a mixture of R-125 and R-134a.

[0030] In a preferred embodiment, the compositions of the invention comprise R-1234ze(E), R-32, R-125 and R-134a.

[0031] An advantageous composition of the invention comprises from about 5 to about 40 % by weight of R-1234ze(E), from about 20 to about 35 % by weight R-32, from about 15 to about 30 % by weight R-125, and from about 12 to about 50 % by weight R-134a.

[0032] In one embodiment, the compositions of the invention contain from about 10 to about 50 % by weight R-1234ze(E), from about 22 to about 40 % by weight R-32, from about 10 to about 30 % by weight R-125, and from about 15 to about 30 % by weight R-134a.

[0033] A preferred group of compositions of the invention contain from about 17 to about 46 % by weight R-1234ze(E), from about 26 to about 40 % by weight R-32, from about 10 to about 18 % by weight R-125, and from about 15 to about 30 % by weight R-134a.

[0034] Further advantageous compositions of the invention contain from about 14 to about 40 % by weight R-1234ze(E), from about 22 to about 38 % by weight R-32, from about 18 to about 28 % by weight R-125, and from about 15 to about 30 % by weight R-134a.

[0035] A preferred composition of the invention consists essentially of about 20 % by weight R-1234ze(E), about 30 % by weight R-32, about 25 % by weight R-125, and about 25 % by weight R-134a.

[0036] In one embodiment, the invention excludes compositions that comprise or consist of approximately 1 to 16 % by weight (e.g. approximately 3 to 8 %) R-1234ze, approximately 8 to 20 % by weight R-32 (e.g. approximately 12 to 18 %), approximately 8 to 20 % by weight R-125 (e.g. approximately 8 to 12 %) and approximately 60 to 72 % by weight R-134a (e.g. about 70 to 75 %). In a further embodiment, the invention excludes compositions that comprise or consist of approximately 6 % by weight R-1234ze, approximately 14 % by weight R-32, approximately 14 % by weight R-125 and approximately 66 % by weight R-134a.

[0037] In one embodiment, the compositions of the invention contain R-161 as a fourth component. Typically, the R-161 is present in such compositions in an amount of from about 10 to about 60 % by weight. In a preferred aspect, the R-161 is present in an amount of from 10 to about 30 % by weight, for example from about 10 to about 20 % by weight.

[0038] A preferred composition of the invention comprises R-1234ze(E), R-32, R-161 and R-134a.

[0039] An advantageous composition of the invention comprises from about 5 to about 60 % by weight R-1234ze(E), from about 20 to about 50 % by weight R-32, from about 10 to about 60 % by weight R-161, and from about 10 to about 40 % by weight R-134a.

[0040] A preferred composition of the invention of comprises from about 10 to about 60 % by weight R-1234ze(E), from about 20 to about 50 % by weight R-32, from about 10 to about 40 % by weight R-161, and from about 10 to about 30 % by weight R-134a.

[0041] A further preferred composition of the invention comprises from about 30 to about 60 % by weight R-1234ze(E), from about 20 to about 50 % by weight R-32, from about 10 to about 30 % by weight R-161, and from about 10 to about 25 % by weight R-134a.

[0042] Another advantageous composition of the invention comprises from about 40 to about 60 % by weight R-1234ze(E), from about 20 to about 50 % by weight R-32, from about 10 to about 20 % by weight R-161, and from about 10 to about 25 % by weight R-134a.

[0043] A preferred composition of the invention comprises R-1234ze(E), R-32, R-161 and R-125.

[0044] An advantageous composition of the invention comprises from about 5 to about 70 % by weight R-1234ze(E), from about 15 to about 50 % by weight R-32, from about 10 to about 40 % by weight R-161, and from about 10 to about 40 % by weight R-125.

[0045] A preferred composition of the invention of comprises from about 10 to about 65 % by weight R-1234ze(E), from about 16 to about 40 % by weight R-32, from about 10 to about 30 % by weight R-161, and from about 10 to about 25 % by weight R-125.

[0046] A further preferred composition of the invention comprises from about 25 to about 60 % by weight R-1234ze(E), from about 20 to about 40 % by weight R-32, from about 10 to about 20 % by weight R-161, and from about 10 to about 25 % by weight R-125.

[0047] Another preferred composition of the invention comprises from about 20 to about 55 % by weight R-1234ze(E), from about 16 to about 35 % by weight R-32, from about 20 to about 30 % by weight R-161, and from about 10 to about 25 % by weight R-125.

[0048] In one aspect, the compositions of the invention consist essentially of any of the stated components, in any of the stated amounts.

[0049] By the term "consist essentially of', we mean that the compositions of the invention contain substantially no other components, particularly no further (hydro)(fluoro)compounds (e.g. (hydro)(fluoro)alkanes or (hydro)(fluoro)alkenes) known to be used in heat transfer compositions. We include the term "consist of" within the meaning of "consist essentially of".

[0050] For the avoidance of doubt, any of the compositions of the invention described herein, including those with specifically defined amounts of components, may consist essentially of (or consist of) the components defined in those compositions.

[0051] Compositions according to the invention conveniently comprise substantially no R-1225 (pentafluoropropene), conveniently substantially no R-1225ye (1,2,3,3,3-pentafluoropropene) or R-1225zc (1,1,3,3,3-pentafluoropropene), which compounds may have associated toxicity issues.

[0052] By "substantially no", we include the meaning that the compositions of the invention contain 0.5% by weight or less of the stated component, preferably 0.1% or less, based on the total weight of the composition.

[0053] The compositions of the invention may contain substantially no:

(i) 2,3,3,3-tetrafluoropropene (R-1234yf),
(ii) *cis*-1,3,3,3-tetrafluoropropene (R-1234ze(Z)), and/or
(iii) 3,3,3-tetrafluoropropene (R-1243zf).

[0054] The compositions of the invention have zero ozone depletion potential.

[0055] Surprisingly, it has been found that the compositions of the invention deliver acceptable properties for use in air conditioning, heat pump and low and medium temperature refrigeration systems as alternatives to existing refrigerants such as R-22, R-410A, R-407A, R-407B, R-407C, R507 and R-404a, while reducing GWP and without resulting in high flammability hazard.

[0056] Unless otherwise stated, as used herein "low temperature refrigeration" means refrigeration having an evaporation temperature of from about -50 to about -20 °C. "Medium temperature refrigeration" means refrigeration having an evaporation temperature of from about -20 to about 0 °C.

[0057] Unless otherwise stated, IPCC (Intergovernmental Panel on Climate Change) TAR (Third Assessment Report) values of GWP have been used herein. The GWP of selected existing refrigerant mixtures on this basis is as follows:

R-407A	1990
R-407B	2695
R-407C	1653
R-404A	3784
R507	3850

[0058] In an embodiment, the compositions of the invention have a GWP less than R-22, R-410A, R-407A, R-407B, R-407C, R507 or R-404a. Conveniently, the GWP of the compositions of the invention is less than about 2800 For instance, the GWP may be less than 2800, 2500, 2300, 2100, 2000, 1900, 1800, 1700, 1500 or 1400.

[0059] Preferably, the compositions of the invention have a GWP that is less than 1500, preferably less than 1400, more preferably less than 1300, 1000, 900 or 700 or 500.

[0060] Advantageously, the compositions are of reduced flammability hazard when compared to the individual flammable components of the compositions, e.g. R-32, propene or propane.

[0061] In one aspect, the compositions have one or more of (a) a higher lower flammable limit; (b) a higher ignition energy; or (c) a lower flame velocity compared to R-32, propene, propane or R-1234yf. In a preferred embodiment, the compositions of the invention are non-flammable (or inflammable).

[0062] Flammability may be determined in accordance with ASHRAE Standard 34 incorporating the ASTM Standard E-681 with test methodology as per Addendum 34p dated 2004, the entire content of which is incorporated herein by reference.

[0063] In some applications it may not be necessary for the formulation to be classed as non-flammable by the ASHRAE 34 methodology; it is possible to develop fluids whose flammability limits will be sufficiently reduced in air to render them safe for use in the application, for example if it is physically not possible to make a flammable mixture by leaking the refrigeration equipment charge into the surrounds. We have found that the effect of adding R-1234ze and R-134a/R-125 to flammable refrigerants R-32, propene and/or propane is to modify the flammability in mixtures with air in this manner.

[0064] Temperature glide, which can be thought of as the difference between bubble point and dew point temperatures of a zeotropic (non-azeotropic) mixture at constant pressure, is a characteristic of a refrigerant; if it is desired to replace a fluid with a mixture then it is often preferable to have similar or reduced glide in the alternative fluid. In an embodiment, the compositions of the invention are zeotropic.

[0065] Conveniently, the temperature glide (in the evaporator) of the compositions of the invention is less than about 10K, preferably less than about 5K.

[0066] Advantageously, the volumetric refrigeration capacity of the compositions of the invention is at least 85% of the existing refrigerant fluid it is replacing, preferably at least 90% or even at least 95%.

[0067] The compositions of the invention typically have a volumetric refrigeration capacity that is at least 90% of that of R-407C in medium temperature and/or low temperature application Preferably, the compositions of the invention have a volumetric refrigeration capacity that is at least 95% of that of R-407C, for example from about 95% to about 120% of that of R-1234yf.

[0068] In one embodiment, the cycle efficiency (Coefficient of Performance, COP) of the compositions of the invention is within about 5% or even better than the existing refrigerant fluid it is replacing

[0069] Conveniently, the compressor discharge temperature of the compositions of the invention is within about 15K of the existing refrigerant fluid it is replacing, preferably about 10K or even about 5K.

[0070] The compositions of the invention preferably have energy efficiency at least 95% (preferably at least 98%) of R-407C, R-407A or R-404A under equivalent conditions, while having reduced or equivalent pressure drop characteristic and cooling capacity at 95% or higher of R-407C, R-407A or R-404A values. Advantageously the compositions have higher energy efficiency and lower pressure drop characteristics than R-407C, R-407A or R-404A under equivalent conditions. The compositions also advantageously have better energy efficiency and pressure drop characteristics than R-407C, R-407A or R-404A alone.

[0071] The heat transfer compositions of the invention are suitable for use in existing designs of equipment, and are compatible with all classes of lubricant currently used with established HFC refrigerants. They may be optionally stabilized or compatibilized with mineral oils by the use of appropriate additives.

[0072] Preferably, when used in heat transfer equipment, the composition of the invention is combined with a lubricant.

[0073] Conveniently, the lubricant is selected from the group consisting of mineral oil, silicone oil, polyalkyl benzenes (PABs), polyol esters (POEs), polyalkylene glycols (PAGs), polyalkylene glycol esters (PAG esters), polyvinyl ethers (PVEs), poly (alpha-olefins) and combinations thereof.

[0074] Advantageously, the lubricant further comprises a stabiliser.

[0075] Preferably, the stabiliser is selected from the group consisting of diene-based compounds, phosphates, phenol compounds and epoxides, and mixtures thereof.

[0076] Conveniently, the composition of the invention may be combined with a flame retardant.

[0077] Advantageously, the additional flame retardant is selected from the group consisting of tri-(2-chloroethyl)-phosphate, (chloropropyl) phosphate, tri-(2,3-dibromopropyl)-phosphate, tri-(1,3-dichloropropyl)-phosphate, diammonium phosphate, various halogenated aromatic compounds, antimony oxide, aluminium trihydrate, polyvinyl chloride, a fluorinated iodocarbon, a fluorinated bromocarbon, trifluoro iodomethane, perfluoroalkyl amines, bromo-fluoroalkyl amines and mixtures thereof.

[0078] Preferably, the heat transfer composition is a refrigerant composition.

[0079] In one embodiment, the invention provides a heat transfer device comprising a composition of the invention.

[0080] Preferably, the heat transfer device is a refrigeration device.

[0081] Conveniently, the heat transfer device is selected from group consisting of automotive air conditioning systems, residential air conditioning systems, commercial air conditioning systems, residential refrigerator systems, residential freezer systems, commercial refrigerator systems, commercial freezer systems, chiller air conditioning systems, chiller refrigeration systems, and commercial or residential heat pump systems. Preferably, the heat transfer device is a refrigeration device or an air-conditioning system.

[0082] Advantageously, the heat transfer device contains a centrifugal-type compressor.

[0083] The invention also provides the use of a composition of the invention in a heat transfer device as herein described.

[0084] According to a further aspect of the invention, there is provided a blowing agent comprising a composition of the invention.

[0085] According to another aspect of the invention, there is provided a foamable composition comprising one or more components capable of forming foam and a composition of the invention.

[0086] Preferably, the one or more components capable of forming foam are selected from polyurethanes, thermoplastic polymers and resins, such as polystyrene, and epoxy resins.

[0087] According to a further aspect of the invention, there is provided a foam obtainable from the foamable composition of the invention.

[0088] Preferably the foam comprises a composition of the invention.

[0089] According to another aspect of the invention, there is provided a sprayable composition comprising a material to be sprayed and a propellant comprising a composition of the invention.

[0090] According to a further aspect of the invention, there is provided a method for cooling an article which comprises condensing a composition of the invention and thereafter evaporating said composition in the vicinity of the article to be cooled.

[0091] According to another aspect of the invention, there is provided a method for heating an article which comprises condensing a composition of the invention in the vicinity of the article to be heated and thereafter evaporating said composition.

[0092] According to a further aspect of the invention, there is provided a method for extracting a substance from biomass comprising contacting the biomass with a solvent comprising a composition of the invention, and separating the substance from the solvent.

[0093] According to another aspect of the invention, there is provided a method of cleaning an article comprising contacting the article with a solvent comprising a composition of the invention.

[0094] According to a further aspect of the invention, there is provided a method for extracting a material from an aqueous solution comprising contacting the aqueous solution with a solvent comprising a composition of the invention, and separating the material from the solvent.

[0095] According to another aspect of the invention, there is provided a method for extracting a material from a particulate solid matrix comprising contacting the particulate solid matrix with a solvent comprising a composition of the invention, and separating the material from the solvent.

[0096] According to a further aspect of the invention, there is provided a mechanical power generation device containing a composition of the invention.

[0097] Preferably, the mechanical power generation device is adapted to use a Rankine Cycle or modification thereof to generate work from heat.

[0098] According to another aspect of the invention, there is provided a method of retrofitting a heat transfer device comprising the step of removing an existing heat transfer fluid, and introducing a composition of the invention. Preferably, the heat transfer device is a refrigeration device or (a static) air conditioning system. Advantageously, the method further comprises the step of obtaining an allocation of greenhouse gas (e.g. carbon dioxide) emission credit.

[0099] In accordance with the retrofitting method described above, an existing heat transfer fluid can be fully removed from the heat transfer device before introducing a composition of the invention. An existing heat transfer fluid can also be partially removed from a heat transfer device, followed by introducing a composition of the invention.

[0100] In another embodiment wherein the existing heat transfer fluid is R-134a, and the composition of the invention contains R134a, R-1234ze(E), the second component, optionally R-125, and optionally the fourth component (and optional components such as a lubricant, a stabiliser or an additional flame retardant), R-1234ze(E), the second component, any R-125 and/or the fourth component can be added to the R-134a in the heat transfer device, thereby forming the compositions of the invention, and the heat transfer device of the invention, *in situ.* Some of the existing R-134a may be removed from the heat transfer device prior to adding the R-1234ze(E), the second component, etc, to facilitate providing the components of the compositions of the invention in the desired proportions.

[0101] Thus, the invention provides a method for preparing a composition and/or heat transfer device of the invention comprising introducing R-1234ze(E), a second component selected from R-32, propene and propane, optionally R-125, and optionally a fourth component selected from R-161, R-152a and mixtures thereof, and optional components such as a lubricant, a stabiliser or an additional flame retardant, into a heat transfer device containing an existing heat transfer fluid which is R-134a. Optionally, at least some of the R-134a is removed from the heat transfer device before introducing the R-1234ze(E), the second component, etc.

[0102] Of course, the compositions of the invention may also be prepared simply by mixing the R-1234ze(E), the second and third components, and optionally the fourth component (and optional components such as a lubricant, a stabiliser or an additional flame retardant) in the desired proportions. The compositions can then be added to a heat transfer device (or used in any other way as defined herein) that does not contain R-134a or any other existing heat transfer fluid, such as a device from which R-134a or any other existing heat transfer fluid have been removed.

[0103] In a further aspect of the invention, there is provided a method for reducing the environmental impact arising from operation of a product comprising an existing compound or composition, the method comprising replacing at least partially the existing compound or composition with a composition of the invention. Preferably, this method comprises the step of obtaining an allocation of greenhouse gas emission credit.

[0104] By environmental impact we include the generation and emission of greenhouse warming gases through operation of the product.

[0105] As mentioned above, this environmental impact can be considered as including not only those emissions of compounds or compositions having a significant environmental impact from leakage or other losses, but also including the emission of carbon dioxide arising from the energy consumed by the device over its working life. Such environmental impact may be quantified by the measure known as Total Equivalent Warming Impact (TEWI). This measure has been used in quantification of the environmental impact of certain stationary refrigeration and air conditioning equipment, including for example supermarket refrigeration systems (see, for example, http://en.wikipedia.org/wiki/Total equivalent warming impact).

[0106] The environmental impact may further be considered as including the emissions of greenhouse gases arising from the synthesis and manufacture of the compounds or compositions. In this case the manufacturing emissions are added to the energy consumption and direct loss effects to yield the measure known as Life-Cycle Carbon Production (LCCP, see for example http://www.sae.org/events/aars/presentations/2007papasavva.pdf). The use of LCCP is common in assessing environmental impact of automotive air conditioning systems.

[0107] Emission credit(s) are awarded for reducing pollutant emissions that contribute to global warming and may, for example, be banked, traded or sold. They are conventionally expressed in the equivalent amount of carbon dioxide. Thus if the emission of 1 kg of R-134a is avoided then an emission credit of 1x1300 = 1300 kg CO_2 equivalent may be awarded.

[0108] In another embodiment of the invention, there is provided a method for generating greenhouse gas emission credit(s) comprising (i) replacing an existing compound or composition with a composition of the invention, wherein the composition of the invention has a lower GWP than the existing compound or composition; and (ii) obtaining greenhouse gas emission credit for said replacing step.

[0109] In a preferred embodiment, the use of the composition of the invention results in the equipment having a lower Total Equivalent Warming Impact, and/or a lower Life-Cycle Carbon Production than that which would be attained by use of the existing compound or composition.

[0110] These methods may be carried out on any suitable product, for example in the fields of air-conditioning, refrigeration (e.g. low and medium temperature refrigeration), heat transfer, blowing agents, aerosols or sprayable propellants, gaseous dielectrics, cryosurgery, veterinary procedures, dental procedures, fire extinguishing, flame suppression, solvents (e.g. carriers for flavorings and fragrances), cleaners, air horns, pellet guns, topical anesthetics, and expansion applications. Preferably, the field is air-conditioning or refrigeration.

[0111] Examples of suitable products include a heat transfer devices, blowing agents, foamable compositions, sprayable compositions, solvents and mechanical power generation devices. In a preferred embodiment, the product is a heat transfer device, such as a refrigeration device or an air-conditioning unit.

[0112] The existing compound or composition has an environmental impact as measured by GWP and/or TEWI and/or LCCP that is higher than the composition of the invention which replaces it. The existing compound or composition may comprise a fluorocarbon compound, such as a perfluoro-, hydrofluoro-, chlorofluoro- or hydrochlorofluoro-carbon compound or it may comprise a fluorinated olefin

[0113] Preferably, the existing compound or composition is a heat transfer compound or composition such as a refrigerant. Examples of refrigerants that may be replaced include R-134a, R-152a, R-1234yf, R-410A, R-407A, R-407B, R-407C, R-407D, R-407F, R507, R-22 and R-404A. The compositions of the invention are particularly suited as replacements for R-22, R-404A, R-407A, R-407B, R-407C or R-410A.

[0114] Any amount of the existing compound or composition may be replaced so as to reduce the environmental impact. This may depend on the environmental impact of the existing compound or composition being replaced and the environmental impact of the replacement composition of the invention. Preferably, the existing compound or composition in the product is fully replaced by the composition of the invention.

[0115] The invention is illustrated by the following non-limiting examples.

<u>Examples</u>

Example 1

[0116] The performance of a composition comprising R-32 30%, R-125 25%, R-134a 25% and R-1234ze(E) 20% (weight basis) was modelled for medium temperature and low temperature refrigeration applications ("Blend A"). The cycle conditions chosen were:

(a) Medium temperature application

[0117] Mean condensing temperature 40°C
[0118] Mean evaporating temperature -10°C
[0119] Suction line return temperature 15°C
[0120] Subcooling 5K
[0121] Evaporator superheat 5K
[0122] Compressor (isentropic) efficiency 65%
[0123] Cooling duty 10 kW
[0124] Suction line pipe diameter 22.7mm

(b) Low temperature application

[0125] Mean condensing temperature 40°C
[0126] Mean evaporating temperature -35°C
[0127] Suction line return temperature -10°C
[0128] Subcooling 5K
[0129] Evaporator superheat 5K
[0130] Compressor (isentropic) efficiency 65%
[0131] Cooling duty 10 kW
[0132] Suction line pipe diameter 22.7mm
[0133] Temperature for initiation of liquid injection to control compressor temperature: 130°C
[0134] These conditions were chosen as representative of those found in a supermarket refrigeration system with air

cooled condenser in European summer conditions. The performance of Blend A is shown in Tables 1 and 2 with the estimated performance of the commercially available and commonly used refrigerants R-407C, R-407A and R-404A indicated for comparison. The capacity, energy efficiency (as Coefficient of Performance) and suction line pressure drop are compared to a baseline of R-407C, as this refrigerant has the highest theoretical COP and lowest direct GWP of the established refrigerants.

[0135] It can be seen that this composition has comparable energy efficiency than R-407C, better cooling capacity than R-407C, lower pressure drop and essentially comparable discharge temperature. Furthermore the capacity and energy efficiency of the composition is superior to R-404A. The composition has lower GWP than R-407C and so the total environmental warming impact (TEWI) of a system using this fluid will be lower than that achievable using R-407C or R-404A.

[0136] The fluid further exhibits close match of performance parameters to R-407A, which is today finding increasing utility as a refrigerant to replace R-404A. The operating pressures are very similar to those found with R-407A, so replacement of R-407A with this composition would require little or no change to a refrigeration system control scheme.

[0137] Furthermore the composition is believed to be essentially non-flammable.

Table 1

Results - Medium temperature		**R407C**	**R407A**	**R404A**	**Blend A**
GWP		1774	2107	3922	1436
Fluorine ratio for blend					0.64
Fluorine ratio for vapour					0.62
COP		2.46	2.42	2.25	2.46
		100.0%	98.2%	91.3%	99.8%
Volumetric capacity	kJ/m^3	2003	2083	2044	2143
		100.0%	104.0%	102.0%	107.0%
Refrigeration effect	kJ/kg	161.9	148.7	113.9	166.2
Pressure ratio		4.71	4.63	4.20	4.65
Evaporator mass flow	kg/hr	222.4	242.2	316.0	216.6
Liquid injection mass flow	kg/hr	0.0	0.0	0.0	0.0
Compressor discharge temperature	°C	101.0	97.5	83.9	102.6
Evaporator inlet pressure	bar	3.49	3.76	4.34	3.76
Condenser inlet pressure	bar	16.4	17.4	18.2	17.5
Evaporator mean temperature	°C	-10.0	-10.0	-10.0	-10.0
Evaporator glide (out-in)	K	4.6	4.2	0.4	5.4
Compressor suction pressure	bar	3.49	3.76	4.34	3.76
Compressor discharge pressure	bar	16.4	17.4	18.2	17.5
Suction line pressure drop	Pa/m	520	536	665	477
Pressure drop relative to reference					91.8%
Condenser mean temperature	°C	40.0	40.0	40.0	40.0
Condenser glide (in-out)	K	5.0	4.4	0.3	5.6

Table 2

Results - Low temperature application		**R407C**	**R407A**	**R404A**	**Blend A**
GWP					1436
Fluorine ratio for blend					0.64
Fluorine ratio for vapour					0.62
COP		1.32	1.29	1.17	1.32
		100.0%	97.7%	88.6%	100.0%
Volumetric capacity	kJ/m^3	556	583	610	610

(continued)

Results - Low temperature application		R407C	R407A	R404A	Blend A
		100.0%	104.9%	109.7%	109.7%
Refrigeration effect	kJ/kg	147.6	134.6	99.3	152.0
Pressure ratio		13.58	13.15	11.02	13.20
Evaporator mass flow	kg/hr	243.9	267.5	362.7	236.8
Liquid injection mass flow	kg/hr	0.0	0.0	0.0	2.0
Compressor discharge temperature	°C	129.5	123.4	99.7	130.0
Evaporator inlet pressure	bar	1.21	1.32	1.65	1.32
Condenser inlet pressure	bar	16.4	17.4	18.2	17.5
Evaporator mean temperature	°C	-35.0	-35.0	-35.0	-35.0
Evaporator glide (out-in)	K	4.2	3.9	0.5	5.0
Compressor suction pressure	bar	1.21	1.32	1.65	1.32
Compressor discharge pressure	bar	16.4	17.4	18.2	17.5
Suction line pressure drop	Pa/m	1630	1674	2085	1469
Pressure drop relative to reference		100.0%	102.7%	127.9%	90.2%
Condenser mean temperature	°C	40.0	40.0	40.0	40.0
Condenser glide (in-out)	K	5.0	4.4	0.3	5.6

Example 2

[0138] The performance was modelled for further compositions of the invention comprising: R-32 in range 20-35% w/w; R-125 in range 15-30% w/w; R-134a in range 15-50% w/w and R-1234ze being the balance, using the same conditions as in Table 1 and with R-407C as the reference fluid for comparison of capacity, energy efficiency and suction line pressure drop. The compositions of the invention give acceptable or improved performance with lower GWP and lower overall TEWI than R-407A, R-407C or R-404A.

Example 3

[0139] The performance was modelled for further compositions of the invention as explained in more detail below. The derivation of the model used is as follows.

[0140] The physical properties of R-1234ze(E) required to model refrigeration cycle performance, namely critical point, vapour pressure, liquid and vapour enthalpy, liquid and vapour density and heat capacities of vapour and liquid were accurately determined by experimental methods over the pressure range 0-200 bar and temperature range -40 to 200 °C, and the resulting data used to generate Helmholtz free energy equation of state models of the Span-Wagner type for the fluid in the NIST REFPROP Version 8.0 software, which is more fully described in the user guide www.nist.gov/srd/PDFfiles/REFPROP8.PDF, and is incorporated herein by reference. The variation of ideal gas enthalpy of both fluids with temperature was estimated using molecular modelling software Hyperchem v7.5 (which is incorporated herein by reference) and the resulting ideal gas enthalpy function was used in the regression of the equation of state for these fluids. The predictions of this model R1234ze(E) were compared to the predictions yielded by use of the standard files for R1234ze(E) included in REFPROP Version 9.0. It was found that close agreement was obtained for each fluid's properties.

[0141] The vapour liquid equilibrium behaviour of R-1234ze(E) was studied in a series of binary pairs with carbon dioxide, R-32, R-125, R-134a, R-152a, R-161, propane and propylene over the temperature range -40 to +60°C, which encompasses the practical operating range of most refrigeration and air conditioning systems. The composition was varied over the full compositional space for each binary in the experimental programme, mixture parameters for each binary pair were regressed to the experimentally obtained data and the parameters were also incorporated into the REFPROP software model. The academic literature was next searched for data on the vapour liquid equilibrium behaviour of carbon dioxide with the hydrofluorocarbons R-32, R-125, R-152a, R-161 and R-152a. The VLE data obtained from sources (referenced in the article Applications of the simple multi-fluid model to correlations of the vapour-liquid equilibrium of refrigerant mixtures containing carbon dioxide, by R. Akasaka, Journal of Thermal Science and Technology, 159-168, 4, 1, 2009) were then used to generate mixing parameters for the relevant binary mixtures and these were then also incorporated into the REFPROP model. The standard REFPROP mixing parameters for carbon dioxide with propane and propylene were also incorporated to this model.

[0142] The resulting software model was used to compare the performance of selected fluids of the invention with R-407A in a low temperature supermarket refrigeration cycle simulation. The use of liquid injection to control compressor discharge temperature was included as a feature of this cycle. Liquid injection is recommended by compressor manufacturers and refrigerant suppliers if R-407A or R-22 is to be used in such applications.

[0143] The quantity of liquid required to maintain the compressor discharge gas at or below the desired maximum temperature was estimated by assuming that the liquid to be injected to the compressor was at the same thermodynamic state as the liquid leaving the condenser and by then performing a heat balance on the machine. The total compression work required was then derived from knowledge of the total mass flow through the compressor and the specified outlet and inlet refrigerant states.

[0144] The comparison of fluids was carried out assuming equivalent mean evaporating and condensing temperatures for the refrigerants, and fixed degrees of subcooling and evaporator superheat. Fixed pressure drops were assumed for R-407A in the evaporator, condenser and compressor suction gas line. The pressure drops for the fluids of the invention were then estimated for the same cycle by estimating the achieved compressor throughput with the fluid, deriving the mass flowrate of the refrigerant in the line and then calculating the pressure drop by comparison with the assumed pressure drop for the reference refrigerant.

[0145] To calculate the achieved compressor throughput for R-407A and the fluids of the invention, the compressor was assumed to be a piston type machine running at fixed speed and known piston displacement with an effective clearance volume ratio of 3% and an average adiabatic (isentropic) efficiency of 65%, operating at a constant compressor suction gas temperature of 20°C. The volumetric efficiency of the compressor was then estimated for each refrigerant from the pressure ratio developed over the compressor and the thermodynamic properties of the gas using the standard relationship for estimation of volumetric efficiency in such a machine.

[0146] The cycle conditions used were:

Mean condenser temperature	°C	40
Mean evaporator temperature	°C	-30
Condenser subcooling	K	5
Evaporator superheat	K	5
Evaporator pressure drop	bar	0.10
Suction line pressure drop	bar	0.20
Condenser pressure drop	bar	0.10
Compressor displacement	m^3/hr	18
Liquid injection temperature	°C	130
Compressor suction temperature	°C	20
Compressor clearance volume ratio		3%
Compressor isentropic efficiency		65%

R-32/R-125/R-134a/R-1234ze(E) Blends

[0147] Using the model set out above, the performance of selected compositions of the invention containing 16 to 40 % by weight R-32, 10 to 24 % by weight R-125, 16 to 28 % by weight R-134a and 8 to 56 % by weight R-1234ze(E) is shown in Tables 3 to 34 below.

[0148] Modelled performance of R-404A, R-407C, R-407D and R-407F is shown in Comparative Table X immediately below.

Table X: Comparative Performance Data for R-407 Series

		R407A	R404A	R407C	R407D	R407F
COP		1.20	1.05	1.24	1.25	1.23
COP relative to Reference		100.0%	87.5%	103.1%	104.4%	102.3%
Achieved cooling capacity	kW	2.49	2.60	2.38	1.96	2.70
Capacity relative to reference		100.0%	104.6%	95.6%	79.1%	108.8%
Suction pressure drop relative to reference		100.0%	155.7%	85.8%	71.9%	95.5%
Pressure ratio		12.34	11.07	12.55	13.30	11.99

(continued)

		R407A	R404A	R407C	R407D	R407F
Mass flow through evaporator	kg/hr	65.2	91.8	56.9	48.0	63.1
Liquid injection mass flow	kg/hr	6.7	1.5	6.9	4.8	8.8
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	2.7	-1.4	3.0	2.2	3.0
Compressor suction pressure	bar	1.42	1.65	1.31	1.06	1.52
Compressor discharge pressure	bar	17.5	18.3	16.5	14.1	18.3
Condenser glide (in-out)	K	4.6	0.7	5.2	5.0	4.6

[0149] It has been found unexpectedly that it is possible to achieve capacities comparable to those of R-404A or R-407F whilst operating at lower condensing pressures than either R-404A or R-407F and at comparable or lower pressure ratios than those achieved with R-407A and R-407F. In fact some compositions of the invention offer pressure ratios comparable to R-404A.

[0150] The incorporation of R-1234ze(E) to the fluid further allows a reduction of GWP of the mixture compared to the GWP of any of the R-407 fluids and compared to R-404A. R1234ze(E) is unsuitable in its own right for this application given its (relatively) high boiling point of -19 °C. Surprisingly, therefore, it has proved possible to use significant quantities of R-1234ze(E) in the compositions of the invention without detrimental effect on the operating pressures of the fluids.

[0151] Therefore, the fluids of the invention offer highly unexpected significant improved environmental performance when compared to comparable known HFC refrigerants (e.g. R-407A, R407F and R-404a) on the grounds of:

- Improved energy efficiency at comparable capacity
- Improved volumetric efficiency and reduced pressure ratio
- Reduced potential for leakage of refrigerant from the high pressure lines of the system
- Reduced direct GWP of the refrigerant

[0152] The currently most preferred fluids of the invention are those whose cooling capacity matches that of R-404A, whose condensing pressure is lower than that of R-404A and whose energy efficiency is higher than that of R-407A or R-407F when compared in this manner.

[0153] It should be noted that at evaporation temperatures typical of medium/high supermarket temperature refrigeration systems the above-stated performance gains are all maintained and thus the fluids are of applicability in all commercial refrigeration applications. In fact the performance of the fluids of the invention compared to R-404A is further improved at higher evaporation temperatures. In particular the COP of the fluids of the invention is found to be similar or better even than that of R-407C. The fluids of the invention can thus find application not only for low stage refrigeration but also for medium high stage refrigeration and air conditioning applications.

[0154] It has also been found possible with the compositions of the invention to exceed the performance of R-407D, a fluid which is used for certain refrigerated transport applications as an alternative to the CFC refrigerant R-500, for example if R-32 content in the range 16-20% is used. It is evident from the performance comparison that the capacity and COP of R-407D can be matched or bettered whilst maintaining compressor discharge pressure at or below that of R-407D. Thus the previously claimed benefits of the fluids are also achieved for this application.

R-32/R-161/R-134a/R-1234ze(E) Blends

[0155] Analysis of selected compositions of the invention containing 20 to 46 % by weight R-32, 10 to 60 % by weight R-161, 10 to 22 % by weight R-134a and 8 to 60 % by weight R-1234ze(E) was carried out using the same refrigeration cycle conditions as detailed above under Example 3. The results are shown in Tables 35 to 105 below (see Table X above for reference).

[0156] It is found unexpectedly that the Coefficient of Performance (COP) of the fluids is not only higher than that of R-407A in the equivalent cycle conditions but is higher than that achievable with the R32/R125/R134a/R1234ze(E) fluids of the invention. The use of minor quantities of R-161 in place of R-125 allows further improvement of the energy efficiency (COP), further reduction of the GWP of the refrigerant, reduction in condenser operating pressure and reduction in the amount of R-32 required to give comparable cooling capacity. The fluids therefore offer similar performance benefits as already stated. These fluids are especially attractive in applications and equipment where mild flammability of the refrigerant can be accepted.

R-32/R-161/R-125/R-1234ze(E) Blends

[0157] Analysis of selected compositions of the invention containing 16 to 40 % by weight R-32, 10 to 30 % by weight R-161, 10 to 25 % by weight R-125 and 10 to 64 % by weight R-1234ze(E) was carried out using the same refrigeration cycle conditions as detailed above under Example 3. The results are shown in Tables 106 to 124 below (see Table X above for reference).

[0158] Surprisingly, the Coefficient of Performance (COP) of the fluids is higher than that of R-407A in the equivalent cycle conditions. The use of minor quantities of R-161 allows improvement of the energy efficiency (COP) and reduction of the GWP of the refrigerant. A reduction in condenser operating pressure and pressure ratio is also observed, alongside a reduction in the amount of R-32 required to give comparable cooling capacity. The fluids therefore offer similar performance benefits as previously stated. These fluids are especially attractive in applications and equipment where mild flammability of the refrigerant can be accepted.

[0159] The invention is defined by the claims.

Table 3: Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 16-28 % R-32, 10 % R-125 and16%R-134a

Composition R-32/R-125/R-134a/R-1234ze(E) % by weight ▶		**16/10/16/58**	**18/10/16/56**	**20/10/16/54**	**22/10/16/52**	**24/10/16/50**	**26/10/16/48**	**28/10/16/46**
COP		1.26	1.27	1.27	1.27	1.27	1.27	1.27
COP relative to Reference		105.4%	105.6%	105.7%	105.9%	105.9%	106.0%	106.0%
Achieved cooling capacity	kW	1.76	1.84	1.92	1.99	2.07	2.15	2.23
Capacity relative to reference		70.7%	73.9%	77.1%	80.3%	83.4%	86.5%	89.6%
Suction pressure drop relative to reference		65.9%	67.6%	69.4%	71.0%	72.6%	74.1%	75.6%
Pressure ratio		13.80	13.63	13.46	13.29	13.14	12.98	12.83
Mass flow through evaporator	kg/hr	43.9	45.1	46.2	47.3	48.4	49.4	50.4
Liquid injection mass flow	kg/hr	3.2	3.6	4.1	4.5	5.0	5.4	5.9
Compressor discharge *temperature*	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.2	4.5	4.8	5.0	5.2	5.3	5.3
Compressor suction pressure	bar	0.93	0.98	1.02	1.06	1.11	1.15	1.19
Compressor discharge pressure	bar	12.9	13.3	13.7	14.1	14.5	14.9	15.3
Condenser glide (in-out)	K	8.7	8.7	8.7	8.7	8.6	8.4	8.3

Table 4 Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 30-40 % R-32, 10 % R-125 and 16 % R-134a

Composition R-32/R-125/R-134a/R-1234ze(E) % by weight ▶		30/10/16/44	32/10/16/42	34/10/16/40	36/10/16/38	38/10/16/36	40/10/16/34
COP		1.27	1.27	1.27	1.27	1.27	1.27
COP relative to Reference		106.0%	106.0%	106.0%	106.0%	105.9%	105.8%
Achieved cooling capacity	kW	2.30	2.38	2.45	2.53	2.60	2.67
Capacity relative to reference		92.7%	95.7%	98.7%	101.6%	104.6%	107.5%
Suction pressure drop relative to reference		77.0%	78.3%	79.6%	80.8%	81.9%	83.0%
Pressure ratio		12.69	12.55	12.42	12.29	12.17	12.05
Mass flow through evaporator	kg/hr	51.3	52.2	53.1	53.9	54.7	55.5
Liquid injection mass flow	kg/hr r	6.4	6.9	7.3	7.8	8.3	8.8
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.3	5.3	5.3	5.2	5.1	5.0
Compressor suction pressure	bar	1.24	1.28	1.32	1.37	1.41	1.46
Compressor discharge pressure	bar	15.7	16.1	16.5	16.8	17.2	17.5
Condenser glide (in-out)	K	8.1	7.8	7.6	7.3	7.0	6.7

Table 5: Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 16-28 % R-32, 10 % R-125 and 20 % R-134a

Composition R-32/R-125/R-134a/R-1234ze(E) % by weight ▶		16/10/20/54	18/10/20/52	20/10/20/50	22/10/20/48	24/10/20/46	26/10/20/44	28/10/20/42
COP		1.26	1.27	1.27	1.27	1.27	1.27	1.27
COP relative to Reference		105.3%	105.5%	105.6%	105.8%	105.8%	105.9%	105.9%
Achieved cooling capacity	kW	1.77	1.85	1.93	2.01	2.09	2.17	2.24
Capacity relative to reference		71.4%	74.6%	77.8%	80.9%	84.0%	87.1%	90.2%
Suction pressure drop relative to reference		66.4%	68.2%	69.8%	71.4%	73.0%	74.5%	75.9%
Pressure ratio		13.75	13.58	13.41	13.25	13.10	12.94	12.80
Mass flow through evaporator	kg/hr	44.3	45.4	46.5	47.6	48.6	49.6	50.6
Liquid injection mass flow	kg/hr	3.3	3.7	4.2	4.6	5.1	5.6	6.0
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.0	4.3	4.5	4.7	4.9	5.0	5.0
Compressor suction pressure	bar	0.95	0.99	1.03	1.07	1.12	1.16	1.20
Compressor discharge pressure	bar	13.0	13.4	13.8	14.2	14.6	*15.0*	*15.4*
Condenser glide (in-out)	K	8.3	8.4	8.4	8.3	8.2	8.1	7.9

Table 6: Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 30-40 % R-32, 10 % R-125 and 20 % R-134a

Composition R-32/R-125/R-134a/R-1234ze(E) % by weight ▶		30/10/20/40	32/10/20/38	34/10/20/36	36/10/20/34	38/10/20/32	40/10/20/30
COP		1.27	1.27	1.27	1.27	1.27	1.27
COP relative to Reference		105.9%	105.9%	105.9%	105.9%	105.8%	105.8%
Achieved cooling capacity	kW	2.32	2.39	2.47	2.54	2.61	2.68
Capacity relative to reference		93.2%	96.2%	99.2%	102.2%	105.1%	107.9%
Suction pressure drop relative to reference		77.3%	78.6%	79.8%	81.0%	82.1%	83.1%
Pressure ratio		12.66	12.52	12.39	12.26	12.14	12.02
Mass flow through evaporator	kg/hr	51.5	52.4	53.2	54.1	54.8	55.6
Liquid injection mass flow	kg/hr	6.5	7.0	7.5	8.0	8.4	8.9
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.1	5.0	5.0	4.9	4.8	4.7
Compressor suction pressure	bar	1.25	1.29	1.33	1.38	1.42	1.46
Compressor discharge pressure	bar	15.8	16.2	16.5	16.9	17.2	17.6
Condenser glide (in-out)	K	7.7	7.5	7.2	7.0	6.7	6.4

Table 7: Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 16-28 % R-32, 10 % R-125 and 24 % R-134a

Composition R-32/R-125/R-134a/R-1234ze(E) % by weight ▶		**16/10/24/50**	**18/10/24/48**	**20/10/24/46**	**22/10/24/44**	**24/10/24/42**	**26/10/24/40**	**28/10/24/38**
COP		1.26	1.26	1.27	1.27	1.27	1.27	1.27
COP relative to Reference		105.2%	105.4%	105.5%	105.7%	105.7%	105.8%	105.8%
Achieved cooling capacity	kW	1.79	1.87	1.95	2.03	2.10	2.18	2.26
Capacity relative to reference		72.1%	75.3%	78.4%	81.5%	84.6%	87.7%	90.8%
Suction pressure drop relative to reference		67.0%	68.6%	70.3%	71.8%	73.4%	74.8%	76.2%
Pressure ratio		13.70	13.53	13.37	13.21	13.06	12.91	12.77
Mass flow through evaporator	kg/hr	44.6	45.7	46.8	47.9	48.9	49.9	50.8
Liquid injection mass flow	kg/hr	3.4	3.9	4.3	4.8	5.2	5.7	6.2
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	3.8	4.1	4.3	4.5	4.6	4.7	4.8
Compressor suction pressure	bar	0.96	1.00	1.04	1.08	1.13	1.17	1.21
Compressor discharge pressure	bar	13.1	13.5	13.9	14.3	14.7	15.1	15.5
Condenser glide (in-out)	K	7.9	8.0	8.0	7.9	7.8	7.7	7.5

Table 8: Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 30-40 % R-32, 10 % R-125 and 24 % R-134a

Composition R-32/R-125/R-134a/R-1234ze(E) % **by weight** ▶		**30/10/24/36**	**32/10/24/34**	**34/10/24/32**	**36/10/24/30**	**38/10/24/28**	**40/10/24/26**
COP		1.27	1.27	1.27	1.27	1.27	1.27
COP relative to Reference		105.9%	105.9%	105.8%	105.8%	105.8%	105.7%
Achieved cooling capacity	kW	2.33	2.40	2.48	2.55	2.62	2.69
Capacity relative to reference		93.8%	96.7%	99.7%	102.6%	105.5%	108.4%
Suction pressure drop relative to reference		77.5%	78.8%	80.0%	81.1%	82.2%	83.2%
Pressure ratio		12.63	12.49	12.36	12.24	12.12	12.00
Mass flow through evaporator	kg/hr	51.7	52.6	53.4	54.2	54.9	55.6
Liquid injection mass flow	kg/hr	6.6	7.1	7.6	8.1	8.6	9.0
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.8	4.8	4.7	4.7	4.6	4.4
Compressor suction pressure	bar	1.26	1.30	1.34	1.38	1.43	1.47
Compressor discharge pressure	bar	15.9	16.2	16.6	16.9	17.3	17.6
Condenser glide (in-out)	K	7.3	7.1	6.9	6.7	6.4	6.2

Table 9: Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 16-28 % R-32, 10 % R-125 and 28 % R-134a

Composition R-32/R-125/R-134a/R-% by weight ▶		16/10/28/46	18/10/28/44	20/10/28/42	22/10/28/40	24/10/28/38	26/10/28/36	28/10/28/34
COP		1.26	1.26	1.27	1.27	1.27	1.27	1.27
COP relative to Reference		105.1%	105.3%	105.5%	105.6%	105.7%	105.7%	105.8%
Achieved cooling capacity	kW	1.81	1.89	1.96	2.04	2.12	2.19	2.27
Capacity relative to reference		72.8%	75.9%	79.0%	82.1%	85.2%	88.3%	91.3%
Suction pressure drop relative to reference		67.4%	69.1%	70.6%	72.2%	73.6%	75.1%	76.4%
Mass flow through evaporator	kg/hr	44.9	46.0	47.1	48.1	49.1	50.0	51.0
Liquid injection mass flow	kg/hr	3.5	4.0	4.4	4.9	5.4	5.8	6.3
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	3.6	3.9	4.1	4.2	4.4	4.5	4.5
Compressor suction pressure	bar	0.97	1.01	1.05	1.09	1.14	1.18	1.22
Compressor discharge pressure	bar	13.2	13.6	14.0	14.4	14.8	15.2	15.6
Condenser glide (in-out)	K	7.6	7.6	7.6	7.6	7.5	7.4	7.2

Table 10: Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 16-28 % R-32, 10 % R-125 and 28 % R-134a

Composition R-32/R-125/R-134a/R-1234ze(E) % by weight ▶		30/10/28/32	32/10/28/30	34/10/28/28	36/10/28/26	38/10/28/24	40/10/28/22
COP		1.27	1.27	1.27	1.27	1.27	1.27
COP relative to Reference		105.8%	105.8%	105.8%	105.8%	105.7%	105.7%
Achieved cooling capacity	kW	2.34	2.42	2.49	2.56	2.63	2.70
Capacity relative to reference		94.3%	97.2%	100.2%	103.0%	105.9% .	108.7%
Suction pressure drop relative to reference		77.7%	78.9%	80.1%	81.1%	82.2%	83.1%
Pressure ratio		12.60	12.47	12.34	12.22	12.10	11.98
Mass flow through evaporator	kg/hr	51.8	52.7	53.5	54.2	55.0	55.7
Liquid injection mass flow	kg/hr	6.8	7.2	7.7	8.2	8.7	9.2
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.5	4.5	4.5	4.4	4.3	4.2
Compressor suction pressure	bar	1.26	1.31	1.35	1.39	1.43	1.48
Compressor discharge pressure	bar	15.9	16.3	16.6	17.0	17.3	17.7
Condenser glide (in-out)	K	7.0	6.8	6.6	6.4	6.2	5.9

Table 11: Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 16-28 % R-32, 15 % R-125 and 16 % R-134a

Composition R-32/R-125/R-134a/R-1234ze(E) % by weight ▶		16/15/16/53	18/15/16/51	20/15/16/49	22/15/16/47	24/15/16/45	26/15/16/43	28/15/16/41
COP		1.26	1.26	1.26	1.26	1.26	1.26	1.26
COP relative to Reference		104.6%	104.8%	104.9%	105.0%	105.1%	105.2%	105.2%
Achieved cooling capacity	kW	1.83	1.91	1.99	2.07	2.15	2.23	2.31
Capacity relative to reference		73.6%	76.9%	80.2%	83.4%	86.6%	89.7%	92.9%
Suction pressure drop relative to reference		70.0%	71.8%	73.5%	75.2%	76.8%	78.4%	79.9%
Pressure ratio		13.65	13.47	13.31	13.14	12.99	12.84	12.69
Mass flow through evaporator	kg/hr	46.5	47.7	48.8	49.9	51.0	52.0	53.0
Liquid injection mass flow	kg/hr	3.4	3.8	4.3	4.8	5.3	5.8	6.2
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.4	4.6	4.8	5.0	5.1	5.1	5.1
Compressor suction pressure	bar	0.98	1.03	1.07	1.11	1.16	1.20	1.25
Compressor discharge pressure	bar	13.4	13.8	14.2	14.7	15.1	15.5	15.9
Condenser glide (in-out)	K	8.5	8.5	8.5	8.4	8.2	8.0	7.8

Table 12: Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 30-40 % R-32, 15 % R-125 and 16 % R-134a

Composition R-32/R-125/R-134a/R-1234ze(E) % by weight ▶		30/15/16/39	32/15/16/37	34/15/16/35	36/15/16/33	38/15/16/31	40/15/16/29
COP		1.26	1.26	1.26	1.26	1.26	1.26
COP relative to Reference		105.2%	105.2%	105.1%	105.1%	105.0%	105.0%
Achieved cooling capacity	kW	2.39	2.46	2.54	2.61	2.69	2.76
Capacity relative to reference		96.0%	99.1%	102.1%	105.1%	108.1%	111.0%
Suction pressure drop relative to reference		81.3%	82.6%	83.9%	85.1%	86.3%	87.4%
Pressure ratio		12.55	12.41	12.28	12.15	12.03	11.91
Mass flow through evaporator	kg/hr	54.0	54.9	55.8	56.6	57.4	58.2
Liquid injection mass flow	kg/hr	6.7	7.2	7.7	8.3	8.8	9.3
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.1	5.1	5.0	4.9	4.7	4.6
Compressor suction pressure	bar	1.29	1.34	1.38	1.43	1.47	1.52
Compressor discharge pressure	bar	16.2	16.6	17.0	17.4	17.7	18.1
Condenser glide (in-out)	K	7.6	7.3	7.1	6.8	6.5	6.2

Table 13: Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 16-28 % R-32, 15 % R-125 and 20 % R-134a

Composition R-32/R-125/R-134a/R-1234ze(E) % by weight ▶		16/15/20/49	18/15/20/47	20/15/20/45	22/15/20/43	24/15/20/41	26/15/20/39	28/15/20/37
COP		1.25	1.26	1.26	1.26	1.26	1.26	1.26
COP relative to Reference		104.5%	104.7%	104.8%	104.9%	105.0%	105.1%	105.1%
Achieved cooling capacity	kW	1.85	1.93	2.01	2.09	2.17	2.25	2.32
Capacity relative to reference		74.4%	77.6%	80.8%	84.0%	87.2%	90.3%	93.5%
Suction pressure drop relative to reference		70.5%	72.3%	74.0%	75.6%	77.2%	78.7%	80.2%
Pressure ratio		13.60	13.43	13.26	13.10	12.95	12.80	12.65
Mass flow through evaporator	kg/hr	46.8	48.0	49.1	50.2	51.3	52.3	53.2
Liquid injection mass flow	kg/hr	3.5	4.0	4.4	4.9	5.4	5.9	6.4
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.1	4.4	4.6	4.7	4.8	4.8	4.9
Compressor suction pressure	bar	0.99	1.04	1.08	1.13	1.17	1.21	1.26
Compressor discharge pressure	bar	13.5	13.9	14.3	14.7	15.1	15.5	15.9
Condenser glide (in-out)	K	8.1	8.1	8.1	8.0	7.8	7.7	7.5

Table 14: Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 30-40 % R-32, 15 % R-125 and 20 % R-134a

Composition R-32/R-125/R-134a/R-1234ze(E) % by weight ▶		30/15/20/35	32/15/20/33	34/15/20/31	36/15/20/29	38/15/20/27	40/15/20/25
COP		1.26	1.26	1.26	1.26	1.26	1.26
COP relative to Reference		105.1%	105.1%	105.0%	105.0%	105.0%	104.9%
Achieved cooling capacity	kW	2.40	2.48	2.55	2.62	2.70	2.77
Capacity relative to reference		96.5%	99.6%	102.6%	105.6%	108.5%	111.5%
Suction pressure drop relative to reference		81.5%	82.9%	84.1%	85.3%	86.4%	87.4%
Pressure ratio		12.52	12.38	12.25	12.13	12.01	11.89
Mass flow through evaporator	kg/hr	54.2	55.1	55.9	56.8	57.5	58.3
Liquid injection mass flow	kg/hr	6.9	7.4	7.9	8.4	8.9	9.4
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.8	4.8	4.7	4.6	4.5	4.3
Compressor suction pressure	bar	1.30	1.35	1.39	1.44	1.48	1.53
Compressor discharge pressure	bar	16.3	16.7	17.1	17.4	17.8	18.1
Condenser glide (in-out)	K	7.2	7.0	6.7	6.5	6.2	5.9

Table 15: Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 16-28 % R-32, 15 % R-125 and 24 % R-134a

Composition R-32/R-125/R-134a/R-1234ze(E) % by weight ▶		**16/15/24/45**	**18/15/24/43**	**20/15/24/41**	**22/15/24/39**	**24/15/24/37**	**26/15/24/35**	**28/15/24/33**
COP		1.25	1.26	1.26	1.26	1.26	1.26	1.26
COP relative to Reference		104.4%	104.6%	104.7%	104.8%	104.9%	105.0%	105.0%
Achieved cooling capacity	kW	1.87	1.95	2.02	2.10	2.18	2.26	2.34
Capacity relative to reference		75.0%	78.3%	81.5%	84.6%	87.8%	90.9%	94.0%
Suction pressure drop relative to reference		71.0%	72.8%	74.4%	76.0%	77.6%	79.0%	80.4%
Pressure ratio		13.55	13.38	13.22	13.06	12.91	12.77	12.62
Mass flow through evaporator	kg/hr	47.2	48.3	49.4	50.5	51.5	52.5	53.4
Liquid injection mass flow	kg/hr	3.6	4.1	4.6	5.0	5.5	6.0	6.5
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	3.9	4.1	4.3	4.4	4.5	4.6	4.6
Compressor suction pressure	bar	1.00	1.05	1.09	1.14	1.18	1.22	1.27
Compressor discharge pressure	bar	13.6	14.0	14.4	14.8	15.2	15.6	16.0
Condenser glide (in-out)	K	7.7	7.8	7.7	7.6	7.5	7.3	7.1

Table 16: Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 30-40 % R-32, 15 % R-125 and 24 % R-134a

Composition R-32/R-125/R-134a/R-1234ze(E) % by weight ▶		30/15/24/31	32/15/24/29	34/15/24/27	36/15/24/25	38/15/24/23	40/15/24/21
COP		1.26	1.26	1.26	1.26	1.26	1.26
COP relative to Reference		105.0%	105.0%	105.0%	105.0%	104.9%	104.9%
Achieved cooling capacity	kW	2.41	2.49	2.56	2.64	2.71	2.78
Capacity relative to reference		97.1%	100.1%	103.1%	106.0%	109.0%	111.9%
Suction pressure drop relative to reference		81.8%	83.0%	84.2%	85.3%	86.4%	87.4%
Pressure ratio		12.49	12.35	12.23	12.10	11.98	11.87
Mass flow through evaporator	kg/hr	54.3	55.2	56.0	56.8	57.6	58.3
Liquid injection mass flow	kg/hr	7.0	7.5	8.0	8.5	9.0	9.5
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.6	4.5	4.4	4.3	4.2	4.1
Compressor suction pressure	bar	1.31	1.36	1.40	1.45	1.49	1.53
Compressor discharge pressure	bar	16.4	16.8	17.1	17.5	17.8	18.2
Condenser glide (in-out)	K	6.9	6.7	6.4	6.2	5.9	5.6

Table 17: Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 16-28 % R-32, 15 % R-125 and 28 % R-134a

Composition R-32/R-125/R-134a/R-1234ze(E) % by weight ▶		16/15/28/41	18/15/28/39	20/15/28/37	22/15/28/35	24/15/28/33	26/15/28/31	28/15/28/29
COP		1.25	1.25	1.26	1.26	1.26	1.26	1.26
COP relative to Reference		104.4%	104.5%	104.7%	104.8%	104.9%	104.9%	104.9%
Achieved cooling capacity	kW	1.88	1.96	2.04	2.12	2.20	2.27	2.35
Capacity relative to reference		75.7%	78.9%	82.1%	85.2%	88.4%	91.5%	94.5%
Suction pressure drop relative to reference		71.5%	73.2%	74.8%	76.3%	77.8%	79.2%	80.6%
Pressure ratio		13.50	13.34	13.18	13.03	12.88	12.73	12.59
Mass flow through evaporator	kg/hr	47.5	48.6	49.6	50.7	51.7	52.7	53.6
Liquid injection mass flow	kg/hr	3.8	4.2	4.7	5.2	5.7	6.2	6.6
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	3.7	3.9	4.1	4.2	4.3	4.3	4.3
Compressor suction pressure	bar	1.01	1.06	1.10	1.14	1.19	1.23	1.28
Compressor discharge pressure	bar	13.7	14.1	14.5	14.9	15.3	15.7	16.1
Condenser glide (in-out)	K	7.4	7.4	7.4	7.3	7.2	7.0	6.8

Table 18: Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 30-40 % R-32, 15 % R-125 and 28 % R-134a

Composition R-32/R-125/R-134a/R-1234ze(E) % by weight ▶		30/15/28/27	32/15/28/25	34/15/28/23	36/15/28/21	38/15/28/19	40/15/28/17
COP		1.26	1.26	1.26	1.26	1.26	1.26
COP relative to Reference		105.0%	105.0%	105.0%	104.9%	104.9%	104.9%
Achieved cooling capacity	kW	2.42	2.50	2.57	2.65	2.72	2.79
Capacity relative to reference		97.5%	100.5%	103.5%	106.4%	109.3%	112.2%
Suction pressure drop relative to reference		81.9%	83.1%	84.3%	85.4%	86.4%	87.3%
Pressure ratio		12.46	12.33	12.20	12.08	11.97	11.85
Mass flow through evaporator	kg/hr	54.5	55.3	56.1	56.9	57.6	58.3
Liquid injection mass flow	kg/hr	7.1	7.6	8.1	8.6	9.2	9.7
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.3	4.3	4.2	4.1	4.0	3.9
Compressor suction pressure	bar	1.32	1.36	1.41	1.45	1.50	1.54
Compressor discharge pressure	bar	16.5	16.8	17.2	17.5	17.9	18.2
Condenser glide (in-out)	K	6.6	6.4	6.2	5.9	5.7	5.4

Table 19: Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 16-28 % R-32, 20 % R-125 and 16 % R-134a

Composition R-32/R-125/R-134a/R-1234ze(E) % by weight ▶		16/20/16/48	18/20/16/46	20/20/16/44	22/20/16/42	24/20/16/40	26/20/16/38	28/20/16/36
COP		1.25	1.25	1.25	1.25	1.25	1.25	1.25
COP relative to Reference		103.8%	104.0%	104.1%	104.2%	104.2%	104.2%	104.3%
Achieved cooling capacity	kW	1.91	1.99	2.07	2.15	2.23	2.31	2.39
Capacity relative to reference		76.7%	80.0%	83.3%	86.6%	89.9%	93.1%	96.3%
Suction pressure drop relative to reference		74.4%	76.2%	78.0%	79.7%	81.4%	83.0%	84.5%
Pressure ratio		13.49	13.32	13.15	12.99	12.83	12.69	12.54
Mass flow through evaporator	kg/hr	49.2	50.4	51.6	52.7	53.8	54.9	55.9
Liquid injection mass flow	kg/hr	3.6	4.1	4.6	5.1	5.6	6.1	6.6
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.4	4.6	4.8	4.9	4.9	4.9	4.9
Compressor suction pressure	bar	1.03	1.08	1.12	1.17	1.22	1.26	1.31
Compressor discharge pressure	bar	13.9	14.3	14.8	15.2	15.6	16.0	16.4
Condenser glide (in-out)	K	8.3	8.2	8.1	8.0	7.8	7.6	7.3

Table 20: Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 30-40 % R-32, 20 % R-125 and 16 % R-134a

Composition R-32/R-125/R-134a/R-1234ze(E) % by weight ▶		30/20/16/34	32/20/16/32	34/20/16/30	36/20/16/28	38/20/16/26	40/20/16/24
COP		1.25	1.25	1.25	1.25	1.25	1.25
COP relative to Reference		104.3%	104.2%	104.2%	104.2%	104.1%	104.1%
Achieved cooling capacity	kW	2.47	2.55	2.62	2.70	2.78	2.85
Capacity relative to reference		99.4%	102.5%	105.6%	108.7%	111.7%	114.7%
Suction pressure drop relative to reference		85.9%	87.3%	88.5%	89.8%	90.9%	92.0%
Pressure ratio		12.40	12.27	12.14	12.01	11.89	11.77
Mass flow through evaporator	kg/hr	56.8	57.8	58.7	59.5	60.4	61.1
Liquid injection mass flow	kg/hr	7.1	7.7	8.2	8.7	9.2	9.8
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.8	4.7	4.6	4.5	4.3	4.1
Compressor suction pressure	bar	1.35	1.40	1.45	1.49	1.54	1.59
Compressor discharge pressure	bar	16.8	17.2	17.6	17.9	18.3	18.7
Condenser glide (in-out)	K	7.1	6.8	6.5	6.2	5.9	5.6

Table 21: Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 16-28 % R-32, 20 % R-125 and 20 % R-134a

Composition R-32/R-125/R-134a/R-1234ze(E) % by weight ▶		16/20/20/44	18/20/20/42	20/20/20/40	22/20/20/38	24/20/20/36	26/20/20/34	28/20/20/32
COP		1.24	1.25	1.25	1.25	1.25	1.25	1.25
COP relative to Reference		103.7%	103.9%	104.0%	104.1%	104.1%	104.2%	104.2%
Achieved cooling capacity	kW	1.92	2.01	2.09	2.17	2.25	2.33	2.41
Capacity relative to reference		77.4%	80.7%	84.0%	87.3%	90.5%	93.7%	96.8%
Suction pressure drop relative to reference		74.9%	76.7%	78.5%	80.2%	81.8%	83.3%	84.7%
Pressure ratio		13.44	13.27	13.11	12.95	12.80	12.65	12.51
Mass flow through evaporator	kg/hr	49.5	50.7	51.9	53.0	54.1	55.1	56.1
Liquid injection mass flow	kg/hr	3.7	4.2	4.7	5.2	5.7	6.2	6.7
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.2	4.3	4.5	4.6	4.6	4.6	4.6
Compressor suction pressure	bar	1.04	1.09	1.13	1.18	1.23	1.27	1.32
Compressor discharge pressure	bar	14.0	14.4	14.9	15.3	15.7	16.1	16.5
Condenser glide (in-out)	K	7.9	7.8	7.7	7.6	7.4	7.2	7.0

Table 22: Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 30-40 % R-32, 20 % R-125 and 20 % R-134a

Composition R-32/R-125/R-134a/R-1234ze(E) % by weight ▶		30/20/20/30	32/20/20/28	34/20/20/26	36/20/20/24	38/20/20/22	40/20/20/20
COP		1.25	1.25	1.25	1.25	1.25	1.25
COP relative to Reference		104.2%	104.2%	104.1%	104.1%	104.1%	104.0%
Achieved cooling capacity	kW	2.48	2.56	2.64	2.71	2.79	2.86
Capacity relative to reference		100.0%	103.1%	106.1%	109.2%	112.1%	115.1%
Suction pressure drop relative to reference		86.1%	87.4%	88.7%	89.9%	91.0%	92.1%
Pressure ratio		12.37	12.24	12.11	11.98	11.87	11.75
Mass flow through evaporator	kg/hr	57.0	57.9	58.8	59.6	60.4	61.2
Liquid injection mass flow	kg/hr	7.3	7.8	8.3	8.9	9.4	9.9
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.6	4.5	4.3	4.2	4.1	3.9
Compressor suction pressure	bar	1.36	1.41	1.46	1.50	1.55	1.59
Compressor discharge pressure	bar	16.9	17.3	17.6	18.0	18.4	18.7
Condenser glide (in-out)	K	6.7	6.5	6.2	5.9	5.6	5.3

Table 23: Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 16-28 % R-32, 20 % R-125 and 24 % R-134a

Composition R-32/R-125/R-134a/R-1234ze(E) % by weight ▶		**16/20/24/40**	**18/20/24/38**	**20/20/24/36**	**22/20/24/34**	**24/20/24/32**	**26/20/24/30**	**28/20/24/28**
COP		1.24	1.24	1.25	1.25	1.25	1.25	1.25
COP relative to Reference		103.6%	103.8%	103.9%	104.0%	104.0%	104.1%	104.1%
Achieved cooling capacity	kW	1.94	2.02	2.10	2.18	2.26	2.34	2.42
Capacity *relative to* reference		78.1%	81.4%	84.6%	87.9%	91.1%	94.2%	97.4%
Suction pressure drop relative to reference		75.4%	77.2%	78.9%	80.5%	82.1%	83.5%	85.0%
Pressure ratio		13.39	13.23	13.07	12.91	12.76	12.62	12.48
Mass flow through evaporator	kg/hr	49.8	51.0	52.1	53.2	54.3	55.3	56.2
Liquid injection mass flow	kg/hr	3.8	4.3	4.8	5.3	5.9	6.4	6.9
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	3.9	4.1	4.2	4.3	4.4	4.4	4.3
Compressor suction pressure	bar	1.05	1.10	1.14	1.19	1.24	1.28	1.33
Compressor discharge pressure	bar	14.1	14.5	14.9	15.4	15.8	16.2	16.6
Condenser glide (in-out)	K	7.5	7.5	7.4	7.2	7.1	6.9	6.7

Table 24: Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 30-40 % R-32, 20 % R-125 and 24 % R-134a

Composition R-32/R-125/R-134a/R-1234ze(E) % by weight ▶		30/20/24/26	32/20/24/24	34/20/24/22	36/20/24/20	38/20/24/18	40/20/24/16
COP		1.25	1.25	1.25	1.25	1.25	1.25
COP relative to Reference		104.1%	104.1%	104.1%	104.1%	104.1%	104.0%
Achieved cooling capacity	kW	2.50	2.57	2.65	2.72	2.80	2.87
Capacity relative to reference		100.5%	103.5%	106.6%	109.6%	112.5%	115.5%
Suction pressure drop relative to reference		86.3%	87.6%	88.8%	89.9%	91.0%	92.0%
Pressure ratio		12.34	12.21	12.08	11.96	11.85	11.73
Mass flow through evaporator	kg/hr	57.2	58.0	58.9	59.7	60.5	61.2
Liquid injection mass flow	kg/hr	7.4	7.9	8.5	9.0	9.5	10.0
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.3	4.2	4.1	4.0	3.8	3.7
Compressor suction pressure	bar	1.37	1.42	1.46	1.51	1.55	1.60
Compressor discharge pressure	bar	16.9	17.3	17.7	18.0	18.4	18.8
Condenser glide (in-out)	K	6.4	6.2	5.9	5.7	5.4	5.1

Table 25: Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 16-28 % R-32, 20 % R-125 and 28 % R-134a

Composition R-32/R-125/R-134a/R-1234ze(E) % by weight ▶		16/20/28/36	18/20/28/34	20/20/28/32	22/20/28/30	24/20/28/28	26/20/28/26	28/20/28/24
COP		1.24	1.24	1.25	1.25	1.25	1.25	1.25
COP relative to Reference		103.5%	103.7%	103.8%	103.9%	104.0%	104.0%	104.1%
Achieved cooling capacity	kW	1.96	2.04	2.12	2.20	2.28	2.35	2.43
Capacity relative to reference		78.7%	82.0%	85.2%	88.4%	91.6%	94.7%	97.9%
Suction pressure drop relative to reference		75.9%	77.6%	79.2%	80.8%	82.3%	83.7%	85.1%
Pressure ratio		13.35	13.19	13.03	12.88	12.73	12.59	12.45
Mass flow through evaporator	kg/hr	50.1	51.3	52.4	53.4	54.4	55.4	56.4
Liquid injection mass flow	kg/hr	4.0	4.5	5.0	5.5	6.0	6.5	7.0
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	3.7	3.9	4.0	4.1	4.1	4.1	4.1
Compressor suction pressure	bar	1.06	1.11	1.15	1.20	1.24	1.29	1.33
Compressor discharge pressure	bar	14.2	14.6	15.0	15.4	15.8	16.2	16.6
Condenser glide (in-out)	K	7.2	7.1	7.0	6.9	6.8	6.6	6.4

Table 26: Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 30-40 % R-32, 20 % R-125 and 28 % R-134a

Composition R-32/R-125/R-134a/R-1234ze(E) % by weight ▶		30/20/28/22	32/20/28/20	34/20/28/18	36/20/28/16	38/20/28/14	40/20/28/12
COP		1.25	1.25	1.25	1.25	1.25	1.25
COP relative to Reference		104.1%	104.1%	104.1%	104.1%	104.1%	104.0%
Achieved cooling capacity	kW	2.51	2.58	2.66	2.73	2.81	2.88
Capacity relative to reference		100.9%	104.0%	107.0%	109.9%	112.9%	115.8%
Suction pressure drop relative to reference		86.4%	87.6%	88.8%	89.8%	90.8%	91.8%
Pressure ratio		12.32	12.19	12.07	11.95	11.83	11.72
Mass flow through evaporator	kg/hr	57.2	58.1	58.9	59.7	60.4	61.1
Liquid injection mass flow	kg/hr	7.5	8.1	8.6	9.1	9.6	10.2
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.1	4.0	3.9	3.8	3.6	3.5
Compressor suction pressure	bar	1.38	1.43	1.47	1.51	1.56	1.60
Compressor discharge pressure	bar	17.0	17.4	17.7	18.1	18.5	18.8
Condenser glide (in-out)	K	6.2	5.9	5.7	5.4	5.2	4.9

Table 27: Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 16-28 % R-32, 24 % R-125 and 16 % R-134a

Composition R-32/R-125/R-134a/R-1234ze(E) % by weight ▶		16/24/16/44	18/24/16/42	20/24/16/40	22/24/16/38	24/24/16/36	26/24/16/34	28/24/16/32
COP		1.24	1.24	1.24	1.24	1.24	1.24	1.24
COP relative to Reference		103.1%	103.2%	103.3%	103.4%	103.5%	103.5%	103.5%
Achieved cooling capacity	kW	1.97	2.05	2.14	2.22	2.30	2.38	2.46
Capacity relative to reference		79.2%	82.6%	85.9%	89.3%	92.6%	95.8%	99.0%
Suction pressure drop relative to reference		78.2%	80.1%	81.9%	83.6%	85.3%	86.9%	88.4%
Pressure ratio		13.36	13.19	13.02	12.86	12.71	12.56	12.42
Mass flow through evaporator	kg/hr	51.5	52.7	53.9	55.1	56.2	57.2	58.3
Liquid injection mass flow	kg/hr	3.8	4.3	4.8	5.3	5.8	6.4	6.9
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.4	4.6	4.7	4.7	4.7	4.7	4.7
Compressor suction pressure	bar	1.07	1.12	1.17	1.21	1.26	1.31	1.36
Compressor discharge pressure	bar	14.3	14.8	15.2	15.6	16.0	16.5	16.9
Condenser glide (in-out)	K	8.0	7.9	7.8	7.6	7.4	7.2	6.9

Table 28: Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 30-40 % R-32, 24 % R-125 and 16 % R-134a

Composition R-32/R-125/R-134a/R-1234ze(E) % by weight ▶		**30/24/16/30**	**32/24/16/28**	**34/24/16/26**	**36/24/16/24**	**38/24/16/22**	**40/24/16/20**
COP		1.24	1.24	1.24	1.24	1.24	1.24
COP relative to Reference		103.5%	103.5%	103.4%	103.4%	103.4%	103.3%
Achieved cooling capacity	kW	2.54	2.62	2.70	2.77	2.85	2.93
Capacity relative to reference		102.2%	105.4%	108.5%	111.6%	114.7%	117.7%
Suction pressure drop relative to reference		89.8%	91.2%	92.5%	93.8%	94.9%	96.0%
Pressure ratio		12.28	12.15	12.02	11.89	11.77	11.65
Mass flow through evaporator	kg/hr	59.3	60.2	61.1	62.0	62.8	63.6
Liquid injection mass flow	kg/hr	7.5	8.0	8.6	9.1	9.7	10.2
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.6	4.4	4.3	4.1	3.9	3.7
Compressor suction pressure	bar	1.40	1.45	1.50	1.55	1.60	1.64
Compressor discharge pressure	bar	17.3	17.6	18.0	18.4	18.8	19.1
Condenser glide (in-out)	K	6.6	6.3	6.0	5.7	5.4	5.1

Table 29: Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 16-28 % R-32, 24 % R-125 and 20 % R-134a

Composition R-32/R-125/R-134a/R-1234ze(E) % by weight ▶		16/24/20/40	18/24/20/38	20/24/20/26	22/24/20/34	24/24/20/32	26/24/20/30	28/24/20/28
COP		1.24	1.24	1.24	1.24	1.24	1.24	1.24
COP relative to Reference		103.0%	103.1%	103.2%	103.3%	103.4%	103.4%	103.4%
Achieved cooling capacity	kW	1.99	2.07	2.15	2.23	2.32	2.40	2.48
Capacity relative to reference		79.9%	83.3%	86.6%	89.9%	93.2%	96.4%	99.6%
Suction pressure drop relative to reference		78.7%	80.5%	82.3%	84.0%	85.6%	87.2%	86.6%
Pressure ratio		13.31	13.14	12.98	12.82	12.67	12.53	12.39
Mass flow through evaporator	kg/hr	51.8	53.0	54.2	55.3	56.4	57.5	58.5
Liquid injection mass flow	kg/hr	3.9	4.4	4.9	5.4	6.0	6.5	7.1
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.1	4.3	4.4	4.4	4.4	4.4	4.4
Compressor suction pressure	bar	1.08	1.13	1.18	1.23	1.27	1.32	1.37
Compressor discharge pressure	bar	14.4	14.9	15.3	15.7	16.1	16.5	16.9
Condenser glide (in-out)	K	7.6	7.5	7.4	7.2	7.0	6.8	6.6

Table 30: Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 30-40 % R-32, 24 % R-125 and 20 % R-134a

Composition R-32/R-125/R-134a/R-1234ze(E) % by weight ▶		**30/24/20/26**	**32/24/20/24**	**34/24/20/22**	**36/24/20/20**	**38/24/20/18**	**40/24/20/16**
COP		1.24	1.24	1.24	1.24	1.24	1.24
COP relative to Reference		103.4%	103.4%	103.4%	103.4%	103.3%	103.3%
Achieved cooling capacity	kW	2.55	2.63	2.71	2.79	2.86	2.94
Capacity relative to reference		102.8%	105.9%	109.0%	112.1%	115.1%	118.1%
Suction pressure drop relative to reference		90.0%	91.4%	92.6%	93.8%	94.9%	96.0%
Pressure ratio		12.25	12.12	11.99	11.87	11.75	11.63
Mass flow through evaporator	kg/hr	59.4	60.3	61.2	62.1	62.9	63.6
Liquid injection mass flow	kg/hr	7.6	8.2	8.7	9.2	9.8	10.3
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.3	4.2	*4.0*	3.9	3.7	3.5
Compressor suction pressure	bar	1.41	1.46	1.51	1.56	1.60	1.65
Compressor discharge pressure	bar	17.3	17.7	18.1	18.5	18.8	19.2
Condenser glide (in-out)	K	6.3	6.0	5.7	5.5	5.2	4.9

Table 31: Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 16-28 % R-32, 24 % R-125 and 24 % R-134a

Composition R-32/R-125/R-134a/R-1234ze(E) % by weight ▶		16/24/24/36	18/24/24/34	20/24/24/32	22/24/24/30	24/24/24/28	26/24/24/26	28/24/24/24
COP		1.23	1.24	1.24	1.24	1.24	1.24	1.24
COP relative to Reference		102.9%	103.0%	103.2%	103.2%	103.3%	103.3%	103.4%
Achieved cooling capacity	kW	2.00	2.09	2.17	2.25	2.33	2.41	2.49
Capacity relative to reference		80.6%	83.9%	87.2%	90.5%	93.7%	96.9%	100.1%
Suction pressure drop relative to reference		79.2%	81.0%	82.7%	84.3%	85.9%	87.4%	88.8%
Pressure ratio		13.26	13.10	12.94	12.79	12.64	12.50	12.36
Mass flow through evaporator	kg/hr	52.1	53.3	54.5	55.6	56.6	57.6	58.6
Liquid injection mass flow	kg/hr	4.0	4.5	5.1	5.6	6.1	6.7	7.2
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	3.9	4.0	4.1	4.2	4.2	4.2	4.1
Compressor suction pressure	bar	1.09	1.14	1.19	1.23	1.28	1.33	1.38
Compressor discharge pressure	bar	14.5	15.0	15.4	15.8	16.2	16.6	17.0
Condenser glide (in-out)	K	7.3	7.2	7.1	6.9	6.7	6.5	6.3

Table 32: Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 30-40 % R-32, 24 % R-125 and 24 % R-134a

Composition R-32/R-125/R-134a/R-1234ze(E) % by weight ▶		30/24/24/22	32/24/24/20	34/24/24/18	36/24/24/16	38/24/24/14	40/24/24/12
COP		1.24	1.24	1.24	1.24	1.24	1.24
COP relative to Reference		103.4%	103.4%	103.4%	103.4%	103.3%	103.3%
Achieved cooling capacity	kW	2.57	2.64	2.72	2.80	2.87	2.94
Capacity relative to reference		103.3%	106.4%	109.4%	112.5%	115.5%	118.4%
Suction pressure drop relative to reference		90.2%	91.4%	92.6%	93.8%	94.8%	95.8%
Pressure ratio		12.22	12.09	11.97	11.85	11.73	11.62
Mass flow through evaporator	kg/hr	59.5	60.4	61.3	62.1	62.9	63.6
Liquid injection mass flow	kg/hr	7.7	8.3	8.8	9.4	9.9	10.5
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.0	3.9	3.8	3.7	3.5	3.3
Compressor suction pressure	bar	1.42	1.47	1.52	1.56	1.61	1.65
Compressor discharge pressure	bar	17.4	17.8	18.1	18.5	18.9	19.2
Condenser glide (in-out)	K	6.0	5.8	5.5	5.2	4.9	4.7

Table 33: Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 16-28 % R-32, 24 % R-125 and 28 % R-134a

Composition R-32/R-125/R-134a/R-1234ze(E) % by weight ▶		16/24/28/32	18/24/28/30	20/24/28/28	22/24/28/26	24/24/28/24	26/24/28/22	28/24/28/20
COP		1.23	1.24	1.24	1.24	1.24	1.24	1.24
COP relative to Reference		102.8%	103.0%	103.1%	103.2%	103.3%	103.3%	103.3%
Achieved cooling capacity	kW	2.02	2.10	2.18	2.26	2.34	2.42	2.50
Capacity relative to reference		81.2%	84.5%	87.8%	91.1%	94.3%	97.4%	100.6%
Suction pressure drop relative to reference		79.6%	81.3%	83.0%	84.6%	86.1%	87.5%	88.9%
Pressure ratio		13.22	13.06	12.91	12.76	12.61	12.47	12.33
Mass flow through evaporator	kg/hr	52.4	53.6	54.7	55.7	56.8	57.8	58.7
Liquid injection mass flow	kg/hr	4.2	4.7	5.2	5.7	6.3	6.8	7.3
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	3.7	3.8	3.9	3.9	3.9	3.9	3.9
Compressor suction pressure	bar	1.10	1.15	1.20	1.24	1.29	1.34	1.38
Compressor discharge pressure	bar .	14.6	15.0	15.5	15.9	16.3	16.7	17.1
Condenser	K	6.9	6.8	6.7	6.6	6.4	6.2	6.0

Table 34: Theoretical Performance Data of Selected R-32/R-125/R-134a/R-1234ze(E) blends containing 30-40 % R-32, 24 % R-125 and 28 % R-134a

Composition R-32/R-125/R-134a/R-1234ze(E) % by weight ▶		30/24128118	32/24/28/16	34/24/28/14	36/24/28/12	38/24/28/10	40/24/28/8
COP		1.24	1.24	1.24	1.24	1.24	1.24
COP relative to Reference		103.4%	103.4%	103.4%	103.4%	103.3%	103.3%
Achieved cooling capacity	kW	2.58	2.65	2.73	2.80	2.88	2.95
Capacity relative to reference		103.7%	106.8%	109.8%	112.8%	115.8%	118.7%
Suction pressure drop relative to reference		90.2%	91.4%	92.5%	93.6%	94.6%	95.6%
Pressure ratio		12.20	12.07	11.95	11.83	11.72	11.61
Mass flow through evaporator	kg/hr	59.6	60.5	61.3	62.1	62.8	63.5
Liquid injection mass flow	kg/hr	7.9	8.4	9.0	9.5	10.1	10.6
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	3.8	3.7	3.6	3.5	3.3	3.2
Compressor suction pressure	bar	1.43	1.48	1.52	1.57	1.61	1.66
Compressor discharge pressure	bar	17.4	17.8	18.2	18.6	18.9	19.3
Condenser glide (in-out)	K	5.8	5.5	5.3	5.0	4.8	4.5

Table 35: Theoretical Performance Data of Selected R-321R-161/R-134a/R-1234ze(E) blends containing 20 % R-32, 10-20 % R-161 and 10 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		20/10/10/60	20/12/10/58	20/14/10/56	20/16/10/54	20/18/10/52	20/20/10/50
COP		1.30	1.31	1.31	1.31	1.31	1.31
COP relative to Reference		108.7%	108.9%	109.1%	109.2%	109.4%	109.5%
Achieved cooling capacity	kW	1.98	2.02	2.07	2.11	2.15	2.19
Capacity relative to reference		79.5%	81.3%	83.1%	84.8%	86.5%	88.1%
Suction pressure drop relative to reference		63.0%	63.3%	63.7%	63.9%	64.2%	64.4%
Pressure ratio		13.17	13.04	12.92	12.81	12.69	12.58
Mass flow through evaporator	kg/hr	41.95	42.10	42.23	42.34	42.45	42.54
Liquid injection mass flow	kg/hr	4.32	4.47	4.62	4.76	4.90	5.03
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.5	5.5	5.6	5.6	5.6	5.6
Compressor suction pressure	bar	1.03	1.05	1.07	1.09	1.11	1.13
Compressor discharge pressure	bar	13.5	13.7	13.8	14.0	14.1	14.2
Condenser glide (in-out)	K	9.5	9.4	9.2	9.1	8.9	8.8

Table 36: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 20 % R-32, 22-32 % R-161 and 10 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		20/22/10/48	20/24/10/46	20/26/10/44	20/28/10/42	20/30/10/40	20/32/10/38
COP		1.32	1.32	1.32	1.32	1.32	1.32
COP relative to Reference		109.6%	109.7%	109.8%	109.9%	110.0%	110.1%
Achieved cooling capacity	kW	2.23	2.27	2.31	2.35	2.38	2.42
Capacity relative to reference		89.8%	91.3%	92.9%	94.4%	95.9%	97.4%
Suction pressure drop relative to reference		64.7%	64.9%	65.1%	65.2%	65.4%	65.5%
Pressure ratio		12.47	12.37	12.26	12.16	12.06	11.97
Mass flow through evaporator	kg/hr	42.62	42.69	42.74	42.79	42.82	42.85
Liquid injection mass flow	kg/hr	5.16	5.28	5.40	5.51	5.62	5.73
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.5	5.5	5.4	5.3	5.2	5.1
Compressor suction pressure	bar	1.15	1.17	1.19	1.21	1.23	1.25
Compressor discharge pressure	bar	14.4	14.5	14.6	14.7	14.9	15.0
Condenser qlide (in-out)	K	8.6	8.4	8.2	8.0	7.8	7.6

Table 37: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 20 % R-32, 34-46 % R-161 and 10 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		20/34/10/36	20/36/10/34	20/38/10/32	20/40/10/30	20/42/10/28	20/44/10/26	20/46/10/24
COP		1.32	1.32	1.32	1.32	1.32	1.33	1.33
COP relative to Reference		110.2%	110.2%	110.3%	110.3%	110.4%	110.5%	110.5%
Achieved cooling capacity	kW	2.46	2.49	2.53	2.56	2.60	2.63	2.66
Capacity relative to reference		98.9%	100.3%	101.7%	103.1%	104.4%	105.8%	107.1%
Suction pressure drop relative to reference		65.6%	65.7%	65.8%	65.9%	66.0%	66.0%	66.1%
Pressure ratio		11.88	11.78	11.70	11.61	11.52	11.44	11.36
Mass flow through evaporator	kg/hr	42.87	42.88	42.89	42.89	42.89	42.88	42.86
Liquid injection mass flow	kg/hr	5.83	5.93	6.02	6.11	6.19	6.28	6.35
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.0	4.9	4.7	4.6	4.4	4.2	4.1
Compressor suction pressure	bar	1.27	1.29	1.31	1.32	1.34	1.36	1.38
Compressor discharge pressure	bar	15.1	15.2	15.3	15.4	15.5	15.6	15.7
Condenser glide (in-out)	K	7.4	7.2	7.0	6.8	6.6	6.4	6.2

Table 38: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 20 % R-32, 48-60 % R-161 and 10 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		20/48/10/22	20/50/10/20	20/52/10/18	20/54/10/16	20/56/10/14	20/58/10/12	20/60/10/10
COP		1.33	1.33	1.33	1.33	1.33	1.33	1.33
COP relative to Reference		110.6%	110.6%	110.7%	110.7%	110.8%	110.9%	110.9%
Achieved cooling capacity	kW	2.69	2.73	2.76	2.79	2.82	2.85	2.88
Capacity relative to reference		108.4%	109.7%	111.0%	112.3%	113.5%	114.8%	116.0%
Suction pressure drop relative to reference		66.1%	66.2%	66.2%	66.3%	66.3%	66.3%	66.3%
Pressure ratio		11.28	11.20	11.12	11.04	10.97	10.90	10.82
Mass flow through evaporator	kg/hr	42.84	42.82	42.80	42.77	42.73	42.70	42.66
Liquid injection mass flow	kg/hr	6.43	6.50	6.57	6.64	6.70	6.76	6.82
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	3.9	3.7	3.5	3.3	3.1	2.9	2.7
Compressor suction pressure	bar	1.40	1.41	1.43	1.45	1.46	1.48	1.50
Compressor discharge pressure	bar	15.7	15.8	15.9	16.0	16.1	16.1	16.2
Condenser glide (in-out)	K	6.0	5.8	5.6	5.4	5.2	5.0	4.9

Table 39: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 24 % R-32, 10-20 % R-161 and 10 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		24/10/10/56	24/12/10/54	24/14/10/52	24/16/10/50	24/18/10/48	24/20/10/46
COP		1.30	1.31	1.31	1.31	1.31	1.31
COP relative to Reference		108.8%	108.9%	109.1%	109.2%	109.3%	109.4%
Achieved cooling capacity	kW	2.13	2.18	2.22	2.27	2.31	2.35
Capacity relative to reference		85.9%	87.7%	89.4%	91.2%	92.8%	94.5%
Suction pressure drop relative to reference		66.2%	66.5%	66.8%	67.1%	67.3%	67.5%
Pressure ratio		12.86	12.74	12.63	12.52	12.41	12.30
Mass flow through evaporator	kg/hr	44.0	44.2	44.3	44.4	44.5	44.5
Liquid injection mass flow	kg/hr	5.1	5.3	5.4	5.5	5.7	5.8
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	6.0	6.0	6.0	6.0	6.0	5.9
Compressor suction pressure	bar	1.11	1.13	1.16	1.18	1.20	1.22
Compressor discharge pressure	bar	14.3	14.4	14.6	14.7	14.9	15.0
Condenser glide (in-out)	K	9.4	9.3	9.1	9.0	8.8	8.6

Table 40: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 24 % R-32, 22-32 % R-161 and 10 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		24/22/10/44	24/24/10/42	24/26/10/40	24/28/10/38	24/30/10/36	24/32/10/34
COP		1.31	1.31	1.32	1.32	1.32	1.32
COP relative to Reference		109.5%	109.6%	109.7%	109.7%	109.8%	109.9%
Achieved cooling capacity	kW	2.39	2.43	2.47	2.50	2.54	2.58
Capacity relative to reference		96.1%	97.7%	99.2%	100.8%	102.2%	103.7%
Suction pressure drop relative to reference		67.7%	67.9%	68.0%	68.2%	68.3%	68.4%
Pressure ratio		12.20	12.10	12.00	11.91	11.82	11.72
Mass flow through evaporator	kg/hr	44.6	44.6	44.7	44.7	44.7	44.7
Liquid injection mass flow	kg/hr	5.9	6.0	6.2	6.3	6.4	6.5
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.8	5.8	5.7	5.6	5.4	5.3
Compressor suction pressure	bar	1.24	1.26	1.28	1.30	1.32	1.34
Compressor discharge pressure	bar	15.1	15.3	15.4	15.5	15.6	15.7
Condenser glide (in-out)	K	8.4	8.2	8.0	7.8	7.6	7.4

Table 41: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 24 % R-32, 34-44 % R-161 and 10 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		24/34/10/32	24/36/10/30	24/38/10/28	24/40/10/26	24/42/10/24	24/44/10/22
COP		1.32	1.32	1.32	1.32	1.32	1.32
COP relative to Reference		109.9%	110.0%	110.0%	110.1%	110.1%	110.2%
Achieved cooling capacity	kW	2.61	2.65	2.68	2.72	2.75	2.79
Capacity relative to reference		105.2%	106.6%	108.0%	109.4%	110.7%	112.1%
Suction pressure drop relative to reference		68.5%	68.6%	68.6%	68.7%	68.7%	68.8%
Pressure ratio		11.64	11.55	11.46	11.38	11.30	11.22
Mass flow through evaporator	kg/hr	44.7	44.7	44.7	44.7	44.7	44.7
Liquid injection mass flow	kg/hr	6.6	6.7	6.7	6.8	6.9	7.0
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.1	5.0	4.8	4.6	4.5	4.3
Compressor suction pressure	bar	1.36	1.38	1.40	1.42	1.44	1.45
Compressor discharge pressure	bar	15.8	15.9	16.0	16.1	16.2	16.3
Condenser glide (in-out)	K	7.2	7.0	6.8	6.6	6.4	6.2

Table 42: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 24 % R-32, 46-56 % R-161 and 10 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		24/46/10/20	24/48/10/18	24/50/10/16	24/52/10/14	24/54/10/12	24/56/10/10
COP		1.32	1.32	1.32	1.32	1.33	1.33
COP relative to Reference		110.2%	110.3%	110.3%	110.4%	110.5%	110.5%
Achieved cooling capacity	kW	2.82	2.85	2.88	2.92	2.95	2.98
Capacity relative to reference		113.4%	114.7%	116.0%	117.3%	118.6%	119.8%
Suction pressure drop relative to reference		68.8%	68.9%	68.9%	68.9%	68.9%	68.9%
Pressure ratio		11.14	11.06	10.99	10.91	10.84	10.76
Mass flow through evaporator	kg/hr	44.6	44.6	44.6	44.5	44.5	44.5
Liquid injection mass flow	kg/hr	7.0	7.1	7.2	7.2	7.3	7.4
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.1	3.9	3.7	3.5	3.3	3.0
Compressor suction pressure	bar	1.47	1.49	1.51	1.52	1.54	1.56
Compressor discharge pressure	bar	16.4	16.5	16.6	16.6	16.7	16.8
Condenser glide (in-out)	K	6.0	5.8	5.6	5.4	5.2	5.1

Table 43: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 28 % R-32, 10-22 % R-161 and 10 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		28/10/10/52	28/12/10/50	28/14/10/48	28/16/10/46	28/18/10/44	28/10/10/42	28/22/10/40
COP		1.30	1.31	1.31	1.31	1.31	1.31	1.31
COP relative to Reference		108.7%	108.8%	108.9%	109.0%	109.1%	109.2%	109.3%
Achieved cooling capacity	kW	2.29	2.33	2.38	2.42	2.46	2.50	2.54
Capacity relative to reference		92.1%	93.9%	95.6%	97.4%	99.0%	100.7%	102.3%
Suction pressure drop relative to reference		69.1%	69.4%	69.7%	69.9%	70.2%	70.3%	70.5%
Pressure ratio		12.57	12.46	12.35	12.25	12.14	12.04	11.95
Mass flow through evaporator	kg/hr	46.0	46.1	46.2	46.3	46.4	46.4	46.5
Liquid injection mass flow	kg/hr	5.9	6.1	6.2	6.3	6.5	6.6	6.7
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	6.3	6.3	6.2	6.2	6.1	6.0	6.0
Compressor suction pressure	bar	1.20	1.22	1.24	1.27	1.29	1.31	1.33
Compressor discharge pressure	bar	15.1	15.2	15.4	15.5	15.6	15.8	15.9
Condenser glide (in-out)	K	9.1	9.0	8.8	8.6	8.5	8.3	8.1

Table 44: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 28 % R-32, 24-36 % R-161 and 10 % R-134a

Composition R-321R-161/R-134a/R-1234ze(E) % by weight ▶		28/24/10/38	28/26/10/36	28/28/10/34	28/30/10/32	28/32/10/30	28/34/10/28	28/36/10/26
COP		1.31	1.31	1.31	1.31	1.31	1.31	1.32
COP relative to Reference		109.3%	109.4%	109.4%	109.5%	109.5%	109.6%	109.6%
Achieved cooling capacity	kW	2.58	2.62	2.66	2.70	2.73	2.77	2.80
Capacity relative to reference		103.9%	105.4%	106.9%	108.4%	109.9%	111.4%	112.8%
Suction pressure drop relative to reference		70.7%	70.8%	70.9%	71.0%	71.1%	71.2%	71.2%
Pressure ratio		11.85	11.76	11.67	11.58	11.49	11.41	11.32
Mass flow through evaporator	kg/hr	46.5	46.5	46.5	46.5	46.5	46.5	46.5
Liquid injection mass flow	kg/hr	6.8	6.9	7.0	7.1	7.2	7.3	7.4
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.8	5.7	5.6	5.4	5.3	5.1	4.9
Compressor suction pressure	bar	1.35	1.37	1.39	1.41	1.43	1.45	1.47
Compressor discharge pressure	bar	16.0	16.1	16.2	16.4	16.5	16.6	16.7
Condenser glide (in-out)	K	7.9	7.7	7.5	7.3	7.0	6.8	6.6

Table 45: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 28 % R-32, 38-52 % R-161 and 10 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ►		28/38/10/24	28/40/10/22	28/42/10/20	28/44/10/18	28/46/10/16	28/48/10/14	28/50/10/12	28/52/10/10
COP		1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32
COP relative to Reference		109.7%	109.7%	109.8%	109.8%	109.9%	110.0%	110.0%	110.1%
Achieved cooling capacity	kW	2.84	2.87	2.91	2.94	2.97	3.01	3.04	3.07
Capacity relative to reference		114.2%	115.6%	117.0%	118.3%	119.6%	121.0%	122.3%	123.6%
Suction pressure drop relative to reference		71.3%	71.3%	71.4%	71.4%	71.5%	71.5%	71.5%	71.5%
Pressure ratio		11.24	11.16	11.08	11.00	10.93	10.85	10.78	10.71
Mass flow through evaporator	kg/hr	46.5	46.5	46.4	46.4	46.4	46.3	46.3	46.2
Liquid injection mass flow	kg/hr	7.5	7.5	7.6	7.7	7.8	7.8	7.9	7.9
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.7	4.5	4.3	4.1	3.9	3.7	3.5	3.3
Compressor suction pressure	bar	1.49	1.51	1.53	1.55	1.56	1.58	1.60	1.62
Compressor discharge pressure	bar	16.8	16.8	16.9	17.0	17.1	17.2	17.3	17.3
Condenser glide (in-out)	K	6.4	6.2	6.0	5.8	5.7	5.5	5.3	5.1

Table 46: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 30 % R-32, 10-22 % R-161 and 10 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		30/10/10/50	30/12/10/48	30/14/10/46	30/16/10/44	30/18/10/42	30/20/10/40	30/22/10/38
COP		1.30	1.30	1.31	1.31	1.31	1.31	1.31
COP relative to Reference		108.6%	108.7%	108.8%	108.9%	109.0%	109.1%	109.1%
Achieved cooling capacity	kW	2.36	2.41	2.45	2.50	2.54	2.58	2.62
Capacity relative to reference		95.1%	96.9%	98.7%	100.4%	102.1%	103.7%	105.3%
Suction pressure drop relative to reference		70.5%	70.8%	71.1%	71.3%	71.5%	71.7%	71.8%
Pressure ratio		12.44	12.33	12.22	12.12	12.02	11.92	11.83
Mass flow through evaporator	kg/hr	46.9	47.0	47.1	47.2	47.3	47.3	47.3
Liquid injection mass flow	kg/hr	6.3	6.5	6.6	6.7	6.9	7.0	7.1
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	6.3	6.3	6.3	6.2	6.1	6.0	5.9
Compressor suction pressure	bar	1.24	1.26	1.29	1.31	1.33	1.35	1.37
Compressor discharge pressure	bar	15.4	15.6	15.7	15.9	16.0	16.1	16.3
Condenser glide (in-out)	K	8.9	8.8	8.6	8.4	8.2	8.0	7.8

Table 47: Theoretical Performance Data of Selected R-321R-161/R-134a/R-1234ze(E) blends containing 30 % R-32, 24-36 % R-161 and 10 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		30/24/10/36	30/26/10/34	30/28/10/32	30/30/10/30	30/32/10/28	30/34/10/26	30/36/10/24
COP		1.31	1.31	1.31	1.31	1.31	1.31	1.31
COP relative to Reference		109.2%	109.2%	109.3%	109.3%	109.4%	109.4%	109.5%
Achieved cooling capacity	kW	2.66	2.70	2.73	2.77	2.81	2.84	2.88
Capacity relative to reference		106.9%	108.5%	110.0%	111.5%	113.0%	114.4%	115.8%
Suction pressure drop relative to reference		72.0%	72.1%	72.2%	72.3%	72.4%	72.5%	72.5%
Pressure ratio		11.73	11.64	11.55	11.47	11.38	11.30	11.22
Mass flow through evaporator	kg/hr	47.4	47.4	47.4	47.4	47.4	47.4	47.4
Liquid injection mass flow	kg/hr	7.2	7.3	7.4	7.5	7.6	7.7	7.8
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.8	5.7	5.5	5.4	5.2	5.0	4.8
Compressor suction pressure	bar	1.40	1.42	1.44	1.46	1.48	1.50	1.52
Compressor discharge pressure	bar	16.4	16.5	16.6	16.7	16.8	16.9	17.0
Condenser glide (in-out)	K	7.6	7.4	7.2	7.0	6.8	6.6	6.4

Table 48: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 30 % R-32, 38-50 % R-161 and 10 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		30/38/10/22	30/40/10/20	30/42/10/18	30/44/10/16	30/46/10/14	30/48/10/12	30/50/10/10
COP		1.31	1.31	1.32	1.32	1.32	1.32	1.32
COP relative to Reference		109.5%	109.6%	109.6%	109.7%	109.7%	109.8%	109.9%
Achieved cooling capacity	kW	2.91	2.95	2.98	3.02	3.05	3.08	3.12
Capacity relative to reference		117.3%	118.6%	120.0%	121.4%	122.7%	124.1%	125.4%
Suction pressure drop relative to reference		72.6%	72.6%	72.7%	72.7%	72.7%	72.8%	72.8%
Pressure ratio		11.13	11.06	10.98	10.90	10.83	10.75	10.68
Mass flow through evaporator	kg/hr	47.3	47.3	47.3	47.3	47.2	47.2	47.1
Liquid injection mass flow	kg/hr	7.8	7.9	8.0	8.1	8.1	8.2	8.2
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.6	4.4	4.2	4.0	3.8	3.6	3.3
Compressor suction pressure	bar	1.54	1.56	1.57	1.59	1.61	1.63	1.65
Compressor discharge pressure	bar	17.1	17.2	17.3	17.4	17.5	17.5	17.6
condenser glide (in-out)	K	6.2	6.0	5.8	5.6	5.4	5.3	5.1

Table 49: Theoretical Performance Data of Selected R-321R-161/R-134a/R-1234ze(E) blends containing 34 % R-32, 10-22 % R-161 and 10 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		**34/10/10/46**	**34/12/10/44**	**34/14/10/42**	**34/16/10/40**	**34/18/10/38**	**34/20/10/36**	**34/22/10/34**
COP		1.30	1.30	1.30	1.30	1.30	1.30	1.31
COP relative to Reference		108.4%	108.5%	108.6%	108.6%	108.7%	108.7%	108.8%
Achieved cooling capacity	kW	2.51	2.56	2.60	2.64	2.69	2.73	2.77
Capacity relative to reference		101.1%	102.9%	104.6%	106.3%	108.0%	109.7%	111.3%
Suction pressure drop relative to reference		73.1%	73.4%	73.6%	73.8%	74.0%	74.2%	74.4%
Pressure ratio		12.18	12.08	11.98	11.88	11.78	11.69	11.60
Mass flow through evaporator	kg/hr	48.6	48.7	48.8	48.9	49.0	49.0	49.0
Liquid injection mass flow	kg/hr	7.2	7.3	7.4	7.6	7.7	7.8	7.9
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	6.3	6.3	6.2	6.1	6.0	5.9	5.8
Compressor suction pressure	bar	1.33	1.35	1.37	1.40	1.42	1.44	1.46
Compressor discharge pressure	bar	16.2	16.3	16.5	16.6	16.7	16.9	17.0
Condenser glide (in-out)	K	8.4	8.3	8.1	7.9	7.7	7.5	7.3

Table 50: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 34 % R-32, 24-34 % R-161 and 10 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		34/24/10/32	34/26/10/30	34/28/10/28	34/30/10/26	34/32/10/24	34/34/10/22
COP		1.31	1.31	1.31	1.31	1.31	1.31
COP relative to Reference		108.8%	108.9%	108.9%	109.0%	109.0%	109.0%
Achieved cooling capacity	kW	2.81	2.84	2.88	2.92	2.96	2.99
Capacity relative to reference		112.9%	114.4%	116.0%	117.5%	119.0%	120.4%
Suction pressure drop relative to reference		74.5%	74.6%	74.7%	74.8%	74.9%	75.0%
Pressure ratio		11.51	11.42	11.33	11.25	11.17	11.09
Mass flow through evaporator	kg/hr	49.1	49.1	49.1	49.1	49.1	49.1
Liquid injection mass flow	kg/hr	8.0	8.1	8.2	8.3	8.4	8.5
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.6	5.5	5.3	5.1	4.9	4.7
Compressor suction pressure	bar	1.49	1.51	1.53	1.55	1.57	1.59
Compressor discharge pressure	bar	17.1	17.2	17.3	17.4	17.5	17.6
Condenser glide (in-out)	K	7.1	6.9	6.7	6.5	6.3	6.1

Table 51: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 34 % R-32, 36-46 % R-161 and 10 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		34/36/10/20	34/38/10/18	34/40/10/16	34/42/10/14	34/44/10/12	34/46/10/10
COP		1.31	1.31	1.31	1.31	1.31	1.31
COP relative to Reference		109.1%	109.1%	109.2%	109.3%	109.3%	109.4%
Achieved cooling capacity	kW	3.03	3.07	3.10	3.14	3.17	3.20
Capacity relative to reference		121.9%	123.3%	124.7%	126.1%	127.5%	128.9%
Suction pressure drop relative to reference		75.0%	75.1%	75.1%	75.2%	75.2%	75.3%
Pressure ratio		11.01	10.93	10.85	10.77	10.70	10.62
Mass flow through evaporator	kg/hr	49.0	49.0	49.0	49.0	48.9	48.9
Liquid injection mass flow	kg/hr	8.5	8.6	8.7	8.7	8.8	8.8
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.5	4.3	4.1	3.9	3.6	3.4
Compressor suction pressure	bar	1.61	1.63	1.65	1.67	1.69	1.71
Compressor discharge pressure	bar	17.7	17.8	17.9	18.0	18.1	18.1
Condenser glide (in-out)	K	5.9	5.7	5.5	5.3	5.1	5.0

Table 52: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 38 % R-32, 10-20 % R-161 and 10 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		38/10/10/42	38/12/10/40	38/14/10/38	38/16/10/36	38/18/10/34	38/20/10/32
COP		1.30	1.30	1.30	1.30	1.30	1.30
COP relative to Reference		108.2%	108.2%	108.3%	108.3%	108.3%	108.4%
Achieved cooling capacity	kW	2.66	2.70	2.74	2.79	2.83	2.87
Capacity relative to reference		106.9%	108.7%	110.4%	112.2%	113.9%	115.5%
Suction pressure drop relative to reference		75.5%	75.7%	76.0%	76.2%	76.4%	76.6%
Pressure ratio		11.94	11.84	11.75	11.65	11.56	11.47
Mass flow through evaporator	kg/hr	50.3	50.4	50.5	50.5	50.6	50.6
Liquid injection mass flow	kg/hr	8.0	8.2	8.3	8.4	8.5	8.6
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	6.1	6.1	6.0	5.9	5.8	5.6
Compressor suction pressure	bar	1.41	1.44	1.46	1.49	1.51	1.53
Compressor discharge pressure	bar	16.9	17.0	17.2	17.3	17.4	17.6
Condenser glide	K	7.9	7.7	7.5	7.3	7.1	6.9

Table 53: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 38 % R-32, 22-32 % R-161 and 10 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		38/22/10/30	38/24/10/28	38/26/10/26	38/28/10/24	38/30/10/22	38/32/10/20
COP		1.30	1.30	1.30	1.30	1.30	1.30
COP relative to Reference		108.4%	108.5%	108.5%	108.5%	108.6%	108.6%
Achieved cooling capacity	kW	2.91	2.95	2.99	3.03	3.07	3.10
Capacity relative to reference		117.2%	118.8%	120.3%	121.9%	123.4%	124.9%
Suction pressure drop relative to reference		76.7%	76.9%	77.0%	77.1%	77.2%	77.3%
Pressure ratio		11.38	11.29	11.21	11.12	11.04	10.96
Mass flow through evaporator	kg/hr	50.6	50.7	50.7	50.7	50.7	50.7
Liquid injection mass flow	kg/hr	8.7	8.8	8.9	9.0	9.1	9.2
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.5	5.3	5.1	4.9	4.7	4.5
Compressor suction pressure	bar	1.55	1.58	1.60	1.62	1.64	1.66
Compressor discharge pressure	bar	17.7	17.8	17.9	18.0	18.1	18.2
Condenser glide (in-out)	K	6.7	6.5	6.3	6.1	5.9	5.7

Table 54: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 38 % R-32, 34-42 % R-161 and 10 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		38/34/10/18	38/36/10/16	38/38/10/14	38/40/10/12	38/42/10/10
COP		1.30	1.30	1.30	1.31	1.31
COP relative to Reference		108.7%	108.7%	108.8%	108.8%	108.9%
Achieved cooling capacity	kW	3.14	3.18	3.21	3.25	3.29
Capacity relative to reference		126.4%	127.9%	129.3%	130.8%	132.2%
Suction pressure drop relative to reference		77.4%	77.4%	77.5%	77.6%	77.6%
Pressure ratio		10.88	10.80	10.73	10.65	10.58
Mass flow through evaporator	kg/hr	50.7	50.6	50.6	50.6	50.6
Liquid injection mass flow	kg/hr	9.2	9.3	9.4	9.4	9.5
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.3	4.1	3.9	3.6	3.4
Compressor suction pressure	bar	1.68	1.70	1.72	1.74	1.76
Compressor discharge pressure	bar	18.3	18.4	18.5	18.6	18.7
Condenser glide (in-out)	K	5.5	5.3	5.1	4.9	4.8

Table 55: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 42 % R-32, 10-24 % R-161 and 10 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		42/10/10/38	42/12/10/36	42/14/10/34	42/16/10/32	42/18/10/30	42/20/10/28	42/22/10/26	42/24/10/24
COP		1.29	1.29	1.29	1.30	1.30	1.30	1.30	1.30
COP relative to Reference		107.9%	107.9%	107.9%	107.9%	108.0%	108.0%	108.0%	108.1%
Achieved cooling capacity	kW	2.80	2.84	2.89	2.93	2.97	3.01	3.06	3.10
Capacity relative to reference		112.6%	114.4%	116.1%	117.9%	119.6%	121.3%	122.9%	124.6%
Suction pressure drop relative to reference		77.7%	77.9%	78.2%	78.4%	78.6%	78.8%	78.9%	79.1%
Pressure ratio		11.72	11.62	11.53	11.44	11.35	11.26	11.17	11.09
Mass flow through evaporator	kg/hr	51.8	51.9	52.0	52.0	52.1	52.1	52.2	52.2
Liquid injection mass flow	kg/hr	8.9	9.0	9.1	9.3	9.4	9.5	9.6	9.6
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.8	5.8	5.6	5.5	5.4	5.2	5.0	4.9
Compressor suction pressure	bar	1.50	1.52	1.55	1.57	1.60	1.62	1.64	1.67
Compressor discharge pressure	bar	17.6	17.7	17.9	18.0	18.1	18.3	18.4	18.5
Condenser glide (in-out)	K	7.2	7.0	6.8	6.6	6.4	6.2	6.0	5.8

Table 56: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 42 % R-32, 26-38 % R-161 and 10 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		42/26/10/22	42/28/10/20	42/30/10/18	42/32/10/16	42/34/10/14	42/36/10/12	42/38/10/10
COP		1.30	1.30	1.30	1.30	1.30	1.30	1.30
COP relative to Reference		108.1%	108.1%	108.2%	108.2%	108.3%	108.3%	108.4%
Achieved cooling capacity	kW	3.14	3.17	3.21	3.25	3.29	3.33	3.36
Capacity relative to reference		126.2%	127.7%	129.3%	130.8%	132.3%	133.9%	135.3%
Suction pressure drop relative to reference		79.2%	79.4%	79.5%	79.6%	79.7%	79.8%	79.9%
Pressure ratio		11.00	10.92	10.84	10.76	10.68	10.61	10.53
Mass flow through evaporator	kg/hr	52.2	52.2	52.2	52.2	52.2	52.2	52.2
Liquid injection mass flow	kg/hr	9.7	9.8	9.9	10.0	10.0	10.1	10.1
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.7	4.4	4.2	4.0	3.8	3.5	3.3
Compressor suction pressure	bar	1.69	1.71	1.73	1.76	1.78	1.80	1.82
Compressor discharge pressure	bar	18.6	18.7	18.8	18.9	19.0	19.1	19.2
Condenser glide (in-out)	K	5.6	5.4	5.2	5.1	4.9	4.7	4.5

Table 57: Theoretical Performance Data of Selected R-32/R-164/R-134a/R-1234ze(E) blends containing 46 % R-32, 10-22 % R-161 and 10 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		46/10/10/34	46/12/10/32	46/14/10/30	46/16/10/28	46/18/10/26	46/20/10/24	46/22/10/22
COP		1.29	1.29	1.29	1.29	1.29	1.29	1.29
COP relative to Reference		107.5%	107.6%	107.6%	107.6%	107.6%	107.6%	107.7%
Achieved cooling capacity	kW	2.94	2.98	3.03	3.07	3.11	3.16	3.20
Capacity relative to reference		118.1%	120.0%	121.8%	123.5%	125.3%	127.0%	128.7%
Suction pressure drop relative to reference		79.7%	79.9%	80.2%	80.4%	80.7%	80.9%	81.1%
Pressure ratio		11.51	11.42	11.32	11.23	11.15	11.06	10.97
Mass flow through evaporator	kg/hr	53.2	53.3	53.4	53.5	53.5	53.6	53.6
Liquid injection mass flow	kg/hr	9.8	9.9	10.0	10.1	10.2	10.3	10.4
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.4	5.3	5.2	5.0	4.9	4.7	4.5
Compressor suction pressure	bar	1.59	1.61	1.64	1.66	1.69	1.71	1.74
Compressor discharge pressure	bar	18.2	18.4	18.5	18.7	18.8	18.9	19.0
Condenser glide (in-out)	K	6.6	6.4	6.2	6.0	5.8	5.6	5.4

Table 58: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 46 % R-32, 24-34 % R-161 and 10 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		46/24/10/20	46/26/10/18	46/28/10/16	46/30/10/14	46/32/10/12	46/34/10/10
COP		1.29	1.29	1.29	1.29	1.29	1.29
COP relative to Reference		107.7%	107.7%	107.8%	107.8%	107.9%	107.9%
Achieved cooling capacity	kW	3.24	3.28	3.32	3.36	3.40	3.44
Capacity relative to reference		130.3%	131.9%	133.6%	135.1%	136.7%	138.3%
Suction pressure drop relative to reference		81.2%	81.4%	81.5%	81.7%	81.8%	81.9%
Pressure ratio		10.89	10.81	10.73	10.65	10.57	10.49
Mass flow through evaporator	kg/hr	53.7	53.7	53.7	53.7	53.7	53.7
Liquid injection mass flow	kg/hr	10.5	10.6	10.6	10.7	10.8	10.8
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.3	4.1	3.9	3.6	3.4	3.1
Compressor suction pressure	bar	1.76	1.78	1.81	1.83	1.85	1.87
Compressor discharge pressure	bar	19.2	19.3	19.4	19.5	19.6	19.7
Condenser glide (in-out)	K	5.2	5.0	4.8	4.6	4.4	4.2

Table 59: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 20 % R-32, 10-20 % R-161 and 14 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		20/10/14/56	20/12/14/54	20/14/14/52	20/16/14/50	20/18/14/48	20/20/14/46
COP		1.30	1.30	1.31	1.31	1.31	1.31
COP relative to Reference		108.5%	108.7%	108.9%	109.0%	109.2%	109.3%
Achieved cooling capacity	kW	2.00	2.04	2.09	2.13	2.17	2.21
Capacity relative to reference		80.4%	82.2%	84.0%	85.7%	87.4%	89.1%
Suction pressure drop relative to reference		63.7%	64.1%	64.4%	64.7%	65.0%	65.3%
Pressure ratio		13.11	12.98	12.86	12.74	12.63	12.52
Mass flow through evaporator	kg/hr	42.4	42.5	42.7	42.8	42.9	43.0
Liquid injection mass flow	kg/hr	4.4	4.6	4.7	4.9	5.0	5.2
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.2	5.3	5.3	5.3	5.3	5.3
Compressor suction pressure	bar	1.04	1.06	1.08	1.10	1.13	1.15
Compressor discharge pressure	bar	13.6	13.8	13.9	14.1	14.2	14.4
Condenser glide (in-out)	K	9.0	8.9	8.8	8.6	8.5	8.3

Table 60: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 20 % R-32, 22-32 % R-161 and 14 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		20/22/14/44	20/24/14/42	20/26/14/40	20/28/14/38	20/30/14/36	20/32/14/34
COP		1.31	1.31	1.31	1.32	1.32	1.32
COP relative to Reference		109.4%	109.5%	109.6%	109.7%	109.8%	109.8%
Achieved cooling capacity	kW	2.25	2.29	2.33	2.37	2.41	2.45
Capacity relative to reference		90.7%	92.3%	93.9%	95.4%	97.0%	98.5%
Suction pressure drop relative to reference		65.5%	65.7%	65.9%	66.1%	66.2%	66.4%
Pressure ratio		12.41	12.30	12.20	12.10	12.00	11.90
Mass flow through evaporator	kg/hr	43.1	43.2	43.3	43.3	43.4	43.4
Liquid injection mass flow	kg/hr	5.3	5.4	5.5	5.6	5.7	5.9
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.2	5.2	5.1	5.0	4.9	4.8
Compressor suction pressure	bar	1.17	1.19	1.21	1.23	1.25	1.27
Compressor discharge pressure	bar	14.5	14.6	14.7	14.9	15.0	15.1
Condenser glide (in-out)	K	8.1	7.9	7.7	7.6	7.4	7.2

Table 61: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 20 % R-32, 34-44 % R-161 and 14 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		20/34/14/32	20/36/14/30	20/38/14/28	20/40/14/26	20/42/14/24	20/44/14/22
COP		1.32	1.32	1.32	1.32	1.32	1.32
COP relative to Reference		109.9%	110.0%	110.0%	110.1%	110.2%	110.2%
Achieved cooling capacity	kW	2.48	2.52	2.55	2.59	2.62	2.66
Capacity relative to reference		99.9%	101.4%	102.8%	104.2%	105.6%	106.9%
Suction pressure drop relative to reference		66.5%	66.6%	66.7%	66.8%	66.9%	67.0%
Pressure ratio		11.81	11.72	11.63	11.54	11.45	11.37
Mass flow through evaporator	kg/hr	43.4	43.4	43.4	43.5	43.5	43.5
Liquid injection mass flow	kg/hr	6.0	6.1	6.1	6.2	6.3	6.4
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.7	4.5	4.4	4.2	4.0	3.9
Compressor suction pressure	bar	1.29	1.31	1.33	1.34	1.36	1.38
Compressor discharge pressure	bar	15.2	15.3	15.4	15.5	15.6	15.7
Condenser qlide (in-out)	K	6.9	6.7	6.5	6.3	6.1	5.9

Table 62: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 20 % R-32, 46-56 % R-161 and 14 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		20/46/14/20	20/48/14/18	20/50/14/16	20/52/14/14	20/54/14/12	20/56/14/10
COP		1.32	1.32	1.32	1.33	1.33	1.33
COP relative to Reference		110.3%	110.3%	110.4%	110.5%	110.5%	110.6%
Achieved cooling capacity	kW	2.69	2.72	2.76	2.79	2.82	2.85
Capacity relative to reference		108.3%	109.6%	110.9%	112.2%	113.5%	114.8%
Suction pressure drop relative to reference		67.1%	67.1%	67.2%	67.2%	67.3%	67.3%
Pressure ratio		11.29	11.20	11.13	11.05	10.97	10.89
Mass flow through evaporator	kg/hr	43.4	43.4	43.4	43.4	43.4	43.3
Liquid injection mass flow	kg/hr	6.5	6.6	6.6	6.7	6.8	6.8
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	3.7	3.5	3.3	3.1	2.9	2.7
Compressor suction pressure	bar	1.40	1.42	1.43	1.45	1.47	1.49
Compressor discharge pressure	bar	15.8	15.9	16.0	16.0	16.1	16.2
Condenser glide (in-out)	K	5.7	5.6	5.4	5.2	5.0	4.8

Table 63: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 24 % R-32, 10-24 % R-161 and 14 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		24/10/14/52	24/12/14/50	24/14/14/48	24/16/14/46	24/18/14/44	24/20/14/42	24/22/14/10	24/24/14/38
COP		1.30	1.30	1.31	1.31	1.31	1.31	1.31	1.31
COP relative to Reference		108.6%	108.7%	108.8%	109.0%	109.1%	109.2%	109.3%	109.3%
Achieved cooling capacity	kW	2.15	2.20	2.24	2.29	2.33	2.37	2.41	2.45
Capacity relative to reference		86.7%	88.5%	90.3%	92.0%	93.7%	95.4%	97.0%	98.6%
Suction pressure drop relative to reference		66.8%	67.2%	67.5%	67.8%	68.0%	68.3%	68.5%	68.7%
Pressure ratio		12.81	12.69	12.57	12.46	12.35	12.24	12.14	12.04
Mass flow through evaporator	kg/hr	44.4	44.6	44.7	44.8	44.9	45.0	45.1	45.1
Liquid injection mass flow	kg/hr	5.2	5.4	5.5	5.7	5.8	5.9	6.0	6.2
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.7	5.7	5.7	5.7	5.6	5.6	5.5	5.4
Compressor suction pressure	bar	1.12	1.15	1.17	1.19	1.21	1.24	1.26	1.28
Compressor discharge pressure	bar	14.4	14.6	14.7	14.8	15.0	15.1	15.3	15.4
Condenser glide (in-out)	K	9.0	8.8	8.7	8.5	8.3	8.1	8.0	7.8

Table 64: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 24 % R-32, 26-38 % R-161 and 14 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		24/26/14/36	24/28/14/34	24/30/14/32	24/32/14/30	24/34/14/28	24/36/14/26	24/38/14/24
COP		1.31	1.31	1.31	1.31	1.32	1.32	1.32
COP relative to Reference		109.4%	109.5%	109.5%	109.6%	109.7%	109.7%	109.8%
Achieved cooling capacity	kW	2.49	2.53	2.57	2.60	2.64	2.68	2.71
Capacity relative to reference		100.2%	101.7%	103.3%	104.7%	106.2%	107.7%	109.1%
Suction pressure drop relative to reference		68.8%	69.0%	69.1%	69.2%	69.3%	69.4%	69.5%
Pressure *ratio*		11.94	11.85	11.75	11.66	11.57	11.48	11.40
Mass flow through evaporator	kg/hr	45.2	45.2	45.2	45.3	45.3	45.3	45.3
Liquid injection mass flow	kg/hr	6.3	6.4	6.5	6.6	6.7	6.8	6.9
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.3	5.2	5.1	4.9	4.8	4.6	4.4
Compressor suction pressure	bar	1.30	1.32	1.34	1.36	1.38	1.40	1.42
Compressor discharge pressure	bar	15.5	15.6	15.7	15.8	15.9	16.1	16.2
Condenser glide (in-out)	K	7.6	7.4	7.2	7.0	6.7	6.5	6.3

Table 65: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 24 % R-32, 26-38 % R-161 and 14 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		24/40/14/22	24/42/14/20	24/44/14/18	24/46/14/16	24/48/14/14	24/50/14/12	24/52/14/10
COP		1.32	1.32	1.32	1.32	1.32	1.32	1.32
COP relative to Reference		109.8%	109.9%	109.9%	110.0%	110.1%	110.1%	110.2%
Achieved cooling capacity	kW	2.75	2.78	2.81	2.85	2.88	2.91	2.95
Capacity relative to reference		110.5%	111.9%	113.3%	114.6%	115.9%	117.3%	118.6%
Suction pressure drop relative to reference		69.6%	69.7%	69.7%	69.8%	69.9%	69.9%	69.9%
Pressure ratio		11.31	11.23	11.15	11.07	10.99	10.91	10.84
Mass flow through evaporator	kg/hr	45.3	45.3	45.2	45.2	45.2	45.2	45.1
Liquid injection mass flow	kg/hr	7.0	7.0	7.1	7.2	7.2	7.3	7.4
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.2	4.0	3.9	3.7	3.4	3.2	3.0
Compressor suction pressure	bar	1.44	1.45	1.47	1.49	1.51	1.53	1.55
Compressor discharge pressure	bar	16.2	16.3	16.4	16.5	16.6	16.7	16.8
Condenser glide (in-out)	K	6.1	5.9	5.7	5.6	5.4	5.2	5.0

Table 66: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 28 % R-32, 10-22 % R-161 and 14 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		**28/10/14/48**	**28/12/14/46**	**28/14/14/44**	**28/16/14/42**	**28/18/14/40**	**28/20/14/38**	**28/22/14/36**
COP		1.30	1.30	1.30	1.31	1.31	1.31	1.31
COP relative to Reference		108.5%	108.6%	108.7%	108.8%	108.9%	109.0%	109.0%
Achieved cooling capacity	kW	2.31	2.35	2.40	2.44	2.48	2.52	2.56
Capacity relative to reference		92.8%	94.6%	96.4%	98.2%	99.9%	101.6%	103.2%
Suction pressure drop relative to reference		69.7%	70.0%	70.3%	70.6%	70.8%	71.0%	71.2%
Pressure ratio		12.52	12.41	12.30	12.19	12.09	11.99	11.89
Mass flow through evaporator	kg/hr	46.3	46.5	46.6	46.7	46.8	46.9	46.9
Liquid injection mass flow	kg/hr	6.1	6.2	6.3	6.5	6.6	6.7	6.8
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	*130.0*
Evaporator glide (out-in)	K	5.9	5.9	5.9	5.8	5.8	5.7	5.6
Compressor suction pressure	bar	1.21	1.23	1.26	1.28	1.30	1.32	1.35
Compressor discharge pressure	bar	15.2	15.3	15.5	15.6	15.7	15.9	16.0
Condenser glide (in-out)	K	8.7	8.5	8.4	8.2	8.0	7.8	7.6

Table 67: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 28 % R-32, 24-36 % R-161 and 14 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		28/24/14/34	28/26/14/32	28/28/14/30	28/30/14/28	28/32/14/26	28/34/14/24	28/36/14/22
COP		1.31	1.31	1.31	1.31	1.31	1.31	1.31
COP relative to Reference		109.1%	109.1%	109.2%	109.2%	109.3%	109.4%	109.4%
Achieved cooling capacity	kW	2.60	2.64	2.68	2.72	2.76	2.79	2.83
Capacity relative to reference		104.8%	106.4%	107.9%	109.4%	110.9%	112.4%	113.9%
Suction pressure drop relative to reference		71.4%	71.6%	71.7%	71.8%	71.9%	72.0%	72.1%
Pressure ratio		11.80	11.70	11.61	11.52	11.43	11.35	11.26
Mass flow through evaporator	kg/hr	47.0	47.0	47.0	47.0	47.0	47.1	47.0
Liquid injection mass flow	kg/hr	7.0	7.1	7.2	7.3	7.4	7.4	7.5
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.5	5.3	5.2	5.0	4.9	4.7	4.5
Compressor suction pressure	bar	1.37	1.39	1.41	1.43	1.45	1.47	1.49
Compressor discharge pressure	bar	16.1	16.2	16.4	16.5	16.6	16.7	16.8
Condenser glide (in-out)	K	7.4	7.2	7.0	6.8	6.6	6.4	6.2

Table 68: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 28 % R-32, 38-50 % R-161 and 14 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		28/38/14/20	28/40/14/18	28/42/14/16	28/44/14/14	28/46/14/12	28/48/14/10	28/50/14/8
COP		1.31	1.31	1.31	1.32	1.32	1.32	1.32
COP relative to Reference		109.5%	109.5%	109.6%	109.6%	109.7%	109.7%	109.8%
Achieved cooling capacity	kW	2.87	2.90	2.94	2.97	3.00	3.04	3.07
Capacity relative to reference		115.3%	116.7%	118.1%	119.5%	120.9%	122.2%	123.6%
Suction pressure drop relative to reference		72.2%	72.3%	72.3%	72.4%	72.4%	72.5%	72.5%
Pressure ratio		11.18	11.10	11.02	10.94	10.86	10.78	10.71
Mass flow through evaporator	kg/hr	47.0	47.0	47.0	47.0	47.0	46.9	46.9
Liquid injection mass flow	kg/hr	7.6	7.7	7.8	7.8	7.9	8.0	8.0
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.3	4.1	3.9	3.7	3.5	3.2	3.0
Compressor suction pressure	bar	1.51	1.53	1.55	1.57	1.59	1.60	1.62
Compressor discharge pressure	bar	16.9	17.0	17.1	17.1	17.2	17.3	17.4
Condenser glide (in-out)	K	6.0	5.8	5.6	5.4	5.2	5.0	4.9

Table 69: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 32 % R-32, 10-22 % R-161 and 14 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		32/10/14/44	32/12/14/42	32/14/14/40	32/16/14/38	32/18/14/36	32/20/14/34	32/22/14/32
COP		1.30	1.30	1.30	1.30	1.30	1.30	1.30
COP relative to Reference		108.3%	108.4%	108.5%	108.6%	108.6%	108.7%	108.7%
Achieved cooling capacity	kW	2.46	2.50	2.55	2.59	2.63	2.67	2.71
Capacity relative to reference		98.8%	100.6%	102.4%	104.2%	105.9%	107.6%	109.2%
Suction pressure drop relative to reference		72.4%	72.7%	73.0%	73.2%	73.4%	73.6%	73.8%
Pressure ratio		12.26	12.15	12.05	11.95	11.85	11.75	11.66
Mass flow through evaporator	kg/hr	48.1	48.3	48.4	48.5	48.5	48.6	48.6
Liquid injection mass flow	kg/hr	6.9	7.0	7.2	7.3	7.4	7.5	7.6
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	6.0	5.9	5.9	5.8	5.7	5.6	5.5
Compressor suction pressure	bar	1.30	1.32	1.34	1.37	1.39	1.41	1.44
Compressor discharge pressure	bar	15.9	16.0	16.2	16.3	16.5	16.6	16.7
Condenser glide (in-out)	K	8.3	8.1	7.9	7.7	7.5	7.3	7.1

Table 70: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 32 % R-32, 24-34 % R-161 and 14 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		32/24/14/30	32/26/14/28	32/28/14/26	32/30/14/24	32/32/14/22	32/34/14/20
COP		1.31	1.31	1.31	1.31	1.31	1.31
COP relative to Reference		108.8%	108.8%	108.9%	108.9%	109.0%	109.0%
Achieved cooling capacity	kW	2.75	2.79	2.83	2.87	2.91	2.95
Capacity relative to reference		110.8%	112.4%	114.0%	115.5%	117.0%	118.5%
Suction pressure drop relative to reference		74.0%	74.1%	74.3%	74.4%	74.5%	74.6%
Pressure ratio		11.56	11.47	11.39	11.30	11.21	11.13
Mass flow through evaporator	kg/hr	48.7	48.7	48.7	48.7	48.8	48.8
Liquid injection mass flow	kg/hr	7.7	7.9	7.9	8.0	8.1	8.2
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.3	5.2	5.0	4.8	4.6	4.4
Compressor suction pressure	bar	1.46	1.48	1.50	1.52	1.54	1.56
Compressor discharge pressure	bar	16.9	17.0	17.1	17.2	17.3	17.4
Condenser glide (in-out)	K	6.9	6.7	6.5	6.3	6.1	5.9

Table 71: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 32 % R-32, 36-46 % R-161 and 14 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		**32/36/14/18**	**32/38/14/16**	**32/40/14/14**	**32/42/14/12**	**32/44/14/10**	**32/46/14/8**
COP		1.31	1.31	1.31	1.31	1.31	1.31
COP relative to Reference		109.1%	109.1%	109.2%	109.2%	109.3%	109.4%
Achieved cooling capacity	kW	2.98	3.02	3.05	3.09	3.12	3.16
Capacity relative to reference		120.0%	121.4%	122.8%	124.3%	125.7%	127.1%
Suction pressure drop relative to reference		74.7%	74.8%	74.8%	74.9%	75.0%	75.0%
Pressure ratio		11.05	10.97	10.89	10.81	10.73	10.66
Mass flow through evaporator	kg/hr	48.7	48.7	48.7	48.7	48.7	48.6
Liquid injection mass flow	kg/hr	8.3	8.4	8.4	8.5	8.6	8.6
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.2	4.0	3.8	3.6	3.3	3.1
Compressor suction pressure	bar	1.58	1.60	1.62	1.64	1.66	1.68
Compressor discharge pressure	bar	17.5	17.6	17.7	17.8	17.8	17.9
Condenser glide (in-out)	K	5.7	5.5	5.3	5.2	5.0	4.8

Table 72: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 36 % R-32, 10-20 % R-161 and 14 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		36/10/14/40	36/12/14/38	36/14/14/36	36/16/14/34	36/18/14/32	36/20/14/30
COP		1.30	1.30	1.30	1.30	1.30	1.30
COP relative to Reference		108.1%	108.2%	108.2%	108.3%	108.3%	108.4%
Achieved cooling capacity	kW	2.60	2.65	2.69	2.74	2.78	2.82
Capacity relative to reference		104.7%	106.5%	108.3%	110.1%	111.8%	113.5%
Suction pressure drop relative to reference		74.8%	75.1%	75.4%	75.6%	75.9%	76.1%
Pressure ratio		12.02	11.91	11.81	11.72	11.62	11.53
Mass flow through evaporator	kg/hr	49.8	49.9	50.0	50.1	50.2	50.2
Liquid injection mass flow	kg/hr	7.7	7.9	8.0	8.1	8.2	8.4
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.9	5.8	5.7	5.6	5.5	5.4
Compressor suction pressure	bar	1.38	1.41	1.43	1.46	1.48	1.50
Compressor discharge pressure	bar	16.6	16.8	16.9	17.0	17.2	17.3
Condenser glide (in-out)	K	7.7	7.6	7.4	7.2	7.0	6.8

Table 73: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 36 % R-32, 22-32 % R-161 and 14 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		36/22/14/28	36/24/14/26	36/26/14/24	36/28/14/22	36/30/14/20	36/32/14/18
COP		1.30	1.30	1.30	1.30	1.30	1.30
COP relative to Reference		108.4%	108.4%	108.5%	108.5%	108.6%	108.6%
Achieved cooling capacity	kW	2.86	2.90	2.94	2.98	3.02	3.06
Capacity relative to reference		115.1%	116.7%	118.3%	119.9%	121.5%	123.0%
Suction pressure drop relative to reference		76.2%	76.4%	76.6%	76.7%	76.8%	76.9%
Pressure ratio		11.44	11.35	11.26	11.17	11.09	11.00
Mass flow through evaporator	kg/hr	50.3	50.3	50.4	50.4	50.4	50.4
Liquid injection mass flow	kg/hr	8.5	8.6	8.7	8.7	8.8	8.9
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.2	5.1	4.9	4.7	4.5	4.3
Compressor suction pressure	bar	1.52	1.55	1.57	1.59	1.61	1.63
Compressor discharge pressure	bar	17.4	17.6	17.7	17.8	17.9	18.0
Condenser glide (in-out)	K	6.6	6.4	6.2	6.0	5.8	5.6

Table 74: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 36 % R-32, 34-42 % R-161 and 14 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		36/34/14/16	36/36/14/14	36/38/14/12	36/40/14/10	36/42/14/8
COP		1.30	1.30	1.30	1.31	1.31
COP relative to Reference		108.7%	108.7%	108.8%	108.8%	108.9%
Achieved cooling capacity	kW	3.09	3.13	3.17	3.20	3.24
Capacity relative to reference		124.5%	126.0%	127.5%	128.9%	130.4%
Suction pressure drop relative to reference		77.0%	77.1%	77.2%	77.3%	77.4%
Pressure ratio		*10.92*	*10.84*	10.76	10.69	10.61
Mass flow through evaporator	kg/hr	50.4	50.4	50.4	50.4	50.3
Liquid injection mass flow	kg/hr	9.0	9.1	9.1	9.2	9.2
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.1	3.8	3.6	3.4	3.1
Compressor suction pressure	bar	1.66	1.68	1.70	1.72	1.74
Compressor discharge pressure	bar	18.1	18.2	18.3	18.4	18.4
Condenser glide (in-out)	K	5.4	5.2	5.0	4.8	4.6

Table 75: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 40 % R-32, 10-24 % R-161 and 14 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		40/10/14/36	40/12/14/34	40/14/14/32	40/16/14/30	40/18/14/28	40/20/14/26	40/22/14/24	40/24/14/22
COP		1.29	1.29	1.29	1.30	1.30	1.30	1.30	1.30
COP relative to Reference		107.8%	107.9%	107.9%	107.9%	108.0%	108.0%	108.0%	108.1%
Achieved cooling capacity	kW	2.74	2.79	2.83	2.88	2.92	2.96	3.01	3.05
Capacity relative to reference		110.4%	112.3%	114.1%	115.8%	117.6%	119.3%	120.9%	122.6%
Suction pressure drop relative to reference		77.0%	77.3%	77.6%	77.9%	78.1%	78.3%	78.5%	78.7%
Pressure ratio		11.79	11.69	11.59	11.50	11.41	11.31	11.23	11.14
Mass flow through evaporator	kg/hr	51.3	51.5	51.6	51.6	51.7	51.8	51.8	51.9
Liquid injection mass flow	kg/hr	8.6	8.7	8.9	9.0	9.1	9.2	9.3	9.4
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.6	5.6	5.4	5.3	5.2	5.0	4.8	4.7
Compressor suction pressure	bar	1.47	1.49	1.52	1.54	1.57	1.59	1.62	1.64
Compressor discharge pressure	bar	17.3	17.5	17.6	17.7	17.9	18.0	18.1	18.2
Condenser qlide (in-out)	K	7.1	7.0	6.8	6.6	6.4	6.2	6.0	5.8

Table 76: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 40 % R-32, 26-38 % R-161 and 14 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		40/26/14/20	40/28/14/18	40/30/14/16	40/32/14/14	40/34/14/12	40/36/14/10	40/38/14/8
COP		1.30	1.30	1.30	1.30	1.30	1.30	1.30
COP relative to Reference		108.1%	108.2%	108.2%	108.2%	108.3%	108.4%	108.4%
Achieved cooling capacity	kW	3.09	3.13	3.17	3.20	3.24	3.28	3.32
Capacity relative to reference		124.2%	125.8%	127.4%	128.9%	130.5%	132.0%	133.5%
Suction pressure drop relative to reference		78.9%	79.0%	79.1%	79.3%	79.4%	79.5%	79.6%
Pressure ratio		11.05	10.97	10.89	10.80	10.72	10.64	10.57
Mass flow through evaporator	kg/hr	51.9	51.9	52.0	52.0	52.0	52.0	52.0
Liquid injection mass flow	kg/hr	9.5	9.6	9.6	9.7	9.8	9.8	9.9
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.5	4.2	4.0	3.8	3.6	3.3	3.1
Compressor suction pressure	bar	1.66	1.68	1.71	1.73	1.75	1.77	1.79
Compressor discharge pressure	bar	18.4	18.5	18.6	18.7	18.8	18.9	18.9
Condenser glide (in-out)	K	5.6	5.4	5.2	5.0	4.8	4.6	4.4

Table 77: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 44 % R-32, 10-22 % R-161 and 14 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		44/10/14/32	44/12/14/30	44/14/14/28	44/16/14/26	44/18/14/24	44/20/14/22	44/22/14/20
COP		1.29	1.29	1.29	1.29	1.29	1.29	1.29
COP relative to Reference		107.6%	107.6%	107.6%	107.6%	107.6%	107.7%	107.7%
Achieved cooling capacity	kW	2.88	2.93	2.98	3.02	3.06	3.11	3.15
Capacity relative to reference		116.0%	117.9%	119.7%	121.5%	123.3%	125.0%	126.7%
Suction pressure drop relative to reference		79.1%	79.4%	79.7%	80.0%	80.2%	80.4%	80.7%
Pressure ratio		11.57	11.48	11.38	11.29	11.20	11.11	11.02
Mass flow through evaporator	kg/hr	52.8	52.9	53.0	53.1	53.2	53.3	53.3
Liquid injection mass flow	kg/hr	9.5	9.6	9.7	9.8	9.9	10.0	10.1
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.3	5.2	5.0	4.9	4.7	4.5	4.4
Compressor suction pressure	bar	1.55	1.58	1.61	1.63	1.66	1.68	1.71
Compressor discharge pressure	bar	18.0	18.1	18.3	18.4	18.6	18.7	18.8
Condenser glide (in-out)	K	6.5	6.3	6.1	5.9	5.7	5.5	5.3

Table 78: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 44 % R-32, 24-34 % R-161 and 14 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		44/24/14/18	44/26/14/16	44/28/14/14	44/30/14/12	44/32/14/10	44/34/14/8
COP		1.29	1.29	1.29	1.29	1.29	1.30
COP relative to Reference		107.7%	107.8%	107.8%	107.8%	107.9%	108.0%
Achieved cooling capacity	kW	3.19	3.23	3.27	3.31	3.35	3.39
Capacity relative to reference		128.4%	130.0%	131.7%	133.3%	134.9%	136.4%
Suction pressure drop relative to reference		80.9%	81.0%	81.2%	81.4%	81.5%	81.7%
Pressure ratio		10.94	10.85	10.77	10.69	10.61	10.53
Mass flow through evaporator	kg/hr	53.4	53.4	53.4	53.5	53.5	53.5
Liquid injection mass flow	kg/hr	10.2	10.3	10.4	10.4	10.5	10.6
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.1	3.9	3.7	3.5	3.2	3.0
Compressor suction pressure	bar	1.73	1.75	1.78	1.80	1.82	1.85
Compressor discharge pressure	bar	18.9	19.0	19.1	19.2	19.3	19.4
Condenser glide (in-out)	K	5.1	4.9	4.7	4.5	4.4	4.2

Table 79: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 20 % R-32, 10-24 % R-161 and 18 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		20/10/18/52	20/12/18/50	20/14/18/48	20/16/18/46	20/18/18/44	20/20/18/42	20/22/18/40	20/24/18/38
COP		1.30	1.30	1.30	1.31	1.31	1.31	1.31	1.31
COP relative to Reference		108.3%	108.5%	108.7%	108.8%	108.9%	109.1%	109.2%	109.3%
Achieved cooling capacity	kW	2.02	2.06	2.11	2.15	2.20	2.24	2.28	2.32
Capacity relative to reference		81.2%	83.0%	84.8%	86.6%	88.3%	90.0%	91.7%	93.3%
Suction pressure drop relative to reference		64.4%	64.8%	65.1%	65.5%	65.8%	66.0%	66.3%	66.5%
Pressure ratio		13.05	12.92	12.80	12.68	12.57	12.45	12.34	12.24
Mass flow through evaporator	kg/hr	42.8	43.0	43.1	43.3	43.4	43.5	43.6	43.7
Liquid injection mass flow	kg/hr	4.5	4.7	4.9	5.0	5.1	5.3	5.4	5.5
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.0	5.0	5.1	5.1	5.0	5.0	4.9	4.9
Compressor suction pressure	bar	1.05	1.07	1.10	1.12	1.14	1.16	1.18	1.20
Compressor discharge pressure	bar	13.7	13.9	14.0	14.2	14.3	14.5	14.6	14.7
Condenser glide (in-out)	K	8.6	8.5	8.4	8.2	8.1	7.9	7.7	7.5

Table 80: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 20 % R-32, 26-40 % R-161 and 18 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		20/26/18/36	20/28/18/34	20/30/18/32	20/32/18/30	20/34/18/28	20/36/18/26	20/38/18/24	20/40/18/22
COP		1.31	1.31	1.31	1.31	1.32	1.32	1.32	1.32
COP relative to Reference		109.4%	109.4%	109.5%	109.6%	109.7%	109.7%	109.8%	109.9%
Achieved cooling capacity	kW	2.36	2.40	2.44	2.47	2.51	2.55	2.58	2.62
Capacity relative to reference		94.9%	96.5%	98.0%	99.5%	101.0%	102.5%	103.9%	105.3%
Suction pressure drop relative to reference		66.7%	66.9%	67.1%	67.3%	67.4%	67.6%	67.7%	67.8%
Pressure ratio		12.13	12.03	11.93	11.84	11.74	11.65	11.56	11.47
Mass flow through evaporator	kg/hr	43.8	43.8	43.9	43.9	44.0	44.0	44.0	44.0
Liquid injection mass flow	kg/hr	5.6	5.8	5.9	6.0	6.1	6.2	6.3	6.4
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.8	4.7	4.6	4.4	4.3	4.2	4.0	3.8
Compressor suction pressure	bar	1.22	1.25	1.27	1.29	1.30	1.32	1.34	1.36
Compressor discharge pressure	bar	14.9	15.0	15.1	15.2	15.3	15.4	15.5	15.6
Condenser glide (in-out)	K	7.3	7.1	6.9	6.7	6.5	6.3	6.1	5.9

Table 81: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 20 % R-32, 42-54 % R-161 and 18 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		20/42/18/20	20/44/18/18	20/46/18/16	20/48/18/14	20/50/18/12	20/52/18/10	20/54/18/8
COP		1.32	1.32	1.32	1.32	1.32	1.32	1.32
COP relative to Reference		109.9%	110.0%	110.0%	110.1%	110.2%	110.2%	110.3%
Achieved cooling capacity	kW	2.65	2.69	2.72	2.76	2.79	2.82	2.85
Capacity relative to reference		106.7%	108.1%	109.5%	110.9%	112.2%	113.5%	114.8%
Suction pressure drop relative to reference		67.9%	68.0%	68.1%	68.1%	68.2%	68.3%	68.3%
Pressure ratio		11.38	11.30	11.22	11.13	11.05	10.97	10.90
Mass flow through evaporator	kg/hr	44.0	44.0	44.0	44.0	44.0	44.0	44.0
Liquid injection mass flow	kg/hr	6.4	6.5	6.6	6.7	6.8	6.8	6.9
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	3.7	3.5	3.3	3.1	2.9	2.7	2.5
Compressor suction pressure	bar	1.38	1.40	1.42	1.44	1.45	1.47	1.49
Compressor discharge pressure	bar	15.7	15.8	15.9	16.0	16.1	16.2	16.2
Condenser glide (in-out)	K	5.7	5.5	5.3	5.1	5.0	4.8	4.6

Table 82: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 24 % R-32, 10-22 % R-161 and 18 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		24/10/18/48	24/12/18/46	24/14/18/44	24/16/18/42	24/18/18/40	24/20/18/38	24/22/18/36
COP		1.30	1.30	1.30	1.30	1.31	1.31	1.31
COP relative to Reference		108.4%	108.5%	108.6%	108.7%	108.8%	108.9%	109.0%
Achieved cooling capacity	kW	2.17	2.22	2.26	2.31	2.35	2.39	2.43
Capacity relative to reference		87.5%	89.3%	91.1%	92.9%	94.6%	96.3%	97.9%
Suction pressure drop relative to reference		67.4%	67.8%	68.1%	68.4%	68.7%	69.0%	69.2%
Pressure ratio		12.75	12.63	12.52	12.40	12.29	12.19	12.08
Mass flow through evaporator	kg/hr	44.8	45.0	45.1	45.3	45.4	45.5	45.5
Liquid injection mass flow	kg/hr	5.4	5.5	5.6	5.8	5.9	6.1	6.2
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.4	5.4	5.4	5.4	5.3	5.3	5.2
Compressor suction pressure	bar	1.14	1.16	1.18	1.21	1.23	1.25	1.27
Compressor discharge pressure	bar	14.5	14.7	14.8	15.0	15.1	15.2	15.4
Condenser glide (in-out)	K	8.5	8.4	8.2	8.1	7.9	7.7	7.5

Table 83: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 24 % R-32, 24-36 % R-161 and 18 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		24/24/18/34	24/26/18/32	24/28/18/30	24/30/18/28	24/32/18/26	24/34/18/24	24/36/18/22
COP		1.31	1.31	1.31	1.31	1.31	1.31	1.31
COP relative to Reference		109.1%	109.2%	109.2%	109.3%	109.4%	109.4%	109.5%
Achieved cooling capacity	kW	2.47	2.51	2.55	2.59	2.63	2.67	2.70
Capacity relative to reference		99.6%	101.2%	102.7%	104.3%	105.8%	107.3%	108.7%
Suction pressure drop relative to reference		69.4%	69.6%	69.8%	70.0%	70.1%	70.2%	70.4%
Pressure ratio		11.98	11.88	11.79	11.69	11.60	11.51	11.42
Mass flow through evaporator	kg/hr	45.6	45.7	45.7	45.8	45.8	45.8	45.8
Liquid injection mass flow	kg/hr	6.3	6.4	6.5	6.6	6.7	6.8	6.9
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.1	5.0	4.8	4.7	4.5	4.4	4.2
Compressor suction pressure	bar	1.29	1.31	1.34	1.36	1.38	1.40	1.42
Compressor discharge pressure	bar	15.5	15.6	15.7	15.9	16.0	16.1	16.2
Condenser glide (in-out)	K	7.3	7.1	6.9	6.7	6.5	6.3	6.1

Table 84: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 24 % R-32, 38-50 % R-161 and 18 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		**24/38/18/20**	**24/40/18/18**	**24/42/18/16**	**24/44/18/14**	**24/46/18/12**	**24/48/18/10**	**24/50/18/8**
COP		1.31	1.31	1.32	1.32	1.32	1.32	1.32
COP relative to Reference		109.5%	109.6%	109.7%	109.7%	109.8%	109.8%	109.9%
Achieved cooling capacity	kW	2.74	2.77	2.81	2.84	2.88	2.91	2.95
Capacity relative to reference		110.2%	111.6%	113.0%	114.4%	115.8%	117.2%	118.5%
Suction pressure drop relative to reference		70.5%	70.6%	70.6%	70.7%	70.8%	70.9%	70.9%
Pressure *ratio*		11.33	11.25	11.16	11.08	11.00	10.92	10.84
Mass flow through evaporator	kg/hr	45.8	45.8	45.8	45.8	45.8	45.8	45.8
Liquid injection mass flow	kg/hr	7.0	7.1	7.2	7.2	7.3	7.4	7.4
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.0	3.8	3.6	3.4	3.2	3.0	2.8
Compressor suction pressure	bar	1.44	1.46	1.47	1.49	1.51	1.53	1.55
Compressor discharge pressure	bar	16.3	16.4	16.5	16.5	16.6	16.7	16.8
Condenser glide (in-out)	K	5.9	5.7	5.5	5.3	5.1	5.0	4.8

Table 85: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 28 % R-32, 10-20 % R-161 and 18 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		28/10/18/44	28/12/18/42	28/14/18/40	28/16/18/38	28/18/18/36	28/20/18/34
COP		1.30	1.30	1.30	1.30	1.30	1.30
COP relative to Reference		108.3%	108.4%	108.5%	108.6%	108.7%	108.7%
Achieved cooling capacity	kW	2.33	2.37	2.42	2.46	2.50	2.55
Capacity relative to reference		93.6%	95.4%	97.2%	99.0%	100.7%	102.4%
Suction pressure drop relative to reference		70.3%	70.6%	70.9%	71.2%	71.5%	71.7%
Pressure ratio		12.48	12.36	12.25	12.14	12.04	11.94
Mass flow through evaporator	kg/hr	46.7	46.9	47.0	47.1	47.2	47.3
Liquid injection mass flow	kg/hr	6.2	6.3	6.5	6.6	6.7	6.9
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.6	5.6	5.6	5.5	5.4	5.3
Compressor suction pressure	bar	1.22	1.25	1.27	1.29	1.32	1.34
Compressor discharge pressure	bar	15.3	15.4	15.6	15.7	15.8	16.0
Condenser glide (in-out)	K	8.3	8.1	7.9	7.8	7.6	7.4

Table 86: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 28 % R-32, 22-32 % R-161 and 18 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		28/22/18/32	28/24/18/30	28/26/18/28	28/28/18/26	28/30/18/24	28/32/18/22
COP		1.31	1.31	1.31	1.31	1.31	1.31
COP relative to Reference		108.8%	108.9%	108.9%	109.0%	109.0%	109.1%
Achieved cooling capacity	kW	2.59	2.63	2.67	2.71	2.74	2.78
Capacity relative to reference		104.1%	105.7%	107.3%	108.9%	110.4%	112.0%
Suction pressure drop relative to reference		72.0%	72.2%	72.3%	72.5%	72.6%	72.8%
Pressure ratio		11.84	11.74	11.64	11.55	11.46	11.37
Mass flow through evaporator	kg/hr	47.4	47.4	47.5	47.5	47.5	47.6
Liquid injection mass flow	kg/hr	7.0	7.1	7.2	7.3	7.4	7.5
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.2	5.1	4.9	4.8	4.6	4.5
Compressor suction pressure	bar	1.36	1.38	1.40	1.43	1.45	1.47
Compressor discharge pressure	bar	16.1	16.2	16.4	16.5	16.6	16.7
Condenser glide (in-out)	K	7.2	7.0	6.8	6.6	6.4	6.2

Table 87: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 28 % R-32, 34-46 % R-161 and 18 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		28/34/18/20	28/36/18/18	28/38/18/16	28/40/18/14	28/42/18/12	28/44/18/10	28/46/18/8
COP		1.31	1.31	1.31	1.31	1.31	1.31	1.31
COP relative to Reference		109.1%	109.2%	109.2%	109.3%	109.4%	109.4%	*109.5%*
Achieved cooling capacity	kW	2.82	2.86	2.89	2.93	2.96	3.00	3.03
Capacity relative to reference		113.5%	114.9%	116.4%	117.8%	119.3%	120.7%	122.1%
Suction pressure drop relative to reference		72.9%	73.0%	73.1%	73.2%	73.3%	73.4%	73.4%
Pressure ratio		11.28	11.20	11.11	11.03	10.95	10.87	10.79
Mass flow through evaporator	kg/hr	47.6	47.6	47.6	47.6	47.6	47.6	47.5
Liquid injection mass flow	kg/hr	7.6	7.7	7.7	7.8	7.9	8.0	8.0
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.3	4.1	3.9	3.7	3.4	3.2	3.0
Compressor suction pressure	bar	1.49	1.51	1.53	1.55	1.57	1.59	1.61
Compressor discharge pressure	bar	16.8	16.9	17.0	17.1	17.2	17.3	17.3
Condenser glide (in-out)	K	6.0	5.8	5.6	5.4	5.2	5.0	4.8

Table 88: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 32 % R-32, 10-20 % R-161 and 18 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		32/10/18/40	32/12/18/38	32/14/18/36	32/16/18/34	32/18/18/32	32/20/18/30
COP		1.30	1.30	1.30	1.30	1.30	1.30
COP relative to Reference		108.2%	108.2%	108.3%	108.4%	108.4%	108.5%
Achieved cooling capacity	kW	2.47	2.52	2.57	2.61	2.65	2.69
Capacity relative to reference		99.5%	101.4%	103.2%	105.0%	106.7%	108.4%
Suction pressure drop relative to reference		72.9%	73.2%	73.5%	73.8%	74.1%	74.3%
Pressure ratio		12.22	12.11	12.00	11.90	11.80	11.70
Mass flow through evaporator	kg/hr	48.5	48.6	48.7	48.8	48.9	49.0
Liquid injection mass flow	kg/hr	7.0	7.2	7.3	7.4	7.6	7.7
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.7	5.6	5.5	5.5	5.3	5.2
Compressor suction pressure	bar	1.31	1.33	1.36	1.38	1.40	1.43
Compressor discharge pressure	bar	16.0	16.1	16.3	16.4	16.6	16.7
Condenser glide (in-out)	K	7.8	7.7	7.5	7.3	7.1	6.9

Table 89: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 32 % R-32, 22-32 % R-161 and 18 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		32/22/18/28	32/24/18/26	32/16/18/24	32/28/18/22	32/30/18/20	32/32/18/18
COP		1.30	1.30	1.30	1.30	1.30	1.30
COP relative to Reference		108.5%	108.6%	108.6%	108.7%	108.7%	108.8%
Achieved cooling capacity	kW	2.74	2.78	2.82	2.86	2.90	2.93
Capacity relative to reference		110.1%	111.7%	113.3%	114.9%	116.5%	118.0%
Suction pressure drop relative to reference		74.5%	74.7%	74.9%	75.0%	75.2%	75.3%
Pressure ratio		11.61	11.51	11.42	11.33	11.24	11.15
Mass flow through evaporator	kg/hr	49.1	49.1	49.2	49.2	49.2	49.3
Liquid injection mass flow	kg/hr	7.8	7.9	8.0	8.1	8.2	8.3
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.1	4.9	4.8	4.6	4.4	4.2
Compressor suction pressure	bar	1.45	1.47	1.50	1.52	1.54	1.56
Compressor discharge pressure	bar	16.8	17.0	17.1	17.2	17.3	17.4
Condenser glide (in-out)	K	6.7	6.5	6.3	6.1	5.9	5.7

Table 90: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 32 % R-32, 34-42 % R-161 and 18 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		32/34/18/16	32/36/18/14	32/38/18/12	32/40/18/10	32/42/18/8
COP		1.31	1.31	1.31	1.31	1.31
COP relative to Reference		108.8%	108.9%	108.9%	109.0%	109.0%
Achieved cooling capacity	kW	2.97	3.01	3.05	3.08	3.12
Capacity relative to reference		119.6%	121.1%	122.5%	124.0%	125.5%
Suction pressure drop relative to reference		75.5%	75.6%	75.7%	75.8%	75.9%
Pressure ratio		11.07	10.99	10.90	10.82	10.74
Mass flow through evaporator	kg/hr	49.3	49.3	49.3	49.3	49.3
Liquid injection mass flow	kg/hr	8.4	8.4	8.5	8.6	8.6
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.0	3.8	3.6	3.3	3.1
Compressor suction pressure	bar	1.58	1.60	1.62	1.64	1.66
Compressor discharge pressure	bar	17.5	17.6	17.7	17.8	17.9
Condenser glide (in-out)	K	5.5	5.3	5.1	4.9	4.8

Table 91: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 36 % R-32, 10-22 % R-161 and 18 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		36/10/18/36	36/12/18/34	36/14/18/32	36/16/18/30	36/18/18/28	36/20/18/26	36/22/18/24
COP		1.30	1.30	1.30	1.30	1.30	1.30	1.30
COP relative to Reference		107.9%	108.0%	108.0%	108.1%	108.1%	108.2%	108.2%
Achieved cooling capacity	kW	2.62	2.67	2.71	2.75	2.80	2.84	2.88
Capacity relative to reference		105.4%	107.2%	109.1%	110.8%	112.6%	114.3%	116.0%
Suction pressure drop relative to reference		75.3%	75.6%	75.9%	76.2%	76.4%	76.7%	76.9%
Pressure ratio		11.98	11.87	11.77	11.67	11.57	11.48	11.39
Mass flow through evaporator	kg/hr	50.1	50.2	50.4	50.5	50.6	50.6	50.7
Liquid injection mass flow	kg/hr	7.9	8.0	8.1	8.3	8.4	8.5	8.6
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.5	5.5	5.4	5.3	5.1	5.0	4.8
Compressor suction pressure	bar	1.39	1.42	1.44	1.47	1.49	1.52	1.54
Compressor discharge pressure	bar	16.7	16.9	17.0	17.1	17.3	17.4	17.5
Condenser glide (in-out)	K	7.3	7.2	7.0	6.8	6.6	6.4	6.2

Table 92: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 36 % R-32, 24-38 % R-161 and 18 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		36/24/18/22	36/26/18/20	36/28/18/18	36/30/18/16	36/32/18/14	36/34/18/12	36/36/18/10	36/38/1818
COP		1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30
COP relative to Reference		108.2%	108.3%	108.3%	108.4%	108.4%	108.5%	108.5%	108.6%
Achieved cooling capacity	kW	2.92	2.96	3.00	3.04	3.08	3.12	3.16	3.20
Capacity relative to reference		117.6%	119.3%	120.9%	122.5%	124.0%	125.6%	127.1%	128.6%
Suction pressure drop relative to reference		77.1%	77.3%	77.5%	77.6%	77.8%	77.9%	78.0%	78.1%
Pressure ratio		11.29	11.21	11.12	11.03	10.95	10.86	10.78	10.70
Mass flow through evaporator	kg/hr	50.8	50.8	50.8	50.9	50.9	50.9	50.9	50.9
Liquid injection mass flow	kg/hr	8.7	8.8	8.9	9.0	9.1	9.1	9.2	9.3
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.6	4.5	4.3	4.1	3.8	3.6	3.4	3.1
Compressor suction pressure	bar	1.56	1.59	1.61	1.63	1.65	1.67	1.70	1.72
Compressor discharge pressure	bar	17.7	17.8	17.9	18.0	18.1	18.2	18.3	18.4
Condenser glide (in-out)	K	6.0	5.8	5.6	5.4	5.2	5.0	4.8	4.6

Table 93: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 40 % R-32, 10-20 % R-161 and 18 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		40/10/18/32	40/12/18/30	40/14/18/28	40/16/18/26	40/18/18/24	40/20/18/22
COP		1.29	1.29	1.29	1.29	1.29	1.29
COP relative to Reference		107.7%	107.7%	107.8%	107.8%	107.8%	107.8%
Achieved cooling capacity	kW	2.76	2.81	2.85	2.90	2.94	2.99
Capacity relative to reference		111.1%	113.0%	114.8%	116.6%	118.4%	120.1%
Suction pressure drop relative to reference		77.5%	77.8%	78.1%	78.4%	78.7%	78.9%
Pressure ratio		11.75	11.65	11.55	11.45	11.36	11.27
Mass flow through evaporator	kg/hr	51.6	51.7	51.9	52.0	52.1	52.2
Liquid injection mass flow	kg/hr	8.7	8.9	9.0	9.1	9.2	9.3
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.3	5.2	5.1	4.9	4.8	4.6
Compressor suction pressure	bar	1.48	1.51	1.53	1.56	1.58	1.61
Compressor discharge pressure	bar	17.4	17.5	17.7	17.8	18.0	18.1
Condenser glide (in-out)	K	6.8	6.6	6.4	6.2	6.0	5.8

Table 94: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 40 % R-32, 22-34 % R-161 and 18 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		40/22/18/20	40/24/18/18	40/26/18/16	40/28/18/14	40/30/18/12	40/32/18/10	40/34/18/8
COP		1.29	1.29	1.30	1.30	1.30	1.30	1.30
COP relative to Reference		107.9%	107.9%	107.9%	108.0%	108.0%	108.1%	108.1%
Achieved cooling capacity	kW	3.03	3.07	3.11	3.15	3.19	3.23	3.27
Capacity relative to reference		121.8%	123.5%	125.1%	126.8%	128.4%	130.0%	131.6%
Suction pressure drop relative to reference		79.2%	79.4%	79.6%	79.7%	79.9%	80.1%	80.2%
Pressure ratio		11.18	11.09	11.00	10.91	10.83	10.75	10.67
Mass flow through evaporator	kg/hr	52.2	52.3	52.3	52.4	52.4	52.5	52.5
Liquid injection mass flow	kg/hr	9.4	9.5	9.6	9.7	9.8	9.9	9.9
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.4	4.2	4.0	3.8	3.6	3.4	3.1
Compressor suction pressure	bar	1.63	1.65	1.68	1.70	1.72	1.75	1.77
Compressor discharge pressure	bar	18.2	18.3	18.5	18.6	18.7	18.8	18.9
Condenser glide (in-out)	K	5.6	5.4	5.2	5.0	4.8	4.6	4.4

Table 95: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 20 % R-32, 10-22 % R-161 and 22 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		20/10/22/48	20/12/22/46	20/14/22/44	20/16/22/42	20/18/22/40	20/20/22/38	20/22/22/36
COP		1.30	1.30	1.30	1.30	1.30	1.31	1.31
COP relative to Reference		108.2% .	108.3%	108.5%	108.6%	108.7%	108.8%	108.9%
Achieved cooling capacity	kW	2.04	2.08	2.13	2.17	2.22	2.26	2.30
Capacity relative to reference		82.0%	83.9%	85.7%	87.5%	89.2%	90.9%	92.6%
Suction pressure drop relative to reference		65.0%	65.4%	65.8%	66.2%	66.5%	66.8%	67.1%
Pressure ratio		12.99	12.87	12.74	12.62	12.51	12.39	12.28
Mass flow through evaporator	kg/hr	43.2	43.4	43.6	43.7	43.9	44.0	44.1
Liquid injection mass flow	kg/hr	4.7	4.8	5.0	5.1	5.3	5.4	5.5
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.8	4.8	4.8	4.8	4.8	4.7	4.7
Compressor suction pressure	bar	1.06	1.09	1.11	1.13	1.16	1.18	1.20
Compressor discharge pressure	bar	13.8	14.0	14.1	14.3	14.4	14.6	14.7
Condenser glide (in-out)	K	8.2	8.1	8.0	7.8	7.6	7.5	7.3

Table 96: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 20 % R-32, 24-36% R-161 and 22 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		20/24/22/34	20/26/22/32	20/28/22/30	20/30/22/28	20/32/22/26	20/34/22/24	20/36/22/22
COP		1.31	1.31	1.31	1.31	1.31	1.31	1.31
COP relative to Reference		109.0%	109.1%	109.2%	109.3%	109.4%	109.4%	109.5%
Achieved cooling capacity	kW	2.34	2.38	2.42	2.46	2.50	2.54	2.57
Capacity relative to reference		94.3%	95.9%	97.5%	99.0%	100.6%	102.1%	103.5%
Suction pressure drop relative to reference		67.3%	67.6%	67.8%	68.0%	68.2%	68.3%	68.5%
Pressure ratio		12.17	12.07	11.97	11.87	11.77	11.68	11.58
Mass flow through evaporator	kg/hr	44.2	44.3	44.3	44.4	44.5	44.5	44.5
Liquid injection mass flow	kg/hr	5.7	5.8	5.9	6.0	6.1	6.2	6.3
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.6	4.5	4.4	4.3	4.1	4.0	3.8
Compressor suction pressure	bar	1.22	1.24	1.26	1.28	1.30	1.32	1.34
Compressor discharge pressure	bar	14.9	15.0	15.1	15.2	15.3	15.4	15.6
Condenser glide (in-out)	K	7.1	6.9	6.7	6.5	6.3	6.1	5.9

Table 97: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 20 % R-32, 38-48 % R-161 and 22 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		20/38/22/20	20/40/22/18	20/42/22/16	20/44/22/14	20/46/22/12	20/48/22/10
COP		1.31	1.32	1.32	1.32	1.32	1.32
COP relative to Reference		109.6%	109.6%	109.7%	109.8%	109.8%	109.9%
Achieved cooling capacity	kW	2.61	2.65	2.68	2.72	2.75	2.79
Capacity relative to reference		105.0%	106.5%	107.9%	109.3%	110.7%	112.1%
Suction pressure drop relative to reference		68.6%	68.7%	68.9%	69.0%	69.1%	69.2%
Pressure ratio		11.49	11.40	11.31	11.23	11.14	11.06
Mass flow through evaporator	kg/hr	44.6	44.6	44.6	44.6	44.6	44.6
Liquid injection mass flow	kg/hr	6.4	6.5	6.6	6.7	6.7	6.8
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	3.6	3.5	3.3	3.1	2.9	2.7
Compressor suction pressure	bar	1.36	1.38	1.40	1.42	1.44	1.46
Compressor discharge pressure	bar	15.7	15.8	15.9	15.9	16.0	16.1
Condenser glide (in-out)	K	5.7	5.5	5.3	5.1	4.9	4.8

Table 98: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 24 % R-32, 10-20 % R-161 and 22 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		24/10/22/44	24/12/22/42	24/14/22/40	24/16/22/38	24/18/22/36	24/20/22/34
COP		1.30	1.30	1.30	1.30	1.30	1.30
COP relative to Reference		108.2%	108.3%	108.4%	108.5%	108.6%	108.7%
Achieved cooling capacity	kW	2.19	2.24	2.28	2.33	2.37	2.42
Capacity relative to reference		88.2%	90.1%	91.9%	93.7%	95.4%	97.2%
Suction pressure drop relative to reference		68.0%	68.4%	68.8%	69.1%	69.4%	69.7%
Pressure ratio		12.70	12.58	12.47	12.35	12.24	12.13
Mass flow through evaporator	kg/hr	45.2	45.4	45.5	45.7	45.8	45.9
Liquid injection mass flow	kg/hr	5.5	5.6	5.8	5.9	6.1	6.2
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.1	5.1	5.1	5.1	5.0	4.9
Compressor suction pressure	bar	1.15	1.17	1.20	1.22	1.24	1.27
Compressor discharge pressure	bar	14.6	14.8	14.9	15.1	15.2	15.3
Condenser qlide (in-out)	K	8.1	8.0	7.8	7.7	7.5	7.3

Table 99: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 24 % R-32, 22-32 % R-161 and 22 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		24/22/22/32	24/24/22/30	24/26/22/28	24/28/22/26	24/30/22/24	24/32/22/22
COP		1.31	1.31	1.31	1.31	1.31	1.31
COP relative to Reference		108.8%	108.9%	108.9%	109.0%	109.1%	109.1%
Achieved cooling capacity	kW	2.46	2.50	2.54	2.58	2.62	2.65
Capacity relative to reference		98.8%	100.5%	102.1%	103.7%	105.3%	106.8%
Suction pressure drop relative to reference		70.0%	70.2%	70.4%	70.6%	70.8%	71.0%
Pressure ratio		12.03	11.92	11.82	11.73	11.63	11.54
Mass flow through evaporator	kg/hr	46.0	46.1	46.1	46.2	46.3	46.3
Liquid injection mass flow	kg/hr	6.3	6.4	6.5	6.7	6.8	6.9
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.9	4.7	4.6	4.5	4.3	4.2
Compressor suction pressure	bar	1.29	1.31	1.33	1.35	1.37	1.39
Compressor discharge pressure	bar	15.5	15.6	15.7	15.9	16.0	16.1
Condenser glide (in-out)	K	7.1	6.9	6.7	6.5	6.3	6.1

Table 100: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 24 % R-32, 34-46 % R-161 and 22 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		24/34/22/20	24/36/22/18	24/38/22/16	24/40/22/14	24/42/22/12	24/44/22/10	24/46/22/8
COP		1.31	1.31	1.31	1.31	1.31	1.31	1.31
COP relative to Reference		109.2%	109.2%	109.3%	109.4%	109.4%	109.5%	109.6%
Achieved cooling capacity	kW	2.69	2.73	2.77	2.80	2.84	2.87	2.91
Capacity relative to reference		108.3%	109.8%	111.3%	112.8%	114.2%	115.6%	117.0%
Suction pressure drop relative to reference		71.1%	71.2%	71.4%	71.5%	71.6%	71.7%	71.8%
Pressure ratio		11.44	11.36	11.27	11.18	11.10	11.01	10.93
Mass flow through evaporator	kg/hr	46.3	46.4	46.4	46.4	46.4	46.4	46.4
Liquid injection mass flow	kg/hr	7.0	7.0	7.1	7.2	7.3	7.4	7.4
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)		4.0	3.8	3.6	3.4	3.2	3.0	2.8
Compressor suction pressure	bar	1.41	1.43	1.45	1.47	1.49	1.51	1.53
Compressor discharge pressure	bar	16.2	16.3	16.4	16.5	16.6	16.7	16.8
Condenser glide (in-out)	K	5.9	5.7	5.5	5.3	5.1	4.9	4.7

Table 101: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 28 % R-32, 10-24 % R-161 and 22 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		28/10/22/40	28/12/22/38	38/14/22/36	28/16/22/34	28/18/22/32	28/20/22/30	28/22/22/28	28/24//22/26
COP		1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30
COP relative to Reference		108.1%	108.2%	108.3%	108.4%	108.5%	108.5%	108.6%	108.6%
Achieved cooling capacity	kW	2.34	2.39	2.44	2.48	2.52	2.57	2.61	2.65
Capacity relative to reference		94.3%	96.2%	98.0%	99.8%	101.5%	103.3%	105.0%	106.6%
Suction pressure drop relative to reference		70.8%	71.2%	71.5%	71.9%	72.1%	72.4%	72.7%	72.9%
Pressure ratio		12.43	12.32	12.20	12.09	11.99	11.88	11.78	11.68
Mass flow through evaporator	kg/hr	47.0	47.2	47.4	47.5	47.6	47.7	47.8	47.9
Liquid injection mass flow	kg/hr	6.3	6.5	6.6	6.7	6.9	7.0	7.1	7.2
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.3	5.3	5.2	5.2	5.1	5.0	4.9	4.7
Compressor suction pressure	bar	1.23	1.26	1.28	1.31	1.33	1.35	1.38	1.40
Compressor discharge pressure	bar	15.4	15.5	15.7	15.8	16.0	16.1	16.2	16.3
Condenser glide (in-out)	K	7.9	7.7	7.5	7.3	7.2	7.0	6.8	6.6

Table 102: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 28 % R-32, 26-40 % R-161 and 22 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		28/26/22/24	28/28/22/22	28/30/22/20	28/32/22/18	28/34/22/16	28/36/22/14	28/38/22/12	28/40/22/10
COP		1.30	1.30	1.31	1.31	1.31	1.31	1.31	1.31
COP relative to Reference		108.7%	108.7%	108.8%	108.9%	108.9%	109.0%	109.0%	109.1%
Achieved cooling capacity	kW	2.69	2.73	2.77	2.81	2.85	2.88	2.92	2.96
Capacity relative to reference		108.2%	109.8%	111.4%	113.0%	114.5%	116.0%	117.5%	119.0%
Suction pressure drop relative to reference		73.1%	73.3%	73.5%	73.6%	73.8%	73.9%	74.0%	74.1%
Pressure ratio		11.59	11.49	11.40	11.31	11.22	11.14	11.05	10.97
Mass flow through evaporator	kg/hr	47.9	48.0	48.0	48.1	48.1	48.1	48.1	48.1
Liquid injection mass flow	kg/hr	7.3	7.4	7.5	7.6	7.7	7.8	7.9	8.0
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.6	4.4	4.2	4.1	3.9	3.7	3.4	3.2
Compressor suction pressure	bar	1.42	1.44	1.46	1.49	1.51	1.53	1.55	1.57
Compressor discharge pressure	bar	16.5	16.6	16.7	16.8	16.9	17.0	17.1	17.2
Condenser glide (in-out)	K	6.4	6.2	6.0	5.8	5.6	5.4	5.2	5.0

Table 102: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 32 % R-32, 10-22 % R-161 and 22 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		32/10/22/36	32/12/22/34	32/14/22/32	32/16/22/30	32/18/22/28	32/20/22/26	32/22/22/24
COP		1.30	1.30	1.30	1.30	1.30	1.30	1.30
COP relative to Reference		108.0%	108.1%	108.1%	108.2%	108.2%	108.3%	108.3%
Achieved cooling capacity	kW	2.49	2.54	2.58	2.63	2.67	2.72	2.76
Capacity relative to reference		100.2%	102.1%	103.9%	105.8%	107.5%	109.3%	110.9%
Suction pressure drop relative to reference		73.3%	73.7%	74.1%	74.4%	74.7%	74.9%	75.2%
Pressure ratio		12.18	12.07	11.96	11.85	11.75	11.65	11.55
Mass flow through evaporator	kg/hr	48.8	48.9	49.1	49.2	49.3	49.4	49.5
Liquid injection mass flow	kg/hr	7.1	7.3	7.4	7.6	7.7	7.8	7.9
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.3	5.3	5.2	5.1	5.0	4.9	4.7
Compressor suction pressure	bar	1.32	1.35	1.37	1.39	1.42	1.44	1.47
Compressor discharge pressure	bar	16.1	16.2	16.4	16.5	16.7	16.8	16.9
Condenser glide (in-out)	K	7.5	7.3	7.1	6.9	6.7	6.5	6.3

Table 103: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 32 % R-32, 24-36 % R-161 and 22 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		32/24/22/22	32/26/22/20	32/28/22/18	32/30/22/16	32/32/22/14	32/34/22/12	32/36/22/10
COP		1.30	1.30	1.30	1.30	1.30	1.30	1.30
COP relative to Reference		108.4%	108.4%	108.5%	108.5%	108.6%	108.6%	108.7%
Achieved cooling capacity	kW	2.80	2.84	2.88	2.92	2.96	3.00	3.04
Capacity relative to reference		112.6%	114.3%	115.9%	117.5%	119.1%	120.6%	122.1%
Suction pressure drop relative to reference		75.4%	75.6%	75.8%	76.0%	76.1%	76.3%	76.4%
Pressure ratio		11.46	11.37	11.27	11.18	11.10	11.01	10.93
Mass flow through evaporator	kg/hr	49.6	49.6	49.7	49.7	49.7	49.8	49.8
Liquid injection mass flow	kg/hr	8.0	8.1	8.2	8.3	8.4	8.5	8.6
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.6	4.4	4.2	4.0	3.8	3.6	3.4
Compressor suction pressure	bar	1.49	1.51	1.53	1.56	1.58	1.60	1.62
Compressor discharge pressure	bar	17.1	17.2	17.3	17.4	17.5	17.6	17.7
Condenser glide (in-out)	K	6.1	5.9	5.7	5.5	5.3	5.1	4.9

Table 104: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 36 % R-32, 10-20 % R-161 and 22 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		36/10/22/32	36/12/22/30	36/14/22/28	36/16/22/26	36/18/22/24	36/20/22/22
COP		1.29	1.29	1.29	1.29	1.30	1.30
COP relative to Reference		107.8%	107.8%	107.9%	107.9%	108.0%	108.0%
Achieved cooling capacity	kW	2.64	2.68	2.73	2.77	2.82	2.86
Capacity relative to reference		106.0%	107.9%	109.8%	111.6%	113.4%	115.1%
Suction pressure drop relative to reference		75.7%	76.1%	76.4%	76.7%	77.0%	77.3%
Pressure ratio		11.94	11.83	11.73	11.63	11.53	11.43
Mass flow through evaporator	kg/hr	50.4	50.5	50.7	50.8	50.9	51.0
Liquid injection mass flow	kg/hr	8.0	8.1	8.3	8.4	8.5	8.6
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.2	5.1	5.0	4.9	4.8	4.6
Compressor suction pressure	bar	1.41	1.43	1.46	1.48	1.51	1.53
Compressor discharge pressure	bar	16.8	16.9	17.1	17.2	17.4	17.5
Condenser glide (in-out)	K	7.0	6.8	6.6	6.4	6.2	6.0

Table 105: Theoretical Performance Data of Selected R-32/R-161/R-134a/R-1234ze(E) blends containing 36 % R-32, 22-32 % R-161 and 22 % R-134a

Composition R-32/R-161/R-134a/R-1234ze(E) % by weight ▶		36/22/22/20	36/24/22/18	36/26/22/16	36/28/22/14	36/30/22/12	36/32/22/10
COP		1.30	1.30	1.30	1.30	1.30	1.30
COP relative to Reference		108.0%	108.1%	108.1%	108.1%	108.2%	108.2%
Achieved cooling capacity	kW	2.90	2.95	2.99	3.03	3.07	3.11
Capacity relative to reference		116.8%	118.5%	120.2%	121.8%	123.5%	125.1%
Suction pressure drop relative to reference		77.5%	77.8%	78.0%	78.2%	78.4%	78.6%
Pressure ratio		11.34	11.24	11.15	11.06	10.98	10.89
Mass flow through evaporator	kg/hr	51.1	51.2	51.2	51.3	51.3	51.4
Liquid injection mass flow	kg/hr	8.7	8.8	8.9	9.0	9.1	9.2
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.4	4.3	4.1	3.9	3.6	3.4
Compressor suction pressure	bar	1.56	1.58	1.60	1.63	1.65	1.67
Compressor discharge pressure	bar	17.6	17.8	17.9	18.0	18.1	18.2
Condenser glide (in-out)	K	5.8	5.6	5.4	5.2	5.0	4.8

Table 106: Theoretical Performance Data of Selected R-32/R-125/R-161/R-1234ze(E) blends containing 16-40 % R-32, 10 % R-125 and 10 % R-161

Composition R-32/R-125/R-161/R-1234ze(E) % by weight ▶		16/10/10/64	20/10/10/60	24/10/10/56	28/10/10/52	32/10/10/48	36/10/10/44	40/10/10/40
COP		1.29	1.29	1.29	1.29	1.29	1.28	1.28
COP relative to Reference		107.6%	107.8%	107.8%	107.6%	107.4%	107.1%	106.7%
Achieved cooling capacity	kW	1.91	2.08	2.24	2.40	2.55	2.71	2.85
Capacity relative to reference		76.7%	83.5%	90.1%	96.5%	102.8%	108.9%	114.8%
Suction pressure drop relative to reference		64.7%	68.5%	71.9%	75.1%	78.0%	80.7%	83.2%
Pressure ratio		13.36	13.02	12.70	12.41	12.15	11.90	11.67
Mass flow through evaporator	kg/hr	42.9	45.3	47.6	49.7	51.6	53.4	55.1
Liquid injection mass flow	kg/hr	3.7	4.5	5.3	6.2	7.1	8.1	9.0
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.6	6.3	6.6	6.8	6.7	6.5	6.1
Compressor suction pressure	bar	1.00	1.09	1.18	1.27	1.36	1.45	1.55
Compressor discharge pressure	bar	13.3	14.1	15.0	15.8	16.5	17.3	18.0
Condenser glide (in-out)	K	10.0	10.1	9.8	9.4	8.8	8.1	7.3

Table 107: Theoretical Performance Data of Selected R-32/R-125/R-161/R-1234ze(E) blends containing 16-40 % R-32, 10 % R-125 and 15 % R-161

Composition R-32/R-125/R-161/R-1234ze(E) % by weight ▶		16/10/15/59	20/10/15/55	24/10/15/51	28/10/15/47	32/10/15/43	36/10/15/39	40/10/15/35
COP		1.30	1.30	1.30	1.30	1.29	1.29	1.28
COP relative to Reference		108.2%	108.3%	108.2%	108.0%	107.6%	107.3%	106.9%
Achieved cooling capacity	kW	2.02	2.18	2.35	2.51	2.66	2.81	2.96
Capacity relative to reference		81.1%	87.9%	94.5%	100.9%	107.1%	113.2%	119.2%
Suction pressure drop relative to reference		65.4%	69.0%	72.4%	75.5%	78.4%	81.0%	83.5%
Pressure ratio		13.04	12.72	12.43	12.15	11.90	11.66	11.43
Mass flow through evaporator	kg/hr	43.1	45.5	47.7	49.7	51.7	53.5	55.2
Liquid injection mass flow	kg/hr	4.1	4.9	5.7	6.6	7.5	8.4	9.3
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.7	6.3	6.6	6.7	6.5	6.3	5.8
Compressor suction pressure	bar	1.05	1.14	1.23	1.33	1.42	1.51	1.61
Compressor discharge pressure	bar	13.7	14.5	15.3	16.1	16.9	17.6	18.4
Condenser glide (in-out)	K	9.7	9.7	9.4	8.9	8.3	7.6	6.8

Table 108: Theoretical Performance Data of Selected R-32/R-125/R-161/R-1234ze(E) blends containing 16-40 % R-32, 10 % R-125 and 20 % R-161

Composition R-32/R-125/R-161/R-1234ze(E) % by weight ▶		16/10/20/54	20/10/20/50	24/10/20/46	28/10/20/42	32/10/20/38	36/10/20/34	40/10/20/30
COP		1.30	1.30	1.30	1.30	1.29	1.29	1.28
COP relative to Reference		108.7%	108.7%	108.5%	108.2%	107.8%	107.4%	107.0%
Achieved cooling capacity	kW	2.12	2.29	2.45	2.61	2.77	2.92	3.07
Capacity relative to reference		85.2%	92.0%	98.6%	105.0%	111.2%	117.4%	123.4%
Suction pressure drop relative to reference		65.9%	69.4%	72.7%	75.8%	78.6%	81.3%	83.8%
Pressure ratio		12.74	12.45	12.16	11.90	11.66	11.43	11.21
Mass flow through evaporator	kg/hr	43.3	45.6	47.7	49.7	51.6	53.4	55.1
Liquid injection mass flow	kg/hr	4.4	5.2	6.1	6.9	7.8	8.7	9.6
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.6	6.1	6.4	6.4	6.2	5.9	5.4
Compressor suction pressure	bar	1.10	1.19	1.29	1.38	1.47	1.57	1.67
Compressor discharge pressure	bar	14.0	14.8	15.6	16.4	17.2	17.9	18.7
Condenser glide (in-out)	K	9.2	9.2	8.9	8.4	7.8	7.1	6.3

Table 109: Theoretical Performance Data of Selected R-32/R-125/R-161/R-1234ze(E) blends containing 16-40 % R-32, 10 % R-125 and 25 % R-161

Composition R-32/R-125/R-161/R-1234ze(E) % by weight ▶		**16/10/25/49**	**20/10/25/45**	**24/10/25/41**	**28/10/25/37**	**32/10/25/33**	**36/10/25/29**	**40/10/25/25**
COP		1.31	1.31	1.30	1.30	1.30	1.29	1.29
COP relative to Reference		109.1%	109.0%	108.7%	108.4%	108.0%	107.6%	107.1%
Achieved cooling capacity	kW	2.22	2.38	2.55	2.71	2.86	3.02	3.17
Capacity relative to reference		89.2%	95.9%	102.5%	108.9%	115.2%	121.3%	127.4%
Suction pressure drop relative to reference		66.3%	69.7%	72.9%	75.9%	78.7%	81.4%	83.9%
Pressure ratio		12.47	12.19	11.92	11.67	11.44	11.22	11.00
Mass flow through evaporator	kg/hr	43.4	45.6	47.7	49.7	51.6	53.3	55.1
Liquid injection mass flow	kg/hr	4.8	5.6	6.4	7.2	8.0	8.9	9.8
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.5	5.9	6.1	6.1	5.9	5.5	4.9
Compressor suction pressure	bar	1.15	1.24	1.34	1.43	1.53	1.62	1.72
Compressor discharge pressure	bar	14.3	15.1	15.9	16.7	17.5	18.2	18.9
Condenser glide (in-out)	K	8.7	8.6	8.3	7.8	7.2	6.5	5.8

Table 110: Theoretical Performance Data of Selected R-32/R-125/R-161/R-1234ze(E) blends containing 16-40 % R-32, 10 % R-125 and 30 % R-161

Composition R-32/R-125/R-161/R-1234ze(E) % by weight ▶		16/10/30/44	20/10/30/40	24/10/30/36	28/10/30/32	32/10/30/28	36/10/30/24	40/10/30/20
COP		1.31	1.31	1.31	1.30	1.30	1.29	1.29
COP relative to Reference		109.4%	109.2%	109.0%	108.6%	108.2%	107.7%	107.3%
Achieved cooling capacity	kW	2.31	2.48	2.64	2.80	2.96	3.11	3.26
Capacity relative to reference		93.0%	99.7%	106.2%	112.6%	118.9%	125.1%	131.3%
Suction pressure drop relative to reference		66.6%	69.9%	73.0%	76.0%	78.8%	81.4%	84.0%
Pressure ratio		12.21	11.94	11.69	11.45	11.23	11.01	10.80
Mass flow through evaporator	kg/hr	43.4	45.6	47.6	49.6	51.4	53.2	54.9
Liquid injection mass flow	kg/hr	5.1	5.8	6.6	7.5	8.3	9.1	10.0
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.3	5.6	5.8	5.7	5.4	4.9	4.4
Compressor suction pressure	bar	1.19	1.29	1.39	1.48	1.58	1.68	1.78
Compressor discharge pressure	bar	14.6	15.4	16.2	17.0	17.7	18.5	19.2
Condenser (in-out)	K	8.2	8.1	7.8	7.3	6.7	6.0	5.3

Table 111: Theoretical Performance Data of Selected R-32/R-125/R-161/R-1234ze(E) blends containing 16-40 % R-32, 15 % R-125 and 10 % R-161

Composition R-32/R-125/R-161/R-1234ze(E) % by weight ▶		16/15/10/59	20/15/10/55	24/15/10/51	28/15/10/47	32/15/10/43	36/15/10/39	40/15/10/35
COP		1.28	1.28	1.28	1.28	1.28	1.27	1.27
COP relative to Reference		106.9%	107.0%	106.9%	106.7%	106.4%	106.1%	105.7%
Achieved cooling capacity	kW	1.98	2.16	2.32	2.48	2.64	2.79	2.95
Capacity relative to reference		79.9%	86.7%	93.4%	99.9%	106.2%	112.4%	118.5%
Suction pressure drop relative to reference		68.7%	72.5%	76.0%	79.3%	82.3%	85.0%	87.6%
Pressure ratio		13.19	12.86	12.55	12.27	12.00	11.76	11.53
Mass flow through evaporator	kg/hr	45.3	47.8	50.1	52.2	54.2	56.1	57.8
Liquid injection mass flow	kg/hr	3.9	4.7	5.6	6.6	7.5	8.5	9.5
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.7	6.2	6.5	6.5	6.4	6.0	5.6
Compressor suction pressure	bar	1.04	1.14	1.23	1.33	1.42	1.52	1.61
Compressor discharge pressure	bar	13.8	14.6	15.5	16.3	17.1	17.8	18.6
Condenser glide (in-out)	K	9.8	9.7	9.3	8.8	8.2	7.4	6.6

Table 112: Theoretical Performance Data of Selected R-32/R-125/R-161/R-1234ze(E) blends containing 16-40 % R-32, 15 % R-125 and 15 % R-161

Composition R-32/R-125/R-161/R-1234ze(E) % by weight ▶		16/15/15/54	20/15/15/50	24/15/15/46	28/15/15/42	32/15/15/38	36/15/15/34	40/15/15/30
COP		1.29	1.29	1.29	1.28	1.28	1.28	1.27
COP relative to Reference		107.5%	107.5%	107.3%	107.0%	106.7%	106.3%	105.9%
Achieved cooling capacity	kW	2.09	2.26	2.43	2.59	2.75	2.90	3.06
Capacity relative to reference		84.2%	91.1%	97.8%	104.3%	110.6%	116.8%	123.0%
Suction pressure drop relative to reference		69.3%	73.0%	76.4%	79.6%	82.6%	85.3%	87.9%
Pressure ratio		12.88	12.57	12.28	12.01	11.75	11.52	11.29
Mass flow through evaporator	kg/hr	45.5	47.9	50.1	52.2	54.2	56.1	57.9
Liquid injection mass flow	kg/hr	4.3	5.1	6.0	6.9	7.9	8.8	9.8
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.7	6.2	6.4	6.3	6.1	5.7	5.2
Compressor suction pressure	bar	1.10	1.19	1.29	1.38	1.48	1.58	1.68
Compressor discharge pressure	bar	14.1	15.0	15.8	16.6	17.4	18.2	18.9
Condenser glide (in-out)	K	9.3	9.2	8.8	8.3	7.6	6.9	6.1

Table 113: Theoretical Performance Data of Selected R-32/R-125/R-161/R-1234ze(E) blends containing 16-40 % R-32, 15 % R-125 and 20 % R-161

Composition R-32/R-125/R-161/R-1234ze(E) % by weight ▶		16/15/20/49	20/15/20/45	24/15/20/41	28/15/20/37	32/15/20/33	36/15/20/29	40/15/20/25
COP		1.30	1.29	1.29	1.29	1.28	1.28	1.27
COP relative to Reference		108.0%	107.9%	107.6%	107.3%	106.9%	106.5%	106.1%
Achieved cooling capacity	kW	2.20	2.37	2.53	2.70	2.85	3.01	3.16
Capacity relative to reference		88.4%	95.3%	101.9%	108.4%	114.8%	121.1%	127.3%
Suction pressure drop relative to reference		69.7%	73.3%	76.7%	79.8%	82.7%	85.5%	88.1%
Pressure ratio		12.59	12.29	12.02	11.76	11.52	11.29	11.07
Mass flow through evaporator	kg/hr	45.6	47.9	50.1	52.2	54.2	56.0	57.8
Liquid injection mass flow	kg/hr	4.7	5.5	6.4	7.3	8.2	9.1	10.1
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.6	6.0	6.1	6.0	5.7	5.3	4.7
Compressor suction pressure	bar	1.15	1.24	1.34	1.44	1.54	1.64	1.74
Compressor discharge pressure	bar	14.4	15.3	16.1	16.9	17.7	18.5	19.2
Condenser glide (in-out)	K	8.8	8.7	8.3	7.8	7.1	6.4	5.6

Table 114: Theoretical Performance Data of Selected R-32/R-125/R-161/R-1234ze(E) blends containing 16-40 % R-32, 15 % R-125 and 25 % R-161

Composition R-32/R-125/R-161/R-1234ze(E) % by weight ▶		16/15/25/44	20/15/25/40	24/15/25/36	28/15125/32	32/15/25/28	36/15/25/24	40/15/25/20
COP		1.30	1.30	1.29	1.29	1.29	1.28	1.28
COP relative to Reference		108.4%	108.2%	107.9%	107.5%	107.1%	106.7%	106.3%
Achieved cooling capacity	kW	2.30	2.47	2.63	2.79	2.95	3.11	3.27
Capacity relative to reference		92.4%	99.2%	105.9%	112.4%	118.8%	125.1%	131.4%
Suction pressure drop relative to reference		70.0%	73.5%	76.8%	79.9%	82.8%	85.6%	88.3%
Pressure ratio		12.31	12.03	11.77	11.53	11.29	11.07	10.85
Mass flow through evaporator	kg/hr	45.6	47.9	50.0	52.1	54.0	55.9	57.7
Liquid injection mass flow	kg/hr	5.0	5.8	6.7	7.6	8.5	9.4	10.3
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.4	5.7	5.8	5.6	5.3	4.8	4.2
Compressor suction pressure	bar	1.20	1.30	1.39	1.49	1.59	1.69	1.79
Compressor discharge pressure	bar	14.7	15.6	16.4	17.2	18.0	18.7	19.5
Condenser glide (in-out)	K	8.3	8.1	7.8	7.2	6.6	5.8	5.1

Table 115: Theoretical Performance Data of Selected R-32/R-125/R-161/R-1234ze(E) blends containing 16-40 % R-32, 15 % R-125 and 30 % R-161

Composition R-32/R-125/R-161/R-1234ze(E) % by weight ▶		16/15/30/39	20/15/30/35	24/15/30/31	28/15/30/27	32/15/30/23	36/15/30/19	40/15/30/15
COP		1.30	1.30	1.30	1.29	1.29	1.28	1.28
COP relative to Reference		108.7%	108.4%	108.1%	107.8%	107.3%	106.9%	106.5%
Achieved cooling capacity	kW	2.39	2.56	2.73	2.89	3.05	3.21	3.36
Capacity relative to reference		96.2%	103.0%	109.7%	116.2%	122.6%	129.0%	135.4%
Suction pressure drop relative to reference		70.2%	73.6%	76.9%	79.9%	82.9%	85.7%	88.4%
Pressure ratio		*12.06*	11.79	11.54	11.31	11.08	*10.86*	10.65
Mass flow through evaporator	kg/hr	45.6	47.8	49.9	51.9	53.9	55.8	57.6
Liquid injection mass flow	kg/hr	5.3	6.1	7.0	7.8	8.7	9.6	10.5
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.1	5.3	5.3	5.1	4.8	4.2	3.5
Compressor suction pressure	bar	1.25	1.34	1.44	1.54	1.64	1.75	1.85
Compressor discharge pressure	bar	15.0	15.9	16.7	17.5	18.2	19.0	19.7
Condenser glide (in-out)	K	7.7	7.6	7.2	6.7	6.0	5.3	4.6

Table 116: Theoretical Performance Data of Selected R-32/R-125/R-161/R-1234ze(E) blends containing 16-40 % R-32, 20 % R-125 and 10 % *R-161*

Composition R-32/R-125/R-161/R-1234ze(E) % by weight ▶		16/20/10/54	20/20/10/50	24/20/10/46	28/20/10/42	32/20/10/38	36/20/10/34	40/20/10/30
COP		1.27	1.27	1.27	1.27	1.27	1.26	1.26
COP relative to Reference		106.1%	106.1%	106.0%	105.7%	105.5%	105.1%	104.8%
Achieved cooling capacity	kW	2.06	2.24	2.41	2.57	2.73	2.89	3.04
Capacity relative to reference		83.1%	90.0%	96.8%	103.4%	109.8%	116.1%	122.4%
Suction pressure drop relative to reference		72.9%	76.8%	80.4%	83.8%	86.8%	89.7%	92.3%
Pressure ratio		13.03	12.70	12.40	12.12	11.86	11.61	11.38
Mass flow through evaporator	kg/hr	47.9	50.4	52.7	54.9	57.0	58.9	60.8
Liquid injection mass flow	kg/hr	4.1	5.0	5.9	6.9	7.9	9.0	10.0
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.7	6.1	6.3	6.2	5.9	5.5	4.9
Compressor suction pressure	bar	1.09	1.19	1.29	1.39	1.49	1.59	1.69
Compressor discharge pressure	bar	14.3	15.1	16.0	16.8	17.6	18.4	19.2
Condenser glide (in-out)	K	9.4	9.2	8.8	8.2	7.5	6.7	5.9

Table 117: Theoretical Performance Data of Selected R-32/R-125/R-161/R-1234ze(E) blends containing 16-40 % R-32, 20 % R-125 and 15 % R-161

Composition R-32/R-125/R-161/R-1234ze(E) % by weight ▶		**16/20/15/49**	**20/20/15/45**	**24/20/15/41**	**28/20/15/37**	**32/20/15/33**	**36/20/15/29**	**40/20/15/25**
COP		1.28	1.28	1.28	1.27	1.27	1.26	1.26
COP relative to Reference		106.7%	106.6%	106.4%	106.1%	105.7%	105.4%	105.0%
Achieved cooling capacity	kW	2.17	2.35	2.52	2.68	2.84	3.00	3.16
Capacity relative to reference		87.5%	94.4%	101.2%	107.8%	114.3%	120.6%	127.0%
Suction pressure drop relative to reference		73.4%	77.2%	80.7%	84.0%	87.1%	89.9%	92.7%
Pressure ratio		12.71	12.41	12.12	11.86	11.60	11.37	11.14
Mass flow through evaporator	kg/hr	48.0	50.4	52.7	54.9	57.0	58.9	60.8
Liquid injection mass flow	kg/hr	4.5	5.4	6.3	7.3	8.3	9.3	10.3
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.7	6.0	6.1	5.9	5.6	5.1	4.5
Compressor suction pressure	bar	1.15	1.25	1.35	1.45	1.55	1.65	1.75
Compressor discharge pressure	bar	14.6	15.5	16.3	17.1	17.9	18.7	19.5
Condenser glide (in-out)	K	8.9	8.7	8.3	7.6	6.9	6.2	5.3

Table 118: Theoretical Performance Data of Selected R-32/R-125/R-161/R-1234ze(E) blends containing 16-40 % R-32, 20 % R-125 and 20 % R-161

Composition R-32/R-125/R-161/R-1234ze(E) % by weight ▶		16/20/20/44	20/20/20/40	24/20/20/36	28/20/20/32	32/20/20/28	36/20/20/24	40/20/20/20
COP		1.29	1.28	1.28	1.28	1.27	1.27	1.26
COP relative to Reference		107.2%	107.0%	106.7%	106.4%	106.0%	105.6%	105.2%
Achieved cooling capacity	kW	2.28	2.45	2.62	2.78	2.95	3.11	3.26
Capacity relative to reference		91.7%	98.6%	105.4%	112.0%	118.5%	124.9%	131.3%
Suction pressure drop relative to reference		73.7%	77.4%	80.9%	84.2%	87.2%	90.1%	92.9%
Pressure ratio		12.42	12.14	11.86	11.61	11.37	11.14	10.91
Mass flow through evaporator	kg/hr	48.0	50.4	52.7	54.8	56.9	58.8	60.7
Liquid injection mass flow	kg/hr	4.9	5.8	6.7	7.6	8.6	9.6	10.6
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.5	5.7	5.7	5.5	5.1	4.6	3.9
Compressor suction pressure	bar	1.20	1.30	1.40	1.50	1.60	1.71	1.81
Compressor discharge pressure	bar	14.9	15.8	16.6	17.4	18.2	19.0	19.8
Condenser glide (in-out)	K	8.4	8.2	7.7	7.1	6.4	5.6	4.8

Table 119: Theoretical Performance Data of Selected R-32/R-125/R-161/R-1234ze(E) blends containing 16-40 % R-32, 20 % R-125 and 25 % R-161

Composition R-32/R-125/R-161/R-1234ze(E) % by weight ▶		16/20/25/39	20/20/25/35	24/20/25/31	28/20/25/27	32/20/25/23	36/20/25/19	40/20/25/15
COP		1.29	1.29	1.28	1.28	1.27	1.27	1.26
COP relative to Reference		107.5%	107.3%	107.0%	106.6%	106.2%	105.8%	105.4%
Achieved cooling capacity	kW	2.38	2.55	2.72	2.88	3.05	3.21	3.37
Capacity relative to reference		95.7%	102.6%	109.4%	116.0%	122.6%	129.1%	135.6%
Suction pressure drop relative to reference		74.0%	77.6%	81.0%	84.2%	87.3%	90.2%	93.1%
Pressure ratio		12.15	11.88	11.62	11.37	11.14	10.91	10.69
Mass flow through evaporator	kg/hr	48.0	50.3	52.6	54.7	56.7	58.7	60.6
Liquid injection mass flow	kg/hr	5.3	6.1	7.0	7.9	8.9	9.8	10.8
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.2	5.4	5.3	5.1	4.6	4.0	3.3
Compressor suction pressure	bar	1.25	1.35	1.45	1.56	1.66	1.77	1.87
Compressor discharge pressure	bar	15.2	16.1	16.9	17.7	18.5	19.3	20.0
Condenser glide (in-out)	K	7.8	7.6	7.1	6.5	5.8	5.1	4.3

Table 120: Theoretical Performance Data of Selected R-32/R-125/R-161/R-1234ze(E) blends containing 16-40 % R-32, 20 % R-125 and 30 % R-161

Composition R-32/R-125/R-161/R-1234ze(E) % by weight ▶		16/20/30/34	20/20/30/30	24/20/30/26	28/20/30/22	32/20/30/18	36/20/30/14	40/20/30/10
COP		1.29	1.29	1.29	1.28	1.28	1.27	1.27
COP relative to Reference		107.9%	107.6%	107.3%	106.9%	106.5%	106.1%	105.7%
Achieved cooling capacity	kW	2.47	2.65	2.81	2.98	3.14	3.31	3.47
Capacity relative to reference		99.5%	106.4%	113.2%	119.9%	126.5%	133.1%	139.7%
Suction pressure drop relative to reference		74.1%	77.6%	81.0%	84.2%	87.3%	90.3%	93.2%
Pressure ratio		11.90	11.64	11.39	11.15	10.92	10.70	10.48
Mass flow through evaporator	kg/hr	47.9	50.2	52.4	54.5	56.5	58.5	60.5
Liquid injection mass flow	kg/hr	5.6	6.4	7.3	8.2	9.1	10.0	11.0
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.9	5.0	4.8	4.5	4.0	3.4	2.6
Compressor suction pressure	bar	1.30	1.40	1.51	1.61	1.72	1.82	1.93
Compressor discharge pressure	bar	15.5	16.3	17.2	18.0	18.7	19.5	20.2
Condenser glide (in-out)	K	7.3	7.0	6.6	6.0	5.3	4.6	3.8

Table 121: Theoretical Performance Data of Selected R-32/R-125/R-161/R-1234ze(E) blends containing 16-40 % R-32, 25 % R-125 and 10 % R-161

Composition R-32/R-125/R-161/R-1234ze(E) % by weight ▶		**16/25/10/49**	**20/25/10/45**	**24/25/10/41**	**28/25/10/37**	**32/25/10/33**	**36/25/10/29**	**40/25/10/25**
COP		1.26	1.26	1.26	1.26	1.25	1.25	1.25
COP relative to Reference		105.2%	105.2%	105.0%	104.7%	104.4%	104.1%	103.8%
Achieved cooling capacity	kW	2.15	2.32	2.49	2.66	2.82	2.98	3.14
Capacity relative to reference		86.4%	93.4%	100.2%	106.9%	113.5%	120.0%	126.4%
Suction pressure drop relative to reference		77.5%	81.5%	85.2%	88.6%	91.8%	94.7%	97.5%
Pressure *ratio*		12.86	12.54	12.24	11.96	11.70	11.45	11.22
Mass flow through evaporator	kg/hr	50.6	53.2	55.6	57.9	60.0	62.0	64.0
Liquid injection mass flow	kg/hr	4.3	5.3	6.3	7.3	8.4	9.4	10.5
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.7	5.9	5.9	5.7	5.3	4.8	4.2
Compressor suction pressure	bar	1.15	1.25	1.35	1.45	1.55	1.66	1.76
Compressor discharge pressure Condenser	bar	14.8	15.7	16.5	17.4	18.2	19.0	19.8
glide (in-out)	K	9.0	8.7	8.2	7.5	6.7	5.9	5.1

Table 122: Theoretical Performance Data of Selected R-32/R-125/R-161/R-1234ze(E) blends containing 16-40 % R-32, 25 % R-125 and 15 % R-161

Composition R-32/R-125/R-161/R-1234ze(E) % by weight ▶		16/25/15/44	20/25/15/40	24/25/15/36	28/25/15/32	32/25/15/28	36/25/15/24	40/25/15/20
COP		1.27	1.27	1.26	1.26	1.26	1.25	1.25
COP relative to Reference		105.8%	105.7%	105.4%	105.1%	104.7%	104.4%	104.0%
Achieved cooling capacity	kW	2.26	2.43	2.60	2.77	2.93	3.10	3.26
Capacity relative to reference		90.8%	97.9%	104.7%	111.5%	118.1%	124.6%	131.2%
Suction pressure drop relative to reference		77.9%	81.8%	85.4%	88.8%	92.0%	95.0%	97.9%
Pressure ratio		12.55	12.25	11.97	11.70	11.45	11.21	10.98
Mass flow through evaporator	kg/hr	50.6	53.2	55.6	57.8	59.9	62.0	64.0
Liquid injection mass flow	kg/hr	4.8	5.7	6.7	7.7	8.7	9.8	10.8
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.5	5.7	5.7	5.4	4.9	4.4	3.6
Compressor suction pressure	bar	1.20	1.31	1.41	1.51	1.62	1.72	1.83
Compressor discharge pressure	bar	15.1	16.0	16.9	17.7	18.5	19.3	20.1
Condenser glide (in-out)	K	8.5	8.1	7.6	6.9	6.2	5.4	4.6

Table 123: Theoretical Performance Data of Selected R-32/R-125/R-161/R-1234ze(E) blends containing 16-40 % R-32, 25 % R-125 and 20 % R-161

Composition R-32/R-125/R-161/R-1234ze(E) % by weight ▶		16/25/20/39	20/25/20/35	24/25/20/31	28/25/20/27	32/25/20/23	36/25/20/19	40/25/20/15
COP		1.28	1.27	1.27	1.26	1.26	1.26	1.25
COP relative to Reference		106.3%	106.1%	105.8%	105.4%	105.0%	104.6%	104.3%
Achieved cooling capacity	kW	2.36	2.54	2.71	2.88	3.04	3.21	3.37
Capacity relative to reference		95.1%	102.1%	109.0%	115.8%	122.4%	129.1%	135.7%
Suction pressure drop relative to reference		78.1%	81.9%	85.5%	88.9%	92.1%	95.2%	98.2%
Pressure ratio		12.26	11.98	11.71	11.45	11.21	10.97	10.75
Mass flow through evaporator	kg/hr	50.6	53.1	55.4	57.7	59.8	61.9	63.9
Liquid injection mass flow	kg/hr	5.2	6.1	7.1	8.0	9.1	10.1	11.1
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	5.3	5.4	5.3	4.9	4.4	3.8	3.0
Compressor suction pressure	bar	1.26	1.36	1.47	1.57	1.68	1.79	1.89
Compressor discharge pressure	bar	15.4	16.3	17.2	18.0	18.8	19.6	20.4
Condenser glide (in-out)	K	7.9	7.6	7.0	6.4	5.6	4.8	4.0

Table 124: Theoretical Performance Data of Selected R-32/R-125/R-161/R-1234ze(E) blends containing 16-40 % R-32, 25 % R-125 and 25 % R-161

Composition R-32/R-125/R-161/R-1234ze(E) % by weight ▶		16/25/25/34	20/25/25/30	24/25/25/26	28/25/25/22	32/25/25/18	36/25/25/14	40/25/25/10
COP		1.28	1.28	1.27	1.27	1.26	1.26	1.25
COP relative to Reference		106.7%	106.4%	106.1%	105.7%	105.3%	104.9%	104.6%
Achieved cooling capacity	kW	2.46	2.64	2.81	2.98	3.15	3.31	3.48
Capacity relative to reference		99.1%	106.2%	113.1%	119.9%	126.6%	133.4%	140.1%
Suction pressure drop relative to reference		78.3%	82.0%	85.5%	88.9%	92.2%	95.3%	98.4%
Pressure ratio		11.99	11.72	11.46	11.22	10.98	10.75	10.52
Mass flow through evaporator	kg/hr	50.5	53.0	55.3	57.5	59.6	61.7	63.8
Liquid injection mass flow	kg/hr	5.5	6.4	7.4	8.3	9.3	10.3	11.3
Compressor discharge temperature	°C	130.0	130.0	130.0	130.0	130.0	130.0	130.0
Evaporator glide (out-in)	K	4.9	5.0	4.8	4.4	3.9	3.2	2.4
Compressor suction pressure	bar	1.31	1.41	1.52	1.63	1.73	1.85	1.96
Compressor discharge pressure	bar	15.7	16.6	17.4	18.2	19.0	19.8	20.6
Condenser glide (in-out)	K	7.3	7.0	6.5	5.8	5.1	4.3	3.5

[0160] Embodiments of the invention are set out in the following numbered paragraphs of the description.

1. A heat transfer composition comprising:

(i) *trans*-1,3,3,3-tetrafluoropropene (R-1234ze(E));
(ii) a second component selected from difluoromethane (R-32), propene (R-1270), propane (R290) and mixtures thereof;
(iii) a third component selected from pentafluoroethane (R-125), 1,1,1,2-tetrafluoroethane (R-134a), and mixtures thereof; and optionally
(iv) a fourth component selected from fluoroethane (R-161), 1,1-difluoroethane (R-152a) and mixtures thereof.

2. A composition according to paragraph 1, comprising from about 5 to about 50 % by weight of R-1234ze(E).

3. A composition according to paragraphs 1 or 2, comprising from about 10 to about 40 % by weight of the second component.

4. A composition according to any of the preceding paragraphs, comprising from about 10 to about 80 % by weight of the third component.

5. A composition according to any of the preceding paragraphs, wherein the second component comprises R-32.

6. A composition according to any of the preceding paragraphs, wherein the third component is R-125 and R-134a.

7. A composition according to any of the preceding paragraphs comprising R-1234ze(E), R-32, R-125 and R-134a.

8. A composition according to paragraph 7, comprising from about 5 to about 40 % by weight of R-1234ze(E), from about 20 to about 35 % by weight R-32, from about 15 to about 30 % by weight R-125, and from about 12 to about 50 % by weight R-134a.

9. A composition according to paragraph 7, comprising from about 10 to about 50 % by weight of R-1234ze(E), from about 22 to about 40 % by weight R-32, from about 10 to about 30 % by weight R-125, and from about 15 to about 30 % by weight R-134a.

10. A composition according to any of the preceding paragraphs 1 to 5, comprising R-161 as the fourth component.

11. A composition according to paragraph 10, comprising R-1234ze(E), R-32, R-134a and R-161.

12. A composition according to paragraph 11, comprising from about 5 to about 60 % by weight R-1234ze(E), from about 20 to about 50 % by weight R-32, from about 10 to about 60 % by weight R-161, and from about 10 to about 40 % by weight R-134a.

13. A composition according to paragraph 12, comprising from about 30 to about 60 % by weight R-1234ze(E), from about 20 to about 50 % by weight R-32, from about 10 to about 30 % by weight R-161, and from about 10 to about 25 % by weight R-134a.

14. A composition according to paragraph 10, comprising R-1234ze(E), R-32, R-125 and R-161.

15. A composition according to paragraph 14, comprising from about 10 to about 65 % by weight R-1234ze(E), from about 15 to about 40 % by weight R-32, from about 10 to about 30 % by weight R-161, and from about 10 to about 25 % by weight R-125.

16. A composition according to paragraph 15, comprising from about 25 to about 60 % by weight R-1234ze(E), from about 20 to about 40 % by weight R-32, from about 10 to about 20 % by weight R-161, and from about 10 to about 25 % by weight R-125.

17. A composition according to any of the preceding paragraphs, wherein the composition has a GWP of less than 2800, preferably less than 1500.

18. A composition according to any of the preceding paragraphs, wherein the temperature glide is less than about 15k, preferably less than about 10k.

19. A composition according to any of the preceding paragraphs, wherein the composition has a volumetric refrigeration capacity within about 15%, preferably within about 10% of the existing refrigerant that it is intended to replace.

20. A composition according to any of the preceding paragraphs, wherein the composition is less flammable than R-32 alone.

21. A composition according to paragraph 20 wherein the composition has:

(a) a higher flammable limit;
(b) a higher ignition energy; and/or
(c) a lower flame velocity

compared to R-32 alone.

22. A composition according to paragraph 20 or 21 which is non-flammable.

23. A composition according to any of the preceding paragraphs, wherein the composition has a cycle efficiency within about 10% of the existing refrigerant that it is intended to replace.

24. A composition according to any of the preceding paragraphs, wherein the composition has a compressor discharge temperature within about 15k, preferably within about 10k, of the existing refrigerant that it is intended to replace.

25. A composition comprising a lubricant and a composition according to any of the preceding paragraphs.

26. A composition according to paragraph 25, wherein the lubricant is selected from mineral oil, silicone oil, polyalkyl benzenes (PABs), polyol esters (POEs), polyalkylene glycols (PAGs), polyalkylene glycol esters (PAG esters), polyvinyl ethers (PVEs), poly (alpha-olefins) and combinations thereof.

27. A composition according to paragraphs 25 or 26 further comprising a stabiliser.

28. A composition according to paragraph 27, wherein the stabiliser is selected from diene-based compounds, phosphates, phenol compounds and epoxides, and mixtures thereof.

29. A composition comprising a flame retardant and a composition according to any of the preceding paragraphs.

30. A composition according to paragraph 29, wherein the additional flame retardant is selected from the group consisting of tri-(2-chloroethyl)-phosphate, (chloropropyl) phosphate, tri-(2,3-dibromopropyl)-phosphate, tri-(1,3-dichloropropyl)-phosphate, diammonium phosphate, various halogenated aromatic compounds, antimony oxide, aluminium trihydrate, polyvinyl chloride, a fluorinated iodocarbon, a fluorinated bromocarbon, trifluoro iodomethane, perfluoroalkyl amines, bromo-fluoroalkyl amines and mixtures thereof.

31. A composition according to any of the preceding paragraphs which is a refrigerant composition.

32. A heat transfer device containing a composition as defined in any one of paragraphs 1 to 31.

33. Use of a composition defined in any of paragraphs 1 to 31 in a heat transfer device.

34. A heat transfer device according to paragraph 32 or 33 which is a refrigeration device.

35. A heat transfer device according to paragraph 34 which is selected from group consisting of automotive air conditioning systems, residential air conditioning systems, commercial air conditioning systems, residential refrigerator systems, residential freezer systems, commercial refrigerator systems, commercial freezer systems, chiller air conditioning systems, chiller refrigeration systems, and commercial or residential heat pump systems.

36. A heat transfer device according to paragraph 34 or 35 which contains a compressor.

37. A blowing agent comprising a composition as defined in any of paragraphs 1 to 31.

38. A foamable composition comprising one or more components capable of forming foam and a composition as defined in any of paragraphs 1 to 31, wherein the one or more components capable of forming foam are selected from polyurethanes, thermoplastic polymers and resins, such as polystyrene, and epoxy resins, and mixtures thereof.

39. A foam obtainable from the foamable composition of paragraph 38.

40. A foam according to paragraph 39 comprising a composition as defined in any one of paragraphs 1 to 31.

41. A sprayable composition comprising material to be sprayed and a propellant comprising a composition as defined in any of paragraphs 1 to 31.

42. A method for cooling an article which comprises condensing a composition defined in any of paragraphs 1 to 31 and thereafter evaporating the composition in the vicinity of the article to be cooled.

43. A method for heating an article which comprises condensing a composition as defined in any one of paragraphs 1 to 31 in the vicinity of the article to be heated and thereafter evaporating the composition.

44. A method for extracting a substance from biomass comprising contacting biomass with a solvent comprising a composition as defined in any of paragraphs 1 to 31, and separating the substance from the solvent.

45. A method of cleaning an article comprising contacting the article with a solvent comprising a composition as defined in any of paragraphs 1 to 31.

46. A method of extracting a material from an aqueous solution comprising contacting the aqueous solution with a solvent comprising a composition as defined in any of paragraphs 1 to 31, and separating the substance from the solvent.

47. A method for extracting a material from a particulate solid matrix comprising contacting the particulate solid matrix with a solvent comprising a composition as defined in any of paragraphs 1 to 31, and separating the material from the solvent.

48. A mechanical power generation device containing a composition as defined in any of paragraphs 1 to 31.

49. A mechanical power generating device according to paragraph 48 which is adapted to use a Rankine Cycle or modification thereof to generate work from heat.

50. A method of retrofitting a heat transfer device comprising the step of removing an existing heat transfer fluid, and introducing a composition as defined in any one of paragraphs 1 to 31.

51. A method of paragraph 50 wherein the heat transfer device is a refrigeration device.

52. A method according to paragraph 51 wherein the heat transfer device is an air conditioning system.

53. A method for reducing the environmental impact arising from the operation of a product comprising an existing compound or composition, the method comprising replacing at least partially the existing compound or composition with a composition as defined in any one of paragraphs 1 to 31.

54. A method for preparing a composition as defined in any of paragraphs 1 to 31, and/or a heat transfer device as defined in any of paragraphs 32 or 34 to 36, which composition or heat transfer device contains R-134a, the method comprising introducing R-1243ze(E), the second component, optionally R-125, optionally the fourth component, and optionally a lubricant, a stabiliser and/or an additional flame retardant, into a heat transfer device containing an existing heat transfer fluid which is R-134a.

55. A method according to paragraph 54 comprising the step of removing at least some of the existing R-134a from

the heat transfer device before introducing the R-1243ze(E), the second component, optionally R-125, optionally the fourth component, and optionally the lubricant, the stabiliser and/or the additional flame retardant.

56. A method for generating greenhouse gas emission credit comprising (i) replacing an existing compound or composition with a composition as defined in any one of paragraphs 1 to 31, wherein the composition as defined in any one of paragraphs 1 to 31 has a lower GWP than the existing compound or composition; and (ii) obtaining greenhouse gas emission credit for said replacing step.

57. A method of paragraph 56 wherein the use of the composition of the invention results in a lower Total Equivalent Warming Impact, and/or a lower Life-Cycle Carbon Production than is be attained by use of the existing compound or composition.

58. A method of paragraph 56 or 57 carried out on a product from the fields of air-conditioning, refrigeration, heat transfer, blowing agents, aerosols or sprayable propellants, gaseous dielectrics, cryosurgery, veterinary procedures, dental procedures, fire extinguishing, flame suppression, solvents, cleaners, air horns, pellet guns, topical anesthetics, and expansion applications.

59. A method according to paragraph 53 or 58 wherein the product is selected from a heat transfer device, a blowing agent, a foamable composition, a sprayable composition, a solvent or a mechanical power generation device.

60. A method according to paragraph 59 wherein the product is a heat transfer device.

61. A method according to any one of paragraphs 53 or 56 to 60 wherein the existing compound or composition is a heat transfer composition.

62. A method according to paragraph 61 wherein the heat transfer composition is a refrigerant selected from R-22, R-410A, R-407A, R-407B, R-407C, R507 and R-404a.

63. Any novel heat transfer composition substantially as hereinbefore described, optionally with reference to the examples.

Claims

1. A heat transfer composition comprising from about 5 to about 40 % by weight of *trans*-1,3,3,3-tetrafluoropropene (R-1234ze(E)), from about 20 to about 35 % by weight difluoromethane (R-32), from about 15 to about 30 % by weight R-125 pentafluoroethane (R-125), and from about 12 to about 50 % by weight 1,1,1,2-tetrafluoroethane (R-134a).

2. A composition according to claim 1, wherein the composition has a volumetric refrigeration capacity within about 10%, or within about 5%, of an existing refrigerant that it is intended to replace.

3. A composition according to claim 1 or 2, wherein the composition is non-flammable.

4. A composition according to any of the preceding claims, wherein the composition has a cycle efficiency within about 10%, or within about 5%, of an existing refrigerant that it is intended to replace.

5. A composition according to any of the preceding claims, wherein the composition has a compressor discharge temperature within about 15 K, or within about 10 K, or within about 5 K, of an existing refrigerant that it is intended to replace.

6. A composition according to any of claims 2 to 5, wherein the existing refrigerant is selected from one or more of R-404A, R-407A and R-407C.

7. A composition comprising a lubricant, a stabiliser and a composition according to any of the preceding claims, optionally wherein the stabiliser is selected from diene-based compounds, phosphates, phenol compounds and epoxides, and mixtures thereof.

8. A heat transfer device containing a composition as defined in any of the preceding claims.

9. Use of a composition as defined in any of claims 1 to 7 in a heat transfer device.

10. A heat transfer device according to claim 8 or a use according to claim 9, wherein the heat transfer device is selected from the group consisting of residential air conditioning systems, commercial air conditioning systems, residential refrigerator systems, residential freezer systems, commercial refrigerator systems, commercial freezer systems, chiller air conditioning systems, chiller refrigeration systems, and commercial or residential heat pump systems, optionally wherein the heat transfer device is selected from commercial refrigerator systems, commercial freezer systems, chiller air conditioning systems and chiller refrigeration systems.

11. A method for cooling an article which comprises condensing a composition defined in any of claims 1 to 7 and thereafter evaporating the composition in the vicinity of the article to be cooled.

12. A method for heating an article which comprises condensing a composition as defined in any one of claims 1 to 7 in the vicinity of the article to be heated and thereafter evaporating the composition.

13. A method of retrofitting a heat transfer device comprising the step of removing an existing heat transfer fluid, and introducing a composition as defined in any one of claims 1 to 7, optionally wherein the heat transfer device is a refrigeration device or an air conditioning system.

14. A method for reducing the environmental impact arising from the operation of a product comprising an existing compound or composition, the method comprising replacing at least partially the existing compound or composition with a composition as defined in any one of claims 1 to 7, optionally wherein the existing compound or composition is a refrigerant selected from R-22, R-410A, R-407A, R-407B, R-407C, R507 and R-404a.

15. A method for preparing a composition as defined in any of claims 1 to 7, and/or a heat transfer device as defined in claim 8 or 10, which composition or heat transfer device contains R-134a, the method comprising introducing R-1234ze(E), R-32, R-125, and optionally a lubricant, a stabiliser, into a heat transfer device containing an existing heat transfer fluid, optionally wherein the method comprises the step of removing at least some of the existing R-134a from the heat transfer device before introducing the R-1243ze(E), R-32, R-125, and optionally the lubricant, the stabiliser.

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EUROPEAN SEARCH REPORT

Application Number
EP 15 16 9704

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	3 September 2015	Puetz, Christine

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摘要

本发明提供了热转移组合物，其包含按重量计约 5%至约 40%的反式-1,3,3,3-四氟丙烯（R-1234ze(E)）、按重量计约 20%至约 35%的二氟甲烷（R-32）、按重量计约 15%至约 30%的 R-125 五氟乙烷（R-125）和按重量计约 12%至约 50%的 1,1,1,2-四氟乙烷（R-134a）。