

TITLE OF THE INVENTION

RECOVERED AND RECLAIMED THERMAL MANAGEMENT FLUID
COMPOSITIONS

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to U.S. Provisional Application No. 63/627,393, filed on January 31, 2024, the disclosure of which is herein incorporated by reference in its entirety.

FIELD OF THE INVENTION

[0002] The present disclosure relates to recovered and reclaimed thermal management fluid compositions, as well as to systems containing the same and processes of thermal management fluid recovery and reclamation. More specifically, the present disclosure relates to thermal management fluid compositions which have been recovered from a heat transfer system, as well as to uses thereof in heat transfer systems, methods of recovery of the same, methods of reclamation of the same, methods of using the same, and storage of the same.

BACKGROUND OF THE INVENTION

[0003] Recovery and reclamation of thermal management fluids has long attracted significant attention, due to regulatory requirements and increasing emphasis on circularity, emissions reduction, and resource efficiency. As the regulatory landscape evolved, thermal management fluids have undergone multiple transitions. For example, ozone depleting chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) were phased out as a result of the Montreal Protocol, and were initially replaced by hydrofluorocarbons (HFCs) and ultimately by hydrofluoroolefins (HFOs) for use as refrigerants, solvents, fire extinguishing agents, blowing agents and propellants.

[0004] With each transition, thermal management fluid reclamation becomes more complicated as more molecules are introduced into the process. For example, HFO-1234yf has replaced HFC-134a in automobile air conditioners, but some residual HFC-134a often remains present in the system. Therefore, HFO-1234yf recovered from retrofitted automobile air conditioner systems may contain residual amounts of

HFC-134a. Typically, the residual HFC-134a is removed during the reclamation process. However, it is energy-intensive, labor-intensive, and time-consuming to completely remove HFC-134a in the reclamation process, because HFC-134a forms an azeotrope with HFO-1234yf under certain temperature and pressure conditions, and also because the difference in boiling points between HFC-134a and HFO-1234yf is less than 10°C. Thus, it is difficult to separate the compounds from each other in the reclaiming process. Further, separating such close-boiling or azeotropic thermal management fluids also results in a large environmental footprint, since large separation columns, extractive distillation and the like are needed. Such challenges and complexities in separation may arise with many recovered thermal management fluids.

[0005] Such challenges and complexities also arise in processes of distilling a single refrigerant compound from a refrigerant blend. For example, distilling R-515B to separate HFO-1234ze(E) from HFC-227ea can be costly and energy and labor intensive, and involves a large environmental footprint, since large separation columns, extractive distillation and the like are needed to separate the HFO from the blend.

[0006] There is a need for refrigerant compositions that not only meet low ODP standards and have low global warming potentials and meet the standards of evolving regulations, but that also can be reclaimed or distilled in a manner which is efficient in terms of costs, energy and time, minimizes environmental footprint, and provides compositions exhibiting equivalent or superior performance in a variety of applications.

SUMMARY OF THE INVENTION

[0007] In certain aspects, the invention relates to thermal management fluid compositions, particularly recovered, recycled or reclaimed thermal management fluid compositions, which comprise at least one residual refrigerant. The invention also relates to systems containing the same and processes of thermal management fluid recovery and reclamation. In certain aspects, the invention relates to such thermal management fluid compositions which have been recovered from a heat transfer systems, as well as to uses thereof in heat transfer systems, methods of recovery of the same, methods of reclamation of the same, methods of using the

same, and storage of the same, for example in a recovery container or cylinder. In some aspects, the invention relates to thermal management fluid compositions which are reprocessed products, such as distillation products, and which comprise at least one residual refrigerant.

[0008] Other features and advantages of the present invention will be apparent from the following more detailed description, taken in conjunction with the accompanying drawings which illustrate, by way of example, the principles of this disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. 1 depicts a schematic operation of a medium or low temperature cycle of an auto or stationary air conditioning or heat pump system;

[0010] FIG. 2 depicts a schematic operation of a cycle of a stationary chiller system; and

[0011] FIG. 3 depicts a schematic operation of an Organic Rankine Cycle.

DETAILED DESCRIPTION

[0012] Before addressing details of embodiments described below, some terms are defined or clarified.

[0013] As used herein, the term heat transfer composition means a composition used to carry heat from a heat source to a heat sink.

[0014] A heat source is defined as any space, location, object or body from which it is desirable to add, transfer, move or remove heat, more particularly any space, location, object or body from which it is desirable to remove heat. Examples of heat sources is spaces (open or enclosed) requiring refrigeration or cooling, such as refrigerator or freezer cases in a supermarket, building spaces requiring air-conditioning, industrial water chillers or the passenger compartment of an automobile requiring air-conditioning. In some embodiments, the heat transfer composition may remain in a constant state throughout the transfer process (i.e., not evaporate or condense). In other embodiments, evaporative cooling processes may utilize heat transfer compositions as well.

[0015] A heat sink is defined as any space, location, object or body capable of absorbing heat. For example, a vapor compression refrigeration system is one example of a system that utilizes both a heat source and a heat sink to operate, with the heat sink being the component into which heat is rejected from the condenser of the vapor compression system.

[0016] A heat transfer system is the system (or apparatus) used to produce a heating or cooling effect in a particular space. A heat transfer system may be a mobile system or a stationary system. In some embodiments related to automotive applications, a heat transfer system implies the heating or cooling system which provides heating or cooling of the passenger compartment of an automobile. Sometimes this system is called a heat pump system and may be a reversible heating system or a reversible cooling system, or simply a heating and cooling system.

[0017] In some embodiments, the disclosed compositions may function as primary refrigerants in secondary loop systems that provide cooling to remote locations by use of a secondary heat transfer fluid, which may comprise water, an aqueous salt solution (e.g., calcium chloride), a glycol, carbon dioxide, or a fluorinated hydrocarbon fluid. In this case the secondary heat transfer fluid is the body to be cooled as it is adjacent to the evaporator and is cooled before moving to a second remote body to be cooled.

[0018] Examples of heat transfer systems included but are not limited to air conditioners, freezers, refrigerators, heat pumps, water chillers, flooded evaporator chillers, direct expansion chillers, walk-in coolers, supermarket systems, heat pumps, mobile refrigerators, mobile air conditioning units and combinations thereof.

[0019] More particularly, examples of air conditioning or heat pump systems include but are not limited to air conditioners, residential heat pumps, chillers, including flooded evaporator chillers and direct expansion chillers, mobile air conditioning units, dehumidifiers, and combinations thereof.

[0020] As used herein, mobile refrigeration, air conditioning or heat pump systems refers to any refrigeration, air conditioner or heat pump apparatus incorporated into a transportation unit for the road, rail, sea or air. Mobile air conditioning or heat pumps systems may be used in automobiles, trucks, railcars or other transportation

systems. Mobile refrigeration may include transport refrigeration in trucks, airplanes, or rail cars. In addition, apparatus which are meant to provide refrigeration for a system independent of any moving carrier, known as “intermodal” systems, are including in the present inventions. Such intermodal systems include “containers” (combined sea/land transport) as well as “swap bodies” (combined road and rail transport).

[0021] As used herein, stationary air conditioning or heat pump systems are systems that are fixed in place during operation. A stationary air conditioning or heat pump system may be associated within or attached to buildings of any variety. These stationary applications may be stationary air conditioning and heat pumps, including but not limited to chillers, heat pumps, including residential and high temperature heat pumps, residential, commercial or industrial air conditioning systems, and including window, ductless, ducted, packaged terminal, and those exterior but connected to the building such as rooftop systems.

[0022] Examples of refrigeration systems the disclosed compositions may be useful in are equipment including commercial, industrial or residential refrigerators and freezers, ice machines, self-contained coolers and freezers, flooded evaporator chillers, direct expansion chillers, walk-in and reach-in coolers and freezers, and combination systems. In some embodiments, the disclosed compositions may be used in supermarket refrigeration systems.

[0023] Additionally, stationary applications may utilize a secondary loop system that uses a primary refrigerant to produce cooling in one location that is transferred to a remote location via a secondary heat transfer fluid.

[0024] The operation cycle of some of these types of heat transfer systems are shown in FIGS. 1-3.

[0025] Organic Rankine Cycle (ORC) systems are often used to recover waste heat from industrial processes. In combined heat and power (cogeneration) applications, waste heat from combustion of fuel used to drive the prime mover of a generator set is recovered and used to make hot water for building heat, for example, or for supplying heat to operate an absorption chiller to provide cooling. In some cases, the demand for hot water is small or does not exist. The most difficult case is when the thermal requirement is variable and load matching becomes

difficult, confounding efficient operation of the combined heat and power system. In such an instance, it is more useful to convert the waste heat to shaft power by using an organic Rankine cycle system. The shaft power can be used to operate pumps, for example, or it may be used to generate electricity. By using this approach, the overall system efficiency is higher and fuel utilization is greater. Air emissions from fuel combustion can be decreased since more electric power can be generated for the same amount of fuel input.

[0026] The process that produces waste heat is at least one selected from the group consisting of fuel cells, internal combustion engines, internal compression engines, external combustion engines, and turbines. Other sources of waste heat can be found in association with operations at oil refineries, petrochemical plants, oil and gas pipelines, chemical industry, commercial buildings, hotels, shopping malls, supermarkets, bakeries, food processing industries, restaurants, paint curing ovens, furniture making, plastics molders, cement kilns, lumber kilns (drying), calcining operations, steel industry, glass industry, foundries, smelting, air-conditioning, refrigeration, and central heating. See U.S. Pat. No. 7,428,816, the disclosure of which is hereby incorporated herein by reference.

[0027] As used herein, “refrigerant compound” refers to any fluorocarbon (FC), hydrofluorocarbon (HFC), hydrochlorofluorocarbon (HCFC), chlorofluorocarbon (CFC), hydrochloroolefin (HCO), hydrofluoroolefin (HFO), chlorofluoroolefin (CFO), hydrochlorofluoroolefin (HCFO), hydrocarbon (HC), or carbon dioxide (R-744) that may be used alone or in a blend with other refrigerant compounds as a thermal management fluid.

[0028] As used herein, “thermal management fluid” refers to any fluid used for heat transfer in a closed-loop system.

[0029] As used herein, “virgin thermal management fluid” refers to a thermal management fluid composition having at least about 95 wt% organic purity, preferably at least about 99 wt% organic purity, most preferably at least about 99.5 wt% organic purity, and that has not yet been used in a thermal management fluid application.

[0030] As used herein, “used thermal management fluid” refers to a thermal management fluid composition having at least about 95 wt% organic purity,

preferably at least about 99 wt% organic purity, most preferably at least about 99.5 wt% organic purity, and that has been used as a thermal management fluid.

[0031] As used herein, “spent thermal management fluid” refers to a thermal management fluid composition having less than about 95 wt% organic purity, preferably less than about 99 wt% organic purity, most preferably less than about 99.5 wt% organic purity, and that has been used as a thermal management fluid.

[0032] As used herein, “recovered thermal management fluid” refers to a spent thermal management fluid or a used thermal management fluid drained or otherwise removed from a thermal management device, such as, for example, a refrigeration, an air-conditioning system or a heat pump.

[0033] As used herein, “recycled thermal management fluid” refers to a recovered thermal management fluid, either as recovered or after purification or other processing, having at least about 95 wt% organic purity, preferably at least about 99 wt% organic purity, most preferably at least about 99.5 wt% organic purity and meeting conventional specifications for commercial use or sale as a thermal management fluid.

[0034] As used herein, “reclaimed thermal management fluid” refers to a thermal management fluid having at least one reprocessed refrigerant, including but not limited to a recovered thermal management fluid or a reprocessed product, such as a distillation product, of a recovered thermal management fluid, and having at least about 95 wt% organic purity, preferably at least about 99 wt% organic purity, most preferably at least about 99.5 wt% organic purity and meeting conventional specifications for commercial use or sale as a thermal management fluid.

[0035] As used herein, “reprocessing” refers to one or more processes including, but not limited to, blending, distillation, nitrogen purging, filtration, dehydration, caustic scrubbing, moisture removal, acid removal, oil removal, decanting, composition ratio adjustment (i.e., adjusting the composition of the thermal management fluid as needed) and combinations thereof. As used herein, “reprocessed product” refers to a product which has been subjected to reprocessing.

[0036] As used herein, “organic purity” refers to the degree to which a fluid or fluid composition is free of contaminants such as oil and inorganic materials, such as water, acid, non-absorbable gases (NAGs), particulates/solids, and the like.

[0037] As used herein, in one embodiment, “residual refrigerant” refers to a refrigerant compound which has been carried over from a retrofit or from replacement of a previously filled system. More particularly, as used herein, in one embodiment, “residual refrigerant” refers to a refrigerant compound which was present in an original refrigerant composition contained in a heat transfer system, wherein the heat transfer system has been or is being retrofitted or filled with a replacement refrigerant composition, and a residual amount of the refrigerant compound of the original refrigerant composition is present in the replacement refrigerant composition contained in the heat transfer system and/or when removed from the heat transfer system.

[0038] As used herein, in another embodiment, “residual refrigerant” refers to a refrigerant compound which has been carried over from reprocessing, such as a distillation process. More particularly, as used herein, in one embodiment, “residual refrigerant” refers to a refrigerant compound which was present in a thermal management fluid blend, for example a refrigerant blend composition contained in a heat transfer system, wherein the thermal management fluid blend is subjected to processing. In one embodiment, such processing may be distillation for separation of the components thereof and isolation of a target refrigerant compound and a residual amount of the carryover refrigerant compound of the thermal management fluid blend is present in the distillation product.

[0039] As used herein, “residual amount” means that the total amount of residual refrigerants present in a composition is greater than zero and no more than about 20 wt%, preferably no more than about 10 wt%, more preferably no more than about 5 wt%, most preferably no more than about 2 wt%, or about 1 wt%, or about 0.9 wt%, or about 0.8 wt%, or about 0.7 wt%, or about 0.6 wt%, or about 0.5 wt%, based on the total weight of the composition.

[0040] As used herein, the terms “comprises,” “comprising,” “includes,” “including,” “has,” “having” or any other variation thereof, are intended to cover a non-exclusive inclusion. For example, a composition, process, method, article, or apparatus that

comprises a list of elements is not necessarily limited to only those elements but may include other elements not expressly listed or inherent to such composition, process, method, article, or apparatus. Further, unless expressly stated to the contrary, "or" refers to an inclusive or and not to an exclusive or. For example, a condition A or B is satisfied by any one of the following: A is true (or present) and B is false (or not present), A is false (or not present) and B is true (or present), and both A and B are true (or present).

[0041] The transitional phrase "consisting of" excludes any element, step, or ingredient not specified. If in the claim such would close the claim to the inclusion of materials other than those recited except for impurities ordinarily associated therewith. When the phrase "consists of" appears in a clause of the body of a claim, rather than immediately following the preamble, it limits only the element set forth in that clause; other elements are not excluded from the claim as a whole.

[0042] The transitional phrase "consisting essentially of" is used to define a composition, method that includes materials, steps, features, components, or elements, in addition to those literally disclosed provided that these additional included materials, steps, features, components, or elements do not materially affect the basic and novel characteristic(s) of the claimed invention, especially the mode of action to achieve the desired result of any of the processes of the present invention. The term 'consisting essentially of' occupies a middle ground between "comprising" and 'consisting of'.

[0043] Where applicants have defined an invention or a portion thereof with an open-ended term such as "comprising," it should be readily understood that (unless otherwise stated) the description should be interpreted to also include such an invention using the terms "consisting essentially of" or "consisting of" including, for example, a composition consisting essentially of or consisting of.

[0044] Also, use of "a" or "an" are employed to describe elements and components described herein. This is done merely for convenience and to give a general sense of the scope of the invention. This description should be read to include one or at least one and the singular also includes the plural unless it is obvious that it is meant otherwise.

[0045] Some of the compounds making up the compositions according to the present invention are defined in Table 1.

TABLE 1

Name	Structure	Chemical Name
CFC-11	CCl ₃ F	trichlorofluoromethane
HCFC-22	CHClF ₂	chlorodifluoromethane
CFC-12	CCl ₂ F ₂	dichlorodifluoromethane
HFC-32	CH ₂ F ₂	difluoromethane
HFC-115	CClF ₂ -CF ₃	chloropentafluoroethane
HCFC-123	CHCl ₂ -CF ₃	1,1-dichloro-2,2,2-trifluoroethane
HFC-125	CHF ₂ -CF ₃	pentafluoroethane
HFC-134a	CH ₂ F-CF ₃	1,1,1,2-tetrafluoroethane
HFC-143a	CH ₃ -CF ₃	1,1,1-trifluoroethane
HFC-152a	CH ₃ -CHF ₂	1,1-difluoroethane
HFC-227ea	CF ₃ -CHF-CF ₃	1,1,1,2,3,3,3-heptafluoropropane
HFC-245fa	CF ₃ -CH ₂ -CHF ₂	1,1,1,3,3-pentafluoropropane
E-HFO-1132	E CHF=CHF	E-1,2-difluoroethylene
Z-HFO-1132	Z CHF=CHF	Z-1,2-difluoroethylene
Z-HCFO-1224yd	Z CHCl=CF-CF ₃	Z-1-chloro-2,3,3,3-tetrafluoropropene
E-HCFO-1233zd	E CHCl=CH-CF ₃	E-1-chloro-3,3,3-tetrafluoropropene
HFO-1234yf	CF ₃ -CF=CH ₂	2,3,3,3-tetrafluoro-1-propene
E-HFO-1234ze	E CF ₃ -CH=CHF	E-1,3,3,3-tetrafluoro-1-propene
Z-HFO-1234ze	Z CF ₃ -CH=CHF	Z-1,3,3,3-tetrafluoro-1-propene
HFO-1252zc	CF ₂ =CH-CH ₃	1,1-difluoropropene
E-HFO-1336mzz	E CF ₃ -CH=CH-CF ₃	E-1,1,1,4,4,4-hexafluoro-2-butene
Z-HFO-1336mzz	Z CF ₃ -CH=CH-CF ₃	Z-1,1,1,4,4,4-hexafluoro-2-butene
t-DCE	trans CHCl=CHCl	trans - 1,2-dichloroethylene

[0046] Some of the compounds used in the compositions of the present invention may exist as different configurational isomers or stereoisomers. The present invention is intended to include all single configurational isomers, single stereoisomers or any combination or mixture thereof. For instance, 1,3,3,3-tetrafluoropropene (HFO-1234ze) is meant to represent the Z-isomer, E-isomer, or any combination or mixture of both isomers in any ratio.

COMPOSITIONS

Embodiment 1

[0047] In one embodiment, a composition comprises, consists essentially of, or consists of HFO-1234yf, and at least one of HFC-134a and CFC-12.

[0048] In some embodiments, the HFO-1234yf constitutes a major refrigerant portion of the composition, while the HFC-134a and/or CFC-12 constitute a minor refrigerant portion thereof.

[0049] In one embodiment, the HFC-134a and/or CFC-12 are residual refrigerants. In one embodiment, a residual amount of the HFC-134a and/or CFC-12 is contained in the composition.

[0050] In some embodiments, the composition comprises from about 99.5 to about 99.9 weight percent of HFO-1234yf, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of at least one of HFC-134a, CFC-12 and combinations thereof.

[0051] It will be understood by those skilled in the art that when an amount, concentration, or other value or parameter is given as either a range, preferred range, or a list of upper preferable values and lower preferable values, this is to be understood as specifically disclosing all ranges formed from any pair of any upper range limit or preferred value and any lower range limit or preferred value, regardless of whether ranges are separately disclosed. Where a range of numerical values is recited herein, unless otherwise stated, the range is intended to include the endpoints thereof, and all integers and fractions within the range. It is not intended that the scope of the invention be limited to the specific values recited when defining a range. In particular, for example, the range of about 0.00001 to about 0.5 weight percent (e.g., in the context of the amount of residual refrigerants present) is intended to encompass all ranges within the broader range, such as, but not limited to, from about 0.0001 to about 0.5 weight percent, or from about 0.0001 to about 0.5 weight percent, or from about 0.001 to about 0.5 weight percent.

[0052] In one embodiment, a composition comprises, consists essentially of, or consists of HFO-1234yf; at least one of HFC-134a and CFC-12; and one or more additional compounds selected from HFO-1225ye, HFO-1243zf, E-HFO-1234ze,

HFC-236ea, HCFC-244bb, HFC-245fa, HFC-245eb, HFC-245cb, 3,3,3-trifluoropropyne, HFC-152a, FO-1114, HFO-1123, HCFO-1131a, trans-HCFO-1131, HCO- 1140, CFO-1214ya, FO-1216, HCFO-1224yd, HFO-1252 isomers, HFC-143a, HCFC-225, HFC-254eb, HFC-263fb, HFC- 236fa, HCFC-142b, HCFC-244cc, HCFO-1223, HFO-1132a and HCC-40.

[0053] In one embodiment, a composition comprises, consists essentially of, or consists of HFO-1234yf, at least one of HFC-134a and CFC-12, and one or more additional compounds selected from HFO-1243zf, HFC-134 and E-HFO-1234ze.

[0054] In some embodiments, the HFO-1234yf constitutes a major refrigerant portion of the composition, while the remaining compounds (e.g., the CFC-12 and/or HFC-134a and the additional compounds) constitute a minor refrigerant portion of the composition.

[0055] In one embodiment, a composition comprises, consists essentially of, or consists of:

a first refrigerant portion comprising, consisting essentially of, or consisting of HFO-1234yf, and one or more additional compounds selected from one or more additional compounds selected from HFO-1225ye, HFO-1243zf, E-HFO-1234ze, HFC-236ea, HCFC-244bb, HFC-245fa, HFC-245eb, HFC-245cb, 3,3,3-trifluoropropyne, HFC-152a, FO-1114, HFO-1123, HCFO-1131a, trans-HCFO-1131, HCO- 1140, CFO-1214ya, FO-1216, HCFO-1224yd, HFO-1252 isomers, HFC-143a, HCFC-225, HFC-254eb, HFC-263fb, HFC- 236fa, HCFC-142b, HCFC-244cc, HCFO-1223, HFO-1132a and HCC-40, and

a second refrigerant portion comprising, consisting essentially of, or consisting of at least one of CFC-12 and HFC-134a.

[0056] In some embodiments, the first refrigerant portion comprises, consists essentially of, or consists of HFO-1234yf, and one or more additional compounds selected from HFO-1243zf, HFC-134 and E-HFO-1234ze.

[0057] In some embodiments, the HFO-1234yf of the first refrigerant portion constitutes a major refrigerant portion of the composition, while the CFC-12 and/or HFC-134a of the second refrigerant portion and the additional compounds of the first refrigerant portion constitute a minor refrigerant portion thereof.

[0058] In some embodiments, the second refrigerant portion of any of the foregoing compositions of Embodiment 1 comprises residual refrigerants.

[0059] In some embodiments, any of the foregoing compositions of Embodiment 1 comprises from about 99.5 to about 99.9 weight percent of the first refrigerant portion, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of the second refrigerant portion.

[0060] In one embodiment, the total amount of additional compound(s) in the first refrigerant portion of any of the foregoing compositions of Embodiment 1 ranges from greater than 0 wt.% to less than or equal to about 2 wt.%, about 1 wt.%, about 0.9 wt.%, about 0.8 wt.%, about 0.7 wt.%, about 0.6 wt.%, about 0.5 wt.%, about 0.4 wt.%, about 0.3 wt.%, about 0.2 wt.%, about 0.1 wt.%, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.01 ppm (weight) to about 1 wt.%, and all values therebetween up to 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.1 ppm (weight) to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 0.5 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.4 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.1 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In one embodiment, the total amount of additional compound(s) is about 0.1 wt.% based on the total weight of the first refrigerant portion of the composition.

Embodiment 2

[0061] In one embodiment, a composition comprises, consists essentially of, or consists of HFC-134a and CFC-12.

[0062] In some embodiments, the HFC-134a constitutes a major refrigerant portion of the composition, while the CFC-12 constitutes a minor refrigerant portion thereof.

[0063] In some embodiments, the composition comprises from about 99.5 to about 99.9 weight percent of HFC-134a, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of CFC-12.

[0064] In one embodiment, the CFC-12 is a residual refrigerant. In one embodiment, a residual amount of the CFC-12 is contained in the composition.

[0065] In one embodiment, a composition comprises, consists essentially of, or consists of HFC-134a; CFC-12; and one or more additional compounds selected from HFC-143a, HFO-1225zc, HFC-245cb, HFC-134, HFC-152a, HFO-1225ye, HFC-161, E-HFO-1234ze, HCFC-22, HFO-1243zf, HCFC-124, HCC-40, HCFO-1122, HCFC-31, CFC-114, CFC-114a and HCO-1140.

[0066] In one embodiment, a composition comprises, consists essentially of, or consists of HFC-134a, CFC-12, and one or more additional compounds selected from HFC-134, HCC-40, HCFC-124, CFC-114a and CFC-114.

[0067] In some embodiments, the HFC-134a constitutes a major refrigerant portion of the composition, while the remaining compounds (e.g., the CFC-12 and the additional compounds) constitute a minor refrigerant portion of the composition.

[0068] In one embodiment, a composition comprises, consists essentially of, or consists of:

a first refrigerant portion comprising, consisting essentially of, or consisting of HFC-134a, and one or more additional compounds selected from HFC-143a, HFO-1225zc, HFC-245cb, HFC-134, HFC-152a, HFO-1225ye, HFC-161, E-HFO-1234ze, HCFC-22, HFO-1243zf, HCFC-124, HCC-40, HCFO-1122, HCFC-31, CFC-114, CFC-114a and HCO-1140, and

a second refrigerant portion comprising, consisting essentially of, or consisting of CFC-12.

[0069] In some embodiments, the first refrigerant portion comprises, consists essentially of, or consists of HFC-134a, and one or more additional compounds selected from HFC-134, HCC-40, HCFC-124, CFC-114a and CFC-114.

[0070] In some embodiments, the HFC-134a of the first refrigerant portion constitutes a major refrigerant portion of the composition, while the CFC-12 of the

second refrigerant portion and the additional compounds of the first refrigerant portion constitute a minor refrigerant portion thereof.

[0071] In some embodiments, the second refrigerant portion of any of the foregoing compositions of Embodiment 2 comprises residual refrigerants.

[0072] In some embodiments, any of the foregoing compositions of Embodiment 2 comprises from about 99.5 to about 99.9 weight percent of the first refrigerant portion, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of the second refrigerant portion.

[0073] In one embodiment, the total amount of additional compound(s) in the first refrigerant portion of any of the foregoing compositions of Embodiment 2 ranges from greater than 0 wt.% to less than or equal to about 2 wt.%, about 1 wt.%, about 0.9 wt.%, about 0.8 wt.%, about 0.7 wt.%, about 0.6 wt.%, about 0.5 wt.%, about 0.4 wt.%, about 0.3 wt.%, about 0.2 wt.%, about 0.1 wt.%, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.01 ppm (weight) to about 1 wt.%, and all values therebetween up to 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.1 ppm (weight) to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 0.5 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.4 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.1 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In one embodiment, the total amount of additional compound(s) is about 0.1 wt.% based on the total weight of the first refrigerant portion of the composition.

Embodiment 3

[0074] In one embodiment, a composition comprises, consists essentially of, or consists of E-HFO-1234ze, and at least one of HFC-134a and HFC-227ea.

[0075] In some embodiments, the E-HFO-1234ze constitutes a major refrigerant portion of the composition, while the HFC-134a and/or HFC-227ea constitute a minor refrigerant portion thereof.

[0076] In some embodiments, the composition comprises from about 99.5 to about 99.9 weight percent of E-HFO-1234ze, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of at least one of HFC-227ea, HFC-134a and combinations thereof.

[0077] In one embodiment, the HFC-134a and/or HFC-227ea are residual refrigerants. In one embodiment, a residual amount of the HFC-134a and/or HFC-227ea is contained in the composition.

[0078] In one embodiment, a composition comprises, consists essentially of, or consists of E-HFO-1234ze; at least one of HFC-134a and HFC-227ea; and one or more additional compounds selected from HFO-1234yf, HFC-245cb, HFO-1225ye(E), HFO-1225ye(Z), HFO-1225zc, HFC-236fa, HFC-152a, HFC-143a, HFC-125, HFC-134a, HFO-1234zc, HCFO-1233xf, HCFO-1233zd, CFC-114, HCFC-124, 3,3,3-trifluoropropyne, HFO-1234ze(Z), HFC-245fa, HFC-227ea, HFO-1243zf, HFC-263fb and HFC-134.

[0079] In one embodiment, a composition comprises, consists essentially of, or consists of E-HFO-1234ze, at least one of HFC-134a and HFC-227ea, and one or more additional compounds selected from HFO-1234yf, HFC-245cb, HFO-1225ye(E), HFO-1225ye(Z), HFO-1225zc and HFC-134.

[0080] In some embodiments, the E-HFO-1234ze constitutes a major refrigerant portion of the composition, while the remaining compounds (e.g., the HFC-227ea and/or HFC-134a and the additional compounds) constitute a minor refrigerant portion of the composition.

[0081] In one embodiment, a composition comprises, consists essentially of, or consists of:

a first refrigerant portion comprising, consisting essentially of, or consisting of E-HFO-1234ze, and one or more additional compounds selected from HFO-1234yf, HFC-245cb, HFO-1225ye(E), HFO-1225ye(Z), HFO-1225zc, HFC-236fa, HFC-152a, HFC-143a, HFC-125, HFC-134a, HFO-1234zc, HCFO-1233xf, HCFO-

1233zd, CFC-114, HCFC-124, 3,3,3-trifluoropropyne, HFO-1234ze(Z), HFC-245fa, HFC-227ea, HFO-1243zf, HFC-263fb and HFC-134, and

a second refrigerant portion comprising, consisting essentially of, or consisting of at least one of HFC-227ea and HFC-134a.

[0082] In some embodiments, the first refrigerant portion comprises, consists essentially of, or consists of E-HFO-1234ze, and one or more additional compounds selected from HFO-1234yf, HFC-245cb, HFO-1225ye(E), HFO-1225ye(Z), HFO-1225zc and HFC-134.

[0083] In some embodiments, the E-HFO-1234ze of the first refrigerant portion constitutes a major refrigerant portion of the composition, while the HFC-227ea and/or HFC-134a of the second refrigerant portion and the additional compounds of the first refrigerant portion constitute a minor refrigerant portion thereof.

[0084] In some embodiments, the second refrigerant portion of any of the foregoing compositions of Embodiment 3 comprises residual refrigerants.

[0085] In some embodiments, any of the foregoing compositions of Embodiment 3 comprises from about 99.5 to about 99.9 weight percent of the first refrigerant portion, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of the second refrigerant portion.

[0086] In one embodiment, the total amount of additional compound(s) in the first refrigerant portion of any of the foregoing compositions of Embodiment 3 ranges from greater than 0 wt.% to less than or equal to about 2 wt.%, about 1 wt.%, about 0.9 wt.%, about 0.8 wt.%, about 0.7 wt.%, about 0.6 wt.%, about 0.5 wt.%, about 0.4 wt.%, about 0.3 wt.%, about 0.2 wt.%, about 0.1 wt.%, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.01 ppm (weight) to about 1 wt.%, and all values therebetween up to 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.1 ppm (weight) to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 0.5 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.4 wt.% or less, based on the

total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt. % to 0.1 wt. % or less, based on the total weight of the first refrigerant portion of the composition. In one embodiment, the total amount of additional compound(s) is about 0.1 wt. % based on the total weight of the first refrigerant portion of the composition.

Embodiment 4

[0087] In one embodiment, a composition comprises, consists essentially of, or consists of E-HFO-1234ze, and at least one of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, Z-HFO-1234ze and E-HFO-1336mzz.

[0088] In some embodiments, the E-HFO-1234ze constitutes a major refrigerant portion of the composition, while the CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, Z-HFO-1234ze and/or E-HFO-1336mzz constitute a minor refrigerant portion thereof.

[0089] In some embodiments, the composition comprises from about 99.5 to about 99.9 weight percent E-HFO-1234ze, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of at least one of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, Z-HFO-1234ze, E-HFO-1336mzz and combinations thereof.

[0090] In one embodiment, the CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, Z-HFO-1234ze and/or E-HFO-1336mzz are residual refrigerants. In one embodiment, a residual amount of the CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, Z-HFO-1234ze and/or E-HFO-1336mzz is contained in the composition.

[0091] In one embodiment, a composition comprises, consists essentially of, or consists of E-HFO-1234ze; at least one of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, Z-HFO-1234ze and E-HFO-1336mzz; and one or more additional compounds selected from HFO-1234yf, HFC-245cb, HFO-1225ye(E), HFO-1225ye(Z), HFO-1225zc, HFC-236fa, HFC-152a, HFC-143a, HFC-125, HFC-134a, HFO-1234zc, HCFO-1233xf, HCFO-1233zd, CFC-114, HCFC-124,

3,3,3-trifluoropropyne, HFO-1234ze(Z), HFC-245fa, HFC-227ea, HFO-1243zf, HFC-263fb and HFC-134.

[0092] In one embodiment, a composition comprises, consists essentially of, or consists of E-HFO-1234ze; at least one of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, Z-HFO-1234ze and E-HFO-1336mzz; and one or more additional compounds selected from HFO-1234yf, HFC-245cb, HFO-1225ye(E), HFO-1225ye(Z), HFO-1225zc and HFC-134.

[0093] In some embodiments, the E-HFO-1234ze constitutes a major refrigerant portion of the composition, while the remaining compounds (e.g., the CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, Z-HFO-1234ze and/or E-HFO-1336mzz and the additional compounds) constitute a minor refrigerant portion of the composition.

[0094] In one embodiment, a composition comprises, consists essentially of, or consists of:

a first refrigerant portion comprising, consisting essentially of, or consisting of E-HFO-1234ze, and one or more additional compounds selected from HFO-1234yf, HFC-245cb, HFO-1225ye(E), HFO-1225ye(Z), HFO-1225zc, HFC-236fa, HFC-152a, HFC-143a, HFC-125, HFC-134a, HFO-1234zc, HCFO-1233xf, HCFO-1233zd, CFC-114, HCFC-124, 3,3,3-trifluoropropyne, HFO-1234ze(Z), HFC-245fa, HFC-227ea, HFO-1243zf, HFC-263fb and HFC-134, and

a second refrigerant portion comprising, consisting essentially of, or consisting of at least one of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, Z-HFO-1234ze and E-HFO-1336mzz.

[0095] In one embodiment, the first refrigerant portion comprises, consists essentially of, or consists of E-HFO-1234ze, and one or more additional compounds selected from HFO-1234yf, HFC-245cb, HFO-1225ye(E), HFO-1225ye(Z), HFO-1225zc and HFC-134.

[0096] In some embodiments, the E-HFO-1234ze of the first refrigerant portion constitutes a major refrigerant portion of the composition, while the CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, Z-HFO-1234ze and/or

E-HFO-1336mzz of the second refrigerant portion and the additional compounds of the first refrigerant portion constitute a minor refrigerant portion thereof.

[0097] In some embodiments, the second refrigerant portion of any of the foregoing compositions of Embodiment 4 comprises residual refrigerants.

[0098] In some embodiments, any of the foregoing compositions of Embodiment 4 comprises from about 99.5 to about 99.9 weight percent of the first refrigerant portion, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of the second refrigerant portion.

[0099] In one embodiment, the total amount of additional compound(s) in the first refrigerant portion of any of the foregoing compositions of Embodiment 4 ranges from greater than 0 wt.% to less than or equal to about 2 wt.%, about 1 wt.%, about 0.9 wt.%, about 0.8 wt.%, about 0.7 wt.%, about 0.6 wt.%, about 0.5 wt.%, about 0.4 wt.%, about 0.3 wt.%, about 0.2 wt.%, about 0.1 wt.%, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.01 ppm (weight) to about 1 wt.%, and all values therebetween up to 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.1 ppm (weight) to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 0.5 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.4 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.1 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In one embodiment, the total amount of additional compound(s) is about 0.1 wt.% based on the total weight of the first refrigerant portion of the composition.

Embodiment 5

[0100] In one embodiment, a composition comprises, consists essentially of, or consists of E-HFO-1234ze, and at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, HFC-152a and CO₂.

[0101] In some embodiments, the E-HFO-1234ze constitutes a major refrigerant portion of the composition, while the HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, HFC-152a and/or CO₂ constitute a minor refrigerant portion thereof.

[0102] In some embodiments, the composition comprises from about 99.5 to about 99.9 weight percent E-HFO-1234ze, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, HFC-152a, CO₂ and combinations thereof.

[0103] In one embodiment, the HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, HFC-152a and/or CO₂ are residual refrigerants. In one embodiment, a residual amount of the HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, HFC-152a and/or CO₂ is contained in the composition.

[0104] In one embodiment, a composition comprises, consists essentially of, or consists of E-HFO-1234ze; at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, HFC-152a and CO₂; and one or more additional compounds selected from HFO-1234yf, HFC-245cb, HFO-1225ye(E), HFO-1225ye(Z), HFO-1225zc, HFC-236fa, HFC-152a, HFC-143a, HFC-125, HFC-134a, HFO-1234zc, HCFO-1233xf, HCFO-1233zd, CFC-114, HCFC-124, 3,3,3-trifluoropropyne, HFO-1234ze(Z), HFC-245fa, HFC-227ea, HFO-1243zf, HFC-263fb and HFC-134.

[0105] In one embodiment, a composition comprises, consists essentially of, or consists of E-HFO-1234ze; at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, HFC-152a and CO₂; and one or more additional compounds selected from HFO-1234yf, HFC-245cb, HFO-1225ye(E), HFO-1225ye(Z), HFO-1225zc and HFC-134.

[0106] In some embodiments, the E-HFO-1234ze constitutes a major refrigerant portion of the composition, while the remaining compounds (e.g., the HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, HFC-152a and/or CO₂ and the additional compounds) constitute a minor refrigerant portion of the composition.

[0107] In one embodiment, a composition comprises, consists essentially of, or consists of:

a first refrigerant portion comprising, consisting essentially of, or consisting of E-HFO-1234ze, and one or more additional compounds selected from HFO-1234yf, HFC-245cb, HFO-1225ye(E), HFO-1225ye(Z), HFO-1225zc, HFC-236fa, HFC-152a, HFC-143a, HFC-125, HFC-134a, HFO-1234zc, HCFO-1233xf, HCFO-1233zd, CFC-114, HCFC-124, 3,3,3-trifluoropropyne, HFO-1234ze(Z), HFC-245fa, HFC-227ea, HFO-1243zf, HFC-263fb and HFC-134, and

a second refrigerant portion comprising, consisting essentially of, or consisting of at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, HFC-152a and CO₂.

[0108] In some embodiments, the first refrigerant portion comprises, consists essentially of, or consists of E-HFO-1234ze, and one or more additional compounds selected from HFO-1234yf, HFC-245cb, HFO-1225ye(E), HFO-1225ye(Z), HFO-1225zc and HFC-134.

[0109] In some embodiments, the E-HFO-1234ze of the first refrigerant portion constitutes a major refrigerant portion of the composition, while the HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, HFC-152a and/or CO₂ of the second refrigerant portion and the additional compounds of the first refrigerant portion constitute a minor refrigerant portion thereof.

[0110] In some embodiments, the second refrigerant portion of any of the foregoing compositions of Embodiment 5 comprises residual refrigerants.

[0111] In some embodiments, any of the foregoing compositions of Embodiment 5 comprises from about 99.5 to about 99.9 weight percent of the first refrigerant portion, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of the second refrigerant portion.

[0112] In one embodiment, the total amount of additional compound(s) in the first refrigerant portion of any of the foregoing compositions of Embodiment 5 ranges from greater than 0 wt.% to less than or equal to about 2 wt.%, about 1 wt.%, about 0.9 wt.%, about 0.8 wt.%, about 0.7 wt.%, about 0.6 wt.%, about 0.5 wt.%, about 0.4 wt.%, about 0.3 wt.%, about 0.2 wt.%, about 0.1 wt.%, based on the total weight of

the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.01 ppm (weight) to about 1 wt.%, and all values therebetween up to 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.1 ppm (weight) to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 0.5 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.4 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.1 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In one embodiment, the total amount of additional compound(s) is about 0.1 wt.% based on the total weight of the first refrigerant portion of the composition.

Embodiment 6

[0113] In one embodiment, a composition comprises, consists essentially of, or consists of E-HFO-1234ze, and at least one of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a and HFO-1234yf.

[0114] In some embodiments, the E-HFO-1234ze constitutes a major refrigerant portion of the composition, while the HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a and/or HFO-1234yf constitute a minor refrigerant portion thereof.

[0115] In some embodiments, the composition comprises from about 99.5 to about 99.9 weight percent E-HFO-1234ze, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of at least one of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a, HFO-1234yf and combinations thereof.

[0116] In one embodiment, the HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a and/or HFO-1234yf are residual refrigerants. In one embodiment, a residual amount of the HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a and/or HFO-1234yf is contained in the composition.

[0117] In one embodiment, a composition comprises, consists essentially of, or consists of E-HFO-1234ze; at least one of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a and HFO-1234yf; and one or more additional compounds selected from HFO-1234yf, HFC-245cb, HFO-1225ye(E), HFO-1225ye(Z), HFO-1225zc, HFC-236fa, HFC-152a, HFC-143a, HFC-125, HFC-134a, HFO-1234zc, HCFO-1233xf, HCFO-1233zd, CFC-114, HCFC-124, 3,3,3-trifluoropropyne, HFO-1234ze(Z), HFC-245fa, HFC-227ea, HFO-1243zf, HFC-263fb and HFC-134.

[0118] In one embodiment, a composition comprises, consists essentially of, or consists of E-HFO-1234ze; at least one of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a and HFO-1234yf; and one or more additional compounds selected from HFO-1234yf, HFC-245cb, HFO-1225ye(E), HFO-1225ye(Z), HFO-1225zc and HFC-134.

[0119] In some embodiments, the E-HFO-1234ze constitutes a major refrigerant portion of the composition, while the remaining compounds (e.g., the HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a and/or HFO-1234yf and the additional compounds) constitute a minor refrigerant portion of the composition.

[0120] In one embodiment, a composition comprises, consists essentially of, or consists of:

a first refrigerant portion comprising, consisting essentially of, or consisting of E-HFO-1234ze, and one or more additional compounds selected from HFO-1234yf, HFC-245cb, HFO-1225ye(E), HFO-1225ye(Z), HFO-1225zc, HFC-236fa, HFC-152a, HFC-143a, HFC-125, HFC-134a, HFO-1234zc, HCFO-1233xf, HCFO-1233zd, CFC-114, HCFC-124, 3,3,3-trifluoropropyne, HFO-1234ze(Z), HFC-245fa, HFC-227ea, HFO-1243zf, HFC-263fb and HFC-134, and

a second refrigerant portion comprising, consisting essentially of, or consisting of at least one of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a and HFO-1234yf.

[0121] In some embodiments, the first refrigerant portion comprises, consists essentially of, or consists of E-HFO-1234ze, and one or more additional compounds selected from HFO-1234yf, HFC-245cb, HFO-1225ye(E), HFO-1225ye(Z), HFO-1225zc and HFC-134.

[0122] In some embodiments, the E-HFO-1234ze of the first refrigerant portion constitutes a major refrigerant portion of the composition, while the HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a and/or HFO-1234yf of the second refrigerant portion and the additional compounds of the first refrigerant portion constitute a minor refrigerant portion thereof.

[0123] In some embodiments, the second refrigerant portion of any of the foregoing compositions of Embodiment 6 comprises residual refrigerants.

[0124] In some embodiments, any of the foregoing compositions of Embodiment 6 comprises from about 99.5 to about 99.9 weight percent of the first refrigerant portion, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of the second refrigerant portion.

[0125] In one embodiment, the total amount of additional compound(s) in the first refrigerant portion of any of the foregoing compositions of Embodiment 6 ranges from greater than 0 wt.% to less than or equal to about 2 wt.%, about 1 wt.%, about 0.9 wt.%, about 0.8 wt.%, about 0.7 wt.%, about 0.6 wt.%, about 0.5 wt.%, about 0.4 wt.%, about 0.3 wt.%, about 0.2 wt.%, about 0.1 wt.%, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.01 ppm (weight) to about 1 wt.%, and all values therebetween up to 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.1 ppm (weight) to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 0.5 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.4 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.1 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In one embodiment, the total amount of additional compound(s) is about 0.1 wt.% based on the total weight of the first refrigerant portion of the composition.

Embodiment 7

[0126] In one embodiment, a composition comprises, consists essentially of, or consists of (i) E-HFO-1234ze; and (ii) at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, HFO-1252zc, Z-HFO-1234ze, E-HFO-1336mzz and CO₂.

[0127] In some embodiments, the E-HFO-1234ze constitutes a major refrigerant portion of the composition, while the CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, HFO-1252zc, Z-HFO-1234ze, E-HFO-1336mzz and/or CO₂ constitute a minor refrigerant portion thereof.

[0128] In some embodiments, the composition comprises from about 99.5 to about 99.9 weight percent E-HFO-1234ze, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of at least one of (ii) at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, HFO-1252zc, Z-HFO-1234ze, E-HFO-1336mzz, CO₂ and combinations thereof.

[0129] In one embodiment, the CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, HFO-1252zc, Z-HFO-1234ze, E-HFO-1336mzz and/or CO₂ are residual refrigerants. In one embodiment, a residual amount of the CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-134, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, HFO-1252zc, Z-HFO-1234ze, E-HFO-1336mzz and/or CO₂ is contained in the composition.

[0130] In one embodiment, a composition comprises, consists essentially of, or consists of (i) E-HFO-1234ze; (ii) at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-134, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, HFO-1252zc, Z-HFO-1234ze, E-HFO-1336mzz and CO₂; and (iii) one or more additional compounds selected from HFO-1234yf, HFC-245cb, HFO-1225ye(E), HFO-1225ye(Z), HFO-1225zc,

HFC-236fa, HFC-152a, HFC-143a, HFC-125, HFC-134a, HFO-1234zc, HCFO-1233xf, HCFO-1233zd, CFC-114, HCFC-124, 3,3,3-trifluoropropyne, HFO-1234ze(Z), HFC-245fa, HFC-227ea, HFO-1243zf, HFC-263fb and HFC-134.

[0131] In one embodiment, a composition comprises, consists essentially of, or consists of E-HFO-1234ze; at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, HFO-1252zc, Z-HFO-1234ze, E-HFO-1336mzz and CO₂; and one or more additional compounds selected from HFO-1234yf, HFC-245cb, HFO-1225ye(E), HFO-1225ye(Z), HFO-1225zc and HFC-134.

[0132] In some embodiments, the E-HFO-1234ze constitutes a major refrigerant portion of the composition, while the remaining compounds (e.g., at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, HFO-1252zc, Z-HFO-1234ze, E-HFO-1336mzz and/or CO₂ and the additional compounds) constitute a minor refrigerant portion of the composition.

[0133] In one embodiment, a composition comprises, consists essentially of, or consists of:

a first refrigerant portion comprising, consisting essentially of, or consisting of E-HFO-1234ze, and one or more additional compounds selected from HFO-1234yf, HFC-245cb, HFO-1225ye(E), HFO-1225ye(Z), HFO-1225zc, HFC-236fa, HFC-152a, HFC-143a, HFC-125, HFC-134a, HFO-1234zc, HCFO-1233xf, HCFO-1233zd, CFC-114, HCFC-124, 3,3,3-trifluoropropyne, HFO-1234ze(Z), HFC-245fa, HFC-227ea, HFO-1243zf, HFC-263fb and HFC-134, and

a second refrigerant portion comprising, consisting essentially of, or consisting of at least one of (ii) at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, HFO-1252zc, Z-HFO-1234ze, E-HFO-1336mzz and CO₂.

[0134] In some embodiments, the first refrigerant portion comprises, consists essentially of, or consists of E-HFO-1234ze, and one or more additional compounds selected from HFO-1234yf, HFC-245cb, HFO-1225ye(E), HFO-1225ye(Z), HFO-1225zc and HFC-134.

[0135] In some embodiments, the E-HFO-1234ze of the first refrigerant portion constitutes a major refrigerant portion of the composition, while the at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, HFO-1252zc, Z-HFO-1234ze, E-HFO-1336mzz and/or CO₂ of the second refrigerant portion and the additional compounds of the first refrigerant portion constitute a minor refrigerant portion thereof.

[0136] In some embodiments, the second refrigerant portion of any of the foregoing compositions of Embodiment 7 comprises residual refrigerants.

[0137] In some embodiments, any of the foregoing compositions of Embodiment 7 comprises from about 99.5 to about 99.9 weight percent of the first refrigerant portion, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of the second refrigerant portion.

[0138] In one embodiment, the total amount of additional compound(s) in the first refrigerant portion of any of the foregoing compositions of Embodiment 7 ranges from greater than 0 wt.% to less than or equal to about 2 wt.%, about 1 wt.%, about 0.9 wt.%, about 0.8 wt.%, about 0.7 wt.%, about 0.6 wt.%, about 0.5 wt.%, about 0.4 wt.%, about 0.3 wt.%, about 0.2 wt.%, about 0.1 wt.%, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.01 ppm (weight) to about 1 wt.%, and all values therebetween up to 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.1 ppm (weight) to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 0.5 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.4 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.1 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In one embodiment, the total amount of additional compound(s) is about 0.1 wt.% based on the total weight of the first refrigerant portion of the composition.

Embodiment 8

[0139] In one embodiment, a composition comprises, consists essentially of, or consists of HFO-1234yf, and at least one of E-HFO-1234ze, HFC-134a and HFC-227ea.

[0140] In some embodiments, the HFO-1234yf constitutes a major refrigerant portion of the composition, while the E-HFO-1234ze, HFC-134a and/or HFC-227ea constitute a minor refrigerant portion thereof.

[0141] In some embodiments, the composition comprises from about 99.5 to about 99.9 weight percent of HFO-1234yf, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of at least one of E-HFO-1234ze, HFC-134a, HFC-227ea and combinations thereof.

[0142] In one embodiment, the E-HFO-1234ze, HFC-134a and/or HFC-227ea are residual refrigerants. In one embodiment, a residual amount of the E-HFO-1234ze, HFC-134a and/or HFC-227ea is contained in the composition.

[0143] In one embodiment, a composition comprises, consists essentially of, or consists of HFO-1234yf; at least one of E-HFO-1234ze, HFC-134a and HFC-227ea; and one or more additional compounds selected from one or more additional compounds selected from HFO-1225ye, HFO-1243zf, E-HFO-1234ze, HFC-236ea, HCFC-244bb, HFC-245fa, HFC-245eb, HFC-245cb, 3,3,3-trifluoropropyne, HFC-152a, FO-1114, HFO-1123, HCFO-1131a, trans-HCFO-1131, HCO-1140, CFO-1214ya, FO-1216, HCFO-1224yd, HFO-1252 isomers, HFC-143a, HCFC-225, HFC-254eb, HFC-263fb, HFC-236fa, HCFC-142b, HCFC-244cc, HCFO-1223, HFO-1132a and HCC-40.

[0144] In one embodiment, a composition comprises, consists essentially of, or consists of HFO-1234yf; at least one of E-HFO-1234ze, HFC-134a and HFC-227ea; and one or more additional compounds selected from HFC-245cb, HFO-1243zf, HFC-152a, 3,3,3-trifluoropropyne and HCC-40.

[0145] In some embodiments, the HFO-1234yf constitutes a major refrigerant portion of the composition, while the remaining compounds (e.g., the E-HFO-1234ze, HFC-134a and/or HFC-227ea and the additional compounds) constitute a minor refrigerant portion of the composition.

[0146] In one embodiment, a composition comprises, consists essentially of, or consists of:

a first refrigerant portion comprising, consisting essentially of, or consisting of HFO-1234yf, and one or more additional compounds selected from HFO-1225ye, HFO-1243zf, E-HFO-1234ze, HFC-236ea, HCFC-244bb, HFC-245fa, HFC-245eb, HFC-245cb, 3,3,3-trifluoropropyne, HFC-152a, FO-1114, HFO-1123, HCFO-1131a, trans-HCFO-1131, HCO- 1140, CFO-1214ya, FO-1216, HCFO-1224yd, HFO-1252 isomers, HFC-143a, HCFC-225, HFC-254eb, HFC-263fb, HFC- 236fa, HCFC-142b, HCFC-244cc, HCFO-1223, HFO-1132a and HCC-40; and

a second refrigerant portion comprising, consisting essentially of, or consisting of at least one of E-HFO-1234ze, HFC-134a and HFC-227ea.

[0147] In some embodiments, the first refrigerant portion comprises, consists essentially of, or consists of HFO-1234yf, and one or more additional compounds selected from HFC-245cb, HFO-1243zf, HFC-152a, 3,3,3-trifluoropropyne and HCC-40.

[0148] In some embodiments, the HFO-1234yf of the first refrigerant portion constitutes a major refrigerant portion of the composition, while the E-HFO-1234ze, HFC-134a and/or HFC-227ea of the second refrigerant portion and the additional compounds of the first refrigerant portion constitute a minor refrigerant portion thereof.

[0149] In some embodiments, the second refrigerant portion of any of the foregoing compositions of Embodiment 8 comprises residual refrigerants.

[0150] In some embodiments, any of the foregoing compositions of Embodiment 8 comprises from about 99.5 to about 99.9 weight percent of the first refrigerant portion, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of the second refrigerant portion.

[0151] In one embodiment, the total amount of additional compound(s) in the first refrigerant portion of any of the foregoing compositions of Embodiment 8 ranges from greater than 0 wt.% to less than or equal to about 2 wt.%, about 1 wt.%, about 0.9 wt.%, about 0.8 wt.%, about 0.7 wt.%, about 0.6 wt.%, about 0.5 wt.%, about 0.4 wt.%, about 0.3 wt.%, about 0.2 wt.%, about 0.1 wt.%, based on the total weight of

the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.01 ppm (weight) to about 1 wt.%, and all values therebetween up to 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.1 ppm (weight) to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 0.5 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.4 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.1 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In one embodiment, the total amount of additional compound(s) is about 0.1 wt.% based on the total weight of the first refrigerant portion of the composition.

Embodiment 9

[0152] In one embodiment, a composition comprises, consists essentially of, or consists of HFO-1234yf, and at least one of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze and E-HFO-1336mzz.

[0153] In some embodiments, the HFO-1234yf constitutes a major refrigerant portion of the composition, while the CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze and/or E-HFO-1336mzz constitute a minor refrigerant portion thereof.

[0154] In some embodiments, the composition comprises from about 99.5 to about 99.9 weight percent HFO-1234yf, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of at least one of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, E-HFO-1336mzz and combinations thereof.

[0155] In one embodiment, the CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze and/or E-HFO-1336mzz are residual refrigerants. In one embodiment, a residual amount of the CFC-12, HFC-32, HFC-134a, HFC-

227ea, Z-HCFO-1224yd, E-HFO-1234ze and/or E-HFO-1336mzz is contained in the composition.

[0156] In one embodiment, a composition comprises, consists essentially of, or consists of E-HFO-1234ze; at least one of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze and E-HFO-1336mzz; and one or more additional compounds selected from HFO-1225ye, HFO-1243zf, E-HFO-1234ze, HFC-236ea, HCFC-244bb, HFC-245fa, HFC-245eb, HFC-245cb, 3,3,3-trifluoropropyne, HFC-152a, FO-1114, HFO-1123, HCFO-1131a, trans-HCFO-1131, HCO- 1140, CFO-1214ya, FO-1216, HCFO-1224yd, HFO-1252 isomers, HFC-143a, HCFC-225, HFC-254eb, HFC-263fb, HFC- 236fa, HCFC-142b, HCFC-244cc, HCFO-1223, HFO-1132a and HCC-40.

[0157] In one embodiment, a composition comprises, consists essentially of, or consists of HFO-1234yf; at least one of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze and E-HFO-1336mzz; and one or more additional compounds selected from HFC-245cb, HFO-1243zf, HFC-152a, 3,3,3-trifluoropropyne and HCC-40.

[0158] In some embodiments, the HFO-1234yf constitutes a major refrigerant portion of the composition, while the remaining compounds (e.g., the CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze and/or E-HFO-1336mzz and the additional compounds) constitute a minor refrigerant portion of the composition.

[0159] In one embodiment, a composition comprises, consists essentially of, or consists of:

a first refrigerant portion comprising, consisting essentially of, or consisting of HFO-1234yf, and one or more additional compounds selected from HFO-1225ye, HFO-1243zf, E-HFO-1234ze, HFC-236ea, HCFC-244bb, HFC-245fa, HFC-245eb, HFC-245cb, 3,3,3-trifluoropropyne, HFC-152a, FO-1114, HFO-1123, HCFO-1131a, trans-HCFO-1131, HCO- 1140, CFO-1214ya, FO-1216, HCFO-1224yd, HFO-1252 isomers, HFC-143a, HCFC-225, HFC-254eb, HFC-263fb, HFC- 236fa, HCFC-142b, HCFC-244cc, HCFO-1223, HFO-1132a and HCC-40, and

a second refrigerant portion comprising, consisting essentially of, or consisting of at least one of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze and E-HFO-1336mzz.

[0160] In some embodiments, the first refrigerant portion comprises, consists essentially of, or consists of HFO-1234yf, and one or more additional compounds selected from HFC-245cb, HFO-1243zf, HFC-152a, 3,3,3-trifluoropropyne and HCC-40.

[0161] In some embodiments, the HFO-1234yf of the first refrigerant portion constitutes a major refrigerant portion of the composition, while the CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze and/or E-HFO-1336mzz of the second refrigerant portion and the additional compounds of the first refrigerant portion constitute a minor refrigerant portion thereof.

[0162] In some embodiments, the second refrigerant portion of any of the foregoing compositions of Embodiment 9 comprises residual refrigerants.

[0163] In some embodiments, any of the foregoing compositions of Embodiment 9 comprises from about 99.5 to about 99.9 weight percent of the first refrigerant portion, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of the second refrigerant portion.

[0164] In one embodiment, the total amount of additional compound(s) in the first refrigerant portion of any of the foregoing compositions of Embodiment 9 ranges from greater than 0 wt.% to less than or equal to about 2 wt.%, about 1 wt.%, about 0.9 wt.%, about 0.8 wt.%, about 0.7 wt.%, about 0.6 wt.%, about 0.5 wt.%, about 0.4 wt.%, about 0.3 wt.%, about 0.2 wt.%, about 0.1 wt.%, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.01 ppm (weight) to about 1 wt.%, and all values therebetween up to 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.1 ppm (weight) to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 0.5 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.4 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In another

embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.1 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In one embodiment, the total amount of additional compound(s) is about 0.1 wt.% based on the total weight of the first refrigerant portion of the composition.

Embodiment 10

[0165] In one embodiment, a composition comprises, consists essentially of, or consists of HFO-1234yf, and at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze and CO₂.

[0166] In some embodiments, the HFO-1234yf constitutes a major refrigerant portion of the composition, while the HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze and/or CO₂ constitute a minor refrigerant portion thereof.

[0167] In some embodiments, the composition comprises from about 99.5 to about 99.9 weight percent HFO-1234yf, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze, CO₂ and combinations thereof.

[0168] In one embodiment, the HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze and/or CO₂ are residual refrigerants. In one embodiment, a residual amount of the HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze and/or CO₂ is contained in the composition.

[0169] In one embodiment, a composition comprises, consists essentially of, or consists of HFO-1234yf; at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze and CO₂; and one or more additional compounds selected from HFO-1225ye, HFO-1243zf, E-HFO-1234ze, HFC-236ea, HCFC-244bb, HFC-245fa, HFC-245eb, HFC-245cb, 3,3,3-trifluoropropyne, HFC-152a, FO-1114, HFO-1123, HCFO-1131a, trans-HCFO-1131, HCO-1140, CFO-1214ya, FO-1216, HCFO-1224yd, HFO-1252 isomers, HFC-143a, HCFC-225, HFC-254eb, HFC-263fb, HFC-236fa, HCFC-142b, HCFC-244cc, HCFO-1223, HFO-1132a and HCC-40.

[0170] In one embodiment, a composition comprises, consists essentially of, or consists of HFO-1234yf; HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze and CO₂; and one or more additional compounds selected from HFC-245cb, HFO-1243zf, HFC-152a, 3,3,3-trifluoropropyne and HCC-40.

[0171] In some embodiments, the HFO-1234yf constitutes a major refrigerant portion of the composition, while the remaining compounds (e.g., the HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze and/or CO₂ and the additional compounds) constitute a minor refrigerant portion of the composition.

[0172] In one embodiment, a composition comprises, consists essentially of, or consists of:

a first refrigerant portion comprising, consisting essentially of, or consisting of HFO-1234yf, and one or more additional compounds selected from HFO-1225ye, HFO-1243zf, E-HFO-1234ze, HFC-236ea, HCFC-244bb, HFC-245fa, HFC-245eb, HFC-245cb, 3,3,3-trifluoropropyne, HFC-152a, FO-1114, HFO-1123, HCFO-1131a, trans-HCFO-1131, HCO-1140, CFO-1214ya, FO-1216, HCFO-1224yd, HFO-1252 isomers, HFC-143a, HCFC-225, HFC-254eb, HFC-263fb, HFC-236fa, HCFC-142b, HCFC-244cc, HCFO-1223, HFO-1132a and HCC-40, and

a second refrigerant portion comprising, consisting essentially of, or consisting of at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze and CO₂.

[0173] In some embodiments, the first refrigerant portion comprises, consists essentially of, or consists of HFO-1234yf, and one or more additional compounds selected from HFC-245cb, HFO-1243zf, HFC-152a, 3,3,3-trifluoropropyne and HCC-40.

[0174] In some embodiments, the HFO-1234yf of the first refrigerant portion constitutes a major refrigerant portion of the composition, while the HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze and/or CO₂ of the second refrigerant portion and the additional compounds of the first refrigerant portion constitute a minor refrigerant portion thereof.

[0175] In some embodiments, the second refrigerant portion of any of the foregoing compositions of Embodiment 10 comprises residual refrigerants.

[0176] In some embodiments, any of the foregoing compositions of Embodiment 10 comprises from about 99.5 to about 99.9 weight percent of the first refrigerant portion, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of the second refrigerant portion.

[0177] In one embodiment, the total amount of additional compound(s) in the first refrigerant portion of any of the foregoing compositions of Embodiment 10 ranges from greater than 0 wt.% to less than or equal to about 2 wt.%, about 1 wt.%, about 0.9 wt.%, about 0.8 wt.%, about 0.7 wt.%, about 0.6 wt.%, about 0.5 wt.%, about 0.4 wt.%, about 0.3 wt.%, about 0.2 wt.%, about 0.1 wt.%, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.01 ppm (weight) to about 1 wt.%, and all values therebetween up to 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.1 ppm (weight) to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 0.5 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.4 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.1 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In one embodiment, the total amount of additional compound(s) is about 0.1 wt.% based on the total weight of the first refrigerant portion of the composition.

Embodiment 11

[0178] In one embodiment, a composition comprises, consists essentially of, or consists of HFO-1234yf, and at least one of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a and E-HFO-1234ze.

[0179] In some embodiments, the HFO-1234yf constitutes a major refrigerant portion of the composition, while the HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a and/or E-HFO-1234ze constitute a minor refrigerant portion thereof.

[0180] In some embodiments, the composition comprises from about 99.5 to about 99.9 weight percent HFO-1234yf, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of at least one of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze and combinations thereof.

[0181] In one embodiment, the HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a and/or E-HFO-1234ze are residual refrigerants. In one embodiment, a residual amount of the HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a and/or E-HFO-1234ze is contained in the composition.

[0182] In one embodiment, a composition comprises, consists essentially of, or consists of HFO-1234yf; at least one of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a and E-HFO-1234ze; and one or more additional compounds selected from HFO-1225ye, HFO-1243zf, E-HFO-1234ze, HFC-236ea, HCFC-244bb, HFC-245fa, HFC-245eb, HFC-245cb, 3,3,3-trifluoropropyne, HFC-152a, FO-1114, HFO-1123, HCFO-1131a, trans-HCFO-1131, HCO-1140, CFO-1214ya, FO-1216, HCFO-1224yd, HFO-1252 isomers, HFC-143a, HCFC-225, HFC-254eb, HFC-263fb, HFC-236fa, HCFC-142b, HCFC-244cc, HCFO-1223, HFO-1132a and HCC-40.

[0183] In one embodiment, a composition comprises, consists essentially of, or consists of HFO-1234yf; at least one of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a and E-HFO-1234ze; and one or more additional compounds selected from HFC-245cb, HFO-1243zf, HFC-152a, 3,3,3-trifluoropropyne (R-2223) and HCC-40.

[0184] In some embodiments, the HFO-1234yf constitutes a major refrigerant portion of the composition, while the remaining compounds (e.g., the HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a and/or E-HFO-1234ze and the additional compounds) constitute a minor refrigerant portion of the composition.

[0185] In one embodiment, a composition comprises, consists essentially of, or consists of:

a first refrigerant portion comprising, consisting essentially of, or consisting of HFO-1234yf, and one or more additional compounds selected from HFO-1225ye, HFO-1243zf, E-HFO-1234ze, HFC-236ea, HCFC-244bb, HFC-245fa, HFC-245eb,

HFC-245cb, 3,3,3-trifluoropropyne, HFC-152a, FO-1114, HFO-1123, HCFO-1131a, trans-HCFO-1131, HCO- 1140, CFO-1214ya, FO-1216, HCFO-1224yd, HFO-1252 isomers, HFC-143a, HCFC-225, HFC-254eb, HFC-263fb, HFC- 236fa, HCFC-142b, HCFC-244cc, HCFO-1223, HFO-1132a and HCC-40, and

a second refrigerant portion comprising, consisting essentially of, or consisting of at least one of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a and E-HFO-1234ze.

[0186] In some embodiments, the first refrigerant portion comprises, consists essentially of, or consists of HFO-1234yf, and one or more additional compounds selected from HFC-245cb, HFO-1243zf, HFC-152a, 3,3,3-trifluoropropyne and HCC-40.

[0187] In some embodiments, the HFO-1234yf of the first refrigerant portion constitutes a major refrigerant portion of the composition, while the HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a and/or E-HFO-1234ze of the second refrigerant portion and the additional compounds of the first refrigerant portion constitute a minor refrigerant portion thereof.

[0188] In some embodiments, the second refrigerant portion of any of the foregoing compositions of Embodiment 11 comprises residual refrigerants.

[0189] In some embodiments, any of the foregoing compositions of Embodiment 11 comprises from about 99.5 to about 99.9 weight percent of the first refrigerant portion, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of the second refrigerant portion.

[0190] In one embodiment, the total amount of additional compound(s) in the first refrigerant portion of any of the foregoing compositions of Embodiment 11 ranges from greater than 0 wt.% to less than or equal to about 2 wt.%, about 1 wt.%, about 0.9 wt.%, about 0.8 wt.%, about 0.7 wt.%, about 0.6 wt.%, about 0.5 wt.%, about 0.4 wt.%, about 0.3 wt.%, about 0.2 wt.%, about 0.1 wt.%, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.01 ppm (weight) to about 1 wt.%, and all values therebetween up to 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.1 ppm (weight) to about 1 wt.%. In another

embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 0.5 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.4 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.1 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In one embodiment, the total amount of additional compound(s) is about 0.1 wt.% based on the total weight of the first refrigerant portion of the composition.

Embodiment 12

[0191] In one embodiment, a composition comprises, consists essentially of, or consists of (i) HFO-1234yf; and (ii) at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and CO₂.

[0192] In some embodiments, the HFO-1234yf constitutes a major refrigerant portion of the composition, while the CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and/or CO₂ constitute a minor refrigerant portion thereof.

[0193] In some embodiments, the composition comprises from about 99.5 to about 99.9 weight percent HFO-1234yf, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of at least one of (ii) at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof.

[0194] In one embodiment, the CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and/or CO₂ are residual refrigerants. In one embodiment, a residual amount of the CFC-12,

HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and/or CO₂ is contained in the composition.

[0195] In one embodiment, a composition comprises, consists essentially of, or consists of (i) HFO-1234yf; (ii) at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and CO₂; and (iii) one or more additional compounds selected from one or more additional compounds selected from HFO-1225ye, HFO-1243zf, E-HFO-1234ze, HFC-236ea, HCFC-244bb, HFC-245fa, HFC-245eb, HFC-245cb, 3,3,3-trifluoropropyne, HFC-152a, FO-1114, HFO-1123, HCFO-1131a, trans-HCFO-1131, HCO-1140, CFO-1214ya, FO-1216, HCFO-1224yd, HFO-1252 isomers, HFC-143a, HCFC-225, HFC-254eb, HFC-263fb, HFC-236fa, HCFC-142b, HCFC-244cc, HCFO-1223, HFO-1132a and HCC-40.

[0196] In one embodiment, a composition comprises, consists essentially of, or consists of (i) HFO-1234yf; (ii) at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and CO₂; and (iii) one or more additional compounds selected from HFC-245cb, HFO-1243zf, HFC-152a, 3,3,3-trifluoropropyne and HCC-40.

[0197] In some embodiments, the HFO-1234yf constitutes a major refrigerant portion of the composition, while the remaining compounds (e.g., at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and/or CO₂ and the additional compounds) constitute a minor refrigerant portion of the composition.

[0198] In one embodiment, a composition comprises, consists essentially of, or consists of:

a first refrigerant portion comprising, consisting essentially of, or consisting of HFO-1234yf, and one or more additional compounds selected from HFO-1225ye, HFO-1243zf, E-HFO-1234ze, HFC-236ea, HCFC-244bb, HFC-245fa, HFC-245eb, HFC-245cb, 3,3,3-trifluoropropyne, HFC-152a, FO-1114, HFO-1123,

HCFO-1131a, trans-HCFO-1131, HCO- 1140, CFO-1214ya, FO-1216, HCFO-1224yd, HFO-1252 isomers, HFC-143a, HCFC-225, HFC-254eb, HFC-263fb, HFC- 236fa, HCFC-142b, HCFC-244cc, HCFO-1223, HFO-1132a and HCC-40, and

a second refrigerant portion comprising, consisting essentially of, or consisting of at least one of (ii) at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and CO₂.

[0199] In some embodiments, the first refrigerant portion comprises, consists essentially of, or consists of HFO-1234yf, and one or more additional compounds selected from HFC-245cb, HFO-1243zf, HFC-152a, 3,3,3-trifluoropropyne and HCC-40.

[0200] In some embodiments, the HFO-1234yf of the first refrigerant portion constitutes a major refrigerant portion of the composition, while the at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and/or CO₂ of the second refrigerant portion and the additional compounds of the first refrigerant portion constitute a minor refrigerant portion thereof.

[0201] In some embodiments, the second refrigerant portion of any of the foregoing compositions of Embodiment 12 comprises residual refrigerants.

[0202] In some embodiments, any of the foregoing compositions of Embodiment 12 comprises from about 99.5 to about 99.9 weight percent of the first refrigerant portion, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of the second refrigerant portion.

[0203] In one embodiment, the total amount of additional compound(s) in the first refrigerant portion of any of the foregoing compositions of Embodiment 12 ranges from greater than 0 wt.% to less than or equal to about 2 wt.%, about 1 wt.%, about 0.9 wt.%, about 0.8 wt.%, about 0.7 wt.%, about 0.6 wt.%, about 0.5 wt.%, about 0.4 wt.%, about 0.3 wt.%, about 0.2 wt.%, about 0.1 wt.%, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total

amount of additional compound(s) ranges from 0.01 ppm (weight) to about 1 wt.%, and all values therebetween up to 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.1 ppm (weight) to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 0.5 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.4 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.1 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In one embodiment, the total amount of additional compound(s) is about 0.1 wt.% based on the total weight of the first refrigerant portion of the composition.

Embodiment 13

[0204] In one embodiment, a composition comprises, consists essentially of, or consists of HFC-32, and at least one of HCFC-22, HFC-125 and HFO-1234yf.

[0205] In some embodiments, the HFC-32 constitutes a major refrigerant portion of the composition, while the HCFC-22, HFC-125 and/or HFO-1234yf constitute a minor refrigerant portion thereof.

[0206] In some embodiments, the composition comprises from about 99.5 to about 99.9 weight percent of HFC-32, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of at least one of HCFC-22, HFC-125, HFO-1234yf and combinations thereof.

[0207] In one embodiment, the HCFC-22, HFC-125 and/or HFO-1234yf are residual refrigerants. In one embodiment, a residual amount of the HCFC-22, HFC-125 and/or HFO-1234yf is contained in the composition.

[0208] In one embodiment, a composition comprises, consists essentially of, or consists of HFC-32; at least one of HCFC-22, HFC-125 and HFO-1234yf; and one or more additional compounds selected from HFC-143a, HFC-41, HFC-134a, HCFC-22, CFC-12 and HCC-40.

[0209] In one embodiment, a composition comprises, consists essentially of, or consists of HFC-32; at least one of HCFC-22, HFC-125 and HFO-1234yf; and one or more additional compounds selected from HFC-143a, HCC-40 and HFC-41.

[0210] In some embodiments, the HFC-32 constitutes a major refrigerant portion of the composition, while the remaining compounds (e.g., the HCFC-22, HFC-125 and/or HFO-1234yf and the additional compounds) constitute a minor refrigerant portion of the composition.

[0211] In one embodiment, a composition comprises, consists essentially of, or consists of:

a first refrigerant portion comprising, consisting essentially of, or consisting of HFC-32, and one or more additional compounds selected from HFC-143a, HFC-41, HFC-134a, HCFC-22, CFC-12 and HCC-40, and

a second refrigerant portion comprising, consisting essentially of, or consisting of at least one of HCFC-22, HFC-125 and HFO-1234yf.

[0212] In some embodiments, the first refrigerant portion comprises, consists essentially of, or consists of HFC-32, and one or more additional compounds selected from HFC-143a, HCC-40 and HFC-41.

[0213] In some embodiments, the HFC-32 of the first refrigerant portion constitutes a major refrigerant portion of the composition, while the HCFC-22, HFC-125 and/or HFO-1234yf of the second refrigerant portion and the additional compounds of the first refrigerant portion constitute a minor refrigerant portion thereof.

[0214] In some embodiments, the second refrigerant portion of any of the foregoing compositions of Embodiment 13 comprises residual refrigerants.

[0215] In some embodiments, any of the foregoing compositions of Embodiment 13 comprises from about 99.5 to about 99.9 weight percent of the first refrigerant portion, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of the second refrigerant portion.

[0216] In one embodiment, the total amount of additional compound(s) in the first refrigerant portion of any of the foregoing compositions of Embodiment 13 ranges from greater than 0 wt.% to less than or equal to about 2 wt.%, about 1 wt.%, about

0.9 wt.%, about 0.8 wt.%, about 0.7 wt.%, about 0.6 wt.%, about 0.5 wt.%, about 0.4 wt.%, about 0.3 wt.%, about 0.2 wt.%, about 0.1 wt.%, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.01 ppm (weight) to about 1 wt.%, and all values therebetween up to 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.1 ppm (weight) to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 0.5 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.4 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.1 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In one embodiment, the total amount of additional compound(s) is about 0.1 wt.% based on the total weight of the first refrigerant portion of the composition.

Embodiment 14

[0217] In one embodiment, a composition comprises, consists essentially of, or consists of HFC-32, and at least one of CFC-12, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze and E-HFO-1336mzz.

[0218] In some embodiments, the HFC-32 constitutes a major refrigerant portion of the composition, while the CFC-12, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze and/or E-HFO-1336mzz constitute a minor refrigerant portion thereof.

[0219] In some embodiments, the composition comprises from about 99.5 to about 99.9 weight percent HFC-32, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of at least one of CFC-12, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, E-HFO-1336mzz and combinations thereof.

[0220] In one embodiment, the CFC-12, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze and/or E-HFO-1336mzz are residual refrigerants. In

one embodiment, a residual amount of the CFC-12, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze and/or E-HFO-1336mzz is contained in the composition.

[0221] In one embodiment, a composition comprises, consists essentially of, or consists of HFC-32; at least one of CFC-12, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze and E-HFO-1336mzz; and one or more additional compounds selected from HFC-143a, HFC-41, HFC-134a, HCFC-22, CFC-12 and HCC-40.

[0222] In one embodiment, a composition comprises, consists essentially of, or consists of HFC-32; at least one of CFC-12, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze and E-HFO-1336mzz; and one or more additional compounds selected from HFC-143a, HCC-40 and HFC-41.

[0223] In some embodiments, the HFC-32 constitutes a major refrigerant portion of the composition, while the remaining compounds (e.g., the CFC-12, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze and/or E-HFO-1336mzz and the additional compounds) constitute a minor refrigerant portion of the composition.

[0224] In one embodiment, a composition comprises, consists essentially of, or consists of:

a first refrigerant portion comprising, consisting essentially of, or consisting of HFC-32, and one or more additional compounds selected from HFC-143a, HFC-41, HFC-134a, HCFC-22, CFC-12 and HCC-40, and

a second refrigerant portion comprising, consisting essentially of, or consisting of at least one of CFC-12, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze and E-HFO-1336mzz.

[0225] In some embodiments, the first refrigerant portion comprises, consists essentially of, or consists of HFC-32, and one or more additional compounds selected from HFC-143a, HCC-40 and HFC-41.

[0226] In some embodiments, the HFC-32 of the first refrigerant portion constitutes a major refrigerant portion of the composition, while the CFC-12, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze and/or E-HFO-1336mzz of

the second refrigerant portion and the additional compounds of the first refrigerant portion constitute a minor refrigerant portion thereof.

[0227] In some embodiments, the second refrigerant portion of any of the foregoing compositions of Embodiment 14 comprises residual refrigerants.

[0228] In some embodiments, any of the foregoing compositions of Embodiment 14 comprises from about 99.5 to about 99.9 weight percent of the first refrigerant portion, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of the second refrigerant portion.

[0229] In one embodiment, the total amount of additional compound(s) in the first refrigerant portion of any of the foregoing compositions of Embodiment 14 ranges from greater than 0 wt.% to less than or equal to about 2 wt.%, about 1 wt.%, about 0.9 wt.%, about 0.8 wt.%, about 0.7 wt.%, about 0.6 wt.%, about 0.5 wt.%, about 0.4 wt.%, about 0.3 wt.%, about 0.2 wt.%, about 0.1 wt.%, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.01 ppm (weight) to about 1 wt.%, and all values therebetween up to 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.1 ppm (weight) to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 0.5 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.4 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.1 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In one embodiment, the total amount of additional compound(s) is about 0.1 wt.% based on the total weight of the first refrigerant portion of the composition.

Embodiment 15

[0230] In one embodiment, a composition comprises, consists essentially of, or consists of HFC-32, and at least one of HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, E-HFO-1234ze and CO₂.

[0231] In some embodiments, the HFC-32 constitutes a major refrigerant portion of the composition, while the HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, E-HFO-1234ze and/or CO₂ constitute a minor refrigerant portion thereof.

[0232] In some embodiments, the composition comprises from about 99.5 to about 99.9 weight percent HFC-32, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of at least one of HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, E-HFO-1234ze, CO₂ and combinations thereof.

[0233] In one embodiment, the HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, E-HFO-1234ze and/or CO₂ are residual refrigerants. In one embodiment, a residual amount of the HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, E-HFO-1234ze and/or CO₂ is contained in the composition.

[0234] In one embodiment, a composition comprises, consists essentially of, or consists of HFC-32; at least one of HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, E-HFO-1234ze and CO₂; and one or more additional compounds selected from HFC-143a, HFC-41, HFC-134a, HCFC-22, CFC-12 and HCC-40.

[0235] In one embodiment, a composition comprises, consists essentially of, or consists of HFC-32; at least one of HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, E-HFO-1234ze and CO₂; and one or more additional compounds selected from HFC-143a, HCC-40 and HFC-41.

[0236] In some embodiments, the HFC-32 constitutes a major refrigerant portion of the composition, while the remaining compounds (e.g., the HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, E-HFO-1234ze and/or CO₂ and the additional compounds) constitute a minor refrigerant portion of the composition.

[0237] In one embodiment, a composition comprises, consists essentially of, or consists of:

a first refrigerant portion comprising, consisting essentially of, or consisting of HFC-32, and one or more additional compounds selected from HFC-143a, HFC-41, HFC-134a, HCFC-22, CFC-12 and HCC-40, and

a second refrigerant portion comprising, consisting essentially of, or consisting of at least one of HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, E-HFO-1234ze and CO₂.

[0238] In some embodiments, the first refrigerant portion comprises, consists essentially of, or consists of HFC-32, and one or more additional compounds selected from HFC-143a, HCC-40 and HFC-41.

[0239] In some embodiments, the HFC-32 of the first refrigerant portion constitutes a major refrigerant portion of the composition, while the HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, E-HFO-1234ze and/or CO₂ of the second refrigerant portion and the additional compounds of the first refrigerant portion constitute a minor refrigerant portion thereof.

[0240] In some embodiments, the second refrigerant portion of any of the foregoing compositions of Embodiment 15 comprises residual refrigerants.

[0241] In some embodiments, any of the foregoing compositions of Embodiment 15 comprises from about 99.5 to about 99.9 weight percent of the first refrigerant portion, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of the second refrigerant portion.

[0242] In one embodiment, the total amount of additional compound(s) in the first refrigerant portion of any of the foregoing compositions of Embodiment 15 ranges from greater than 0 wt.% to less than or equal to about 2 wt.%, about 1 wt.%, about 0.9 wt.%, about 0.8 wt.%, about 0.7 wt.%, about 0.6 wt.%, about 0.5 wt.%, about 0.4 wt.%, about 0.3 wt.%, about 0.2 wt.%, about 0.1 wt.%, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.01 ppm (weight) to about 1 wt.%, and all values therebetween up to 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.1 ppm (weight) to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 0.5 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.4 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to

0.1 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In one embodiment, the total amount of additional compound(s) is about 0.1 wt.% based on the total weight of the first refrigerant portion of the composition.

Embodiment 16

[0243] In one embodiment, a composition comprises, consists essentially of, or consists of HFC-32, and at least one of HCFC-22, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze and HFO-1234yf.

[0244] In some embodiments, the HFC-32 constitutes a major refrigerant portion of the composition, while the HCFC-22, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze and/or HFO-1234yf constitute a minor refrigerant portion thereof.

[0245] In some embodiments, the composition comprises from about 99.5 to about 99.9 weight percent HFC-32, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of at least one of HCFC-22, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze, HFO-1234yf and combinations thereof.

[0246] In one embodiment, the HCFC-22, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze and/or HFO-1234yf are residual refrigerants. In one embodiment, a residual amount of the HCFC-22, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze and/or HFO-1234yf is contained in the composition.

[0247] In one embodiment, a composition comprises, consists essentially of, or consists of HFC-32; at least one of HCFC-22, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze and HFO-1234yf; and one or more additional compounds selected from HFC-143a, HFC-41, HFC-134a, HCFC-22, CFC-12 and HCC-40.

[0248] In one embodiment, a composition comprises, consists essentially of, or consists of HFC-32; at least one of HCFC-22, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze and HFO-1234yf; and one or more additional compounds selected from HFC-143a, HCC-40 and HFC-41.

[0249] In some embodiments, the HFC-32 constitutes a major refrigerant portion of the composition, while the remaining compounds (e.g., the HCFC-22, HFC-125,

HFC-134a, HFC-143a, E-HFO-1234ze and/or HFO-1234yf and the additional compounds) constitute a minor refrigerant portion of the composition.

[0250] In one embodiment, a composition comprises, consists essentially of, or consists of:

a first refrigerant portion comprising, consisting essentially of, or consisting of HFC-32, and one or more additional compounds selected from HFC-143a, HFC-41, HFC-134a, HCFC-22, CFC-12 and HCC-40, and

a second refrigerant portion comprising, consisting essentially of, or consisting of at least one of HCFC-22, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze and HFO-1234yf.

[0251] In some embodiments, the first refrigerant portion comprises, consists essentially of, or consists of HFC-32, and one or more additional compounds selected from HFC-143a, HCC-40 and HFC-41.

[0252] In some embodiments, the HFC-32 of the first refrigerant portion constitutes a major refrigerant portion of the composition, while the HCFC-22, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze and/or HFO-1234yf of the second refrigerant portion and the additional compounds of the first refrigerant portion constitute a minor refrigerant portion thereof.

[0253] In some embodiments, the second refrigerant portion of any of the foregoing compositions of Embodiment 16 comprises residual refrigerants.

[0254] In some embodiments, any of the foregoing compositions of Embodiment 16 comprises from about 99.5 to about 99.9 weight percent of the first refrigerant portion, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of the second refrigerant portion.

[0255] In one embodiment, the total amount of additional compound(s) in the first refrigerant portion of any of the foregoing compositions of Embodiment 16 ranges from greater than 0 wt.% to less than or equal to about 2 wt.%, about 1 wt.%, about 0.9 wt.%, about 0.8 wt.%, about 0.7 wt.%, about 0.6 wt.%, about 0.5 wt.%, about 0.4 wt.%, about 0.3 wt.%, about 0.2 wt.%, about 0.1 wt.%, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.01 ppm (weight) to about 1 wt.%,

and all values therebetween up to 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.1 ppm (weight) to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 0.5 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.4 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.1 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In one embodiment, the total amount of additional compound(s) is about 0.1 wt.% based on the total weight of the first refrigerant portion of the composition.

Embodiment 17

[0256] In one embodiment, a composition comprises, consists essentially of, or consists of (i) HFC-32; and (ii) at least one of CFC-12, HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and CO₂.

[0257] In some embodiments, the HFC-32 constitutes a major refrigerant portion of the composition, while the CFC-12, HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and/or CO₂ constitute a minor refrigerant portion thereof.

[0258] In some embodiments, the composition comprises from about 99.5 to about 99.9 weight percent HFC-32, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of at least one of (ii) at least one of CFC-12, HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof.

[0259] In one embodiment, the CFC-12, HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-

1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and/or CO₂ are residual refrigerants. In one embodiment, a residual amount of the CFC-12, HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and/or CO₂ is contained in the composition.

[0260] In one embodiment, a composition comprises, consists essentially of, or consists of (i) HFC-32; (ii) at least one of CFC-12, HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and CO₂; and (iii) one or more additional compounds selected from HFC-143a, HFC-41, HFC-134a, HCFC-22, CFC-12 and HCC-40.

[0261] In one embodiment, a composition comprises, consists essentially of, or consists of (i) HFC-32; (ii) at least one of CFC-12, HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and CO₂; and (iii) one or more additional compounds selected from HFC-143a, HCC-40 and HFC-41.

[0262] In some embodiments, the HFC-32 constitutes a major refrigerant portion of the composition, while the remaining compounds (e.g., at least one of CFC-12, HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and/or CO₂ and the additional compounds) constitute a minor refrigerant portion of the composition.

[0263] In one embodiment, a composition comprises, consists essentially of, or consists of:

a first refrigerant portion comprising, consisting essentially of, or consisting of HFC-32, and one or more additional compounds selected from HFC-143a, HFC-41, HFC-134a, HCFC-22, CFC-12 and HCC-40, and

a second refrigerant portion comprising, consisting essentially of, or consisting of at least one of (ii) at least one of CFC-12, HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and CO₂.

[0264] In some embodiments, the first refrigerant portion comprises, consists essentially of, or consists of HFC-32, and one or more additional compounds selected from HFC-143a, HCC-40 and HFC-41.

[0265] In some embodiments, the HFC-32 of the first refrigerant portion constitutes a major refrigerant portion of the composition, while the at least one of CFC-12, HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and/or CO₂ of the second refrigerant portion and the additional compounds of the first refrigerant portion constitute a minor refrigerant portion thereof.

[0266] In some embodiments, the second refrigerant portion of any of the foregoing compositions of Embodiment 17 comprises residual refrigerants.

[0267] In some embodiments, any of the foregoing compositions of Embodiment 17 comprises from about 99.5 to about 99.9 weight percent of the first refrigerant portion, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of the second refrigerant portion.

[0268] In one embodiment, the total amount of additional compound(s) in the first refrigerant portion of any of the foregoing compositions of Embodiment 17 ranges from greater than 0 wt.% to less than or equal to about 2 wt.%, about 1 wt.%, about 0.9 wt.%, about 0.8 wt.%, about 0.7 wt.%, about 0.6 wt.%, about 0.5 wt.%, about 0.4 wt.%, about 0.3 wt.%, about 0.2 wt.%, about 0.1 wt.%, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.01 ppm (weight) to about 1 wt.%, and all values therebetween up to 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.1 ppm (weight) to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 0.5 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.4 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.1 wt.% or less, based on the total weight of the first refrigerant portion of the

composition. In one embodiment, the total amount of additional compound(s) is about 0.1 wt.% based on the total weight of the first refrigerant portion of the composition.

Embodiment 18

[0269] In one embodiment, a composition comprises, consists essentially of, or consists of HFC-134a, and at least one of CFC-12, HFC-32, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1234yf and E-HFO-1336mzz. In one embodiment, the composition is free of or substantially free of HFC-32.

[0270] In some embodiments, the HFC-134a constitutes a major refrigerant portion of the composition, while the CFC-12, HFC-32, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1234yf and/or E-HFO-1336mzz constitute a minor refrigerant portion thereof.

[0271] In some embodiments, the composition comprises from about 99.5 to about 99.9 weight percent HFC-134a, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of at least one of CFC-12, HFC-32, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1234yf, E-HFO-1336mzz and combinations thereof.

[0272] In one embodiment, the CFC-12, HFC-32, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1234yf and/or E-HFO-1336mzz are residual refrigerants. In one embodiment, a residual amount of the CFC-12, HFC-32, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1234yf and/or E-HFO-1336mzz is contained in the composition.

[0273] In one embodiment, a composition comprises, consists essentially of, or consists of HFC-134a; at least one of CFC-12, HFC-32, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1234yf and E-HFO-1336mzz; and one or more additional compounds selected from HFC-143a, HFO-1225zc, HFC-245cb, HFC-134, HFC-152a, HFO-1225ye, HFC-161, E-HFO-1234ze, HCFC-22, HFO-1243zf, HCFC-124, HCC-40, HCFO-1122, HCFC-31, CFC-114, CFC-114a and HCO-1140.

[0274] In one embodiment, a composition comprises, consists essentially of, or consists of HFC-134a; at least one of CFC-12, HFC-32, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1234yf and E-HFO-1336mzz; and one or more

additional compounds selected from HFC-134, HCC-40, HCFC-124, CFC-114a and CFC-114.

[0275] In some embodiments, the HFC-134a constitutes a major refrigerant portion of the composition, while the remaining compounds (e.g., the CFC-12, HFC-32, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1234yf and/or E-HFO-1336mzz and the additional compounds) constitute a minor refrigerant portion of the composition.

[0276] In one embodiment, a composition comprises, consists essentially of, or consists of:

a first refrigerant portion comprising, consisting essentially of, or consisting of HFC-134a, and one or more additional compounds selected from HFC-143a, HFO-1225zc, HFC-245cb, HFC-134, HFC-152a, HFO-1225ye, HFC-161, E-HFO-1234ze, HCFC-22, HFO-1243zf, HCFC-124, HCC-40, HCFO-1122, HCFC-31, CFC-114, CFC-114a and HCO-1140, and

a second refrigerant portion comprising, consisting essentially of, or consisting of at least one of CFC-12, HFC-32, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1234yf and E-HFO-1336mzz.

[0277] In some embodiments, the first refrigerant portion comprises, consists essentially of, or consists of HFC-134a, and one or more additional compounds selected from HFC-134, HCC-40, HCFC-124, CFC-114a and CFC-114.

[0278] In some embodiments, the HFC-134a of the first refrigerant portion constitutes a major refrigerant portion of the composition, while the CFC-12, HFC-32, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1234yf and/or E-HFO-1336mzz of the second refrigerant portion and the additional compounds of the first refrigerant portion constitute a minor refrigerant portion thereof.

[0279] In some embodiments, the second refrigerant portion of any of the foregoing compositions of Embodiment 18 comprises residual refrigerants.

[0280] In some embodiments, any of the foregoing compositions of Embodiment 18 comprises from about 99.5 to about 99.9 weight percent of the first refrigerant portion, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of the second refrigerant portion.

[0281] In one embodiment, the total amount of additional compound(s) in the first refrigerant portion of any of the foregoing compositions of Embodiment 18 ranges from greater than 0 wt.% to less than or equal to about 2 wt.%, about 1 wt.%, about 0.9 wt.%, about 0.8 wt.%, about 0.7 wt.%, about 0.6 wt.%, about 0.5 wt.%, about 0.4 wt.%, about 0.3 wt.%, about 0.2 wt.%, about 0.1 wt.%, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.01 ppm (weight) to about 1 wt.%, and all values therebetween up to 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.1 ppm (weight) to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 0.5 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.4 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.1 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In one embodiment, the total amount of additional compound(s) is about 0.1 wt.% based on the total weight of the first refrigerant portion of the composition.

Embodiment 19

[0282] In one embodiment, a composition comprises, consists essentially of, or consists of HFC-134a, and at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze and CO₂.

[0283] In some embodiments, the HFC-134a constitutes a major refrigerant portion of the composition, while the HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze and/or CO₂ constitute a minor refrigerant portion thereof.

[0284] In some embodiments, the composition comprises from about 99.5 to about 99.9 weight percent HFC-134a, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze, CO₂ and combinations thereof.

[0285] In one embodiment, the HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze and/or CO₂ are residual refrigerants. In one embodiment, a residual amount of the HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze and/or CO₂ is contained in the composition.

[0286] In one embodiment, a composition comprises, consists essentially of, or consists of HFC-134a; at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze and CO₂; and one or more additional compounds selected from HFC-143a, HFO-1225zc, HFC-245cb, HFC-134, HFC-152a, HFO-1225ye, HFC-161, E-HFO-1234ze, HCFC-22, HFO-1243zf, HCFC-124, HCC-40, HCFO-1122, HCFC-31, CFC-114, CFC-114a and HCO-1140.

[0287] In one embodiment, a composition comprises, consists essentially of, or consists of HFC-134a; at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze and CO₂; and one or more additional compounds selected from HFC-134, HCC-40, HCFC-124, CFC-114a and CFC-114.

[0288] In some embodiments, the HFC-134a constitutes a major refrigerant portion of the composition, while the remaining compounds (e.g., the HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze and/or CO₂ and the additional compounds) constitute a minor refrigerant portion of the composition.

[0289] In one embodiment, a composition comprises, consists essentially of, or consists of:

a first refrigerant portion comprising, consisting essentially of, or consisting of HFC-134a, and one or more additional compounds selected from HFC-143a, HFO-1225zc, HFC-245cb, HFC-134, HFC-152a, HFO-1225ye, HFC-161, E-HFO-1234ze, HCFC-22, HFO-1243zf, HCFC-124, HCC-40, HCFO-1122, HCFC-31, CFC-114, CFC-114a and HCO-1140, and

a second refrigerant portion comprising, consisting essentially of, or consisting of at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze and CO₂.

[0290] In some embodiments, the first refrigerant portion comprises, consists essentially of, or consists of HFC-134a, and one or more additional compounds selected from HFC-134, HCC-40, HCFC-124, CFC-114a and CFC-114.

[0291] In some embodiments, the HFC-134a of the first refrigerant portion constitutes a major refrigerant portion of the composition, while the HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze and/or CO₂ of the second refrigerant portion and the additional compounds of the first refrigerant portion constitute a minor refrigerant portion thereof.

[0292] In some embodiments, the second refrigerant portion of any of the foregoing compositions of Embodiment 19 comprises residual refrigerants.

[0293] In some embodiments, any of the foregoing compositions of Embodiment 19 comprises from about 99.5 to about 99.9 weight percent of the first refrigerant portion, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of the second refrigerant portion.

[0294] In one embodiment, the total amount of additional compound(s) in the first refrigerant portion of any of the foregoing compositions of Embodiment 19 ranges from greater than 0 wt.% to less than or equal to about 2 wt.%, about 1 wt.%, about 0.9 wt.%, about 0.8 wt.%, about 0.7 wt.%, about 0.6 wt.%, about 0.5 wt.%, about 0.4 wt.%, about 0.3 wt.%, about 0.2 wt.%, about 0.1 wt.%, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.01 ppm (weight) to about 1 wt.%, and all values therebetween up to 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.1 ppm (weight) to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 0.5 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.4 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.1 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In one embodiment, the total amount of additional compound(s) is

about 0.1 wt.% based on the total weight of the first refrigerant portion of the composition.

Embodiment 20

[0295] In one embodiment, a composition comprises, consists essentially of, or consists of HFC-134a, and at least one of HCFC-22, HFC-32, HFC-125, HFC-143a, HFO-1234yf and E-HFO-1234ze.

[0296] In some embodiments, the HFC-134a constitutes a major refrigerant portion of the composition, while the HCFC-22, HFC-32, HFC-125, HFC-143a, HFO-1234yf and/or E-HFO-1234ze constitute a minor refrigerant portion thereof.

[0297] In some embodiments, the composition comprises from about 99.5 to about 99.9 weight percent HFC-134a, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of at least one of HCFC-22, HFC-32, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze and combinations thereof.

[0298] In one embodiment, the HCFC-22, HFC-32, HFC-125, HFC-143a, HFO-1234yf and/or E-HFO-1234ze are residual refrigerants. In one embodiment, a residual amount of the HCFC-22, HFC-32, HFC-125, HFC-143a, HFO-1234yf and/or E-HFO-1234ze is contained in the composition.

[0299] In one embodiment, a composition comprises, consists essentially of, or consists of HFC-134a; at least one of HCFC-22, HFC-32, HFC-125, HFC-143a, HFO-1234yf and E-HFO-1234ze; and one or more additional compounds selected from HFC-143a, HFO-1225zc, HFC-245cb, HFC-134, HFC-152a, HFO-1225ye, HFC-161, E-HFO-1234ze, HCFC-22, HFO-1243zf, HCFC-124, HCC-40, HCFO-1122, HCFC-31, CFC-114, CFC-114a and HCO-1140.

[0300] In one embodiment, a composition comprises, consists essentially of, or consists of HFC-134a; at least one of HCFC-22, HFC-32, HFC-125, HFC-143a, HFO-1234yf and E-HFO-1234ze; and one or more additional compounds selected from HFC-134, HCC-40, HCFC-124, CFC-114a and CFC-114.

[0301] In some embodiments, the HFC-134a constitutes a major refrigerant portion of the composition, while the remaining compounds (e.g., the HCFC-22,

HFC-32, HFC-125, HFC-143a, HFO-1234yf and/or E-HFO-1234ze and the additional compounds) constitute a minor refrigerant portion of the composition.

[0302] In one embodiment, a composition comprises, consists essentially of, or consists of:

a first refrigerant portion comprising, consisting essentially of, or consisting of HFC-134a, and one or more additional compounds selected from HFC-143a, HFO-1225zc, HFC-245cb, HFC-134, HFC-152a, HFO-1225ye, HFC-161, E-HFO-1234ze, HCFC-22, HFO-1243zf, HCFC-124, HCC-40, HCFO-1122, HCFC-31, CFC-114, CFC-114a and HCO-1140, and

a second refrigerant portion comprising, consisting essentially of, or consisting of at least one of HCFC-22, HFC-32, HFC-125, HFC-143a, HFO-1234yf and E-HFO-1234ze.

[0303] In some embodiments, the first refrigerant portion comprises, consists essentially of, or consists of HFC-134a, and one or more additional compounds selected from HFC-134, HCC-40, HCFC-124, CFC-114a and CFC-114.

[0304] In some embodiments, the HFC-134a of the first refrigerant portion constitutes a major refrigerant portion of the composition, while the HCFC-22, HFC-32, HFC-125, HFC-143a, HFO-1234yf and/or E-HFO-1234ze of the second refrigerant portion and the additional compounds of the first refrigerant portion constitute a minor refrigerant portion thereof.

[0305] In some embodiments, the second refrigerant portion of any of the foregoing compositions of Embodiment 20 comprises residual refrigerants.

[0306] In some embodiments, any of the foregoing compositions of Embodiment 20 comprises from about 99.5 to about 99.9 weight percent of the first refrigerant portion, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of the second refrigerant portion.

[0307] In one embodiment, the total amount of additional compound(s) in the first refrigerant portion of any of the foregoing compositions of Embodiment 20 ranges from greater than 0 wt.% to less than or equal to about 2 wt.%, about 1 wt.%, about 0.9 wt.%, about 0.8 wt.%, about 0.7 wt.%, about 0.6 wt.%, about 0.5 wt.%, about 0.4 wt.%, about 0.3 wt.%, about 0.2 wt.%, about 0.1 wt.%, based on the total weight of

the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.01 ppm (weight) to about 1 wt.%, and all values therebetween up to 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.1 ppm (weight) to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 0.5 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.4 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.1 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In one embodiment, the total amount of additional compound(s) is about 0.1 wt.% based on the total weight of the first refrigerant portion of the composition.

Embodiment 21

[0308] In one embodiment, a composition comprises, consists essentially of, or consists of (i) HFC-134a; and (ii) at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and CO₂.

[0309] In some embodiments, the HFC-134a constitutes a major refrigerant portion of the composition, while the CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and/or CO₂ constitute a minor refrigerant portion thereof.

[0310] In some embodiments, the composition comprises from about 99.5 to about 99.9 weight percent HFC-134a, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of at least one of (ii) at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof.

[0311] In one embodiment, the CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and/or CO₂ are residual refrigerants. In one embodiment, a residual amount of the CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and/or CO₂ is contained in the composition.

[0312] In one embodiment, a composition comprises, consists essentially of, or consists of (i) HFC-134a; (ii) at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and CO₂; and (iii) one or more additional compounds selected from HFC-143a, HFO-1225zc, HFC-245cb, HFC-134, HFC-152a, HFO-1225ye, HFC-161, E-HFO-1234ze, HCFC-22, HFO-1243zf, HCFC-124, HCC-40, HCFO-1122, HCFC-31, CFC-114, CFC-114a and HCO-1140.

[0313] In one embodiment, a composition comprises, consists essentially of, or consists of (i) HFC-134a; (ii) at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and CO₂; and (iii) one or more additional compounds selected from HFC-134, HCC-40, HCFC-124, CFC-114a and CFC-114.

[0314] In some embodiments, the HFC-134a constitutes a major refrigerant portion of the composition, while the remaining compounds (e.g., at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and/or CO₂ and the additional compounds) constitute a minor refrigerant portion of the composition.

[0315] In one embodiment, a composition comprises, consists essentially of, or consists of:

a first refrigerant portion comprising, consisting essentially of, or consisting of HFC-134a, and one or more additional compounds selected from HFC-143a, HFO-1225zc, HFC-245cb, HFC-134, HFC-152a, HFO-1225ye, HFC-161, E-HFO-

1234ze, HCFC-22, HFO-1243zf, HCFC-124, HCC-40, HCFO-1122, HCFC-31, CFC-114, CFC-114a and HCO-1140; and

a second refrigerant portion comprising, consisting essentially of, or consisting of at least one of (ii) at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and CO₂.

[0316] In some embodiments, the first refrigerant portion comprises, consists essentially of, or consists of HFC-134a, and one or more additional compounds selected from HFC-134, HCC-40, HCFC-124, CFC-114a and CFC-114.

[0317] In some embodiments, the HFC-134a of the first refrigerant portion constitutes a major refrigerant portion of the composition, while the at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and/or CO₂ of the second refrigerant portion and the additional compounds of the first refrigerant portion constitute a minor refrigerant portion thereof.

[0318] In some embodiments, the second refrigerant portion of any of the foregoing compositions of Embodiment 21 comprises residual refrigerants.

[0319] In some embodiments, any of the foregoing compositions of Embodiment 21 comprises from about 99.5 to about 99.9 weight percent of the first refrigerant portion, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of the second refrigerant portion.

[0320] In one embodiment, the total amount of additional compound(s) in the first refrigerant portion of any of the foregoing compositions of Embodiment 21 ranges from greater than 0 wt.% to less than or equal to about 2 wt.%, about 1 wt.%, about 0.9 wt.%, about 0.8 wt.%, about 0.7 wt.%, about 0.6 wt.%, about 0.5 wt.%, about 0.4 wt.%, about 0.3 wt.%, about 0.2 wt.%, about 0.1 wt.%, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.01 ppm (weight) to about 1 wt.%, and all values therebetween up to 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.1 ppm (weight) to about 1 wt.%. In another

embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 0.5 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.4 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.1 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In one embodiment, the total amount of additional compound(s) is about 0.1 wt.% based on the total weight of the first refrigerant portion of the composition.

Embodiment 22

[0321] In one embodiment, a composition comprises, consists essentially of, or consists of E-HCFO-1233zd and at least one compound selected from CFC-11, HFC-245fa, trans-1,2-dichloroethylene (t-DCE) and Z-HFO-1336mzz.

[0322] In some embodiments, the E-HCFO-1233zd constitutes a major refrigerant portion of the composition, while the CFC-11, HFC-245fa, t-DCE and/or Z-HFO-1336mzz constitute a minor refrigerant portion thereof.

[0323] In some embodiments, the composition comprises from about 99.5 to about 99.9 weight percent E-HCFO-1233zd, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of at least one of CFC-11, HFC-245fa, t-DCE, Z-HFO-1336mzz and combinations thereof.

[0324] In one embodiment, the CFC-11, HFC-245fa, t-DCE and/or Z-HFO-1336mzz are residual refrigerants. In one embodiment, a residual amount of the CFC-11, HFC-245fa, t-DCE and/or Z-HFO-1336mzz is contained in the composition.

[0325] In one embodiment, a composition comprises, consists essentially of, or consists of E-HCFO-1233zd; at least one of CFC-11, HFC-245fa, t-DCE and Z-HFO-1336mzz; and one or more additional compounds selected from E-HFO-1234ze, HFC-245fa, Z-HFO-1234ze, HFC-254fb, HCFO-1233xf, HCFC-235da, HCFO-1223za and HCFO-1335 isomer.

[0326] In one embodiment, a composition comprises, consists essentially of, or consists of E-HCFO-1233zd; at least one of CFC-11, HFC-245fa, t-DCE and Z-HFO-

1336mzz; and one or more additional compounds selected from E-HFO-1234ze, HFC- 245fa, Z-HFO-1234ze, HCFO-1233xf and HCFC-235da.

[0327] In some embodiments, the E-HCFO-1233zd constitutes a major refrigerant portion of the composition, while the remaining compounds (e.g., the CFC-11, HFC-245fa, t-DCE and/or Z-HFO-1336mzz and the additional compounds) constitute a minor refrigerant portion of the composition.

[0328] In one embodiment, a composition comprises, consists essentially of, or consists of:

a first refrigerant portion comprising, consisting essentially of, or consisting of E-HCFO-1233zd, and one or more additional compounds selected from E-HFO-1234ze, HFC-245fa, Z-HFO-1234ze, HFC-254fb, HCFO-1233xf, HCFC-235da, HCFO-1223za and HCFO-1335 isomer, and

a second refrigerant portion comprising, consisting essentially of, or consisting of at least one of CFC-11, HFC-245fa, t-DCE and Z-HFO-1336mzz.

[0329] In some embodiments, the first refrigerant portion comprises, consists essentially of, or consists of E-HCFO-1233zd, and one or more additional compounds selected from E-HFO-1234ze, HFC- 245fa, Z-HFO-1234ze, HCFO-1233xf and HCFC-235da.

[0330] In some embodiments, the E-HCFO-1233zd of the first refrigerant portion constitutes a major refrigerant portion of the composition, while the CFC-11, HFC-245fa, t-DCE and/or Z-HFO-1336mzz of the second refrigerant portion and the additional compounds of the first refrigerant portion constitute a minor refrigerant portion thereof.

[0331] In some embodiments, the second refrigerant portion of any of the foregoing compositions of Embodiment 22 comprises residual refrigerants.

[0332] In some embodiments, any of the foregoing compositions of Embodiment 22 comprises from about 99.5 to about 99.9 weight percent of the first refrigerant portion, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of the second refrigerant portion.

[0333] In one embodiment, the total amount of additional compound(s) in the first refrigerant portion of any of the foregoing compositions of Embodiment 22 ranges from greater than 0 wt.% to less than or equal to about 2 wt.%, about 1 wt.%, about 0.9 wt.%, about 0.8 wt.%, about 0.7 wt.%, about 0.6 wt.%, about 0.5 wt.%, about 0.4 wt.%, about 0.3 wt.%, about 0.2 wt.%, about 0.1 wt.%, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.01 ppm (weight) to about 1 wt.%, and all values therebetween up to 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.1 ppm (weight) to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 0.5 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.4 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.1 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In one embodiment, the total amount of additional compound(s) is about 0.1 wt.% based on the total weight of the first refrigerant portion of the composition.

Embodiment 23

[0334] In one embodiment, a composition comprises, consists essentially of, or consists of Z-HFO-1336mzz and at least one compound selected from CFC-11, HCFC-123, HFC-245fa, t-DCE and E-HCFO-1233zd.

[0335] In some embodiments, the Z-HFO-1336mzz constitutes a major refrigerant portion of the composition, while the CFC-11, HCFC-123, HFC-245fa, t-DCE and/or E-HCFO-1233zd constitute a minor refrigerant portion thereof.

[0336] In some embodiments, the composition comprises from about 99.5 to about 99.9 weight percent Z-HFO-1336mzz, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of at least one of CFC-11, HCFC-123, HFC-245fa, t-DCE, E-HCFO-1233zd and combinations thereof.

[0337] In one embodiment, the CFC-11, HCFC-123, HFC-245fa, t-DCE and/or E-HCFO-1233zd are residual refrigerants. In one embodiment, a residual amount of the CFC-11, HCFC-123, HFC-245fa, t-DCE and/or E-HCFO-1233zd is contained in the composition.

[0338] In one embodiment, a composition comprises, consists essentially of, or consists of Z-HFO-1336mzz; at least one of CFC-11, HCFC-123, HFC-245fa, t-DCE and E-HCFO-1233zd; and one or more additional compounds selected from HFO-1326mxz(E), HFO-1326mxz(Z), HFC-346mdf, HFC-356mff and HFO-1336mzz(E).

[0339] In one embodiment, a composition comprises, consists essentially of, or consists of Z-HFO-1336mzz; at least one of CFC-11, HCFC-123, HFC-245fa, t-DCE and E-HCFO-1233zd; and one or more additional compounds selected from E-HFO-1234ze, HFC- 245fa, Z-HFO-1234ze, HCFO-1233xf and HCFC-235da.

[0340] In some embodiments, the Z-HFO-1336mzz constitutes a major refrigerant portion of the composition, while the remaining compounds (e.g., the CFC-11, HCFC-123, HFC-245fa, t-DCE and/or E-HCFO-1233zd and the additional compounds) constitute a minor refrigerant portion of the composition.

[0341] In one embodiment, a composition comprises, consists essentially of, or consists of:

a first refrigerant portion comprising, consisting essentially of, or consisting of Z-HFO-1336mzz, and one or more additional compounds selected from HFO-1326mxz(E), HCFO-1326mxz(Z), HFC-346mdf, HFC-356mff and HFO-1336mzz(E); and

a second refrigerant portion comprising, consisting essentially of, or consisting of at least one of CFC-11, HCFC-123, HFC-245fa, t-DCE and E-HCFO-1233zd.

[0342] In some embodiments, the first refrigerant portion comprises, consists essentially of, or consists of Z-HFO-1336mzz, and one or more additional compounds selected from E-HFO-1234ze, HFC- 245fa, Z-HFO-1234ze, HCFO-1233xf and HCFC-235da.

[0343] In some embodiments, the Z-HFO-1336mzz of the first refrigerant portion constitutes a major refrigerant portion of the composition, while the CFC-11, HCFC-123, HFC-245fa, t-DCE and/or E-HCFO-1233zd of the second refrigerant portion

and the additional compounds of the first refrigerant portion constitute a minor refrigerant portion thereof.

[0344] In some embodiments, the second refrigerant portion of any of the foregoing compositions of Embodiment 23 comprises residual refrigerants.

[0345] In some embodiments, any of the foregoing compositions of Embodiment 23 comprises from about 99.5 to about 99.9 weight percent of the first refrigerant portion, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of the second refrigerant portion.

[0346] In one embodiment, the total amount of additional compound(s) in the first refrigerant portion of any of the foregoing compositions of Embodiment 23 ranges from greater than 0 wt.% to less than or equal to about 2 wt.%, about 1 wt.%, about 0.9 wt.%, about 0.8 wt.%, about 0.7 wt.%, about 0.6 wt.%, about 0.5 wt.%, about 0.4 wt.%, about 0.3 wt.%, about 0.2 wt.%, about 0.1 wt.%, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.01 ppm (weight) to about 1 wt.%, and all values therebetween up to 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.1 ppm (weight) to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 0.5 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.4 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.1 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In one embodiment, the total amount of additional compound(s) is about 0.1 wt.% based on the total weight of the first refrigerant portion of the composition.

Embodiment 24

[0347] In one embodiment, a composition comprises, consists essentially of, or consists of pentafluoroethane (HFC-125) and at least one compound selected from CFC-12, HCFC-22, HFC-115, HFC-32, HFC-134a, HFC-143a, HFC-152a,

HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂, HFC-23, CFO-1113 and HCC-40.

[0348] In some embodiments, the HFC-125 constitutes a major refrigerant portion of the composition, while the CFC-12, HCFC-22, HFC-115, HFC-32, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂, HFC-23, CFO-1113 and/or HCC-40 constitute a minor refrigerant portion thereof.

[0349] In some embodiments, the composition comprises from about 99.5 to about 99.9 weight percent HFC-125, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of at least one of CFC-12, HCFC-22, HFC-115, HFC-32, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂, HFC-23, CFO-1113, HCC-40 and combinations thereof.

[0350] In one embodiment, the CFC-12, HCFC-22, HFC-115, HFC-32, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂, HFC-23, CFO-1113 and/or HCC-40 are residual refrigerants. In one embodiment, a residual amount of the CFC-12, HCFC-22, HFC-115, HFC-32, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂, HFC-23, CFO-1113 and/or HCC-40 is contained in the composition.

[0351] In one embodiment, a composition comprises, consists essentially of, or consists of HFC-125; at least one of CFC-12, HCFC-22, HFC-115, HFC-32, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂, HFC-23, CFO-1113 and HCC-40; and one or more additional compounds selected from HFC-23, HFC-32, HFC-143a, HFC-134a, CFC-115, CFO-1113 and HCC-40.

[0352] In some embodiments, the HFC-125 constitutes a major refrigerant portion of the composition, while the remaining compounds (e.g., the CFC-12, HCFC-22, HFC-115, HFC-32, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-

1336mzz, CO₂, HFC-23, CFO-1113 and/or HCC-40 and the additional compounds) constitute a minor refrigerant portion of the composition.

[0353] In one embodiment, a composition comprises, consists essentially of, or consists of:

a first refrigerant portion comprising, consisting essentially of, or consisting of HFC-125, and one or more additional compounds selected from HFC-23, HFC-32, HFC-143a, HFC-134a, CFC-115, CFCO-1113 and HCC-40; and

a second refrigerant portion comprising, consisting essentially of, or consisting of at least one of CFC-12, HCFC-22, HFC-115, HFC-32, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂, HFC-23, CFO-1113 and HCC-40.

[0354] In some embodiments, the HFC-125 of the first refrigerant portion constitutes a major refrigerant portion of the composition, while the CFC-12, HCFC-22, HFC-115, HFC-32, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂, HFC-23, CFO-1113 and/or HCC-40 of the second refrigerant portion and the additional compounds of the first refrigerant portion constitute a minor refrigerant portion thereof.

[0355] In some embodiments, the second refrigerant portion of any of the foregoing compositions of Embodiment 24 comprises residual refrigerants.

[0356] In some embodiments, any of the foregoing compositions of Embodiment 24 comprises from about 99.5 to about 99.9 weight percent of the first refrigerant portion, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of the second refrigerant portion.

[0357] In one embodiment, the total amount of additional compound(s) in the first refrigerant portion of any of the foregoing compositions of Embodiment 24 ranges from greater than 0 wt.% to less than or equal to about 2 wt.%, about 1 wt.%, about 0.9 wt.%, about 0.8 wt.%, about 0.7 wt.%, about 0.6 wt.%, about 0.5 wt.%, about 0.4 wt.%, about 0.3 wt.%, about 0.2 wt.%, about 0.1 wt.%, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total

amount of additional compound(s) ranges from 0.01 ppm (weight) to about 1 wt.%, and all values therebetween up to 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.1 ppm (weight) to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 0.5 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.4 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.1 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In one embodiment, the total amount of additional compound(s) is about 0.1 wt.% based on the total weight of the first refrigerant portion of the composition.

Embodiment 25

[0358] In one embodiment, a composition comprises, consists essentially of, or consists of E-HFO-1336mzz and at least one compound selected from Z-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, E-HCFO-1233zd, HCFC-133a, HFO-1243zf, Z-HCFO-1326mxz, E-HCFO-1326mxz and HCFC-346mdf.

[0359] In some embodiments, the E-HFO-1336mzz constitutes a major refrigerant portion of the composition, while the Z-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, E-HCFO-1233zd, HCFC-133a, HFO-1243zf, Z-HCFO-1326mxz, E-HCFO-1326mxz and/or HCFC-346mdf constitute a minor refrigerant portion thereof.

[0360] In some embodiments, the composition comprises from about 99.5 to about 99.9 weight percent E-HFO-1336mzz, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of at least one of Z-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, E-HCFO-1233zd, HCFC-133a, HFO-1243zf, Z-HCFO-1326mxz, E-HCFO-1326mxz, HCFC-346mdf and combinations thereof.

[0361] In one embodiment, the Z-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, E-HCFO-1233zd, HCFC-133a, HFO-1243zf, Z-HCFO-1326mxz, E-HCFO-1326mxz and/or HCFC-346mdf are residual refrigerants. In one embodiment, a residual amount of the Z-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, E-HCFO-1233zd, HCFC-133a, HFO-1243zf, Z-HCFO-1326mxz, E-HCFO-1326mxz and/or HCFC-346mdf is contained in the composition.

[0362] In one embodiment, a composition comprises, consists essentially of, or consists of E-HFO-1336mzz; at least one of Z-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, E-HCFO-1233zd, HCFC-133a, HFO-1243zf, Z-HCFO-1326mxz, E-HCFO-1326mxz and HCFC-346mdf; and one or more additional compounds selected from HCC-30, HCFC-114, HCFC-114a, HCFC-133, HCFC-133a, HFC-245fa, HFC-338mee, HFC-338mf, HFC-347mef, HCO-1140, HCFO-1224 isomers, HCFO-1224yd, HCFO-1224yb, HCFO-1233xf, HCFO-1233zd, HFO-1243zf, HFO-1327mz, HFO-1336ft and HCFO-1326mxz.

[0363] In some embodiments, the E-HFO-1336mzz constitutes a major refrigerant portion of the composition, while the remaining compounds (e.g., the Z-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, E-HCFO-1233zd, HCFC-133a, HFO-1243zf, Z-HCFO-1326mxz, E-HCFO-1326mxz and/or HCFC-346mdf and the additional compounds) constitute a minor refrigerant portion of the composition.

[0364] In one embodiment, a composition comprises, consists essentially of, or consists of:

a first refrigerant portion comprising, consisting essentially of, or consisting of E-HFO-1336mzz, and one or more additional compounds selected from HCC-30, HCFC-114, HCFC-114a, HCFC-133, HCFC-133a, HFC-245fa, HFC-338mee, HFC-338mf, HFC-347mef, HCO-1140, HCFO-1224 isomers, HCFO-1224yd, HCFO-1224yb, HCFO-1233xf, HCFO-1233zd, HFO-1243zf, HFO-1327mz, HFO-1336ft and HCFO-1326mxz; and

a second refrigerant portion comprising, consisting essentially of, or consisting of at least one of Z-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, E-HCFO-1233zd, HCFC-133a, HFO-1243zf, Z-HCFO-1326mxz, E-HCFO-1326mxz and HCFC-346mdf.

[0365] In some embodiments, the Z-HFO-1336mzz of the first refrigerant portion constitutes a major refrigerant portion of the composition, while the Z-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, E-HCFO-1233zd, HCFC-133a, HFO-1243zf, Z-HCFO-1326mxz, E-HCFO-1326mxz and/or HCFC-346mdf of the second refrigerant portion and the additional compounds of the first refrigerant portion constitute a minor refrigerant portion thereof.

[0366] In some embodiments, the second refrigerant portion of any of the foregoing compositions of Embodiment 25 comprises residual refrigerants.

[0367] In some embodiments, any of the foregoing compositions of Embodiment 25 comprises from about 99.5 to about 99.9 weight percent of the first refrigerant portion, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of the second refrigerant portion.

[0368] In one embodiment, the total amount of additional compound(s) in the first refrigerant portion of any of the foregoing compositions of Embodiment 25 ranges from greater than 0 wt.% to less than or equal to about 2 wt.%, about 1 wt.%, about 0.9 wt.%, about 0.8 wt.%, about 0.7 wt.%, about 0.6 wt.%, about 0.5 wt.%, about 0.4 wt.%, about 0.3 wt.%, about 0.2 wt.%, about 0.1 wt.%, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.01 ppm (weight) to about 1 wt.%, and all values therebetween up to 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.1 ppm (weight) to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 0.5 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.4 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to

0.1 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In one embodiment, the total amount of additional compound(s) is about 0.1 wt.% based on the total weight of the first refrigerant portion of the composition.

Embodiment 26

[0369] In one embodiment, a composition comprises, consists essentially of, or consists of Z-HFO-1234ze, and at least one of Z-HFO-1336mzz, E-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze and E-HCFO-1233zd.

[0370] In some embodiments, the Z-HFO-1234ze constitutes a major refrigerant portion of the composition, while the Z-HFO-1336mzz, E-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze and/or E-HCFO-1233zd constitute a minor refrigerant portion thereof.

[0371] In some embodiments, the composition comprises from about 99.5 to about 99.9 weight percent Z-HFO-1234ze, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of at least one of Z-HFO-1336mzz, E-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, E-HCFO-1233zd and combinations thereof.

[0372] In one embodiment, the Z-HFO-1336mzz, E-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze and/or E-HCFO-1233zd are residual refrigerants. In one embodiment, a residual amount of the Z-HFO-1336mzz, E-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze and/or E-HCFO-1233zd is contained in the composition.

[0373] In one embodiment, a composition comprises, consists essentially of, or consists of Z-HFO-1234ze; at least one of Z-HFO-1336mzz, E-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze and E-HCFO-1233zd; and one or more additional compounds selected from E-HFO-1234ze, HFC-263fb, HFO-1234zc, HFC-245fa, HFO-1233zf, E-HCFO-1233zd, CFC-114, HFC-227ea, HFC-236fa, HFO-1327 isomer and HFO-1336 isomer.

[0374] In some embodiments, the Z-HFO-1234ze constitutes a major refrigerant portion of the composition, while the remaining compounds (e.g., the Z-HFO-1336mzz, E-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze and/or E-HCFO-1233zd and the additional compounds) constitute a minor refrigerant portion of the composition.

[0375] In one embodiment, a composition comprises, consists essentially of, or consists of:

a first refrigerant portion comprising, consisting essentially of, or consisting of Z-HFO-1234ze, and one or more additional compounds selected from E-HFO-1234ze, HFC-263fb, HFO-1234zc, HFC-245fa, HFO-1233zf, E-HCFO-1233zd, CFC-114, HFC-227ea, HFC-236fa, HFO-1327 isomer and HFO-1336 isomer, and

a second refrigerant portion comprising, consisting essentially of, or consisting of at least one of Z-HFO-1336mzz, E-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze and E-HCFO-1233zd.

[0376] In some embodiments, the Z-HFO-1234ze of the first refrigerant portion constitutes a major refrigerant portion of the composition, while the Z-HFO-1336mzz, E-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze and/or E-HCFO-1233zd of the second refrigerant portion and the additional compounds of the first refrigerant portion constitute a minor refrigerant portion thereof.

[0377] In some embodiments, the second refrigerant portion of any of the foregoing compositions of Embodiment 26 comprises residual refrigerants.

[0378] In some embodiments, any of the foregoing compositions of Embodiment 26 comprises from about 99.5 to about 99.9 weight percent of the first refrigerant portion, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of the second refrigerant portion.

[0379] In one embodiment, the total amount of additional compound(s) in the first refrigerant portion of any of the foregoing compositions of Embodiment 26 ranges from greater than 0 wt.% to less than or equal to about 2 wt.%, about 1 wt.%, about 0.9 wt.%, about 0.8 wt.%, about 0.7 wt.%, about 0.6 wt.%, about 0.5 wt.%, about 0.4 wt.%, about 0.3 wt.%, about 0.2 wt.%, about 0.1 wt.%, based on the total weight of

the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.01 ppm (weight) to about 1 wt.%, and all values therebetween up to 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.1 ppm (weight) to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 0.5 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.4 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.1 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In one embodiment, the total amount of additional compound(s) is about 0.1 wt.% based on the total weight of the first refrigerant portion of the composition.

Embodiment 27

[0380] In one embodiment, a composition comprises, consists essentially of, or consists of Z-HFO-1132, and at least one of HFC-32, HFC-134a, HFC-134, HFC-152a, HFC-227ea, E-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc and E-HFO-1336mzz.

[0381] In some embodiments, the Z-HFO-1132 constitutes a major refrigerant portion of the composition, while the HFC-32, HFC-134a, HFC-134, HFC-152a, HFC-227ea, E-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc and/or E-HFO-1336mzz constitute a minor refrigerant portion thereof.

[0382] In some embodiments, the composition comprises from about 99.5 to about 99.9 weight percent Z-HFO-1132, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of at least one of HFC-32, HFC-134a, HFC-134, HFC-152a, HFC-227ea, E-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and combinations thereof.

[0383] In one embodiment, the HFC-32, HFC-134a, HFC-134, HFC-152a, HFC-227ea, E-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc and/or E-HFO-1336mzz are residual refrigerants. In one embodiment, a residual amount of the HFC-32, HFC-134a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc and/or E-HFO-1336mzz is contained in the composition.

[0384] In one embodiment, a composition comprises, consists essentially of, or consists of Z-HFO-1132; at least one of HFC-32, HFC-134a, HFC-134, HFC-152a, HFC-227ea, E-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc and E-HFO-1336mzz; and one or more additional compounds selected from difluoromethane (HFC-32), 1,1,1,2,2 pentafluoroethane (HFC-125), E-1-chloro-1,2-difluoroethylene (HCFO-E-1122a), Z-1-chloro-1,2-difluoroethylene (HCFO-Z-1122a), 1,1,2-trifluoroethylene (HFO-1123), fluoroethylene (HFO-1141), 1-chloro-1,2,2-trifluoroethane (HCFC-133), 1-chloro-1,1,2-trifluoroethane (HCFC-133b), 1,1-dichloro-2,2,2-trifluoroethane (HCFC-123), 1,2-difluoroethane (HFC-152), 1,1,2-trifluoroethane (HFC-143), fluoromethane (HFC-41), chlorodifluoromethane (HCFC-22), ethylene, 1-chloro-1,2-difluoroethane (HCFC-142a), 1,1-difluoroethylene (HFO-1132a), 1-chloro-1-fluoroethene (HCFO-1131a), E-1-chloro-2-fluoroethene (HCFO-E-1131), Z-1-chloro-1-fluoroethene (HCFO-Z-1131), 1-chloro-2,2-difluoroethylene (HCFO-1122), HFO-E-1132, vinyl chloride (HCO-1140), acetylene and fluoroacetylene.

[0385] In some embodiments, the Z-HFO-1132 constitutes a major refrigerant portion of the composition, while the remaining compounds (e.g., the HFC-32, HFC-134a, HFC-134, HFC-152a, HFC-227ea, E-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc and/or E-HFO-1336mzz and the additional compounds) constitute a minor refrigerant portion of the composition.

[0386] In one embodiment, a composition comprises, consists essentially of, or consists of:

a first refrigerant portion comprising, consisting essentially of, or consisting of Z-HFO-1132, and one or more additional compounds selected from difluoromethane (HFC-32), 1,1,1,2,2 pentafluoroethane (HFC-125), E-1-chloro-1,2-difluoroethylene (HCFO-E-1122a), Z-1-chloro-1,2-difluoroethylene (HCFO-Z-1122a), 1,1,2-

trifluoroethylene (HFO-1123), fluoroethylene (HFO-1141), 1-chloro-1,2,2-trifluoroethane (HCFC-133), 1-chloro-1,1,2-trifluoroethane (HCFC-133b), 1,1-dichloro-2,2,2-trifluoroethane (HCFC-123), 1,2-difluoroethane (HFC-152), 1,1,2-trifluoroethane (HFC-143), fluoromethane (HFC-41), chlorodifluoromethane (HCFC-22), ethylene, 1-chloro-1,2-difluoroethane (HCFC-142a), 1,1-difluoroethylene (HFO-1132a), 1-chloro-1-fluoroethene (HCFO-1131a), E-1-chloro-2-fluoroethene (HCFO-E-1131), Z-1-chloro-1-fluoroethene (HCFO-Z-1131), 1-chloro-2,2-difluoroethylene (HCFO-1122), HFO-E-1132, vinyl chloride (HCO-1140), acetylene and fluoroacetylene, and

a second refrigerant portion comprising, consisting essentially of, or consisting of at least one of HFC-32, HFC-134a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc and E-HFO-1336mzz.

[0387] In some embodiments, the Z-HFO-1132 of the first refrigerant portion constitutes a major refrigerant portion of the composition, while the HFC-32, HFC-134a, HFC-134, HFC-152a, HFC-227ea, E-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc and/or E-HFO-1336mzz of the second refrigerant portion and the additional compounds of the first refrigerant portion constitute a minor refrigerant portion thereof.

[0388] In some embodiments, the second refrigerant portion of any of the foregoing compositions of Embodiment 27 comprises residual refrigerants.

[0389] In some embodiments, any of the foregoing compositions of Embodiment 27 comprises from about 99.5 to about 99.9 weight percent of the first refrigerant portion, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of the second refrigerant portion.

[0390] In one embodiment, the total amount of additional compound(s) in the first refrigerant portion of any of the foregoing compositions of Embodiment 27 ranges from greater than 0 wt.% to less than or equal to about 2 wt.%, about 1 wt.%, about 0.9 wt.%, about 0.8 wt.%, about 0.7 wt.%, about 0.6 wt.%, about 0.5 wt.%, about 0.4 wt.%, about 0.3 wt.%, about 0.2 wt.%, about 0.1 wt.%, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.01 ppm (weight) to about 1 wt.%,

and all values therebetween up to 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.1 ppm (weight) to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 0.5 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.4 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.1 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In one embodiment, the total amount of additional compound(s) is about 0.1 wt.% based on the total weight of the first refrigerant portion of the composition.

Embodiment 28

[0391] In one embodiment, a composition comprises, consists essentially of, or consists of E-HFO-1132, and at least one of HFC-32, HFC-134a, HFC-134, HFC-152a, HFC-227ea, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc and E-HFO-1336mzz.

[0392] In some embodiments, the E-HFO-1132 constitutes a major refrigerant portion of the composition, while the HFC-32, HFC-134a, HFC-134, HFC-152a, HFC-227ea, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc and/or E-HFO-1336mzz constitute a minor refrigerant portion thereof.

[0393] In some embodiments, the composition comprises from about 99.5 to about 99.9 weight percent E-HFO-1132, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of at least one of HFC-32, HFC-134a, HFC-134, HFC-152a, HFC-227ea, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and combinations thereof.

[0394] In one embodiment, the HFC-32, HFC-134a, HFC-134, HFC-152a, HFC-227ea, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc and/or E-HFO-1336mzz are residual refrigerants. In one

embodiment, a residual amount of the HFC-32, HFC-134a, HFC-152a, HFC-227ea, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc and/or E-HFO-1336mzz is contained in the composition.

[0395] In one embodiment, a composition comprises, consists essentially of, or consists of E-HFO-1132; at least one of HFC-32, HFC-134a, HFC-134, HFC-152a, HFC-227ea, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc and E-HFO-1336mzz; and one or more additional compounds selected from HFC-32, HFC-125, HCFO-E-1122a, HCFO-Z-1122a, HFO-1123, HFO-1141, HCFC-133, HCFC-133b, HCFC-123, HFC-152, HFC-143, HFC-41, HCFC-22, ethylene, HCFC-142a, HFO-1132a, HCFO-1131a, HCFO-E-1131, HCFO-Z-1131, HCFO-1122, acetylene and HCO-1140.

[0396] In some embodiments, the E-HFO-1132 constitutes a major refrigerant portion of the composition, while the remaining compounds (e.g., the HFC-32, HFC-134a, HFC-134, HFC-152a, HFC-227ea, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc and/or E-HFO-1336mzz and the additional compounds) constitute a minor refrigerant portion of the composition.

[0397] In one embodiment, a composition comprises, consists essentially of, or consists of:

a first refrigerant portion comprising, consisting essentially of, or consisting of E-HFO-1132, and one or more additional compounds selected from HFC-32, HFC-125, HCFO-E-1122a, HCFO-Z-1122a, HFO-1123, HFO-1141, HCFC-133, HCFC-133b, HCFC-123, HFC-152, HFC-143, HFC-41, HCFC-22, ethylene, HCFC-142a, HFO-1132a, HCFO-1131a, HCFO-E-1131, HCFO-Z-1131, HCFO-1122, acetylene and HCO-1140, and

a second refrigerant portion comprising, consisting essentially of, or consisting of at least one of HFC-32, HFC-134a, HFC-134, HFC-152a, HFC-227ea, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc and E-HFO-1336mzz.

[0398] In some embodiments, the E-HFO-1132 of the first refrigerant portion constitutes a major refrigerant portion of the composition, while the HFC-32, HFC-134a, HFC-134, HFC-152a, HFC-227ea, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc and/or E-HFO-1336mzz of the

second refrigerant portion and the additional compounds of the first refrigerant portion constitute a minor refrigerant portion thereof.

[0399] In some embodiments, the second refrigerant portion of any of the foregoing compositions of Embodiment 28 comprises residual refrigerants.

[0400] In some embodiments, any of the foregoing compositions of Embodiment 28 comprises from about 99.5 to about 99.9 weight percent of the first refrigerant portion, and from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, of the second refrigerant portion.

[0401] In one embodiment, the total amount of additional compound(s) in the first refrigerant portion of any of the foregoing compositions of Embodiment 28 ranges from greater than 0 wt.% to less than or equal to about 2 wt.%, about 1 wt.%, about 0.9 wt.%, about 0.8 wt.%, about 0.7 wt.%, about 0.6 wt.%, about 0.5 wt.%, about 0.4 wt.%, about 0.3 wt.%, about 0.2 wt.%, about 0.1 wt.%, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.01 ppm (weight) to about 1 wt.%, and all values therebetween up to 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.1 ppm (weight) to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 1 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to about 0.5 wt.%. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.4 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In another embodiment, the total amount of additional compound(s) ranges from 0.001 wt.% to 0.1 wt.% or less, based on the total weight of the first refrigerant portion of the composition. In one embodiment, the total amount of additional compound(s) is about 0.1 wt.% based on the total weight of the first refrigerant portion of the composition.

[0402] In one embodiment, any of the compositions of any of the foregoing Embodiments comprise one additional compound, or two additional compounds, or three or more additional compounds.

[0403] In some embodiments, any of the compositions of any of the foregoing Embodiments may be free of or substantially free of HFO-E-1132 and/or HFO-Z-1132, with “substantially free of” meaning 2,000 ppm or less.

REFRIGERANT ADDITIVES

[0404] In one embodiment, compositions of the present invention may further comprise at least one non-refrigerant component. That is, in one embodiment, the present invention relates to compositions comprising a refrigerant composition, such as any of the compositions of the foregoing Embodiments disclosed herein, and one or more non-refrigerant components.

[0405] The optional non-refrigerant components (also referred to herein as “additives”) in the compositions disclosed herein may include one or more of the following components: lubricants, dyes (including UV dyes), solubilizing agents, compatibilizers, stabilizers, tracers, perfluoropolyethers, anti-wear agents, extreme pressure agents, corrosion and oxidation inhibitors, polymerization inhibitors, metal surface energy reducers, metal surface deactivators, acid scavengers, foam control agents, viscosity index improvers, pour point depressants, detergents, viscosity adjusters, performance enhancers, flame suppressants and mixtures thereof. Indeed, many of these optional non-refrigerant components fit into one or more of these categories and may have qualities that lend themselves to achieve one or more performance characteristics.

[0406] The additive component(s) and amounts thereof selected for the disclosed compositions are elected on the basis of utility, individual equipment components, and/or the system requirements.

[0407] Lubricants which may be included in compositions of the present invention comprise those suitable for use with refrigeration or air-conditioning apparatus. Among these lubricants are those conventionally used in compression refrigeration apparatus utilizing chlorofluorocarbon refrigerants. Such lubricants and their properties are discussed in the 1990 ASHRAE Handbook, Refrigeration Systems and Applications, chapter 8, titled “Lubricants in Refrigeration Systems”, pages 8.1 through 8.21, herein incorporated by reference. Lubricants of the present invention may comprise those commonly known as “mineral oils” in the field of compression

refrigeration lubrication. Mineral oils comprise paraffins (i.e. straight-chain and branched-carbon-chain, saturated hydrocarbons), naphthenes (i.e. cyclic or ring structure saturated hydrocarbons, which may be paraffins) and aromatics (i.e. unsaturated, cyclic hydrocarbons containing one or more rings characterized by alternating double bonds). Lubricants of the present invention further comprise those commonly known as "synthetic oils" in the field of compression refrigeration lubrication. Synthetic oils comprise alkylaryls (i.e. linear and branched alkyl alkylbenzenes), synthetic paraffins and naphthenes, silicones, and polyalphaolefins. Representative conventional lubricants of the present invention are the commercially available BVM 100 N (paraffinic mineral oil sold by BVA Oils), naphthenic mineral oil commercially available under the trademark from Suniso® 3GS and Suniso® 5GS by Crompton Co., naphthenic mineral oil commercially available from Pennzoil under the trademark Sontex® 372LT, naphthenic mineral oil commercially available from Calumet Lubricants under the trademark Calumet® RO-30, linear alkylbenzenes commercially available from Shrieve Chemicals under the trademarks Zerol® 75, Zerol® 150 and Zerol® 500 and branched alkylbenzene, sold by Nippon Oil as HAB 22.

[0408] Lubricants of the present invention further comprise those which have been designed for use with hydrofluorocarbon refrigerants and are miscible with refrigerants of the present invention under compression refrigeration and air-conditioning apparatus' operating conditions. Such lubricants and their properties are discussed in "Synthetic Lubricants and High-Performance Fluids", R. L. Shubkin, editor, Marcel Dekker, 1993. Such lubricants include, but are not limited to, polyol esters (POEs) such as Castrol® 100 (Castrol, United Kingdom), polyalkylene glycols (PAGs) such as RL-488A from Dow (Dow Chemical, Midland, Mich.), and polyvinyl ethers (PVEs) such as PVE-FVC68D.

[0409] In one particular embodiment, the foregoing refrigerant compositions are combined with a PAG lubricant or a POE lubricant for usage in an automotive A/C system having an internal combustion engine or an electric or hybrid electric drive train.

[0410] In the compositions of the present invention including a lubricant, the lubricant may be present in an amount of less than 80 weight percent of the total

composition. The lubricant may further be present in an amount of less than 60 weight percent of the total composition. In other embodiments, the amount of lubricant may be between about 0.1 and 50 weight percent of the total composition. The lubricant may also be between about 0.1 and 20 weight percent of the total composition. The lubricant may also be between about 0.1 and 5 weight percent of the total composition.

[0411] In one aspect of the invention, the inventive refrigerant composition is used to introduce lubricant into the A/C system as well as or alternatively other additives, such as a) acid scavengers, b) performance enhancers, and c) flame suppressants. In one preferred embodiment, the present compositions comprise an acid scavenger.

[0412] Examples of the acid scavengers that may be included in the present compositions include, but are not limited, the stabilizers and/or the epoxide component of the stabilizers disclosed in U.S. Patent No. 8,535,555 and the acid scavengers disclosed in International Application Publication No. WO 2020/222864, the disclosure of each of which is incorporated herein by reference in its entirety.

[0413] In some embodiments, an acid scavenger may comprise one or more epoxides, one or more amines and/or one or more hindered amines, such as, for example but not limited to, epoxybutane.

[0414] In some embodiments, an acid scavenger may comprise a siloxane, an activated aromatic compound, or a combination of both. Serrano et al (paragraph 38 of US 2011/0272624 A1), which is hereby incorporated by reference, discloses that the siloxane may be any molecule having a siloxyfunctionality. The siloxane may include an alkyl siloxane, an aryl siloxane, or a siloxane containing mixtures of aryl and alkyl substituents. For example, the siloxane may be an alkyl siloxane, including a dialkylsiloxane or a polydialkylsiloxane. Preferred siloxanes include an oxygen atom bonded to two silicon atoms, i.e., a group having the structure: SiOSi. For example, the siloxane may be a siloxane of Formula IV:

$R_1[Si(R_2R_3)_4O]_nSi(R_2R_3)R_4$, where n is 1 or more. Siloxanes of Formula IV have n that is preferably 2 or more, more preferably 3 or more, (e.g., about 4 or more). Siloxanes of formula IV have n that is preferably about 30 or less, more preferably about 12 or less, and most preferably about 7 or less. Preferably the R₄ group is an aryl group or an alkyl group. Preferably the R₂ groups are aryl groups or alkyl groups.

or mixtures thereof. Preferably the R3 groups are aryl groups or alkyl groups or mixtures thereof. Preferably the R4 group is an aryl group or an alkyl group. Preferably R1, R2, R3, R4, or any combination thereof are not hydrogen. The R2 groups in a molecule may be the same or different. Preferably the R2 groups in a molecule are the same. The R2 groups in a molecule may be the same or different from the R3 groups. Preferably, the R2 groups and R3 groups in a molecule are the same. Preferred siloxanes include siloxanes of Formula IV, wherein R1, R2, R3, R4, R5, or any combination thereof is a methyl, ethyl, propyl, or butyl group, or any combination thereof. Exemplary siloxanes that may be used include hexamethyldisiloxane, polydimethylsiloxane, polymethylphenylsiloxane, dodecamethylpentasiloxane, decamethylcyclo-pentasiloxane, decamethyltetrasiloxane, octamethyltrisiloxane, or any combination thereof.

[0415] Incorporated by previous reference from Serrano et al paragraph notes that in one aspect of the invention, the siloxane is an alkylsiloxane containing from about 1 to about 12 carbon atoms, such as hexamethyldisiloxane. The siloxane may also be a polymer such as polydialkylsiloxane, Where the alkyl group is a methyl, ethyl, propyl, butyl, or any combination thereof. Suitable polydialkylsiloxanes have a molecular weight from about 100 to about 10,000. Highly preferred siloxanes include hexamethyldisiloxane, polydimethylsiloxane, and combinations thereof. The siloxane may consist essentially of polydimethylsiloxane, hexamethyldisiloxane, or a combination thereof.

[0416] The activated aromatic compound may be any aromatic molecule activated towards a Friedel-Crafts addition reaction, or mixtures thereof. An aromatic molecule activated towards a Friedel-Crafts addition reaction is defined to be any aromatic molecule capable of an addition reaction with mineral acids. Especially aromatic molecules capable of addition reactions with mineral acids either in the application environment (AC system) or during the ASHRAE 97: 2007 "Sealed Glass Tube Method to Test the Chemical Stability of Materials for Use within Refrigerant Systems" thermal stability test. Such molecules or compounds are typically activated by substitution of a hydrogen atoms of the aromatic ring with one of the following groups: NH₂, NHR, NR₂, ADH, AD, NHCOCH₃, NHCOR, 4OCH₃, OR, CH₃, 4C₂H₅, R, or C₆H₅, where R is a hydrocarbon (preferably a hydrocarbon containing from about 1 to about 100 carbon atoms). The activated aromatic molecule may be an

alcohol, or an ether, where the oxygen atom (i.e., the oxygen atom of the alcohol or ether group) is bonded directly to an aromatic group. The activated aromatic molecule may be an amine Where the nitrogen atom (i.e., the nitrogen atom of the amine group) is bonded directly to an aromatic group. By way of example, the activated aromatic molecule may have the formula $ArXR_n$, Where X is O (i.e., oxygen) or N (i.e., nitrogen); $n:1$ When $X:O$; $n:2$ When $x:N$; Ar is an aromatic group (i.e., group, C_6H_5); R may be H or a carbon containing group; and When $n:2$, the R groups may be the same or different. For example, R may be H (i.e., hydrogen), Ar, an alkyl group, or any combination thereof, Exemplary activated aromatic molecules that may be employed in a refrigerant composition according to the teachings herein include diphenyl oxide (i.e., diphenyl ether), methyl phenyl ether (e.g., anisole), ethyl phenyl ether, butyl phenyl ether or any combination thereof. One highly preferred aromatic molecule activated to Wards a Friedel-Crafts addition reaction is diphenyl oxide.

[0417] Incorporated by previous reference from Serrano et al. The acid scavenger (e.g., the activated aromatic compound, the siloxane, or both) may be present in any concentration that results in a relatively low total acid number, a relatively low total halides concentration, a relatively low total organic acid concentration, or any combination thereof.

[0418] Preferably the acid scavenger is present at a concentration greater than about 0.0050 wt%, more preferably greater than about 0.05 wt% and even more preferably greater than about 0.1 wt% (e.g. greater than about 0.5 wt%) based on the total weight of the refrigerant composition. The acid scavenger preferably is present in a concentration less than about 5 wt%, less than about 4 wt%, less than about 3 wt%, more preferably less than about 2.5 wt% and most preferably greater than about 2 wt% (e. g. less than about 1.8 wt%) based on the total weight of the refrigerant composition.

[0419] Additional examples of acid scavengers which may be included in the refrigerant composition and preferably are excluded from the refrigerant composition include those described by Kaneko (U.S. patent application Ser. No. 11/575,256, published as U.S. Patent Publication 2007/0290164, paragraph 42, expressly incorporated herein by reference), such as one or more of: phenyl glycidyl ethers,

alkyl glycidyl ethers, alkylene glycol glycidylethers, cyclohexene oxides, oxetanes, or epoxy compounds such as epoxidized soybean oil, and those described by Singh et al. (U.S. patent application Ser. No. 11/250,219, published as 2006/0116310, paragraphs 34-42, expressly incorporated herein by reference).

[0420] Preferred additives include those described in U.S. Pat. Nos. 5,152,926; 4,755,316, which are hereby incorporated by reference. In particular, the preferred extreme pressure additives include mixtures of (A) tolyltriazole or substituted derivatives thereof, (B) an amine (e.g. Jeffamine M-600) and (C) a third component which is (i) an ethoxylated phosphate ester (e.g. Antara LP-700 type), or (ii) a phosphate alcohol (e.g. ZELEC 3337 type), or (iii) a Zinc dialkyldithiophosphate (e.g. Lubrizol 5139, 5604, 5178, or 5186 type), or (iv) a mercaptobenzothiazole, or (v) a 2,5-dimercapto-1,3,4-triazole derivative (e.g. Curvan 826) or a mixture thereof. Additional examples of additives which may be used are given in U.S. Pat. No. 5,976,399 (Schnur, 5:12-6:51, hereby incorporated by reference).

[0421] Acid number is measured according to ASTM D664-01 in units of mg KOH/g. The total halides concentration, the fluorine ion concentration, and the total organic acid concentration is measured by ion chromatography. Chemical stability of the refrigerant system is measured according to ASHRAE 97: 2007 (RA 2017) "Sealed Glass Tube Method to Test the Chemical Stability of Materials for Use within Refrigerant Systems". The viscosity of the lubricant is tested at 40°C according to ASTM D-7042.

[0422] Mouli et al. (WO 2008/027595 and WO 2009/042847) teach the use of alkyl silanes as a stabilizer in refrigerant compositions containing fluorolefins. Phosphates, phosphites, epoxides, and phenolic additives also have been employed in certain refrigerant compositions. These are described for example by Kaneko (U.S. patent application Ser. No. 11/575,256, published as U.S. Publication 2007/0290164) and Singh et al. (U.S. patent application Ser. No. 11/250,219, published as U.S. Publication 2006/0116310). All of these aforementioned applications are expressly incorporated herein by reference.

[0423] Preferred flame suppressants include the flame retardants described in patent application "Refrigerant compositions containing fluorine substituted olefins CA 2557873 A1" and incorporated by reference, as well as fluorinated products such

as HFC-125 and/or Krytox® lubricants, also incorporated by reference and described in patent application “Refrigerant compositions comprising fluoroolefins and uses thereof WO2009018117A1.”

[0424] In one embodiment, compositions of the present invention include a composition comprising HFO-1234ze(Z) and at least one acid scavenger. In particular, in some embodiments, any of the HFO-1234ze(Z) compositions disclosed herein may include at least one acid scavenger.

[0425] Additionally, the present compositions may further comprise at least one tracer compound or mixture of tracer compounds. Tracers may be used to identify the process by which a refrigerant, or refrigerant mixture is produced. The tracer compounds may be specific to the manner of production or may be added as a single tracer or mixture of tracers in particular amounts in order to detect dilution, adulteration, contamination, or other unauthorized practices.

[0426] The tracer may be a single compound or two or more tracer compounds from the same class of compounds or from different classes of compounds. In some embodiments, the tracer is present in the compositions at a total concentration of about 1 part per million by weight (ppm) to about 5000 ppm, based on the weight of the total composition. In other embodiments, the tracer is present at a total concentration of about 1 ppm to about 1000 ppm. In other embodiments, the tracer is present at a total concentration of about 2 ppm to about 500 ppm. Alternatively, the tracer is present at a total concentration of about 10 ppm to about 300 ppm.

[0427] The tracer compound or compounds in amounts up to 100 ppm, 200 ppm, 300, ppm, 400 ppm, 500 ppm, 600 ppm, 700 ppm, 800 ppm and 900 ppm may be selected from hydrofluorocarbons, hydrofluoroolefins, hydrochlorocarbons, hydrochloroolefins, hydrochlorofluorocarbons, hydrochlorofluoroolefins, hydrochlorocarbons, hydrochloroolefins, chlorofluorocarbons, chlorofluoroolefins, hydrocarbons, perfluorocarbons, perfluoroolefins, and combinations thereof. In particular, the tracers may include, but are not limited to compounds selected from HFC-23 (trifluoromethane), HCFC-31 (chlorofluoromethane), HFC-41 (fluoromethane), HFC-161 (fluoroethane), HFC-152a (1,1-difluoromethane), HFC-143a (1,1,1-trifluoroethane), HFC-227ca (1,1,1,2,2,3,3-heptafluoropropane), HFC-227ea (1,1,1,2,3,3,3-heptafluoropropane), HFC-236fa (1,1,1,3,3,3-

hexafluoropropane), HFC-236cb (1,1,1,2,2,3-hexafluoropropane), HFC-236ea (1,1,1,2,3,3-hexafluoropropane), HFC-245cb (1,1,1,2,2-pentafluoropropane), HFC-245fa (1,1,1,3,3-pentafluoropropane), HFC-245eb (1,1,1,2,3-pentafluoropropane), HFC-254eb (1,1,1,2-tetrafluoropropane), HFC-263fb (1,1,1-trifluoropropane), HFC-272ca (2,2-difluoropropane), HFC-281ea (2-fluoropropane), HFC-281fa (1-fluoropropane), HFC-329p (1,1,1,2,2,3,3,4,4-nonafluorobutane), HFC-329mmz (2-trifluoromethyl-1,1,1,3,3,3-hexafluoropropane), HFC-338mf (1,1,1,2,2,4,4,4-octafluorobutane), HFC-338pcc (1,1,2,2,3,3,4,4-octafluorobutane), CFC-12 (dichlorodifluoromethane), CFC-11 (trichlorofluoromethane), CFC-114 (1,2-dichloro-1,1,2,2-tetrafluoroethane), CFC-114a (2,2-dichloro-1,1,1,2-tetrafluoroethane), CFC-115 (chloropentafluoroethane), HCFC-22 (chlorodifluoromethane), HCFC-123 (2,2-dichloro-1,1,1-trifluoroethane), HCFC-124 (2-chloro-1,1,1,2-tetrafluoroethane), HCFC-124a (1-chloro-1,1,2,2-tetrafluoroethane), HCFC-141b (1,1-dichloro-1-fluoroethane), HCFC-142b (1-chloro-1,1-difluoroethane), HCFC-151a (1-chloro-1-fluoroethane), HCFC-244bb (2-chloro-1,1,1,2-tetrafluoropropane), HCC-40 (chloromethane), HFO-1141 (fluoroethylene), HCO-1130 (1,2-dichloroethylene, E- and/or Z-isomer), HCO-1130a (1,1-dichloroethylene), HCFO-1131 (1-chloro-2-fluoroethylene, E- and/or Z-isomer), HCFO-1131a (1-chloro-1-fluoroethylene), HCFO-1122 (2-chloro-1,1-difluoroethylene), HFO-1123 (trifluoroethylene), HFO-1234ye (1,2,3,3-tetrafluoropropene), HFO-1243zf (3,3,3-trifluoropropene), HFO-1225yeZ (1,2,3,3,3-pentafluoropropene), HFO-1225zc (1,1,3,3,3-pentafluoropropene), PFC-116 (hexafluoroethane), PFC-C216 (hexafluorocyclopropane), PFC-218 (octafluoropropane), PFC-C318 (octafluorocyclobutane), PFC-1216 (hexafluoropropene), PFC-31-10mc (decafluorobutane), PFC-31-10my (2-trifluoromethyl-1,1,1,2,3,3,3-heptafluoropropane), 2-chloro-1,1,2-trifluoroethylene (CFO-1113), 1,1,1,3,3,3-pentafluorobutane (HFC-365mfc), 1,1,1,2,3,4,4,5,5,5-decafluoropentane (HFC-43-10mee), 1,1,1,2,2,3,4,5,5,6,6,7,7,7-tetradecafluoroheptane, hexafluorobutadiene, 3,3,3-trifluoropropyne, deuterated hydrocarbons, deuterated hydrofluorocarbons, perfluorocarbons, fluoroethers, and mixtures thereof.

[0428] In some embodiments, the tracer is a blend containing two or more hydrofluorocarbons, or one hydrofluorocarbon in combination with one or more perfluorocarbons. In other embodiments, the tracer is a blend of at least one CFC

and at least one HCFC, HFC, or PFC. In one embodiment, compositions of the present invention may comprise HFO-1234ze(Z), HFO-1336mzz(Z), HFO-1336mzz(E), HCFO-1224yd(E), HCFO-1224yd(Z), HFO-1327mz(Z), HFO-1327mz(E), one or more hydrofluoroethers, and one or more hydrofluorocarbons.

[0429] In exemplary embodiments, for any of the compositions of Embodiments 1-8 which includes at least one HFO refrigerant compound, particularly HFO-1234yf or HFO-1234ze(E), the composition may further comprise a stabilizer package. In exemplary embodiments, the stabilizer package includes an effective amount of at least one inhibitor such that the thermal management fluid remains substantially free of oligomeric, homopolymeric, or other polymeric products derived from the thermal management fluid. In some embodiments, at least one inhibitor is selected from hydrocarbons including at least one of cyclic monoterpene; lipophilic organic compounds including tocopherols such as α -tocopherol; or phenols, aromatic organic compounds having at least one chemical moiety $-C_6H_4(OH)$, including benzene-1,4-diol. Specific examples of inhibitor compounds include at least one member selected from the group consisting of limonene, α -pinene, β -pinene, α -terpinene, α -tocopherol, butylated hydroxytoluene (BHT), 4-methoxyphenol, and benzene-1,4-diol. In one embodiment, the inhibitor composition includes a liquid at a temperature from about -80°C to about 180°C , about -70°C to about 170°C , and in some cases about -60°C to about 160°C . By "stabilized" it is meant to refer to a composition including an effective amount of at least one inhibitor compound that inhibits, if not eliminates, a fluoroethylene from interacting with another compound and forming dimers, oligomers, homopolymers, or polymeric products.

STORAGE, SYSTEMS, METHODS OF USE OR REPLACEMENT, RECOVERY, RECYCLE AND RECLAIM

[0430] The compositions disclosed herein are useful as heat transfer compositions, aerosol propellants, foaming agents, blowing agents, solvents, cleaning agents, carrier fluids, displacement drying agents, buffing abrasion agents, polymerization media, expansion agents for polyolefins and polyurethane, gaseous dielectrics, fire extinguishing agents, and fire suppression agents. Additionally, in liquid or gaseous form, the disclosed compositions may act as working fluids used to carry heat from a heat source to a heat sink. Such heat transfer compositions may

also be useful as refrigerants in a cycle wherein the fluid undergoes phase changes; that is, from a liquid to a gas and back or vice versa.

[0431] In one embodiment, there is provided a heat transfer system containing a composition as disclosed herein. In another embodiment is disclosed a refrigeration, air-conditioning, or heat pump apparatus containing a composition as disclosed herein. In another embodiment, is disclosed a stationary refrigeration, air-conditioning, or heat pump apparatus containing a composition as disclosed herein. In yet another embodiment is disclosed a mobile refrigeration or air conditioning apparatus containing a composition as disclosed herein.

[0432] In another embodiment, disclosed is a method of using the composition of the present invention as a heat transfer fluid composition. The method comprises transporting said composition from a heat source to a heat sink.

[0433] Examples of heat transfer systems which may contain any of the compositions of any of the foregoing Embodiments include but are not limited to air conditioners, freezers, refrigerators, heat pumps, water chillers, flooded evaporator chillers, direct expansion chillers, walk-in coolers, heat pumps, mobile refrigerators, mobile air conditioning units and combinations thereof.

[0434] These compositions of the present invention are useful in connection with numerous methods and systems, including as heat transfer fluids in methods and systems for transferring heat, such as refrigerants used in refrigeration, air conditioning, including vehicle air conditioning systems, and heat pump systems including high temperature heat pump systems (with condenser temperatures greater than 55°C, 70°C, or 100°C).

[0435] Additionally, in some embodiments, the disclosed compositions may function as primary refrigerants in secondary loop systems that provide cooling to remote locations by use of a secondary heat transfer fluid.

[0436] In some embodiments, some of the disclosed compositions are useful in a heat transfer system, particularly automotive applications for heating or cooling of the passenger compartment of an automobile. Sometimes this system is called a heat pump system and may be a reversible heating system or a reversible cooling system, or simply a heating and cooling system.

[0437] In many applications, some embodiments of the disclosed compositions are useful as refrigerants and provide at least comparable cooling performance (meaning cooling capacity and energy efficiency) as the refrigerant for which a replacement is being sought.

[0438] In some embodiments, the compositions disclosed herein are useful for any positive displacement compressor system designed for any number of heat transfer compositions. Additionally, many of the compositions disclosed are useful in new equipment utilizing positive displacement compressors to provide similar performance to the aforementioned refrigerants.

[0439] In one embodiment, disclosed herein is a process to produce cooling comprising condensing a composition as disclosed herein and thereafter evaporating said composition in the vicinity of a body to be cooled.

[0440] In another embodiment, disclosed herein is a process to produce heat comprising condensing a composition as disclosed herein in the vicinity of a body to be heated and thereafter evaporating said composition.

[0441] In some embodiments, the use of the above disclosed compositions includes using the composition as a heat transfer composition in a process for producing cooling, wherein the composition is first cooled and stored under pressure and when exposed to a warmer environment, the composition absorbs some of the ambient heat, expands, and the warmer environment is thusly cooled.

[0442] In some embodiments, the compositions as disclosed herein may be useful in particular in air conditioning applications including but not limited to chillers, high temperature heat pumps, residential, commercial or industrial air conditioning systems (including residential heat pumps), and air conditioning units including window, ductless and ducted, packaged terminal, chillers, and those exterior but connected to the building such as rooftop systems.

[0443] In some embodiments, the compositions as disclosed herein may be useful in particular in refrigeration applications including high, medium or low temperature refrigeration and other specific uses such as in commercial, industrial or residential refrigerators and freezers, ice machines, self-contained coolers and freezers, supermarket rack and distributed systems, flooded evaporator chillers, direct

expansion chillers, walk-in and reach-in coolers and freezers, and combination systems.

[0444] Low temperature refrigeration systems include, but are not limited to, supermarket and convenience store freezer cabinets and displays, ice machines and frozen food transport. Other specific uses include, but are not limited to, commercial, industrial or residential refrigerators and freezers, ice machines, self-contained coolers and freezers, supermarket rack and distributed systems, flooded evaporator chillers, direct expansion chillers, walk-in and reach-in coolers and freezers, and combination systems.

[0445] Medium temperature refrigeration systems include, but are not limited to, supermarket and convenience store refrigerated cases, such as cases for beverages, dairy, fresh food, and other refrigerated items. Medium temperature refrigeration systems may also include fresh food transport systems.

[0446] High temperature refrigeration systems include those for supermarket produce sections among others.

[0447] In some embodiments, the compositions disclosed herein, particularly any of the HFO-1234ze or HFO-1234yf or HFC-134a compositions disclosed herein, are useful as heat transfer compositions in low, medium and high temperature refrigeration systems, aerosol propellants, foaming agents, blowing agents, solvents, cleaning agents, carrier fluids, displacement drying agents, buffing abrasion agents, polymerization media, expansion agents for polyolefins and polyurethane, gaseous dielectrics, fire extinguishing agents, and fire suppression agents.

[0448] In some embodiments, any of the HFC-32 compositions disclosed herein are useful in air conditioning systems, refrigeration applications, and heat pump systems. In some embodiments, the air conditioning or heat pump systems comprise an evaporator, compressor, condenser and an expansion device. In one embodiment, the refrigeration, air conditioning or heat pump system is a stationary refrigeration, air conditioning or heat pump system. In another embodiment the refrigeration, air conditioning or heat pump system is a mobile refrigeration, air conditioning or heat pump system. Examples of air conditioning or heat pump systems include but are not limited to air conditioners, residential heat pumps,

chillers, including flooded evaporator chillers and direct expansion chillers, mobile air conditioning units, dehumidifiers, and combinations thereof.

[0449] In some embodiments, any of the compositions disclosed herein, particularly the HCFO-1233zd and HFO-1336mzz compositions, are useful in refrigeration applications, heat pumps and more particularly high temperature heat pumps, and in an Organic Rankine Cycle system such as for recovering waste heat.

[0450] In another embodiment is provided a method for recharging a heat transfer system that contains a refrigerant to be replaced and a lubricant, said method comprising removing the refrigerant to be replaced from the heat transfer system while retaining a substantial portion of the lubricant in said system and introducing one of the compositions herein disclosed to the heat transfer system.

[0451] In another embodiment, a heat exchange system comprising a composition disclosed herein is provided, wherein said system is selected from the group consisting of air conditioners, freezers, refrigerators, water chillers, flooded evaporator chillers, direct expansion chillers, walk-in coolers, heat pumps, mobile refrigerators, mobile air conditioning units, and systems having combinations thereof.

[0452] In some embodiments, the invention relates to a method for producing heating or cooling in a refrigeration, air-conditioning, or heat pump apparatus, wherein the method comprises introducing a working fluid comprising any of the compositions of any of the foregoing Embodiments into the apparatus.

[0453] In some embodiments, the invention relates to a refrigeration, air-conditioning or heat pump apparatus containing any of the compositions of any of the foregoing Embodiments.

[0454] In some embodiments, the invention relates to a mobile refrigeration or air-conditioning apparatus containing any of the compositions of any of the foregoing Embodiments.

[0455] In some embodiments, the invention relates to a stationary refrigeration, air-conditioning or heat pump apparatus containing any of the compositions of any of the foregoing Embodiments.

[0456] Further aspects of the compositions of the foregoing Embodiments (e.g., uses thereof, applications thereof, storage thereof, etc.) are discussed in greater detail below.

[0457] In some embodiments, the invention relates to a method for replacing an original refrigerant with a replacement refrigerant in a heat transfer system that uses, used or was designed to use the original refrigerant. The method comprises charging the heat transfer system that was designed for use with the original refrigerant with the replacement refrigerant, wherein at least some of the original refrigerant remains in the heat transfer system as a residual refrigerant, and wherein

- (i) the original refrigerant comprises, consists essentially of or consists of at least one CFC-12, HFC-134a and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;
- (ii) the original refrigerant comprises, consists essentially of or consists of at least CFC-12, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-134a;
- (iii) the original refrigerant comprises, consists essentially of or consists of at least one of HFC-134a, HFC-227ea and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1234ze;
- (iv) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1234ze;
- (v) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1234ze;
- (vi) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a, HFO-

- 1234yf and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1234ze;
- (vii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1234ze;
- (viii) the original refrigerant comprises, consists essentially of or consists of at least one of HFC-134a, HFC-227ea, E-HFO-1234ze and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;
- (ix) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;
- (x) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;
- (xi) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;
- (xii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;

- (xiii) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-125, HFO-1234yf and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-32;
- (xiv) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-32;
- (xv) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, E-HFO-1234ze, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-32;
- (xvi) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze, HFO-1234yf and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-32;
- (xvii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-32;
- (xviii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HFC-32, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1234yf, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-134a;
- (xix) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze, CO₂ and combinations thereof, and the

replacement refrigerant comprises, consists essentially of or consists of at least HFC-134a;

- (xx) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-134a;
- (xxi) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-134a;
- (xxii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-11, HFC-245fa, t-DCE, Z-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HCFO-1233zd;
- (xxiii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-11, HCFC-123, HFC-245fa, t-DCE, E-HCFO-1233zd and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least Z-HFO-1336mzz;
- (xxiv) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HCFC-22, HFC-115, HFC-32, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂, HFC-23, CFO-1113, HCC-40 and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-125;
- (xxv) the original refrigerant comprises, consists essentially of or consists of at least one of Z-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, E-HCFO-1233zd, HCFC-133a, HFO-1243zf, Z-HCFO-1326mxz, E-HCFO-1326mxz,

- HCFC-346mdf and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1336mzz;
- (xxvi) the original refrigerant comprises, consists essentially of or consists of at least one of Z-HFO-1336mzz, E-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, E-HCFO-1233zd and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least Z-HFO-1234ze;
- (xxvii) the original refrigerant comprises, consists essentially of or consists of at least one of HFC-32, HFC-134a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least Z-HFO-1132; or
- (xxviii) the original refrigerant comprises, consists essentially of or consists of at least one of HFC-32, HFC-134a, HFC-152a, HFC-227ea, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1132.

[0458] In some embodiments, a method for replacing an original refrigerant with a replacement refrigerant in a heat transfer system that uses, used or was designed to use the original refrigerant comprises removing a substantial portion of the original refrigerant from the heat transfer system, at least a portion of the original refrigerant remaining in the system as a residual refrigerant, optionally retaining a substantial portion of any lubricant present in the system, and charging the system with the replacement refrigerant, wherein

- (i) the original refrigerant comprises, consists essentially of or consists of at least one CFC-12, HFC-134a and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;
- (ii) the original refrigerant comprises, consists essentially of or consists of at least one CFC-12, HFC-134a and combinations thereof, and the

- replacement refrigerant comprises, consists essentially of or consists of at least HFC-134a;
- (iii) the original refrigerant comprises, consists essentially of or consists of at least one of HFC-134a, HFC-227ea and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1234ze;
 - (iv) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1234ze;
 - (v) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1234ze;
 - (vi) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a, HFO-1234yf and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1234ze;
 - (vii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1234ze;
 - (viii) the original refrigerant comprises, consists essentially of or consists of at least one of HFC-134a, HFC-227ea, E-HFO-1234ze and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;
 - (ix) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd,

E-HFO-1234ze, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;

- (x) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;
- (xi) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;
- (xii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;
- (xiii) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-125, HFO-1234yf and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-32;
- (xiv) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-32;
- (xv) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, E-HFO-1234ze, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-32;

- (xvi) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze, HFO-1234yf and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-32;
- (xvii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-32;
- (xviii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HFC-32, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1234yf, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-134a;
- (xix) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-134a;
- (xx) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-134a;
- (xxi) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-134a;
- (xxii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-11, HFC-245fa, t-DCE, Z-HFO-1336mzz and

- combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HCFO-1233zd;
- (xxiii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-11, HCFC-123, HFC-245fa, t-DCE, E-HCFO-1233zd and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least Z-HFO-1336mzz;
- (xxiv) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HCFC-22, HFC-115, HFC-32, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂, HFC-23, CFO-1113, HCC-40 and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-125;
- (xxv) the original refrigerant comprises, consists essentially of or consists of at least one of Z-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, E-HCFO-1233zd, HCFC-133a, HFO-1243zf, Z-HCFO-1326mxz, E-HCFO-1326mxz, HCFC-346mdf and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1336mzz;
- (xxvi) the original refrigerant comprises, consists essentially of or consists of at least one of Z-HFO-1336mzz, E-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, E-HCFO-1233zd and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least Z-HFO-1234ze;
- (xxvii) the original refrigerant comprises, consists essentially of or consists of at least one of HFC-32, HFC-134a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least Z-HFO-1132; or
- (xxviii) the original refrigerant comprises, consists essentially of or consists of at least one of HFC-32, HFC-134a, HFC-152a, HFC-227ea, Z-HFO-1132, Z-

HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1132.

[0459] In some embodiments of any of the foregoing replacement methods, the replacement refrigerant is a recovered thermal management fluid. In some embodiments of any of the foregoing replacement methods, the replacement refrigerant is a recycled thermal management fluid. In some embodiments of any of the foregoing replacement methods, the replacement refrigerant is a reclaimed thermal management fluid.

[0460] In some embodiments, any of the compositions of any of the foregoing Embodiments may be a reprocessed product, such as a distillation product, of a thermal management fluid blend. In some embodiments, the thermal management fluid blend is a recovered thermal management fluid, and more particularly a spent thermal management fluid or a used thermal management fluid drained or otherwise removed from a thermal management device, such as, for example, a refrigeration, an air-conditioning system or a heat pump, as defined herein.

[0461] In some embodiments, any of the compositions of any of the foregoing Embodiments may be obtained by a distillation process. The process comprises distilling a thermal management fluid blend to separate components thereof, and obtaining any of the compositions of any of the foregoing Embodiments as a product of the distillation. The distillation is carried out such that a total amount of the residual refrigerants in the composition is from about 0.00001 to about 2 weight percent, preferably about 0.00001 to about 0.5 weight percent, more preferably about 0.0001 to about 0.5 weight percent or about 0.001 to about 0.5 weight percent, based on a total weight of the composition. In some embodiments, the thermal management fluid blend is a recovered thermal management fluid, and more particularly a spent thermal management fluid or a used thermal management fluid drained or otherwise removed from a thermal management device, such as, for example, a refrigeration, an air-conditioning system or a heat pump, as defined herein.

[0462] In some embodiments, any of the compositions of any of the foregoing Embodiments may be a recovered thermal management fluid, and more particularly a spent thermal management fluid or a used thermal management fluid drained or otherwise removed from a thermal management device, such as, for example, a refrigeration, an air-conditioning system or a heat pump, as defined herein.

[0463] In some embodiments, any of the compositions of any of the foregoing Embodiments may be a reclaimed thermal management fluid, and more particularly a reprocessed product, such as a distillation product, of a recovered thermal management fluid having at least about 95 wt% organic purity, preferably at least about 99 wt% organic purity, most preferably at least about 99.5 wt% organic purity and meeting conventional specifications for commercial use or sale as a thermal management fluid, as defined herein.

[0464] In a further embodiment, all or a portion of any of the compositions of any of the foregoing Embodiments may be prepared from recycled or reclaimed refrigerant. One or more of the components may be recycled or reclaimed by means of removing contaminants, such as air, water, or residue, which may include lubricant or particulate residue from system components. The means of removing the contaminants may vary widely, but can include one or more of distillation, decantation, filtration, and/or drying by use of molecular sieves or other absorbents.

[0465] In some embodiments, the invention relates to a recovery container, a recovery cylinder, or a recycle, recover, recharge ("RRR") machine containing any of the compositions of the foregoing Embodiments. RRR machines are portable containers used in connection with servicing heat transfer systems, particularly refrigeration circuits such as the air conditioning unit of a vehicle. The portable machines include hoses coupled to the system to be serviced. RRR machines operate to recover refrigerant from the system, optionally store the recovered refrigerant in a refrigerant tank, recycle the refrigerant to some intermittent quality level removing gross contaminants, and then recharge the refrigerant back into the same system after repairs or servicing have been completed. The recovered refrigerant may also be stored in a refrigerant tank in the RRR machine until needed for use in another system.

[0466] In some embodiments, at least a portion of any of the compositions of any of the foregoing Embodiments may comprise one or more reclaimed thermal management fluids.

[0467] In some embodiments, any of the compositions of any of the foregoing Embodiments may be collected and stored as a recovered thermal management fluid or a reclaimed thermal management fluid in a storage tank until needed for a further application.

[0468] In some embodiments, the invention relates to a method of reclaiming refrigerant comprising:

- recovering a refrigerant composition from a heat transfer system, the recovered refrigerant composition having at least a first refrigerant compound and a second refrigerant compound; and
- performing at least one treatment selected from transferring, blending, distillation, nitrogen purging, filtration, dehydration, caustic scrubbing, moisture removal, acid removal, oil removal, decanting, composition ratio adjustment and combinations thereof to form a partially reclaimed refrigerant composition or a reclaimed refrigerant composition; and
- either storing the partially reclaimed refrigerant composition or a reclaimed refrigerant composition in a container for use in another system or introducing the partially reclaimed refrigerant composition or a reclaimed refrigerant composition back into the heat transfer system,

wherein the treatment does not completely remove the second refrigerant compound from the recovered refrigerant composition, and more particularly wherein after the treatment (e.g., distillation) is performed, a total amount of the second refrigerant compounds is from about 0.00001 to about 2 weight percent, preferably about 0.00001 to about 0.5 weight percent, more preferably about 0.0001 to about 0.5 weight percent or about 0.001 to about 0.5 weight percent, based on a total weight of the composition.

[0469] In some embodiments of this reclamation method, the recovered refrigerant composition is any of the compositions of any of the foregoing Embodiments, the second refrigerant compounds are residual refrigerants, and a residual amount of the

second refrigerant compounds is present in the partially reclaimed or reclaimed refrigerant compositions. In some embodiments, the recovered refrigerant composition comprises a plurality of second refrigerant compounds which are not completely removed from the recovered composition during the treatment, such that a residual amount of the plurality of second refrigerant compounds is present in the partially reclaimed or reclaimed refrigerant compositions.

[0470] In some embodiments, the reclaiming method further comprise performing an analysis selected from the group consisting of gas chromatography, mass spectrometry, atomic absorption spectroscopy, flame emission spectroscopy, infra-red spectroscopy, and combinations thereof on the unreclaimed refrigerant composition to determine the composition of the unreclaimed refrigerant composition sample.

[0471] In some embodiments, the invention relates to a method of recycling refrigerant comprising:

- removing a spent or used refrigerant composition from a heat transfer system, the spent or used refrigerant composition having at least a first refrigerant compound and a second refrigerant compound; and
- performing at least one treatment selected from oil separation, acids removal, moisture removal, denag and optionally distillation, and combinations thereof to form a recycled refrigerant composition; and
- introducing the recycled refrigerant composition back into the heat transfer system,

wherein the treatment does not completely remove the second refrigerant compound from the recovered refrigerant composition, and more particularly wherein after the treatment is performed, a total amount of the second refrigerant compounds is from about 0.00001 to about 2 weight percent, preferably about 0.00001 to about 0.5 weight percent, more preferably about 0.0001 to about 0.5 weight percent or about 0.001 to about 0.5 weight percent, based on a total weight of the composition. It will be understood by those skilled in the art that “denag” refers to the removal of non-absorbable or non-condensable gases.

[0472] In embodiments of this recycling method, the used or spent refrigerant composition is any of the compositions of any of the foregoing Embodiments, the second refrigerant compounds are residual refrigerants, and a residual amount of the second refrigerant compounds is present in the recycled refrigerant composition. In some embodiments, the used or spent refrigerant composition comprises a plurality of second refrigerant compounds which are not completely removed from the used or spent composition during the treatment, such that a residual amount of the plurality of second refrigerant compounds is present in the recycled refrigerant composition.

[0473] In some embodiments, the present invention relates to a container or storage tank comprising any of the compositions of any of the foregoing Embodiments.

[0474] Another embodiment of the invention relates to storing any of the foregoing compositions of any of the foregoing Embodiments in gaseous and/or liquid phases within a sealed container. The water concentration within the gas and/or liquid phase in the sealed container ranges from about 0.1 to 200 ppm by weight. The oxygen concentration within the gas and/or liquid phase in the sealed container ranges from about 10 ppm by volume to about 1 volume percent, preferably from about 10 ppm by volume to about 0.35 volume percent, at about 25°C. The air concentration within the gas and/or liquid phase in the sealed container ranges from about 100 ppm by volume to about 5 volume percent, preferably from about 100 ppm by volume to about 1.5 volume percent.

[0475] The container for storing the foregoing compositions can be constructed of any suitable material and design that is capable of sealing the compositions therein while maintaining gaseous and liquids phases. Examples of suitable containers comprise pressure resistant containers such as a tank, a filling cylinder, and a secondary filling cylinder. The container can be constructed from any suitable material such as carbon steel, manganese steel, chromium-molybdenum steel, among other low-alloy steels, stainless steel and in some cases an aluminum alloy.

[0476] In some embodiments, all or a portion of any of the compositions of any of the foregoing Embodiments may be packaged and sold as a blending building block, such as for forming commercial thermal management fluid blends.

[0477] In some embodiments, all or a portion of any of the compositions of any of the foregoing Embodiments may be combined with all or a portion of a virgin, a used, a reclaimed, or other thermal management fluid(s) sharing at least some of the same refrigerant compounds to adjust their composition ratios, such as to make an azeotropic or zeotropic composition or azeotropic or zeotropic commercial thermal management fluid blend.

[0478] In some embodiments, all or a portion of any of the compositions of any of the foregoing Embodiments may be combined with all or a portion of a virgin, a used, a reclaimed, or other thermal management fluid(s) having at least one additional refrigerant compound to make an azeotropic or zeotropic composition or azeotropic or zeotropic commercial thermal management fluid blend.

EXAMPLES

[0479] It has been found that the presence of residual refrigerants, as defined and described herein, in any of the compositions of any of the foregoing Embodiments, not only avoids the need for complex and costly separation processes and equipment, such as large separation columns, extractive distillation and the like, and thus minimizes environmental footprint, for example for a reclamation process, but also does not negatively impact performance of the compositions and, in some cases, actually enhances performance, for example in terms of capacity and/or coefficient of performance, as demonstrated in the Examples.

[0480] The modeled cycles presented in the Examples were performed using physical properties from NIST Refprop and thermodynamic calculations.

Example 1

[0481] Tables 2-7 show the performance of some exemplary HFO-1234yf compositions containing residual refrigerant(s) (CFC-12, HFC-134a, HFC-32 and/or E-HFO-1234ze) as compared with the same compositions without the residual refrigerant(s) in a stationary chiller system, automotive air conditioning system, medium temperature refrigeration system and low temperature refrigeration system, as shown in Figs. 1-2. The data are based on the following conditions.

Chiller

Condenser Mid-Point Temperature	40.6°C
Condenser Subcooling	0 K
Evaporator Mid-Point Temperature	5.0°C
Useful Superheat	11.1 K
Compressor Isentropic Efficiency	0.7

Automotive Air Conditioning

Condenser Mid-Point Temperature	46.1°C
Condenser Subcooling	0 K
Evaporator Mid-Point Temperature	10°C
Useful Superheat	11.1 K
Compressor Isentropic Efficiency	0.7

Medium Temperature Refrigeration

Condenser Mid-Point Temperature	43.3°C
Condenser Subcooling	0 K
Evaporator Mid-Point Temperature	-6.7°C
Useful Superheat	11.1 K
Compressor Isentropic Efficiency	0.7

Low Temperature Refrigeration

Condenser Mid-Point Temperature	40.6°C
Condenser Subcooling	0 K
Evaporator Mid-Point Temperature	-31.7°C
Useful Superheat	11.1 K
Compressor Isentropic Efficiency	0.7

Table 2
Performance of HFO-1234yf Compositions in Auto A/C System

Blend Composition (wt fraction)				NBP (°F)	Average Glide (K)
R-12	R-1234YF	R-1234ZEE	R-1243ZF		
0	0.995	0	0.005	-21.035	0.001
0	0.995	0.001	0.004	-21.033	0.001
0	0.995	0.002	0.003	-21.031	0.001
0	0.995	0.003	0.002	-21.029	0.001
0	0.995	0.004	0.001	-21.026	0.001
0	0.995	0.005	0	-21.024	0.001
0	0.996	0	0.004	-21.04	0.001
0	0.996	0.001	0.003	-21.038	0.001
0	0.996	0.002	0.002	-21.036	0.001
0	0.996	0.003	0.001	-21.034	0.001
0	0.996	0.004	0	-21.032	0.001
0	0.997	0	0.003	-21.046	0.001
0	0.997	0.001	0.002	-21.044	0.001
0	0.997	0.002	0.001	-21.041	0.001
0	0.997	0.003	0	-21.039	0.001
0	0.998	0	0.002	-21.051	0.001
0	0.998	0.001	0.001	-21.049	0.001
0	0.998	0.002	0	-21.047	0
0	0.999	0	0.001	-21.056	0
0	0.999	0.001	0	-21.054	0
0	1	0	0	-21.062	0
0.001	0.995	0	0.004	-21.038	0.001
0.001	0.995	0.001	0.003	-21.036	0.001
0.001	0.995	0.002	0.002	-21.034	0.001
0.001	0.995	0.003	0.001	-21.032	0.001
0.001	0.995	0.004	0	-21.03	0.001
0.001	0.996	0	0.003	-21.044	0.001
0.001	0.996	0.001	0.002	-21.041	0.001
0.001	0.996	0.002	0.001	-21.039	0.001
0.001	0.996	0.003	0	-21.037	0.001
0.001	0.997	0	0.002	-21.049	0.001
0.001	0.997	0.001	0.001	-21.047	0.001
0.001	0.997	0.002	0	-21.045	0.001
0.001	0.998	0	0.001	-21.054	0.001
0.001	0.998	0.001	0	-21.052	0
0.001	0.999	0	0	-21.06	0
0.002	0.995	0	0.003	-21.041	0.001
0.002	0.995	0.001	0.002	-21.039	0.001
0.002	0.995	0.002	0.001	-21.037	0.001
0.002	0.995	0.003	0	-21.035	0.001
0.002	0.996	0	0.002	-21.047	0.001
0.002	0.996	0.001	0.001	-21.045	0.001
0.002	0.996	0.002	0	-21.043	0.001
0.002	0.997	0	0.001	-21.052	0.001
0.002	0.997	0.001	0	-21.05	0.001
0.002	0.998	0	0	-21.058	0
0.003	0.995	0	0.002	-21.045	0.001
0.003	0.995	0.001	0.001	-21.043	0.001
0.003	0.995	0.002	0	-21.041	0.001
0.003	0.996	0	0.001	-21.05	0.001

Blend Composition (wt fraction)				NBP (°F)	Average Glide (K)
<i>R-12</i>	<i>R-1234YF</i>	<i>R-1234ZEE</i>	<i>R-1243ZF</i>		
0.003	0.996	0.001	0	-21.048	0.001
0.003	0.997	0	0	-21.056	0.001
0.004	0.995	0	0.001	-21.048	0.001
0.004	0.995	0.001	0	-21.046	0.001
0.004	0.996	0	0	-21.054	0.001
0.005	0.995	0	0	-21.052	0.001

Table 2 (Continued)

Performance of HFO-1234yf Compositions in Auto A/C System

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
60.711	2664.584	4.316	-0.02994	0.023175
60.709	2664.604	4.316	-0.02919	0.023175
60.707	2664.623	4.316	-0.02848	0.023175
60.705	2664.64	4.316	-0.02784	0.023175
60.703	2664.656	4.316	-0.02724	0.023175
60.701	2664.673	4.316	-0.0266	0.023175
60.706	2664.744	4.316	-0.02394	0.023175
60.705	2664.764	4.316	-0.02319	0.023175
60.703	2664.782	4.316	-0.02251	0.023175
60.701	2664.799	4.316	-0.02187	0.023175
60.699	2664.817	4.315	-0.0212	0
60.702	2664.904	4.316	-0.01793	0.023175
60.7	2664.924	4.316	-0.01718	0.023175
60.698	2664.942	4.315	-0.01651	0
60.697	2664.959	4.315	-0.01587	0
60.698	2665.063	4.315	-0.01197	0
60.696	2665.082	4.315	-0.01126	0
60.694	2665.1	4.315	-0.01058	0
60.694	2665.223	4.315	-0.00597	0
60.692	2665.241	4.315	-0.00529	0
60.69	2665.382	4.315	0	0
60.714	2664.722	4.316	-0.02476	0.023175
60.712	2664.742	4.316	-0.02401	0.023175
60.71	2664.76	4.316	-0.02334	0.023175
60.708	2664.777	4.316	-0.0227	0.023175
60.706	2664.794	4.316	-0.02206	0.023175
60.709	2664.882	4.316	-0.01876	0.023175
60.708	2664.902	4.316	-0.01801	0.023175
60.706	2664.919	4.316	-0.01737	0.023175
60.704	2664.937	4.316	-0.0167	0.023175
60.705	2665.041	4.316	-0.01279	0.023175
60.703	2665.06	4.316	-0.01208	0.023175
60.701	2665.079	4.316	-0.01137	0.023175
60.701	2665.201	4.316	-0.00679	0.023175
60.699	2665.22	4.316	-0.00608	0.023175
60.697	2665.361	4.315	-0.00079	0
60.717	2664.861	4.316	-0.01955	0.023175
60.715	2664.88	4.316	-0.01883	0.023175
60.713	2664.897	4.316	-0.0182	0.023175
60.711	2664.914	4.316	-0.01756	0.023175
60.712	2665.021	4.316	-0.01354	0.023175

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
60.711	2665.039	4.316	-0.01287	0.023175
60.709	2665.057	4.316	-0.01219	0.023175
60.708	2665.18	4.316	-0.00758	0.023175
60.706	2665.198	4.316	-0.0069	0.023175
60.704	2665.34	4.316	-0.00158	0.023175
60.72	2664.999	4.316	-0.01437	0.023175
60.718	2665.017	4.316	-0.01369	0.023175
60.716	2665.035	4.316	-0.01302	0.023175
60.715	2665.158	4.316	-0.0084	0.023175
60.713	2665.177	4.316	-0.00769	0.023175
60.711	2665.318	4.316	-0.0024	0.023175
60.723	2665.137	4.317	-0.00919	0.04635
60.721	2665.155	4.316	-0.00852	0.023175
60.718	2665.297	4.316	-0.00319	0.023175
60.726	2665.276	4.317	-0.00398	0.04635

Table 3

Performance of HFO-1234yf Compositions in Auto A/C System

Blend Composition				NBP (°F)	Average Glide (K)
R-134A	R-1234YF	R-1234ZEE	R-1243ZF		
0	0.995	0	0.005	-21.035	0.001
0	0.995	0.001	0.004	-21.033	0.001
0	0.995	0.002	0.003	-21.031	0.001
0	0.995	0.003	0.002	-21.029	0.001
0	0.995	0.004	0.001	-21.026	0.001
0	0.995	0.005	0	-21.024	0.001
0	0.996	0	0.004	-21.04	0.001
0	0.996	0.001	0.003	-21.038	0.001
0	0.996	0.002	0.002	-21.036	0.001
0	0.996	0.003	0.001	-21.034	0.001
0	0.996	0.004	0	-21.032	0.001
0	0.997	0	0.003	-21.046	0.001
0	0.997	0.001	0.002	-21.044	0.001
0	0.997	0.002	0.001	-21.041	0.001
0	0.997	0.003	0	-21.039	0.001
0	0.998	0	0.002	-21.051	0.001
0	0.998	0.001	0.001	-21.049	0.001
0	0.998	0.002	0	-21.047	0
0	0.999	0	0.001	-21.056	0
0	0.999	0.001	0	-21.054	0
0	1	0	0	-21.062	0
0.001	0.995	0	0.004	-21.047	0.002
0.001	0.995	0.001	0.003	-21.045	0.002
0.001	0.995	0.002	0.002	-21.043	0.002
0.001	0.995	0.003	0.001	-21.041	0.002
0.001	0.995	0.004	0	-21.039	0.002
0.001	0.996	0	0.003	-21.052	0.002
0.001	0.996	0.001	0.002	-21.05	0.002
0.001	0.996	0.002	0.001	-21.048	0.002
0.001	0.996	0.003	0	-21.046	0.002

Blend Composition				NBP (°F)	Average Glide (K)
<i>R-134A</i>	<i>R-1234YF</i>	<i>R-1234ZEE</i>	<i>R-1243ZF</i>		
0.001	0.997	0	0.002	-21.058	0.002
0.001	0.997	0.001	0.001	-21.056	0.002
0.001	0.997	0.002	0	-21.054	0.002
0.001	0.998	0	0.001	-21.063	0.001
0.001	0.998	0.001	0	-21.061	0.001
0.001	0.999	0	0	-21.069	0.001
0.002	0.995	0	0.003	-21.059	0.003
0.002	0.995	0.001	0.002	-21.057	0.003
0.002	0.995	0.002	0.001	-21.055	0.003
0.002	0.995	0.003	0	-21.053	0.003
0.002	0.996	0	0.002	-21.064	0.003
0.002	0.996	0.001	0.001	-21.062	0.003
0.002	0.996	0.002	0	-21.06	0.003
0.002	0.997	0	0.001	-21.07	0.002
0.002	0.997	0.001	0	-21.068	0.002
0.002	0.998	0	0	-21.075	0.002
0.003	0.995	0	0.002	-21.071	0.004
0.003	0.995	0.001	0.001	-21.069	0.004
0.003	0.995	0.002	0	-21.067	0.004
0.003	0.996	0	0.001	-21.077	0.003
0.003	0.996	0.001	0	-21.075	0.003
0.003	0.997	0	0	-21.082	0.003
0.004	0.995	0	0.001	-21.083	0.004
0.004	0.995	0.001	0	-21.081	0.004
0.004	0.996	0	0	-21.089	0.004
0.005	0.995	0	0	-21.095	0.005

Table 3 (Continued)

Performance of HFO-1234yf Compositions in Auto A/C System

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
60.711	2664.584	4.316	-0.02994	0.023175
60.709	2664.604	4.316	-0.02919	0.023175
60.707	2664.623	4.316	-0.02848	0.023175
60.705	2664.64	4.316	-0.02784	0.023175
60.703	2664.656	4.316	-0.02724	0.023175
60.701	2664.673	4.316	-0.0266	0.023175
60.706	2664.744	4.316	-0.02394	0.023175
60.705	2664.764	4.316	-0.02319	0.023175
60.703	2664.782	4.316	-0.02251	0.023175
60.701	2664.799	4.316	-0.02187	0.023175
60.699	2664.817	4.315	-0.0212	0
60.702	2664.904	4.316	-0.01793	0.023175
60.7	2664.924	4.316	-0.01718	0.023175
60.698	2664.942	4.315	-0.01651	0
60.697	2664.959	4.315	-0.01587	0
60.698	2665.063	4.315	-0.01197	0
60.696	2665.082	4.315	-0.01126	0
60.694	2665.1	4.315	-0.01058	0
60.694	2665.223	4.315	-0.00597	0

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
60.692	2665.241	4.315	-0.00529	0
60.69	2665.382	4.315	0	0
60.715	2665.444	4.316	0.002326	0.023175
60.713	2665.464	4.316	0.003076	0.023175
60.711	2665.482	4.316	0.003752	0.023175
60.709	2665.5	4.316	0.004427	0.023175
60.707	2665.517	4.316	0.005065	0.023175
60.71	2665.604	4.316	0.008329	0.023175
60.708	2665.624	4.316	0.009079	0.023175
60.707	2665.643	4.316	0.009792	0.023175
60.705	2665.661	4.315	0.010468	0
60.706	2665.765	4.316	0.014369	0.023175
60.704	2665.785	4.315	0.01512	0
60.702	2665.803	4.315	0.015795	0
60.702	2665.925	4.315	0.020372	0
60.7	2665.945	4.315	0.021123	0
60.698	2666.086	4.315	0.026413	0
60.718	2666.304	4.316	0.034592	0.023175
60.717	2666.324	4.316	0.035342	0.023175
60.715	2666.343	4.316	0.036055	0.023175
60.713	2666.361	4.316	0.03673	0.023175
60.714	2666.465	4.316	0.040632	0.023175
60.712	2666.485	4.316	0.041382	0.023175
60.71	2666.504	4.315	0.042095	0
60.71	2666.627	4.315	0.04671	0
60.708	2666.647	4.315	0.04746	0
60.706	2666.788	4.315	0.05275	0
60.722	2667.164	4.316	0.066857	0.023175
60.72	2667.185	4.316	0.067645	0.023175
60.719	2667.204	4.316	0.068358	0.023175
60.718	2667.327	4.316	0.072973	0.023175
60.716	2667.347	4.315	0.073723	0
60.714	2667.49	4.315	0.079088	0
60.726	2668.026	4.316	0.099198	0.023175
60.724	2668.047	4.315	0.099986	0
60.722	2668.19	4.315	0.105351	0
60.73	2668.889	4.315	0.131576	0

Table 4

Performance of HFO-1234yf Compositions in Auto A/C System

Blend Composition					NBP (°F)	Average Glide (K)
R-12	R-134a	R-1234yf	R-1234zeE	R-1243zf		
0	0	0.995	0	0.005	-21.035	0.001
0	0	0.995	0.001	0.004	-21.033	0.001
0	0	0.995	0.002	0.003	-21.031	0.001
0	0	0.995	0.003	0.002	-21.029	0.001
0	0	0.995	0.004	0.001	-21.026	0.001
0	0	0.995	0.005	0	-21.024	0.001
0	0	0.996	0	0.004	-21.04	0.001
0	0	0.996	0.001	0.003	-21.038	0.001
0	0	0.996	0.002	0.002	-21.036	0.001

Blend Composition					NBP (°F)	Average Glide (K)
R-12	R-134a	R-1234yf	R-1234zeE	R-1243zf		
0	0	0.996	0.003	0.001	-21.034	0.001
0	0	0.996	0.004	0	-21.032	0.001
0	0	0.997	0	0.003	-21.046	0.001
0	0	0.997	0.001	0.002	-21.044	0.001
0	0	0.997	0.002	0.001	-21.041	0.001
0	0	0.997	0.003	0	-21.039	0.001
0	0	0.998	0	0.002	-21.051	0.001
0	0	0.998	0.001	0.001	-21.049	0.001
0	0	0.998	0.002	0	-21.047	0
0	0	0.999	0	0.001	-21.056	0
0	0	0.999	0.001	0	-21.054	0
0	0	1	0	0	-21.062	0
0	0.001	0.995	0	0.004	-21.047	0.002
0	0.001	0.995	0.001	0.003	-21.045	0.002
0	0.001	0.995	0.002	0.002	-21.043	0.002
0	0.001	0.995	0.003	0.001	-21.041	0.002
0	0.001	0.995	0.004	0	-21.039	0.002
0	0.001	0.996	0	0.003	-21.052	0.002
0	0.001	0.996	0.001	0.002	-21.05	0.002
0	0.001	0.996	0.002	0.001	-21.048	0.002
0	0.001	0.996	0.003	0	-21.046	0.002
0	0.001	0.997	0	0.002	-21.058	0.002
0	0.001	0.997	0.001	0.001	-21.056	0.002
0	0.001	0.997	0.002	0	-21.054	0.002
0	0.001	0.998	0	0.001	-21.063	0.001
0	0.001	0.998	0.001	0	-21.061	0.001
0	0.001	0.999	0	0	-21.069	0.001
0	0.002	0.995	0	0.003	-21.059	0.003
0	0.002	0.995	0.001	0.002	-21.057	0.003
0	0.002	0.995	0.002	0.001	-21.055	0.003
0	0.002	0.995	0.003	0	-21.053	0.003
0	0.002	0.996	0	0.002	-21.064	0.003
0	0.002	0.996	0.001	0.001	-21.062	0.003
0	0.002	0.996	0.002	0	-21.06	0.003
0	0.002	0.997	0	0.001	-21.07	0.002
0	0.002	0.997	0.001	0	-21.068	0.002
0	0.002	0.998	0	0	-21.075	0.002
0	0.003	0.995	0	0.002	-21.071	0.004
0	0.003	0.995	0.001	0.001	-21.069	0.004
0	0.003	0.995	0.002	0	-21.067	0.004
0	0.003	0.996	0	0.001	-21.077	0.003
0	0.003	0.996	0.001	0	-21.075	0.003
0	0.003	0.997	0	0	-21.082	0.003
0	0.004	0.995	0	0.001	-21.083	0.004
0	0.004	0.995	0.001	0	-21.081	0.004
0	0.004	0.996	0	0	-21.089	0.004
0	0.005	0.995	0	0	-21.095	0.005
0.001	0	0.995	0	0.004	-21.038	0.001
0.001	0	0.995	0.001	0.003	-21.036	0.001
0.001	0	0.995	0.002	0.002	-21.034	0.001
0.001	0	0.995	0.003	0.001	-21.032	0.001
0.001	0	0.995	0.004	0	-21.03	0.001
0.001	0	0.996	0	0.003	-21.044	0.001
0.001	0	0.996	0.001	0.002	-21.041	0.001

Blend Composition					NBP (°F)	Average Glide (K)
<i>R-12</i>	<i>R-134a</i>	<i>R-1234yf</i>	<i>R-1234zeE</i>	<i>R-1243zf</i>		
0.001	0	0.996	0.002	0.001	-21.039	0.001
0.001	0	0.996	0.003	0	-21.037	0.001
0.001	0	0.997	0	0.002	-21.049	0.001
0.001	0	0.997	0.001	0.001	-21.047	0.001
0.001	0	0.997	0.002	0	-21.045	0.001
0.001	0	0.998	0	0.001	-21.054	0.001
0.001	0	0.998	0.001	0	-21.052	0
0.001	0	0.999	0	0	-21.06	0
0.001	0.001	0.995	0	0.003	-21.05	0.002
0.001	0.001	0.995	0.001	0.002	-21.048	0.002
0.001	0.001	0.995	0.002	0.001	-21.046	0.002
0.001	0.001	0.995	0.003	0	-21.044	0.002
0.001	0.001	0.996	0	0.002	-21.056	0.002
0.001	0.001	0.996	0.001	0.001	-21.054	0.002
0.001	0.001	0.996	0.002	0	-21.052	0.002
0.001	0.001	0.997	0	0.001	-21.061	0.002
0.001	0.001	0.997	0.001	0	-21.059	0.002
0.001	0.001	0.998	0	0	-21.067	0.001
0.001	0.002	0.995	0	0.002	-21.062	0.003
0.001	0.002	0.995	0.001	0.001	-21.06	0.003
0.001	0.002	0.995	0.002	0	-21.058	0.003
0.001	0.002	0.996	0	0.001	-21.068	0.003
0.001	0.002	0.996	0.001	0	-21.066	0.003
0.001	0.002	0.997	0	0	-21.073	0.002
0.001	0.003	0.995	0	0.001	-21.075	0.004
0.001	0.003	0.995	0.001	0	-21.073	0.004
0.001	0.003	0.996	0	0	-21.08	0.003
0.001	0.004	0.995	0	0	-21.087	0.004
0.002	0	0.995	0	0.003	-21.041	0.001
0.002	0	0.995	0.001	0.002	-21.039	0.001
0.002	0	0.995	0.002	0.001	-21.037	0.001
0.002	0	0.995	0.003	0	-21.035	0.001
0.002	0	0.996	0	0.002	-21.047	0.001
0.002	0	0.996	0.001	0.001	-21.045	0.001
0.002	0	0.996	0.002	0	-21.043	0.001
0.002	0	0.997	0	0.001	-21.052	0.001
0.002	0	0.997	0.001	0	-21.05	0.001
0.002	0	0.998	0	0	-21.058	0
0.002	0.001	0.995	0	0.002	-21.054	0.002
0.002	0.001	0.995	0.001	0.001	-21.052	0.002
0.002	0.001	0.995	0.002	0	-21.05	0.002
0.002	0.001	0.996	0	0.001	-21.059	0.002
0.002	0.001	0.996	0.001	0	-21.057	0.002
0.002	0.001	0.997	0	0	-21.065	0.002
0.002	0.002	0.995	0	0.001	-21.066	0.003
0.002	0.002	0.995	0.001	0	-21.064	0.003
0.002	0.002	0.996	0	0	-21.072	0.003
0.002	0.003	0.995	0	0	-21.078	0.004
0.003	0	0.995	0	0.002	-21.045	0.001
0.003	0	0.995	0.001	0.001	-21.043	0.001
0.003	0	0.995	0.002	0	-21.041	0.001
0.003	0	0.996	0	0.001	-21.05	0.001
0.003	0	0.996	0.001	0	-21.048	0.001
0.003	0	0.997	0	0	-21.056	0.001

Blend Composition					NBP (°F)	Average Glide (K)
<i>R-12</i>	<i>R-134a</i>	<i>R-1234yf</i>	<i>R-1234zeE</i>	<i>R-1243zf</i>		
0.003	0.001	0.995	0	0.001	-21.057	0.002
0.003	0.001	0.995	0.001	0	-21.055	0.002
0.003	0.001	0.996	0	0	-21.063	0.002
0.003	0.002	0.995	0	0	-21.07	0.003
0.004	0	0.995	0	0.001	-21.048	0.001
0.004	0	0.995	0.001	0	-21.046	0.001
0.004	0	0.996	0	0	-21.054	0.001
0.004	0.001	0.995	0	0	-21.061	0.002
0.005	0	0.995	0	0	-21.052	0.001

Table 4 (Continued)

Performance of HFO-1234yf Compositions in Auto A/C System

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
60.711	2664.586	4.316	-0.02994	0.023175
60.709	2664.607	4.316	-0.02915	0.023175
60.707	2664.625	4.316	-0.02848	0.023175
60.705	2664.642	4.316	-0.02784	0.023175
60.703	2664.659	4.316	-0.0272	0.023175
60.701	2664.676	4.316	-0.02656	0.023175
60.706	2664.746	4.316	-0.02394	0.023175
60.704	2664.766	4.316	-0.02319	0.023175
60.703	2664.785	4.316	-0.02247	0.023175
60.701	2664.802	4.316	-0.02184	0.023175
60.699	2664.819	4.315	-0.0212	0
60.702	2664.906	4.316	-0.01793	0.023175
60.7	2664.926	4.316	-0.01718	0.023175
60.698	2664.944	4.315	-0.01651	0
60.696	2664.961	4.315	-0.01587	0
60.698	2665.065	4.315	-0.01197	0
60.696	2665.084	4.315	-0.01126	0
60.694	2665.102	4.315	-0.01058	0
60.694	2665.225	4.315	-0.00597	0
60.692	2665.244	4.315	-0.00525	0
60.69	2665.384	4.315	0	0
60.714	2665.446	4.316	0.002326	0.023175
60.713	2665.466	4.316	0.003076	0.023175
60.711	2665.485	4.316	0.003789	0.023175
60.709	2665.502	4.316	0.004427	0.023175
60.707	2665.52	4.316	0.005102	0.023175
60.71	2665.607	4.316	0.008367	0.023175
60.708	2665.627	4.316	0.009117	0.023175
60.706	2665.645	4.316	0.009792	0.023175
60.705	2665.663	4.315	0.010468	0
60.706	2665.767	4.316	0.014369	0.023175
60.704	2665.787	4.315	0.01512	0
60.702	2665.805	4.315	0.015795	0
60.702	2665.928	4.315	0.02041	0
60.7	2665.947	4.315	0.021123	0
60.698	2666.088	4.315	0.026413	0
60.718	2666.306	4.316	0.034592	0.023175

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
60.716	2666.326	4.316	0.035342	0.023175
60.715	2666.345	4.316	0.036055	0.023175
60.713	2666.363	4.316	0.03673	0.023175
60.714	2666.467	4.316	0.040632	0.023175
60.712	2666.487	4.316	0.041382	0.023175
60.71	2666.506	4.315	0.042095	0
60.71	2666.629	4.315	0.04671	0
60.708	2666.649	4.315	0.04746	0
60.706	2666.79	4.315	0.05275	0
60.722	2667.166	4.316	0.066857	0.023175
60.72	2667.187	4.316	0.067645	0.023175
60.718	2667.206	4.316	0.068358	0.023175
60.718	2667.329	4.316	0.072973	0.023175
60.716	2667.349	4.315	0.073723	0
60.714	2667.492	4.315	0.079088	0
60.726	2668.028	4.316	0.099198	0.023175
60.724	2668.049	4.315	0.099986	0
60.722	2668.192	4.315	0.105351	0
60.73	2668.891	4.315	0.131576	0
60.714	2664.725	4.316	-0.02472	0.023175
60.712	2664.745	4.316	-0.02397	0.023175
60.71	2664.762	4.316	-0.02334	0.023175
60.708	2664.779	4.316	-0.0227	0.023175
60.706	2664.796	4.316	-0.02206	0.023175
60.709	2664.885	4.316	-0.01872	0.023175
60.707	2664.904	4.316	-0.01801	0.023175
60.706	2664.922	4.316	-0.01733	0.023175
60.704	2664.939	4.316	-0.0167	0.023175
60.705	2665.044	4.316	-0.01276	0.023175
60.703	2665.062	4.316	-0.01208	0.023175
60.701	2665.081	4.316	-0.01137	0.023175
60.701	2665.204	4.316	-0.00675	0.023175
60.699	2665.222	4.316	-0.00608	0.023175
60.697	2665.363	4.315	-0.00079	0
60.717	2665.587	4.316	0.007616	0.023175
60.716	2665.606	4.316	0.008329	0.023175
60.714	2665.624	4.316	0.009004	0.023175
60.712	2665.642	4.316	0.00968	0.023175
60.713	2665.748	4.316	0.013657	0.023175
60.711	2665.767	4.316	0.014369	0.023175
60.709	2665.785	4.316	0.015045	0.023175
60.709	2665.907	4.316	0.019622	0.023175
60.707	2665.929	4.316	0.020447	0.023175
60.705	2666.068	4.316	0.025662	0.023175
60.721	2666.449	4.316	0.039957	0.023175
60.719	2666.469	4.316	0.040707	0.023175
60.718	2666.488	4.316	0.04142	0.023175
60.717	2666.611	4.316	0.046035	0.023175
60.715	2666.63	4.316	0.046747	0.023175
60.713	2666.772	4.316	0.052075	0.023175
60.725	2667.312	4.316	0.072335	0.023175
60.723	2667.332	4.316	0.073085	0.023175
60.721	2667.475	4.316	0.07845	0.023175
60.729	2668.177	4.316	0.104788	0.023175
60.716	2664.863	4.316	-0.01955	0.023175

Discharge Temp (°C)	Capacity (kJ/m ³)	COP	Cap % Increase	COP % Increase
60.715	2664.882	4.316	-0.01883	0.023175
60.713	2664.899	4.316	-0.0182	0.023175
60.711	2664.917	4.316	-0.01752	0.023175
60.712	2665.023	4.316	-0.01354	0.023175
60.71	2665.041	4.316	-0.01287	0.023175
60.709	2665.059	4.316	-0.01219	0.023175
60.708	2665.182	4.316	-0.00758	0.023175
60.706	2665.2	4.316	-0.0069	0.023175
60.704	2665.342	4.316	-0.00158	0.023175
60.72	2665.727	4.316	0.012869	0.023175
60.719	2665.746	4.316	0.013582	0.023175
60.717	2665.764	4.316	0.014257	0.023175
60.716	2665.888	4.316	0.018909	0.023175
60.714	2665.907	4.316	0.019622	0.023175
60.712	2666.049	4.316	0.02495	0.023175
60.724	2666.592	4.316	0.045322	0.023175
60.722	2666.612	4.316	0.046072	0.023175
60.72	2666.754	4.316	0.0514	0.023175
60.728	2667.459	4.316	0.07785	0.023175
60.719	2665.001	4.316	-0.01437	0.023175
60.718	2665.019	4.316	-0.01369	0.023175
60.716	2665.037	4.316	-0.01302	0.023175
60.715	2665.16	4.316	-0.0084	0.023175
60.713	2665.179	4.316	-0.00769	0.023175
60.711	2665.32	4.316	-0.0024	0.023175
60.723	2665.868	4.316	0.018159	0.023175
60.722	2665.887	4.316	0.018872	0.023175
60.719	2666.029	4.316	0.024199	0.023175
60.727	2666.736	4.316	0.050724	0.023175
60.722	2665.139	4.317	-0.00919	0.04635
60.721	2665.157	4.316	-0.00852	0.023175
60.718	2665.299	4.316	-0.00319	0.023175
60.726	2666.009	4.316	0.023449	0.023175
60.725	2665.278	4.317	-0.00398	0.04635

Table 5
Performance of HFO-1234yf Compositions in Chiller System

Blend Composition				NBP (°F)	Average Glide (K)
<i>R-1234zeE</i>	<i>R-1234yf</i>	<i>R-1243zf</i>	<i>R-1225yeZ</i>		
0	0.995	0	0.005	-21.009	0.008
0	0.995	0.001	0.004	-21.014	0.007
0	0.995	0.002	0.003	-21.019	0.005
0	0.995	0.003	0.002	-21.024	0.004
0	0.995	0.004	0.001	-21.03	0.003
0	0.995	0.005	0	-21.035	0.001
0	0.996	0	0.004	-21.019	0.006
0	0.996	0.001	0.003	-21.025	0.005
0	0.996	0.002	0.002	-21.03	0.004
0	0.996	0.003	0.001	-21.035	0.002
0	0.996	0.004	0	-21.04	0.001
0	0.997	0	0.003	-21.03	0.005

Blend Composition				NBP (°F)	Average Glide (K)
<i>R-1234zeE</i>	<i>R-1234yf</i>	<i>R-1243zf</i>	<i>R-1225yeZ</i>		
0	0.997	0.001	0.002	-21.035	0.003
0	0.997	0.002	0.001	-21.04	0.002
0	0.997	0.003	0	-21.046	0.001
0	0.998	0	0.002	-21.041	0.003
0	0.998	0.001	0.001	-21.046	0.002
0	0.998	0.002	0	-21.051	0.001
0	0.999	0	0.001	-21.051	0.002
0	0.999	0.001	0	-21.056	0
0	1	0	0	-21.062	0
0.001	0.995	0	0.004	-21.012	0.007
0.001	0.995	0.001	0.003	-21.017	0.005
0.001	0.995	0.002	0.002	-21.022	0.004
0.001	0.995	0.003	0.001	-21.028	0.003
0.001	0.995	0.004	0	-21.033	0.001
0.001	0.996	0	0.003	-21.023	0.005
0.001	0.996	0.001	0.002	-21.028	0.004
0.001	0.996	0.002	0.001	-21.033	0.002
0.001	0.996	0.003	0	-21.038	0.001
0.001	0.997	0	0.002	-21.033	0.003
0.001	0.997	0.001	0.001	-21.038	0.002
0.001	0.997	0.002	0	-21.044	0.001
0.001	0.998	0	0.001	-21.044	0.002
0.001	0.998	0.001	0	-21.049	0.001
0.001	0.999	0	0	-21.054	0
0.002	0.995	0	0.003	-21.015	0.005
0.002	0.995	0.001	0.002	-21.02	0.004
0.002	0.995	0.002	0.001	-21.025	0.003
0.002	0.995	0.003	0	-21.031	0.001
0.002	0.996	0	0.002	-21.026	0.004
0.002	0.996	0.001	0.001	-21.031	0.002
0.002	0.996	0.002	0	-21.036	0.001
0.002	0.997	0	0.001	-21.036	0.002
0.002	0.997	0.001	0	-21.041	0.001
0.002	0.998	0	0	-21.047	0.001
0.003	0.995	0	0.002	-21.018	0.004
0.003	0.995	0.001	0.001	-21.023	0.003
0.003	0.995	0.002	0	-21.029	0.001
0.003	0.996	0	0.001	-21.029	0.002
0.003	0.996	0.001	0	-21.034	0.001
0.003	0.997	0	0	-21.039	0.001
0.004	0.995	0	0.001	-21.021	0.003
0.004	0.995	0.001	0	-21.026	0.001
0.004	0.996	0	0	-21.032	0.001
0.005	0.995	0	0	-21.024	0.001

Table 5 (Continued)

Performance of HFO-1234yf Compositions in Chiller System

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
55.736	2372.779	4.382	-0.0940206	0.0228258
55.738	2373.069	4.382	-0.0818101	0.0228258

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
55.741	2373.358	4.382	-0.0696418	0.0228258
55.743	2373.648	4.382	-0.0574313	0.0228258
55.746	2373.937	4.382	-0.0452629	0.0228258
55.748	2374.225	4.382	-0.0331367	0.0228258
55.734	2373.226	4.381	-0.0751996	0
55.736	2373.516	4.381	-0.0629892	0
55.739	2373.806	4.381	-0.0507787	0
55.741	2374.095	4.382	-0.0386103	0.0228258
55.744	2374.383	4.382	-0.0264841	0.0228258
55.732	2373.673	4.381	-0.0563787	0
55.734	2373.963	4.381	-0.0441682	0
55.737	2374.252	4.381	-0.0319998	0
55.739	2374.541	4.381	-0.0198315	0
55.73	2374.12	4.381	-0.0375577	0
55.732	2374.409	4.381	-0.0253893	0
55.735	2374.697	4.381	-0.0132631	0
55.728	2374.566	4.381	-0.0187789	0
55.73	2374.855	4.381	-0.0066105	0
55.726	2375.012	4.381	0	0
55.736	2373.076	4.381	-0.0815154	0
55.739	2373.366	4.382	-0.0693049	0.0228258
55.741	2373.656	4.382	-0.0570944	0.0228258
55.743	2373.946	4.382	-0.044884	0.0228258
55.746	2374.235	4.382	-0.0327156	0.0228258
55.734	2373.523	4.381	-0.0626944	0
55.737	2373.813	4.381	-0.050484	0
55.739	2374.103	4.381	-0.0382735	0
55.741	2374.392	4.381	-0.0261051	0
55.732	2373.97	4.381	-0.0438735	0
55.735	2374.26	4.381	-0.031663	0
55.737	2374.549	4.381	-0.0194946	0
55.73	2374.417	4.381	-0.0250525	0
55.733	2374.705	4.381	-0.0129263	0
55.728	2374.863	4.381	-0.0062737	0
55.736	2373.372	4.381	-0.0690523	0
55.739	2373.662	4.381	-0.0568418	0
55.741	2373.953	4.382	-0.0445892	0.0228258
55.744	2374.243	4.382	-0.0323788	0.0228258
55.734	2373.82	4.381	-0.0501892	0
55.737	2374.11	4.381	-0.0379788	0
55.739	2374.4	4.381	-0.0257683	0
55.733	2374.267	4.381	-0.0313683	0
55.735	2374.556	4.381	-0.0191999	0
55.731	2374.712	4.381	-0.0126315	0
55.737	2373.669	4.381	-0.0565471	0
55.739	2373.959	4.381	-0.0443366	0
55.742	2374.249	4.381	-0.0321262	0
55.735	2374.116	4.381	-0.0377261	0
55.737	2374.406	4.381	-0.0255157	0
55.733	2374.563	4.381	-0.0189052	0
55.737	2373.965	4.381	-0.044084	0
55.739	2374.254	4.381	-0.0319156	0
55.735	2374.412	4.381	-0.025263	0
55.737	2374.26	4.381	-0.031663	0

Table 6
Performance of HFO-1234yf Compositions in Med Temp Refrig System

Blend Composition				NBP (°F)	Average Glide (K)
<i>R-32</i>	<i>R-1234yf</i>	<i>R-1243zf</i>	<i>R-1225yeZ</i>		
0	0.995	0	0.005	-21.009	0.007
0	0.995	0.001	0.004	-21.014	0.006
0	0.995	0.002	0.003	-21.019	0.005
0	0.995	0.003	0.002	-21.024	0.004
0	0.995	0.004	0.001	-21.03	0.003
0	0.995	0.005	0	-21.035	0.001
0	0.996	0	0.004	-21.019	0.006
0	0.996	0.001	0.003	-21.025	0.005
0	0.996	0.002	0.002	-21.03	0.004
0	0.996	0.003	0.001	-21.035	0.002
0	0.996	0.004	0	-21.04	0.001
0	0.997	0	0.003	-21.03	0.004
0	0.997	0.001	0.002	-21.035	0.003
0	0.997	0.002	0.001	-21.04	0.002
0	0.997	0.003	0	-21.046	0.001
0	0.998	0	0.002	-21.041	0.003
0	0.998	0.001	0.001	-21.046	0.002
0	0.998	0.002	0	-21.051	0.001
0	0.999	0	0.001	-21.051	0.001
0	0.999	0.001	0	-21.056	0
0	1	0	0	-21.062	0
0.001	0.995	0	0.004	-21.419	0.092
0.001	0.995	0.001	0.003	-21.423	0.091
0.001	0.995	0.002	0.002	-21.428	0.09
0.001	0.995	0.003	0.001	-21.432	0.088
0.001	0.995	0.004	0	-21.437	0.087
0.001	0.996	0	0.003	-21.429	0.091
0.001	0.996	0.001	0.002	-21.434	0.089
0.001	0.996	0.002	0.001	-21.438	0.088
0.001	0.996	0.003	0	-21.443	0.087
0.001	0.997	0	0.002	-21.44	0.089
0.001	0.997	0.001	0.001	-21.444	0.088
0.001	0.997	0.002	0	-21.449	0.087
0.001	0.998	0	0.001	-21.45	0.088
0.001	0.998	0.001	0	-21.455	0.086
0.001	0.999	0	0	-21.461	0.086
0.002	0.995	0	0.003	-21.822	0.176
0.002	0.995	0.001	0.002	-21.826	0.174
0.002	0.995	0.002	0.001	-21.83	0.173
0.002	0.995	0.003	0	-21.834	0.172
0.002	0.996	0	0.002	-21.832	0.174
0.002	0.996	0.001	0.001	-21.836	0.173
0.002	0.996	0.002	0	-21.84	0.172
0.002	0.997	0	0.001	-21.843	0.173
0.002	0.997	0.001	0	-21.847	0.171
0.002	0.998	0	0	-21.853	0.171
0.003	0.995	0	0.002	-22.218	0.259
0.003	0.995	0.001	0.001	-22.222	0.257
0.003	0.995	0.002	0	-22.225	0.255
0.003	0.996	0	0.001	-22.229	0.257
0.003	0.996	0.001	0	-22.232	0.256

Blend Composition				NBP (°F)	Average Glide (K)
R-32	R-1234yf	R-1243zf	R-1225yeZ		
0.003	0.997	0	0	-22.239	0.256
0.004	0.995	0	0.001	-22.608	0.34
0.004	0.995	0.001	0	-22.611	0.339
0.004	0.996	0	0	-22.619	0.339
0.005	0.995	0	0	-22.992	0.421

Table 6 (Continued)

Performance of HFO-1234yf Compositions in Med Temp Refrig System

Discharge Temp (°C)	Capacity (kJ/m ³)	COP	Cap % Increase	COP % Increase
60.795	1454.529	2.719	-0.0978054	0.0367918
60.799	1454.749	2.719	-0.082695	0.0367918
60.803	1454.969	2.719	-0.0675846	0.0367918
60.807	1455.19	2.719	-0.0524055	0.0367918
60.811	1455.41	2.719	-0.0372952	0.0367918
60.815	1455.629	2.719	-0.0222535	0.0367918
60.793	1454.814	2.718	-0.0782305	0
60.797	1455.034	2.719	-0.0631202	0.0367918
60.8	1455.255	2.719	-0.0479411	0.0367918
60.804	1455.475	2.719	-0.0328307	0.0367918
60.808	1455.694	2.719	-0.017789	0.0367918
60.79	1455.099	2.718	-0.0586557	0
60.794	1455.319	2.718	-0.0435454	0
60.798	1455.539	2.718	-0.028435	0
60.802	1455.759	2.719	-0.0133246	0.0367918
60.787	1455.384	2.718	-0.0390809	0
60.791	1455.604	2.718	-0.0239706	0
60.795	1455.823	2.718	-0.0089289	0
60.785	1455.668	2.718	-0.0195748	0
60.789	1455.888	2.718	-0.0044644	0
60.782	1455.953	2.718	0	0
60.92	1459.42	2.718	0.2381258	0
60.924	1459.637	2.718	0.2530301	0
60.927	1459.854	2.718	0.2679345	0
60.931	1460.071	2.718	0.2828388	0
60.935	1460.288	2.718	0.2977431	0
60.917	1459.705	2.718	0.2577006	0
60.921	1459.922	2.718	0.272605	0
60.925	1460.139	2.718	0.2875093	0
60.929	1460.356	2.718	0.3024136	0
60.915	1459.99	2.718	0.2772754	0
60.918	1460.207	2.718	0.2921798	0
60.922	1460.424	2.718	0.3070841	0
60.912	1460.275	2.718	0.2968502	0
60.916	1460.492	2.718	0.3117546	0
60.909	1460.56	2.718	0.316425	0
61.044	1464.305	2.718	0.5736449	0
61.047	1464.519	2.718	0.5883432	0
61.051	1464.733	2.718	0.6030414	0
61.054	1464.947	2.718	0.6177397	0
61.041	1464.59	2.717	0.5932197	-0.0367918

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
61.045	1464.804	2.718	0.607918	0
61.048	1465.018	2.718	0.6226163	0
61.038	1464.876	2.717	0.6128632	-0.0367918
61.042	1465.09	2.717	0.6275615	-0.0367918
61.036	1465.161	2.717	0.632438	-0.0367918
61.166	1469.184	2.717	0.9087519	-0.0367918
61.17	1469.395	2.717	0.9232441	-0.0367918
61.173	1469.606	2.717	0.9377363	-0.0367918
61.164	1469.47	2.717	0.9283954	-0.0367918
61.167	1469.68	2.717	0.9428189	-0.0367918
61.161	1469.755	2.717	0.9479702	-0.0367918
61.288	1474.057	2.717	1.2434467	-0.0367918
61.291	1474.265	2.717	1.2577329	-0.0367918
61.285	1474.343	2.716	1.2630902	-0.0735835
61.409	1478.925	2.716	1.5777982	-0.0735835

Table 7

Performance of HFO-1234yf Compositions in Low Temp Refrig System

Blend Composition				NBP (°F)	Average Glide (K)
R-22	R-1234yf	R-1243zf	R-1225yeZ		
0	0.995	0	0.005	-21.009	0.007
0	0.995	0.001	0.004	-21.014	0.006
0	0.995	0.002	0.003	-21.019	0.005
0	0.995	0.003	0.002	-21.024	0.004
0	0.995	0.004	0.001	-21.03	0.002
0	0.995	0.005	0	-21.035	0.001
0	0.996	0	0.004	-21.019	0.006
0	0.996	0.001	0.003	-21.025	0.005
0	0.996	0.002	0.002	-21.03	0.003
0	0.996	0.003	0.001	-21.035	0.002
0	0.996	0.004	0	-21.04	0.001
0	0.997	0	0.003	-21.03	0.004
0	0.997	0.001	0.002	-21.035	0.003
0	0.997	0.002	0.001	-21.04	0.002
0	0.997	0.003	0	-21.046	0.001
0	0.998	0	0.002	-21.041	0.003
0	0.998	0.001	0.001	-21.046	0.002
0	0.998	0.002	0	-21.051	0.001
0	0.999	0	0.001	-21.051	0.001
0	0.999	0.001	0	-21.056	0
0	1	0	0	-21.062	0
0.001	0.995	0	0.004	-21.048	0.009
0.001	0.995	0.001	0.003	-21.053	0.008
0.001	0.995	0.002	0.002	-21.058	0.007
0.001	0.995	0.003	0.001	-21.063	0.005
0.001	0.995	0.004	0	-21.068	0.004
0.001	0.996	0	0.003	-21.058	0.008
0.001	0.996	0.001	0.002	-21.063	0.006
0.001	0.996	0.002	0.001	-21.069	0.005
0.001	0.996	0.003	0	-21.074	0.004
0.001	0.997	0	0.002	-21.069	0.006

Blend Composition				NBP (°F)	Average Glide (K)
R-22	R-1234yf	R-1243zf	R-1225yeZ		
0.001	0.997	0.001	0.001	-21.074	0.005
0.001	0.997	0.002	0	-21.079	0.004
0.001	0.998	0	0.001	-21.079	0.005
0.001	0.998	0.001	0	-21.085	0.003
0.001	0.999	0	0	-21.09	0.003
0.002	0.995	0	0.003	-21.086	0.011
0.002	0.995	0.001	0.002	-21.092	0.01
0.002	0.995	0.002	0.001	-21.097	0.008
0.002	0.995	0.003	0	-21.102	0.007
0.002	0.996	0	0.002	-21.097	0.009
0.002	0.996	0.001	0.001	-21.102	0.008
0.002	0.996	0.002	0	-21.107	0.007
0.002	0.997	0	0.001	-21.108	0.008
0.002	0.997	0.001	0	-21.113	0.007
0.002	0.998	0	0	-21.118	0.006
0.003	0.995	0	0.002	-21.125	0.012
0.003	0.995	0.001	0.001	-21.13	0.011
0.003	0.995	0.002	0	-21.135	0.01
0.003	0.996	0	0.001	-21.136	0.011
0.003	0.996	0.001	0	-21.141	0.01
0.003	0.997	0	0	-21.146	0.009
0.004	0.995	0	0.001	-21.164	0.014
0.004	0.995	0.001	0	-21.169	0.013
0.004	0.996	0	0	-21.174	0.013
0.005	0.995	0	0	-21.202	0.016

Table 7 (Continued)

Performance of HFO-1234yf Compositions in Low Temp Refrig System

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
65.819	493.571	1.475	-0.112926	0
65.826	493.676	1.475	-0.0916765	0
65.833	493.782	1.475	-0.0702246	0
65.84	493.888	1.475	-0.0487727	0
65.847	493.993	1.475	-0.0275232	0
65.854	494.098	1.475	-0.0062737	0
65.815	493.683	1.475	-0.0902598	0
65.822	493.788	1.475	-0.0690103	0
65.829	493.894	1.475	-0.0475584	0
65.836	493.999	1.475	-0.0263089	0
65.843	494.105	1.475	-0.004857	0
65.81	493.794	1.475	-0.0677961	0
65.817	493.9	1.475	-0.0463442	0
65.824	494.006	1.475	-0.0248923	0
65.831	494.111	1.475	-0.0036428	0
65.806	493.906	1.475	-0.0451299	0
65.813	494.012	1.475	-0.023678	0
65.82	494.117	1.475	-0.0024285	0
65.802	494.017	1.475	-0.0226661	0
65.809	494.123	1.475	-0.0012143	0
65.797	494.129	1.475	0	0
65.86	494.079	1.475	-0.0101188	0

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
65.867	494.184	1.475	0.0111307	0
65.874	494.29	1.476	0.0325826	0.0677966
65.881	494.395	1.476	0.0538321	0.0677966
65.888	494.5	1.476	0.0750816	0.0677966
65.856	494.191	1.475	0.0125473	0
65.863	494.296	1.475	0.0337968	0
65.87	494.401	1.475	0.0550464	0
65.877	494.507	1.475	0.0764982	0
65.851	494.302	1.475	0.0350111	0
65.858	494.408	1.475	0.056463	0
65.865	494.513	1.475	0.0777125	0
65.847	494.414	1.475	0.0576772	0
65.854	494.519	1.475	0.0789268	0
65.843	494.525	1.475	0.080141	0
65.901	494.587	1.476	0.0926883	0.0677966
65.908	494.692	1.476	0.1139379	0.0677966
65.915	494.797	1.476	0.1351874	0.0677966
65.922	494.902	1.476	0.1564369	0.0677966
65.897	494.699	1.476	0.1153545	0.0677966
65.904	494.804	1.476	0.136604	0.0677966
65.911	494.909	1.476	0.1578535	0.0677966
65.892	494.81	1.476	0.1378183	0.0677966
65.899	494.915	1.476	0.1590678	0.0677966
65.888	494.921	1.475	0.160282	0
65.942	495.095	1.476	0.1954955	0.0677966
65.949	495.2	1.476	0.216745	0.0677966
65.956	495.305	1.476	0.2379945	0.0677966
65.938	495.206	1.476	0.2179593	0.0677966
65.945	495.311	1.476	0.2392088	0.0677966
65.933	495.317	1.476	0.240423	0.0677966
65.983	495.603	1.476	0.2983027	0.0677966
65.99	495.707	1.476	0.3193498	0.0677966
65.979	495.714	1.476	0.3207664	0.0677966
66.024	496.11	1.476	0.4009075	0.0677966

[0482] Performance of the HFO-1234yf compositions containing one or more of the residual refrigerants is similar to the HFO-1234yf composition which does not contain these residual refrigerants. More particularly, differences in capacity among the compositions are *de minimis* and the energy efficiency (shown as COP) increases slightly for compositions containing the residual refrigerants. Thus, the data indicate that the presence of CFC-12, HFC-134a, HFC-32 and/or E-HFO-1234ze as residual refrigerants in HFO-1234yf compositions does not negatively impact performance of the compositions.

Impact on Distillation

[0483] Tables 8 and 9 show distillation requirements for obtaining an HFO-1234yf composition containing up to 0.5 wt.% residual HFC-134a or up to 0.5 wt.% residual

CFC-12, as compared with obtaining an HFO-1234yf composition containing little to no (e.g., 10 ppm) residual HFC-134a or CFC-12. The mass reflux ratio for distilling the latter is significantly higher than required for a composition that contains up to 0.5 wt.% of the residual refrigerants. Thus, the data show that removing essentially all of the residual refrigerants from the composition would require a significantly larger distillation column and higher energy input, and thus exhibit a much larger environmental footprint, as compared with allowing up to 0.5 wt.% of the residual refrigerants to remain in the composition.

Table 8

	10% 134a to 0.5% 134a			10% 134a to 10 ppm 134a		
Column Stages	150			150		
Feed Stage	75			75		
Mass Reflux Ratio	8.9			34.7		
Stream	Feed	Overhead	Bottom	Feed	Overhead	Bottom
Temp (deg C)	25.0	35.3	36.3	25.0	35.2	36.4
Pressure (psia)	139.7	134.7	134.7	139.7	134.7	134.7
1234yf wt fraction	0.90000	0.80500	0.99500	0.90000	0.80001	0.99999
134a wt fraction	0.10000	0.19500	0.00500	0.10000	0.19999	0.00001

	1% 134a to 0.5% 134a			1% 134a to 10 ppm 134a		
Column Stages	150			150		
Feed Stage	75			75		
Mass Reflux Ratio	2.4			16.2		
Stream	Feed	Overhead	Bottom	Feed	Overhead	Bottom
Temp (deg C)	25.0	36.3	36.4	25.0	36.3	36.4
Pressure (psia)	134.7	134.7	134.7	134.7	134.7	134.7
1234yf wt fraction	0.99900	0.98500	0.99500	0.99900	0.98001	0.99999
134a wt fraction	0.00100	0.01500	0.00500	0.00100	0.01999	0.00001

Table 9

	10% CFC-12 to 0.5% CFC-12			10% CFC-12 to 10 ppm CFC-12		
Column Stages	300			300		
Feed Stage	150			150		
Mass Reflux Ratio	28.9			551		
Stream	Feed	Overhead	Bottom	Feed	Overhead	Bottom
Temp (deg C)	25.0	36.4	36.9	25.0	36.4	36.9
Pressure (psia)	139.7	134.7	134.7	139.7	134.7	134.7
1234yf wt fraction	0.90000	0.99500	0.80500	0.90000	0.99999	0.80001
12 wt fraction	0.10000	0.00500	0.19500	0.10000	0.00001	0.19999

	1% CFC-12 to 0.5% CFC-12			1% CFC-12 to 10 ppm CFC-12		
Column Stages	300			300		
Feed Stage	150			150		
Mass Reflux Ratio	10.7			111		
Stream	Feed	Overhead	Bottom	Feed	Overhead	Bottom
Temp (deg C)	25.0	36.4	36.5	25.0	36.4	36.5
Pressure (psia)	134.7	134.7	134.7	134.7	134.7	134.7
1234yf wt fraction	0.99900	0.99500	0.98381	0.99900	0.99999	0.98001
12 wt fraction	0.00100	0.00500	0.01619	0.00100	0.00001	0.01999

Example 2

[0484] Tables 10-13 show the performance of some exemplary HFC-134a compositions containing residual refrigerant(s) (CFC-12, HFO-1234yf and/or HCFC-22) as compared with the same compositions without the residual refrigerant(s) in an automotive air conditioning system and medium temperature refrigeration system, as shown in Figs. 1-2. The data are based on the same conditions as set forth above in Example 1 for these types of systems.

Table 10
Performance of HFC-134a Compositions in Auto A/C System

Blend Composition			NBP (°F)	Average Glide (K)
R-12	R-134A	R-134		
0	0.995	0.005	-14.876	0.005
0	0.996	0.004	-14.885	0.004
0	0.997	0.003	-14.895	0.003
0	0.998	0.002	-14.904	0.002
0	0.999	0.001	-14.913	0.001
0	1	0	-14.922	0
0.001	0.995	0.004	-14.981	0.018
0.001	0.996	0.003	-14.99	0.017
0.001	0.997	0.002	-14.999	0.016
0.001	0.998	0.001	-15.008	0.015
0.001	0.999	0	-15.017	0.014
0.002	0.995	0.003	-15.085	0.031
0.002	0.996	0.002	-15.094	0.03
0.002	0.997	0.001	-15.103	0.029
0.002	0.998	0	-15.112	0.028
0.003	0.995	0.002	-15.188	0.044
0.003	0.996	0.001	-15.197	0.043
0.003	0.997	0	-15.206	0.042
0.004	0.995	0.001	-15.291	0.056
0.004	0.996	0	-15.3	0.055
0.005	0.995	0	-15.393	0.069

Table 10 (Continued)
Performance of HFC-134a Compositions in Auto A/C System

Discharge Temp (°C)	Capacity (kJ/m ³)	COP	Cap % Increase	COP % Increase
69.205	2844.291	4.475	-0.074901	0.0223514
69.204	2844.718	4.475	-0.0598997	0.0223514
69.204	2845.144	4.475	-0.0449336	0.0223514
69.204	2845.571	4.475	-0.0299323	0.0223514
69.203	2845.997	4.475	-0.0149662	0.0223514
69.203	2846.423	4.474	0	0
69.215	2846.383	4.474	-0.0014053	0
69.214	2846.809	4.474	0.0135609	0
69.214	2847.236	4.474	0.0285622	0
69.214	2847.662	4.474	0.0435283	0
69.213	2848.089	4.474	0.0585296	0
69.225	2848.472	4.474	0.0719851	0
69.224	2848.898	4.474	0.0869512	0
69.224	2849.325	4.474	0.1019525	0
69.223	2849.751	4.473	0.1169187	-0.0223514
69.234	2850.558	4.473	0.14527	-0.0223514
69.234	2850.984	4.473	0.1602362	-0.0223514
69.234	2851.41	4.473	0.1752024	-0.0223514
69.244	2852.641	4.473	0.2184496	-0.0223514
69.244	2853.067	4.473	0.2334158	-0.0223514
69.254	2854.721	4.472	0.2915238	-0.0447027

Table 11
Performance of HFC-134a Compositions in Auto A/C System

Blend Composition			NBP (°F)	Average Glide (K)
<i>R-1234YF</i>	<i>R-134A</i>	<i>R-134</i>		
0	0.995	0.005	-14.876	0.005
0	0.996	0.004	-14.885	0.004
0	0.997	0.003	-14.895	0.003
0	0.998	0.002	-14.904	0.002
0	0.999	0.001	-14.913	0.001
0	1	0	-14.922	0
0.001	0.995	0.004	-14.906	0.005
0.001	0.996	0.003	-14.915	0.004
0.001	0.997	0.002	-14.924	0.003
0.001	0.998	0.001	-14.933	0.002
0.001	0.999	0	-14.942	0.001
0.002	0.995	0.003	-14.935	0.005
0.002	0.996	0.002	-14.944	0.004
0.002	0.997	0.001	-14.953	0.003
0.002	0.998	0	-14.962	0.002
0.003	0.995	0.002	-14.964	0.006
0.003	0.996	0.001	-14.973	0.005
0.003	0.997	0	-14.982	0.004
0.004	0.995	0.001	-14.993	0.006
0.004	0.996	0	-15.002	0.005
0.005	0.995	0	-15.022	0.006

Table 11 (Continued)
Performance of HFC-134a Compositions in Auto A/C System

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
69.205	2844.291	4.475	-0.074901	0.0223514
69.204	2844.718	4.475	-0.0598997	0.0223514
69.204	2845.144	4.475	-0.0449336	0.0223514
69.204	2845.571	4.475	-0.0299323	0.0223514
69.203	2845.997	4.475	-0.0149662	0.0223514
69.203	2846.423	4.474	0	0
69.196	2845.016	4.475	-0.0494305	0.0223514
69.195	2845.443	4.475	-0.0344292	0.0223514
69.195	2845.869	4.474	-0.019463	0
69.194	2846.296	4.474	-0.0044617	0
69.194	2846.722	4.474	0.0105044	0
69.186	2845.74	4.474	-0.023995	0
69.186	2846.167	4.474	-0.0089937	0
69.186	2846.594	4.474	0.0060075	0
69.185	2847.02	4.474	0.0209737	0
69.177	2846.464	4.474	0.0014404	0
69.177	2846.891	4.474	0.0164417	0
69.176	2847.318	4.474	0.031443	0
69.168	2847.187	4.474	0.0268407	0
69.168	2847.614	4.473	0.041842	-0.0223514
69.159	2847.91	4.473	0.052241	-0.0223514

Table 12
Performance of HFC-134a Compositions in Auto A/C System

Blend Composition				NBP (°F)	Average Glide (K)
<i>R-12</i>	<i>R-1234yf</i>	<i>R-134a</i>	<i>R-134</i>		
0	0	0.995	0.005	-14.876	0.005
0	0	0.996	0.004	-14.885	0.004
0	0	0.997	0.003	-14.895	0.003
0	0	0.998	0.002	-14.904	0.002
0	0	0.999	0.001	-14.913	0.001
0	0	1	0	-14.922	0
0	0.001	0.995	0.004	-14.906	0.005
0	0.001	0.996	0.003	-14.915	0.004
0	0.001	0.997	0.002	-14.924	0.003
0	0.001	0.998	0.001	-14.933	0.002
0	0.001	0.999	0	-14.942	0.001
0	0.002	0.995	0.003	-14.935	0.005
0	0.002	0.996	0.002	-14.944	0.004
0	0.002	0.997	0.001	-14.953	0.003
0	0.002	0.998	0	-14.962	0.003
0	0.003	0.995	0.002	-14.964	0.006
0	0.003	0.996	0.001	-14.973	0.005
0	0.003	0.997	0	-14.982	0.004
0	0.004	0.995	0.001	-14.993	0.006
0	0.004	0.996	0	-15.002	0.005

Blend Composition				NBP (°F)	Average Glide (K)
<i>R-12</i>	<i>R-1234yf</i>	<i>R-134a</i>	<i>R-134</i>		
0	0.005	0.995	0	-15.022	0.006
0.001	0	0.995	0.004	-14.981	0.018
0.001	0	0.996	0.003	-14.99	0.017
0.001	0	0.997	0.002	-14.999	0.016
0.001	0	0.998	0.001	-15.008	0.015
0.001	0	0.999	0	-15.017	0.014
0.001	0.001	0.995	0.003	-15.01	0.018
0.001	0.001	0.996	0.002	-15.019	0.017
0.001	0.001	0.997	0.001	-15.028	0.016
0.001	0.001	0.998	0	-15.037	0.015
0.001	0.002	0.995	0.002	-15.039	0.018
0.001	0.002	0.996	0.001	-15.048	0.017
0.001	0.002	0.997	0	-15.057	0.016
0.001	0.003	0.995	0.001	-15.068	0.019
0.001	0.003	0.996	0	-15.077	0.018
0.001	0.004	0.995	0	-15.097	0.019
0.002	0	0.995	0.003	-15.085	0.031
0.002	0	0.996	0.002	-15.094	0.03
0.002	0	0.997	0.001	-15.103	0.029
0.002	0	0.998	0	-15.112	0.028
0.002	0.001	0.995	0.002	-15.113	0.031
0.002	0.001	0.996	0.001	-15.123	0.03
0.002	0.001	0.997	0	-15.132	0.029
0.002	0.002	0.995	0.001	-15.142	0.031
0.002	0.002	0.996	0	-15.151	0.03
0.002	0.003	0.995	0	-15.171	0.031
0.003	0	0.995	0.002	-15.188	0.044
0.003	0	0.996	0.001	-15.197	0.043
0.003	0	0.997	0	-15.206	0.042
0.003	0.001	0.995	0.001	-15.216	0.044
0.003	0.001	0.996	0	-15.226	0.043
0.003	0.002	0.995	0	-15.245	0.044
0.004	0	0.995	0.001	-15.291	0.056
0.004	0	0.996	0	-15.3	0.055
0.004	0.001	0.995	0	-15.319	0.056
0.005	0	0.995	0	-15.393	0.069

Table 12 (Continued)
Performance of HFC-134a Compositions in Auto A/C System

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
69.205	2844.212	4.475	-0.07487	0.022351
69.204	2844.638	4.475	-0.0599	0.022351
69.204	2845.064	4.475	-0.04493	0.022351
69.204	2845.49	4.475	-0.02997	0.022351
69.203	2845.917	4.474	-0.01497	0
69.203	2846.343	4.474	0	0
69.196	2844.936	4.475	-0.04943	0.022351
69.195	2845.363	4.474	-0.03443	0
69.195	2845.789	4.474	-0.01946	0
69.194	2846.215	4.474	-0.0045	0

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
69.194	2846.641	4.474	0.01047	0
69.186	2845.66	4.474	-0.024	0
69.186	2846.086	4.474	-0.00903	0
69.186	2846.513	4.474	0.005973	0
69.185	2846.939	4.474	0.020939	0
69.177	2846.383	4.474	0.001405	0
69.177	2846.809	4.474	0.016372	0
69.176	2847.236	4.474	0.031374	0
69.168	2847.105	4.473	0.026771	-0.02235
69.168	2847.532	4.473	0.041773	-0.02235
69.159	2847.827	4.473	0.052137	-0.02235
69.215	2846.302	4.474	-0.00144	0
69.214	2846.728	4.474	0.013526	0
69.214	2847.155	4.474	0.028528	0
69.214	2847.581	4.474	0.043494	0
69.213	2848.007	4.474	0.058461	0
69.206	2847.024	4.474	0.023925	0
69.205	2847.451	4.474	0.038927	0
69.205	2847.877	4.474	0.053894	0
69.204	2848.303	4.474	0.06886	0
69.196	2847.746	4.474	0.049291	0
69.196	2848.172	4.473	0.064258	-0.02235
69.195	2848.599	4.473	0.07926	-0.02235
69.187	2848.467	4.473	0.074622	-0.02235
69.187	2848.894	4.473	0.089624	-0.02235
69.178	2849.187	4.473	0.099918	-0.02235
69.225	2848.39	4.474	0.071917	0
69.224	2848.816	4.474	0.086883	0
69.224	2849.242	4.473	0.10185	-0.02235
69.223	2849.668	4.473	0.116817	-0.02235
69.215	2849.11	4.473	0.097212	-0.02235
69.215	2849.536	4.473	0.112179	-0.02235
69.215	2849.962	4.473	0.127146	-0.02235
69.206	2849.829	4.473	0.122473	-0.02235
69.206	2850.256	4.473	0.137475	-0.02235
69.197	2850.548	4.473	0.147733	-0.02235
69.234	2850.474	4.473	0.145134	-0.02235
69.234	2850.901	4.473	0.160135	-0.02235
69.234	2851.327	4.473	0.175102	-0.02235
69.225	2851.192	4.473	0.170359	-0.02235
69.225	2851.619	4.473	0.185361	-0.02235
69.216	2851.91	4.472	0.195584	-0.0447
69.244	2852.556	4.473	0.21828	-0.02235
69.244	2852.983	4.472	0.233282	-0.0447
69.235	2853.272	4.472	0.243435	-0.0447
69.254	2854.636	4.472	0.291356	-0.0447

Table 13
Performance of HFC-134a Compositions in Med Temp Refrig System

Blend Composition			NBP (°F)	Average Glide (K)	Discharge Temp (°C)
<i>R-22</i>	<i>R-134a</i>	<i>R-134</i>			
0	0.995	0.005	-14.876	0.005	73.655
0	0.996	0.004	-14.885	0.004	73.654
0	0.997	0.003	-14.895	0.003	73.653
0	0.998	0.002	-14.904	0.002	73.652
0	0.999	0.001	-14.913	0.001	73.651
0	1	0	-14.922	0	73.651
0.001	0.995	0.004	-14.945	0.013	73.679
0.001	0.996	0.003	-14.954	0.012	73.678
0.001	0.997	0.002	-14.963	0.011	73.677
0.001	0.998	0.001	-14.972	0.01	73.676
0.001	0.999	0	-14.982	0.009	73.675
0.002	0.995	0.003	-15.014	0.02	73.703
0.002	0.996	0.002	-15.023	0.019	73.702
0.002	0.997	0.001	-15.032	0.018	73.701
0.002	0.998	0	-15.041	0.017	73.7
0.003	0.995	0.002	-15.082	0.028	73.727
0.003	0.996	0.001	-15.091	0.027	73.726
0.003	0.997	0	-15.1	0.026	73.725
0.004	0.995	0.001	-15.15	0.035	73.751
0.004	0.996	0	-15.159	0.034	73.75
0.005	0.995	0	-15.218	0.043	73.775

Table 13 (Continued)
Performance of HFC-134a Compositions in Med Temp Refrig System

Capacity (kJ/m ³)	COP	Cap % Increase	COP % Increase
1536.069	2.864	-0.0837152	0.0349284
1536.326	2.864	-0.0669981	0.0349284
1536.584	2.864	-0.0502161	0.0349284
1536.841	2.864	-0.0334991	0.0349284
1537.099	2.864	-0.016717	0.0349284
1537.356	2.863	0	0
1537.397	2.864	0.0026669	0.0349284
1537.653	2.864	0.0193189	0.0349284
1537.911	2.864	0.0361009	0.0349284
1538.168	2.863	0.052818	0
1538.426	2.863	0.0696	0
1538.723	2.864	0.0889189	0.0349284
1538.98	2.863	0.1056359	0
1539.238	2.863	0.122418	0
1539.496	2.863	0.1392	0
1540.05	2.863	0.1752359	0
1540.308	2.863	0.192018	0
1540.566	2.863	0.2088	0
1541.378	2.863	0.261618	0
1541.636	2.863	0.2784001	0
1542.706	2.863	0.3480001	0

[0485] Performance of the HFC-134a compositions containing one or more of the residual refrigerants is similar to or better than the HFC-134a composition which does not contain these residual refrigerants. More particularly, differences in capacity among the compositions are *de minimis* and the energy efficiency (shown as COP) increases slightly for compositions containing the residual refrigerants. Thus, the data indicate that the presence of CFC-12, HFO-1234yf and/or HCFC-22 as residual refrigerants in HFC-134a compositions does not negatively impact performance of the compositions.

IMPACT ON DISTILLATION

[0486] Tables 14 and 15 show distillation requirements for obtaining an HFC-134a composition containing up to 0.5 wt.% residual CFC-12 or up to 0.5 wt.% residual HFO-1234yf, as compared with obtaining an HFC-134a composition containing little to no (e.g., 10 ppm) residual CFC-12 or HFO-1234yf. The mass reflux ratio for distilling the latter is significantly higher than required for a composition that contains up to 0.5 wt.% of the residual refrigerants. Thus, the data show that removing essentially all of the residual refrigerants from the composition would require a significantly larger distillation column and higher energy input, and thus exhibit a much larger environmental footprint, as compared with allowing up to 0.5 wt.% of the residual refrigerants to remain in the composition.

Table 14

	10% CFC-12 to 0.5% CFC-12			10% CFC-12 to 10 ppm CFC-12		
Column Stages	50			50		
Feed Stage	25			25		
Mass Reflux Ratio	4.5			10.4		
Stream	Feed	Overhead	Bottom	Feed	Overhead	Bottom
Temp (deg C)	25.0	30.2	36.5	25.0	30.1	36.7
Pressure (psia)	139.7	134.7	134.7	139.7	134.7	134.7
134a wt fraction	0.90000	0.61500	0.99500	0.90000	0.60003	0.99999
12 wt fraction	0.10000	0.38500	0.00500	0.10000	0.39997	0.00001

	1% CFC-12 to 0.5% CFC-12			1% CFC-12 to 10 ppm CFC-12		
Column Stages	50			50		
Feed Stage	25			25		
Mass Reflux Ratio	0.76			5.9		
Stream	Feed	Overhead	Bottom	Feed	Overhead	Bottom
Temp (deg C)	25.0	36.0	36.5	25.0	96.0	98.0
Pressure (psia)	134.7	134.7	134.7	134.7	134.7	134.7
134a wt fraction	0.99900	0.97500	0.99500	0.99900	0.96003	0.99999
12 wt fraction	0.00100	0.02500	0.00500	0.00100	0.03997	0.00001

Table 15

	10% 1234yf to 0.5% 1234yf			10% 1234yf to 10 ppm 1234yf		
Column Stages	80			80		
Feed Stage	40			40		
Mass Reflux Ratio	8.7			223		
Stream	Feed	Overhead	Bottom	Feed	Overhead	Bottom
Temp (deg C)	25	35.5	36.7	25	35.5	37
Pressure (psia)	139.7	134.7	134.7	139.7	134.7	134.7
134a wt fraction	0.90000	0.80500	0.99500	0.90000	0.80001	0.99999
1234yf wt fraction	0.10000	0.19500	0.00500	0.10000	0.19999	0.00001

	1% 1234yf to 0.5% 1234yf			1% 1234yf to 10 ppm 1234yf		
Column Stages	80			80		
Feed Stage	40			40		
Mass Reflux Ratio	1.8			12		
Stream	Feed	Overhead	Bottom	Feed	Overhead	Bottom
Temp (deg C)	25	36.6	36.7	25	35.5	37
Pressure (psia)	134.7	134.7	134.7	134.7	134.7	134.7
134a wt fraction	0.99900	0.98500	0.99500	0.99900	0.80001	0.99999
1234yf wt fraction	0.00100	0.01500	0.00500	0.00100	0.19999	0.00001

Example 3

[0487] Tables 16-21 show the performance of some exemplary E-HFO-1234ze compositions containing residual refrigerant(s) (CFC-12, HFC-134a, HFO-1234yf and/or HCFC-22) as compared with the same compositions without the residual refrigerant(s) in stationary chiller systems and in low and medium temperature refrigeration systems, as shown in Figs. 1-2. The data are based on the same conditions as set forth above in Example 1 for these types of systems.

Table 16
Performance of E-HFO-1234ze Compositions in Stationary Chiller System

Blend Composition				NBP (°F)	Average Glide (K)
<i>R-134A</i>	<i>R-1234zeE</i>	<i>R-1234yf</i>	<i>R-245cb</i>		
0	0.995	0	0.005	-2.167	0.001
0	0.995	0.001	0.004	-2.204	0.007
0	0.995	0.002	0.003	-2.241	0.013
0	0.995	0.003	0.002	-2.278	0.019
0	0.995	0.004	0.001	-2.315	0.026
0	0.995	0.005	0	-2.351	0.032
0	0.996	0	0.004	-2.162	0
0	0.996	0.001	0.003	-2.199	0.007
0	0.996	0.002	0.002	-2.235	0.013
0	0.996	0.003	0.001	-2.272	0.019
0	0.996	0.004	0	-2.309	0.026
0	0.997	0	0.003	-2.156	0
0	0.997	0.001	0.002	-2.193	0.007
0	0.997	0.002	0.001	-2.23	0.013
0	0.997	0.003	0	-2.267	0.019
0	0.998	0	0.002	-2.15	0
0	0.998	0.001	0.001	-2.187	0.007
0	0.998	0.002	0	-2.224	0.013
0	0.999	0	0.001	-2.145	0
0	0.999	0.001	0	-2.182	0.006
0	1	0	0	-2.139	0
0.001	0.995	0	0.004	-2.189	0.005
0.001	0.995	0.001	0.003	-2.226	0.011
0.001	0.995	0.002	0.002	-2.263	0.017
0.001	0.995	0.003	0.001	-2.299	0.024
0.001	0.995	0.004	0	-2.336	0.03
0.001	0.996	0	0.003	-2.183	0.005
0.001	0.996	0.001	0.002	-2.22	0.011
0.001	0.996	0.002	0.001	-2.257	0.017
0.001	0.996	0.003	0	-2.294	0.023
0.001	0.997	0	0.002	-2.178	0.005
0.001	0.997	0.001	0.001	-2.215	0.011
0.001	0.997	0.002	0	-2.251	0.017
0.001	0.998	0	0.001	-2.172	0.004
0.001	0.998	0.001	0	-2.209	0.011
0.001	0.999	0	0	-2.166	0.004
0.002	0.995	0	0.003	-2.211	0.009
0.002	0.995	0.001	0.002	-2.247	0.015
0.002	0.995	0.002	0.001	-2.284	0.021
0.002	0.995	0.003	0	-2.321	0.028
0.002	0.996	0	0.002	-2.205	0.009
0.002	0.996	0.001	0.001	-2.242	0.015
0.002	0.996	0.002	0	-2.279	0.021
0.002	0.997	0	0.001	-2.199	0.009
0.002	0.997	0.001	0	-2.236	0.015
0.002	0.998	0	0	-2.194	0.009
0.003	0.995	0	0.002	-2.232	0.013
0.003	0.995	0.001	0.001	-2.269	0.019
0.003	0.995	0.002	0	-2.306	0.026
0.003	0.996	0	0.001	-2.227	0.013
0.003	0.996	0.001	0	-2.263	0.019

Blend Composition				NBP (°F)	Average Glide (K)
<i>R-134A</i>	<i>R-1234zeE</i>	<i>R-1234yf</i>	<i>R-245cb</i>		
0.003	0.997	0	0	-2.221	0.013
0.004	0.995	0	0.001	-2.254	0.017
0.004	0.995	0.001	0	-2.291	0.024
0.004	0.996	0	0	-2.248	0.017
0.005	0.995	0	0	-2.275	0.021

Table 16 (Continued)
Performance of E-HFO-1234ze Compositions in Stationary Chiller System

Discharge Temp (°C)	Capacity (kJ/m ³)	COP	Cap % Increase	COP % Increase
58.46	1875.08	4.542	0.00064	-0.0220119
58.469	1875.89	4.542	0.0438384	-0.0220119
58.478	1876.7	4.542	0.0870368	-0.0220119
58.487	1877.51	4.542	0.1302353	-0.0220119
58.496	1878.319	4.542	0.1733804	-0.0220119
58.505	1879.129	4.542	0.2165788	-0.0220119
58.468	1875.079	4.542	0.0005866	-0.0220119
58.477	1875.889	4.542	0.0437851	-0.0220119
58.486	1876.699	4.542	0.0869835	-0.0220119
58.495	1877.508	4.542	0.1301286	-0.0220119
58.504	1878.318	4.542	0.173327	-0.0220119
58.476	1875.077	4.542	0.00048	-0.0220119
58.485	1875.887	4.542	0.0436784	-0.0220119
58.494	1876.697	4.542	0.0868768	-0.0220119
58.503	1877.506	4.542	0.130022	-0.0220119
58.484	1875.075	4.542	0.0003733	-0.0220119
58.493	1875.884	4.542	0.0435184	-0.0220119
58.502	1876.694	4.542	0.0867169	-0.0220119
58.492	1875.072	4.543	0.0002133	0
58.501	1875.881	4.542	0.0433584	-0.0220119
58.5	1875.068	4.543	0	0
58.476	1875.902	4.542	0.0444784	-0.0220119
58.485	1876.712	4.542	0.0876768	-0.0220119
58.494	1877.522	4.542	0.1308753	-0.0220119
58.503	1878.332	4.542	0.1740737	-0.0220119
58.512	1879.142	4.542	0.2172721	-0.0220119
58.484	1875.9	4.542	0.0443717	-0.0220119
58.493	1876.71	4.542	0.0875702	-0.0220119
58.502	1877.521	4.542	0.1308219	-0.0220119
58.511	1878.331	4.542	0.1740204	-0.0220119
58.492	1875.898	4.542	0.0442651	-0.0220119
58.501	1876.708	4.542	0.0874635	-0.0220119
58.51	1877.519	4.542	0.1307153	-0.0220119
58.501	1875.896	4.543	0.0441584	0
58.51	1876.706	4.542	0.0873568	-0.0220119
58.509	1875.893	4.543	0.0439984	0
58.493	1876.723	4.542	0.0882635	-0.0220119
58.502	1877.533	4.542	0.1314619	-0.0220119
58.511	1878.344	4.542	0.1747137	-0.0220119
58.52	1879.155	4.542	0.2179654	-0.0220119
58.501	1876.721	4.542	0.0881568	-0.0220119

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
58.51	1877.532	4.542	0.1314086	-0.0220119
58.519	1878.342	4.542	0.174607	-0.0220119
58.509	1876.719	4.542	0.0880501	-0.0220119
58.518	1877.53	4.542	0.1313019	-0.0220119
58.517	1876.717	4.543	0.0879435	0
58.509	1877.544	4.542	0.1320485	-0.0220119
58.518	1878.355	4.542	0.1753003	-0.0220119
58.527	1879.166	4.542	0.2185521	-0.0220119
58.517	1877.542	4.542	0.1319419	-0.0220119
58.526	1878.353	4.542	0.1751936	-0.0220119
58.525	1877.54	4.543	0.1318352	0
58.526	1878.365	4.542	0.1758336	-0.0220119
58.535	1879.177	4.542	0.2191387	-0.0220119
58.534	1878.364	4.542	0.1757803	-0.0220119
58.542	1879.186	4.542	0.2196187	-0.0220119

Table 17

Performance of E-HFO-1234ze Compositions in Med Temp Refrig System

Blend Composition				NBP (°F)	Average Glide (K)
R-12	R-1234zeE	R-1234yf	R-245cb		
0	0.995	0	0.005	-2.167	0.001
0	0.995	0.001	0.004	-2.204	0.006
0	0.995	0.002	0.003	-2.241	0.012
0	0.995	0.003	0.002	-2.278	0.018
0	0.995	0.004	0.001	-2.315	0.024
0	0.995	0.005	0	-2.351	0.03
0	0.996	0	0.004	-2.162	0.001
0	0.996	0.001	0.003	-2.199	0.006
0	0.996	0.002	0.002	-2.235	0.012
0	0.996	0.003	0.001	-2.272	0.018
0	0.996	0.004	0	-2.309	0.024
0	0.997	0	0.003	-2.156	0
0	0.997	0.001	0.002	-2.193	0.006
0	0.997	0.002	0.001	-2.23	0.012
0	0.997	0.003	0	-2.267	0.018
0	0.998	0	0.002	-2.15	0
0	0.998	0.001	0.001	-2.187	0.006
0	0.998	0.002	0	-2.224	0.012
0	0.999	0	0.001	-2.145	0
0	0.999	0.001	0	-2.182	0.006
0	1	0	0	-2.139	0
0.001	0.995	0	0.004	-2.18	0.002
0.001	0.995	0.001	0.003	-2.217	0.008
0.001	0.995	0.002	0.002	-2.254	0.013
0.001	0.995	0.003	0.001	-2.291	0.019
0.001	0.995	0.004	0	-2.327	0.025
0.001	0.996	0	0.003	-2.175	0.002
0.001	0.996	0.001	0.002	-2.212	0.007
0.001	0.996	0.002	0.001	-2.248	0.013
0.001	0.996	0.003	0	-2.285	0.019
0.001	0.997	0	0.002	-2.169	0.001

Blend Composition				NBP (°F)	Average Glide (K)
R-12	R-1234zeE	R-1234yf	R-245cb		
0.001	0.997	0.001	0.001	-2.206	0.007
0.001	0.997	0.002	0	-2.243	0.013
0.001	0.998	0	0.001	-2.163	0.001
0.001	0.998	0.001	0	-2.2	0.007
0.001	0.999	0	0	-2.158	0.001
0.002	0.995	0	0.003	-2.193	0.003
0.002	0.995	0.001	0.002	-2.23	0.009
0.002	0.995	0.002	0.001	-2.267	0.014
0.002	0.995	0.003	0	-2.304	0.02
0.002	0.996	0	0.002	-2.188	0.003
0.002	0.996	0.001	0.001	-2.225	0.008
0.002	0.996	0.002	0	-2.261	0.014
0.002	0.997	0	0.001	-2.182	0.003
0.002	0.997	0.001	0	-2.219	0.008
0.002	0.998	0	0	-2.176	0.002
0.003	0.995	0	0.002	-2.206	0.004
0.003	0.995	0.001	0.001	-2.243	0.01
0.003	0.995	0.002	0	-2.28	0.015
0.003	0.996	0	0.001	-2.201	0.004
0.003	0.996	0.001	0	-2.238	0.01
0.003	0.997	0	0	-2.195	0.004
0.004	0.995	0	0.001	-2.219	0.005
0.004	0.995	0.001	0	-2.256	0.011
0.004	0.996	0	0	-2.214	0.005
0.005	0.995	0	0	-2.232	0.006

Table 17 (Continued)

Performance of E-HFO-1234ze Compositions in Med Temp Refrig System

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
64.849	1132.843	2.856	-0.0049431	-0.0350018
64.86	1133.345	2.856	0.039368	-0.0350018
64.872	1133.848	2.856	0.0837674	-0.0350018
64.883	1134.35	2.856	0.1280785	-0.0350018
64.894	1134.852	2.856	0.1723896	-0.0350018
64.905	1135.354	2.856	0.2167007	-0.0350018
64.861	1132.855	2.856	-0.0038838	-0.0350018
64.872	1133.357	2.856	0.0404273	-0.0350018
64.883	1133.86	2.856	0.0848266	-0.0350018
64.895	1134.362	2.856	0.1291377	-0.0350018
64.906	1134.864	2.856	0.1734488	-0.0350018
64.873	1132.867	2.857	-0.0028246	0
64.884	1133.369	2.857	0.0414865	0
64.895	1133.872	2.856	0.0858859	-0.0350018
64.906	1134.374	2.856	0.130197	-0.0350018
64.884	1132.878	2.857	-0.0018537	0
64.895	1133.38	2.857	0.0424574	0
64.907	1133.883	2.857	0.0868568	0
64.896	1132.888	2.857	-0.000971	0
64.907	1133.391	2.857	0.0434284	0
64.907	1132.899	2.857	0	0

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
64.871	1133.154	2.857	0.0225086	0
64.882	1133.657	2.856	0.066908	-0.0350018
64.894	1134.16	2.856	0.1113074	-0.0350018
64.905	1134.662	2.856	0.1556185	-0.0350018
64.916	1135.164	2.856	0.1999296	-0.0350018
64.883	1133.166	2.857	0.0235679	0
64.894	1133.669	2.857	0.0679672	0
64.905	1134.171	2.857	0.1122783	0
64.916	1134.674	2.856	0.1566777	-0.0350018
64.894	1133.177	2.857	0.0245388	0
64.906	1133.68	2.857	0.0689382	0
64.917	1134.183	2.857	0.1133376	0
64.906	1133.189	2.857	0.025598	0
64.917	1133.691	2.857	0.0699091	0
64.918	1133.199	2.857	0.0264807	0
64.893	1133.466	2.857	0.0500486	0
64.904	1133.969	2.857	0.094448	0
64.915	1134.471	2.857	0.1387591	0
64.927	1134.973	2.857	0.1830702	0
64.905	1133.478	2.857	0.0511078	0
64.916	1133.98	2.857	0.0954189	0
64.927	1134.483	2.857	0.1398183	0
64.916	1133.489	2.857	0.0520788	0
64.928	1133.991	2.857	0.0963899	0
64.928	1133.5	2.857	0.0530497	0
64.915	1133.778	2.857	0.0775886	0
64.926	1134.28	2.857	0.1218997	0
64.937	1134.782	2.857	0.1662108	0
64.927	1133.789	2.857	0.0785595	0
64.938	1134.291	2.857	0.1228706	0
64.938	1133.8	2.857	0.0795305	0
64.937	1134.089	2.857	0.1050403	0
64.948	1134.591	2.857	0.1493514	0
64.948	1134.1	2.857	0.1060112	0
64.959	1134.401	2.857	0.1325802	0

Table 18

Performance of E-HFO-1234ze Compositions in Med Temp Refrig System

Blend Composition				NBP (°F)	Average Glide (K)
<i>R-134a</i>	<i>R-1234zeE</i>	<i>R-1234yf</i>	<i>R-245cb</i>		
0	0.995	0	0.005	-2.167	0.001
0	0.995	0.001	0.004	-2.204	0.006
0	0.995	0.002	0.003	-2.241	0.012
0	0.995	0.003	0.002	-2.278	0.018
0	0.995	0.004	0.001	-2.315	0.024
0	0.995	0.005	0	-2.351	0.03
0	0.996	0	0.004	-2.162	0.001
0	0.996	0.001	0.003	-2.199	0.006
0	0.996	0.002	0.002	-2.235	0.012
0	0.996	0.003	0.001	-2.272	0.018
0	0.996	0.004	0	-2.309	0.024

Blend Composition				NBP (°F)	Average Glide (K)
<i>R-134a</i>	<i>R-1234zeE</i>	<i>R-1234yf</i>	<i>R-245cb</i>		
0	0.997	0	0.003	-2.156	0
0	0.997	0.001	0.002	-2.193	0.006
0	0.997	0.002	0.001	-2.23	0.012
0	0.997	0.003	0	-2.267	0.018
0	0.998	0	0.002	-2.15	0
0	0.998	0.001	0.001	-2.187	0.006
0	0.998	0.002	0	-2.224	0.012
0	0.999	0	0.001	-2.145	0
0	0.999	0.001	0	-2.182	0.006
0	1	0	0	-2.139	0
0.001	0.995	0	0.004	-2.189	0.004
0.001	0.995	0.001	0.003	-2.226	0.01
0.001	0.995	0.002	0.002	-2.263	0.016
0.001	0.995	0.003	0.001	-2.299	0.022
0.001	0.995	0.004	0	-2.336	0.028
0.001	0.996	0	0.003	-2.183	0.004
0.001	0.996	0.001	0.002	-2.22	0.01
0.001	0.996	0.002	0.001	-2.257	0.016
0.001	0.996	0.003	0	-2.294	0.022
0.001	0.997	0	0.002	-2.178	0.004
0.001	0.997	0.001	0.001	-2.215	0.01
0.001	0.997	0.002	0	-2.251	0.016
0.001	0.998	0	0.001	-2.172	0.004
0.001	0.998	0.001	0	-2.209	0.01
0.001	0.999	0	0	-2.166	0.004
0.002	0.995	0	0.003	-2.211	0.008
0.002	0.995	0.001	0.002	-2.247	0.014
0.002	0.995	0.002	0.001	-2.284	0.02
0.002	0.995	0.003	0	-2.321	0.026
0.002	0.996	0	0.002	-2.205	0.008
0.002	0.996	0.001	0.001	-2.242	0.014
0.002	0.996	0.002	0	-2.279	0.02
0.002	0.997	0	0.001	-2.199	0.008
0.002	0.997	0.001	0	-2.236	0.014
0.002	0.998	0	0	-2.194	0.008
0.003	0.995	0	0.002	-2.232	0.012
0.003	0.995	0.001	0.001	-2.269	0.018
0.003	0.995	0.002	0	-2.306	0.024
0.003	0.996	0	0.001	-2.227	0.012
0.003	0.996	0.001	0	-2.263	0.018
0.003	0.997	0	0	-2.221	0.012
0.004	0.995	0	0.001	-2.254	0.016
0.004	0.995	0.001	0	-2.291	0.022
0.004	0.996	0	0	-2.248	0.016
0.005	0.995	0	0	-2.275	0.02

Table 18 (Continued)
Performance of E-HFO-1234ze Compositions in Med Temp Refrig System

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
64.849	1132.843	2.856	-0.0049431	-0.0350018
64.86	1133.345	2.856	0.039368	-0.0350018
64.872	1133.848	2.856	0.0837674	-0.0350018
64.883	1134.35	2.856	0.1280785	-0.0350018
64.894	1134.852	2.856	0.1723896	-0.0350018
64.905	1135.354	2.856	0.2167007	-0.0350018
64.861	1132.855	2.856	-0.0038838	-0.0350018
64.872	1133.357	2.856	0.0404273	-0.0350018
64.883	1133.86	2.856	0.0848266	-0.0350018
64.895	1134.362	2.856	0.1291377	-0.0350018
64.906	1134.864	2.856	0.1734488	-0.0350018
64.873	1132.867	2.857	-0.0028246	0
64.884	1133.369	2.857	0.0414865	0
64.895	1133.872	2.856	0.0858859	-0.0350018
64.906	1134.374	2.856	0.130197	-0.0350018
64.884	1132.878	2.857	-0.0018537	0
64.895	1133.38	2.857	0.0424574	0
64.907	1133.883	2.857	0.0868568	0
64.896	1132.888	2.857	-0.000971	0
64.907	1133.391	2.857	0.0434284	0
64.907	1132.899	2.857	0	0
64.872	1133.369	2.856	0.0414865	-0.0350018
64.883	1133.872	2.856	0.0858859	-0.0350018
64.894	1134.374	2.856	0.130197	-0.0350018
64.905	1134.877	2.856	0.1745963	-0.0350018
64.917	1135.379	2.856	0.2189074	-0.0350018
64.883	1133.381	2.857	0.0425457	0
64.895	1133.883	2.857	0.0868568	0
64.906	1134.386	2.856	0.1312562	-0.0350018
64.917	1134.888	2.856	0.1755673	-0.0350018
64.895	1133.392	2.857	0.0435167	0
64.906	1133.895	2.857	0.087916	0
64.918	1134.398	2.857	0.1323154	0
64.907	1133.403	2.857	0.0444876	0
64.918	1133.906	2.857	0.088887	0
64.918	1133.414	2.857	0.0454586	0
64.894	1133.895	2.857	0.087916	0
64.906	1134.397	2.856	0.1322271	-0.0350018
64.917	1134.9	2.856	0.1766265	-0.0350018
64.928	1135.403	2.856	0.2210259	-0.0350018
64.906	1133.906	2.857	0.088887	0
64.917	1134.409	2.857	0.1332864	0
64.928	1134.912	2.857	0.1776857	0
64.918	1133.918	2.857	0.0899462	0
64.929	1134.421	2.857	0.1343456	0
64.929	1133.929	2.857	0.0909172	0
64.917	1134.42	2.857	0.1342573	0
64.928	1134.923	2.857	0.1786567	0
64.939	1135.426	2.857	0.2230561	0
64.928	1134.432	2.857	0.1353166	0
64.94	1134.935	2.857	0.1797159	0

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
64.94	1134.444	2.857	0.1363758	0
64.939	1134.946	2.857	0.1806869	0
64.951	1135.449	2.857	0.2250863	0
64.951	1134.958	2.857	0.1817461	0
64.962	1135.471	2.857	0.2270282	0

Table 19

Performance of E-HFO-1234ze Compositions in Med Temp Refrig System

Blend Composition					NBP (°F)	Average Glide (K)
<i>R-12</i>	<i>R-134a</i>	<i>R-1234zeE</i>	<i>R-1234yf</i>	<i>R-245cb</i>		
0	0	0.995	0	0.005	-2.167	0.001
0	0	0.995	0.001	0.004	-2.204	0.006
0	0	0.995	0.002	0.003	-2.241	0.012
0	0	0.995	0.003	0.002	-2.278	0.018
0	0	0.995	0.004	0.001	-2.315	0.024
0	0	0.995	0.005	0	-2.351	0.03
0	0	0.996	0	0.004	-2.162	0.001
0	0	0.996	0.001	0.003	-2.199	0.006
0	0	0.996	0.002	0.002	-2.235	0.012
0	0	0.996	0.003	0.001	-2.272	0.018
0	0	0.996	0.004	0	-2.309	0.024
0	0	0.997	0	0.003	-2.156	0
0	0	0.997	0.001	0.002	-2.193	0.006
0	0	0.997	0.002	0.001	-2.23	0.012
0	0	0.997	0.003	0	-2.267	0.018
0	0	0.998	0	0.002	-2.15	0
0	0	0.998	0.001	0.001	-2.187	0.006
0	0	0.998	0.002	0	-2.224	0.012
0	0	0.999	0	0.001	-2.145	0
0	0	0.999	0.001	0	-2.182	0.006
0	0	1	0	0	-2.139	0
0	0.001	0.995	0	0.004	-2.189	0.004
0	0.001	0.995	0.001	0.003	-2.226	0.01
0	0.001	0.995	0.002	0.002	-2.263	0.016
0	0.001	0.995	0.003	0.001	-2.299	0.022
0	0.001	0.995	0.004	0	-2.336	0.028
0	0.001	0.996	0	0.003	-2.183	0.004
0	0.001	0.996	0.001	0.002	-2.22	0.01
0	0.001	0.996	0.002	0.001	-2.257	0.016
0	0.001	0.996	0.003	0	-2.294	0.022
0	0.001	0.997	0	0.002	-2.178	0.004
0	0.001	0.997	0.001	0.001	-2.215	0.01
0	0.001	0.997	0.002	0	-2.251	0.016
0	0.001	0.998	0	0.001	-2.172	0.004
0	0.001	0.998	0.001	0	-2.209	0.01
0	0.001	0.999	0	0	-2.166	0.004
0	0.002	0.995	0	0.003	-2.211	0.008
0	0.002	0.995	0.001	0.002	-2.247	0.014
0	0.002	0.995	0.002	0.001	-2.284	0.02
0	0.002	0.995	0.003	0	-2.321	0.026

Blend Composition					NBP (°F)	Average Glide (K)
<i>R-12</i>	<i>R-134a</i>	<i>R-1234zeE</i>	<i>R-1234yf</i>	<i>R-245cb</i>		
0	0.002	0.996	0	0.002	-2.205	0.008
0	0.002	0.996	0.001	0.001	-2.242	0.014
0	0.002	0.996	0.002	0	-2.279	0.02
0	0.002	0.997	0	0.001	-2.199	0.008
0	0.002	0.997	0.001	0	-2.236	0.014
0	0.002	0.998	0	0	-2.194	0.008
0	0.003	0.995	0	0.002	-2.232	0.012
0	0.003	0.995	0.001	0.001	-2.269	0.018
0	0.003	0.995	0.002	0	-2.306	0.024
0	0.003	0.996	0	0.001	-2.227	0.012
0	0.003	0.996	0.001	0	-2.263	0.018
0	0.003	0.997	0	0	-2.221	0.012
0	0.004	0.995	0	0.001	-2.254	0.016
0	0.004	0.995	0.001	0	-2.291	0.022
0	0.004	0.996	0	0	-2.248	0.016
0	0.005	0.995	0	0	-2.275	0.02
0.001	0	0.995	0	0.004	-2.18	0.002
0.001	0	0.995	0.001	0.003	-2.217	0.008
0.001	0	0.995	0.002	0.002	-2.254	0.013
0.001	0	0.995	0.003	0.001	-2.291	0.019
0.001	0	0.995	0.004	0	-2.327	0.025
0.001	0	0.996	0	0.003	-2.175	0.002
0.001	0	0.996	0.001	0.002	-2.212	0.007
0.001	0	0.996	0.002	0.001	-2.248	0.013
0.001	0	0.996	0.003	0	-2.285	0.019
0.001	0	0.997	0	0.002	-2.169	0.001
0.001	0	0.997	0.001	0.001	-2.206	0.007
0.001	0	0.997	0.002	0	-2.243	0.013
0.001	0	0.998	0	0.001	-2.163	0.001
0.001	0	0.998	0.001	0	-2.2	0.007
0.001	0	0.999	0	0	-2.158	0.001
0.001	0.001	0.995	0	0.003	-2.202	0.006
0.001	0.001	0.995	0.001	0.002	-2.239	0.011
0.001	0.001	0.995	0.002	0.001	-2.276	0.017
0.001	0.001	0.995	0.003	0	-2.313	0.023
0.001	0.001	0.996	0	0.002	-2.197	0.005
0.001	0.001	0.996	0.001	0.001	-2.233	0.011
0.001	0.001	0.996	0.002	0	-2.27	0.017
0.001	0.001	0.997	0	0.001	-2.191	0.005
0.001	0.001	0.997	0.001	0	-2.228	0.011
0.001	0.001	0.998	0	0	-2.185	0.005
0.001	0.002	0.995	0	0.002	-2.224	0.009
0.001	0.002	0.995	0.001	0.001	-2.261	0.015
0.001	0.002	0.995	0.002	0	-2.297	0.021
0.001	0.002	0.996	0	0.001	-2.218	0.009
0.001	0.002	0.996	0.001	0	-2.255	0.015
0.001	0.002	0.997	0	0	-2.213	0.009
0.001	0.003	0.995	0	0.001	-2.246	0.013
0.001	0.003	0.995	0.001	0	-2.282	0.019
0.001	0.003	0.996	0	0	-2.24	0.013
0.001	0.004	0.995	0	0	-2.267	0.017
0.002	0	0.995	0	0.003	-2.193	0.003
0.002	0	0.995	0.001	0.002	-2.23	0.009

Blend Composition					NBP (°F)	Average Glide (K)
<i>R-12</i>	<i>R-134a</i>	<i>R-1234zeE</i>	<i>R-1234yf</i>	<i>R-245cb</i>		
0.002	0	0.995	0.002	0.001	-2.267	0.014
0.002	0	0.995	0.003	0	-2.304	0.02
0.002	0	0.996	0	0.002	-2.188	0.003
0.002	0	0.996	0.001	0.001	-2.225	0.008
0.002	0	0.996	0.002	0	-2.261	0.014
0.002	0	0.997	0	0.001	-2.182	0.003
0.002	0	0.997	0.001	0	-2.219	0.008
0.002	0	0.998	0	0	-2.176	0.002
0.002	0.001	0.995	0	0.002	-2.215	0.007
0.002	0.001	0.995	0.001	0.001	-2.252	0.013
0.002	0.001	0.995	0.002	0	-2.289	0.018
0.002	0.001	0.996	0	0.001	-2.21	0.007
0.002	0.001	0.996	0.001	0	-2.246	0.012
0.002	0.001	0.997	0	0	-2.204	0.006
0.002	0.002	0.995	0	0.001	-2.237	0.011
0.002	0.002	0.995	0.001	0	-2.274	0.016
0.002	0.002	0.996	0	0	-2.231	0.01
0.002	0.003	0.995	0	0	-2.259	0.014
0.003	0	0.995	0	0.002	-2.206	0.004
0.003	0	0.995	0.001	0.001	-2.243	0.01
0.003	0	0.995	0.002	0	-2.28	0.015
0.003	0	0.996	0	0.001	-2.201	0.004
0.003	0	0.996	0.001	0	-2.238	0.01
0.003	0	0.997	0	0	-2.195	0.004
0.003	0.001	0.995	0	0.001	-2.228	0.008
0.003	0.001	0.995	0.001	0	-2.265	0.014
0.003	0.001	0.996	0	0	-2.223	0.008
0.003	0.002	0.995	0	0	-2.25	0.012
0.004	0	0.995	0	0.001	-2.219	0.005
0.004	0	0.995	0.001	0	-2.256	0.011
0.004	0	0.996	0	0	-2.214	0.005
0.004	0.001	0.995	0	0	-2.242	0.009
0.005	0	0.995	0	0	-2.232	0.006

Table 19 (Continued)

Performance of E-HFO-1234ze Compositions in Med Temp Refrig System

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
64.849	1132.831	2.856	-0.0050314	-0.0350018
64.86	1133.333	2.856	0.0392801	-0.0350018
64.872	1133.835	2.856	0.0835917	-0.0350018
64.883	1134.337	2.856	0.1279032	-0.0350018
64.894	1134.84	2.856	0.172303	-0.0350018
64.905	1135.342	2.856	0.2166145	-0.0350018
64.861	1132.843	2.856	-0.0039721	-0.0350018
64.872	1133.345	2.856	0.0403394	-0.0350018
64.883	1133.847	2.856	0.0846509	-0.0350018
64.895	1134.349	2.856	0.1289624	-0.0350018
64.906	1134.851	2.856	0.173274	-0.0350018
64.873	1132.855	2.857	-0.0029129	0

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
64.884	1133.357	2.857	0.0413986	0
64.895	1133.859	2.856	0.0857101	-0.0350018
64.906	1134.361	2.856	0.1300217	-0.0350018
64.884	1132.866	2.857	-0.0019419	0
64.895	1133.368	2.857	0.0423696	0
64.907	1133.87	2.857	0.0866811	0
64.896	1132.877	2.857	-0.000971	0
64.907	1133.379	2.857	0.0433406	0
64.907	1132.888	2.857	0	0
64.872	1133.356	2.856	0.0413104	-0.0350018
64.883	1133.859	2.856	0.0857101	-0.0350018
64.894	1134.361	2.856	0.1300217	-0.0350018
64.905	1134.864	2.856	0.1744215	-0.0350018
64.917	1135.366	2.856	0.218733	-0.0350018
64.883	1133.368	2.857	0.0423696	0
64.895	1133.871	2.856	0.0867694	-0.0350018
64.906	1134.373	2.856	0.1310809	-0.0350018
64.917	1134.875	2.856	0.1753924	-0.0350018
64.895	1133.38	2.857	0.0434288	0
64.906	1133.882	2.857	0.0877404	0
64.918	1134.385	2.857	0.1321402	0
64.907	1133.391	2.857	0.0443998	0
64.918	1133.894	2.857	0.0887996	0
64.918	1133.402	2.857	0.0453708	0
64.894	1133.882	2.857	0.0877404	0
64.906	1134.385	2.856	0.1321402	-0.0350018
64.917	1134.887	2.856	0.1764517	-0.0350018
64.928	1135.39	2.856	0.2208515	-0.0350018
64.906	1133.894	2.857	0.0887996	0
64.917	1134.396	2.857	0.1331111	0
64.928	1134.899	2.857	0.1775109	0
64.918	1133.905	2.857	0.0897706	0
64.929	1134.408	2.857	0.1341704	0
64.929	1133.917	2.857	0.0908298	0
64.917	1134.407	2.857	0.1340821	0
64.928	1134.91	2.857	0.1784819	0
64.939	1135.413	2.857	0.2228817	0
64.929	1134.419	2.857	0.1351413	0
64.94	1134.922	2.857	0.1795411	0
64.94	1134.431	2.857	0.1362006	0
64.939	1134.933	2.857	0.1805121	0
64.951	1135.436	2.857	0.2249119	0
64.951	1134.945	2.857	0.1815713	0
64.962	1135.459	2.857	0.2269421	0
64.871	1133.142	2.857	0.0224206	0
64.882	1133.644	2.856	0.0667321	-0.0350018
64.894	1134.147	2.856	0.1111319	-0.0350018
64.905	1134.649	2.856	0.1554434	-0.0350018
64.916	1135.151	2.856	0.199755	-0.0350018
64.883	1133.154	2.857	0.0234798	0
64.894	1133.656	2.857	0.0677913	0
64.905	1134.158	2.857	0.1121029	0
64.916	1134.661	2.856	0.1565027	-0.0350018
64.894	1133.166	2.857	0.0245391	0
64.906	1133.668	2.857	0.0688506	0

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
64.917	1134.17	2.857	0.1131621	0
64.906	1133.177	2.857	0.02551	0
64.917	1133.679	2.857	0.0698216	0
64.918	1133.188	2.857	0.026481	0
64.894	1133.669	2.857	0.0689389	0
64.905	1134.171	2.857	0.1132504	0
64.916	1134.674	2.856	0.1576502	-0.0350018
64.927	1135.176	2.856	0.2019617	-0.0350018
64.905	1133.681	2.857	0.0699981	0
64.917	1134.183	2.857	0.1143096	0
64.928	1134.685	2.857	0.1586212	0
64.917	1133.692	2.857	0.0709691	0
64.928	1134.194	2.857	0.1152806	0
64.929	1133.703	2.857	0.07194	0
64.916	1134.195	2.857	0.1153689	0
64.927	1134.698	2.857	0.1597687	0
64.939	1135.201	2.857	0.2041685	0
64.928	1134.207	2.857	0.1164281	0
64.939	1134.71	2.857	0.1608279	0
64.94	1134.218	2.857	0.1173991	0
64.939	1134.722	2.857	0.1618871	0
64.95	1135.225	2.857	0.2062869	0
64.95	1134.734	2.857	0.1629464	0
64.961	1135.248	2.857	0.2083172	0
64.893	1133.454	2.857	0.0499608	0
64.904	1133.956	2.857	0.0942723	0
64.915	1134.458	2.857	0.1385839	0
64.927	1134.96	2.857	0.1828954	0
64.905	1133.465	2.857	0.0509318	0
64.916	1133.967	2.857	0.0952433	0
64.927	1134.47	2.857	0.1396431	0
64.916	1133.477	2.857	0.051991	0
64.928	1133.979	2.857	0.0963025	0
64.928	1133.488	2.857	0.052962	0
64.916	1133.981	2.857	0.0964791	0
64.927	1134.484	2.857	0.1408789	0
64.938	1134.986	2.857	0.1851904	0
64.927	1133.993	2.857	0.0975383	0
64.938	1134.495	2.857	0.1418499	0
64.939	1134.004	2.857	0.0985093	0
64.938	1134.509	2.857	0.1430856	0
64.949	1135.011	2.857	0.1873972	0
64.95	1134.52	2.857	0.1440566	0
64.961	1135.036	2.857	0.1896039	0
64.915	1133.765	2.857	0.0774128	0
64.926	1134.267	2.857	0.1217243	0
64.937	1134.769	2.857	0.1660358	0
64.927	1133.776	2.857	0.0783837	0
64.938	1134.279	2.857	0.1227835	0
64.938	1133.788	2.857	0.079443	0
64.937	1134.293	2.857	0.1240193	0
64.949	1134.796	2.857	0.1684191	0
64.949	1134.305	2.857	0.1250786	0
64.96	1134.822	2.857	0.1707141	0
64.937	1134.076	2.857	0.1048647	0

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
64.948	1134.578	2.857	0.1491763	0
64.948	1134.088	2.857	0.105924	0
64.959	1134.606	2.857	0.1516478	0
64.959	1134.388	2.857	0.132405	0

Table 20

Performance of E-HFO-1234ze Compositions in Low Temp Refrig System

Blend Composition				NBP (°F)	Average Glide (K)
R-22	R-1234zeE	R-1234yf	R-245cb		
0	0.995	0	0.005	-2.167	0.001
0	0.995	0.001	0.004	-2.204	0.006
0	0.995	0.002	0.003	-2.241	0.012
0	0.995	0.003	0.002	-2.278	0.017
0	0.995	0.004	0.001	-2.315	0.023
0	0.995	0.005	0	-2.351	0.028
0	0.996	0	0.004	-2.162	0.001
0	0.996	0.001	0.003	-2.199	0.006
0	0.996	0.002	0.002	-2.235	0.012
0	0.996	0.003	0.001	-2.272	0.017
0	0.996	0.004	0	-2.309	0.023
0	0.997	0	0.003	-2.156	0.001
0	0.997	0.001	0.002	-2.193	0.006
0	0.997	0.002	0.001	-2.23	0.012
0	0.997	0.003	0	-2.267	0.017
0	0.998	0	0.002	-2.15	0
0	0.998	0.001	0.001	-2.187	0.006
0	0.998	0.002	0	-2.224	0.011
0	0.999	0	0.001	-2.145	0
0	0.999	0.001	0	-2.182	0.006
0	1	0	0	-2.139	0
0.001	0.995	0	0.004	-2.238	0.013
0.001	0.995	0.001	0.003	-2.274	0.018
0.001	0.995	0.002	0.002	-2.311	0.024
0.001	0.995	0.003	0.001	-2.348	0.029
0.001	0.995	0.004	0	-2.384	0.035
0.001	0.996	0	0.003	-2.232	0.013
0.001	0.996	0.001	0.002	-2.269	0.018
0.001	0.996	0.002	0.001	-2.305	0.024
0.001	0.996	0.003	0	-2.342	0.029
0.001	0.997	0	0.002	-2.226	0.013
0.001	0.997	0.001	0.001	-2.263	0.018
0.001	0.997	0.002	0	-2.3	0.024
0.001	0.998	0	0.001	-2.221	0.012
0.001	0.998	0.001	0	-2.257	0.018
0.001	0.999	0	0	-2.215	0.012
0.002	0.995	0	0.003	-2.308	0.025
0.002	0.995	0.001	0.002	-2.344	0.03
0.002	0.995	0.002	0.001	-2.381	0.036
0.002	0.995	0.003	0	-2.417	0.041
0.002	0.996	0	0.002	-2.302	0.025
0.002	0.996	0.001	0.001	-2.339	0.03

Blend Composition				NBP (°F)	Average Glide (K)
<i>R-22</i>	<i>R-1234zeE</i>	<i>R-1234yf</i>	<i>R-245cb</i>		
0.002	0.996	0.002	0	-2.375	0.036
0.002	0.997	0	0.001	-2.296	0.025
0.002	0.997	0.001	0	-2.333	0.03
0.002	0.998	0	0	-2.291	0.024
0.003	0.995	0	0.002	-2.377	0.037
0.003	0.995	0.001	0.001	-2.414	0.042
0.003	0.995	0.002	0	-2.451	0.048
0.003	0.996	0	0.001	-2.372	0.037
0.003	0.996	0.001	0	-2.408	0.042
0.003	0.997	0	0	-2.366	0.037
0.004	0.995	0	0.001	-2.447	0.049
0.004	0.995	0.001	0	-2.484	0.054
0.004	0.996	0	0	-2.442	0.049
0.005	0.995	0	0	-2.517	0.061

Table 20 (Continued)

Performance of E-HFO-1234ze Compositions in Low Temp Refrig System

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
72.854	359.424	1.574	-0.003895	-0.0634921
72.87	359.594	1.574	0.0434011	-0.0634921
72.886	359.764	1.574	0.0906971	-0.0634921
72.901	359.935	1.574	0.1382714	-0.0634921
72.917	360.107	1.574	0.1861239	-0.0634921
72.933	360.279	1.574	0.2339764	-0.0634921
72.873	359.427	1.574	-0.0030603	-0.0634921
72.888	359.596	1.574	0.0439575	-0.0634921
72.904	359.767	1.574	0.0915318	-0.0634921
72.92	359.938	1.574	0.139106	-0.0634921
72.936	360.109	1.574	0.1866803	-0.0634921
72.891	359.429	1.575	-0.0025039	0
72.907	359.599	1.575	0.0447921	0
72.923	359.769	1.574	0.0920882	-0.0634921
72.939	359.94	1.574	0.1396625	-0.0634921
72.91	359.432	1.575	-0.0016693	0
72.926	359.602	1.575	0.0456268	0
72.942	359.772	1.575	0.0929228	0
72.929	359.435	1.575	-0.0008346	0
72.944	359.604	1.575	0.0461832	0
72.947	359.438	1.575	0	0
72.926	359.825	1.575	0.1076681	0
72.942	359.996	1.575	0.1552424	0
72.958	360.167	1.574	0.2028166	-0.0634921
72.974	360.339	1.574	0.2506691	-0.0634921
72.989	360.511	1.574	0.2985216	-0.0634921
72.945	359.828	1.575	0.1085027	0
72.961	359.998	1.575	0.1557988	0
72.976	360.17	1.575	0.2036513	0
72.992	360.341	1.575	0.2512255	0
72.964	359.83	1.575	0.1090591	0
72.979	360.001	1.575	0.1566334	0

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
72.995	360.172	1.575	0.2042077	0
72.982	359.833	1.575	0.1098938	0
72.998	360.003	1.575	0.1571898	0
73.001	359.835	1.575	0.1104502	0
72.999	360.228	1.575	0.2197876	0
73.014	360.4	1.575	0.26764	0
73.03	360.572	1.575	0.3154925	0
73.046	360.745	1.575	0.3636232	0
73.017	360.23	1.575	0.220344	0
73.033	360.402	1.575	0.2681965	0
73.049	360.574	1.575	0.3160489	0
73.036	360.233	1.575	0.2211786	0
73.052	360.404	1.575	0.2687529	0
73.055	360.235	1.575	0.221735	0
73.071	360.632	1.575	0.3321852	0
73.086	360.805	1.575	0.3803159	0
73.102	360.978	1.575	0.4284466	0
73.089	360.635	1.575	0.3330199	0
73.105	360.807	1.575	0.3808724	0
73.108	360.637	1.575	0.3335763	0
73.143	361.038	1.575	0.4451394	0
73.159	361.212	1.575	0.4935483	0
73.162	361.04	1.575	0.4456958	0
73.215	361.446	1.576	0.5586499	0.0634921

Table 21

Performance of E-HFO-1234ze Compositions in Low Temp Refrig System

Blend Composition			NBP (°F)	Average Glide (K)
<i>R-1234yf</i>	<i>R-1234zeE</i>	<i>R-245cb</i>		
0	0.995	0.005	-2.167	0.001
0	0.996	0.004	-2.162	0.001
0	0.997	0.003	-2.156	0.001
0	0.998	0.002	-2.15	0
0	0.999	0.001	-2.145	0
0	1	0	-2.139	0
0.001	0.995	0.004	-2.204	0.006
0.001	0.996	0.003	-2.199	0.006
0.001	0.997	0.002	-2.193	0.006
0.001	0.998	0.001	-2.187	0.006
0.001	0.999	0	-2.182	0.006
0.002	0.995	0.003	-2.241	0.012
0.002	0.996	0.002	-2.235	0.012
0.002	0.997	0.001	-2.23	0.012
0.002	0.998	0	-2.224	0.011
0.003	0.995	0.002	-2.278	0.017
0.003	0.996	0.001	-2.272	0.017
0.003	0.997	0	-2.267	0.017
0.004	0.995	0.001	-2.315	0.023
0.004	0.996	0	-2.309	0.023
0.005	0.995	0	-2.351	0.028

Table 21 (Continued)
Performance of E-HFO-1234ze Compositions in Low Temp Refrig System

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
72.854	359.409	1.574	-0.0027823	-0.0634921
72.873	359.411	1.574	-0.0022258	-0.0634921
72.892	359.413	1.575	-0.0016694	0
72.91	359.415	1.575	-0.0011129	0
72.929	359.417	1.575	-0.0005565	0
72.948	359.419	1.575	0	0
72.87	359.581	1.574	0.0450727	-0.0634921
72.889	359.584	1.574	0.0459074	-0.0634921
72.907	359.586	1.574	0.0464639	-0.0634921
72.926	359.588	1.575	0.0470203	0
72.945	359.59	1.575	0.0475768	0
72.886	359.754	1.574	0.093206	-0.0634921
72.904	359.757	1.574	0.0940407	-0.0634921
72.923	359.759	1.574	0.0945971	-0.0634921
72.942	359.761	1.575	0.0951536	0
72.901	359.927	1.574	0.1413392	-0.0634921
72.92	359.93	1.574	0.1421739	-0.0634921
72.939	359.932	1.574	0.1427304	-0.0634921
72.917	360.1	1.574	0.1894725	-0.0634921
72.936	360.103	1.574	0.1903071	-0.0634921
72.933	360.273	1.574	0.2376057	-0.0634921

[0488] Performance of the E-HFO-1234ze compositions containing one or more of the residual refrigerants is similar to or better than the E-HFO-1234ze composition which does not contain these residual refrigerants. More particularly, differences in energy efficiency (shown as COP) among the compositions are *de minimis* and the capacity increases slightly for compositions containing the residual refrigerants. Thus, the data indicate that the presence of CFC-12, HFC-134a, HFO-1234yf and/or HCFC-22 as residual refrigerants in E-HFO-1234ze compositions does not negatively impact performance of the compositions.

IMPACT ON DISTILLATION

[0489] Table 22 shows distillation requirements for obtaining an E-HFO-1234ze composition containing up to 0.5 wt.% residual HFC-134a, as compared with obtaining an E-HFO-1234ze composition containing little to no (e.g., 10 ppm) residual HFC-134a. The mass reflux ratio for distilling the latter is significantly higher than required for a composition that contains up to 0.5 wt.% of the residual refrigerants. Thus, the data show that removing essentially all of the residual refrigerants from the composition would require a significantly larger distillation

column and higher energy input, and thus exhibit a much larger environmental footprint, as compared with allowing up to 0.5 wt.% of the residual refrigerants to remain in the composition.

Table 22

	10% 134a to 0.5% 134a			10% 134a to 10 ppm 134a		
Column Stages	80			80		
Feed Stage	40			40		
Mass Reflux Ratio	2.2			8		
Stream	Feed	Overhead	Bottom	Feed	Overhead	Bottom
Temp (deg C)	25	44	47.2	25	44.2	47.3
Pressure (psia)	139.7	134.7	134.7	139.7	134.7	134.7
E-1234ze wt fraction	0.90000	0.80500	0.99500	0.90000	0.81917	0.99999
134a wt fraction	0.10000	0.19500	0.00500	0.10000	0.18083	0.00001

Example 4

[0490] Tables 23-25 show the performance of some exemplary HFC-32 compositions containing residual refrigerant(s) (HCFC-22) as compared with the same compositions without the residual refrigerant in medium temperature refrigeration systems, stationary air conditioning systems and a heat pump system, as shown in Figs. 1-2. The data are based on the following conditions.

Stationary Air Conditioning

Condenser Mid-Point Temperature	46.1°C
Condenser Subcooling	0 K
Evaporator Mid-Point Temperature	10°C
Useful Superheat	11.1 K
Compressor Isentropic Efficiency	0.7

Heat Pump

Condenser Mid-Point Temperature	35°C
Condenser Subcooling	0 K
Evaporator Mid-Point Temperature	-15°C
Useful Superheat	11.1 K
Compressor Isentropic Efficiency	0.7

Medium Temperature Refrigeration

Condenser Mid-Point Temperature	43.3°C
Condenser Subcooling	0 K
Evaporator Mid-Point Temperature	-6.7°C
Useful Superheat	11.1 K
Compressor Isentropic Efficiency	0.7

Table 23
Performance of HFC-32 Compositions in Stationary A/C System

Blend Composition			NBP (°F)	Average Glide (K)
<i>R-22</i>	<i>R-32</i>	<i>R-143a</i>		
0	0.995	0.005	-60.986	0
0	0.996	0.004	-60.981	0
0	0.997	0.003	-60.976	0
0	0.998	0.002	-60.972	0
0	0.999	0.001	-60.967	0
0	1	0	-60.963	0
0.001	0.995	0.004	-60.974	0.003
0.001	0.996	0.003	-60.969	0.003
0.001	0.997	0.002	-60.965	0.003
0.001	0.998	0.001	-60.96	0.003
0.001	0.999	0	-60.956	0.003
0.002	0.995	0.003	-60.962	0.006
0.002	0.996	0.002	-60.958	0.005
0.002	0.997	0.001	-60.953	0.005
0.002	0.998	0	-60.948	0.005
0.003	0.995	0.002	-60.95	0.008
0.003	0.996	0.001	-60.946	0.008
0.003	0.997	0	-60.941	0.008
0.004	0.995	0.001	-60.939	0.011
0.004	0.996	0	-60.934	0.011
0.005	0.995	0	-60.927	0.013

Table 23 (Continued)
Performance of HFC-32 Compositions in Stationary A/C System

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
97.73	6771.336	4.177	-0.0900045	-0.0239349
97.763	6772.559	4.177	-0.0719594	-0.0239349
97.797	6773.78	4.177	-0.0539437	-0.0239349
97.831	6775	4.177	-0.0359428	-0.0239349
97.865	6776.219	4.177	-0.0179566	-0.0239349
97.899	6777.436	4.178	0	0
97.755	6770.808	4.177	-0.0977951	-0.0239349
97.789	6772.03	4.177	-0.0797647	-0.0239349
97.823	6773.251	4.177	-0.061749	-0.0239349

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
97.857	6774.471	4.178	-0.0437481	0
97.89	6775.689	4.178	-0.0257767	0
97.781	6770.279	4.177	-0.1056004	-0.0239349
97.814	6771.501	4.178	-0.08757	0
97.848	6772.722	4.178	-0.0695543	0
97.882	6773.941	4.178	-0.0515682	0
97.806	6769.75	4.178	-0.1134057	0
97.84	6770.972	4.178	-0.0953753	0
97.874	6772.192	4.178	-0.0773744	0
97.832	6769.221	4.178	-0.121211	0
97.866	6770.442	4.178	-0.1031954	0
97.857	6768.692	4.178	-0.1290163	0

Table 24

Performance of HFC-32 Compositions in Heat Pump System

Blend Composition			NBP (°F)	Average Glide (K)
<i>R-22</i>	<i>R-32</i>	<i>R-143a</i>		
0	0.995	0.005	-60.986	0
0	0.996	0.004	-60.981	0
0	0.997	0.003	-60.976	0
0	0.998	0.002	-60.972	0
0	0.999	0.001	-60.967	0
0	1	0	-60.963	0
0.001	0.995	0.004	-60.974	0
0.001	0.996	0.003	-60.969	0
0.001	0.997	0.002	-60.965	0
0.001	0.998	0.001	-60.96	0
0.001	0.999	0	-60.956	0
0.002	0.995	0.003	-60.962	0
0.002	0.996	0.002	-60.958	0
0.002	0.997	0.001	-60.953	0
0.002	0.998	0	-60.948	0
0.003	0.995	0.002	-60.95	0
0.003	0.996	0.001	-60.946	0
0.003	0.997	0	-60.941	0
0.004	0.995	0.001	-60.939	0
0.004	0.996	0	-60.934	0
0.005	0.995	0	-60.927	0

Table 24 (Continued)

Performance of HFC-32 Compositions in Heat Pump System

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
115.2	4422	3.703	-0.0677966	0
115.2	4422.6	3.703	-0.0542373	0
115.3	4423.2	3.703	-0.040678	0
115.3	4423.8	3.703	-0.0271186	0
115.4	4424.4	3.703	-0.0135593	0

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
115.5	4425	3.703	0	0
115.2	4421.4	3.703	-0.0813559	0
115.3	4422	3.703	-0.0677966	0
115.3	4422.6	3.703	-0.0542373	0
115.4	4423.2	3.703	-0.040678	0
115.5	4423.8	3.703	-0.0271186	0
115.3	4420.8	3.703	-0.0949153	0
115.3	4421.4	3.703	-0.0813559	0
115.4	4422	3.703	-0.0677966	0
115.4	4422.6	3.703	-0.0542373	0
115.3	4420.2	3.703	-0.1084746	0
115.4	4420.8	3.703	-0.0949153	0
115.4	4421.4	3.703	-0.0813559	0
115.3	4419.6	3.703	-0.1220339	0
115.4	4420.2	3.703	-0.1084746	0
115.4	4418.9	3.703	-0.1378531	0

Table 25
Performance of HFC-32 Compositions in Med Temp Refrig System

Blend Composition			NBP (°F)	Average Glide (K)
<i>R-12</i>	<i>R-32</i>	<i>R-143a</i>		
0	0.995	0.005	-60.986	0
0	0.996	0.004	-60.981	0
0	0.997	0.003	-60.976	0
0	0.998	0.002	-60.972	0
0	0.999	0.001	-60.967	0
0	1	0	-60.963	0
0.001	0.995	0.004	-61.003	0.001
0.001	0.996	0.003	-60.998	0.001
0.001	0.997	0.002	-60.994	0.001
0.001	0.998	0.001	-60.989	0.001
0.001	0.999	0	-60.985	0.001
0.002	0.995	0.003	-61.02	0.002
0.002	0.996	0.002	-61.016	0.002
0.002	0.997	0.001	-61.011	0.002
0.002	0.998	0	-61.007	0.002
0.003	0.995	0.002	-61.038	0.003
0.003	0.996	0.001	-61.033	0.003
0.003	0.997	0	-61.028	0.003
0.004	0.995	0.001	-61.055	0.004
0.004	0.996	0	-61.05	0.004
0.005	0.995	0	-61.072	0.004

Table 25 (Continued)
Performance of HFC-32 Compositions in Med Temp Refrig System

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
117.815	4037.618	2.719	-0.087302	0
117.871	4038.325	2.719	-0.0698069	0
117.926	4039.032	2.719	-0.0523119	0
117.982	4039.738	2.719	-0.0348416	0
118.037	4040.442	2.719	-0.0174208	0
118.093	4041.146	2.719	0	0
117.835	4038.23	2.719	-0.0721577	0
117.89	4038.938	2.719	-0.054638	0
117.946	4039.645	2.719	-0.0371429	0
118.001	4040.35	2.719	-0.0196974	0
118.057	4041.055	2.719	-0.0022518	0
117.854	4038.842	2.719	-0.0570135	0
117.91	4039.55	2.719	-0.0394937	0
117.965	4040.257	2.719	-0.0219987	0
118.021	4040.963	2.719	-0.0045284	0
117.874	4039.454	2.719	-0.0418693	0
117.929	4040.162	2.719	-0.0243495	0
117.985	4040.869	2.719	-0.0068545	0
117.894	4040.066	2.719	-0.0267251	0
117.949	4040.774	2.719	-0.0092053	0
117.913	4040.677	2.718	-0.0116056	-0.0367782

[0491] Performance of the HFC-32 compositions containing the residual refrigerants is similar to or better than the HFC-32 composition which does not contain this residual refrigerant. More particularly, differences in energy efficiency (shown as COP) and capacity among the compositions are *de minimis*. Thus, the data indicate that the presence of HCFC-22 as a residual refrigerant in HFC-32 compositions does not negatively impact performance of the compositions.

IMPACT ON DISTILLATION

[0492] Tables 26 and 27 show distillation requirements for obtaining an HFC-32 composition containing up to 0.5 wt.% residual HFC-125 or up to 0.5 wt.% residual HCFC-22, as compared with obtaining an HFC-32 composition containing little to no (e.g., 10 ppm) residual HFC-125 or HCFC-22. The mass reflux ratio for distilling the latter is significantly higher than required for a composition that contains up to 0.5 wt.% of the residual refrigerants. Thus, the data show that removing essentially all of the residual refrigerants from the composition would require a significantly larger distillation column and higher energy input, and thus exhibit a much larger

environmental footprint, as compared with allowing up to 0.5 wt.% of the residual refrigerants to remain in the composition.

Table 26

	10% 125 to 0.5% 125			10% 125 to 10 ppm 125		
Column Stages	300			300		
Feed Stage	150			150		
Mass Reflux Ratio	20			143.5		
Stream	Feed	Overhead	Bottom	Feed	Overhead	Bottom
Temp (deg C)	25	4.1	4.2	25	4.1	4.2
Pressure (psia)	139.7	134.7	134.7	139.7	134.7	134.7
32 wt fraction	0.90000	0.86833	0.99500	0.90000	0.86667	0.99999
125 wt fraction	0.10000	0.13167	0.00500	0.10000	0.13333	0.00001

Table 27

	10% HCFC-22 to 0.5% HCFC-22			10% HCFC-22 to 10 ppm HCFC-22		
Column Stages	100			100		
Feed Stage	50			50		
Mass Reflux Ratio	2.7			5.6		
Stream	Feed	Overhead	Bottom	Feed	Overhead	Bottom
Temp (deg C)	25	4.3	5.7	25	4.2	5.7
Pressure (psia)	139.7	134.7	134.7	139.7	134.7	134.7
32 wt fraction	0.90000	0.99500	0.80500	0.90000	0.99999	0.80001
22 wt fraction	0.10000	0.00500	0.19500	0.10000	0.00001	0.19999

Example 5

[0493] Tables 28-33 show the performance of some exemplary E-HCFO-1233zd compositions containing residual refrigerant(s) (HFC-245fa, CFC-11) as compared with the same compositions without the residual refrigerant in stationary chiller systems, organic rankine cycles, and high temperature heat pump systems, as shown in Figs. 1-3. The data are based on the following conditions.

Stationary Chiller

Condenser Mid-Point Temperature	40.6°C
Condenser Subcooling	0 K
Evaporator Mid-Point Temperature	5°C
Useful Superheat	11.1 K
Compressor Isentropic Efficiency	0.7

High Temp Heat Pump

Condenser Mid-Point Temperature	150°C
Condenser Subcooling	0 K
Evaporator Mid-Point Temperature	100°C
Useful Superheat	11.1 K
Compressor Isentropic Efficiency	0.7

Organic Rankine Cycle

Condenser Temperature	4.4°C
Evaporator Temperature	37.8°C
Expander Efficiency	0.85
Pump Efficiency	0.85
Subcooling Temperature	3.1 K
Superheat Temperature	6.2 K

Table 28**Performance of E-HCFO-1233zd Compositions in Stationary Chiller System**

Blend Composition				NBP (°F)	Average Glide K
R-245fa	R-1233zdE	R-1233xf	R-1234zeZ		
0	0.995	0	0.005	64.718	0.029
0	0.995	0.001	0.004	64.736	0.025
0	0.995	0.002	0.003	64.753	0.021
0	0.995	0.003	0.002	64.771	0.017
0	0.995	0.004	0.001	64.789	0.013
0	0.995	0.005	0	64.807	0.009
0	0.996	0	0.004	64.751	0.023
0	0.996	0.001	0.003	64.769	0.019
0	0.996	0.002	0.002	64.787	0.015
0	0.996	0.003	0.001	64.805	0.011
0	0.996	0.004	0	64.823	0.007
0	0.997	0	0.003	64.785	0.017
0	0.997	0.001	0.002	64.803	0.013
0	0.997	0.002	0.001	64.821	0.009
0	0.997	0.003	0	64.839	0.005
0	0.998	0	0.002	64.819	0.012
0	0.998	0.001	0.001	64.837	0.007
0	0.998	0.002	0	64.855	0.003
0	0.999	0	0.001	64.853	0.006
0	0.999	0.001	0	64.871	0.002
0	1	0	0	64.887	0

Blend Composition				NBP (°F)	Average Glide K
R-245fa	R-1233zdE	R-1233xf	R-1234zeZ		
0.001	0.995	0	0.004	64.756	0.023
0.001	0.995	0.001	0.003	64.774	0.019
0.001	0.995	0.002	0.002	64.792	0.015
0.001	0.995	0.003	0.001	64.81	0.011
0.001	0.995	0.004	0	64.828	0.007
0.001	0.996	0	0.003	64.79	0.018
0.001	0.996	0.001	0.002	64.808	0.013
0.001	0.996	0.002	0.001	64.826	0.009
0.001	0.996	0.003	0	64.844	0.005
0.001	0.997	0	0.002	64.824	0.012
0.001	0.997	0.001	0.001	64.842	0.008
0.001	0.997	0.002	0	64.86	0.004
0.001	0.998	0	0.001	64.858	0.006
0.001	0.998	0.001	0	64.875	0.002
0.001	0.999	0	0	64.891	0
0.002	0.995	0	0.003	64.795	0.018
0.002	0.995	0.001	0.002	64.813	0.014
0.002	0.995	0.002	0.001	64.831	0.01
0.002	0.995	0.003	0	64.848	0.006
0.002	0.996	0	0.002	64.829	0.012
0.002	0.996	0.001	0.001	64.846	0.008
0.002	0.996	0.002	0	64.864	0.004
0.002	0.997	0	0.001	64.862	0.006
0.002	0.997	0.001	0	64.88	0.002
0.002	0.998	0	0	64.896	0
0.003	0.995	0	0.002	64.833	0.012
0.003	0.995	0.001	0.001	64.851	0.008
0.003	0.995	0.002	0	64.869	0.004
0.003	0.996	0	0.001	64.867	0.007
0.003	0.996	0.001	0	64.885	0.002
0.003	0.997	0	0	64.901	0.001
0.004	0.995	0	0.001	64.872	0.007
0.004	0.995	0.001	0	64.89	0.003
0.004	0.996	0	0	64.906	0.001
0.005	0.995	0	0	64.911	0.001

Table 28 (Continued)

Performance of E-HCFO-1233zd Compositions in Stationary Chiller System

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
61.943	555.614	4.802	0.2609317	0
61.937	555.464	4.802	0.2338641	0
61.93	555.314	4.802	0.2067965	0
61.924	555.164	4.802	0.1797289	0
61.917	555.014	4.802	0.1526613	0
61.911	554.864	4.802	0.1255937	0
61.937	555.325	4.802	0.2087815	0
61.931	555.175	4.802	0.1817138	0
61.924	555.025	4.802	0.1546462	0
61.918	554.875	4.802	0.1275786	0

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
61.911	554.725	4.802	0.100511	0
61.931	555.036	4.802	0.1566312	0
61.925	554.886	4.802	0.1295636	0
61.918	554.736	4.802	0.102496	0
61.912	554.586	4.802	0.0754284	0
61.925	554.747	4.802	0.104481	0
61.919	554.597	4.802	0.0774133	0
61.912	554.447	4.802	0.0503457	0
61.919	554.458	4.802	0.0523307	0
61.913	554.308	4.802	0.0252631	0
61.913	554.168	4.802	0	0
61.935	555.278	4.802	0.2003003	0
61.929	555.128	4.802	0.1732327	0
61.922	554.978	4.802	0.1461651	0
61.916	554.828	4.802	0.1190975	0
61.91	554.678	4.802	0.0920299	0
61.929	554.989	4.802	0.14815	0
61.923	554.839	4.802	0.1210824	0
61.916	554.689	4.802	0.0940148	0
61.91	554.539	4.802	0.0669472	0
61.923	554.7	4.802	0.0959998	0
61.917	554.55	4.802	0.0689322	0
61.91	554.399	4.802	0.0416841	0
61.917	554.41	4.802	0.0436691	0
61.911	554.26	4.802	0.0166015	0
61.911	554.12	4.802	-0.0086616	0
61.927	554.942	4.802	0.1396688	0
61.921	554.792	4.802	0.1126012	0
61.914	554.642	4.802	0.0855336	0
61.908	554.492	4.802	0.058466	0
61.921	554.652	4.802	0.0873381	0
61.915	554.502	4.802	0.0602705	0
61.908	554.352	4.802	0.0332029	0
61.915	554.363	4.802	0.0351879	0
61.909	554.213	4.802	0.0081203	0
61.909	554.073	4.802	-0.0171428	0
61.919	554.606	4.802	0.0790374	0
61.913	554.456	4.802	0.0519698	0
61.907	554.306	4.802	0.0249022	0
61.913	554.316	4.802	0.0267067	0
61.907	554.166	4.802	-0.0003609	0
61.907	554.026	4.802	-0.025624	0
61.911	554.269	4.802	0.0182255	0
61.905	554.119	4.802	-0.0088421	0
61.905	553.98	4.802	-0.0339247	0
61.903	553.933	4.802	-0.0424059	0

Table 29
Performance of E-HCFO-1233zd Compositions in Stationary Chiller System

Blend Composition				NBP (°F)	Average Glide K
<i>R-11</i>	<i>R-1233zdE</i>	<i>R-245fa</i>	<i>R-1233xf</i>		
0	0.995	0	0.005	64.807	0.009
0	0.995	0.001	0.004	64.828	0.007
0	0.995	0.002	0.003	64.848	0.006
0	0.995	0.003	0.002	64.869	0.004
0	0.995	0.004	0.001	64.89	0.003
0	0.995	0.005	0	64.911	0.001
0	0.996	0	0.004	64.823	0.007
0	0.996	0.001	0.003	64.844	0.005
0	0.996	0.002	0.002	64.864	0.004
0	0.996	0.003	0.001	64.885	0.002
0	0.996	0.004	0	64.906	0.001
0	0.997	0	0.003	64.839	0.005
0	0.997	0.001	0.002	64.86	0.004
0	0.997	0.002	0.001	64.88	0.002
0	0.997	0.003	0	64.901	0.001
0	0.998	0	0.002	64.855	0.003
0	0.998	0.001	0.001	64.875	0.002
0	0.998	0.002	0	64.896	0
0	0.999	0	0.001	64.871	0.002
0	0.999	0.001	0	64.891	0
0	1	0	0	64.887	0
0.001	0.995	0	0.004	64.834	0.009
0.001	0.995	0.001	0.003	64.855	0.007
0.001	0.995	0.002	0.002	64.875	0.006
0.001	0.995	0.003	0.001	64.896	0.004
0.001	0.995	0.004	0	64.917	0.003
0.001	0.996	0	0.003	64.85	0.007
0.001	0.996	0.001	0.002	64.871	0.006
0.001	0.996	0.002	0.001	64.891	0.004
0.001	0.996	0.003	0	64.912	0.003
0.001	0.997	0	0.002	64.866	0.005
0.001	0.997	0.001	0.001	64.887	0.004
0.001	0.997	0.002	0	64.908	0.002
0.001	0.998	0	0.001	64.882	0.004
0.001	0.998	0.001	0	64.903	0.002
0.001	0.999	0	0	64.898	0.002
0.002	0.995	0	0.003	64.861	0.009
0.002	0.995	0.001	0.002	64.882	0.007
0.002	0.995	0.002	0.001	64.903	0.006
0.002	0.995	0.003	0	64.924	0.004
0.002	0.996	0	0.002	64.877	0.007
0.002	0.996	0.001	0.001	64.898	0.006
0.002	0.996	0.002	0	64.919	0.004
0.002	0.997	0	0.001	64.893	0.005
0.002	0.997	0.001	0	64.914	0.004
0.002	0.998	0	0	64.909	0.004
0.003	0.995	0	0.002	64.888	0.009
0.003	0.995	0.001	0.001	64.909	0.007
0.003	0.995	0.002	0	64.93	0.006
0.003	0.996	0	0.001	64.904	0.007

Blend Composition				NBP (°F)	Average Glide K
<i>R-11</i>	<i>R-1233zdE</i>	<i>R-245fa</i>	<i>R-1233xf</i>		
0.003	0.996	0.001	0	64.925	0.006
0.003	0.997	0	0	64.92	0.005
0.004	0.995	0	0.001	64.915	0.009
0.004	0.995	0.001	0	64.936	0.007
0.004	0.996	0	0	64.931	0.007
0.005	0.995	0	0	64.942	0.009

Table 29 (Continued)

Performance of E-HCFO-1233zd Compositions in Stationary Chiller System

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
61.911	554.864	4.802	0.1255937	0
61.91	554.678	4.802	0.0920299	0
61.908	554.492	4.802	0.058466	0
61.907	554.306	4.802	0.0249022	0
61.905	554.119	4.802	-0.0088421	0
61.903	553.933	4.802	-0.0424059	0
61.911	554.725	4.802	0.100511	0
61.91	554.539	4.802	0.0669472	0
61.908	554.352	4.802	0.0332029	0
61.907	554.166	4.802	-0.0003609	0
61.905	553.98	4.802	-0.0339247	0
61.912	554.586	4.802	0.0754284	0
61.91	554.399	4.802	0.0416841	0
61.909	554.213	4.802	0.0081203	0
61.907	554.026	4.802	-0.025624	0
61.912	554.447	4.802	0.0503457	0
61.911	554.26	4.802	0.0166015	0
61.909	554.073	4.802	-0.0171428	0
61.913	554.308	4.802	0.0252631	0
61.911	554.12	4.802	-0.0086616	0
61.913	554.168	4.802	0	0
61.922	554.603	4.802	0.0784961	0
61.92	554.416	4.802	0.0447518	0
61.919	554.23	4.802	0.0111879	0
61.917	554.044	4.802	-0.0223759	0
61.916	553.857	4.802	-0.0561202	0
61.922	554.464	4.802	0.0534134	0
61.921	554.277	4.802	0.0196691	0
61.919	554.09	4.802	-0.0140752	0
61.918	553.904	4.802	-0.047639	0
61.923	554.324	4.802	0.0281503	0
61.921	554.137	4.802	-0.005594	0
61.92	553.951	4.802	-0.0391578	0
61.923	554.185	4.802	0.0030677	0
61.922	553.998	4.802	-0.0306766	0
61.923	554.045	4.802	-0.0221954	0
61.933	554.341	4.802	0.031218	0
61.931	554.154	4.802	-0.0025263	0
61.93	553.968	4.802	-0.0360901	0
61.928	553.781	4.802	-0.0698344	0

Discharge Temp (°C)	Capacity (kJ/m ³)	COP	Cap % Increase	COP % Increase
61.933	554.201	4.802	0.0059549	0
61.932	554.015	4.802	-0.027609	0
61.93	553.828	4.802	-0.0613532	0
61.933	554.062	4.802	-0.0191278	0
61.932	553.875	4.802	-0.0528721	0
61.934	553.922	4.802	-0.0443909	0
61.943	554.079	4.803	-0.0160601	0.0208247
61.942	553.892	4.803	-0.0498044	0.0208247
61.94	553.705	4.803	-0.0835487	0.0208247
61.944	553.939	4.803	-0.0413232	0.0208247
61.942	553.752	4.803	-0.0750675	0.0208247
61.944	553.799	4.803	-0.0665863	0.0208247
61.954	553.816	4.803	-0.0635186	0.0208247
61.953	553.629	4.803	-0.0972629	0.0208247
61.955	553.676	4.803	-0.0887817	0.0208247
61.965	553.553	4.803	-0.1109772	0.0208247

Table 30

Performance of E-HCFO-1233zd Compositions in ORC

Blend Composition				NBP (°F)	Evaporator Heat Duty (kJ/kg)
R-245fa	R-1233zdE	R-1233xf	R-1234zeZ		
0	1	0	0	64.887	233.629
0.001	0.995	0	0.004	64.756	233.701
0.001	0.995	0.004	0	64.828	233.562
0.002	0.995	0.001	0.002	64.813	233.663
0.002	0.995	0.002	0.001	64.831	233.628
0.003	0.995	0.001	0.001	64.851	233.66
0.003	0.997	0	0	64.901	233.665
0.005	0.995	0	0	64.911	233.689

Table 30 (Continued)

Performance of E-HCFO-1233zd Compositions in ORC

Volumetric Capacity at outlet (kJ/m ³)	Expander Work (kJ/kg)	Pump Work (kJ/kg)	Thermal Efficiency	Cap % Increase	Efficiency % Increase
62.09	19.308	0.127	8.21	0	0
62.212	19.321	0.128	8.213	0.196489	0.036541
62.146	19.305	0.127	8.211	0.090192	0.01218
62.159	19.315	0.127	8.212	0.111129	0.024361
62.142	19.311	0.127	8.211	0.083749	0.01218
62.122	19.313	0.127	8.211	0.051538	0.01218
62.075	19.311	0.127	8.21	-0.02416	0
62.065	19.313	0.127	8.21	-0.04026	0

Table 31
Performance of E-HCFO-1233zd Compositions in ORC

Blend Composition				NBP (°F)	Evaporator Heat Duty (kJ/kg)
<i>R-11</i>	<i>R-1233zdE</i>	<i>R-1233xf</i>	<i>R-1234zeZ</i>		
0	1	0	0	64.887	233.629
0.001	0.995	0	0.004	64.756	233.673
0.001	0.995	0.004	0	64.828	233.534
0.002	0.995	0.001	0.002	64.813	233.607
0.002	0.995	0.002	0.001	64.831	233.573
0.003	0.995	0.001	0.001	64.851	233.576
0.003	0.997	0	0	64.901	233.581
0.005	0.995	0	0	64.911	233.549

Table 31 (Continued)
Performance of E-HCFO-1233zd Compositions in ORC

Volumetric Capacity at outlet (kJ/m ³)	Expander Work (kJ/kg)	Pump Work (kJ/kg)	Thermal Efficiency	Cap % Increase	Efficiency % Increase
62.09	19.308	0.127	8.21	0	0
62.201	19.32	0.128	8.213	0.178773	0.036541
62.135	19.304	0.127	8.211	0.072475	0.01218
62.137	19.312	0.127	8.212	0.075697	0.024361
62.12	19.308	0.127	8.2112	0.048317	0.014616
62.089	19.309	0.127	8.212	-0.00161	0.024361
62.042	19.306	0.127	8.211	-0.07731	0.01218
62.009	19.306	0.127	8.212	-0.13046	0.024361

Table 32
Performance of E-HCFO-1233zd Compositions in High Temp Heat Pump

Blend Composition				NBP (°F)	Average Glide K
<i>R-245fa</i>	<i>R-1233zdE</i>	<i>R-1233xf</i>	<i>R-1234zeZ</i>		
0	1	0	0	64.887	0
0.001	0.995	0	0.004	64.756	0.0102
0.001	0.995	0.004	0	64.828	0.0017
0.002	0.995	0.001	0.002	64.813	0.0056
0.002	0.995	0.002	0.001	64.831	0.0035
0.003	0.995	0.001	0.001	64.851	0.0031
0.003	0.997	0	0	64.901	0.0002

Table 32 (Continued)

Performance of E-HCFO-1233zd Compositions in High Temp Heat Pump

Discharge Temp (°C)	Capacity (kJ/m ³)	COP	Cap % Increase	COP % Increase
153.2	4870.5	3.745	0	0
153.185	4873.09	3.7415	0.0531773	-0.0934579
153.172	4866.53	3.7404	-0.0815111	-0.1228304
153.172	4870.825	3.7419	0.0066728	-0.082777
153.168	4869.19	3.7416	-0.0268966	-0.0907877
153.162	4870.197	3.7425	-0.0062211	-0.0667557
153.149	4870.529	3.7445	0.0005954	-0.0133511

Table 33

Performance of E-HCFO-1233zd Compositions in High Temp Heat Pump

Blend Composition				NBP (°F)	Average Glide (K)
R-11	R-1233zdE	R-245fa	R-1233xf		
0	1	0	0	64.887	0
0.001	0.995	0.004	0	64.917	0.002
0.002	0.995	0.001	0.002	64.882	0.0044
0.002	0.995	0.002	0.001	64.903	0.0041
0.003	0.995	0.001	0.001	64.909	0.0058
0.003	0.997	0	0	64.92	0.0053

Table 33 (Continued)

Performance of E-HCFO-1233zd Compositions in High Temp Heat Pump

Discharge Temp (°C)	Capacity (kJ/m ³)	COP	Cap % Increase	COP % Increase
153.153	4870.468	3.7451	0	0
153.148	4871.636	3.7459	0.0239813	0.0213612
153.163	4870.695	3.7458	0.0046607	0.0186911
153.157	4871.697	3.7468	0.0252337	0.0453926
153.159	4872.756	3.7485	0.046977	0.0907853
153.155	4873.709	3.7498	0.0665439	0.1254973

[0494] Performance of the E-HCFO-1233zd compositions containing the residual refrigerants is similar to or better than the E-HCFO-1233zd composition which does not contain these residual refrigerants. More particularly, differences in energy efficiency (shown as COP) and capacity among the compositions are *de minimis*. Thus, the data indicate that the presence of HFC-245fa or CFC-11 as a residual refrigerant in E-HCFO-1233zd compositions does not negatively impact performance of the compositions.

Example 6

[0495] Tables 34-38 show the performance of some exemplary Z-HFO-1336mzz compositions containing residual refrigerant(s) (HCFC-123, CFC-11) as compared with the same compositions without the residual refrigerant in stationary chiller systems, organic rankine cycles, and high temperature heat pump systems, as shown in Figs. 1-3. The data are based on the same conditions as set forth above in Example 5.

Table 34
Performance of Z-HFO-1336mzz Compositions in Stationary Chiller

Blend Composition				NBP (°F)	Average Glide K
<i>R-11</i>	<i>R-1336mzzZ</i>	<i>R-1326mxzZ</i>	<i>R-1326mxzE</i>		
0	0.995	0	0.005	92.291	0.013
0	0.995	0.001	0.004	92.281	0.01
0	0.995	0.002	0.003	92.271	0.008
0	0.995	0.003	0.002	92.261	0.005
0	0.995	0.004	0.001	92.251	0.003
0	0.995	0.005	0	92.241	0
0	0.996	0	0.004	92.279	0.01
0	0.996	0.001	0.003	92.269	0.008
0	0.996	0.002	0.002	92.259	0.005
0	0.996	0.003	0.001	92.249	0.003
0	0.996	0.004	0	92.239	0
0	0.997	0	0.003	92.266	0.008
0	0.997	0.001	0.002	92.256	0.005
0	0.997	0.002	0.001	92.246	0.003
0	0.997	0.003	0	92.236	0
0	0.998	0	0.002	92.254	0.005
0	0.998	0.001	0.001	92.244	0.003
0	0.998	0.002	0	92.234	0
0	0.999	0	0.001	92.242	0.002
0	0.999	0.001	0	92.232	0
0	1	0	0	92.229	0
0.001	0.995	0	0.004	92.265	0.012
0.001	0.995	0.001	0.003	92.255	0.009
0.001	0.995	0.002	0.002	92.245	0.007
0.001	0.995	0.003	0.001	92.235	0.004
0.001	0.995	0.004	0	92.225	0.002
0.001	0.996	0	0.003	92.253	0.009
0.001	0.996	0.001	0.002	92.243	0.007
0.001	0.996	0.002	0.001	92.232	0.004
0.001	0.996	0.003	0	92.222	0.002
0.001	0.997	0	0.002	92.24	0.007
0.001	0.997	0.001	0.001	92.23	0.004
0.001	0.997	0.002	0	92.22	0.002
0.001	0.998	0	0.001	92.228	0.004
0.001	0.998	0.001	0	92.218	0.002
0.001	0.999	0	0	92.216	0.002
0.002	0.995	0	0.003	92.239	0.011

Blend Composition				NBP (°F)	Average Glide K
<i>R-11</i>	<i>R-1336mzzZ</i>	<i>R-1326mxzZ</i>	<i>R-1326mxzE</i>		
0.002	0.995	0.001	0.002	92.229	0.008
0.002	0.995	0.002	0.001	92.219	0.006
0.002	0.995	0.003	0	92.209	0.003
0.002	0.996	0	0.002	92.226	0.008
0.002	0.996	0.001	0.001	92.216	0.006
0.002	0.996	0.002	0	92.206	0.003
0.002	0.997	0	0.001	92.214	0.006
0.002	0.997	0.001	0	92.204	0.003
0.002	0.998	0	0	92.202	0.003
0.003	0.995	0	0.002	92.213	0.01
0.003	0.995	0.001	0.001	92.202	0.007
0.003	0.995	0.002	0	92.192	0.005
0.003	0.996	0	0.001	92.2	0.007
0.003	0.996	0.001	0	92.19	0.005
0.003	0.997	0	0	92.188	0.005
0.004	0.995	0	0.001	92.186	0.009
0.004	0.995	0.001	0	92.176	0.006
0.004	0.996	0	0	92.174	0.006
0.005	0.995	0	0	92.16	0.007

Table 34 (Continued)

Performance of Z-HFO-1336mzz Compositions in Stationary Chiller

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
53.738	311.883	4.743	-0.1511101	0
53.735	311.961	4.743	-0.1261385	0
53.732	312.038	4.743	-0.1014871	0
53.73	312.115	4.743	-0.0768357	0
53.727	312.192	4.743	-0.0521842	0
53.724	312.268	4.743	-0.0278529	0
53.739	311.978	4.743	-0.120696	0
53.736	312.055	4.743	-0.0960446	0
53.733	312.132	4.743	-0.0713931	0
53.73	312.209	4.743	-0.0467417	0
53.727	312.286	4.743	-0.0220902	0
53.74	312.072	4.743	-0.090602	0
53.737	312.15	4.743	-0.0656305	0
53.734	312.227	4.743	-0.040979	0
53.731	312.303	4.743	-0.0166477	0
53.74	312.167	4.743	-0.0601879	0
53.737	312.244	4.743	-0.0355365	0
53.734	312.321	4.743	-0.0108851	0
53.741	312.261	4.743	-0.030094	0
53.738	312.338	4.743	-0.0054425	0
53.742	312.355	4.743	0	0
53.755	312.087	4.743	-0.0857998	0
53.752	312.164	4.743	-0.0611484	0
53.749	312.242	4.743	-0.0361768	0
53.746	312.319	4.743	-0.0115253	0
53.743	312.396	4.743	0.0131261	0
53.755	312.181	4.743	-0.0557058	0
53.752	312.259	4.743	-0.0307343	0

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
53.749	312.336	4.743	-0.0060828	0
53.746	312.413	4.743	0.0185686	0
53.756	312.276	4.743	-0.0252917	0
53.753	312.353	4.743	-0.0006403	0
53.75	312.43	4.743	0.0240111	0
53.757	312.37	4.743	0.0048022	0
53.754	312.447	4.743	0.0294537	0
53.757	312.464	4.743	0.0348962	0
53.771	312.29	4.744	-0.0208097	0.0210837
53.768	312.368	4.744	0.0041619	0.0210837
53.765	312.445	4.744	0.0288134	0.0210837
53.762	312.522	4.743	0.0534648	0
53.772	312.384	4.744	0.0092843	0.0210837
53.769	312.462	4.744	0.0342559	0.0210837
53.766	312.539	4.743	0.0589073	0
53.772	312.479	4.744	0.0396984	0.0210837
53.769	312.556	4.744	0.0643499	0.0210837
53.773	312.573	4.744	0.0697924	0.0210837
53.787	312.493	4.744	0.0441805	0.0210837
53.784	312.571	4.744	0.0691521	0.0210837
53.781	312.648	4.744	0.0938035	0.0210837
53.788	312.587	4.744	0.0742745	0.0210837
53.785	312.665	4.744	0.0992461	0.0210837
53.788	312.682	4.744	0.1046886	0.0210837
53.804	312.696	4.744	0.1091707	0.0210837
53.801	312.774	4.744	0.1341422	0.0210837
53.804	312.79	4.744	0.1392646	0.0210837
53.82	312.899	4.744	0.1741608	0.0210837

Table 35

Performance of Z-HFO-1336mzz Compositions in Stationary Chiller

Blend Composition				NBP (°F)	Average Glide K
R-123	R-1336mzzZ	R-1326mxzZ	R-1326mxzE		
0	0.995	0	0.005	92.291	0.013
0	0.995	0.001	0.004	92.281	0.01
0	0.995	0.002	0.003	92.271	0.008
0	0.995	0.003	0.002	92.261	0.005
0	0.995	0.004	0.001	92.251	0.003
0	0.995	0.005	0	92.241	0
0	0.996	0	0.004	92.279	0.01
0	0.996	0.001	0.003	92.269	0.008
0	0.996	0.002	0.002	92.259	0.005
0	0.996	0.003	0.001	92.249	0.003
0	0.996	0.004	0	92.239	0
0	0.997	0	0.003	92.266	0.008
0	0.997	0.001	0.002	92.256	0.005
0	0.997	0.002	0.001	92.246	0.003
0	0.997	0.003	0	92.236	0
0	0.998	0	0.002	92.254	0.005
0	0.998	0.001	0.001	92.244	0.003
0	0.998	0.002	0	92.234	0
0	0.999	0	0.001	92.242	0.002

Blend Composition				NBP (°F)	Average Glide K
R-123	R-1336mzzZ	R-1326mxzZ	R-1326mxzE		
0	0.999	0.001	0	92.232	0
0	1	0	0	92.229	0
0.001	0.995	0	0.004	92.23	0.021
0.001	0.995	0.001	0.003	92.22	0.018
0.001	0.995	0.002	0.002	92.209	0.016
0.001	0.995	0.003	0.001	92.2	0.013
0.001	0.995	0.004	0	92.19	0.011
0.001	0.996	0	0.003	92.217	0.018
0.001	0.996	0.001	0.002	92.207	0.016
0.001	0.996	0.002	0.001	92.197	0.013
0.001	0.996	0.003	0	92.187	0.011
0.001	0.997	0	0.002	92.205	0.016
0.001	0.997	0.001	0.001	92.195	0.013
0.001	0.997	0.002	0	92.185	0.011
0.001	0.998	0	0.001	92.192	0.013
0.001	0.998	0.001	0	92.183	0.011
0.001	0.999	0	0	92.18	0.011
0.002	0.995	0	0.003	92.168	0.029
0.002	0.995	0.001	0.002	92.158	0.026
0.002	0.995	0.002	0.001	92.148	0.024
0.002	0.995	0.003	0	92.138	0.021
0.002	0.996	0	0.002	92.156	0.026
0.002	0.996	0.001	0.001	92.146	0.024
0.002	0.996	0.002	0	92.136	0.021
0.002	0.997	0	0.001	92.143	0.024
0.002	0.997	0.001	0	92.133	0.021
0.002	0.998	0	0	92.131	0.021
0.003	0.995	0	0.002	92.107	0.037
0.003	0.995	0.001	0.001	92.097	0.034
0.003	0.995	0.002	0	92.087	0.032
0.003	0.996	0	0.001	92.094	0.034
0.003	0.996	0.001	0	92.084	0.032
0.003	0.997	0	0	92.082	0.032
0.004	0.995	0	0.001	92.046	0.045
0.004	0.995	0.001	0	92.036	0.042
0.004	0.996	0	0	92.033	0.042
0.005	0.995	0	0	91.985	0.053

Table 35 (Continued)

Performance of Z-HFO-1336mzz Compositions in Stationary Chiller

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
53.738	311.883	4.743	-0.1511101	0
53.735	311.961	4.743	-0.1261385	0
53.732	312.038	4.743	-0.1014871	0
53.73	312.115	4.743	-0.0768357	0
53.727	312.192	4.743	-0.0521842	0
53.724	312.268	4.743	-0.0278529	0
53.739	311.978	4.743	-0.120696	0
53.736	312.055	4.743	-0.0960446	0
53.733	312.132	4.743	-0.0713931	0
53.73	312.209	4.743	-0.0467417	0

Discharge Temp (°C)	Capacity (kJ/m3)	COP	Cap % Increase	COP % Increase
53.727	312.286	4.743	-0.0220902	0
53.74	312.072	4.743	-0.090602	0
53.737	312.15	4.743	-0.0656305	0
53.734	312.227	4.743	-0.040979	0
53.731	312.303	4.743	-0.0166477	0
53.74	312.167	4.743	-0.0601879	0
53.737	312.244	4.743	-0.0355365	0
53.734	312.321	4.743	-0.0108851	0
53.741	312.261	4.743	-0.030094	0
53.738	312.338	4.743	-0.0054425	0
53.742	312.355	4.743	0	0
53.752	312.215	4.743	-0.0448208	0
53.749	312.293	4.743	-0.0198492	0
53.746	312.37	4.743	0.0048022	0
53.743	312.447	4.743	0.0294537	0
53.74	312.524	4.743	0.0541051	0
53.753	312.31	4.743	-0.0144067	0
53.75	312.387	4.743	0.0102448	0
53.747	312.464	4.743	0.0348962	0
53.744	312.541	4.743	0.0595476	0
53.753	312.404	4.743	0.0156873	0
53.75	312.482	4.743	0.0406589	0
53.747	312.559	4.743	0.0653103	0
53.754	312.499	4.743	0.0461014	0
53.751	312.576	4.743	0.0707528	0
53.754	312.593	4.743	0.0761954	0
53.766	312.547	4.743	0.0614685	0
53.763	312.625	4.743	0.0864401	0
53.76	312.702	4.743	0.1110915	0
53.757	312.779	4.743	0.135743	0
53.766	312.642	4.743	0.0918826	0
53.763	312.719	4.743	0.1165341	0
53.76	312.797	4.743	0.1415057	0
53.767	312.737	4.743	0.1222967	0
53.764	312.814	4.743	0.1469482	0
53.767	312.831	4.743	0.1523907	0
53.779	312.879	4.743	0.1677578	0
53.776	312.957	4.743	0.1927294	0
53.773	313.034	4.743	0.2173809	0
53.78	312.974	4.743	0.198172	0
53.777	313.051	4.743	0.2228234	0
53.78	313.069	4.743	0.2285861	0
53.792	313.211	4.743	0.2740472	0
53.789	313.289	4.743	0.2990187	0
53.793	313.306	4.743	0.3044613	0
53.806	313.543	4.743	0.3803365	0

Table 36
Performance of Z-HFO-1336mzz Compositions in ORC

Blend Composition				NBP (°F)	Critical Temp (C)
<i>R-11</i>	<i>R-1336mzzZ</i>	<i>R-1326mxzZ</i>	<i>R-1326mxzE</i>		
0	1	0	0	92.229	171.35
0.001	0.995	0	0.004	92.265	171.41
0.001	0.995	0.004	0	92.225	171.42
0.002	0.995	0.001	0.002	92.229	171.44
0.002	0.995	0.002	0.001	92.219	171.45
0.003	0.995	0.001	0.001	92.202	171.47
0.003	0.997	0	0	92.188	171.46
0.005	0.995	0	0	92.16	171.52

Table 36 (Continued)
Performance of Z-HFO-1336mzz Compositions in ORC

Critical Pressure (Mpa)	P_Conc (Mpa)	P_Evap (Mpa)	Volumetric Capacity at outlet (kJ/m ³)	Efficiency	Cap % Increase	Efficiency % Increase
2.903	0.031	0.118	35.581	8.054	0	0
2.9043	0.03	0.118	35.545	8.056	-0.1011776	0.0248324
2.9062	0.031	0.119	35.584	8.055	0.0084315	0.0124162
2.9062	0.03	0.118	35.577	8.056	-0.011242	0.0248324
2.9071	0.031	0.119	35.586	8.056	0.0140524	0.0248324
2.9083	0.031	0.119	35.598	8.057	0.0477783	0.0372486
2.9082	0.031	0.119	35.611	8.056	0.0843147	0.0248324
2.911	0.031	0.119	35.631	8.058	0.1405244	0.0496648

Table 37
Performance of Z-HFO-1336mzz Compositions in ORC

Blend Composition				NBP (°F)	Critical Temp (C)
<i>R-123</i>	<i>R-1336mzzZ</i>	<i>R-1326mxzZ</i>	<i>R-1326mxzE</i>		
0	1	0	0	92.229	171.35
0.001	0.995	0	0.004	92.23	171.37
0.001	0.995	0.004	0	92.19	171.38
0.002	0.995	0.001	0.002	92.158	171.36
0.002	0.995	0.002	0.001	92.148	171.35
0.003	0.995	0.001	0.001	92.097	171.34
0.003	0.997	0	0	92.082	171.33
0.005	0.995	0	0	91.985	171.31

Table 37 (Continued)
Performance of Z-HFO-1336mzz Compositions in ORC

Critical Pressure (Mpa)	P _{Cond} (Mpa)	P _{Evap} (Mpa)	Volumetric Capacity at outlet (kJ/m ³)	Efficiency	Cap % Increase	Efficiency % Increase
2.903	0.031	0.118	35.581	8.054	0	0
2.9036	0.03	0.118	35.561	8.057	-0.0562098	0.0372486
2.9055	0.031	0.119	35.599	8.055	0.0505888	0.0124162
2.9048	0.031	0.119	35.607	8.058	0.0730727	0.0496648
2.9051	0.031	0.119	35.617	8.057	0.1011776	0.0372486
2.9057	0.031	0.119	35.644	8.059	0.1770608	0.062081
2.906	0.031	0.119	35.657	8.059	0.2135971	0.062081
2.9071	0.031	0.119	35.707	8.062	0.3541216	0.0993295

Table 38
Performance of Z-HFO-1336mzz Compositions in High Temp Heat Pump

Blend Composition				NBP (°F)	Average Glide (K)
R-123	R-1336mzzZ	R-1326mxzZ	R-1326mxzE		
0	1	0	0	92.229	0
0.001	0.995	0	0.004	92.23	0.0074
0.001	0.995	0.004	0	92.19	0.0032
0.002	0.995	0.001	0.002	92.158	0.0082
0.002	0.995	0.002	0.001	92.148	0.0071
0.003	0.995	0.001	0.001	92.097	0.01
0.003	0.997	0	0	92.082	0.0088
0.005	0.995	0	0	91.985	0.0145

Table 38 (Continued)
Performance of Z-HFO-1336mzz Compositions in High Temp Heat Pump

Discharge Temp (°C)	Capacity (kJ/m ³)	COP	Cap % Increase	COP % Increase
145.844	3270.575	3.5814	0	0
145.839	3270.103	3.582	-0.0144317	0.0167532
145.646	3270.966	3.5811	0.0119551	-0.0083766
145.851	3272.284	3.5818	0.0522538	0.0111688
145.851	3272.499	3.5816	0.0588276	0.0055844
145.863	3274.247	3.5818	0.1122738	0.0111688
145.869	3275.006	3.5818	0.1354808	0.0111688
145.886	3277.957	3.582	0.2257095	0.0167532

[0496] Performance of the Z-HFO-1336mzz compositions containing the residual refrigerants is similar to or better than the Z-HFO-1336mzz composition which does not contain these residual refrigerants. More particularly, differences in energy

efficiency (shown as COP) and capacity among the compositions are *de minimis* and COP and capacity increased for some of the compositions containing the residual refrigerants. Thus, the data indicate that the presence of HCFC-123 or CFC-11 as a residual refrigerant in Z-HFO-1336mzz compositions does not negatively impact performance of the compositions.

Other Embodiments

[0497] Embodiment 1. A composition comprising HFO-1234yf and at least one residual refrigerant selected from at least one of the following groups:

- (i) one or more of HFC-134a, CFC-12 and combinations thereof;
- (ii) one or more of E-HFO-1234ze, HFC-134a, HFC-227ea and combinations thereof;
- (iii) one or more of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, E-HFO-1336mzz and combinations thereof;
- (iv) one or more of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze, CO₂ and combinations thereof;
- (v) one or more of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze and combinations thereof;
- (vi) one or more of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1113, Z-HFO-1113, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof; or
- (vii) combinations of any of groups (i), (ii), (iii), (iv), (v) and/or (vi).

[0498] Embodiment 2. The composition of Embodiment 1, further comprising at least one additional compound selected from the group consisting of HFO-1225ye, HFO-1243zf, E-HFO-1234ze, HFC-236ea, HCFC-244bb, HFC-245fa, HFC-245eb, HFC-245cb, 3,3,3-trifluoropropyne, HFC-152a, FO-1114, HFO-1123, HCFO-1131a, trans-HCFO-1131, HCO-1140, CFO-1214ya, FO-1216, HCFO-1224yd, HFO-1252 isomers, HFC-143a, HCFC-225, HFC-254eb, HFC-263fb, HFC-236fa, HCFC-142b, HCFC-244cc, HCFO-1223, HFO-1132a, HCC-40 and combinations thereof.

[0499] Embodiment 3. The composition of Embodiment 1, wherein the composition (i) further comprises at least one additional compound selected from the group consisting of HFO-1243zf, HFC-134, E-HFO-1234ze and combinations thereof.

[0500] Embodiment 4. The composition of Embodiment 1, wherein the composition (ii), (iii), (iv), (v), or (vi) further comprises at least one additional compound selected from the group consisting of HFC-245cb, HFO-1243zf, HFC-152a, 3,3,3-trifluoropropyne, HCC-40 and combinations thereof.

[0501] Embodiment 5. A composition comprising:

a first refrigerant portion comprising HFO-1234yf and at least one additional compound selected from the group consisting of HFO-1225ye, HFO-1243zf, E-HFO-1234ze, HFC-236ea, HCFC-244bb, HFC-245fa, HFC-245eb, HFC-245cb, 3,3,3-trifluoropropyne, HFC-152a, FO-1114, HFO-1123, HCFO-1131a, trans-HCFO-1131, HCO-1140, CFO-1214ya, FO-1216, HCFO-1224yd, HFO-1252 isomers, HFC-143a, HCFC-225, HFC-254eb, HFC-263fb, HFC-236fa, HCFC-142b, HCFC-244cc, HCFO-1223, HFO-1132a, HCC-40 and combinations thereof; and

a second refrigerant portion comprising at least one residual refrigerant selected from at least one of the following groups:

- (i) one or more of HFC-134a, CFC-12 and combinations thereof;
- (ii) one or more of E-HFO-1234ze, HFC-134a, HFC-227ea and combinations thereof;
- (iii) one or more of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, E-HFO-1336mzz and combinations thereof;
- (iv) one or more of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze, CO₂ and combinations thereof;
- (v) one or more of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze and combinations thereof;
- (vi) one or more of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-

HCFO-1224yd, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof; or

(vii) combinations of any of groups (i), (ii), (iii), (iv), (v) and/or (vi).

[0502] Embodiment 6. A composition comprising a first refrigerant portion comprising HFO-1234yf and at least one additional compound, and a second refrigerant portion comprising at least one residual refrigerant, wherein

- (i) the at least one additional compound is selected from the group consisting of HFO-1243zf, HFC-134, E-HFO-1234ze and combinations thereof, and the at least one residual refrigerant selected from the group consisting of HFC-134a, CFC-12 and combinations thereof;
- (ii) the at least one additional compound is selected from the group consisting of HFC-245cb, HFO-1243zf, HFC-152a, 3,3,3-trifluoropropyne, HCC-40 and combinations thereof, and the at least one residual refrigerant is selected from the group consisting of E-HFO-1234ze, HFC-134a, HFC-227ea and combinations thereof;
- (iii) the at least one additional compound is selected from the group consisting of HFC-245cb, HFO-1243zf, HFC-152a, 3,3,3-trifluoropropyne, HCC-40 and combinations thereof, and the at least one residual refrigerant is selected from the group consisting of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, E-HFO-1336mzz and combinations thereof;
- (iv) the at least one additional compound is selected from the group consisting of HFC-245cb, HFO-1243zf, HFC-152a, 3,3,3-trifluoropropyne, HCC-40 and combinations thereof, and the at least one residual refrigerant is selected from the group consisting of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze, CO₂ and combinations thereof;
- (v) the at least one additional compound is selected from the group consisting of HFC-245cb, HFO-1243zf, HFC-152a, 3,3,3-trifluoropropyne, HCC-40 and combinations thereof, and the at least one residual refrigerant is selected from the group consisting of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze and combinations thereof;

- (vi) the at least one additional compound is selected from the group consisting of HFC-245cb, HFO-1243zf, HFC-152a, 3,3,3-trifluoropropyne, HCC-40 and combinations thereof, and the at least one residual refrigerant is selected from the group consisting of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof; or
- (vii) combinations of any of (i), (ii), (iii), (iv), (v) and/or (vi).

[0503] Embodiment 7. A composition comprising HFC-134a and at least one residual refrigerant selected from at least one of the following groups:

- (i) at least CFC-12;
- (ii) one or more of CFC-12, HFC-32, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1234yf, E-HFO-1336mzz and combinations thereof;
- (iii) one or more of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze, CO₂ and combinations thereof;
- (iv) one or more of HCFC-22, HFC-32, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze and combinations thereof;
- (v) one or more of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof; or
- (vi) combinations of any of groups (i), (ii), (iii), (iv) and/or (v).

[0504] Embodiment 8. The composition of Embodiment 7, further comprising at least one additional compound selected from the group consisting of HFC-143a, HFO-1225zc, HFC-245cb, HFC-134, HFC-152a, HFO-1225ye, HFC-161, E-HFO-1234ze, HCFC-22, HFO-1243zf, HCFC-124, HCC-40, HCFO-1122, HCFC-31, CFC-114, CFC-114a, HCO-1140 and combinations thereof.

[0505] Embodiment 9. The composition of Embodiment 7, wherein the composition further comprises at least one additional compound selected from the group consisting of HFC-134, HCC-40, HCFC-124, CFC-114a, CFC-114 and combinations thereof.

[0506] Embodiment 10. A composition comprising:

a first refrigerant portion comprising HFC-134a and at least one additional compound selected from the group consisting of HFC-143a, HFO-1225zc, HFC-245cb, HFC-134, HFC-152a, HFO-1225ye, HFC-161, E-HFO-1234ze, HCFC-22, HFO-1243zf, HCFC-124, HCC-40, HCFO-1122, HCFC-31, CFC-114, CFC-114a, HCO-1140 and combinations thereof; and

a second refrigerant portion comprising at least one residual refrigerant selected from at least one of the following groups:

- (i) at least CFC-12;
- (ii) one or more of CFC-12, HFC-32, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1234yf, E-HFO-1336mzz and combinations thereof;
- (iii) one or more of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze, CO₂ and combinations thereof;
- (iv) one or more of HCFC-22, HFC-32, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze and combinations thereof;
- (v) one or more of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof; or
- (vi) combinations of any of groups (i), (ii), (iii), (iv) and/or (v).

[0507] Embodiment 11. A composition comprising a first refrigerant portion comprising HFC-134a and at least one additional compound selected from the group consisting of HFC-134, HCC-40, HCFC-124, CFC-114a, CFC-114 and combinations thereof; and a second refrigerant portion comprising at least one residual refrigerant selected from at least one of the following groups:

- (i) at least CFC-12;
- (ii) one or more of CFC-12, HFC-32, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1234yf, E-HFO-1336mzz and combinations thereof;
- (iii) one or more of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze, CO₂ and combinations thereof;

- (iv) one or more of HCFC-22, HFC-32, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze and combinations thereof;
- (v) one or more of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof; or
- (vi) combinations of any of groups (i), (ii), (iii), (iv) and/or (v).

[0508] Embodiment 12. A composition comprising E-HFO-1234ze and at least one residual refrigerant selected from at least one of the following groups:

- (i) one or more of HFC-134a, HFC-227ea and combinations thereof;
- (ii) one or more of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, Z-HFO-1234ze, E-HFO-1336mzz and combinations thereof;
- (iii) one or more of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, HFC-152a, CO₂ and combinations thereof;
- (iv) one or more of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a, HFO-1234yf and combinations thereof;
- (v) one or more of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, HFO-1252zc, Z-HFO-1234ze, E-HFO-1336mzz, CO₂ and combinations thereof;
- (vi) combinations of any of groups (i), (ii), (iii), (iv) and/or (v).

[0509] Embodiment 13. The composition of Embodiment 12, further comprising at least one additional compound selected from the group consisting of HFO-1234yf, HFC-245cb, HFO-1225ye(E), HFO-1225ye(Z), HFO-1225zc, HFC-236fa, HFC-152a, HFC-143a, HFC-125, HFC-134a, HFO-1234zc, HCFO-1233xf, HCFO-1233zd, CFC-114, HCFC-124, 3,3,3-trifluoropropyne, HFO-1234ze(Z), HFC-245fa, HFC-227ea, HFO-1243zf, HFC-263fb, HFC-134 and combinations thereof.

[0510] Embodiment 14. The composition of Embodiment 12, wherein the composition further comprises at least one additional compound selected from the group consisting of HFO-1234yf, HFC-245cb, HFO-1225ye(E), HFO-1225ye(Z), HFO-1225zc, HFC-134 and combinations thereof.

[0511] Embodiment 15. A composition comprising:

a first refrigerant portion comprising E-HFO-1234ze and at least one additional compound selected from the group consisting of HFO-1234yf, HFC-245cb, HFO-1225ye(E), HFO-1225ye(Z), HFO-1225zc, HFC-236fa, HFC-152a, HFC-143a, HFC-125, HFC-134a, HFO-1234zc, HCFO-1233xf, HCFO-1233zd, CFC-114, HCFC-124, 3,3,3-trifluoropropyne, HFO-1234ze(Z), HFC-245fa, HFC-227ea, HFO-1243zf, HFC-263fb, HFC-134 and combinations thereof; and

a second refrigerant portion comprising at least one residual refrigerant selected from at least one of the following groups:

- (i) one or more of HFC-134a, HFC-227ea and combinations thereof;
- (ii) one or more of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, Z-HFO-1234ze, E-HFO-1336mzz and combinations thereof;
- (iii) one or more of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, HFC-152a, CO₂ and combinations thereof;
- (iv) one or more of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a, HFO-1234yf and combinations thereof;
- (v) one or more of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-11132, Z-HFO-11132, Z-HCFO-1224yd, HFO-1234yf, HFO-1252zc, Z-HFO-1234ze, E-HFO-1336mzz, CO₂ and combinations thereof; or
- (vi) combinations of any of groups (i), (ii), (iii), (iv) and/or (v).

[0512] Embodiment 16. A composition comprising a first refrigerant portion comprising E-HFO-1234ze and at least one additional compound selected from the group consisting of HFO-1234yf, HFC-245cb, HFO-1225ye(E), HFO-1225ye(Z), HFO-1225zc, HFC-134 and combinations thereof; and a second refrigerant portion comprising at least one residual refrigerant selected from at least one of the following groups:

- (i) one or more of HFC-134a, HFC-227ea and combinations thereof;
- (ii) one or more of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, Z-HFO-1234ze, E-HFO-1336mzz and combinations thereof;

- (iii) one or more of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, HFC-152a, CO₂ and combinations thereof;
- (iv) one or more of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a, HFO-1234yf and combinations thereof;
- (v) one or more of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, HFO-1252zc, Z-HFO-1234ze, E-HFO-1336mzz, CO₂ and combinations thereof; or
- (vi) combinations of any of groups (i), (ii), (iii), (iv) and/or (v).

[0513] Embodiment 17. A composition comprising HFC-32 and at least one residual refrigerant selected from at least one of the following groups:

- (i) one or more of HCFC-22, HFC-125, HFO-1234yf and combinations thereof;
- (ii) one or more of CFC-12, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, E-HFO-1336mzz and combinations thereof;
- (iii) one or more of HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, E-HFO-1234ze, CO₂ and combinations thereof;
- (iv) one or more of HCFC-22, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze, HFO-1234yf and combinations thereof;
- (v) one or more of CFC-12, HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof; or
- (vi) combinations of any of groups (i), (ii), (iii), (iv) and/or (v).

[0514] Embodiment 18. The composition of Embodiment 17, further comprising at least one additional compound selected from the group consisting of HFC-143a, HFC-41, HFC-134a, HCFC-22, CFC-12, HCC-40 and combinations thereof.

[0515] Embodiment 19. The composition of Embodiment 17, wherein the composition further comprises at least one additional compound selected from the group consisting of HFC-143a, HCC-40, HFC-41 and combinations thereof.

[0516] Embodiment 20. A composition comprising:

a first refrigerant portion comprising HFC-32 and at least one additional compound selected from the group consisting of HFC-143a, HFC-41, HFC-134a, HCFC-22, CFC-12, HCC-40 and combinations thereof; and

a second refrigerant portion comprising at least one residual refrigerant selected from at least one of the following groups:

- (i) one or more of HCFC-22, HFC-125, HFO-1234yf and combinations thereof;
- (ii) one or more of CFC-12, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, E-HFO-1336mzz and combinations thereof;
- (iii) one or more of HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, E-HFO-1234ze, CO₂ and combinations thereof;
- (iv) one or more of HCFC-22, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze, HFO-1234yf and combinations thereof;
- (v) one or more of CFC-12, HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof; or
- (vi) combinations of any of groups (i), (ii), (iii), (iv) and/or (v).

[0517] Embodiment 21. A composition comprising a first refrigerant portion comprising HFC-32 and at least one additional compound selected from the group consisting of HFC-143a, HCC-40, HFC-41 and combinations thereof; and a second refrigerant portion comprising at least one residual refrigerant selected from at least one of the following groups:

- (i) one or more of HCFC-22, HFC-125, HFO-1234yf and combinations thereof;
- (ii) one or more of CFC-12, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, E-HFO-1336mzz and combinations thereof;
- (iii) one or more of HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, E-HFO-1234ze, CO₂ and combinations thereof;
- (iv) one or more of HCFC-22, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze, HFO-1234yf and combinations thereof;
- (v) one or more of CFC-12, HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-

1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof; or

(vi) combinations of any of groups (i), (ii), (iii), (iv) and/or (v).

[0518] Embodiment 22. A composition comprising E-HCFO-1233zd, and at least one residual refrigerant selected from the group consisting of CFC-11, HFC-245fa, trans-1,2-dichloroethylene (t-DCE), Z-HFO-1336mzz and combinations thereof.

[0519] Embodiment 23. The composition of Embodiment 22, further comprising at least one additional compound selected from the group consisting of E-HFO-1234ze, HFC-245fa, Z-HFO-1234ze, HFC-254fb, HCFO-1233xf, HCFC-235da, HCFO-1223za, HCFO-1335 isomer and combinations thereof.

[0520] Embodiment 24. A composition comprising:

a first refrigerant portion comprising E-HCFO-1233zd and at least one additional compound selected from the group consisting of E-HFO-1234ze, HFC-245fa, Z-HFO-1234ze, HFC-254fb, HCFO-1233xf, HCFC-235da, HCFO-1223za, HCFO-1335 isomer, and combinations thereof; and

a second refrigerant portion comprising at least one residual refrigerant selected from the group consisting of CFC-11, HFC-245fa, trans-1,2-dichloroethylene (t-DCE), Z-HFO-1336mzz and combinations thereof.

[0521] Embodiment 25. A composition comprising Z-HFO-1336mzz, and at least one residual refrigerant selected from the group consisting of CFC-11, HCFC-123, HFC-245fa, trans-1,2-dichloroethylene (t-DCE), E-HCFO-1233zd and combinations thereof.

[0522] Embodiment 26. The composition of Embodiment 25, further comprising at least one additional compound selected from the group consisting of HFO-1326mxz(E), HCFO-1326mxz(Z), HFC-346mdf, HFC-356mff and HFO-1336mzz(E) and combinations thereof.

[0523] Embodiment 27. The composition of Embodiment 25, further comprising at least one additional compound selected from the group consisting of E-HFO-1234ze, HFC-245fa, Z-HFO-1234ze, HCFO-1233xf, HCFC-235da and combinations thereof.

[0524] Embodiment 28. A composition comprising:

a first refrigerant portion comprising Z-HFO-1336mzz and at least one additional compound selected from the group consisting of HFO-1326mxz(E), HCFO-1326mxz(Z), HFC-346mdf, HFC-356mff and HFO-1336mzz(E) and combinations thereof; and

a second refrigerant portion comprising at least one residual refrigerant selected from the group consisting of CFC-11, HCFC-123, HFC-245fa, trans-1,2-dichloroethylene (t-DCE), E-HCFO-1233zd and combinations thereof.

[0525] Embodiment 29. A composition comprising:

a first refrigerant portion comprising Z-HFO-1336mzz and at least one additional compound selected from the group consisting of E-HFO-1234ze, HFC-245fa, Z-HFO-1234ze, HCFO-1233xf, HCFC-235da, and combinations thereof; and

a second refrigerant portion comprising at least one residual refrigerant selected from the group consisting of CFC-11, HCFC-123, HFC-245fa, trans-1,2-dichloroethylene (t-DCE), E-HCFO-1233zd and combinations thereof.

[0526] Embodiment 30. A composition comprising Z-HFO-1234ze, and at least one residual refrigerant selected from the group consisting of Z-HFO-1336mzz, E-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, E-HCFO-1233zd and combinations thereof.

[0527] Embodiment 31. The composition of Embodiment 30, further comprising at least one additional compound selected from the group consisting of E-HFO-1234ze, HFC-263fb, HFO-1234zc, HFC-245fa, HFO-1233zf, E-HCFO-1233zd, CFC-114, HFC-227ea, HFC-236fa, HFO-1327 isomer, HFO-1336 isomer and combinations thereof.

[0528] Embodiment 32. A composition comprising:

a first refrigerant portion comprising E-HFO-1234ze and at least one additional compound selected from the group consisting of E-HFO-1234ze, HFC-263fb, HFO-1234zc, HFC-245fa, HFO-1233zf, E-HCFO-1233zd, CFC-114, HFC-227ea, HFC-236fa, HFO-1327 isomer, HFO-1336 isomer and combinations thereof; and

a second refrigerant portion comprising at least one residual refrigerant selected from the group consisting of Z-HFO-1336mzz, E-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, E-HCFO-1233zd and combinations thereof.

[0529] Embodiment 33. A composition comprising HFC-125, and at least one residual refrigerant selected from the group consisting of CFC-12, HCFC-22, HFC-115, HFC-32, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂, HFC-23, CFC-1113, HCC-40 and combinations thereof.

[0530] Embodiment 34. The composition of Embodiment 33, further comprising at least one additional compound selected from the group consisting of HFC-23, HFC-32, HFC-143a, HFC-134a, CFC-115, CFCO-1113, HCC-40 and combinations thereof.

[0531] Embodiment 35. A composition comprising:

a first refrigerant portion comprising HFC-125 and at least one additional compound selected from the group consisting of HFC-23, HFC-32, HFC-143a, HFC-134a, CFC-115, CFCO-1113, HCC-40 and combinations thereof; and

a second refrigerant portion comprising at least one residual refrigerant selected from the group consisting of CFC-12, HCFC-22, HFC-115, HFC-32, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂, HFC-23, CFC-1113, HCC-40 and combinations thereof.

[0532] Embodiment 36. A composition comprising E-HFO-1336mzz, and at least one residual refrigerant selected from the group consisting of Z-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, E-HCFO-1233zd, HCFC-133a, HFO-1243zf, Z-HCFO-1326mxz, E-HCFO-1326mxz, HCFC-346mdf and combinations thereof.

[0533] Embodiment 37. The composition of Embodiment 36, further comprising at least one additional compound selected from the group consisting of HCC-30, HCFC-114, HCFC-114a, HCFC-133, HCFC-133a, HFC-245fa, HFC-338mee, HFC-338mf, HFC-347mef, HCO-1140, HCFO-1224 isomers, HCFO-1224yd, HCFO-

1224yb, HCFO-1233xf, HCFO-1233zd, HFO-1243zf, HFO-1327mz, HFO-1336ft, HCFO-1326mxz and combinations thereof.

[0534] Embodiment 38. A composition comprising:

a first refrigerant portion comprising E-HFO-1336mzz and at least one additional compound selected from the group consisting of HCC-30, HCFC-114, HCFC-114a, HCFC-133, HCFC-133a, HFC-245fa, HFC-338mee, HFC-338mf, HFC-347mef, HCO-1140, HCFO-1224 isomers, HCFO-1224yd, HCFO-1224yb, HCFO-1233xf, HCFO-1233zd, HFO-1243zf, HFO-1327mz, HFO-1336ft, HCFO-1326mxz and combinations thereof; and

a second refrigerant portion comprising at least one residual refrigerant selected from the group consisting of Z-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, E-HCFO-1233zd, HCFC-133a, HFO-1243zf, Z-HCFO-1326mxz, E-HCFO-1326mxz, HCFC-346mdf and combinations thereof.

[0535] Embodiment 39. A composition comprising Z-HFO-1132, and at least one residual refrigerant selected from the group consisting of HFC-32, HFC-134a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and combinations thereof.

[0536] Embodiment 40. The composition of Embodiment 39, further comprising at least one additional compound selected from the group consisting of difluoromethane (HFC-32), 1,1,1,2,2 pentafluoroethane (HFC-125), E-1-chloro-1,2-difluoroethylene (HCFO-E-1122a), Z-1-chloro-1,2-difluoroethylene (HCFO-Z-1122a), 1,1,2-trifluoroethylene (HFO-1123), fluoroethylene (HFO-1141), 1-chloro-1,2,2-trifluoroethane (HCFC-133), 1-chloro-1,1,2-trifluoroethane (HCFC-133b), 1,1-dichloro-2,2,2-trifluoroethane (HCFC-123), 1,2-difluoroethane (HFC-152), 1,1,2-trifluoroethane (HFC-143), fluoromethane (HFC-41), chlorodifluoromethane (HCFC-22), ethylene, 1-chloro-1,2-difluoroethane (HCFC-142a), 1,1-difluoroethylene (HFO-1132a), 1-chloro-1-fluoroethene (HCFO-1131a), E-1-chloro-2-fluoroethene (HCFO-E-1131), Z-1-chloro-1-fluoroethene (HCFO-Z-1131), 1-chloro-2,2-difluoroethylene (HCFO-1122), HFO-E-1132, vinyl chloride (HCO-1140), acetylene, fluoroacetylene and combinations thereof.

[0537] Embodiment 41. A composition comprising:

a first refrigerant portion comprising Z-HFO-1132 and at least one additional compound selected from the group consisting of difluoromethane (HFC-32), 1,1,1,2,2 pentafluoroethane (HFC-125), E-1-chloro-1,2-difluoroethylene (HCFO-E-1122a), Z-1-chloro-1,2-difluoroethylene (HCFO-Z-1122a), 1,1,2-trifluoroethylene (HFO-1123), fluoroethylene (HFO-1141), 1-chloro-1,2,2-trifluoroethane (HCFC-133), 1-chloro-1,1,2-trifluoroethane (HCFC-133b), 1,1-dichloro-2,2,2-trifluoroethane (HCFC-123), 1,2-difluoroethane (HFC-152), 1,1,2-trifluoroethane (HFC-143), fluoromethane (HFC-41), chlorodifluoromethane (HCFC-22), ethylene, 1-chloro-1,2-difluoroethane (HCFC-142a), 1,1-difluoroethylene (HFO-1132a), 1-chloro-1-fluoroethene (HCFO-1131a), E-1-chloro-2-fluoroethene (HCFO-E-1131), Z-1-chloro-1-fluoroethene (HCFO-Z-1131), 1-chloro-2,2-difluoroethylene (HCFO-1122), HFO-E-1132, vinyl chloride (HCO-1140), acetylene, fluoroacetylene and combinations thereof; and

a second refrigerant portion comprising at least one residual refrigerant selected from the group consisting of HFC-32, HFC-134a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and combinations thereof.

[0538] Embodiment 42. A composition comprising E-HFO-1132, and at least one residual refrigerant selected from the group consisting of HFC-32, HFC-134a, HFC-152a, HFC-227ea, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and combinations thereof.

[0539] Embodiment 43. The composition of Embodiment 42, further comprising at least one additional compound selected from the group consisting of HFC-32, HFC-125, HCFO-E-1122a, HCFO-Z-1122a, HFO-1123, HFO-1141, HCFC-133, HCFC-133b, HCFC-123, HFC-152, HFC-143, HFC-41, HCFC-22, ethylene, HCFC-142a, HFO-1132a, HCFO-1131a, HCFO-E-1131, HCFO-Z-1131, HCFO-1122, acetylene, HCO-1140 and combinations thereof.

[0540] Embodiment 44. A composition comprising:

a first refrigerant portion comprising Z-HFO-1132 and at least one additional compound selected from the group consisting of HFC-32, HFC-125, HCFO-E-1122a, HCFO-Z-1122a, HFO-1123, HFO-1141, HCFC-133, HCFC-133b, HCFC-123, HFC-152, HFC-143, HFC-41, HCFC-22, ethylene, HCFC-142a, HFO-1132a,

HCFO-1131a, HCFO-E-1131, HCFO-Z-1131, HCFO-1122, acetylene, HCO-1140 and combinations thereof; and

a second refrigerant portion comprising at least one residual refrigerant selected from the group consisting of HFC-32, HFC-134a, HFC-152a, HFC-227ea, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and combinations thereof.

[0541] Embodiment 45. The composition according to any one of Embodiments 1-4, 7-9, 12-14, 17-19, 22-23, 25-27, 30-31, 33-34, 36-37, 39-40 and 42-43, wherein a total amount of the residual refrigerants is from about 0.00001 to about 2 weight percent, preferably about 0.00001 to about 0.5 weight percent, more preferably about 0.0001 to about 0.5 weight percent or about 0.001 to about 0.5 weight percent, based on a total weight of the composition.

[0542] Embodiment 46. The composition according to any one of Embodiments 5-6, 10-11, 15-16, 20-21, 24, 28, 32, 35, 38, 41 and 44, wherein an amount of the second refrigerant portion is from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, based on a total weight of the composition.

[0543] Embodiment 47. The composition according to any of Embodiments 1 to 46, wherein the composition is a reprocessed product, preferably a distillation product, of a thermal management fluid blend.

[0544] Embodiment 48. A process of obtaining the composition according to any of Embodiments 1 to 47, the process comprising distilling a thermal management fluid blend to separate components thereof, and obtaining the composition, preferably wherein a total amount of the residual refrigerants in the composition is from about 0.00001 to about 2 weight percent, more preferably about 0.00001 to about 0.5 weight percent, more preferably about 0.0001 to about 0.5 weight percent or about 0.001 to about 0.5 weight percent, based on a total weight of the composition

[0545] Embodiment 49. The composition according to Embodiment 47 or the process according to Embodiment 48, wherein the thermal management fluid blend is a recovered thermal management fluid.

[0546] Embodiment 50. A heat transfer system comprising the composition of any of Embodiments 1 to 46.

[0547] Embodiment 51. The heat transfer system of Embodiment 50, wherein said heat transfer system is designed for use with or previously contained at least one of the residual refrigerants.

[0548] Embodiment 52. The heat transfer system of any of Embodiments 50-51, wherein the heat transfer system comprises at least one member selected from the group consisting of air conditioners, freezers, refrigerators, heat pumps, water chillers, flooded evaporator chillers, direct expansion chillers, walk-in coolers, heat pumps, mobile refrigerators, mobile air conditioning units and combinations thereof; and wherein the heat transfer system comprises a working fluid comprising the composition of any one of Embodiments 1 to 46.

[0549] Embodiment 53. The heat transfer system of any of Embodiments 50-52, comprising a commercial refrigeration system.

[0550] Embodiment 54. The heat transfer system of any of Embodiments 50-52, comprising a medium or low temperature refrigeration system.

[0551] Embodiment 55. The heat transfer system of any of Embodiments 50-52, comprising a residential refrigerator or freezer.

[0552] Embodiment 56. The heat transfer system of any of Embodiments 50-52, comprising a heat pump.

[0553] Embodiment 57. The heat transfer system of any of Embodiments 50-52, comprising a high temperature heat pump.

[0554] Embodiment 58. The heat transfer system of any of Embodiments 50-52, comprising a chiller.

[0555] Embodiment 59. The heat transfer system of any of Embodiments 50-52, comprising an air conditioning system.

[0556] Embodiment 60. The heat transfer system of any of Embodiments 50-52, comprising an automotive air conditioning system.

[0557] Embodiment 61. A container or cylinder, preferably a recovery container or recovery cylinder, containing the composition of any of Embodiments 1 to 47.

[0558] Embodiment 62. A RRR machine containing the composition of any of Embodiments 1 to 47.

[0559] Embodiment 63. The composition of any of Embodiments 1 to 46, wherein the composition is a spent or used thermal management fluid.

[0560] Embodiment 64. The composition of any of Embodiments 1 to 46, wherein the composition is a recovered thermal management fluid.

[0561] Embodiment 65. The composition of any of Embodiments 1 to 47, wherein the composition is a recycled thermal management fluid.

[0562] Embodiment 66. The composition of any of Embodiments 1 to 47, wherein the composition is a reclaimed thermal management fluid.

[0563] Embodiment 67. The composition of any of Embodiments 1 to 47, wherein at least a portion of the composition is a reclaimed thermal management fluid.

[0564] Embodiment 68. The composition of any of Embodiments 1-6, 12-16, 22-32 and 36-44, the composition further comprising an effective amount of at least one inhibitor, such that the composition remains substantially free of oligomeric, homopolymeric, or other polymeric products derived from hydrofluoroolefin refrigerants of the composition.

[0565] Embodiment 69. The composition of Embodiment 68, wherein the at least one inhibitor is selected from the group consisting of hydrocarbons including at least one of cyclic monoterpene; lipophilic organic compounds including tocopherols such as α -tocopherol; phenols and aromatic organic compounds having at least one chemical moiety $-C_6H_4(OH)$.

[0566] Embodiment 70. The composition of any of Embodiments 68-69, wherein the at least one inhibitor comprises a member selected from the group consisting of limonene, α -pinene, β -pinene, α -terpinene, α -tocopherol, butylated hydroxytoluene (BHT), 4-methoxyphenol, and benzene-1,4-diol.

[0567] Embodiment 71. A method of obtaining the composition of any of Embodiments 1 to 46, the method comprising removing the composition from a heat transfer system.

[0568] Embodiment 72. The method of Embodiment 71, wherein the at least one residual refrigerant is not separated from the composition after removal from the heat transfer system.

[0569] Embodiment 73. The method of Embodiment 71, wherein the second refrigerant portion is not separated from the first refrigerant portion after removal from the heat transfer system.

[0570] Embodiment 74. The method of Embodiment 71, wherein said heat transfer system is designed for use with or previously contained at least one of the residual refrigerants.

[0571] Embodiment 75. The heat transfer system of Embodiment 71, wherein the heat transfer system comprises at least one member selected from the group consisting of air conditioners, freezers, refrigerators, heat pumps, water chillers, flooded evaporator chillers, direct expansion chillers, walk-in coolers, heat pumps, mobile refrigerators, mobile air conditioning units and combinations thereof.

[0572] Embodiment 76. A method for replacing an original refrigerant with a replacement refrigerant in a heat transfer system that uses, used or was designed to use the original refrigerant, the method comprising charging the heat transfer system with the replacement refrigerant, wherein at least some of the original refrigerant remains in the heat transfer system as a residual refrigerant, and wherein:

- (i) the original refrigerant comprises, consists essentially of or consists of at least CFC-12, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;
- (ii) the original refrigerant comprises, consists essentially of or consists of at least one CFC-12, HFC-134a and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-134a;
- (iii) the original refrigerant comprises, consists essentially of or consists of at least one of HFC-134a, HFC-227ea and combinations thereof, and the

replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1234ze;

- (iv) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1234ze;
- (v) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1234ze;
- (vi) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a, HFO-1234yf and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1234ze;
- (vii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1234ze;
- (viii) the original refrigerant comprises, consists essentially of or consists of at least one of HFC-134a, HFC-227ea, E-HFO-1234ze and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;
- (ix) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;

- (x) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;
- (xi) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;
- (xii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;
- (xiii) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-125, HFO-1234yf and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-32;
- (xiv) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-32;
- (xv) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, E-HFO-1234ze, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-32;
- (xvi) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze,

- HFO-1234yf and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-32;
- (xvii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-32;
- (xviii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HFC-32, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1234yf, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-134a;
- (xix) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-134a;
- (xx) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-134a;
- (xxi) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-134a;
- (xxii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-11, HFC-245fa, t-DCE, Z-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HCFO-1233zd;

- (xxiii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-11, HCFC-123, HFC-245fa, t-DCE, E-HCFO-1233zd and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least Z-HFO-1336mzz;
- (xxiv) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HCFC-22, HFC-115, HFC-32, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂, HFC-23, CFO-1113, HCC-40 and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-125;
- (xxv) the original refrigerant comprises, consists essentially of or consists of at least one of Z-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, E-HCFO-1233zd, HCFC-133a, HFO-1243zf, Z-HCFO-1326mxz, E-HCFO-1326mxz, HCFC-346mdf and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1336mzz;
- (xxvi) the original refrigerant comprises, consists essentially of or consists of at least one of Z-HFO-1336mzz, E-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, E-HCFO-1233zd and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least Z-HFO-1234ze;
- (xxvii) the original refrigerant comprises, consists essentially of or consists of at least one of HFC-32, HFC-134a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least Z-HFO-1132; or
- (xxviii) the original refrigerant comprises, consists essentially of or consists of at least one of HFC-32, HFC-134a, HFC-152a, HFC-227ea, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and combinations thereof, and the replacement

refrigerant comprises, consists essentially of or consists of at least E-HFO-1132.

[0573] Embodiment 77. A method for replacing an original refrigerant with a replacement refrigerant in a heat transfer system that uses, used or was designed to use the original refrigerant, the method comprising removing a substantial portion of the original refrigerant from the heat transfer system, optionally retaining a substantial portion of any lubricant present in the system, and charging the heat transfer system with the replacement refrigerant, wherein at least a portion of the original refrigerant remains in the heat transfer system as a residual refrigerant, and wherein:

- (i) the original refrigerant comprises, consists essentially of or consists of at least one CFC-12, HFC-134a and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;
- (ii) the original refrigerant comprises, consists essentially of or consists of at least CFC-12, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-134a;
- (iii) the original refrigerant comprises, consists essentially of or consists of at least one of HFC-134a, HFC-227ea and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1234ze;
- (iv) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1234ze;
- (v) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1234ze;

- (vi) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a, HFO-1234yf and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1234ze;
- (vii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1234ze;
- (viii) the original refrigerant comprises, consists essentially of or consists of at least one of HFC-134a, HFC-227ea, E-HFO-1234ze and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;
- (ix) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;
- (x) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;
- (xi) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;
- (xii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and

- combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;
- (xiii) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-125, HFO-1234yf and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-32;
- (xiv) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-32;
- (xv) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, E-HFO-1234ze, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-32;
- (xvi) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze, HFO-1234yf and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-32;
- (xvii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-32;
- (xviii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HFC-32, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1234yf, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-134a;

- (xix) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-134a;
- (xx) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-134a;
- (xxi) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-134a;
- (xxii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-11, HFC-245fa, t-DCE, Z-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HCFO-1233zd;
- (xxiii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-11, HCFC-123, HFC-245fa, t-DCE, E-HCFO-1233zd and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least Z-HFO-1336mzz;
- (xxiv) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HCFC-22, HFC-115, HFC-32, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂, HFC-23, CFO-1113, HCC-40 and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-125;
- (xxv) the original refrigerant comprises, consists essentially of or consists of at least one of Z-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-

HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, E-HCFO-1233zd, HCFC-133a, HFO-1243zf, Z-HCFO-1326mxz, E-HCFO-1326mxz, HCFC-346mdf and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1336mzz;

- (xxvi) the original refrigerant comprises, consists essentially of or consists of at least one of Z-HFO-1336mzz, E-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, E-HCFO-1233zd and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least Z-HFO-1234ze;
- (xxvii) the original refrigerant comprises, consists essentially of or consists of at least one of HFC-32, HFC-134a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least Z-HFO-1132; or
- (xxviii) the original refrigerant comprises, consists essentially of or consists of at least one of HFC-32, HFC-134a, HFC-152a, HFC-227ea, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1132.

[0574] Embodiment 78. The composition of any of Embodiments 76-77, wherein the replacement refrigerant is recovered thermal management fluid.

[0575] Embodiment 79. The composition of any of Embodiments 76-77, wherein the replacement refrigerant is a recycled thermal management fluid.

[0576] Embodiment 80. The composition of any of Embodiments 76-77, wherein the replacement refrigerant is a reclaimed thermal management fluid.

[0577] Embodiment 81. The composition of any of Embodiments 76-77, wherein at least a portion of the replacement refrigerant is a reclaimed thermal management fluid.

[0578] Embodiment 82. A method of reclaiming refrigerant, the method comprising:

removing a refrigerant composition from a heat transfer system, the refrigerant composition being one of the compositions of any of Embodiments 11-4, 7-9, 12-14, 17-19, 22-23, 25-27, 30-31, 33-34, 36-37, 39-40 and 42-43;

performing at least one treatment selected from transferring, blending, distillation, nitrogen purging, filtration, dehydration, caustic scrubbing, moisture removal, acid removal, oil removal, decanting, composition ratio adjustment and combinations thereof to form a partially reclaimed refrigerant composition or a reclaimed refrigerant composition, wherein a total amount of the residual refrigerants after the treatment is from about 0.00001 to about 2 weight percent, preferably about 0.00001 to about 0.5 weight percent, more preferably about 0.0001 to about 0.5 weight percent or about 0.001 to about 0.5 weight percent, based on a total weight of the composition; and

either storing the partially reclaimed refrigerant composition or a reclaimed refrigerant composition in a container for use in another system or introducing the partially reclaimed refrigerant composition or a reclaimed refrigerant composition back into the heat transfer system.

[0579] Embodiment 83. A method of reclaiming refrigerant, the method comprising:

removing a refrigerant composition from a heat transfer system, the refrigerant composition being one of the compositions of any of Embodiments 5-6, 10-11, 15-16, 20-21, 24, 28, 32, 35, 38, 41 and 44;

performing at least one treatment selected from transferring, blending, distillation, nitrogen purging, filtration, dehydration, caustic scrubbing, moisture removal, acid removal, oil removal, decanting, composition ratio adjustment and combinations thereof to form a partially reclaimed refrigerant composition or a reclaimed refrigerant composition, wherein an amount of the second portion after the treatment is from about 0.00001 to about 2 weight percent, preferably about 0.00001 to about 0.5 weight percent, more preferably about 0.0001 to about 0.5 weight percent or about 0.001 to about 0.5 weight percent, based on a total weight of the composition; and

either storing the partially reclaimed refrigerant composition or a reclaimed refrigerant composition in a container for use in another system or introducing the partially reclaimed refrigerant composition or a reclaimed refrigerant composition back into the heat transfer system.

[0580] Embodiment 84. A method of reclaiming refrigerant, the method comprising:

subjecting a thermal management fluid blend to distillation to obtain the composition according to any of Embodiments 1 to 47, a total amount of the residual refrigerants after the treatment being from about 0.00001 to about 2 weight percent, preferably about 0.00001 to about 0.5 weight percent, based on a total weight of the composition; and

either storing the composition in a container for use in a heat transfer system or directly introducing the composition into a heat transfer system.

[0581] Embodiment 85. The method of Embodiment 84, the method further comprising a step of recovering the thermal management fluid blend from a heat transfer system.

[0582] Embodiment 86. A container or cylinder, preferably a recovery container or recovery cylinder, containing a composition reclaimed by the method of any of Embodiments 84-85.

[0583] Embodiment 87. A RRR machine containing a composition reclaimed by the method of any of Embodiments 84-85.

CLAIMS

What is claimed is:

1. A composition comprising HFO-1234yf and at least one residual refrigerant selected from at least one of the following groups:
 - (i) one or more of HFC-134a, CFC-12 and combinations thereof;
 - (ii) one or more of E-HFO-1234ze, HFC-134a, HFC-227ea and combinations thereof;
 - (iii) one or more of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, E-HFO-1336mzz and combinations thereof;
 - (iv) one or more of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze, CO₂ and combinations thereof;
 - (v) one or more of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze and combinations thereof;
 - (vi) one or more of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof; or
 - (vii) combinations of any of groups (i), (ii), (iii), (iv), (v) and/or (vi).
2. The composition of claim 1, further comprising at least one additional compound selected from the group consisting of HFO-1225ye, HFO-1243zf, E-HFO-1234ze, HFC-236ea, HCFC-244bb, HFC-245fa, HFC-245eb, HFC-245cb, 3,3,3-trifluoropropyne, HFC-152a, FO-1114, HFO-1123, HCFO-1131a, trans-HCFO-1131, HCO-1140, CFO-1214ya, FO-1216, HCFO-1224yd, HFO-1252 isomers, HFC-143a, HCFC-225, HFC-254eb, HFC-263fb, HFC-236fa, HCFC-142b, HCFC-244cc, HCFO-1223, HFO-1132a, HCC-40 and combinations thereof.
3. The composition of claim 1, wherein the composition (i) further comprises at least one additional compound selected from the group consisting of HFO-1243zf, HFC-134, E-HFO-1234ze and combinations thereof.
4. The composition of claim 1, wherein the composition (ii), (iii), (iv), (v), or (vi) further comprises at least one additional compound selected from the group

consisting of HFC-245cb, HFO-1243zf, HFC-152a, 3,3,3-trifluoropropyne, HCC-40 and combinations thereof.

5. A composition comprising:

a first refrigerant portion comprising HFO-1234yf and at least one additional compound selected from the group consisting of HFO-1225ye, HFO-1243zf, E-HFO-1234ze, HFC-236ea, HCFC-244bb, HFC-245fa, HFC-245eb, HFC-245cb, 3,3,3-trifluoropropyne, HFC-152a, FO-1114, HFO-1123, HCFO-1131a, trans-HCFO-1131, HCO-1140, CFO-1214ya, FO-1216, HCFO-1224yd, HFO-1252 isomers, HFC-143a, HCFC-225, HFC-254eb, HFC-263fb, HFC-236fa, HCFC-142b, HCFC-244cc, HCFO-1223, HFO-1132a, HCC-40 and combinations thereof; and

a second refrigerant portion comprising at least one residual refrigerant selected from at least one of the following groups:

- (i) one or more of HFC-134a, CFC-12 and combinations thereof;
- (ii) one or more of E-HFO-1234ze, HFC-134a, HFC-227ea and combinations thereof;
- (iii) one or more of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, E-HFO-1336mzz and combinations thereof;
- (iv) one or more of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze, CO₂ and combinations thereof;
- (v) one or more of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze and combinations thereof;
- (vi) one or more of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof; or
- (vii) combinations of any of groups (i), (ii), (iii), (iv), (v) and/or (vi).

6. A composition comprising a first refrigerant portion comprising HFO-1234yf and at least one additional compound, and a second refrigerant portion comprising at least one residual refrigerant, wherein

- (i) the at least one additional compound is selected from the group consisting of HFO-1243zf, HFC-134, E-HFO-1234ze and combinations

- thereof, and the at least one residual refrigerant selected from the group consisting of HFC-134a, CFC-12 and combinations thereof;
- (ii) the at least one additional compound is selected from the group consisting of HFC-245cb, HFO-1243zf, HFC-152a, 3,3,3-trifluoropropyne, HCC-40 and combinations thereof, and the at least one residual refrigerant is selected from the group consisting of E-HFO-1234ze, HFC-134a, HFC-227ea and combinations thereof;
 - (iii) the at least one additional compound is selected from the group consisting of HFC-245cb, HFO-1243zf, HFC-152a, 3,3,3-trifluoropropyne, HCC-40 and combinations thereof, and the at least one residual refrigerant is selected from the group consisting of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, E-HFO-1336mzz and combinations thereof;
 - (iv) the at least one additional compound is selected from the group consisting of HFC-245cb, HFO-1243zf, HFC-152a, 3,3,3-trifluoropropyne, HCC-40 and combinations thereof, and the at least one residual refrigerant is selected from the group consisting of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze, CO₂ and combinations thereof;
 - (v) the at least one additional compound is selected from the group consisting of HFC-245cb, HFO-1243zf, HFC-152a, 3,3,3-trifluoropropyne, HCC-40 and combinations thereof, and the at least one residual refrigerant is selected from the group consisting of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze and combinations thereof;
 - (vi) the at least one additional compound is selected from the group consisting of HFC-245cb, HFO-1243zf, HFC-152a, 3,3,3-trifluoropropyne, HCC-40 and combinations thereof, and the at least one residual refrigerant is selected from the group consisting of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof; or

- (vii) combinations of any of (i), (ii), (iii), (iv), (v) and/or (vi).
7. A composition comprising HFC-134a and at least one residual refrigerant selected from at least one of the following groups:
- (i) at least CFC-12;
 - (ii) one or more of CFC-12, HFC-32, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1234yf, E-HFO-1336mzz and combinations thereof;
 - (iii) one or more of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze, CO₂ and combinations thereof;
 - (iv) one or more of HCFC-22, HFC-32, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze and combinations thereof;
 - (v) one or more of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof; or
 - (vi) combinations of any of groups (i), (ii), (iii), (iv) and/or (v).
8. The composition of claim 7, further comprising at least one additional compound selected from the group consisting of HFC-143a, HFO-1225zc, HFC-245cb, HFC-134, HFC-152a, HFO-1225ye, HFC-161, E-HFO-1234ze, HCFC-22, HFO-1243zf, HCFC-124, HCC-40, HCFO-1122, HCFC-31, CFC-114, CFC-114a, HCO-1140 and combinations thereof.
9. The composition of claim 7, wherein the composition further comprises at least one additional compound selected from the group consisting of HFC-134, HCC-40, HCFC-124, CFC-114a, CFC-114 and combinations thereof.
10. A composition comprising:
- a first refrigerant portion comprising HFC-134a and at least one additional compound selected from the group consisting of HFC-143a, HFO-1225zc, HFC-245cb, HFC-134, HFC-152a, HFO-1225ye, HFC-161, E-HFO-1234ze, HCFC-22, HFO-1243zf, HCFC-124, HCC-40, HCFO-1122, HCFC-31, CFC-114, CFC-114a, HCO-1140 and combinations thereof; and

a second refrigerant portion comprising at least one residual refrigerant selected from at least one of the following groups:

- (i) at least CFC-12;
- (ii) one or more of CFC-12, HFC-32, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1234yf, E-HFO-1336mzz and combinations thereof;
- (iii) one or more of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze, CO₂ and combinations thereof;
- (iv) one or more of HCFC-22, HFC-32, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze and combinations thereof;
- (v) one or more of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof; or
- (vi) combinations of any of groups (i), (ii), (iii), (iv) and/or (v).

11. A composition comprising a first refrigerant portion comprising HFC-134a and at least one additional compound selected from the group consisting of HFC-134, HCC-40, HCFC-124, CFC-114a, CFC-114 and combinations thereof; and a second refrigerant portion comprising at least one residual refrigerant selected from at least one of the following groups:

- (i) at least CFC-12;
- (ii) one or more of CFC-12, HFC-32, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1234yf, E-HFO-1336mzz and combinations thereof;
- (iii) one or more of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze, CO₂ and combinations thereof;
- (iv) one or more of HCFC-22, HFC-32, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze and combinations thereof;
- (v) one or more of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof; or

- (vi) combinations of any of groups (i), (ii), (iii), (iv) and/or (v).
12. A composition comprising E-HFO-1234ze and at least one residual refrigerant selected from at least one of the following groups:
- (i) one or more of HFC-134a, HFC-227ea and combinations thereof;
 - (ii) one or more of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, Z-HFO-1234ze, E-HFO-1336mzz and combinations thereof;
 - (iii) one or more of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, HFC-152a, CO₂ and combinations thereof;
 - (iv) one or more of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a, HFO-1234yf and combinations thereof;
 - (v) one or more of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, HFO-1252zc, Z-HFO-1234ze, E-HFO-1336mzz, CO₂ and combinations thereof;
 - (vi) combinations of any of groups (i), (ii), (iii), (iv) and/or (v).
13. The composition of claim 12, further comprising at least one additional compound selected from the group consisting of HFO-1234yf, HFC-245cb, HFO-1225ye(E), HFO-1225ye(Z), HFO-1225zc, HFC-236fa, HFC-152a, HFC-143a, HFC-125, HFC-134a, HFO-1234zc, HCFO-1233xf, HCFO-1233zd, CFC-114, HCFC-124, 3,3,3-trifluoropropyne, HFO-1234ze(Z), HFC-245fa, HFC-227ea, HFO-1243zf, HFC-263fb, HFC-134 and combinations thereof.
14. The composition of claim 12, wherein the composition further comprises at least one additional compound selected from the group consisting of HFO-1234yf, HFC-245cb, HFO-1225ye(E), HFO-1225ye(Z), HFO-1225zc, HFC-134 and combinations thereof.
15. A composition comprising:
- a first refrigerant portion comprising E-HFO-1234ze and at least one additional compound selected from the group consisting of HFO-1234yf, HFC-245cb, HFO-1225ye(E), HFO-1225ye(Z), HFO-1225zc, HFC-236fa, HFC-152a, HFC-143a, HFC-125, HFC-134a, HFO-1234zc, HCFO-1233xf, HCFO-

1233zd, CFC-114, HCFC-124, 3,3,3-trifluoropropyne, HFO-1234ze(Z), HFC-245fa, HFC-227ea, HFO-1243zf, HFC-263fb, HFC-134 and combinations thereof; and

a second refrigerant portion comprising at least one residual refrigerant selected from at least one of the following groups:

- (i) one or more of HFC-134a, HFC-227ea and combinations thereof;
- (ii) one or more of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, Z-HFO-1234ze, E-HFO-1336mzz and combinations thereof;
- (iii) one or more of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, HFC-152a, CO₂ and combinations thereof;
- (iv) one or more of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a, HFO-1234yf and combinations thereof;
- (v) one or more of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, HFO-1252zc, Z-HFO-1234ze, E-HFO-1336mzz, CO₂ and combinations thereof; or
- (vi) combinations of any of groups (i), (ii), (iii), (iv) and/or (v).

16. A composition comprising a first refrigerant portion comprising E-HFO-1234ze and at least one additional compound selected from the group consisting of HFO-1234yf, HFC-245cb, HFO-1225ye(E), HFO-1225ye(Z), HFO-1225zc, HFC-134 and combinations thereof; and a second refrigerant portion comprising at least one residual refrigerant selected from at least one of the following groups:

- (i) one or more of HFC-134a, HFC-227ea and combinations thereof;
- (ii) one or more of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, Z-HFO-1234ze, E-HFO-1336mzz and combinations thereof;
- (iii) one or more of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, HFC-152a, CO₂ and combinations thereof;
- (iv) one or more of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a, HFO-1234yf and combinations thereof;

- (v) one or more of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, HFO-1252zc, Z-HFO-1234ze, E-HFO-1336mzz, CO₂ and combinations thereof; or
 - (vi) combinations of any of groups (i), (ii), (iii), (iv) and/or (v).
17. A composition comprising HFC-32 and at least one residual refrigerant selected from at least one of the following groups:
- (i) one or more of HCFC-22, HFC-125, HFO-1234yf and combinations thereof;
 - (ii) one or more of CFC-12, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, E-HFO-1336mzz and combinations thereof;
 - (iii) one or more of HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, E-HFO-1234ze, CO₂ and combinations thereof;
 - (iv) one or more of HCFC-22, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze, HFO-1234yf and combinations thereof;
 - (v) one or more of CFC-12, HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof; or
 - (vi) combinations of any of groups (i), (ii), (iii), (iv) and/or (v).
18. The composition of claim 17, further comprising at least one additional compound selected from the group consisting of HFC-143a, HFC-41, HFC-134a, HCFC-22, CFC-12, HCC-40 and combinations thereof.
19. The composition of claim 17, wherein the composition further comprises at least one additional compound selected from the group consisting of HFC-143a, HCC-40, HFC-41 and combinations thereof.
20. A composition comprising:
- a first refrigerant portion comprising HFC-32 and at least one additional compound selected from the group consisting of HFC-143a, HFC-41, HFC-134a, HCFC-22, CFC-12, HCC-40 and combinations thereof; and

a second refrigerant portion comprising at least one residual refrigerant selected from at least one of the following groups:

- (i) one or more of HCFC-22, HFC-125, HFO-1234yf and combinations thereof;
- (ii) one or more of CFC-12, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, E-HFO-1336mzz and combinations thereof;
- (iii) one or more of HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, E-HFO-1234ze, CO₂ and combinations thereof;
- (iv) one or more of HCFC-22, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze, HFO-1234yf and combinations thereof;
- (v) one or more of CFC-12, HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof; or
- (vi) combinations of any of groups (i), (ii), (iii), (iv) and/or (v).

21. A composition comprising a first refrigerant portion comprising HFC-32 and at least one additional compound selected from the group consisting of HFC-143a, HCC-40, HFC-41 and combinations thereof; and a second refrigerant portion comprising at least one residual refrigerant selected from at least one of the following groups:

- (i) one or more of HCFC-22, HFC-125, HFO-1234yf and combinations thereof;
- (ii) one or more of CFC-12, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, E-HFO-1336mzz and combinations thereof;
- (iii) one or more of HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, E-HFO-1234ze, CO₂ and combinations thereof;
- (iv) one or more of HCFC-22, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze, HFO-1234yf and combinations thereof;
- (v) one or more of CFC-12, HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-

- HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof; or
- (vi) combinations of any of groups (i), (ii), (iii), (iv) and/or (v).
22. A composition comprising E-HCFO-1233zd, and at least one residual refrigerant selected from the group consisting of CFC-11, HFC-245fa, trans-1,2-dichloroethylene (t-DCE), Z-HFO-1336mzz and combinations thereof.
23. The composition of claim 22, further comprising at least one additional compound selected from the group consisting of E-HFO-1234ze, HFC-245fa, Z-HFO-1234ze, HFC-254fb, HCFO-1233xf, HCFC-235da, HCFO-1223za, HCFO-1335 isomer and combinations thereof.
24. A composition comprising:
- a first refrigerant portion comprising E-HCFO-1233zd and at least one additional compound selected from the group consisting of E-HFO-1234ze, HFC-245fa, Z-HFO-1234ze, HFC-254fb, HCFO-1233xf, HCFC-235da, HCFO-1223za, HCFO-1335 isomer, and combinations thereof; and
 - a second refrigerant portion comprising at least one residual refrigerant selected from the group consisting of CFC-11, HFC-245fa, trans-1,2-dichloroethylene (t-DCE), Z-HFO-1336mzz and combinations thereof.
25. A composition comprising Z-HFO-1336mzz, and at least one residual refrigerant selected from the group consisting of CFC-11, HCFC-123, HFC-245fa, trans-1,2-dichloroethylene (t-DCE), E-HCFO-1233zd and combinations thereof.
26. The composition of claim 25, further comprising at least one additional compound selected from the group consisting of HFO-1326mxz(E), HCFO-1326mxz(Z), HFC-346mdf, HFC-356mff and HFO-1336mzz(E) and combinations thereof.
27. The composition of claim 25, further comprising at least one additional compound selected from the group consisting of E-HFO-1234ze, HFC-245fa, Z-HFO-1234ze, HCFO-1233xf, HCFC-235da and combinations thereof.

28. A composition comprising:
- a first refrigerant portion comprising Z-HFO-1336mzz and at least one additional compound selected from the group consisting of HFO-1326mxz(E), HCFO-1326mxz(Z), HFC-346mdf, HFC-356mff and HFO-1336mzz(E) and combinations thereof; and
 - a second refrigerant portion comprising at least one residual refrigerant selected from the group consisting of CFC-11, HCFC-123, HFC-245fa, trans-1,2-dichloroethylene (t-DCE), E-HCFO-1233zd and combinations thereof.
29. A composition comprising:
- a first refrigerant portion comprising Z-HFO-1336mzz and at least one additional compound selected from the group consisting of E-HFO-1234ze, HFC- 245fa, Z-HFO-1234ze, HCFO-1233xf , HCFC-235da, and combinations thereof; and
 - a second refrigerant portion comprising at least one residual refrigerant selected from the group consisting of CFC-11, HCFC-123, HFC-245fa, trans-1,2-dichloroethylene (t-DCE), E-HCFO-1233zd and combinations thereof.
30. A composition comprising Z-HFO-1234ze, and at least one residual refrigerant selected from the group consisting of Z-HFO-1336mzz, E-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, E-HCFO-1233zd and combinations thereof.
31. The composition of claim 30, further comprising at least one additional compound selected from the group consisting of E-HFO-1234ze, HFC-263fb, HFO-1234zc, HFC-245fa, HFO-1233zf, E-HCFO-1233zd, CFC-114, HFC-227ea, HFC-236fa, HFO-1327 isomer, HFO-1336 isomer and combinations thereof.
32. A composition comprising:
- a first refrigerant portion comprising E-HFO-1234ze and at least one additional compound selected from the group consisting of E-HFO-1234ze, HFC-263fb, HFO-1234zc, HFC-245fa, HFO-1233zf, E-HCFO-1233zd, CFC-114, HFC-227ea, HFC-236fa, HFO-1327 isomer, HFO-1336 isomer and combinations thereof; and

a second refrigerant portion comprising at least one residual refrigerant selected from the group consisting of Z-HFO-1336mzz, E-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, E-HCFO-1233zd and combinations thereof.

33. A composition comprising HFC-125, and at least one residual refrigerant selected from the group consisting of CFC-12, HCFC-22, HFC-115, HFC-32, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂, HFC-23, CFO-1113, HCC-40 and combinations thereof.
34. The composition of claim 33, further comprising at least one additional compound selected from the group consisting of HFC-23, HFC-32, HFC-143a, HFC-134a, CFC-115, CFCO-1113, HCC-40 and combinations thereof.
35. A composition comprising:
 - a first refrigerant portion comprising HFC-125 and at least one additional compound selected from the group consisting of HFC-23, HFC-32, HFC-143a, HFC-134a, CFC-115, CFCO-1113, HCC-40 and combinations thereof; and
 - a second refrigerant portion comprising at least one residual refrigerant selected from the group consisting of CFC-12, HCFC-22, HFC-115, HFC-32, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂, HFC-23, CFO-1113, HCC-40 and combinations thereof.
36. A composition comprising E-HFO-1336mzz, and at least one residual refrigerant selected from the group consisting of Z-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, E-HCFO-1233zd, HCFC-133a, HFO-1243zf, Z-HCFO-1326mxz, E-HCFO-1326mxz, HCFC-346mdf and combinations thereof.
37. The composition of claim 36, further comprising at least one additional compound selected from the group consisting of HCC-30, HCFC-114, HCFC-114a, HCFC-133, HCFC-133a, HFC-245fa, HFC-338mee, HFC-338mf, HFC-347mef, HCO-1140, HCFO-1224 isomers, HCFO-1224yd, HCFO-1224yb,

HCFO-1233xf, HCFO-1233zd, HFO-1243zf, HFO-1327mz, HFO-1336ft, HCFO-1326mxz and combinations thereof.

38. A composition comprising:

a first refrigerant portion comprising E-HFO-1336mzz and at least one additional compound selected from the group consisting of HCC-30, HCFC-114, HCFC-114a, HCFC-133, HCFC-133a, HFC-245fa, HFC-338mee, HFC-338mf, HFC-347mef, HCO-1140, HCFO-1224 isomers, HCFO-1224yd, HCFO-1224yb, HCFO-1233xf, HCFO-1233zd, HFO-1243zf, HFO-1327mz, HFO-1336ft, HCFO-1326mxz and combinations thereof; and

a second refrigerant portion comprising at least one residual refrigerant selected from the group consisting of Z-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, E-HCFO-1233zd, HCFC-133a, HFO-1243zf, Z-HCFO-1326mxz, E-HCFO-1326mxz, HCFC-346mdf and combinations thereof.

39. A composition comprising Z-HFO-1132, and at least one residual refrigerant selected from the group consisting of HFC-32, HFC-134a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and combinations thereof.

40. The composition of claim 39, further comprising at least one additional compound selected from the group consisting of difluoromethane (HFC-32), 1,1,1,2,2 pentafluoroethane (HFC-125), E-1-chloro-1,2-difluoroethylene (HCFO-E-1122a), Z-1-chloro-1,2-difluoroethylene (HCFO-Z-1122a), 1,1,2-trifluoroethylene (HFO-1123), fluoroethylene (HFO-1141), 1-chloro-1,2,2-trifluoroethane (HCFC-133), 1-chloro-1,1,2-trifluoroethane (HCFC-133b), 1,1-dichloro-2,2,2-trifluoroethane (HCFC-123), 1,2-difluoroethane (HFC-152), 1,1,2-trifluoroethane (HFC-143), fluoromethane (HFC-41), chlorodifluoromethane (HCFC-22), ethylene, 1-chloro-1,2-difluoroethane (HCFC-142a), 1,1-difluoroethylene (HFO-1132a), 1-chloro-1-fluoroethene (HCFO-1131a), E-1-chloro-2-fluoroethene (HCFO-E-1131), Z-1-chloro-1-fluoroethene (HCFO-Z-1131), 1-chloro-2,2-difluoroethylene (HCFO-1122), HFO-E-1132, vinyl chloride (HCO-1140), acetylene, fluoroacetylene and combinations thereof.

41. A composition comprising:

a first refrigerant portion comprising Z-HFO-1132 and at least one additional compound selected from the group consisting of difluoromethane (HFC-32), 1,1,1,2,2 pentafluoroethane (HFC-125), E-1-chloro-1,2-difluoroethylene (HCFO-E-1122a), Z-1-chloro-1,2-difluoroethylene (HCFO-Z-1122a), 1,1,2-trifluoroethylene (HFO-1123), fluoroethylene (HFO-1141), 1-chloro-1,2,2-trifluoroethane (HCFC-133), 1-chloro-1,1,2-trifluoroethane (HCFC-133b), 1,1-dichloro-2,2,2-trifluoroethane (HCFC-123), 1,2-difluoroethane (HFC-152), 1,1,2-trifluoroethane (HFC-143), fluoromethane (HFC-41), chlorodifluoromethane (HCFC-22), ethylene, 1-chloro-1,2-difluoroethane (HCFC-142a), 1,1-difluoroethylene (HFO-1132a), 1-chloro-1-fluoroethene (HCFO-1131a), E-1-chloro-2-fluoroethene (HCFO-E-1131), Z-1-chloro-1-fluoroethene (HCFO-Z-1131), 1-chloro-2,2-difluoroethylene (HCFO-1122), HFO-E-1132, vinyl chloride (HCO-1140), acetylene, fluoroacetylene and combinations thereof; and

a second refrigerant portion comprising at least one residual refrigerant selected from the group consisting of HFC-32, HFC-134a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and combinations thereof.

42. A composition comprising E-HFO-1132, and at least one residual refrigerant selected from the group consisting of HFC-32, HFC-134a, HFC-152a, HFC-227ea, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and combinations thereof.

43. The composition of claim 42, further comprising at least one additional compound selected from the group consisting of HFC-32, HFC-125, HCFO-E-1122a, HCFO-Z-1122a, HFO-1123, HFO-1141, HCFC-133, HCFC-133b, HCFC-123, HFC-152, HFC-143, HFC-41, HCFC-22, ethylene, HCFC-142a, HFO-1132a, HCFO-1131a, HCFO-E-1131, HCFO-Z-1131, HCFO-1122, acetylene, HCO-1140 and combinations thereof.

44. A composition comprising:

a first refrigerant portion comprising Z-HFO-1132 and at least one additional compound selected from the group consisting of HFC-32, HFC-125, HCFO-E-

1122a, HCFO-Z-1122a, HFO-1123, HFO-1141, HCFC-133, HCFC-133b, HCFC-123, HFC-152, HFC-143, HFC-41, HCFC-22, ethylene, HCFC-142a, HFO-1132a, HCFO-1131a, HCFO-E-1131, HCFO-Z-1131, HCFO-1122, acetylene, HCO-1140 and combinations thereof; and

a second refrigerant portion comprising at least one residual refrigerant selected from the group consisting of HFC-32, HFC-134a, HFC-152a, HFC-227ea, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and combinations thereof.

45. The composition according to any one of claims 1-4, 7-9, 12-14, 17-19, 22-23, 25-27, 30-31, 33-34, 36-37, 39-40 and 42-43, wherein a total amount of the residual refrigerants is from about 0.00001 to about 2 weight percent, preferably about 0.00001 to about 0.5 weight percent, more preferably about 0.0001 to about 0.5 weight percent or about 0.001 to about 0.5 weight percent, based on a total weight of the composition.
46. The composition according to any one of claims 5-6, 10-11, 15-16, 20-21, 24, 28, 32, 35, 38, 41 and 44, wherein an amount of the second refrigerant portion is from about 0.00001 to about 0.5 weight percent, preferably from about 0.0001 to about 0.5 weight percent, based on a total weight of the composition.
47. The composition according to any of claims 1 to 46, wherein the composition is a reprocessed product, preferably a distillation product, of a thermal management fluid blend.
48. A process of obtaining the composition according to any of claims 1 to 47, the process comprising distilling a thermal management fluid blend to separate components thereof, and obtaining the composition, preferably wherein a total amount of the residual refrigerants in the composition is from about 0.00001 to about 2 weight percent, more preferably about 0.00001 to about 0.5 weight percent, more preferably about 0.0001 to about 0.5 weight percent or about 0.001 to about 0.5 weight percent, based on a total weight of the composition.
49. The composition according to claim 47 or the process according to claim 48, wherein the thermal management fluid blend is a recovered thermal management fluid.

50. A heat transfer system comprising the composition of any of claims 1 to 46.
51. The heat transfer system of claim 50, wherein said heat transfer system is designed for use with or previously contained at least one of the residual refrigerants.
52. The heat transfer system of any of claims 50-51, wherein the heat transfer system comprises at least one member selected from the group consisting of air conditioners, freezers, refrigerators, heat pumps, water chillers, flooded evaporator chillers, direct expansion chillers, walk-in coolers, heat pumps, mobile refrigerators, mobile air conditioning units and combinations thereof; and wherein the heat transfer system comprises a working fluid comprising the composition of any one of claims 1 to 46.
53. The heat transfer system of any of claims 50-52, comprising a commercial refrigeration system.
54. The heat transfer system of any of claims 50-52, comprising a medium or low temperature refrigeration system.
55. The heat transfer system of any of claims 50-52, comprising a residential refrigerator or freezer.
56. The heat transfer system of any of claims 50-52, comprising a heat pump.
57. The heat transfer system of any of claims 50-52, comprising a high temperature heat pump.
58. The heat transfer system of any of claims 50-52, comprising a chiller.
59. The heat transfer system of any of claims 50-52, comprising an air conditioning system.
60. The heat transfer system of any of claims 50-52, comprising an automotive air conditioning system.
61. A container or cylinder, preferably a recovery container or recovery cylinder, containing the composition of any of claims 1 to 47.
62. A RRR machine containing the composition of any of claims 1 to 47.

63. The composition of any of claims 1 to 46, wherein the composition is a spent or used thermal management fluid.
64. The composition of any of claims 1 to 46, wherein the composition is recovered thermal management fluid.
65. The composition of any of claims 1 to 47, wherein the composition is a recycled thermal management fluid.
66. The composition of any of claims 1 to 47, wherein the composition is a reclaimed thermal management fluid.
67. The composition of any of claims 1 to 47, wherein at least a portion of the composition is a reclaimed thermal management fluid.
68. The composition of any of claims 1-6, 12-16, 22-32 and 36-44, the composition further comprising an effective amount of at least one inhibitor, such that the composition remains substantially free of oligomeric, homopolymeric, or other polymeric products derived from hydrofluoroolefin refrigerants of the composition.
69. The composition of claim 68, wherein the at least one inhibitor is selected from the group consisting of hydrocarbons including at least one of cyclic monoterpene; lipophilic organic compounds including tocopherols such as α -tocopherol; phenols and aromatic organic compounds having at least one chemical moiety $-C_6H_4(OH)$.
70. The composition of any of claims 68-69, wherein the at least one inhibitor comprises a member selected from the group consisting of limonene, α -pinene, β -pinene, α -terpinene, α -tocopherol, butylated hydroxytoluene (BHT), 4-methoxyphenol, and benzene-1,4-diol.
71. A method of obtaining the composition of any of claims 1 to 46, the method comprising removing the composition from a heat transfer system.
72. The method of claim 71, wherein the at least one residual refrigerant is not separated from the composition after removal from the heat transfer system.
73. The method of claim 71, wherein the second refrigerant portion is not separated from the first refrigerant portion after removal from the heat transfer system.

74. The method of claim 71, wherein said heat transfer system is designed for use with or previously contained at least one of the residual refrigerants.
75. The heat transfer system of claim 71, wherein the heat transfer system comprises at least one member selected from the group consisting of air conditioners, freezers, refrigerators, heat pumps, water chillers, flooded evaporator chillers, direct expansion chillers, walk-in coolers, heat pumps, mobile refrigerators, mobile air conditioning units and combinations thereof.
76. A method for replacing an original refrigerant with a replacement refrigerant in a heat transfer system that uses, used or was designed to use the original refrigerant, the method comprising charging the heat transfer system with the replacement refrigerant, wherein at least some of the original refrigerant remains in the heat transfer system as a residual refrigerant, and wherein:
- (i) the original refrigerant comprises, consists essentially of or consists of at least CFC-12, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;
 - (ii) the original refrigerant comprises, consists essentially of or consists of at least one CFC-12, HFC-134a and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-134a;
 - (iii) the original refrigerant comprises, consists essentially of or consists of at least one of HFC-134a, HFC-227ea and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1234ze;
 - (iv) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1234ze;
 - (v) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, CO₂ and combinations thereof, and the

replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1234ze;

- (vi) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a, HFO-1234yf and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1234ze;
- (vii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1234ze;
- (viii) the original refrigerant comprises, consists essentially of or consists of at least one of HFC-134a, HFC-227ea, E-HFO-1234ze and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;
- (ix) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;
- (x) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;
- (xi) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze and combinations thereof, and the replacement

refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;

- (xii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;
- (xiii) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-125, HFO-1234yf and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-32;
- (xiv) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-32;
- (xv) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, E-HFO-1234ze, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-32;
- (xvi) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze, HFO-1234yf and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-32;
- (xvii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-

- 1336mzz, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-32;
- (xviii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HFC-32, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1234yf, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-134a;
- (xix) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-134a;
- (xx) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-134a;
- (xxi) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-134a;
- (xxii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-11, HFC-245fa, t-DCE, Z-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HCFO-1233zd;
- (xxiii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-11, HCFC-123, HFC-245fa, t-DCE, E-HCFO-1233zd and combinations thereof, and the replacement refrigerant

comprises, consists essentially of or consists of at least Z-HFO-1336mzz;

- (xxiv) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HCFC-22, HFC-115, HFC-32, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂, HFC-23, CFO-1113, HCC-40 and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-125;
- (xxv) the original refrigerant comprises, consists essentially of or consists of at least one of Z-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, E-HCFO-1233zd, HCFC-133a, HFO-1243zf, Z-HCFO-1326mxz, E-HCFO-1326mxz, HCFC-346mdf and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1336mzz;
- (xxvi) the original refrigerant comprises, consists essentially of or consists of at least one of Z-HFO-1336mzz, E-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, E-HCFO-1233zd and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least Z-HFO-1234ze;
- (xxvii) the original refrigerant comprises, consists essentially of or consists of at least one of HFC-32, HFC-134a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least Z-HFO-1132; or
- (xxviii) the original refrigerant comprises, consists essentially of or consists of at least one of HFC-32, HFC-134a, HFC-152a, HFC-227ea, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and combinations thereof,

and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1132.

77. A method for replacing an original refrigerant with a replacement refrigerant in a heat transfer system that uses, used or was designed to use the original refrigerant, the method comprising removing a substantial portion of the original refrigerant from the heat transfer system, optionally retaining a substantial portion of any lubricant present in the system, and charging the heat transfer system with the replacement refrigerant, wherein at least a portion of the original refrigerant remains in the heat transfer system as a residual refrigerant, and wherein:

- (i) the original refrigerant comprises, consists essentially of or consists of at least one CFC-12, HFC-134a and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;
- (ii) the original refrigerant comprises, consists essentially of or consists of at least CFC-12, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-134a;
- (iii) the original refrigerant comprises, consists essentially of or consists of at least one of HFC-134a, HFC-227ea and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1234ze;
- (iv) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1234ze;
- (v) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1234ze;

- (vi) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a, HFO-1234yf and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1234ze;
- (vii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1234ze;
- (viii) the original refrigerant comprises, consists essentially of or consists of at least one of HFC-134a, HFC-227ea, E-HFO-1234ze and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;
- (ix) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HFC-32, HFC-134a, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;
- (x) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;
- (xi) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;

- (xii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFO-1234yf;
- (xiii) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-125, HFO-1234yf and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-32;
- (xiv) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HFC-134a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-32;
- (xv) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFO-1234yf, E-HFO-1234ze, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-32;
- (xvi) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-125, HFC-134a, HFC-143a, E-HFO-1234ze, HFO-1234yf and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-32;
- (xvii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HCFC-22, HFC-115, HFC-125, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-32;

- (xviii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HFC-32, HFC-227ea, Z-HCFO-1224yd, E-HFO-1234ze, HFO-1234yf, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-134a;
- (xix) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-134a;
- (xx) the original refrigerant comprises, consists essentially of or consists of at least one of HCFC-22, HFC-32, HFC-125, HFC-143a, HFO-1234yf, E-HFO-1234ze and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-134a;
- (xxi) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HCFC-22, HFC-32, HFC-115, HFC-125, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂ and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-134a;
- (xxii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-11, HFC-245fa, t-DCE, Z-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HCFO-1233zd;
- (xxiii) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-11, HCFC-123, HFC-245fa, t-DCE, E-HCFO-1233zd and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least Z-HFO-1336mzz;

- (xxiv) the original refrigerant comprises, consists essentially of or consists of at least one of CFC-12, HCFC-22, HFC-115, HFC-32, HFC-134a, HFC-143a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz, CO₂, HFC-23, CFO-1113, HCC-40 and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least HFC-125;
- (xxv) the original refrigerant comprises, consists essentially of or consists of at least one of Z-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, E-HCFO-1233zd, HCFC-133a, HFO-1243zf, Z-HCFO-1326mxz, E-HCFO-1326mxz, HCFC-346mdf and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1336mzz;
- (xxvi) the original refrigerant comprises, consists essentially of or consists of at least one of Z-HFO-1336mzz, E-HFO-1336mzz, HFC-134a, HFC-152a, HFC-227ea, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, E-HCFO-1233zd and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least Z-HFO-1234ze;
- (xxvii) the original refrigerant comprises, consists essentially of or consists of at least one of HFC-32, HFC-134a, HFC-152a, HFC-227ea, E-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least Z-HFO-1132; or
- (xxviii) the original refrigerant comprises, consists essentially of or consists of at least one of HFC-32, HFC-134a, HFC-152a, HFC-227ea, Z-HFO-1132, Z-HCFO-1224yd, HFO-1234yf, E-HFO-1234ze, Z-HFO-1234ze, HFO-1252zc, E-HFO-1336mzz and combinations thereof, and the replacement refrigerant comprises, consists essentially of or consists of at least E-HFO-1132.

78. The composition of any of claims 76-77, wherein the replacement refrigerant is recovered thermal management fluid.
79. The composition of any of claims 76-77, wherein the replacement refrigerant is a recycled thermal management fluid.
80. The composition of any of claims 76-77, wherein the replacement refrigerant is a reclaimed thermal management fluid.
81. The composition of any of claims 76-77, wherein at least a portion of the replacement refrigerant is a reclaimed thermal management fluid.
82. A method of reclaiming refrigerant, the method comprising:
- removing a refrigerant composition from a heat transfer system, the refrigerant composition being one of the compositions of any of claims 11-4, 7-9, 12-14, 17-19, 22-23, 25-27, 30-31, 33-34, 36-37, 39-40 and 42-43;
 - performing at least one treatment selected from transferring, blending, distillation, nitrogen purging, filtration, dehydration, caustic scrubbing, moisture removal, acid removal, oil removal, decanting, composition ratio adjustment and combinations thereof to form a partially reclaimed refrigerant composition or a reclaimed refrigerant composition, wherein a total amount of the residual refrigerants after the treatment is from about 0.00001 to about 2 weight percent, preferably about 0.00001 to about 0.5 weight percent, more preferably about 0.0001 to about 0.5 weight percent or about 0.001 to about 0.5 weight percent, based on a total weight of the composition; and
 - either storing the partially reclaimed refrigerant composition or a reclaimed refrigerant composition in a container for use in another system or introducing the partially reclaimed refrigerant composition or a reclaimed refrigerant composition back into the heat transfer system.
83. A method of reclaiming refrigerant, the method comprising:
- removing a refrigerant composition from a heat transfer system, the refrigerant composition being one of the compositions of any of claims 5-6, 10-11, 15-16, 20-21, 24, 28, 32, 35, 38, 41 and 44;
 - performing at least one treatment selected from transferring, blending, distillation, nitrogen purging, filtration, dehydration, caustic scrubbing,

moisture removal, acid removal, oil removal, decanting, composition ratio adjustment and combinations thereof to form a partially reclaimed refrigerant composition or a reclaimed refrigerant composition, wherein an amount of the second portion after the treatment is from about 0.00001 to about 2 weight percent, preferably about 0.00001 to about 0.5 weight percent, more preferably about 0.0001 to about 0.5 weight percent or about 0.001 to about 0.5 weight percent, based on a total weight of the composition; and

either storing the partially reclaimed refrigerant composition or a reclaimed refrigerant composition in a container for use in another system or introducing the partially reclaimed refrigerant composition or a reclaimed refrigerant composition back into the heat transfer system.

84. A method of reclaiming refrigerant, the method comprising:

subjecting a thermal management fluid blend to reprocessing to obtain the composition according to any of claims 1 to 47, a total amount of the residual refrigerants after the treatment being from about 0.00001 to about 2 weight percent, preferably about 0.00001 to about 0.5 weight percent, more preferably about 0.0001 to about 0.5 weight percent or about 0.001 to about 0.5 weight percent, based on a total weight of the composition; and

either storing the composition in a container for use in a heat transfer system or directly introducing the composition into a heat transfer system.

85. The method of claim 84, the method further comprising a step of recovering the thermal management fluid blend from a heat transfer system.

86. The method of claim 84 or 85, wherein the reprocessing comprises at least one of blending, distillation, nitrogen purging, filtration, dehydration, caustic scrubbing, moisture removal, acid removal, oil removal, decanting, composition ratio adjustment and combinations thereof.

87. A container or cylinder, preferably a recovery container or recovery cylinder, containing a composition reclaimed by the method of any of claims 84-86.

88. A RRR machine containing a composition reclaimed by the method of any of claims 84-86.