

CLAIMS

1. An integrated air conditioning and liquid heating system (100) comprising
a refrigeration circuit (110) having one or more primary heat exchangers (101);
5 a liquid heating circuit (120); and
a secondary heat exchanger (102) connected to the refrigeration circuit (110) and liquid
heating circuit (120);
wherein the system (100) is configured to selectively activate and configure function
of the primary heat exchangers (101) and secondary heat exchanger (102) for providing
10 switchable operation modes including space cooling by the refrigeration circuit, liquid
heating by the liquid heating circuit or both with similar or different cooling load and
heating load.
2. The integrated air conditioning and liquid heating system (100) according to claim 1,
15 wherein the refrigeration circuit (110) comprising a first primary heat exchanger
(101a), a compressor (103) and a second primary heat exchanger (101b).
3. The integrated air conditioning and liquid heating system (100) according to claim 2,
20 wherein the first primary heat exchanger (101a) is located downstream of the second
primary heat exchanger (101b) and upstream of the compressor (103).
4. The integrated air conditioning and liquid heating system (100) according to claim 2
or 3, wherein the secondary heat exchanger (102) is located downstream of the
compressor (103) and upstream of the second primary heat exchanger (101b).
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5. The integrated air conditioning and liquid heating system (100) according to any one
of claims 2 to 4, further comprising a first expansion valve (104a) located downstream
of the second primary heat exchanger (101b) and upstream of the first primary heat
exchanger (101a).
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6. The integrated air conditioning and liquid heating system (100) according to claim 5,
further comprising a first control valve (106a) located at a first sub path (110a) within
the refrigeration circuit (110), wherein the first sub path (110a) is positioned

downstream of the second primary heat exchanger (101b) and upstream of the compressor (103).

- 5 7. The integrated air conditioning and liquid heating system (100) according to claim 6, further comprising a second control valve (106b) located either at a first position or a second position, wherein the first position is at downstream of the secondary heat exchanger (102) and upstream of the second primary heat exchanger (101b), and the second position is positioned at a second sub path (110b) within the refrigeration circuit (110) that is downstream of the compressor (103) and upstream of the second primary
10 heat exchanger (101b).
8. The integrated air conditioning and liquid heating system (100) according to claim 7, further comprising a second expansion valve (104b) located either at a third sub path (110c) when the second control valve (106b) is at the first position, or downstream of
15 the secondary heat exchanger (102) and upstream of the second primary heat exchanger (101b) when the second control valve (106b) is at the second position.
9. The integrated air conditioning and liquid heating system (100) according to claim 8, further comprising at least one liquid receiver (107) for storing excess refrigerant and
20 the liquid receiver is positioned downstream of the secondary heat exchanger (102) and upstream of the second expansion valve (104b), and/or downstream of the second primary heat exchanger (101b) and upstream of the first expansion valve (104a).
10. The integrated air conditioning and liquid heating system (100) according to any one
25 of claims 1 to 9, wherein the primary heat exchanger (101a, 101b) functions as a condenser or evaporator.
11. The integrated air conditioning and liquid heating system (100) according to any one
30 of claims 2 to 10, wherein the secondary heat exchanger (102) functions as a condenser or desuperheater.
12. The integrated air conditioning and liquid heating system (100) according to claim 11, wherein the operating modes include any one or a combination of

- a first operating mode that provides space cooling by having the first primary heat exchanger (101a) functioning as the evaporator, the second primary heat exchanger (101b) functioning as the condenser and the secondary heat exchanger (102) being inoperative;
- 5 a second operating mode that provides fluid heating by having the first primary heat exchanger (101a) being inoperative, the second primary heat exchanger (101b) functioning as the evaporator and the secondary heat exchanger (102) functioning as the condenser;
- 10 a third operating mode that provides both space cooling and fluid heating with the cooling load being similar to the heating load, by having the first primary heat exchanger (101a) functioning as the evaporator, the second primary heat exchanger (101b) being inoperative and the secondary heat exchanger (102) functioning as the condenser;
- 15 a fourth operating mode that provides both space cooling and fluid heating with the cooling load being substantially higher than the heating load, by having the first primary heat exchanger (101a) functioning as the evaporator, the second primary heat exchanger (101b) functioning as the condenser and the secondary heat exchanger (102) functioning as the desuperheater; and
- 20 a fifth operating mode that provides both space cooling and fluid heating, with the cooling load being substantially lower than the heating load, by having the first primary heat exchanger (101a) functioning as the evaporator, the second primary heat exchanger (101b) functioning as the evaporator or the condenser and the secondary heat exchanger (102) functioning as the condenser.
- 25 13. An integrated air conditioning and liquid heating system (100) comprising
- a refrigeration circuit (110) having a first primary heat exchanger (101a) and a second primary heat exchanger (101b);
- a liquid heating circuit (120); and
- 30 a secondary heat exchanger (102) connected to the refrigeration circuit (110) and liquid heating circuit (120);

wherein the system (100) provides space cooling by the refrigeration circuit (110) and fluid heating by the liquid heating circuit (120), with the cooling load being different from the heating load.

- 5 14. The integrated air conditioning and liquid heating system according to claim 13, wherein the first primary heat exchanger (101a) functions as an evaporator, the second primary heat exchanger (101b) functions as a condenser and the secondary heat exchanger (102) functions as a desuperheater for providing space cooling and fluid heating, with the cooling load being substantially higher than the heating load.
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- 15 15. The integrated air conditioning and liquid heating system (100) according to claim 13, wherein the first primary heat exchanger (101a) functions as an evaporator, the second primary heat exchanger (101b) functions as an evaporator or a condenser and the secondary heat exchanger (102) functions as a condenser for providing space cooling and fluid heating, with the cooling load being substantially lower than the heating load.
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