United States Patent Application Publication	20250264254
Kind Code	A1
Publication Date	August 21, 2025
Inventor(s)	Qiu; Yifan

SYSTEM AND METHOD FOR LUBRICANT MANAGEMENT IN A HEATING, VENTILATION, AIR CONDITIONING, AND REFRIGERATION (HVACR) SYSTEM

Abstract

A lubricant management system for a HVACR system, is disclosed. The lubricant management system includes a compressor, a first and a second set of orifices, and a flow regulating valve. The compressor includes lubricant inlet ports and lubricant outlet ports. The first set of orifices are adapted to receive lubricant via a first passageway and a second passageway via a flow regulating valve disposed in the second passageway, such that the first passageway and the second passageway are fluidly connected. The second set of orifices are adapted to receive lubricant supplied by the first passageway and the second passageway. Moreover, the second set of orifices are adapted to supply the received lubricant to each of the lubricant inlet ports such that the flow regulating valve is open to supply lubricant based on the pressure difference between a first and a second pressure region of the compressor.

Inventors:	**Qiu; Yifan (Manlius, NY)**
Applicant:	**Carrier Corporation** (Palm Beach Gardens, FL)
Family ID:	**1000008520453**
Appl. No.:	**19/045254**
Filed:	**February 04, 2025**

Related U.S. Application Data

us-provisional-application US 63555308 20240219

Publication Classification

Int. Cl.: **F25B31/00** (20060101); **F25B43/02** (20060101)

U.S. Cl.:

CPC **F25B31/002** (20130101); **F25B43/02** (20130101);

Background/Summary

CROSS REFERENCE TO RELATED APPLICATION [0001] This application claims the benefit of U.S. Provisional Patent Application No. 63/555,308 filed on Feb. 19, 2024, which is incorporated by reference herein in its entirety.

FIELD OF THE INVENTION
[0002] The disclosure relates to lubricating systems for compressors of a Heating, Ventilation, Air Conditioning, and Refrigeration (HVACR) system. More particularly, the present disclosure relates to a lubricant management system for optimizing supply of lubricant to a compressor of the HVACR system.
BACKGROUND
[0003] An HVACR system typically includes a compressor, which can be a screw compressor or a scroll compressor, among others. Such compressors employ bearings to facilitate the rotation of a shaft. The bearings are generally equipped with a lubrication system for facilitating smooth rotation of the shaft.
[0004] Conventionally, compressors include lubrication systems that supply lubricant into compression chambers and/or bearings of the compressors. As such, existing lubrication systems provide lubrication, cooling, and improved sealing within the compression chambers. However, the lubricant flow for the bearings of the compressor is driven by the pressure differential of discharge pressure and suction pressure of the HVACR system. In this regard, the compressor is required to work in both extremely low and extremely high pressure differential conditions. In the event of inadequate lubrication during either the extremely low pressure or the extremely high pressure differential conditions, the bearings, and consequently the compressor, may experience premature failure before reaching the anticipated bearing lifespan.
[0005] Therefore, it is desirable to provide a lubrication management system and method that optimizes supply of the lubricant to the compressor of the HVACR system.
SUMMARY
[0006] This summary is provided to introduce a selection of concepts, in a simplified format, that are further described in the detailed description of the invention. This summary is neither intended to identify key or essential inventive concepts of the invention and nor is it intended for determining the scope of the invention.
[0007] A lubricant management system for a Heating, Ventilation, Air Conditioning, and Refrigeration (HVACR) system, is disclosed. The lubricant management system includes a compressor, a first set of orifices, a second set of orifices, and a flow regulating valve. The compressor includes a plurality of lubricant inlet ports and a plurality of lubricant outlet ports. The first set of orifices include a first orifice adapted to receive lubricant via a first passageway and a second orifice adapted to receive the lubricant via a flow regulating valve disposed in a second passageway such that the first passageway and the second passageway are fluidly connected. The second set of orifices are adapted to receive the lubricant supplied by the first passageway and the second passageway. Moreover, the second set of orifices are adapted to supply the received lubricant to each of the lubricant inlet ports such that the flow regulating valve is adapted to open to supply the lubricant based on the pressure difference between a first pressure region and a second pressure region of the HVACR system.
[0008] In one or more embodiments according to the disclosure, the opening of the second orifice

is greater than the opening of the first orifice.
[0009] In one or more embodiments according to the disclosure, the first pressure region is a region upstream of the first set of orifices and the flow regulating valve.
[0010] In one or more embodiments according to the disclosure, the second pressure region is a region downstream of each of the second set of orifices.
[0011] In one or more embodiments according to the disclosure, the flow regulating valve is adapted to open to supply the lubricant based on the pressure difference between the first pressure region and the second pressure region of the compressor exceeding a first threshold pressure difference.
[0012] In one or more embodiments according to the disclosure, the flow regulating valve is adapted to open to supply the lubricant based on the pressure difference between the first pressure region and the second pressure region of the compressor falling below a second threshold pressure difference.
[0013] In one or more embodiments according to the disclosure, the flow regulating valve is adapted to close based on the pressure difference between the first pressure region and the second pressure region of the compressor ranges between the second threshold pressure difference and the first threshold pressure difference.
[0014] A method for optimizing supply of a lubricant to a compressor of a Heating, Ventilation, Air Conditioning, and Refrigeration (HVACR) system, is disclosed. The method includes the step of providing a lubricant management system including a compressor, a first set of orifices, a second set of orifices, and a flow regulating valve. Next, the method includes selectively actuating the flow regulating valve to open to supply the lubricant based on the pressure difference between a first pressure region and a second pressure region of the HVACR system.
[0015] In one or more embodiments according to the disclosure, selectively actuating the flow regulating valve to open to supply the lubricant includes determining whether the pressure difference between the first pressure region and the second pressure region of the compressor exceeds a first threshold pressure difference and actuating the flow regulating valve to supply the lubricant.
[0016] In one or more embodiments according to the disclosure, selectively actuating the flow regulating valve to open to supply the lubricant includes determining whether the pressure difference between the first pressure region and the second pressure region of the compressor falls below a second threshold pressure difference and actuating the flow regulating valve to supply the lubricant.
[0017] In one or more embodiments according to the disclosure, the first pressure region is a region upstream of the first set of orifices and the flow regulating valve.
[0018] In one or more embodiments according to the disclosure, the second pressure region is a region downstream of each of the second set of orifices.
[0019] In one or more embodiments according to the disclosure, the opening of the second orifice is greater than the opening of the first orifice.
[0020] In one or more embodiments according to the disclosure, the flow regulating valve is adapted to close based on the pressure difference between the first pressure region and the second pressure region of the compressor ranging between the second threshold pressure difference and the first threshold pressure difference.
[0021] To further clarify the advantages and features of the methods, systems, and apparatuses/devices, a more particular description of the methods, systems, and apparatuses/devices will be rendered by reference to specific embodiments thereof, which are illustrated in the appended drawings. It is appreciated that these drawings depict only typical embodiments of the disclosure and are therefore not to be considered limiting of its scope. The disclosure will be described and explained with additional specificity and detail with the accompanying drawings.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] These and other features, aspects, and advantages of the invention will become better understood when the following detailed description is read with reference to the accompanying drawings in which like characters represent like parts throughout the drawings, wherein:

[0023] FIG. **1** illustrates a schematic diagram depicting a refrigerant circuit of a Heating Ventilation Airconditioning and Refrigeration (HVACR) system according to one or more embodiments of the disclosure;

[0024] FIG. **2**A illustrates a block diagram of a lubrication management system deployed in a compressor of the Heating, Ventilation, Air Conditioning, and Refrigeration (HVACR) system, according to one or more embodiments of the disclosure;

[0025] FIG. **2**B illustrates a typical compressor operating envelope graph plotted between a first pressure region and a second pressure region of the Heating, Ventilation, Air Conditioning, and Refrigeration (HVACR) system, according to one or more embodiments of the disclosure; and

[0026] FIG. **3** illustrates a flowchart depicting a method for optimizing supply of a lubricant to the compressor of the HVACR system, according to one or more embodiments of the disclosure.

[0027] Further, skilled artisans will appreciate that elements in the drawings are illustrated for simplicity and may not have necessarily been drawn to scale. For example, the flow charts illustrate the method in terms of the most prominent steps involved to help to improve understanding of aspects of the disclosure. Furthermore, in terms of the construction of the device, one or more components of the device may have been represented in the drawings by conventional symbols, and the drawings may show only those specific details that are pertinent to understanding the embodiments of the disclosure so as not to obscure the drawings with details that will be readily apparent to those of ordinary skill in the art having the benefit of the description herein.

DETAILED DESCRIPTION OF FIGURES

[0028] For the purpose of promoting an understanding of the principles of the disclosure, reference will now be made to the various embodiments and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the disclosure is thereby intended, such alterations and further modifications in the illustrated system and device, and such further applications of the principles of the disclosure as illustrated therein being contemplated as would normally occur to one skilled in the art to which the disclosure relates.

[0029] It will be understood by those skilled in the art that the foregoing general description and the following detailed description are explanatory of the disclosure and are not intended to be restrictive thereof.

[0030] Reference throughout this specification to “an aspect”, “another aspect” or similar language means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the disclosure. Thus, appearances of the phrase “in an embodiment”, “in another embodiment”, “some embodiments”, “one or more embodiments” and similar language throughout this specification may, but do not necessarily, all refer to the same embodiment.

[0031] The terms “comprises”, “comprising”, or any other variations thereof, are intended to cover a non-exclusive inclusion, such that a process or method that comprises a list of steps does not include only those steps but may include other steps not expressly listed or inherent to such process or method. Similarly, one or more devices or sub-systems or elements or structures or components proceeded by “comprises . . . a” does not, without more constraints, preclude the existence of other devices or other sub-systems or other elements or other structures or other components or additional devices or additional sub-systems or additional elements or additional structures or additional components.

[0032] The term “unit” used herein may imply a unit including, for example, one of hardware, software, and firmware or a combination of two or more of them. The “unit” may be interchangeably used with a term such as logic, a logical block, a component, a circuit, and the like. The “unit” may be a minimum system component for performing one or more functions or may be a part thereof.

[0033] Embodiments of the disclosure will be described below in detail with reference to the accompanying drawings.

[0034] FIG. **1** illustrates a schematic diagram depicting an exemplary refrigerant circuit of a Heating Ventilation Airconditioning and Refrigeration (HVACR) system **100** according to one or more embodiments of the disclosure. As used herein, the “Heating Ventilation Airconditioning and Refrigeration (HVACR) system **100**” refers to conventional chillers, air conditioners, refrigeration systems, or heat pumps that employ compressors, oil separators, condensers, metering devices, and evaporators connected in this order. It may be appreciated that the HVACR system **100** may include several additional components to regulate flow, pressure, and other parameters. Such additional components may include, but is not limited to regulating valves, ON/OFF valves, ejectors, etc. A compressor **101** used in such HVACR systems **100** may include, but are not limited to, reciprocating compressors, rotary compressors, scroll compressors, screw compressors, centrifugal compressors, and the like. The compressor **101** of the HVACR system **100**, disclosed herein, compresses a refrigerant vapor to increase the pressure and temperature of the refrigerant vapor up to superheated levels. The compressor **101** discharges the superheated refrigerant vapor in addition to oil via a discharge line exemplarily illustrated in FIG. **1**.

[0035] As used herein, “oil” refers to lubricating oil used to lubricate the moving components of the compressor **101**. The oil in the compressor **101** also functions to cool the bearings down and to improve the smooth movement of the moving parts thereby increasing the system efficiency and prolonging life of the bearings. A condenser **105** is adapted to receive the mixture of oil and refrigerant vapor discharged from the compressor. The condenser **105** may include an oil storage and separation portion **107** that functions to separate oil from the mixture of oil and refrigerant vapor discharged from the compressor **101**. In one or more embodiments, the oil storage and separation portion **107** may be housed within a secondary casing inside a single casing. Alternatively, the oil storage and separation portion **107** and a condenser portion **106** may be enclosed within the single casing. The remaining oil is collected in the oil storage and separation portion **107** and supplied back to the compressor **101** via an oil return line. On the other hand, the separated refrigerant vapor rises and is transferred to the condenser portion **106**.

[0036] The separated oil within the oil storage and separation portion **107** of the condenser **105** is continually supplied to the compressor **101** through the oil return line connected to the compressor **101**. In case the residual oil levels are insufficient to supply the compressor **101**, the oil level switches will detect the lack of oil and controls will trip the system off and raise an alarm. The pressure difference between the high and low sides of the HVACR system **100** is the driving force for the oil to travel from the condenser **105** to the compressor **101**. In one or more embodiments, auxiliary components such as oil pumps and intermediate oil reservoirs may also be utilized to supply oil to the compressor **101**.

[0037] The oil storage and separation portion **107** is adapted to transfer the refrigerant vapor separated from the mixture of oil and refrigerant vapor from the oil storage and separation portion **107** to the condenser portion **106** of the condenser **105**. The condenser portion **106** condenses the separated refrigerant vapor to a high temperature refrigerant fluid. A cooling water circuit **104** exchanges heat with the condenser portion **106** thereby cooling the refrigerant vapor to form the high temperature refrigerant fluid. The high temperature refrigerant fluid is then passed through a metering device **102**, such as an expansion valve, for expanding the condensed refrigerant fluid. After the refrigerant fluid passes through the metering device **102**, the pressure of the refrigerant fluid is further reduced which lowers the temperature of the refrigerant fluid thereby supplying a low temperature and low pressure refrigerant fluid to an evaporator **103**. The evaporator **103** evaporates the refrigerant fluid. A chilled water circuit **104′** exchanges heat with the refrigerant fluid in the evaporator **103**. The chilled water circuit **104′** may then be circulated to external terminal units, for example, fan coil units, to exchange heat with air from the space to be cooled. While the low temperature and low pressure refrigerant fluid passes through the evaporator **103**, the chilled water circuit **104′** to be cooled exchanges heat with the refrigerant fluid thereby converting the refrigerant fluid completely to low temperature and low pressure refrigerant vapor. Finally, the low-pressure refrigerant vapor is supplied back to the compressor **101** to complete the refrigerant circuit.

[0038] FIG. **2**A illustrates a block diagram of a lubricant management system **200** deployed in the compressor **101** of the Heating, Ventilation, Air Conditioning, and Refrigeration (HVACR) system **100**, according to one or more embodiments of the disclosure.

[0039] The lubricant management system **200**, disclosed herein includes the compressor **101**, a first set of orifices **201**, **202**, a flow regulating valve **203**, and a second set of orifices **204***a*, **204***b*, **204***c*. The compressor **101** includes a plurality of lubricant inlet ports **207***a*, **207***b*, **207***c* and a plurality of lubricant outlet ports. The first set of orifices **201**, **202** includes a first orifice **201** and a second orifice **202**. The first orifice **201** is adapted to receive lubricant via a first passageway **205**. The second orifice **202** is adapted to receive lubricant via the flow regulating valve **203** disposed in a second passageway **206**. In one or more embodiments, the opening of the second orifice **202** is greater than the opening of the first orifice **201**. The first passageway **205** and the second passageway **206** are fluidly connected to the compressor **101** at one end and connected to the condenser **105** or a lubricant reservoir (not shown) at another end. The first passageway **205** and the second passageway **206** collectively supply the lubricant to each of the lubricant inlet ports **207***a*, **207***b*, **207***c* via the second set of orifices **204***a*, **204***b*, **204***c* respectively. It may be appreciated that the openings of the first set of orifices **201**, **202**, and the second set of orifices **204***a*, **204***b*, **204***c* may have a circular cross sectional profile or any other cross sectional shaped profile such as oval, rectangular, elliptical, square, and the like without departing from the scope of the disclosure.

[0040] The second set of orifices **204***a*, **204***b*, **204***c* are adapted to receive lubricant supplied by the first passageway **205** and the second passageway **206** from the liquid reservoir or the condenser **105**. Moreover, the second set of orifices **204***a*, **204***b*, **204***c* are adapted to supply the received lubricant to each of the lubricant inlet ports **207***a*, **207***b*, **207***c* respectively. The lubricant management system **200** optimizes the lubricant flow such that the flow regulating valve **203** is adapted to open to supply lubricant based on the pressure difference between a first pressure region and a second pressure region of the HVACR system **100**. The first pressure region is a region upstream of the first set of orifices **201**, **202**, and the flow regulating valve **203**. In one or more embodiments, the flow regulating valve **203** is a solenoid valve. The second pressure region is a region downstream of each of the second set of orifices **204***a*, **204***b*, **204***c*.

[0041] As shown in FIG. **2**A, the first set of orifices **201**, **202** is shown to include the first orifice **201** and the second orifice **202** only. Moreover, the second set of orifices are **204***a*, **204***b*, **204***c* and only a single flow regulating valve **203** is depicted in the block diagram. However, it will be appreciated that several configurations may be envisioned without departing from the scope of the disclosure. For example, the number of first set of orifices **201**, **202** may include more than two orifices without departing from the scope of the present disclosure. Similarly, the second set of orifices **204***a*, **204***b*, **204***c* may include only two orifices or more than three orifices. As such, it will be appreciated the number of orifices, the number of associated passageways, and the number of flow regulating valves may be selected based on the desired flow settings of the lubricant management system **100**.

[0042] The flow regulating valve **203** is adapted to open to supply lubricant based on the pressure difference between the first pressure region and the second pressure region of the HVACR system

100 exceeding a first threshold pressure difference. Alternatively, the flow regulating valve **203** is adapted to open to supply lubricant based on the pressure difference between the first pressure region and the second pressure region of the compressor **101** falling below a second threshold pressure difference. At extremely low or high pressure differential conditions, the flow regulating valve **203** opens and the pressure drop across the first set of orifices **201**, **202** lowers, resulting in the overall flow rate increase thereby providing sufficient flow of the lubricant to the bearings. This is implemented through an oil manifold block with built-in solenoid valve. The block has one inlet passageway, which is then split to the first passageway **205** passing through the first orifice **201** and the second passageway **206** passing through the second orifice **202**. Since the second orifice **202** has a larger opening than the first orifice **201**, the second passageway **206** has a larger opening than the first passageway **205**. The open and close of the large second passageway **206** is controlled by the flow regulating valve **203** (solenoid valve). Finally, the first passageway **205** and the second passageway **206** are joined together to feed the compressor **101**.

[0043] The flow regulating valve **203** is adapted to close based on the pressure difference between the first pressure region and the second pressure region of the compressor **101** ranges between the second threshold pressure difference and the first threshold pressure difference. At normal pressure differential conditions, the flow regulating valve **203** closes and the lubricant flows only through the second orifice **202** resulting in a high pressure drop across the first set of orifices **201**, **202** and therefore a low flow rate of lubricant passing through the second set of orifices **204***a*, **204***b*, **204***c* to the bearings. As a result, the compressor **101** can run at an extremely low pressure differential condition without lubrication failure by providing sufficient lubricant flow for bearing lubrication. The compressor **101** can run during normal conditions without sacrificing efficiency loss due to oversupply of oil. Moreover, the compressor **101** can run at exceedingly high pressure differential without bearing failure due to overheating by providing sufficient lubricant for cooling of the bearings.

[0044] FIG. **2**B illustrates a typical compressor operating envelope graph plotted between the first pressure region and the second pressure region of the Heating, Ventilation, Air Conditioning, and Refrigeration (HVACR) system **100**, according to one or more embodiments of the disclosure. As disclosed in the detailed description of FIG. **2**A, the flow regulating valve **203** is adapted to open to supply lubricant based on the pressure difference between the first pressure region and the second pressure region of the HVACR system **100** exceeding the first threshold pressure difference or falling below the second threshold pressure difference. At extremely low or high pressure differential conditions, the flow regulating valve **203** opens and the pressure drop across the first set of orifices **201**, **202** lowers, resulting in the overall flow rate increase thereby providing sufficient flow of the lubricant to the bearings.

[0045] As illustrated in the graph, the area between dotted lines A and B is the normal pressure differential area (when pressure differential ranges between the second threshold pressure difference and the first threshold pressure difference). Within this range, the flow regulating valve **203** closes and the lubricant flows only through the second orifice **202** resulting in a high pressure drop across the first set of orifices **201**, **202** and therefore a low flow rate of lubricant passing through the second set of orifices **204***a*, **204***b*, **204***c* to the bearings.

[0046] As illustrated in the graph, the area above the dotted line A is the high pressure differential area (when pressure differential between the first pressure region and the second pressure region of the HVACR system **100** exceeds the first threshold pressure difference). Similarly, the area below the dotted line B is the low pressure differential area (when pressure differential between the first pressure region and the second pressure region of the HVACR system **100** falls below the second threshold pressure difference). At extremely low or high pressure differential conditions, the flow regulating valve **203** opens and the pressure drop across the first set of orifices **201**, **202** lowers, resulting in the overall flow rate increase thereby providing sufficient flow of the lubricant to the bearings. The lubricant management system **200**, disclosed herein, can change the overall flow of the lubricant to the compressor **101** without affecting the proportion of the total flow of the lubricant to each inlet port of the compressor **101**. Some components, say, bearings, need more lubricant than other components, say rotors. With this setup, the bearings will always get more supply of the lubricant than rotors no matter the overall flow. This makes the use and supply of the lubricant more efficient.

[0047] FIG. **3** illustrates a flowchart depicting a method **300** for optimizing supply of the lubricant to the compressor **101** of the Heating, Ventilation, Air Conditioning, and Refrigeration (HVACR) system **100**.

[0048] At Step **301**, the method **300** includes providing a lubricant management system **200** including the compressor **101**, the first set of orifices **201**, **202**, the second set of orifices **204***a*, **204***b*, **204***c*, and the flow regulating valve **203**.

[0049] At Step **303**, the method **300** includes selectively actuating the flow regulating valve **203** to open to supply lubricant based on the pressure difference between the first pressure region and the second pressure region of the HVACR system **100**.

[0050] In one or more embodiments, the step of selectively actuating the flow regulating valve **203** to open to supply the lubricant includes determining whether the pressure difference between the first pressure region and the second pressure region of the HVACR system **100** exceeds a first threshold pressure difference and actuating the flow regulating valve **203** to supply the lubricant.

[0051] In one or more embodiments, the step of selectively actuating the flow regulating valve **203** to open to supply the lubricant includes determining whether the pressure difference between the first pressure region and the second pressure region of the HVACR system **100** falls below a second threshold pressure difference and actuating the flow regulating valve **203** to supply the lubricant.

[0052] While specific language has been used to describe the subject matter, any limitations arising on account thereto, are not intended. As would be apparent to a person in the art, various working modifications may be made to the method in order to implement the inventive concept as taught herein. The drawings and the foregoing description give examples of embodiments. Those skilled in the art will appreciate that one or more of the described elements may well be combined into a single functional element. Alternatively, certain elements may be split into multiple functional elements. Elements from one embodiment may be added to another embodiment.

Claims

1. A lubricant management system for a Heating, Ventilation, Air Conditioning, and Refrigeration (HVACR) system, the lubricant management system comprising: a compressor including a plurality of lubricant inlet ports and a plurality of lubricant outlet ports; a first set of orifices comprising: a first orifice adapted to receive lubricant via a first passageway; a second orifice adapted to receive the lubricant via a flow regulating valve disposed in a second passageway, wherein the first passageway and the second passageway are fluidly connected; a second set of orifices adapted to receive the lubricant supplied by the first passageway and the second passageway, the second set of orifices adapted to supply the received lubricant to each of the lubricant inlet ports of the compressor, wherein the flow regulating valve is adapted to open to supply the lubricant based on the pressure difference between a first pressure region and a second pressure region of the HVACR system.

2. The lubricant management system according to claim 1, wherein the opening of the second orifice is greater than the opening of the first orifice.

3. The lubricant management system according to claim 1, wherein the first pressure region is a region upstream of the first set of orifices and the flow regulating valve.

4. The lubricant management system according to claim 1, wherein the second pressure region is a region downstream of each of the second set of orifices.

5. The lubricant management system according to claim 1, wherein the flow regulating valve is adapted to open to supply the lubricant based on the pressure difference between the first pressure region and the second pressure region of the HVACR system exceeding a first threshold pressure difference.

6. The lubricant management system according to claim 1, wherein the flow regulating valve is adapted to open to supply the lubricant based on the pressure difference between the first pressure region and the second pressure region of the HVACR system falling below a second threshold pressure difference.

7. The lubricant management system according to claim 1, wherein the flow regulating valve is adapted to close based on the pressure difference between the first pressure region and the second pressure region of the HVACR system ranging between the second threshold pressure difference and the first threshold pressure difference.

8. A method for optimizing supply of a lubricant to a compressor of a Heating, Ventilation, Air Conditioning, and Refrigeration (HVACR) system, the method comprising: providing a lubricant management system comprising a compressor, a first set of orifices, a second set of orifices, and a flow regulating valve; and selectively actuating the flow regulating valve to open to supply lubricant based on the pressure difference between a first pressure region and a second pressure region of the HVACR system.

9. The method according to claim 8, wherein selectively actuating the flow regulating valve to open to supply the lubricant comprises: determining whether the pressure difference between the first pressure region and the second pressure region of the HVACR system exceeds a first threshold pressure difference; and actuating the flow regulating valve to supply the lubricant.

10. The method according to claim 8, wherein selectively actuating the flow regulating valve to open to supply the lubricant comprises: determining whether the pressure difference between the first pressure region and the second pressure region of the HVACR system falls below a second threshold pressure difference; and actuating the flow regulating valve to supply the lubricant.

11. The lubricant management system according to claim 8, wherein the first pressure region is a region upstream of the first set of orifices and the flow regulating valve.

12. The lubricant management system according to claim 8, wherein the second pressure region is a region downstream of each of the second set of orifices.

13. The lubricant management system according to claim 8, wherein the opening of the second orifice is greater than the opening of the first orifice.

14. The lubricant management system according to claim 8, wherein the flow regulating valve is adapted to close based on the pressure difference between the first pressure region and the second pressure region of the HVACR system ranging between the second threshold pressure difference and the first threshold pressure difference.