



RE-MI Series

TECHNICAL MANUAL

*High IPLV and SEER
design Screw compressor
dedicated to:*

*R134a, R513A, R450A
R1234ze and R1234yf*

Variable Volume Ratio
RE-MI Series

VFD Screw Compressor



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1. General

Hanbell, a global leader of compressor designer and manufacturer, continues giving its effort on the solutions of energy efficiency and new technology.

Hanbell RE-MI series screw compressor is designed and manufactured to provide the exemplary standard for variable frequency drive (VFD). The compressor has built-in three-phase, six-pole permanent-magnet synchronous motor and exceptional variable compression ratio mechanism. Thanks to the variable compression ratio design, RE compressor gives an optimum match for compressor running in a variety of working conditions as well as seasonal factors.

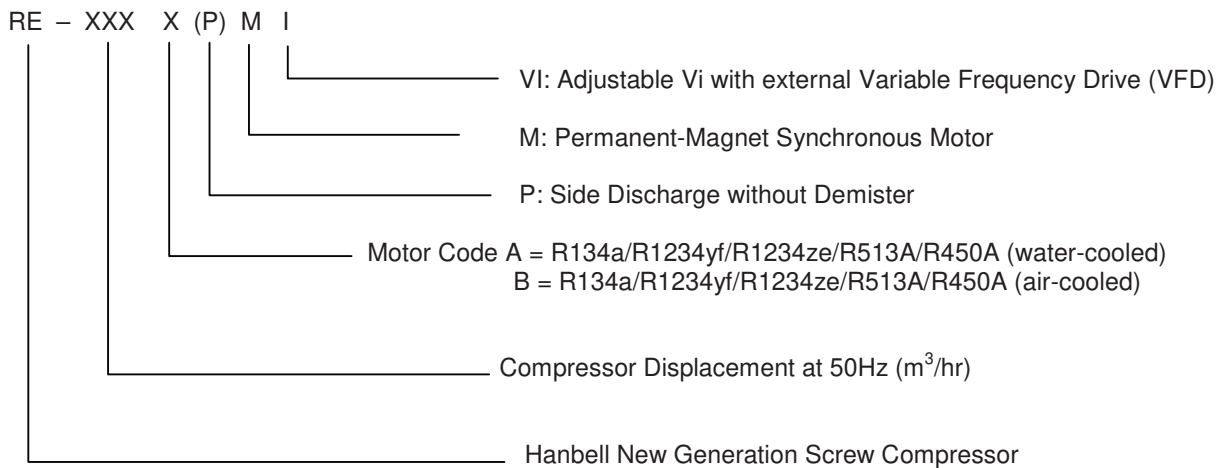
RE compressor is designed for R134a and HFO refrigerant such as R513A, R1234ze, R1234yf with compact footprint, high COP and IPLV suitable for the chillers designed in compliance with ASHRAE 90.1, ISEER and EU 2016/2281.

This manual contains the essential information for correct and safe use of RE compressor. Engineers and person in charge are required to be familiar this manual prior to the installation and start-up.

RE-MI series is semi-hermetic screw compressor suitable for direct expansion or flooded evaporators, water-cooled or air-cooled condensers, and variable frequency drive chiller packages.

2. Specifications and description of design

2.1 Compressor nomenclature



2.2 Compressor specifications

MODEL	COMPRESSOR			MOTOR			LUBRICANT CHARGE	WEIGHT	
	Displacement at 3,600 RPM	Rotation Speed Range	Vi Control	Nominal HP		Starting			Primary Voltage
	m ³ /hr	rpm	Step	A motor	B motor				
RE-340A(P)MI RE-340B(P)MI	423	1200 ~ 3600/4200	Low Mid High	80	108	VFD Starting	380 ~ 480	L	kg
RE-380A(P)MI RE-380B(P)MI	471			90	122			16	570
RE-420A(P)MI RE-420B(P)MI	501			97	146			16	600
RE-480A(P)MI RE-480B(P)MI	579			107	166			17	630
RE-550A(P)MI RE-550B(P)MI	666			131	185			19	670
RE-620A(P)MI RE-620B(P)MI	752			146	215			23	870
RE-710A(P)MI RE-710B(P)MI	857			166	233			26	920
RE-820A(P)MI RE-820B(P)MI	987			196	257			28	1050
RE-920A(P)MI RE-920B(P)MI	1112			215	298			28	1135
RE-1050A(P)MI RE-1050B(P)MI	1254			241	322			40	1480
RE-1150A(P)MI RE-1150B(P)MI	1374			264	354			40	1500

Note:

1. Motor type: 3 phase, 6 pole permanent-magnet synchronous motor
2. Motor insulation: Class F
3. Motor protection: PTC Motor temperature thermistor, PT1000 Motor temperature sensor
4. Allowable pressure : 21kgf/cm²G
5. Pneumatic pressure test: 26kgf/cm²G
6. RE-APMI / RE-BPMI without lubricant charge
7. The nominal motor hp is not equal to the maximum compressors hp. Please refer to the output of Hanbell selection software for operation current and at chiller designed conditions to select the capacity of Inverter, magnetic contactor, cable size, fuse, wire and relays...etc

2.3 Design features

Variable volume ratio- Compressor volume ratio (Vi) is adjustable. It eliminates the possibility of energy waste when cooling load varies on actual requirement. Optimal Vi make compressor running at maximum efficiency at peak and off-peak hours by adjusting the compression ratio automatically.

High efficiency permanent-magnet synchronous motor- RE-MI is assembled a new self-developed IPM permanent magnet VFD motor, and ensures that the compressor can achieve the best energy efficiency under various working conditions. Comparing with induction motors, permanent magnet motors have no rotation speed slip, no loss of power output, and low-temperature rise of the motor which can reduce unnecessary suction superheat to improve the volumetric efficiency of the compressor. In partial load, the efficiency of the permanent magnet motor is much better than induction motors. Permanent magnet motors have high density; therefore the volume and weight are smaller than the induction motors under the same house power. It greatly reduces mechanical vibration of the compressor at high speed.

VFD (variable frequency drive)- Because of VFD application, the capacity control is more accurate and is closed to the actual loading%. The most important point is that the power saving effect is more significant. By VFD application, it can avoid frequent times of starting & stopping for compressors. It reduces unstable operation of system and decreases compressor starting current. VFD starting reduces loss of mechanical components effectively and improves the reliability of compressors.

High-efficiency screw rotor profile- The high-efficiency rotor profile is designed for the characteristics of HFC & HFO refrigerant with high tip speed and consumes less power input. Every screw rotor is manufactured by precise CNC machining center, milling machine and grinding machine. With the precise inspection equipment of ZEISS 3D coordinate measuring machines, screw rotors are manufactured according to the design profile of high-efficiency, high-quality, low-noise and low-vibration.

Heavy duty bearing-The screw compressors utilize a combination of axial and radial bearings to ensure high reliability of operation at variable speed.



Oil separator- An oil separation chamber made of ductile material is inbuilt with RE-MI compressor. It is designed for high efficient oil separation and simplified system oil circuit to manage the oil inside the compressor. The three-stage oil separation and low-pressure-drop demister also minimize refrigerant dilution in the oil.

Protection modules- RE-MI screw compressor is built in motor PTC thermistor and motor temperature sensor gives a full-time protection on motor from running at high temperature. Motor protection module is supplied as standard devices by Hanbell to protect the compressor from high discharge temperature and high motor temperature. An optical oil level switch is supplied as standard accessory for every RE-MI compressor as well to monitor oil level at all time. Hanbell supplies pressure relief device for RE-MI compressor as an optional part.

Minimum pressure valve (optional accessory) - Minimum pressure valve is suggested to be installed when the pressure differential is lower than 4 kg/cm^2 between oil supply pressure and suction pressure. The low pressure differential is usually happen at partial load especially when compressor operates at low motor speed continuously, in the case MPV is a suitable accessory to ensure compressor run with pressure differential.

2.4 Compression process

- (A) Suction and sealing:
At the beginning of the compression cycle, gas from suction port fills the interlobe space. Refrigerant at suction pressure continues to fill it, until the trailing lobe crosses the suction area and the gas is trapped inside the space.
- (B) Compression:
As the male rotor and female rotor meshes, the interlobe space moves towards to discharge end and its volume decreases so that gas pressure increases consequently.
- (C) Discharge:
Gas is discharged from the interlobe space when the leading lobe crosses the discharge port whose volume ratio is designed differently for various applications.

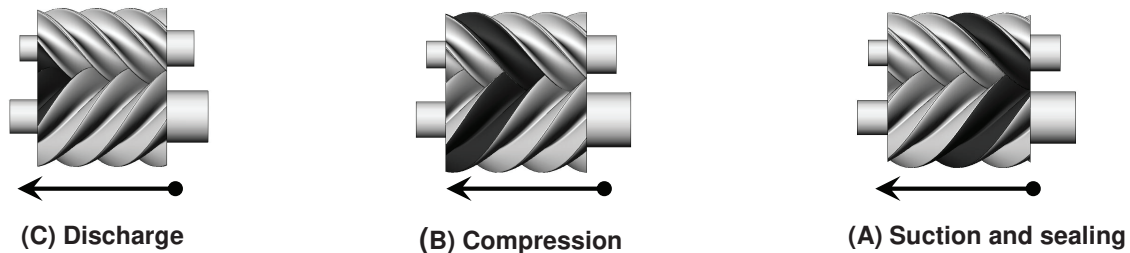


Figure: Compression process

2.5 Compressor volume ratio (Vi)

The volume ratio (Vi) of the compressor can be defined as the ratio of suction volume to discharge volume in the compressor. The smaller the concavity of slide valve in the discharge end means the larger the volume ratio. The volume ratio directly affects the internal compression ratio (Pi). Low Vi corresponds to low Pi and high Vi corresponds to high Pi. In the equation below, in order to prevent over or under compression, the system compression ratio (CR) should be equal to compressor's internal compression ratio (Pi). Please refer to P-V (pressure – volume) diagram below to figure out this relation.

$$CR = P_d/P_s$$

$$P_i = V_i^k$$

$$V_i = V_s/V_d$$

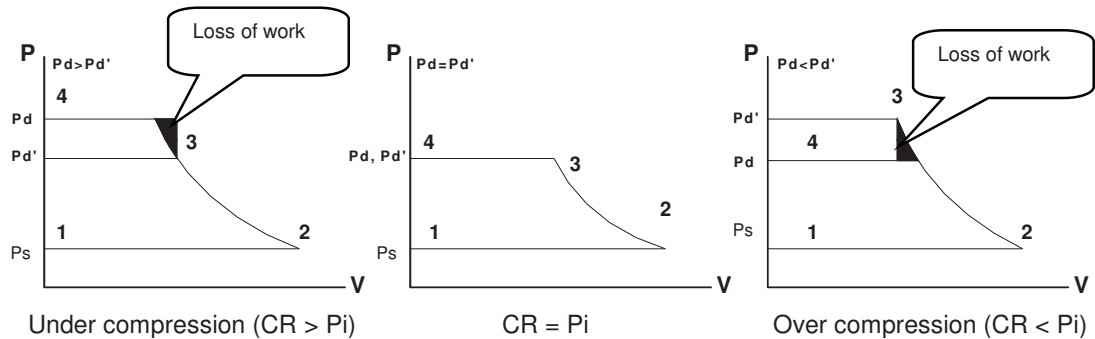


Figure: P-V Diagram

Where: CR: system compression ratio
 Vi: internal volume ratio
 Pd: system pressure (absolute pressure)
 Pd': discharge pressure (absolute pressure)
 Ps: suction pressure (absolute pressure)
 Vs: suction volume
 Vd: discharge volume
 K: refrigerant specific heat ratio
 Pi: internal compression ratio

Compressor is designed with variable Vi mechanism which keeps compressor's internal compression ratio (Pi) is closed to system compression ratio (CR), which means no loss of work and energy waste. Compression volume ratio is adjustable through three solenoid valves automatically as following illustration:

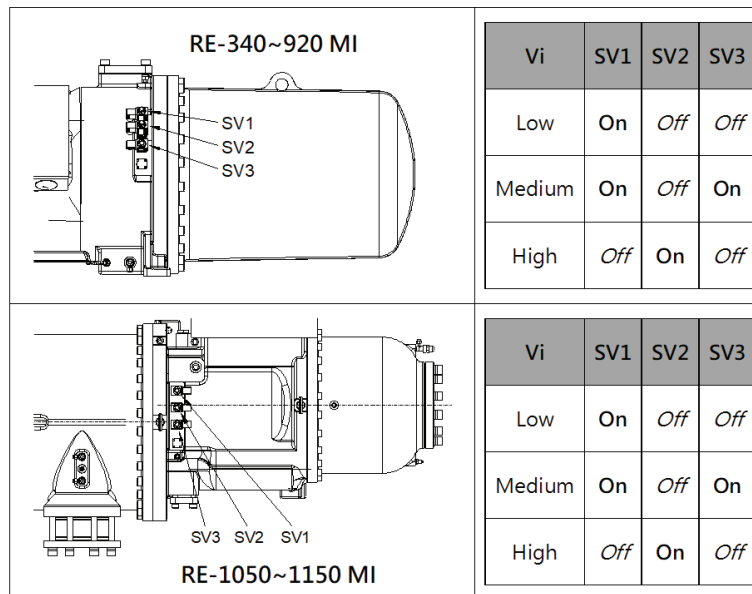


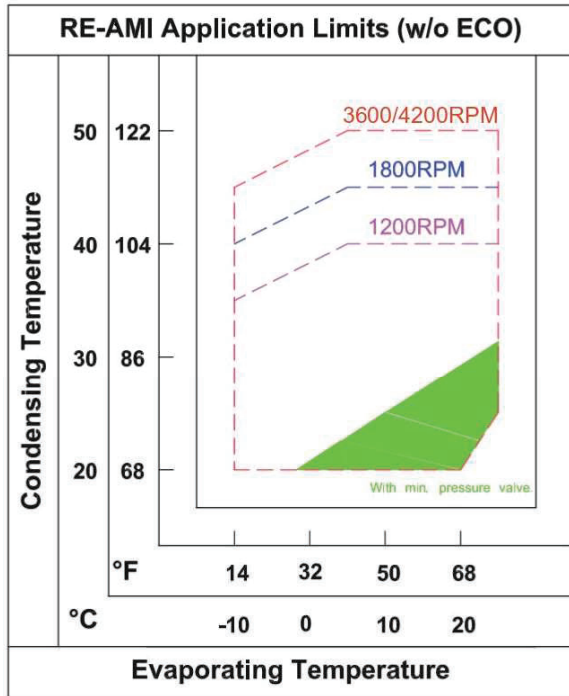
Figure: Vi Control



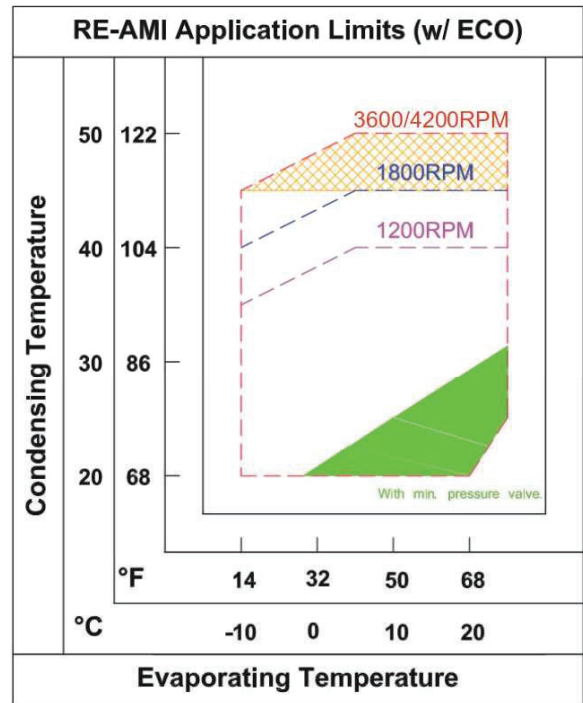
2.6 Application limits

The compressor load varies significantly at different types of refrigerant, it is important to monitor the operation conditions and make sure the actual saturated evaporating and condensing temperature within the compressor operation range.

a. RE-340AMI ~ RE-1150AMI (R134a/R513A/R450A/R1234yf) :

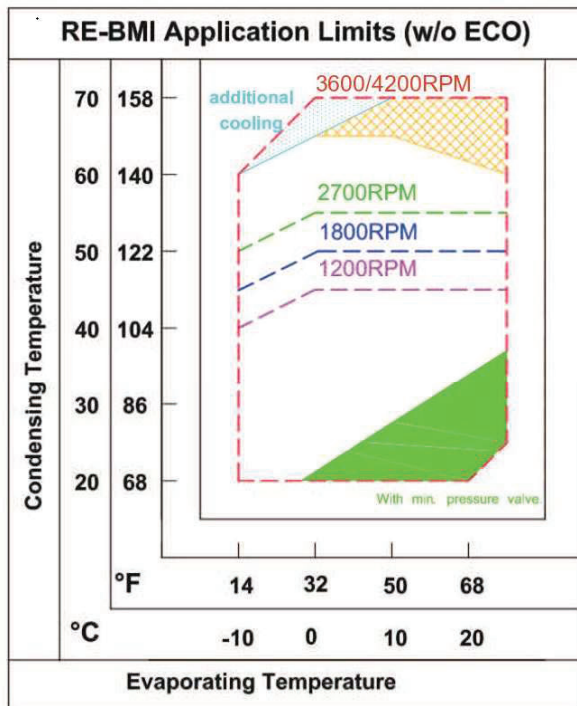


RE-340AMI~1150AMI

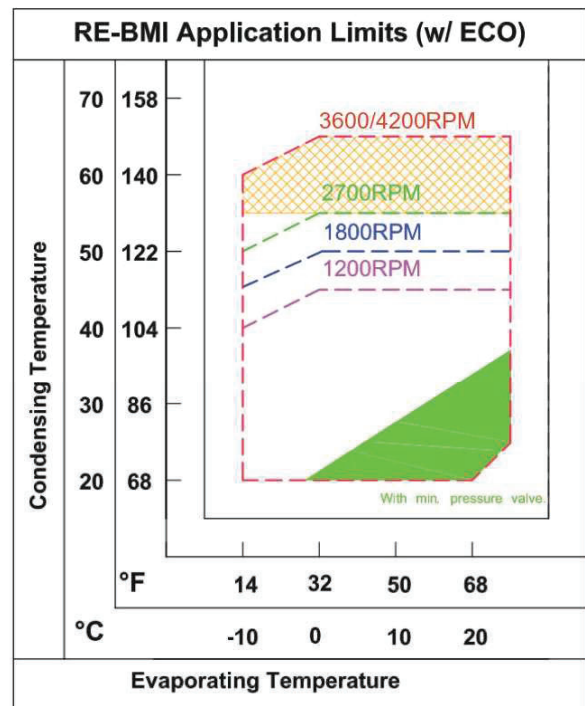


RE-340AMI~1150AMI

b. RE-340BVI ~ RE-1150BVI (R134a/R513A/R450A/R1234yf) :



RE-340BVI~1150BVI



RE-340BVI~1150BVI



Note:

1. Yellow area: Please contact HANBELL for further operating recommendation.
2. Compressor running continuously at partial load will cause insufficient cooling to motor coils. Hanbell suggest an installation of liquid injection to motor to ensure additional cooling to motor coils, please contact. Hanbell for choosing the thermal expansion valve for liquid injection.
3. Hanbell suggest maintain discharge superheat at least 10K higher than the condensing temperature (normally discharge superheat is around 20K at R134a) to avoid liquid filling back to compressor and lubrication failure. For other refrigerants, please consult Hanbell.
4. It is recommended to monitor oil supplied pressure and maintain it at least 4 kgf/cm²(G) higher than suction pressure. (for adequate oil sealing and lubrication for bearings). When operation conditions fall into the zone of minimum pressure valve, we recommend install the minimum pressure valve to ensure the pressure differential is maintained.

2.7 Rated Current and Compressor Maximum Continuous Current (MOA)

Model	Compressor				Primary Power Supply (before inverter)		Secondary Power Supply (after inverter)	
	Motor Rated Power (kW)	Speed (RPM)	Rated Current (A)	Maximum Continuous Current MOA(A)	Frequency (Hz)	Voltage (V)	Compressor Input Frequency (Hz)	Compressor Input Voltage (V)
RE-340A(P)MI	60	1200	115	160	50 / 60	380 400 440 415 / 440 460 480	180	380
RE-380A(P)MI	67		128	179				
RE-420A(P)MI	72		138	193				
RE-480A(P)MI	80		153	214				
RE-550A(P)MI	98		187	262				
RE-620A(P)MI	109		208	291				
RE-710A(P)MI	124		237	332				
RE-820A(P)MI	146		279	390				
RE-920A(P)MI	160		306	428				
RE-1050A(P)MI	165		315	441				
RE-1150A(P)MI	182		347	485				
		~						
RE-340B(P)MI	72	3600 / 4200	138	193	50 / 60	380 400 440 415 / 440 460 480	180	380
RE-380B(P)MI	80		153	214				
RE-420B(P)MI	98		187	262				
RE-480B(P)MI	105		200	280				
RE-550B(P)MI	122		233	326				
RE-620B(P)MI	146		279	390				
RE-710B(P)MI	160		306	428				
RE-820B(P)MI	179		341	477				
RE-920B(P)MI	196		375	525				
RE-1050B(P)MI	248		474	663				
RE-1150B(P)MI	272		519	727				



3. Inverter Installation and Operation

3.1 Inverter Selection

To drive RE-MI series with an inverter, please read the following check points for selecting suitable inverter:

- i. Refer to the values of MOA and select suitable inverter spec which is higher than MOA at least.
- ii. Select the suitable inverter which produces side effects of harmonics mildly because harmonics from inverter impact the motor efficiency and power factor negatively.
- iii. The voltage drops will lead to higher operating current when using inverter and it has to be considered when selecting suitable inverter. The phase monitor function is also necessary on inverter selection.

3.2 Electrical Installation

To drive RE-MI series with an inverter, please read the following check points on electrical installation:

- i. Select electrical components which follow local guidelines of safety and operation.
- ii. Please select suitable power cable spec. which is between inverter and compressor motor according to EMC approval if necessary.
- iii. Power supply is stable and meets inverter spec., including phase sequence, three-phase voltage and frequency balance.
- iv. Power cable spec. meets inverter spec..
- v. It's recommended to install a reactor between the primary side (before inverter) to improve input power factor and reduce harmonics.
- vi. The ambient temperature and humidity meet inverter spec..
- vii. The jumpers need to be fixed firmly on six terminal bolts of terminal cover plate with correct torque value as following drawing. Please also make sure the phase sequence between inverter and compressor is correct.

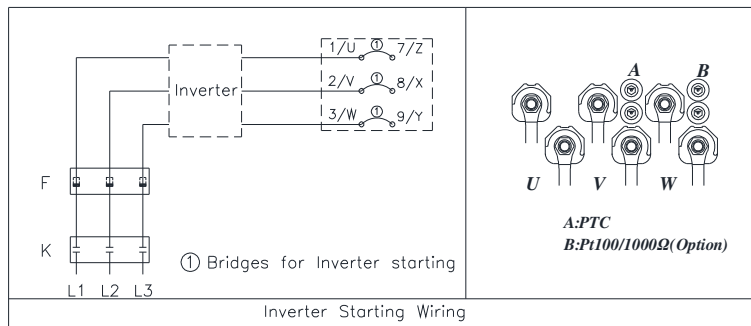


Figure: Cable Wiring Connection



4. Lubricants

The main functions of lubrication oil in RE-MI compressors are lubrication for bearings, compression chamber sealing, controlling discharge temperature, and Vi adjustment.

When bearings are in service, they require steady lubrication. Oil flow in compression chamber creates a film of oil for sealing in the compression housing to increase efficiency and dissipate compression heat.

Oil temperature is crucial to compressor bearings' life. Oil is usually lower in viscosity when it is at high temperature. Low viscosity of oil results in poor lubrication and heat dissipation to compressor.

Viscosity is recommended to keep over 10mm²/s at any temperatures for oil. Oil temperature in the oil sump should be kept above the saturated condensing temperature to prevent refrigerant migration into lubrication system. Oil becomes high viscous in winter time with lower ambient temperature or compressor not started for a long-time. When oil viscosity is high, the lower oil flow speed may cause insufficient lubrication to compressor or delay of the lubrication process. Hanbell suggest turn on oil heater to warm up oil when compressor is not in operation.

If the compressor operates close to the operation limits with the discharge temperature higher than 80°C, the external oil cooler is recommended. Please refer to Hanbell selection software for the required capacity and oil flow of the oil cooler.

Oil return from the evaporator is usually difficult in refrigeration systems and flooded chillers, which is easier to cause oil loss in the compressor. Secondary oil separator is recommended to be installed between the compressor discharge side and condenser for such application.

Every RE-MI compressor has an oil sight glass on oil sump to monitor the condition of the oil. It is a normal observation the level in sight glass fluctuates when compressor in operation due to pressure differential varies. An optical oil level switch is installed to monitor the oil level at all time and gives alarm or trip the compressor if it is lose of oil.

4.1 Lubricants table

Applicable oil types (R134a, R513A, R450A, R1234ze and R1234yf)

SPECIFICATION		UNITS	HBR -B04	HBR -B08	HBR -B09	HBR-B44
SPECIFIC GRAVITY		kg/m ³	0.95	0.94	0.95	1.01
VISCOSITY	40°C	mm ² /s (cSt)	220	100	170	104.1
	100°C		18.1	11	16.2	18.7
FLASH POINT		°C	275	260	280	238
POUR POINT		°C	-24	-33	-33	-48

Lubricants information

Note: For other refrigerants, please consult HANBELL to select suitable lubricants.



4.2 Pre-cautions of changing oil

1. To use only Hanbell certified oil and do not mix different brands of oil together. Selection of oil should match characteristics of the refrigerant used. Oil remained in the compressor should be totally cleaned up in the system before charging new oil.
2. When using polyester oil for chiller systems, please make sure that do not expose oil to air to avoid oil deterioration. Therefore, it is necessary to vacuum the system completely when installing compressors.
3. In order to ensure no moisture inside the system, it is suggested to clean the system by charging it with dry Nitrogen and then vacuuming it repeatedly as long as possible.
4. It is a must to change oil in motor-burnt cases because acid substance remains inside the system. Please follow the procedures mentioned as above to change oil in the system. Check acidity of oil after 72 hours of operation and then changing it again until acidity of oil becomes normal.
5. Please contact Hanbell local distributors/agents for selection of oil.

4.3 Oil change

1. It's strongly suggested to change oil periodically and check lubrication oil every 10,000 hours of continuous running. For the first operation of the compressor, it is recommended to change the oil and clean the oil filter after running 2,000 hours. Check the system whether clean or not and changing oil every 20,000 hours or 3-year continuous running while the system operates in good condition.
2. To avoid clogging in oil filter with debris or swarf, an optional oil pressure differential switch is recommended to be installed. The switch will trip when the oil pressure differential between the primary and secondary sides reaches 1.5 bar (g) to prevent compressor damage due to oil loss.

5. Compressor handling and installation

5.1 Compressor lifting

Each HANBELL screw compressor has been carefully tested at the factory and every precautionary measures have been taken to make sure that compressors will keep in perfect condition when reach customers' work. After the compressor arrives at your warehouse, please check if its crate is kept in good condition and check all the compressor accessories with shipping documents to see if there is any discrepancy.

When lifting the compressor, it is recommended to use a steel chain or steel wire which can be used for loading capacity of 1,500kgf as shown in the figure below. Make sure that chains, cables or other lifting equipments are properly positioned to protect the compressor and its accessories from damaging. Keep the compressor in horizontal position when lifting, and prevent it from crashing or falling on the ground, hitting the wall or any other accident that may damage it or its accessories.

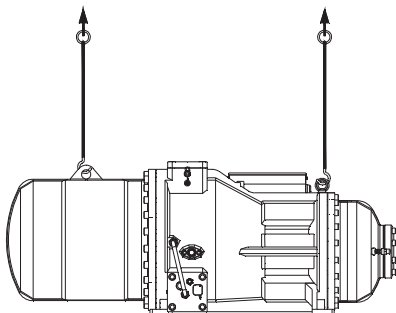
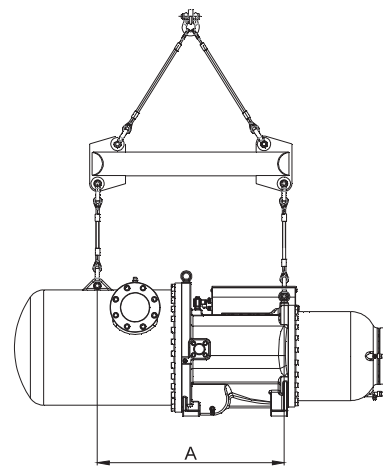


Figure: Lift the compressor with steel chain or steel cable



Model	A(mm)
RE-820	1115
RE-920	1175
RE-1050	980
RE-1150	1008

Figure: Lift the compressor with Lifting beam (RE-820~1150)

5.2 Mounting the compressor

The installation of the compressor in the refrigeration system should be accessible and make sure that the chiller base or site is far enough from the heat source to prevent heat radiation. The compressor should also be installed as close as possible to the electrical power supply for easier connection and must keep good ventilation and low humidity condition in the site. Make sure that the frame or supporter is strong enough to prevent excessive vibration and noise while the compressor is running and must reserve enough space for compressors' future overhauling work.

The compressor must be installed horizontally and in order to prevent excessive vibration transferred by the structure and piping of the chiller while in operation, the cushion or anti-vibration pad should be installed. The screws should only be tightened until slight deformation of the rubber pad is visible. ※ It is strongly recommended to position the compressor higher than the evaporator

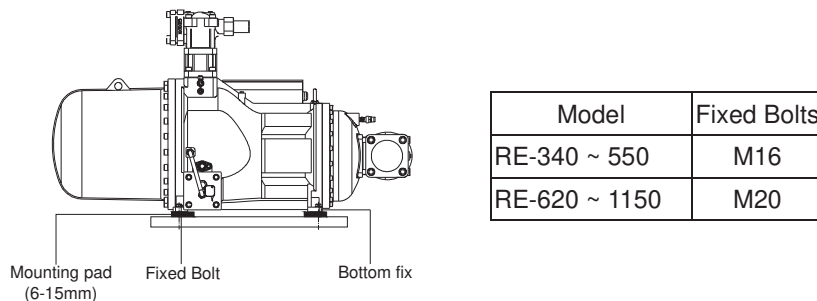


Figure: Installation of anti-vibration pads

Suggestions on piping works

The unsuitable piping works done to the compressor could cause abnormal vibration and noise that might damage the compressor. Take notice of the following pointers to prevent this situation from happening:

1. Cleanliness of the system should be kept after welding the piping to avoid any swarf or debris contained inside the system as it may cause serious damage to the compressor during operation.
2. In order to reduce the vibration on the piping tubes, it is recommended to use copper tube to be the suction and discharge piping tubes. Copper tubes are better to minimize the vibration in the piping while the compressor is in operation. In case steel tubes are used in piping system, the suitable welding works are very important to avoid any stress in the piping. This inner stress can cause harmonic vibration and noise that can reduce the life of the compressor. If a large-caliber copper tube is not easily accessible and a steel tube is used instead in suction port, Hanbell also recommends the use of a copper tube in discharge port to best minimize abnormal vibration and noise.
3. Remove the oxidized impurities, swarf or debris caused by welding in the piping tubes. If these materials fall into the compressor, the oil filter might be clogged and result in the malfunction of lubrication system.
4. The material of suction and discharge flange bushings is forged steel and it can be welded directly with piping connectors. After welding the flange bushing and pipes, it must be cooled down by ambient air. Do not use water to cool it down because water quenching is prohibited.

Installing the compressor in a sloping position

The following figure shows a 15° limit of oblique angle for installation of compressor. In case the oblique angle is higher than the limit, compressor will be shut down easily. For special applications like the installation in ships, fishing boats, etc..., where the oblique angle might exceed the limit, external oil separators, oil tanks and related accessories are recommended to be installed. Please contact HANBELL or local distributors for further layout recommendation.

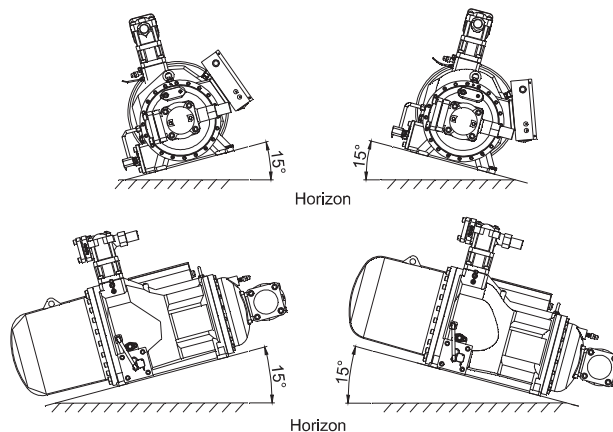
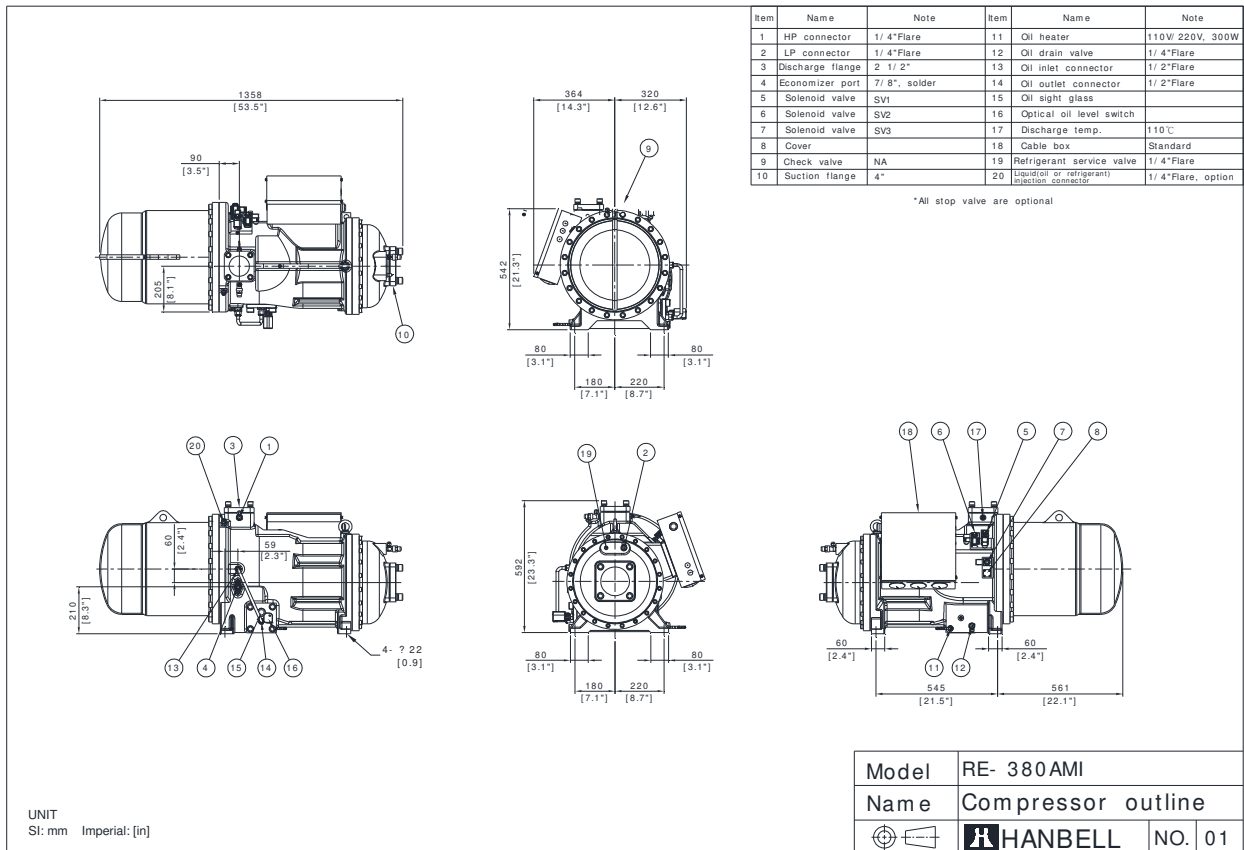
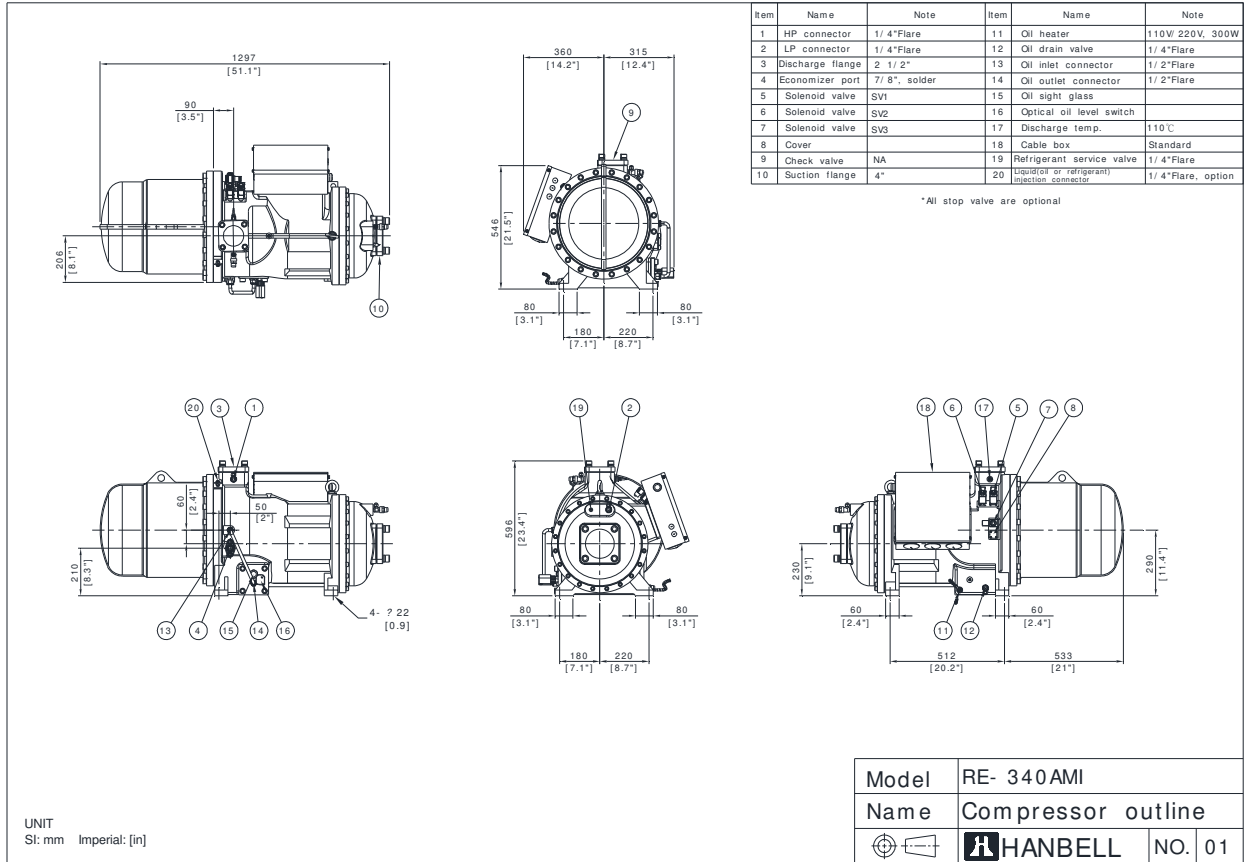


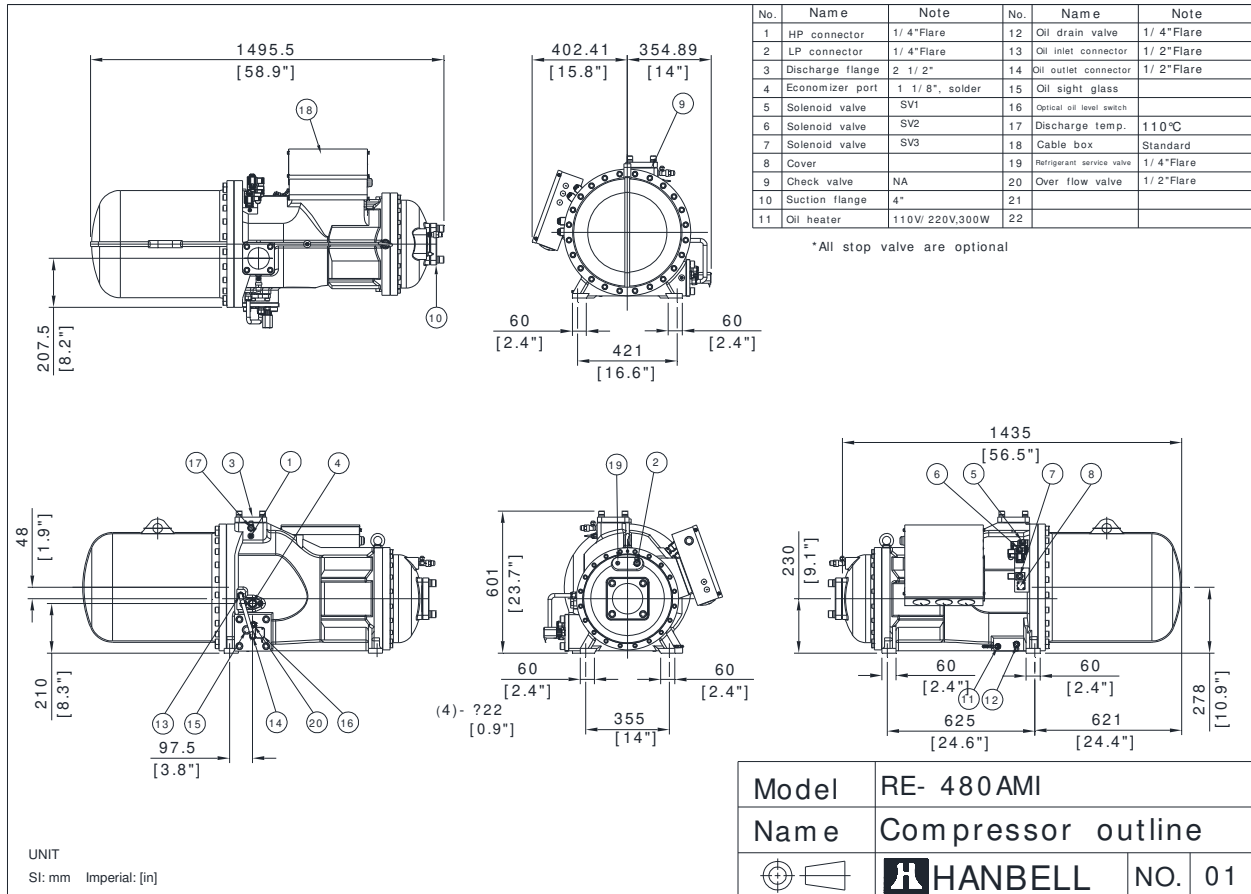
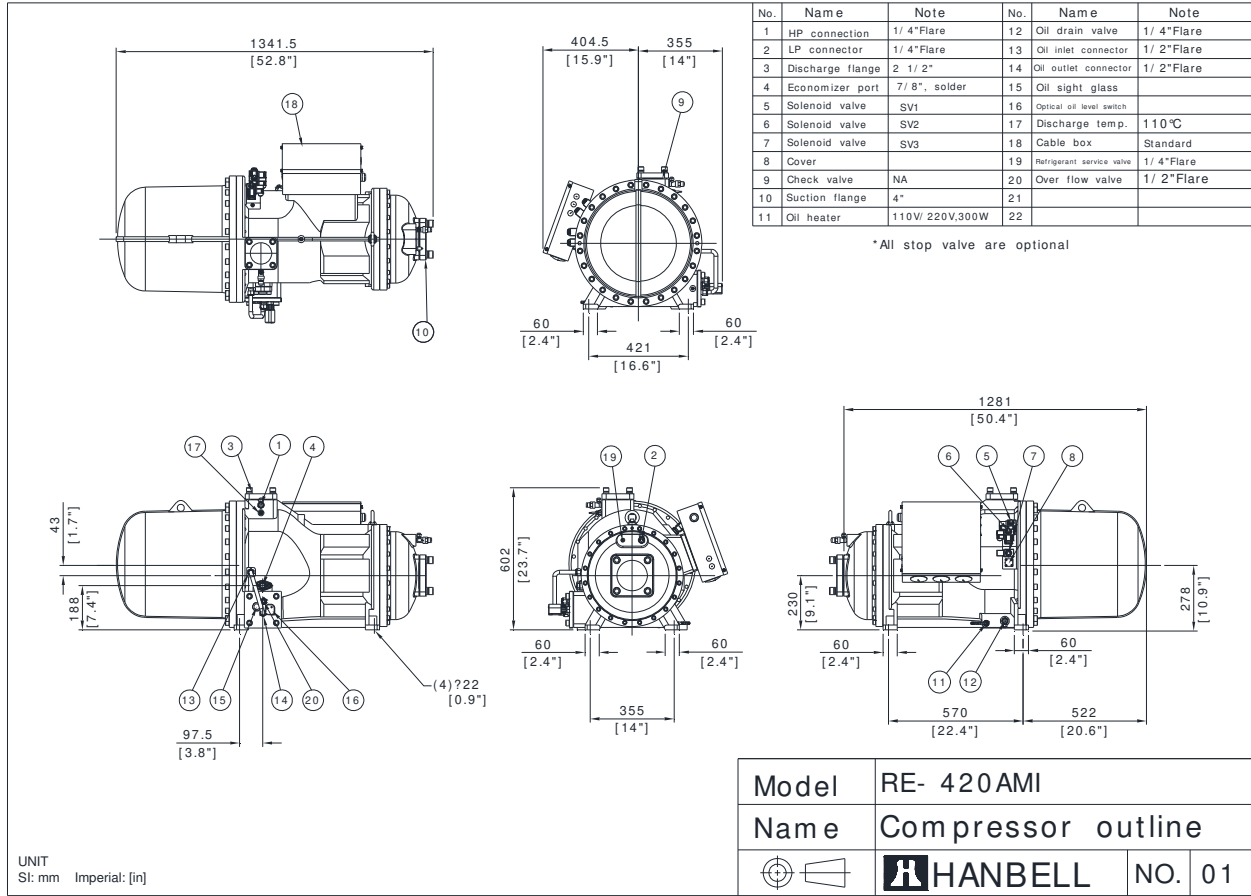
Figure: Limits of oblique angle for the installation of the compressor

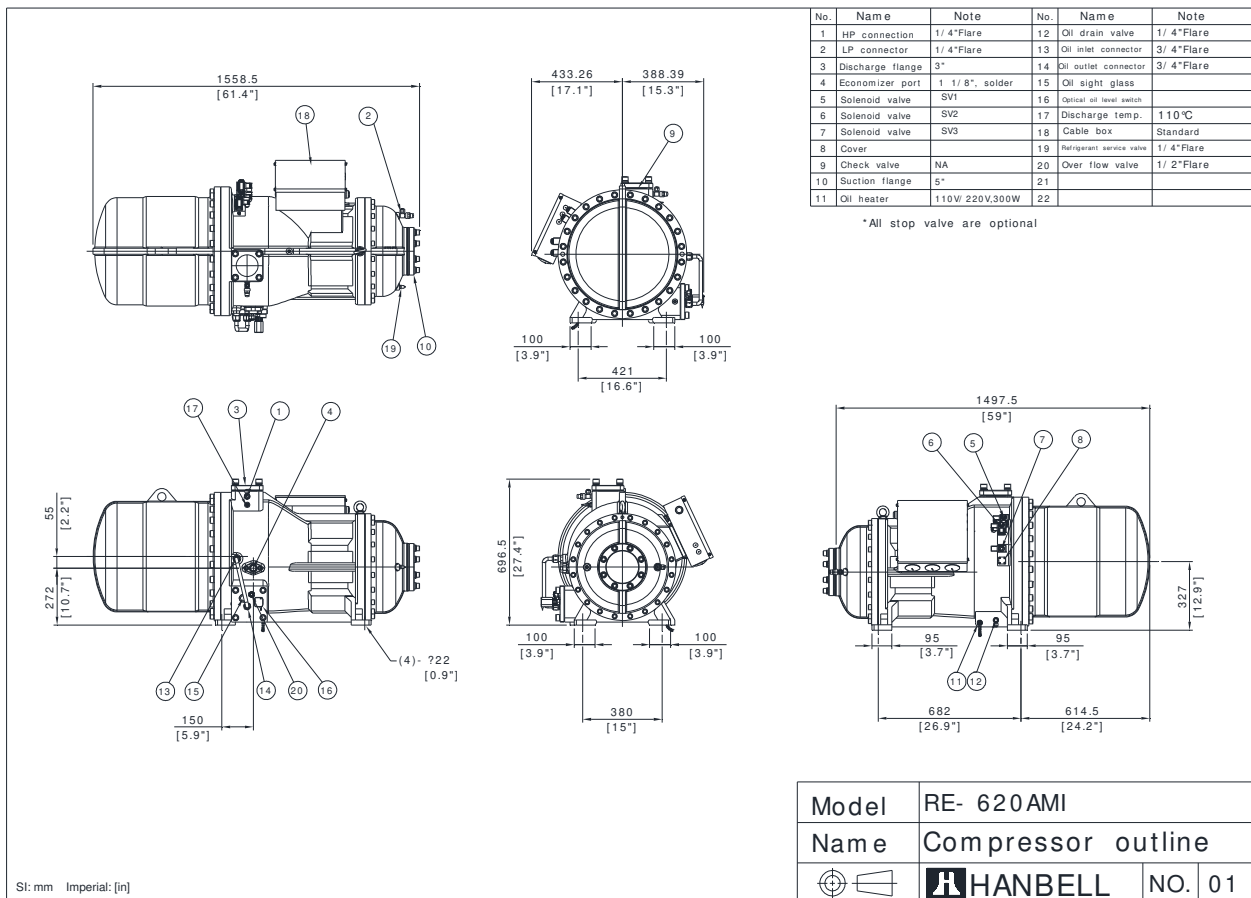
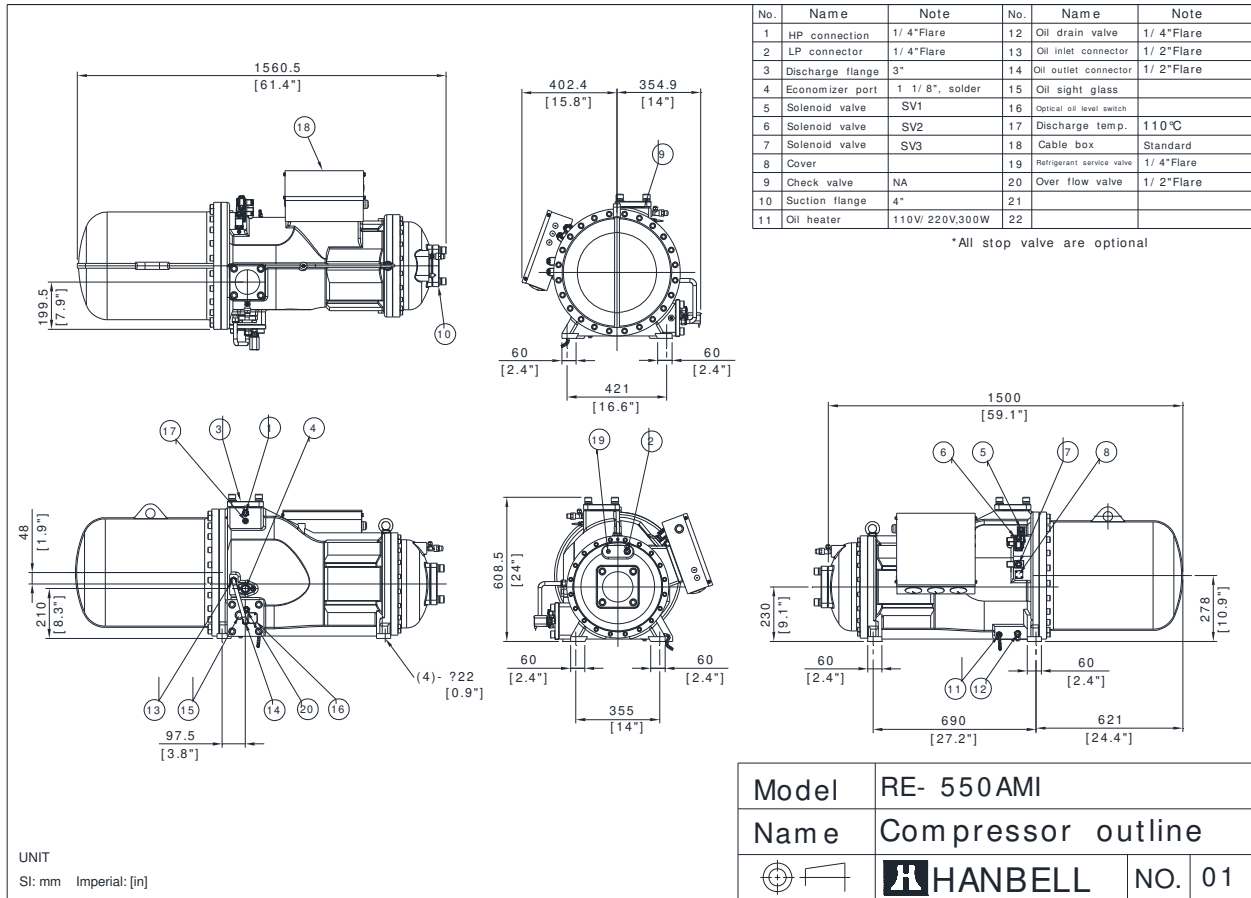


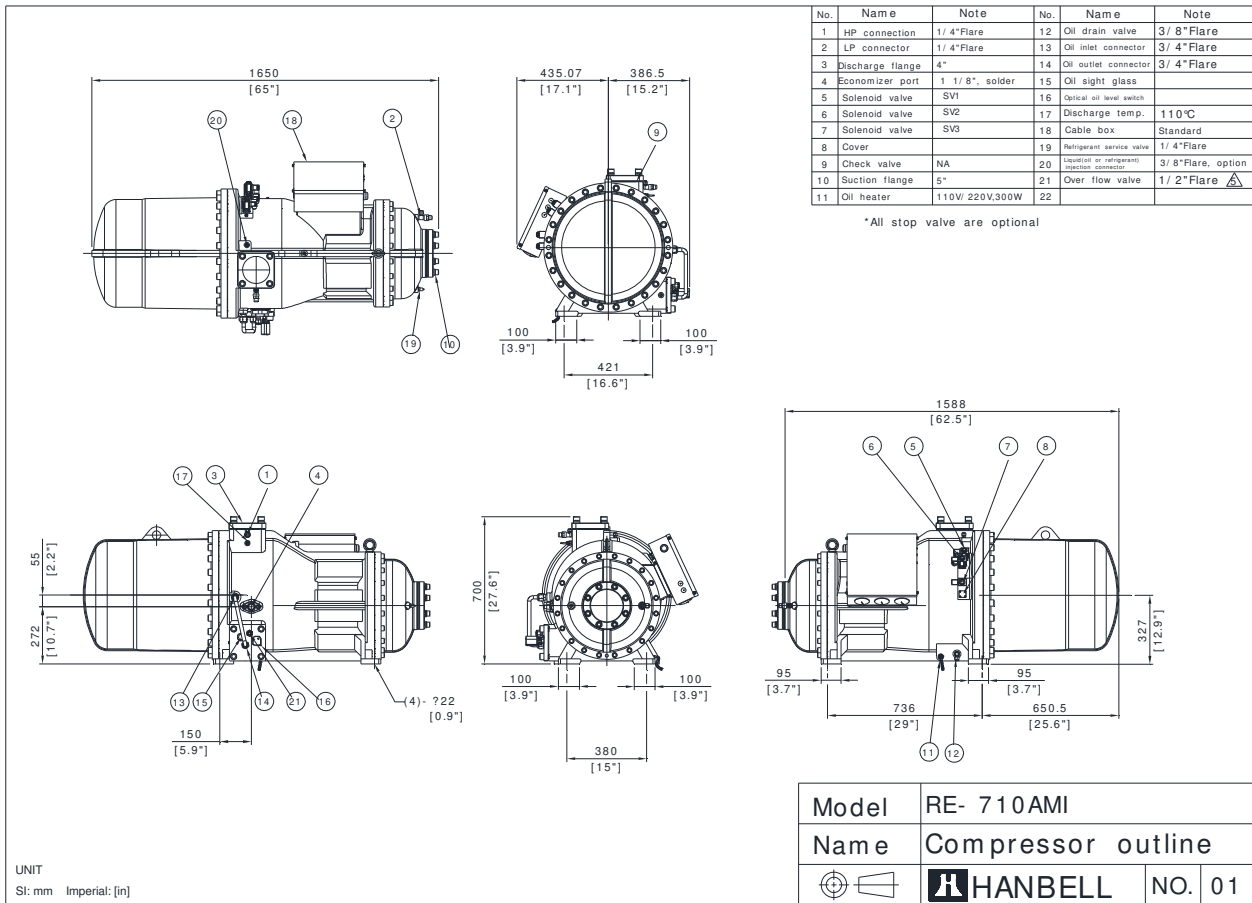
5.3 RE-MI 2D diagram

5.3.1 RE-AMI



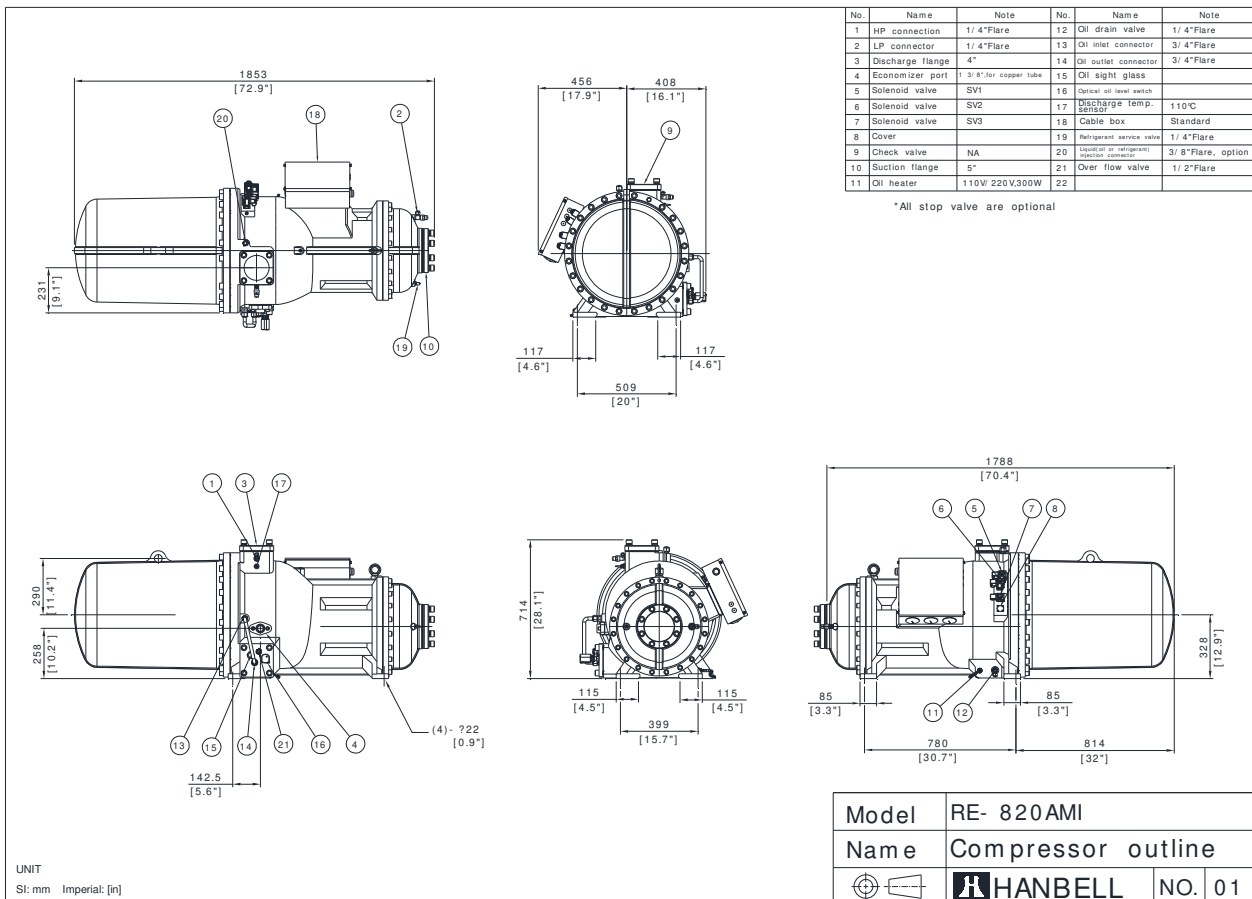






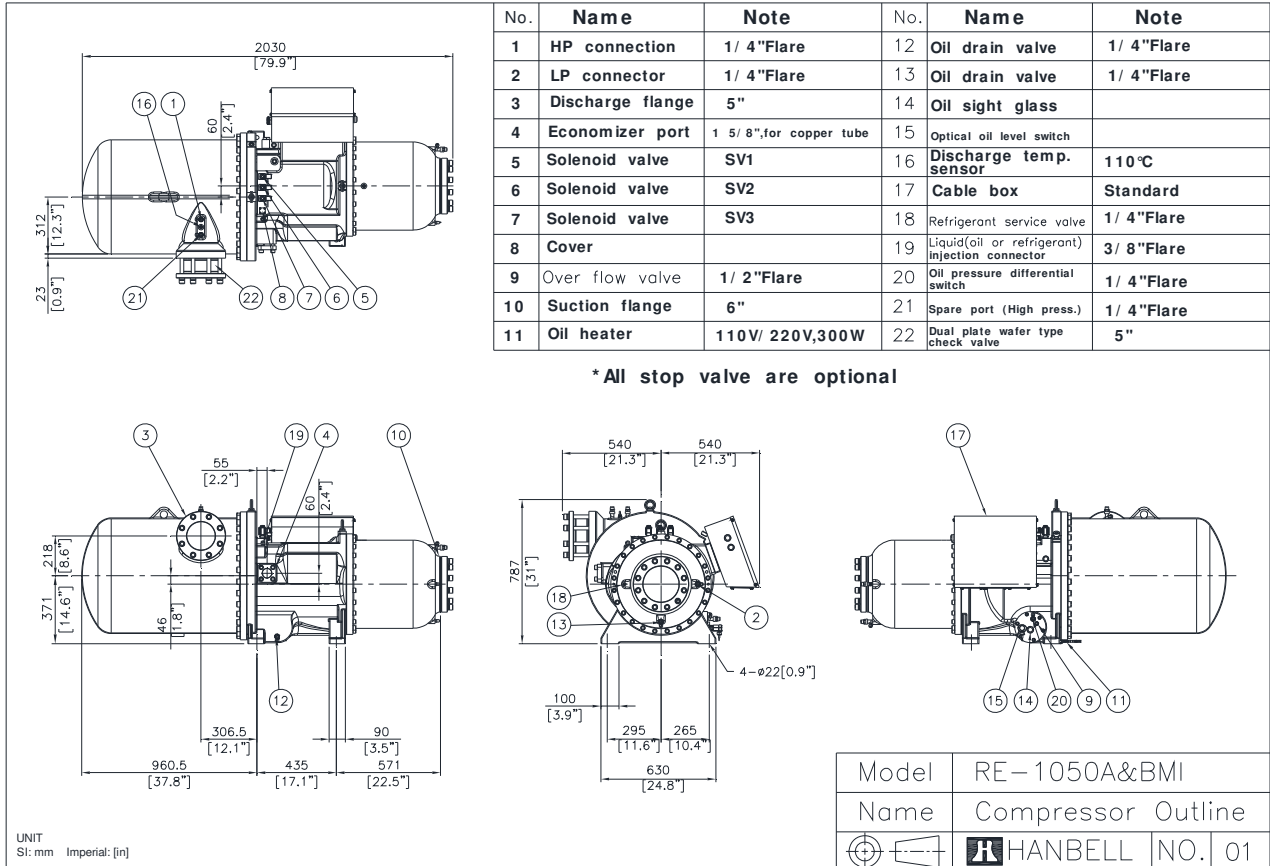
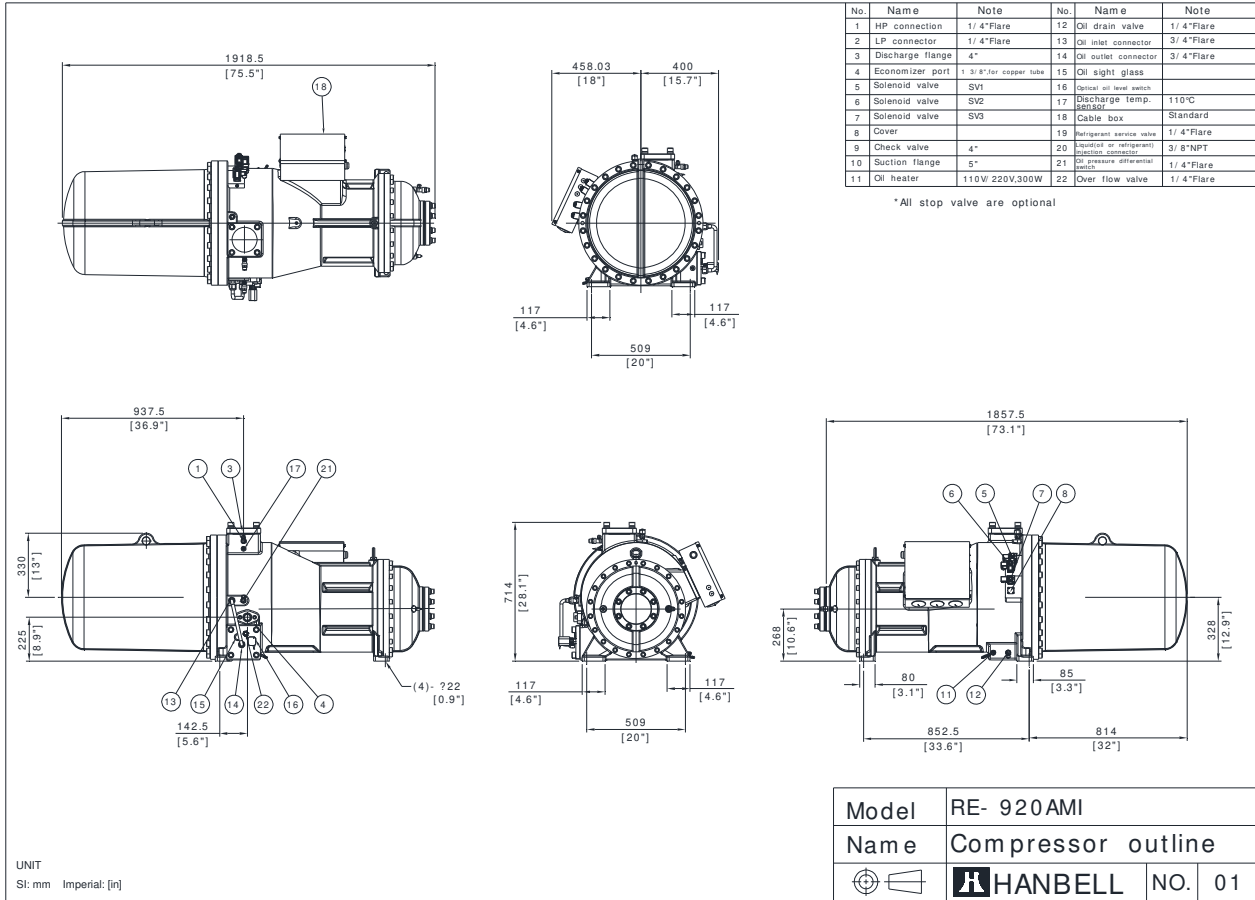
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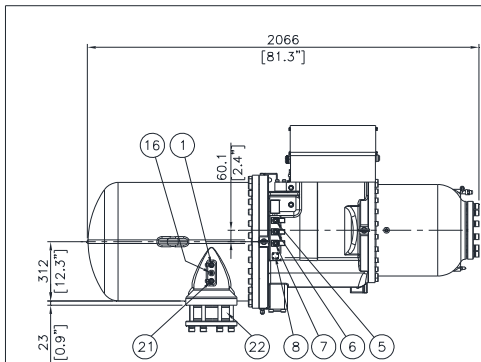
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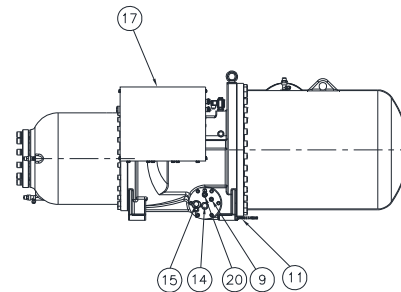
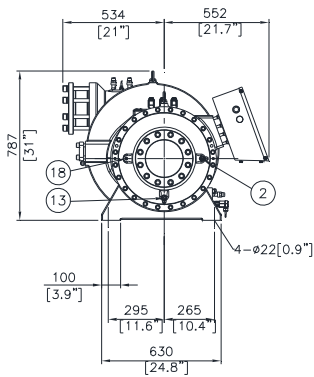
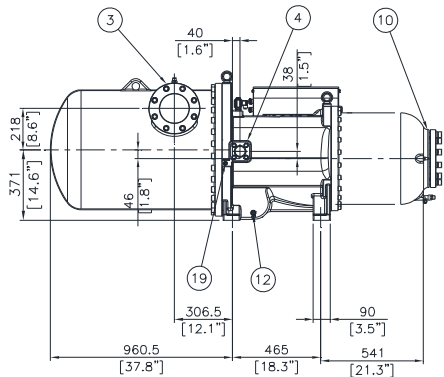
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No.	Name	Note	No.	Name	Note
1	HP connection	1/4"Flare	12	Oil drain valve	1/4"Flare
2	LP connector	1/4"Flare	13	Oil drain valve	1/4"Flare
3	Discharge flange	5"	14	Oil sight glass	
4	Economizer port	1 5/8",for copper tube	15	Optical oil level switch	
5	Solenoid valve	SV1	16	Discharge temp. sensor	110°C
6	Solenoid valve	SV2	17	Cable box	Standard
7	Solenoid valve	SV3	18	Refrigerant service valve	1/4"Flare
8	Cover		19	Liquid(oil or refrigerant) injection connector	3/8"Flare
9	Over flow valve	5/8"Flare	20	Oil pressure differential switch	1/4"Flare
10	Suction flange	6"	21	Spare port (High press.)	1/4"Flare
11	Oil heater	110V/220V,300W	22	Dual plate wafer type check valve	5"

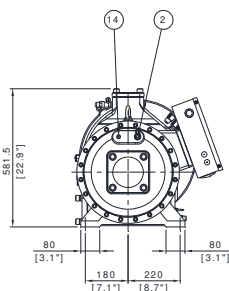
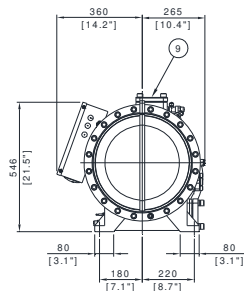
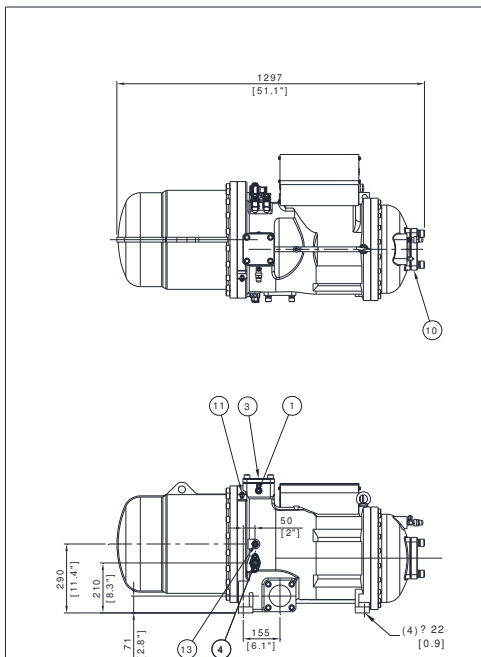
*All stop valve are optional



Model	RE-1150A&BMI
Name	Compressor Outline
	HANBELL NO. 01

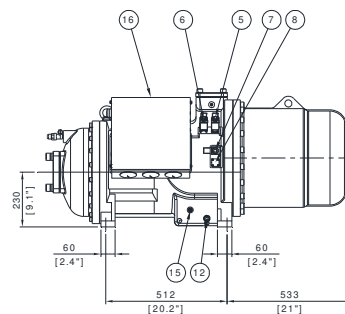
UNIT
SI: mm Imperial: [in]

5.3.2 RE-APMI



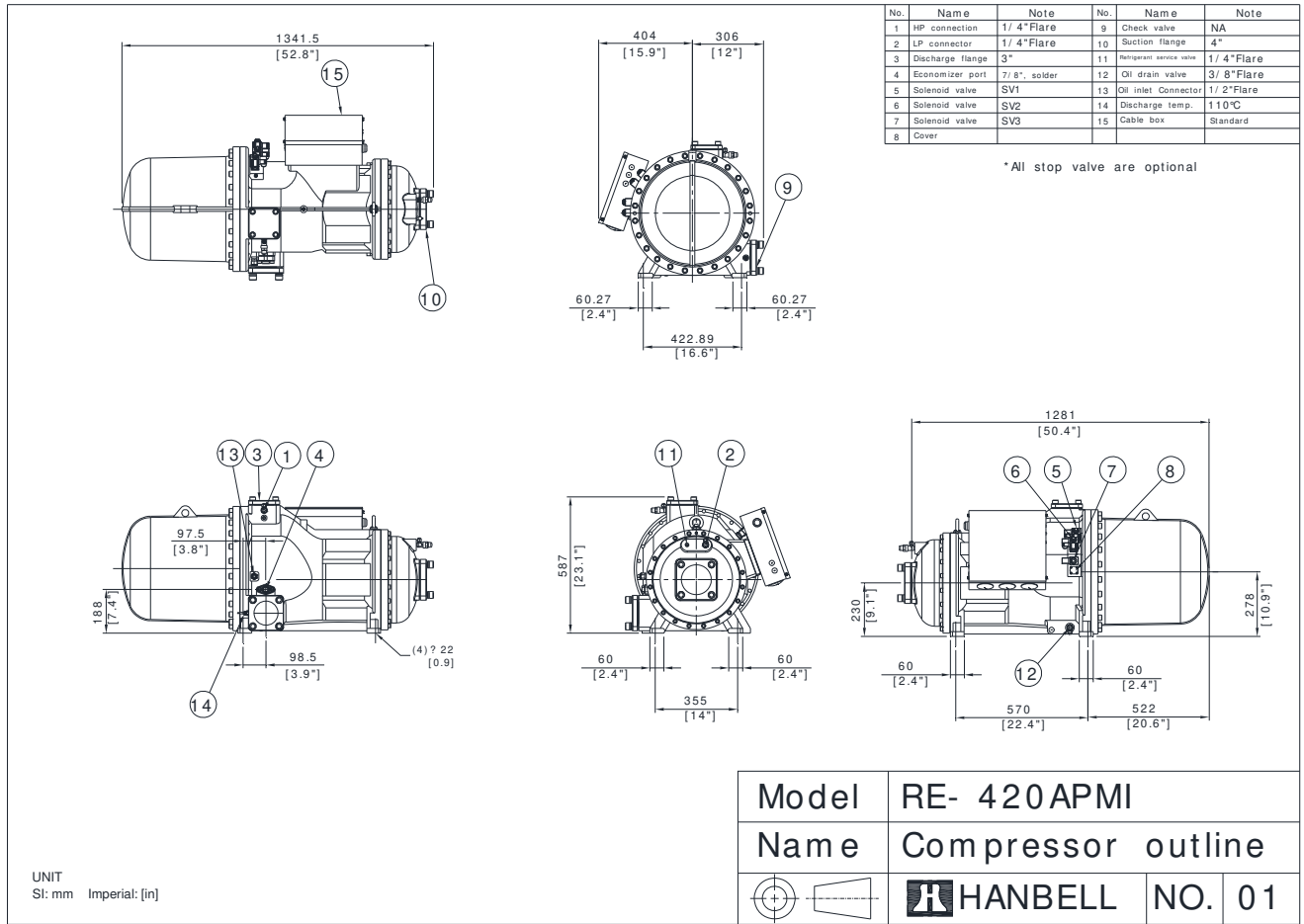
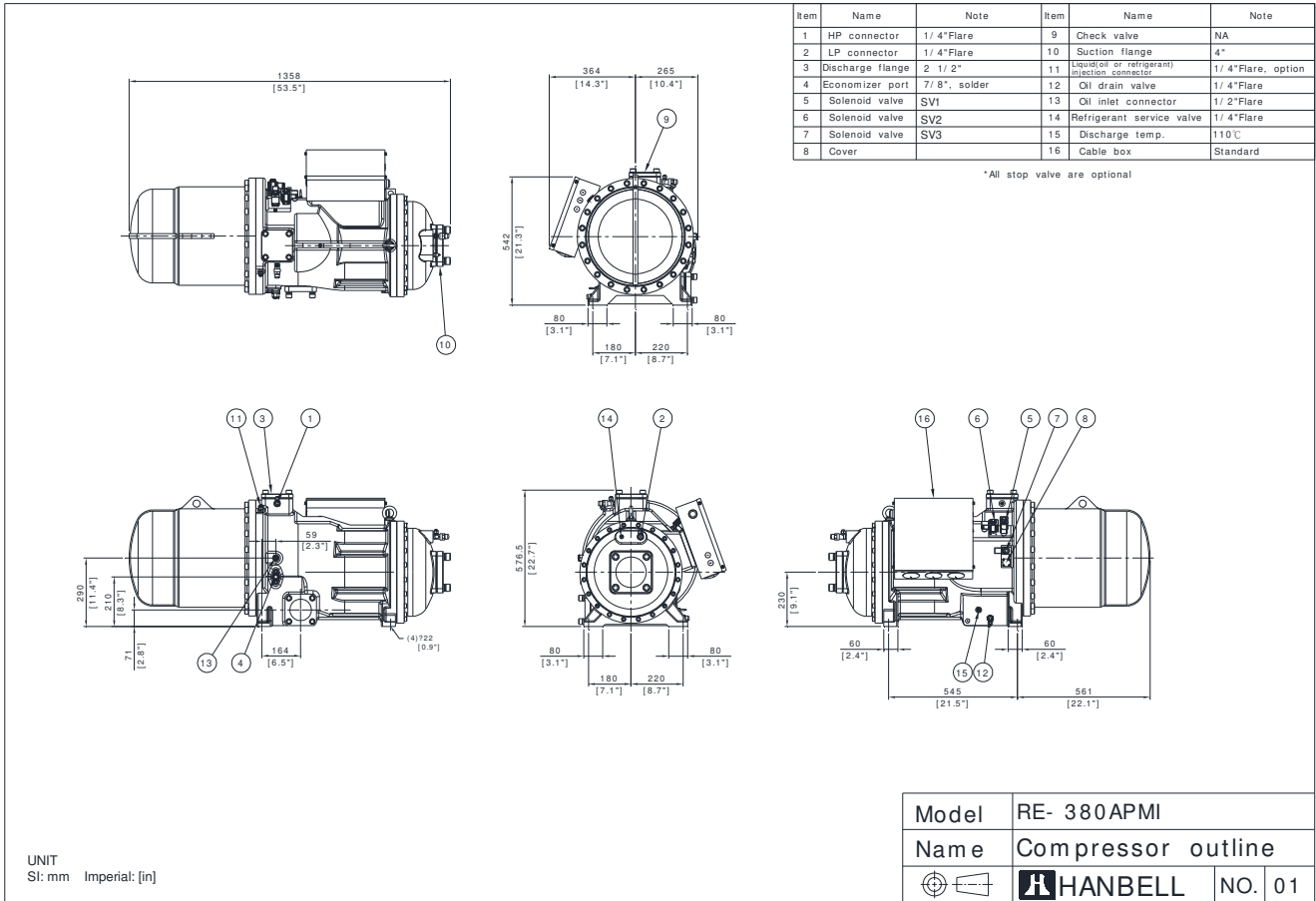
Item	Name	Note	Item	Name	Note
1	HP connector	1/4"Flare	9	Check valve	NA
2	LP connector	1/4"Flare	10	Suction flange	4"
3	Discharge flange	2 1/2"	11	Liquid(oil or refrigerant) injection connector	1/4"Flare, option
4	Economizer port	7/8", solder	12	Oil drain valve	1/4"Flare
5	Solenoid valve	SV1	13	Oil inlet connector	1/2"Flare
6	Solenoid valve	SV2	14	Refrigerant service valve	1/4"Flare
7	Solenoid valve	SV3	15	Discharge temp.	110°C
8	Cover		16	Cable box	Standard

*All stop valve are optional



Model	RE- 340APMI
Name	Compressor outline
	HANBELL NO. 01

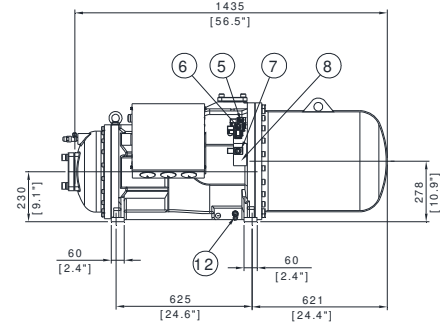
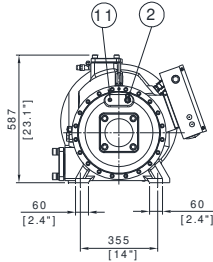
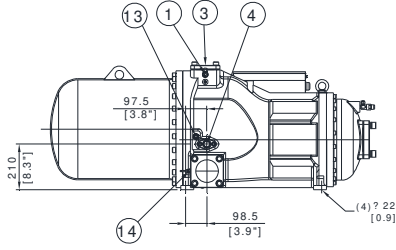
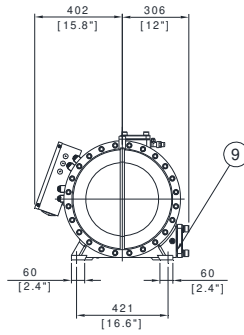
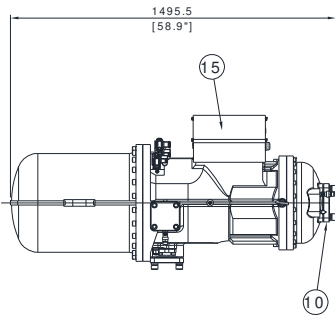
UNIT
SI: mm Imperial: [in]





No.	Name	Note	No.	Name	Note
1	HP connection	1/ 4"Flare	9	Check valve	NA
2	LP connector	1/ 4"Flare	10	Suction flange	4"
3	Discharge flange	3"	11	Refrigerant service valve	1/ 4"Flare
4	Economizer port	1 1/ 8", Solder	12	Oil drain valve	3/ 8"Flare
5	Solenoid valve	SV1	13	Oil inlet Connector	1/ 2"Flare
6	Solenoid valve	SV2	14	Discharge temp.	110°C
7	Solenoid valve	SV3	15	Cable box	Standard
8	Cover				

*All stop valve are optional

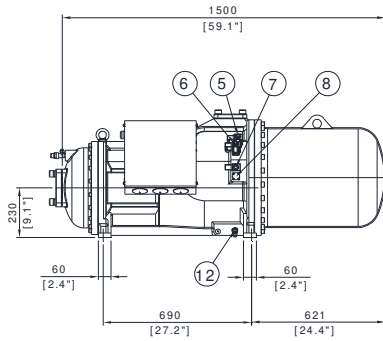
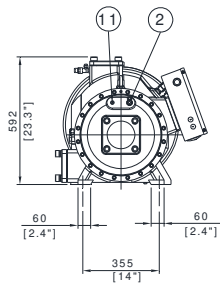
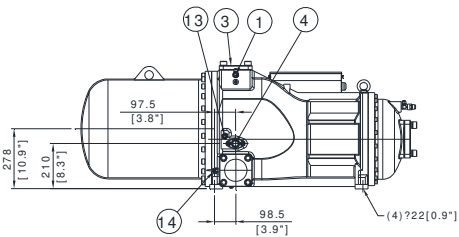
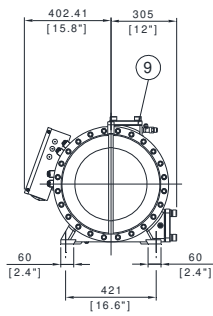
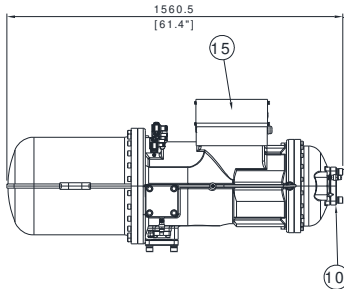


UNIT
SI: mm Imperial: [in]

Model	RE- 480APMI
Name	Compressor outline
	HANBELL NO. 01

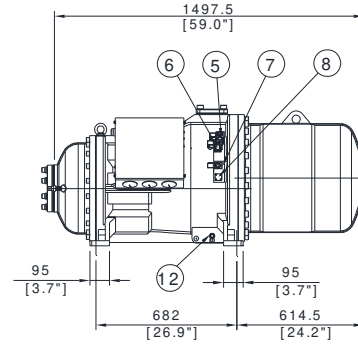
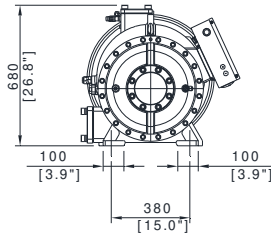
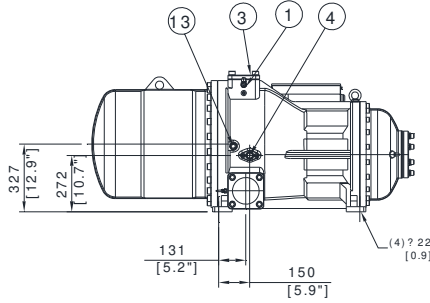
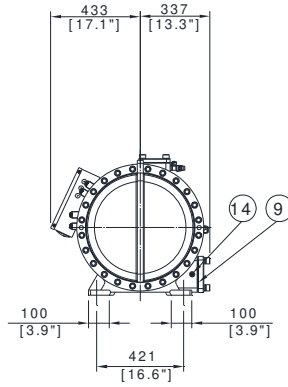
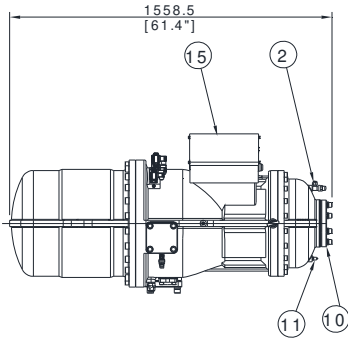
No.	Name	Note	No.	Name	Note
1	HP connection	1/ 4"Flare	9	Check valve	NA
2	LP connector	1/ 4"Flare	10	Suction flange	4"
3	Discharge flange	3"	11	Refrigerant service valve	1/ 4"Flare
4	Economizer port	1 1/ 8", Solder	12	Oil drain valve	3/ 8"Flare
5	Solenoid valve	SV1	13	Oil inlet Connector	1/ 2"Flare
6	Solenoid valve	SV2	14	Discharge temp.	110°C
7	Solenoid valve	SV3	15	Cable box	Standard
8	Cover				

*All stop valve are optional



UNIT
SI: mm Imperial: [in]

Model	RE- 550APMI
Name	Compressor outline
	HANBELL NO. 01

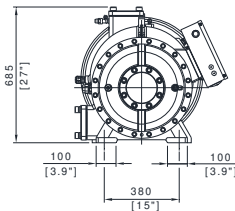
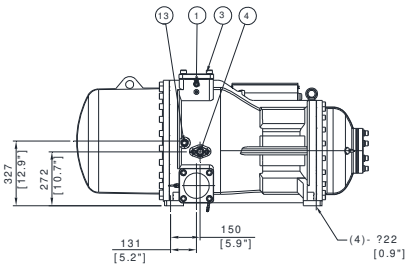
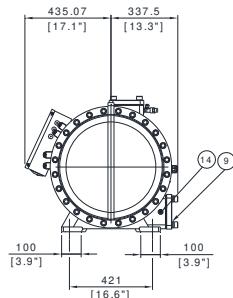
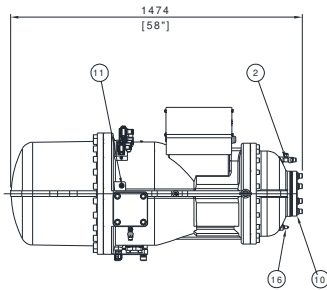


No.	Name	Note	No.	Name	Note
1	HP connection	1/ 4"Flare	9	Check valve	NA
2	LP connector	1/ 4"Flare	10	Suction flange	5"
3	Discharge flange	4"	11	Refrigerant service valve	1/ 4"Flare
4	Economizer port	1 1/ 8",solder	12	Oil drain valve	3/ 8"Flare
5	Solenoid valve		13	Oil inlet Connector	3/ 4"Flare
6	Solenoid valve		14	Discharge temp.	110°C
7	Solenoid valve		15	Cable box	Standard
8	Cover				

*All stop valve are optional

UNIT:
SI: mm Imperial: [in]

Model	RE- 620APMI
Name	Compressor outline
	NO. 01

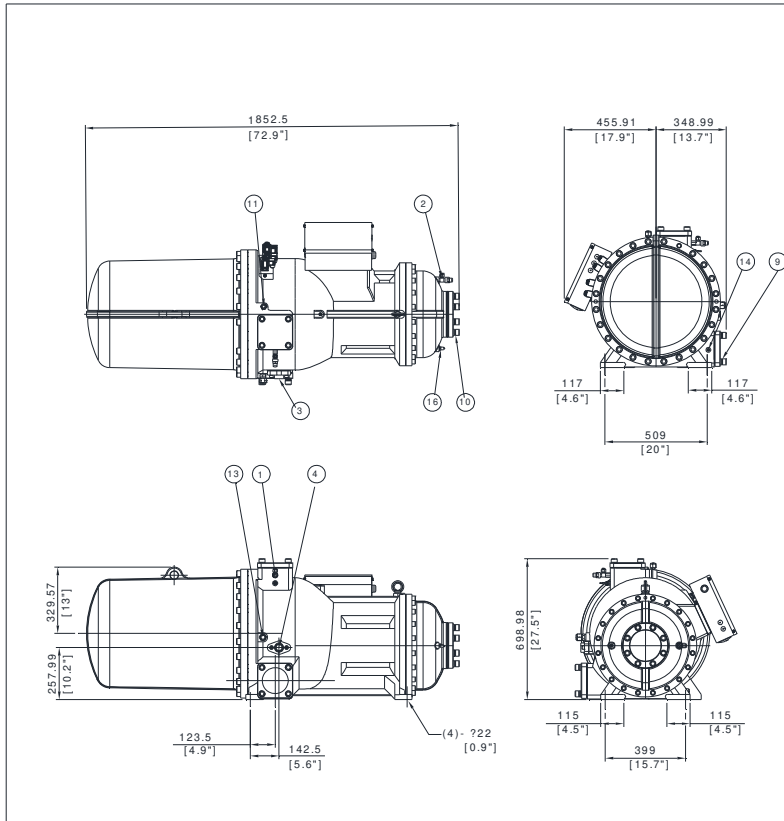


No.	Name	Note	No.	Name	Note
1	HP connection	1/ 4"Flare	10	Suction flange	5"
2	LP connector	1/ 4"Flare	11	Liquid or refrigerant service connector	3/ 8"Flare, option
3	Discharge flange	4"	12	Oil drain valve	3/ 8"Flare
4	Economizer port	1 1/ 8",solder	13	Oil inlet Connector	3/ 4"Flare
5	Solenoid valve	SV1	14	Discharge temp.	110°C
6	Solenoid valve	SV2	15	Cable box	Standard
7	Solenoid valve	SV3	16	Refrigerant service valve	1/ 4"Flare
8	Cover				
9	Check valve	NA			

*All stop valve are optional

UNIT:
SI: mm Imperial: [in]

Model	RE- 710APMI
Name	Compressor outline
	NO. 01

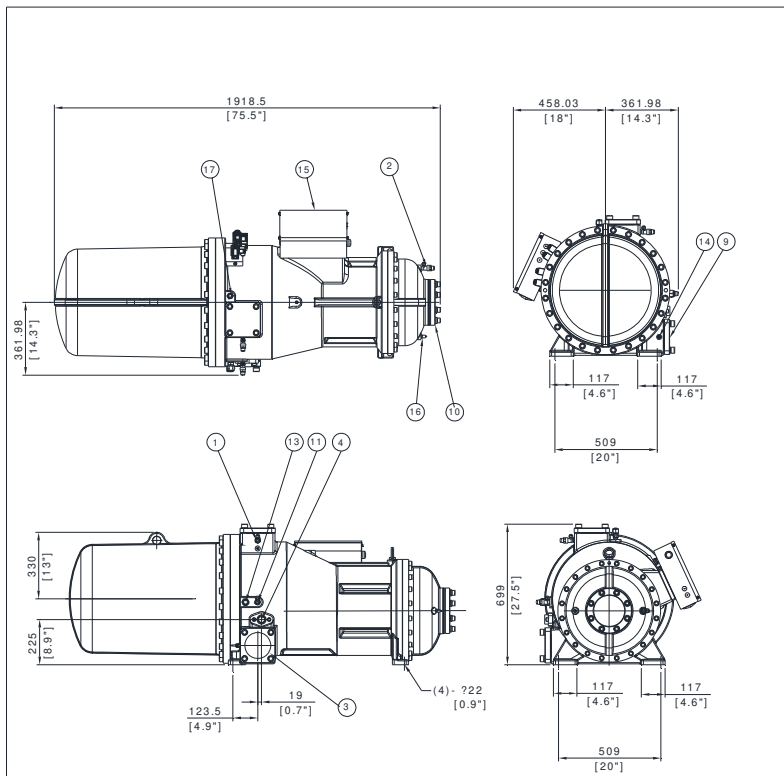


No.	Name	Note	No.	Name	Note
1	HP connection	1/ 4"Flare	10	Suction flange	5"
2	LP connector	1/ 4"Flare	11	Liquid (or refrigerant) injection connector	3/ 8"Flare, option
3	Discharge flange	4"	12	Oil drain valve	1/ 4"Flare
4	Economizer port	1 3/ 8".Solder	13	Oil inlet Connector	3/ 4"Flare
5	Solenoid valve	SV1	14	Discharge temp.	110°C
6	Solenoid valve	SV2	15	Cable box	Standard
7	Solenoid valve	SV3	16	Refrigerant service valve	1/ 4"Flare
8	Cover				
9	Check valve	NA			

*All stop valve are optional

UNIT
SI: mm Imperial: [in]

Model	RE- 820APMI
Name	Compressor outline
	NO. 01

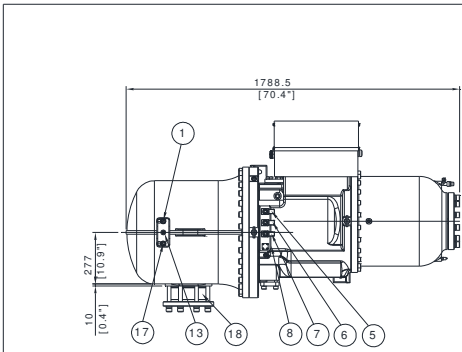


No.	Name	Note	No.	Name	Note
1	HP connection	1/ 4"Flare	10	Suction flange	5"
2	LP connector	1/ 4"Flare	11	Oil pressure differential switch	1/ 4"Flare
3	Discharge flange	4"	12	Oil drain valve	3/ 8"Flare
4	Economizer port	1 3/ 8".Solder	13	Oil inlet Connector	3/ 4"Flare
5	Solenoid valve	SV1	14	Discharge temp.	110°C
6	Solenoid valve	SV2	15	Cable box	Standard
7	Solenoid valve	SV3	16	Refrigerant service valve	1/ 4"Flare
8	Cover		17	Liquid (or refrigerant) injection connector	3/ 8"NPT
9	Check valve	NA			

*All stop valve are optional

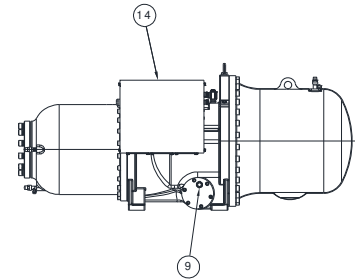
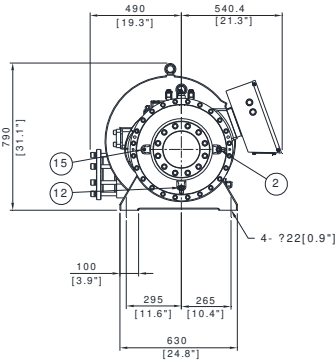
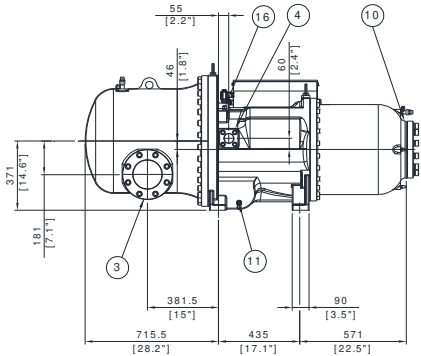
UNIT
SI: mm Imperial: [in]

Model	RE- 920APMI
Name	Compressor outline
	NO. 01



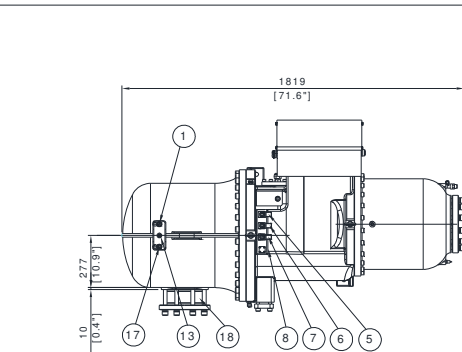
No.	Name	Note	No.	Name	Note
1	HP connection	1/ 4"Flare	10	Suction flange	6"
2	LP connector	1/ 4"Flare	11	Oil drain valve	1/ 4"Flare
3	Discharge flange	5"	12	Oil drain valve	1/ 4"Flare
4	Economizer port	1 5/ 8",for copper tube	13	Discharge temp. sensor	110°C
5	Solenoid valve	SV1	14	Cable box	Standard
6	Solenoid valve	SV2	15	Refrigerant service valve	1/ 4"Flare
7	Solenoid valve	SV3	16	Liquid(oil or refrigerant) injection connector	3/ 8"Flare
8	Cover		17	Spare port (High press.)	1/ 4"Flare
9	Oil inlet Connector	3/ 4"Flare	18	Dual plate wafer type check valve	5"

*All stop valve are optional



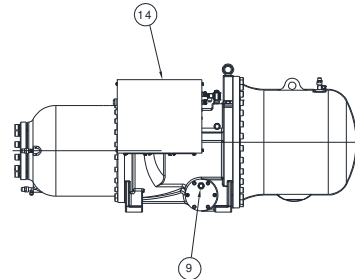
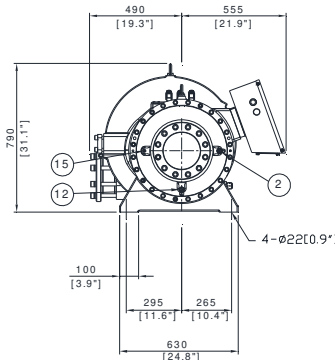
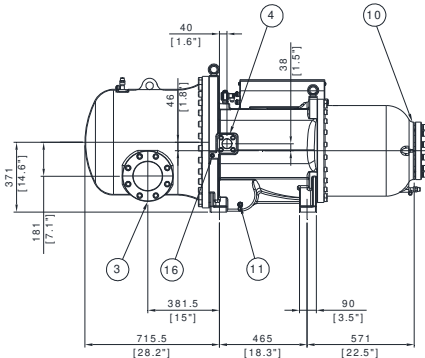
UNIT
SI: mm Imperial: [in]

Model	RE- 1050APMI& BPMI
Name	Compressor outline
	NO. 01



No.	Name	Note	No.	Name	Note
1	HP connection	1/ 4"Flare	10	Suction flange	6"
2	LP connector	1/ 4"Flare	11	Oil drain valve	1/ 4"Flare
3	Discharge flange	5"	12	Oil drain valve	1/ 4"Flare
4	Economizer port	1 5/ 8",for copper tube	13	Discharge temp. sensor	110°C
5	Solenoid valve	SV1	14	Cable box	Standard
6	Solenoid valve	SV2	15	Refrigerant service valve	1/ 4"Flare
7	Solenoid valve	SV3	16	Liquid(oil or refrigerant) injection connector	3/ 8"Flare
8	Cover		17	Spare port (High press.)	1/ 4"Flare
9	Oil inlet Connector	3/ 4"Flare	18	Dual plate wafer type check valve	5"

*All stop valve are optional



UNIT
SI: mm Imperial: [in]

Model	RE- 1150APMI& BPMI
Name	Compressor outline
	NO. 01



5.3.3 RE-BMI

Item	Name	Note	Item	Name	Note
1	HP connector	1/4"Flare	11	Oil heater	110V/220V, 300W
2	LP connector	1/4"Flare	12	Oil drain valve	1/4"Flare
3	Discharge flange	2 1/2"	13	Oil inlet connector	1/2"Flare
4	Economizer port	7/8", solder	14	Oil outlet connector	1/2"Flare
5	Solenoid valve	SV1	15	Oil sight glass	
6	Solenoid valve	SV2	16	Optical oil level switch	
7	Solenoid valve	SV3	17	Discharge temp.	110°C
8	Cover		18	Cable box	Standard
9	Check valve	NA	19	Refrigerant service valve	1/4"Flare
10	Suction flange	4"	20	Liquid(or) refrigerant injection connector	1/4"Flare, option

*All stop valve are optional

Model	RE- 340BMI
Name	Compressor outline
	HANBELL NO. 01

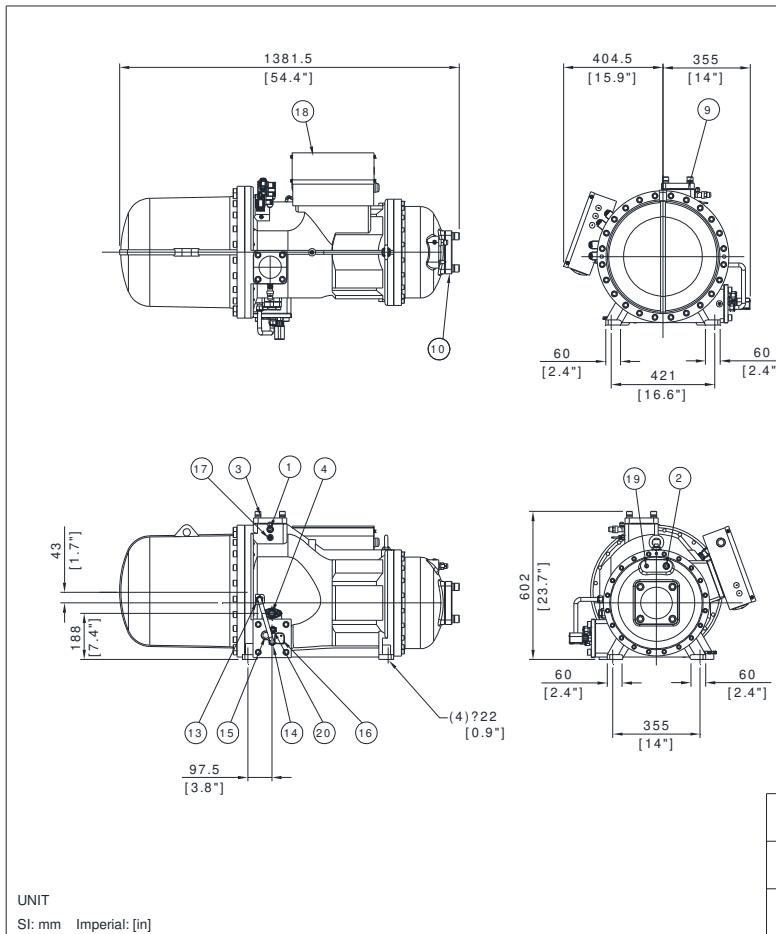
UNIT
SI: mm Imperial: [in]

Item	Name	Note	Item	Name	Note
1	HP connector	1/4"Flare	11	Oil heater	110V/220V, 300W
2	LP connector	1/4"Flare	12	Oil drain valve	1/4"Flare
3	Discharge flange	2 1/2"	13	Oil inlet connector	1/2"Flare
4	Economizer port	7/8", solder	14	Oil outlet connector	1/2"Flare
5	Solenoid valve	SV1	15	Oil sight glass	
6	Solenoid valve	SV2	16	Optical oil level switch	
7	Solenoid valve	SV3	17	Discharge temp.	110°C
8	Cover		18	Cable box	Standard
9	Check valve	NA	19	Refrigerant service valve	1/4"Flare
10	Suction flange	4"	20	Liquid(or) refrigerant injection connector	1/4"Flare, option

*All stop valve are optional

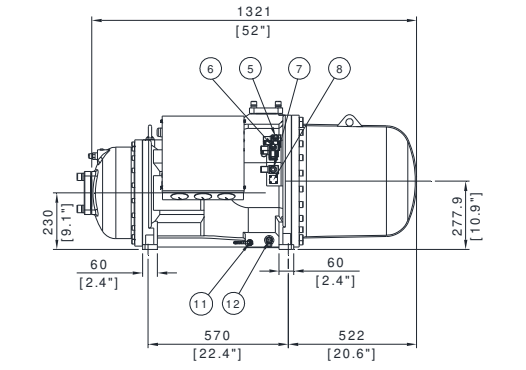
Model	RE- 380BMI
Name	Compressor outline
	HANBELL NO. 01

UNIT
SI: mm Imperial: [in]



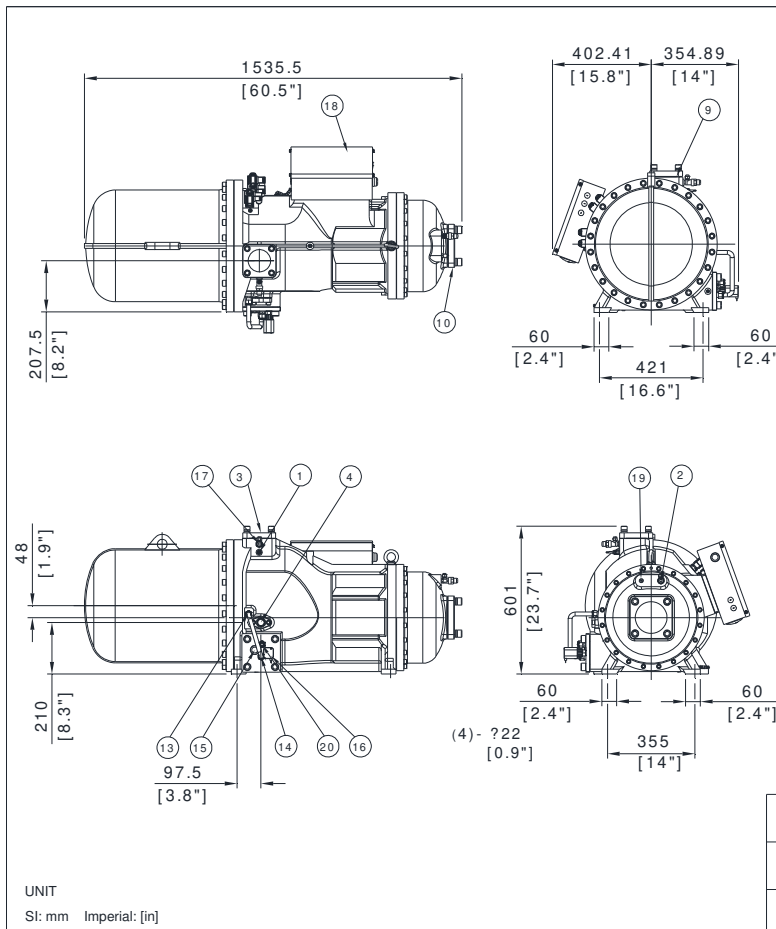
No.	Name	Note	No.	Name	Note
1	HP connection	1/4"Flare	12	Oil drain valve	1/4"Flare
2	LP connector	1/4"Flare	13	Oil inlet connector	1/2"Flare
3	Discharge flange	2 1/2"	14	Oil outlet connector	1/2"Flare
4	Economizer port	7/8", solder	15	Oil sight glass	
5	Solenoid valve	SV1	16	Optical oil level switch	
6	Solenoid valve	SV2	17	Discharge temp.	110°C
7	Solenoid valve	SV3	18	Cable box	Standard
8	Cover		19	Refrigerant service valve	1/4"Flare
9	Check valve	NA	20	Over flow valve	1/2"Flare
10	Suction flange	4"	21		
11	Oil heater	110V 220V,300W	22		

*All stop valve are optional



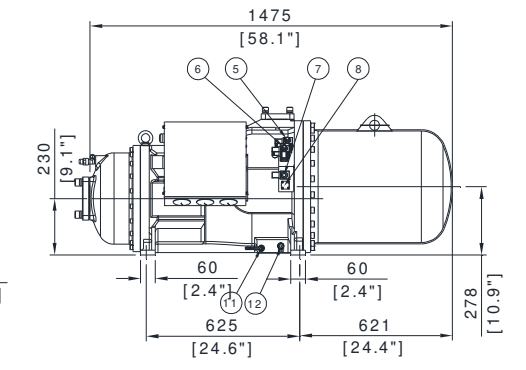
Model	RE- 420BMI
Name	Compressor outline
	NO. 01

UNIT
SI: mm Imperial: [in]



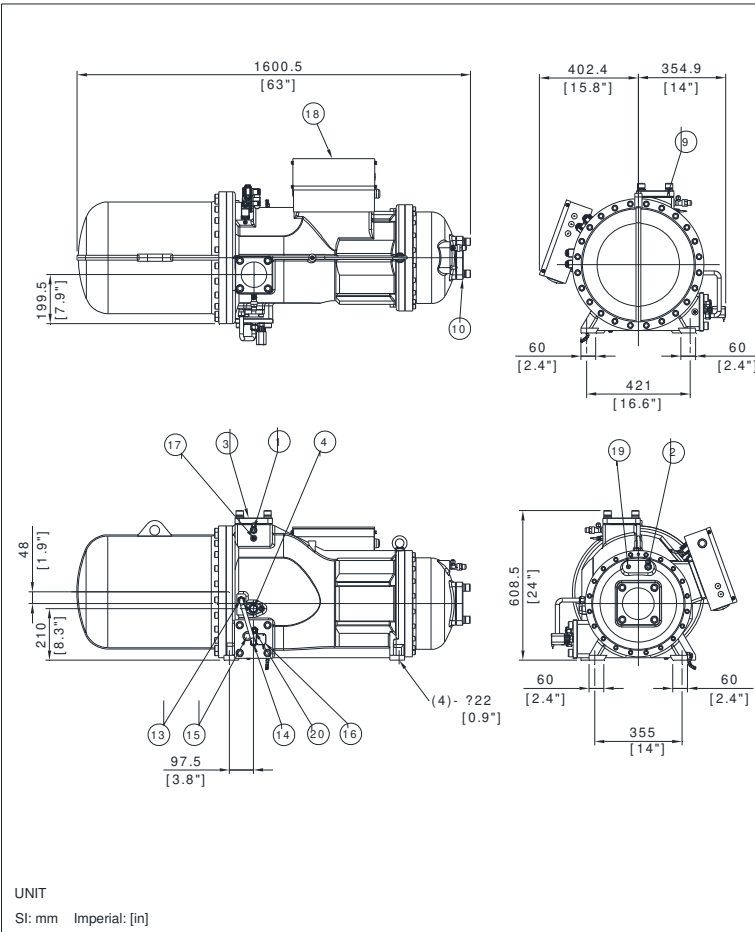
No.	Name	Note	No.	Name	Note
1	HP connector	1/4"Flare	12	Oil drain valve	1/4"Flare
2	LP connector	1/4"Flare	13	Oil inlet connector	1/2"Flare
3	Discharge flange	2 1/2"	14	Oil outlet connector	1/2"Flare
4	Economizer port	1 1/8", solder	15	Oil sight glass	
5	Solenoid valve	SV1	16	Optical oil level switch	
6	Solenoid valve	SV2	17	Discharge temp.	110°C
7	Solenoid valve	SV3	18	Cable box	Standard
8	Cover		19	Refrigerant service valve	1/4"Flare
9	Check valve	NA	20	Over flow valve	1/2"Flare
10	Suction flange	4"	21		
11	Oil heater	110V 220V,300W	22		

*All stop valve are optional



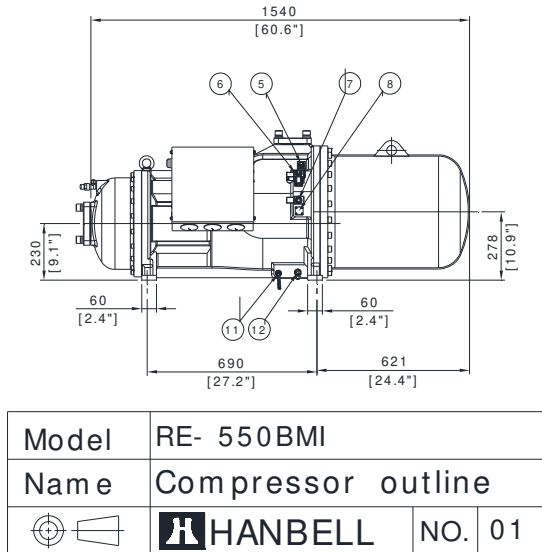
Model	RE- 480BMI
Name	Compressor outline
	NO. 01

UNIT
SI: mm Imperial: [in]



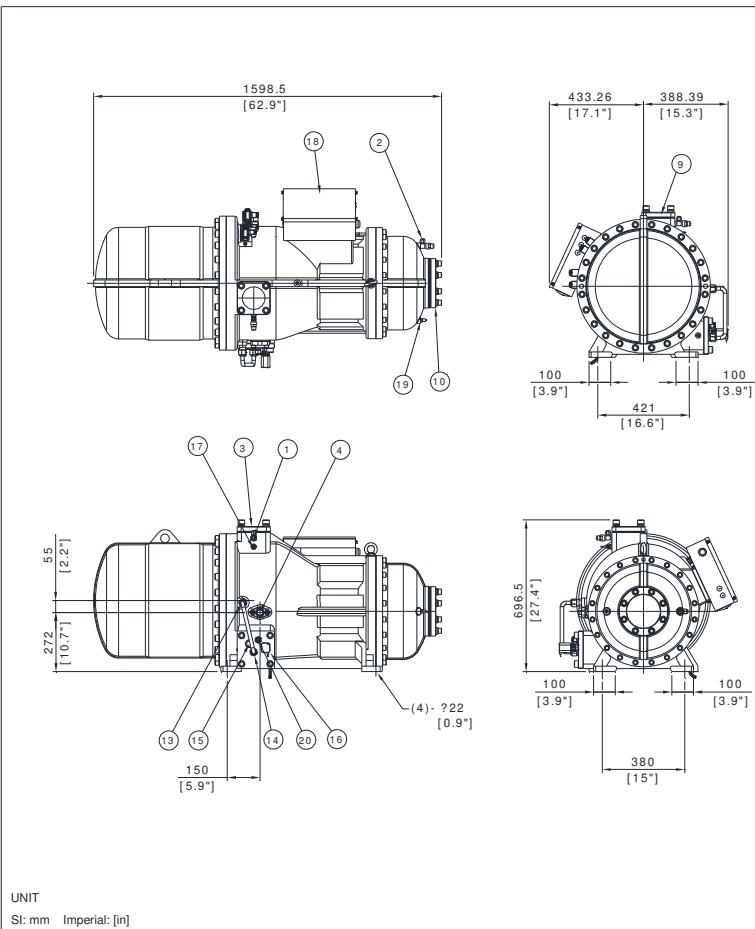
No.	Name	Note	No.	Name	Note
1	HP connection	1/4"Flare	12	Oil drain valve	1/4"Flare
2	LP connector	1/4"Flare	13	Oil inlet connector	1/2"Flare
3	Discharge flange	3"	14	Oil outlet connector	1/2"Flare
4	Economizer port	1 1/8", solder	15	Oil sight glass	
5	Solenoid valve	SV1	16	Optical oil level switch	
6	Solenoid valve	SV2	17	Discharge temp.	110°C
7	Solenoid valve	SV3	18	Cable box	Standard
8	Cover		19	Refrigerant service valve	1/4"Flare
9	Check valve	NA	20	Over flow valve	1/2"Flare
10	Suction flange	4"	21		
11	Oil heater	110W/220V,300W	22		

*All stop valve are optional



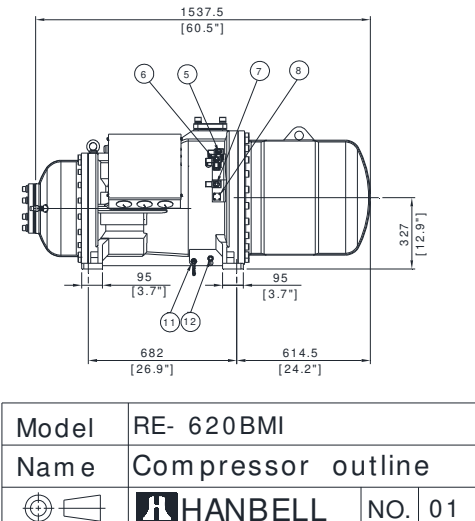
Model	RE- 550BMI
Name	Compressor outline
	NO. 01

UNIT
SI: mm Imperial: [in]



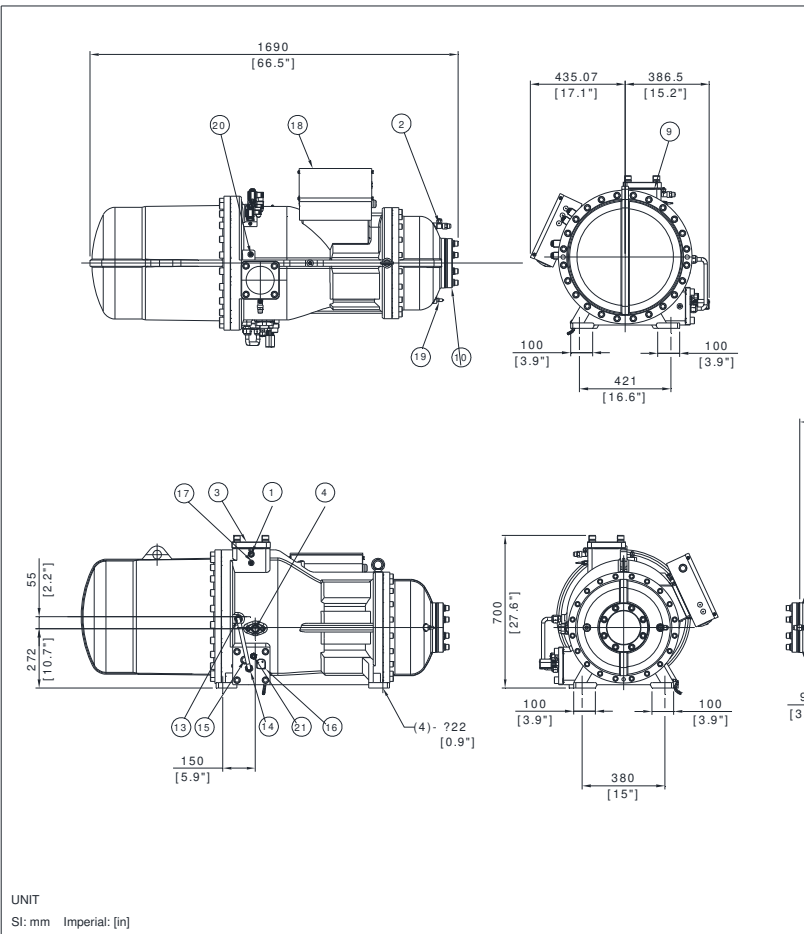
No.	Name	Note	No.	Name	Note
1	HP connection	1/4"Flare	12	Oil drain valve	1/4"Flare
2	LP connector	1/4"Flare	13	Oil inlet connector	3/4"Flare
3	Discharge flange	3"	14	Oil outlet connector	3/4"Flare
4	Economizer port	1 1/8", solder	15	Oil sight glass	
5	Solenoid valve	Stepless/NC or NO,option	16	Optical oil level switch	
6	Solenoid valve	25%(NC)	17	Discharge temp.	110°C
7	Solenoid valve	50%(NC)	18	Cable box	Standard
8	Solenoid valve	75%(NC)	19	Refrigerant service valve	1/4"Flare
9	Check valve	NA	20	Over flow valve	1/2"Flare
10	Suction flange	5"	21		
11	Oil heater	110W/220V,300W	22		

*All stop valve are optional



Model	RE- 620BMI
Name	Compressor outline
	NO. 01

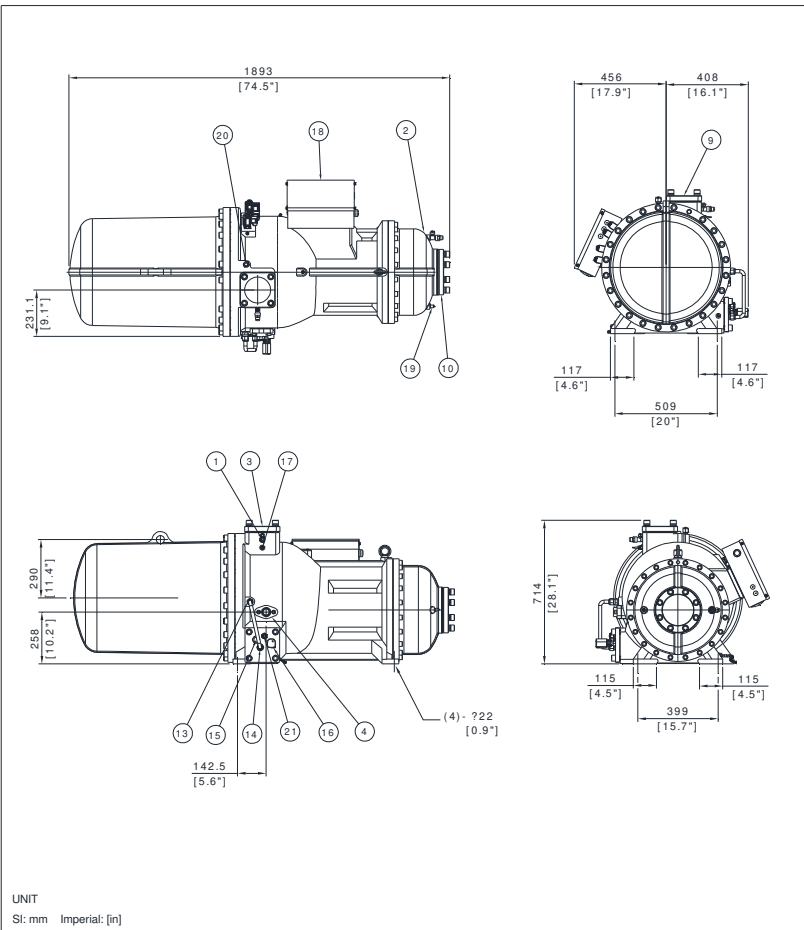
UNIT
SI: mm Imperial: [in]



No.	Name	Note	No.	Name	Note
1	HP connection	1/4"Flare	12	Oil drain valve	3/8"Flare
2	LP connector	1/4"Flare	13	Oil inlet connector	3/4"Flare
3	Discharge flange	4"	14	Oil outlet connector	3/4"Flare
4	Economizer port	1 1/8", solder	15	Oil sight glass	
5	Solenoid valve	SV1	16	Optical oil level switch	
6	Solenoid valve	SV2	17	Discharge temp. sensor	110°C
7	Solenoid valve	SV3	18	Cable box	Standard
8	Cover		19	Refrigerant service valve	1/4"Flare
9	Check valve	NA	20	Liquid or refrigerant injection connector	3/8"Flare, option
10	Suction flange	5"	21	Over flow valve	1/2"Flare
11	Oil heater	110W/220V,300W	22		

*All stop valve are optional

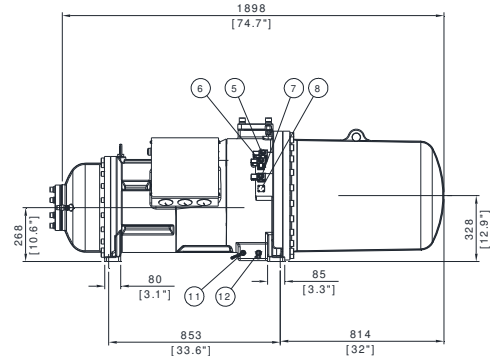
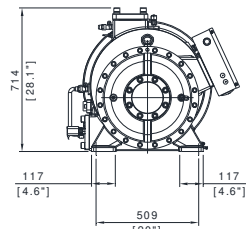
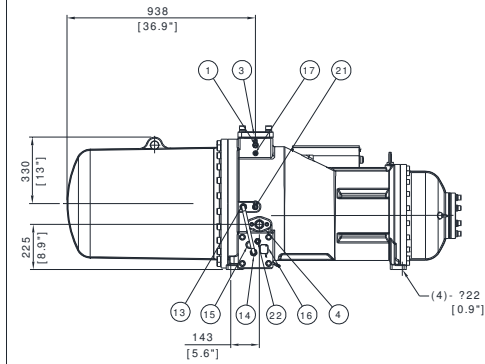
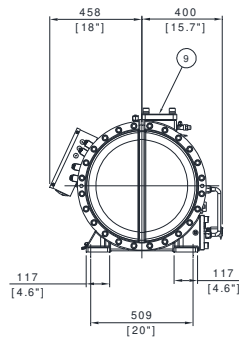
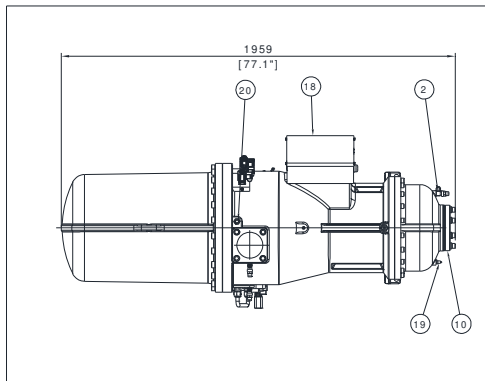
Model	RE- 710BMI
Name	Compressor outline
	HANBELL NO. 01



No.	Name	Note	No.	Name	Note
1	HP connection	1/4"Flare	12	Oil drain valve	1/4"Flare
2	LP connector	1/4"Flare	13	Oil inlet connector	3/4"Flare
3	Discharge flange	4"	14	Oil outlet connector	3/4"Flare
4	Economizer port	1 3/8", for copper tube	15	Oil sight glass	
5	Solenoid valve	SV1	16	Optical oil level switch	
6	Solenoid valve	SV2	17	Discharge temp. sensor	110°C
7	Solenoid valve	SV3	18	Cable box	Standard
8	Cover		19	Refrigerant service valve	1/4"Flare
9	Check valve	NA	20	Liquid or refrigerant injection connector	3/8"Flare, option
10	Suction flange	5"	21	Over flow valve	1/2"Flare
11	Oil heater	110W/220V,300W	22		

*All stop valve are optional

Model	RE- 820BMI
Name	Compressor outline
	HANBELL NO. 01

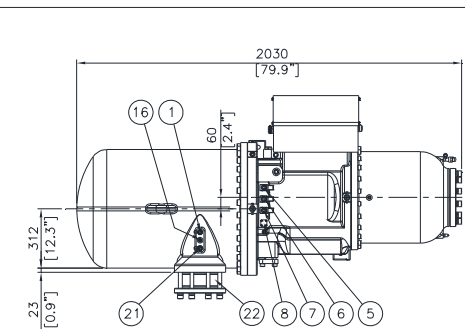


No.	Name	Note	No.	Name	Note
1	HP connection	1/4"Flare	12	Oil drain valve	1/4"Flare
2	LP connector	1/4"Flare	13	Oil inlet connector	3/4"Flare
3	Discharge flange	4"	14	Oil outlet connector	3/4"Flare
4	Economizer port	1 3/8",for copper tube	15	Oil sight glass	
5	Solenoid valve	SV1	16	Optical oil level switch	
6	Solenoid valve	SV2	17	Discharge temp. sensor	110°C
7	Solenoid valve	SV3	18	Cable box	Standard
8	Cover		19	Refrigerant service valve	1/4"Flare
9	Check valve	4"	20	Liquid (oil or refrigerant) injection connector	3/8"NPT
10	Suction flange	5"	21	Oil pressure differential switch	1/4"Flare
11	Oil heater	110W 220V,300W	22	Over flow valve	1/4"Flare

*All stop valve are optional

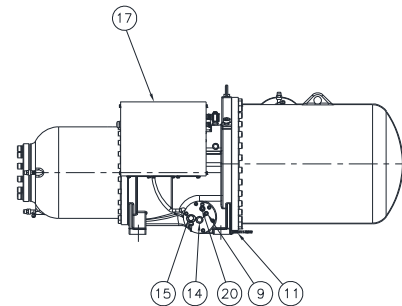
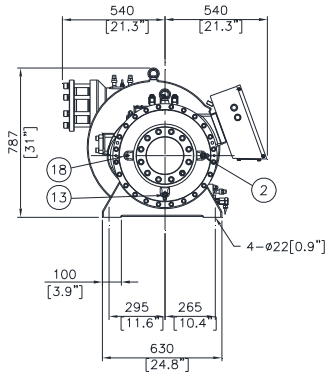
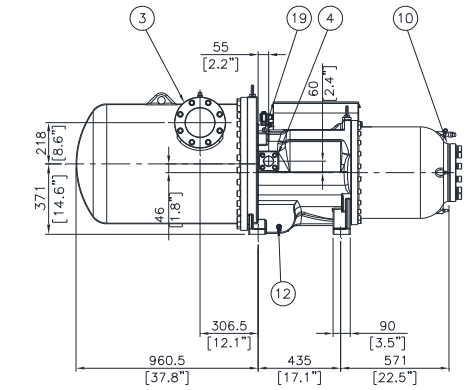
UNIT
SI: mm Imperial: [in]

Model	RE- 920BMI
Name	Compressor outline
	NO. 01



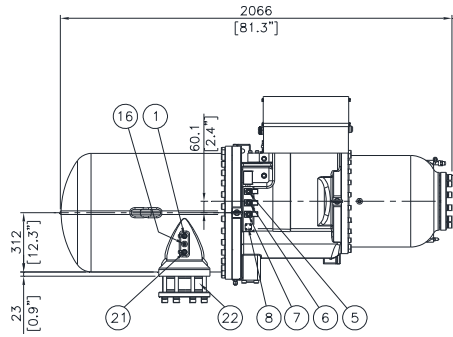
No.	Name	Note	No.	Name	Note
1	HP connection	1/4"Flare	12	Oil drain valve	1/4"Flare
2	LP connector	1/4"Flare	13	Oil drain valve	1/4"Flare
3	Discharge flange	5"	14	Oil sight glass	
4	Economizer port	1 5/8",for copper tube	15	Optical oil level switch	
5	Solenoid valve	SV1	16	Discharge temp. sensor	110°C
6	Solenoid valve	SV2	17	Cable box	Standard
7	Solenoid valve	SV3	18	Refrigerant service valve	1/4"Flare
8	Cover		19	Liquid(oil or refrigerant) injection connector	3/8"Flare
9	Over flow valve	1/2"Flare	20	Oil pressure differential switch	1/4"Flare
10	Suction flange	6"	21	Spare port (High press.)	1/4"Flare
11	Oil heater	110W 220V,300W	22	Dual plate wafer type check valve	5"

*All stop valve are optional



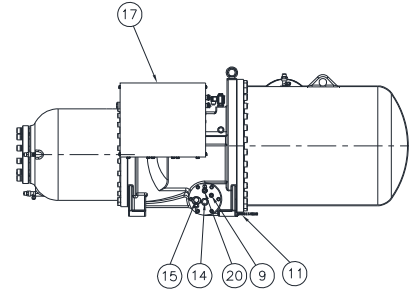
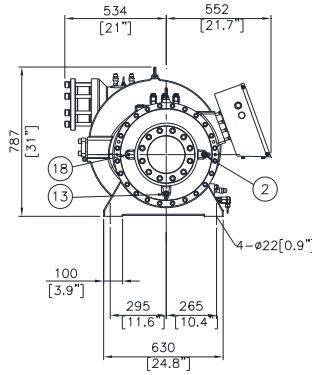
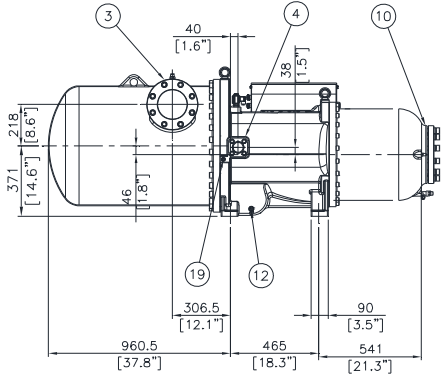
UNIT
SI: mm Imperial: [in]

Model	RE-1050A&BMI
Name	Compressor Outline
	NO. 01



No.	Name	Note	No.	Name	Note
1	HP connection	1/4"Flare	12	Oil drain valve	1/4"Flare
2	LP connector	1/4"Flare	13	Oil drain valve	1/4"Flare
3	Discharge flange	5"	14	Oil sight glass	
4	Economizer port	1 5/8",for copper tube	15	Optical oil level switch	
5	Solenoid valve	SV1	16	Discharge temp. sensor	110°C
6	Solenoid valve	SV2	17	Cable box	Standard
7	Solenoid valve	SV3	18	Refrigerant service valve	1/4"Flare
8	Cover		19	Liquid(oil or refrigerant) injection connector	3/8"Flare
9	Over flow valve	5/8"Flare	20	Oil pressure differential switch	1/4"Flare
10	Suction flange	6"	21	Spare port (High press.)	1/4"Flare
11	Oil heater	110V/220V,300W	22	Dual plate wafer type check valve	5"

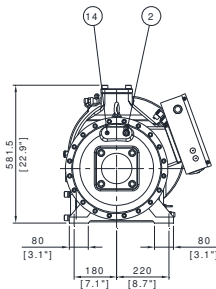
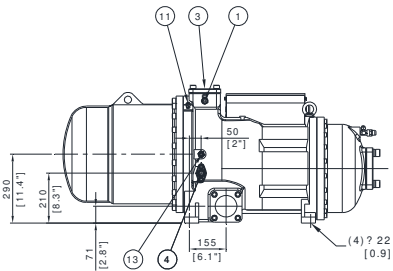
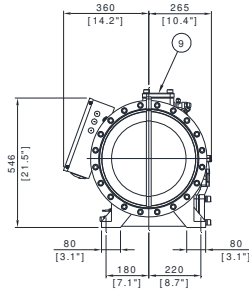
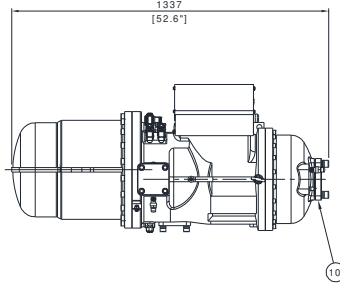
*All stop valve are optional



Model	RE-1150A&BMI
Name	Compressor Outline
	HANBELL NO. 01

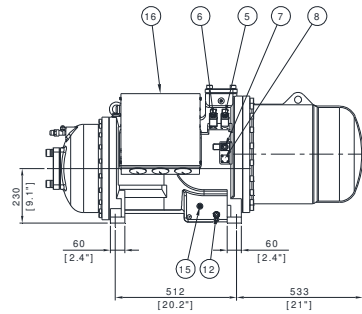
UNIT
SI: mm Imperial: [in]

5.3.4 RE-BPMI



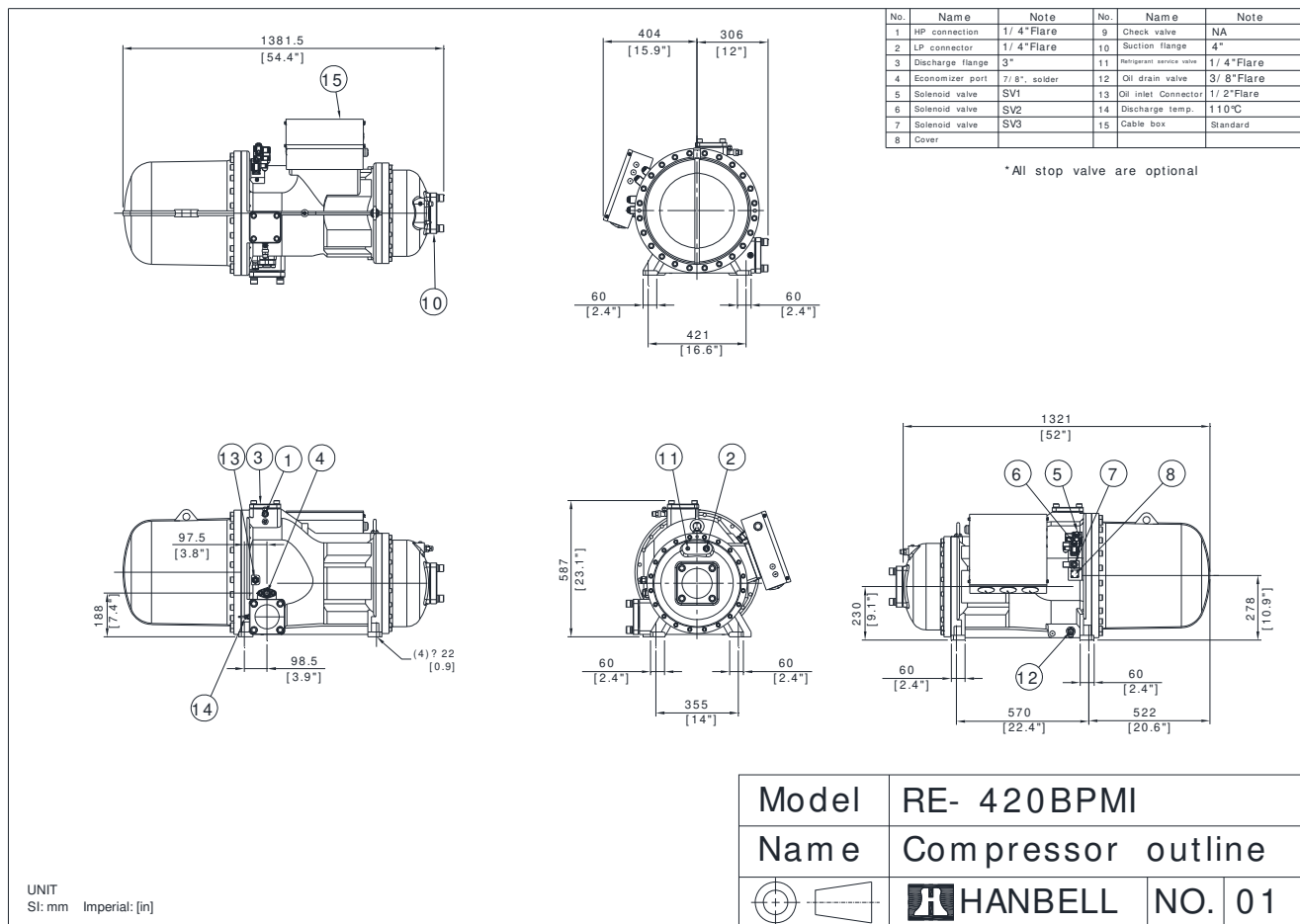
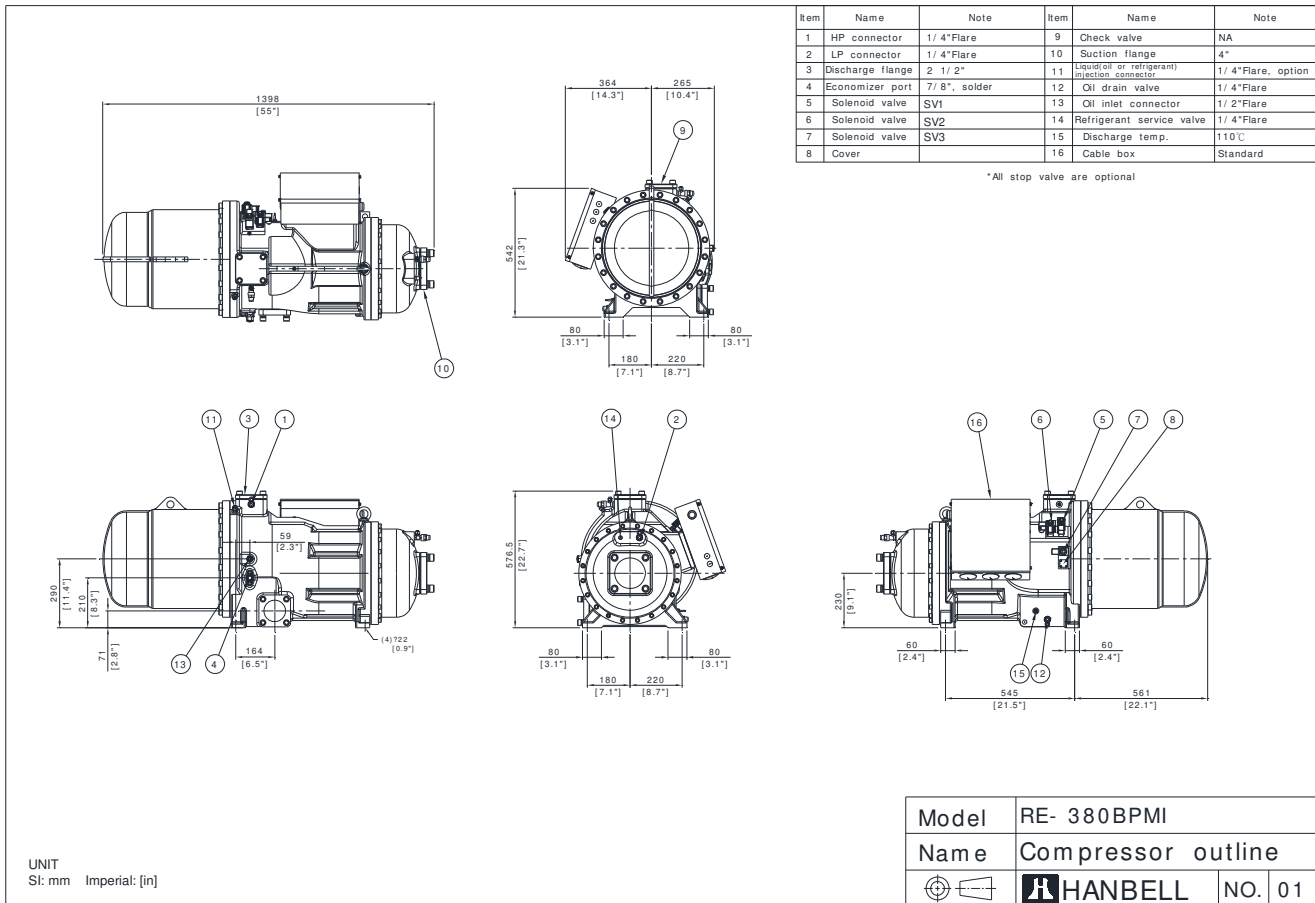
Item	Name	Note	Item	Name	Note
1	HP connector	1/4"Flare	9	Check valve	NA
2	LP connector	1/4"Flare	10	Suction flange	4"
3	Discharge flange	2 1/2"	11	Liquid(oil or refrigerant) injection connector	1/4"Flare, option
4	Economizer port	7/8", solder	12	Oil drain valve	1/4"Flare
5	Solenoid valve	SV1	13	Oil inlet connector	1/2"Flare
6	Solenoid valve	SV2	14	Refrigerant service valve	1/4"Flare
7	Solenoid valve	SV3	15	Discharge temp.	110°C
8	Cover		16	Cable box	Standard

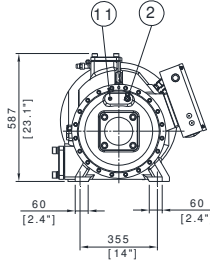
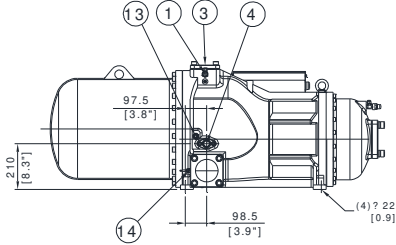
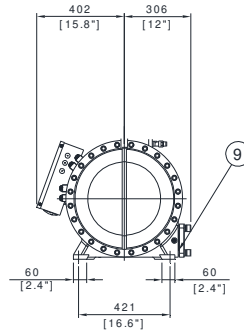
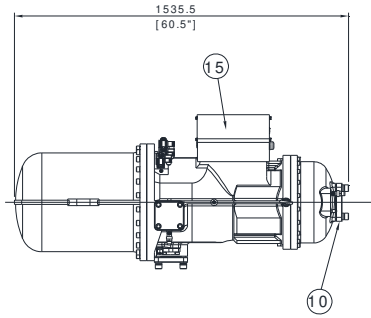
*All stop valve are optional



UNIT
SI: mm Imperial: [in]

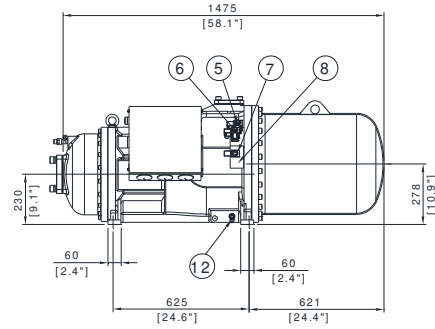
Model	RE- 340BPMI
Name	Compressor outline
	HANBELL NO. 01





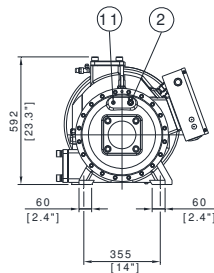
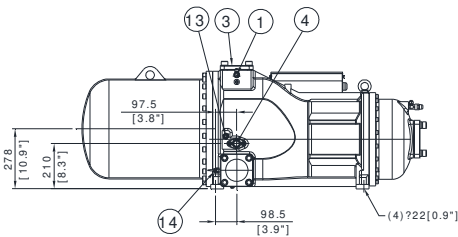
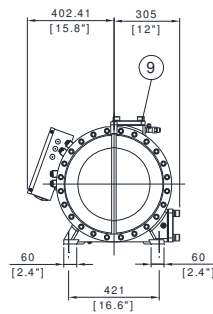
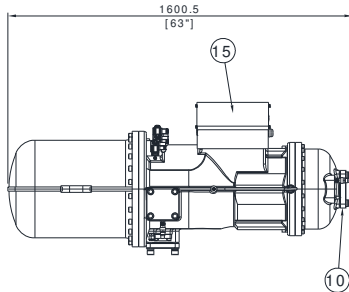
No.	Name	Note	No.	Name	Note
1	HP connection	1/ 4"Flare	9	Check valve	NA
2	LP connector	1/ 4"Flare	10	Suction flange	4"
3	Discharge flange	3"	11	Refrigerant service valve	1/ 4"Flare
4	Economizer port	1 1/ 8", Solder	12	Oil drain valve	3/ 8"Flare
5	Solenoid valve	SV1	13	Oil inlet Connector	1/ 2"Flare
6	Solenoid valve	SV2	14	Discharge temp.	110°C
7	Solenoid valve	SV3	15	Cable box	Standard
8	Cover				

*All stop valve are optional



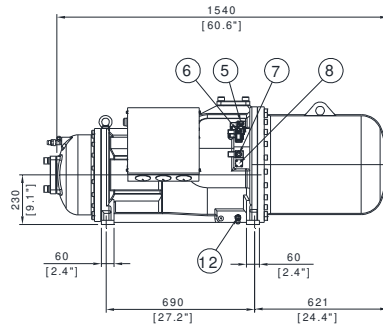
UNIT
SI: mm Imperial: [in]

Model	RE- 480BPMI
Name	Compressor outline
	HANBELL NO. 01



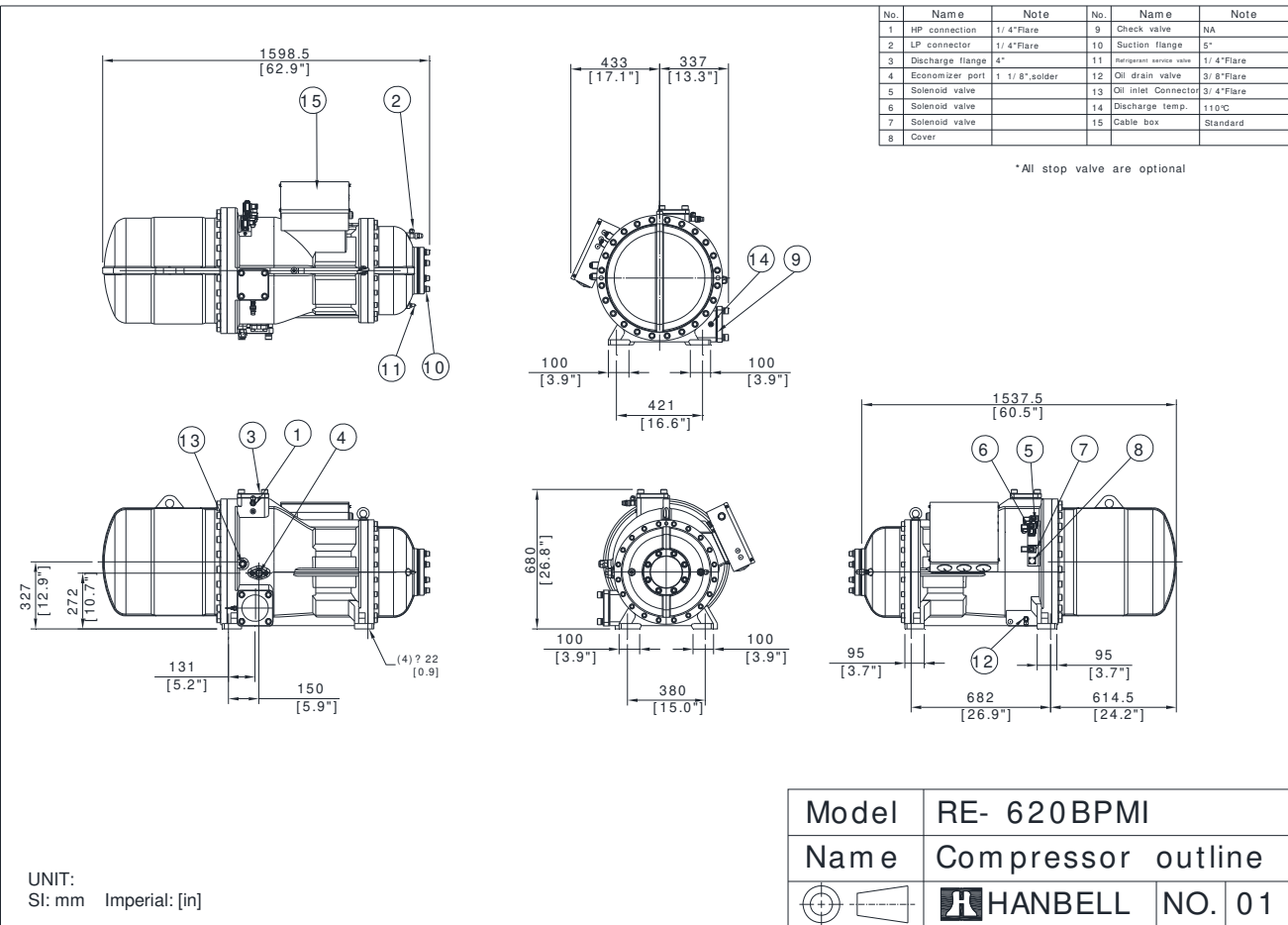
No.	Name	Note	No.	Name	Note
1	HP connection	1/ 4"Flare	9	Check valve	NA
2	LP connector	1/ 4"Flare	10	Suction flange	4"
3	Discharge flange	3"	11	Refrigerant service valve	1/ 4"Flare
4	Economizer port	1 1/ 8", Solder	12	Oil drain valve	3/ 8"Flare
5	Solenoid valve	SV1	13	Oil inlet Connector	1/ 2"Flare
6	Solenoid valve	SV2	14	Discharge temp.	110°C
7	Solenoid valve	SV3	15	Cable box	Standard
8	Cover				

*All stop valve are optional

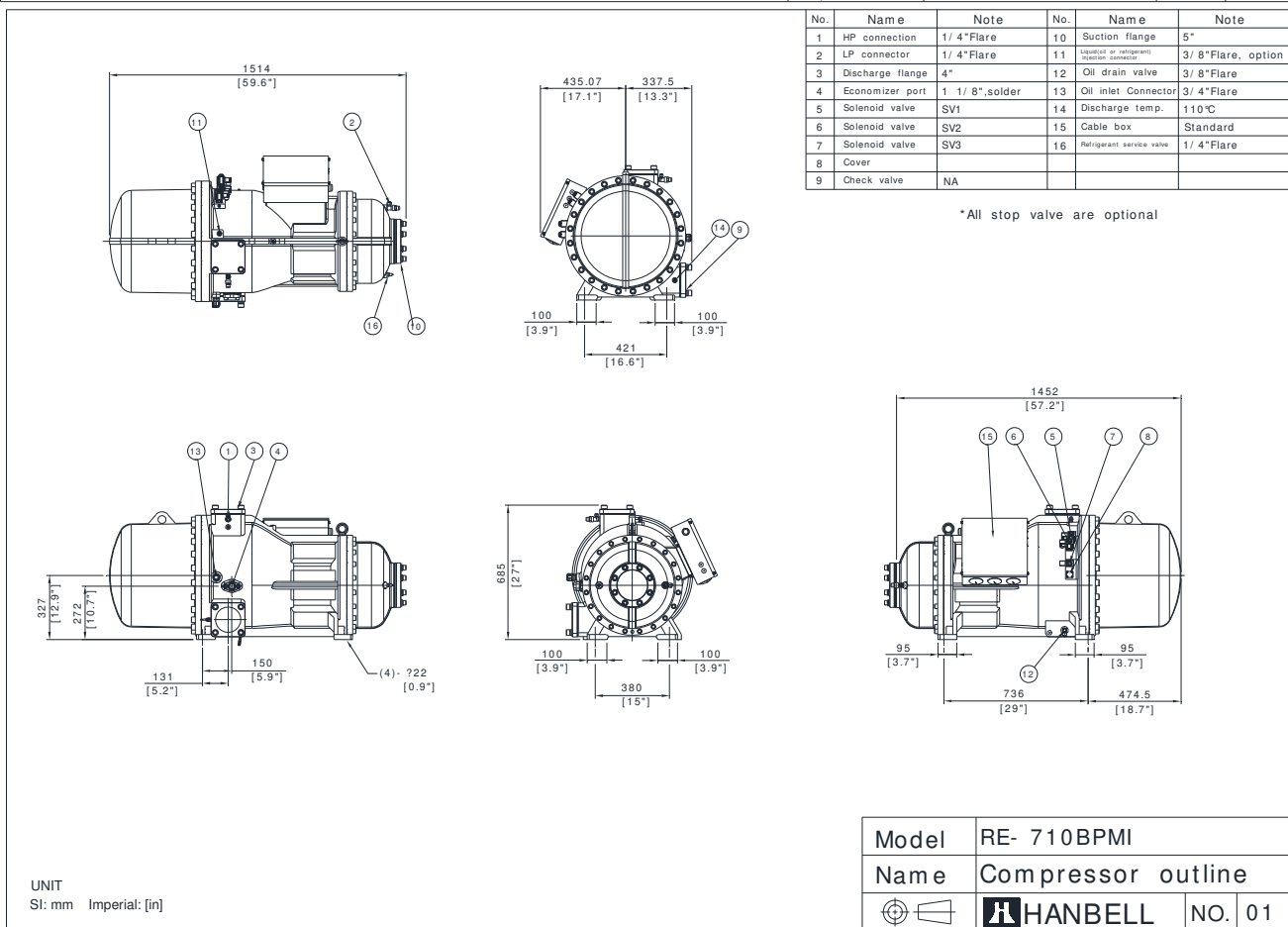


UNIT
SI: mm Imperial: [in]

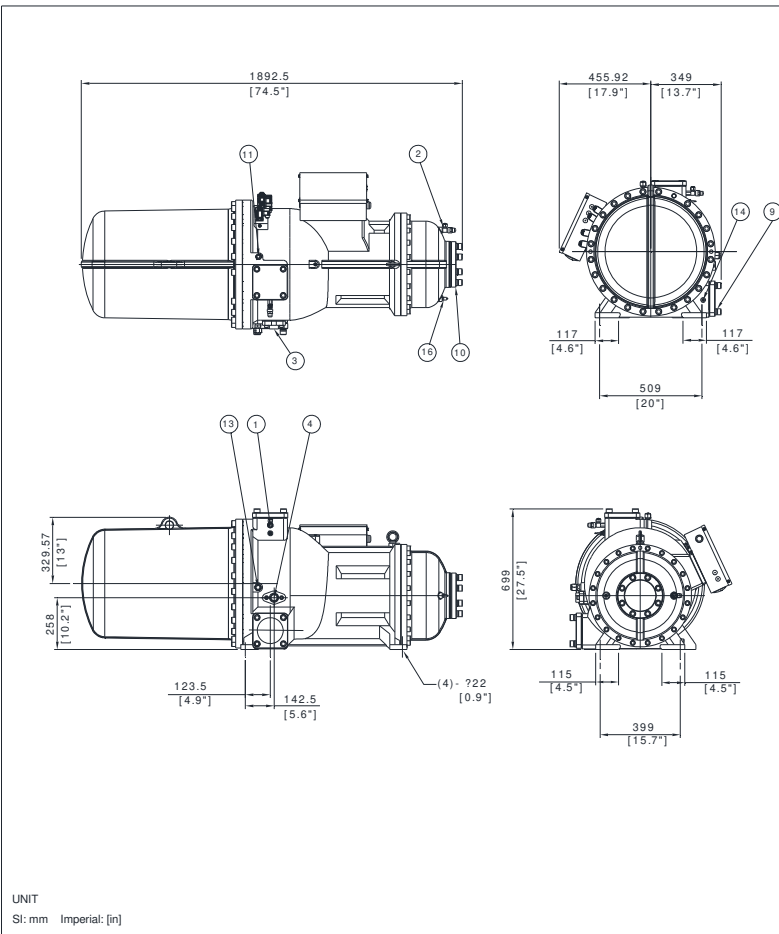
Model	RE- 550BPMI
Name	Compressor outline
	HANBELL NO. 01



UNIT:
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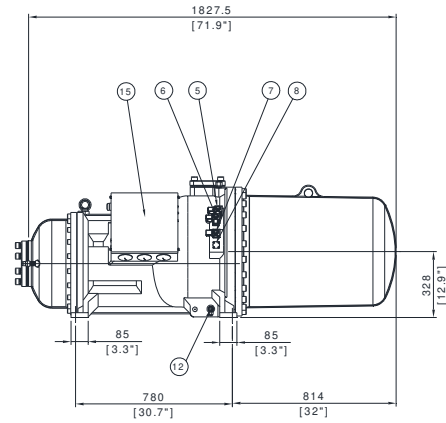


UNIT:
SI: mm Imperial: [in]



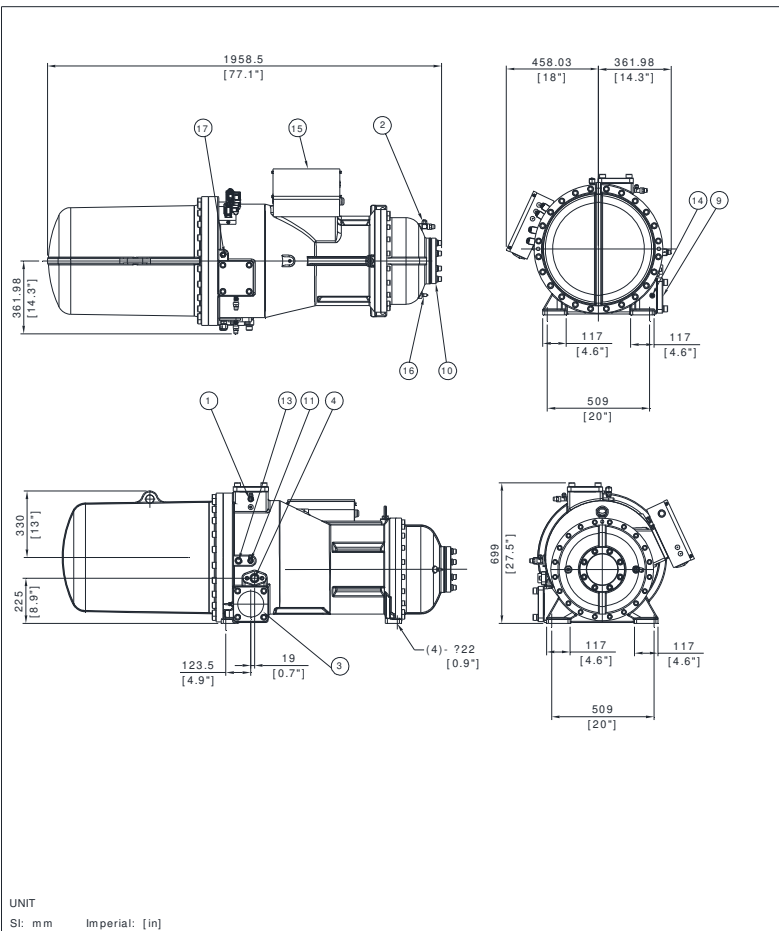
No.	Name	Note	No.	Name	Note
1	HP connection	1/ 4"Flare	10	Suction flange	5"
2	LP connector	1/ 4"Flare	11	Liquid (or refrigerant) injection connector	3/ 8"Flare, option
3	Discharge flange	4"	12	Oil drain valve	1/ 4"Flare
4	Economizer port	1 3/ 8" Solder	13	Oil inlet Connector	3/ 4"Flare
5	Solenoid valve	SV1	14	Discharge temp.	110°C
6	Solenoid valve	SV2	15	Cable box	Standard
7	Solenoid valve	SV3	16	Refrigerant service valve	1/ 4"Flare
8	Cover				
9	Check valve	NA			

*All stop valve are optional



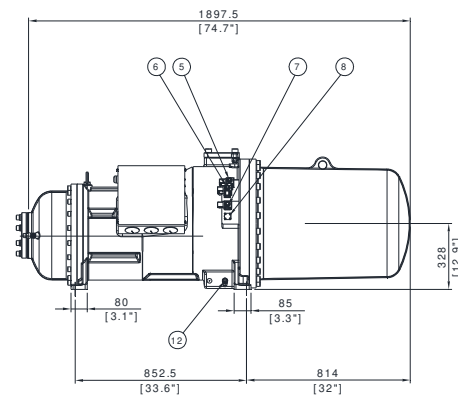
Model	RE- 820BPM
Name	Compressor outline
	NO. 01

UNIT
SI: mm Imperial: [in]



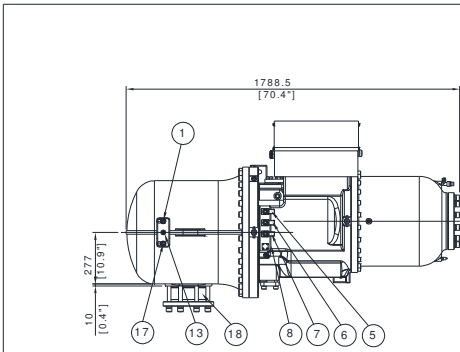
No.	Name	Note	No.	Name	Note
1	HP connection	1/ 4"Flare	10	Suction flange	5"
2	LP connector	1/ 4"Flare	11	Oil pressure differential tap/pt.	1/ 4"Flare
3	Discharge flange	4"	12	Oil drain valve	3/ 8"Flare
4	Economizer port	1 3/ 8" Solder	13	Oil inlet Connector	3/ 4"Flare
5	Solenoid valve	SV1	14	Discharge temp.	110°C
6	Solenoid valve	SV2	15	Cable box	Standard
7	Solenoid valve	SV3	16	Refrigerant service valve	1/ 4"Flare
8	Cover		17	Liquid (or refrigerant) injection connector	3/ 8"NPT
9	Check valve	NA			

*All stop valve are optional



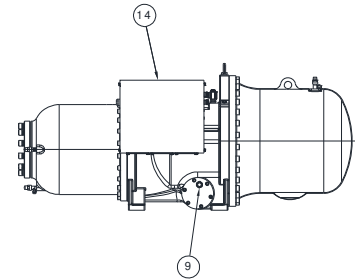
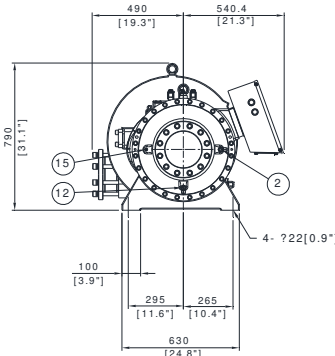
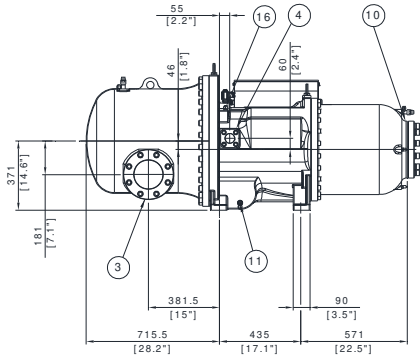
Model	RE- 920BPM
Name	Compressor outline
	NO. 01

UNIT
SI: mm Imperial: [in]



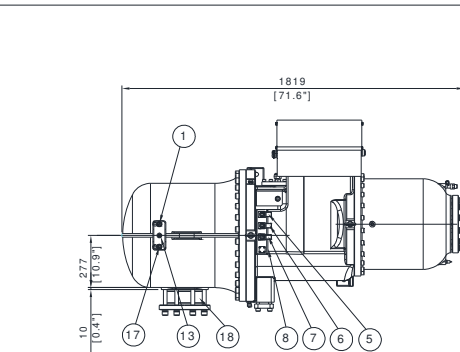
No.	Name	Note	No.	Name	Note
1	HP connection	1/ 4"Flare	10	Suction flange	6"
2	LP connector	1/ 4"Flare	11	Oil drain valve	1/ 4"Flare
3	Discharge flange	5"	12	Oil drain valve	1/ 4"Flare
4	Economizer port	1 5/ 8",for copper tube	13	Discharge temp. sensor	110°C
5	Solenoid valve	SV1	14	Cable box	Standard
6	Solenoid valve	SV2	15	Refrigerant service valve	1/ 4"Flare
7	Solenoid valve	SV3	16	Liquid(oil or refrigerant) injection connector	3/ 8"Flare
8	Cover		17	Spare port (High press.)	1/ 4"Flare
9	Oil inlet Connector	3/ 4"Flare	18	Dual plate wafer type check valve	5"

*All stop valve are optional



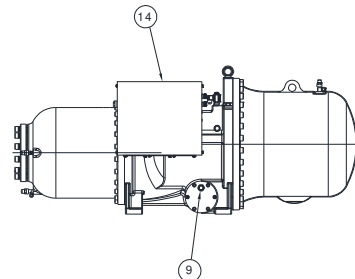
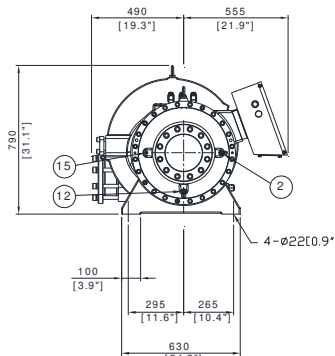
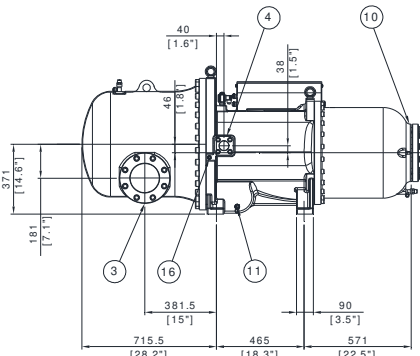
UNIT
SI: mm Imperial: [in]

Model	RE- 1050APMI& BPMI
Name	Compressor outline
	HANBELL NO. 01



No.	Name	Note	No.	Name	Note
1	HP connection	1/ 4"Flare	10	Suction flange	6"
2	LP connector	1/ 4"Flare	11	Oil drain valve	1/ 4"Flare
3	Discharge flange	5"	12	Oil drain valve	1/ 4"Flare
4	Economizer port	1 5/ 8",for copper tube	13	Discharge temp. sensor	110°C
5	Solenoid valve	SV1	14	Cable box	Standard
6	Solenoid valve	SV2	15	Refrigerant service valve	1/ 4"Flare
7	Solenoid valve	SV3	16	Liquid(oil or refrigerant) injection connector	3/ 8"Flare
8	Cover		17	Spare port (High press.)	1/ 4"Flare
9	Oil inlet Connector	3/ 4"Flare	18	Dual plate wafer type check valve	5"

*All stop valve are optional



UNIT
SI: mm Imperial: [in]

Model	RE- 1150APMI& BPMI
Name	Compressor outline
	HANBELL NO. 01



5.4 Compressors accessories

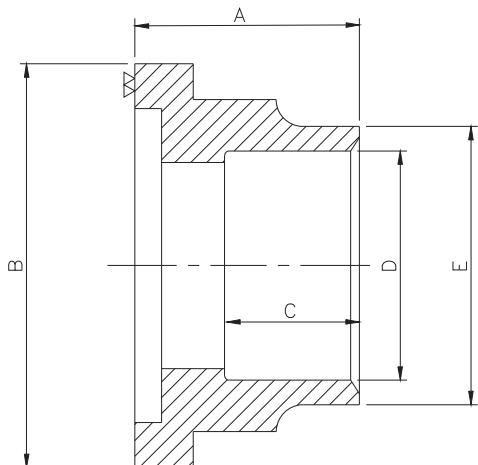
Accessory table

● : Standard, △ : Optional	340	380	420	480	550	620	710	820	920	1050	1150
Vi control solenoid valves & coils	●	●	●	●	●	●	●	●	●	●	●
Dual-plate horizontal discharge check valve	●	●	●	●	●	●	●	●	●	●	●
Suction & discharge connection bushings	●	●	●	●	●	●	●	●	●	●	●
Discharge stop valve	●	●	●	●	●	●	●	●	●	●	●
Synthetic lubricant	●	●	●	●	●	●	●	●	●	●	●
Suction filter	●	●	●	●	●	●	●	●	●	●	●
Suction & discharge flanges	●	●	●	●	●	●	●	●	●	●	●
Discharge temperature thermistor	●	●	●	●	●	●	●	●	●	●	●
Motor temperature thermistor	●	●	●	●	●	●	●	●	●	●	●
INT69HBY motor protector	●	●	●	●	●	●	●	●	●	●	●
IP54 cable box	●	●	●	●	●	●	●	●	●	●	●
Oil filter	●	●	●	●	●	●	●	●	●	●	●
Oil heater	●	●	●	●	●	●	●	●	●	●	●
Optical oil level switch sensor	●	●	●	●	●	●	●	●	●	●	●
Oil drain valve	●	●	●	●	●	●	●	●	●	●	●
Pt1000 motor temperature sensor	●	●	●	●	●	●	●	●	●	●	●
Mounting pads	●	●	●	●	●	●	●	●	●	●	●
Suction stop valve	△	△	△	△	△	△	△	△	△	△	△
Pt100 motor temperature sensor	△	△	△	△	△	△	△	△	△	△	△
The accessories of liquid injection system	△	△	△	△	△	△	△	△	△	△	△
External oil separator	△	△	△	△	△	△	△	△	△	△	△
External oil filter	△	△	△	△	△	△	△	△	△	△	△
Oil flow switch	△	△	△	△	△	△	△	△	△	△	△
Oil cooler	△	△	△	△	△	△	△	△	△	△	△
Oil pump	△	△	△	△	△	△	△	△	△	△	△
Oil filter pressure differential switch	△	△	△	△	△	△	△	△	△	△	△
Built-in safety valve	△	△	△	△	△	△	△	△	△	△	△
Micro controller	△	△	△	△	△	△	△	△	△	△	△
Sound jacket	△	△	△	△	△	△	△	△	△	△	△

Note: The accessory table is just for reference only. Actual specification and accessories enclosed might vary with different quotation and agreement respectively. If any optional accessory is required and out of above mentioned standard accessory, please contact Hanbell for detailed specification and price.

Description of bushings

Suction and discharge bushings



Model	Discharge		Suction	
	Copper pipe	Steel pipe	Copper pipe	Steel pipe
RE-340MI	2 1/2"	2 5/8"	4"	4 1/8"
RE-380MI	2 1/2"	2 5/8"	4"	4 1/8"
RE-420MI	2 1/2"	2 5/8"	4"	4 1/8"
RE-480MI	2 1/2"	2 5/8"	4"	4 1/8"
RE-550MI	3"	3 1/8"	4"	4 1/8"
RE-620MI	3"	3 1/8"	5"	5 1/8"
RE-710MI	4"	4 1/8"	5"	5 1/8"
RE-820MI	4"	4 1/8"	5"	5 1/8"
RE-920MI	4"	4 1/8"	5"	5 1/8"
RE-1050MI	5"	5 1/8"	6"	—
RE-1150MI	5"	5 1/8"	6"	—

Figure: bushing size drawing

Suction/Discharge size (standard type)

Note: The above table lists specification of standard bushing for every model of Hanbell compressors. Their dimensions correspond to flange bushing dimensions and the table below. If bushing dimensions are not indicated in purchasing order, Hanbell will provide standard type. Suitable piping of customers' choice is also shown in the table below. If non-standard bushing is needed, please contact Hanbell sales representatives.

Flange bushing dimensions (standard type)

Model	Suction/Discharge	Standard Discharge Flange Bushing		Bushing size (mm)				
				A	B	C	D	E
RE-340	Discharge	Copper	2 5/8"	60	110	35	67	77
		Steel	2 1/2"				77.2	90
RE-380	Discharge	Copper	4 1/8"	76	145	50	105.1	116
		Steel	4"				115.6	128
RE-420	Suction	Copper	3 1/8"	66	120	45	79.8	90
		Steel	3"				90.2	103
RE-480	Suction	Copper	4 1/8"	76	145	50	105.1	116
		Steel	4"				115.6	128
RE-550	Discharge	Copper	3 1/8"	66	120	45	79.8	90
		Steel	3"				90.2	103
RE-620	Suction	Copper	4 1/8"	76	145	50	105.1	116
		Steel	4"				115.6	128
RE-710	Discharge	Copper	3 1/8"	66	120	45	79.8	90
		Steel	3"				90.2	103
RE-820	Suction	Copper	5 1/8"	75	174	35	130.5	146.5
		Steel	5"				141.3	154
RE-920	Discharge	Copper	4 1/8"	76	145	50	105.1	116
		Steel	4"				115.6	128
RE-1050	Suction	Copper	5 1/8"	75	174	35	130.5	146.5
		Steel	5"				141.3	154
RE-1150	Discharge	Copper	4 1/8"	76	145	50	105.1	116
		Steel	5"				141.3	154
	Suction	Steel	6"	75	215	40	166.7	196

Table: Discharge/suction bushing size



a. Discharge/suction piping size

Hanbell suggests enlarging discharge & suctioning pipes to achieve the highest running efficiency.

Model	Material	Type	Suction size	Discharge size	Dual-plate discharge check valve size
RE-340	Steel	Standard	5	3"	3"
		P type	5	3"	3"
	Copper	Standard	5 1/8"	3 1/8"	3 1/8"
		P type	5 1/8"	3 1/8"	3 1/8"
RE-380	Steel	Standard	5	3"	3"
		P type	5	3"	3"
	Copper	Standard	5 1/8"	3 1/8"	3 1/8"
		P type	5 1/8"	3 1/8"	3 1/8"
RE-420	Steel	Standard	5	3"	3"
		P type	5	4"	4"
	Copper	Standard	5 1/8"	3 1/8"	3 1/8"
		P type	5 1/8"	4 1/8"	4 1/8"
RE-480	Steel	Standard	5	3"	3"
		P type	5	4"	4"
	Copper	Standard	5 1/8"	3 1/8"	3 1/8"
		P type	5 1/8"	4 1/8"	4 1/8"
RE-550	Steel	Standard	5	4"	4"
		P type	5	4"	4"
	Copper	Standard	5 1/8"	4 1/8"	4 1/8"
		P type	5 1/8"	4 1/8"	4 1/8"
RE-620	Steel	Standard	6	4"	4"
		P type	6	5"	5"
	Copper	Standard	NA	4 1/8"	4 1/8"
		P type	NA	5 1/8"	5 1/8"
RE-710	Steel	Standard	6	5"	5"
		P type	6	5"	5"
	Copper	Standard	NA	5 1/8"	5 1/8"
		P type	NA	5 1/8"	5 1/8"
RE-820	Steel	Standard	6	5"	5"
		P type	6	5"	5"
	Copper	Standard	NA	5 1/8"	5 1/8"
		P type	NA	5 1/8"	5 1/8"
RE-920	Steel	Standard	6	5"	5"
		P type	6	5"	5"
	Copper	Standard	NA	5 1/8"	5 1/8"
		P type	NA	5 1/8"	5 1/8"
RE-1050	Steel	Standard	8"	6"	6"
		P type	8"	6"	6"
	Copper	Standard	NA	NA	NA
		P type	NA	NA	NA
RE-1150	Steel	Standard	8"	6"	6"
		P type	8"	6"	6"
	Copper	Standard	NA	NA	NA
		P type	NA	NA	NA

Table: Specifications of discharge/suction piping

c-1. Pipe connection of compressors

c-1-1. Suction pipe:

We suggest to use reducers to enlarge the suction pipe size. The location of reducers should be closed to the compressor suction port.

For example as below: RE-620's suction port is 5 inch. Please use a reducer to connect 5" bushing and 6-inch pipe to achieve high operation efficiency.

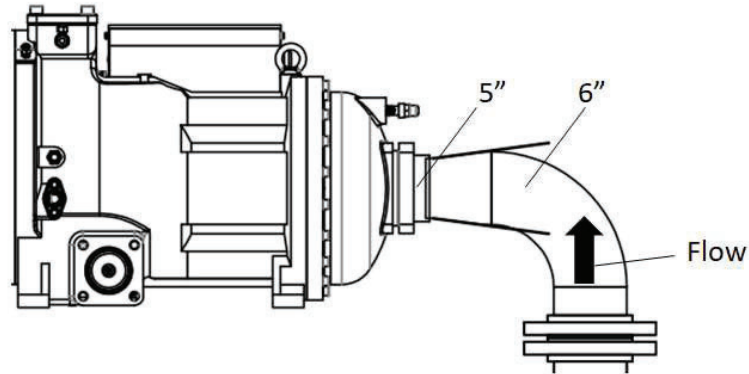


Figure: Suction piping

c-1-2. Discharge pipe (RE-AMI / RE-BMI, standard type) :

We suggest using reducers to enlarge the discharge pipe size. The location of reducers should be closed to the compressor discharge port.

For example as below: RE-620's discharge port is 3 inch. Please use a reducer to connect 3" bushing and 4-inch pipe to achieve high operation efficiency.

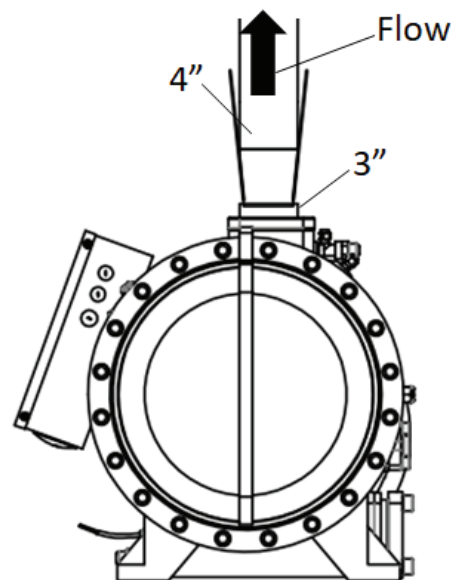


Figure: Discharge piping



c-1-3. Discharge pipe (RE-APMI / RE-BPMI, P-type) :

We suggest using reducers to enlarge the discharge pipe size. The location of reducers should be closed to the compressor discharge port.

For example as below: RE-620APMI's discharge port is 4 inch. Please use a reducer to connect 4" bushing and 5-inch pipe to achieve high operation efficiency.

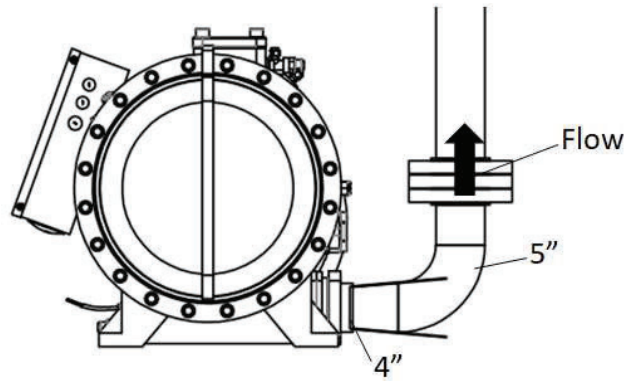


Figure: Discharge Piping (RE-APMI/BPMI)

d. Dual-plate discharge check valve

Hanbell standard discharge check valve for RE-MI Series is dual-plate type which manufactured according to API, ASTM, ANSI, JIS, AWWA, ISO, and other international standardization. It can be installed on both horizontal and vertical pipelines. This type of check valves offers the advantages of allowing high-flow rates of refrigerants and low pressure-drop loss.

After compressors shut down, the dual-plate check valve quickly closes effectively to avoid high-pressure refrigerant gas returns back from condenser side into the compressor.

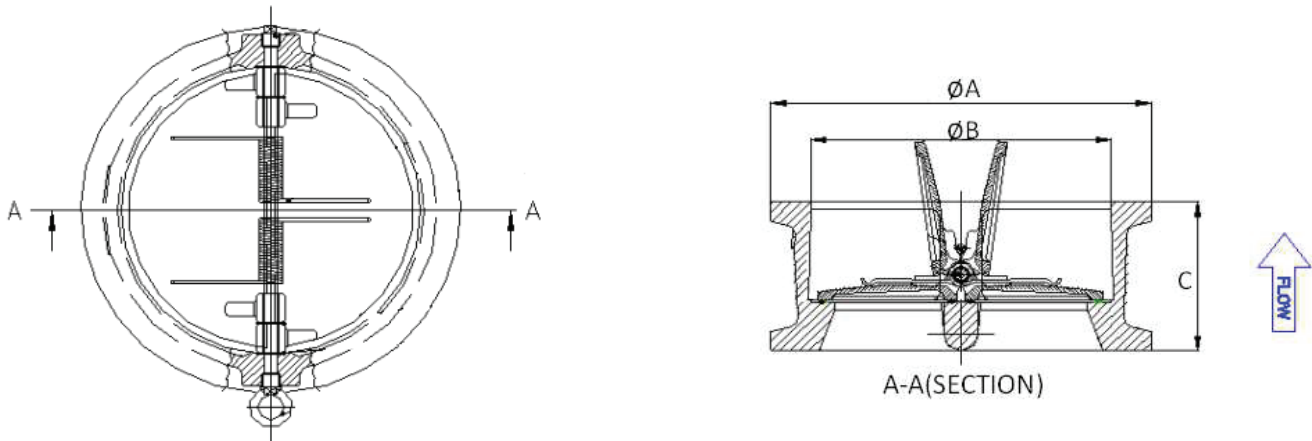


Figure: Dual-plate discharge check valve

SIZE	ϕA	ϕB	C
INCH			
2.5"	130	73	67
3"	149	89	73
4"	181	114	73
5"	216	141	86
6"	251	168	98

Table: spec of Dual-plate check valve

d-1 Assembly of Dual-plate discharge check valve (with flanges & bolts)

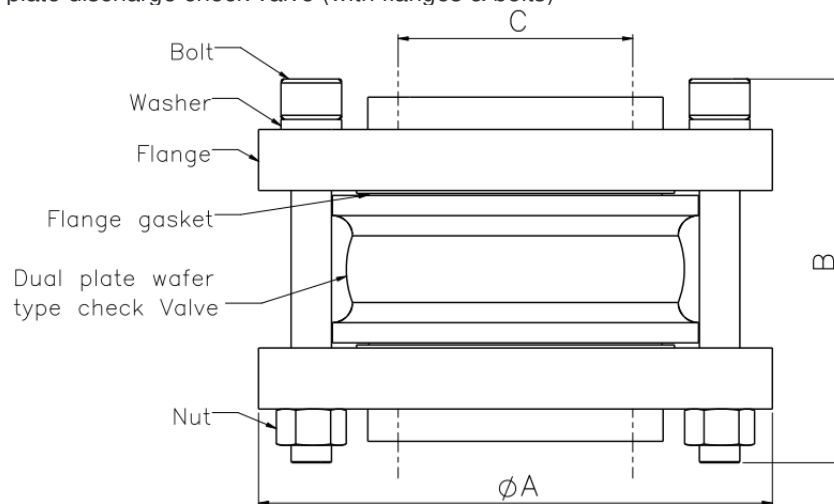


Figure: Assembly of Dual-plate discharge check valve (with flanges & bolts)

Steel pipes:

SIZE	φA	φB (ID of flange)	C	Weight(kg)
INCH				
2.5"	190.5	170	74.6	15.6
3"	209.6	190	90.7	22
4"	254	190	116	30
5"	279.4	210	143.7	40
6"	317.5	220	170.6	58

Table: Assembly of dual-plate check valve spec. (steel pipes)

Copper pipes:

SIZE	φA	φB (ID of flange)	C	Weight(kg)
INCH				
2 5/8"	190.5	170	67.7	16.6
3 1/8"	209.6	190	80.4	23
4 1/8"	254	190	105.8	32
5 1/8"	279.4	210	131.2	43

Table: Assembly of dual-plate check valve spec. (copper pipes)

Note: Please pay attention to support the pipes because of the weight of check valve assembly.

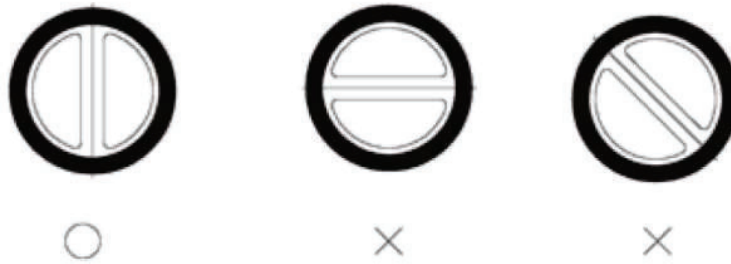


d-1-1. Installation of Dual-plate discharge check valve

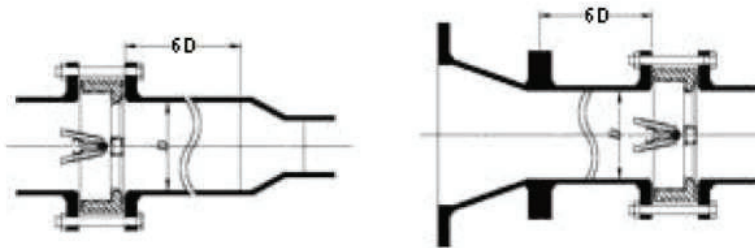
d-1-1-1. When installing the check valve in the pipeline, it is necessary to follow the gas flow direction indicated on the check valve. °



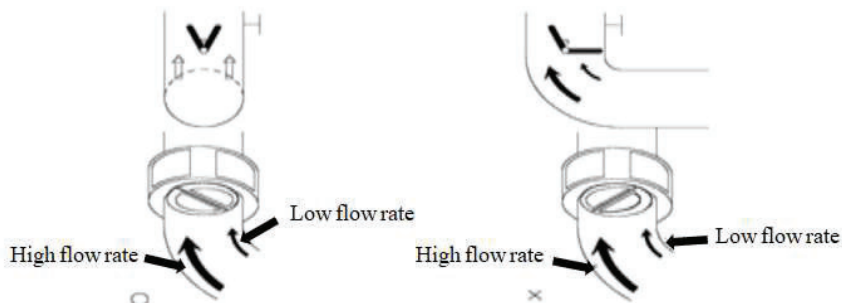
d-1-1-2. In horizontal pipelines, the check valve needs to be installed as showed as below to ensure that it can be opened uniformly.



d-1-1-3. A minimum distance between check valve and reducer is 6-time of valve diameter (6D) at least.



d-1-1-4. When installing a check valve at a pipe bend, it is important to pay attention to the direction of the plates of valve to ensure that it can be opened uniformly.



e. Suction and discharge stop valves

For compressor maintenance, it is recommended to install suction and discharge stop valves. Discharge stop valves need to be installed after the dual-plate discharge check valve to avoid excessive pressure-drop loss. Please refer to following details of Hanbell stop valves.

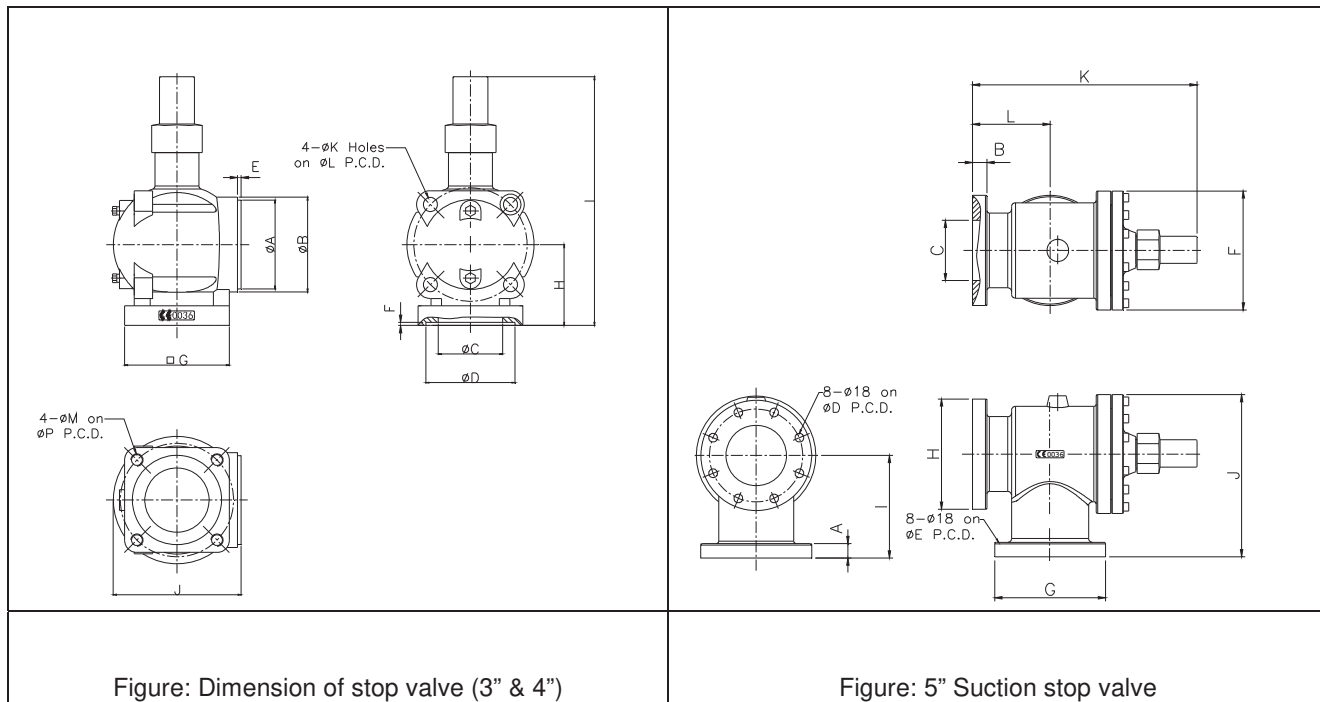


Figure: Dimension of stop valve (3" & 4")

Figure: 5" Suction stop valve

Dia.	Dimensions													
	A	B	C	D	E	F	G	H	I	J	K	L	M	P
3"	120	135	80	121	6	5	152	107	349	185	22	160	M20x2.5	160
4"	145	155	105	146	6	5	175	132	406	209	23	185	M20x2.5	185

Dia.	Dimensions											
	A	B	C	D	E	F	G	H	I	J	K	L
5"	30	30	126	194	194	248	230	230	214	338	466	161

Specifications of stop valve

Maximum allowable pressure	Pneumatic pressure test	Refrigerant	Temperature range
21kgf / cm ² G	26kgf / cm ² G	HFC, HFO	-40°C~150°C

f. INT69HBY diagnose control module and PTC temperature thermistor

To protect compressor, each RE-VI compressor has been installed three PTC temperature thermistors inside motor coil and another one at discharge port. These thermistors are connected in series to Hanbell motor protector module INT69HBY to monitor the motor and discharge temperature. The module resets when the temperature drops below the response temperature by 5K. The output replay provides a potential-free change-over contact and is energized as long as the nominal response temperature is not exceeded.

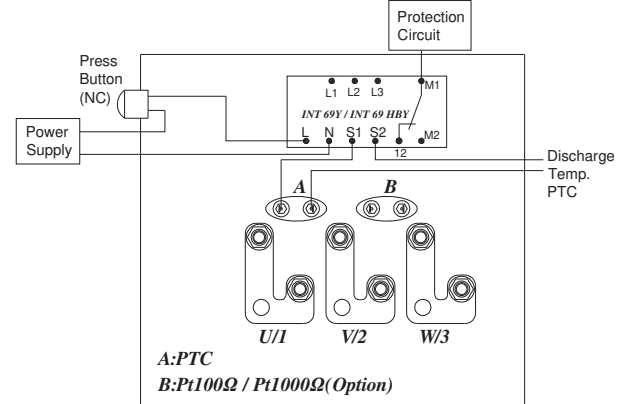
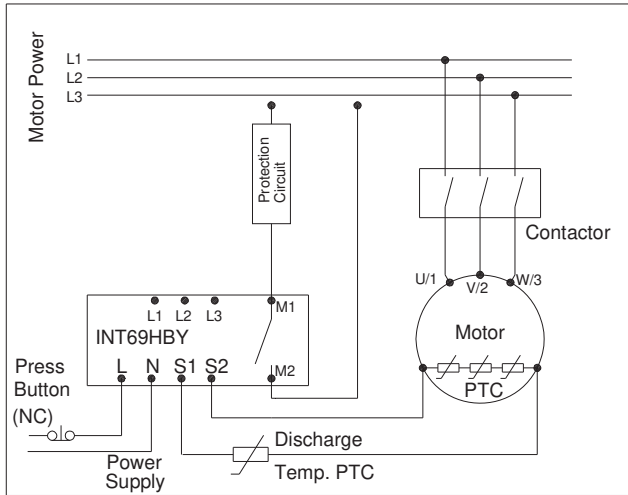


Figure: INT69HBY & PTC connection diagram

Other major functional descriptions are as follow:

- The temperature monitoring in the motor winding is according to the static evaluation process; the motor is switched off immediately if the nominal response temperature of the built-in PTC sensors is reached.
- A short circuit of PTC input will also leads to a switch-off. A short cycling leads to a reset delay.
- After cooling down or elimination of the error and a subsequent reset delay, the compressor can be restarted
- The phase monitoring function will be provided on the inverter, it is not applicable on motor protector.
- A dual LED (red, orange/ green) provides additional information about the motor protector and compressor status.

INT69HBY Technical data:

Supply voltage AC 50/60 Hz 115/240V...+10% 3VA
 Ambient temperature -30 ... +70 °C
 Relay output max. AC 240V, max. 2.5A, C300

Blink code display & diagram:

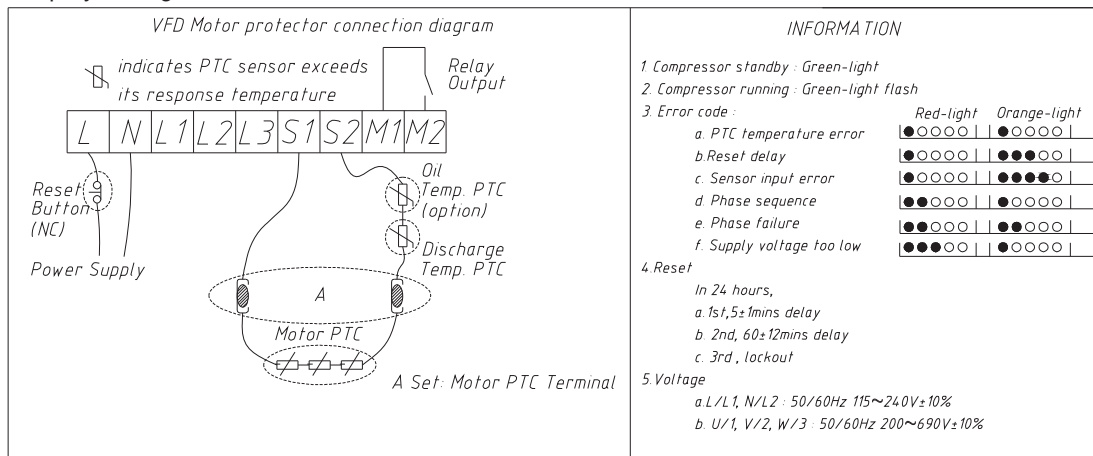


Figure: The connection diagram of motor protector and fault indicator lights

g Oil heater

An UL approved oil heater has been installed in every compressor with build-in oil separator as a standard accessory. Before re-start compressor, please turn on oil heater at least 8 hours if it shuts down for a long time. It makes the temperature inside compressor higher than system temperature and ambient temperature to prevent condensation of refrigerant inside oil sump of compressor which may result in liquid compression in next start-up and poor lubrication due to too low viscosity of lubricant oil.

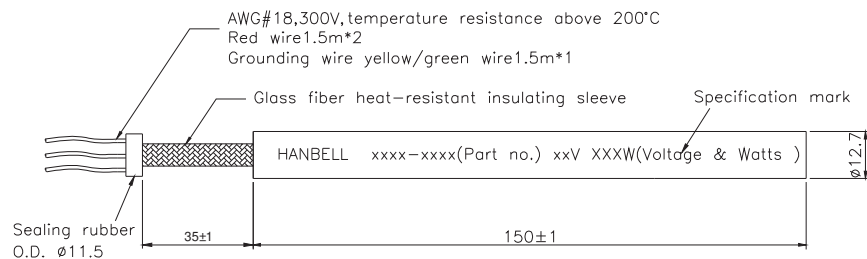


Figure: Oil heater

Specification : 300W; 110V or 220V; IP 54; UL approval

Note: If compressor is installed in low ambient temperature, it is recommended to insulate oil separator against cold ambience.

h. Optical oil level switch

The optical oil level switch consists of four wire connections. Two of them (OG - orange and GY - gray) are used to connect to the main control loop or any independent loop of a microcontroller. The other two wires (BU - blue and BN - brown) are used for controlling the power supply connection. To prevent from optical oil level switch trip caused by oil foaming or surging in the sump, a time delay around 10 ~ 15 seconds is recommended before shut down the compressor.

Supply voltage	AC 50/60Hz 230V ±10% 3VA AC 50/60Hz 115V ±10% 3VA
Permitted ambient temperature	-30...+60°C
Medium temperature Max.	+120°C (<1h) Max. +100°C
Permitted rel. humidity	10-95% r. h. no condensation
Switch delay	
After applying the supply voltage	3s ± 1s
Level missing or fault	5s ± 2s
Level good and no fault	5s ± 2s
Relay	AC 240V 2.5A C300
Contact	at least AC/DC 24V 20mA
Mechanical service life	Approx. 1 million switching cycles
Connection type	Cable 4 x AWG 18/7

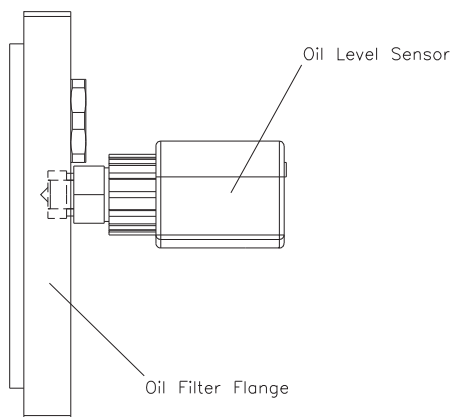
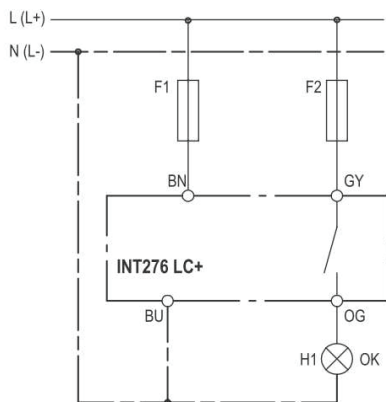
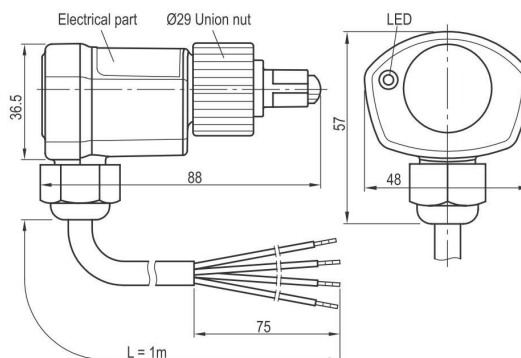


Figure: The installation & connection diagram of optical oil level switch



i Oil drain valve

Oil drain valve is equipped on compressor to drain out oil for maintenance.

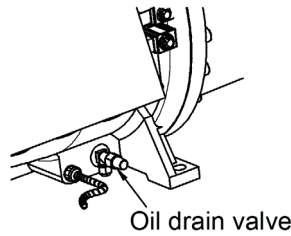


Figure: Oil drain valve

j Terminal box

Hanbell designs and makes the cable box which meets IP54 protection degree. Please refer to the dimension of the cable box (for motor power line and control power line) below:

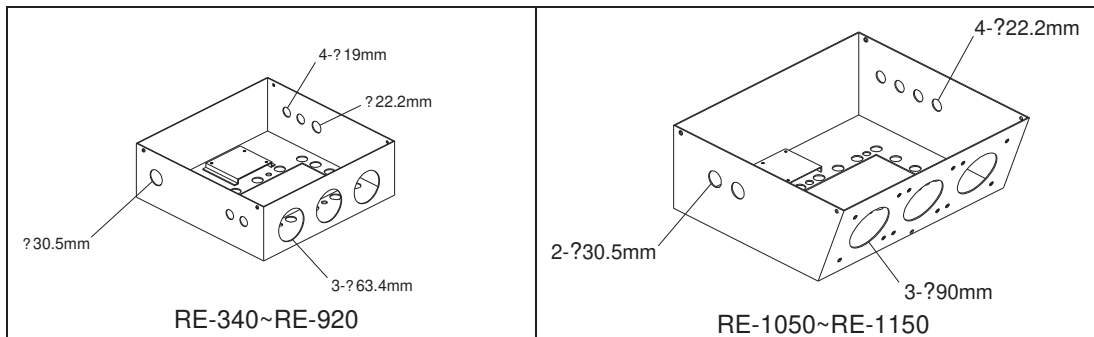


Figure :Cable box

k. Oil flow switch

The oil flow rate switch is commonly used with external oil separator to ensure proper oil supply and prevent compressor damage due to oil loss. It is recommended to use a 10-15 second delay before tripping to ensure the oil flow rate switch operates correctly and to prevent false triggering of the main system. Please refer to the specifications and system installation depicted in the following table:

Type	Connection	Pipe size		Part No. (Thread type)	Part No. (Weld type)
		Thread	weld (d)		
138	Thread/weld	3/8"	Φ10	32011-89N4	32011-89N2
138	Thread/weld	5/8"	Φ16	32014-89N4	32014-89N2
125	Weld		Φ25.5	32014-89N4	32045-89N2

Table: Oil flow switch spec

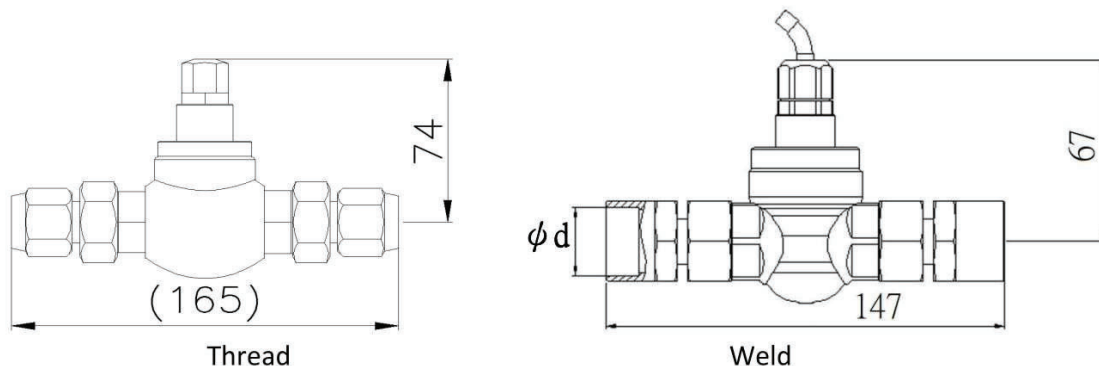


Figure: Oil flow switch

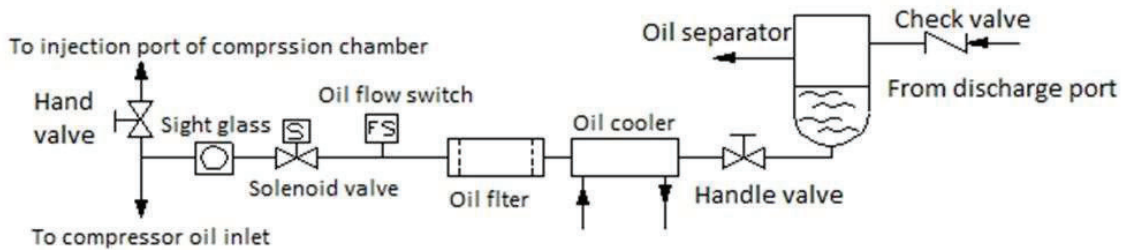
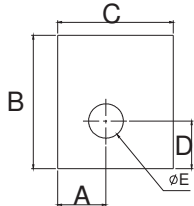


Figure: Oil flow switch piping

I. Mounting pads

Hanbell supplies mounting pads which shall be installed properly in between compressor feet and chiller base. It helps to reduce vibration and noise during operation, its dimension is shown as follows:



unit:mm

Model	Part No.	A	B	C	D	E	Thickness	Req. Q'ty
RE-340MI, RE-380MI	31107-9815AA	20	60	80	20	22	20	4
RE-420MI, RE-480MI, RE-550MI	31109-9815AA	22.5	60	60	22.5	22	20	4
RE-620MI, RE-710MI	31062-9815AA	40	100	100	35	22	20	4
RE-820MI, RE-920MI	31114-9815AA	22.5	85	117	22.5	22	20	4
RE-1050MI, RE-1150MI	31062-9815AA	40	100	100	35	22	20	4

Figure: Compressor mounting pad

m. Temperature sensors Pt1000 or Pt100 (Optional)

RE models utilize suction return gas to cool down the motor coil. To effectively detect temperature of motor coil and adequately adjust volume of liquid injection by measured temperature, Hanbell specially mounts Pt1000 or Pt100 temperature sensor in the motor coil to monitor the motor temperature. This temperature sensor can be used to work with liquid injection valve as additional cooling based on the motor temperature, as shown in the diagram below:

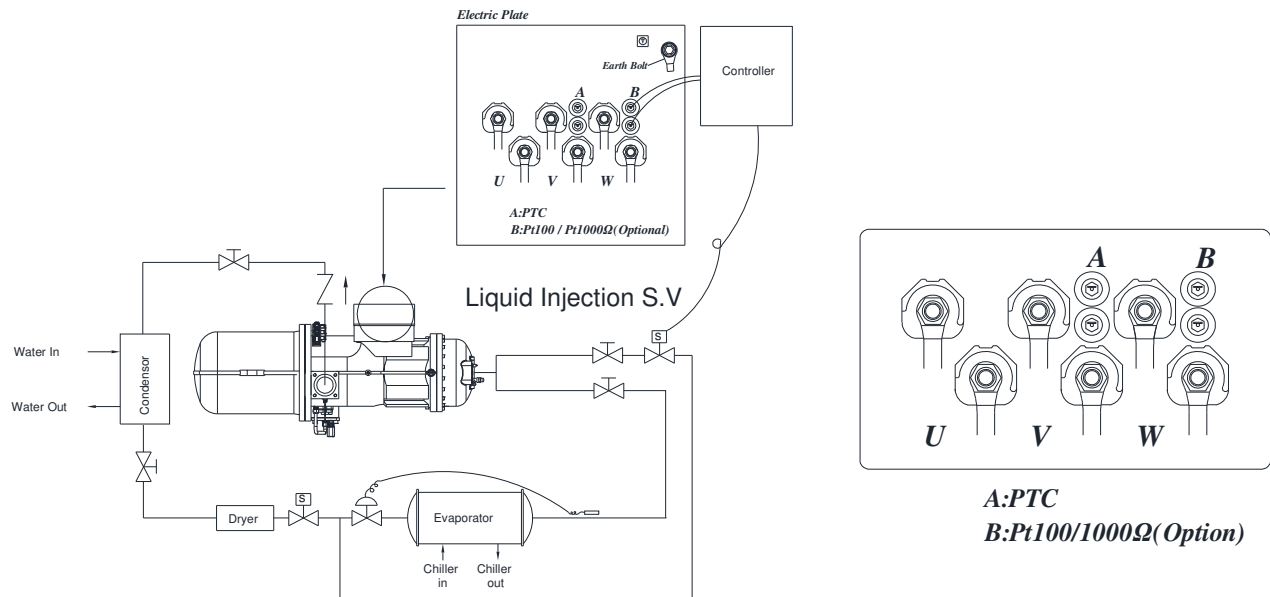


Figure: Liquid injection connection diagrams

Note: A terminal: PTC, B terminal:PT1000/PT100

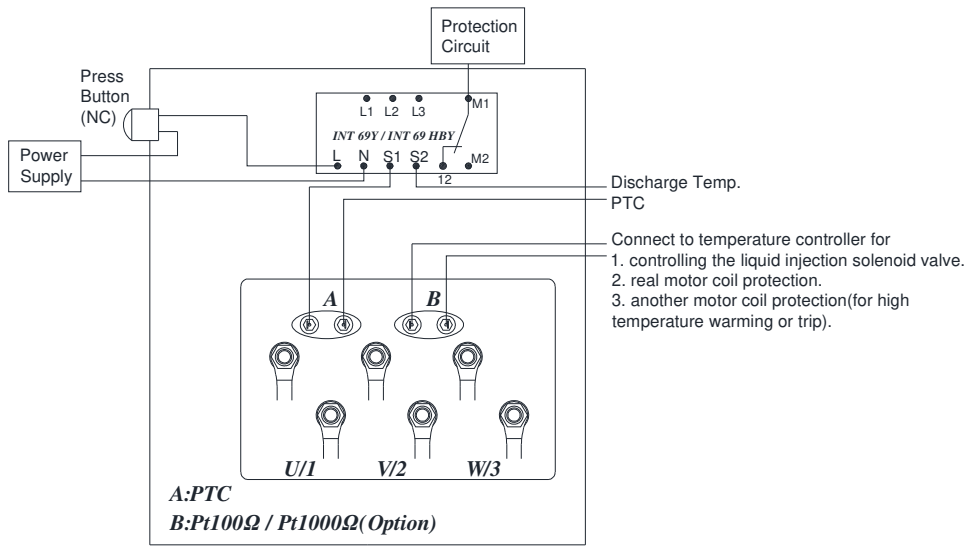


Figure: Connection diagram of Pt1000/Pt100 sensor

Specification: Pt1000 sensor

Recommended max. meas. Current for heat coefficient $< 0.1K - DC 0.2 \sim 2mA$

Sensor resistance at $0^{\circ}C - 1000\Omega \pm 1.20\Omega$

Change of resistance $0 \sim 100^{\circ}C - 3.85\Omega/K$

Insulation test voltage U is – AC 1.5kV

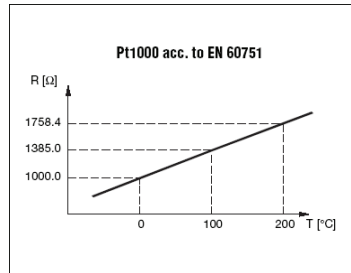


Figure: Pt1000 sensor

Specification: Pt100 sensor

Recommended max. meas. Current for heat coefficient $< 0.1K - DC 1 \sim 3 mA$

Heating coefficient - $10m\Omega/K$

Sensor resistance at $0^{\circ}C - 100\Omega \pm 0.12\Omega$

Change of resistance $0 \sim 100^{\circ}C - 0.385\Omega/K$

Insulation test voltage U is – AC 1.5kV

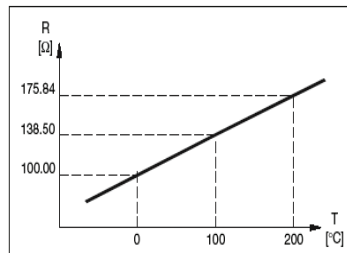


Figure: Pt100 sensor

6. Electrical data and design

6.1 Inverter starting

Inverter starting is different from traditional star-delta or part-winding starting methods. The motor voltage and frequency is regulated with a variable frequency drive simultaneously. The advantage is that when the motor voltage is low during start, the starting current and starting torque is low too. Please refer to the following diagram for wiring of inverter starting.

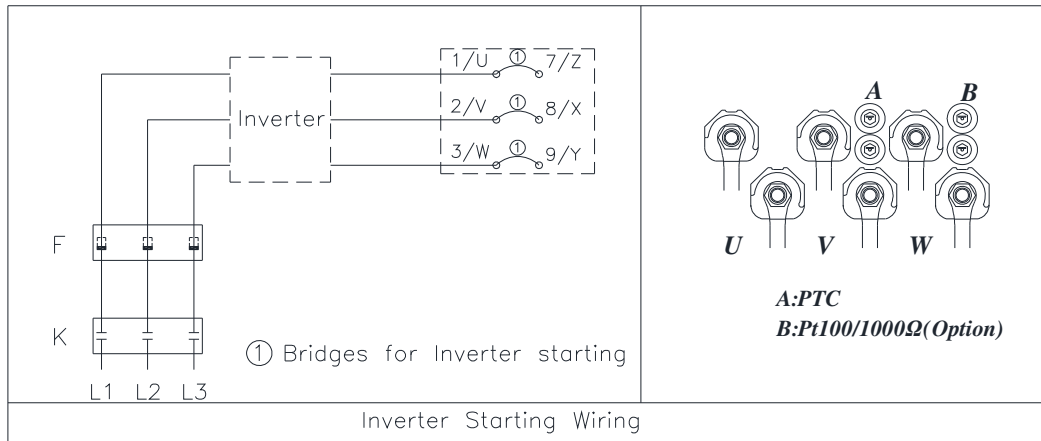


Figure: Inverter starting diagram

Attention:

- *Please ensure VFD power supply output and motor terminal wires are connected in correct sequence.
- *Any power phase reverse or phase loss could lead to serious damage to personnel and compressor motor.

Steps of setting PM motor with inverter:

1. Restore original factory settings.
2. Switch to permanent magnet drive mode.
3. Input the motor parameters of compressor nameplate into the inverter.
 - (1) Rated speed.
 - (2) Rated frequency.
 - (3) Rated voltage.
 - (4) Rated current.
 - (5) Numbers of poles.
4. Parameter auto-tuning.
 - (1) Before tuning, please confirm cable connection correctly on terminal cover plate (correct phase sequence & without phase failure).
 - (2) If there is any operational issue after tuning, please check the setting of motor parameters.
 - (3) After tuning, please check rotating direction (suction pressure drops and discharge pressure goes up immediately) before compressor start-up.
5. Setting limit.
 - (1) Starting current limit: Hanbell suggests to set 60% of the rated current even lower.
 - (2) Upper and lower limits of motor speed: Refer to the speed range specified on the compressor nameplate.
 - (3) Current limit: Refer to the MOA specified on the compressor nameplate.
 - (4) Acceleration and deceleration time: It is recommended to use 30 RPM/sec as a reference. If the setting time is shorter, it may cause excessive load changes and trigger protection mechanisms.
 - (5) Carrier frequency: Hanbell suggests that the setting value should be 10 times bigger than the rated frequency (e.g., if the motor's rated frequency is 180 Hz, please set the carrier frequency to 2 kHz or higher).
6. Additional reminders.
 - (1) It is recommended to set the speed variation span as 600 RPM to avoid excessive load variations.
 - (2) Verify the unit definitions of motor parameters.
 - (3) It is recommended to avoid over-frequency operation because it can result in low output voltage, operating in the weak magnetic field (lower efficiency & unstable drive).
 - (4) In parallel system, if one machine #A is running and you need to start the second machine #B, there may be a problem of excessive pressure from high pressure side then resulting in high startup load. It is recommended to reduce the operating speed of machine #A then accelerating with machine #B synchronously to the required load.
 - (5) The motor temperature should be control lower than 100°C degrees.
 - (6) The insulation class of PM motor is F, and the temperature protection PTC trips at 110°C degrees.
 - (7) Regarding de-rating coefficient, please consult inverter suppliers.
 - (8) If the power supply is unstable, please pay attention to the power-off protection settings. Hanbell suggests re-starting the inverter 20 minutes later because of excessive pressure from high pressure side.



6.2 Compressor protection devices

The table below shows the list of protection devices which are essential to protect the compressor and operate safely. Follow the protection devices listed in the below table to ensure the compressor running under normal condition.

Protection device	Set point	Remark
Motor winding temperature protector (PTC sensor)	Trip at 110°C, 100°C ※	Standard
Discharge temperature protector (PTC sensor)	Trip at 110°C, 100°C ※	Standard
Optical oil level switch	Time delay setting: 10~15 seconds	Standard
Oil filter pressure differential switch	Trip at 1.5 kgf/cm ² g	Optional
Oil pressure differential switch	Oil inlet pressure should be 4 kgf/cm ² g higher than the suction pressure. When it is not 4kgf/cm ² g higher than the suction pressure, it is necessary to add a minimum pressure valve or an oil pump to ensure proper oil supply	Optional
Oil flow switch	Time delay setting: 10~15 seconds	Optional
Pt1000 (standard) or Pt100 (optional) for liquid injection to motor chamber.	Depends on customer's application. Suggest Cut in 105°C, cut out 95°C	Standard /Optional

Note:

Noted that the resistance of motor thermistors and discharge thermistors response quickly to the temperature when it is close to 110°C; thermistors must be connected in series to INT69HBY in terminal box as a guardian to protect compressor. Alarm lamp for this protector is required to be embedded on control panel as indicator. Any intention to bypass INT69HBY and start compressor is strictly prohibited. It will void the warranty of compressors if there is any failure caused.

When INT69HBY trips on protection devices, manual rest can only be performed when troubleshooting is completed and issues are resolved.

6.3 Power supply

A. Limitation of power supply

Voltage limitation

Long-term running: rated voltage ±5%

Instant running: rated voltage ±10%

b. Frequency:

Rated frequency ±2%

Note:

In the region where the electricity power is unstable, install an additional hi-low voltage protector with ± 5% tolerance of normal voltage to ensure safe operating of the compressor.

B. Unbalanced voltages :

Unbalanced voltages usually occur because of variations in the load. When the loading on one or more of the phases are different from the others, unbalanced voltages will appear. This can be due to different impedances, type, and value of loading in each phase. Unbalanced voltages may cause serious problems, particularly to the motor.

NEMA defines voltage unbalance as follows:

$$\text{Percent voltage unbalance} = 100 \times \frac{(\text{Maximum voltage deviation from average voltage})}{(\text{Average voltage})}$$

NEMA states that poly-phase motors shall operate successfully under running conditions at rated load when voltage unbalance at the motor terminals does not exceed 1%. Furthermore, operation of a motor with over 5% unbalance is not recommended for it probably results in motor damage.

Unbalanced voltages at motor terminals cause phase current unbalance ranging from 6 to 10 times the percent of voltage unbalance for a fully loaded motor. This causes motor over current resulting in excessive heat that shortens motor life, and hence, eventual motor burnout. If the voltage unbalance is great enough, the reduced torque capability might not be adequate for the application and the motor will not attain rated speed.

Some of the more common causes of unbalance voltages are:

- Unbalanced incoming utility supply
- Open delta connected transformer banks
- Large single phase distribution transformer in the system
- Open phase on the primary 3-phase transformer in the distribution system
- Blow fuse on 3 phase bank of power factor improvement capacitors
- Unequal impedance in conductors of power supply wiring
- Unbalanced distribution of single phase loads such as lighting
- Unequal transformer tap settings
- Faults or grounds in power transformer
- Heavy reactive single phase loads such as welders

6.4 Grounding

There is a grounding terminal on compressor terminal plate. Please connect it to grounding of control panel correctly of the chiller system.

Suggestions:

- The regular setting of electric leak protection should be greater than 50mA; for a humid location, 25mA is better.
- Grounding voltage of casing should be no greater than 50V; for a humid location, the limit is 25V.
- Grounding resistance should be not greater than 500 Ohm.
- Air cut board (ACB) is regularly equipped with electric leak protection. Please refer to related settings for its normal action.
- If electric leak protection is active, please check if insulation of equipments is normal and if its wiring and setting are correct.

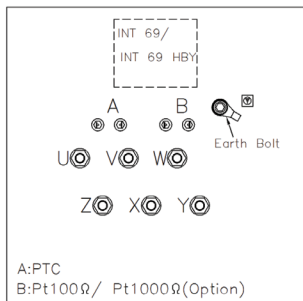
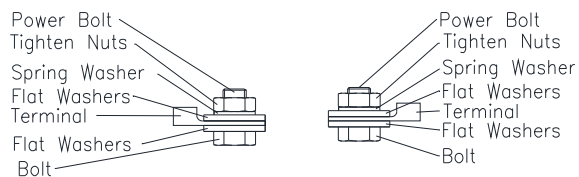


Figure: Grounding Terminal

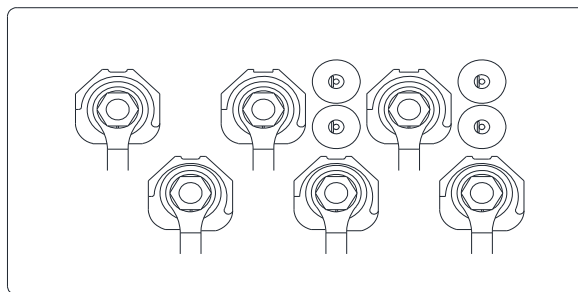
Note:

Please make sure all wires are installed tightly and correctly before starting the compressor. Any loose wire of connection may cause serious damage to personnel and compressor.

6.5 Torque value for power bolts



Spec. of power bolts tightening		
Model	Bolt Size	Torque value (kgf-cm)
RE-300-920MI	M12	350
RE-1050-1150MI	M16	500





7. Operation and maintenance

7.1 Compressor start-up

PRE-START CHECKING

Please read following procedures and checkpoints prior to starting-up the compressor during commissioning:

Items	Things to be checked	States or standard values
1. Accessories	1. Oil level	1. Higher than the middle line of oil level sight glass
	2. Oil heater	2. Should be kept energizing after compressor shut down.
	3. service valves	3. Fully opened
	4. Solenoid valves	4. Fixed correctly
2. Electrical system	1. Voltage of main power (primary side, power supply to inverter)	1. Please refer to inverter manual.
	2. Voltage of main power (secondary side, inverter to compressor motor)	2. The voltage of primary side needs to be higher than the voltage of secondary side
	3. Insulation resistance value of the motor between phase to phase and phase to ground.	3. Phase to phase: Insulation resistance values are zero. phase to ground: Insulation resistance value needs to be higher than 5MΩ.
	4. Power cables and terminal connection.	4. Power terminals are firmly fixed on terminal plate and well insulated. Keep power cables away from heat source and sharpened metal. Six power terminal nuts are fixed firmly on 6 terminal bolts and also well insulated.
	5. Grounding	5. Follow local electricity regulations and guidance
	6. Capacity of electrical components	6. Properly selected (or inquired by the system designer.)
	7. Settings of switches, sensors and controller.	7. Properly set (or inquired by the system designer.)
3. Piping system	1. piping work	1. Welded and fixed firmly.
	2. Leaking test	2. No leakage.
	3. Bolts to fix the compressor.	3. Fix the compressor tightly.
4. Safety devices	1. Motor coil thermistor	1. Connected in series with discharge thermistor to INT69HBY
	2. Discharge thermistor	2. Connected in series with motor thermistor to INT69HBY
5. Inverter setting	1. power cable connection 2. Inverter settings	1. Refer to the chapter#6 and inverter manual.

Compressor Start :

In addition to the pre-start checking, please read following guidance carefully before starting compressor:

- A. It is necessary to pay attention to auxiliary facilities while the chiller is commissioning and after initial start-up.
- B. In order to keep the Vi control smoothly under the low ambient temperature with the normal viscosity of oil, oil heater should be kept energizing after compressor shut-down for preparation of next start-up.
- C. Check all settings of pressure gauge/ switch/ set points are correct.
- D. Check if all the stop valves in the system are fully open prior to starting the compressor.
- E. The power cables are wired to inverter and compressor correctly (inverter primary and secondary side). The inverter setting is completed with static test before starting the system. Please refer to the chapter#6 for setup the inverter with compressor specifications.
- F. The compressor shall start at minimum frequency. Before starting, the pressure inside compressor is balanced between suction and discharge. The ramp up/ cycle off time shall be maintained at least 2 second for every 10Hz, it has to be complied with operation guideline of inverter.

Operating Precautions :

- A. Check the rotating direction of the compressor by starting the compressor for approx. 0.5...1sec. and check the suction and discharge pressure. The correct rotating direction is: suction pressure drops immediately and the discharge pressure will go up.
- B. Compressor lubrication should be checked immediately after starting. Oil condition can be observed from oil sight glass. It is normal to see the oil level fluctuating on sight glass during start-up due to unstable working conditions.
- C. Oil foaming can be generated during starting phase, but it should reduce when the compressor is under stable operating conditions. Otherwise this can indicate excessive liquid coming back from suction gas.
- D. The running condition of compressor after commissioning should be adjusted to maintain the discharge temperature at least 20K above the saturated condensing temperature, and suction vapor superheat should be within 10K to the saturated evaporating temperature in R134a. For other refrigerants, please consult Hanbell representatives.
- E. The pipelines must be checked if there is abnormal vibration. Please contact HANBELL or local distributor if any abnormal vibrations or noise found while compressor is in operation.
- F. Regularly check the chiller unit according to local safety and operation guidelines and check operating data of the machine:
 - Check the lubrication / oil level
 - All compressor protection devices
 - Check electrical cable connections and tightness of six terminal bolts
 - Compressor motor is operating within operation speed range
 - Compressor is operating within working conditions range
 - The volume ratio is adjusted automatically in line with working conditions
 - Continuous monitoring operating current and voltage is during compressor ramp up and cycle off, and ramp up/ cycle off time is maintained at 2 second for every 10Hz.

Compressor stop:

*Compressor runs at the minimum operating frequency before compressor stops, and the working condition is within operation range.

*Please adjust to low volume ratio by energizing compressor solenoid valve (refer to chapter#2.5)

*Following standard process for compressor stop, any power out of power supply to inverter or chiller unit is strictly prohibited.



7.2 Troubleshooting

The table below showed situation personnel may face at the jobsite during commissioning or upon operation of compressor and its corrective actions. This table will only serve as a guide for engineers to understand the situation if they occurs.

PROBLEMS	PROBABILITY CAUSES	REMEDY / CORRECTIVE ACTION	
Sudden trip of motor thermistor / sensor	Low suction pressure cause low refrigerant flow rate	Install liquid injection to motor coil	
	Refrigerant shortage	Charge refrigerant	
	Suction filter clogged	Clean filter	
	High suction temperature	Install liquid injection to motor coil	
	High suction superheat	Adjust the superheat less than 10K	
	Unstable electricity system or failure	Check electricity power supply	
	Motor overload	Consult Hanbell representatives	
	Bad motor coil causing temperature rising rapidly	Consult Hanbell representatives	
Unable to change motor speed/ frequency	1.Incorrect inverter setting on frequency upper and lower limit 2.Incorrect inverter setting on the motor 3.The operating torque and current is beyond the inverter setting	1.Refer to compressor nameplate for inverter setting (ref to chapter#2.7) 2.Refer to compressor nameplate for inverter setting (ref to chapter#2.7) 3.Check the setting is in line with compressor specifications. .	
Poor insulation of motor	1. Bad compressor motor coil.	Check the coil or change the motor stator	
	2. Motor power terminal or bolt wet or frosty.		
	3. Motor power terminal or bolt bad or dusty.		
	4. Bad insulation of magnetic contactors.		
	5. Acidified internal refrigeration system.		
	6. Motor coil running long time continuously under high temperature.		
	7. Compressor restart counts too many times.		
Start failure	1. incorrect wiring on power cables 2. incorrect inverter setup 3. PM motor failure	1.Check the power cables are correctly fasten on the terminal plate 2.Check the inverter setting 3.Check that whether it is degaussed or not (check the current of the secondary side is too high or the power factor% is too low) 3. Check the insulation resistance values between phase to phase & phase to ground.	
	Tripping on inverter during operation	1.High operating current 2.High operating torque 3.High temperature on IGBT	1.Check the inverter setting and compare to the data of selection software under the same condition 2.Check the inverter setting is in line with actual running conditions 3. Check the inverter cooling fan is working and working environment is in line with requirement.
		Abnormal vibration and noise of compressor	Damaged bearings.
Phenomenon of liquid compression.			Adjust proper suction superheat
Friction between rotors or between rotor and compression chamber.	Change screw rotors or/and compression chamber.		
Insufficient lubrication oil.	Check the oil level of the compressor if enough, add some oil if necessary.		
Loosen internal parts.	Dismantle the compressor and change the damaged parts.		
Electromagnetic sound of the solenoid valve.	Check		
System harmonic vibration caused by improper piping system.	Check the system piping and if possible improve it using copper pipe.		
External debris fallen into the compressor.	Dismantle the compressor and check the extent of the damage.		
Compressor does not run	Friction between slide valve and rotors.	Dismantle the compressor and change the damaged parts.	
	Motor rotor rotates imbalance.	Check and repair.	
	Motor line open	Check	
	Tripped overload	Check the electrical connection	
	Screw rotors seized	Replace screw rotors, bearings etc....	
	Motor broken	Change motor.	
	High discharge temperature	Insufficient refrigerant.	Check for leaks. Charge additional refrigerant and adjust suction superheat less than 10K
		Condenser problem of bad heat exchange.	Check and clean condenser
Refrigerant overcharge.		Reduce the refrigerant charge	
Air / moisture in the refrigerant system		Recover and purify refrigerant and vacuum system	
Improper expansion valve.		Check and adjust proper suction super heat	
Insufficient lubrication oil.		Check the oil level and add oil.	
Damaged bearings.		Stop the compressor and change the bearings and other damaged parts.	
Improper Vi value.		Change the slide valve.	
Compressor losses oil	No system additional cooling (Liquid injection or oil cooler)	Install additional system cooling (liquid injection or oil cooling or both base on working condition limitation)	
	Lack of refrigerant	Check for leaks. Charge additional refrigerant.	
	Improper system piping	Check and correct the piping or install an external oil separator	
Low suction pressure	Liquid fills back	Maintain suitable suction superheat at compressor	
	Lack of refrigerant	Check for leaks. Charge additional refrigerant.	
	Evaporator dirty or iced	Defrost or clean coil	
	Clogged liquid line filter drier	Replace the cartridge	
	Clogged suction line or compressor suction strainer	Clean or change suction strainer	
	Expansion valve malfunctioning	Check and reset for proper superheat	
Vi control failure	Condensing temperature too low	Check means for regulating condensing temperature	
	1.Solenoid coil are not energized correctly 2. Control logic setting on solenoid valve is incorrect. 3.Oil pressure too low	Check the solenoid valve are on and off correctly by energizing the solenoid coils Check the Vi control logic is accordingly to chapter#2.5 Check the oil pressure is closed to discharge pressure and pressure differential between oil pressure and suction pressure is maintained at least 4 bars.	

Note:

The replacement of compressor internal parts should be performed only by certified service technician with full knowledge of HANBELL screw compressors.



7.3 Compressor checking list

Please fill in the compressor checking list and send it to Hanbell, if any failure of compressor happened. Hanbell will reply and suggest solutions to solve the failure.

CHECK LIST FOR TROUBLESHOOTING OF HANBELL SCREW COMPRESSOR

Compressor model : _____ Compressor S/N : _____
 System design condition (SCT/SST) : _____ Evaporator type : _____
 Refrigerant type : _____ Liquid injection : Motor Chamber
 Secondary-side voltage : R-S: _____ S-T: _____ R-T: _____
 Secondary-side current : _____ A
 Over load setting : _____ A
 Operating current (full load) : R: _____ S: _____ T: _____
 Description of problem :

- A : abnormal noise dBA at % capacity
- B : abnormal vibration
- C : over current
- D : motor burnout
- E : unable to load
- F : unable to unload
- G : leakage (Photo would be a plus)
- H : accessory parts damaged (Photo would be a plus)

Suction pressure	Discharge pressure	Suction temp.	Discharge temp.	Liquid line temp.	Condenser water temp.		Chiller water temp.		Oil cooler temp.	
					inlet	outlet	inlet	outlet	inlet	outlet

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8. Application Instructions and Precautions

8.1 Auxiliary Cooling

When the compressor is used in the following scenarios, it is recommended to install auxiliary cooling devices to reduce the discharge temperature, maintain oil temperature, and cool the motor coils, ensuring the compressor operates safely and efficiently.

- Condenser is air-cooled system.
- High compression ratio systems such as heat pumps and low-temperature refrigeration systems.
- Systems with high discharge temperatures, such as heat recovery systems.
- Other high-load applications.

The following are detailed explanations of two types of auxiliary cooling devices.

a. Liquid Refrigerant Injection Cooling System

When operating under conditions of high condensing temperature or low evaporating temperature (within the permissible operating range), additional cooling devices are required to maintain the safe operation of the compressor. Generally, a liquid refrigerant injection system is installed on the motor side (low-pressure side) or compression chamber (mid-pressure side) of the compressor as an additional cooling device.

The purpose of installing a liquid injection system is to prevent the compressor from overheating. By controlling the expansion valve and solenoid valve, a portion of the liquid refrigerant is extracted from the liquid pipe and injected into the compression chamber and motor for cooling, ensuring normal and safe operation of the compressor. For operation under air-cooled and heat pump conditions, it is recommended to control the intake superheat within the range of 5K to 10K. Users can adjust the opening of the expansion valve to control the refrigerant flow rate and thus control the superheat at the suction side. Especially during the startup of the unit, when the water temperature is high and the motor load is heavy, the low-pressure side may experience excessively high superheat, and in such cases, the liquid injection system must supply sufficient cooling capacity to prevent compressor overheating.

Cooling Capacity Calculation of Liquid Injection System

The cooling capacity of the liquid injection system can be calculated using the selection software provided by our company or by self-calculating the system heat load. When self-calculating, consider the most extreme operating conditions faced during actual operation. For example, consider the lowest evaporating temperature, highest suction superheat, and highest condensing temperature.

Application of Low-temperature Expansion Valve Liquid Injection System

For low-temperature applications (evaporating temperature below -10°C), there are two options for liquid refrigerant injection: One is in front of the compressor motor and the other is in the middle section of the compression chamber. The former provides auxiliary cooling for the motor and discharge temperature control, while the latter reduces the discharge temperature, as shown in the diagram below. However, if the system is already equipped with ECO, oil coolers, or operates under low condensing temperature and low discharge temperature conditions, the liquid injection system may not operate even if there is excessive motor temperature rise. In such cases, it is recommended to install a motor temperature detector (PT100 Ω or PT1000 Ω) to assist the liquid injection system.

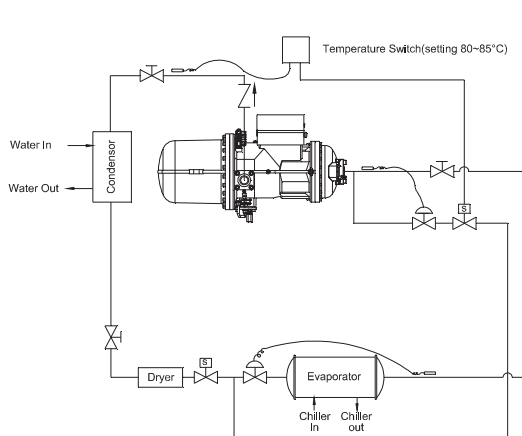


Figure: Liquid Injection for Cooling Motor

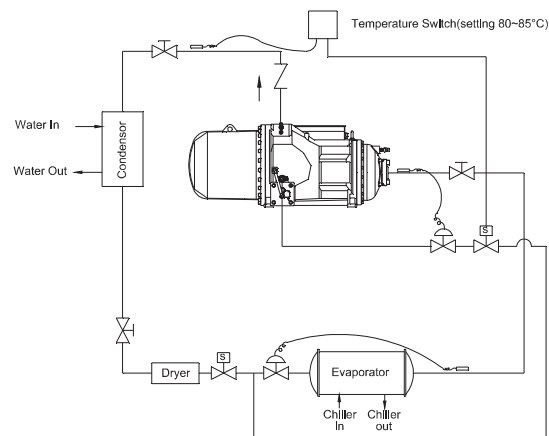


Figure: Liquid Injection for Cooling Compression Chamber

Application of High-temperature Expansion Valve Liquid Injection System

By selecting a high-temperature expansion valve that senses the compressor's discharge temperature, the opening of the expansion valve can be controlled based on the temperature range to achieve optimal cooling effectiveness. Generally, it is recommended to control the compressor's discharge temperature at around 80 to 90°C for the best results.

In front of the high-temperature expansion valve, a solenoid valve or stop valve can be installed to facilitate future maintenance operations. The solenoid valve can be activated simultaneously with the compressor. The balance pipe of the high-temperature expansion valve should be connected to the high-pressure side for internal balancing purposes.

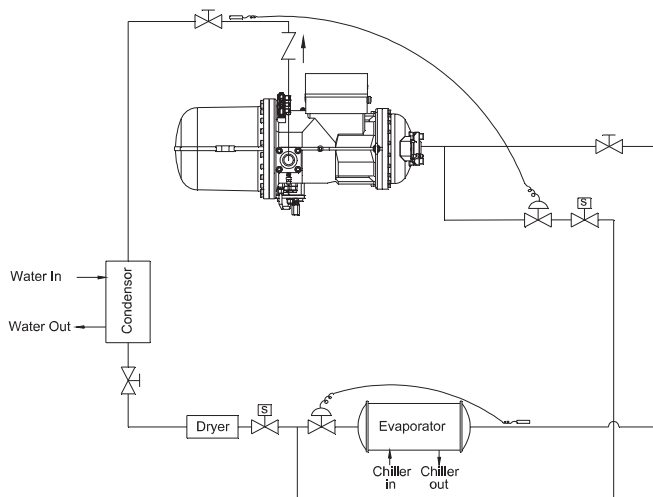


Figure: Liquid Refrigerant Injection (High-temperature Expansion Type) Linked with the Motor

b. External Oil Cooler for Compressor

Compared to the liquid injection system, an external oil cooler not only reduces the discharge temperature but also improves the compression efficiency by enhancing the sealing effect of the compression chamber. There are three types of oil coolers: liquid refrigerant cooling, air cooling, and water cooling. The cooling performance of the oil cooler can be calculated based on the system's thermal load or determined using selection software provided by the manufacturer. When calculating manually, it is important to consider the most extreme operating conditions faced during actual operation, such as the lowest evaporating temperature, highest suction superheat, highest condensing temperature, and real operating conditions.

Liquid Refrigerant Cooling:

The oil cooler utilizes refrigerant as the cooling medium.

Note: As shown in the diagram, control the opening and closing of the pipeline of the liquid line solenoid valve based on the oil temperature discharged from the compressor.

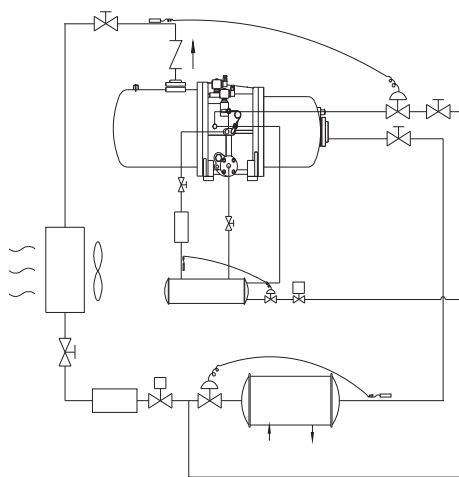


Figure: Liquid Refrigerant Cooling
(Refrigerant returning to the compressor liquid injection port or economizer port)



Air-cooled Cooling System

The following figure represents a typical air-cooled cooling system. This cooling method utilizes the continuous circulation of ambient air through the oil cooler to achieve a reduction in oil temperature.

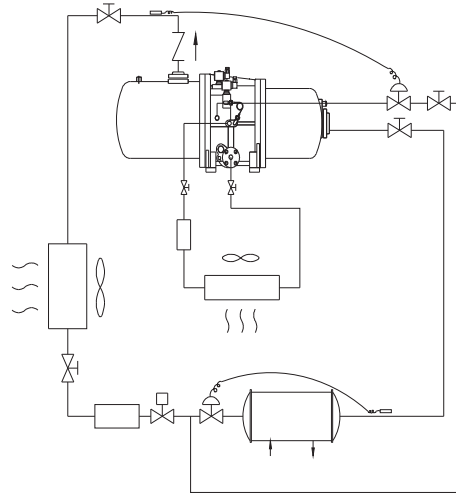


Figure: Air-cooled Oil Cooling System

Water-cooled Cooling System

This cooling method utilizes a shell and tube heat exchanger design and relies on external cooling water from a cooling tower or a closed-loop evaporator for cooling. It is also possible to use a non-circulating water cooling method, but it requires a significant amount of water. In an indirect cooling system, a pump is used to circulate the cooling medium, and the heat is expelled from the cooling medium through a cooling water tower or an evaporative cooler.

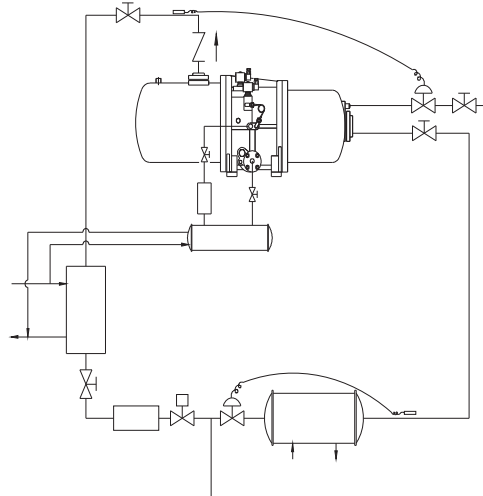


Figure: Water-cooled Cooling System

Note:

1. The heat load of the oil cooler can be calculated using our company's selection software.
2. It is recommended that the pressure drop of the oil cooler's piping should not exceed 1.5 kg/cm².
3. When an oil cooler is installed on the compressor, please add an appropriate amount of lubricating oil to the oil cooler and oil lines.

8.2 Parallel System Application

In a multiple compressor parallel system, uneven distribution of oil return in the evaporator may occur, leading to uneven oil return to each compressor. Over time, this can result in low oil levels or even oil loss in certain compressors. Therefore, it is necessary to install oil level switches on each compressor and oil flow switches in the oil return line to ensure proper oil return and maintain normal oil levels.

The following figure depicts the basic circuit design of a parallel system with dual compressor units. The components shown in the diagram are the fundamental equipment. For additional applications or protective devices, please contact our company or local distributors for further information.

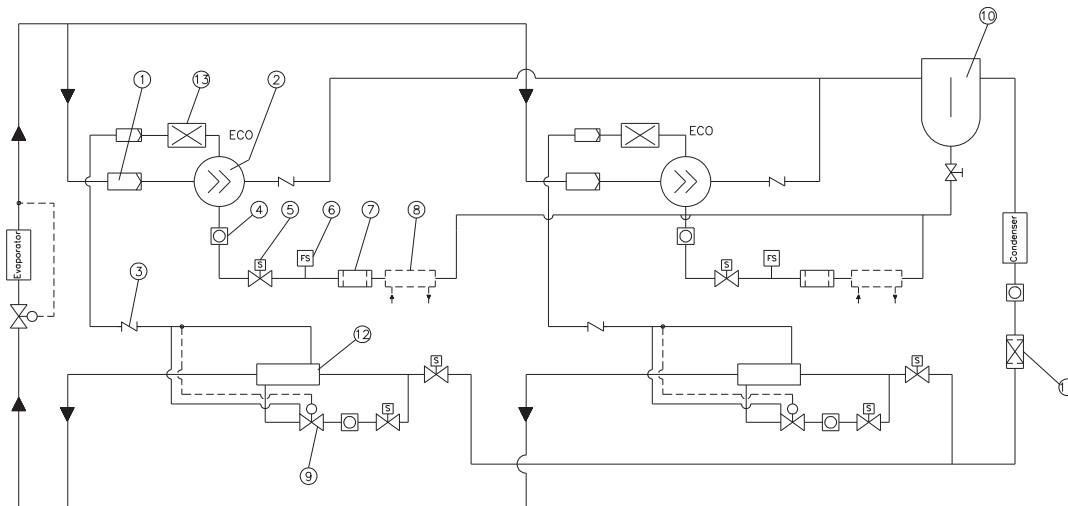


Figure: Dual Compressor Parallel Main Unit System

Item	Description	Item	Description	Item	Description
1	Suction filter	6	Oil flow switch	11	Filter dryer
2	Compressor	7	Oil filter	12	Economizer
3	Stop valve	8	Oil cooler	13	Muffler
4	Sight glass	9	Expansion valve		
5	Flow switch solenoid valve	10	External oil separator		

Table: Explanation of Dual Unit Parallel Main System Flow



8.3 Oil Pump Application

When the pressure difference in the system is less than 4 bar, it is recommended to install an oil pump. In situations of low pressure difference, it can affect the operation of the compressor's capacity control device, as well as lubrication and cooling of the bearings. This can lead to severe damage to the compressor. In addition to installing an oil pump, it is also advisable to install a high-low pressure differential switch in the system. For further information on oil pump application, please contact our company.

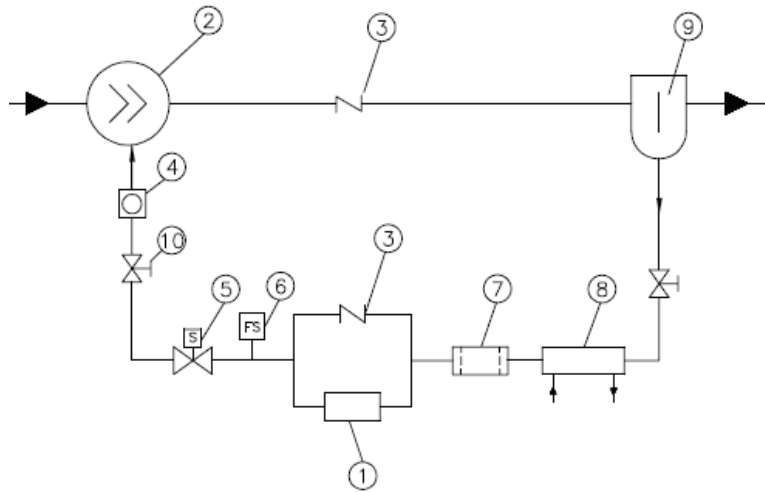


Figure: Recommended Oil Pump Diagram

tem	Description	Item	Description	Item	Description
1	Suction filter	6	Oil flow switch	11	Dry filter
2	Compressor	7	Oil filter	12	Economizer
3	Stop valve	8	Oil cooler	13	Muffler
4	Sight glass	9	Expansion valve		
5	Flow switch solenoid valve	10	External oil separator		

8.4 Important Considerations for Compressors

Unless for maintenance or long-term shutdown purposes, Hanbell advises that do not to perform pump down procedures during regular operation. This is because during pump down, the sudden reduction in refrigerant volume at the suction side can cause overheating of the motor and excessive temperature in the compression chamber. If pump down is absolutely necessary, please follow the following guidelines:

- It is recommended to perform compressor pump down procedures under full load conditions.
- Each pump down procedure should be completed in one operation. Avoid repeating pump down procedures as it can cause serious damage to internal components of the compressor.
- The minimum pressure at the suction side during pump down should be greater than 0.5 kg/cm²G.
- The pump down procedure should not exceed 15 seconds each time.
- During pump down, the discharge temperature of the compressor should not exceed 110°C.
- Pay attention to details such as high-low pressure differentials, oil level, and noise. If any abnormalities occur, immediate shutdown is recommended.

2. Long-Term Operation at Partial Load

If the compressor needs to operate regularly at partial load, even if it is within the operating limits and the motor temperature does not exceed the thermal trip setting, there may be insufficient motor cooling due to lower refrigerant flow at the suction side during partial load operation. On the other hand, if the compressor operates at high temperatures for an extended period, the insulation of the motor will gradually deteriorate, leading to motor damage. Therefore, it is recommended to install a liquid injection cooling system to cool the motor windings if the compressor needs to operate under these harsh conditions. It is also advisable to select and use a motor temperature detector such as PT100Ω or PT1000Ω (as mentioned earlier) to effectively control the motor temperature during operation. The recommended cooling switch activation is when the motor coil temperature exceeds 80-90°C, and deactivation when it falls below 60-70°C.

3. Occasions for using a low-pressure liquid receiver:

- Heat pump system
- Parallel system
- System with long piping
- Used in low ambient temperature
- System with significant thermal load variations

9. Selection Software

Please download the latest selection software from the official Hanbell website.
http://www.hanbell.com/service_program.html



10. Product Warranty

All our compressors undergo strict quality control and performance testing before leaving the factory. During the warranty period, we provide free service for any quality defects or damages caused by manufacturing reasons, as determined by our company. However, certain consumable parts of the products are not covered under this free service warranty. Incidents such as damage during transportation, natural disasters, wars, or malfunctions caused by improper operation, maintenance, or unauthorized repair or modification by personnel other than our company's staff are not included in the product warranty.

We advise all customers using Hanbell products to immediately notify the original manufacturer if any abnormal conditions or compressor malfunctions are observed, in order to eliminate the factors causing the issue. Modifying the system or forcing the operation of the compressor without proper authorization may result in compressor damage. The warranty period for the entire Hanbell product range is 12 months after operation or 18 months after compressor delivery, whichever comes first.



North American Distributor of Hanbell Compressors

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