Contents

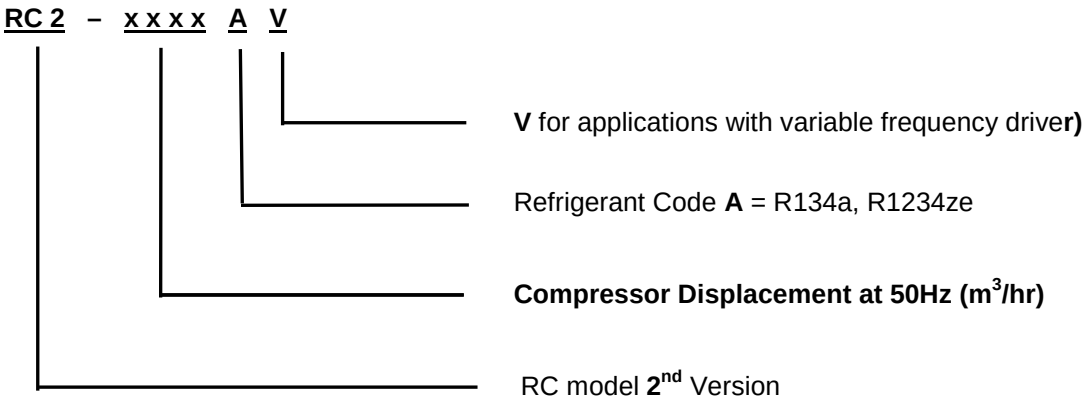
1. General

HANBELL **RC2-AV** series semi-hermetic screw compressor is developed especially for applications with variable frequency drive, VFD (frequency inverter) in air-conditioning and refrigeration. It inherits merits of RC2 series compressor in its basic design but is upgraded in its mechanism of capacity modulation as well as its dedicated design of motor for VFD applications. Each HANBELL compressor has the latest and advanced **5-to-6 Patented Screw Rotor Profile** designed to ensure high capacity and efficiency in all operating conditions. Each unit is carefully manufactured and inspected by high precision THREAD SCREW ROTOR GRINDING MACHINE, CNC MACHINING CENTER, and 3D COORDINATE MEASURING MACHINE. Each **HANBELL** compressor follows **ISO 9001** quality system. This certification assures that its quality is controlled under severe quality procedures and good service to all customers.

RC2-AV series compressor is equipped with liquid injection, economizer connection, PTC motor temperature thermistors, discharge temperature thermistors and a motor protector for additional cooling and basic protection; other accessories such as oil level switch and oil pressure differential switch are also available for advanced protection. The complete accessories and their new designs guarantee the compressor has the best reliability, longest bearing life during heavy duty running and strict operating conditions.

This Technical Manual contains information about lifting, dimensions, installation, operation, applications and basic trouble-shooting. It is strongly recommended that relevant personnel read this manual carefully before lifting, installation, and commissioning of RC2-AV series compressor in order to prevent any accident or damage. Please contact HANBELL or its local distributors/agents for more information or further assistance.

2. Specifications and description of design
2.1 Compressor nomenclature



2.2 Compressor specifications

RC2-AV

MODEL	COMPRESSOR			MOTOR							Lubricant charge	Oil Heater	Hydrostatic Pressure Test	WEIGHT
	Displacement 50Hz(m3/hr)	Rated Speed (rpm)	VI	Type	Nominal (Hp)		Starting	Voltage (V)	Insulation	Protection	L	W	Kg/cm2G	kg
RC2-100AV	98	1750~4750	2.2 2.6 3.0 3.5 4.8	3 Phase, 2 Pole, Squirrel Cage, Induction Motor	30	19	△ start	380~460	Class F	PTC	7	150/300	42	275
RC2-140AV	137	1750~4750			42	26					7			280
RC2-180AV	180	1750~4750			56	35					7			300
RC2-200AV	193	1750~4750			59	37					8			420
RC2-230AV	230	1750~4750			70	44					14			540
RC2-260AV	257	1750~4750			78	49					14			545
RC2-300AV	293	1750~4750			90	56					16			590
RC2-310AV	308	1750~3550			71	59					16			575
RC2-340AV	339	1750~4750			102	64					16			600
RC2-370AV	366	1750~3550			84	70					16			610
RC2-410AV	407	1750~4750			125	78					16			730
RC2-430AV	423	1750~4750			125	78					16			735
RC2-470AV	471	1750~4750			144	90					18			800
RC2-510AV	508	1750~3550			117	98					20			760
RC2-550AV	549	1750~4750			168	105					23			820
RC2-580AV	583	1750~3550			131	109					20			805
RC2-620AV	619	1750~4750			182	114					23			850
RC2-710AV	713	1750~3550			158	131					28			1099
RC2-790AV	791	1750~3550			175	146					28			1140
RC2-830AV	825	1750~3550			183	152					28			1150
RC2-930AV	929	1750~3550			212	176					28			1180
RC2-1020AV	1017	1750~3550			227	189					40			1500
RC2-1130AV	1122	1750~3550			248	206					40			1520
RC2-1270AV	1268	1750~3550			286	238					53			2100
RC2-1530AV	1539	1750~3550			331	275					53			2200

Nominal horse power:
All the above Nominal Hp values are not the maximum compressor Hp. Please refer to Hanbell selection software for rated current according to various operating conditions while sizing inverter, AC reactor, contactor, cable, fuse and wirings, etc…

2.3 RC2-AV series compressor construction

RC2-100AV, RC2-140AV, RC2-180AV construction

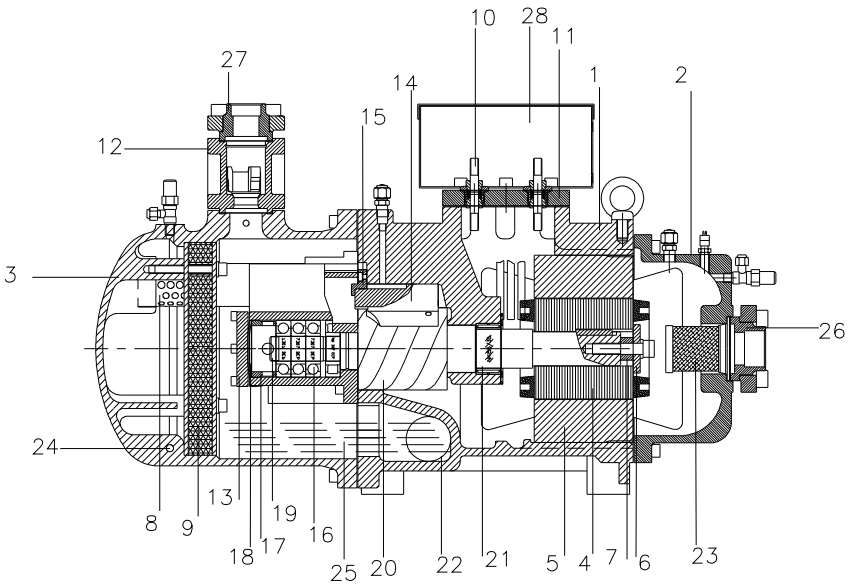


Figure 1

Item	Description	Item	Description	Item	Description	Item	Description
1	Compressor casing	8	Oil separator muffler	15	Vi plug key	22	Oil filler cartridge
2	Motor casing	9	Oil separator demister	16	Discharge bearings	23	Suction filter
3	Oil separator	10	Power bolt	17	Discharge bearing fixed ring	24	Oil heater
4	Motor rotor assembly	11	Terminal cover plate	18	Disc spring	25	Refrigeration Oil
5	Motor stator assembly	12	Discharge check valve	19	Bearing lock nut	26	Suction flange
6	Motor rotor washer	13	Discharge cover plate	20	Male rotor	27	Discharge flange
7	Motor rotor spacer ring	14	Fixed Vi plug	21	Suction bearings	28	Cable box

RC2-200AV, RC2-230AV, RC2-260AV, RC2-300AV, RC2-310AV, RC2-340AV, RC2-370AV, RC2-410AV, RC2-430AV, RC2-470AV, RC2-510AV, RC2-580AV construction

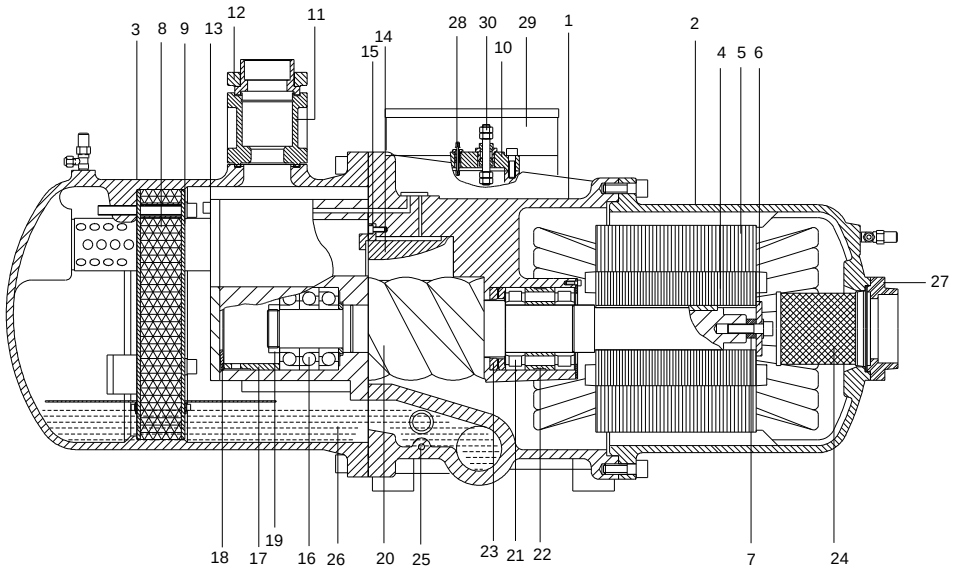


Figure 2

Item	Description	Item	Description	Item	Description	Item	Description
1	Compressor casing	9	Oil separator demister	17	Discharge bearing fixed ring	25	Oil heater
2	Motor casing	10	Terminal cover plate	18	Disc spring	26	Refrigeration Oil
3	Oil separator	11	Discharge check valve	19	Bearing lock nut	27	Suction flange
4	Motor rotor assembly	12	Discharge flange	20	Male rotor	28	PTC terminals
5	Motor stator assembly	13	Discharge cover plate	21	Suction bearings	29	Cable box
6	Motor rotor washer	14	Fixed Vi plug	22	Suction bearing inner/outer spacer ring	30	Power bolt
7	Motor rotor spacer ring	15	Vi plug key	23	Oil guiding ring		
8	Oil separator muffler	16	Discharge bearings	24	Suction filter		

RC2-550AV, RC2-620AV construction

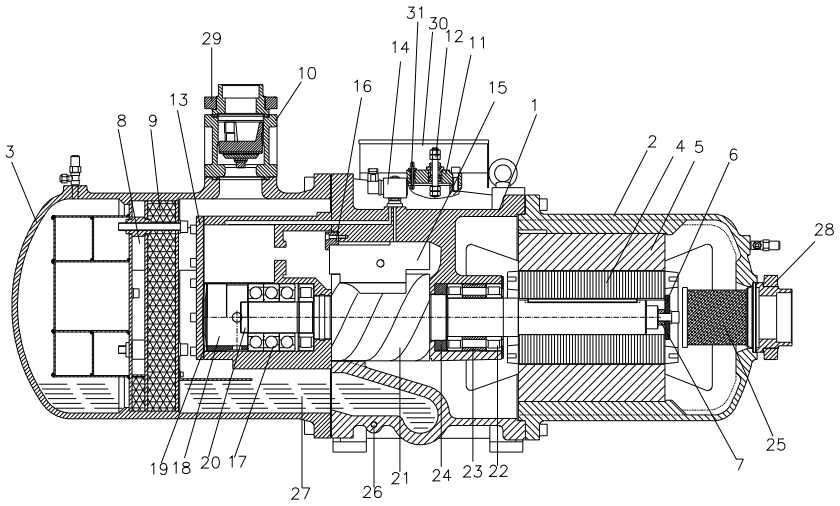


Figure 3

Item	Description	Item	Description	Item	Description	Item	Description
1	Compressor casing	9	Oil separator cartridge	17	Discharge bearings	25	Suction filter
2	Motor casing	10	Discharge check valve	18	Discharge fixed ring	26	Oil heater
3	Oil separator	11	Motor cable cover plate	19	Disc spring	27	Refrigeration Lubricant
4	Motor rotor assembly	12	Power bolt	20	Bearing lock nut	28	Suction flange
5	Motor stator assembly	13	Bearing seat's cover plate	21	Male rotor	29	Discharge flange
6	Motor rotor washer	14	Modulation solenoid valve	22	Suction bearings	30	Cable box
7	Motor rotor spacer ring	15	Fixed Vi plug	23	Suction bearings inner/outer spacer ring	31	Thermostat terminals
8	Oil separator baffle	16	Vi plug key	24	Oil guiding ring		

RC2-710AV, RC2-790AV, RC2-830AV, RC2-930AV Construction

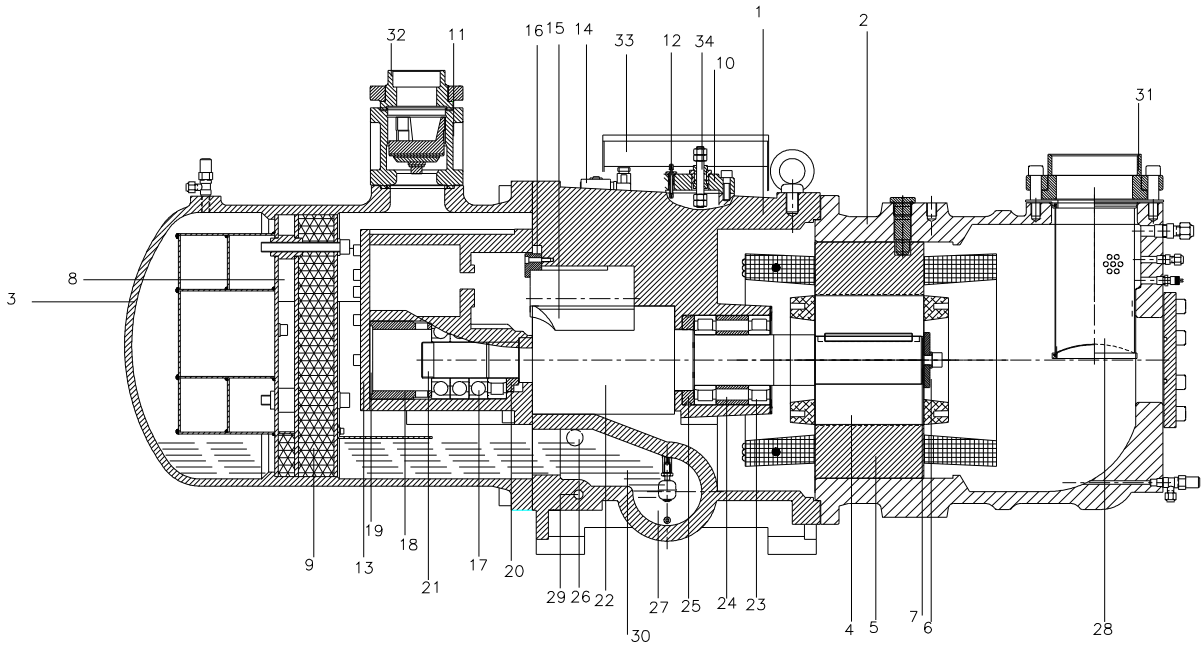


Figure 4

Item	Description	Item	Description	Item	Description	Item	Description
1	Compressor casing	11	Discharge check valve	21	Bearing lock nut	31	Suction flange
2	Motor casing	12	Thermostat terminals	22	Male rotor	32	Discharge flange
3	Oil separator	13	Bearing seat cover plate	23	Suction bearings	33	Cable box
4	Motor rotor assembly	14	Modulation solenoid valve	24	Suction bearings inner/outer spacer ring	34	Power bolt
5	Motor stator assembly	15	Fixed Vi plug	25	Oil guiding ring		
6	Motor rotor washer	16	Vi plug key	26	Oil level sight glass		
7	Motor rotor spacer ring	17	Discharge bearings	27	Oil filler cartridge		
8	Oil separator baffle	18	Discharge fixed ring	28	Suction filter		
9	Oil separator cartridge	19	Disc spring	29	Oil heater		
10	Motor cable cover plate	20	α-Balance piston	30	Refrigeration Lubricant		

RC2-1020AV, RC2-1130AV, RC2-1270AV, RC2-1530AV construction

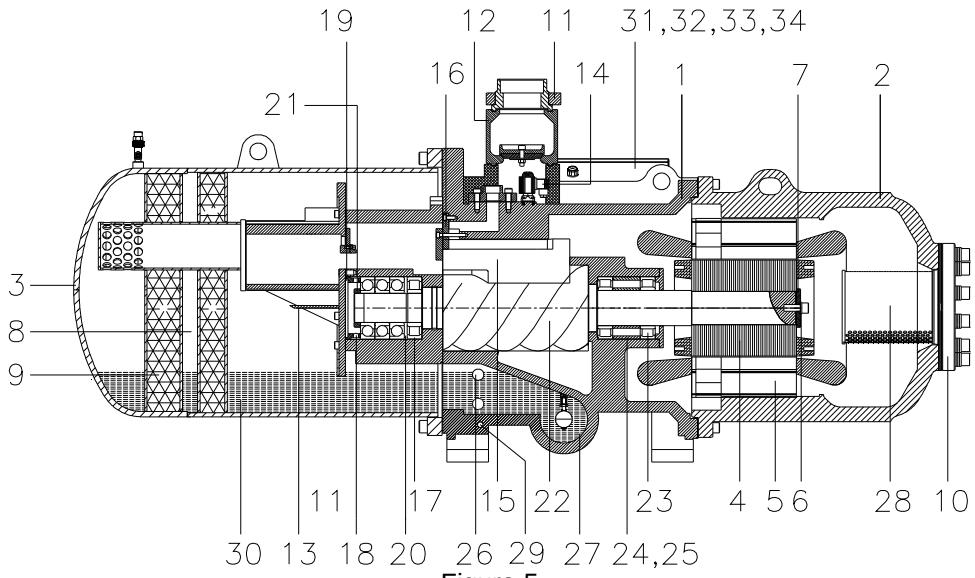


Figure 5

Item	Description	Item	Description	Item	Description	Item	Description
1	Compressor casing	10	Suction flange	19	Disc spring	28	Suction filter
2	Motor casing	11	Discharge flange	20	Balance piston	29	Oil heater
3	Oil separator	12	Discharge check valve	21	Bearing slot nut	30	Refrigeration Lubricant
4	Motor rotor assembly	13	Bearing seat cover plate	22	Male rotor	31	Thermostat terminals
5	Motor stator assembly	14	Modulation solenoid valve	23	Suction bearings	32	Motor cable cover plate
6	Motor rotor washer	15	Modulation slide valve	24	Suction bearings inner/outer spacer ring	33	Cable box
7	Motor rotor spacer ring	16	Slide valve key	25	Oil guiding ring	34	Power bolt
8	Oil separator Baffle	17	Discharge bearings	26	Oil level sight glass		
9	Oil separator cartridge	18	Discharge fixed ring	27	Oil filler cartridge		

2.4 Design features

HANBELL screw compressors feature simple and robust construction by elimination of some components such as pistons, piston rings, valve plates, oil pumps which are found in reciprocating compressors. Without these components, screw compressors run with low noise level, minimized vibration, high reliability and durability. HANBELL screw compressors are of two-shaft rotary displacement design with the latest and advanced 5:6 patented screw rotors. Screw rotors are precisely installed with roller bearings, i.e. radial bearings at both suction and discharge ends as well as angular contact ball bearings i.e. axial bearings at discharge end. A three-phase, two-pole squirrel-cage induction motor drives the compressor. The motor rotor is located on the shaft of the male screw rotor. Cooling of the motor is achieved with suction refrigerant vapor.

Compressor technical features:

Full product range- RC2-V series compressor consists of 26 models with displacement ranging from 98 m^3/hr up to 1539 m^3/hr at 50Hz.

Multinational patents of high-efficiency screw rotors- The new 5:6 high efficiency screw rotor profile is patented in Taiwan, UK, US, and China. This new large-volume, high-efficiency rotor profile is designed especially for modern refrigerant characteristics. High-efficiency screw rotors are accomplished by using precision CNC machining centers, rotor milling machines, rotor grinding machines. Strict ISO 9001 process controlling and the application of precise inspection equipments, such as ZEISS 3D coordinate measuring machines, ensure high-efficiency, high-quality, low-noise and low-vibration HANBELL RC2-V series screw compressors.

High efficiency motor- Premium grade low-loss core steel with special motor cooling slot and refrigerant guide vane which pilot the cold suction refrigerant gas through the motor provides the highest operating efficiency possible no matter how strict operating conditions are. The winding and insulation is especially made for variable speed drive application.

Long life bearings and high reliability- RC2-AV screw compressors utilize precise axial and radial bearings and α axial balance piston to ensure longer bearing life and higher compressor reliability.

Double-walled rotor housing- Double casing structure with high strength inner ribs has been designed to minimize noise and ensure rigidity. The rotor housing is made of high-strength gray cast iron FC25 that is extremely stable, therefore no expansion will occur even at high-pressure condition. These casings are machined by computer aided machining centers and inspected by precision measuring machines to enhance reliability.

Direct flange-on oil separator- A vessel made of ductile material FC 500 specially designed to withstand high pressure and provide the highest efficiency of oil separation. Simple oil management, three-staged oil separator, low-pressure-drop demister to ensure the minimum refrigerant dilution in the oil and maintain high oil viscosity.

Precise capacity control- Instead of slide valve, RC2-V series screw compressors modulate capacity by varying rotation speed of motor rotor between 20 and 80(60) Hz.

Perceptive protection modules- RC2-V series screw compressors are equipped with PTC thermistors and motor protection module which could monitor discharge and motor coil temperature. Accessories such as oil level switch to monitor the level of oil, pressure differential switch, and pressure relief valve are options for specific applications.

Adaptable with additional cooling- Liquid injection connection port located on the motor casing and the compression casing. There are also oil cooler connectors and economizer connection port to meet application needs.

2.5 Compression process

a. Suction and sealing:
   At the beginning of the compression cycle, as the male rotor and female rotor unmesh, gas from suction port fills the interlobe space (refer to the dark area in Figure 6). Refrigerant at suction pressure continues to fill it, until the trailing lobe crosses the suction area and the gas is trapped inside the interlobe 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.

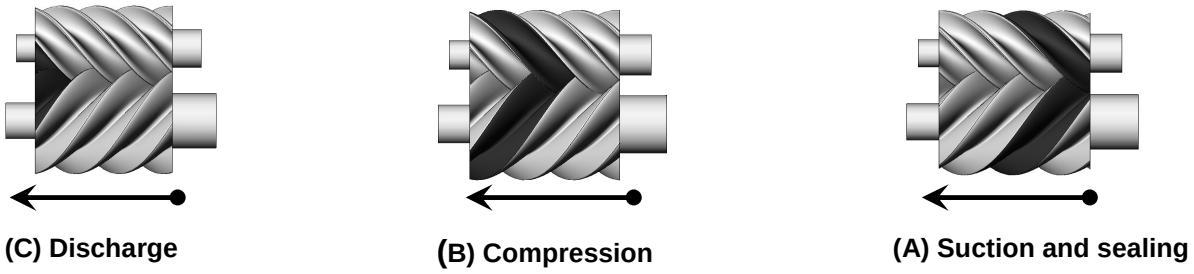


Figure 6 Compression process

2.6 Guide to VFD application

When operating RC2-V series screw compressor with frequency inverter (VFD, variable frequency driver), pay attention to following points:

1. Max rotation frequency must be within nominal rotation frequency of the motor; min rotation frequency should be 20Hz.
2. To run compressors out of working frequency mentioned above, e.g. powering a 380V/3P/70Hz motor between 20 and 80Hz, please consult Hanbell before running. Running at frequency out of designed range will result in lower efficiency or serious damage to the compressor and motor.
3. Consult your VFD supplier before installation to check if the ambient conditions are proper for the VFD. If necessary, the VFD should be fully-enclosed for adequate cooling and humidity-control.
4. Consult your VFD supplier to get compatible NFBs for better protection.
5. An AC reactor should be installed between the power supply and the VFD (primary side). The installation of another AC reactor between the compressor and the VFD (secondary side) is strongly recommended, especially when the wiring length between the VFD and the motor is longer than 5m. Consult your VFD supplier for reactor selection and installation.
6. Wiring of chiller controller and compressor protection modules such as PTC thermistors or oil level switch should be isolated from wiring of the VFD's power input/output to prevent interference.
7. VFD and compressor must be well-grounded respectively.
8. Use VFD phase loss and phase sequence detecting functions and nullify detection of motor protector INT69HBY to

prevent interference.

9. To prevent reverse rotation caused by incorrect wiring, inspect high/low pressures by pressure switches or programming in commissioning.
10. High/low pressure differential of compressor should be kept above 4kg/cm^2, especially at low rotation speed. If there is external oil circuit, oil flow switch should be installed and oil pressure in the main oil return line should be monitored to ensure adequate lubrication of compressor.
11. If high/low pressure differential or oil pressure in the main oil return line can't be ensured, an oil pump or pressure regulation valve must be installed.

2.7 Capacity control system

Although RC2-V series is similar to the RC2 series, the mechanism of capacity modulation has been changed from slide valve into variation of motor rotation speed. Compared to modulating by slide valve, varying rotation speed through VFD can greatly enhance effectiveness of compression, and especially volume efficiency under partial load. On the other hand, VFD can supply motor adequate voltage and power input according to target rotation speed; in this way, variation in power input during capacity modulation becomes more linear so it reduces unnecessary power loss. As a result, capacity modulation by VFD is superior than by slide valve in volume efficiency and power consumption.

Capacity modulation by VFD is similar to step-less capacity modulation by slide valve. As long as VFD receives analog signals e.g. DC 0~10V or 4~20mA from PLC or microcontroller, it directs the compressor to run at corresponding rotation speed proportionally to achieve capacity modulation.

To have PLC or microcontroller control VFD stably, pay attention to the following notes:

1. Wiring for analog signals should be well-insulated to prevent interference and noise.
2. Wiring for signals connected to VFD should be isolated from wirings of VFD power supply at a distance.
3. PLC, microcontroller and VFD should be well-grounded respectively to prevent cross interference.

Procedures for initial setting are as follows:

1. When completing VFD setting, remove wiring of VFD power output, and check if VFD's output frequency and corresponding voltage comply with output signal of PLC or microcontroller, e.g. for DC 0~10V with 380V/3P/70Hz motor, when analog signal is 10V, VFD output should be 70Hz and 380V; when analog signal is 7.14V, VFD output should be 50Hz and 272V and so on.
2. VFD output current can't be verified without any load but its frequency and output voltage still can be registered by VFD display. VFD output voltage is not normal A/C voltage so it can't be measured by general clamp meter.
3. In addition to analog signals, other communication between microcontroller and VFD should be checked also, such as VFD failure feedback or reset command, etc…

2.8 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, 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.

$CR = Pd/Ps$
$Pi = Vi^{k}$
$Vi = Vs/Vd$

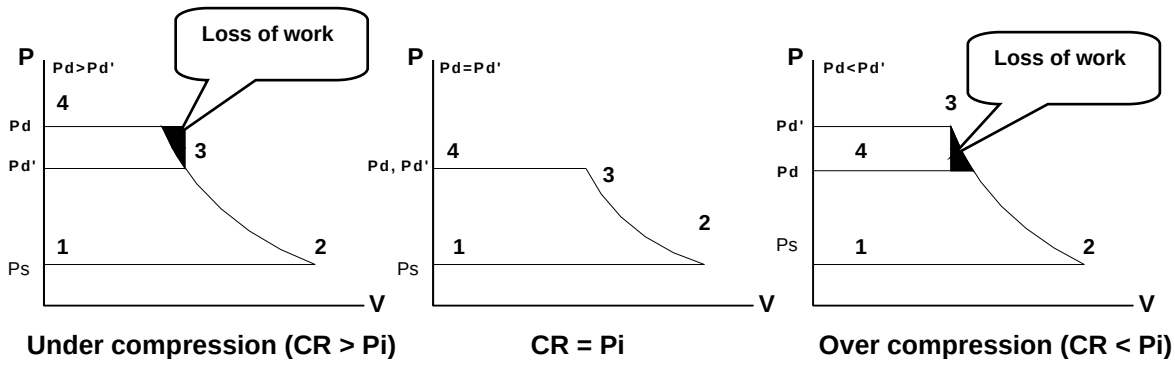


Figure 7 P-V Diagram

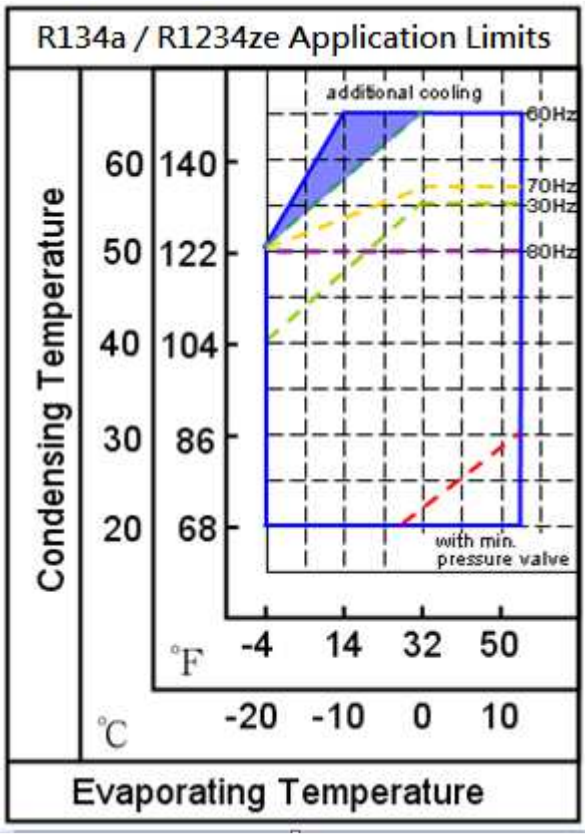
Where:

CR: system compression ratio
Pi: internal 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

2.9 Application limits

Application limits of the compressor vary significantly with the type of refrigerant used. The application limits shown below are based on saturated suction and discharge operating conditions, for continuous operation over extended periods of time. It is important to operate within these limits to maintain proper compressor life. Operating at extra low saturated suction temperature, may cause oil management and motor cooling problems, while operating at extra high saturated condensing temperature will shorten the compressor life due to insufficient motor and compressor chamber cooling.

Application limits of RC2-100AV~RC2-1530AV



Note:

1. When Hanbell screw compressors operate at partial or full load within application limits, motor coil and discharge temperature will rise simultaneously. In order to keep compressor running safely and continuously, Hanbell recommends the following additional cooling devices:
   (1) Oil cooler or
   (2) Liquid injection to chamber or
   (3) Liquid injection to motor

   Please use Hanbell selection software to get recommended additional cooling capacity.

2. Hanbell recommends monitor oil pressure and keep it 4 kg/cm^{2}g over the suction pressure for adequate seal, lubrication by pressure differential switch. Oil pump could be applied especially under operation conditions with low condensing temperature and high evaporating temperature such as flooded water-cooled chillers whose high-low pressure differential tends to be less than 4kg/cm^{2}g. Contact Hanbell to verify potential operating conditions outside the application limits shown above.

3. The minimum discharge superheat is 10K higher than the condensing temperature (normally discharge superheat is around 20K) to avoid liquid returning to compressor and lubrication failure.

3. Lubricants

The main functions of lubrication oil in screw compressors are lubrication, internal sealing and cooling. At most conditions, the design of positive pressure differential lubrication system makes RC2-AV series to run without extra oil pump which is necessary for reciprocating compressors. However, in some special applications, it is still necessary to install an extra oil pump to screw compressors for safety.

Bearings used in RC2-V series compressors require a small and steady quantity of oil for lubrication. Oil injection into compression chamber creates oil film for sealing in the compression housing to increase efficiency and also dissipate some compression heat.

Please pay attention to the oil temperature, which is crucial to compressor bearing life. Viscosity of oil becomes low at high temperatures. Low viscosity of oil results in poor lubrication and poor heat dissipation in the compressor. Viscosity should be over 10mm^2/s at any oil temperature. Oil temperature in sump should be kept above the saturated condensing temperature to prevent refrigerant migration into lubrication system.

If the compressor operates under critical operating conditions, oil cooler is required – please refer to Hanbell selection software for the required capacity and oil flow of the oil cooler. High-viscosity oil is recommended for high operating conditions because high discharge temperatures will make oil less viscous. Oil return could be problems from the evaporator in refrigeration systems and flooded chillers, etc…, in which it is difficult for oil to be carried back and it may cause oil loss for compressor. If the system encounters oil return problems, an extra 2nd oil separator should be installed between the compressor discharge port and the condenser.

Every HANBELL RC2-AV compressors is equipped with oil sight glasses. The function of internal oil line sight glass is to monitor lubricant flow to bearings. While reverse running, it is unable to see the oil flow via sight glass. The normal oil level in the compressor oil sump should be maintained above the top of the low-level sight glass and in the middle level of high-level sight glass when compressor is running. It is strongly recommended to install the optional accessory of oil level switch to prevent compressor failure from oil insufficiency.

3.1 Lubricants table

SPECIFICATION		UNITS	HBR -B05	HBR -B08	HBR -B09	HBR -B04	HBR –B27
COLOR, ASTM			–	–	–	–	–
SPECIFIC GRAVITY			0.945	0.94	0.95	0.95	–
VISCOSITY	40℃		64	131	175	215.9	150
	100℃	mm^2/s (cSt)	8.9	14.53	16.5	20.8	17.3
FLASH POINT		℃	266	254	265	271	254
POUR POINT		℃	-43	-36.5	-30	-25	-42
T.A.N		mg KOH/g	–	–	–	–	–
COPPER STRIP 100℃/3hr			–	–	–	–	–
MOISTURE		ppm	–	–	–	–	–
FLOC POINT		℃	–	–	–	–	–
DIELETRIC STRENGTH 2.5mm		kV	–	–	46.6	–	–

Note: To use oils not listed in the chart, please consult HANBELL firstly for approval.

3.2 Pre-cautions of oil change

1. Use qualified oil only and do not mix different brands of oil. Choice of oil should match characteristics of the refrigerant used. Some types of synthetic oil is incompatible with mineral oil. Oil remained in the compressor should be totally cleaned up in the system before charging different brands of oil. Charge the compressor with oil for the first start and then change it into new oil again to ensure that there's no mix at all.

2. When using polyester oil for chiller systems, please make sure not to expose oil to the atmosphere for prevention of change in its property. Therefore, it is necessary to vacuum the system completely when installing the compressor.

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 vacuum it repeatedly as long as possible.

4. It is a must to change oil especially if the motor has burned out because acid debris may still remain inside the system. Please follow the procedures mentioned above to change oil in the system. Check acidity of oil after 72 hours of operation and then change it again until acidity of oil becomes normal.

5. Please contact Hanbell local distributors/agents for oil selection.

3.3 Oil change

1. Change oil periodically: 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 external oil filter after 2,000 hours running. Check whether the system is clean or not and then change oil every 20,000 hours or after 3 years' continuous running while the system operates in good condition.

2. Avoid clogging in oil filter with debris or swarf which may cause bearing failure. An optional oil pressure differential switch is recommended. The switch will trip when the oil pressure differential between the primary and secondary sides reaches the critical point and then the compressor will automatically shut down to prevent the bearings from damage due to oil loss.

4. Compressor lifting and installation

4.1 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 reaching 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 cable which can be used for loading capacity of 2000kgf 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.

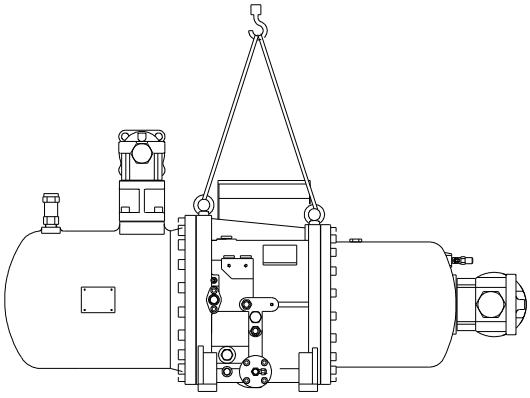


Figure 8
Lifting the compressor with steel chains or steel cables

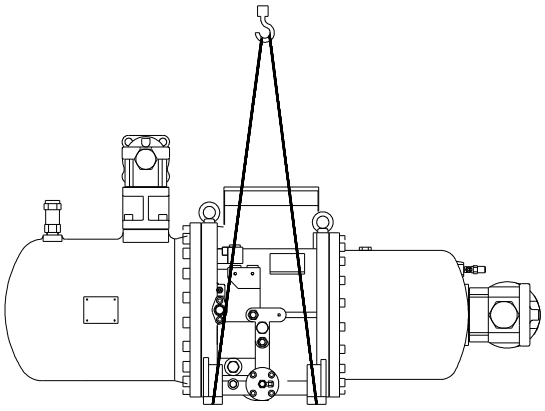


Figure 9
Lifting the compressor with safety ropes

4.2 Mounting the compressor

The installation of the compressor in the refrigeration system should be made 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 electrical power supply for easy connection. Keep good ventilation and low humidity condition at the site. Make sure that the frame or support is strong enough to prevent excessive vibration and noise while the compressor is running and must reserve enough space for 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, cushion or anti-vibration pads should be installed. The installation of the anti-vibration pads is shown in Figure 10. The screws should only be tightened until slight deformation of the rubber pads is visible.

※ It is strongly recommended to position the compressor higher than the evaporator

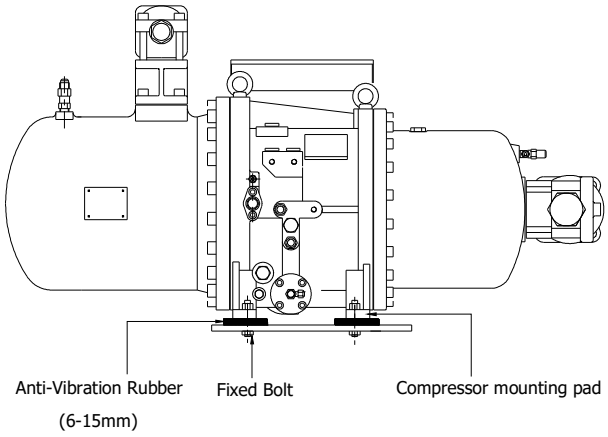


Figure 10 Installation of anti-vibration pads

Pipings:

Improper piping works could cause abnormal vibration and noise and might damage the compressor. Take notice of the following points to prevent this situation from happening:

1. System cleanliness should be kept after welding the piping to avoid any swarf or debris inside the system as they may cause serious damage to the compressor during operation.
2. In order to reduce the vibration on the piping tubes, it is recommended use copper tubes for suction and discharge piping tubes. Copper tubes could limit the vibration in the piping while the compressor is in operation. In case steel tubes are used, welding jobs are important to avoid any stress in the piping, which could cause harmonic vibration and noise that damage compressors. If a large-caliber copper tube is not easily accessible and a steel tube is used instead in suction piping, Hanbell also recommends use of a copper tube in discharge piping to minimize vibration and noise.
3. Remove oxidized impurities, swarf or debris brought by welding in the piping tubes. If they fall into the compressor, the oil filter might be clogged resulting in malfunctioning of lubrication system, bearings and capacity control system.
4. The material of suction and discharge flanges is forged steel and it can be welded directly with piping. After welding the flanges 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 on slope:

Figure 11 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.

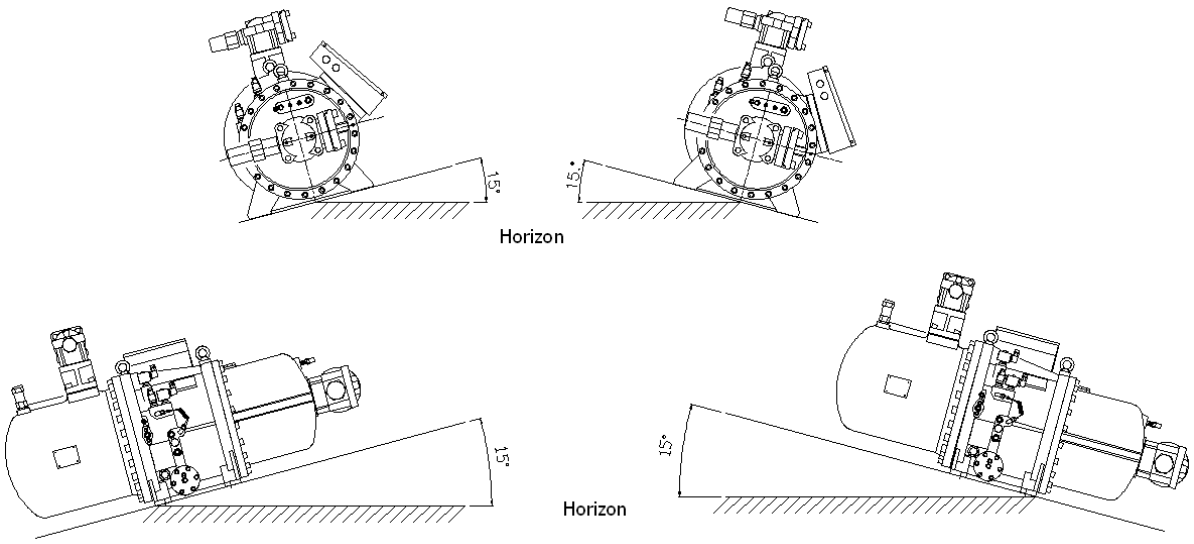
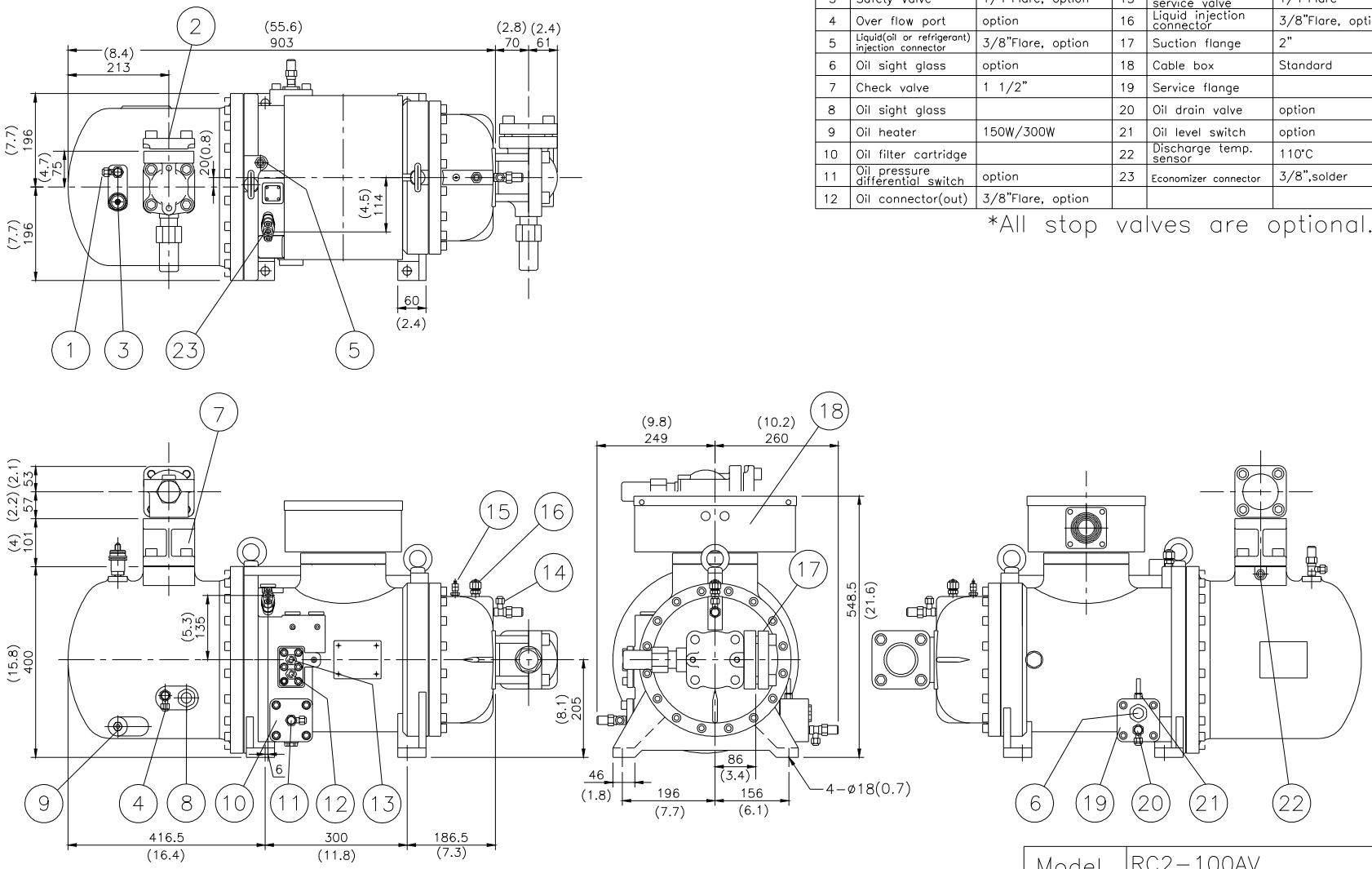


Figure 11 Limits of oblique angle for the installation of the compressor

4.3 RC2-AV series compressor outline drawings

No.	Name	Note	No.	Name	Note
1	Angle valve	1/4"Flare	13	Oil connector(in)	3/8"Flare, option
2	Discharge flange	1 1/2"	14	Angle valve	1/4"Flare
3	Safety Valve	1/4"Flare, option	15	Refrigerant service valve	1/4"Flare
4	Over flow port	option	16	Liquid injection connector	3/8"Flare, option
5	Liquid(oil or refrigerant) injection connector	3/8"Flare, option	17	Suction flange	2"
6	Oil sight glass	option	18	Cable box	Standard
7	Check valve	1 1/2"	19	Service flange	
8	Oil sight glass		20	Oil drain valve	option
9	Oil heater	150W/300W	21	Oil level switch	option
10	Oil filter cartridge		22	Discharge temp. sensor	110°C
11	Oil pressure differential switch	option	23	Economizer connector	3/8",solder
12	Oil connector(out)	3/8"Flare, option			

*All stop valves are optional.



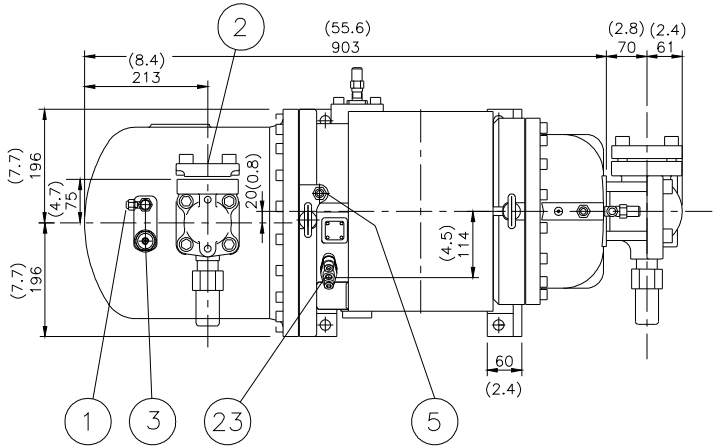
UNIT
SI: mm Imperial: (in)

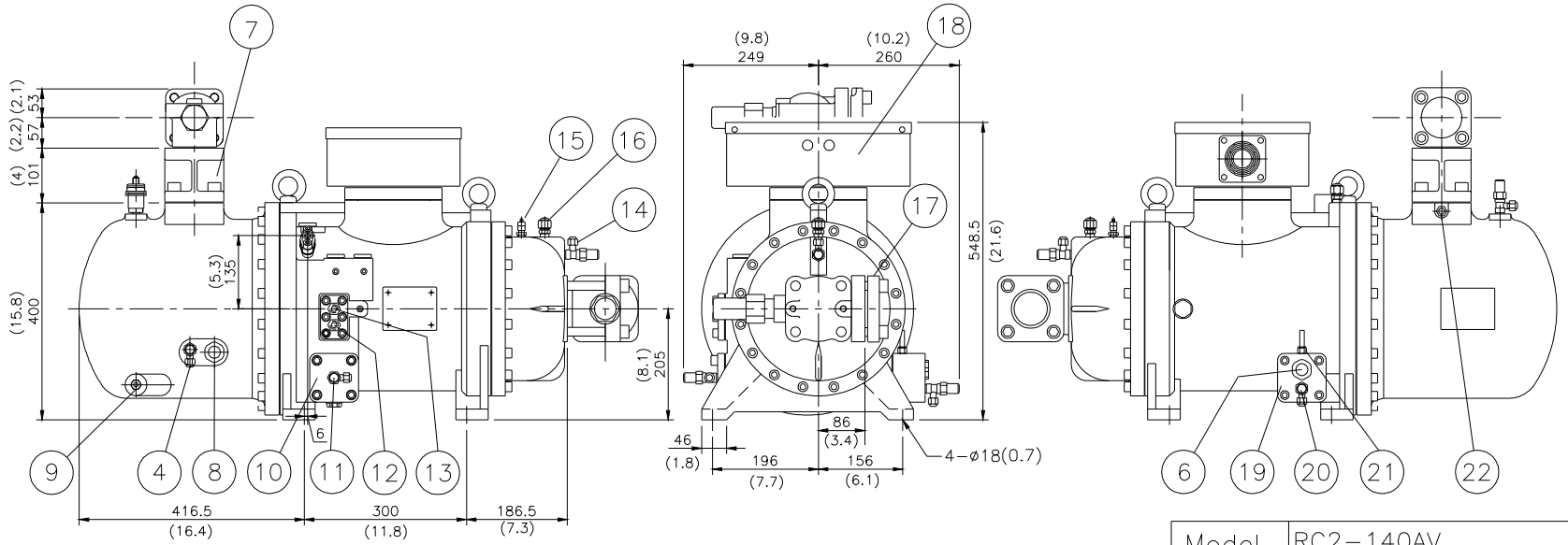
Item	Date	Modification
3		
2		
1		

Model	RC2-100AV
Name	Compressor outline
HANBELL	Ver. 01

No.	Name	Note	No.	Name	Note
1	Angle valve	1/4"Flare	13	Oil connector(in)	3/8"Flare, option
2	Discharge flange	1 1/2"	14	Angle valve	1/4"Flare
3	Safety Valve	1/4"Flare, option	15	Refrigerant service valve	1/4"Flare
4	Over flow port	option	16	Liquid injection connector	3/8"Flare, option
5	Liquid(oil or refrigerant) injection connector	3/8"Flare, option	17	Suction flange	2"
6	Oil sight glass	option	18	Cable box	Standard
7	Check valve	1 1/2"	19	Service flange	
8	Oil sight glass		20	Oil drain valve	option
9	Oil heater	150W/300W	21	Oil level switch	option
10	Oil filter cartridge		22	Discharge temp. sensor	110°C
11	Oil pressure differential switch	option	23	Economizer connector	3/8",solder
12	Oil connector(out)	3/8"Flare, option			

*All stop valves are optional.





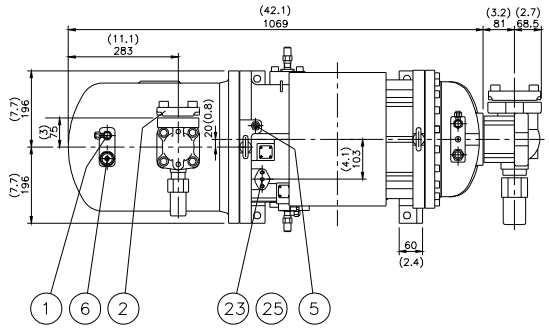
UNIT
SI: mm Imperial: (in)

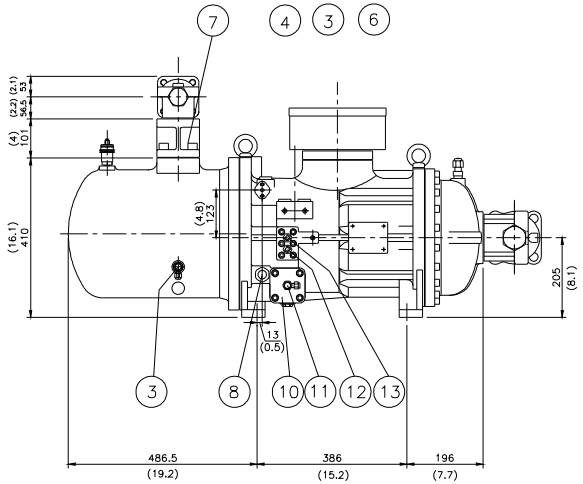
Item	Date	Modification
3		
2		
1		

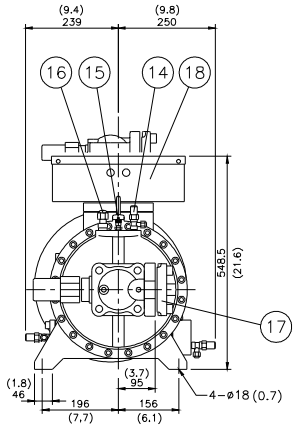
Model	RC2-140AV
Name	Compressor outline
	HANBELL Ver. 01

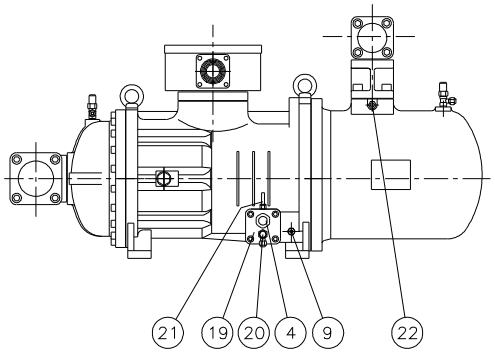
No.	Name	Note	No.	Name	Note
1	Angle valve	1/4"Flare	13	Oil connector(in)	3/8"Flare, option
2	Discharge flange	1 1/2"	14	Angle valve	1/4"Flare
3	Over flow port	option	15	Refrigerant service valve	1/4"Flare
4	Oil sight glass	option	16	Liquid injection connector	3/8"Flare, option
5	Liquid(oil or refrigerant) injection connector	3/8"Flare, option	17	Suction flange	2 1/2"
6	Safety Valve	1/2"NPT, option	18	Cable box	Standard
7	Check valve	1 1/2"	19	Service flange	
8	Oil sight glass		20	Oil drain valve	option
9	Oil heater	150W/300W	21	Oil level switch	option
10	Oil filter cartridge		22	Discharge temp. sensor	110°C
11	Oil pressure differential switch	option	23	Economizer connector	5/8",solder
12	Oil connector(out)	3/8"Flare, option			

*All stop valves are optional.









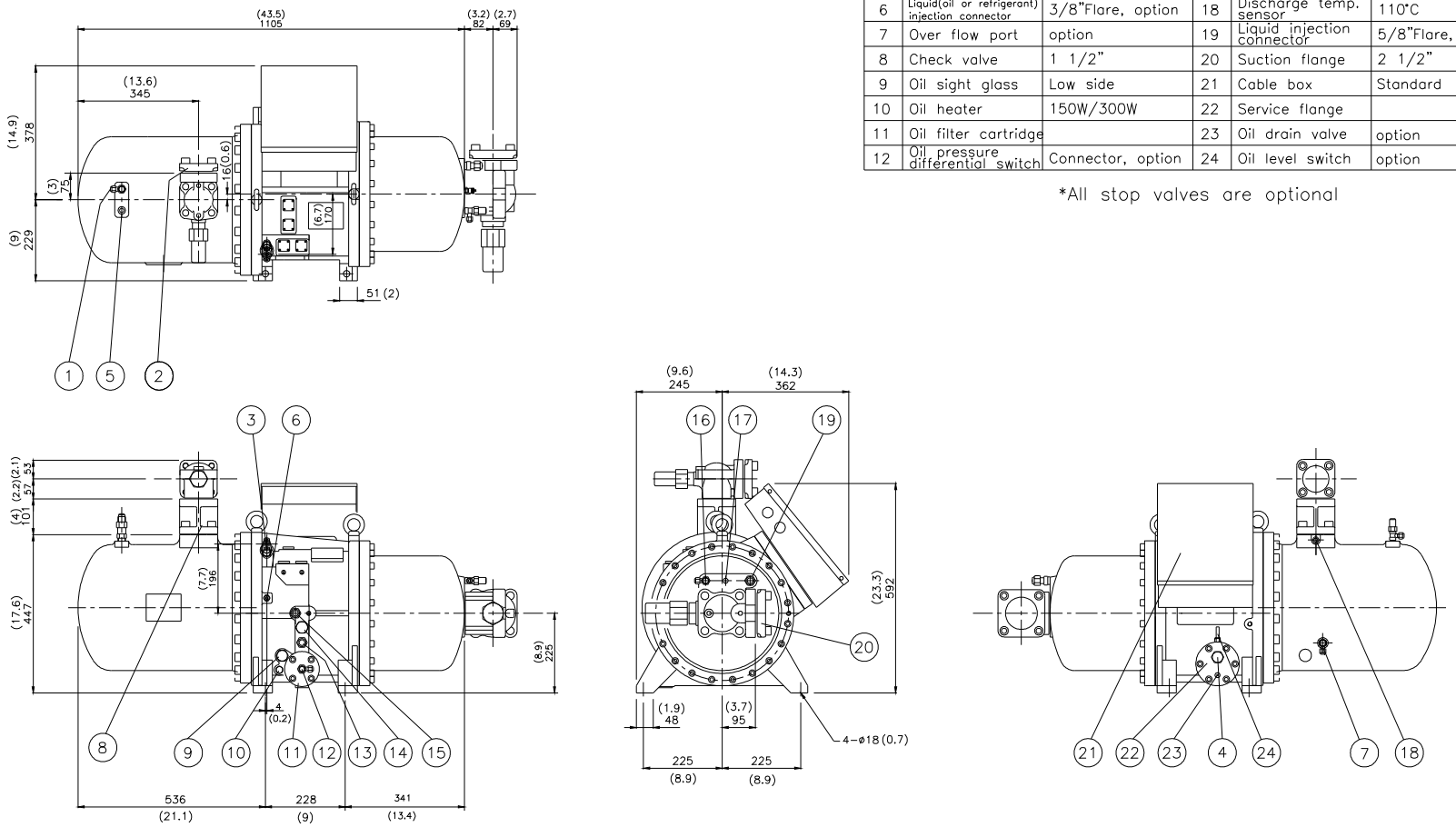
Item	Date	Modification
3		
2		
1		

Model	RC2-180AV
Name	Compressor outline
	HANBELL Ver. 01

UNIT
SI: mm Imperial: (in)

No.	Name	Note	No.	Name	Note
1	Angle valve	1/4"Flare	13	Oil cooler connector(out)	5/8"Flare, option
2	Discharge flange	1 1/2"	14	Stop pin	option
3	Economizer port	5/8", solder	15	Oil cooler connector(in)	5/8"Flare, option
4	Oil sight glass	High side	16	Angle valve	1/4"Flare
5	Safety Valve	1/2" NPT,option	17	Refrigerant service valve	1/4"Flare
6	Liquid(oil or refrigerant) injection connector	3/8"Flare, option	18	Discharge temp. sensor	110°C
7	Over flow port	option	19	Liquid injection connector	5/8"Flare, option
8	Check valve	1 1/2"	20	Suction flange	2 1/2"
9	Oil sight glass	Low side	21	Cable box	Standard
10	Oil heater	150W/300W	22	Service flange	
11	Oil filter cartridge		23	Oil drain valve	option
12	Oil pressure differential switch	Connector, option	24	Oil level switch	option

*All stop valves are optional



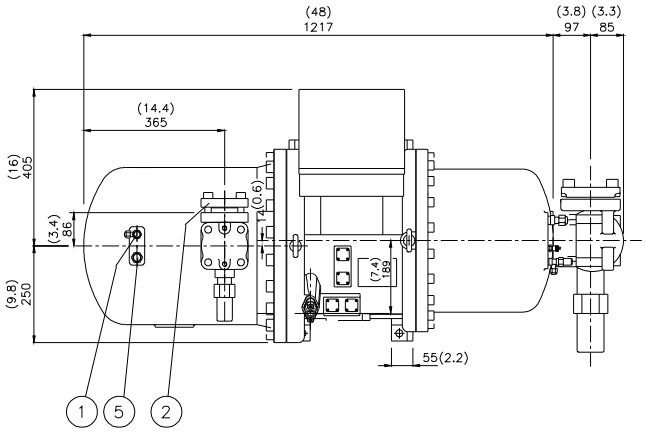
UNIT
SI: mm Imperial: (in)

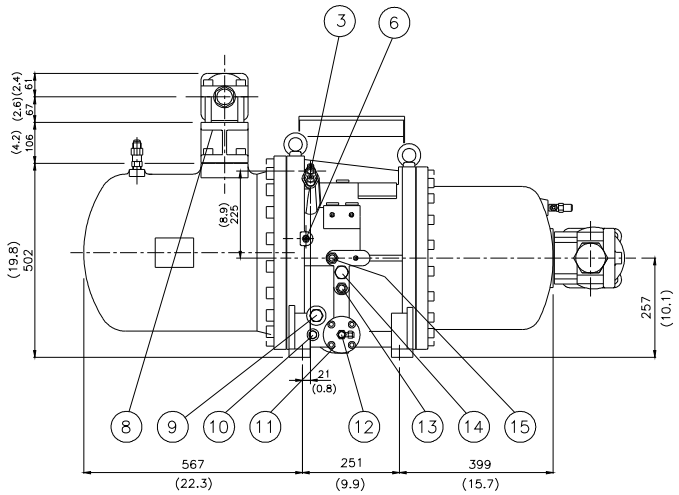
Item	Date	Modification
3		
2		
1		

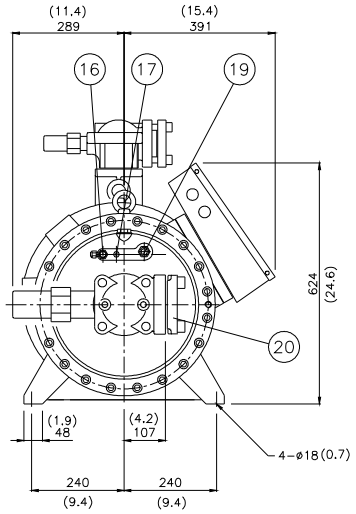
Model	RC2-200AV
Name	Compressor outline
HANBELL	Ver. 01

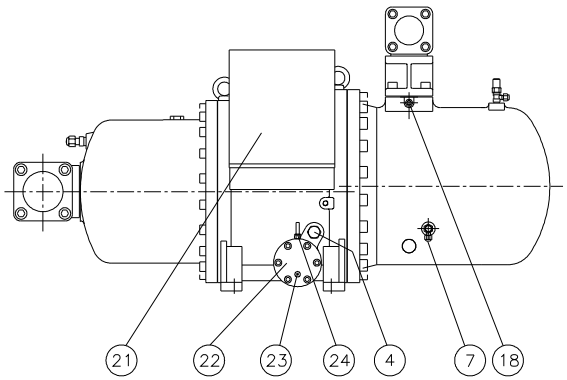
No.	Name	Note	No.	Name	Note
1	Angle valve	1/4"Flare	13	Oil cooler connector(out)	5/8"Flare, option
2	Discharge flange	1 1/2"	14	Stop pin	option
3	Economizer port	5/8", solder	15	Oil cooler connector(in)	5/8"Flare, option
4	Oil sight glass	High side	16	Angle valve	1/4"Flare
5	Safety Valve	1/2" NPT,option	17	Refrigerant service valve	1/4"Flare
6	Liquid(oil or refrigerant) injection connector	3/8"Flare, option	18	Discharge temp. sensor	110°C
7	Over flow port	option	19	Liquid injection connector	5/8"Flare, option
8	Check valve	1 1/2"	20	Suction flange	2 1/2"
9	Oil sight glass	Low side	21	Cable box	Standard
10	Oil heater	150W/300W	22	Service flange	
11	Oil filter cartridge		23	Oil drain valve	option
12	Oil pressure differential switch	Connector, option	24	Oil level switch	option

*All stop valves are optional









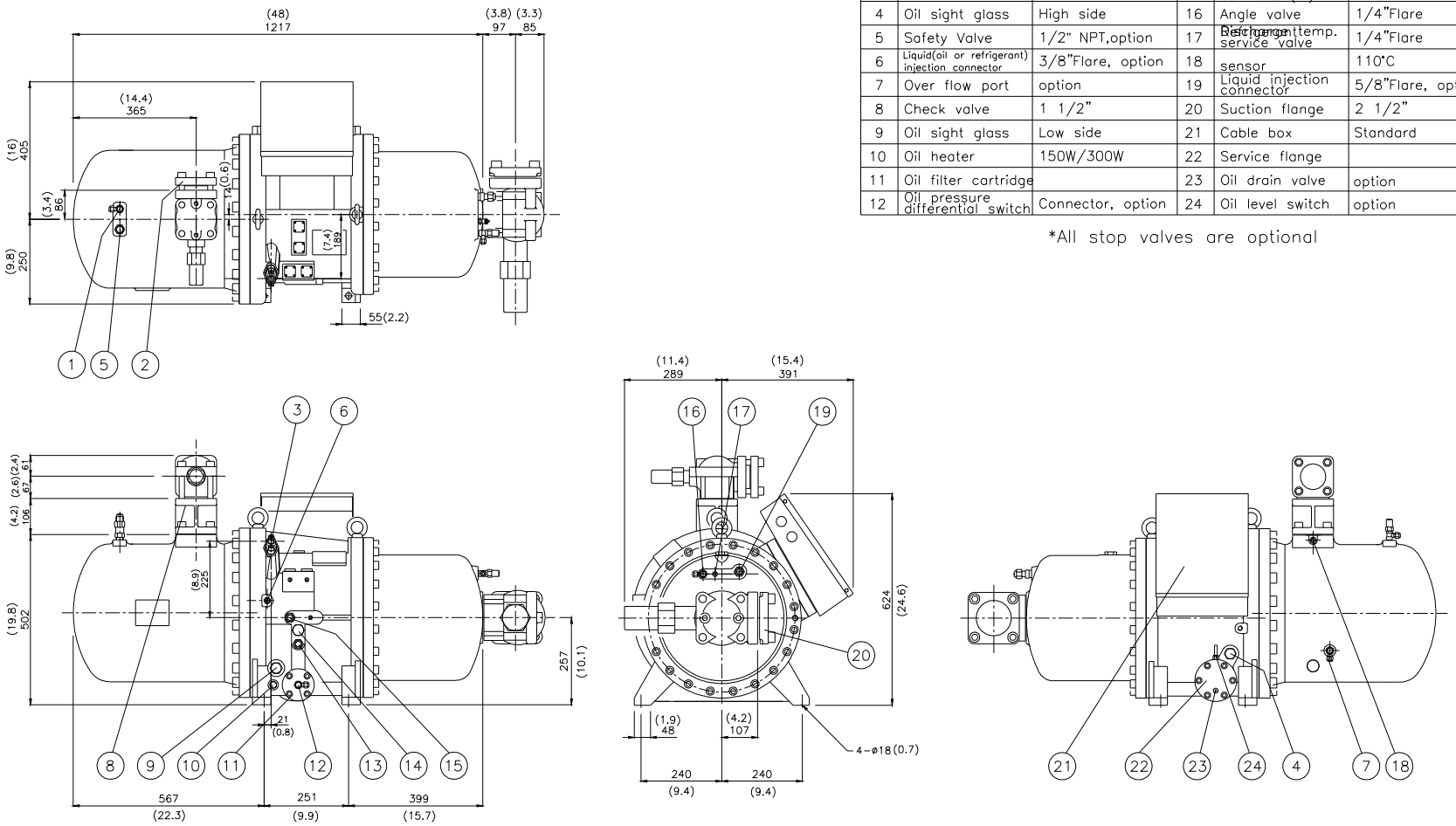
UNIT
SI: mm Imperial: (in)

Item	Date	Modification
3		
2		
1		

Model	RC2-230AV
Name	Compressor outline
HANBELL	Ver. 01

No.	Name	Note	No.	Name	Note
1	Angle valve	1/4"Flare	13	Oil cooler connector(out)	5/8"Flare, option
2	Discharge flange	1 1/2"	14	Stop pin	option
3	Economizer port	5/8", solder	15	Oil cooler connector(in)	5/8"Flare, option
4	Oil sight glass	High side	16	Angle valve	1/4"Flare
5	Safety Valve	1/2" NPT,option	17	Discharge temp. service valve	1/4"Flare
6	Liquid(oil or refrigerant) injection connector	3/8"Flare, option	18	sensor	110°C
7	Over flow port	option	19	Liquid injection connector	5/8"Flare, option
8	Check valve	1 1/2"	20	Suction flange	2 1/2"
9	Oil sight glass	Low side	21	Cable box	Standard
10	Oil heater	150W/300W	22	Service flange	
11	Oil filter cartridge		23	Oil drain valve	option
12	Oil pressure differential switch	Connector, option	24	Oil level switch	option

*All stop valves are optional



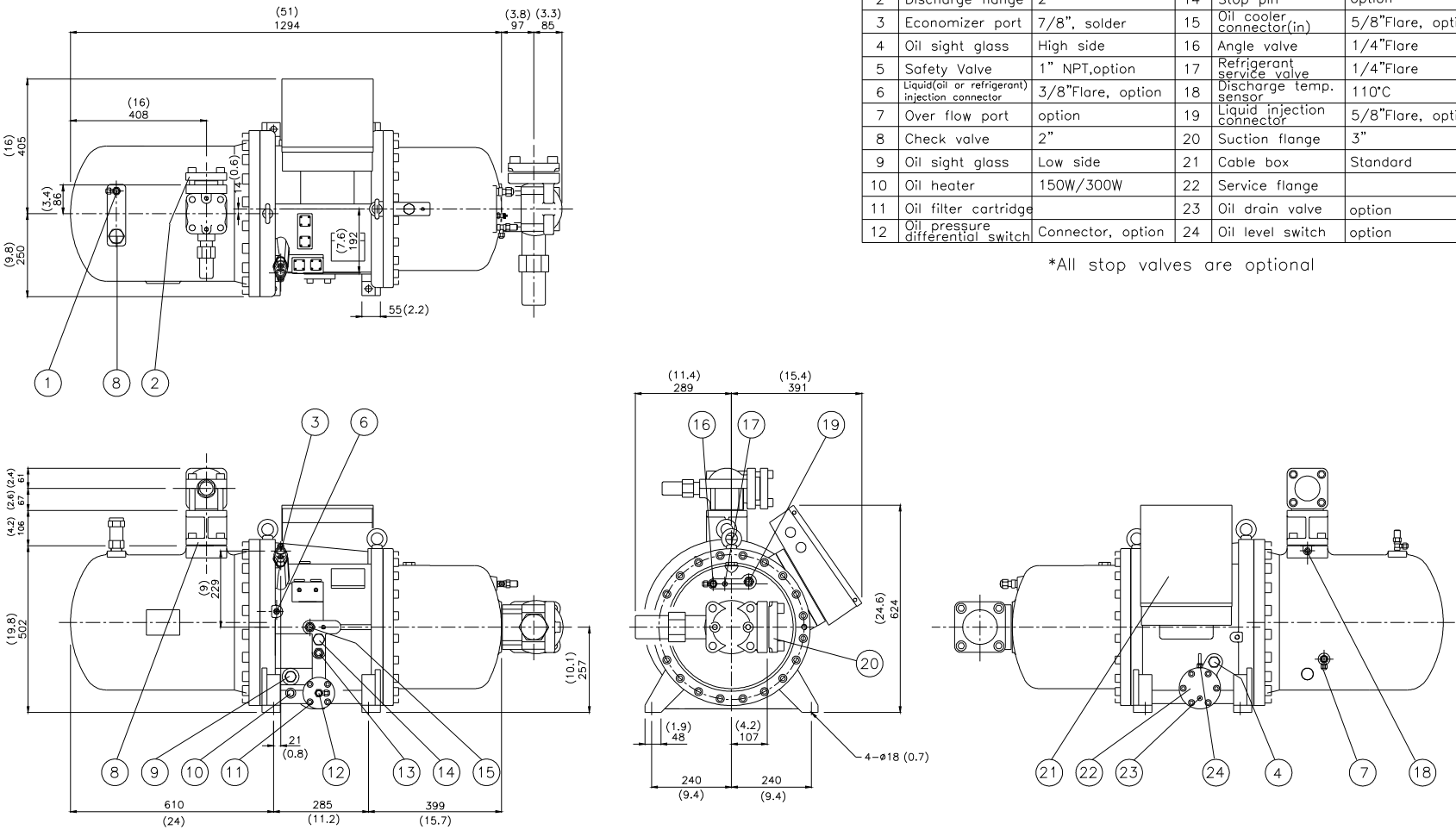
UNIT
SI: mm Imperial: (in)

Item	Date	Modification
3		
2		
1		

Model	RC2-260AV
Name	Compressor outline
HANBELL	Ver. 01

No.	Name	Note	No.	Name	Note
1	Angle valve	1/4"Flare	13	Oil cooler connector(out)	5/8"Flare, option
2	Discharge flange	2"	14	Stop pin	option
3	Economizer port	7/8", solder	15	Oil cooler connector(in)	5/8"Flare, option
4	Oil sight glass	High side	16	Angle valve	1/4"Flare
5	Safety Valve	1" NPT,option	17	Refrigerant service valve	1/4"Flare
6	Liquid(oil or refrigerant) injection connector	3/8"Flare, option	18	Discharge temp. sensor	110°C
7	Over flow port	option	19	Liquid injection connector	5/8"Flare, option
8	Check valve	2"	20	Suction flange	3"
9	Oil sight glass	Low side	21	Cable box	Standard
10	Oil heater	150W/300W	22	Service flange	
11	Oil filter cartridge		23	Oil drain valve	option
12	Oil pressure differential switch	Connector, option	24	Oil level switch	option

*All stop valves are optional



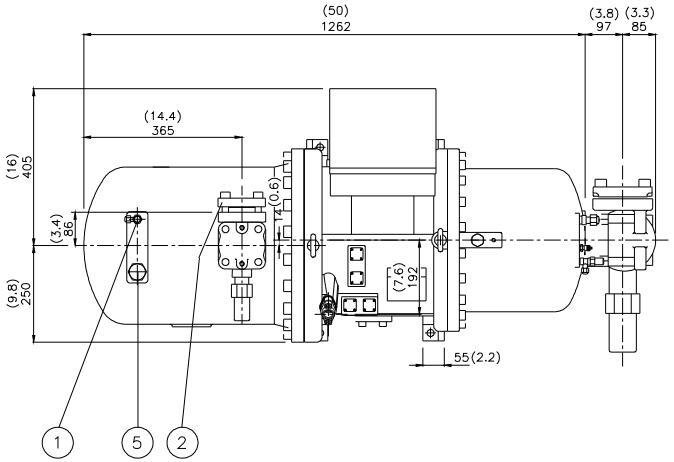
UNIT
SI: mm Imperial: (in)

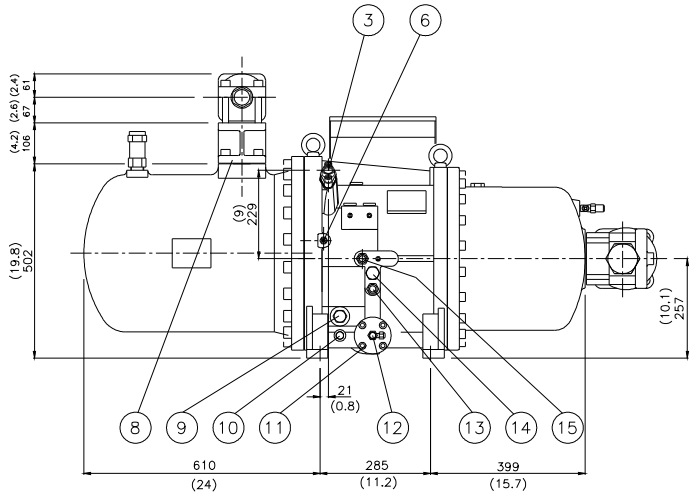
Item	Date	Modification
3		
2		
1		

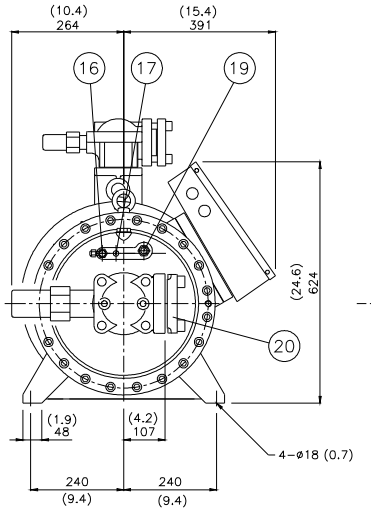
Model	RC2-300AV
Name	Compressor outline
HANBELL	Ver. 01

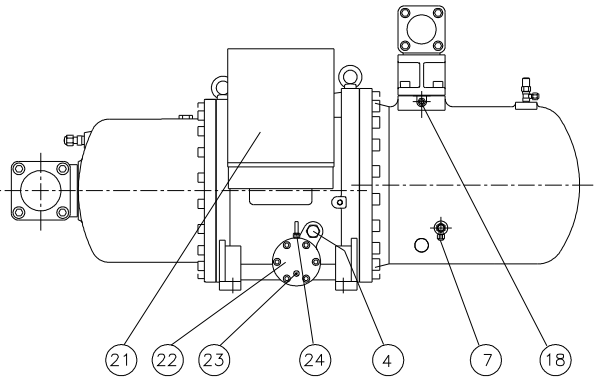
No.	Name	Note	No.	Name	Note
1	Angle valve	1/4"Flare	13	Oil cooler connector(out)	5/8"Flare, option
2	Discharge flange	2"	14	Stop pin	option
3	Economizer port	7/8", solder	15	Oil cooler connector(in)	5/8"Flare, option
4	Oil sight glass	High side	16	Angle valve	1/4"Flare
5	Safety Valve	1" NPT,option	17	Refrigerant service valve	1/4"Flare
6	Liquid(oil or refrigerant) injection connector	3/8"Flare, option	18	Discharge temp. sensor	110°C
7	Over flow port	option	19	Liquid injection connector	5/8"Flare, option
8	Check valve	2"	20	Suction flange	3"
9	Oil sight glass	Low side	21	Cable box	Standard
10	Oil heater	150W/300W	22	Service flange	
11	Oil filter cartridge		23	Oil drain valve	option
12	Oil pressure differential switch	Connector, option	24	Oil level switch	option

*All stop valves are optional









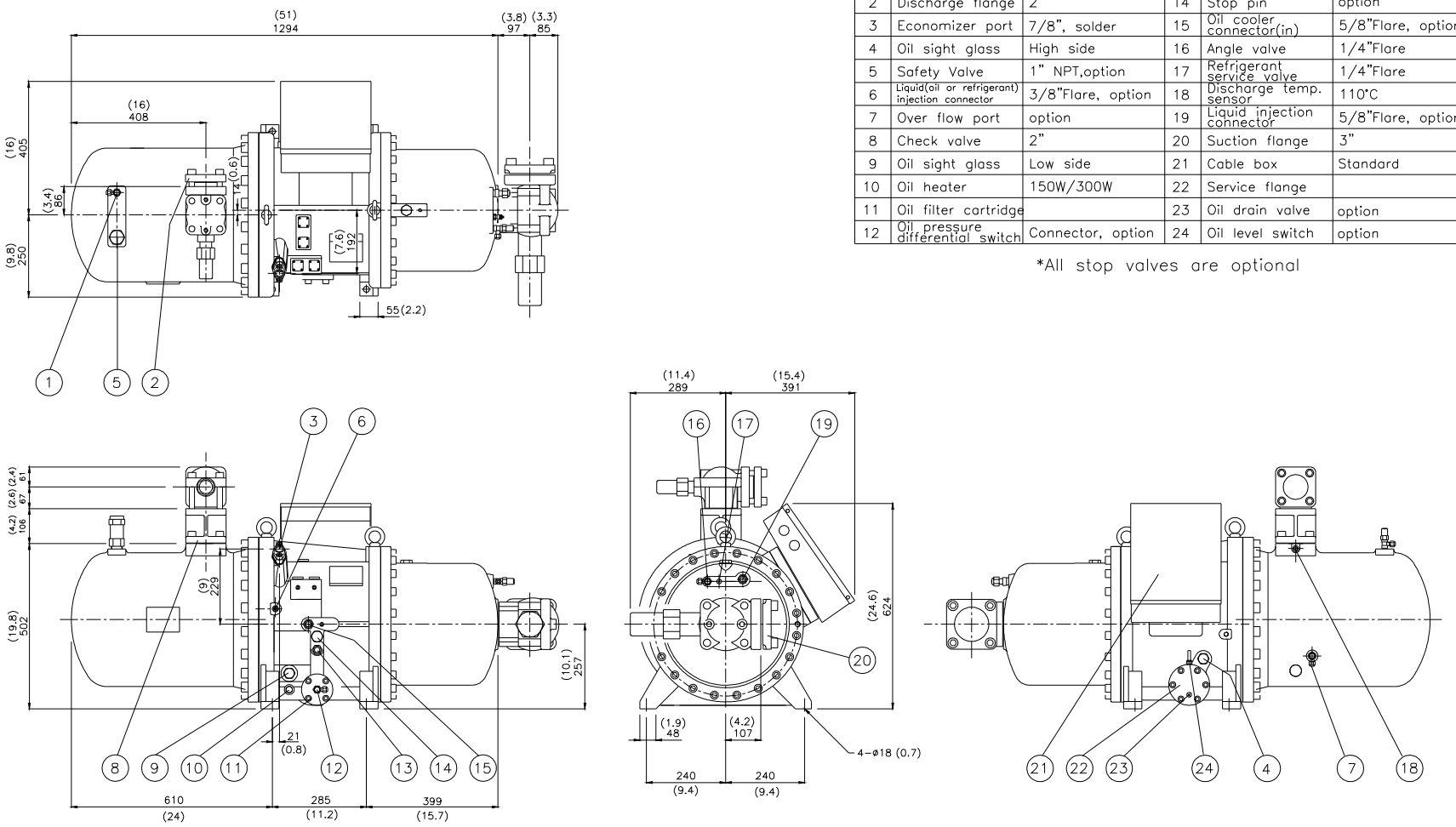
UNIT
SI: mm Imperial: (in)

Item	Date	Modification
3		
2		
1		

Model	RC2-310AV
Name	Compressor outline
	HANBELL Ver. 01

No.	Name	Note	No.	Name	Note
1	Angle valve	1/4"Flare	13	Oil cooler connector(out)	5/8"Flare, option
2	Discharge flange	2"	14	Stop pin	option
3	Economizer port	7/8", solder	15	Oil cooler connector(in)	5/8"Flare, option
4	Oil sight glass	High side	16	Angle valve	1/4"Flare
5	Safety Valve	1" NPT,option	17	Refrigerant service valve	1/4"Flare
6	Liquid(oil or refrigerant) injection connector	3/8"Flare, option	18	Discharge temp. sensor	110°C
7	Over flow port	option	19	Liquid injection connector	5/8"Flare, option
8	Check valve	2"	20	Suction flange	3"
9	Oil sight glass	Low side	21	Cable box	Standard
10	Oil heater	150W/300W	22	Service flange	
11	Oil filter cartridge		23	Oil drain valve	option
12	Oil pressure differential switch	Connector, option	24	Oil level switch	option

*All stop valves are optional



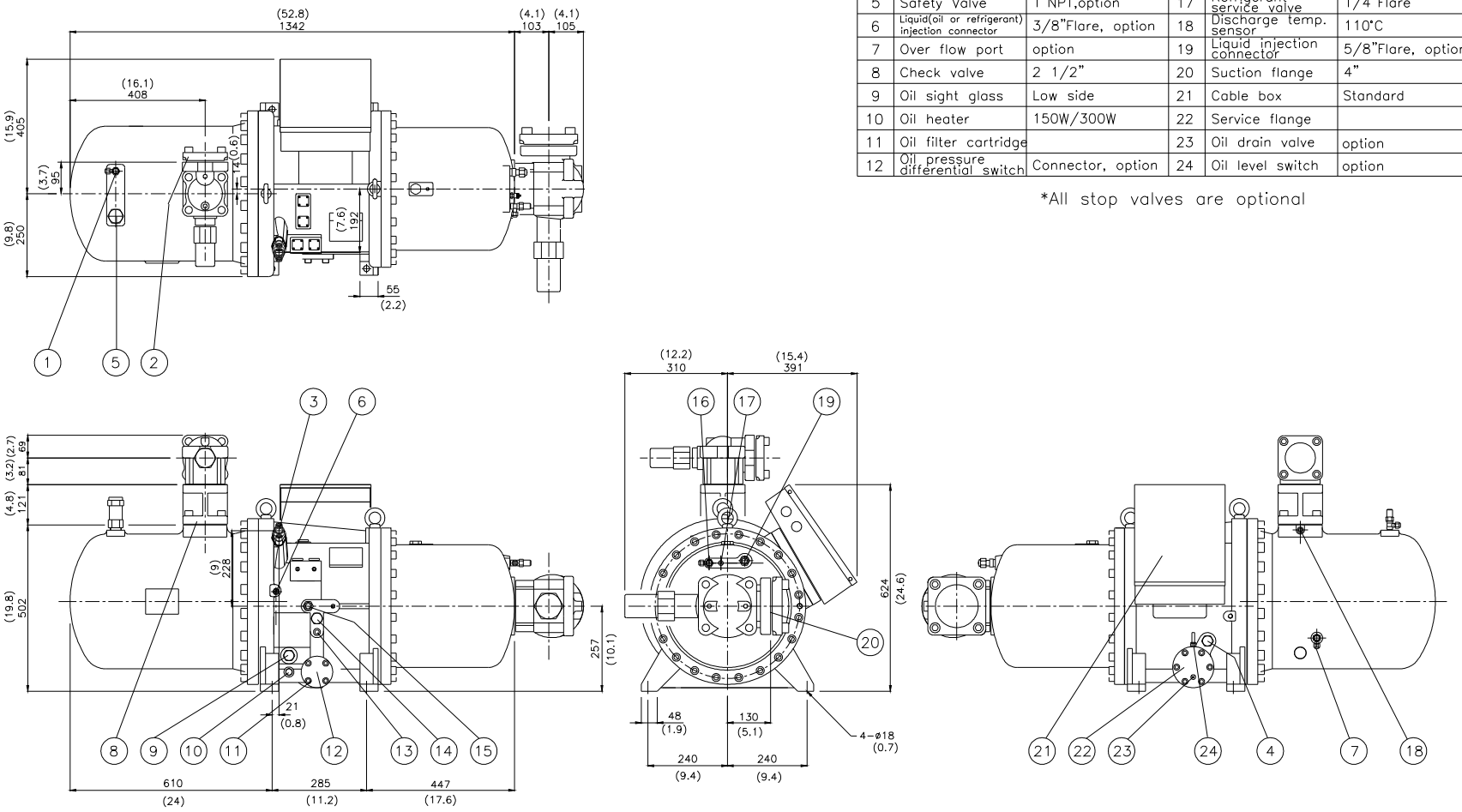
UNIT
SI: mm Imperial: (in)

Item	Date	Modification
3		
2		
1		

Model	RC2-320AV
Name	Compressor outline
	HANBELL Ver. 01

No.	Name	Note	No.	Name	Note
1	Angle valve	1/4"Flare	13	Oil cooler connector(out)	5/8"Flare, option
2	Discharge flange	2 1/2"	14	Stop pin	option
3	Economizer port	7/8", solder	15	Oil cooler connector(in)	5/8"Flare, option
4	Oil sight glass	High side	16	Angle valve	1/4"Flare
5	Safety Valve	1"NPT,option	17	Refrigerant service valve	1/4"Flare
6	Liquid(oil or refrigerant) injection connector	3/8"Flare, option	18	Discharge temp. sensor	110°C
7	Over flow port	option	19	Liquid injection connector	5/8"Flare, option
8	Check valve	2 1/2"	20	Suction flange	4"
9	Oil sight glass	Low side	21	Cable box	Standard
10	Oil heater	150W/300W	22	Service flange	
11	Oil filter cartridge		23	Oil drain valve	option
12	Oil pressure differential switch	Connector, option	24	Oil level switch	option

*All stop valves are optional



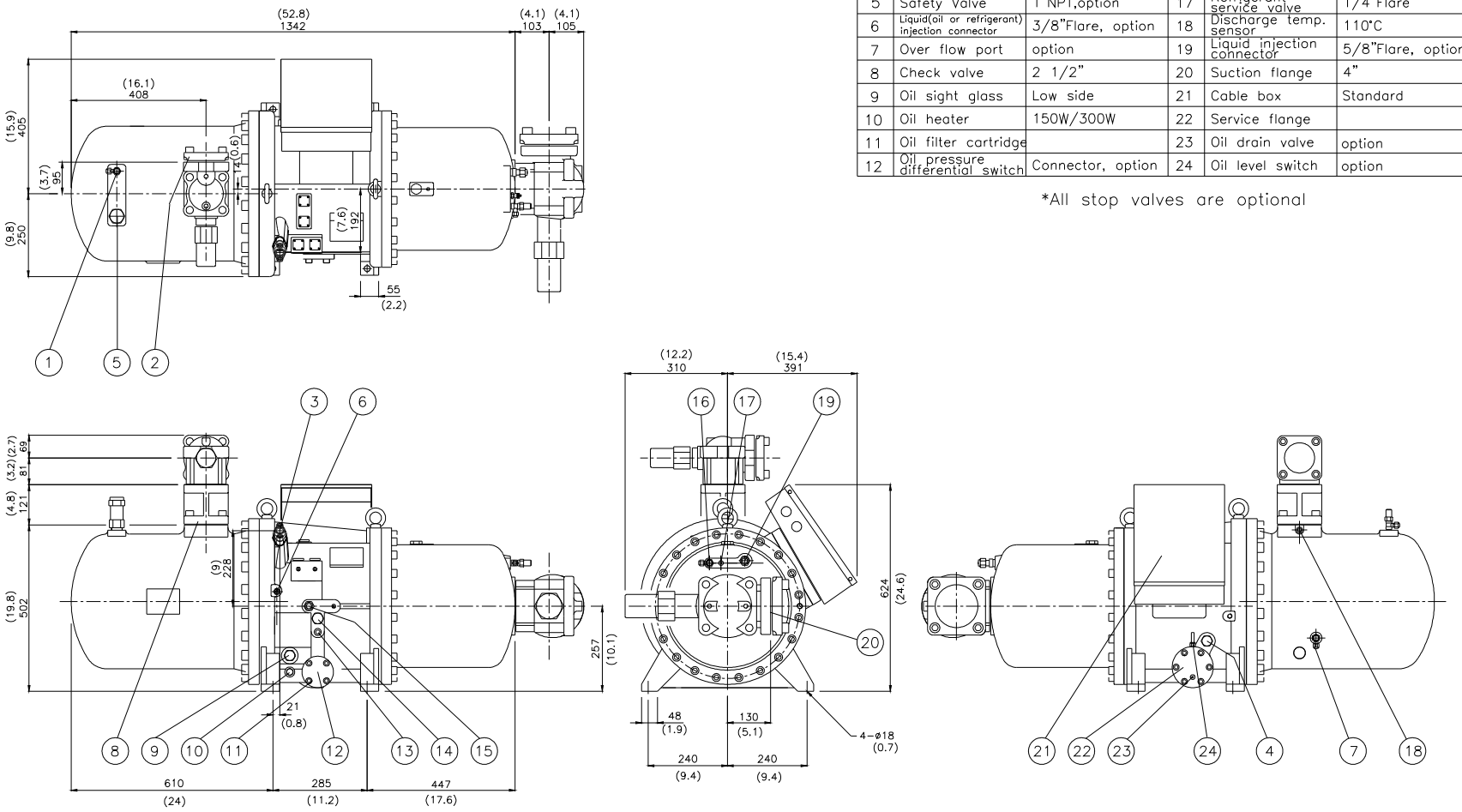
UNIT
SI: mm Imperial: (in)

Item	Date	Modification
3		
2		
1		

Model	RC2-340AV
Name	Compressor outline
	HANBELL Ver. 01

No.	Name	Note	No.	Name	Note
1	Angle valve	1/4"Flare	13	Oil cooler connector(out)	5/8"Flare, option
2	Discharge flange	2 1/2"	14	Stop pin	option
3	Economizer port	7/8", solder	15	Oil cooler connector(in)	5/8"Flare, option
4	Oil sight glass	High side	16	Angle valve	1/4"Flare
5	Safety Valve	1"NPT,option	17	Refrigerant service valve	1/4"Flare
6	Liquid(oil or refrigerant) injection connector	3/8"Flare, option	18	Discharge temp. sensor	110°C
7	Over flow port	option	19	Liquid injection connector	5/8"Flare, option
8	Check valve	2 1/2"	20	Suction flange	4"
9	Oil sight glass	Low side	21	Cable box	Standard
10	Oil heater	150W/300W	22	Service flange	
11	Oil filter cartridge		23	Oil drain valve	option
12	Oil pressure differential switch	Connector, option	24	Oil level switch	option

*All stop valves are optional



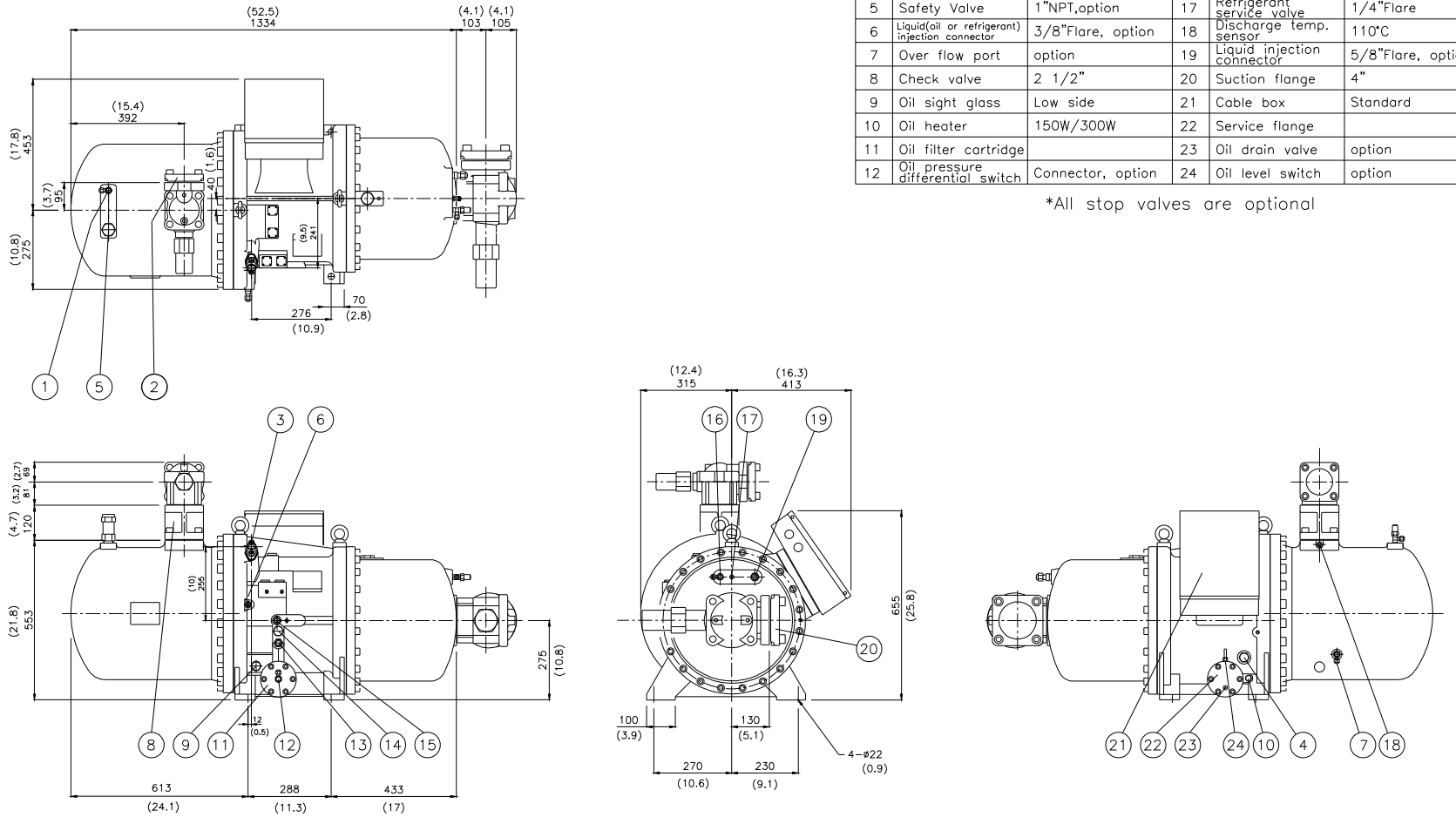
UNIT
SI: mm Imperial: (in)

Item	Date	Modification
3		
2		
1		

Model	RC2-370AV
Name	Compressor outline
HANBELL	Ver. 01

No.	Name	Note	No.	Name	Note
1	Angle valve	1/4"Flare	13	Oil cooler connector(out)	5/8"Flare, option
2	Discharge flange	2 1/2"	14	Stop pin	option
3	Economizer port	7/8", solder	15	Oil cooler connector(in)	5/8"Flare, option
4	Oil sight glass	High side	16	Angle valve	1/4"Flare
5	Safety Valve	1"NPT,option	17	Refrigerant service valve	1/4"Flare
6	Liquid(oil or refrigerant) injection connector	3/8"Flare, option	18	Discharge temp. sensor	110°C
7	Over flow port	option	19	Liquid injection connector	5/8"Flare, option
8	Check valve	2 1/2"	20	Suction flange	4"
9	Oil sight glass	Low side	21	Cable box	Standard
10	Oil heater	150W/300W	22	Service flange	
11	Oil filter cartridge		23	Oil drain valve	option
12	Oil pressure differential switch	Connector, option	24	Oil level switch	option

*All stop valves are optional



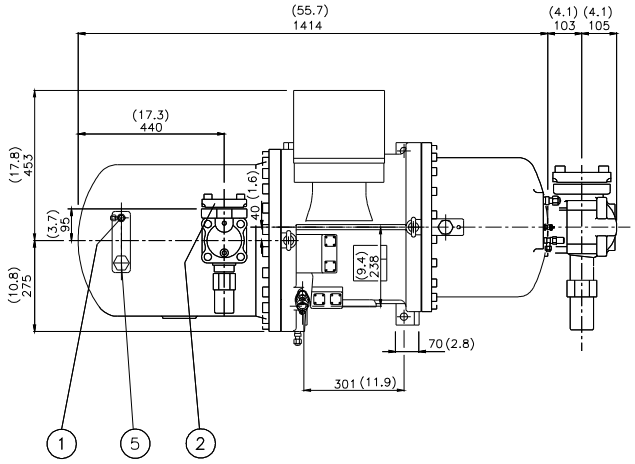
UNIT
SI: mm Imperial: (in)

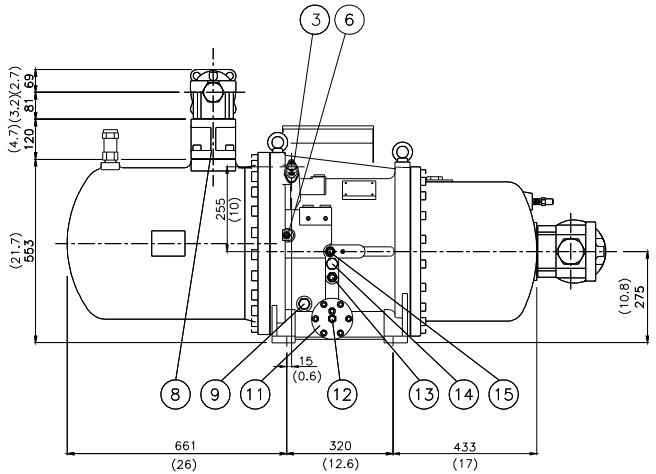
Item	Date	Modification
3		
2		
1		

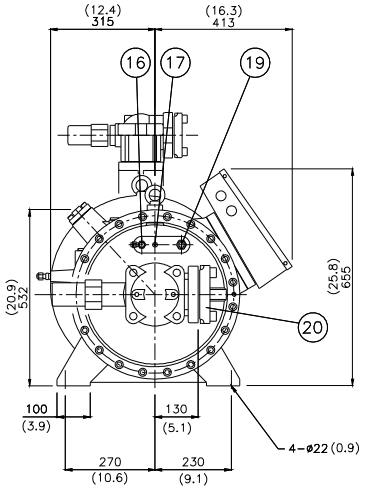
Model	RC2-430AV		
Name	Compressor outline		
	HANBELL	Ver.	01

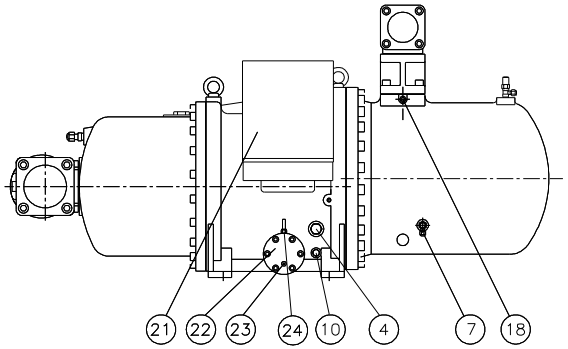
No.	Name	Note	No.	Name	Note
1	Angle valve	1/4"Flare	13	Oil cooler connector(out)	5/8"Flare, option
2	Discharge flange	2 1/2"	14	Stop pin	option
3	Economizer port	7/8", solder	15	Oil cooler connector(in)	5/8"Flare, option
4	Oil sight glass	High side	16	Angle valve	1/4"Flare
5	Safety Valve	1"NPT,option	17	Refrigerant service valve	1/4"Flare
6	Liquid(oil or refrigerant) injection connector	3/8"Flare, option	18	Discharge temp. sensor	110°C
7	Over flow port	option	19	Liquid injection connector	5/8"Flare, option
8	Check valve	2 1/2"	20	Suction flange	4"
9	Oil sight glass	Low side	21	Cable box	Standard
10	Oil heater	150W/300W	22	Service flange	
11	Oil filter cartridge		23	Oil drain valve	option
12	Oil pressure differential switch	Connector, option	24	Oil level switch	option

*All stop valves are optional









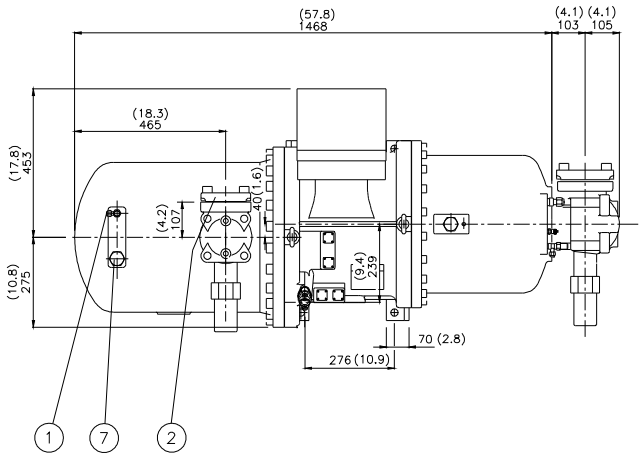
UNIT
SI: mm Imperial: (in)

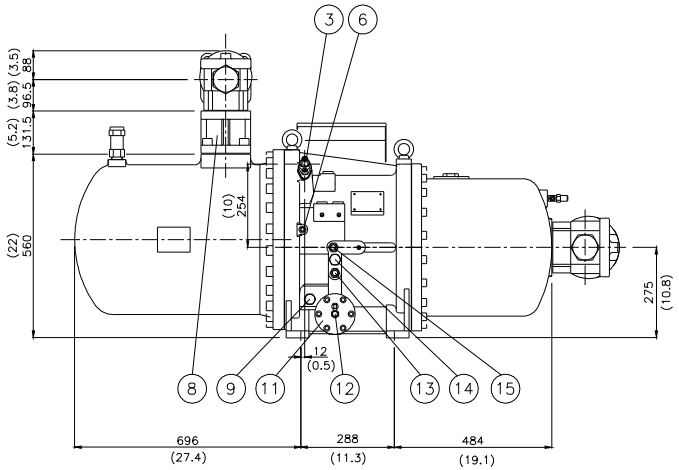
Item	Date	Modification
3		
2		
1		

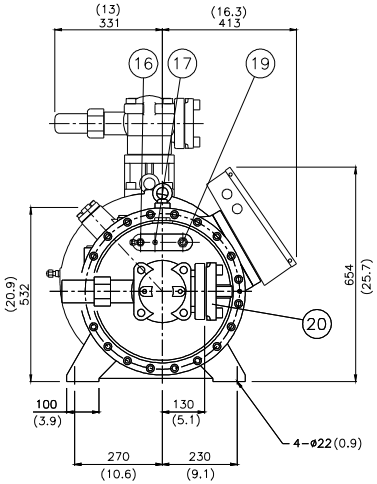
Model	RC2-470AV
Name	Compressor outline
	HANBELL Ver. 01

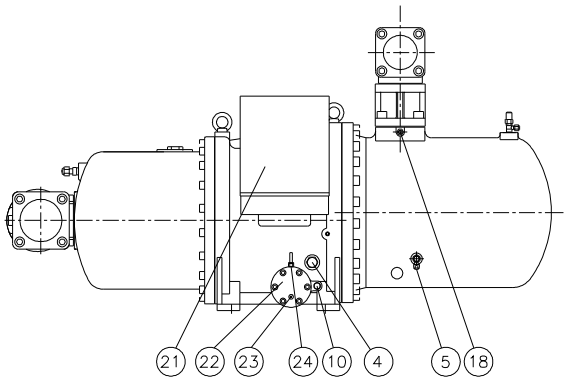
No.	Name	Note	No.	Name	Note
1	Angle valve	1/4"Flare	13	Oil connector(out)	5/8"Flare, option
2	Discharge flange	3"	14	Stop pin	option
3	Economizer port	7/8", solder	15	Oil connector(in)	5/8"Flare, option
4	Oil sight glass	High side	16	Angle valve	1/4"Flare
5	Over flow port	option	17	Refrigerant service valve	1/4"Flare
6	Liquid(oil or refrigerant) injection connector	3/8"Flare, option	18	Discharge temp. sensor	110°C
7	Safety Valve	1"NPT,option	19	Liquid injection connector	5/8"Flare, option
8	Check valve	3"	20	Suction flange	4"
9	Oil sight glass	Low side	21	Cable box	Standard
10	Oil heater	150W/300W	22	Service flange	
11	Oil filter cartridge		23	Oil drain valve	option
12	Oil pressure differential switch	Connector, option	24	Oil level switch	option

*All stop valves are optional









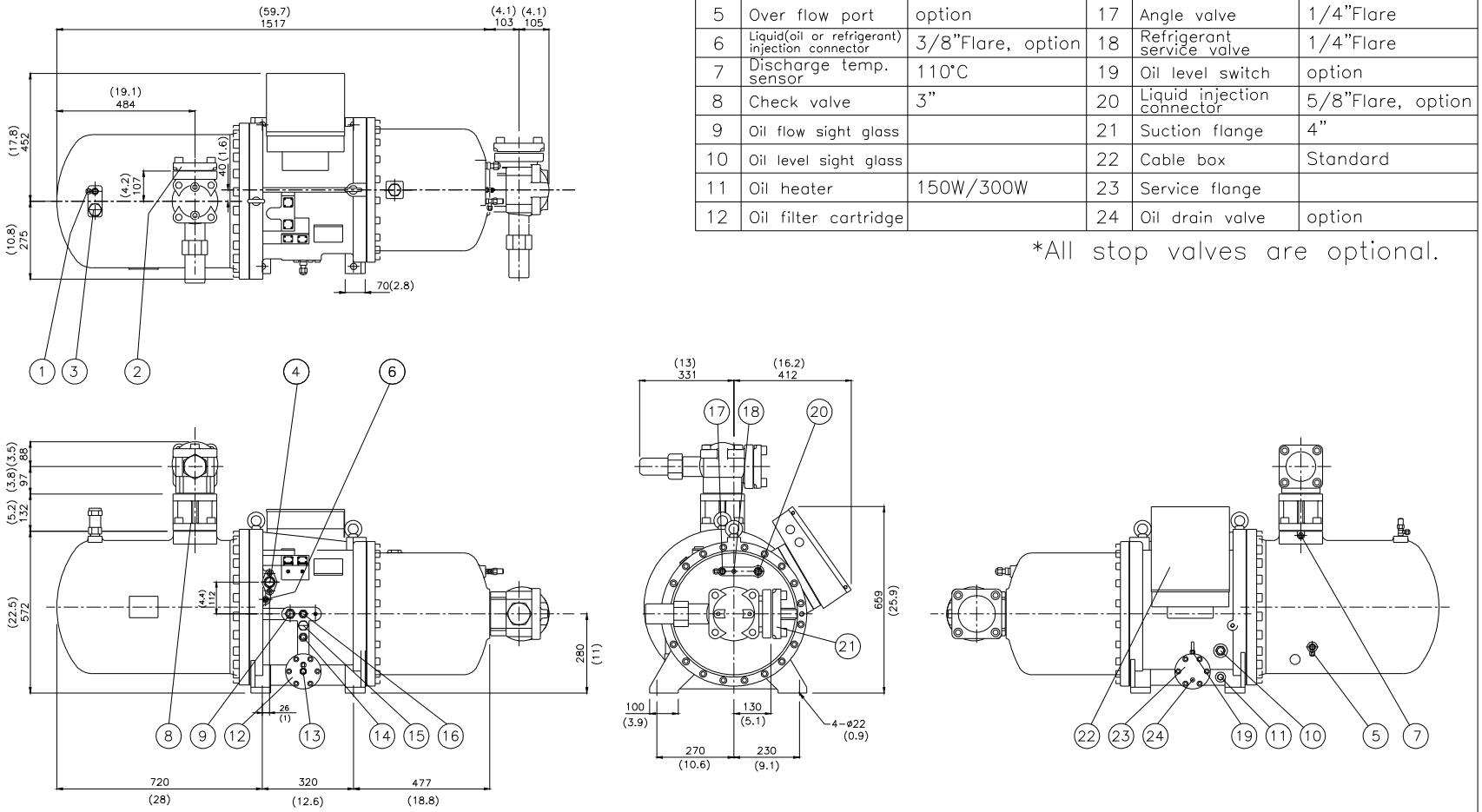
UNIT
SI: mm Imperial: (in)

Item	Date	Modification
3		
2		
1		

Model	RC2-510AV
Name	Compressor outline
HANBELL	Ver. 01

No.	Name	Note	No.	Name	Note
1	Angle valve	1/4"Flare	13	Oil pressure differential switch	option
2	Discharge flange	3"	14	Oil connector(out)	5/8"Flare, option
3	Safety Valve	option	15	Stop pin	option
4	Economizer connector	1 1/8",solder	16	Oil connector(in)	5/8"Flare, option
5	Over flow port	option	17	Angle valve	1/4"Flare
6	Liquid(oil or refrigerant) injection connector	3/8"Flare, option	18	Refrigerant service valve	1/4"Flare
7	Discharge temp. sensor	110°C	19	Oil level switch	option
8	Check valve	3"	20	Liquid injection connector	5/8"Flare, option
9	Oil flow sight glass		21	Suction flange	4"
10	Oil level sight glass		22	Cable box	Standard
11	Oil heater	150W/300W	23	Service flange	
12	Oil filter cartridge		24	Oil drain valve	option

*All stop valves are optional.

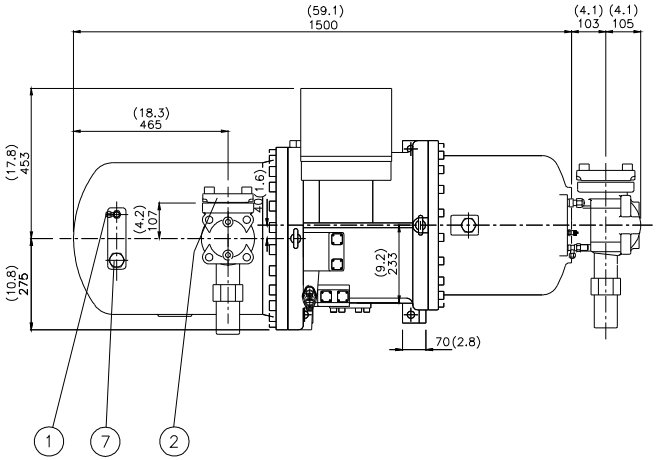


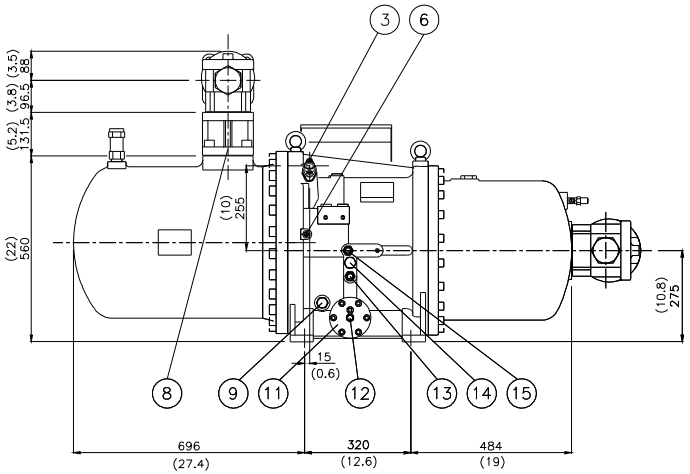
Item	Date	Modification
3		
2		
1		

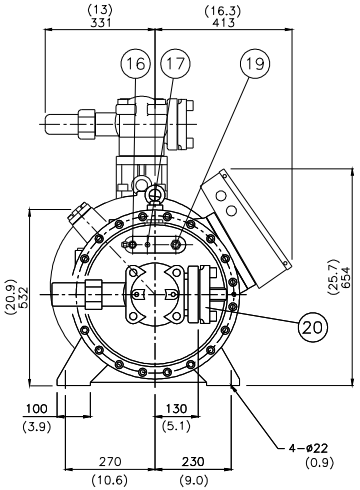
Model	RC2-550AV		
Name	Compressor outline		
	HANBELL	Ver.	01

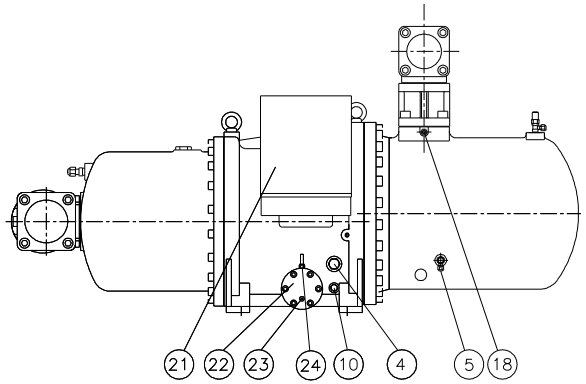
No.	Name	Note	No.	Name	Note
1	Angle valve	1/4"Flare	13	Oil connector(out)	5/8"Flare, option
2	Discharge flange	3"	14	Stop pin	option
3	Economizer port	1 1/8", solder	15	Oil connector(in)	5/8"Flare, option
4	Oil sight glass	High side	16	Angle valve	1/4"Flare
5	Over flow port	option	17	Refrigerant service valve	1/4"Flare
6	Liquid(oil or refrigerant) injection connector	3/8"Flare, option	18	Discharge temp. sensor	110°C
7	Safety Valve	1"NPT,option	19	Liquid injection connector	5/8"Flare, option
8	Check valve	3"	20	Suction flange	4"
9	Oil sight glass	Low side	21	Cable box	Standard
10	Oil heater	150W/300W	22	Service flange	
11	Oil filter cartridge		23	Oil drain valve	option
12	Oil pressure differential switch	Connector, option	24	Oil level switch	option

*All stop valves are optional









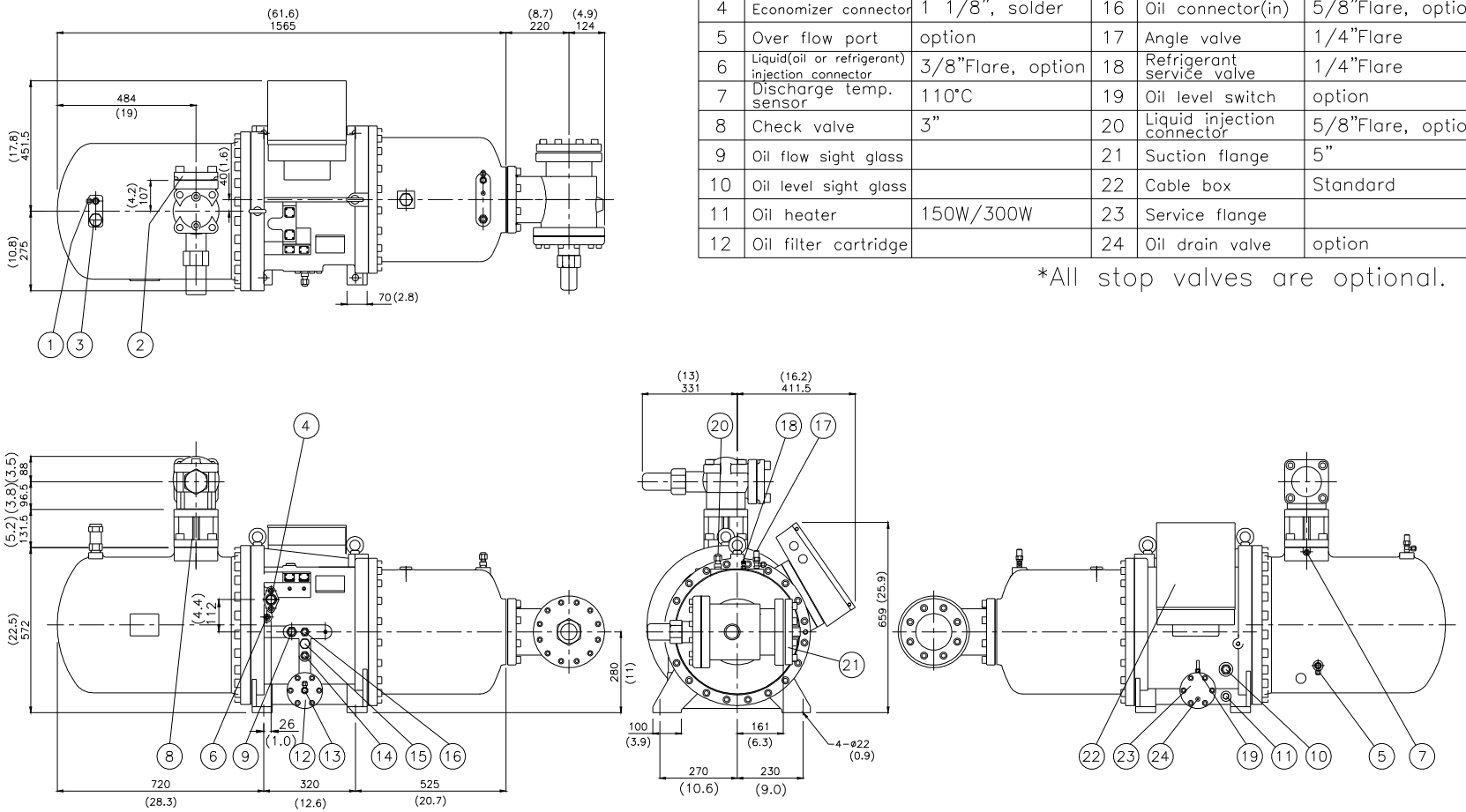
UNIT
SI: mm Imperial: (in)

Item	Date	Modification
3		
2		
1		

Model	RC2-580AV
Name	Compressor outline
	HANBELL Ver. 01

No.	Name	Note	No.	Name	Note
1	Angle valve	1/4"Flare	13	Oil pressure differential switch	Connector, option
2	Discharge flange	3"	14	Oil connector(out)	5/8"Flare, option
3	Safety Valve	1"NPT,option	15	Stop pin	option
4	Economizer connector	1 1/8", solder	16	Oil connector(in)	5/8"Flare, option
5	Over flow port	option	17	Angle valve	1/4"Flare
6	Liquid(oil or refrigerant) injection connector	3/8"Flare, option	18	Refrigerant service valve	1/4"Flare
7	Discharge temp. sensor	110°C	19	Oil level switch	option
8	Check valve	3"	20	Liquid injection connector	5/8"Flare, option
9	Oil flow sight glass		21	Suction flange	5"
10	Oil level sight glass		22	Cable box	Standard
11	Oil heater	150W/300W	23	Service flange	
12	Oil filter cartridge		24	Oil drain valve	option

*All stop valves are optional.



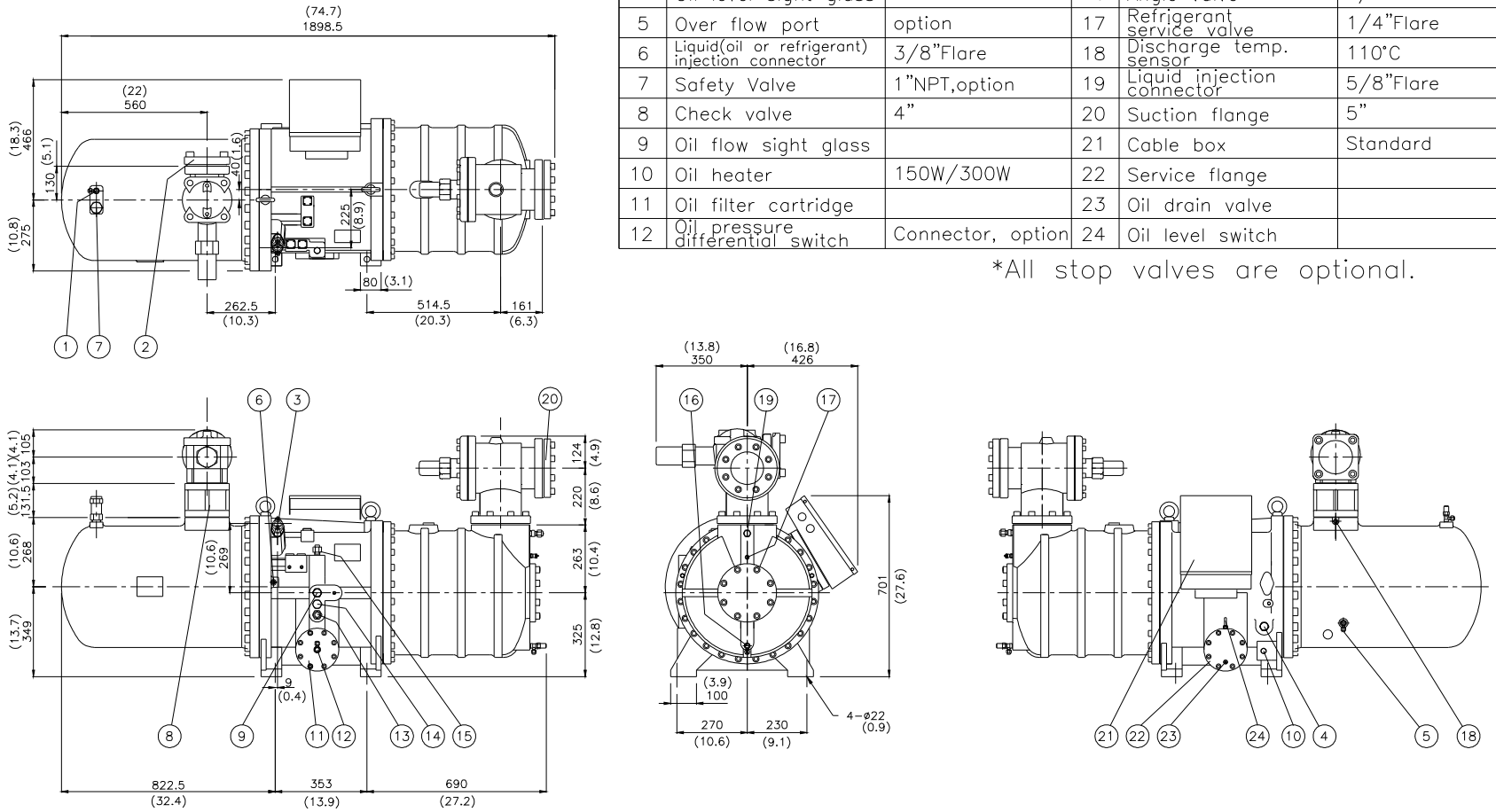
Item	Date	Modification
3		
2		
1		

Model	RC2-620AV		
Name	Compressor outline		
	HANBELL	Ver.	01

UNIT:
SI: mm Imperial: (in)

No.	Name	Note	No.	Name	Note
1	Angle valve	1/4"Flare	13	Oil cooler connector(out)	3/4"Flare, option
2	Discharge flange	4"	14	Stop pin	option
3	Economizer port	1 1/8", solder	15	Oil cooler connector(in)	3/4"Flare, option
4	Oil level sight glass		16	Angle valve	1/4"Flare
5	Over flow port	option	17	Refrigerant service valve	1/4"Flare
6	Liquid(oil or refrigerant) injection connector	3/8"Flare	18	Discharge temp. sensor	110°C
7	Safety Valve	1"NPT,option	19	Liquid injection connector	5/8"Flare
8	Check valve	4"	20	Suction flange	5"
9	Oil flow sight glass		21	Cable box	Standard
10	Oil heater	150W/300W	22	Service flange	
11	Oil filter cartridge		23	Oil drain valve	
12	Oil pressure differential switch	Connector, option	24	Oil level switch	

*All stop valves are optional.



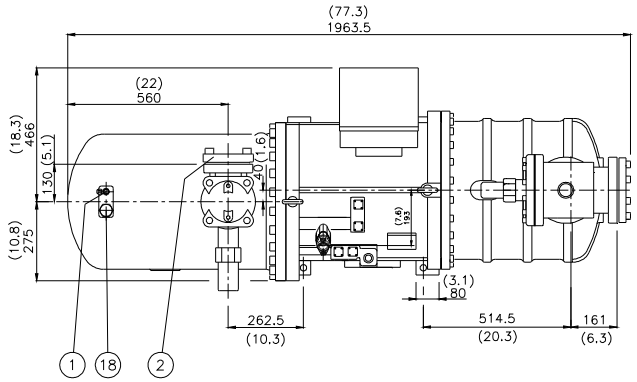
UNIT:
SI: mm Imperial: (in)

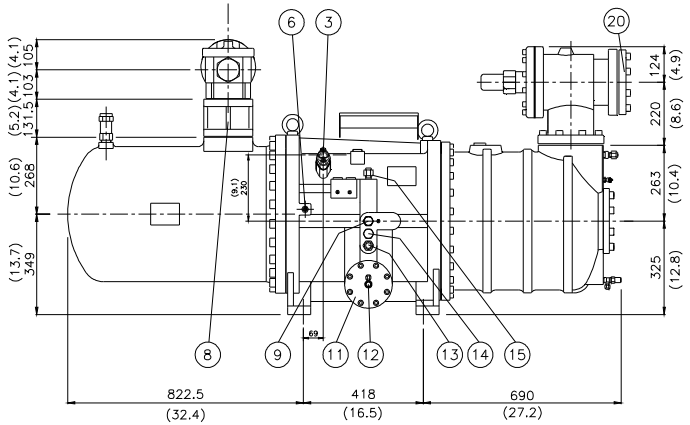
Item	Date	Modification
3		
2		
1		

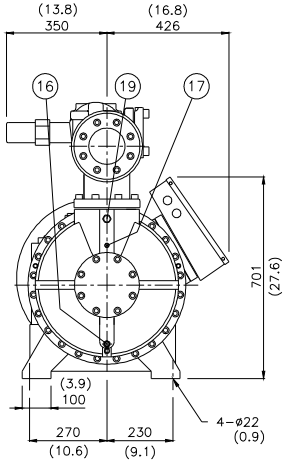
Model	RC2-710AV		
Name	Compressor outline		
	HANBELL	Ver.	01

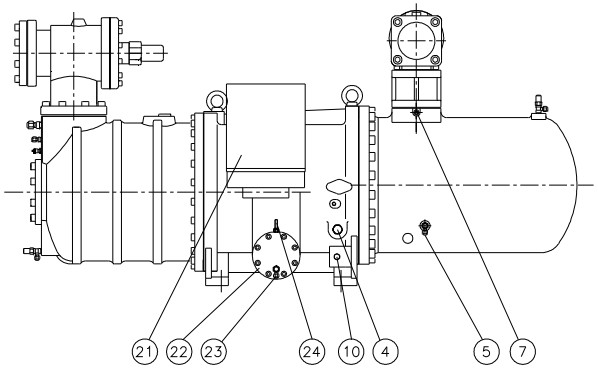
No.	Name	Note	No.	Name	Note
1	Angle valve	1/4"Flare	13	Oil cooler connector(out)	3/4"Flare, option
2	Discharge flange	4"	14	Stop pin	option
3	Economizer port	1 1/8", solder	15	Oil cooler connector(in)	3/4"Flare, option
4	Oil level sight glass		16	Liquid injection Angle valve	1/4"Flare
5	Over flow port	option	17	Refrigerant service valve	1/4"Flare
6	Liquid(oil or refrigerant) injection connector	3/8"Flare	18	Safety Valve	1"NPT,option
7	Discharge temp. sensor	110°C	19	connector	5/8"Flare
8	Check valve	4"	20	Suction flange	5"
9	Oil flow sight glass		21	Cable box	Standard
10	Oil heater	150W/300W	22	Service flange	
11	Oil filter cartridge		23	Oil drain valve	
12	Oil pressure differential switch	Connector, option	24	Oil level switch	

*All stop valves are optional.









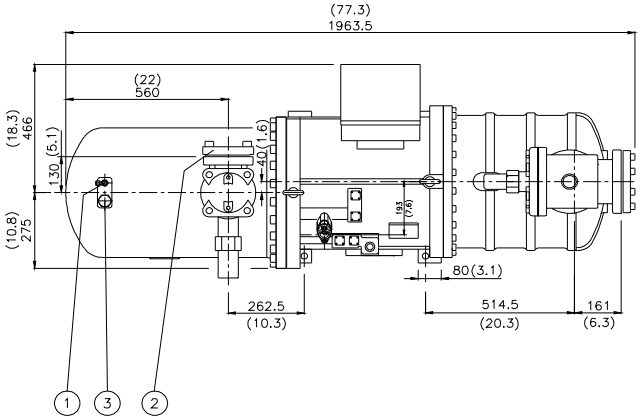
UNIT:
SI: mm Imperial: (in)

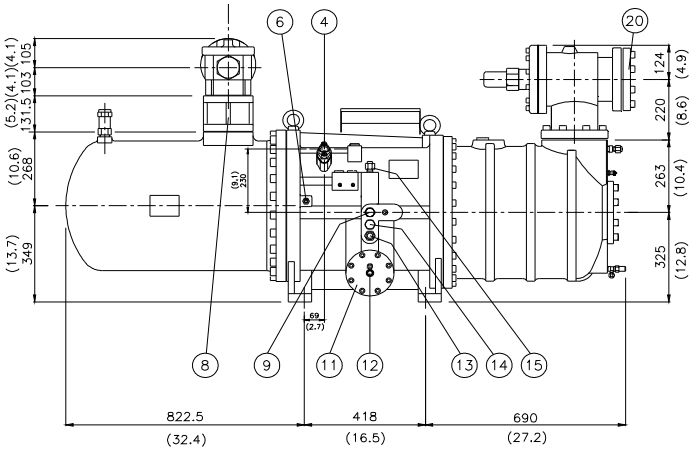
Item	Date	Modification
3		
2		
1		

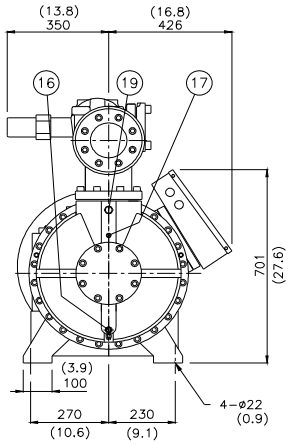
Model	RC2-790AV
Name	Compressor outline
HANBELL	Ver. 01

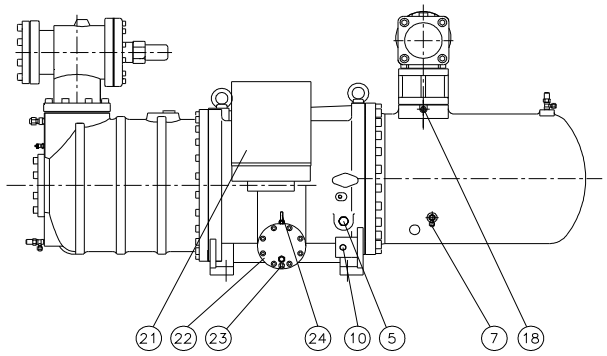
No.	Name	Note	No.	Name	Note
1	Angle valve	1/4"Flare	13	Oil cooler connector(out)	3/4"Flare, option
2	Discharge flange	4"	14	Stop pin	option
3	Safety Valve	1"NPT,option	15	Oil cooler connector(in)	3/4"Flare, option
4	Economizer port	1 1/8", solder	16	Angle valve	1/4"Flare
5	Oil level sight glass		17	Refrigerant service valve	1/4"Flare
6	Liquid(oil or refrigerant) injection connector	3/8"Flare	18	Discharge temp. sensor	110°C
7	Over flow port	option	19	Liquid injection connector	5/8"Flare
8	Check valve	4"	20	Suction flange	5"
9	Oil flow sight glass		21	Cable box	Standard
10	Oil heater	150W/300W	22	Service flange	
11	Oil filter cartridge		23	Oil drain valve	
12	Oil pressure differential switch	Connector, option	24	Oil level switch	

*All stop valves are optional.









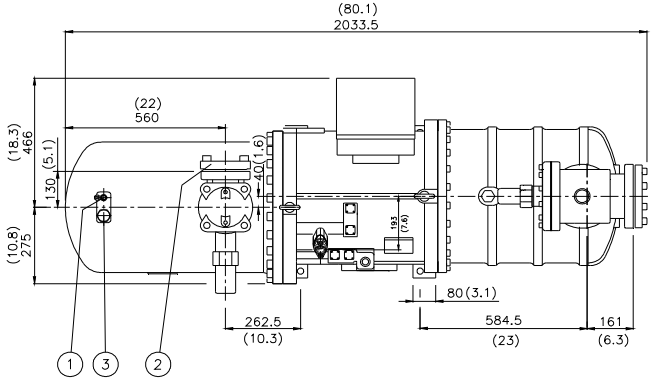
UNIT:
SI: mm Imperial: (in)

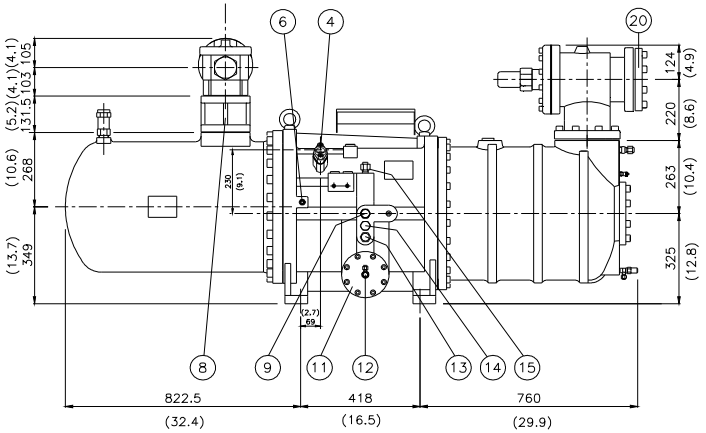
Item	Date	Modification
3		
2		
1		

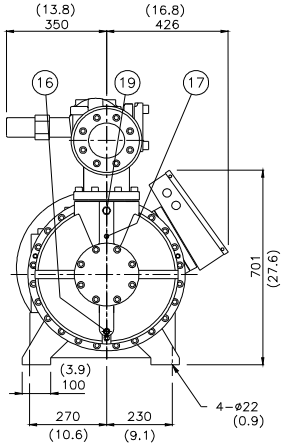
Model	RC2-830AV		
Name	Compressor outline		
	HANBELL	Ver.	01

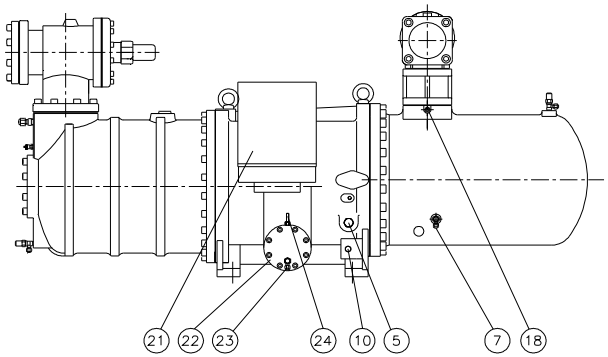
No.	Name	Note	No.	Name	Note
1	Angle valve	1/4"Flare	13	Oil cooler connector(out)	3/4"Flare, option
2	Discharge flange	4"	14	Stop pin	option
3	Safety Valve	1"NPT,option	15	Oil cooler connector(in)	3/4"Flare, option
4	Economizer port	1 1/8", solder	16	Angle valve	1/4"Flare
5	Oil level sight glass		17	Refrigerant service valve	1/4"Flare
6	Liquid(oil or refrigerant) injection connector	3/8"Flare	18	Discharge temp. sensor	110°C
7	Over flow port	option	19	Liquid injection connector	5/8"Flare
8	Check valve	4"	20	Suction flange	5"
9	Oil flow sight glass		21	Cable box	Standard
10	Oil heater	150W/300W	22	Service flange	
11	Oil filter cartridge		23	Oil drain valve	
12	Oil pressure differential switch	Connector, option	24	Oil level switch	

*All stop valves are optional.





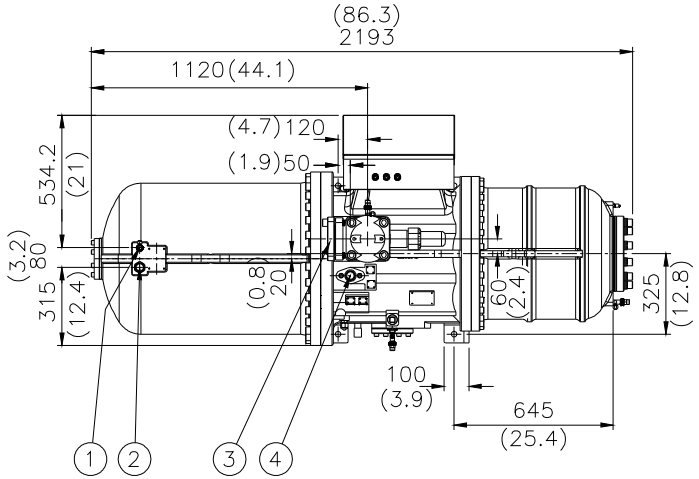




UNIT:
SI: mm Imperial: (in)

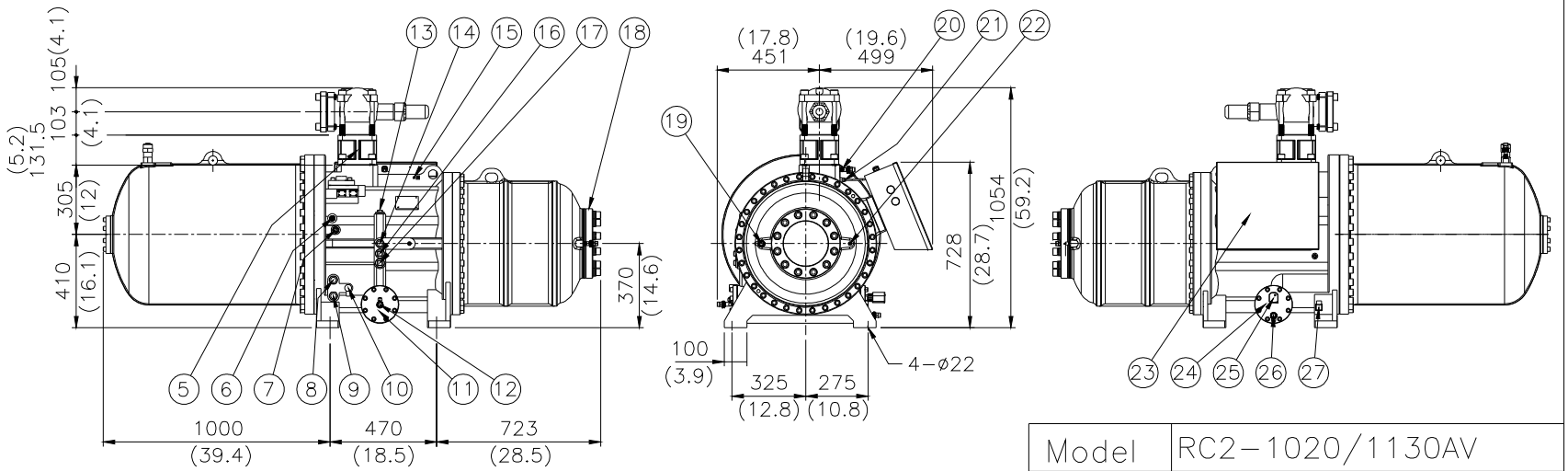
Item	Date	Modification
3		
2		
1		

Model	RC2-930AV
Name	Compressor outline
HANBELL	Ver. 01



No.	Name	Note	No.	Name	Note
1	Angle valve	1/4"Flare	15	Earth bolt	M8
2	Safety valve	1 1/4",option	16	Stop Pin	option
3	Discharge flange	4"	17	Oil cooler connector(out)	3/4"Flare
4	Economizer port	1 3/8", solder	18	Suction flange	6"
5	Check valve	4"	19	Angle valve	1/4"Flare
6	Displacement indicator	Option	20	Angle valve	1/4"Flare,option
7	Oil or Liquid refrigerant injection connector	5/8"Flare	21	Discharge temp. sensor	110°C
8	Oil sight glass	High side	22	Refrigerant service valve	1/4"Flare
9	Oil sight glass	Low side	23	Cable box	Standard
10	Oil equalization valve	1/2"Flare,option	24	service flange	
11	Oil filter cartridge		25	Oil level switch	
12	oil pressure differential switch	connector,option	26	Oil drain valve	1/4"Flare
13	Oil cooler connector(in)	3/4"Flare	27	Oil heater	300W
14	Oil flow sight glass				

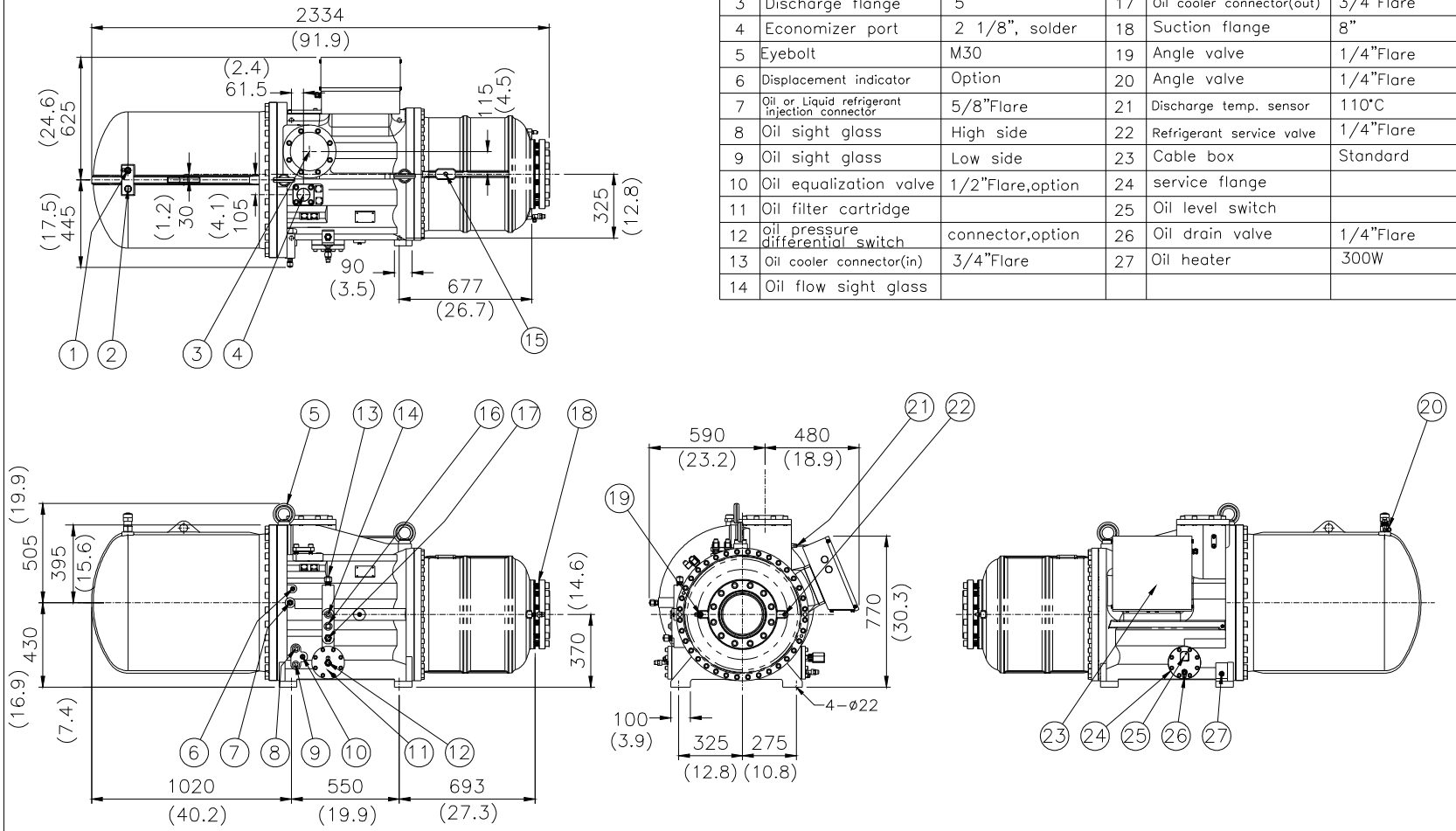
*All stop valve are optional



Unit:
SI:mm Imperial:(in)

Model	RC2-1020/1130AV
Name	Compressor outline
	HANBELL NO. 01

No.	Name	Note	No.	Name	Note
1	Angle valve	1/4"Flare	15	Service eyebolt hole	M20
2	Safety valve	1 1/4",option	16	Stop Pin	option
3	Discharge flange	5"	17	Oil cooler connector(out)	3/4"Flare
4	Economizer port	2 1/8", solder	18	Suction flange	8"
5	Eyebolt	M30	19	Angle valve	1/4"Flare
6	Displacement indicator	Option	20	Angle valve	1/4"Flare
7	Oil or Liquid refrigerant injection connector	5/8"Flare	21	Discharge temp. sensor	110°C
8	Oil sight glass	High side	22	Refrigerant service valve	1/4"Flare
9	Oil sight glass	Low side	23	Cable box	Standard
10	Oil equalization valve	1/2"Flare,option	24	service flange	
11	Oil filter cartridge		25	Oil level switch	
12	oil pressure differential switch	connector,option	26	Oil drain valve	1/4"Flare
13	Oil cooler connector(in)	3/4"Flare	27	Oil heater	300W
14	Oil flow sight glass				



Unit:

SI:mm Imperial:(in)

Model	RC2-1270/1530AV
Name	Compressor outline
	HANBELL NO. 01

4.4 Compressors accessories

To supply “Total Solution” for customers, Hanbell designs complete standard and optional accessories according to various application requirements for safe and steady running and best performance of compressors.

1. Compressors standard and optional accessories:

● : Standard, △ : Optional

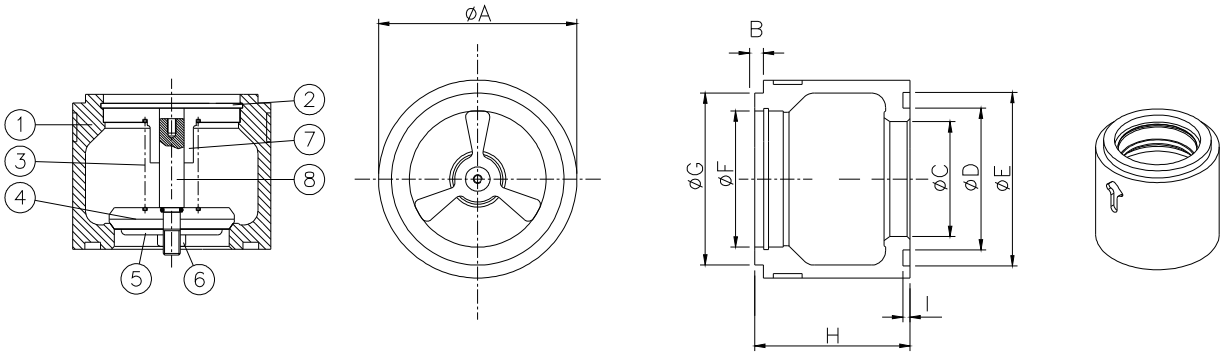
Model & Accessory	RC2-AV																									
	100	140	180	200	230	260	300	310	320	340	370	410	430	470	510	550	580	620	710	790	830	930	1020	1130	1270	1530
Discharge check valve	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Suction & discharge connection bushings	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Suction & discharge stop valves	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△
PTC temp. sensor	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
INT69HBY controller	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
IP54 cable box	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
150W oil heater	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Oil level switch	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△
Oil drain valve	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△
Liquid injection system (solenoid valve + expansion valve)	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△
Liquid injection system (solenoid valve + stop valve)	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△
Horizontal check valve	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△
External oil separator	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△
External oil filter	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△
Oil flow switch	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△
Economizer	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△
Economizer connection stop valve	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△
Oil cooler	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△
Oil pump	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△
Oil filter pressure differential switch connector	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△
Safety valve	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△
Explosion proof accessories	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△
Mounting pad	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△
Lubricant oil	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△
Micro controller	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△
Sound jacket	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△
Temperature sensors Pt100 or Pt1000 – for motor coil temp. monitoring	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△

Note：The accessory chart 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.

2. Description of accessories

a. Suction and discharge check valve

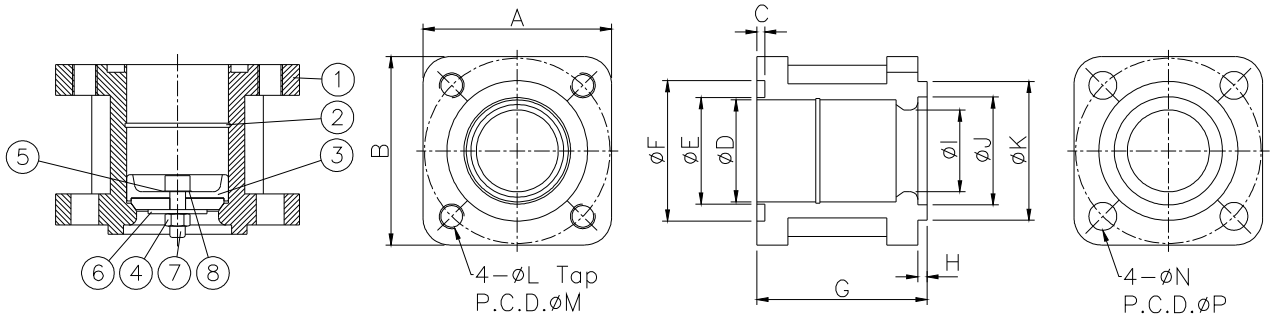
Hanbell standard check valve is gravity-driven with characteristics of large flow volume and low pressure drop. After shut-down of the compressor, Teflon taper guider inside can simultaneously seal up the precisely machined base of check valve by gravity force to effectively prevent return of high-pressured gas to compressor. The gravity-driven check valve is equipped vertically. Due to limitation of space or piping requirements, alternative horizontal check valve is accessible.



Dia.	Dimension								unit: mm
	A	B	C	D	E	F	G	H	I
2”	102	6	53	69	91	65	90	85	5
2 1/2″	122	6	69	89	111	85	110	97	5
3″	138	6	80	99	121	95	120	108	5
4″	163	6	96	124	146	120	145	123	5

No.	1	2	3	4	5	6	7	8
Item	Body	C clipper	Spring	Valve plate	Gasket	Nut	Guide seat	Shaft

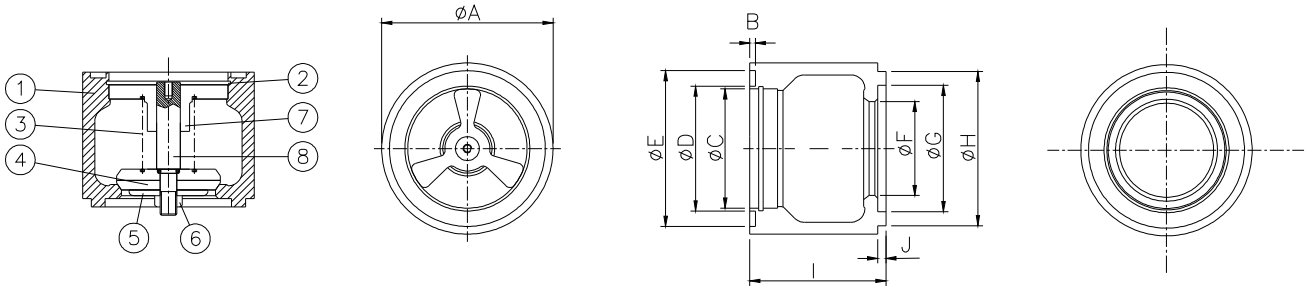
Figure 12 Suction check valve outline drawing (Horizontal type)



Dia.	Dimension														unit: mm
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	P
1 1/2″	109	109	5	55	59	76	105	6	34	60	75	M16x2	105	18	105
2”	122	122	5	65	69	91	110	6	46	70	90	M16x2	120	18	120
2 1/2″	134	134	5	85	89	111	125	6	55	90	110	M16x2	140	18	140
3″	153	153	5	95	99	121	135	6	66	100	120	M20x2.5	160	22	160
4″	171	171	5	120	124	146	135	6	80.5	125	145	M20x2.5	185	22	185

No.	1	2	3	4	5	6	7	8
Item	Body	C clipper	Guide seat	Nut	Valve plate	Gasket	Bolt	Washer

Figure 13 Discharge check valve outline drawing (Vertical type)

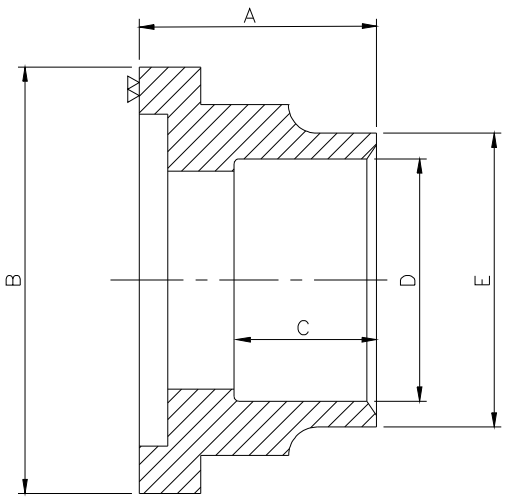


Dia.	Dimension unit: mm									
	A	B	C	D	E	F	G	H	I	J
1 1/2″	86	4	55	59	76	42	60	75	80.5	6
2”	102	4	65	69	91	53	70	90	85	6
2 1/2″	122	4	85	89	111	67	90	110	97	6
3″	138	4	95	99	121	80	100	120	108	6
4″	163	4	120	124	146	96	125	145	123	6
6”	238	5	190	195	216	146	190	215	160	6

No.	1	2	3	4	5	6	7	8
Item	Body	C clipper	Spring	Valve platet	Gasket	Nut	Guide seat	Shaft

Figure 14 Discharge check valve outline drawing (Horizontal type)

b. Suction and discharge connection bushings



Model	Standard Discharge Flange Bushing		Standard Suction Flange Bushing	
	Steel pipe	Copper pipe	Steel pipe	Copper pipe
RC2-100	1 1/2″	1 5/8”	2″	2 1/8”
RC2-140	1 1/2″	1 5/8”	2″	2 1/8”
RC2-180	1 1/2″	1 5/8”	2 1/2″	2 5/8”
RC2-200	1 1/2″	1 5/8”	2 1/2″	2 5/8”
RC2-230	2 ″	2 1/8”	3″	3 1/8”
RC2-260	2 ″	2 1/8”	3″	3 1/8”
RC2-300	2 ″	2 1/8”	3″	3 1/8”
RC2-310	2 ″	2 1/8”	3″	3 1/8”
RC2-320	2 ″	2 1/8”	3″	3 1/8”
RC2-340	2 1/2″	2 5/8”	4″	4 1/8”
RC2-370	2 1/2″	2 5/8”	4″	4 1/8”
RC2-410	2 1/2″	2 5/8”	4″	4 1/8”
RC2-430	2 1/2″	2 5/8”	4″	4 1/8”
RC2-470	2 1/2″	2 5/8”	4″	4 1/8”
RC2-510	3″	3 1/8”	4″	4 1/8”
RC2-550	3″	3 1/8”	4″	4 1/8”
RC2-580	3″	3 1/8”	4″	4 1/8”
RC2-620	3″	3 1/8”	5″	5 1/8”
RC2-710	4″	4 1/8”	5″	5 1/8”
RC2-790	4″	4 1/8”	5″	5 1/8”
RC2-830	4″	4 1/8”	5″	5 1/8”
RC2-930	4″	4 1/8”	5″	5 1/8”
RC2-1020	4”	4 1/8”	6”	
RC2-1130	4”	4 1/8”	6”	
RC2-1270	5”		8”	
RC2-1530	5”		8”	

Figure 15 Flange bushing dimensions

Note：The above table lists specification of standard bushing for every model of RC2-AV series compressors. Their dimensions refer to flange bushing dimensions and the table below. If bushing dimensions are not indicated in purchasing orders, Hanbell will provide standard type. Suitable piping of customers’ choice is also shown in the table below. If non-standard bushing is needed, please double-check with Hanbell sales representatives when placing orders for compressors.

Specification and dimension of optional flange bushing:

Model	Discharge / Suction port	Materials and Sizes of pipes		Dimension of flanges bushing				
				A	B	C	D	E
RC2-100 RC2-140	Discharge	Copper	1 5/8"	52	75	35	41.6	52
			2 1/8"				54.3	65
		Steel	1 1/2"				49.3	64
	Suction	Copper	1 5/8"	50	90	30	41.6	55
			2 1/8"				54.3	65
			2 5/8"				67	74
		Steel	2"				61.3	74
RC2-180 RC2-200	Discharge	Copper	15/8”	52	75	35	41.6	52
			2 1/8"				54.3	65
		Steel	1 1/2"				49.3	64
	Suction	Copper	2 1/8"	60	110	35	54.3	65
			2 5/8"				67	77
			3 1/8"				79.8	90
		Steel	2 1/2"				77.2	90
RC2-230 RC2-260 RC2-300 RC2-310 RC2-320	Discharge	Copper	1 5/8"	50	90	30	41.6	55
			2 1/8"				54.3	65
			2 5/8"				67	74
		Steel	2"				61.3	74
	Suction	Copper	2 1/8"	66	120	45	54.3	65
			2 5/8"				67	77
			3 1/8"				79.8	90
		Steel	2 1/2"				77.2	92
			3				90.2	103
RC2-340 RC2-370 RC2-410 RC2-430 RC2-470	Discharge	Copper	2 1/8"	60	110	35	54.3	65
			2 5/8"				67	77
			3 1/8"				79.8	90
		Steel	2 1/2"				77.2	90
	Suction	Copper	3 1/8"	76	145	50	79.8	90
			3 5/8"				92.4	103
			4 1/8"				105.1	116
		Steel	3"				90.2	105
			3 1/2"				102.8	117
			4"				115.6	128
RC2-510 RC2-550 RC2-580	Discharge	Copper	2 1/8"	66	120	45	54.3	65
			2 5/8"				67	77
			3 1/8"				79.8	90
		Steel	2 1/2"				77.2	92
			3"				90.2	103
	Suction	Copper	3 1/8"	76	145	50	79.8	90
			3 5/8"				92.4	103
			4 1/8"				105.1	116
		Steel	3"				90.2	105
			3 1/2"				102.8	117
			4"				115.6	128
RC2-620	Discharge	Copper	2 1/8"	66	120	45	54.3	65
			2 5/8"				67	77
			3 1/8"				79.8	90
		Steel	2 1/2"				77.2	92
			3"				90.2	103
	Suction	Copper	4 1/8"	80	174	35	105.1	121.2
			5 1/8"	75			130.5	146.5
		Steel	5"	75			141.3	154
RC2-710 RC2-790 RC2-830 RC2-930	Discharge	Copper	3 1/8"	76	145	50	79.8	90
			3 5/8"				92.4	103
			4 1/8"				105.1	116
		Steel	3"				90.2	105
			3 1/2"				102.8	117
			4"				115.6	128
	Suction	Copper	4 1/8"	80	174	35	105.1	121.2
			5 1/8"	75			130.5	146.5
		Steel	5"	75			141.3	154
RC2-1020 RC2-1130	Discharge	Copper	3 1/8”	76	145	50	79.8	90
			3 5/8”				92.4	103
			4 1/8”				105.1	116
		Steel	3”				90.2	105
			3 1/2"				102.8	117
			4"				115.6	128
	Suction	Steel	6"	75	215	40	166.7	196
RC2-1270 RC2-1530	Discharge	Steel	5”	75	174	35	141.3	154
	Suction	Steel	8”		260	40	218	241

c. Suction and discharge stop valves

In order to isolate the compressor from system for maintenance and service purposes, it is recommended install suction and discharge stop valves. Please refer to the following detail of Hanbell stop valves.

Model	Stop Valve Size		Model	Stop Valve Size	
	Discharge	Suction		Discharge	Suction
RC2-100	1 1/2″	2″	RC2-470	2 1/2″	4″
RC2-140	1 1/2″	2″	RC2-510	3″	4″
RC2-180	1 1/2″	2 1/2″	RC2-550	3″	4″
RC2-200	1 1/2″	2 1/2″	RC2-580	3″	4″
RC2-230	2″	3″	RC2-620	3″	5″
RC2-260	2″	3″	RC2-710	4″	5″
RC2-300	2″	3″	RC2-790	4″	5″
RC2-310	2″	3″	RC2-830	4″	5″
RC2-320	2″	3″	RC2-930	4″	5″
RC2-340	2 1/2″	4″	RC2-1020	4″	6″
RC2-370	2 1/2″	4″	RC2-1130	4″	6″
RC2-410	2 1/2″	4″	RC2-1270	5″	8″
RC2-430	2 1/2″	4″	RC2-1530	5″	8″

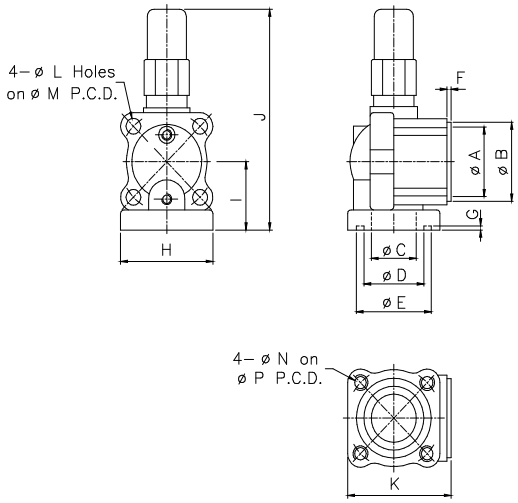


Figure 16 Dimension of stop valve

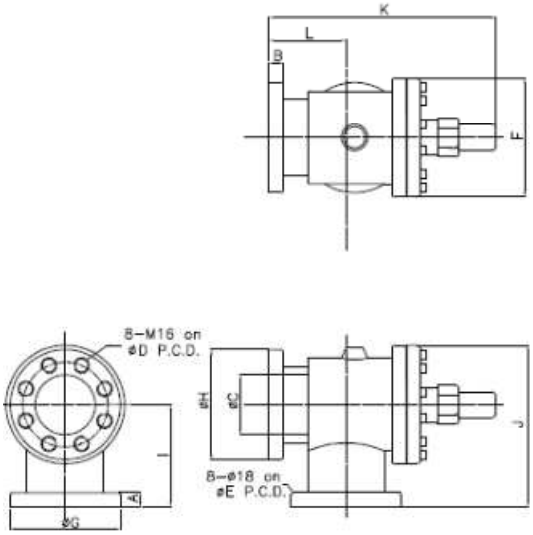


Figure 17 5” Suction stop valve

Dia.	Dimensions														unit: mm
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	P
1 1/2″	60	75	36	59	76	6	5	106	75	256	115	18	105	M16x2	105
2”	70	90	60	69	91	6	5	122	86	280	128	18	120	M16x2	120
2 1/2″	90	110	67	89	111	6	5	137	95	307	153	18	140	M16x2	140
3″	100	120	80	99	121	6	5	154	117	398	177	22	160	M20x2.5	160
4″	125	145	105	124	146	6	5	171	130	445	201	22	185	M20x2.5	185
5”	30	30	126	194	194	248	230	230	214	338	474	161			

* Specification of stop valve

Maximum working pressure	Hydrostatic pressure test	Refrigerant	Temperature range
28 kg / cm² g	42 kg / cm² g	HFC, HCFC	–40˚C~150˚C

d. INT69HBY motor protector and PTC temperature sensor

In order to protect compressors, every RC2-AV series compressor has four PTC temperature sensors (thermistors), three embedded in motor coil and one at the discharge port of the compressor. These sensors are connected to INT69HBY protection module to monitor the motor coil temperature and discharge temperature. If the temperature in one of the positions monitored exceeds the target temperature (for standard PTC thermistor: 110^{o}C), the sensor resistance increases dramatically and the protector INT69HBY output relay trips.

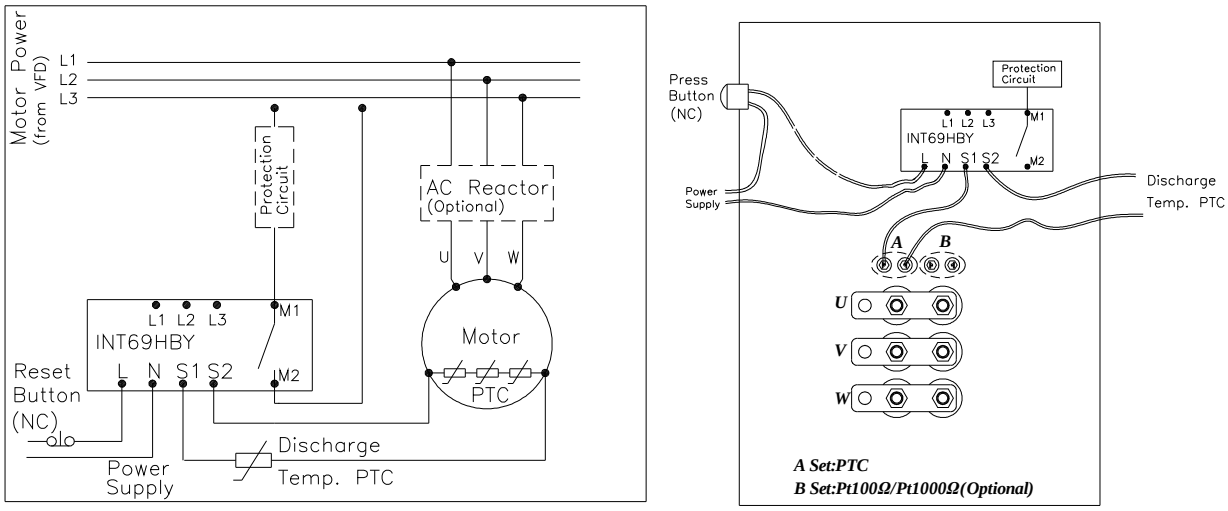


Figure 18 INT69HBY & PTC connection diagram

Other major functions are described follow:

1. When supply voltage is applied, the output relay pulls in after an initialization period of 3 seconds (approximately), provided all thermistors lie below their rated response temperature.
2. 1 to 9 PTC thermistors with varied rated response temperatures can be connected in series to input terminals.
3. If any thermistor resistance increases above trip level the relay drops out. This failure results in a lockout. (5 minutes delay for the 1st PTC failure, 60 minutes delay for the 2nd failure, eternal lockout for the 3rd failure until manual reset)
4. Lockout and time delay can be cancelled by mains reset of approx. 5 seconds.
5. LED with red/green light provides operational information.
6. The relay is fed out as a N/O dry contact, which is closed under good conditions.
7. Sensor and supply circuits are galvanic isolated.

Note: Motor protector phase monitor (phase loss and phase sequence) function is not suitable for variable frequency drive application.

Technical data of INT69HBY

- ●Supply voltage
  AC 50/60 Hz 115/120V-15…+10% 3VA
  AC 50/60 Hz 230/240V-15…+10% 3VA
- ●Ambient temperature
  -30…+70℃
- ●Relay output

  max. AC 240V, max. 2.5A, C300
  min. ＞ 24V AC/DC, >20 mA

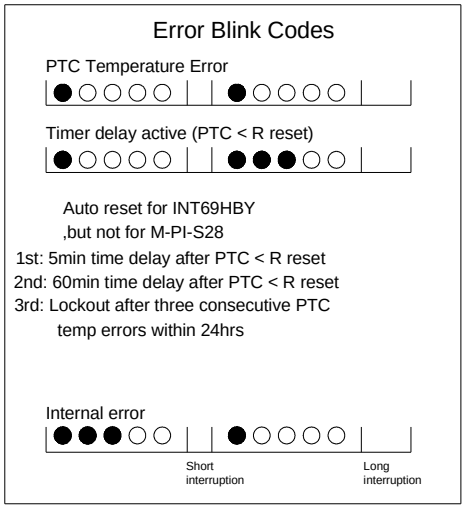


Figure 19 INT69HBY Blink codes display

e. Oil heater

One UL approved 150W oil heater has been installed in every compressor as a standard accessory. Before restart of compressor after shutdown for a long time, please turn on oil heater at least 8 hours to make the temperature inside compressor higher than system temperature and ambient temperature. This action prevents condensed refrigerant inside oil sump of compressors which may result in liquid compression in following operations and poor lubrication due to low viscosity of lubrication oil. Hanbell also offers 300W oil heater to keep adequate lubricant oil temperature for large external oil separator and applications in areas where the ambient temperature is low.

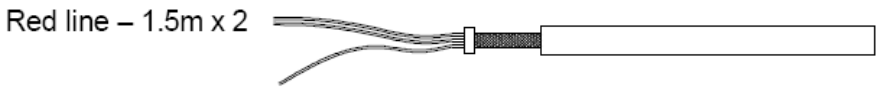


Figure 20 Oil heater

Specification： 150W, 300W; 110V or 220V; IP 54; UL approval

Note: If the compressor is installed in low ambient temperature area, it is recommended insulate oil separator against cold environment.

f. Oil level switch

There are 3 wires on Hanbell oil level switch. 2 of them are for the interlock to main control circuit or independent circuit for micro controller, the other one with green color for grounding. To prevent oil level switch from tripping caused by oil foaming or surging in the sump, a time delay of max 15 seconds is recommended.

Max. contact capacity = 50VA DC/AC
Initial contact resistance = 150mΩ (Max.)
Switching voltage = 600V DC
Max. voltage = 300V DC/AC
Max. current = 0.5A DC/AC

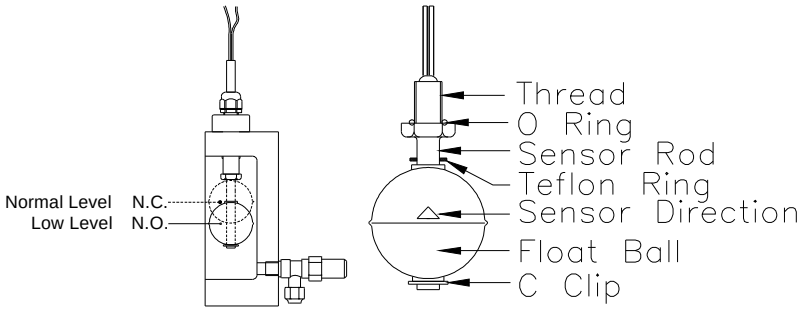


Figure 21 Oil level switch

Notes:
1. There is a triangle mark on the float indicating the sensor direction. Before you install an oil level switch on a compressor or an external oil separator, please take the triangle mark as reference before installing any oil level switch on the compressor or external oil separator.
2. Please check the triangle mark and modify the oil level switch if needed. This triangle mark should point upward in any case.
3. The installations of the oil level switch on a compressor and an external oil separator are shown below.

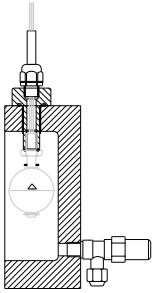


Figure 22 Oil level switch on a compressor

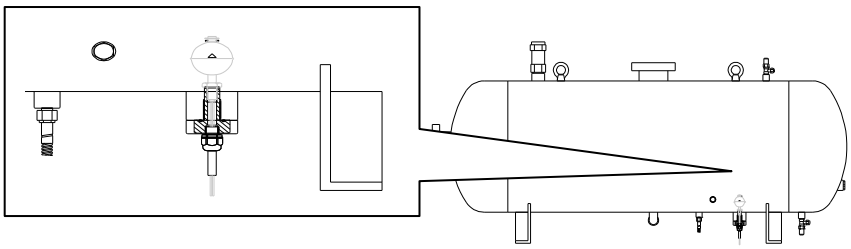


Figure 23 Oil level switch on an external oil separator

g. Oil drain valve

Oil drain valve is installed in a compressor to drain out oil for maintenance.

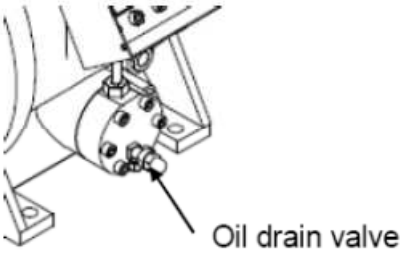
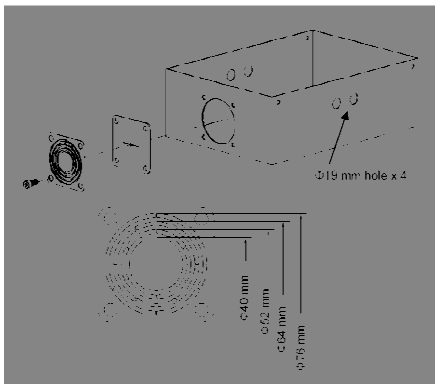


Figure 24 Oil drain valve

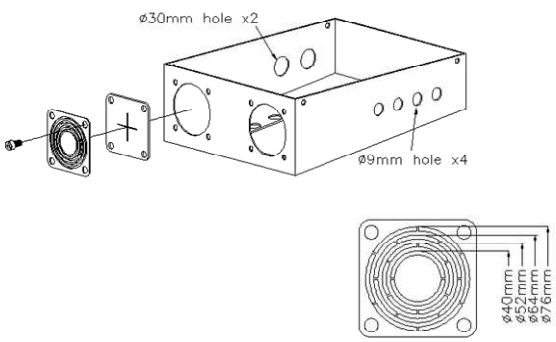
h.IP54 cable box

Hanbell designs and makes the cable box which meets IP54 specification. Dimensions of cable box and the size of opening in cable box (for motor power lines and control power lines) refer to the drawing below

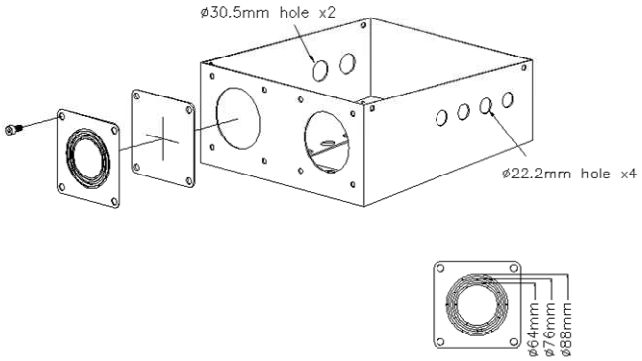
①RC2-100/140/180AV cable box



②RC2-200~620AV cable box



③RC2-710~930AV cable box



④RC2-1020~1530AV cable box

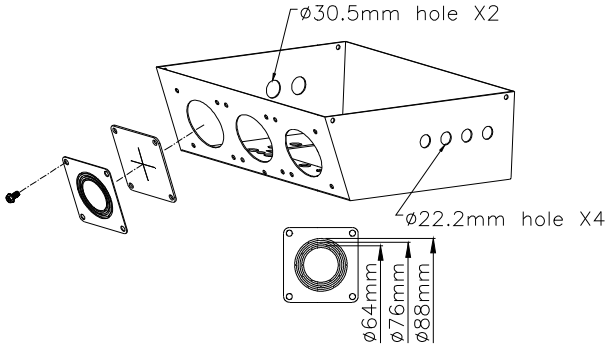


Figure 25 IP54 cable box

i. Liquid injection system (solenoid valve + expansion valve)

Liquid injection system provides an additional cooling to motor coil. RC2-AV compressors cools the motor coil by suction gas flow. For applications whose condensing temperature is high or evaporating temperature is low, liquid injection to motor is recommended. For high compression ratio applications, liquid injection to compression chamber is also recommended to absorb high compression heat to maintain discharge temperature below 80^{o}C which Hanbell recommends for most applications. Please refer to Chapter 7 to know more details about additional cooling.

Hanbell provides the following liquid injection expansion valves and solenoid valves for customers to choose. Please calculate through Hanbell selection software to know needed additional cooling capacity choose appropriate liquid injection expansion valves.

Brand	Model	Low Temp. Type	Mid Temp. Type	High Temp. Type
SPORLAN	Y1037-FV-3-180,3/8"SAE			○
	Y1037-FV-5-180,3/8"SAE			○
ALCO	TCLE-3HW-6A	○		
	TCLE-5HW-6A	○		
	TCLE-10HW-6A	○		
FUJIKOKI	JBE-E60HFKT-1			○
HANBELL	HB-EXP-5L	○		
	HB-EXP-12L	○		
	HB-EXP-5M		○	
	HB-EXP-12M		○	
	HB-EXP-5H			○
	HB-EXP-12H			○

j. Liquid injection system (solenoid valve + stop valve)

This simple liquid injection system adjusts amount of liquid injection by stop valve, suitable for application with level load and ambient temperature but it's not recommended. Opening ratio of stop valve is fix even system loading and motor/discharge temperature change. Therefore, frequent check of discharge temperature can prevent damage of compressor due to over cooling or insufficient cooling.

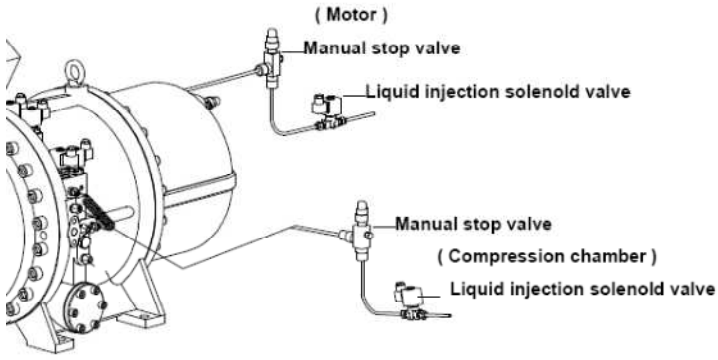


Figure 26 Liquid injection – solenoid valve + stop valve

k. Horizontal check valve

Horizontal check valve is a standard accessory of compressors for flooded system. Please refer to section C. for dimension of horizontal check valve. A sample installation is shown below:

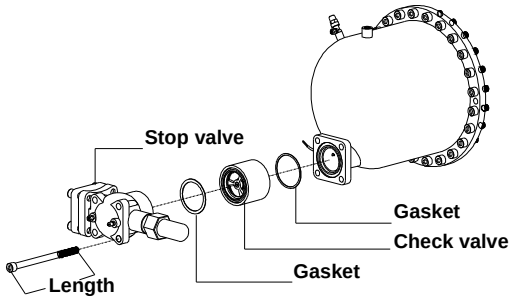


Figure 27 Dimensions and installation of horizontal check valve

l. External oil separator

For improvement of oil return in flooded-type, low-temperature and parallel systems, system with long piping, Hanbell specially designs a complete series of external oil separators – OS series with characteristics of high separation efficiency and low pressure drop. The following table shows details of OS series:

(Ⅰ) Technical data：

Model	Type	Oil Volume (Liter)		Range of application based on Displacement (m^3/hr) (Recommended)	Shell Diameter
		High level	Low level		
OS40	Vertical	17	9	205	14”
OS50	Vertical	22	12	206~270	16”
OS65	Vertical	31	18	271~440	18”
OS80	Horizontal	33	20	441~705	20”
OS100	Horizontal	40	27	706~1120	20”
OS125	Horizontal	50	30	1121~1310	24”
OS150	Horizontal	60	36	1311~1835	24”

(Ⅱ) Accessories：

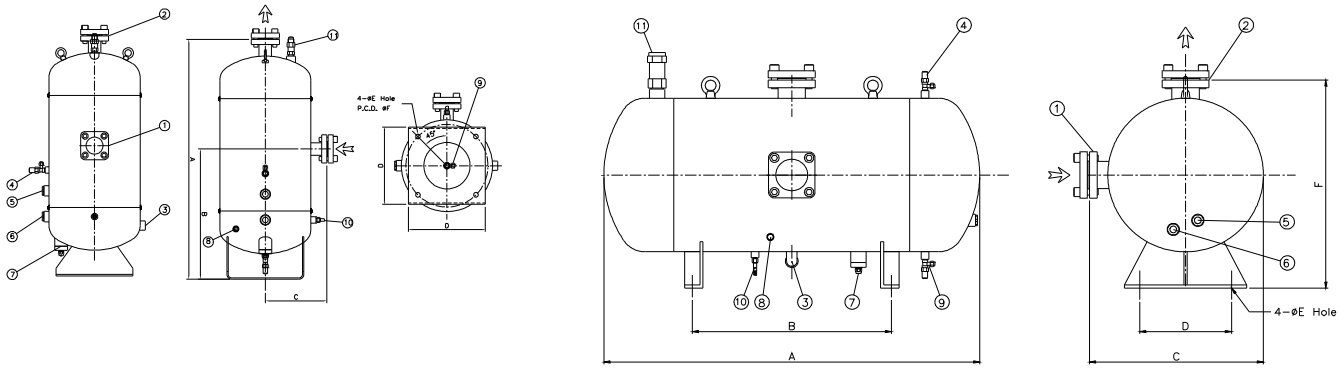
No.	Description	OS40	OS50	OS65	OS80	OS100	OS125	OS150
1	Refrigerant inlet	1 1/2”	2”	2 1/2”	3”	4”	5”	6”
2	Refrigerant outlet	1 1/2”	2”	2 1/2”	3”	4”	5”	6”
3	Oil outlet	5/8” Flare	5/8” Flare	5/8” Flare	1” PF	1” PF	1 1/4” PF	1 1/4” PF
4	Oil charge valve	1/4” Flare						
5	High oil S.G.	1 PCS						
6	Low oil S.G.	1 PCS						
7	Oil level switch	1 PCS						
8	Oil heater	150W	150W	150W	150W	150W	300W	300W
9	Oil drain valve	1/4” Flare						
10	Oil temp. protection (option)	1/8” NPTF						
11	Safety valve (option)	1/2”	1/2”	1/2”	1”	1”	1 1/2”	1 1/2”

(Ⅲ) Dimensions：

No.	OS40	OS50	OS65	OS80	OS100	OS125	OS150
A	930	1050	1110	1227	1637	1829	2229
B	505	585	595	650	1000	1080	1480
C	240	275	300	568	354	409	409
D	300	350	350	300	300	400	400
E	18	22	22	23	23	23	23
F	320	360	360	688	698	830	830

Note：It is recommended to install a muffler before the external oil separator to avoid noise and vibration which is caused by resonance.

(Ⅳ) Drawing：

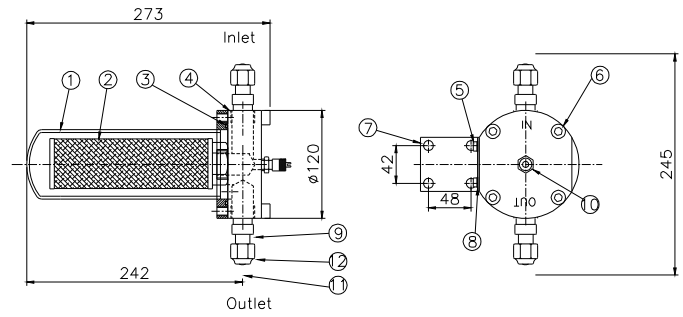


Vertical－OS40~65　　Horizontal－OS80~150

Figure 28 OS series external oil separator

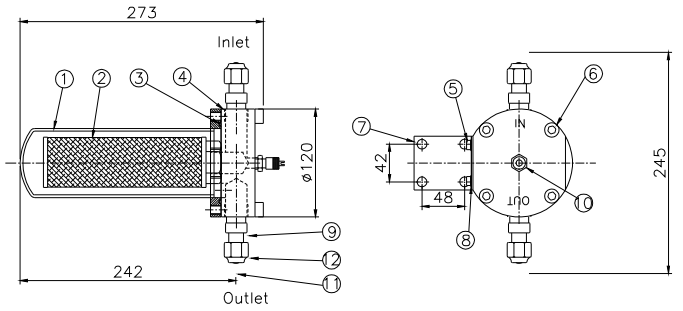
m. External oil filter

External oil filter is an optional accessory. It is suggested to install an external oil filter in oil return line before the suction port of compressor for safe running of compressors.



3131－3140A－1

Item	Part number	Part name	Specification	Q'ty
1	4210－10	Filter shell		1
2	3105－1143B	oil cartridge	300mesh	1
3	4201－VG085	O－Ring	G85 VTION	1
4	4210－11	Filter flange	5/8"F出入口	1
5	4301－108016	Bolt	M8X16L	2
6	4301－110050	Bolt	M10X50L	4
7	4212－12	L supporter		1
8	4303－108	Washer	M8	2
9	3101－1092A	Connector	1/2"NPTX5/8F"	2
10	4304－201	Connector	1/4"NPT	1
11	4302－306	Copper Nut	5/8"F	2
12	3107－1091AA	Nut	5/8"F	2



3136－3140A－1

Item	Part number	Part name	Specification	Q'ty
1	4210－10	Filter shell		1
2	3105－1143B	oil cartridge	300mesh	1
3	4201－VG085	O－Ring	G85 VTION	1
4	4210－13	Filter flange	5/8"F出入口	1
5	4301－108016	Bolt	M8X16L	2
6	4301－110050	Bolt	M10X50L	4
7	4212－12	L supporter		1
8	4303－108	Washer	M8	2
9	3107－1092A	Connector	3/4"NPTX3/4F"	2
10	4304－201	Connector	1/4"NPT	1
11	4302－309	Copper Nut	3/4"F	2
12	3101－1091AA	Nut	3/4"F	2

Figure 29 External oil filter

n. Oil flow switch

Oil flow switch operates in oil return line between external oil separator and compressor to prevent deficient oil return. Specification and installation of oil flow switch are shown as below:

Specification:

	G	Type	PN bar	Qmax. Recom. l/min	switch value l/min selectable range for fixed switch	L mm	H mm	SW mm	X mm	Weight kg
bronze	G 1/2	FF-015GR012	200	20	0.4-12	68	79	29	13	0.6
	G 3/4	FF-020GR025	25	40	0.6-25	73	79	32	11	0.7
	G 1	FF-025GR040	25	60	1.5-40	87	90	41	14	1

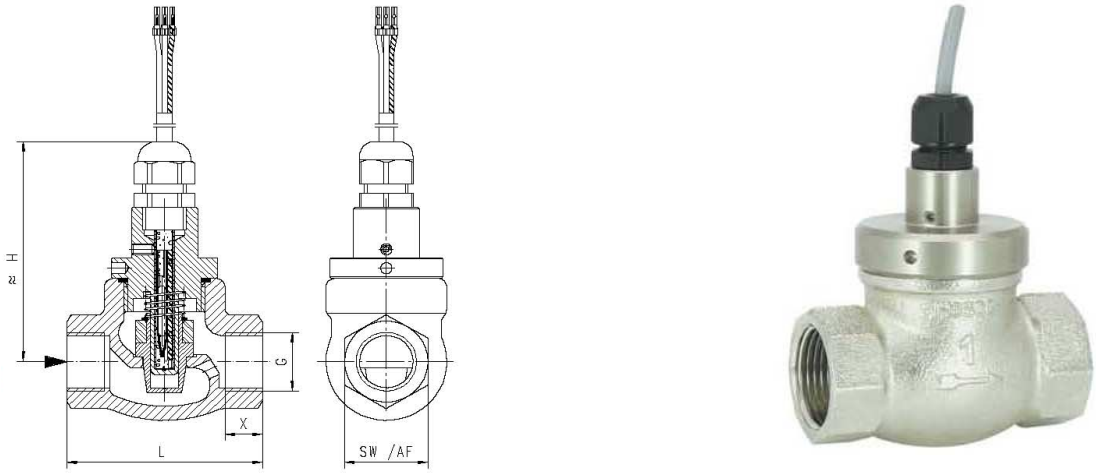


Figure 30 Oil flow switch

(1) Tolerance：+/- 0.3l/min
(2) Media temperature: max 110℃
(3) Average pressure loss:0.4 bar at Qmax
(4) Hysteresis: depending on switch value minimum 0.4 l/min

Note：Switch value is indicated for horizontally decreasing flow.

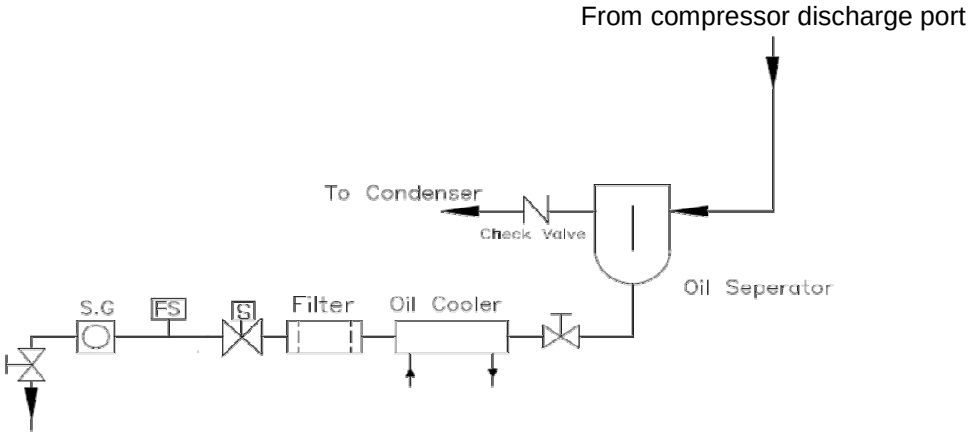


Figure 31 Installation of oil flow switch

o. Economizer connection muffler

When economizer is used, it is recommended to install a muffler and check valve before ECO port on compression casing to effectively mitigate pulsation noise in middle pressure as shown below:

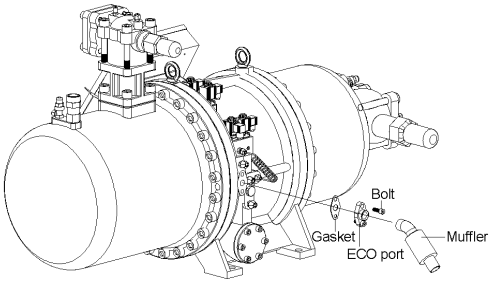


Figure 32 Installation of ECO muffler

p. Mounting pad

To avoid extra vibration and noise resulted from direct contact between compressor footings and the base on which the compressor is mounted, it is recommended to add mounting pads in between as the drawing below shown.

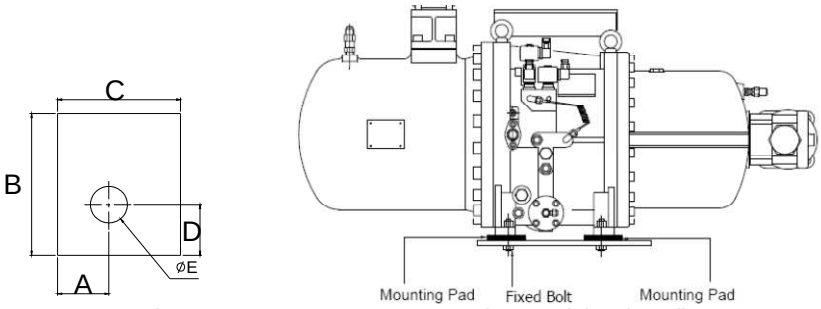


Figure 33 Compressor mounting pad (optional)

Model	Part No.	A	B	C	D	E	Thickness	Req. Q'ty
RC2-100~320AV	3131-9815B	20	55	50	20	22	20 mm	4
RC2-340~580AV	3136-9815B	26	100	70	25	22	20 mm	4
RC2-620~930AV	3139-9815B	25	100	80	25	22	20 mm	4
RC2-1020~1530AV	3142-9815B	40	100	80	40	22	20 mm	4

q. Temperature sensors Pt100 or Pt1000

To detect temperature of motor coil, Hanbell mounts Pt100 or Pt1000 sensor on motor coil as optional accessories. This temperature sensor along with controller of the system monitor motor coil temperature and then control on/off of liquid injection valve accordingly to provide suitable liquid injection as shown in the diagram below.

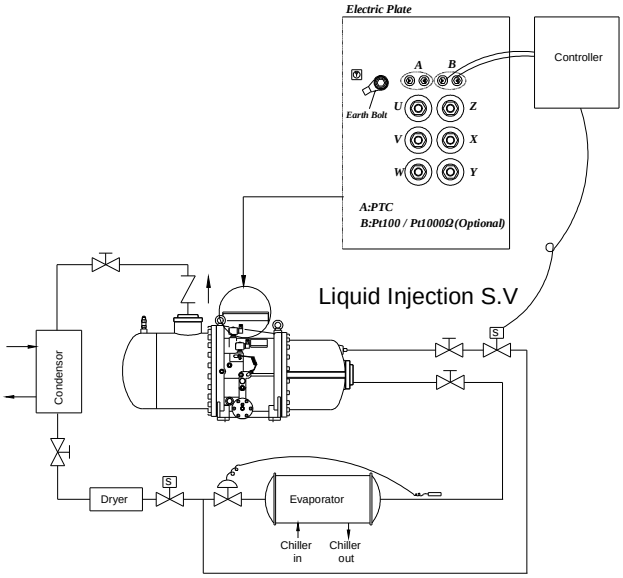


Figure 34 Liquid injection connection diagram

Note:

1. Liquid injection solenoid valve is controlled by the controller according to temperatures measured by Pt100/Pt1000 sensor.
2. Liquid injection sub solenoid valve is for auxiliary use. Its control logic is the same with that of aforementioned liquid injection valve.
3. Hanbell suggests to control temperature of motor coil at 60℃ (not higher than 60℃)

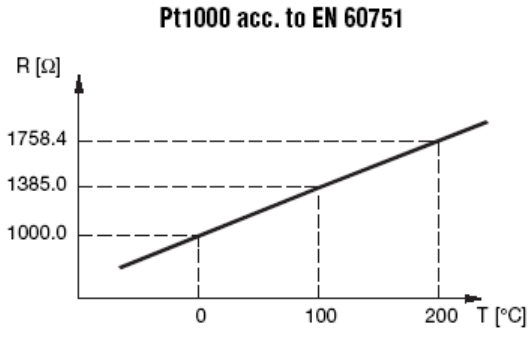


Figure 35 Pt1000 sensor

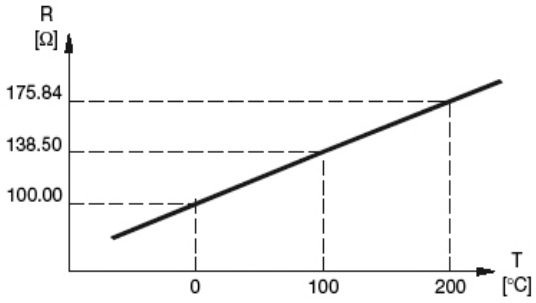


Figure 36 Pt100 sensor

Specification: Pt100 sensor

- Recommended max. meas. Current for heat coefficient <0.1K - DC 1 ~ 3 mA
- Heating coefficient - 10mΩ/K
- Sensor resistance at 0℃ - 100Ω±0.12Ω
- Change of resistance 0 ~ 100℃ - 0.385Ω/K
- Insulation test voltage U is – AC 1.5kV

Specification: Pt1000 sensor

- Recommended max. meas. Current for heat coefficient < 0.1K – DC0.2 ~ 2mA
- Sensor resistance at 0℃ - 1000Ω±1.20Ω
- Change of resistance 0 ~ 100℃ - 3.85Ω/K
- Insulation test voltage U is – AC 1.5kV

Compressors motor can be equipped with either Pt100 or Pt1000 sensor to precisely control liquid injection and maintain motor coil while running. Please specify Pt100 or Pt1000 sensor when placing orders to Hanbell. Their connection refers to Figure 37.

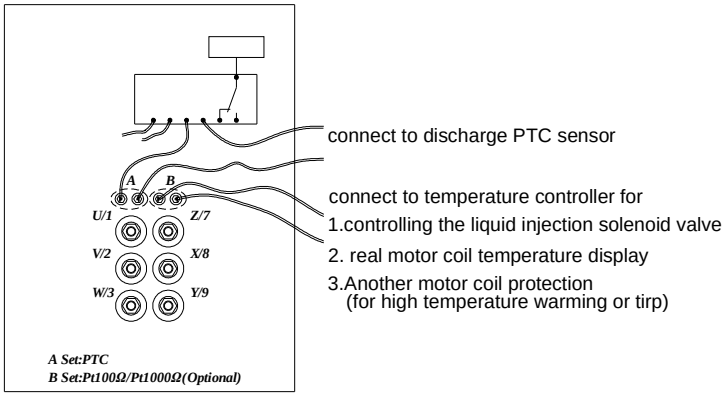


Figure 37 Connection diagram of Pt100/Pt1000 sensor

5. Electrical data and design

5.1 Motor design

HANBELL RC2-AV series screw compressors are equipped with Y-Δ motor for frequency inverter (VFD, variable frequency drive). The motor is specially winded and its insulation is enhanced for wide frequency applications. During starting, until reaching specified operating condition, the current will increase proportionally. The motor voltage is low during start, as a result the starting current and starting torque are also low.

5.2 Electrical installation with VFD

RC2-AV series compressors are compatible with any general inverters. The general connection diagram is as shown below in Figure 38. An AC reactor should be installed between the power supply and the inverter in order to prevent power system from serious breakdown. The installation of another AC reactor between the compressor and the inverter is strongly recommended, especially when the wiring length between VFD and motor exceeds 5m; otherwise it might cause serious damage to the inverter or the motor. Please discuss with your VFD providers whether this AC reactor should be installed. Connection of power supply of the compressor (from the inverter), Pt100/1000 and PTC sensors is as shown in 37.

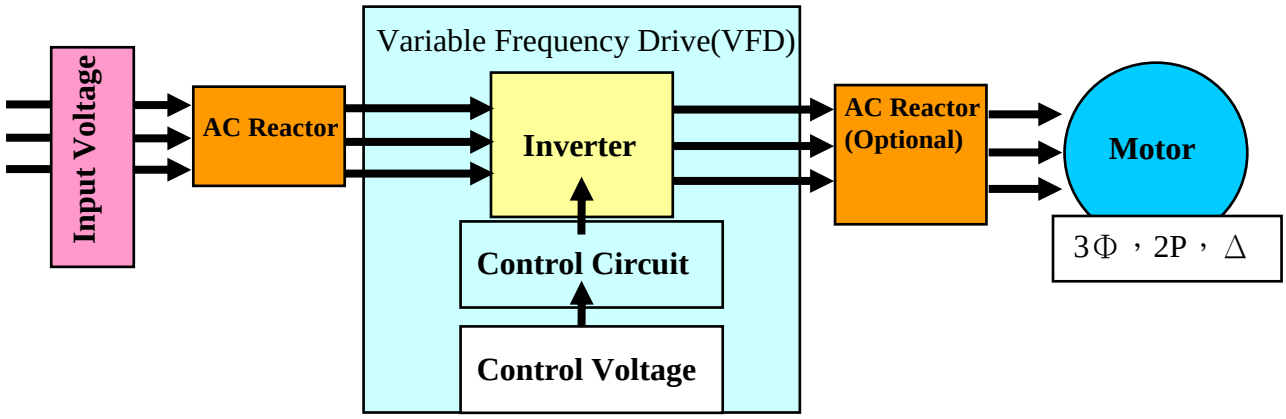


Figure 38 RC2-AV compressor & VFD installation diagram

5.3 V-F diagram

The motor of RC2-AV series compressor is designed for variable speed operations. Its voltage vs. frequency relationship is shown below in Figure 39. Please set your inverter corresponding to Figure 39 to operate the compressor properly.

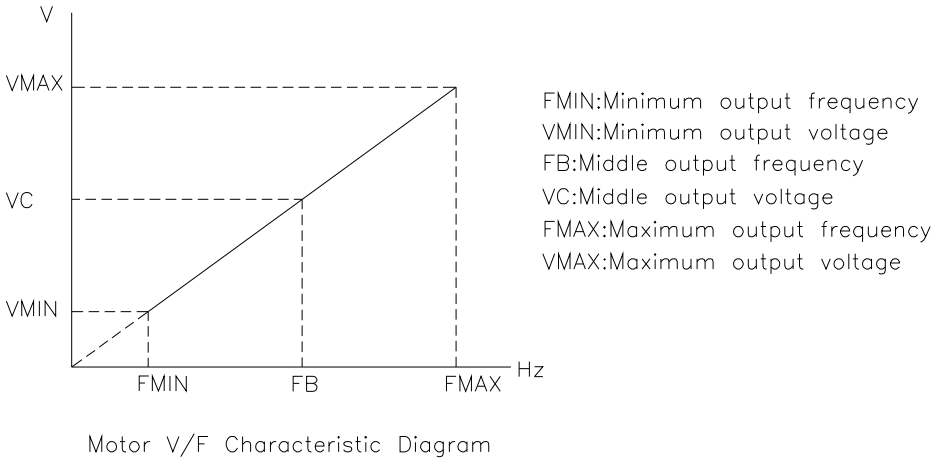


Figure 39 RC2-AV motor V/F diagram

Notes:

1. VMAX / FMAX = Motor rated Voltage / Frequency.
2. FMIN or FB could be random. Make sure that VMIN / FMIN = VC / FB = VMAX / FMAX;
   FMAX > FB > FMIN; VMAX > VC > VMIN.
   For 400V, 80Hz Motor,
   VMAX is 400(V), and FMAX is 80(Hz)
   If FMIN is 0.5Hz, VMIN would be 400÷80×0.5 = 2.5 (V);

If FB is 3Hz, VC would be 400÷80×3 = 15 (V)

3. For safety reason, the recommended way to check V/F setting is to operate VFD without connecting motor. If the ratio of output voltage and frequency is always equal to VMAX / FMAX, V/F setting could be finished.
4. Once VFD starts to drive motor, please check the output current at the beginning. Incorrect V/F setting would result in an excessive current. If so, please shutdown VFD immediately and recheck all of the settings.

5.4 Compressor protection devices

The table below shows the list of protection devices which protects the compressor to operate safely. Apply protection devices listed below to ensure your compressor could run under normal condition.

Protection device	Set point	Remark
Motor wiring temperature protector (PTC sensor)	Cutout 110℃, cut in 100℃ ※	Standard
Discharge temperature protector (PTC sensor)	Cutout 110℃, cut in 100℃ ※	Standard
Oil level switch		Optional
Oil filter pressure differential switch	Cutout 1.5kg/cm^{2}g	Optional
Oil flow switch		Optional
Pt100 or Pt1000 for liquid injection to motor chamber.	Depends on applications. Normally the injection starts at 60℃ and cut out at 50℃	Optional

※Manual reset suggested

Motor thermistors and discharge thermistors are temperature sensors with quick response while the temperature approaches to their set point; thermistors must be connected in series to a controller (INT69HBY) in cable 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 short controllers for starting of compressors is prohibited. It is beyond Hanbell warranty of compressors if any action mentioned is found.

Note: when any protection device trips, please do troubleshooting and reset manually. Do not let the compressor reset automatically after any trip!

5.5 Grounding

There's a grounding terminal on terminal plate. Please connect it to grounding of system control panel.

Suggestion:

a. The regular setting of electric leak protection should be greater than 50mA; for humid locations, 25mA is recommended.
b. Grounding voltage of casing should be less than 50V; for humid locations, the maximum is 25V.
c. Grounding resistance should be less than 500 Ohm.
d. Air cut board (ACB) is regularly equipped with electric leak protection. Please refer to related settings for its normal action.
e. If electric leak protection is active, please check if insulation of equipments is normal and if its wiring and setting are correct.

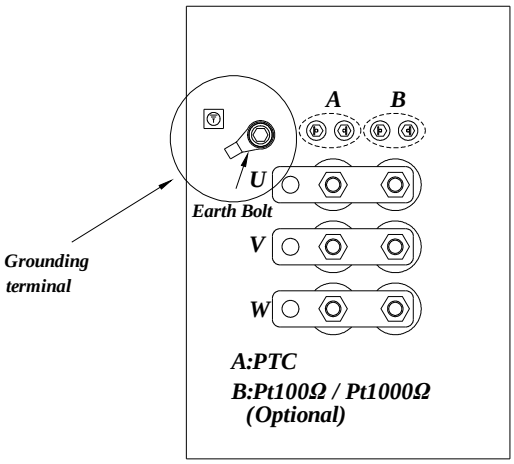


Figure 40 Grounding Terminal

Please make sure nothing is wrong before turning on power. If there are any questions, please contact the supplier of equipments.

6. Operation and maintenance

6.1 Compressor start-up

PRE-START CHECKING- The table below shows the required procedures and checkpoints before starting the compressor during commissioning or initial operation of the unit.

Items	Things to be checked	States or standard values
1. Accessories	1. Oil level 2. Oil heater 3. System valves status 4. Solenoid valves	1. Oil should be enough 2. Should be kept energized after the compressor's shutdown. 3. Opened 4. Fixed firmly.
2. Electrical system	1. Voltage of main power 2. Voltage of control circuit 3. Insulation resistance value of the motor between phase to phase and phase to ground. 4. Power terminals and wire cables' terminal connection. 5. Grounded 6. Capacity of electrical accessories 7. Settings of switches, sensors and controllers	1. Voltage of power supply should be kept within 5% tolerance to the rated voltage, instant maximum voltage drop while starting should be less than 10% tolerance to the rated voltage. 2. Standard voltage is 220V. Maximum voltage is 230V. If there is other demand, contact HANBELL. 3. Insulation resistance value should be above 5MΩ 4. Power terminals are firmly fixed on terminal block and well insulated. Keep cables away from heat source and sharpened metal. 5. Regulated by the local electricity regulations. 6. Properly selection (or required by the system designer) 7. Proper settings (or required by system designer)
3. Piping system	1. Outer piping system 2. Leakage test 3. Bolts to fix the compressor.	1. Fixed firmly 2. No leakage 3. Fix the compressor tightly
4. Safety devices	1. Motor coil temperature sensor (thermistor) 2. Discharge temperature sensor (thermistor) 3. Controller	1. Connected in series with discharge temperature sensor to INT69HBY 2. Connected in series with motor temperature sensor to INT69HBY 3. Close circuit (no reaction)
5. VFD setting	1. Connection with controller 2. V/F, motor rated current setting 3. Acceleration / deceleration time	1. Those functions as speed control, malfunction feedback, VFD reset should be workable 2. Should follow the nameplate of compressor 3. Acceleration: 50~60 sec from 0Hz to 50Hz; deceleration: vice versa
6.Compressor motor	1. Motor temperature (from Pt100/1000) 2. Liquid level (from motor sight glass)	1. Temperature meter should be correct. 2. Lower than the upper level of sight glass.

In addition to the pre-start checking given in the above table, also consider the following:

a. It is necessary to pay extra attention to the auxiliary facilities while commissioning the chiller at job-site and have periodic maintenance after the initial start-up.
b. In order to keep steady lubrication at low ambient temperature, oil heater should be energized after the compressor shuts down to maintain oil temperature for the next start-up.
c. Check all the settings on each pressure switch.
d. Check if all the stop valves in the system are opened.
e. Check the rotating direction of the compressor by starting the compressor for a transient period (0.5 to 1 sec.) and check the suction and discharge pressure gauges. If the compressor runs rightly, the suction pressure drops and the discharge pressure climbs immediately.
f. Oil supply to compressor should be checked immediately after start-up. Oil flow switch is suggested so that oil flow rate could be monitored automatically.
g. Oil foaming may occur during starting stage. Foams should disappear afterwards when the compressor reaches stable operating conditions. Otherwise, it indicates excessive liquid in suction gas.
h. The running condition of the compressor after commissioning should be adjusted - discharge temperature should be at least 10K above the saturated condensing temperature and the suction vapor superheat should be within 10K to the saturated evaporating temperature.
i. The whole plant, especially the pipelines and capillary tubes must be checked for possible abnormal vibrations. Contact HANBELL or local distributors if any abnormal vibrations or noise is found.
j. Regularly check the field according to national regulations and the following items also should be checked:

●Operating data of the machine
●The lubrication/oil level
●All compressor protection devices
●Electrical cable wirings

Procedures to operate RC2-AV compressors

Start the compressor:
1. For loading and unloading the compressor with the inverter, it's recommended to increase or decrease frequency 1Hz per 1~2 second.
2. Open all solenoid valves in the system. Then start and load the compressor to 20Hz.
3. During the ramping period to 30Hz, make sure the changes of discharge and suction pressures. Discharge pressure should be higher and higher while suction pressure gets lower and lower.
4. If there is any unusual vibration or noise from the compressor during starting stage, please recheck inverter settings until the problem improves.
5. Check the sight glasses to know if refrigeration oil sufficient and managed well.

Load/unload:
1. After running at 20Hz for 3~5 minutes, load the compressor by another 10~20Hz increment. Then, hold the frequency for 1~2 minutes before next loading.
2. After reaching full load the first time, controller can load/unload the compressor to meet the demand of system.
3. When changing frequency, the expansion valve should be adjusted simultaneously to meet the new flow rate.

Shutdown:
Unload the compressor by 1Hz every second or every two second until it stops.

6.2 Troubleshooting

The table below shows some problems that might happen at jobsites. This table could be a guide for engineers when problems are found.

PROBLEMS	POSSIBLE CAUSES	REMEDY / CORRECTIVE ACTION
Sudden trip of motor thermistor / sensor	Low refrigerant mass flow rate	Apply liquid injection to motor
	Refrigerant shortage	Charge refrigerant
	Suction filter clogged	Clean/change filter
	High suction temperature	Install liquid injection to motor coil
	High suction superheat	Adjust suction superheat within 10K
	Unstable electricity system or failure	Check electricity power supply
	Motor overload	
	Bad motor coil causing temperature rising rapidly	Change motor
Poor insulation of motor	Bad compressor motor coil	Check the coil or change the motor stator
	Motor power terminal or bolt wet or frosty	Check if the VFD settings are correct
	Motor power terminal or bolt bad or dusty	
	Bad insulation of magnetic contactors	
	Acidified internal refrigeration system	
	Motor coil running long time continuously under high temperature	
	Frequent start-ups and shutdowns	
Compressor starting failure	Incorrect voltage	Check the power supply
	Voltage drops dramatically during starting of compressor or magnetic contactor or phase fails	Check the power supply and the contactor
	Motor broken down	Change the motor
	Motor thermistor trips	See "sudden trip of motor sensor" above
	Incorrect supply power connection	Check and re-connect
	Discharge or suction stop valve closed	Open the stop valve
	Locked rotor	Check and repair
	Earth fault	Check and repair
	Protection device trip	Check
	Damaged bearings	Change bearing.

PROBLEMS	POSSIBLE CAUSES	REMEDY / CORRECTIVE ACTION
Abnormal vibration and noise of compressor	Liquid compression	Adjust proper suction superheat
	Friction between rotors or between rotor and compression chamber	Change screw rotors or compression chamber or both.
	Insufficient lubrication oil	Check the oil supply of the compressor is enough, add some oil if necessary
	Loose internal parts	Dismantle the compressor and tighten/change loose parts
	System harmonic vibration caused by improper piping system	Check the system piping and if possible replace steel pipe by copper pipe
	External debris fallen into the compressor	Dismantle the compressor and check the damage. Clean and polish rotor and chamber surfaces. Replacement might be needed depending on damages.
	Friction between slide valve and rotors	Dismantle the compressor and change damaged parts
	Motor rotor rotates imbalance	Check and repair
	Motor line open	Check
Start-up difficulties	Tripped overload	Check the electrical connection
	Screw rotors seized	Replace screw rotors, bearings etc…
	Broken motor	Change motor
	Insufficient refrigerant	Leakage test. Charge additional refrigerant and adjust suction superheat less than 10K
High discharge temperature	Poor heat exchange in condenser	Check and clean the condenser
	Refrigerant overcharge	Reduce the refrigerant charge
	Air/moisture in refrigerant system	Recover, 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 necessary parts
	Improper Vi value	Change the slide valve
	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
Compressor losses oil	Improper system piping	Check and correct the piping or install an external oil separator
	Liquid fills back	Maintain suitable suction superheat at compressor
	Lack of refrigerant	Check for leakage. Charge additional refrigerant
Low suction pressure	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
	Condensing temperature too low	Check means for regulating condensing temperature

Note: Replacements of compressor parts should be performed by a qualified / certified serviceman with full knowledge of HANBELL screw compressors or HANBELL service engineers.

7. Applications
7.1 Additional cooling

When compressors operate at following application conditions, installation of an additional cooling apparatus is recommended to control discharge temperature, maintain proper temperature of lubricant and ensure safety of the motor.

- Air-cooled system
- High compression ratio system such as heat pump, low temperature and refrigeration systems
- High discharge temperature system such as heat recovery system
- Any other heavy duty application

There are two type of additional cooling methods:

a. Liquid injection applications

In areas with high condensing temperature and/or low evaporating temperature as in the limitation diagram, additional cooling is required in order for the compressor to work properly. A relatively simple method of additional cooling is direct refrigerant injection into the compressor, to motor or compression chamber or to both places at the same time once needed.

The purpose of liquid injection systems is to prevent the compressor from overheated. The system is with a liquid injection expansion valve between the liquid line and compressor for cooling down the compression chamber and motor to ensure the continuous and safe running of the compressor. The suction superheat should be controlled between 5K~10K for air-cooled and heat pump chillers by means of expansion valve devices. These devices can be adjusted by the stem of the expansion valve to control suction superheat by means of refrigerant flow rate. During the initial startup, the loading of the chiller is heavy due to high temperature chilled water, so the liquid injection devices capacity should be selected or calculated enough to reduce the overheat of the compressor.

Calculating the cooling capacity of liquid injection devices:
Liquid injection devices can be calculated with the **HANBELL selection software** or manually. For manual calculation, consider the most extreme conditions to be expected during actual operations i.e. minimum evaporating temperature, maximum suction gas super heat and condensing temperature.

Liquid injection applied with low temperature expansion valve:
When the compressor applied in the low temperature system (E.T. $\leqq$ -10°C) the compression ratio is high at this condition, also the discharge temperature will be very high. The design of the liquid injection system for low temperature application is similar to the illustration shown in figure below. There are two connectors for the liquid injection in the compressor, one is in the motor side to cool down the motor temperature and reduce the discharge temperature. The other is in the compression chamber side and its function is to reduce the discharge temperature and increase the compression efficiency. However, when additional cooling in compression chamber like economizer operation, oil cooler application is used or when condensing temperature is low, discharge temperature be kept low and liquid injection may not be turned on, although motor load is severe and motor coil temperature is high. This may lead to motor failure. Therefore, in application mentioned above Pt100 or Pt1000 for liquid injection to motor is recommended instead.

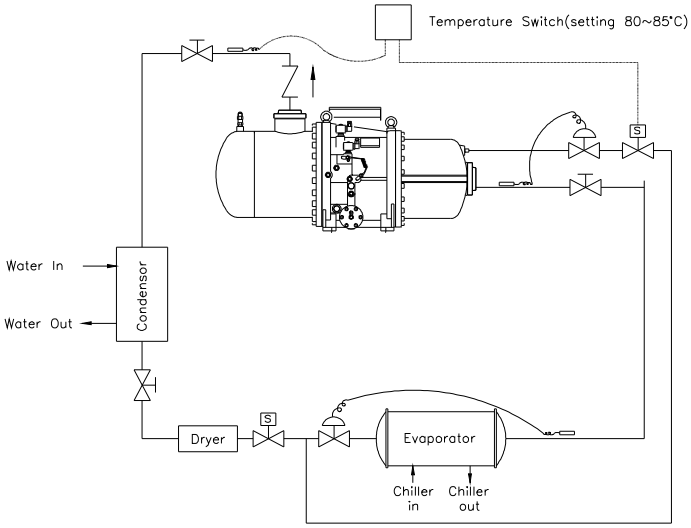


Figure 41 Liquid injection connected to motor

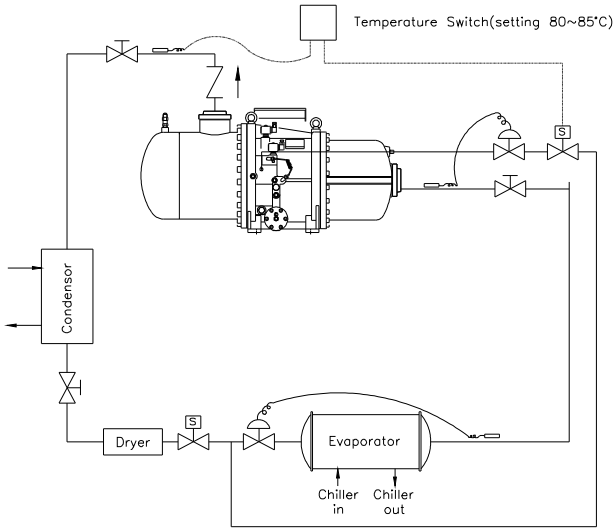


Figure 42 Liquid injection connected to compression chamber

Liquid injection applied with high temperature expansion valve:
Select the high temperature expansion valve, which can sense the discharge temperature with its remote bulb. This can control the opening of expansion valve proportionally, and can reach the best cooling effect; it will control the compressor discharge temperature at an optimal situation of around 80°C. It can also be installed with an additional solenoid valve or service valve in front of the high temperature expansion valve for the maintenance purposes. The solenoid valve will be opened while starting the compressor. The equilibrium tube of high temperature expansion valve should be connected to the high-pressure side to counter the internal pressure.

However, when additional cooling in compression chamber like economizer operation, oil cooler application is used, or when condensing temperature is low, discharge temperature may be kept low and liquid injection may not be turned on, although motor load is severe and motor coil temperature is high. This may lead to motor failure. Therefore, in applications mentioned above, Pt100 or Pt1000 for liquid injection to motor is recommended instead.

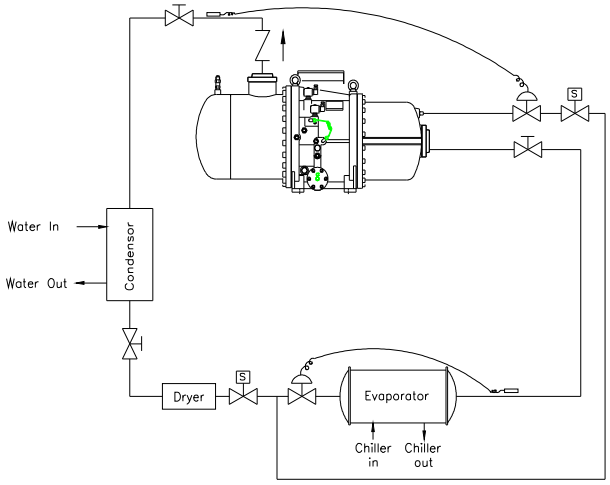


Figure 43 Liquid injection (high temperature type) connected to motor

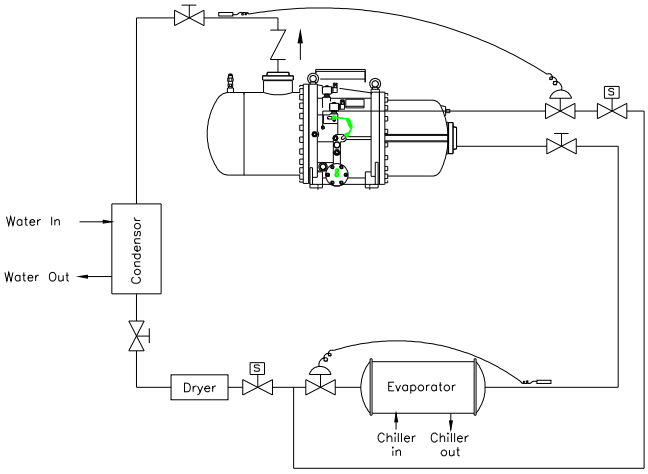


Figure 44 Liquid injection (high temperature type) to compression chamber

b. Oil cooler applications
Compared to liquid injection applications, external oil cooler reduces the discharge temperature and at the same time gives better efficiency. Oil cooler application can be classified into 3 types: cooling by refrigerant, cooling by ambient air, cooling by cooling water. Oil cooler capacity can be calculated manually or using HANBELL selection software. When calculating manually, worst case operating conditions must be considered: minimum evaporating temperature, maximum suction gas superheat, maximum condensing temperature and the operation mode.

Cooling by refrigerant:
The cooler uses refrigerant as the cooling medium. A basic refrigerant-cooled oil cooling system is shown in Figure 45.

In the oil cooler, solenoid valve for refrigerant circuit is controlled by oil temperature of the oil outlet of compressor.

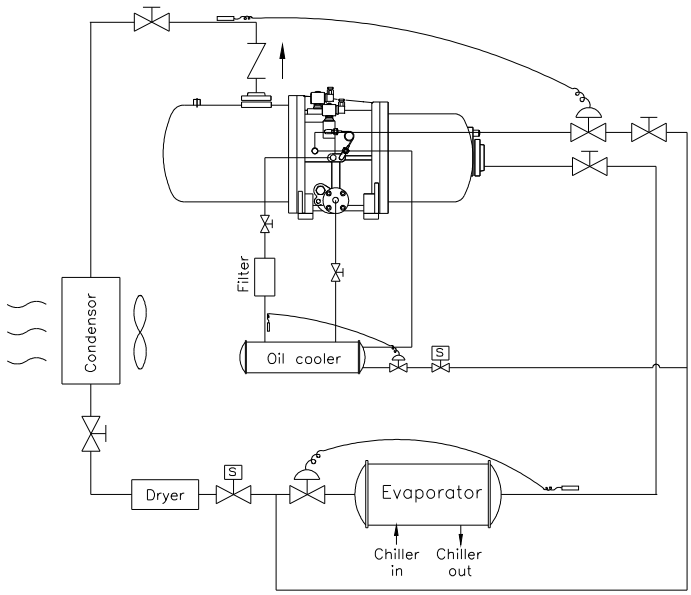
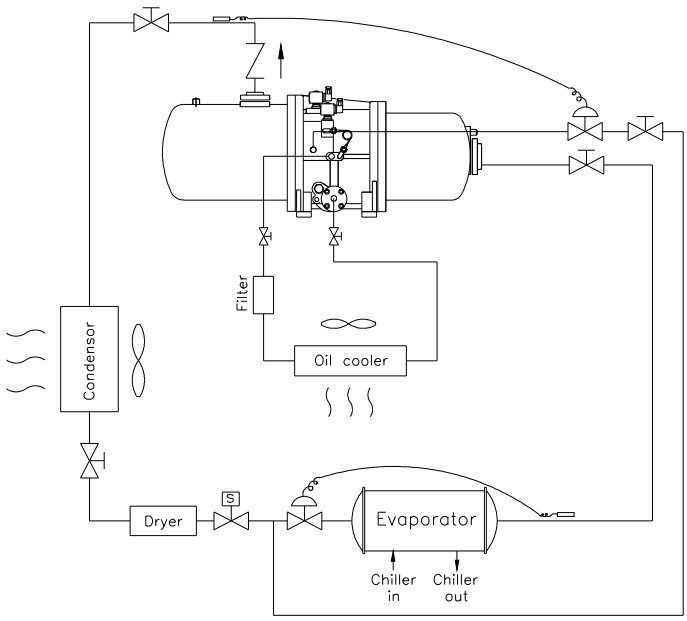


Figure 45 Oil cooling by refrigerant

Air-cooled oil cooling (cooling by ambient air):

The basic air-cooled oil cooling system is shown in Figure 46. This method of cooling is indirect cooling which uses ambient air to cool down the oil, which circulates in the oil cooler.



In the oil cooler, fan is controlled by oil temperature of the oil outlet of compressor.

Figure 46 Oil cooling by ambient air

Water-cooled oil cooling (cooling by water):

This cooling method utilizes a shell and tube heat exchanger and a source of cooled liquid from an external cooling tower or closed loop evaporative cooler. Once-through water can be used but results in high water usage. An indirect cooling system uses a pump to circulate the cooling medium and a cooling tower or evaporative cooler to reject heat from the cooling medium. The basic water-cooled oil cooling system is shown in Figure 47.

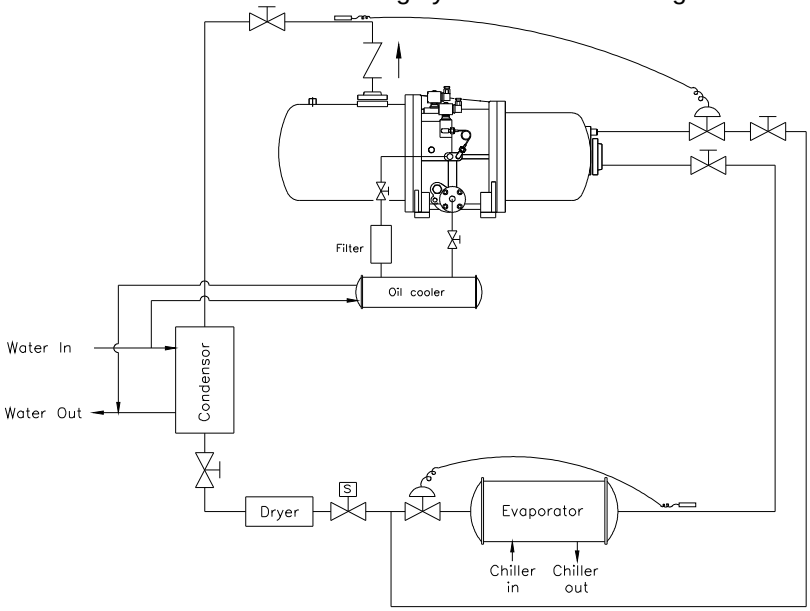


Figure 47 Oil cooling by water

Note:

1. Please decide appropriate oil cooler capacity by referring to HANBELL selection software.
2. Maximum pressure drop allowed in external oil cooler is 1.5 kg/cm^2. When it exceeds 1.5kg/cm^2, clean or change oil filter.
3. When applying any oil cooler to compressor, please add appropriate refrigeration oil in accordance with the size of oil cooler and the length of piping.
4. For RC2-100/140/180AV, the oil circuit is different to others. These models don't use the oil stop pin for external oil cooler application. If you find the oil connector (inlet/outlet) installed on the compressor, this means the oil needs to

flow out from the oil outlet connector and flow in to the oil inlet connector. If you don't use external additional cooling, you should simply see a cover plate on this position which means the oil will pass this internal tunnel on the plate and up to the cylinder and bearings. Please refer to the illustration below.

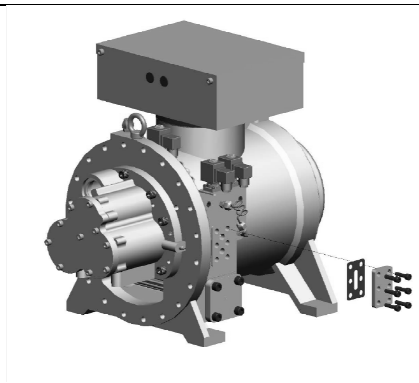


Figure 48 Internal oil circuit application

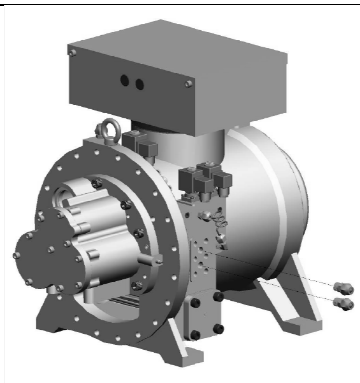


Figure 49 External oil circuit application

7.2 Economizer applications

HANBELL screw compressor can be fitted with an additional middle connection for economizer operation. With this form of operation, refrigeration capacity and also system efficiency can be improved by means of a sub-cooling circuit or two-stage refrigerant expansion. Based on HANBELL extensive research a special design of the economizer connection has been developed so that the connection causes no additional back flow losses during compression. As a result, compressor capacity is fully retained at all operating conditions. Please refer to Hanbell selection software for calculation of economizer capacity at different operating conditions.

Principle of operation
As opposed to the reciprocating operation of a piston compressor, the compression in a screw compressor takes place only with one flow direction. When the rotors turn, refrigerant vapor is pressed into the rotor grooves by the opposing rotor teeth and transported to end wall of the corresponding working space. In this phase, the volume is steadily reduced and the vapor is compressed from suction pressure to condensing pressure. The pressure at the additional middle connection is at a similar level to the intermediate pressure with a two-stage system. As a result of these features, a screw compressor of this design can be combined with an additional sub-cooling circuit or an intermediate pressure vessel (flash type sub-cooler) for two-stage expansion. These measures result in a clearly increased refrigeration capacity due to additional liquid sub-cooling, especially with high-pressure ratios. The power consumption of the compressor increases slightly compare to the additional work that takes place at a better level of efficiency.

System with Economizer (sub-cooler)
With this form of operation, a heat exchanger (refrigerant sub-cooler) is used to sub-cooled liquid refrigerant. The sub-cooling is achieved by injecting a part of the refrigerant from the condenser through an expansion device in counter flow into the sub-cooler, which then evaporates due to the absorption of heat. The superheated vapor is pulled into the compressor at the Economizer connection and mixed with the vapor, which is already slightly compressed from the evaporator. The sub-cooled liquid is at condensing pressure with this form of operation, the pipeline to the evaporator does not therefore require any special features, aside from insulation. The system can be generally applied. Figure 51 shows the system with economizer, **sub-cooler**.

System with economizer (flash type)
The liquid sub-cooling is achieved with this form of operation by reducing the boiling point pressure in an intermediate pressure vessel **(flash type sub-cooler)** arranged between condenser and evaporator. This physical effect leads to the cooling of the liquid down to the boiling point, due to evaporation of part of the liquid. To stabilize the pressure of the vessel, a regulator is used which at the same time controls the quantity of vapor flowing to economizer connection of the compressor. This form of operation gives the most economical thermodynamic performance due to direct heat exchanging. As the intermediate pressure is reduced to the boiling point temperature this system should only be used with flooded evaporators. Figure 52 shows the system with economizer, **flash type sub-cooler.**

Notes:
1. When economizer is used, it is recommended to install a muffler before middle-pressure returned gas port in compression chamber to effectively mitigate pulsation noise in middle pressure as shown in the drawing below.
2. A filter and check valve are also recommended to install before ECO port of compressor.

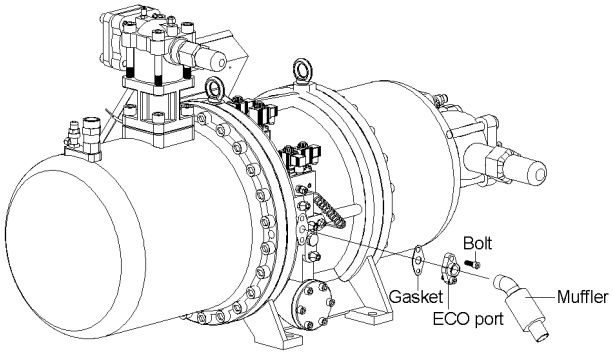


Figure 50 Installation of ECO muffler

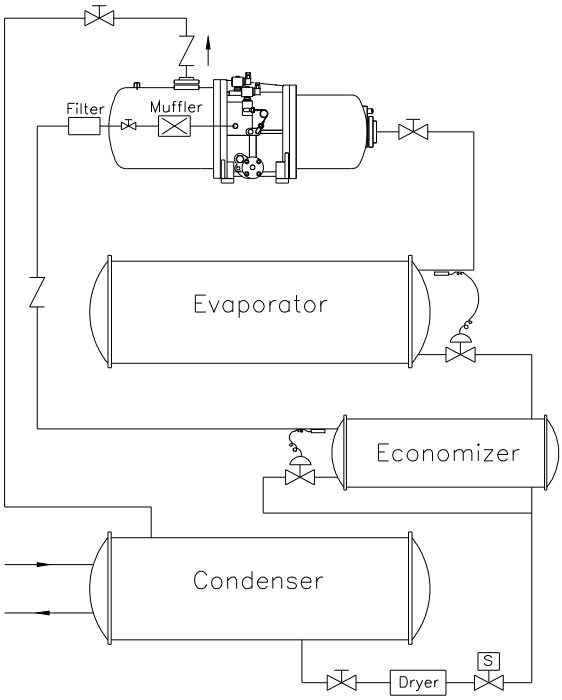


Figure 51 System with economizer (sub-cooler)

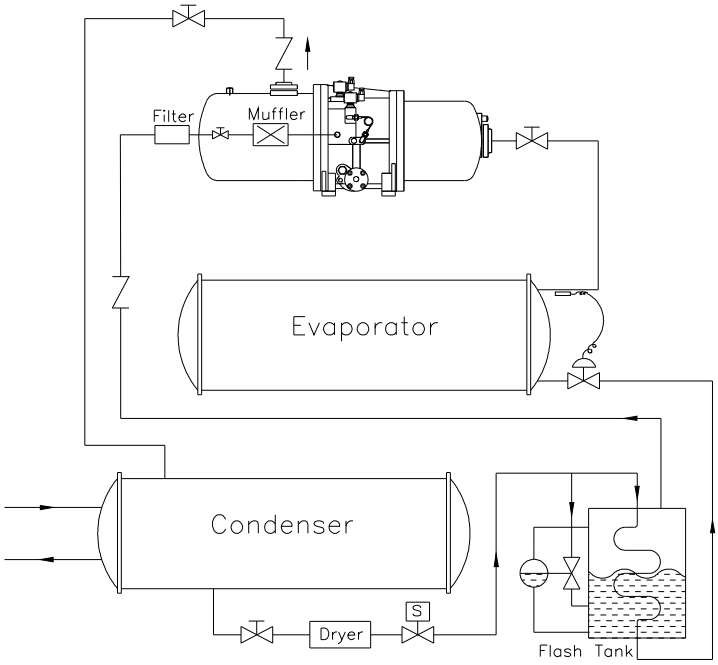


Figure 52 System with economizer (flash type sub-cooler)

7.3 Parallel system applications

In the rack or parallel system, it is possible to find unequal-distribution of returned oil from the evaporator that could cause low oil level in one or more of the compressors. Be sure oil level switch is installed inside each compressors and oil flow switch is installed in each oil return line to monitor sufficient oil returning to each compressor with normal oil level. The basic design of the system is shown below in Figure 53, twin compressor parallel system connections. The accessories installed are the basic and any further applications and protection you would like to use, please contact HANBELL or local distributor/agent for more information or further confirmation.

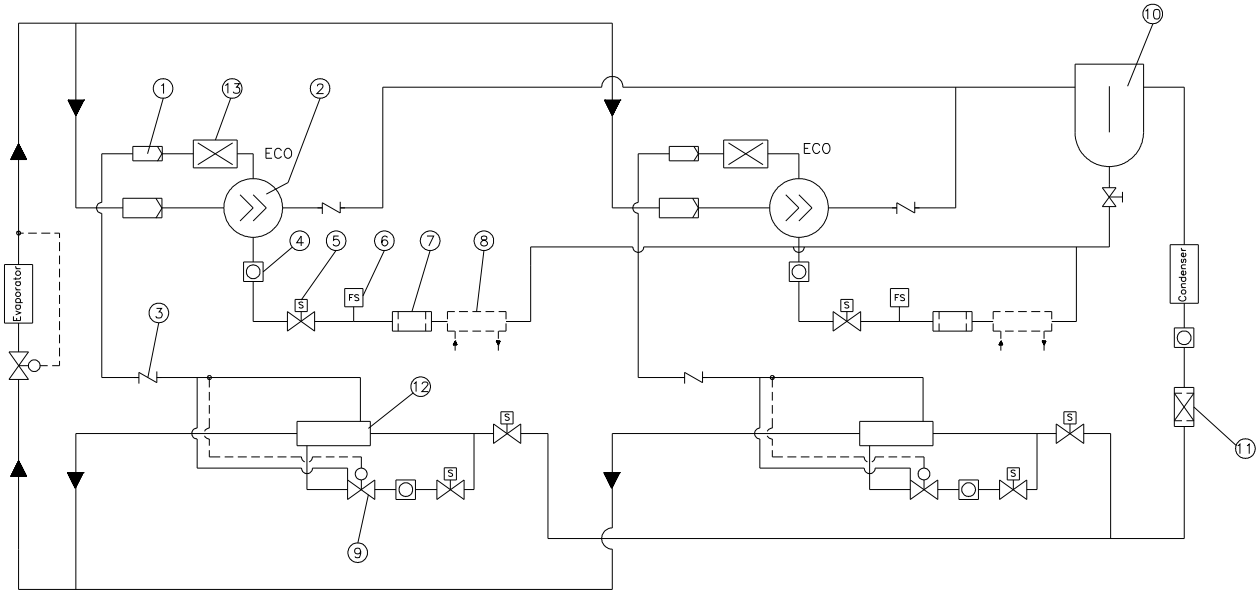


Figure 53 Parallel system with two compressors

Item	Description	Item	Description	Item	Description
1	Filter	6	Flow switch	11	Dryer
2	Compressor	7	Oil filter	12	Secondary cooler
3	Check valve	8	Oil cooler	13	Muffler
4	Sight glass	9	Expansion valve		
5	Solenoid valve	10	Oil separator		

7.4 Oil pump applications

An additional oil pump is recommended to install to the system when the differential pressure between oil pressure and suction pressure is less than 4bar (for example: water cooled flooder chiller). If compressor is operating at the mentioned condition, there would be capacity modulation failure and lack of lubrication and could seriously damage the compressor. Besides the installation of oil pumps, a high – low pressure differential switch is also recommended to apply to this kind of system. Please contact Hanbell for more detailed information of oil pump.

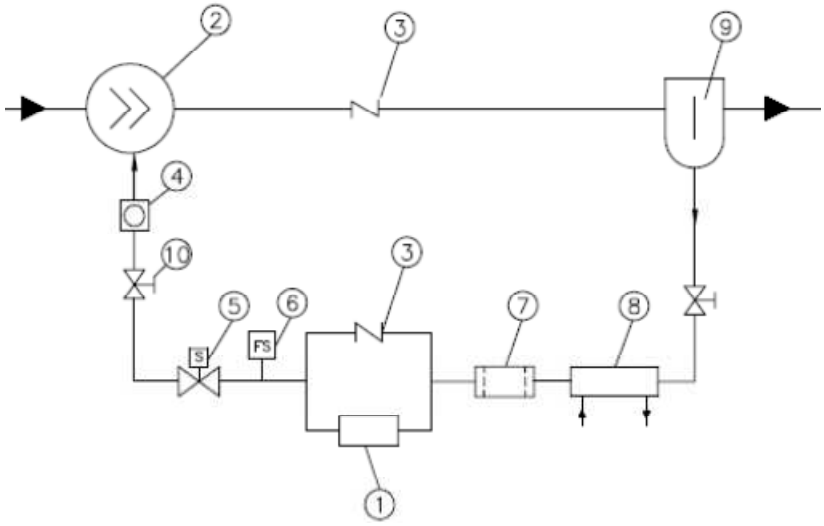


Figure 54 Oil pump installation

Item	Description	Item	Description	Item	Description
1	Oil pump	5	Solenoid valve	9	External oil separator
2	Compressor	6	Flow switch	10	Service valve
3	Check valve	7	Oil filter cartridge		
4	Sight glass	8	Oil cooler		

7.5 Important notes about applications of compressor

1. Pump down
   Do not pump down the compressor on the chiller as a routine operation. Only pump down for urgent maintenance or a long term shut down. Because pump down will cause extremely high temperature in the compression chamber and overheat of the motor as well due to less amount of refrigerant in the suction side. When doing the pump down, be sure to take notice of the items listed below:

a. Pump down should be done once each time. Repeated pump down may damage the compressor.
b. The minimum suction pressure when pumping down should is 0.5kg/cm2.
c. Time for pumping down should be shorter than 15 seconds.
d. When doing pump down, notice the high discharge temperature. It should not go over 110℃.
e. Notice oil level of the compressor and the sound of running as well. If there is any abnormal value or situation, emergently stop pumping down.

2. Low pressure receiver
   When a compressor operates in the following application conditions, installation of a low pressure receiver is recommended in order to prevent massive liquid refrigerant from returning to the compressor under momentary changes of operation condition.

●Heat pump ●Parallel system ●system with long piping
●operating in the low ambient temperature area ●system heating load varies extremely