Micro Control Systems

HANBELL

Rev. M 5.9
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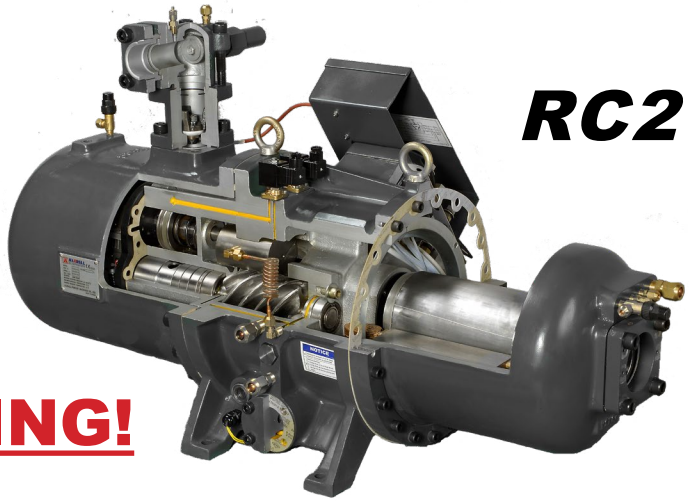
HANBELL COMPRESSOR INSTALLATION & START-UP GUIDE



RC2 Series

WARNING!

NO OIL is shipped in compressor.

Compressor must **NEVER** be run backwards.

Oxygen is never to be used to pressure test any refrigerant system.

These Safeties ARE Required at Startup to Maintain Hanbell Warranty

a) Motor Module Trip (INT69HBY): Open for 1 second
b) Low Oil Level Float Trip: Open for 60 seconds **+30 seconds extension**
c) Unsafe Suction: Less than 5 psi for 3 seconds **+25 seconds extension**
d) High Discharge Temperature: Greater than 230°F for 2 seconds
e) Low Differential Pressure: Less than 65 psi for 60 seconds (Oil-Suction) **+60 seconds extension**
f) Unsafe Differential Pressure: Less than 35 psi for 5 seconds (Oil-Suction) **+25 seconds extension**
g) Dirty Filter (Discharge Pressure - Oil Pressure): Greater than 20 psi for 60 seconds
h) Low Discharge Superheat: Less than 20°F for 300 seconds

+ ***Indicates allowable time extension added to the trip delay during the first 5 minutes of compressor operation while starting.***

Please read pages 36 ~ 40 for Warranty Information

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www.mcscontrols.com

The MCS Commitment is to provide practical solutions for the industries needs and to be both a leader and partner in the effective use of microprocessor controls.

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Table of Contents

Chapter - 1. Compressor Crate Unpacking & Inspection

1. Inspect crate and compressor for any shipping damage.
2. The compressor is in an easy open crate, cut straps and lift off crate top from base.
3. Use either steel cable or safety ropes to lift the compressor, see Figure 1. The cable should be capable of holding up to a minimum of 2 tons.

Use caution while lifting the compressor

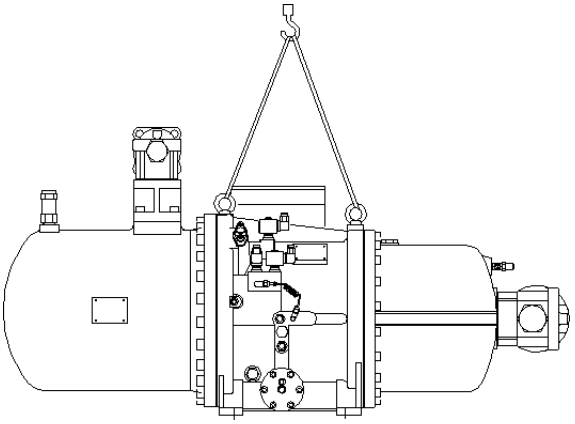


Figure 1
Lifting Compressor with Steel Cable

- ► Make sure that the steel cable does not touch the Solenoid Valves, Capillary, Oil Heater, Discharge Temperature Sensor and or Power Terminals, etc. to prevent damage.
- ► Use only steel cable or safety ropes to lift the compressor; make sure that the cable/rope has the proper strength to lift the compressor.
- ► Keep the compressor horizontal while lifting.

4. Check compressor nameplate for correct model and voltage designation.
5. To facilitate customer installation requirements, the parts listed in Table 1 are factory supplied in separate boxes located in the compressor terminal box or packed in the compressor shipping container. Please verify that you have received all accessory parts.

Table 1: Compressor Accessories & Service Valve Parts

Qty	Description
1	**Stop Valve Assembly** 1 stop valve, 2 gaskets, 1 charging valve, 4 bolts, 1 half union connector, 1 flare nut, 1 flare seal bonnet
1	Discharge bushing connector
1	Suction bushing connector
1	**Motor Terminal Junction Box Assembly** 1 terminal box, 1 motor protection, 2 plastic terminal plugs, 1 reset button, 4 wires

Chapter - 2. Safety and Installation Procedures

2.1. Compressor Safety Instructions

1. Follow recognized safety procedures and practices.
2. In order to prevent the penetration of moisture, air or impurities, the compressor has been charged with Nitrogen gas. Do not remove any compressor bolts or fittings until the factory supplied holding charge has been relieved.
3. Do not apply any power to the compressor unless all valves are open and solenoids are energized (suction / discharge, service valves, economizer and oil shut off valves).
4. Do not operate or provide any electrical power to the compressor unless the terminal box cover is in place and secured. Measurements of the current and voltage during running conditions must be taken at other points in the power supply.
5. Do not remove terminal box cover until all electrical sources have been disconnected.

WARNING: Failure to follow these instructions could result in serious personal injury.

2.2. Installation Procedures

1. **Holding Charge: T**he screw compressor is factory supplied with 15 psig (0.5 bar) holding charge of nitrogen gas. The internal pressure must be relieved before attempting to remove any compressor fittings or parts. Relieve the holding charge by removing the threaded cap on the low pressure Schrader connection fitting and depressing the internal Schrader stem.

CAUTION: This compressor may contain trace amounts of oil. Do not relieve the holding charge or open the compressor ports until it is ready to be connected to a closed dry system. Excessive moisture will shorten compressor life.

2. **Installation of the Compressor Electrical Terminal Box**: Four bolts located on the top of the electrical terminal box cover mount the electrical terminal box; it is adjustable to the cable hole direction to meet the power cables' optional connection direction from the chiller.
3. **Oils:** Adding and removing oil is done through the Drain valve located on the solenoid side of compressor.

The compressor has no oil and is not charged with oil. When adding or doing a complete change, use only the listed Hanbell approved oils. **POE oils readily absorb moisture and cause acid formation in the system. Keep oil exposure to the atmosphere to a minimum.**

4. **Installation of the Service/Stop Valve:** Unpack the service/stop valve's box then check against the list on the outside of the box to ensure correct parts. Be sure that all parts inside the carton are clean. Use the four bolts to secure the service/stop valve. Use PTFE sealer to seal the adapter while tightening it. Please refer to page 19, 'Maintenance Area Requirement' for space that is required for future service and maintenance needs.
5. Service/stop Valve Recommended Connection

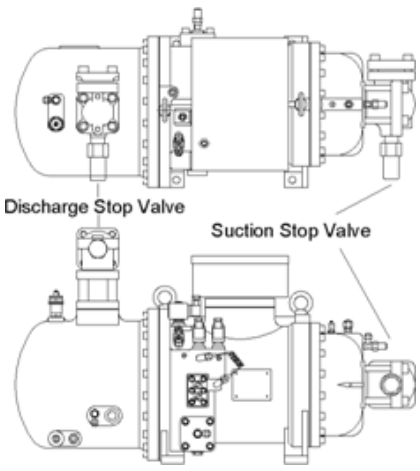


Figure 3-A RC2-100, 140 & 180

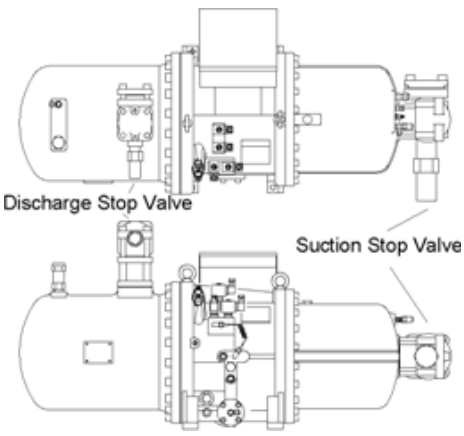


Figure 3-B RC2-170, 200~580 & 620

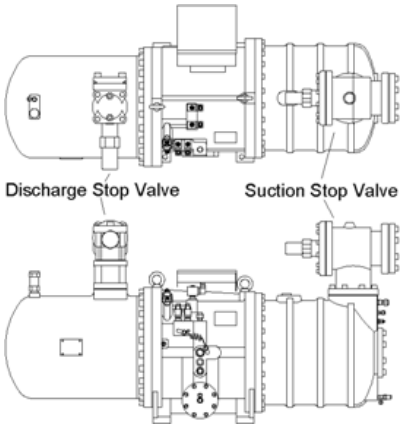


Figure 3-C RC2-610, 710~930

Chapter - 3. Recommended Liquid Injection Piping

1. **Liquid Injection Solenoid Valve and Expansion Valve (Required, Not included with compressor):** The liquid injection system may be piped, but it is necessary to consider the required space for adjustment of the expansion valve while testing or running the compressor. Please refer to installation guide in the following section for connection points.

Recommended Liquid Injection Piping

Note:

RC2-100B, RC2-140B and RC2-180B have the Liquid Injection port on top.

Pipe diameters should be:
3/8" (if Model is smaller than RC2-1020)
or
5/8" (if Model is equal or larger than RC2-1020)

Hanbell A & B Models	Liquid Injection Chamber Port Size
RC2-100 to RC2-930	3/8" Flare
RC2-1020 to RC2-1530	5/8" Flare

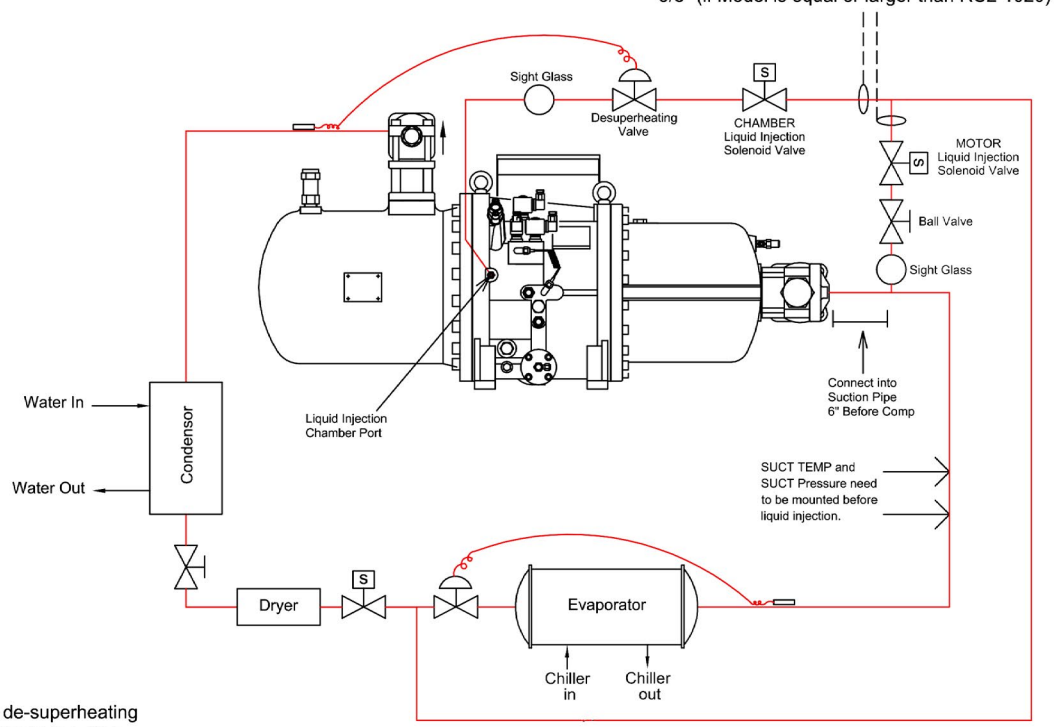
Desuperheating Valve	Connector Sizes
4403-13 and 4403-14	3/8" Flare

Liquid Injection Control

CHAMBER
Turn ON:
Discharge Temp > 180°F
Turn OFF:
Discharge Temp < 170°F
OR
Discharge Superheat < 10°F

MOTOR
Turn ON When:
Motor Temp > 140°F
Turn OFF When:
Motor Temp < 120°F

The liquid feed for the motor cooling and de-superheating valve must come off of the bottom of the liquid line. This will ensure that the line will have a full column of liquid refrigerant. Vapor refrigerant does not cool efficiently.



Pipe diameter should be:
5/8" (if Liquid Injection Chamber Port is 3/8")
or
7/8" (if Liquid Injection Chamber Port is 5/8")

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Note A: It is necessary to adjust the Ball Valve to feed small amounts of liquid (drops) to the compressor motor.

Chapter - 4. Electrical Wiring

1. If the compressor application is low voltage, the following items should be considered:
2. Use conduit to insulate and protect the main power cables between the control panel and compressors' electrical terminal box.
3. Press each main power cable connecting head with bolts firmly on each power terminal in electrical terminal box. Keep enough space and distance between the main power cable heads.
4. Choose suitable electrical accessories to meet the required critical running conditions. An **AC-3 contactor** is recommended to meet the rated capacity of power. Select an overload protector with a response time of **15 seconds** for overload.
5. Ensure the electricity voltage drop between each two phases is less than 2%. If unable to reduce the length of main power cable then a larger diameter of main power cable should be chosen. Please refer to Figure 7-A shown below.

The chart below is an estimate for wire sizes based on maximum continuous current being used. Local electrical codes should be followed prior to wiring the compressor and selecting a wire size.

Main power cable Size AWG / MCM (mm^2)	8 awg (8 mm^2)	6 awg (14 mm^2)	4 awg (22 mm^2)	2 awg (30 mm^2)	1 awg (38 mm^2)	0 awg (50 mm^2)	00 awg (60 mm^2)	3/0 awg (80mm^2)	4/0 awg (100 mm^2)	4/0 awg (125 mm^2)	300 mcm (150 mm^2)	500 mcm (200 mm^2)
Maximum continuous current (Amp)	55	80	100	125	145	175	200	230	270	310	360	425

Table 7-A Main Power Cable Size vs MCC

Maximum main power cable temperature is at 60°C. Maximum ambient temperature is at 35°C.

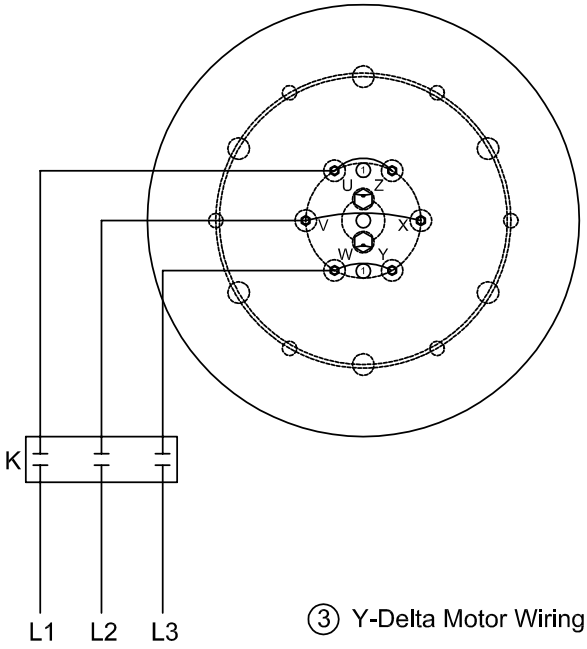
6. To avoid any danger or accidents due to the shortage of electrical power, you are required to follow local Electrical Regulations for the grounding of the electrical terminal box, heater and compressor body etc.
7. The motor PTC and discharge PTC are temperature sensors with a quick response in relation to the temperature approach to their setpoint. The thermisters must be connected in series to a controller (INT69HBY – Kriwan provided with the compressor) in the terminal box for protection of the compressor. An alarm for the motor protector is required to be embedded on the control panel as an indicator. Do not bypass/jump-out the INT69HBY to start and run the compressor.

Warning: Reverse rotation of the compressor will cause compressor damage and will void the compressor warranty.

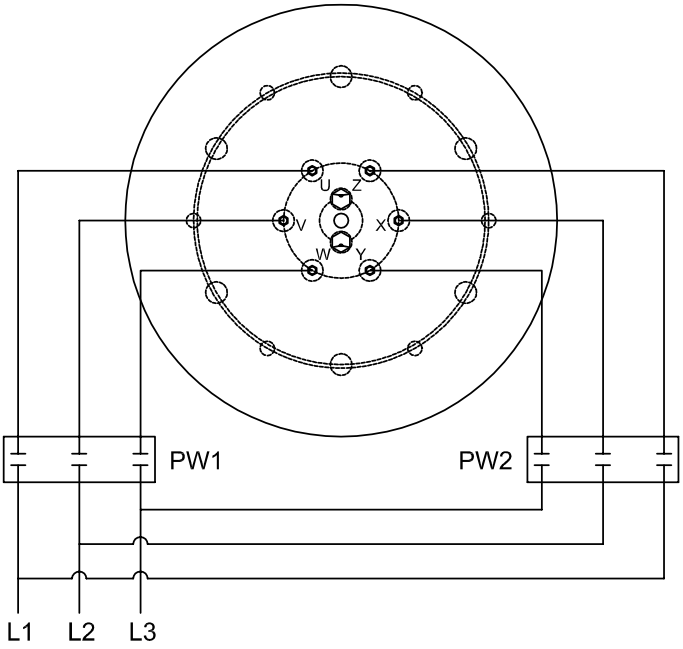
Chapter - 5. Wiring Procedures - Y-Delta / Part Winding

Following the diagrams below will prevent damage to the electrical terminals and possibility of personal injury.

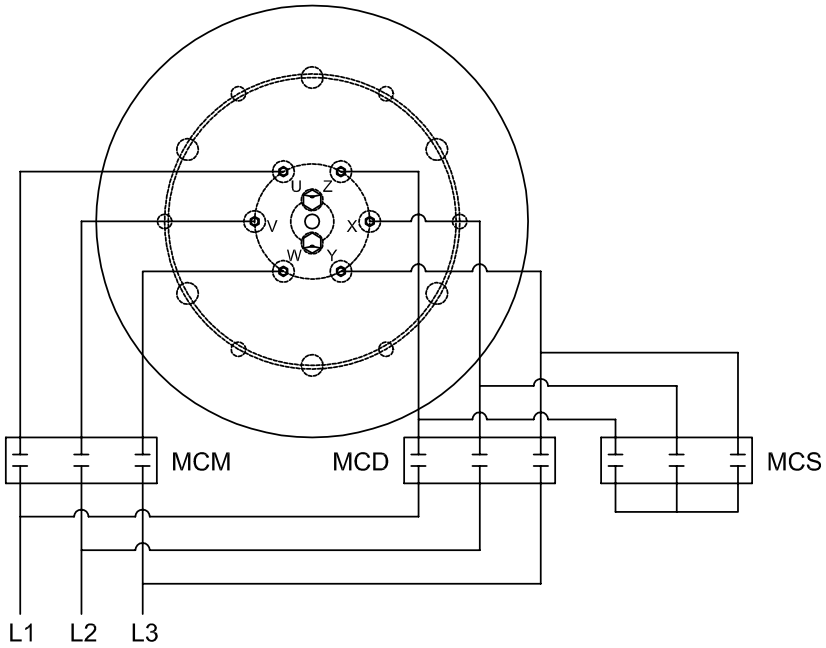
① Bridges for Direct start on Y-Delta Motor



② Part Winding Motor Start
Recommended switch time: 0.5 - 1sec



③ Y-Delta Motor Wiring



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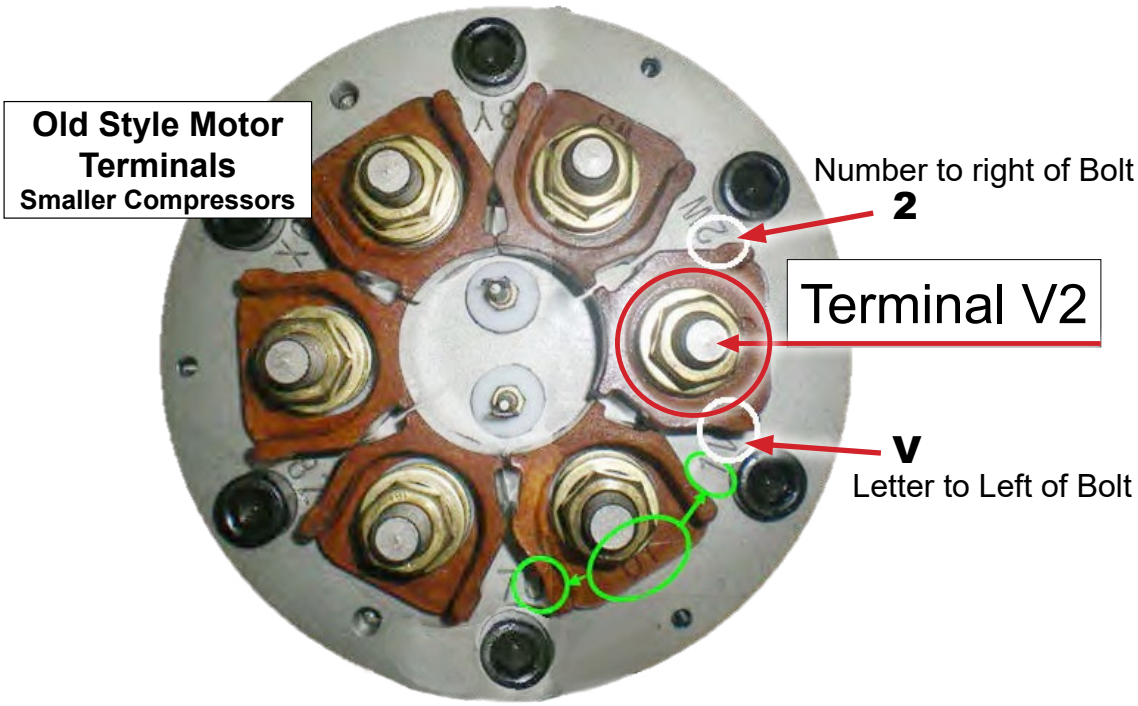
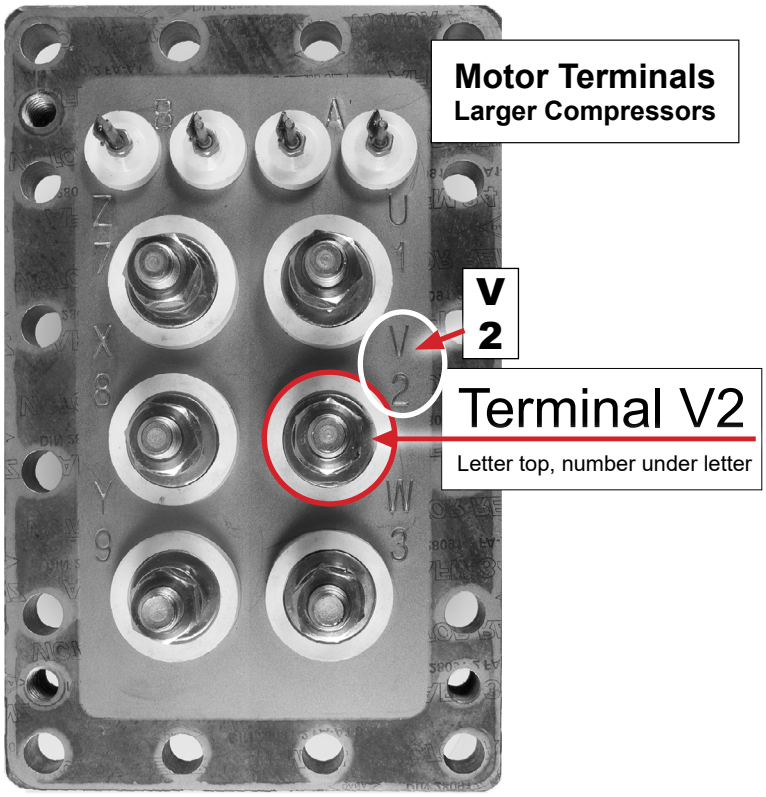
Motor Terminals

The method to tell the terminals for wiring (V-Phase):

1. Star-Delta Motor - refer to Letter by terminal bolt.
2. PWS Motor - refer to Number by terminal bolt.





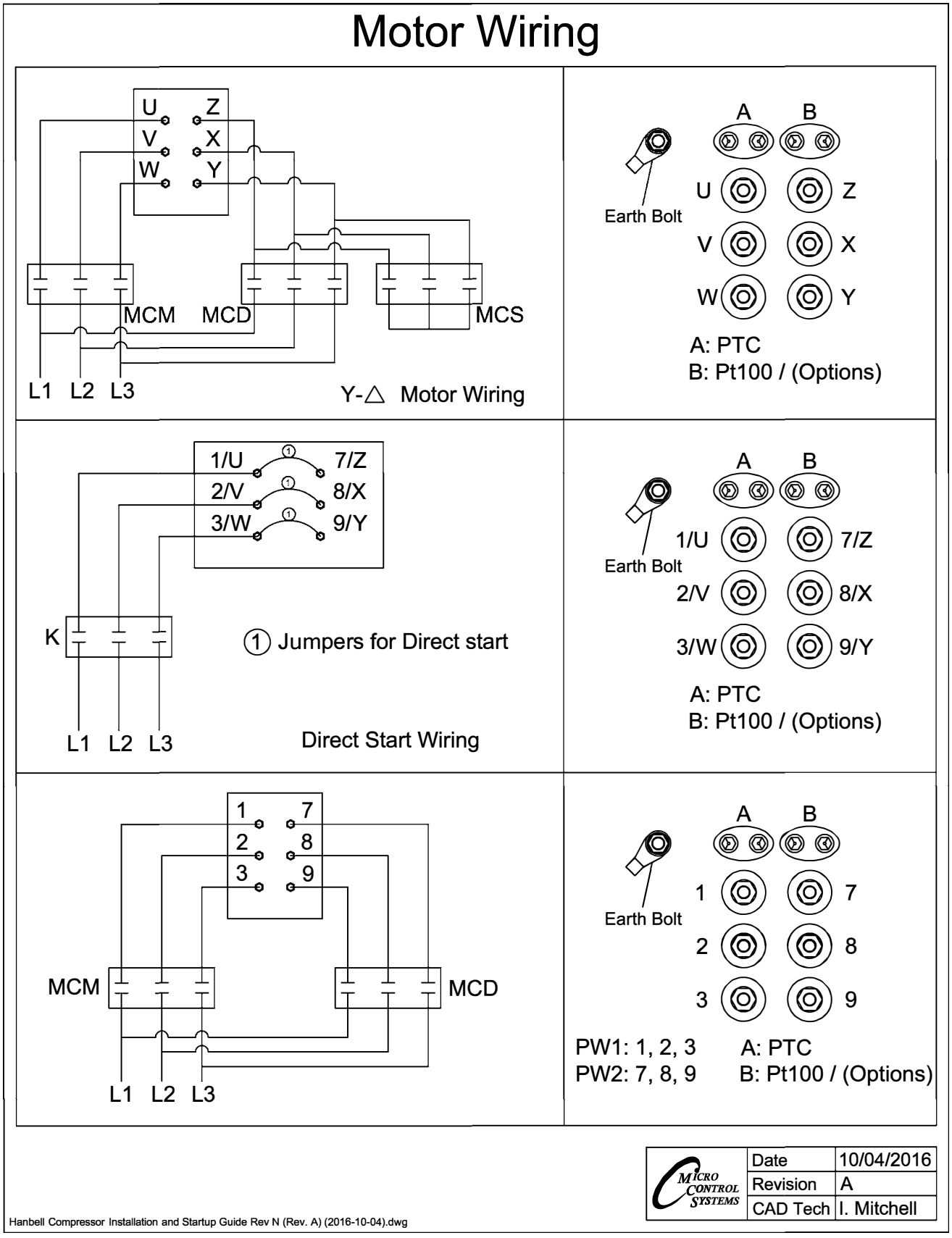


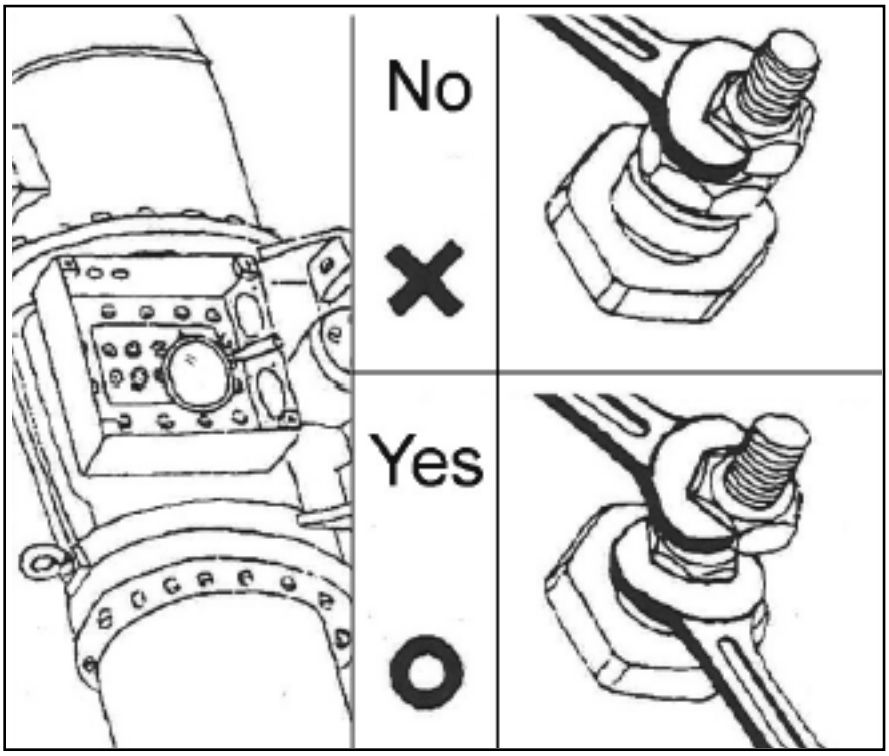
Figure 5-A Motor Wiring

5.1. Electrical Power Terminals

The power terminals of Hanbell compressors are made from ceramic materials and are insulated with more than 1000MΩ. Be careful connecting the wiring and follow the instructions below:

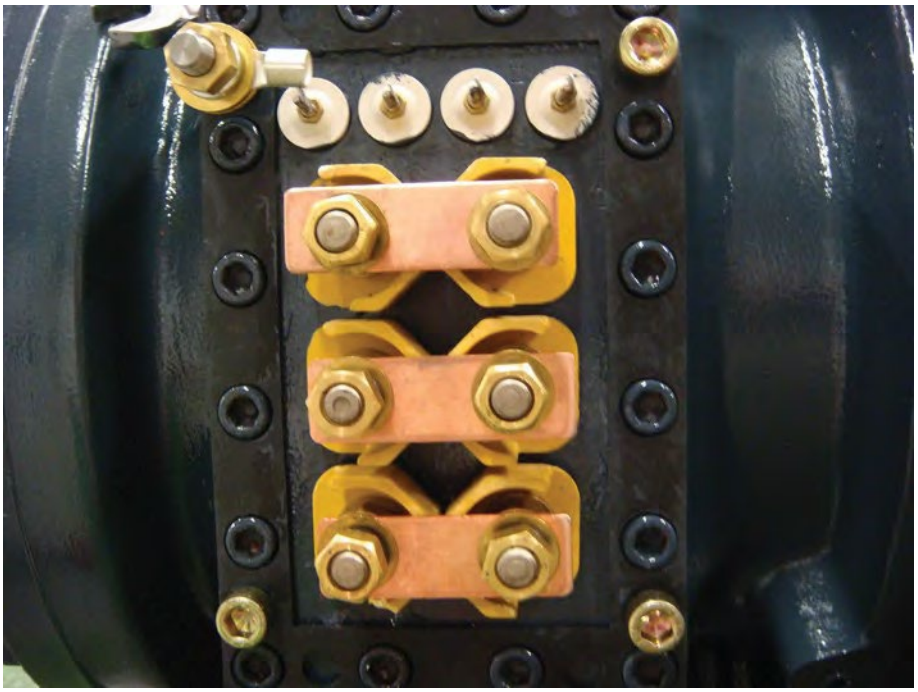
- ► When tightening the terminal nuts, be careful not to hit the ceramic part of the terminal. The insulation of the power terminal could be degraded.
- ► The setting of the torque wrench for tightening the copper nut of the terminal bolts should be set less than 500 kg-cm (36 pound/inch).

Shut down the chiller first for service if the insulation value of the power terminal is lower than 5MΩ.



Chapter - 6. Across the Line Jumper Bar Installation

Photo shows extra nuts installed under jumper bar for clearance of power bolt Insulation



Connect line voltage directly on Terminal post

Chapter - 7. INT69HBY MOTOR PROTECTION

7.1. Description - INT69HBY DIAGNOSE

Hanbell supplies INT69 HBY Diagnose for motor protection with monitoring functions of phase loss, phase sequence, motor temperature, and discharge temperature. The module has built in flash codes that are helpful for diagnosing safety faults.

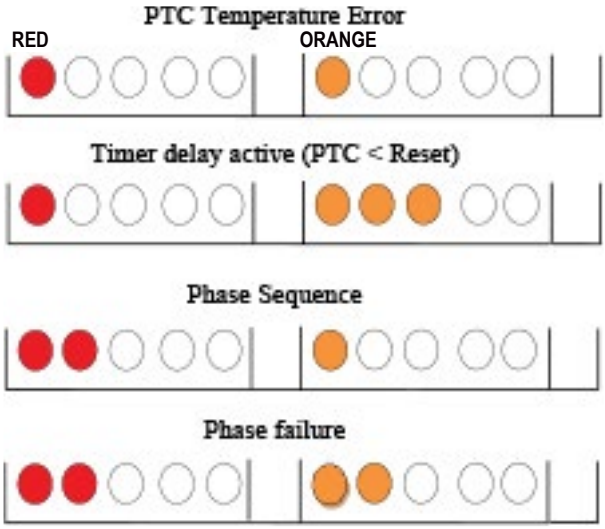
In order to protect the compressor, each RC2 series compressor has been built with three PTC temperature sensors inside the motor coil and one at the discharge port neck of the compressor. These sensors are connected to the motor module to monitor coil temperature and discharge temperature. Up to 9 sensors can be connected in series and used with one module.

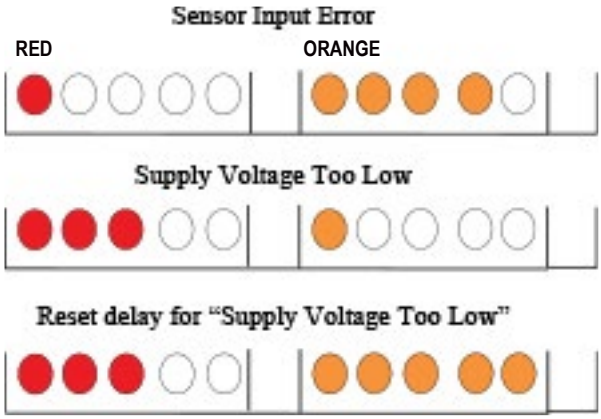
If the temperature in one of the positions monitored exceeds nominal response temperature of the respective PTC thermistor (230° F, 4.5 ohms ±20%), the sensor resistance increases and the module trips (M1 and M2 open). The failure results in a lockout. The module resets when the response temperature drops 3kΩ (when temp decreases below 212°F, 2.75 ohms ±20%). 5 min delay for the first PTC failure, 60 min delay for the 2nd failure, latching lockout for the 3rd within 24 hour period. Monitoring is inactive for 20 seconds after motor stop to prevent nuisance trips from brief reverse rotation.

Phase failure (loss) and Phase sequence safety trips result in a first time lockout. Phase sequence monitoring is active 1 second after motor start for 10 seconds. Phase loss is monitored 1 second after motor start till motor stop.

Lockout and time delay can be canceled by interrupting power to the module for 5 seconds. An optional power supply reset button can be added to electrical connection box.

7.2. Flash Codes





7.3. Flash Code Overview

Green lit	Compressor Operational
Green flashing	Compressor Running
Red/Orange flashing	Error, Compressor is switched off; for description see table below

1st flashing sequence (Red LED)	**2nd flashing sequence (Orange LED)**	**Description**
1	1	Motor temperature; Static switch off, Permissible winding temperature exceeded
	3	Motor temperature; Reset delay after static switch off
	4	Motor temperature; Sensor input detected open circuit or short circuit
2	1	Motor voltage; Incorrect phase sequence
	2	Motor voltage; Phase failure/asymmetry
3	1	General; Supply voltage too low
	5	General; Reset delay after “General” error

Error	**Active**	**Condition**	**Time delay**
Motor temperature static trip	Always	Rtrip 4,5kΩ ±20% Rreset 2,75kΩ ±20%	1. / 24h 5min 2. / 24h 60min 3. / 24h locked out Time delay starts after cooling down
Operation cycle limitation	Always	>3 switch off within 30s	5min
Phase sequence	1s after motor start for 10s		Locked out
Phase loss failure	1s after motor start till motor stop, monitoring is inactive for 20 seconds after motor stop to prevent nuisance trips from brief reverse rotation.		Locked out

7.4. How to Wire INT69HBY Diagnose

The following diagram shows the proper wiring connections for the module. The module is connected to L1, L2 and L3 for phase monitoring. Stake on connectors at terminal “A” are connected in series with the discharge PTC and wired back to S1 and S2.

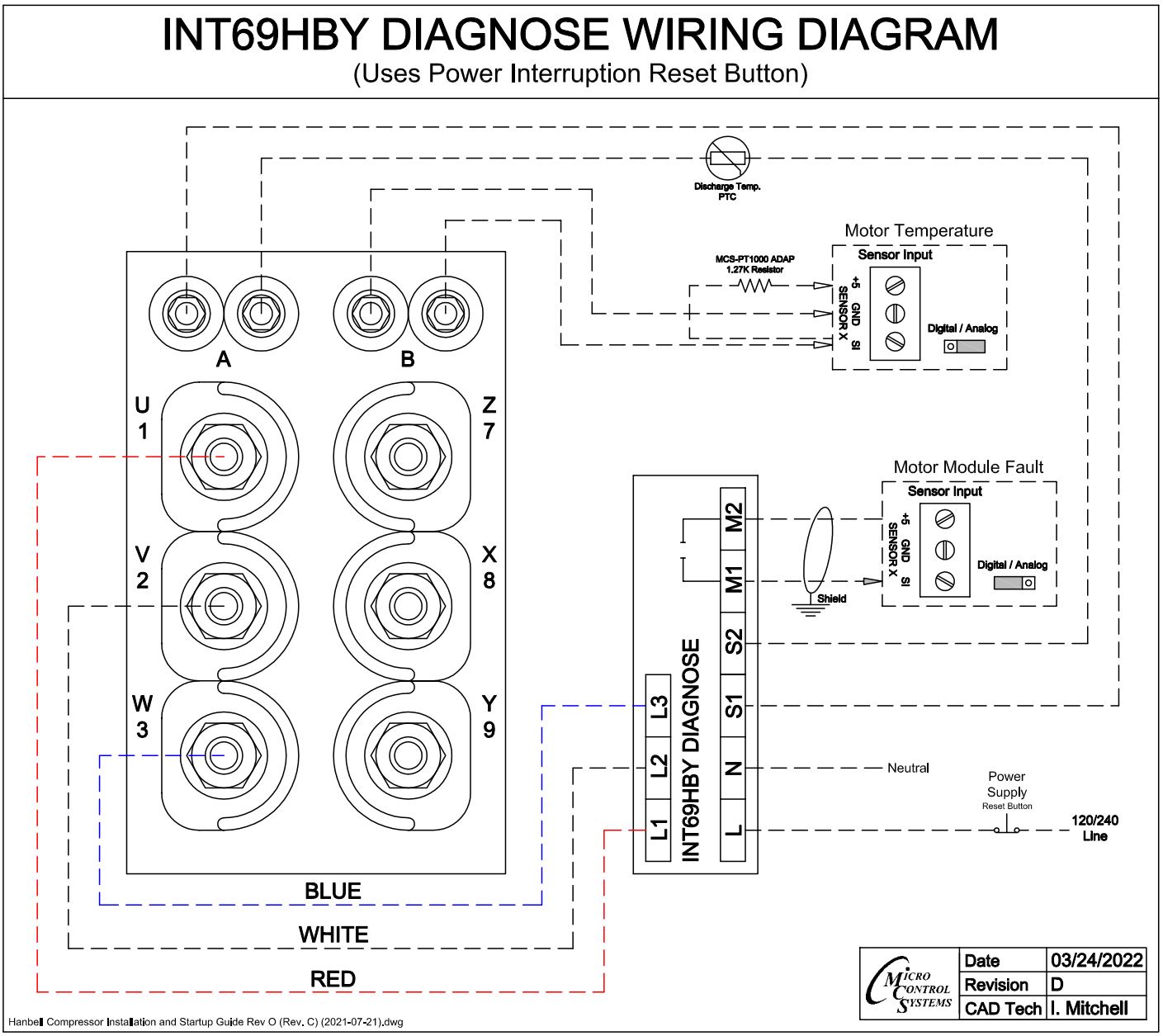
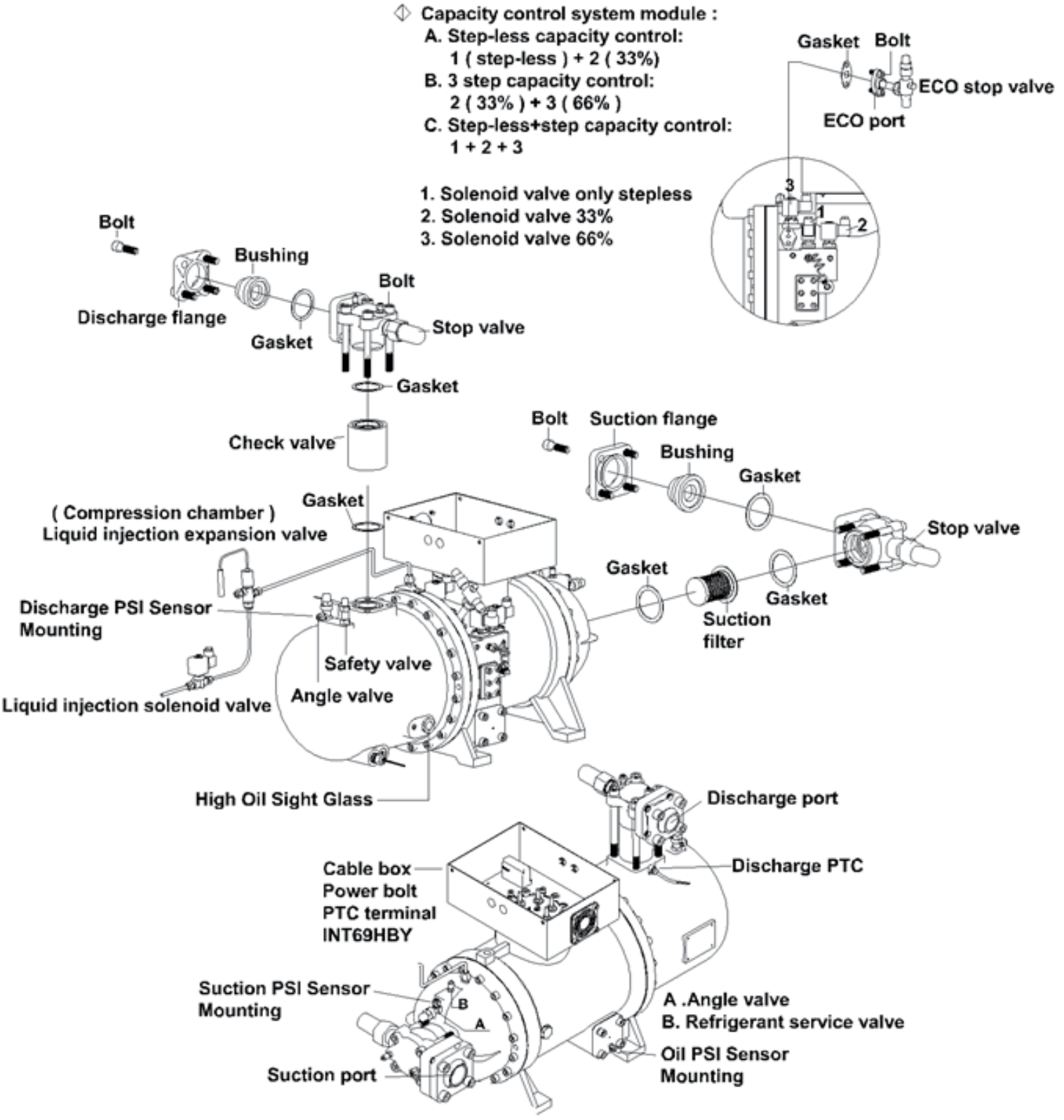


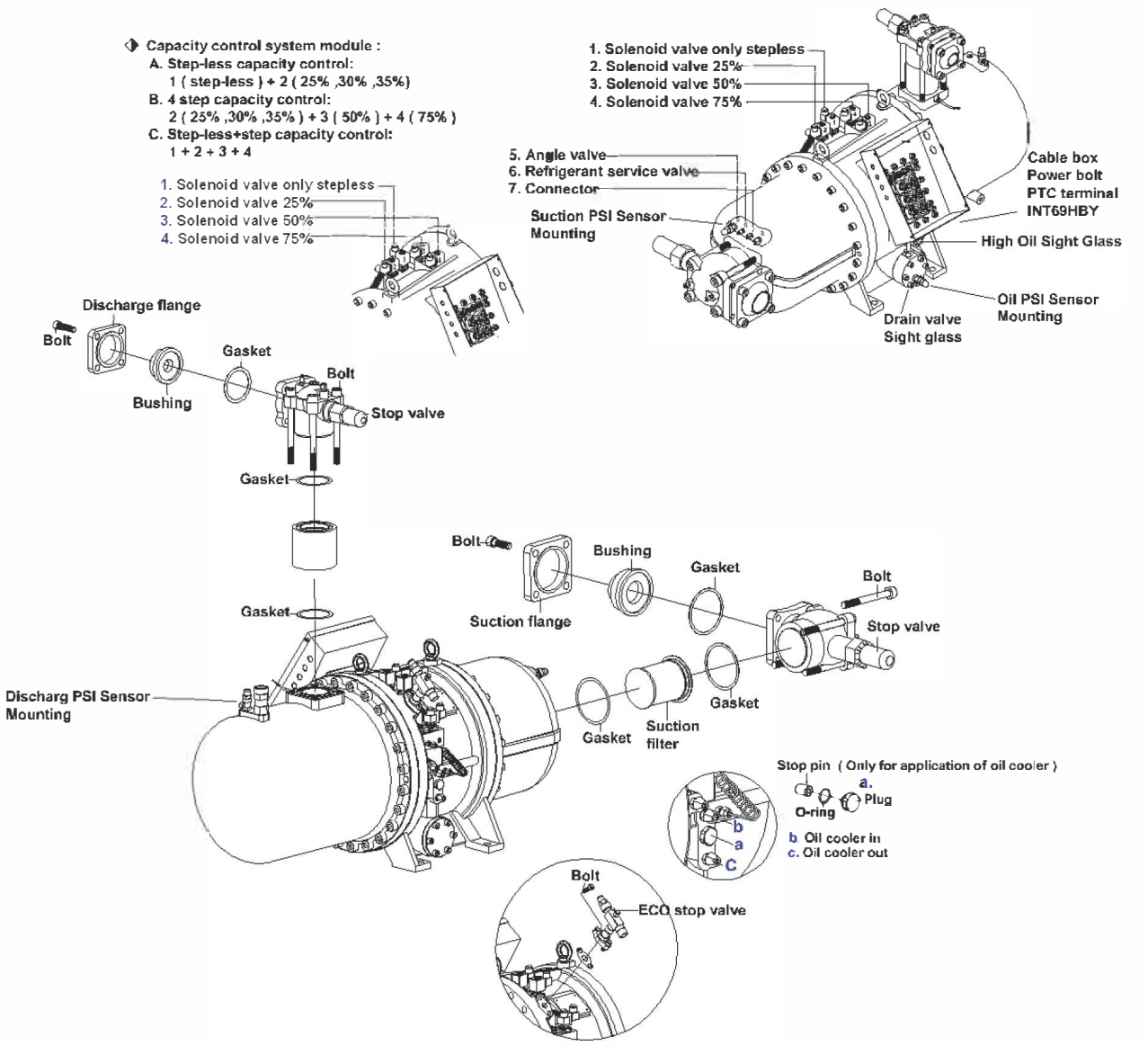
Diagram shows a typical setup using MCS Controls. Your wiring may be different from this diagram.

Chapter - 8. RC2-100, 140 Installation Guide



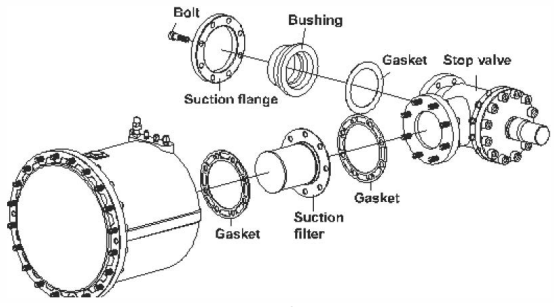
Chapter - 9. RC2-170 ~ 580 Installation Guide

RC2-170~580 Installation Guide



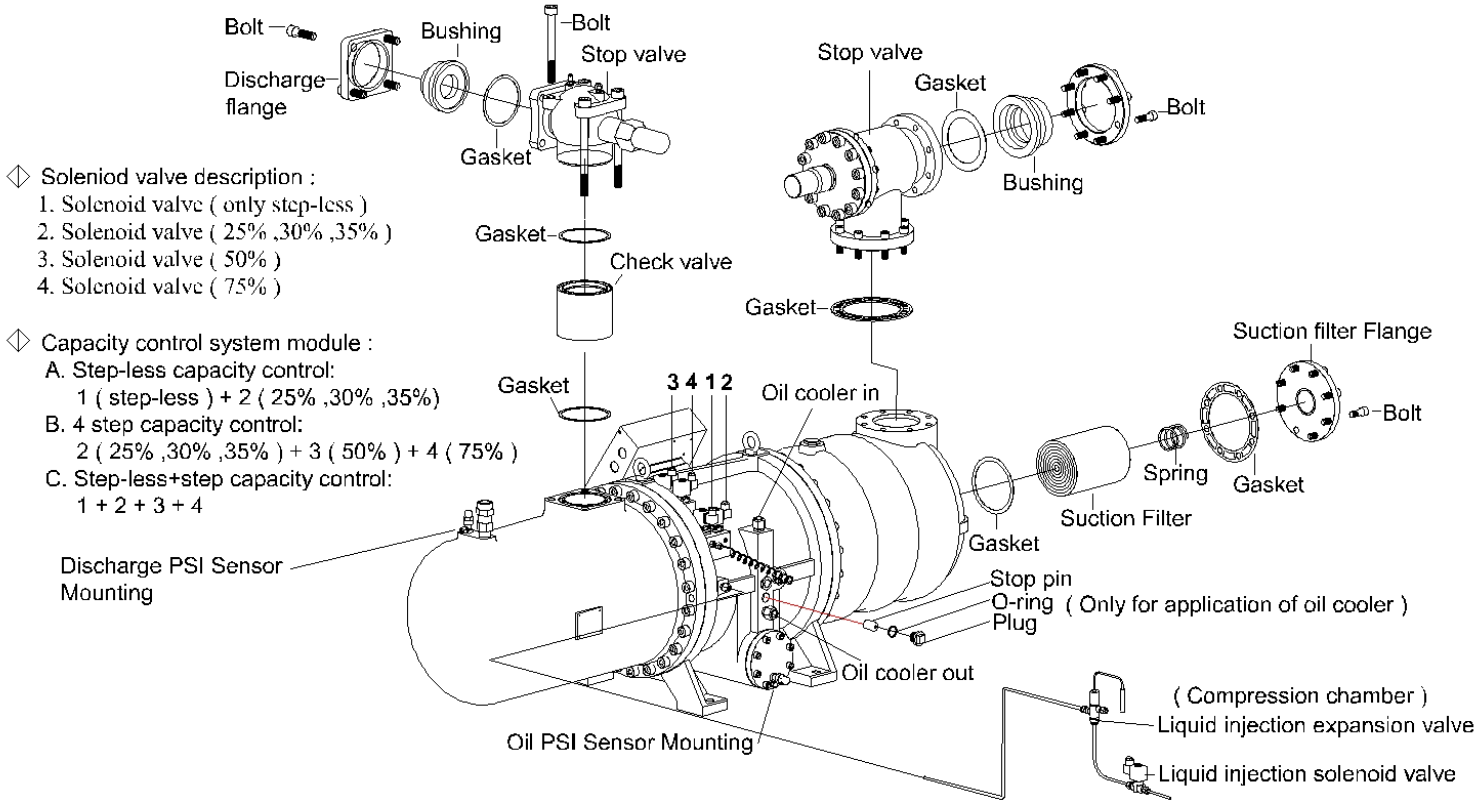
RC2-620 (The difference compared with RC2-170~580)

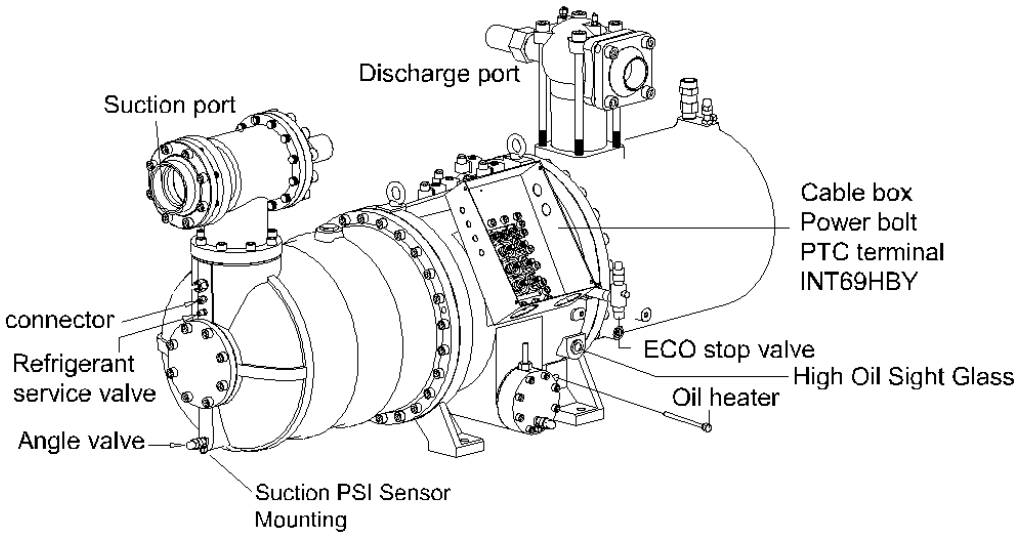
RC2-620 Suction side only



Chapter - 10. RC2-710 ~ 930 Installation Guide

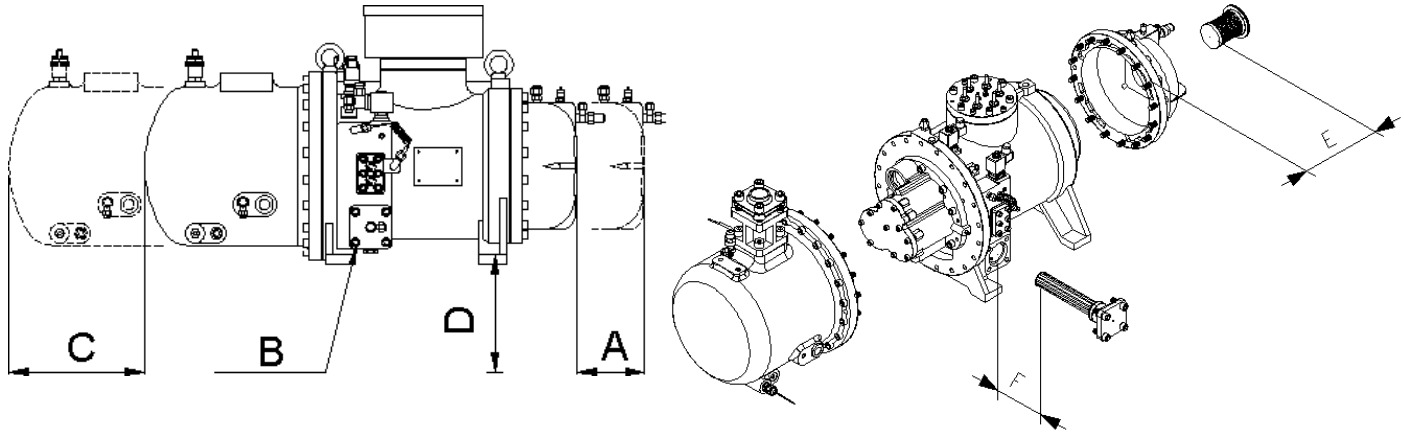
RC2-710~930 Installation Guide





Chapter - 11. Maintenance Area Requirement

Please refer to the below tables for recommended minimum space requirements



	RC2-100	RC2-140	RC2-180	RC2-170	RC2-200	RC2-230	RC2-260	RC2-300
A.(cm)	5.9” (15)			16.1” (41)	18.1” (46)	18.5” (47)		20.1” (51)
B.Outwards(cm)	11” (28)							
C.(cm)	9.8” (25)			10.2 (26)	11.8” (30)			13” (33)
D.(cm)	5.9” (15)							
E.Suction filter(mm)	3.7” (95)				4” (103)	5.6” (143)		
F.Oil filter(mm)	7.8” (200)							
	RC2-310	RC2-320	RC2-340	RC2-370	RC2-410	RC2-470	RC2-510	RC2-550
A.(cm)	20” (51)		22” (56)		21.3” (54)	23.3” (59)	21.7” (55)	23.3” (59)
B.Outwards(cm)	11” (28)							
C.(cm)	13” (33)				11.8” (30)	13.8” (35)		14.6” (37)
D.(cm)	5.9” (15)							
E.Suction filter(mm)	5.6” (143				6” (153)			
F.Oil filter(mm)	7.8” (200)							
	RC2-580	RC2-610	RC2-620	RC2-710	RC2-790	RC2-830	RC2-930	
A.(cm)	21.7” (55)	23.6” (60)	23.6” (60)	25.6” (65)			31.5” (80)	
B.Outwards(cm)	11” (28)	13.8” (35)	11” (28)	13.8” (35)				
C.(cm)	13.8” (35)	14.6” (37)		17.7” (45)				
D.(cm)	5.9” (15)	---	5.9” (15)	---				
E.Suction filter(mm)	6” (153)	8.2” (210)	6” (153)	8.2” (210)				
F.Oil filter(mm)	7.8” (200)	9.1” (232)	7.8” (200)	9.1” (232)				

Table 7-A Compressor Recommended Space for Maintenance

1. Reserve enough space for connection and installation of the electrical terminal box, service/stop valves and solenoid valves on the compressor.
2. Consider the compressors’ future overhaul when determining space requirements. All compressors’ outside parts and electrical controller lines and terminal connections etc should be spaced for easy dismantle and re-assemble.

Chapter - 12. Compressor Piping

1. To avoid abnormal vibration and noise pay close attention to how the compressor is piped.
2. When soldering copper pipe or bushings to the compressor, a 15% silver solder should be used. Once all piping is completed, perform a pressure test to ensure there are no leaks (maximum compressor pressure 350 psi or 24 bar). The cleanliness of the system should be checked after pipe welding to help avoid any debris operating inside the system that can cause compressor damage during operation. Nitrogen must be used to purge the refrigerant or oil lines when any solder is being done.
3. To avoid compressor harmonic vibration transferred by the structure and piping to the chiller while in operation, a cushion or shock absorber should be installed on the suction and discharge tube.
4. Refer to Figure 8-A showing a 6mm to 15mm.
5. Rubber pads are installed under the compressor-mounting feet to help isolate the vibration and noise transferred from other portions of the system.

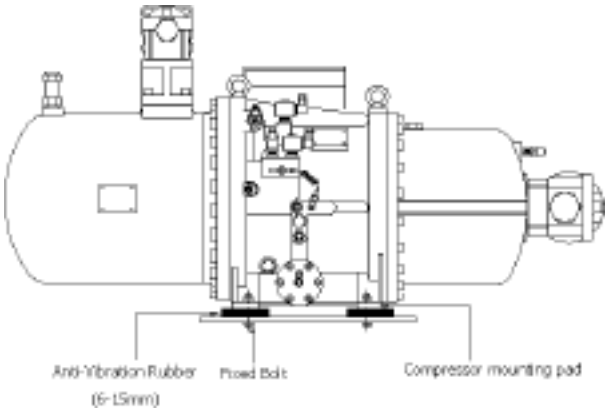


Figure 8-A Absorber Installation

6. In order to reduce vibration, copper tubes for suction and discharge pipes are recommended; copper suction and discharge pipes will minimize the vibration from the piping while the compressor is running. In the case of steel piping, it is very important for suitable welding to avoid the inner stress on piping due to harmonic vibration and noise, which will reduce the compressor life.
7. Remove oxidized impurities, swarf or debris caused by welding on piping tubes, if these impurities, swarf or debris are in the compressor, the oil filter will be clogged resulting in the lubrication system bearings and capacity control system malfunctioning.
8. The suction and discharge bushings are forged steel that can be welded directly with piping connectors (standard size for copper piping, if connecting to steel piping contact your Hanbell representative) After welding the flanges and pipes, they should be cooled down by ambient air.
9. **Water dousing is prohibited**. **Do not use water to cool down the pipes and flanges after welding.**

Chapter - 13. Pre-Start-Up Procedure

1. Oil Charging: Only lubricants listed in Hanbell's Technical Manual are to be used. NO SUBSTITUTES. Make sure the oil level is to the middle of the high side sight glass, which is the terminal box side of the compressor. (For compressors with internal oil separators)
2. Oil Heater: The heater needs to be energized for 24 hours prior to running the compressor and energized when the compressor is off.
3. Make sure all valves are open (stop, angle valves with transducers, etc.)
4. Make sure all solenoids are wired correctly.
5. Make sure the motor module (INT69HBY) is wired correctly.
6. Make sure the electrical system is wired correctly and properly grounded.
7. Verify the controller is wired correctly. (Dry run)

Lubricant Charge

Model #	Oil Needed (In Gallons)
RC2-100	1.9
RC2-140	1.9
RC2-170	1.9
RC2-180	1.9
RC2-200	2.1
RC2-230	3.7
RC2-260	3.7
RC2-300	4.2
RC2-310	4.2
RC2-320	4.2
RC2-340	4.2
RC2-370	4.2
RC2-410	4.0
RC2-470	4.8
RC2-510	5.3
RC2-550	6.1
RC2-580	5.3
RC2-610	6.1
RC2-620	6.1
RC2-710	7.4
RC2-790	7.4
RC2-830	7.4
RC2-930	7.4
RC2-1090	N/A
RC2-1280	N/A
RC2-1520	N/A

13.1. Oil Types

Note: For other applicable oil types, please consult with MCS / HANBELL first for approval

SPECIFICATION		UNITS	TOTAL LUNARIA		SUN SUNISO		CPI SOLEST	CPI CP-4214			MOBIL SHC		
			56	68	4GS	5GS	170	100	150	320	68	120	220
COLOR, ASTM			1.5	L2.0	L1.0	L1.0	–	–	–	–	L0.5	L0.5	L0.5
SPECIFIC GRAVITY			0.883	0.883	0.914	0.925	0.95	0.96	1.01	1.05	0.834	0.838	0.846
VISCOSITY	40℃	mm^2/s	56.0	68.0	54.5	96.5	175	123	168	298	68	95	209
	100℃	(cSt)	7.0	7.8	6.07	8.12	16.5	14.2	20.2	32.0	10.0	13.7	25.0
FLASH POINT		℃	220	230	188	198	265	292	290	271	250	255	260
POUR POINT		℃	-40	-35	-35	-25	-30	-35	-43	-35	-45	-45	-39
T.A.N		MgKOH/g	0.01	0.01	0.00	0.01	–	–	–	–	–	–	–
COPPER STRIP		100℃/3hr	1a	1a	1a	1a	–	–	–	–	–	–	–
MOISTURE		ppm	15	15	20	20	–	–	–	–	–	–	–
FLOC POINT		℃	-75	-75	-45	-35	–	–	–	–	–	–	–
DIELETRIC STRENGTH 2.5mm		KV	75	70	50	50	46.6	–	–	–	–	–	–

Applicable oil types (R134a, R404A, R407C)

		UNITS	CPI SOLEST				MOBIL EAL		ICI EMKARATE		
			68	120	220	370	68	100	RL411	RL375	RL421
COLOR, ASTM			–	–	–	–	0.5	0.5	1.5	L2.0	L1.0
SPECIFIC GRAVITY			0.945	0.94	0.95	0.955	0.971	0.966	0.9723	0.9783	0.9759
VISCOSITY	40℃	mm^2/s	64	131	215.9	385.96	62.5	95.8	48.0	74.1	134
	100℃	(cSt)	8.9	14.53	20.8	29.23	8.3	10.5	7.3	10.1	15.0
FLASH POINT		℃	266	254	271	302	254	260	273	246	265
POUR POINT		℃	-43	-36.5	-25	-21	-43	-37	-40	-35	-37
T.A.N		mg KOH/g	–	–	–		–	–	<0.05	<0.05	<0.05
COPPER STRIP 100℃/3hr			–	–	–		–	–	–	–	–
MOISTURE		ppm	–	–	–		<100	<100	–	–	–
FLOC POINT		℃	–	–	–		–	–	–	–	–
DIELETRIC STRENGTH 2.5mm		KV	–	–	–		–	–	–	–	–

Note: For other applicable oil types, please consult with MCS / HANBELL first for approval

IMPORTANT

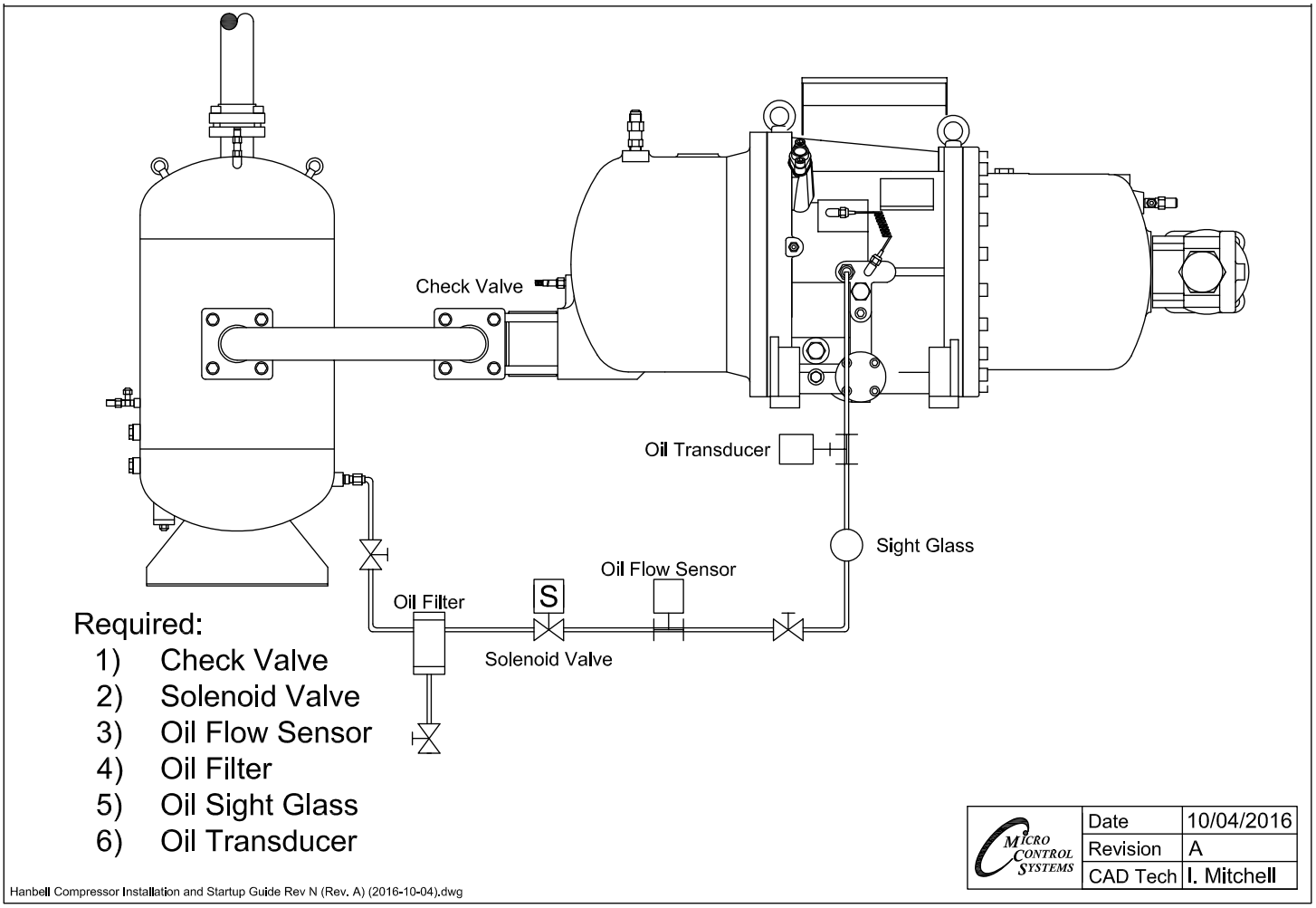
Do not start the compressor without first reviewing the Start-up section of this document.

Standing at the suction end of the compressor the motor rotates counter clockwise.

NOTE: RC2-AF, RC2-BF, and LA Series Compressors do not have an Oil Separator or Sump

These compressors do not hold oil and therefore have no oil filter, oil level switch, or heater. Therefore you must have an external oil separator with an oil sump and oil level float. Also, on the return line from the oil sump to the compressor you must have an oil filter and oil flow switch. Please follow the piping diagram below. Please ensure there is oil charged in the piping feeding the compressor to avoid a dry start-up.

13.2. HANBELL FLOODED TYPE WITH OIL SEPARATOR



13.3. HANBELL FLOODED TYPE WITH OIL SEPARATOR & OIL COOLER

To obtain high oil filtering efficiency low pressure drop loss and non-interruption with lubricant supply system, the oil separator is built outside the compressor. The installation of lubricant circuit is a very important issue during the whole procedures. So, before starting, please make sure to read all the instructions of this manual carefully and ensure each step is done in accordance with the specifications.

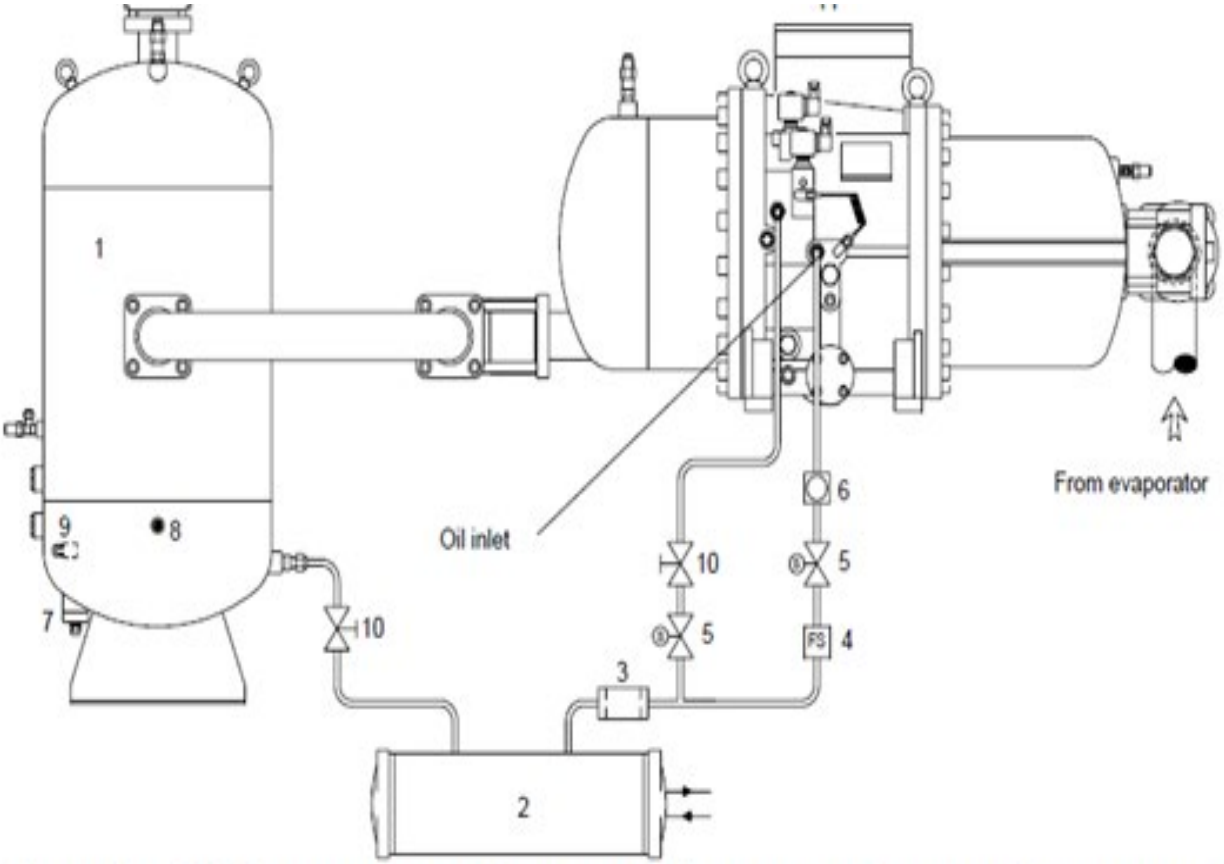


Illustration of RCF compressor and its external oil separator and accessories recommendatic

1.External oil separator	7. Oil level switch
2. Oil cooler	8. Oil temperature sensor
3. Oil filter and cartridge	9. Oil heater
4. Lubricant flow switch	10. Manually adjustable flow valve
5. Oil solenoid valve	11. Compressor
6. Sight glass	

In the lubricant circuit, installing the oil solenoid valve in the proper place is very important. As the compressor is shut down, lubricant will automatically inject into the compressor due to pressure differential. It will easily make the system difficult to restart because of low oil level or lubricant injection inside the compressor chamber.

Chapter - 14. Start-up Procedure

- Check using a rotation testing instrument, checking the rotation by starting the compressor can and will cause damage to the compressor.
- Compressor rotation is counterclockwise CCW. (***Reverse rotation is not covered by warranty).***
- Before stating the compressor, the rotation must be correct. This can be achieved with the use of a Phase rotation meter (FLUKE-9040, or IDEAL® 61-520 are examples of this type of meter).
- Checking the rotation by starting the compressors and watching the suction and discharge is not the correct way to test rotation.
- Proper rotation is critical. If the compressor is operated in reverse, severe damage may occur.
- Recheck oil level. The oil level should be to the middle of the high side sight glass.
- Hanbell recommends suction superheat 10°F to 20°F, discharge superheat 30°F and a pressure differential of at least 70 psig.

14.1. These Safeties ARE Required at Startup to Maintain Hanbell Warranty

a) Motor Module Trip (INT69HBY): Open for 1 second
b) Low Oil Level Float Trip: Open for 60 seconds **+30 seconds extension**
c) Unsafe Suction: Less than 5 psi for 3 seconds **+25 seconds extension**
d) High Discharge Temperature: Greater than 230°F for 2 seconds
e) Low Differential Pressure: Less than 65 psi for 60 seconds (Oil-Suction) **+60 seconds extension**
f) Unsafe Differential Pressure: Less than 35 psi for 5 seconds (Oil-Suction) **+25 seconds extension**
g) Dirty Filter (Discharge Pressure - Oil Pressure): Greater than 20 psi for 60 seconds
h) Low Discharge Superheat: Less than 20°F for 300 seconds

+ ***Indicates allowable time extension added to the trip delay during the first 5 minutes of compressor operation while starting.***

Chapter - 15. Hanbell with VFD

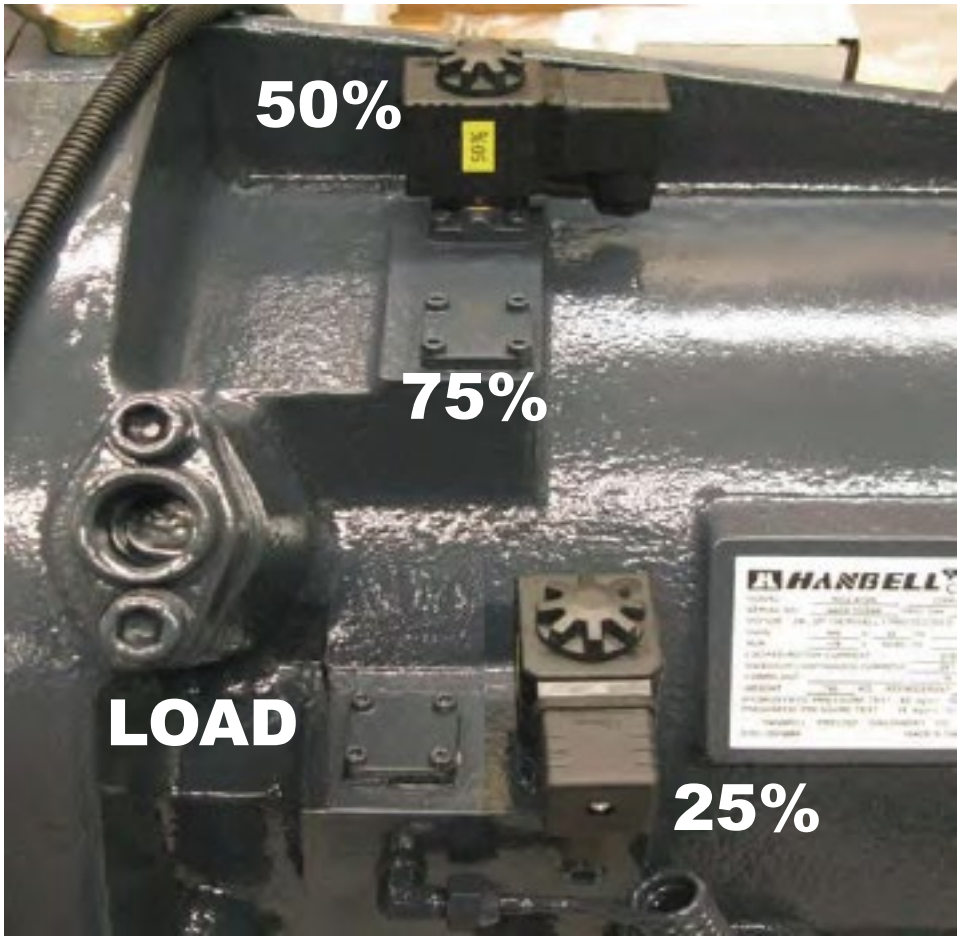
15.1. Wiring & Controls Set Up

- **For a new installation**, **DO NOT CONNECT** the L1, L2, and L3 Red, White and Blue wires to the INT69HBY motor module.
- **For an existing installed compressor REMOVE** the red, white and Blue wires from the INT69HBY motor module.
- Place the amp sensor(s) on the line side of the VFD.
- Select only a constant torque VFD type to use.
- Set for no Direct Current (DC) braking
- Set Acceleration Time to 3-5 second

15.2. Compressor Set Up

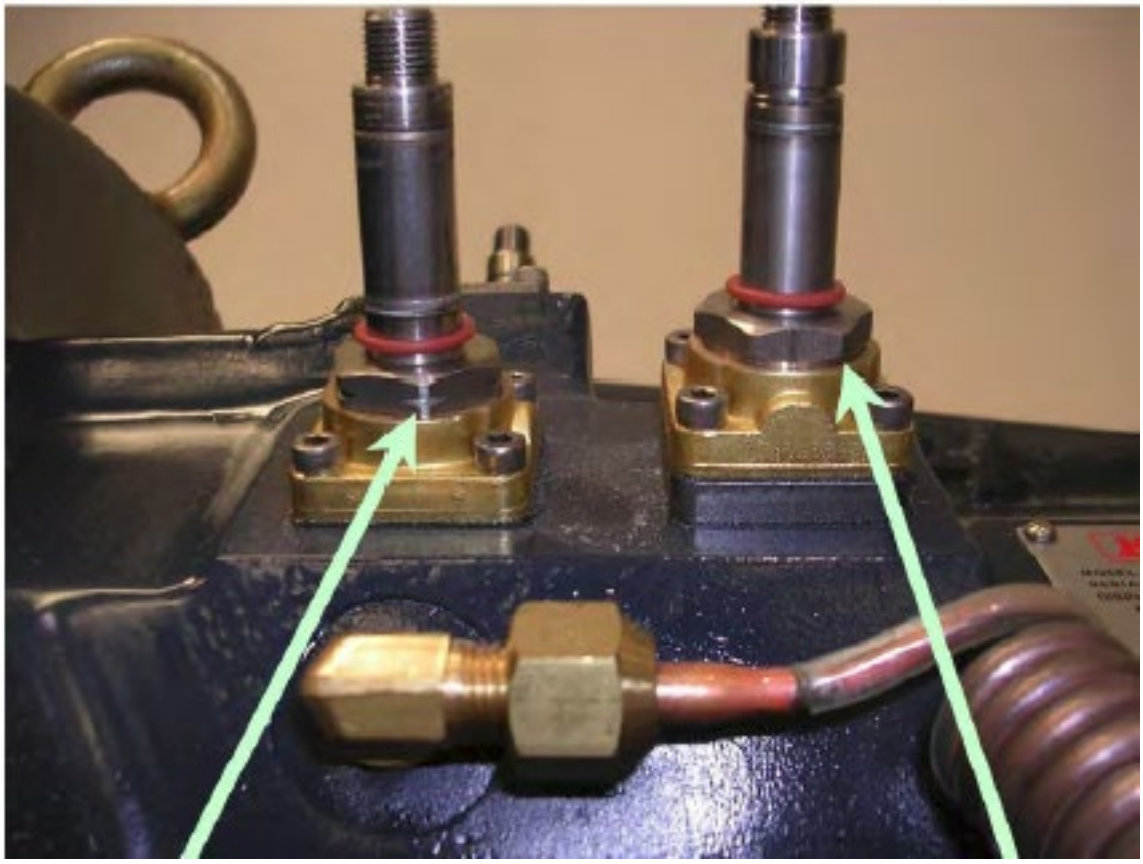
- Remove the 50% load solenoid coil (50% is no longer used).
- The 25% load solenoid is used as the Fast Unload.
- Remove the Load solenoid stem and install a Load Cap in its place.

Final Configuration

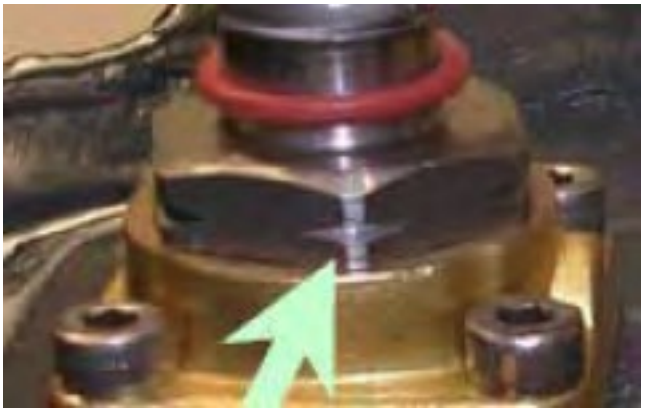


15.3. Solenoids

15.3.1 Solenoid Identification (Normally Open / Normally Closed)

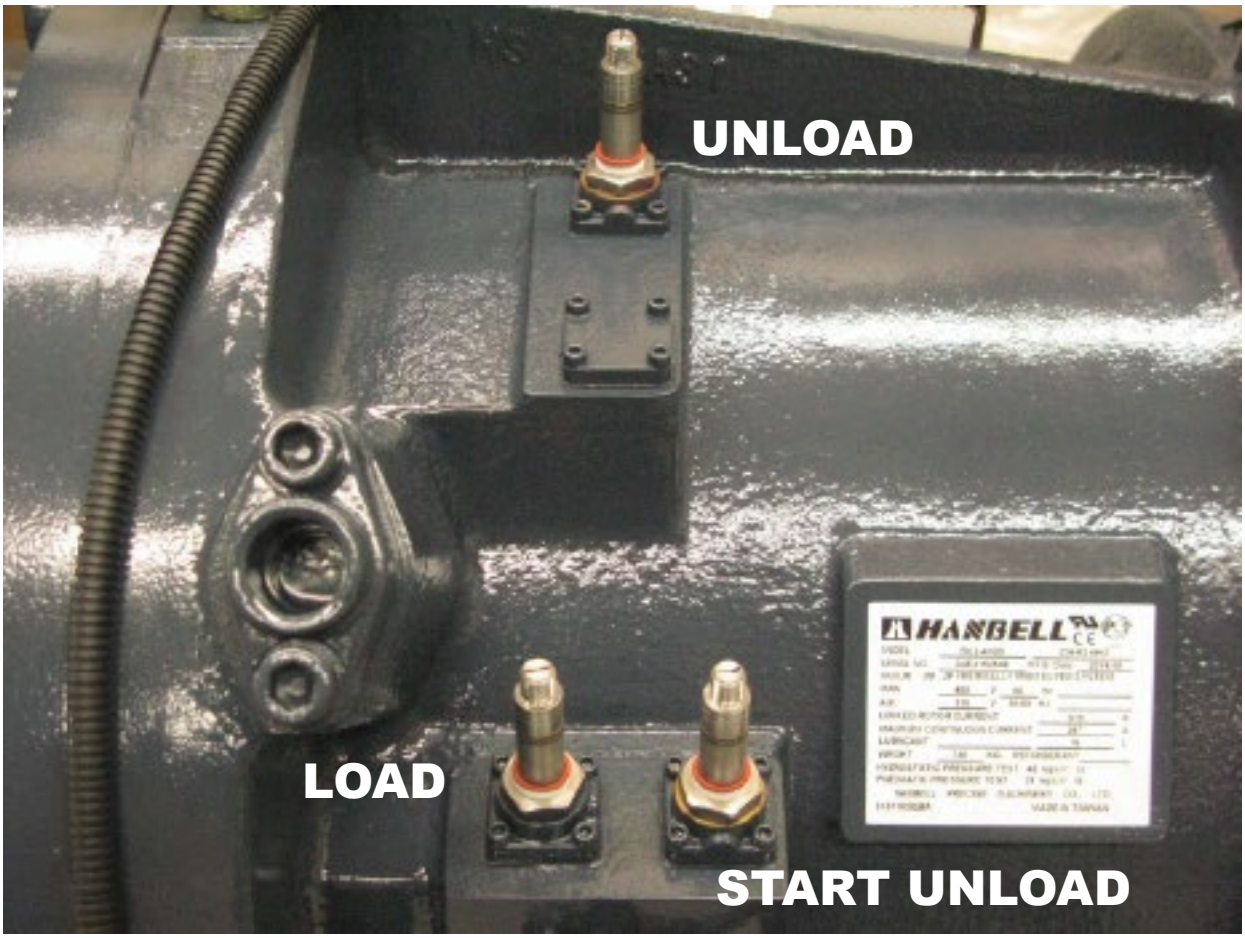


NORMALLY OPEN SOLENOID
CAN BE IDENTIFIED BY NOTCHES ON NUT



NORMALLY CLOSED SOLENOID
THERE ARE NO NOTCHES ON THE NUT

15.3.2 Infinite Capacity (Stepless) Minimum (50-100%)



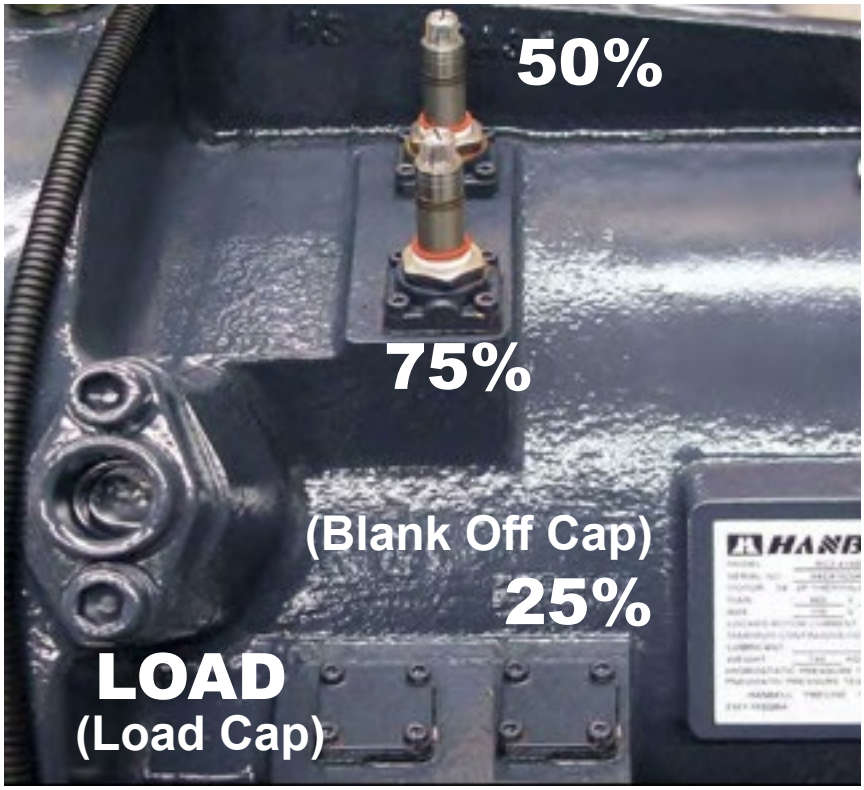
1. For new continuous (step-less) capacity control system, Hanbell equipped all solenoid valves a Normally Closed. If it is necessary to be equipped with other type solenoid valve, please specify it with MCS / Hanbell before order confirmation.

Verify compressor load solenoid as Normally Open or Normally Closed.

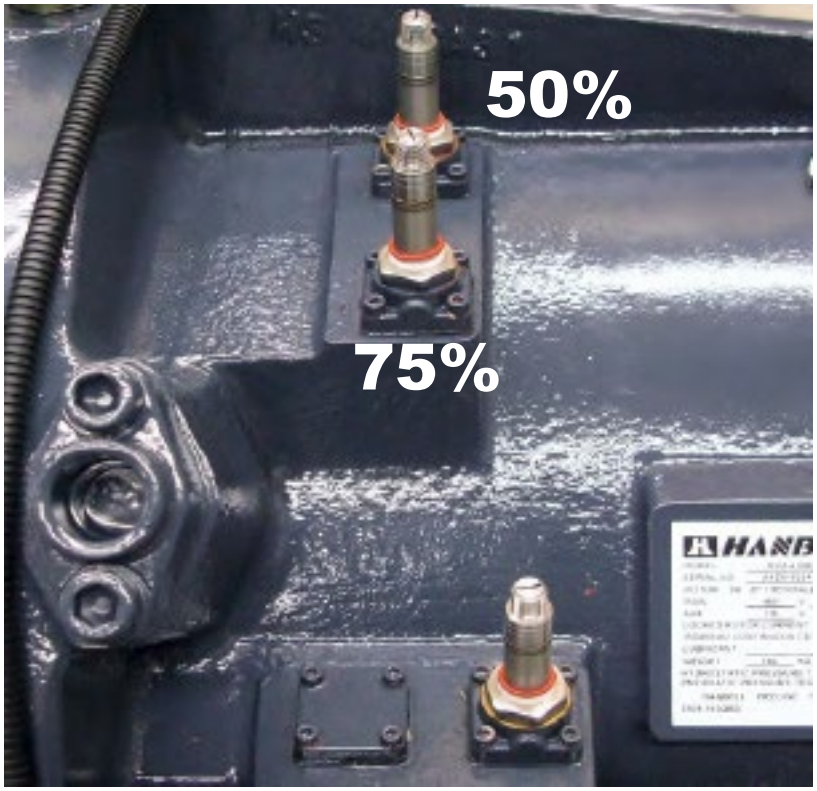
2. If normally Open Solenoid, wire through the Normally Closed Relay Output.
3. If normally Closed Solenoid, wire through Normally Open Relay Output.

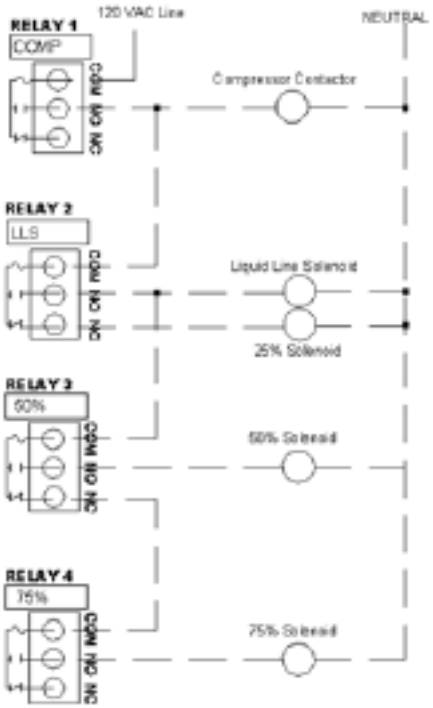
	UNLOAD (NC)	LOAD (NC)	STRT UNLD (NC)
Start	Energize	Not energize	Energize
Loading	Not energize	Energize	Not energize
Unloading	Energize	Not energize	Not energize
Stable	Not energize	Not energize	Not energize

15.3.3 Step Load 50%, 75%, 100%



15.3.4 Step Load 25% 50%, 75% & 100% (Only 25% at Start-Up and Shut-Down)





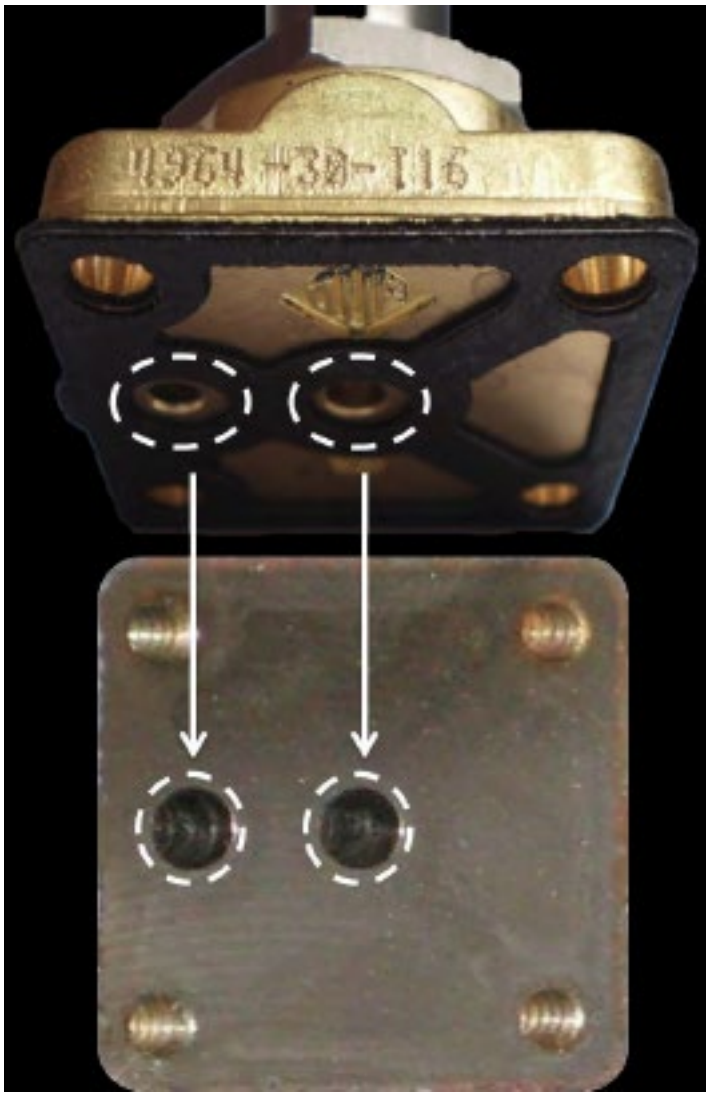
Please see APP Note 76 for Step Loading Instruction Kit

15.3.5 Solenoid Alignment

IMPORTANT

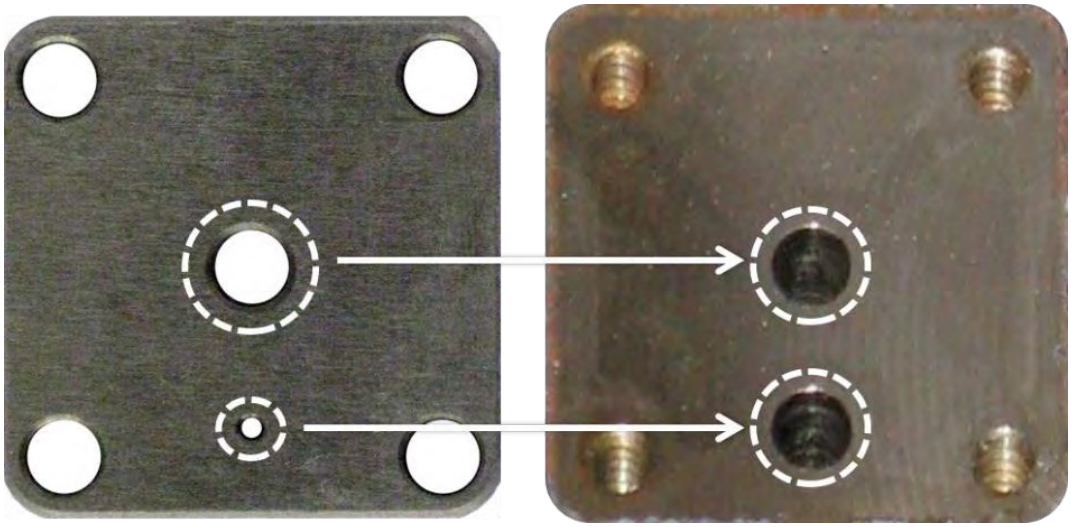
SOLENOID ALIGNMENT IS CRITICAL TO PROPER FUNCTIONING OF COMPRESSOR

WHEN INSTALLING SOLENOIDS ON THE COMPRESSOR, ENSURE THAT THE HOLES MATCH FOR PROPER OIL FLOW TO OCCUR.

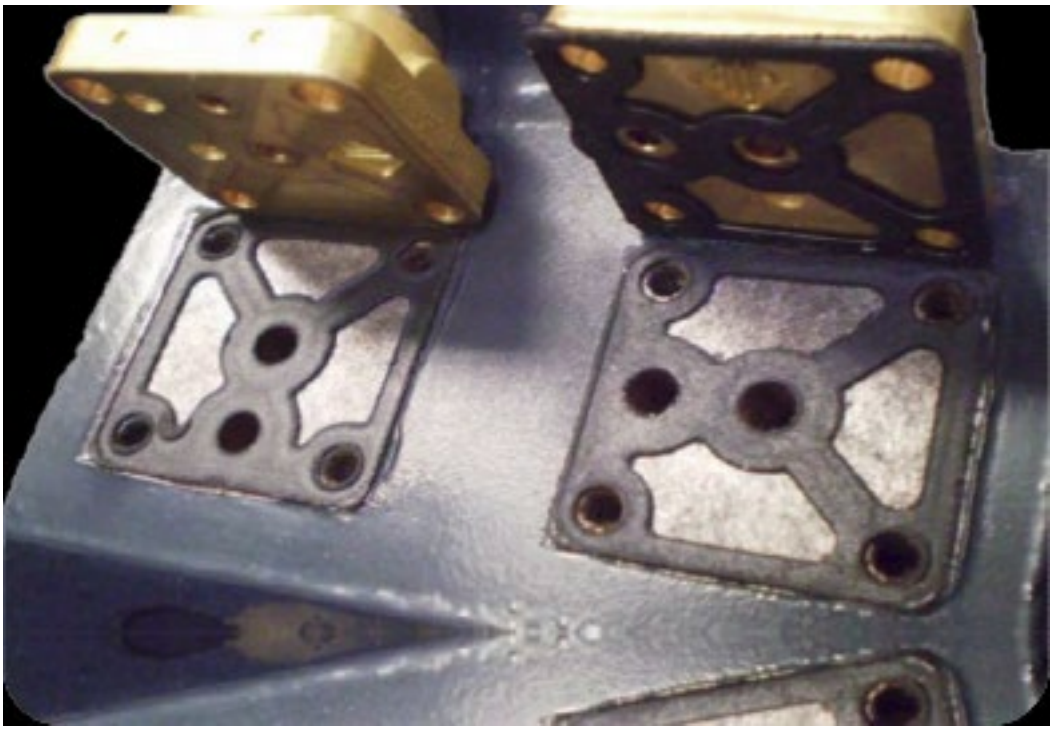


WHEN INSTALLING A LOAD CAP, MAKE SURE THAT THE CIRCULAR HOLE IN THE GASKET COVERS BOTH OF THE COMPRESSOR OIL FLOW HOLES.

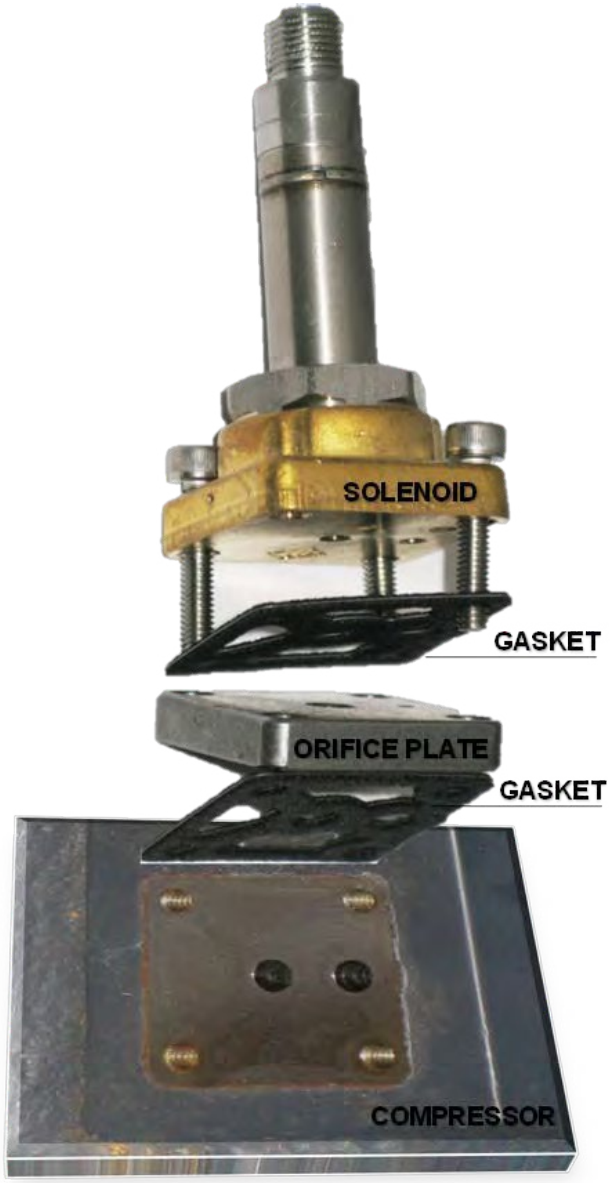
ALSO MAKE SURE HOLES LINE UP IF INSTALLING ORIFICE PLATE
(FOR COMPRESSORS MANUFACTURED BEFORE APRIL 2013)



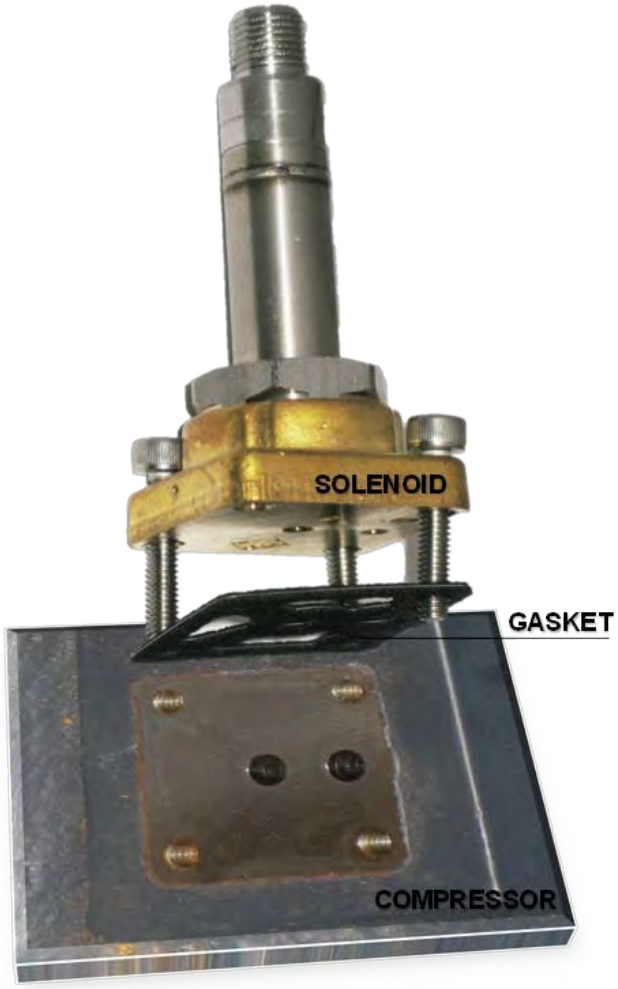
NOT ALL OIL FLOW HOLES ARE ORIENTED THE SAME WAY. BE SURE TO DOUBLE CHECK THAT THE SOLENOID HOLES LINE UP PROPERLY AS SHOWN BELOW.



PROPER INSTALLATION OF A SOLENOID
WITH ORIFICE PLATE



PROPER INSTALLATION OF A SOLENOID
WITHOUT ORIFICE PLATE



ATTENTION

ORIFICE PLATES WERE REPLACED BY ORIFICE PLUGS IN COMPRESSORS MANUFACTURED AFTER APRIL 2013

Before	After
 orifice plate	 orifice plug
 solenoid valve + orifice plate	 solenoid valve + orifice plug

Chapter - 16. Slide Amp Calculation

16.1. Slide Amp Calculation through MCS-Connect

MCS Controls with a Hanbell Infinite Control (stepless) compressor, you need to follow these steps when commissioning the compressor to ensure correct operation.

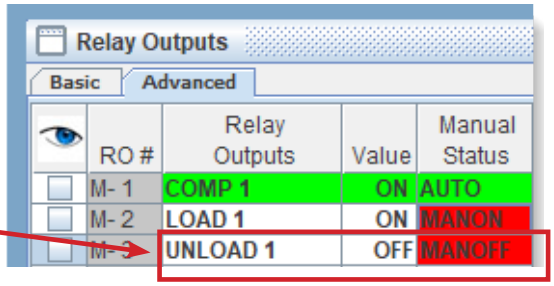
General Concept

Not all compressors will run exactly at the full load amperage rating that the manufacturer provides. Likely it will be very close, but some fine tuning of the configuration will enable the operator to maximize efficiency and control of the unit. This manual is designed to walk you through the steps of adjusting your slide amp calculation through MCS-Connect for optimum performance of your system.

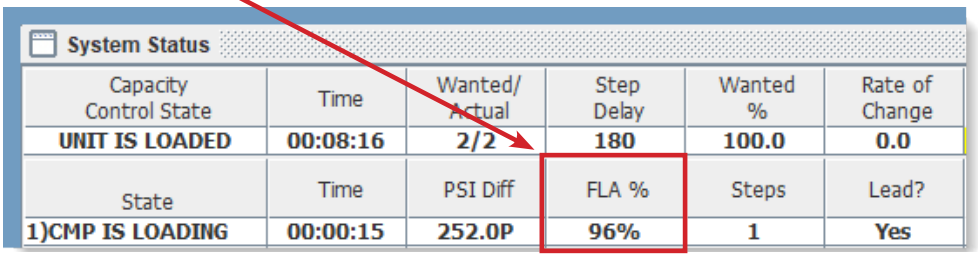
1. Setting the Upper Limit

a. Use MCS-Connect to link with the Magnum control board and get authorized at Supervisor or Factory level.

b. While the compressor is running near design conditions, turn the UNLOAD relay manually OFF, and the LOAD relay manually ON.



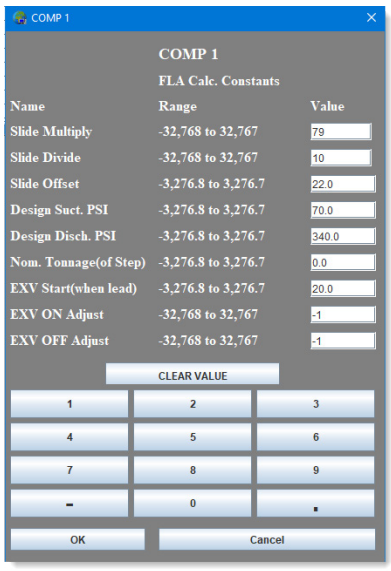
c. Wait until the compressor is fully loaded. Then check the value in the FLA% in the circuit grid for that compressor.



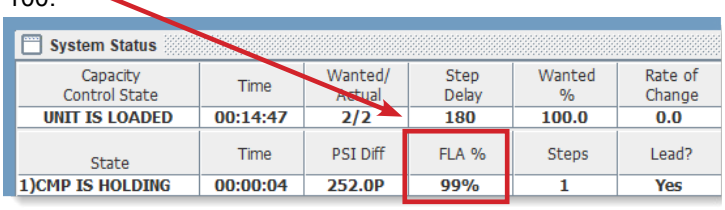
- If the FLA% is 101 or above, then increase the slide offset.
- If the FLA% is 97 or below, decrease the slide offset.

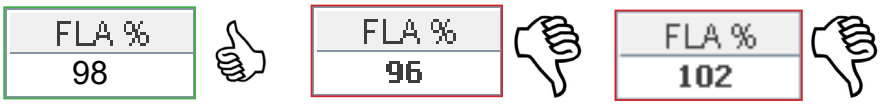
d. To access the slide offset you must first have the proper authorization level to make changes to the unit. Double-click on the relay for the compressor you are tuning (in this example COMP is the name of the relay output).

e. A window will pop up (as shown on right) with the slide amp calculation. Increase or decrease the “Slide Offset” value and press the OK button to accept the changes.



f. Check the FLA% value again. It should say 99 or 100. If not, then repeat steps C and D again until you reach a value of 99 or 100.



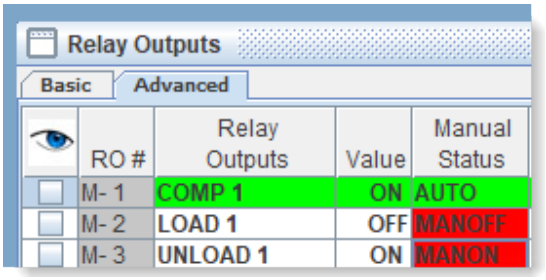


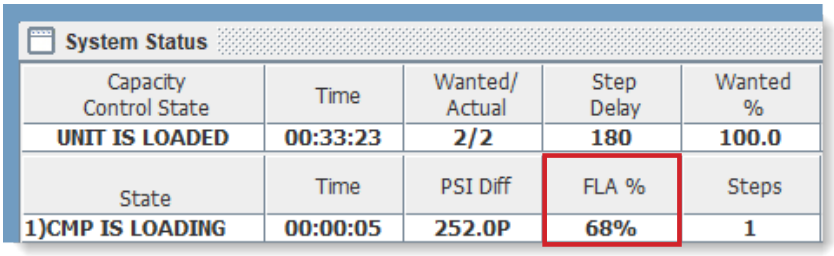
2. Setting the Lower Limit

Now that you have finished calibrating the upper FLA% you may now work on setting the minimum FLA% limit.

a. Begin by turning the LOAD relay manually OFF, and UNLOAD relay manually ON.

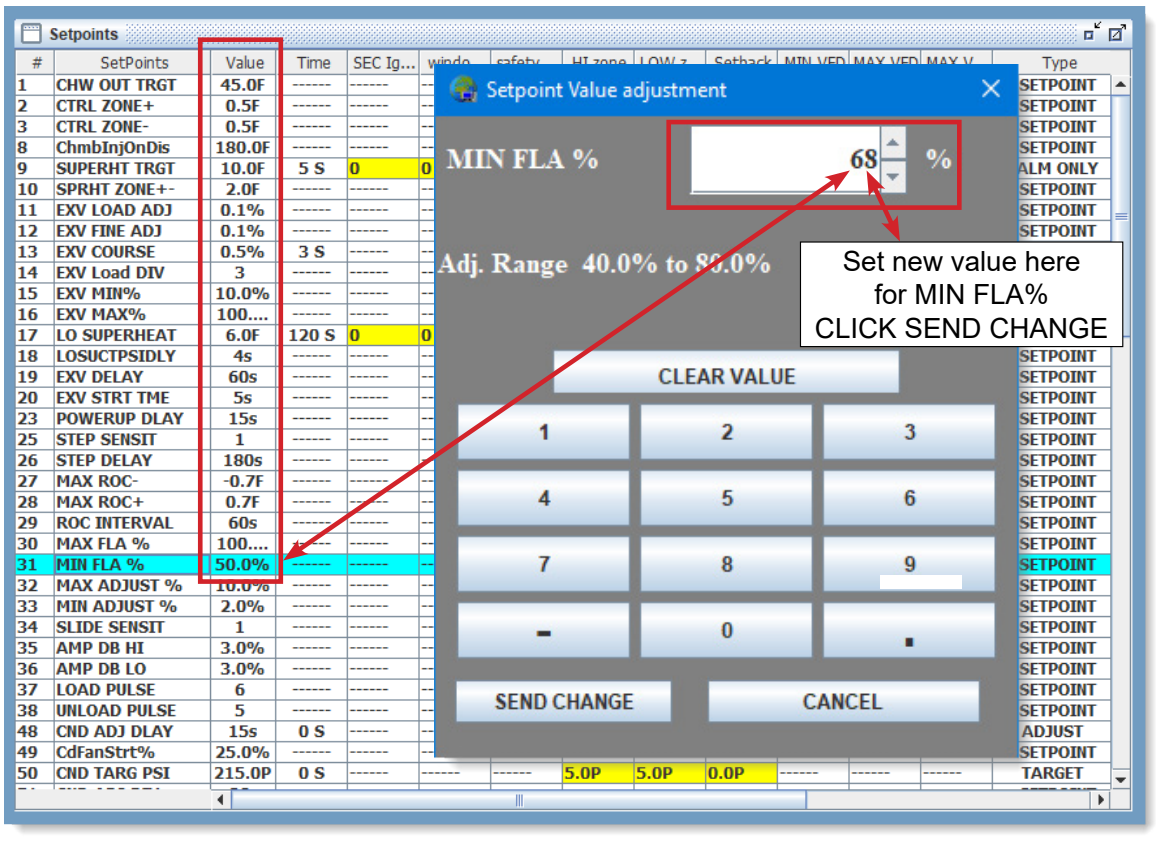
b. Wait until the compressor is fully unloaded and then check the FLA% value in the circuit grid.





c. Take this number, double click on the “Value” column for setpoint #31 “MIN FLA %” and set this number as the new value.

(Note: if you have multiple compressors you should use an average of their fully unloaded values).



Chapter - 17. Compressor Warranty Information

Rev. - 07-21-2021
Supersedes previous version:

Compressor Warranty Information and Suggested Guidelines for Preventive Maintenance

All HANBELL screw compressors are put through strict quality and performance testing prior to shipping from the factory.

Provided that terms of payment are observed, a two-year (24 month) Manufacturer's Warranty against factory defects is offered from the date of installation or 27 months from date of shipment; whichever occurs earlier.

The following procedures and safeguards must be followed for the Warranty to be validated:

- The Warranty Start-up/Status Report Form must be completed and returned for each compressor purchased at the time of startup.
- An Oil Sample Report must be submitted to and approved by MCS after initial break-in period for each compressor purchased. Preferably around 72 hours of run time, but no less than 4 hours.
- The compressor must be equipped with an Over/Under Voltage Phase Protection Device.

HANBELL compressors sold by MCS, which are controlled by an MCS micro controller with software and configuration written and tested by MCS, shall be covered under a three-year (36 months) warranty agreement on the compressor only.

MCS may, at its option, repair or replace defective items that are under warranty. Repair or replacement of a warrantied compressor does NOT reset the warranty date; however, the Factory Warranty will remain in effect for the remaining period of time.

1.1. Maintenance

The technicians should be familiar with the Hanbell compressor before attempting any maintenance on the unit.

Periodical checks and regular maintenance are very important for the long-term and trouble-free compressor life and for maintaining the warranty. The content here is to help the operator and service people to know how the regular maintenance can be done and when a suitable time is for each item. Operators and service people should follow the instructions on these pages when working on the maintenance.

Besides the regular maintenance, Technicians should check the system's working status by noting down its working parameters on a set schedule. Most of the time abnormal system conditions can be found via comparing its working parameters with its daily operating data.

- Compressor unit should be stopped before doing the maintenance work.
- Disconnect power from unit before doing the maintenance work.
- Close all the isolation valves before doing the maintenance work.
- Wear safety equipment when doing the maintenance work.
- Ensure adequate ventilation before doing the maintenance work.
- Take safety precautions for the refrigerant used and work with care.

1.2. Short Term Maintenance

During commissioning period or after a few hundred hours of compressor run time, the following checks and replacement shall be done in order to protect the compressor and understand the compressor's working status.

1.2.1 Suction Strainer

The Suction strainer plays a very important role to long-term compressor life. In the initial commissioning, debris and welding slag might find its way to the compressor's suction side. With the help of the suction strainer, debris will be gathered inside the strainer to protect the compressor from rotor damage. Technicians should check the suction strainer at the ***end of commissioning and after 200 hours of initial running***. Any dirt and unwanted material should be removed during this check. Wash the strainer basket in solvent and blow clean with air.

1.2.2 Oil Analysis

At the ***end of commission or after 200 hours of initial running***, oil analysis is mandatory and must be executed at the jobsite. The purpose of doing oil analysis is to understand the compressor's working environment and ensure the oil quality. If moisture contamination exists in the system, this will lead to changing of the oil quality and cause poor lubrication for internal moving parts which can cause severe damage to the compressor in the future. Technicians should replace the oil immediately to protect the internal moving parts with good lubrication and recheck the oil ***again after 200 hours operation***. If the oil analysis shows the oil is in good condition, ***recheck the oil every 6 months*** to ensure the condition remains safe.

In the case of being unable to do the oil analysis periodically, consult Hanbell oil change schedule because the interval of oil change varies by the oil type and compressor operating condition.

Check the oil acidity periodically and change the oil if the oil acidity value measures lower than pH6.

1.3. Long Term Maintenance

The information below is focusing on standard long term maintenance. Technicians should understand that these items are not assumed to take over all the necessary routine checks. Daily check for operation conditions is also very important to have a stable operating system.

Please refer to the recommended maintenance schedule found on the following pages. This schedule is only for the technician's reference and should be considered as the minimum guideline to maintain the system's normal operation. Technicians still can do any examination by their own that will ensure a stable system operation. In case of any irregular situation or abnormal condition that takes place in the compressor system. Technicians should stop the compressor and contact the contractor who installed the unit.

1.3.1 Piston Sealing

The Piston is also recommended to be inspected every year to ensure the function of capacity control. If abnormal wearing is found, the corresponding part should be replaced by a new one. Prior to replacing, the technicians should do an inspection and determine what is causing the wearing problem.

1.3.2 Vibration Analysis

Vibration analysis can help to detect bearing wear and other mechanical failures. A certified Hanbell Technician should perform this check.

Overhaul Review

Overhaul review is recommended to be done at least ***every 3 years***. It is the best time to review the internal parts and replace all wearing parts for the following long-term operation. A certified Hanbell Technician should perform this review.

Supersedes all other warranties

Chapter - 18. Handling POE Oils

Please read as improper handling can cause compressor failure and void the compressor warranty.

POE oils are very hygroscopic compared to mineral oils, so exposing POE oils to air will result in their absorbing moisture quicker than mineral oils. When POE oils are exposed to moisture and heat in a refrigeration system, they will react forming acid that is harmful to the system.

As a result, it is imperative that contractors keep containers of POE oils sealed, except when the oils are actually being dispensed. POE oils should also be stored properly in their original container because many plastics used to package oils are permeable to moisture. It is also important to keep compressors and systems closed, except when work is actually being done on the equipment, and to filter out undesirable contaminants. This can be achieved with proper installation and service techniques as well as the use of correct filters and driers.

Once moisture is in the oil it is extremely difficult to remove, even under a high vacuum it can take many hours to reduce the level of moisture. Several filter drier changes should be planned when replacing a compressor. Often an oil change and filter driers are required to correct the problem.

Oil should be sampled every six months and sent to an oil testing lab.

High moisture and acid levels will cause coppering in the slide chamber and will cause premature slide failure. In extreme cases copper will be deposited on the compressor screws and cause high noise levels and compressor failure. High acid levels will also cause compressor motor failure (Failure due to of lack of maintenance is not covered under warranty).

Any questions or concerns please contact sales@mcscontrols.com

or call 239-694-0089 and ask to speak to a sales person

www.mcscontrols.com

Chapter - 19. Hanbell Maintenance Forms

Company_____

Technician _____ Phone _____

Site Information

Installation Site Name _____

Unit Information - USE A SEPARATE SHEET FOR EACH COMPRESSOR

	Model Number	Serial Number	Type Oil Used
Unit			

Factory recommends that the oil filter cartridge should be checked and cleaned at 24 hours after startup. Then checked or replaced at 10,000 hours then every 10,000 of run time.

It is important that the oil filter cartridge is not clogged; it might result in the malfunction of the lubrication systems, bearings and capacity control system.

Recommended Maintenance Schedule

Check Point	Running Period								
	24 hrs.	1000 hrs.	2500 hrs.	5000 hrs.	10000 hrs.	15000 hrs.	20000 hrs.	25000 hrs.	30000 hrs.
Motor Insulation					O		O		O
Oil Filter Cartridge	O				O		O		O
Suction Filter	O								O
Piston Rings				O	O	O	O	O	O/△
Oil Level	O	O	O	O	O	O	O	O	O
Oil Change	O		O		△		△		△
Discharge PTC				O	O	O	O	O	O
Bearings					O		O		O/△

O Check or Clean, △Replace

Note:
This is an estimated schedule to keep the compressor running at its highest efficiency and avoid compressor breakdown, not a basis for any claim. The appropriate running period for each checkpoint will be vary from working conditions, applications, control logics, refrigerant, lubricant, etc. Please contact Hanbell or local distributors/agents for more details.

Replacement of piston rings and bearings should be performed by HANBELL authorized technicians.

Every 5000hrs, please ensure the chiller unit keeps its target temperature when discharge superheat is between 10°C and 20°C; Please check vibration level of bearings in compressor every 10000hrs.

Oil Change; use only Hanbell authorized HBR lubricant and do not mix difference brands of the oil together. Oil remaining in the compressor and system should be totally evacuated prior to changing the oil. It may be necessary to change the compressor oil a second time to ensure that there is no oil mix.

It is critical to change the oil after a motor burned out because acid and debris may still remain inside the system. Check acidity of the oil after several hours of operation and continue to perform periodic oil / filter-dryer changes until acidity drops to an acceptable level.

If the burn out is severe, a suction-line filter/dryer and an oversized liquid-line drier should be installed. The filters should be monitored and replaced if a pressure drop across them is observed. Filters should be replaced until acidity drops to an acceptable level at which time the suction-line filter can be removed.

Weekly Preventive Maintenance

Check oil level and color
Check the operation of oil heater and solenoid coil

Monthly Preventive Maintenance

Perform weekly preventive maintenance
Check compressor suction pressure
Check compressor discharge pressure
Check entering water temperature
Check leaving water temperature
Measure ambient temperature
Check compressor amp.

19.1. Hanbell Warranty Startup Form

A fillable form is available on our website, download and fill out:
https://mcscontrols.com/Documents/Hanbell/Other/Hanbell%20Warranty%20Startup%20Form.pdf

MICRO CONTROL SYSTEMS

HANBELL

Warranty Start Up / Status Report

Upon startup, please complete the form with as much detail as possible

1) FILL OUT THE FORM
2) PRINT TO PDF (Creates a file on your desktop or other)
3) EMAIL FILE TO SALES@MCSCONTROLS.COM

Date _____ Sales Order # _____

Company _____ Address _____

Name _____ Phone _____ Mobile _____ Email _____

Installation Site Name _____ Manufacturer _____ Evaporator Type ◯ FLOODED ◯ DX ◯ AIR COIL

Example: ABC Elementary School *Example: Trane CVHE32, York YT*

COMP #1: Model # _____ **Serial #** _____

COMP #2: Model # _____ **Serial #** _____

		COMP #1	COMP #2
	Refrigerant Type		
	Type of Oil		
	Run Hours		
	Suction Pressure		
A	Saturated Suction Temp		
	Discharge Pressure		
B	Saturated Discharge Temp		
	Oil Filter PSI		
C	Suction Line Temp		
D	Discharge Line Temp		
E	Liquid Line Temp		
	Evaporator In Temp		
F	Evaporator Out Temp		
	Condenser In Temp		
G	Condenser Out Temp		
	Oil Sump Temp		

	COMP #1	COMP #2
Suction / Oil PSI Differential		
Motor Temp		
Ambient Temp		
Amps L1		
Amps L2		
Amps L3		
Volts L1 to L2 (running)		
Volts L2 to L3 (running)		
Volts L3 to L1 (running)		
H Condenser Sat Temp		
Evaporator Sat Temp		
Evaporator Approach Temp **(F - A =)**		
Sub Cooling Temp **(H - E =)**		
Suction Superheat Temp **(C - A =)**		
Discharge Superheat Temp **(D - B =)**		
Condenser Approach Temp **(H - G =)**		

Remarks: