



# HANBELL **SCREW** COMPRESSORS

**HVAC & Refrigeration Type**  
**with Internal Oil Separators**

**Quiet &  
Efficient**



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## **RC 10 ~ RC 21**

*28 Tons ~ 334 Tons*

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### **RC Series**

**HVAC & Refrigeration  
Screw Compressors**

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**+14° ~ +59°F**  
**-15° ~ +15°C**

**R22**

**R134a**

**R407C**

**R404A**

# HANBELL **SCREW** COMPRESSORS .....

## Superior **Quality** Products and Services

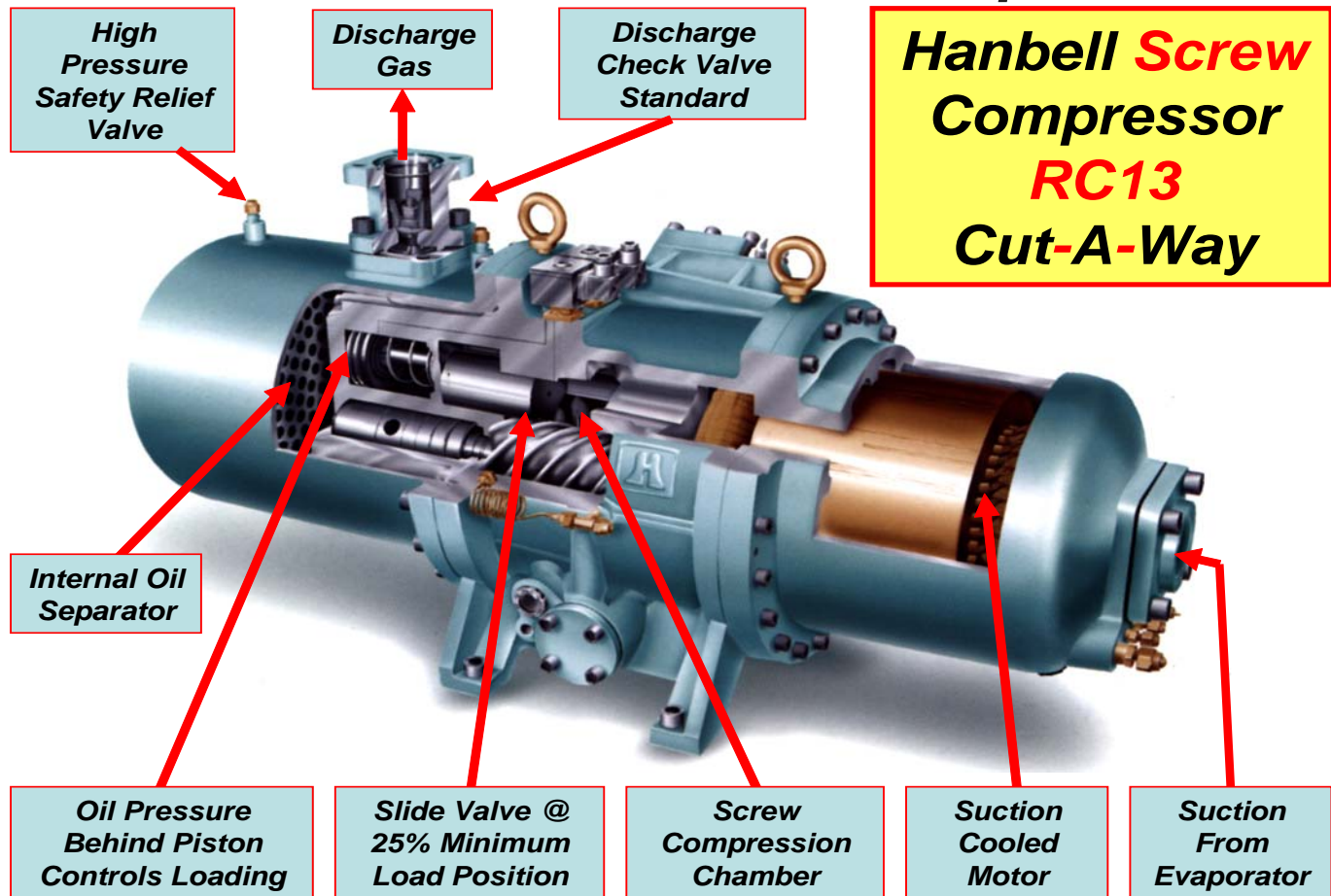
### Superior **Quality** Assurance

ISO-9001 **Quality** Assurance Manufacturer

Manufactured with Highest **Quality** Precision Equipment Available

ISO-2151 International Sound Measurement Standard

## Hanbell **Dual Rotor** Screw Compressors



### MCS & Hanbell's Competitive Advantage

Superior **Quality** ~ Hanbell **Screw** Compressors

Superior **Quality** ~ MCS ~ Microcomputer Control Systems

High **Efficiency** available in 12 Models from 28 to 334 Tons

Quietest **Screw** Compressor in the Industry

Competitively Priced

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## MODEL DESIGNATION .....

<b>HANBELL SCREW COMPRESSOR ~ NOMENCLATURE</b>			
R	C	10	Z D6 2.6 KR OL
Refrigeration Duty		Accessories	
Series		OL = Oil Level Float Safety Switch	
Model Designation		Motor Protection Module	
10, 11, 12, 13, 14, 15L, 16, 17, 18, 19, 20, 21		KR = INT 69 - KRIWAN	
Refrigerant		Vi ~ Volume Ratio	
Z R-22		2.2, 2.6, 3.0, 3.5, 4.8	
Y R-407C		Voltages Available	
X R-134a		Code	Voltage Range Comments
W R-404A		C6	220/3/60 187-253 Stocked in LA ~ UL Recognized
V R-507A		D6	460/3/60 415-506 Stocked in LA ~ UL Recognized
		E6	575/3/60 517-633 Special Order ~ Contact MCS
		Other voltages available upon request ~ Consult MCS Factory	

# Introduction .....

## Micro Control Systems Inc. and Hanbell PRECISE MACHINERY COMPANY, LTD.

### Commitment of Excellence

**MICRO CONTROL SYSTEMS INC. and HANBELL PRECISE MACHINERY COMPANY, LTD. are proud to offer this new generation of RC Series, HANBELL Screw Compressors.**

*The RC Series Hanbell Screw Compressors were developed to handle the rugged Commercial and Industrial Duty applications, with a built-in tough design, to provide high efficiency and reliability, while operating in a wide range of operating conditions. Such applications include air-conditioning, thermal storage, and various refrigeration applications.*

**The RC Series Dual Rotor Screw Compressor Design**, combines Hanbell's latest 5 to 6 lobe Patented Rotor Profile with an "α Balance Piston Design", and separate radial and axial force bearings.

- A discharge check valve & discharge service valve
- Suction service valve
- INT69 Motor Temperature Protection Module
- Crankcase oil heater
- Discharge temperature sensor
- Oil cooler, liquid injection and economizer ports are supplied as standard features.

*This new design incorporates superior bearing design for extended bearing life under heavy duty operating conditions.*

**The Hanbell RC Series Screw Compressors** are manufactured and inspected under the ISO 9001 quality assurance program and given a final factory run test to verify reliability. This ISO 9001 certification assures that each compressor is manufactured under strict controlled quality manufacturing guidelines and procedures. The Hanbell RC Series Screw Compressors will provide superior life & quality when installed, operated, and maintained with the same attention to quality.

# **Features and Owner Benefits .....**

## **Size Range**

- 12 Models from 28 to 334 Tons
- High Compressor EER at ARI Standard Conditions
- Rated with R-22 - HCFC Refrigerant  
R407C - HFC Refrigerant  
R404A - HFC Refrigerant  
R134a - HFC Refrigerant

## **Quiet Operation**

- RC 10 ~ RC21 Sound Ratings range from 73.1 to 87.6 dB(A)
- Sound Ratings are based on ISO-2151 Standards


## **Dual Rotor Screw Compressor**

- Precision Engineered for 3550 RPM
- Precision Testing During Manufacturing Processes
- Final Run Tested and TQM inspected, per ISO 9001 Quality Assurance Standards
- Smooth & Quiet Operating due to the rotary rather than the reciprocating motion
- Designed for Quiet Operation with Cast Iron and Double Wall Steel Construction

## **Standard Accessories**

- Discharge Check Valve
- Discharge Service Valve
- High and Low Pressure Gauge Port Service Valves
- Oil Sight Glass
- INT69 Motor Protection Module - 115 Volt Control Voltage
- 115 Volt Crankcase Heater
- Liquid Injection Ports for Motor and Compression Chamber Cooling
- Oil Cooling Ports
- Economizer Injection Port

## **Electrical Control**

- 115 Volt Control and Crankcase Heater Voltage supplied standard on all models
- UL/CSA ~  ~ Recognized

## **Optional Accessories .....**

- Oil Level Float Safety Switch



# Compressor Features .....

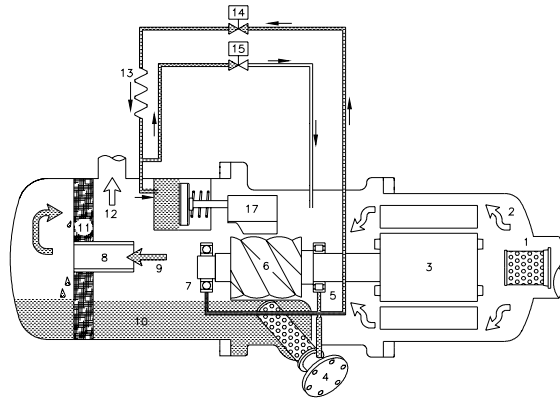
## Continuous Modulating Capacity Control (Stepless)

**Hanbell Screw Compressors** are supplied with Continuous Modulating Capacity Control to precisely match the compressor loading to the refrigeration system load. The RC10 and RC11 will operate from 33 to 100 % and the RC12 ~ RC21 modulates from 25% to 100% load. The compressors will start and stop in an unloaded condition. After a call for cooling the compressor will load and unload based on the refrigeration system requirement for cooling. A microcomputer controller is needed to control the continuous capacity control system and will start the compressor unloaded, and will fully unload it again before shutting down.

When coupled with a MCS Microcomputer Controller, the system will operate at an optimum efficiency level throughout the entire operating range of the system.

There are load and unload solenoid valves plus a capillary tube restrictor to manage the smooth loading and unloading of the compressor throughout the operating cycle.

The loading and unloading solenoids are externally mounted and internally ported. The view at the right is a graphical representation of the loading/un-loading function. The capillary restrictor tube, is externally mounted and piped at the factory.



## Motors and Electrical Data

**Hanbell Screw Compressor Motors** are supplied for Y-Delta starting, with standard voltages of 220/460/575/3/60. Other voltages including medium and high voltages are available upon request. The Specifications and Electrical Data section of this catalogue show standard voltages and RLA and LRA information. The R134a compressors have reduced HP motors and that data is also shown in the Electrical Data Tables.

The electrical power and current information can be found in the **Hanbell “ESP” Electronic Selection Program** software or can be supplied by your Hanbell supplier.

## Motor Protection Device

**Hanbell compressors** are supplied with INT 69 Motor Temperature Protection Modules. This device together with the embedded motor temperature sensors provide excellent compressor motor protection. If the motor overheats for any reason, the INT 69 Motor Temperature Protection Module will take the compressor off line. A manual reset is required to restart the compressor after proper servicing is performed to determine the cause of the overheating, and the motor has cooled down.

**Discharge gas PTC temperature sensor** is supplied to be added to the discharge line near the compressor discharge to monitor discharge gas temperature. This PTC discharge temperature sensor should be wired in series with the embedded PTC sensors to add extra motor protection. Contact your Hanbell supplier for details or refer to the Hanbell Technical Manual.

# Compressor Features .....

## Refrigerants and Lubricants

**The Hanbell Screw Compressors** are designed to operate using R22, R407C, R404A and R134a refrigerants. Compressors designed for R22, R407C and R404A may also be used for R134a but are not optimized for R134a. Optimizing of a compressor for R134a duty involves matching the motor HP to the compressor performance for R134a operation. Optimized Compressors for R134a applications have smaller motors, and likewise have smaller RLA and LRA electrical demands. The “operating current” is roughly the same for Non-Optimized and Optimized R134a compressors because the “operating current” is based on the work being done.

## HFC Refrigerants and “POE” Lubricants

**HFC (Hydro-Floro-Carbon) refrigerants** require special miscible POE (Poly-O-Ester) lubricants and the standard refrigerant mineral oils are not miscible with HFC refrigerants. POE lubricants are very hydroscopic and require special handling, which means they must not come in contact with air and moisture. The refrigeration system moisture count must not exceed 50 PPM.

Standard Hanbell compressors will be supplied with mineral oil for HCFC refrigerant use unless special ordered for HFC operation. Hanbell is pleased to supply compressors charged with POE oil, however it must be understood that special handling is required. The compressors are shipped with a suction blank-off plate, if optional suction valves are not supplied. The compressors are shipped with a minimal positive pressure charge of dry nitrogen to keep the compressor free of moisture. It is easy, however, to remove the mineral oil from a standard compressor and charge the POE oil and HFC refrigerant at time of compressor start-up.

## Refrigerant and Lubricant Usage

Refrigerant Type	Standard Factory Supplied Lubricant	Alternate Lubricants
R22	SUN ~ SUNISCO - 5GS	CPI ~ CP-4214-320 Mobil ~ SHC-220
R134A, R407C, R404A	CPI ~ SOLEST 370	Mobil ~ EAL-100 ICI ~ Emkarate RL421

For further assistance with refrigerants and appropriate lubricants refer to the Hanbell Technical Manual, or contact your MCS / Hanbell representative.

## Liquid Injection Ports

**Liquid Injection Ports** are standard features to be used for additional compressor motor and compression chamber cooling if required for high discharge and low evaporating temperature applications. See Application Data for details or contact your MCS / Hanbell representative.

## Oil Cooling Ports

**Oil Cooling Ports** are available for extra high condensing and low evaporating applications where oil cooling may be required.

# ***Receiving, Handling, Storage and Installation* .....**

***The RC Series Hanbell Screw Compressors*** have been developed to handle the rugged Commercial and Industrial Duty applications, while operating in a wide range of operating conditions. These compressors were designed with the latest enhanced 5 to 6 Patented Rotor Profile design. Each compressor is manufactured and inspected by precise THREAD SCREW ROTOR GRINDING MACHINE, CNC MACHINING CENTER, and 3D COORDINATE MEASURING MACHINES. Each compressor at HANBELL is manufactured under the ISO 9001 quality certification system. This ISO 9001 certification assures that each compressor is manufactured under strict controlled quality manufacturing guidelines and procedures.

***The receiving, handling, storage and installation*** of these compressors is just as important as the manufacturing processes outlined above.

## **Receiving Recommendations**

***Receiving Inspection*** is important before the carrier's representative leaves, to see that the shipment is complete as ordered, and that there is no shipping damage.

1. Check all crates and cartons received against the Bill of Lading / Shipping Papers to be sure they agree.
2. Check the model numbers and electrical characteristics on the nameplate to determine if they are correct.
3. Check for freight damage, shortages or other discrepancies and note them on the delivery receipt before signing acceptance of the shipment.

In the event there is shipping damage found, missing items, or incorrect material received, a claim should be filed immediately. **As all shipments are made at the purchaser's risk**, such discrepancies should be noted on the shipping receipt, before the delivering carrier leaves, as well as the purchaser filing the claim immediately, to protect their interests.

## **Handling Recommendations**

***Rigging and Handling Care is very important*** to prevent damage to the compressor or attachments during those operations.

Each compressor is carefully tested at the factory where every precaution is taken to assure the compressor reaches you in perfect condition. It is very important that the riggers and movers use the same care and precaution in moving the equipment into place. Make sure that chains, cables or other moving equipment are placed so as to avoid damage to the compressor or attachments. The compressor attachments must not be used as a ladder or as a hand hold. Move the compressor in an upright position and let it down gently from trucks, rollers or rigging.

It is preferred to move the compressors by forklift, or by rigging using the rigging eye bolts provided on the top of the compressor. It is also possible to rig the compressor by strapping under the compressor, as long as sufficient care is used to prevent damage.



# ***Receiving, Handling, Storage and Installation .....***

## **Storage Recommendations**

***If Storage is required*** the compressor should be stored out of the weather in a clean dry location where it will not be damaged. ***Please note*** that all compressors are shipped with a slight positive charge of dry nitrogen to protect all internal parts from oil contamination, rust, corrosion and motor deterioration.

## **Installation Recommendations**

***Pre-Installation Inspection*** is recommended once the compressor is uncrated, to determine that all of the accessories are present and no storage or handling damage has occurred.

***The Mounting Location*** must be level and structurally sound to handle the weight of the compressor and provide proper oil management.

1. The Hanbell Screw Compressor is particularly quiet and smooth operating, but it is recommended to mount the compressor on rubber pads to minimize sound transmission into the base structure.
2. It is necessary to remove the high pressure relief valve cap before operating the compressor.
3. Servicing clearance should be considered when mounting the compressor.
4. Please contact your Local Hanbell Sales Office for factory application assistance, if the compressor is to be installed on vehicles, boats or other locations that will not allow level mounting.

# Application Data .....

## Compressor Application Issues

**Application of the Refrigeration System** is just as important as the manufacturing, shipping, storage and installation of your Hanbell Screw Compressor. You may also refer to the Hanbell Technical Manual, form # MCS-HBME-RC-00-C for additional information.

**Hanbell Screw Compressors** are supplied with “Continuous Capacity Control” (Stepless), unless special ordered for “Step Type Capacity Control” with 3 or 4 discrete steps. The refrigeration load increases and decreases gradually, not in steps, and the Hanbell Screw Compressor supplied with a “**Continuous Capacity Control System**” loads and unloads accordingly, which provides a more stable and efficient cooling system.

A “**Microcomputer Controller**” should be used to control the Hanbell Screw Compressor including the “Continuous Capacity Control System”. Controlling the superheat is also an important function for the Microcomputer Controller to provide the most efficient operating system possible. The **MCS Microcomputer Controller** was designed specifically for such control systems. The MCS Microcomputer Controller capabilities are outlined in separate publications as well as briefly on the last page of this catalogue, or contact your local MCS / Hanbell Sales office.

## Compressor Selection Guidelines

**Compressor Selection** is based on specific operating conditions known as “Conditions of Service” or (C.O.S.).

**O.E.M. Manufacturers**, select their own equipment operating conditions of service to meet Government and ASHRAE 90.1 Efficiency Standards, as well as competitive equipment efficiencies.

**For Equipment needing Replacement Compressors**, the operating C.O.S. will not necessarily be known so the following operating guidelines are provided for quick reference.

**The Hanbell “ESP” (Electronic Selection Program)** can provide Performance Data for specific Compressor Models, or Compressor Model Selection based on performance requirements. Contact your Hanbell / MCS Sales office for assistance with selecting the correct Hanbell Model for your application.

**Hanbell Screw Compressor Performance Tables** are provided in the Performance Data Section of this catalogue.

**Suggested Compressor Selection Criteria** for “**Chillers and Split-System Applications**” are dependent on the type of evaporator and condenser selected.

1. **DX Type Chillers** operate on roughly a 5° to 10°F TD (temperature difference between the refrigerant and the desired water temperature)
2. **Flooded Type Chillers**, operate with roughly 1.5° to 2.5°F TD.
3. **Water Cooled Condensers** operate at roughly 105°F SCT (Saturated Condensing Temperature), based on 85°F to 95°F entering to leaving condenser water temperatures.
4. **Evaporative Cooled Condensers** operate at roughly 98°F to 100°F SCT.
5. **Air Cooled Condensers** operate at roughly 120-125° SCT, based on 95°F ambient or entering air temperatures.
6. **Operating Efficiency** of the compressor and entire refrigeration system, is dependent on design saturated suction temperature, saturated condensing temperature, suction superheat and liquid subcooling. **Higher evaporating and lower condensing temperatures increase the compressor and equipment efficiency.**

# Application Data .....

## Compressor Selection Guidelines ~ Reference Tables

Chiller Application ~ *Compressor Selection Guidelines*, intended for quick reference only

<b>Compressor Selection Guidelines ~ "Chiller Applications"</b> (Reference data based on Cooling Water from 54°F - 44°F)					
	<b>Description</b>	<b>Evaporator</b>	<b>Condenser</b>	<b>Suction Superheat</b>	<b>Liquid Subcooling</b>
1.	DX ~ Water Cooled Chillers	35-40°F SST	100-105°F SCT	20°F	10°F
2.	DX ~ Evaporative Cooled Chillers	35-40°F SST	98-100°F SCT	20°F	10°F
3.	DX ~ Air Cooled Chillers	35-40°F SST	120-125°F SCT	20°F	15°F
4.	Flooded ~ Water Cooled Chillers	41-42.5°F SST	100-105°F SCT	12-15°F	2-5°F
5.	Flooded ~ Evaporative Cooled Chillers	41-42.5°F SST	98-100°F SCT	12-15°F	2-5°F
6.	Flooded ~ Air Cooled Chillers	41-42.5°F SST	120-125°F SCT	12-15°F	2-5°F

Split-System Application ~ *Compressor Selection Guidelines*, intended for quick reference only

<b>Compressor Selection Guidelines ~ for "Split-Systems"</b> with Condensing Units and Remote DX Evaporators (based on 55°F leaving air temperature off the cooling coil for a 70°F room air temperature)					
	<b>Description</b>	<b>Evaporator</b>	<b>Condenser</b>	<b>Suction Superheat</b>	<b>Liquid Subcooling</b>
1.	DX ~ Water Cooled Chillers	35-38°F SST	100-105°F SCT	20°F	10°F
2.	DX ~ Evaporative Cooled Chillers	35-38°F SST	98-100°F SCT	20°F	10°F
3.	DX ~ Air Cooled Chillers	35-38°F SST	120-125°F SCT	20°F	15°F

# Application Data .....

## Liquid Injection Options

**Liquid Injection Ports** are provided for Motor or Compression Chamber Cooling. High condensing and/or low evaporating temperature applications may require liquid injection for proper compressor cooling. Compressor longevity and efficiency are negatively effected when the compressor is operated over 176°F (80°C) discharge temperature for extended periods of time.

**Liquid Injection and Oil Cooling** (Discussed in the next section of this catalogue) are methods of lowering the discharge gas temperatures and extending the longevity of the compressor when needed for specific applications. The Hanbell screw compressors are designed to operate without additional cooling up to roughly 176°F (80°C) discharge temperature, which covers most applications for water and evaporative cooled equipment. Air cooled equipment may require liquid injection and/or oil cooling, depending on operating conditions.

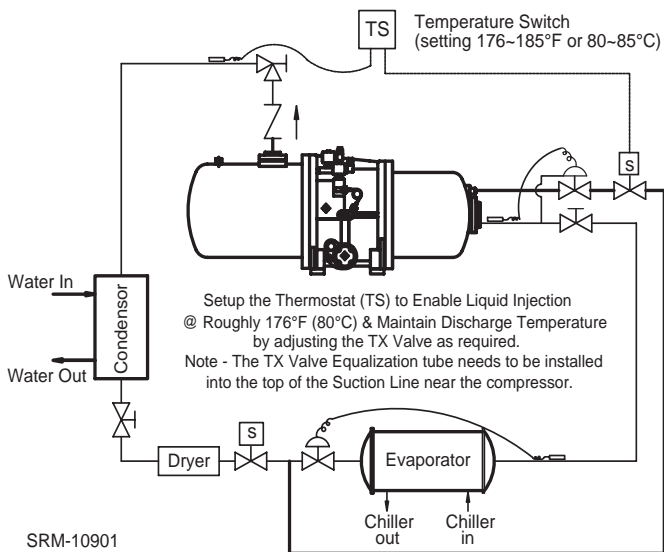
**Computer selections** are available from your Hanbell Sales Office with the recommended amount of Liquid Injection and/or Oil Cooling to maintain proper compressor longevity.

**HFC refrigerant applications** may also require additional compressor cooling due to generally higher condensing temperatures, (See Application and Operating Limits” in this catalogue).

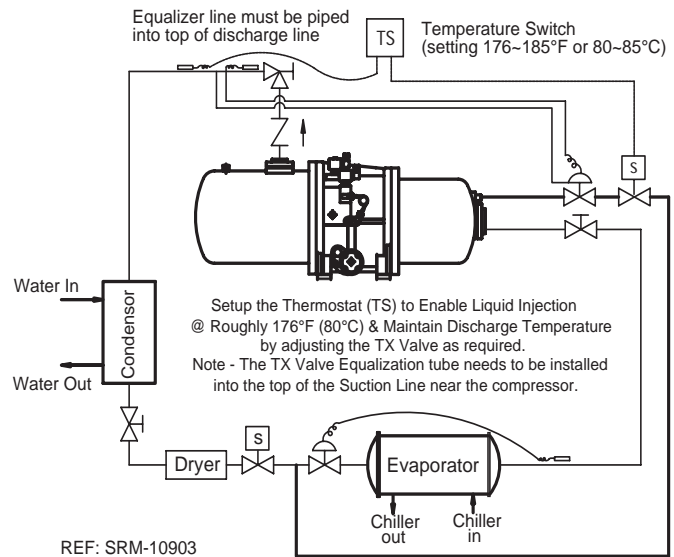
The following **Liquid Injection System Diagrams** are listed for reference showing Motor Cooling, and Compression Chamber Cooling.

### Liquid Injection for Motor Cooling:

**Liquid Refrigerant** is injected into the motor chamber, but controlled differently for the two methods of motor cooling, as shown below.



**Liquid Injection for Motor Cooling,  
Suction Temperature Controlled,  
Discharge Temperature Enabled**  
(Low Temp Type ~ Ref TM Fig 1.13)

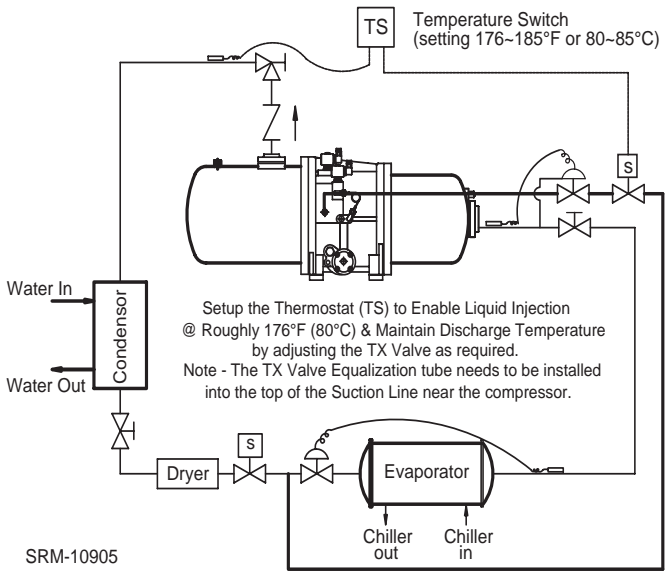


**Liquid Injection for Motor Cooling,  
Discharge Temperature Controlled**  
(High Temp Type ~ Ref TM Fig 1.15)

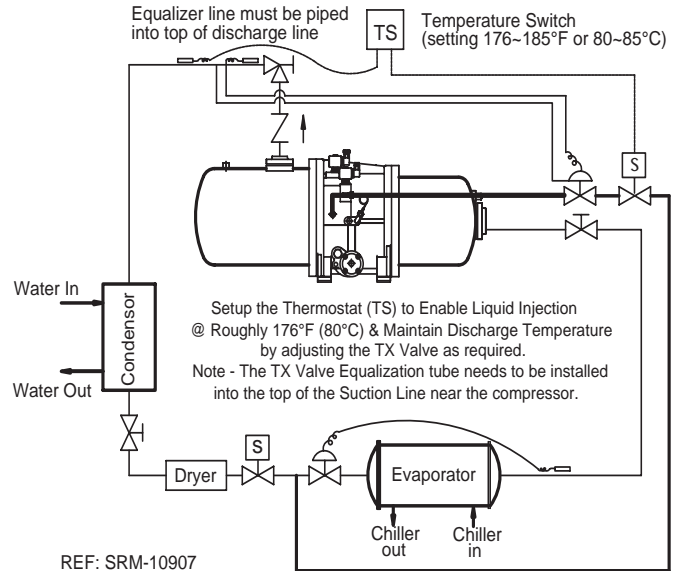
# Application Data .....

## Liquid Injection for Compression Chamber Cooling:

**Liquid Refrigerant** is injected into the **compression chamber**, but controller differently, for the two methods of **compression chamber** cooling, as shown below.



**Liquid Injection for Compression Chamber Cooling, Suction Temperature Controlled, Discharge Temperature Enabled**  
(Low Temp Type ~ Ref TM Fig 1.14)



**Liquid Injection for Compression Chamber Cooling, Discharge Temperature Controlled**  
(High Temp Type ~ Ref TM Fig 1.16)

# **Application Data** .....

## **Oil Cooling Option**

**Oil Cooling Ports** are provided for optional Oil Cooling. The Oil Cooling Option may be needed for specific high temperature applications.

**Computer selections** are available from your Hanbell Sales Office that will show the recommended amount of Liquid Injection and/or Oil Cooling to maintain proper compressor longevity.

**The purpose for additional Oil Cooling** is to maintain proper oil temperatures within the compressor to ensure proper lubrication of bearings, slide valve and compression rotors. The addition of an external oil cooler reduces the temperature of the oil and the entire compressor. The compressor discharge temperature should be monitored at all times to measure the operating temperatures of the compressor, and protect it from overheating. Oil cooling and Liquid Injection are methods of maintaining proper compressor operating conditions.

**High Condensing and Low Evaporating temperature applications** cause abnormally high temperature operating conditions that will shorten the compressor life and may cause nuisance trips if the motor winding temperatures reach motor protection setpoints.

**Oil Cooling and Liquid Injection** options are recommended if the compressor is to operate in high ambient temperature areas, 122°F (50°C) or higher. This high ambient temperature working condition causes extra high internal compressor temperatures and will damage the compressor if not corrected. The compressor discharge sensor will sense this extra high discharge temperature and cause nuisance trips if oil cooling and liquid injection are not applied.

**The Oil Cooler** should be sized to maintain roughly 194°F (90°C) return oil temperature back to the compressors.

**The Oil Cooling Option** is a more expensive means of compressor cooling, so Liquid Injection should be considered first, and then add Oil Cooling as needed. As noted above, some applications will require the addition of Oil Cooling and Liquid Injection.

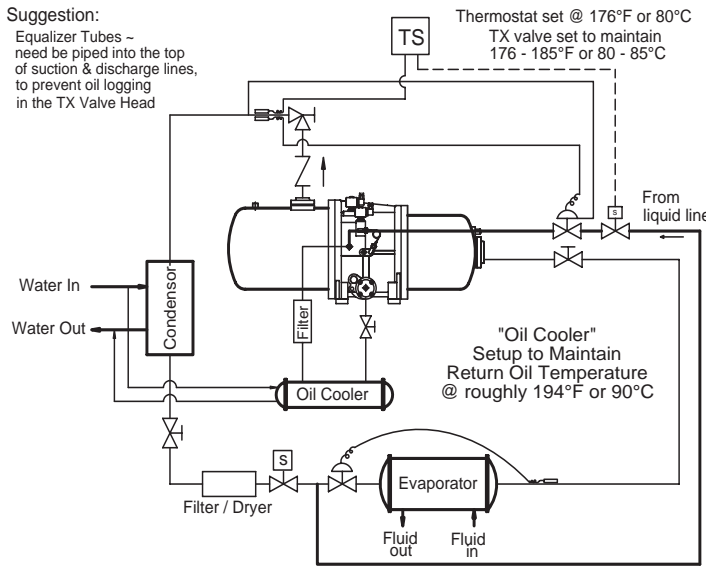
**HFC refrigerant applications** may also require additional compressor cooling due to generally higher condensing temperatures, (See “Application and Operating Limits” in this catalogue).

**The following Oil Cooling System Diagrams** shown on the following page, are listed for reference.



# Application Data .....

## Oil Cooling Option ~ plus Liquid Injection for Motor Cooling:



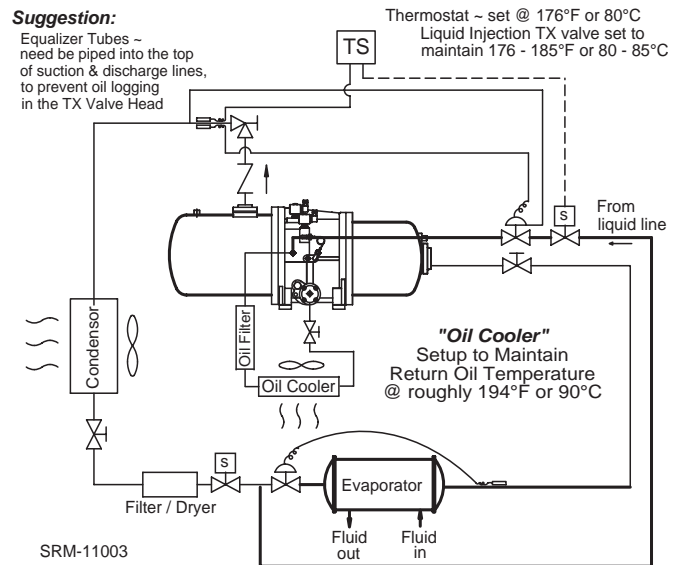
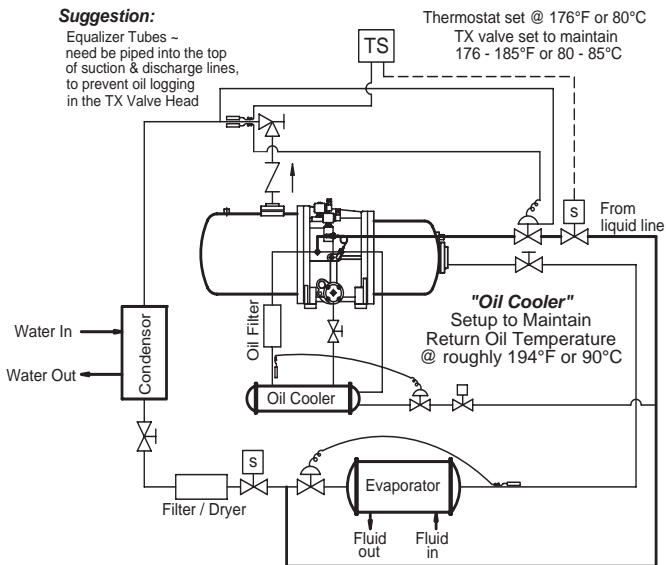
### Note:

1. The purpose for additional Oil Cooling is to maintain proper oil temperatures within the compressor to ensure proper lubrication of bearings, slide valve and compression rotors.
2. The Oil Cooler should be sized to maintain roughly 194°F (90°C) return oil temperature back to the compressor.

### **Oil Cooler Option ~ Water Cooled Type, plus Liquid Injection for Motor Cooling, Discharge Temperature Controlled**

Oil Cooling By Water (water-cooled type) ~ Ref TM Fig 1.37

## Oil Cooling Option ~ plus Liquid Injection for Compression Chamber Cooling:



### **Oil Cooler Option ~ DX Refrigerant Cooled Type, plus Liquid Injection for Compression Chamber Cooling, Discharge Temperature Controlled**

Oil Cooling By Refrigerant (refrigerant cooled type) ~ Ref TM Fig 1.35

### **Oil Cooler Option ~ Air Cooled Type, plus Liquid Injection for Compression Chamber Cooling, Discharge Temperature Controlled**

Oil Cooling By Ambient Air (air cooled type) ~ Ref TM Fig 1.36

# Application Data .....

## Application and Operating Limits

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

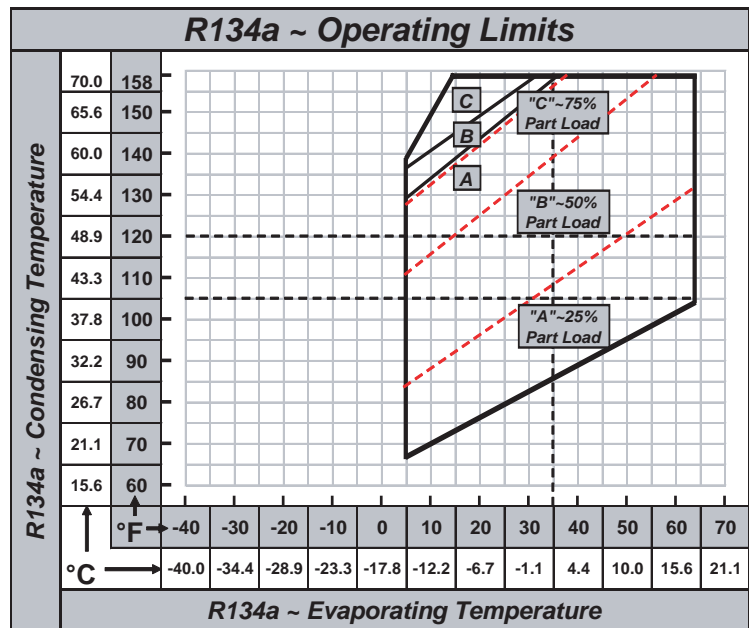
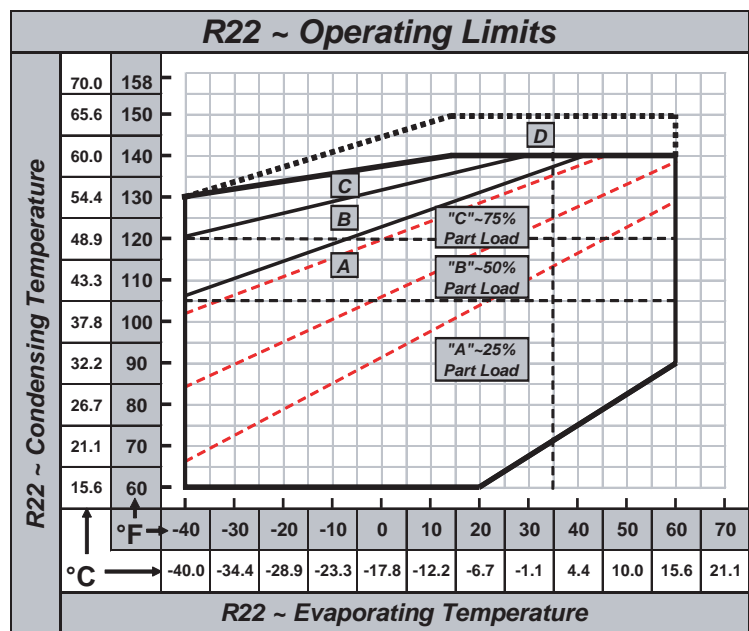
**“Operating Limits”** are described on the respective refrigerant charts.

**Proper Compressor Cooling** is required to maintain expected compressor life.

**“Part Load ~ Operating Zones”** are described below and shown on the respective refrigerant charts.

- A** **Normal Operation Range** with no additional Liquid Injection or Oil Cooling.
- B** **Liquid Injection or Oil Cooling** is required to maintain proper motor and compressor cooling.
- C** **Liquid Injection and Oil Cooling** may both be required to maintain proper Motor, Bearings and Compression Chamber temperatures, to maintain expected compressor life.
- D** **Check with your MCS / Hanbell Representative to verify potential Operating Conditions outside the conditions shown.**

**NOTE!**  
A maximum of 27°F (15°C) Suction Super Heat is recommended.

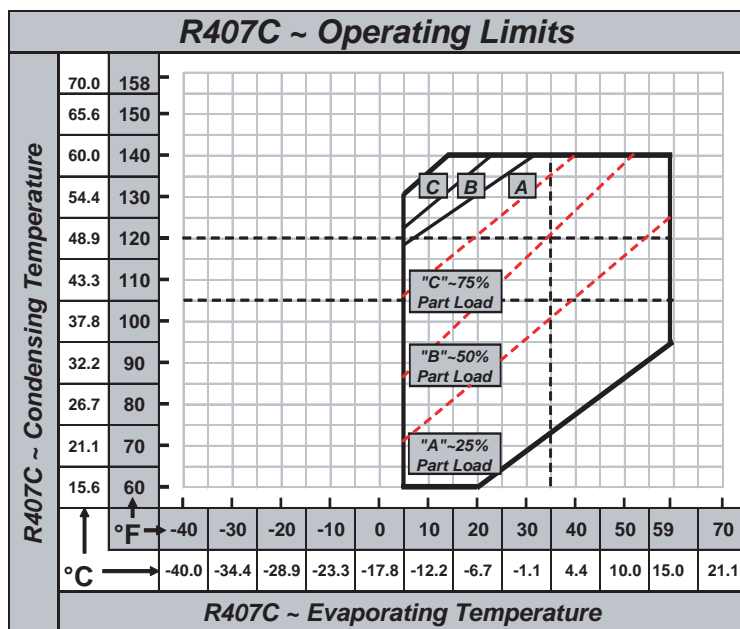


# Application Data .....

## Application and Operating Limits

**Evaporating and Condensing Temperature Limits** also vary for each type of refrigerant used.

The two charts, shown below and to the left, outline the Hanbell compressor operating temperature limits and provide the full and part load, continuous operating condition parameters, as shown in A, B, C, & D “Zones”. Part load operating conditions cause higher operating temperatures within the compressor due to the reduced mass flow of cool refrigerant vapor for motor and compression chamber cooling. Liquid injection and/or oil cooling may be required to maintain proper compressor operating temperatures. **Full load operating conditions are shown between solid lines, and the part load operating limits are shown between dashed lines represented as “Part Load Operating Zones”.**



**“Operating Limits”** are described on the respective refrigerant charts.

**Proper Compressor Cooling** is required to maintain expected compressor life.

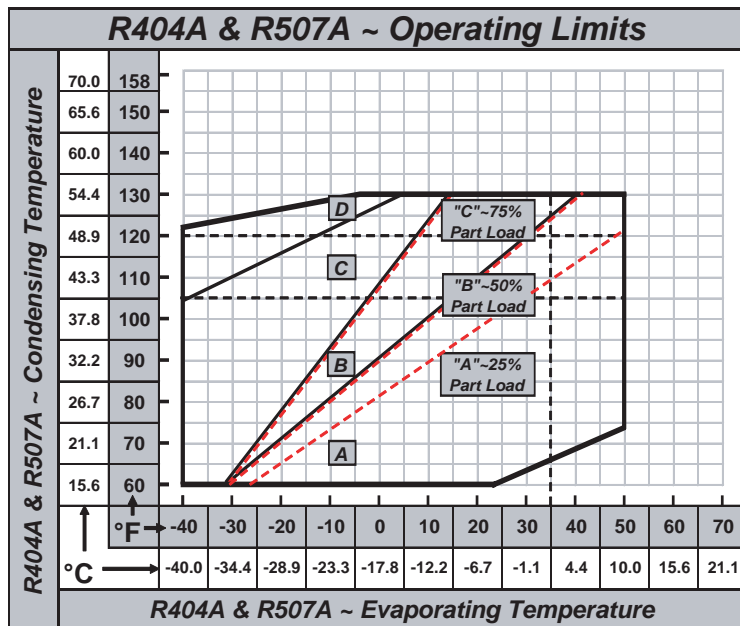
**“Part Load ~ Operating Zones”** are described below and shown on the respective refrigerant charts.

**A** **Normal Operation Range** with no additional Liquid Injection or Oil Cooling.

**B** **Liquid Injection or Oil Cooling** is required to maintain proper motor and compressor cooling.

**C** **Liquid Injection and Oil Cooling** may both be required to maintain proper Motor, Bearings and Compression Chamber temperatures to maintain expected compressor life.

**D** **Check with your MCS / Hanbell Representative to verify potential Operating Conditions outside the conditions shown.**



**NOTE!**  
A maximum of 27°F (15°C) Suction Super Heat is recommended.

# **Application Data** .....

## **Compressor Performance Data ~ R22, R407C, R134a, R404A & R507A**

**Basic Compressor Performance Data** is provided for R22, R407C and R134a on the following page. For specific application selections not shown, contact your MCS / Hanbell representative.

**Size Compressors Properly** to do the job required, but do not oversize. (Remember “Supersized” only works for Cold Drinks and Hot Coffee.) Oversizing of compressors costs money, requires larger electrical service, causes frequent cycling of the compressor which shortens its life, and causes operational problems at lower ambients and minimal load conditions. Compressors run better at full or nearly full load conditions and the refrigeration system is also more stable if the compressor is not oversized.

**Special Application Selections** for R22, R407C, R134a plus selections for R404A & R507A can be obtained from the **Hanbell ESP** (**E**lectronic **S**election **P**rogram) Selection Program, or your MCS / Hanbell representative.

## **HFC ~ R407C, R134a, R404A and R507A ~ Operation and Performance Issues**

**Hanbell Compressors are normally shipped with 5GS Mineral Oil** for R22 (HCFC Refrigerant) operation. If a stock compressor is needed for HFC (R407C, R404A, R507A or R134a) Refrigerant operation, it will be necessary to drain the 5GS Mineral Oil and re-charge with the appropriate P.O.E. Oil recommended for the specific refrigerant used. (See “Refrigerant and Lubricant Usage” on page 6) It is also possible to special order the compressor with the appropriate refrigerant oil for the required HFC Refrigerant.

**P.O.E. Lubricants are very Hydro-Scopic**, (which means they absorb water rapidly) **and very easy to contaminate beyond use**. If exposed to the air for only a few minutes the lubricant absorbs water and becomes not useable. It is not possible to field dry the lubricant once water is in it, so the lubricant must be replaced to prevent damage to the compressor. **This caution is the same for all P.O.E. refrigerant lubricants.**

## **Performance Data ~ 60 Hz ~ R22, R407C & R134a**

The following Performance Data Table is intended to provide basic Chiller and Split-System compressor performance data.

1. **Performance for R22, R407C & R134a** is based on 20°F Suction Superheat and 15°F Liquid Subcooling.
2. **R407C & R134a Data** is for reference only, & applications should be reviewed by an authorized Hanbell Representative to optimize the compressor selection.
3. **kW & EER** is based on operating the compressor with “Oil Cooling Active” for Shaded Operating Conditions.
4. **Shaded Operating Conditions** may require “Oil Cooling” to maintain proper compressor discharge temperature at roughly 176°F (90°C).
5. **Operating without Oil Cooling** for shaded operating conditions may shorten the compressor life due to high operating temperatures, and cause some increase in KW and decrease in EER
6. **Liquid Injection** does help reduce the compressors’ discharge temperature to ensure compressor longevity, but will reduce operating efficiency slightly do to the extra refrigerating load requirements.

# Performance Data ~ 60 Hz ~ R22, R407C & R404A

## R22 ~ 60Hz ~ Performance Reference Data

RC Series Model	Water/Evaporative Cooled Ratings						Air Cooled Ratings					
	35°F SST & 105°F SCT			45°F SST & 105°F SCT			35°F SST & 120°F SCT			45°F SST & 120°F SCT		
	Capacity	Power	EER	Capacity	Power	EER	Capacity	Power	EER	Capacity	Power	EER
	Tons	kW	BTU/h/w	Tons	kW	BTU/h/w	Tons	kW	BTU/h/w	Tons	kW	BTU/h/w
RC10	30.9	28.0	13.2	37.4	29.8	15.1	28.1	32.5	10.4	43.1	34.5	15.0
RC11	41.7	36.9	13.6	50.5	39.2	15.5	37.9	42.7	10.7	46.1	45.4	12.2
RC12	52.9	46.5	13.7	64.0	49.4	15.5	48.0	53.9	10.7	58.3	57.2	12.2
RC13	59.6	51.2	14.0	72.1	54.4	15.9	54.1	59.4	10.9	65.8	63.1	12.5
RC14	78.9	68.8	13.8	95.6	72.9	15.7	71.7	79.5	10.8	87.1	84.5	12.4
RC15L	101.2	83.4	14.6	122.6	88.6	16.6	92.0	96.7	11.4	111.7	102.7	13.1
RC16	126.9	106.9	14.2	153.6	113.6	16.2	115.3	123.9	11.2	140.0	131.6	12.8
RC17	152.5	124.8	14.7	184.6	132.6	16.7	138.5	144.6	11.5	168.3	153.6	13.1
RC18	178.0	142.8	15.0	215.6	151.7	17.1	161.8	165.5	11.7	196.5	175.8	13.4
RC19	195.8	156.6	15.0	237.0	166.4	17.1	177.9	181.6	11.8	216.1	192.8	13.5
RC20	256.1	202.7	15.2	310.0	215.4	17.3	232.7	234.9	11.9	282.6	249.5	13.6
RC21	276.2	218.1	15.2	334.4	231.7	17.3	250.9	252.8	11.9	304.8	268.5	13.6

## R407C ~ 60Hz ~ Performance Reference Data

RC Series Model	Water/Evaporative Cooled Ratings						Air Cooled Ratings					
	35°F SST & 105°F SCT			45°F SST & 105°F SCT			35°F SST & 120°F SCT			45°F SST & 120°F SCT		
	Capacity	Power	EER	Capacity	Power	EER	Capacity	Power	EER	Capacity	Power	EER
	Tons	kW	BTU/h/w	Tons	kW	BTU/h/w	Tons	kW	BTU/h/w	Tons	kW	BTU/h/w
RC10	30.1	27.0	13.4	37.1	28.3	15.7	26.6	31.9	10.0	33.1	33.2	12.0
RC11	40.2	35.9	13.4	49.5	37.6	15.8	35.4	42.4	10.0	44.2	44.1	12.0
RC12	50.1	43.8	13.7	61.8	45.8	16.2	44.2	51.7	10.3	55.1	53.7	12.3
RC13	58.2	49.7	14.1	68.0	52.0	15.7	51.4	58.7	10.5	64.0	61.0	12.6
RC14	76.7	66.5	13.8	94.5	69.7	16.3	67.6	78.6	10.3	84.3	81.7	12.4
RC15L	98.8	80.6	14.7	121.8	84.5	17.3	87.1	95.2	11.0	108.6	99.0	13.2
RC16	125.0	103.6	14.5	154.0	108.6	17.0	110.2	122.4	10.8	137.4	127.3	13.0
RC17	146.4	118.9	14.8	180.5	124.6	17.4	129.1	140.4	11.0	160.9	146.0	13.2
RC18	171.0	140.3	14.6	210.8	147.0	17.2	150.9	165.6	10.9	188.0	172.3	13.1
RC19	188.2	154.0	14.7	232.0	161.3	17.3	166.0	181.9	11.0	206.9	189.2	13.1
RC20	246.0	199.2	14.8	303.2	208.6	17.4	217.0	235.2	11.1	270.4	244.6	13.3
RC21	265.3	214.4	14.8	326.9	224.5	17.5	234.0	253.1	11.1	291.6	263.3	13.3

## R134a ~ 60Hz ~ Performance Reference Data

RC Series Model	Water/Evaporative Cooled Ratings						Air Cooled Ratings					
	35°F SST & 105°F SCT			45°F SST & 105°F SCT			35°F SST & 120°F SCT			45°F SST & 120°F SCT		
	Capacity	Power	EER	Capacity	Power	EER	Capacity	Power	EER	Capacity	Power	EER
	Tons	kW	BTU/h/w	Tons	kW	BTU/h/w	Tons	kW	BTU/h/w	Tons	kW	BTU/h/w
RC10	20.3	17.2	14.2	25.1	17.9	16.8	18.2	20.0	10.9	22.7	20.9	13.0
RC11	27.8	23.4	14.3	34.4	24.4	16.9	24.9	27.2	11.0	31.1	28.4	13.1
RC12	35.2	29.6	14.3	43.6	30.8	17.0	31.6	34.5	11.0	39.4	36.0	13.1
RC13	40.6	33.0	14.8	50.3	34.4	17.5	36.4	38.5	11.3	45.4	40.2	13.6
RC14	53.1	44.0	14.5	65.9	45.9	17.2	47.7	51.3	11.2	59.5	53.6	13.3
RC15L	67.7	53.4	15.2	83.9	55.7	18.1	60.8	62.3	11.7	75.8	65.1	14.0
RC16	86.5	69.1	15.0	107.2	72.2	17.8	77.7	80.7	11.6	96.8	84.2	13.8
RC17	100.1	79.8	15.1	124.0	83.2	17.9	89.8	93.0	11.6	112.0	97.1	13.8
RC18	119.2	93.3	15.3	147.7	97.4	18.2	107.0	108.9	11.8	133.4	113.6	14.1
RC19	130.9	100.2	15.7	162.2	104.6	18.6	117.5	116.9	12.1	146.5	122.1	14.4
RC20	170.4	129.7	15.8	211.2	135.3	18.7	153.0	151.3	12.1	190.7	157.9	14.5
RC21	183.5	139.5	15.8	227.5	145.6	18.8	164.8	162.8	12.1	205.4	170.0	14.5



# Technical Data .....

## Physical Specifications

Description		RC10	RC11	RC12	RC13	RC14	RC15L		
<b>Compressor</b>	Displacement @ 60 Hz.	CFH	4167	5827	7310	7875	10912	13561	
	Displacement @ 50 Hz.	CFH	3461	4838	6074	6816	9076	11301	
	Rated Speed	RPM	60 Hz. = 3550 & 50 Hz. = 2950						
	Volume Ratios Available	Vi	2.2, 2.4, 2.6, 3.0, 3.5, 4.8						
	Capacity Control System	%	Continuous Capacity Control between 25% & 100%						
	Refrigerant		R22, R134a, R407C, R404A, R507A						
	Lubrication System		Differential Pressure Feed Lubrication						
	Oil Heater Wattage	Watts	150 Watts						
	Lubricant Type	Mineral	SUN SUNISO - 5GS or CPI 4214-320						
	Lubricant Type	POE	CPI SOLEST - 370						
	Lubricant Charge	Quarts	7.4	7.4	7.4	8.5	14.8	16.9	
	Lubricant Charge	Liters	7	7	7	8	14	16	
	Hydrostatic Pressure Test	PSIG	600						
	Discharge Connection Size	inches	1 5/8" O.D.	1 5/8" O.D.	1 5/8" O.D.	1 5/8" O.D.	2 1/8" O.D.	2 1/8" O.D.	
	Suction Connection Size	inches	2 1/8" O.D.	2 1/8" O.D.	2 5/8" O.D.	2 5/8" O.D.	3 1/8" O.D.	3 1/8" O.D.	
Compressor Weights	Lbs.	573	595	860	959	1190	1367		
Compressor Weights	kg	260	270	390	435	540	620		
<b>Motor</b>	Motor & Voltage Phase	Type	3 Phase, 2 Pole, Squirrel Cage, Induction Motor						
	Starting Methods	YD	YD Starting ~ (60Hz. and 50Hz.)						
	Voltage Availability	60 Hz	220/3/60, 460/3/60, 575/3/60						
	Voltage Availability	50 Hz	380/3/50, 400/3/50, 415/3/50						
	Insulation	Type	Class F						
	Protection	Type	PTC Protection						

## Physical Specifications

Description		RC16	RC17	RC18	RC19	RC20	RC21		
<b>Compressor</b>	Displacement @ 60 Hz.	CFH	17304	20023	23661	25956	33619	36162	
	Displacement @ 50 Hz.	CFH	14373	16633	19246	21118	27333	29382	
	Rated Speed	RPM	60 Hz. = 3550 & 50 Hz. = 2950						
	Volume Ratios Available	Vi	2.2, 2.4, 2.6, 3.0, 3.5, 4.8						
	Capacity Control System	%	Continuous Capacity Control between 25% & 100%						
	Refrigerant		R22, R134a, R407C, R404A, R507A						
	Lubrication		Differential Pressure Feed Lubrication						
	Oil Heater Wattage	Watts	300 Watts						
	Lubricant Type	Mineral	SUN SUNISO - 5GS or CPI 4214-320						
	Lubricant Type	POE	CPI SOLEST - 370						
	Lubricant Charge	Quarts	15.9	19.0	24.3	24.3	29.6	29.6	
	Lubricant Charge	Liters	15	18	23	23	28	28	
	Hydrostatic Pressure Test	PSIG	600						
	Discharge Connection Size	inches	2 5/8" O.D.	2 5/8" O.D.	3 1/8" O.D.	3" I.P.S.	4" I.P.S.	4" I.P.S.	
	Suction Connection Size	inches	4 1/8" O.D.	4 1/8" O.D.	4 1/8" O.D.	5" I.P.S.	5" I.P.S.	5" I.P.S.	
Compressor Weights	Lbs.	1675	1830	1940	2183	2690	2734		
Compressor Weights	kg	760	830	880	990	1220	1240		
<b>Motor</b>	Motor & Voltage Phase	Type	3 Phase, 2 Pole, Squirrel Cage, Induction Motor						
	Starting Methods	YD	YD Starting ~ (60Hz. and 50Hz.)						
	Voltage Availability	60 Hz	460/3/60, 575/3/60 - Standard						
	Voltage Availability	50 Hz	380/3/50, 400/3/50, 415/3/50						
	Insulation	Type	Class F						
	Protection	Type	PTC Protection						



# Electrical Data .....

## Electrical Data for R22, R407C & R404A

R22, R407C, R404A													
Power		RC10		RC11		RC12		RC13		RC14		RC15L	
Hz	Volts	MCC	LRA	MCC	LRA	MCC	LRA	MCC	LRA	MCC	LRA	MCC	LRA
60	220	150	515	185	565	240	735	255	915	342	1070	438	1352
60	460	72	240	88	265	108	335	121	430	164	500	219	741
60	575	58	190	71	205	87	285	97	345	132	405	175	627
50	380	72	245	89	270	109	330	122	435	165	525	220	796
50	400	68	235	85	260	104	330	116	430	157	515	210	768
50	415	65	225	81	245	100	305	111	415	151	500	202	730

R22, R407C, R404A													
Power		RC16		RC17		RC18		RC19		RC20		RC21	
Hz	Volts	MCC	LRA	MCC	LRA	MCC	LRA	MCC	LRA	MCC	LRA	MCC	LRA
60	220	-	-	-	-	-	-	-	-	-	-	-	-
60	460	254	740	294	945	346	1090	379	1415	487	1690	524	1690
60	575	203	615	235	795	276	870	303	1120	389	1470	419	1470
50	380	256	775	295	1000	347	1160	381	1325	490	1580	528	2010
50	400	243	745	281	940	330	1050	362	1415	465	1665	501	1685
50	415	234	705	271	780	318	975	349	1240	448	1425	483	1750

## Optimized Motor ~ Electrical Data for R134a

R134A ~ Optimized Motor													
Power		RC10		RC11		RC12		RC13		RC14		RC15L	
Hz	Volts	MCC	LRA	MCC	LRA	MCC	LRA	MCC	LRA	MCC	LRA	MCC	LRA
60	220	122	365	149	425	180	525	203	690	270	770	350	1105
60	460	59	175	70	195	87	245	97	320	129	360	173	529
60	575	47	145	56	160	70	200	78	260	103	295	138	420
50	380	58	175	71	205	87	250	97	315	129	375	175	561
50	400	56	170	66	200	82	240	93	305	123	360	166	545
50	415	54	165	64	190	79	230	90	290	119	340	160	529

R134A ~ Optimized Motor													
Power		RC16		RC17		RC18		RC19		RC20		RC21	
Hz	Volts	MCC	LRA	MCC	LRA	MCC	LRA	MCC	LRA	MCC	LRA	MCC	LRA
60	220	-	-	-	-	-	-	-	-	-	-	-	-
60	460	203	555	235	695	276	760	303	1060	392	1195	422	1430
60	575	163	450	188	565	221	595	243	790	314	1100	338	1100
50	380	204	575	236	725	277	790	305	980	395	1315	425	1350
50	400	195	560	225	685	264	745	290	910	375	1160	403	1400
50	415	187	540	217	655	255	700	279	935	361	1205	388	1245

# Electrical Data .....

## General Electrical Notes

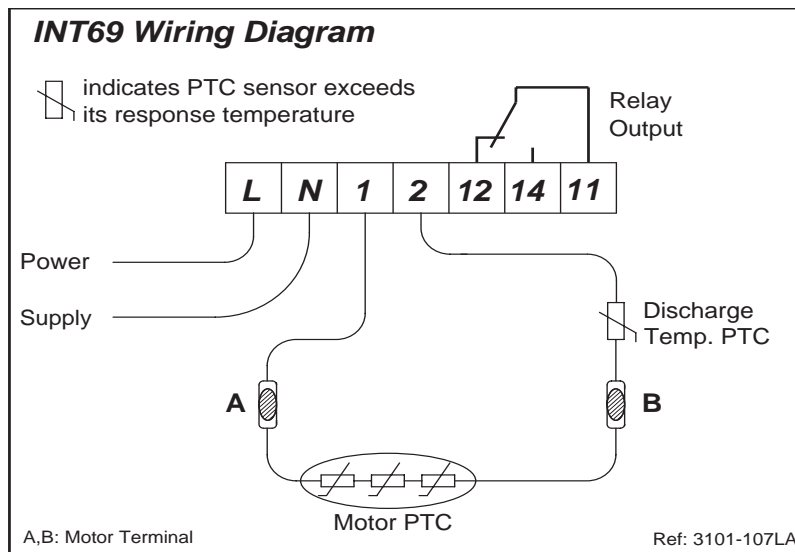
1. Main Power must be supplied from a single power source. Power supply is three phase.
2. Standard Compressor Starting is "Y-Delta". (See Typical Wiring Diagrams)
3. Optional Compressor Starting is XL (DOL) Across-the-Line. (See Typical Wiring Diagrams)
4. Control Power is 115/1/60/50 voltage, with INT 69 Motor Protection Module.
5. Crankcase Oil Heaters are 115/1/60/50 voltage. See Physical Specifications for wattage.
6. The compressor crankcase heaters must be energized for 24 hours before the compressor is initially started and after any prolonged shutdowns.
7. All wiring must be done in accordance with all national and local codes.
8. SUPPLY VOLTAGE TOLERANCES:
  - 1) 220/3/60 Voltage Min. 187 ~ Max. 253 volts
  - 2) 460/3/60 Voltage Min. 414 ~ Max. 506 volts
  - 3) 575/3/60 Voltage Min. 518 ~ Max. 632 volts
  - 4) 220/3/50 Min. 200 ~ Max. 240 volts
  - 5) 380/400/415 Min. 342 ~ Max. 457 volts
9. MCC = Maximum Continuous Current
10. LRA = Locked Rotor Amps

## INT 69 Motor Protection Module

**Hanbell Screw Compressor Motors** are equipped with internally embedded PTC sensors that are wired in series inside the compressor motor housing and extended outside to terminals inside the electrical junction box. These PTC sensors measure internal motor temperatures and provide protection from motor overheat when wired to the INT 69 Motor Protection Module. (**PTC = Positive Temperature Coefficient, sensors**)

**Hanbell has provided a Discharge Temperature (PTC) sensor**, in addition to the embedded Motor (PTC) sensors, plus an optional Oil Level Float Safety Switch, and all three are to be wired in series to terminals 1 and 2 of the INT 69 Motor Protection Module. This combination of compressor safeties provides superior overheat and oil failure compressor protection. (**Note: The Oil Level Float Safety Switch needs to have a 60-90 second time delay to prevent short term oil level fluctuation nuisance trips.**)

**The INT 69 Motor Temperature Protection Module** wiring diagram shown below, outlines the compressor safeties mentioned above.



# **Electrical Data** .....

## **Typical Sequence of Operation and Compressor Control**

### **Sequence of Operation for Microcomputer Controlled Hanbell Screw Compressors**

**The following is a Typical Sequence of Operation** for a two compressor unit. Refer to the unit OEM Manufacturer's and Microcomputer Manufacturer's wiring diagram for control and power wiring details.

#### **Preliminary Sequence of Operation**

**Close the Main Power Disconnect Switch**, once a thorough safety inspection has been performed and the unit is ready for start-up.

1. Verify main and control voltage, for proper voltage.
2. Check to see that the indicating light on the Over / Under Voltage Relay (O/UVR) is lit. Some models of O/UVR show a green light for proper operation This light must be on (and green) to indicate proper phase rotation for the compressors. If the light is not on properly, disconnect the main power and reverse any two phase legs at the Main Incoming Power Terminal Block. (WARNING! DO NOT SIMPLY REVERSE THE LEADS ON THE PHASE LOSS MONITOR, BECAUSE DOING SO WILL NOT CORRECT THE PHASE REVERSAL PROBLEM, AND THIS WILL ALLOW THE COMPRESSORS TO RUN BACKWARDS, CAUSING SEVERE DAMAGE, & WILL VOID THE COMPRESSOR WARRANTY!)
3. Check the phase sequence again using a meter before starting the compressor (s).
4. The crankcase heater (s) relay contacts are closed and are supplying power to the compressor crankcase heaters. The crankcase heater (s) should be energized for 24 hours prior to starting the compressor.
5. Customer control contact closed, and control power switch in the "ON" position, for at least 5 minutes.
6. Start the chilled water pump.. The water flow is confirmed when the water flow switch closes and when the chilled water pump auxiliary (CWP) closes.
7. Check to make sure the unit control contacts close when the unit needs to operate. Set the desired leaving water temperature (e.G. 44°F - 6.6°C) in the microcomputer setpoint called "Control Zone+".
8. Place the compressor control circuit switches in the "ON" position, thus energizing the balance of the control circuit. All safety controls must be satisfied and the microcomputer has been RESET. The system may be in a "Time In" mode with up to 15 minutes time delay before the first compressor will start.

#### **Stage-Up ~ Sequence of Operation**

**Stage 1 Starting** - the following conditions must be met to start a compressor:

1. System voltage within over/under voltage relay (O/UVR) limits
2. Chiller water pump running and auxiliary switch closed
3. Chiller water flow switch closed
4. Customer unit contact closed
5. Control switch and compressor control switches on
6. Microcomputer reset pressed on keypad
7. Power has been on the microcomputer for 15 minutes
8. All safety conditions satisfied
9. Leaving water temperature 2°F (1°C) or more above setpoint
10. Schedule in Microcomputer set for unit operation

# **Electrical Data** .....

## **Typical Sequence of Operation and Compressor Control ~ (Continued)**

**“Y-Delta Open-Transition”, Y-Delta Closed-Transition, and XL (Across-the-Line) DOL (Direct-on-Line)** starting/operating methods are suggested for Hanbell Screw Compressors. Refer to the following pages for specific starting methods and details.

After all of the conditions are met, the microcomputer will call for compressor #1 to start once the 15 minute anti-recycle timer has timed out.

The liquid line will open when the compressor starts.

### ***Stage 1, Compressor #1 ~ Starting & Loading Modulation***

When the compressor starts, the microcomputer monitors amperage by means of a current transformer, leaving water temperature and condensing pressure. These inputs are used to control the staging and loading of the compressor. The compressors loading is controlled by pulsing signals to the load and unload solenoids.

### ***Stage 2, Compressor #2 ~ Starting & Loading Modulation***

If the safety conditions are satisfied for the #2 compressor, at least 1 minute has elapsed since #1 compressor has reached full load, and the leaving water temperature remains above the deadband, the second compressor's contactors will be activated by the microcomputer. #2 compressor also has a 15 minute anti-recycle timer built into the microcomputer. Loading of the #2 compressor is controlled in the same manner as Compressor #1.

The #2 circuit liquid line will open when the compressor starts.

## **Shutdown ~ Sequence of Operation**

### ***Stage 2 ~ Shutdown Sequence***

When the leaving water temperature falls below the setpoint minus deadband, the compressor begins to unload. When the operating compressor capacities fall below a pre-determined setpoint, the last compressor is shut down and the corresponding liquid line valve closes. When a compressor turns off, the remaining compressor loads up to maintain the leaving water temperature.

### ***Stage 1 ~ Shutdown Sequence***

If the leaving water temperature is still lower than the setpoint, compressor #1 unloads fully and then turns off and circuit #1 liquid line valve also turns off. When a refrigerant circuit is cycled off, a one-time pumpdown of that circuit is performed. When suction pressure falls below pumpdown-cutout setpoint, the compressor will shut down.

# Electrical Data .....

## Typical Wiring Diagram for Compressor “Y-Delta Starting”

### Y-Delta “Open-Transition” Starting Method

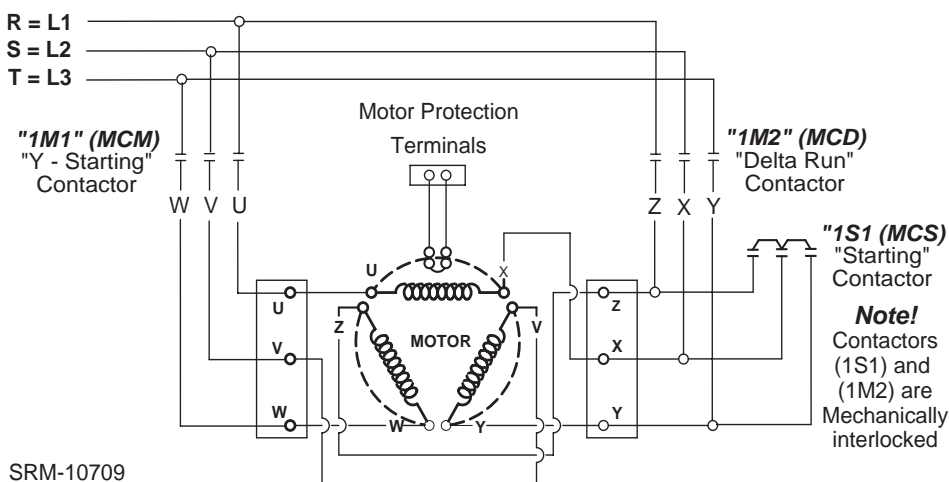
The Y-Delta “Open-Transition” Compressor Starting Method is a method of soft starting compressors by reducing the starting voltage/inrush current and torque to one-third the rated delta-connected values. After acceleration in the “Y” Connection, these windings are reconnected in delta for the run condition.

**Starting Sequence for Open-Transition Starting** begins when contactors (1S1)(MCS) and (1M1)(MCM) close, connecting one end of the winding in “Y” and the other end to the line. After a preset time delay, contactor (1S1)(MCS) is opened and contactor (1M2)(MCD) closes, which applies full voltage to the windings now connected in delta.

**Y-Delta “Open-Transition” starting** is more economical than other reduced voltage methods because no external voltage reduction devices are required. Hanbell Screw Compressor motors are designed with delta-connected windings, with all six leads brought to terminals in the electrical junction box. No other special features are required for the “open transition” starting method. During transition from “Y” to delta connection, there is a brief period when motor windings are not energized. This may result in a momentary high inrush at the instant of the delta connection. For power systems where this inrush current is objectionable, a “closed-transition” type starter should be used. The “Y-Delta “Open-Transition” Wiring Diagram” shown below outlines this starting method.

**Y-Delta “Open-Transition”** magnetic motor starters are used when low inrush current is required, at lowest cost. Y-Delta starting provides a low inrush current with sufficient torque to accelerate the compressor. When the motor windings are connected in “Y” during starting, the line current is 33 percent of normal locked rotor current. Reconnecting to “delta run” applies full voltage to each winding.

### Typical Wiring Diagram ~ Y-Delta “Open-Transition” Starting Method



SRM-10709

### **Y-Delta “Open-Transition” Starting Sequence**

1. **“Y-Delta” Starting ~ First Step**  
**1M1 & 1S1 Close** (1M2 is Open) for 4 seconds Time Period (+/- 1 Second)  
**“Y-Delta” Starting Time Period** can be extended, but not longer than 15 seconds, at 25% Minimum Load Capacity.
2. **Shift Time from “Y-Start”** to “Delta Run” is 40 milliseconds.
3. **“Delta-Run” Operating Condition**  
**“1S1” Opens** and **“1M2” Closes** (1M1 & 1M2 are closed for Y-Delta Operation)

**Note!**  
 Contactors (1S1) and (1M2) are Mechanically interlocked

# Electrical Data .....

## Y-Delta "Closed-Transition" Starting Method

**Y-Delta "Closed-Transition" starting**, is similar to "open-transition" starting, except during transition from "Y" to delta connection. The closed-transition circuit is made by adding resistors and a contactor (1T1), as shown in the "**Closed-Transition Wiring Diagram**" shown below.

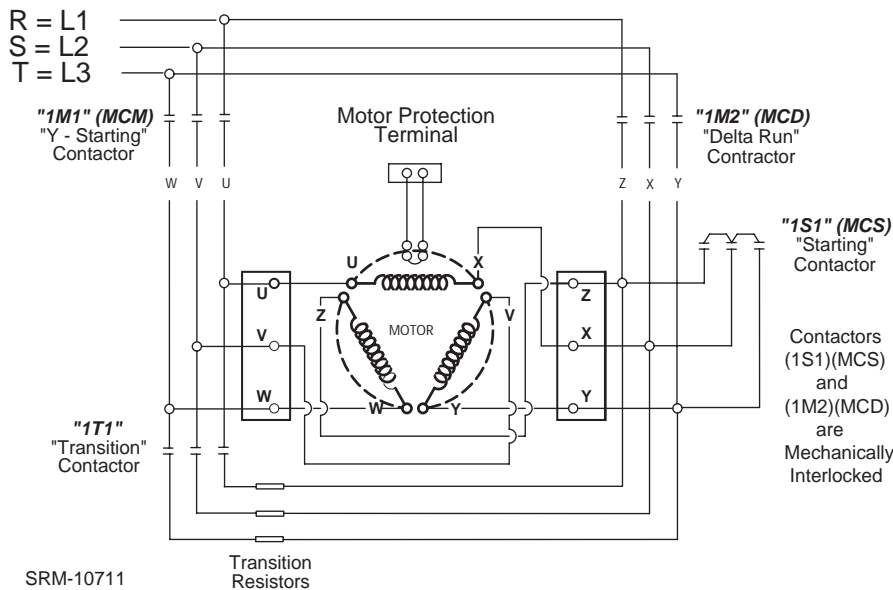
When the motor windings are connected in "Y" during starting, the line current is 33 percent of normal locked-rotor current. Reconnecting to "delta run" applies full voltage to each winding.

**Closed-Transition Y-Delta starting** is not as economical as "open-transition" y-delta starting due to the added contactor and resistors required for the closed-transition function.

**Starting Sequence for "closed-transition starting"** begins when contactors (1S1)(MCS) and (1M1)(MCM) close, connecting one end of the winding in "Y", and the other end to the line voltage.

After a preset time delay, contactor (1T1) closes, connecting the resistors in "Y" and in parallel with the motor windings. Contactor (1S1)(MCS) is then opened, which switches the windings and resistors into a series-delta connection. Contactor (1M2)(MCS) closes, contactor (1T1) opens taking the resistors out of the circuit. The motor windings are continuously energized, thereby reducing the objectional transient current peaks.

## Typical Wiring Diagram ~ Y-Delta "Closed-Transition" Starting Sequence



### **Y-Delta "Closed-Transition" Starting Sequence**

1. **First Step**  
1M1 & 1S1 Close,  
(1M2 & 1T1 are both Open)  
for a 4 second Time Delay (+/- 1 Second)  
**"Y-Delta" Starting Time Period**  
can be extended, but not longer than  
15 seconds, at 25% Minimum Load Capacity.
2. **After the 4 second (+/- 1 Second) time delay, 1T1 closes,**  
connecting the resistors in "Y" (star)  
and in parallel with the motor windings.
3. **1S1 is then opened after a 40 millisecond time delay,**  
which switches the windings and resistors  
in a series-delta connection.
4. **1M2 Closes & 1T1 Opens,**  
taking the resistors out of the circuit.  
(1M1 & 1M2 are now both closed for  
Y-Delta Operation)



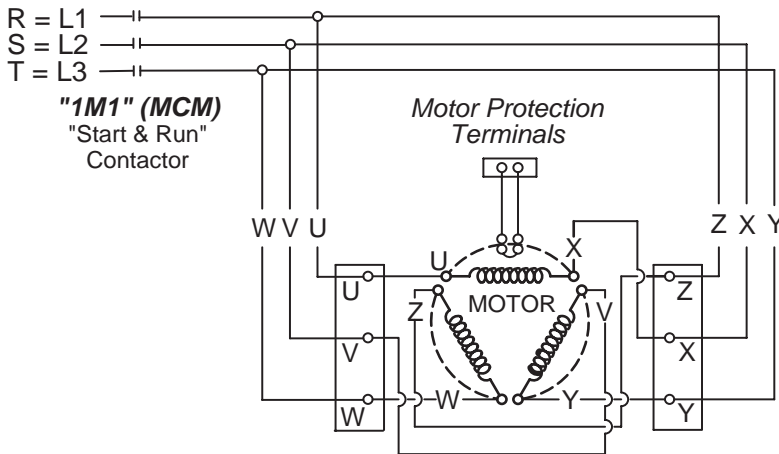
# Electrical Data .....

## XL (Across-the-Line), or DOL (Direct-on-Line) Starting Method

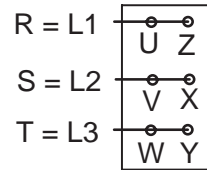
**The XL Starting Method** is the least expensive starting method. The XL starting current is basically equal to the motor LRA (Locked Rotor Amps), so this starting method does not offer the benefits of the Y-Delta reduced starting voltage/inrush current starting method. The XL Starting Method is a single step starting method, with a single contactor. The compressor terminals "U-Z", "V-X" and "W-Y" must be barred or connected with wire, to facilitate the three conductor XL Starting Method.

**Starting Sequence for XL Starting** is based on a single contactor (1M1)(MCM) closing, which applies full voltage to the terminals U, V, W, plus Z, X, and Y simultaneously as shown below.

### **Typical Wiring Diagram for "XL" or "DOL" Starting Sequence**



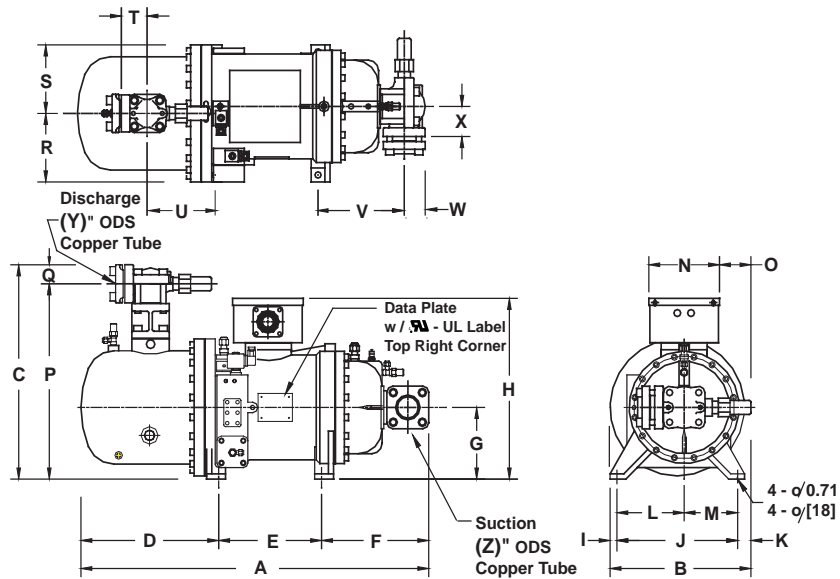
- "XL" (Across-the-Line) or "DOL" (Direct on Line) Starting Sequence**
1. **XL (DOL) Starting ~ 1M1 Closes and U, V, W plus Z, X, and Y are all energized simultaneously.**
  2. **XL (DOL) Starting Method is a single step starting, with a single contactor.**
  3. **The compressor terminals must be barred, "U-Z", "V-X", & "W-Y", for a three terminal wiring system as shown.**



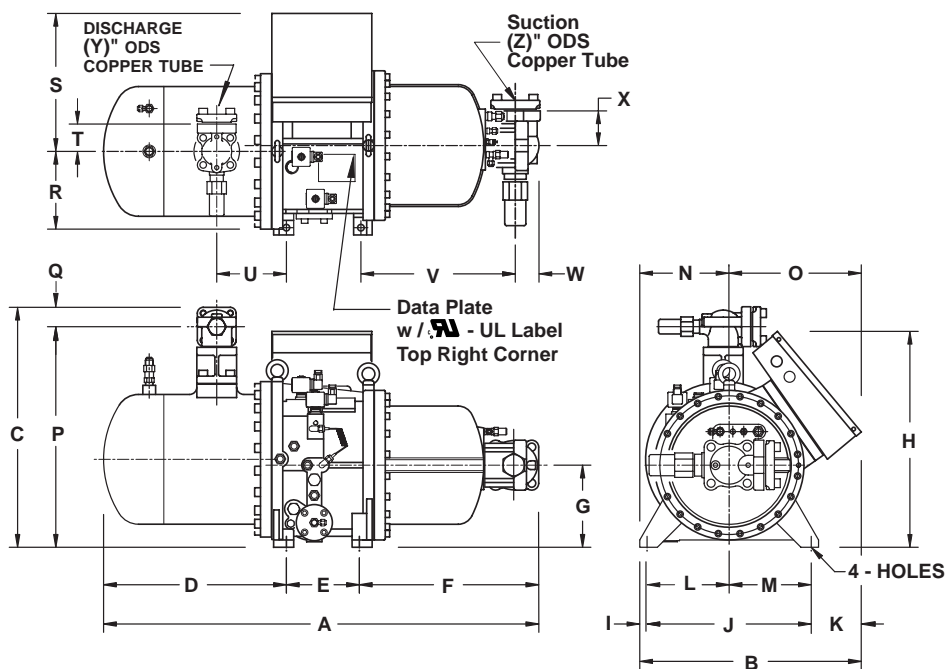
SRM-10713

# Outline Dimensions

## RC10 & RC11



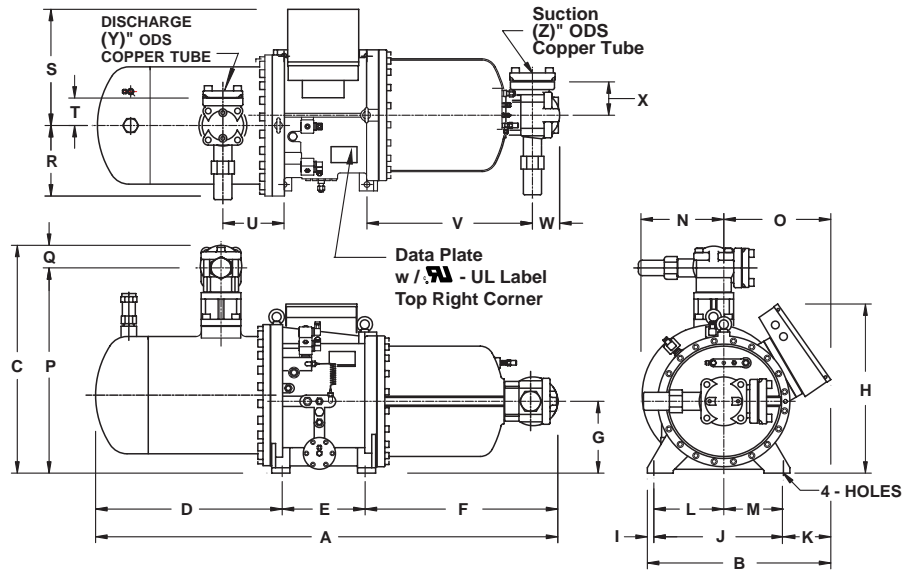
## RC12 ~ 17



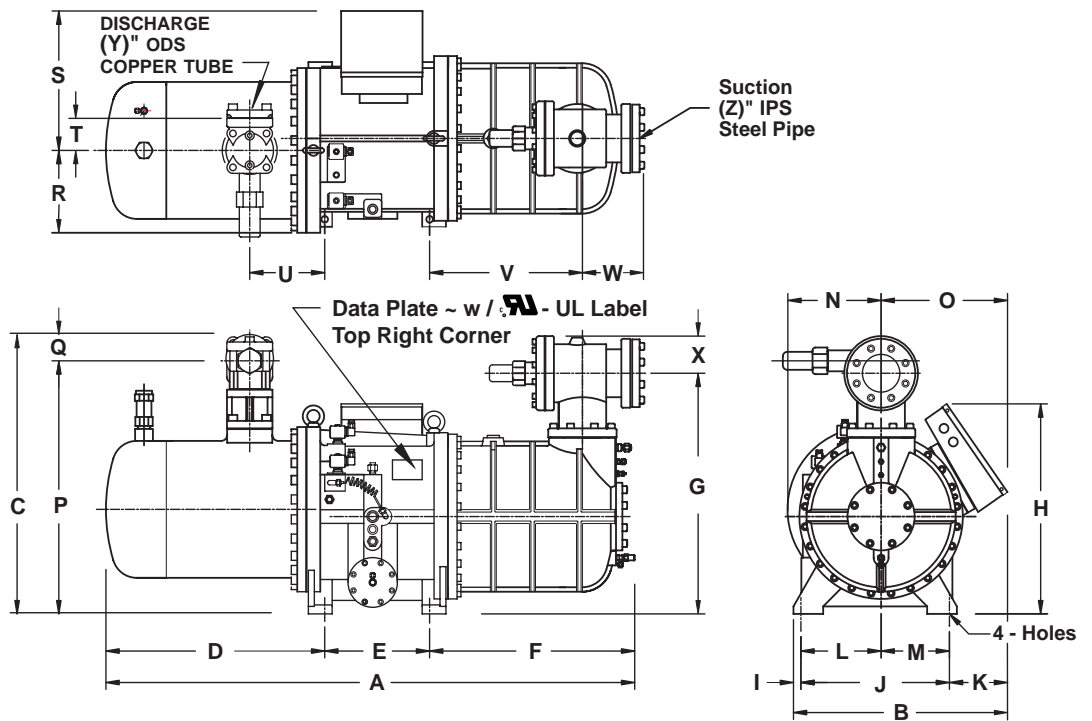
Model	Dimensions in Inches ~ Converted from Metric "mm"																									
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
RC10	39.9	16.2	24.1	15.8	11.8	12.3	8.1	20.4	0.79	13.9	1.5	7.7	6.2	8.1	3.6	22.0	2.2	7.7	7.7	3.0	7.8	9.9	2.4	3.4	1 5/8	2 1/8
RC11	39.9	16.2	24.1	15.8	11.8	12.3	8.1	20.4	0.79	13.9	1.5	7.7	6.2	8.1	3.6	22.0	2.2	7.7	7.7	3.0	7.8	9.9	2.4	3.4	1 5/8	2 1/8
RC12	47.0	23.9	25.9	19.7	7.9	19.4	8.9	23.3	0.79	17.7	5.4	8.9	8.9	9.7	14.3	23.8	2.1	9.0	14.9	3.0	7.5	16.7	2.7	3.7	1 5/8	2 5/8
RC13	51.2	23.9	25.9	21.1	9.0	21.1	8.9	23.3	0.79	17.7	5.4	8.9	8.9	9.7	14.3	23.8	2.1	9.0	14.9	3.0	7.5	18.4	2.7	3.7	1 5/8	2 5/8
RC14	55.2	26.8	28.9	22.3	9.9	23.0	10.1	24.6	1.93	18.9	6.0	9.45	9.45	11.2	15.4	26.5	2.4	9.7	16.0	3.4	8.0	19.5	3.5	4.2	2 1/8	3 1/8
RC15L	60.0	26.8	28.9	24.0	11.2	24.8	10.1	24.6	1.93	18.9	6.0	9.45	9.45	11.4	15.4	26.5	2.4	9.7	16.0	3.4	8.0	21.3	3.5	4.2	2 1/8	3 1/8
RC16	60.7	28.6	32.4	25.1	10.4	25.2	10.8	25.8	1.73	19.7	7.2	10.6	9.1	12.4	16.3	29.7	2.7	10.0	17.8	2.8	8.7	21.1	4.1	5.1	2 5/8	4 1/8
RC17	65.6	28.6	32.4	26.0	12.6	27.0	10.8	25.8	1.73	19.7	7.2	10.6	9.1	12.4	16.3	29.7	2.7	10.0	17.8	3.7	8.9	22.9	4.1	5.1	2 5/8	4 1/8

# Outline Dimensions

## RC18 Only



## RC19 ~ 21



Model	Dimensions in Inches ~ Converted from Metric "mm"												
	A	B	C	D	E	F	G	H	I	J	K	L	M
RC18	70.22	28.61	34.96	28.35	12.60	29.27	11.02	25.96	1.73	19.69	7.20	10.63	9.06
RC19	71.36	29.78	36.73	29.00	13.90	24.70	12.80	27.61	1.73	19.69	7.70	10.63	9.06
RC20-21	78.78	30.48	37.64	32.38	16.46	27.46	31.63	27.58	1.73	19.69	7.65	10.63	9.06
Model	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
RC18	23.36	16.25	31.50	3.46	10.04	17.83	4.21	9.29	25.14	4.13	5.12	3 1/8	4 1/8
RC19	13.03	16.75	33.27	3.46	10.04	18.33	4.21	9.94	20.24	8.22	4.88	3" IPS	5" IPS
RC20-21	13.58	16.70	33.50	4.13	10.04	18.33	5.12	10.33	23.00	8.22	4.88	4" IPS	5" IPS

# Compressor Sound Data.....

## Sound Pressure Ratings & dB(A)

Model	RC10	RC11	RC12	RC13	RC14	RC15L	RC16	RC17	RC18	RC19	RC20	RC21	
<b>R22 ~ Nominal Capacity in Tons</b>	33	44	56	63	85	106	139	162	189	208	271	293	
<b>Frequency in Hz.</b>	<b>63</b>	52.4	52.9	56.0	56.2	56.8	57.4	59.6	60.4	61.9	62.2	62.6	62.8
	<b>125</b>	54.1	54.6	57.8	58.0	58.6	59.3	61.5	62.3	63.9	64.3	64.6	64.9
	<b>250</b>	61.0	61.5	65.2	65.5	66.1	66.9	69.4	70.3	72.0	72.5	72.9	73.1
	<b>500</b>	58.2	58.7	62.2	62.4	63.1	63.8	66.2	67.1	68.7	69.1	69.5	69.8
	<b>1000</b>	60.4	60.9	64.6	64.8	65.5	66.2	68.7	69.6	71.3	71.7	72.2	72.4
	<b>1600</b>	63.8	64.3	68.2	68.4	69.1	69.9	72.5	73.5	75.3	75.7	76.2	76.4
	<b>2000</b>	62.7	63.2	66.9	67.2	67.9	68.6	71.2	72.2	74.0	74.4	74.8	75.1
	<b>2500</b>	62.7	63.2	66.9	37.2	67.9	68.6	71.2	72.2	74.0	74.4	74.8	75.1
	<b>4000</b>	58.8	59.3	62.8	63.1	63.7	64.4	66.8	67.7	69.4	69.8	70.2	70.5
	<b>8000</b>	45.6	46.0	48.8	48.9	49.4	50.0	51.9	52.6	53.9	54.2	54.4	54.7
<b>Overall dB(A)</b>	<b>73.1</b>	<b>73.7</b>	<b>78.1</b>	<b>78.4</b>	<b>79.2</b>	<b>80.1</b>	<b>83.1</b>	<b>84.2</b>	<b>86.3</b>	<b>86.8</b>	<b>87.3</b>	<b>87.6</b>	

**Note:**

1. The above 1/3 octave spectrum data is based on 122°F (50°C) SCT, 32°F (0°C) SST, with R22
2. The sound data is compatible for R22, R134a, R407C, R404A & R507A providing the compressor is operated within operating limits.
3. The sound data is very similar for all refrigerants and working conditions, with +/- 2dBa OVERALL tolerance.
4. The above data is based on ISO-2151 Standards.

## Quality Assurance .....

Each compressor at HANBELL is manufactured under the ISO 9001 quality certification system. This ISO 9001 certification assures that each compressor is manufactured under strict controlled quality manufacturing procedures.

All RC Series screw compressors are put through strict quality and performance testing prior to shipping from the factory. The RC Series screw compressors are manufactured from the finest quality material and workmanship available, and are **warranted to operate properly for the period of two years from the time of the original start-up, or up to 30 months from date of original sale** by Hanbell or designated sales agent, whichever comes first. Proof of purchase and full payment will be required for any potential warranty issue.

Neither Hanbell or Micro Control Systems, will be responsible if the compressor does not operate properly for any of the following reasons: 1) damage caused by others including shipping, natural disaster, war, etc. 2) damage caused by improper installation, operation, physical damage, 3) lack of, or improper maintenance that is not in accordance with the Hanbell Technical Manual or instruction, 4) damage caused by modification of any part on or connected to the compressor, and/or damage caused by the improper maintenance or repair by a non-authorized repair technician. Hanbell and Micro Control systems will also not be responsible for any accident which happens to personnel while installing, setting up, operating, maintaining, and or repairing the compressor.

**All warranties will be null and void if the compressor, options and accessories are not paid for in full.**

## HVAC and Refrigeration Control Solutions with 'Energy Saving Control Logic'

PC-Connect for the MCS-8 Status Screen

Micro Control										CHILLER #1									
RELAY	OUTPUTS	VALUE	STATUS	MANUAL	LAST ON	LAST OFF	1	SENSOR	INPUTS	VALUE	STATUS	OFFSET	SENSOR	TYPE	LAST ON	LAST OFF	MAX	TODAY	
M-1	COMP	ON	AUTO	OFF	07:36:16	07:33:44	0	M-1	SUCT1	60.96	AUTO	0.00	M-1	TEMP	11.500		64.2		
M-2	LOAD1	OFF	AUTO	OFF	07:41:15	07:38:49	0	M-2	DISC1	1.76	SP	AUTO	0.00	M-2	TEMP	11.500		176.5	
M-3	UNLOAD1	OFF	AUTO	OFF	07:40:35	07:38:47	0	M-3	AMPS1	80.0A	AUTO	0.0A	M-3	CT-250				81.3A	
M-4	S UNLD1	OFF	AUTO	OFF	07:38:18	07:38:47	0	M-4	SUCT1TMP1	45.2F	AUTO	0.0F	M-4	MCS1100				45.2	
M-5	LLS1	ON	AUTO	OFF	07:38:48	07:33:44	0	M-5	DISCTMP1	147.6F	AUTO	0.0F	M-5	MCS1100				147.6	
M-6	ENDPMP1	ON	AUTO	OFF	07:36:45	07:33:44	0	M-6	EXTSTY1	OFF	AUTO	0.0F	M-6	DIGITAL				00:00:00	
M-7	CNDFAN1	OFF	AUTO	OFF	00:00:00	00:00:00	0	M-7	SENSORS	NO	AUTO	0.0F	M-7	DIGITAL				00:00:00	
M-8	ALARM	OFF	AUTO	OFF	00:00:00	00:00:00	0	M-8	FLOW	ON	AUTO	0.00	M-8	DIGITAL				00:00:00	
L-1	TEMP1	ON	MANUAL	OFF	00:39:49	00:39:49	0	L-1	DISC2	182.2P	AUTO	0.00	L-1	TEMP	11.500			182.2	
L-2	LOAD2	OFF	LOCKIN	OFF	07:41:06	00:00:00	0	L-2	DISC2	182.2P	AUTO	0.00	L-2	TEMP	11.500			182.2	
L-3	UNLOAD2	OFF	AUTO	OFF	07:41:00	07:40:18	0	L-3	AMPS2	82.1A	AUTO	0.0A	L-3	CT-250				82.1	
L-4	S UNLD2	OFF	AUTO	OFF	07:39:49	07:40:18	0	L-4	SUCT1TMP2	51.0F	AUTO	0.0F	L-4	MCS1100				51.2	
L-5	LLS2	OFF	AUTO	OFF	00:00:00	00:00:00	0	L-5	DISCTMP2	132.2F	AUTO	0.0F	L-5	MCS1100				132.9	
L-6	SPARE1-6	OFF	AUTO	OFF	07:36:06	07:36:30	0	L-6	EXTSTY2	OFF	AUTO	0.00	L-6	DIGITAL				00:00:00	
L-7	SPARE1-7	OFF	AUTO	OFF	00:00:00	00:00:00	0												
L-8	SPARE1-8	OFF	AUTO	OFF	00:00:00	00:00:00	0												

PC-Connect

MCS PC-Config - CHILLER CFG - [Chiller V8 Information Screen]

Chiller V8 Information Screen

General Information

Run/Stop Switch: RUN/STOP  
Phase Loss: PHASLOSS  
Ambient Temperature: Not Used

Emergency Stop Switch: Not Used  
Target (SP #1) Reset: Not Used  
Alarm Output: ALARM

Control Temperature On: Entering Trip  
Control Method: Control Zone  
MCD Motor Line RD: Not Used  
Warning Relay: Not Used

Compressor Information

Compressor Type: Continuous Pump Drive  
Fluid Control (YES, set up as Circuit #1): Yes  
Anti Cycle Limit: ON

Evaporator Information

Refrigerant Type: R22  
Entering Temperature: ENT LIQ  
Leaving Temperature: LEV LIQ

Flow Switch: FLOW  
Bypass Heater Relay: Not Used  
Pump #1 Relay: Not Used  
Pump #2 Relay: Not Used

All S/N 8 000 and greater Anti-cycle is controlled by steps 50-60 (T/C OFF) and step 63 (ANTI-CYC ON) Anti-Cycle Option is ignored.

PC-Config



File No: E169780 (115vac & 24vac)



MCS-8

- Windows Based 'Point & Click' Status and Trending for Local & Remote Communications
- Windows Based 'Point & Click' Configurator with Energy Saving Control Logic
- Chillers, Condensing Units, Air Handlers, Fluid Coolers & Cooling Towers
- Hermetic, Semi-Hermetic, Open Drive, Steam or Gas Engine
- Reciprocating, Scroll, Screw & Centrifugal Comp.
- Controls for New & Retrofit Applications



## HANBELL **SCREW** COMPRESSORS

**HVAC & Refrigeration Type**  
**with Internal Oil Separators**

**Superior *Quality* Products and Services**  
**MCS-8 *Microcomputer* Controllers**  
**& Hanbell *Screw* Compressors**



***Micro Control Systems, Inc.***

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Ft. Myers, Florida 33905

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Website: [www.mcscontrols.com](http://www.mcscontrols.com)

E-mail: [sales@mcscontrols.com](mailto:sales@mcscontrols.com)

Form # MCS HB RC10-21