

MB MASTER-BILT[®] *Refrigeration Solutions*

MAC-7&8

*Featuring Advanced Master Controller 2.0 Technology
Reverse Cycle Defrost*

Installation & Operations Manual



02-14-145revision

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Introduction

Thank you for purchasing Master-Bilt refrigeration equipment. This manual contains important instructions for installation. Read this manual carefully before installing or servicing your Master-Bilt refrigeration equipment. Also, for complete technical information of our walk-in cooler and freezer refrigeration systems, please consult *Master-Bilt Condensing Unit and Refrigeration System Installation & Operation Manual and the Master Controller 2.0 Installation & Operation Manual*.



NOTICE

Installation and service of the refrigeration and electrical components must be performed by a refrigeration mechanic or licensed electrician.



DANGER

Improper or faulty hook-up of electrical components of the refrigeration units can result in severe injury or death.

All electrical wiring hook-ups must be done in accordance with all applicable local, regional or national standards.



NOTICE

Read this manual before installing your refrigeration. Keep the manual and refer to it before doing any service. Failure to do so could result in personal injury or equipment damage.

The portions of this manual covering refrigeration and electrical components contain technical instructions intended only for persons qualified to perform refrigeration and electrical work.

This manual cannot cover every installation, use or service situation. If you need additional information, contact us:

**Parts and Technical Service Department
Master-Bilt Products
908 Highway 15 North
New Albany, MS 38652
Phone (800) 684-8988
Fax (800) 232-3966
E-Mail: service@master-bilt.com**

Warning Labels and Safety Instructions



This symbol is the safety-alert symbol. When you see this symbol on your cabinet or in this manual, be alert to the potential for personal injury or damage to your equipment.

Be sure you understand all safety messages and always follow recommended precautions and safe operating practices.



NOTICE TO EMPLOYERS

You must make sure that everyone who installs, uses or services your refrigeration equipment is thoroughly familiar with all safety information and procedures.

Important safety information is presented in this section and throughout the manual. The following signal words are used in the warnings and safety messages:

DANGER: Severe injury or death will occur if you ignore the message.

WARNING: Severe injury or death can occur if you ignore the message.

CAUTION: Minor injury or damage to your cabinet can occur if you ignore the message.

NOTICE: This is important installation, operation or service information. If you ignore the message, you may damage your cabinet.

The warning and safety labels shown throughout this manual are placed on your Master-Bilt Products refrigeration unit at the factory. Follow all warning label instructions. If any warning or safety labels become lost or damaged, call Master-Bilt's customer service department at (800) 684-8988 for replacements.



This label is located on the condensing unit.

General Information

Please read this manual prior to installing your Master-Bilt equipment. This information is based on good refrigeration practice and should be used as a guide for installation and operations.

Delivery Inspection

Be sure to check for damage when this equipment is delivered by the carrier. Indicate damage on the carrier's Bill of Lading so that a claim may be filed.

Condensing Unit Specifications

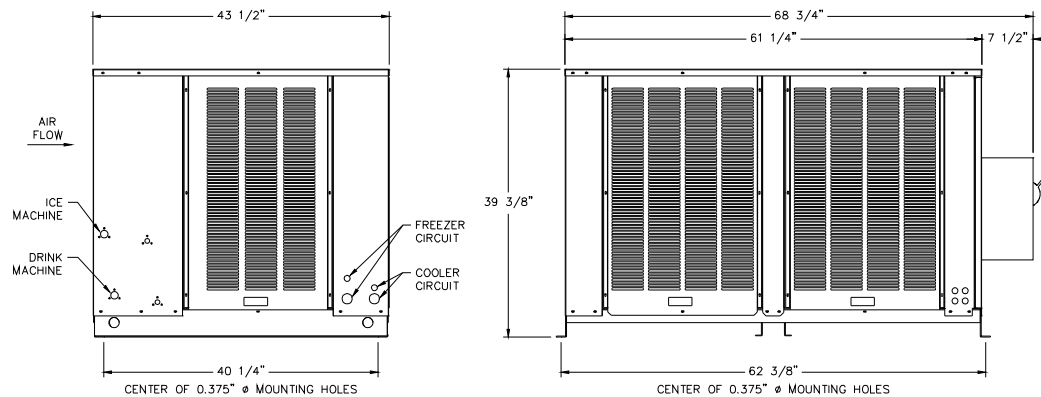


Table 1. Specifications for system where evaporators use condensing unit power

Model	Sales Nomenclature	Location	Compressor	Refrig	Voltage	HP	System MCA	System MOP	Wt. LBS
R62R11B4CS*	MAC-7	Cooler	ZS11KAE-TF5	R404A	208-230/3	1 1/2	35	40	717
		Freezer	ZS30K4E-TF5	R404A	208-230/3	4			
R62R11B3CS*	MAC-8	Cooler	ZS11KAE-TF5	R404A	208-230/3	1 1/2	43	50	717
		Freezer	ZS38K4E-TF5	R404A	208-230/3	5			
R62R11B5CS*	MAC-8C	Cooler	ZS11KAE-TF5	R404A	208-230/3	1 1/2	46	60	717
		Freezer	ZS45K4E-TF5	R404A	208-230/3	6			

* NOTE: For coated condenser coil, this place is "C"

Important Notice: Do not use reverse cycle defrost when the ambient is lower than -20°F.

Table 1.1 Specifications for system where evaporators use separate power source

Model	Sales Nomenclature	Location	Compressor	Refrig	Voltage	HP	System MCA	System MOP	Wt. LBS
R62R11B4CS	MAC-7	Cooler	ZS11KAE-TF5	R404A	208-230/3	1 1/2	32	40	717
		Freezer	ZS30K4E-TF5	R404A	208-230/3	4			
R62R11B3CS	MAC-8	Cooler	ZS11KAE-TF5	R404A	208-230/3	1 1/2	39	50	717
		Freezer	ZS38K4E-TF5	R404A	208-230/3	5			
R62R11B5CS	MAC-8C	Cooler	ZS11KAE-TF5	R404A	208-230/3	1 1/2	42	50	717

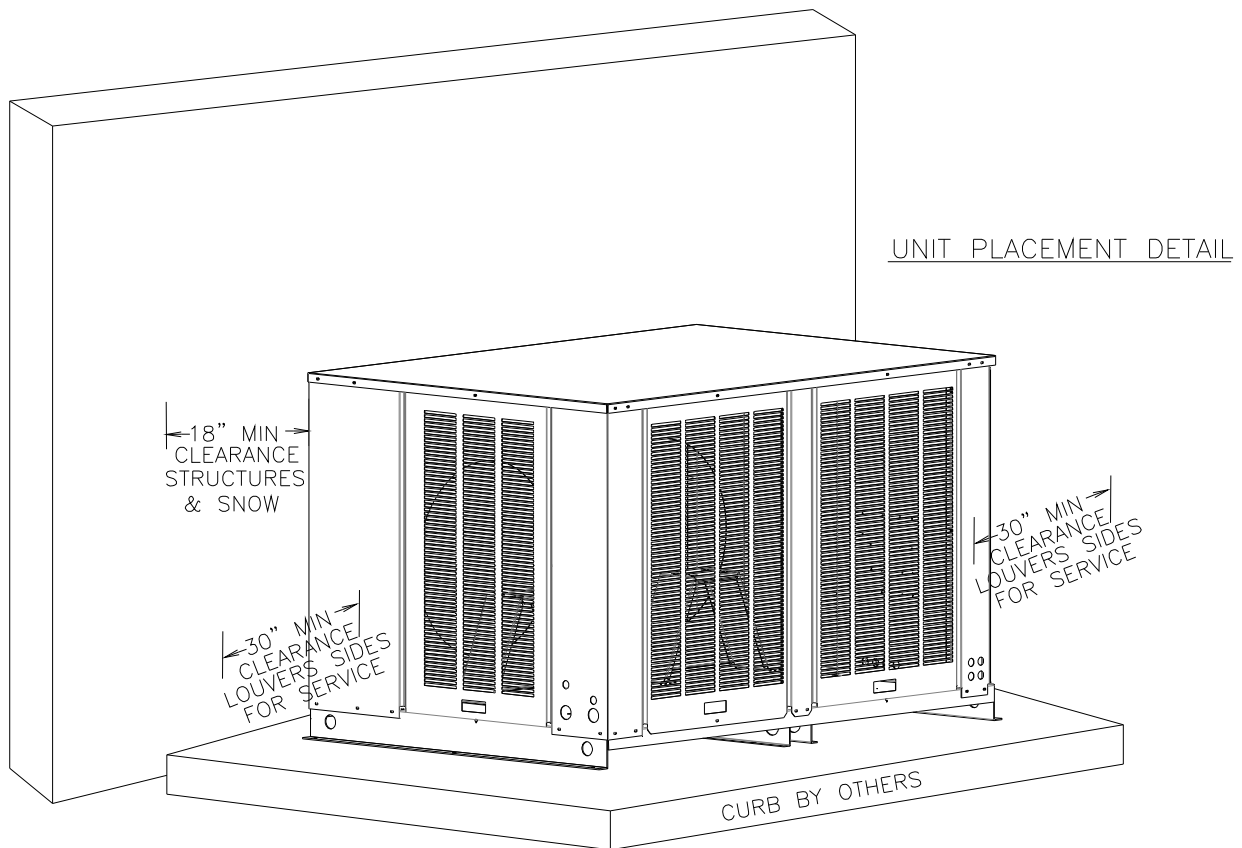
Handling and Placement of Condensing Unit

To minimize damage to the unit housing, it is recommended that the crate not be removed until the unit is moved to its final location.

The following should be considered when placing the unit:

- A. The condenser coil (air inlet) should not be located so as to restrict air flow into the coil or direct facing of sunlight. A minimum of 12" is required (18" is preferred) between the face of the coil and a wall or other vertical obstruction.
- B. Keep snow accumulation **18" to 30"** away from condenser coils (air inlets) at all times.
- C. A minimum of 30" is required on the three louvered sides to allow access for maintenance.
- D. Do not position multiple units so that the air discharge of one is into the air intake condenser of another.
- E. The roof mounting curb for the MAC units should be designed in such a way as to fully support all four of the bottom rails.

Holes are provided in the base supports for mounting bolts and for bridle lift rods.



Evaporator Coils

To minimize damage to the evaporator coil, it is recommended that the carton (or crate) not be removed until the evaporator coil is moved close to its final location. When the container is removed from the evaporator coil, extreme care must be used when lifting and mounting to the ceiling, to prevent sheet metal damage. Consult evaporator “Operating and Installation Instructions” for proper installation details.

Dimensional Data

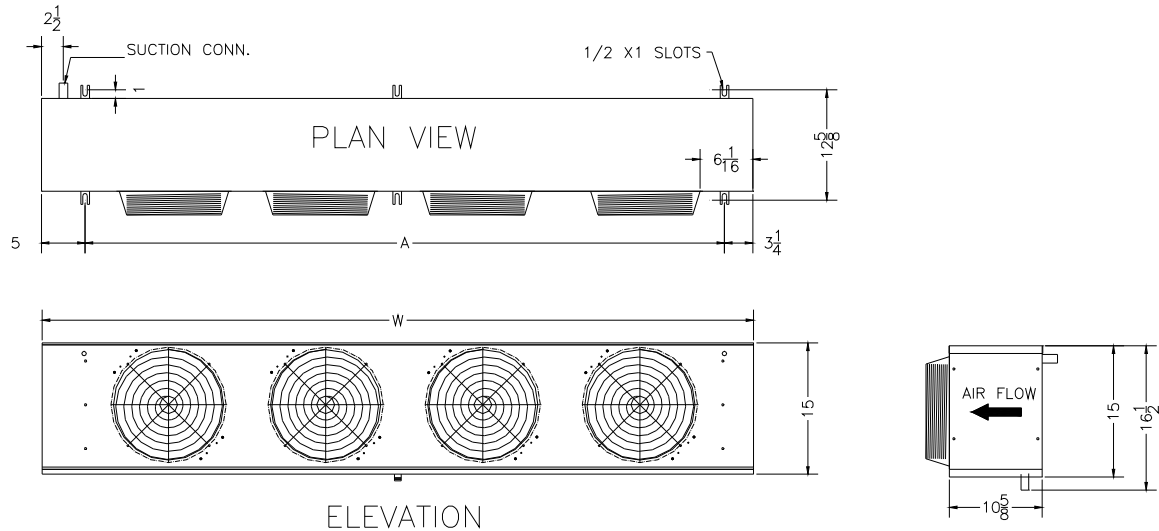


Table 2. Specifications of evaporators

Model	Description	Capacity		Connection			Amps (230)		MCA	MOP	Wt. lbs.	"A" in	"W" in	No. Fan
		Refrig.	BTUH*	Inlet	Outlet	Drain	Mtrs	Htrs						
EMHZ0133B**	MAC-7,8 COOLER	R404A	13300	1/2 OD	7/8 OD	3/4 MPT	1.24		10	10	61	41.25	49.5	2
EMRZ0143B**	MAC-7 FREEZER	R404A	14000	1/2 OD	7/8 OD	3/4 MPT	1.86	4.0	10	10	82	55.25	63.5	3
EMRZ0183B**	MAC-8 FREEZER	R404A	18200	5/8 OD	1 1/8 OD	3/4 MPT	2.48	5.2	10	10	101	73.25	81.5	4
EMRZ0203B**	MAC-8C FREEZER	R404A	21700	5/8 OD	1 1/8 OD	3/4 MPT	3.1	6.5	10	10	125	86.25	94.5	5

* Based on 10°F TD, +25°F SST for med-temp, -20°F SST for low-temp

** 208-230V / 1 phase /EC Motors, W/Master Controller, Electric Expansion Valve pre-mounted

The evaporator units are built in with Master Controller 2.0 system. It has standard demand defrost features. The number of defrosts per day varies depending on moisture condition in the freezer. For more information of a Master Controller 2.0 System, please consult the Master Controller 2.0 System I/O Manuals.



For non standard units other than listed in previously pages, please consult factory for detail specifications and wiring diagrams. The non standard units are larger size freezer compressor, three phase power supply to evaporator defrost heaters, reverse cycle defrost systems, etc.

Ice Machine and Drink Machine Remote Circuits

Each MAC-7 and MAC-8 condenser is equipped with two remote circuits for use with the stores ice machine and/or drink machine. These circuits are factory charged with nitrogen and sealed with quick connect fittings (1/2" for entering condenser and 3/8" for leaving condenser). Each circuit has a BTUH capacity of 16,800 BHUH (at 10F TD), an internal volume of 155 cubic inches and has approximately 667 CFM of air flow.

Electrical

Electric power supply must match the condensing unit power requirements indicated on the unit data plate. The typical wiring diagram is provided in this manual. A system wiring diagram is located on the inside of the electrical box cover. All field wiring may enter the electrical box through the holes provided in the side of the box. All field wiring should be done in a professional manner, in accordance with any and all governing codes. Double check all wiring connections, including factory terminals, before start-up of condensing unit.

Refrigerant Lines

Refrigeration lines must be properly sized. For line sizing data see Table 3 below. Horizontal suction lines should be sloped toward the compressor at least 1/2" every 10 feet to insure good oil return. All vertical suction risers should be trapped at the bottom. Certain installations may require multiple P-traps which should be placed one every 15 to 20 feet. Insulate all suction lines with at least 3/4" thick Armaflex insulation. **Insulate the indoor portion of liquid line with at least 1/2" thick Armaflex to prevent condensate water dripping on ceilings during defrost.**

Table 3. Appropriate Line Sizes

System	Room	Connection		Max. Riser	Suction Line*			Liquid Line		
		Suct	Liq.		< 75'	>75', < 150'	>150'	< 75'	>75', < 150'	>150'
MAC-7	Freezer	7/8"	1/2"	1 1/8"	1 1/8"	1 1/8"	Consult Factory	1/2"	5/8"	Consult Factory
MAC-7,8	Cooler	7/8"	3/8"	7/8"	7/8"	7/8"	Consult Factory	3/8"	3/8"	Consult Factory
MAC-8	Freezer	7/8"	5/8"	1 1/8"	1 1/8"	1 1/8"	Consult Factory	5/8"	5/8"	Consult Factory
MAC-8C	Freezer	7/8"	5/8"	1 1/8"	1 3/8"	1 3/8"	Consult Factory	5/8"	5/8"	Consult Factory

Note: P-trap and vertical suction riser should one size down than the horizontal suction pipe.

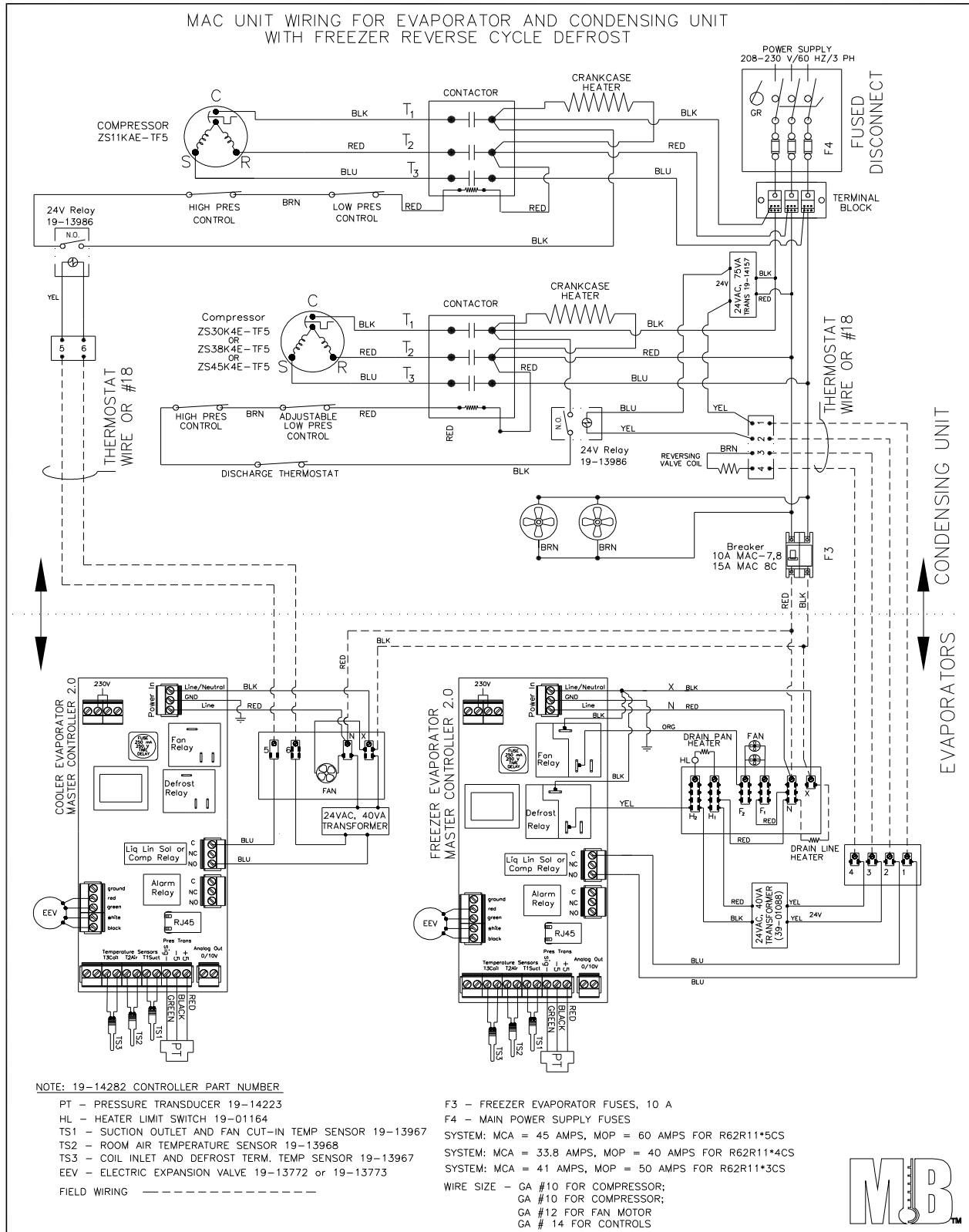
It is recommended that all brazed joints be made with silver alloy-type solders. A small amount of dry nitrogen should be fed into the tubing during brazing operations to minimize formation of scale and oxidation inside the tubing. Also, use care to keep tubing free of foreign matter and moisture. Purge the pipe with high pressure dry nitrogen before brazing the last joint. Remove all remaining flux from the joints after brazing. Remote refrigeration must be installed in accordance with all governing codes. Copper tubing must be refrigeration grade, ACR or in accordance with all governing codes.

Evaporator Suction Outlet Temperature Sensor Location:

The sensor should be mounted on the suction line about 6" or more away from the evaporator as indicated in the picture below. The sensor should be mounted on 10:00 to 2:00 O'clock position for true vapor temperature reading. Use metal strap provided by factory to fasten the sensor bulb. Apply insulation around the suction line after installation.



MAC-7 and MAC-8 Wiring Diagram with Reverse Cycle Defrost



Note: Evaporators and condensing unit powers are from same power sources. The actual wiring diagram for each system is attached on the back of the electric box cover.

Leak Check

When all refrigeration line connections have been made, the complete system, including factory connections, should be leak checked. Failure to do so may waive factory warranty. Remove the low pressure transducer before pressurizing for leak check. Charge the system 300 PSIG with dry-nitrogen and check each joint and connection with soap bubble for leak. Install the pressure transducer back after the pressure is released.

Evacuation, Dehydration and Start-Up

A vacuum of 500 microns or less must be pulled to properly dehydrate the system. This requires a two-stage vacuum pump with an electronic vacuum indicator. The vacuum level has to be maintained to be sure no moisture is inside the oil.

CAUTION: Do not operate the compressor while the system is in a vacuum. This will waive factory warranty for Scroll compressor.

Evacuation Procedure

- A. Open all condensing unit service valves and relieve system pressure. Also, open any line valves installed in the system and energize all solenoid valves to facilitate evacuation.
- B. Connect the vacuum pump to the high and low sides of the system using 1/4" or larger copper lines or 1/4" ID hoses with high vacuum designation.
- C. Leaks or moisture will be indicated if the system pressure rises when the vacuum line is closed off.
- D. A final vacuum of 500 microns should be pulled and maintained before charging. Charge the high side until the system pressure is equal to the pressure in the refrigerant cylinder.

Charging Procedure

A. Preliminary

1. Calculate the preliminary refrigerant charge using the following Formula:

Preliminary Charge = (Rated Tons of Refrigeration x 3 lbs of R-404A) + (Liquid Line Refrigerant Volume)

Rated Tons for various compressors in MAC-7-8 are given below in Table 4.

Table 4

Compressor	Capacity (Tons)	Evap Temp (°F)
ZF13	1.17	-20
ZF15	1.46	-20
ZF18	1.77	-20
CS10	1.13	25

NOTE: For Liquid Line Refrigerant Volume, Reference Table 5 Below

Table 5

	Lbs. of R-404A to fill Liquid line by Length		
Length	Liquid Line Size (in.ODS)		
Feet	3/8"	1/2"	5/8"
5	0.18	0.32	0.52
10	0.36	0.64	1.04
15	0.54	0.96	1.56
20	0.72	1.28	2.08
25	0.9	1.6	2.6
30	1.08	1.92	3.12
50	1.8	3.2	5.2
75	2.7	4.8	7.8
100	3.6	6.4	10.4
150	5.4	9.6	15.6

FOR EXAMPLE:

Calculate the Preliminary Charge for a ZF13 compressor with a 25 ft. liquid line, 1/2" ODS Copper

Rated Tons of Capacity (From Table 4) = 1.17

Amount of Refrigerant to Fill a 1/2" ODS Liquid Line, 25 ft. long (From Table 5) = 1.6 lbs.

Preliminary Charge = (Rated Tons of Refrigeration x 3 lbs of R-404A) + (Liquid Line Refrigerant Volume)

Preliminary Charge = (1.17 x 3) + 1.6 = 5.11 lbs (This value is also given in Table 6 below)

2. Weigh in the preliminary charge from Calculations, or from Table 6
3. Be sure all service valves are "open".
4. Start the system by "flipping on" the disconnect on the side of the electrical box.
5. Check evaporator fan motors after start-up. Medium temperature, air defrost fans run continuously (the cooler) , low temperature fans provided with electric defrost (the freezer) will be delayed by the fan control.
6. During pulldown, expect evaporator superheat to be high, as the box is under a very high load. As the room temperature approaches set point, the superheat will begin to drop, and begin to approach the superheat setpoint, designated in the controller programming, typically 10⁰F. Continue to let the box temperature fall. This is a good opportunity to calibrate the adjustable low pressure controller. Recommended set points are as follows:
Cut Out = 2 psig Cut-In = 20 psig
7. When the box temperature approached set point, this is the time test the defrost cycle. The reaction of the compressor during a defrost cycle is a good time to determine if the system is charged properly. The following sequence will likely be seen if the charge is not correct.

IF SHORT CYCLING ON THE LOW PRESSURE CONTROL AT THE BEGINNING OF THE DEFROST, THE SYSTEM IS UNDERCHARGED.

IF SHORT CYCLING ON THE HEAD PRESSURE CONTROL AT THE END OF THE DEFROST, THE SYSTEM IS OVERCHARGED.

IF THE PRELIMINARY CHARGE IS USED, YOU WILL NOT SEE AN OVERCHARGE.

IF ANY SHORT CYCLING IS OBSERVED AT THE BEGINNING OF THE DEFROST CYCLE. ADD 1/2 INCRIMENTS OF R-404A UNTIL THE SHORT CYCLING GOES AWAY. ALLOW THE SYSTEM TO PULL BACK DOWN TO TARGET ROOM TEMPERATURE, THEN TEST SYSTEM AGAIN WITH A MANUAL DEFROST. REPEAT UNTIL NO SHORT CYCLING IS SEEN.

NOTE: DO NOT BLAME SHORT CYCLING ON THE CHARGE UNTIL THE LOW PRESSURE SETPOINTS ABOVE HAVE BEEN CONFIRMED.

8. Since the Master Control Refrigeration System is designed to operate at a floating head pressure, low head pressure may be seen at low ambient condition. For example, at a box temperature of -10°F and an outside ambient temperature of 50°F , the suction pressure should be at the neighborhood of 15 to 18 PSIG, the head pressure should be at the neighborhood of 125-150 PSIG.

Note: Do not overcharge the system!

Table 6. Preliminary Refrigerant Charges by Compressor/Line Size/Length

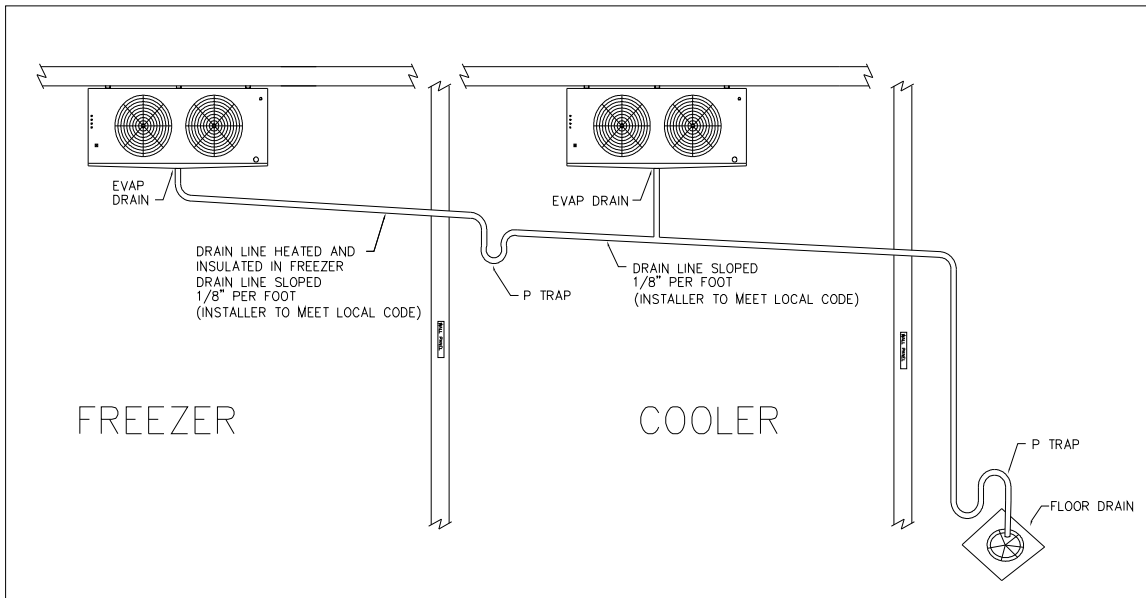
Line Size	1/2	5/8	5/8	3/8
Length	ZF13	ZF15	ZF18	CS10
5.0	3.8	4.9	5.8	3.6
10.0	4.1	5.4	6.3	3.7
15.0	4.5	5.9	6.9	3.9
20.0	4.8	6.5	7.4	4.1
25.0	5.1	7.0	7.9	4.3
30.0	5.4	7.5	8.4	4.5
50.0	6.7	9.6	10.5	5.2
75.0	8.3	12.2	13.1	6.1

Line Size	5/8	5/8	5/8	3/8
Length	ZF13	ZF15	ZF18	CS10
100.0	13.9	14.8	15.7	7.0
150.0	19.1	20.0	20.9	8.8

9. Check operating pressures while charging and on initial pulldown to prevent damage if problem occurs.

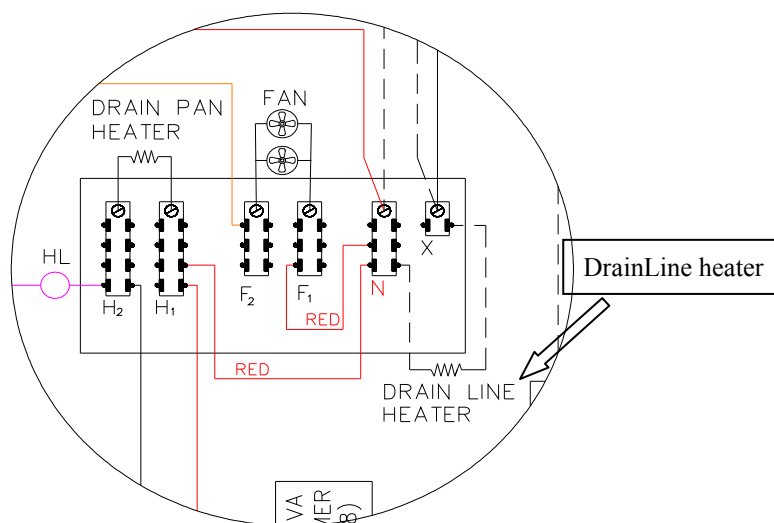
Drain Lines

- Copper lines must be used for drains. **Plastics are not acceptable.**
- Drain lines must exit the freezer or cooler as quickly as possible and must have a pitch of at least 1/8" inch/foot downward or meet the local code requirements.
- Drain lines must have individual traps for the cooler and the freezer and the trap cannot be inside the freezer.



- Drain line heater should be routed through the back (right side) of the freezer evaporator through the designated knockout and wired to "X" and "N" as shown in the diagram.
- Clip and secure the wire along the back bottom of the evaporator to the drain line.
- The drain line heater tape must be wrapped the entire drain line inside the freezer**, starting at the bottom of the evaporator coil. The heater must extend through the wall of the freezer to include the trap.
- There should be approximately 2 feet of heater tape per 1 foot of drain line with no overlapping. The heat tape should be routed in such a way that it does not contact any defrost heater or pan heater element.
- The entire length of drain lines inside both the cooler and the freezer should be wrapped with 3/4" thick Armaflex-type insulation.

***Refer to section-diagram below for wire hook-up.



Final Check List

- A. Check high-low pressure control setting for freezer unit.
Recommended Low Pressure Settings: Cut-in 26 PSIG, Cut-out 2 PSIG or Differential 24
Recommended High Pressure Setting: 400 PSIG Cut-out
- B. Check operating pressures vs. box temperature and ambient temperature.
Suction Pressure measured at around 15 PSIG when -10F box temp is reached.
Head pressure is floating but the if the TD (= Condensing Temperature – Ambient Temperature) is higher than 25 F, the system may be over charged or non-condensable gas inside the system.
- C. Check electrical requirements of unit to power supply voltage.
The power supply voltage should match the Lead Color Voltage of the 24VAC primary input voltage. If NOT, switch the leads.
- D. Set desired temperature range:
 - a. Cooler temperature is preset at 35°F cut-out, 38°F cut-in.
 - b. Freezer temperature is preset at -10°F cut-out, -5°F cut-in.
- E. Check the operating True Superheat (SH) for proper refrigeration charge.
Never use level of fullness of sight glass to determine the charging level. Always use weighing scale and Superheat Approach Charging Method mentioned above.
- F. Check compressor oil level.
- G. Check compressor crankcase heater operation.
- H. Check systems for proper defrost operation.
Adjust the defrost termination set point (dS) to clear all frost if needed.
- I. Check condensing unit for vibrating or rubbing tubing. Dampen or clamp as required.
- J. Open all valves completely counter clockwise.
- K. Check packing nuts on all service valves.
- L. Insure that all covers and panels are fully secured to the unit.
- M. Refer to the Master Controller Manual for system control.
- N. Call Factory if there's any doubt.

Periodic Check of Entire System

A periodic check of the entire system should be done at least once every 4 months. Be sure to check all electrical connections, wiring, insulators, contactors, fan motors and motor mounts, defrost heaters, and drain line heaters. The condenser coil surface, the evaporator coil surface, and the drain pan should be cleaned. Check the sequence of operations of the system, the safety controls, the defrost controls, and the drain line. Check that all flare connections are tight and tighten as required.

Sale And Disposal

Owner Responsibility

If you sell or give away your Master-Bilt walk-in or refrigeration system you must make sure that all safety labels and the proper Installation and Operations Manual are included with it. If you need replacement labels or manuals, Master-Bilt will provide them free. Contact the customer service department at Master-Bilt at (662) 534-9061.

The customer service department at Master-Bilt should be contacted at the time of sale or disposal of your walk-in or refrigeration system so records may be kept of its new location.

If you sell or give away your Master-Bilt cabinet and you evacuate the refrigerant charge before shipment, Master-Bilt recommends that the refrigerant charge be properly recovered in compliance with section 608 of the Clean Air Act effective November 1995 and in accordance with all applicable local, regional, or national standards.