

Single-Package Marine Cooling Units

Installation, Operation and Service Instructions

SAFETY CONSIDERATIONS

The 90MA/MU Units are designed to provide safe and reliable service when operated within design specifications. However, due to system pressures, electrical components, and equipment location, some aspects of installation, operation and servicing of this equipment can be hazardous.

Only trained, qualified installers and service technicians should install, operate, and service this equipment.

When working on the equipment, observe all precautions on tags or labels attached to the unit. Safety notes in the literature, and any other safety precautions that apply.

- Follow all safety codes.
- Wear safety glasses and work gloves.
- Use care in handling, rigging, and placing bulky equipment.

WARNING

Never reach into unit while fan is running. Lock open and tag power disconnect before working on a fan. Remove the fuses and take them with you after noting this on tag.

Check assembly and component weight to be sure rigging equipment can handle them safely. Note also any specific rigging instructions.

When steam cleaning coils, be sure area is clear of personnel.

GENERAL

The 90MA/MU water cooled single-package cooling units are designed to provide air conditioning aboard marine vessels. The 90MA units are fitted with a water cooled condenser and are factory charged, wired and piped. The 90MU units are similar to the 90MA except they are configured for use of a remote mounted condenser.

An accessory discharge plenum may be installed to provide free-blow into the conditioned space. Also, an optional electric heater may be specified to provide comfort heating.

INSTALLATION

Step 1 - Inspect Unit - Check unit against shipping order. Inspect carefully for concealed shipping damage. If shipment is damaged or incomplete, *file claim with transportation company and advise Carrier Transicold immediately.*

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Step 2 - Protect Unit from Damage - To maintain warranty, protect unit against adverse weather, theft, or vandalism on job site.

Step 3 - Provide Unit Support - Refer to Figure 2 and Tables 1A/B/C/2A/B/C for unit size and weight. If desired, construct a frame of I-beams or angle iron that adequately supports unit. See unit support drawings contained in this document.

TABLE 1A - 90MA/MU PHYSICAL DATA – R-134A , ENGLISH UNITS (See Table 2A for SI units)

BASE UNIT (90MA/MU)		UNITS	308	312
NOMINAL CAPACITY		Tons	5.5	8
REFRIGERANT			R-134A	
OPERATING WEIGHT				
	Base unit 90MA	Pounds	895	950
	Base Unit 90MU	Pounds	N/A	N/A
	Discharge Plenum	Pounds	50	50
COMPRESSOR TYPE			Semi-Hermetic, Recip	
	Qty Cylinders		4	6
	Qty Unloading Cylinders		0	2
	Qty Capacity Steps		1	2
DISCHARGE PRESSURE SWITCH				
	Opens (90MA)	PSIG	335+/-10	
	Closes (90MA)	PSIG	235+/-10	
	Opens (90MU)	PSIG	N/A	
	Closes (90MU)	PSIG	N/A	
SUCTION PRESSURE SWITCH				
	Opens	PSIG	7+/-3	
	Closes	PSIG	22+/-5	
REFRIGERANT				
	Type		R-134A	
	Qty (90MA ONLY)	Pounds	11.2	10
CONDENSER (90MA ONLY)				
	Number...Type		1...Tube in Tube	
	Water Volume	Gallons	2.42	
EVAPORATOR AIR FAN			Adjustable, Belt Driven Centrifugal: 1750 RPM Motor @ 60hz	
	Nominal Flow	CFM	3000	4000
	Standard Speed Range	RPM	487-690	591-838
	Maximum Allowable Speed	RPM	1250	
	Belt Qty/Pulley Pitch Diameter	Inches	1 / 8.5	1 / 7.0
	Motor Pulley Pitch Diameter Range	Inches	2.4 to 3.4 inches	
	Motor Nominal Rating (@ 60Hz)...Frame Size			
	Standard	HP	1...56	2...56
	Alternate (See Note 1)	HP	2...56	3...56
	Alternate (See Note 1)	HP	3...56	N/A
EVAPORATOR COIL			3/8 OD, Copper Tubes, Aluminum Fin	
	Tube Type		Prime	
	Qty Rows...Fin Spacing	Fins/Inch	3...12.5	
	Face Area	Sq Ft	7.3	8.5
RETURN AIR FILTERS			Factory Supplied, Cleanable	
	Qty...Size	Inches	4...16 x 20 x 1	
CONDENSER CONNECTIONS (90MA ONLY)				
	Water Inlet (bottom)	Inches FPT	1	1
	Water Outler (top)	Inches FPT	1	1
	Maximum Working Pressure (Refrigerant Side)	PSIG	400	
CONDENSATE DRAIN CONNECTIONS		Inches FPT	3/4	
ACCESSORY ELECTRIC HEAT				
	Capacity @ 460 volts	Watts	17.5	
	Capacity @ 400 volts	Watts	13.4	
	Number of Electric Heat Stages		2	

LEGEND

FPT = Female Pipe Thread MPT = Male Pipe Thread ODF = Outside Diameter Female

NOTES:

1. Motors other than those furnished with unit must be purchased separately. Contact your Carrier Marine representative

TABLE 1B - 90MA/MU PHYSICAL DATA – R-407C , ENGLISH UNITS (See Table 2B for SI units)

BASE UNIT (90MA/MU)	UNITS	404	406	408	412
NOMINAL CAPACITY	Tons	3	5	7.5	10
REFRIGERANT		R-407C			
OPERATING WEIGHT					
Base unit 90MA	Pounds	390	427	895	950
Base Unit 90MU	Pounds	330	360	835	890
Discharge Plenum	Pounds	25	25	50	50
COMPRESSOR TYPE		Scroll		Semi-Hermetic, Recip	
Qty Cylinders		N/A		4	6
Qty Unloading Cylinders		N/A		0	2
Qty Capacity Steps		1		1	2
DISCHARGE PRESSURE SWITCH					
Opens (90MA)	PSIG	395+/-10			
Closes (90MA)	PSIG	295+/-10			
Opens (90MU)	PSIG	426+/-7			
Closes (90MU)	PSIG	320+/-20			
SUCTION PRESSURE SWITCH					
Opens	PSIG	27+/-4			
Closes	PSIG	67+/-4			
REFRIGERANT					
Type		R-407C			
Qty (90MA ONLY)	Pounds	3.1	5.3	11.2	10.0
CONDENSER (90MA ONLY)					
Number...Type		1...Tube in Tube			
Water Volume	Gallons	0.39	0.86	2.42	
EVAPORATOR AIR FAN		Adjustable, Belt Driven Centrifugal: 1750 RPM Motor @ 60hz			
Nominal Flow	CFM	1200	2000	3000	4000
Standard Speed Range	RPM	647-914	647-915	487-690	591-838
Maximum Allowable Speed	RPM	1250			
Belt Qty/Pulley Pitch Diameter	Inches	1 / 6.4	1 / 6.4	1 / 8.5	1 / 7.0
Motor Pulley Pitch Diameter Range	Inches	2.4 to 3.4 inches			
Motor Nominal Rating (@ 60Hz)...Frame Size					
Standard	HP	1/3...56	3/4...56	1...56	2...56
Alternate (See Note 1)	HP	3/4...56	1...56	2...56	3...56
Alternate (See Note 1)	HP	N/A	N/A	3...56	N/A
EVAPORATOR COIL		3/8 OD, Copper Tubes, Aluminum Fin			
Tube Type		Prime			
Qty Rows...Fin Spacing	Fins/Inch	2...14.4	3...14.4	3...12.5	
Face Area	Sq Ft	5	5	7.3	8.5
RETURN AIR FILTERS		Factory Supplied, Cleanable			
Qty...Size	Inches	2...16 x 25 x 1		4...16 x 20 x 1	
CONDENSER CONNECTIONS (90MA ONLY)					
Water Inlet (bottom)	Inches FPT	1/2	3/4	1	1
Water Outlet (top)	Inches FPT	1/2	3/4	1	1
Maximum Working Pressure (Refrigerant Side)	PSIG	400			
CONDENSATE DRAIN CONNECTIONS	Inches FPT	3/4			
ACCESSORY ELECTRIC HEAT					
Capacity @ 460 volts	Watts	5.25		17.5	
Capacity @ 400 volts	Watts	4.03		13.4	
Number of Electric Heat Stages		1		2	

LEGEND

FPT = Female Pipe Thread MPT = Male Pipe Thread ODF = Outside Diameter Female

NOTES:

1. Motors other than those furnished with unit must be purchased separately. Contact your Carrier Marine representative

TABLE 1C - 90MA/MU PHYSICAL DATA – R-404A , ENGLISH UNITS (See Table 2C for SI units)

BASE UNIT (90MA/MU)	UNITS	504	506	508	512
NOMINAL CAPACITY	Tons	3	5	7.5	10
REFRIGERANT		R-404A			
OPERATING WEIGHT					
Base unit 90MA	Pounds	390	427	895	950
Base Unit 90MU	Pounds	330	360	835	890
Discharge Plenum	Pounds	25	25	50	50
COMPRESSOR TYPE		Scroll		Semi-Hermetic, Recip	
Qty Cylinders		N/A		4	6
Qty Unloading Cylinders		N/A		0	2
Qty Capacity Steps		1		1	2
DISCHARGE PRESSURE SWITCH					
Opens (90MA)	PSIG	395+/-10			
Closes (90MA)	PSIG	295+/-10			
Opens (90MU)	PSIG	426+/-7			
Closes (90MU)	PSIG	320+/-20			
SUCTION PRESSURE SWITCH					
Opens	PSIG	27+/-4			
Closes	PSIG	67+/-4			
REFRIGERANT					
Type		R-404A			
Qty (90MA ONLY)	Pounds	3.1	5.3	11.2	10.0
CONDENSER (90MA ONLY)					
Number...Type		1...Tube in Tube			
Water Volume	Gallons	0.39	0.86	2.42	
EVAPORATOR AIR FAN		Adjustable, Belt Driven Centrifugal: 1750 RPM Motor @ 60hz			
Nominal Flow	CFM	1200	2000	3000	4000
Standard Speed Range	RPM	647-915	647-915	487-690	591-838
Maximum Allowable Speed	RPM	1250			
Belt Qty/Pulley Pitch Diameter	Inches	1 / 6.4	1 / 6.4	1 / 8.5	1 / 7.0
Motor Pulley Pitch Diameter Range	Inches	2.4 to 3.4 inches			
Motor Nominal Rating (@ 60Hz)...Frame Size					
Standard	HP	1/3...56	3/4...56	1...56	2...56
Alternate (See Note 1)	HP	3/4...56	1...56	2...56	3...56
Alternate (See Note 1)	HP	N/A	N/A	3...56	N/A
EVAPORATOR COIL		3/8 OD, Copper Tubes, Aluminum Fin			
Tube Type		Prime			
Qty Rows...Fin Spacing	Fins/Inch	2...14.4	3...14.4	3...12.5	
Face Area	Sq Ft	5	5	7.3	8.5
RETURN AIR FILTERS		Factory Supplied, Cleanable			
Qty...Size	Inches	2...16 x 25 x 1		4...16 x 20 x 1	
CONDENSER CONNECTIONS (90MA ONLY)					
Water Inlet (bottom)	Inches FPT	1/2	3/4	1	1
Water Outlet (top)	Inches FPT	1/2	3/4	1	1
Maximum Working Pressure (Refrigerant Side)	PSIG	400			
CONDENSATE DRAIN CONNECTIONS	Inches FPT	3/4			
ACCESSORY ELECTRIC HEAT					
Capacity @ 460 volts	Watts	5.25		17.5	
Capacity @ 400 volts	Watts	4.03		13.4	
Number of Electric Heat Stages		1		2	

LEGEND

FPT = Female Pipe Thread MPT = Male Pipe Thread ODF = Outside Diameter Female

NOTES:

1. Motors other than those furnished with unit must be purchased separately. Contact your Carrier Marine representative

TABLE 2A - 90MA/MU PHYSICAL DATA – R-134A , SI UNITS

BASE UNIT (90MA/MU)	UNITS	308	312
NOMINAL CAPACITY	kW	19.3	28.1
REFRIGERANT		R-134A	
OPERATING WEIGHT			
Base unit 90MA	kg	406	431
Base Unit 90MU	kg	N/A	N/A
Discharge Plenum	kg	22.7	22.7
COMPRESSOR TYPE		Semi-Hermetic, Recip	
Qty Cylinders		4	6
Qty Unloading Cylinders		0	2
Qty Capacity Steps		1	2
DISCHARGE PRESSURE SWITCH			
Opens (90MA)	kPa	2310+/-69	
Closes (90MA)	kPa	1620+/-138	
Opens (90MU)	kPa	N/A	
Closes (90MU)	kPa	N/A	
SUCTION PRESSURE SWITCH			
Opens	kPa	48+/-12	
Closes	kPa	152+/-35	
REFRIGERANT			
Type		R-134A	
Qty (90MA ONLY))	kg	5.1	4.5
CONDENSER (90MA ONLY)			
Number...Type		1...Tube in Tube	
Water Volume	Liter	9.2	
EVAPORATOR AIR FAN		Adjustable, Belt Driven Centrifugal:1750 RPM Motor @60hz	
Nominal Flow	m3/hr	4245	5660
Standard Speed Range	RPM	402-570	488-692
Maximum Allowable Speed	RPM	1250	
Belt Qty/Pulley Pitch Diameter	cm	1 / 21.6	1 / 17.8
Motor Pulley Pitch Diameter Range	cm	6.1 to 8.6 cm	
Motor Nominal Rating (@ 60Hz)...Frame Size			
Standard	kW	0.75...56	1.5...56
Alternate (SeeNote 1)	kW	1.5...56	2.2...56
Alternate (See Note 1)	kW	2.2...56	N/A
EVAPORATOR COIL		3/8 OD, Copper Tubes, Aluminum Fin	
Tube Type		Prime	
Qty Rows...Fin Spacing	Fins/cm	3...4.9	
Face Area	m2	0.68	0.79
RETURN AIR FILTERS		Factory Supplied, Cleanable	
Qty...Size	cm	4...40.6 x 50.8 x 2.5	
CONDENSER CONNECTIONS (90MA ONLY)			
Water Inlet (bottom)	Inches FPT	1	1
Water Outlet (top)	Inches FPT	1	1
Maximum Working Pressure (Refrigerant Side)	kPa	2758	
CONDENSATE DRAIN CONNECTIONS	Inches FPT	3/4	
ACCESSORY ELECTRIC HEAT			
Capacity @ 460 volts	kW	17.5	
Capacity @ 400 volts	kW	13.4	
Number of Electric Heat Stages		2	

LEGEND

FPT = Female Pipe Thread MPT = Male Pipe Thread ODF = Outside Diameter Female

NOTES:

1. Motors other than those furnished with unit must be purchased separately. Contact your Carrier Marine representative

TABLE 2B - 90MA/MU PHYSICAL DATA – R-407C , SI UNITS

BASE UNIT (90MA/MU)		UNITS	404	406	408	412
NOMINAL CAPACITY		kW	10.5	17.6	26.4	35.1
REFRIGERANT			R-407C			
OPERATING WEIGHT						
	Base unit 90MA	kg	177	194	406	431
	Base Unit 90MU	kg	150	163	379	404
	Discharge Plenum	kg	11.3	11.3	22.7	22.7
COMPRESSOR TYPE			Scroll		Semi-Hermetic, Recip	
	Qty Cylinders		N/A		4	6
	Qty Unloading Cylinders		N/A		0	2
	Qty Capacity Steps		1		1	2
DISCHARGE PRESSURE SWITCH						
	Opens (90MA)	kPa	2725+/-69			
	Closes (90MA)	kPa	2034+/-138			
	Opens (90MU)	kPa	2937+/-48			
	Closes (90MU)	kPa	2206+/-138			
SUCTION PRESSURE SWITCH						
	Opens	kPa	186+/-28			
	Closes	kPa	462+/-48			
REFRIGERANT						
	Type		R-407C			
	Qty (90MA ONLY))	kg	1.4	2.4	5.1	4.5
CONDENSER (90MA ONLY)						
	Number...Type		1...Tube in Tube			
	Water Volume	Liter	1.48	3.3	9.2	
EVAPORATOR AIR FAN			Adjustable, Belt Driven Centrifugal: 1750 RPM Motor @60hz			
	Nominal Flow	m3/hr	1698	2830	4245	5660
	Standard Speed Range	RPM	534-757	534-757	402-570	488-692
	Maximum Allowable Speed	RPM	1250			
	Belt Qty/Pulley Pitch Diameter	cm	1 / 16.3	1 / 16.3	1 / 21.6	1 / 17.8
	Motor Pulley Pitch Diameter Range	cm	6.1 to 8.6 cm			
	Motor Nominal Rating (@ 60Hz)...Frame Size					
	Standard	kW	0.25...56	0.56...56	0.75...56	1.5...56
	Alternate (See Note 1)	kW	0.56...56	0.75...56	1.5...56	2.2...56
	Alternate (See Note 1)	kW	N/A	N/A	2.2...56	N/A
EVAPORATOR COIL			3/8 OD, Copper Tubes, Aluminum Fin			
	Tube Type		Prime			
	Qty Rows...Fin Spacing	Fins/cm	2...5.7	3...5.7	3...4.9	
	Face Area	m2	0.46	0.46	0.68	0.79
RETURN AIR FILTERS			Factory Supplied, Cleanable			
	Qty...Size	cm	2...40.6 x 63.5 x 2.5		4...40.6 x 50.8 x 2.5	
CONDENSER CONNECTIONS (90MA ONLY)						
	Water Inlet (bottom)	Inches FPT	1/2	3/4	1	1
	Water Outlet (top)	Inches FPT	1/2	3/4	1	1
	Maximum Working Pressure (Refrigerant Side)	kPa	2758			
CONDENSATE DRAIN CONNECTIONS		Inches FPT	3/4			
ACCESSORY ELECTRIC HEAT						
	Capacity @ 460 volts	kW	5.25		17.5	
	Capacity @ 400 volts	kW	4.03		13.4	
	Number of Electric Heat Stages		1		2	

LEGEND

FPT = Female Pipe Thread MPT = Male Pipe Thread ODF = Outside Diameter Female

NOTES:

1. Motors other than those furnished with unit must be purchased separately. Contact your Carrier Marine representative

TABLE 2C - 90MA/MU PHYSICAL DATA – R-404A , SI UNITS

BASE UNIT (90MA/MU)	UNITS	504	506	508	512
NOMINAL CAPACITY	kW	10.5	17.6	26.4	35.1
REFRIGERANT		R-404A			
OPERATING WEIGHT					
Base unit 90MA	kg	177	194	406	431
Base Unit 90MU	kg	150	163	379	404
Discharge Plenum	kg	11.3	11.3	22.7	22.7
COMPRESSOR TYPE		Scroll		Semi-Hermetic, Recip	
Qty Cylinders		N/A		4	6
Qty Unloading Cylinders		N/A		0	2
Qty Capacity Steps		1		1	2
DISCHARGE PRESSURE SWITCH					
Opens (90MA)	kPa	2725+/-69			
Closes (90MA)	kPa	2034+/-138			
Opens (90MU)	kPa	2937+/-48			
Closes (90MU)	kPa	2206+/-138			
SUCTION PRESSURE SWITCH					
Opens	kPa	186+/-28			
Closes	kPa	462+/-48			
REFRIGERANT					
Type		R-404A			
Qty (90MA ONLY)	kg	1.4	2.4	5.1	4.5
CONDENSER (90MA ONLY)					
Number...Type		1...Tube in Tube			
Water Volume	Liter	1.48	3.3	9.2	
EVAPORATOR AIR FAN		Adjustable, Belt Driven Centrifugal: 1750 RPM Motor@60hz			
Nominal Flow	m3/hr	1698	2830	4245	5660
Standard Speed Range	RPM	534-757	534-757	402-570	488-692
Maximum Allowable Speed	RPM	1250			
Belt Qty/Pulley Pitch Diameter	cm	1 / 16.3	1 / 16.3	1 / 21.6	1 / 17.8
Motor Pulley Pitch Diameter Range	cm	6.1 to 8.6 cm			
Motor Nominal Rating (@ 60Hz)...Frame Size					
Standard	kW	0.25...56	0.56...56	0.75...56	1.5...56
Alternate (See Note 1)	kW	0.56...56	0.75...56	1.5...56	2.2...56
Alternate (See Note 1)	kW	N/A	N/A	2.2...56	N/A
EVAPORATOR COIL		3/8 OD, Copper Tubes, Aluminum Fin			
Tube Type		Prime			
Qty Rows...Fin Spacing	Fins/cm	2...5.7	3...5.7	3...4.9	
Face Area	m2	0.46	0.46	0.68	0.79
RETURN AIR FILTERS		Factory Supplied, Cleanable			
Qty...Size	cm	2...40.6 x 63.5 x 2.5		4...40.6 x 50.8 x 2.5	
CONDENSER CONNECTIONS (90MA ONLY)					
Water Inlet (bottom)	Inches FPT	1/2	3/4	1	1
Water Outlet (top)	Inches FPT	1/2	3/4	1	1
Maximum Working Pressure (Refrigerant Side)	kPa	2758			
CONDENSATE DRAIN CONNECTIONS	Inches FPT	3/4			
ACCESSORY ELECTRIC HEAT					
Capacity @ 460 volts	kW	5.25		17.5	
Capacity @ 400 volts	kW	4.03		13.4	
Number of Electric Heat Stages		1		2	

LEGEND

FPT = Female Pipe Thread MPT = Male Pipe Thread ODF = Outside Diameter Female

NOTES:

1. Motors other than those furnished with unit must be purchased separately. Contact your Carrier Marine representative

Step 4 - Rig and Place Unit -

NOTE: Install accessories before placing unit.

- a. Provide space around unit for service, filter access, and overhead clearance as indicated in Figure 2.
- b. Move and store unit in upright position.
- c. Use slings with spacer under base skid to prevent panel damage when using hoist.
- d. Units as shipped are adequately dampened against vibration. If additional dampening is desired, place sponge rubber or rubber mat, between deck and base of unit or install vibration isolators.
- e. Unit should be level. Unit leveling tolerance is 1/8 in. per linear ft in any direction.

Step 5 - Install Accessory Plenum (If Supplied) - Use plenum as template to mark hole locations in top panel. Drill 0.154-in. holes in top panel at marked locations and attach plenum with screws supplied.

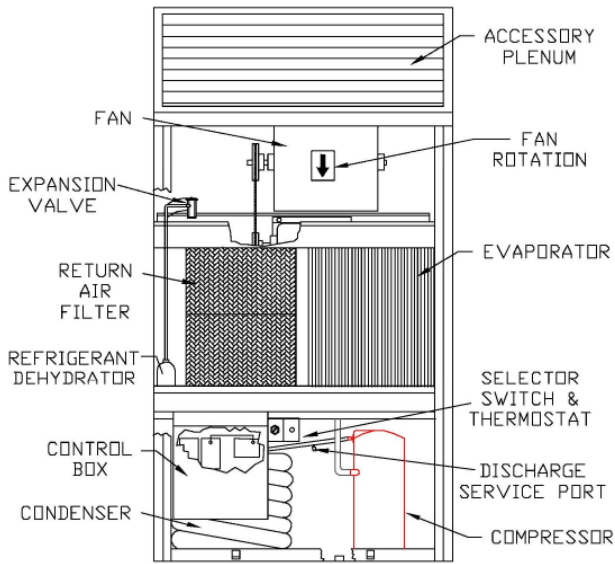


FIGURE 1 - BASE UNIT INTERIOR DETAILS (TYPICAL UNIT SHOWN)

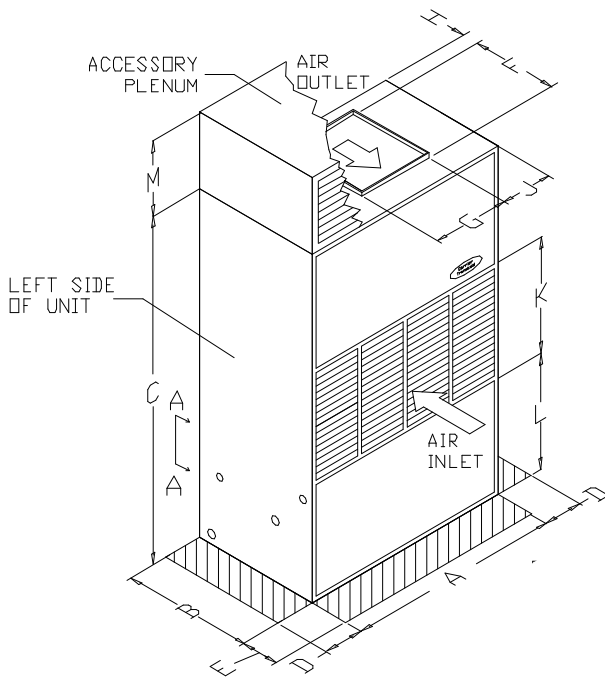
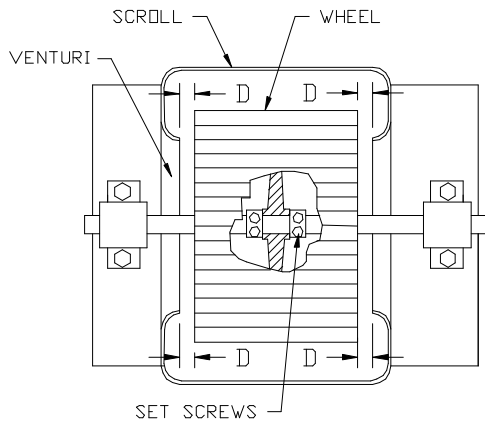


FIGURE 2 - UNIT DIMENSIONS

UNIT	*04	*06	*08,*12
A	36.13(918)		48.26(1226)
B	21.63(549)		29.88(759)
C	59.25(1505)		72.00(1828)
D	SEE NOTE 2		
E	24(51)		
F	11.25(286)	13.50(343)	15.63(397)
G	13.00(330)	15.50(394)	18.38(466)
H	0.75(19)	0.75(19)	1.00(25)
J	11.59(294)	10.34(263)	11.37(289)
K	17.13(435)		24.20(615)
L	20.38(519)		25.50(646)
M	17.11(435)		17.11(435)

NOTES:

- 1. Certified dimension drawings available upon request
- 2. Minimum required clearance at back of unit is zero. Clearance above and at right (90MA*08,*12 only) and at left of unit depends on space required for accessory plenum, ductwork, condenser piping, accessory heater piping, condensate drain line and power wiring
- 3. Water connections are located on left side of unit (Refer to "Make Condenser Connections", Condensate drain connections are located on left side of unit for *04 & *06, and on both sides of unit for *08 & *12.



DIMENSION "D" MUST BE
EQUAL ALL AROUND

FIGURE 3 - HORIZONTAL WHEEL CENTERING

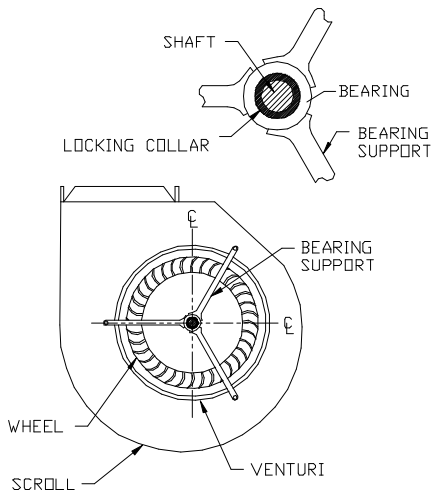


FIGURE 4 - CONCENTRIC WHEEL ALIGNMENT

Step 6 – Check Fan Shaft and Wheel Alignment-
HORIZONTAL WHEEL CENTERING - All wheels must be horizontally centered between the inside edges of their fan scroll venturi (Figure. 3).

Adjust as follows:

- Loosen set screws holding wheel to shaft.
- Center the wheel by sliding it horizontally.
- Re-tighten set screws.

CONCENTRIC ALIGNMENT - Shaft and wheels must be concentrically centered with the venturi (Figure. 4). Shaft bearings are supported by bearing supports. If shaft and wheels are concentrically misaligned from shipping shock, it is possible to re-bend bearing support arms to original positions. Replace the bearing support if it has been extensively damaged during shipping.

Step 7 - Install Ventilation-Air Ductwork (If required)- Connect ventilation ducts to flanges on outside-air supply opening (Figure. 2) using a flexible connection. Attach ductwork to ship structure, insulate and cover with vapor barrier to reduce sound transmission and prevent vapor condensation.

Weatherproof external ductwork, joints, and openings in accordance with applicable codes. Ducts passing through an unconditioned space must be insulated and covered with a vapor barrier.

Step 8 - Check Return-Air Filters - Ensure filters shipped with unit are in place. Never operate unit without return air filters in place.

Step 9 - Check Compressor Spring Mounts (*08 & *12 size only) - The compressors are held rigid in shipment by bolts extending through a washer, grommet and compressor foot into a weld nut.

Loosen each bolt (4 per compressor) until compressor floats freely on springs. Then re-tighten bolts until there is slight pressure on the neoprene gasket. This will steady the compressor and prevent start and stop rocking.

The compressors have reversible oil pumps that operate in either direction; therefore, the direction of rotation need not be checked.

Step 10 - Make Condenser Connections

UNIT MOUNTED 90MA UNITS- Piping arrangements for condenser cooling water are shown in Figure. 5. Condensers have water inlet and outlet connections as shown in Figure 6.

Connect condenser water supply and return lines as indicated. When connecting water lines, hold the condenser inlet and outlet stubs firmly with a wrench at the female pipe thread hex fitting to prevent twisting. Do not use water lines smaller than connection sizes shown in Figure 6. Observe all applicable plumbing and sanitary codes.

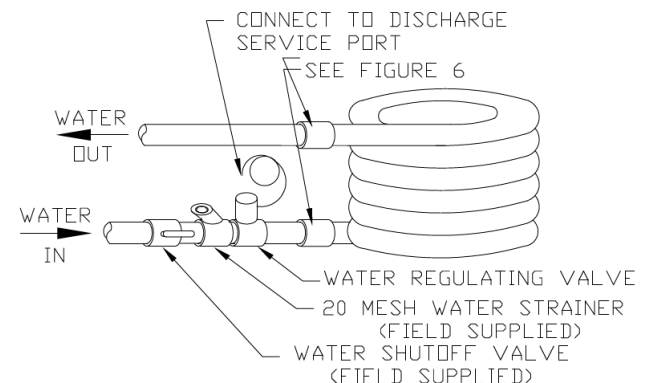


FIGURE 5 - TYPICAL CONDENSER WATER PIPING

Install water-regulating valve in water supply line outside cabinet as follows.

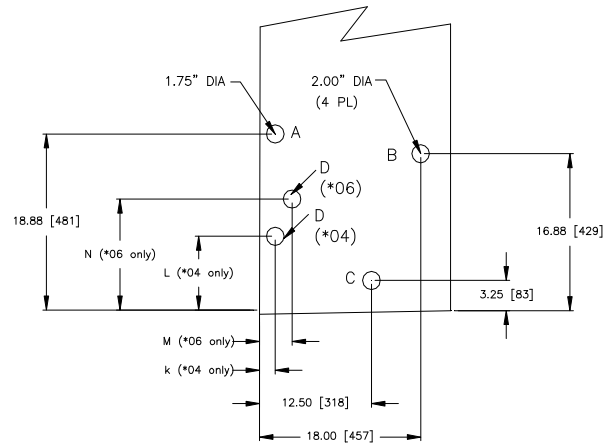
- Route regulating valve capillary with its flare nut to the fitting on refrigerant discharge line (Figure. 1), using

- any convenient unused opening on side of unit. Use a grommet in panel to prevent chafing of capillary.
- Remove cap from discharge line fitting.
 - Remove cotter pin taped to discharge line fitting. Insert pin, split end first, into regulating valve flare
 - Hold flare tightly against fitting while connecting flare nut. Round end of cotter pin will depress core of fitting. The opened fitting allows refrigerant pressure to act on water regulating valve. Tighten nut to prevent leakage. Fitting automatically seals when nut is removed.

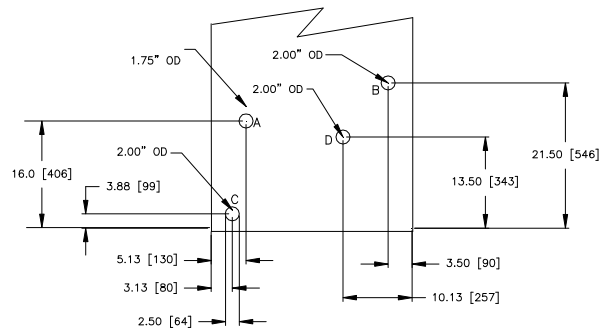
90MU UNITS-Install remote mounted condenser in accordance with the installation instructions provided with condenser. Recommended line sizes are given in Table 3. Additional instructions can be found in Carrier System Design Manual, Part 3, for standard refrigeration piping techniques. On *08 and *12 size units, secure discharge line to bracket at unit outlet using proper clamp from supplied fastener package

Condenserless (90MU) units are shipped with a refrigerant holding charge. After refrigerant connections are made, leak test, reclaim refrigerant, evacuate, and charge system as described in "Service, Charging The System".

90MA*04/*06 UNITS



90MA*08/*12 UNITS



- A = Condensate, 3/4 inch Female Pipe Thread,
- B = Electrical Opening,
- C = Condenser In, 1 inch FPT,
- D = Condenser Out, 1 Inch FPT

FIGURE 6 - CONNECTION LOCATIONS

TABLE 3 - RECOMMENDED LINE SIZES (INCHES) REMOTE CONDENSERS

UNIT 90MU	REFRIGERANT TYPE	LENGTH OF RUN							
		0-25		26-50		51-75		76-100	
		DISCH	LIQUID	DISCH	LIQUID	DISCH	LIQUID	DISCH	LIQUID
404	R-407C	1/2	3/8	5/8	3/8	5/8	3/8	5/8	3/8
406	R-407C	5/8	3/8	3/4	3/8	3/4	3/8	3/4	3/8
408	R-407C	3/4	1/2	3/4	1/2	7/8	1/2	7/8	1/2
412	R-407C	7/8	1/2	7/8	1/2	7/8	1/2	1-1/8	5/8
504	R-404A	5/8	3/8	5/8	3/8	3/4	3/8	3/4	3/8
506	R-404A	3/4	1/2	3/4	1/2	7/8	1/2	7/8	1/2
508	R-404A	7/8	1/2	7/8	1/2	1-1/8	1/2	1-1/8	5/8
512	R-404A	7/8	5/8	1-1/8	5/8	1-1/8	5/8	1-1/8	5/8

* Recommended line sizes correspond to 2 degree F drop.

NOTES:

1. Pipe sizes should never be smaller than cooling unit connection size.
2. Table is based on 2 degree F drop over entire length. Excessive (more than a few) elbows and fittings will significantly affect pressure drop. If this situation exists, line sizing must be re-calculated.

Step 11 - Install Unit Drain Line - Install a trapped condensate drain line at unit drain connection. The drain requires standard pipe connected to condensate pan nipple(s). Figure 7 shows proper trap design.

Determine design negative static pressure. This pressure is not the same as fan total static pressure, which includes pressure losses downstream as well as upstream from the evaporator air fan. Always assume the worst conditions, such as having return air filters clogged with debris.

Referring to Figure 7, differential 1 must be equal to or larger than negative static pressure at design operating condition. Store enough water in trap to prevent losing seal. Differential 2 must be equal to or larger than one-half the maximum negative static pressure. To avoid loss of seal when the fan starts, differential 3 must be greater than the maximum negative static pressure.

Do not use drain line smaller than 3/4 inch. Use hole(s) provided in panel for drain line. Pitch drain line downward toward scupper. Installation of a plugged tee is recommended for cleaning. Fill trap with water to make an air seal. Observe all sanitary requirements.

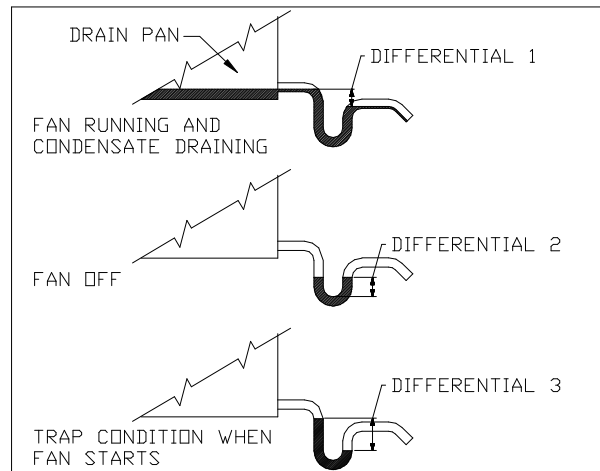


FIGURE 7 - CONDENSATE DRAIN TRAP

Step 12 - Make Electrical Connections

GENERAL - Provide an adequate fused disconnect switch within sight of the unit. Provision for locking switch open (OFF) is advisable to prevent power from being turned on when unit is being serviced.

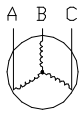
POWER WIRING - Conduit opening for all units is on left side of unit near control box. Connect field power wires at the compressor contactor.

Supply voltage must be in accordance with nameplate voltage. Voltage between phases must be balanced within 2% and current within 10% with compressor running. Correct improper voltage or phase imbalance. Unit failure as a result of operation on improper line voltage or excessive phase imbalance constitutes abuse and shall void the Carrier warranty. Use the following formula to determine the percent voltage imbalance.

DETERMINE PERCENT OF VOLTAGE IMBALANCE

$$\% = 100 \times \frac{\text{MAX DEVIATION FROM AVERAGE VOLTAGE}}{\text{AVERAGE VOLTAGE}}$$

EXAMPLE: SUPPLY VOLTAGE IS 460-3-60 AND
AB = 452v BC = 464v AC = 455v



$$\begin{aligned} \text{AVERAGE VOLTAGE} &= \frac{425 + 464 + 455}{3} \\ &= \frac{1371}{3} = 457 \end{aligned}$$

DETERMINE MAXIMUM DEVIATION FROM
AVERAGE VOLTAGE

$$\begin{aligned} \langle \text{AB} \rangle & 457 - 452 = 5\text{v} \\ \langle \text{BC} \rangle & 464 - 457 = 7\text{v} \\ \langle \text{AC} \rangle & 457 - 455 = 2\text{v} \end{aligned}$$

MAXIMUM DEVIATION IS 7 VOLTS.

DETERMINE PERCENT OF IMBALANCE:

$$\% = 100 \times \frac{7}{457} = 1.53\%$$

THIS AMOUNT OF PHASE IMBALANCE IS SATISFACTORY AS IT IS BELOW THE MAXIMUM ALLOWABLE 2 PERCENT.

CONTROL WIRING - On extended voltage (208/230-v) units, the control transformer is factory wired for 208-v usage. If unit is to be used on 230-v system, reconnect primary wiring on transformer. See Figure 12 (90MA*04/*06) or figure 14 (90MA*08/*12).

On all units, the thermostat is factory installed. A sensing element is provided in the return air. To wire these units to a remote thermostat, or to a remote control switch and thermostat, refer to unit Wiring Diagram or contact your Carrier Transicold representative.

OPERATION

CAUTION

Compressor crankcase heater must be energized for 24 hours prior to startup to prevent compressor bearing damage.

To start unit:

1. Thoroughly inspect exterior of unit. Clean and dust up debris, then wash with mild soap and water solution.
2. On 90MA*08 &*12 units, ensure compressor discharge, suction and liquid service valves are open. (Refer to "Operation - Service Valves.") Check oil level in compressor sight glass. If level is below glass, add oil to bring level to approximately 1/4 glass. If level is above bottom of glass, do not remove any oil until the crankcase heater has been energized for at least twenty-four hours.
3. With selector switch in OFF position, turn main power on. Leave power on for 24 hours so that crankcase heater can drive off accumulated refrigerant.
4. If desired, the selector switch may be placed in the FAN position during the crankcase warm-up period. On first start-up, check fan speed (Tables 1A/B/C/2A/B/C) and rotation (Figure 1). If fan requires adjustment, refer to "Service, Evaporator-Fan Adjustment".
5. Allow crankcase heater to remain energized (unit power on) for at least 24 hours. Open any valves in condenser cooling water supply lines and then set selector switch at COOL position. If room temperature is above thermostat setting compressor will start. On first start-up, set water regulating valve. (Refer to "Service, Water Regulating Valve.")
6. Set thermostat for comfort as desired.

To Shut Down Unit:

1. Turn selector switch to OFF position. Do not shut off main power except to service unit. The crankcase heater is operative only when main power is on. (Refer to "Service, Crankcase Heater").
2. If unit is to be used for winter heating, set selector switch at HEAT position and re-set thermostat at desired setting.
3. If unit may be exposed to freezing temperatures, drain water from condenser and water piping. Add a non-corrosive antifreeze to residual water in system.

Service Valves - Always ensure that compressor suction, and discharge service valves and liquid service valve are open before operating unit.

The valves are accessible from the front of the unit. To open valve, turn counterclockwise. After opening, replace and tighten valve cap to prevent leakage.

SERVICE

WARNING

NEVER reach into unit while fan is running. LOCK OPEN AND TAG unit disconnect before working on fan. Remove fuses and take them with you after noting this on tag.

CAUTION

1. Sharp edges of coil fins are exposed. To prevent injury, cover top of evaporator with cardboard or a few layers of heavy tape.
2. To avoid coil damage, cover evaporator face with plywood or other rigid sheet material. If any coil fins are mashed or bent, straighten with a coil fin comb of the proper tooth spacing (refer to "coil fins/inch" in Table 1). Check for refrigerant leaks.

Return-Air Grille Removal

1. Pull grille out from top.
2. Pull grille up to release hinge pins from lower panel.
3. To reassemble, reverse procedure.

Access Panel Removal - Remove return-air grille as described above.

Remove the panel fastening screws now exposed.
TOP PANEL - Pull out and down.
BOTTOM - Pull out and up.

Evaporator Fan Adjustment - Observe fan compartment Caution note above. The fan motor pulleys are factory set at the fan speeds listed in Table 1.

TO CHANGE FAN SPEED

1. Shut off unit power supply.
2. Loosen fan belt by loosening fan motor from mounting bracket. Do not loosen fan motor mounting bracket from unit.
3. Loosen movable pulley flange set screw (Figure. 8).
4. Screw movable flange toward fixed flange to increase fan speed and away from fixed flange to decrease speed. Increasing fan speed increases load on motor. Do not exceed maximum allowable fan speed (Tables 1A/B/C/2A/B/C) or motor full load amps indicated on motor nameplate.
5. Set movable flange set screw at nearest flat of pulley hub and tighten set screw.

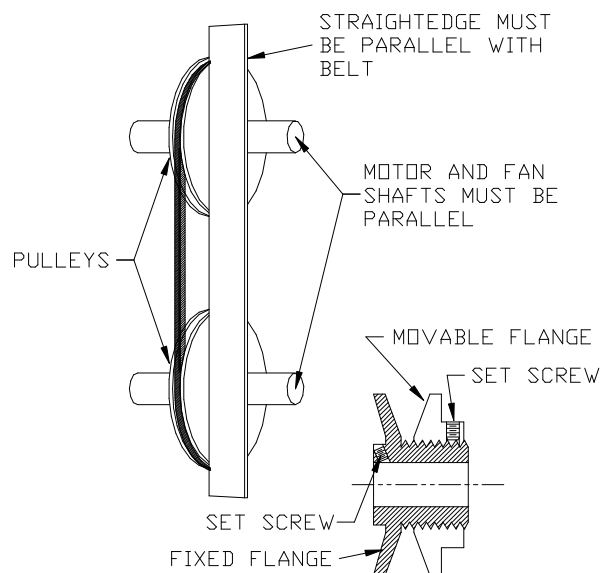


FIGURE 8 - FAN PULLEY ADJUSTMENT

6. Check pulley alignment and belt tension adjustment as described below.
7. Check fan operation. Repeat above procedure as required.

PULLEY ALIGNMENT - Shut off unit power supply. Loosen fan motor pulley set screws and slide fan pulley along fan shaft. Make angular alignment by loosening motor from mounting bracket (See Figure. 8).

BELT TENSION ADJUSTMENT - Shut off unit power supply. Loosen fan motor from mounting bracket. Do not loosen motor mounting bracket from unit. Move fan motor up or down until proper belt tension is achieved (approximately 3/4-in. deflection with 8-pound tension at midpoint of belt span).

Lubrication - Fan motor and fan shaft bearings are lubricated for the life of the bearings. No re-lubrication is required

Return-Air Filters - Inspect filters twice monthly and clean as required by operating conditions. Filter size and type are listed in Tables 1A/B/C/2A/B/C. To clean filters flush with hot water or steam or soak in a mild water solution of soap or detergent. Refer to filter manufacturer's instructions as applicable.

Do not operate unit without return-air filters in place.

Condensate Drains - Clean the drain line and unit drain pan at the start of each cooling season. Check flow by pouring water into drain. Be sure trap is filled as shown in Figure. 7 to maintain an air seal.

Evaporator Coil - Observe fan compartment Caution note at the beginning of the Service section.

Remove dirt and debris from evaporator coil as required by condition. Clean coil with a stiff brush, vacuum cleaner or compressed air. Use a fin comb of the correct tooth spacing (Refer to Tables 1A/B/C/2A/B/C for coil fins/inch) when straightening mashed or bent coil fins.

Water Regulating Valve

PREPARATION FOR OPERATION.

1. Open the water regulating valve inlet and outlet isolation valves.
2. Close the water regulating valve bypass valve.

ADJUSTMENT

NOTE: Adjustments to the water regulating valve must be made slowly, allowing ample time for response and stabilization.

1. The compressor discharge pressure is controlled by the water regulating valve and may be monitored by observing liquid line pressure.
2. Install a calibrated gauge at the liquid line service port.
FOR 90MA: Operating liquid line range for R-407C units is 200 to 215 psig, operating range for R-404A units is 240 to 260 psig, operating range for R-134a units is 122 to 130 psig.
FOR 90MU : Operating liquid line range for R-407C units is 265 to 285 psig, operating range for R-404A units is 290 to 315 psig, If pressure reading is below operating range, rotate the square head adjusting screw counterclockwise; this will increase spring tension, decrease water flow and increase pressure. If pressure reading is above operating range, rotate the square head adjusting screw clockwise; this will decrease spring tension, increase water flow and decrease pressure.
3. Only the water regulating valve opening point is adjustable. The closing point is 3 to 7 psig below the opening point and is non-adjustable.

Condenser - Condensers may require cleaning of water-deposited scale.

CAUTION

Follow all Safety codes. Wear safety glasses and rubber gloves when using inhibited hydrochloric acid solution.

Clean condensers with an inhibited hydrochloric acid solution. The acid can stain hands and clothing, attack concrete and, without inhibitor, can attack steel. Cover surroundings to guard against splashing. Vapors from vent pipe are not harmful, but take care to prevent liquid from being carried over by the gases.

Warm solution acts faster, but cold solution is just as effective if applied for a longer period.

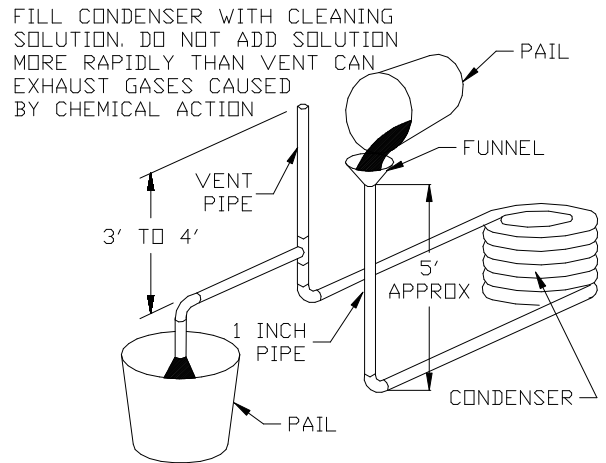


FIGURE 9 - GRAVITY FLOW METHOD

GRAVITY FLOW METHOD (Figure. 9) -

1. Disconnect condenser piping at unit, including isolation valves and water regulating valve.
2. Fill condenser as shown in figure 9. Follow acid manufacturer's instructions. When condenser is full, allow solution to remain overnight
3. Drain condenser and flush with clean water.

FORCED CIRCULATION METHOD (Figure. 10) -

1. Disconnect condenser piping at unit, including isolation valves and water regulating valve.
2. Fill system as shown in figure 10. Follow acid manufacturer's instructions. Fully open vent pipe when filling system. The vent may be closed when system is full and pump is operating.
3. Regulate flow to condenser with a supply line valve. If pump is a non-overloading type, the valve may be fully closed while pump is running. For average scale deposit, allow solution to remain in condenser overnight. For heavy scale deposit, allow 24 hours.
4. Drain condenser and flush with clean water.

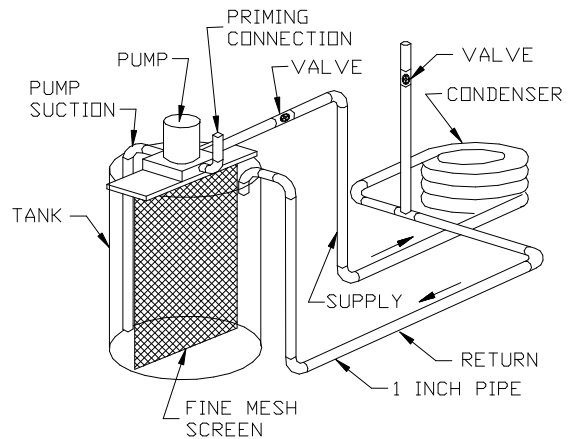


FIGURE 10 - FORCED CIRCULATION METHOD

Charging the System (90MA) - These units are shipped with a full operating charge. If recharging is necessary (complete charge lost), weigh in amount of refrigerant indicated on unit nameplate and in Table 1.

If unit has partial charge, it must be recharged by removing existing charge and recharging by weighing in the required amount of refrigerant. (Refer to Table 1A/B/C/2A/B/C)

Charging the System (90MU)

UNIT SIZES 90MU Units - These units, used with remote condensers, are shipped with a holding charge only. To charge:

1. Open discharge and liquid service valves.
2. Leak test, reclaim refrigerant and evacuate.
3. Using standard refrigerant charging techniques and subcooling charts (Figure 11) add refrigerant as required to maintain proper operating conditions. Subcooling is determined by subtracting the actual temperature entering the TXV from the saturated temperature entering the TXV.

IMPORTANT: Charge on both the HIGH and LOW side simultaneously of idle compressors to prevent axial loading of the scroll, which may cause a temporary *no start* condition for the compressor. If this occurs, leave the system off for approximately 30 minutes. Attempt to restart the compressor; internal pressures should equalize enough to allow compressor to start. If removing the compressor, evacuate both the HIGH and LOW side simultaneously.

Required Subcooling (°F)	R407C PRESSURE AT LIQUID LINE SERVICE VALVE PSIG												
	137	149	162	176	205	222	239	256	275	295	315	336	359
0	70	75	80	85	90	95	100	105	110	115	120	125	130
5	65	70	75	80	85	90	95	100	105	110	115	120	125
10	60	65	70	75	80	85	90	95	100	105	110	115	120
15	55	60	65	70	75	80	85	90	95	100	105	110	115
20	50	55	60	65	70	75	80	85	90	95	100	105	110
25	45	50	55	60	65	70	75	80	85	90	95	100	105

Required Subcooling (°F)	R404A PRESSURE AT LIQUID LINE SERVICE VALVE PSIG												
	150	163	176	190	205	221	237	255	273	292	313	334	356
0	70	75	80	85	90	95	100	105	110	115	120	125	130
5	65	70	75	80	85	90	95	100	105	110	115	120	125
10	60	65	70	75	80	85	90	95	100	105	110	115	120
15	55	60	65	70	75	80	85	90	95	100	105	110	115
20	50	55	60	65	70	75	80	85	90	95	100	105	110
25	45	50	55	60	65	70	75	80	85	90	95	100	105

Required Subcooling (°C)	R407C PRESSURE AT LIQUID LINE SERVICE VALVE kPa												
	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
0	23	26	29	32	34	37	39	42	44	46	48	50	52
3	20	23	26	29	31	34	36	39	41	43	45	47	49
5	18	21	24	27	29	32	34	37	39	41	43	45	47
7	16	19	22	25	27	30	32	35	37	39	41	43	45
10	13	16	19	22	24	27	29	32	34	36	38	40	42
13	10	13	16	19	21	24	26	29	31	33	35	37	39

Required Subcooling (°C)	R404A PRESSURE AT LIQUID LINE SERVICE VALVE kPa												
	1190	1288	1392	1503	1580	1701	1786	1918	2011	2107	2206	2308	2414
0	23	26	29	32	34	37	39	42	44	46	48	50	52
3	20	23	26	29	31	34	36	39	41	43	45	47	49
5	18	21	24	27	29	32	34	37	39	41	43	45	47
7	16	19	22	25	27	30	32	35	37	39	41	43	45
10	13	16	19	22	24	27	29	32	34	36	38	40	42
13	10	13	16	19	21	24	26	29	31	33	35	37	39

FIGURE 11 - CHARGING CHARTS

Evaporator-Fan Motor Removal - Motor power wires need not be disconnected from motor terminals before motor is removed from unit.

1. Shut off unit main power supply.

WARNING

LOCK OPEN AND TAG unit disconnect before working on fan motor. Remove fuses and take them with you after noting this on tag.

CAUTION

Before attempting to remove fan motors or motor mounts, place a piece of plywood over evaporator coils to prevent coil damage.

2. Loosen motor hold down bolts on mounting bracket so that fan belt can be removed.
3. Loosen but do not remove the 2 motor mounting bracket bolts on left side of bracket.
4. Slide motor/bracket assembly to extreme right, remove bolts and lift out through space between fan scroll and side Rest motor on a high platform such as a step ladder. Do not allow motor to hang by its power wires.

Pressure Relief Device - All units are equipped with a fusible-plug type safety relief device on the refrigerant tubing. The relief setting is 197 °F to 203 °F on all units.

Crankcase Heater - A Crankcase heater is supplied on 90MA, MU*08 and *12 size units. The heater prevents liquid refrigerant from accumulating in the compressor crankcase during extended shutdown periods. Heater is automatically energized whenever unit main power is on and compressor is stopped. Heater is de-energized when compressor starts.

Do not shut off main power supply for an extended period except for servicing unit. Turn on power supply for at least 24 hours after an extended shutdown before starting compressor. Refer to "Operation".

Cycle-Loc™ - Protection Device - All units are equipped with Cycle-LOC current-sensing lockout relay. This device will lock out the compressor after any safety trip (discharge pressure switch, suction-pressure switch, or internal overload of the compressor). Check reason for lockout before resetting the device. Refer to unit label wiring diagram. To reset, turn the system switch to OFF, then back to COOL.

Discharge and Suction Pressure Switches - Refer to Table 1 for opening and closing settings for these safety devices.

The discharge pressure switch is located on the compressor on 06DA compressor equipped units and on the discharge line on all other units. The suction pressure switch is located on top of the compressor on 06DA compressor equipped units and on the suction line on all other units.

Oil Charge - All units are factory charged with oil. On 06D compressors, observe the oil level in the sight glass at start-up. If unit oil level is below sight glass, add oil until level reaches approximately 1/4 sight glass.

If oil charge is above sight glass, do not remove any oil until the compressor crankcase heater has been energized for at least 24 hours.

When additional oil or a complete charge is required, use only the following Carrier approved oil.

R-407C, R-404A, and R-134a units
Castrol - Icematic SW68
ICI - Emkarate RL68HP

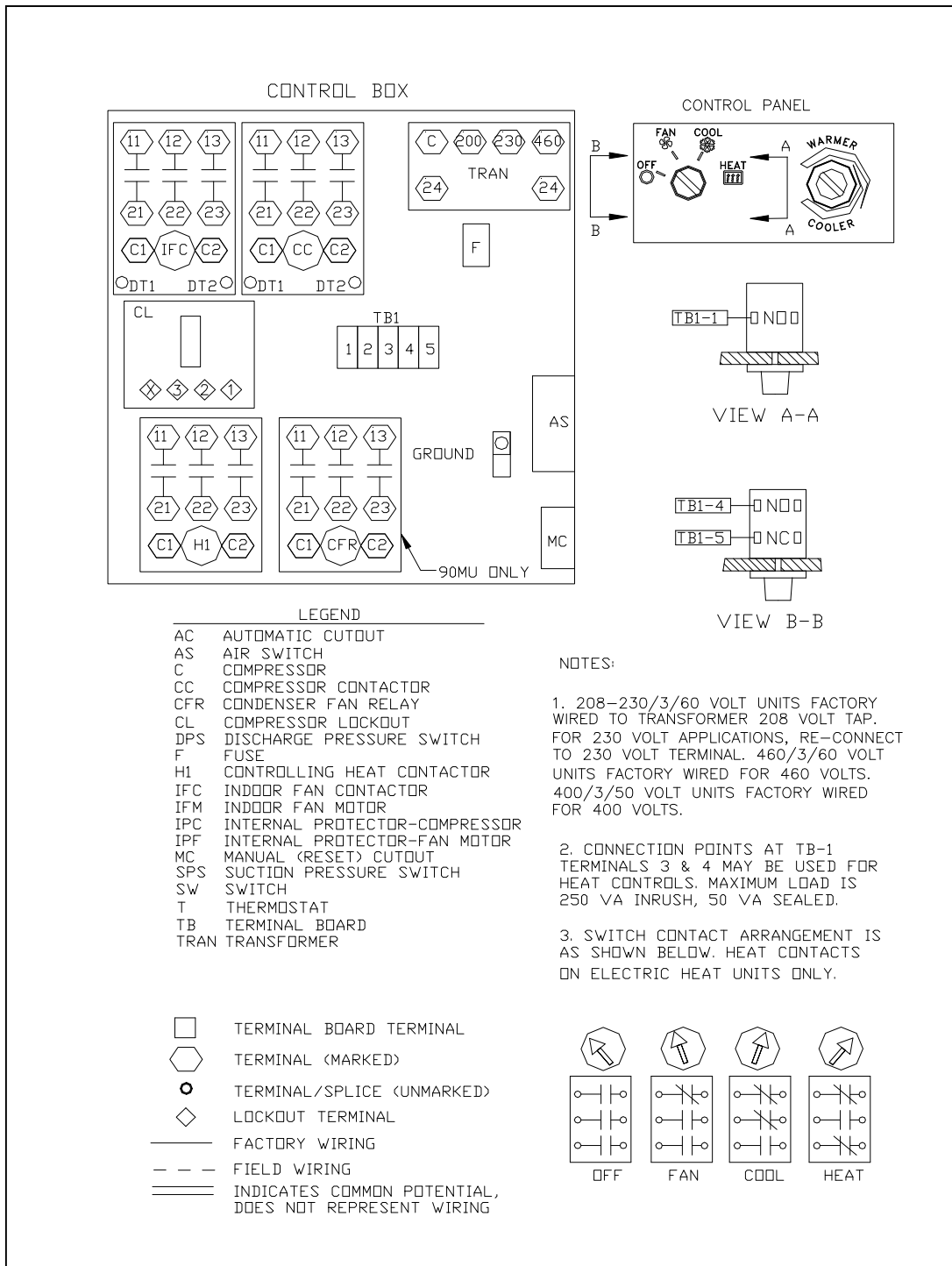
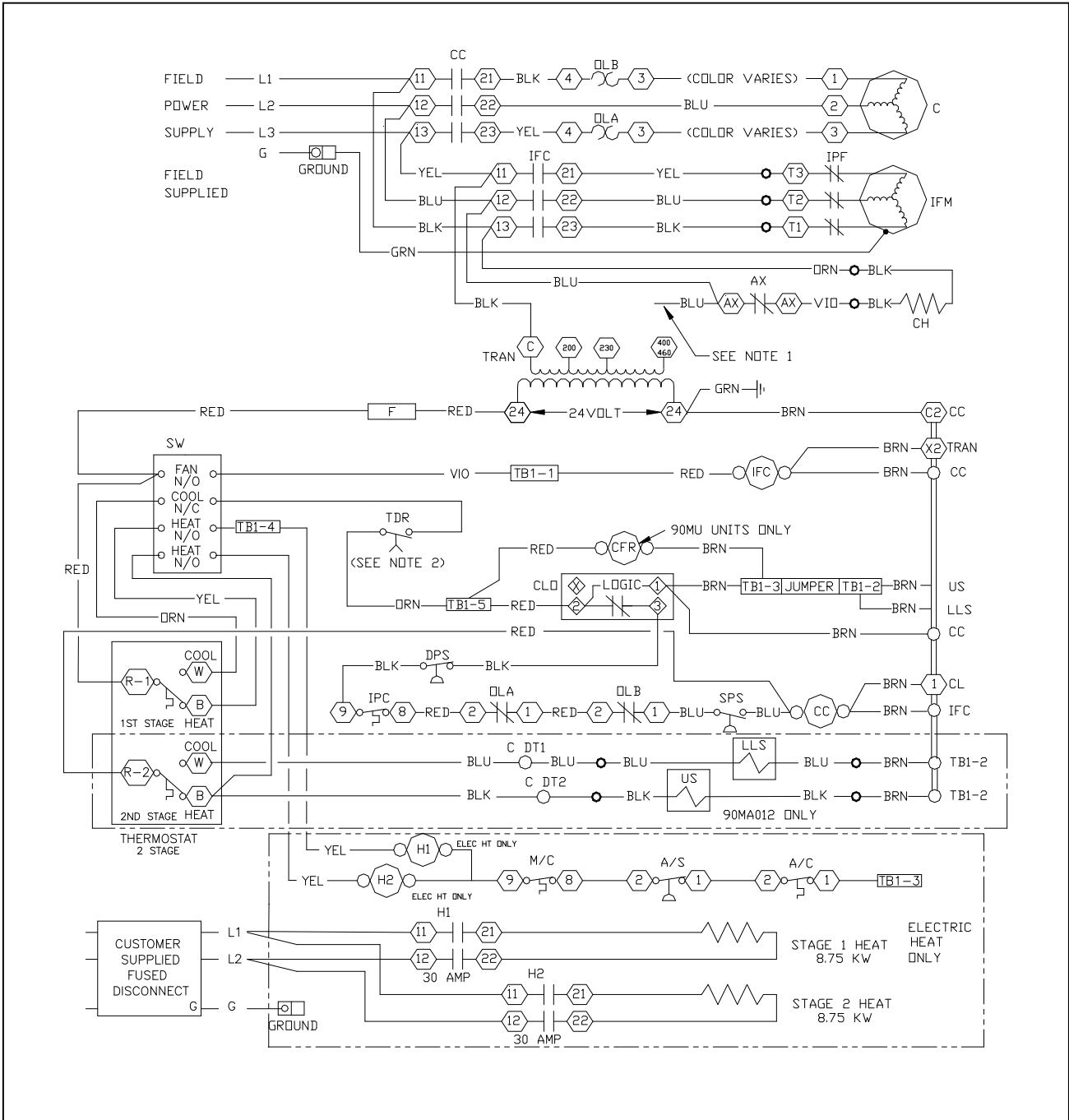


FIGURE 13 COMPONENT ARRANGEMENT - 90MA/MU*04/*06



FOR NOTES AND LEGEND, SEE FIGURE 15

FIGURE 14 - ELECTRICAL SCHEMATIC - 90MA/MU*08/*12

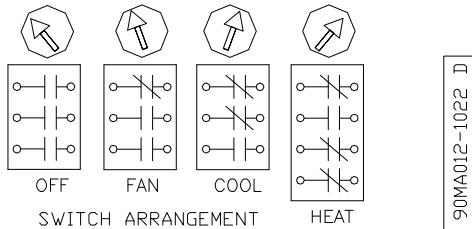
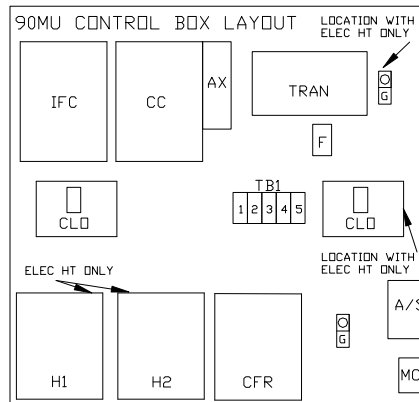
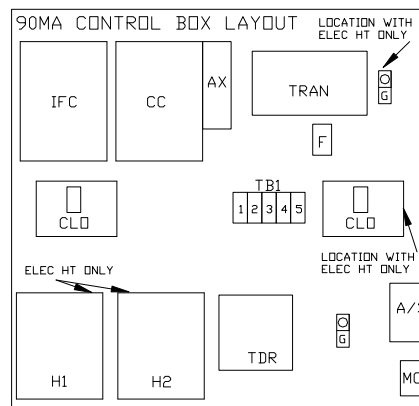
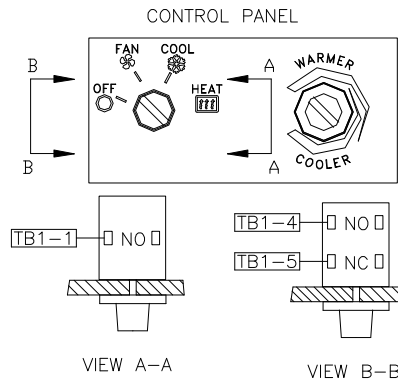
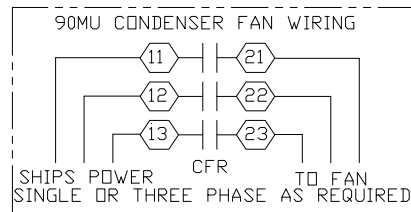
LEGEND

- A/S AIR SWITCH
- A/C AUTOMATIC OVER TEMPERATURE CUTOUT
- AX AUXILLARY CONTACTOR
- C COMPRESSOR
- CC COMPRESSOR CONTACTOR
- CH CRANKCASE HEATER
- CFR CONDENSER FAN RELAY (90 MU ONLY)
- CL COMPRESSOR LOCKOUT
- DPS DISCHARGE PRESSURE SWITCH
- DT DUMMY TERMINAL
- F FUSE
- H1 STAGE 1 HEAT CONTACTOR
- H2 STAGE 2 HEAT CONTACTOR
- IFC INDOOR FAN CONTACTOR
- IFM INDOOR FAN MOTOR
- IPC INTERNAL PROTECTOR-COMPRESSOR
- IPF INTERNAL PROTECTOR-FAN MOTOR
- LLS LIQUID LINE SOLENOID
- M/C MANUAL (RESET) OVER TEMPERATURE CUTOUT
- OL OVER LOAD
- SPS SUCTION PRESSURE SWITCH
- SW SWITCH
- T THERMOSTAT
- TB TERMINAL BOARD
- TDR TIME DELAY RELAY
- TRAN TRANSFORMER
- US UNLOADER SOLENOID

- TERMINAL BOARD TERMINAL
- TERMINAL (MARKED)
- TERMINAL/SPLICE (UNMARKED)
- ◇ LOCKOUT TERMINAL
- FACTORY WIRING
- - - FIELD WIRING
- ==== INDICATES COMMON POTENTIAL, DOES NOT REPRESENT WIRING
- - - - FACTORY OPTION

NOTES:

1. 208-230/3/60 VOLT UNITS FACTORY WIRED TO TRANSFORMER 200 VOLT TAP. FOR 230 VOLT APPLICATIONS, RE-CONNECT TO 230 VOLT TERMINAL. 460/3/60 VOLT UNITS FACTORY WIRED FOR 460 VOLTS. 400/3/50 VOLT UNITS FACTORY WIRED FOR 400 VOLTS.
2. 30 SEC. TIMER ON COMP. START CIRCUIT IS NORMALLY CLOSED, BUT OPENS FOR 30 SECONDS AT POWER ON.



90MA012-1022 D

FIGURE 15 - COMPONENT ARRANGEMENT - 90MA/MU008/012

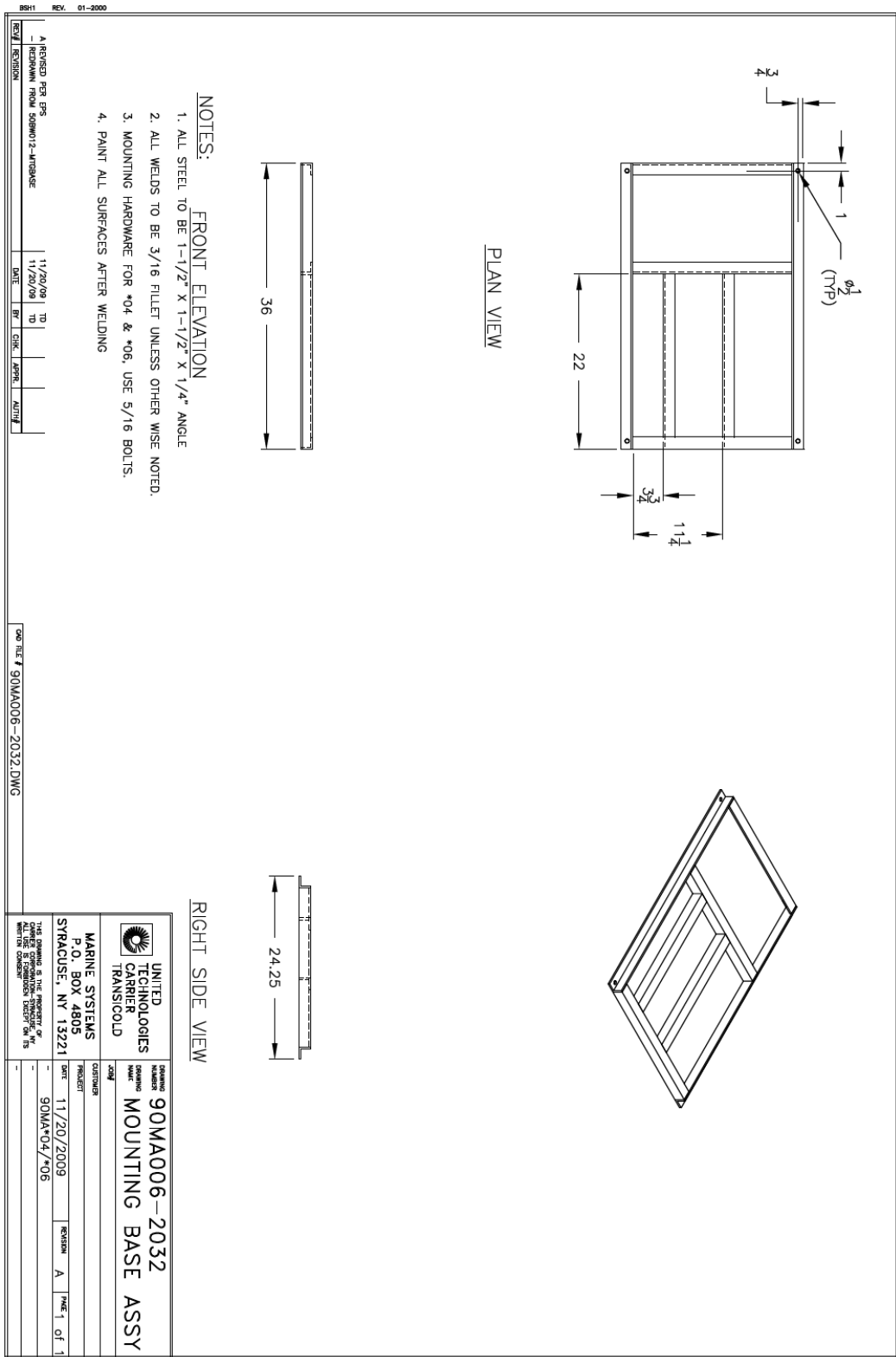


FIGURE 16 – MOUNTING BASE ASSEMBLY – 90MA/MU*04/*06

