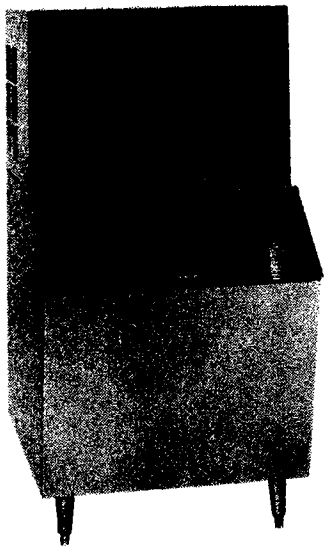
Manitowoc

C-0200 & C-0400 SERIES ICE CUBER SERVICE MANUAL



Series C-0200 or C-0400 Cuber
C-400 Bin, 606 Adjustable Legs

This manual covers the following models:

CR-0200A	CR-0400A	Regular Cube, Air Cooled
CR-0201W	CR-0401W	Regular Cube, Water Cooled
CD-0202A	CD-0402A	Dice Cube, Air Cooled
CD-0203W	CD-0403W	Dice Cube, Water Cooled
CY-0204A	CY-0404A	Half Dice, Air Cooled
CY-0205W	CY-0405W	Half Dice, Water Cooled

Manitowoc equipment works MANITOWOC WISCONSIN 54220

Division of The Manitowoc Company, Inc., 2110 S. 26th St.

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FORWARD

Manitowoc Equipment Works, Division of The Manitowoc Company, Inc., Manitowoc Wisconsin, presents this Service Manual to assist the serviceman with information concerning CONSTRUCTION, INSTALLATION, and MAINTENANCE of the MANITOWOC ICE MAKER.

The problems of the user and the serviceman have been given special emphasis in the development of the latest MANITOWOC Ice Machines.

If you encounter a problem which is not answered by this manual, please feel free to write or call the Service Department of the Manitowoc Equipment Works, Division of The Manitowoc Company, Inc., Manitowoc, Wisconsin, describing the problem you have encountered. The Service Department will be happy to give you particularized advice and assistance. Whenever calling or writing, please state the complete model and serial number of the ice making equipment.

MANITOWOC EQUIPMENT WORKS
Div. of The MANITOWOC CO., INC.
2110 South 26th Street
Manitowoc, Wisconsin 54220
(414) 682-0161

TABLE OF CONTENTS

WARRANTY

Parts and Material	One year — parts only
Compressor	Five years — parts only

Defective parts must be returned transportation prepaid.

(See "Ice Machine and Bin Warranty" on inside back cover and registration card shipped with the unit for warranty conditions.)

FREIGHT DAMAGE AND LOSS INFORMATION

The transportation company, dealer, or contractor who delivers this merchandise is responsible for loss and/or damage. If the transportation company made direct delivery, we suggest you follow the steps outlined below.

A. SHORTAGES
1. Check number of cartons delivered with the quantity shown on your receipt.
2. If quantities do not tally, have driver note shortage and file your claim accordingly.

B. VISIBLE DAMAGE
1. If cartons appear damaged in any way, open the carton and inspect the contents in the driver's presence.
2. To remove the cuber carton, cut the banding and slide the carton up and off the cuber.
3. Have the driver note the nature and extent of the damage on the freight bill.
4. Notify the transportation company's office to inspect the merchandise. Carrier claim rules require inspection within 15-days of delivery.

C. CONCEALED DAMAGE
1. If damage is noticed later when the ice machine or storage bin is unpacked, notify the transportation company immediately and ask to have an inspection.
2. Do not destroy packing materials until inspection is completed.
3. Unless these conditions are met, it is very difficult to have your claim accepted by the transportation company.

D. FILING CLAIMS
File claim for loss or damage at once. In your claim with the transportation company, you may elect to:
a. Make a cash adjustment,
b. Arrange to have repairs made, or
c. Replace the merchandise.

INSTALLATION OF SERIES C-0200 and C-0400 CUBER

LOCATION

For best performance select a location away from radiators, ovens, refrigeration condensing units, direct sunlight and other sources of heat.

Allow a minimum of 5 inches clearance around the cuber for air circulation. Restricted air flow over an air cooled condenser will adversely affect ice production.

An air cooled cuber will perform more efficiently in a 70° F. room than in a 90° F. room. Recommended room temperature should not range below 55° F. nor above 100° F.

If the cuber is located in an unheated area, it must be protected from freezing temperatures or shut down and winterized. Refer to "Winterizing Cuber," Page 24.

SET-UP OF THE ICE STORAGE BIN

1. Open the top of the ice storage bin carton. Lay the carton on it's back. Remove the internal corrugated packing and place on the floor adjacent to the bin top. Slide the bin from the carton onto the cardboard packing to prevent scratching. Screw the legs into the bin bottom.
2. Set the bin in its general location and level by adjusting the legs. The foot of the leg will screw up or down for adjustment.

REMOVAL OF PACKING AND INSTALLING CUBER

1. To remove the cuber carton, cut the banding and slide the carton up and off the cuber.
2. Set and align the cuber on the bin. Care should be taken to prevent tearing ⅛" foam tape around the bin top.
3. If you desire the bin lid to stay in the open position when raised, make sure the cuber is placed far enough back on the bin so the lid rests on the cuber front panel.
4. Remove the front panel by pulling forward on the sides near the bottom. Lift up and off. To remove the wrap-around top and side panel, remove the screws on each side and lift the entire panel forward and up.
5. Remove the water pump, ice chute, damper door and water curtain from the corrugated carton and install these components. (Refer to Fig. 2 & 3.)
   a. Hang the water curtain over the evaporator and bend each hook 25° outward to prevent the curtain from falling off during operation. It should swing freely.
   b. Plug in the water pump service cord and hang the water pump on the mounting studs. Place the water tube on the pump discharge.
   c. Set the ice chute assembly in place and secure with the knurled thumb screw provided.
6. Remove the water inlet strainer. It will be installed later in the ice making water inlet line. Remove the wooden wedges from under the compressor.

ELECTRICAL REQUIREMENTS AND CONNECTIONS (See Cuber Specs. Page 12)

All electrical connections should conform to local and national codes. The combination serial and electrical plate is located inside the cuber above the water pump. The model and serial numbers should always be used to identify your machine when parts and/or service are required. (Refer to Fig. 2, Item 5.)

The cuber should be connected to a separately fused circuit. Fuse size must not exceed maximum fuse size shown on the electrical plate. The supply voltage should not vary more than 10% above or below the rated voltage. All electrical wiring must be rated equal to or greater than the minimum ampacity shown on the electrical plate.

Run the supply wires through the electrical supply hole located on the back panel, Fig. 1, and through the hole on the back of the control box. Connect the two power supply lines to the black and white leads and the ground to the green screw located on the base of the control box.

WATER & DRAIN REQUIREMENTS & CONNECTIONS (Refer to Fig. 1, Also see Fig. 5 & 6 for Location Reference.)

All water and drain connections should conform to local and national codes. We recommend installing a shut-off valve in both the ice making and condenser water lines. All water and drain lines should be covered with insulation to prevent condensation.

The ice making cold water supply is connected to a ¼" female pipe fitting in the rear panel. Use ⅜" O.D. copper tubing. Install the water strainer in this line with the arrow toward the cuber and the clean-out plug down.

The condenser water supply is connected to a ⅜" female pipe fitting in the rear panel. Use a minimum of ½" O.D. copper tubing. A minimum of 25 pounds per square inch condenser water pressure must be maintained at the cuber for proper operation.

Drain connections should not allow waste water to back up into the cuber or storage bin. Drain lines must have a 1½" drop per 5 feet of run. If drains are not close enough to allow proper drainage, or water is to be drained in a stationary sink, an automatic condensate pump will be required.

The bin and cuber drain lines should run separately to an open trapped or vented floor drain. The cuber drain lines require a minimum ½" I.D. tubing. The bin drain line requires a minimum ¾" I.D. tubing. The cuber base drain and bin drain lines should be vented to atmosphere. (Refer to Fig. 1.)

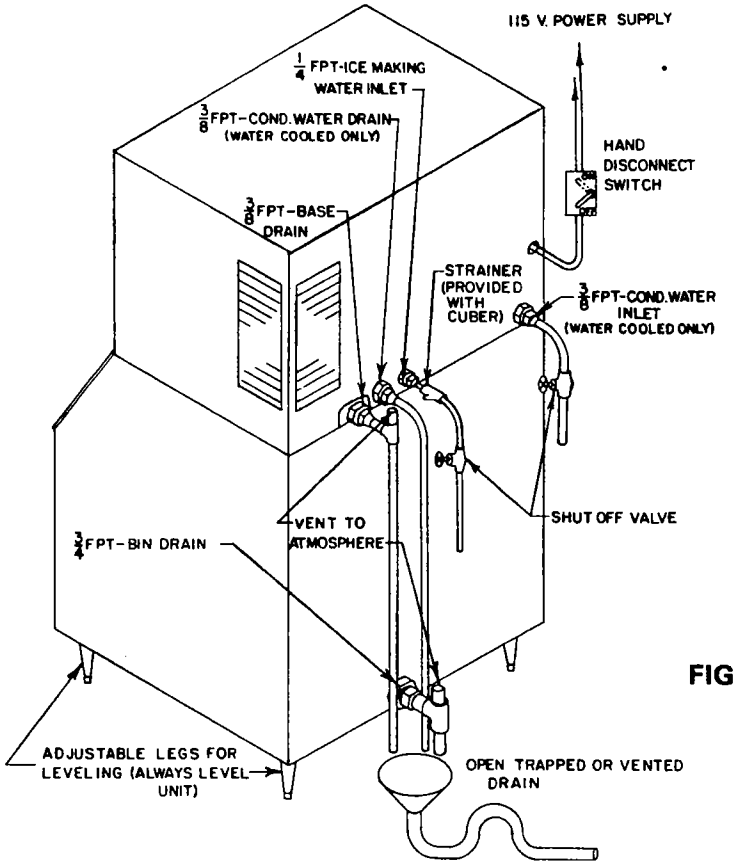
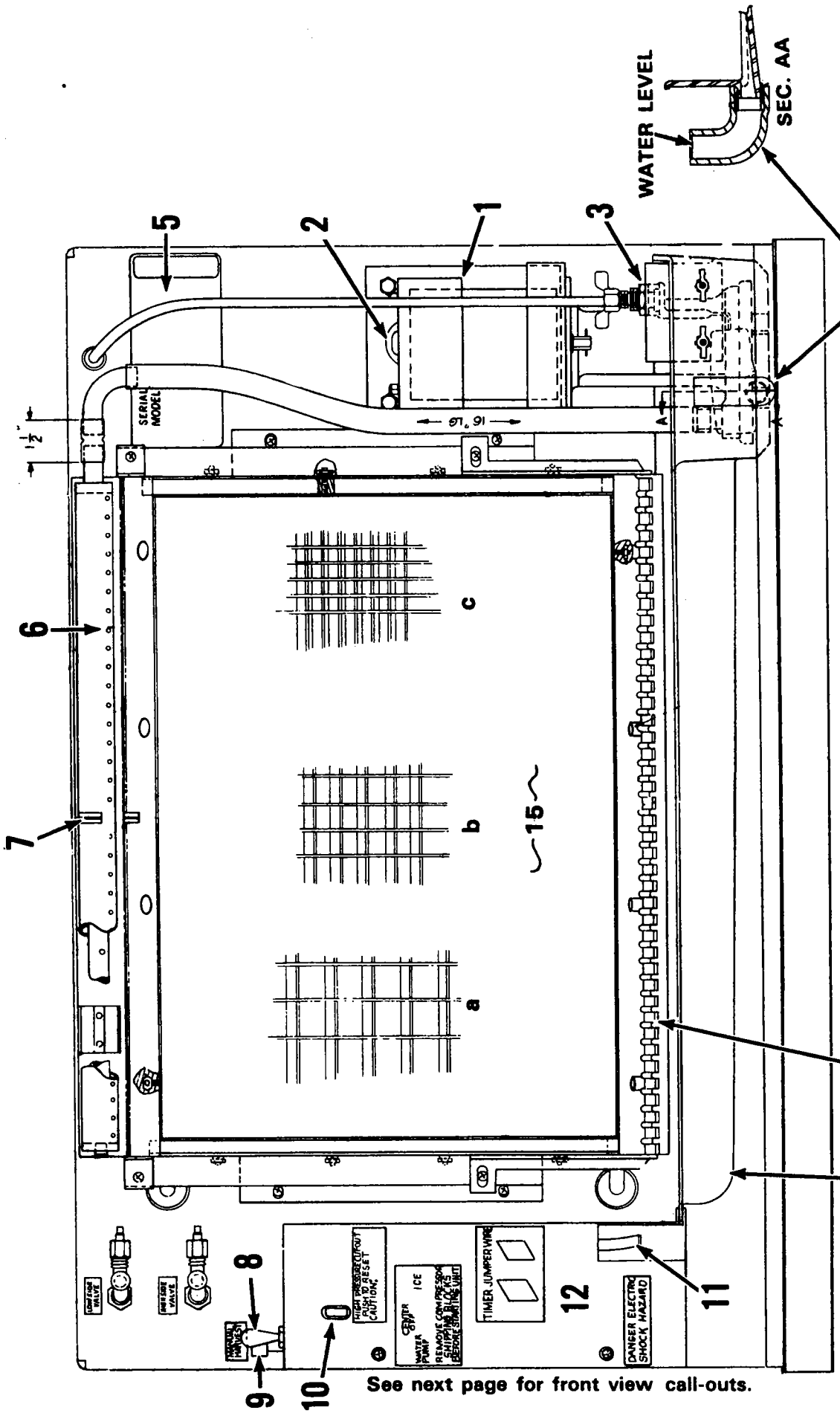


FIG. 1

INSTALLATION CHECK LIST

1. Is the cuber level?
2. Has all the internal packing been removed; tape, compressor blocks, etc?
3. Have all the electrical and water connections been completed?
4. Has the supply voltage been tested and checked against the rating on the nameplate?
5. Is there 5" clearance around the cuber for proper air circulation?
6. Is the cuber installed where ambient will not vary below 55° F. or above 100° F? Are you prepared to winterize?
7. Is there a separate drain for the water cooled condenser?
8. Has the water strainer been installed in incoming ice making water line?
9. Are the base and bin drains vented?
10. Check to be sure refrigerant and electrical lines are not touching one another.
11. Check for, and repair refrigerant leaks.
12. Are all the following components in place and secured? Ice chute, damper door, water curtain, water pump, harvest rack, overflow elbow, water distributor, connecting lines and float valve.
13. Are the water curtain hooks bent 25° outward and does the curtain swing freely? (Refer to Fig. 2 & 3.)
14. Has the storage bin been cleaned?
15. Turn on the ice making water supply and the condenser water supply (if water cooled) and check for and repair any leaks. The wrap-around panel can now be replaced.



C0200 & C0400 ICE MAKING COMPARTMENT
(With Water Curtain & Ice Chute Removed)
FRONT VIEW
FIG. 2

See next page for front view call-outs.

FIG. 2

1. Water pump.
2. Water pump electrical plug.
3. Float valve assembly.
4. Overflow elbow.
5. Serial No. and electrical date plate.
6. Distributor tube assembly.
7. Distributor alignment markers.
8. ON-OFF toggle switch, has 3 positions:
   a. ICE — cuber operates.
   b. OFF — cuber is shut down.
   c. WATER PUMP — Only the pump operates for cleaning or servicing.
9. Manual harvest button — momentarily pushing this button will start the harvest cycle to clear the ice off the evaporator for cleaning or servicing.
10. Reset button, high pressure cut-out. This control is only used on water cooled models. If there is an interruption of water to the condenser, the system pressure will rise, tripping the high pressure control, which stops the cuber. This control must be manually reset.
11. Damper door bin switch arm. The bin switch cycles the cuber from harvest to freeze cycles and shuts the cuber off when the bin is full.
12. Control box.
13. Sump trough.
14. Harvest rack.
15. Evaporator (cube plate).
    a. Regular cube size.
    b. Dice cube size.
    c. Half dice cube size.

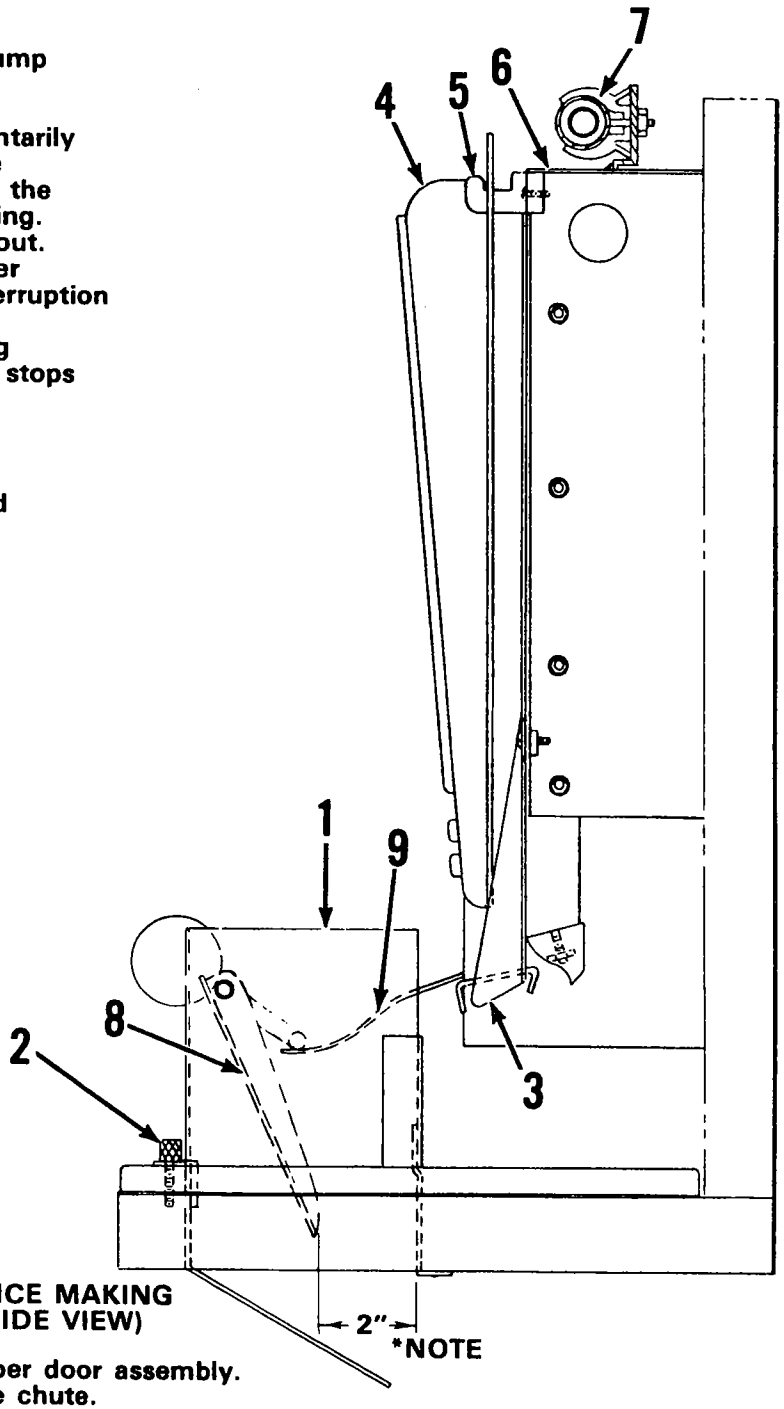


FIG. 3

C-0200 & C-0400 ICE MAKING COMPARTMENT (SIDE VIEW)

1. Ice chute and damper door assembly.
2. Thumbscrew for ice chute.
3. Harvest rack.
4. Water curtain.
5. Mounting hooks, water curtain.
6. Evaporator.
7. Water distributor tube.
8. Damper door.
9. Damper door bin switch arm.

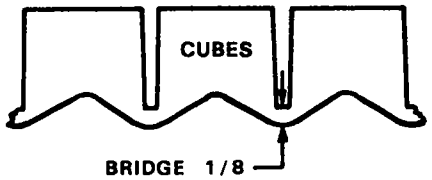
*NOTE: With the damper door open 2" the bin switch arm should be depressed shutting off the cuber. Bend the bin switch arm to achieve proper action. Item 9.

OPERATING PROCEDURE (Refer to Fig. 2 & 3)

1. Place the ON-OFF toggle switch in the WATER PUMP position. Only the water pump will operate. Check for proper water flow through the distributor tube and over the evaporator.
2. With the pump operating, the float valve should shut off the water when the level is just below the top of the overflow elbow. If necessary adjust the float valve by loosening the two wing nuts and slide the float assembly up or down as required.
3. Turn the water pump on and off at approximately 1 minute intervals. Do this three times to flush clean water through the system and inspect for proper drainage.
4. Turn on the cuber by placing the toggle switch in the ICE position; the compressor should operate. The condenser fan cycles on a pressure control which may delay the starting of the fan motor.
5. Damper door bin switch operation: This switch cycles the cuber from the harvest to freeze mode and turns the cuber off when the storage bin is full of ice.

   To adjust with the cuber operating, hold the damper door open 2-inches. This opens the damper door switch and stops the cuber until the damper door is released. If the cuber doesn't stop, bend the switch arm until proper operation is achieved. (Refer to Fig. 3, Item 9.)
6. On water cooled models, check head pressure, recommended setting is 135 PSIG. Adjust the water regulating valve (Fig. 6, Item 5) for proper setting.
7. Check bridging of cubes and adjust if needed. For optimum ice production and maximum cube separation, the ice connecting the individual cubes should be a minimum ⅛" thick at the center rows of the waffle. Bridge thickness will vary slightly from top to bottom.

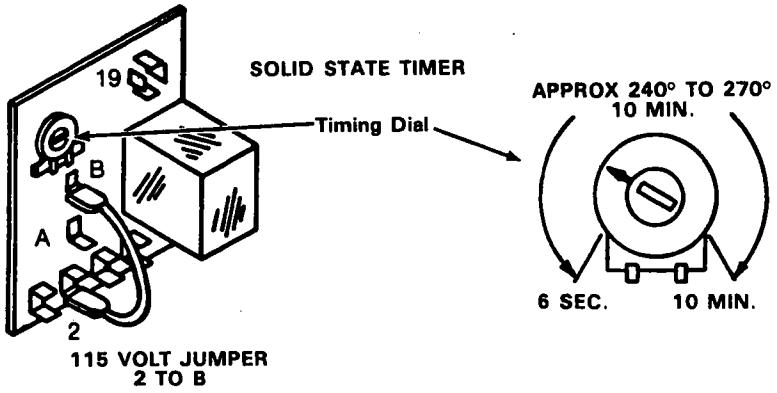
FIG. 4



To change bridge thickness, an adjustment of the solid state timer is required. This timer is located inside the electrical control box.

CAUTION: Before removing the control box cover, the cuber's main power supply should be turned off to prevent any electrical shock or accidental wire shorting.

FIG. 5



To adjust the solid state timer — (Fig. 4, Item 6)

1. Remove control box cover, Fig. 2, Item 12.
2. Locate the timer and the dial.
3. To increase bridge thickness, rotate dial clockwise.
4. To decrease bridge thickness, rotate dial counter-clockwise.

Adjustments should not be greater than 10° to 15° at one time. After each adjustment allow the cuber to produce two ice harvests and observe bridge thickness. Repeat this procedure as required.

C-0200 & C-0400 SYSTEM CONTROL AND SEQUENCE OF OPERATION

The main ON-OFF toggle switch for the cuber is located on the control box. The toggle switch has three positions; the center of "OFF" position, the "WATER PUMP" position (only the water pump runs), and the "ICE" position.

Placing the toggle switch in the Ice position will start the compressor, the condenser fan motor* (air cooled cubers), and the water pump. The cuber is now in the freeze cycle. As water flows over the evaporator, ice will begin to form on the cube plate.

As the ice forms, the suction pressure will continually decrease. At a preset point the reverse acting low pressure cut-in control will close its contacts. 10 PSIG for regular and dice cubes and 11 PSIG for half dice cubes.

Closing of the low pressure cut-in control contacts energizes the time delay circuit of the solid state timer through terminal 1. The other side of the line is completed through the safety thermodisc to terminal 2. The remaining freeze time is dependent upon the timer setting. At the end of the timing sequence the timer relay will energize. This will open the relay contacts between terminals 4 and 5, shutting off the water pump and condenser fan motor and close its contacts between terminals 3 and 4, energizing the hot gas solenoid valve. The cuber is now in the harvest mode.

Shortly after the hot gas solenoid valve opens, the suction pressure will rise to 38 PSIG plus. This opens the low pressure control contacts. The solid state timer relay remains energized through the timer relay interlock circuit.

As the harvest cycle progresses the hot gas will warm the evaporator allowing the ice to fall out of the evaporator and through the ice chute, opening the damper door. Opening of the damper trips the bin switch, momentarily de-energizing the entire cuber. The timer relay will return to its normal position, de-energizing the hot gas solenoid and energizing the water pump and condenser fan motor (air cooled cubers). The cuber is now in a new freeze cycle.

The ice cuber will continue to cycle until the ice storage bin is full. The cuber automatically discontinues ice production as the ice fills the chute, holding the damper door and the bin switch open.

If, for some reason, the bin switch would fail when the ice falls through the ice chute, the cuber would remain in the harvest cycle until the hot gas raised the suction temperature approximately 65°F ± 5°. At this time the safety thermodisc, located on the suction line, would open its contacts, de-energizing the timer relay and hot gas solenoid valve, placing the cuber back into the freeze cycle. As the evaporator begins to cool, the thermodisc will reclose its contacts at 40°F ± 5°.

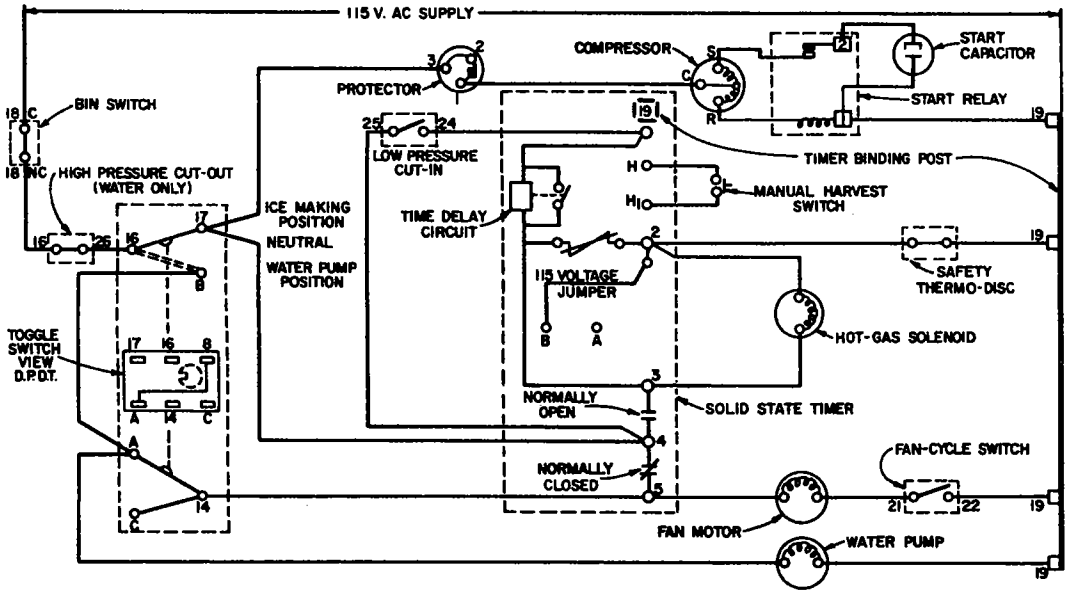
A high pressure cut-out control is used on the water cooled models only. This control shuts the entire cuber off, should the condensing pressure become too high.

Manually placing a unit into the harvest mode can be done by momentarily pressing the harvest button. Fig. 2, Item 9.

*NOTE: The condenser fan motor operates on a high pressure fan cycling control. This can delay the fan motor from starting when the toggle switch is placed in the ice position.

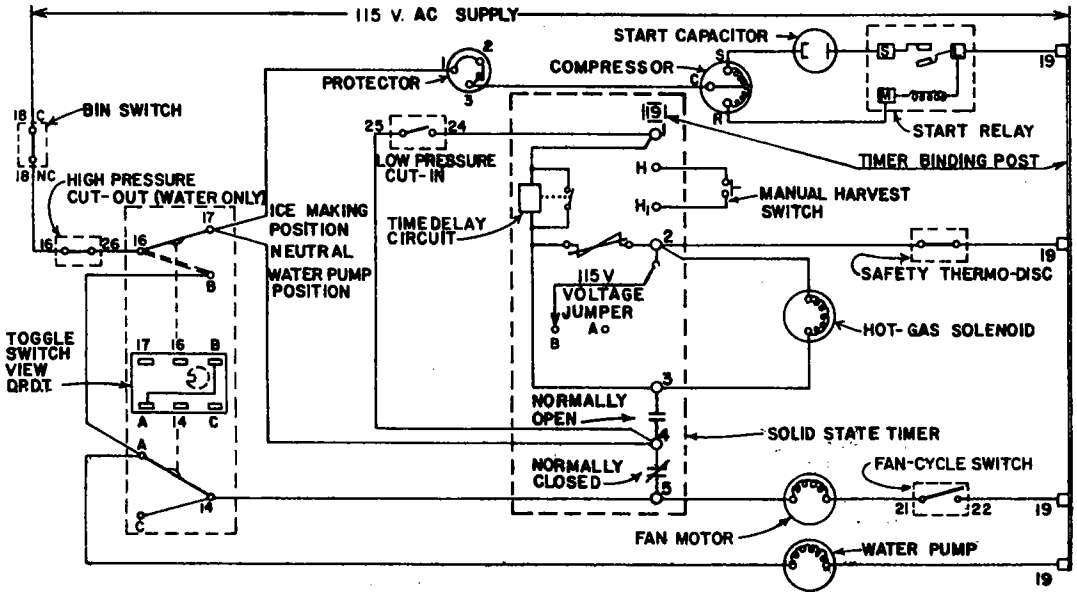
WIRING DIAGRAM FOR C-0200 SERIES CUBER 115V. 60 HZ, 50HZ 1 PHASE AIR AND WATER

SHOWN AT BEGINNING OF ICE MAKING CYCLE, LOW PRESSURE CONTROL NORMALLY OPEN FAN OR AIR MODELS ONLY



WIRING DIAGRAM FOR C-0400 SERIES CUBER 115V. 60 HZ, 50 HZ 1 PHASE AIR AND WATER

SHOWN AT BEGINNING OF ICE MAKING CYCLE LOW PRESSURE CONTROL NORMALLY OPEN FAN ON AIR MODELS ONLY



REFRIGERATION CYCLE — C-0200 and C-0400

*(Assume the cuber is operating at 90°F Air and 70°F Water)

Freeze Mode

During the freeze mode the high pressure discharge gas is pumped into the condenser. (*air cooled-Ave. head 135-155 PSIG; water cooled-Ave. head 125-135 PSIG.) The high pressure gas is condensed to a high pressure liquid. The high pressure liquid leaves the condenser, goes through the filter-drier, and into the heat exchanger. The receiver stores extra refrigerant when it is not used. This depends on operating conditions.

The high pressure liquid leaves the heat exchanger at a reduced temperature making the system more efficient. The high pressure liquid is then metered into the evaporator by a thermostatic expansion valve. The expansion valve regulates the rate of refrigerant liquid flow into the evaporator in the exact proportion to the rate of evaporation of the refrigerant liquid in the evaporator. The expansion valve does this by responding to (1) the pressure in the evaporator, (2) the temperature of the refrigerant gas leaving the evaporator using the valve feeler bulb to sense the gas temperature.

After the low pressure liquid evaporates to a low pressure gas, it passes through the suction line heat exchanger and into the compressor. The average suction pressure will start at approximately 20 PSIG and drop to approximately 8-10 PSIG when the cuber goes into harvest.

Harvest Mode

The harvest is initiated by the solid state timer energizing the solenoid valve allowing high pressure hot gas to flow through the evaporator and harvest the ice. The suction pressure during the harvest is approximately *45-55 PSIG (air cooled) and 38-45 PSIG (water cooled). *The head pressure will drop to approximately 80-100 PSIG (air cooled). The cuber goes back into the freeze mode automatically when the solenoid valve is closed by the harvesting ice tripping the bin switch.

The cuber is now in a new freeze cycle.

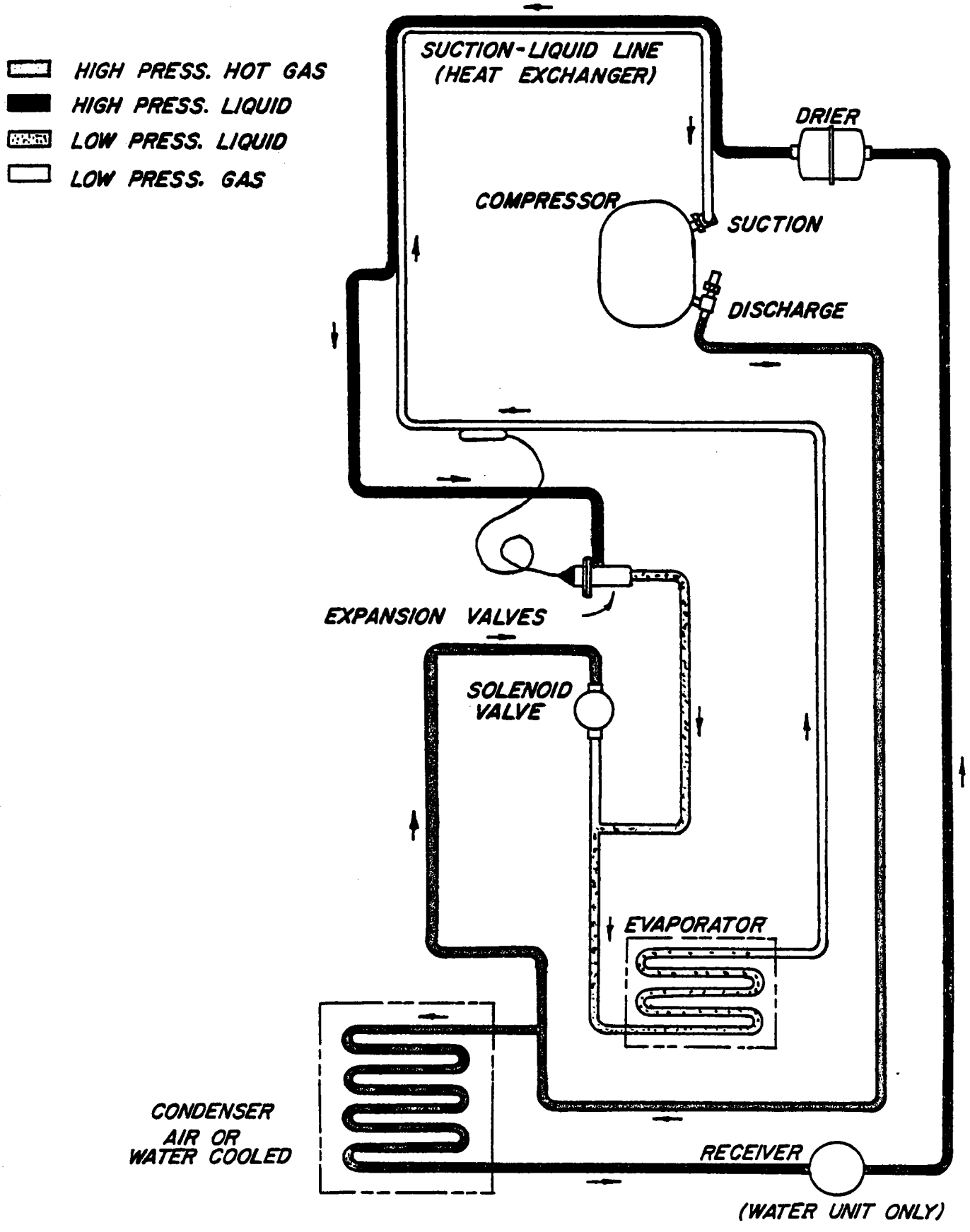
C-0200 & C-0400 Series Operating Pressures*

	Air Temp. °F	Air Cooled		Water Cooled	
		Freeze Mode	Harvest Mode	Freeze Mode	Harvest Mode
Head PSIG	55	100-135	65-80	135-125	90-70
	70	100-135	70-85	135-125	90-70
	80	110-135	80-95	135-125	90-70
	90	120-140	85-100	135-125	90-70
	100	135-155	90-115	135-125	90-70
Suction PSIG	55-100	22-5.5	35-65	22-5.5	34-34
Total Cycle Time	55-100	minutes		minutes	

*These are approx. pressures that vary depending on operating conditions.

NOTE: Fan cycling switch used on air cooled operates out 100 PSIG, in 135 PSIG.

C-0200 & C-0400 SERIES TUBING SCHEMATIC — REFRIGERATION CYCLE



CUBER SPECIFICATIONS AND COMPONENT DATA

C-0200

Model	Minimum Ampacity	Cube Size	Shipping Weight
CR-0200A	9.5	Regular	170
CR-0201W	8.8	Regular	162
CD-0202A	9.5	Dice	172
CD-0203W	8.8	Dice	164
CY-0204A	9.5	Half Dice	170
CY-0205W	8.8	Half Dice	160

ELECTRIC: 115/60/1. Maximum fuse size 15.0 amps.

24-hour Production (Lbs.)*							
Air Cooled Unit				Water Cooled Unit			
Air Temp. °F	Water Temp. °F			Air Temp. °F	Water Temp. °F		
	50°	70°	90°		50°	70°	90°
70°	220	210	200	70°	190	175	155
80°	195	185	175	80°	185	170	150
90°	180	170	160	90°	180	165	145

*Production for Dice and Half Dice cubes. Regular cube, 6% less than chart.

C-0400

Model	Minimum Ampacity	Cube Size	Shipping Weight
CR-0400A	13.4	Regular	202
CR-0401W	12.7	Regular	200
CD-0402A	13.4	Dice	206
CD-0403W	12.7	Dice	202
CY-0404A	13.4	Half Dice	208
CY-0405W	12.7	Half Dice	206

ELECTRIC: 115/60/1. Maximum fuse size 20.0 amps.

24-hour Production (Lbs.)*							
Air Cooled Unit				Water Cooled Unit			
Air Temp. °F	Water Temp. °F			Air Temp. °F	Water Temp. °F		
	50°	70°	90°		50°	70°	90°
70°	410	380	350	70°	370	340	305
80°	380	350	320	80°	365	335	300
90°	350	320	290	90°	360	330	295

*Production for Dice and Half Dice cubes. Regular cube, 6% less than chart.

Condenser Water Usage*				
Incoming Water Temp. °F		50	70	90
Gals./24 hrs. Running	C-0200	155	265	935
	C-0400	255	410	1120

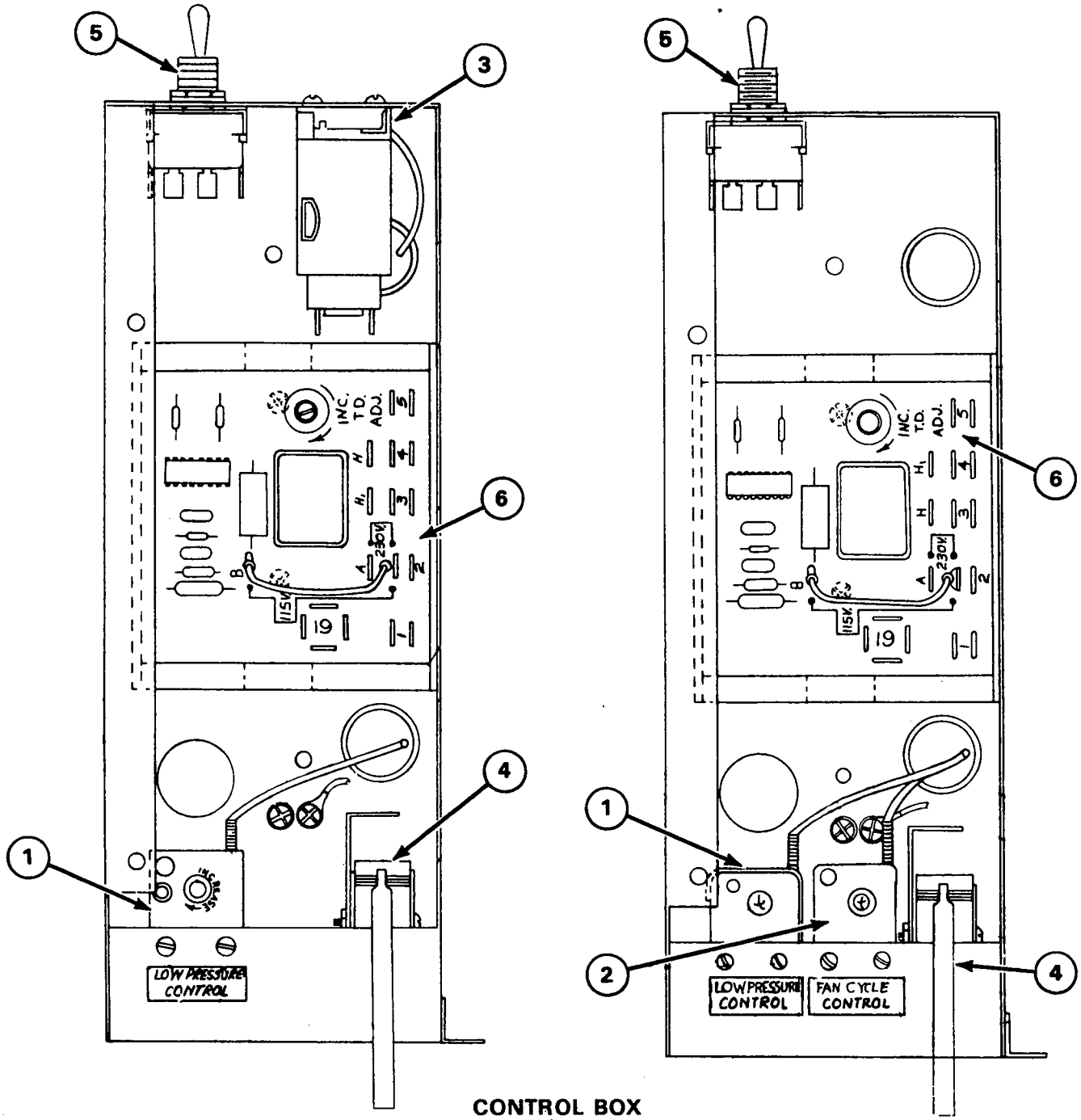
*At factory head pressure setting of 130 PSIG and a clean condenser.

Portable water consumption, gallons per 24 hrs. = $\frac{1.3 \times 24 \text{ hours ice production}}{8.34}$

	C-0200 - 60CY	C-0400 - 60CY
Compressor Model	Tecumseh #AE256AT-681	Copelwald #RSN2-0050-1AA
Compressor Voltage	115V-60CY	115V-60CY
Compressor Winding Resistance		
Start to common (OHMS)	5-9	3.35-4.46
Run to common (OHMS)	1-2	.51- .69
Relay	Tecumseh #82473	Copelwald #040-0098-00
Start Capacitor	Tecumseh #85709	Copelwald #014-0008-71
	270-324 MFD 110V	189-210 MFD 220V
Overload	Tecumseh #8300MRTE40	Copelwald #071-0127-34
Field Oil Recharge*	9 oz.	20 oz.
Refrigerant Charge R-12	Air 22 oz./Water 10 oz.	Air 22 oz./Water 15 oz.
Unit Running Amperage —		
Freeze Cycle	6- 9 AMPs	9 -12 AMPs
Harvest Mode	6-10 AMPs	8.5-13.0 AMPs
Hot Gas Solenoid Coil		
ALCO AMS, 115 Volt	70°F 143 OHMS ± 10%	70°F 143 OHMS ± 10%

	C-0200 - 50CY	C-0400 - 50CY
Compressor Model	Tecumseh #AE334JT-616-A4	Copelwald #RSH2-0050-1AG
Compressor Voltage	230V-50CY	230V-50CY
Compressor Winding Resistance		
Start to common (OHMS)	4-7	22.69-26.11
Run to common (OHMS)	.5-1	2.33- 2.68
Relay	Tecumseh #82645	Copelwald #404-0098-02
Overload	Tecumseh #8300MSPD91	Copelwald #071-0127-22
Start Capacitor	Tecumseh #85710-1	Copelwald #014-0008-70
	72-88 MFD 220V	41-53 MFD 320V
Field Oil Recharge*	11.5 oz.	20.0 oz.

*Recommended compressor oil, 150 viscosity oil, Grade-Suniso #365



WATER COOLED MODEL ONLY

CONTROL BOX
FIG. 4

AIR COOLED MODEL ONLY

1. Low pressure cut-in.
2. Fan cycle control.
3. High pressure cut-out.
4. Damper door micro switch.
5. Toggle switch.
6. Solid state timer.

1. Safety thermodisc.
2. Hot gas solenoid valve.
3. Expansion valve.
4. Drier.
5. Start relay & overload.
6. Start capacitor
7. Compressor.
8. Fan motor bracket.
9. Fan motor.
10. Fan blade.
11. Condenser, air cooled.
12. Plastic water tube.
13. Nylon insert.
14. Ice water inlet adapter.
15. Brass union.
16. Nylon sleeve & nut.

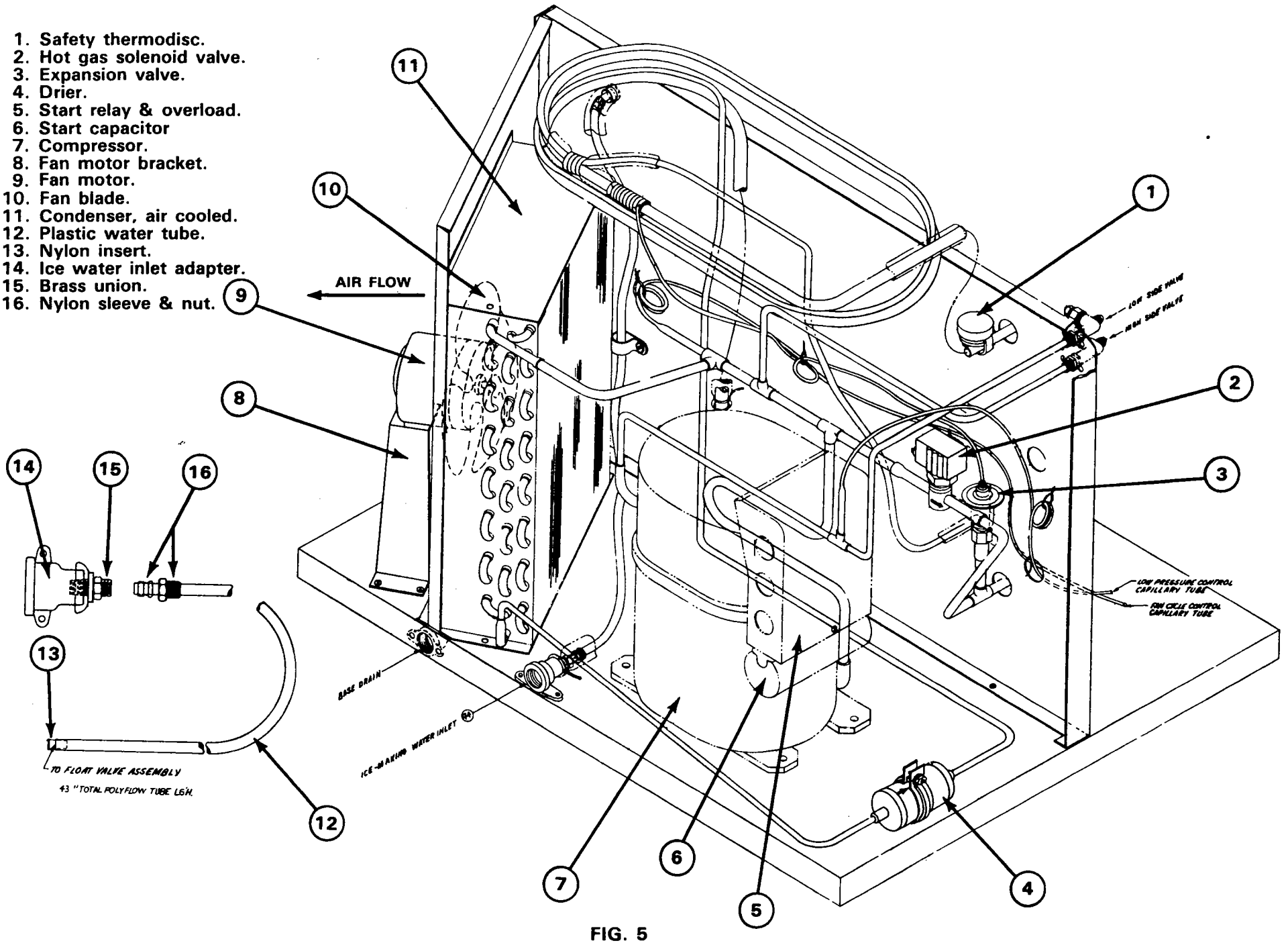


FIG. 5
AIR COOLED COMPRESSOR COMPARTMENT

1. Hot gas solenoid valve.
2. Expansion valve.
3. Start relay & overload.
4. Drier.
5. Water regulating valve & condenser water supply connection.
6. Start capacitor.
7. Compressor.
8. Condenser, water cooled.
9. Safety thermodisc.

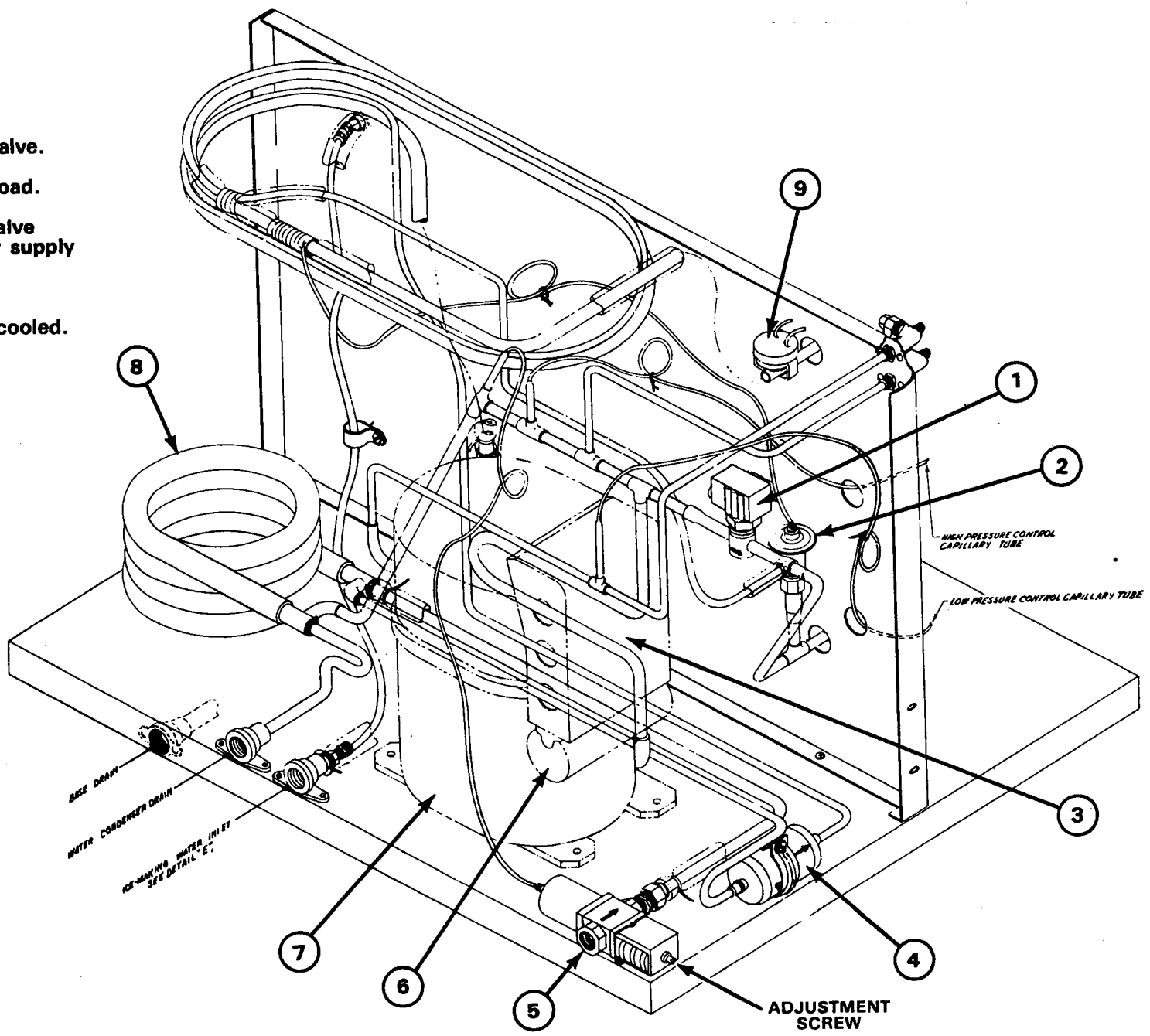


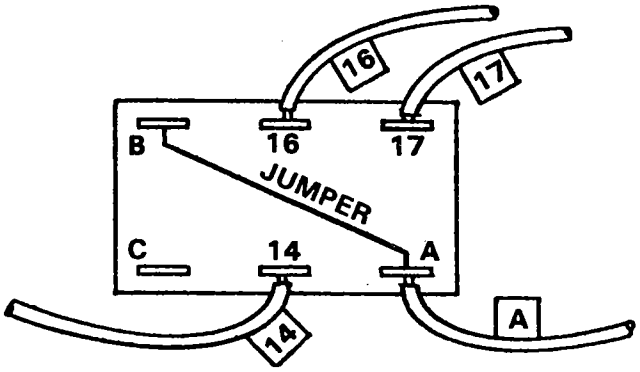
FIG. 6
WATER COOLED COMPRESSOR COMPARTMENT

CONTROL DESCRIPTION & CHECK-OUT PROCEDURE

TOGGLE SWITCH — Fig. 4, Item 5

The main power "ON and OFF" toggle switch is a double pole, double throw switch with "OFF" in the center position. With the toggle switch in the "water pump" position, only the water pump will operate. This is for circulating cleaning solution and checking pump operation.

With the toggle switch in the Ice position, the water pump compressor and condenser fan (air cooled models) operate for a normal ice making cycle.



TOGGLE SWITCH
(REAR VIEW)

Check Out Procedure — Toggle Switch

1. Turn power off. Check toggle switch by removing all wires on one side (terminals B, 16 & 17) and make continuity check with switch in all three (3) positions with ohmmeter. If the results are positive, rewire leads to assigned terminals. Likewise examine the opposite side of the toggle switch (terminals A, C. & 14).
2. Check also the jumper for proper position and continuity. Jumper should be across terminals A & B.

LOW PRESSURE CUT-IN CONTROL — Fig. 4, Item 1

This is a low pressure reverse acting control that closes its contacts on a drop in pressure and opens its contacts on a rise in pressure. The low pressure control contacts close at 10½ PSIG for regular and dice cubes, and 11 PSIG for half dice cubes. The differential is fixed at 12 PSIG so the contacts will open at approximately 22 PSIG.

The low pressure control is used to initiate the timing circuit of the solid state timer. If the timer is set at its maximum or minimum setting and the proper bridge thickness cannot be obtained, the low pressure control cut-in point must be recalibrated.

Check Out Procedure — Low Pressure Cut-In

1. Install a service gage on the suction service valve and voltmeter prods on terminals 1 and the common binding post "19."
2. Turn the cuber on. As it runs, unplug the water pump to discontinue water flow over the evaporator. This will cause the pressure to fall. When the suction pressure reaches 10-11 PSIG, the contacts should close giving you a 230 volt reading.
3. To change the cut-in point, turn the phillip head screw clockwise to increase the cut-in point and counter-clockwise to decrease the cut-in point.
4. Allow the timer to time out and place the cuber in harvest. The suction pressure will rise, opening the low pressure control contacts at approximately 22 PSIG.

HIGH PRESSURE CUT-OUT — WATER COOLED UNITS ONLY — Fig. 4, Item 3

This high pressure cut-out shuts off the entire cuber, should the head pressure exceed 275 PSIG. If the cuber goes out on high head pressure, the high pressure cut-out control has to be manually reset after the cause of the high head pressure condition has been corrected.

Check Out Procedure — High Pressure Cut-Out

With the power supply turned off to the cuber, place an ohmmeter across the terminals after removing one of the leads. Push reset button. If no continuity reading, replace control.

SOLID STATE TIMER — Fig. 4, Item 6

The primary function of the timer is to control the ice bridge thickness in conjunction with the low pressure control (length of the freeze cycle) and to initiate the harvest cycle by energizing the hot gas solenoid valve and de-energizing the water pump and condenser fan motor. The timer is activated by the low pressure cut-in control and is de-energize by the opening of the bin switch or thermodisc.

The ice cuber models C-0200 and C-0400 are manufactured with four different make solid state timers. All four timers are interchangeable. The wiring is the same — be sure the numbered wires are placed on the terminals with corresponding numbers. When replacing the timer, check jumper wire for proper location, terminals 2 to B for 115 volt.

Solid State Timer Adjustment — See Operating Procedure, No. 7, Page 7

Check Out Procedure — Solid State Timer (P/N 24-0623-9)

To benchtest timer: set the jumper wire for proper voltage, set the timer to minimum, and apply line voltage across terminals 1 and 2. The small mechanical relay should energize in less than 30 seconds and remain energized until either power leg is disconnected. Exception: Timer made by omnetics, their P/N J1103, needs a jumper wire from terminals No. 1 to No. 4. Without jumper, the relay will chatter when energized.

Trouble shooting timer in unit: when unit is freezing but not cycling into the harvest mode, make the following checks. Do not switch the unit off or defrost the evaporator until the service sequence below has been followed.

1. Check for line voltage between terminals #1 and #2 on the timer. If line voltage is there, check for proper installation of the jumper wire and turn the timer to the minimum setting. If the unit does not switch into the harvest mode at this time, replace the timer.
2. If you do not get line voltage between terminals #1 and #2, check for voltage between #2 and #4. If no line voltage between #2 and #4, see thermodisc check out procedure.
3. If you had line voltage between #2 and #4, the thermodisc is closed and not the cause of the problem. Check for voltage between terminals #19 and #1. If you do not have line voltage, the low pressure control is open.
4. If the suction pressure is below the cut-in point of the control, the problem is with the control itself. The control will require readjustment or replacement. See low pressure cut-in check out procedure.
5. If the suction pressure is above the cut-in point of the low pressure control, the refrigeration system operation must be analyzed. Check the following:
   a. Excessive head
   b. Improper charge
   c. Expansion valve flooding
   d. Hot gas solenoid valve leaking
   e. Inefficient compressor

DAMPER DOOR MICRO SWITCH — Fig. 4, Item 4

This micro switch is used to cycle the cuber from harvest to freeze cycles and shut the cuber OFF when the ice bin is full. The switch is tripped by the damper door counterweight when the harvesting ice falls through the ice chute.

Check Out Procedure — Damper Door Micro Switch

1. Check free movement of damper door.
2. Check bin switch arm for ON and OFF action, by opening or closing damper door. Switch should open when the damper door is open approximately 1-1½" to 2" shutting cuber off.
3. Turn main power supply off to the cuber. Make a continuity check across the switch. Be sure to remove one lead first. Tripping the metal arm will open the switch contacts, and releasing the arm will close the contacts. To verify switch action, open and close the switch. Replace switch, if defective. The two leads should be wired to the normally closed terminals.

FAN CYCLE CONTROL — Fig. 4, Item 2

This is a high side pressure control that cycles the fan motor off at approximately 100 PSIG and on at 135 PSIG. The purpose is to maintain a minimum head pressure for proper operation.

Check Out Procedure — Fan Cycle Control

1. Install a service gage on the high side service valve.
2. Turn the cuber on; as the unit runs, note the pressures the fan motor cycles. If adjustment is needed, turn the phillip head screw clockwise to increase the cycling pressures and counter-clockwise to decrease the cycling pressures. The differential is fixed.

MANUAL HARVEST BUTTON — Fig. 2, Item 9

This is a momentary push button that will place the unit in the harvest mode to clear the ice for cleaning or servicing.

Check Out Procedure — Manual Harvest Button

1. Turn main toggle switch OFF.
2. Remove the leads from H and H_1 on the timer. Place voltmeter prods across the two leads. Depressing the button should give you a continuity reading; releasing the button should give no reading.

SAFETY THERMO-DISC — Fig. 5, Item 1

The thermo-disc is a safety control located on the suction line. The control is temperature sensitive and opens at 70°F ± 5°F. The thermo-disc prevents the cuber from overheating. If the bin damper door switch should fail when the ice harvests, the cuber hot gas valve would remain open. The suction temperature would rise and the thermo-disc would open at 70°F. This will place the cuber back into the freezing cycle by de-energizing the timer and hot gas solenoid.

Check Out Procedure — Thermo-Disc

1. The thermo-disc is a normally open control at 70°F and above, and recloses at 40°F. Closing is accomplished by operating the cuber on for approximately 5 minutes. The thermo-disc will open only if the cuber sits idle in room temperature for a period of time, or the cuber bin switch fails in harvest.
2. Disconnect the thermo-disc leads at terminals #2 and #19 of the timer, after the cuber has been operating. Check continuity with ohmmeter. If there is no reading, check for contact between the suction-line and the thermo-disc. If contact is adequate, replace thermo-disc.

3. To check the cut-out temperature of the thermo-disc, remove the damper door from the ice chute. Start the cuber and wait for the evaporator to harvest. With the door removed, the unit will remain in its harvest cycle. This will increase the suction line temperature sharply until the thermo-disc reaches its calibrated opening point (70°F ± 5°F). From the time the ice has harvested to the point the thermo-disc opens, under normal ambient temperatures, it should take no longer than 2-3 minutes.

WATER REGULATING VALVE (Water Cooled Condensers) — Fig. 6, Item 5

The water regulating valve is used on water cooled cubers only. The valve is mounted in the incoming condenser water line. Its primary function is to maintain the proper head pressure by controlling the amount of water flow through the condenser. The valve is adjustable and should be set to maintain a 125 PSIG ± 5 PSIG operating head.

Check Out Procedure — Water Regulating Valve

1. Install a gage on the high side of the system, either on the discharge valve or the receiver valve.
2. The water valve has an adjustment knob on the top of the valve. With the cuber operating and while watching your high side gage, adjust the valve until the cuber head pressure is in the 125 PSIG range.
3. The water regulating valve should shut off completely during the harvest cycle. This can be checked by looking at your condenser water drain or removing the flare fitting on the out-let side of the valve. If the valve fails to close during harvest, the condenser will condense the hot gas needed for harvesting the ice.

CHECK OUT PROCEDURE FOR COMPRESSOR AND STARTING COMPONENTS

(A) Compressor will not run —

If the compressor fails to start and run properly, it is possible that the external electrical components may be defective, the protector may be open, a safety device may be tripped, or other conditions may be preventing compressor operation.

1. Check the voltage at compressor terminals. If there is not voltage, check back from the compressor to the power supply to find where the circuit is interrupted. Check across terminals #17 on toggle switch and #19 on timer. If no voltage check the following: overload on compressor (allow 10 minutes to reset), bin switch, high pressure cut-out (water cooled units only — has a manual reset on the control), the toggle switch for proper operation.
2. If power is available at the compressor terminals and the compressor does not run, check the voltage at the compressor while attempting to start the compressor. If the voltage is below 90% of the nameplate voltage, it is possible the motor may not develop sufficient torque to start. Check to determine if the power supply is adequate, electrical connections are loose, the circuit is overloaded, or if supply wire sizes are adequate.
3. A defective capacitor or relay may prevent the compressor starting. If the compressor attempts to start, but is unable to do so, or if the compressor hums or trips out on the overload protector, check:

   (Disconnect Power to unit Before Proceeding.)

   RELAY — Current Type

   Pull relay off compressor terminals — **keep upright!** The relay contacts should be open, check continuity with ohmmeter — if relay contacts are closed, replace relay.

   Check continuity through the relay coil, replace relay if no continuity.

   CAPACITORS —

   Any capacitor found to be bulging, leaking, or damaged should be replaced.

   Caution: Before removing leads for testing purposes, short across capacitor that do not have bleed resistors to discharge capacitor.

A quick check is to replace suspected capacitors with a known good capacitor. Be sure specified capacitors are used.

If a capacitor tester is not available, an ohmmeter may be used to check start capacitors for shorts or open circuits. Set the ohmmeter to its highest scale, and connect prods to capacitor terminals.

A. With a good capacitor, the indicator should first move to zero, and then gradually increase to infinity.

B. If there is no movement of the ohmmeter indicator, an open circuit is indicated.

C. If the ohmmeter indicator moves to zero and remains there or on a low resistance reading, a short circuit is indicated.

(B) If the compressor fails to start or blows fuses (start relay and capacitor is functional), proceed to check compressor as follows:

CAUTION: Turn power off. Before removing supply leads to compressor short across both capacity terminals to discharge capacitors.

1. Using an ohmmeter check for **continuity** from terminals C to R, and C to S. If the compressor is warm, wait one hour for compressor to cool and recheck. The internal overload protector can cause a lack of continuity. If continuity cannot be established through all motor windings, the compressor should be replaced.

2. Check compressor motor for **ground** by means of a continuity check between terminals C, R, and S to the compressor shell or copper refrigeration line (be sure to scrape metal surface clean to get good contact). If no continuity reading, the compressor windings are grounded and the compressor should be replaced.

(C) If compressor starts but trips repeatedly on the overload protector, check:

1. Operating pressures should be within limitations of normal operating conditions shown on Page .

2. Check the line voltage at the motor terminals while the compressor is operating. The voltage should be within 10% of nameplate voltage. If outside those limits, the voltage supply must be brought within the proper range.

3. Check the amperage drawn while the compressor is operating. Under normal operating conditions, the continuous amperage drawn will seldom exceed 100% of compressor nameplate amperage and should never exceed 120% of nameplate amperage. High amperage can be caused by:

   Low voltage.
   High head pressure.
   High suction pressure.
   Defective running capacitors or starting relay.
   Compressor mechanical damage.

GENERAL SYSTEM SERVICE ANALYSIS

SYMPTOM	CAUSE	CORRECTIVE MEASURE
Cuber will not run	Toggle switch in neutral position.	Turn switch to ice-making position.
	Compressor or starting components defective.	See compressor check procedure.
	Toggle switch defective.	See toggle switch check procedure.
	High pressure cut-out tripped.	Reset & check condenser water supply.
	Blow fuse or power off.	Replace fuse, check main switch.
	Bin switch open.	Bend switch arm for proper action; check free movement of damper door. See bin switch check procedure.
Cuber doesn't release ice or slow harvest	Leaking cond. water valve during harvest (water cooled).	Clean or replace valve.
	Ice bridge too thin, cubes should fall as sheet.	Adjust time up to increase bridge thickness.
	Harvest rack bent-up restricting harvest.	Bend center of rack down.
	Contaminated or limed water system, evaporator suction release holes plugged.	Clean evaporator & water system.
	Low ambient (air cooled cubers) causing low head pressure.	Ambient temperature must be above 55°.
	Cond. water valve set too low (water cooled).	Set water valve to 135 PSIG head.
	Improperly charged system.	Evacuate system & measure name plate refrigerate charge.
Cuber doesn't cycle into harvest mode	Low pressure control not closing.	See low pressure control check procedure.
	Solid state time defective, not energizing.	See S.S. timer check procedure.
	Safety thermodisc defective or loose on suction line.	See safety thermodisc check procedure.
	Leaky hot gas valve during freeze cycle.	Replace valve.
	Defrost solenoid coil defective.	Replace solenoid coil or valve.
	Suction pressure doesn't drop properly	
	a. Defective expansion valve	Replace expansion valve.
	b. Leaky hot gas solenoid valve.	Replace valve.
	c. Expansion valve bulb loose.	Tighten & insulate to suction line.

SYMPTOM	CAUSE	CORRECTIVE MEASURE
Ice shells instead of cubes or bridging too small	Timer out of adjustment.	See check procedure.
	Low pressure cut-in control not opening.	Check control; replace, if defective. See check procedure.
	Low refr. charge, leak in system.	Locate leak, repair, evacuate & recharge, if necessary.
Irregular size cubes & some cubes cloudy	Water system scaled up.	Clean system, water treatment may be needed.
	Shortage of water.	Check pump & water level in sump.
	High concentrations of minerals in water.	Have water tested, water treatment may be needed.
	Distributor not in proper location.	Adjust.
Too large cube bridge	Timer set too high — Low Pressure cut-in set too low.	See timer check procedure. See L.P. cut-in check procedure.
Low ice capacity	Sump overflow elbow out of position.	Adjust elbow.
	Defective Expansion Valve.	Replace.
	Sump water overflowing elbow during freeze cycle.	Adjust float to maintain water level approx. ¼" of flush elbow top.
	Float stuck in open position.	Adjust until float moves freely.
	Water strainer dirty.	Remove & clean mesh screen.
	Leaky hot gas valve.	Check & replace if necessary.
	Inefficient compressor.	Check & replace if necessary.
	High head pressure.	See high head pressure.
High head pressure	Fan motor or fan cycle switch defective.	Replace; see check procedure.
	Condenser water valve defective or not adjusted properly.	Replace water valve or adjust to 135 PSIG head.
	Dirty condenser.	Clean condenser; see cleaning instructions.
	Inadequate water supply (water cooled).	Check supply line & water valve.
	Defective expansion valve	Replace if necessary.
	Too hot cuber location with poor air circulation.	Relocate or provide ventilation to area.
	Air in refrig. system.	Evacuate and recharge.
	Overcharge of refrigerant	Charge to nameplate.
Low head pressure	Ambient temp. below 55°F.	Heat area or install low ambient fan switch.
Compressor cycles on overload	Low voltage.	Check circuit for overload condition.
	High head pressure.	See "Complaint-High head pressure."
	Weak overload	Replace overload.
	Bad start components	Check, replace. See check procedure-compressor.

CLEANING INSTRUCTIONS

Efficient operation requires periodic cleaning.

Cleaning frequency will depend largely on water conditions. If you have hard water or high concentrations of impurities, water treatment filters may be needed to improve ice quality and reduce cleaning frequency. Check with local water treatment firms for advice.

The ice making water supply strainer should be cleaned every time the water system is cleaned. (Refer to Fig. 1.) Proceed as follows:

1. Turn off the water supply.
2. Remove the plug and strainer.
3. Clean the strainer and replace.

CLEANING OF THE ICE MAKING SECTION

We recommend two ice machine cleaning solutions. They are Lime-A-Way from Economics Laboratories or Nickel-Safe from Calgon. Other cleaners from the same or other companies may be harmful to the nickel plating on the evaporator. Lime-A-Way can be purchased from Manitowoc ice machine distributors. Manitowoc's part number is 94-0546-9.

IN PLACE CLEANING

To clean the water system without removing the components proceed as follows: This method is acceptable when build-up is not excessive.

1. Remove front panel.
2. Remove any existing ice in the evaporator by pushing the manual harvest button.
3. Turn cuber off and remove all ice from bin.
4. Drain the sump trough water.
5. Pour 1 oz. of Lime-A-Way or Nickel-Safe cleaner in the sump and fill with fresh water.
6. Flip the toggle switch to the WATER PUMP position. Circulate the cleaner for a maximum of 15 minutes. If not sufficiently clean, proceed to hand cleaning instructions.
7. Flip the toggle switch to the OFF position, drain the water and cleaner solution. Proceed to "Sanitizing Procedure."

HAND CLEANING (Refer to Fig. 2 & 3)

Used when material build-up is too severe for "in place cleaning."

1. Turn the cuber and the water supply off. Remove the water pump, water distributor, water curtain, sump trough and ice from the bin.
2. Use a cleaning solution of 2 oz. of recommended cleaner per one gallon of warm water.
3. Soak the water distributor in a hot cleaning solution while cleaning the remaining parts. If necessary, the distributor tube can be disassembled.
4. Snap the water pump inlet screen out and clean.
5. Scrub all parts using a nylon brush and cleaning solution.
6. Scrub the base and evaporator assembly. Clean and flush the base drain. With a small brush, clean the weep holes in the corner of each evaporator cube cavity. Rinse with clear water.
7. Replace all the internal components and proceed to "Sanitizing Procedure."

STORAGE BIN CLEANING

1. Scrub the bin interior with 1 oz. of recommended cleaner per gallon of water. This solution may be used to clean other water and ice contact surfaces.
2. Rinse with clear water.

SANITIZING PROCEDURE

1. Reassemble unit.
2. Mix one teaspoon of solium hypochlorate (chlorine bleach) in one gallon of water. Fill sump trough.
3. Place toggle switch in WATER PUMP position and continue to add solution until the pump is fully primed. Circulate solution for one minute.
4. Turn off water pump and drain solution from sump trough into the bin to sanitize the bin.
5. Turn on the fresh water supply and allow the sump to fill. Flush the system several times by running the water pump at 1-minute intervals and then drain the sump.
6. Flush the bin out several times with clean water.
7. Turn cuber on by placing toggle switch in ICE position.
8. Make a visual inspection for leaks, drainage and proper water level and flow. Check all components for proper location and tighten all screws before replacing front panel. See Operational Procedure for adjustment.

CLEANING OF STAINLESS STEEL TRIM AND CHUTES

Stainless steel can show signs of brown staining or rusting when exposed to certain chemicals such as chlorine. This chlorine gas is expelled during the ice making process and will combine with water vapor and condense on stainless steel surfaces as a Hydrochloric Acid. The stainless metal parts should be cleaned periodically to prevent this staining from causing pitting of the stainless steel.

1. Empty Ice Bin and disassembly per disassembly instructions for cleaning.
2. With frequent cleanings an ordinary cleaning powder such as Copper-Glo or Bon-Ami with water will remove the brown staining. Do not use any bleaching agents with chlorine compounds. Rinse thoroughly with clean water.
3. If very heavy deposits and pitting have occurred, a chemical cleaner such as Oakit No. 33 from Oakit Productions, Inc. may be needed. Use one part cleaner to two parts water with chemical cleaners.
4. Clean the stainless steel with soap and water as described above. Then swab the solution over the stainless steel surfaces and let stand for 15 minutes. Rinse with clean water and repeat as necessary to completely remove staining.

   Be sure to read instructions for safety precautions when using any chemical cleaner. These cleaners could be harmful to surfaces and materials other than stainless steel.

PROTECTING STAINLESS STEEL SURFACES

To help protect stainless steel against staining the surface should be treated with a Nitric Acid solution of one part Nitric Acid to two parts water.

1. Clean the stainless surface and rinse thoroughly with clean water.
2. Then swab the Nitric Acid and water solution on the stainless steel and allow to stand for approximately 30 minutes.
3. Thoroughly rinse the stainless surface and the storage bin with clean water.

AIR COOLED CONDENSER CLEANING

The air cooled condenser should be cleaned frequently. A dirty condenser restricts air flow, causing reduced ice production.

1. Turn off main power supply.
2. Remove the front and wrap-around panels. Most dirt will collect on the inlet side of the condenser. This is opposite the fan motor.
3. Use a stiff brush to work the dust and dirt loose and remove with a vacuum cleaner.
4. If the cuber is located in an area where grease collects on the condenser, scrub with a solution of warm water and detergent. Keep solution away from wiring and electrical components.
5. Clean fan blades.
6. Check for loose items before replacing panels.

WINTERIZING CUBER

If the cuber is located in an unheated area, it must be protected from freezing temperatures or shut down and winterized. When the cuber is shut down for the winter, it is very important that all water be removed from the cuber. Refer to Fig. 2 & 3.

- — Turn main ice water and condenser water (if water cooled) supply valves off, disconnect and drain all water lines.
- — Drain the sump trough by removing the overflow elbow.
- — On water cooled models it is very important to completely drain the condenser. After the main water line has been disconnected, the outlet water line on the water regulating valve should be disconnected. All water should be forced from the condenser with compressed air. Any water left in the condenser can freeze and cause serious damage.

Ice Machine and Bin Warranty

From the date of original installation, we do hereby warrant each new Ice Machine and Bin to be free from defects in material and workmanship, under normal use and service, for a period of one year, and four additional years on the hermetic motor compressor in the Ice Machine.

Our obligation under this warranty is limited solely to correcting or replacing without charge at the factory in Manitowoc, Wisconsin any part or parts of this equipment which shall have been returned, transportation prepaid, and which our examination discloses to our satisfaction to be defective.

This warranty does not apply to any equipment that has been damaged by flood, fire, or suffered abuse, misuse, neglect or accident, or to any Ice Machine which has been altered so as to affect performance or reliability, except where such alteration has been accomplished with our prior written consent.

We further limit this warranty in that we shall not be held liable under this contract for any special, indirect, or consequential damages whatsoever resulting from any defect in material and workmanship which interferes with the normal use and service of such Ice Machine and Bin.

This warranty is a complete and exclusive statement of all terms of the agreement between the Manitowoc Equipment Works and the owner of the equipment, and all representations of the parties. This agreement shall not be varied, supplemented, qualified or interpreted by any prior course of dealing between the parties or by any usage of the trade.

Sales are made on the express understanding that there are no express or implied warranties other than the express warranty herein contained and that there are no implied warranties that the goods shall be merchantable or fit for a particular purpose other than the expressed one year and five year warranty set forth above.

To validate this warranty, the registration card must be signed on the date of installation and mailed promptly to the Manitowoc Equipment Works, Manitowoc, Wisconsin.

DEALER _____

_____

_____

INSTALLATION DATE _____

MANITOWOC EQUIPMENT WORKS
(A division of The Manitowoc Co., Inc.)
2110 South 26th St., Ph: 414-682-0161
Manitowoc, Wisconsin 54220

Form 80-0055-3
ALL