



**RecipPak LIQUID CHILLERS
AIR COOLED – RECIPROCATING HERMETIC**

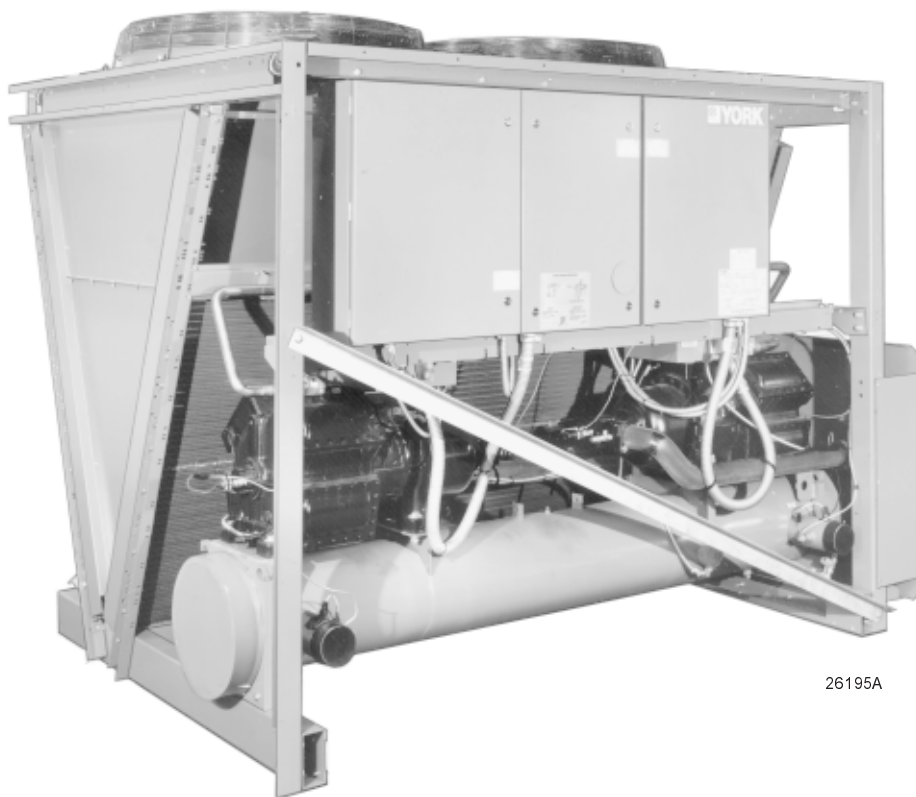
INSTALL., OPER., MAINTEN.

Supersedes: 150.44-NM3 in ERR only

Form 150.44-NM4 (395)

**60 HZ MODELS
YCAZ33BA3, YCAZ44BA3, YCAZ74BB3,
YCAZ77CB3, YCAZ88DB3**

STYLE A*



26195A

200, 230, 460-3-60

*With EPROM

031-01096C001

(Standard, Brine & Metric Models, Combined)

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WARNING

HIGH VOLTAGE
is used in the operation of this equipment.
DEATH OR SERIOUS INJURY
may result if personal fail to observe safety precautions.

Work on electronic equipment should not be undertaken unless the individual(s) have been trained in the proper maintenance of equipment and is (are) familiar with its potential hazards.

Shut off power supply to equipment before beginning work and follow lockout procedures. When working inside equipment with power off, take special care to discharge every capacitor likely to hold dangerous potential.

Be careful not to contact high voltage connections when installing or operating this equipment.

LOW VOLTAGE
DO NOT be misled by the term "low voltage".
Voltages as low as 50 volts may cause death.

GENERAL INFORMATION

GENERAL DESCRIPTION

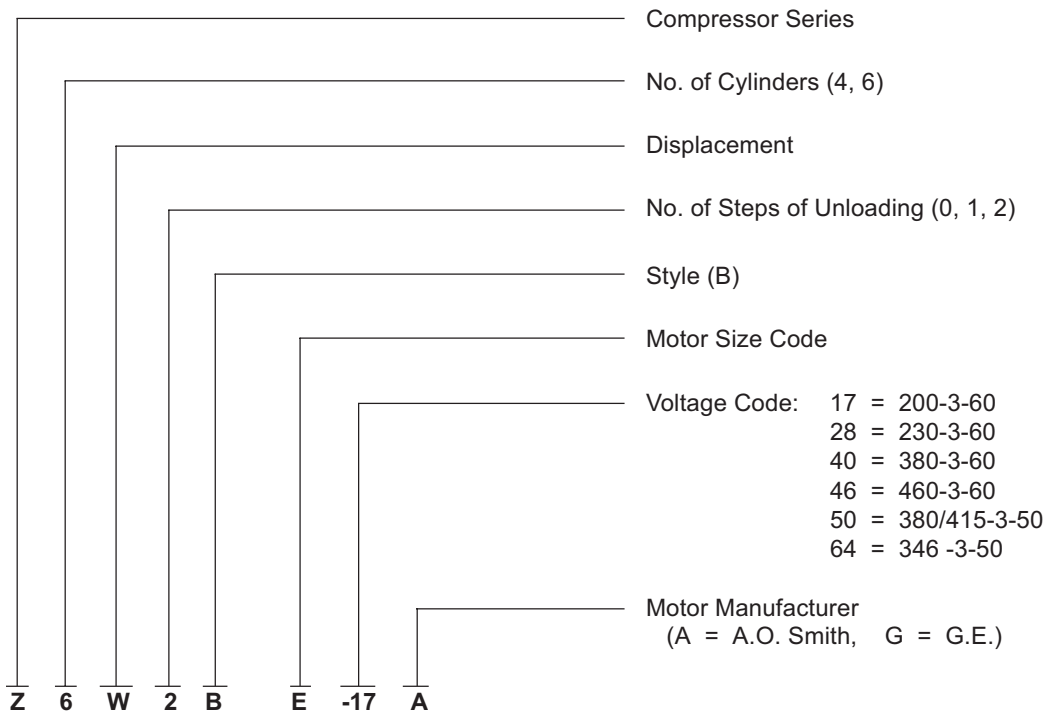
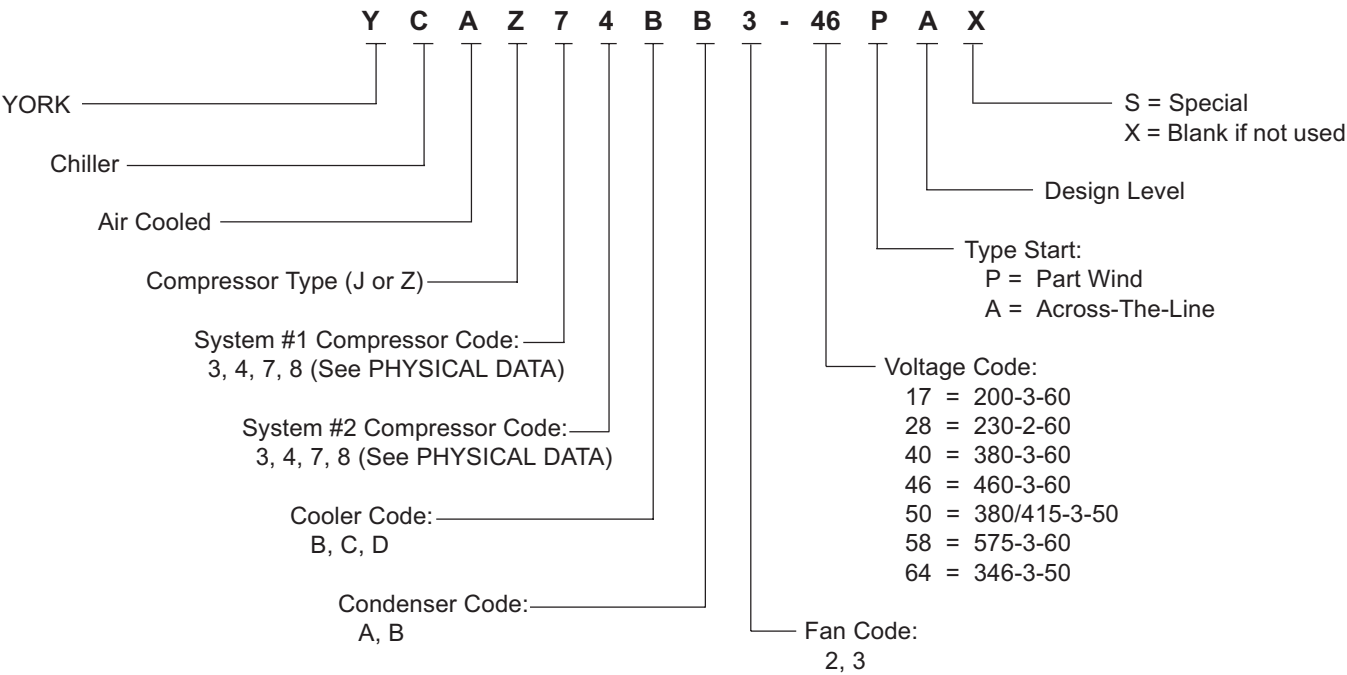
These packaged liquid chillers are completely self-contained outdoor units shipped ready for final job installation requiring only liquid connections, power and control wiring. They are designed primarily for central station air conditioning applications with normal installations being on roof-tops or on ground level beside the building.

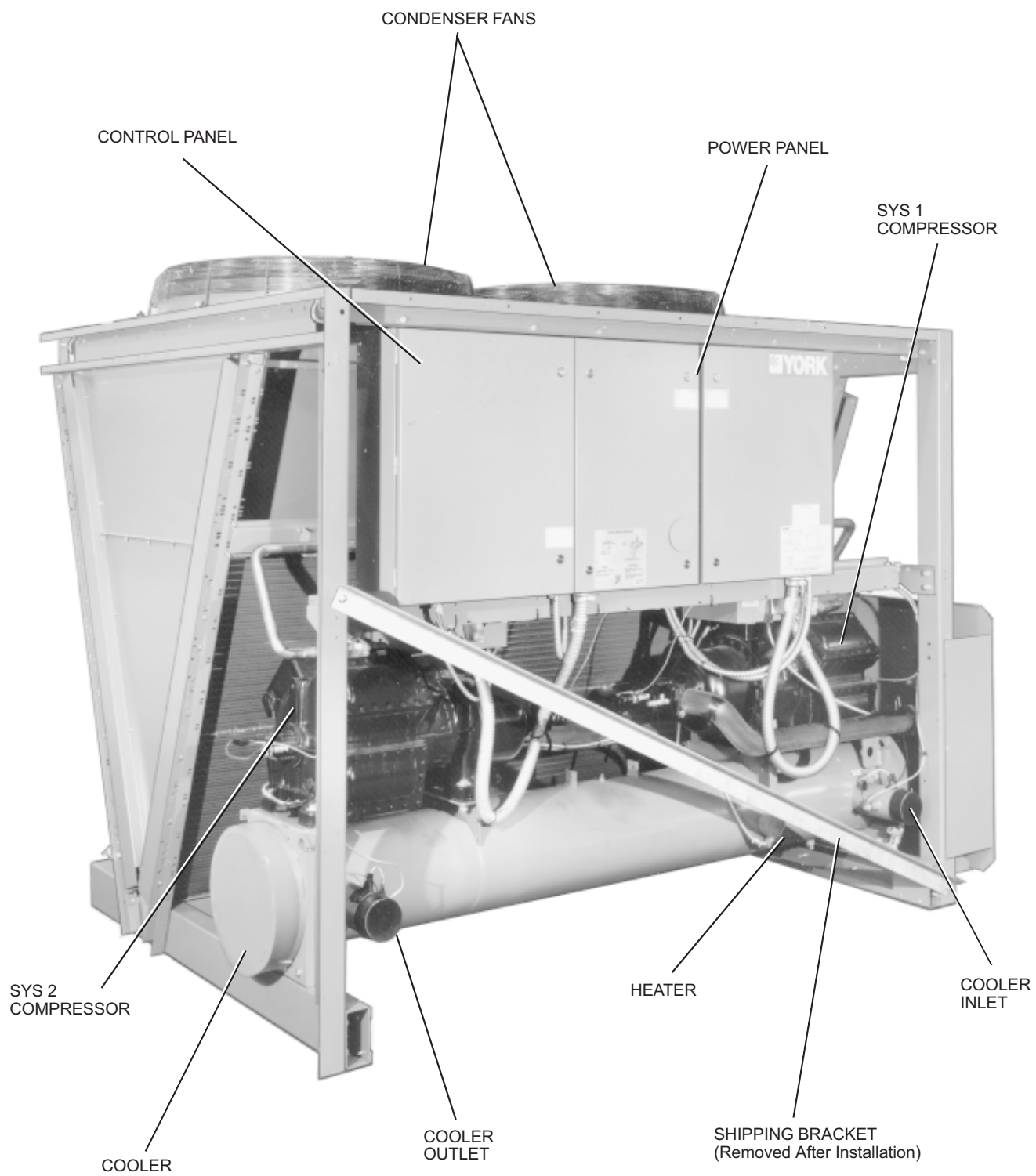
CODE STATUS

The units are designed in accordance with UL (200, 230, 460-3-60), N.E.C., ASHRAE/ANS STANDARD 15, and ASME Codes.

UNIT NOMENCLATURE

The model number denotes the following characteristics of the unit:





26195A(R)

FIG. 1 – UNIT COMPONENTS



HOT GAS BY-PASS (OPTIONAL)
SYSTEM #1

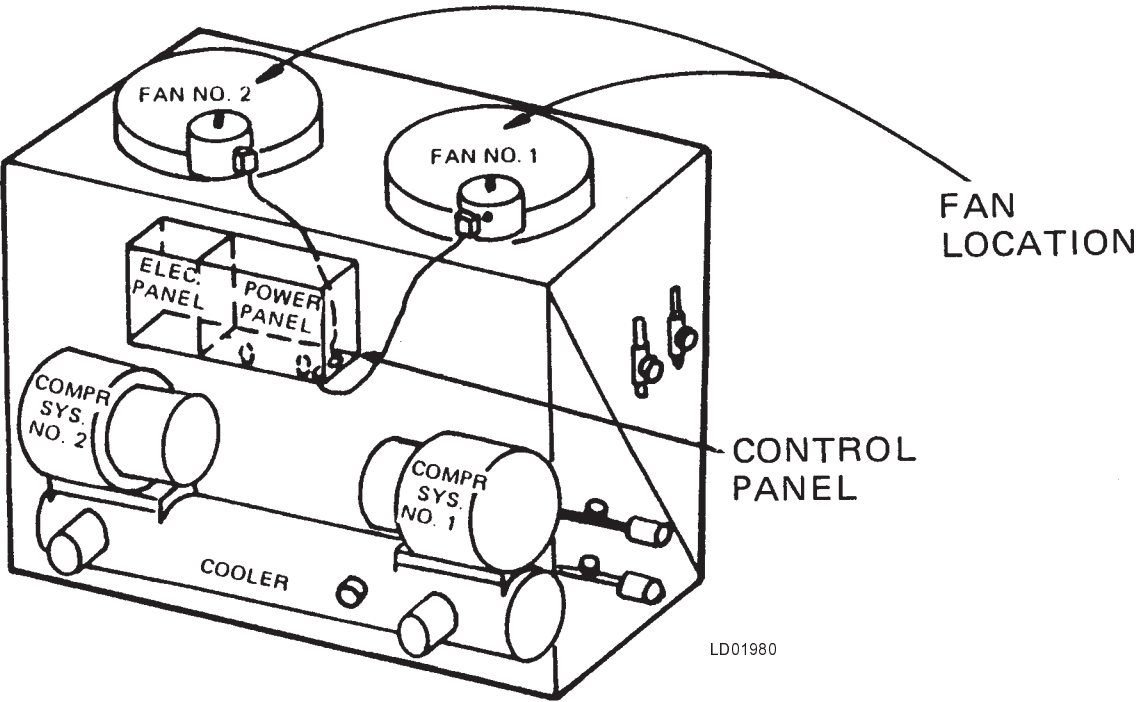


FIG. 1 – UNIT COMPONENTS (Cont'd)

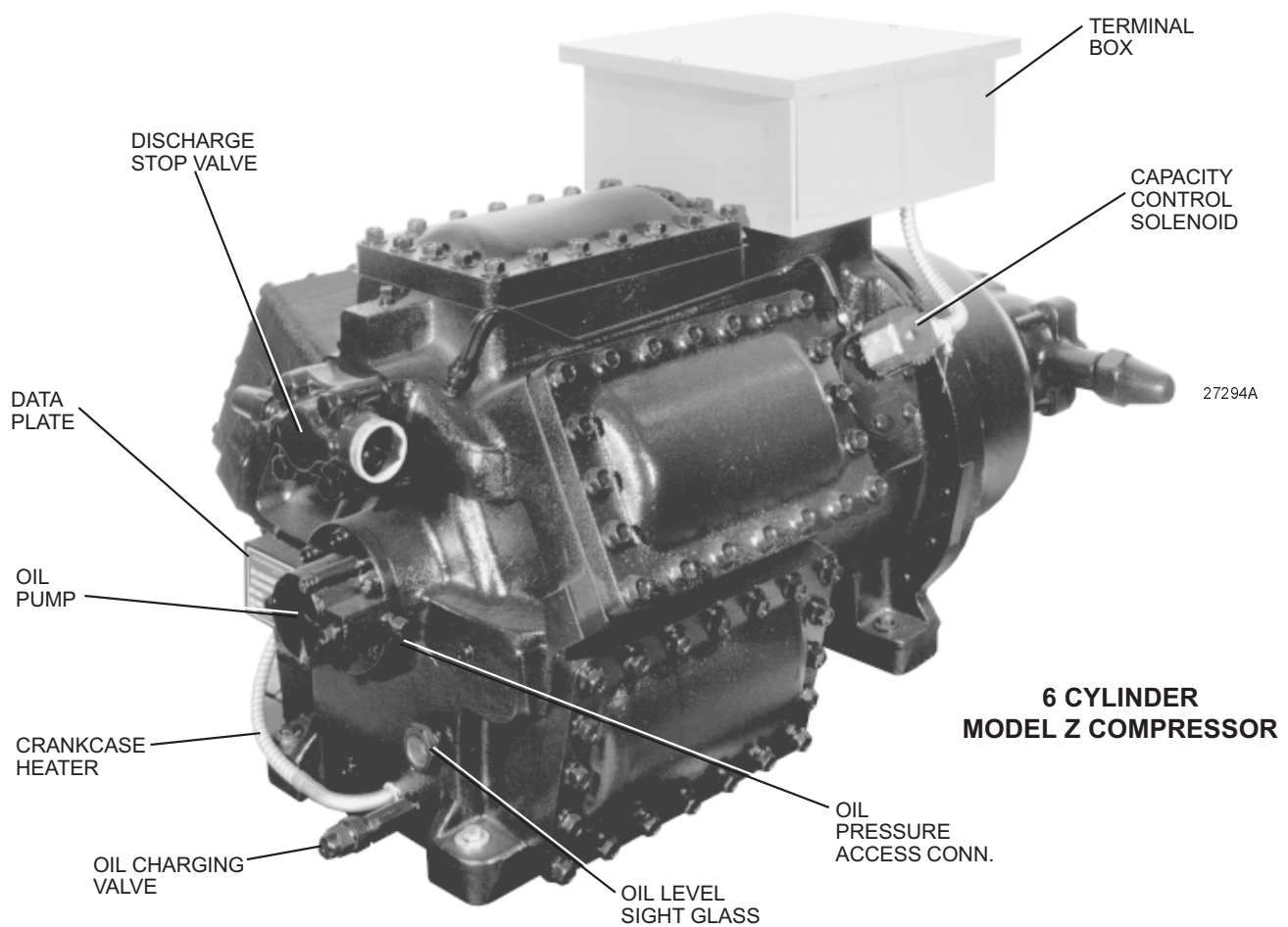
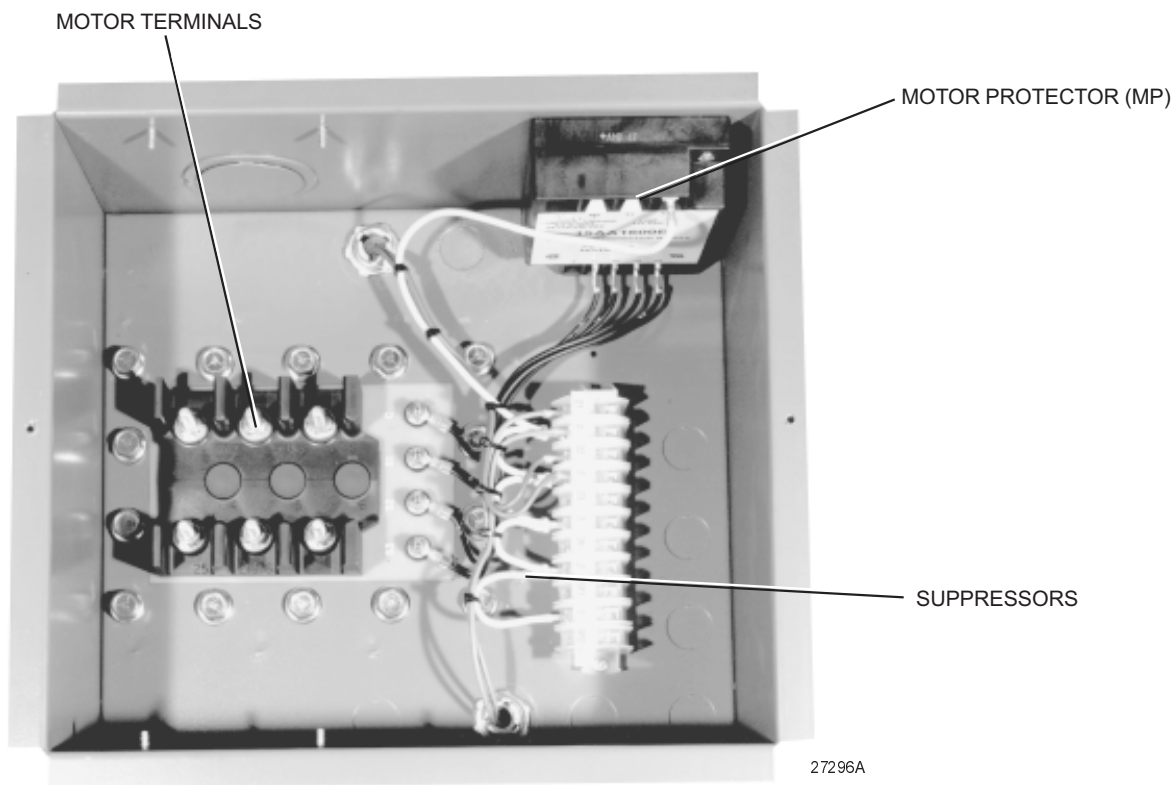
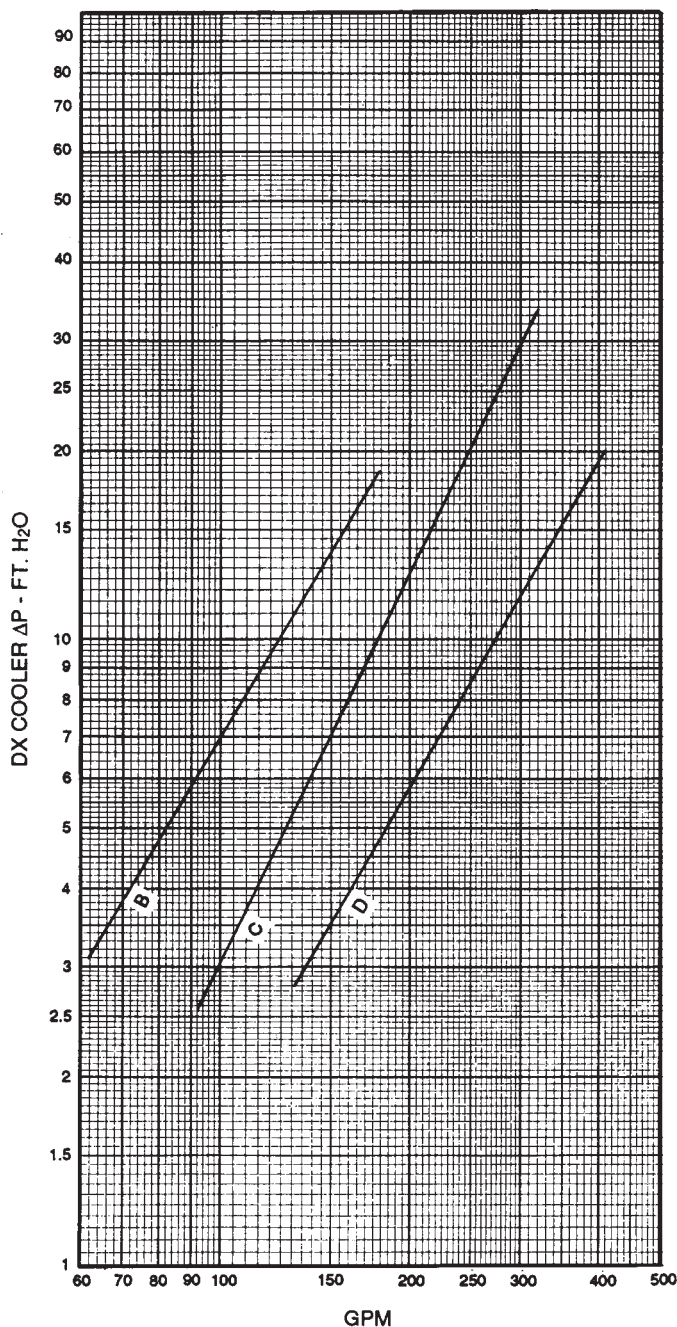


FIG. 1A – COMPRESOR COMPONENTS

OPERATIONAL LIMITATIONS



LD01981

CODE	MODEL YCA
B	Z33BA3
C	Z44BA3, Z74BB3, Z77CB3
D	Z88DB3

VOLTAGE LIMITATIONS

The following voltage limitations are absolute and operation beyond these limits may cause serious damage to the compressor.

VOLTAGES

UNIT POWER	MIN.	MAX.
200-3-60	180	220
230-3-60	207	253
380-3-60	355	415
460-3-60	414	506
380/415-3-50	342	440
346-3-50	311	381
575-3-60	517	633

TEMPERATURES AND FLOWS

MODEL YCA	LVG. WATER TEMP. °F		COOLER GPM		AIR ON COND. - °F	
	MIN. ¹	MAX.	MIN.	MAX.	MIN. ²	MAX. ³
Z33BA3	40	50	75	250	0	130
Z44BA3	40	50	90	250	0	130
Z74BB3	40	50	90	250	0	130
Z77CB3	40	50	90	315	0	130
Z88DB3	40	50	130	390	0	130

NOTES:

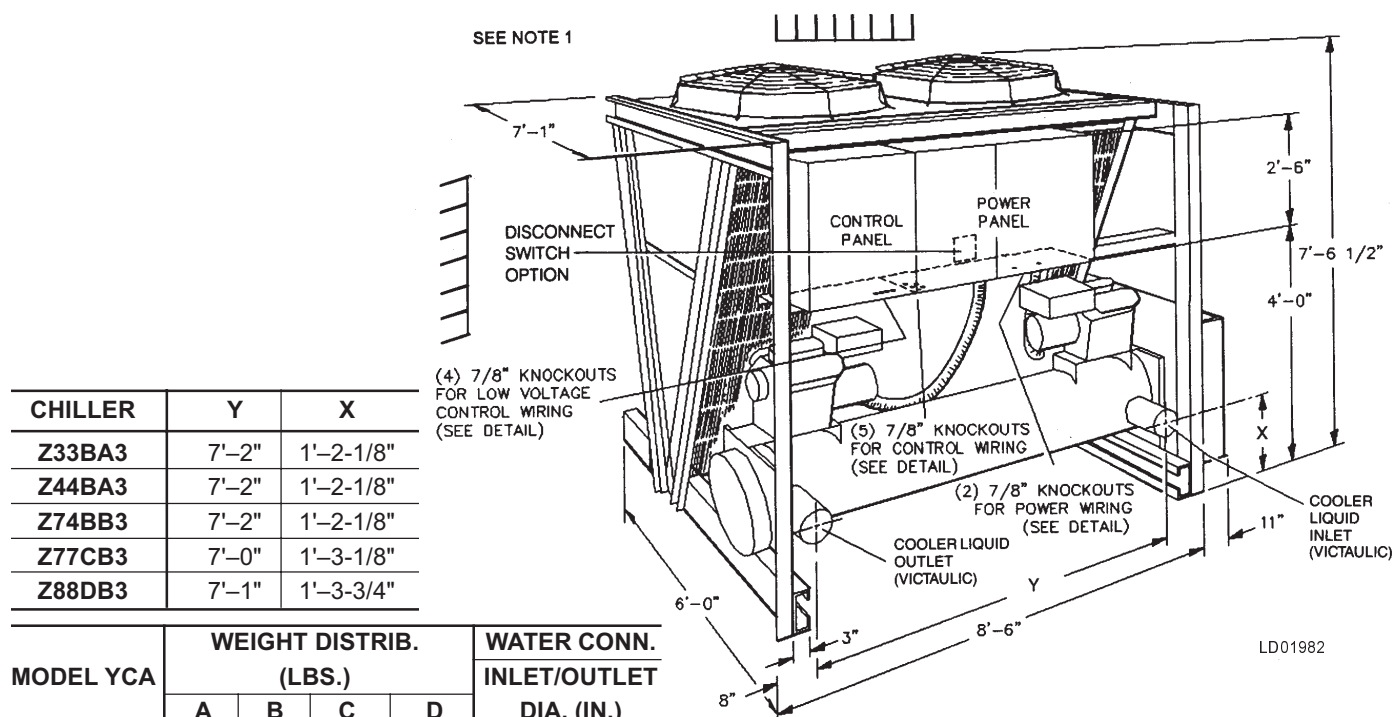
- Units can be used for brine temperatures between 15°F and 39°F by resetting standard controls.
- Operation below 25°F requires the Optional Low Ambient Kit (Minimum recommended operating temperature is 0°F).
- Operation above 115°F requires Optional High Ambient Kit (Maximum recommended operating temperature is 130°F).
- The evaporator is protected against freeze-up to -20°F with an electrical heater cable standard.

CAUTION: Excessive flow will cause damage to the cooler. Do not exceed maximum Cooler GPM. Special care should be taken when multiple chillers are fed by a single pump.

PHYSICAL DATA

MODEL YCA		60 HZ	Z33BA3	Z44BA3	Z74BB3	Z77CB3	Z88DB3
NOMINAL TONS			51.8	58.2	65.1	70.5	81.9
NO. OF REFRIG. CIRCUITS			2	2	2	2	2
ACCESSIBLE HERMETIC COMPRESSOR MODEL (COMPRESSOR HP)			(2)ZB4K1-B (35 HP)	(2)ZB4M1-C (45 HP)	(1)ZB6S1-D (55 HP) (1)ZB4M1-C (45 HP)	(2)ZB6S1-D (55 HP)	(2)ZB6WZ-E (65 HP)
UNIT CAPACITY CONTROL	STANDARD		5 Steps	5 Steps	5 Steps	5 Steps	5 Steps
	OPTIONAL		N/A	N/A	6 Steps	7 Steps	7 Steps
CONDENSER – DWP 450 PSIG NO. OF FANS (42" Dia Direct Drive)			2	2	2	2	2
HP/KW Each (850 RPM)			3/2.5	3/2.5	3/2.5	3/2.5	3/2.5
CFM TOTAL			30,300	30,300	34,400	34,400	34,400
COOLER – DUAL CIRCUITED DWP – 235 PSIG REF. SIDE, 150 PSIG WATER SIDE							
DIA. x LENGTH			11" x 8"	11" x 8"	11" x 8"	12" x 8"	14" x 8"
WATER VOLUME (GALS.)			25	25	25	30	38
GPM	MIN.		75	75	75	90	130
	MAX.		250	250	250	315	390
WEIGHT LBS.	SHIPPING	AL Fins	4,800	5,150	5,550	5,675	5,850
		CU Fins	5,350	5,700	6,375	6,500	6,675
	OPERATING	AL Fins	5,000	5,350	5,750	5,900	6,150
		CU Fins	5,550	5,900	6,575	6,725	6,975
REFRIGERANT CHARGE (LBS. R-22)		Sys. 1	42	50	56	56	65
		Sys. 2	42	50	50	56	65

DIMENSIONS



MODEL YCA	WEIGHT DISTRIB. (LBS.)				WATER CONN. INLET/OUTLET DIA. (IN.)
	A	B	C	D	
Z33BA3	791	791	1707	1707	4
Z44BA3	858	858	1811	1811	4
Z74BB3	931	931	1948	1948	4
Z77CB3	935	935	2011	2011	6
Z88DB3	977	977	2079	2079	6
Z88DB3	977	977	2079	2079	6

NOTES

CAUTION

FAILURE TO HEED FOLLOWING MINIMUM RECOMMENDED CLEARANCES MAY RESULT IN REDUCED SYSTEM PERFORMANCE, NUISANCE SHUT-DOWNS, AND SERVICE PROBLEMS.

1. CLEARANCES – Recommended YORK required clearances to prevent condenser air recirculation and faulty operation of units are as follows:

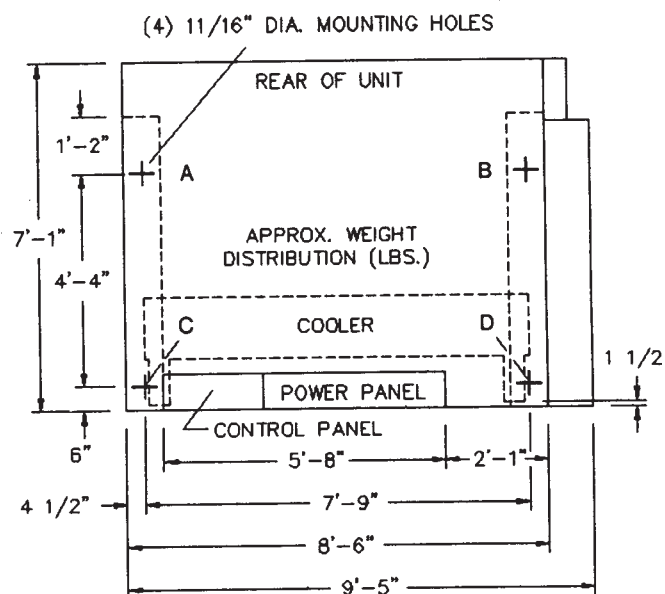
Side to wall - 5'-0" ** / Rear to wall - 8'-0" ** / Front to wall - 8'-0" ** / Top - 50'-0" / Distance between adjacent units - 12'-0"

* No more than one wall can be higher than the top of the unit.

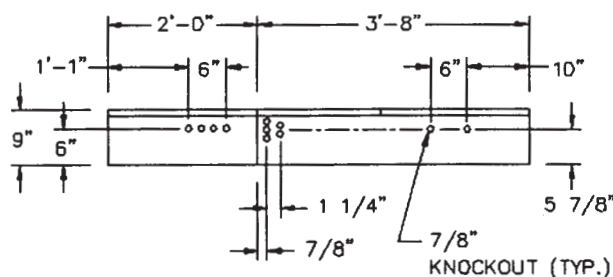
Failure to heed recommended clearances may result in reduced system performance, nuisance shutdowns and servicing problems.

The area within the clearances shown above and area under the unit must be kept clear of all obstructions that would impede free air flow to the unit. In installations where winter operation is intended and snow accumulations are expected, additional unit height must be provided to insure full air flow.

2. Panel bottom to be punched in field to accommodate power wiring conduit.
3. Use of isolators (optional) will increase height of unit approximately 6".
4. Drawings not to scale and are for planning purposes only. Refer to QMS drawings for most up-to-date dimensions.
5. Be sure to review WARNINGS on page 2 prior to installation.



PLAN VIEW



BOTTOM VIEW - CONTROL / POWER PANELS

ELECTRICAL DATA

MODEL YCA		UNIT POWER SUPPLY					INCOMING WIRE RANGE ⁶			SYS. 1 COMPR.		
		MCA ¹	DUAL ELEM FUSE SIZE		DISC MIN ⁴	MAX SIZE CKT BKR HACR TYPE ⁵	PW START	ACL START	YORK SUPPLIED NON-FUSED DISCONNECT (OPTIONAL)	RLA	ACL/ LRA	PW/ LRA
			MIN ²	MAX ³								
Z33BA3	-17	274	350	350	400	350	(2)#4-250MCM	N/A	(1) #1-600MCM OR (2) #1-250MCM	112	582	368
Z33BA3	-28	237	300	300	400	300	(2)#4-250MCM	N/A	(1) #1-600MCM OR (2) #1-250MCM	97	506	320
Z33BA3	-46	119	150	150	200	150	(2)#4-250MCM	(2)#4-250MCM	(1) #6-350MCM	48.5	253	160
Z33BA3	-58	95	125	125	200	125	(2)#4-250MCM	(2)#4-250MCM	(1) #6-350MCM	38.8	202	128
Z44BA3	-17	319	400	450	400	450	(2)#4-250MCM	N/A	(1) #1-600MCM OR (2) #1-250MCM	132	674	414
Z44BA3	-28	276	350	350	400	350	(2)#4-250MCM	N/A	(1) #1-600MCM OR (2) #1-250MCM	114	586	360
Z44BA3	-46	138	175	175	200	175	(2)#4-250MCM	(2)#4-250MCM	(1) #6-350MCM	57	293	180
Z44BA3	-58	110	150	150	200	150	(2)#4-250MCM	(2)#4-250MCM	(1) #6-350MCM	45.6	234	144
Z74BB3	-17	353	450	500	400	500	(2)#4-250MCM	N/A	(1) #1-600MCM OR (2) #1-250MCM	159	741	582
Z74BB3	-28	306	350	400	400	400	(2)#4-250MCM	N/A	(1) #1-600MCM OR (2) #1-250MCM	138	644	506
Z74BB3	-46	153	200	200	200	200	(2)#4-250MCM	(2)#4-250MCM	(1) #6-350MCM	69	322	253
Z74BB3	-58	122	150	175	200	175	(2)#4-250MCM	(2)#4-250MCM	(1) #6-350MCM	55	258	202
Z77CB3	-17	380	450	500	600	500	(2)#4-250MCM	N/A	(1-2) #2/0-500MCM	159	741	582
Z77CB3	-28	330	400	450	400	450	(2)#4-250MCM	NM	(1) #1-600MCM OR (2) #1-250MCM	138	644	506
Z77CB3	-46	165	200	225	200	225	(2)#4-250MCM	(2)#4-250MCM	(1) #6-350MCM	69	322	253
Z77CB3	-58	131	175	175	200	175	(2)#4-250MCM	(2)#4-250MCM	(1) #6-350MCM	55	258	202
Z88DB3	-17	468	6W	600	600	600	(2)#4-250MCM	NM	(1-2) #2/0-500MCM	198	880	675
Z88DB3	-28	406	500	500	600	500	(2)#4-250MCM	NM	(1-2) #2/0-500MCM	172	765	587
Z88DB3	-46	203	250	250	250	250	(2)#4-250MCM	(2)*4-250MCM	(1) #6-350MCM	86	383	294
Z88DB3	-58	162	200	225	200	225	(2)#4-250MCM	(2)#4-250MCM	(1) #6-350MCM	68.8	306	235

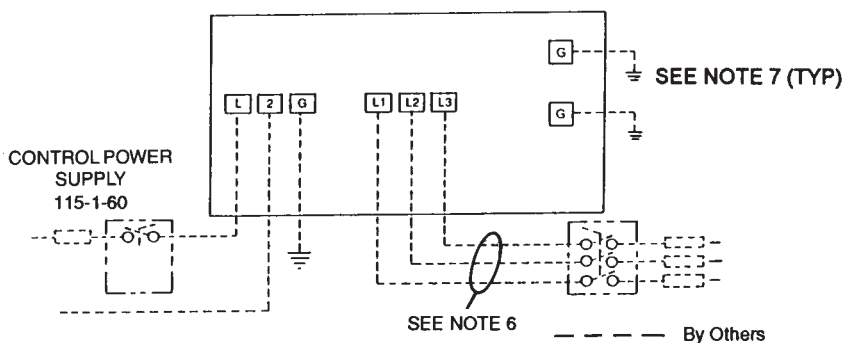
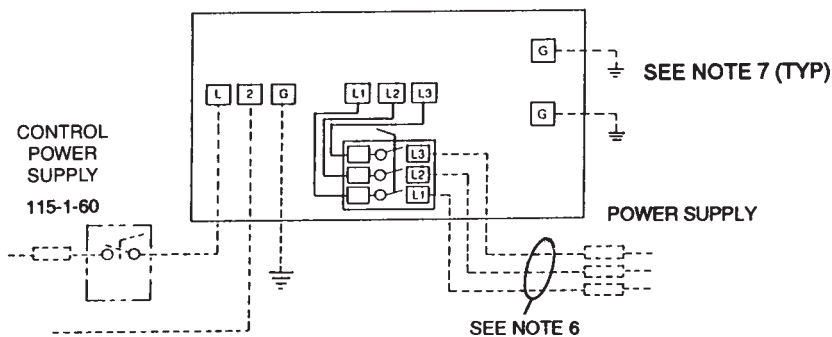
NOTES

1. Minimum Circuit Ampacity (MCA) is based on 125% of the rated load amps for the largest motor plus 100% of the loaded amps for all other loads included in the circuit, per N.E.C. Article 430-24. If a Factory Mounted Control Transformer is provided, add the following to the system #1 MCA values in the YCA Tables: -17, add 10 amps; -28, add 9 amps; -46, add 4 amps; -58, add 3 amps.
2. Minimum fuse size is based on 150% of the largest motor RLA plus 100% of the remaining RLA's. (U.L. Standard 1995, Section 36.1). It is not recommended in applications where brown-outs, frequent starting and stopping of the unit, and/or operation at ambient temperatures in excess of 95°F is anticipated.
3. Maximum dual element fuse size is based on 225% maximum plus 100% of the rated load amps for all other loads included in the circuit, per N.E.C. 440-22.
4. The recommended disconnect switch is based on a minimum of 115% of the summation rated load amps of all the loads included in the circuit, per N.E.C. 440-12A1.
5. Maximum HACR is based on 225% maximum plus 100% of the rated load amps for all loads included in the circuit, per circuit, per UL 1995 Fig 36.2.
6. The "INCOMING WIRE RANGE" is the minimum and maximum wire size that can be accommodated by the unit wiring lugs. The (1), (2), (3), or (4) preceding the wire range indicates the number of termination points available per phase of the wire range specified. The (1 -2) preceding the wire range indicates that a single double-barreled lug is available per phase that can accept up to two wires of the wire range specified. "(1) #1-600MCM OR (2) #1-250MCM" indicates that a single lug is supplied and it will accept a single wire up to 600MCM or 2 wires up to 250MCM. Actual wire size and number of wires per phase must be determined based on ampacity and job requirements using N.E.C. wire sizing information. The above recommendations are based on the National Electrical Code and using copper connectors only. Field wiring must also comply with local codes.
7. A ground lug is provided for each compressor system to accommodate field grounding conductor per N.E.C. Article 250-54. A control circuit grounding lug is also supplied. Incoming ground wire range is #6 - #2/0.

SYS. 2 COMPR.			COND. FAN FLA EACH
RLA	ACL/ LRA	PW/ LRA	
112	582	368	11.0
97	506	320	9.6
48.5	253	160	4.8
38.8	202	128	3.8
132	674	414	11.0
114	586	360	9.6
57	293	180	4.8
45.6	234	144	3.8
132	674	414	11.0
114	586	360	9.6
57	293	180	4.8
45.6	234	144	3.8
159	741	582	11.0
138	644	506	9.6
69	322	253	4.8
55	258	202	3.8
198	880	675	11.0
172	765	587	9.6
86	383	294	4.8
68.8	306	235	3.8

LEGEND:

VOLT	=	Voltage
MCA	=	Minimum Circuit Ampacity
DISC	=	Disconnect
ACL	=	Across-the-Line
PW	=	Part Wind
N/A	=	Not Available
RLA	=	Running Load Amps
FLA	=	Full Load Amps
ACL/LRA	=	Across-the-Line Inrush Amps
PW/LRA	=	Part Wind Inrush Amps
CKT BRK	=	Circuit Breaker
HACR	=	Heating, Air Conditioning and Refrigeration

YCAZ 50 - 90
POWER WIRING CONNECTIONS
STANDARD UNIT

NON-FUSED DISCONNECT SWITCH OPTION


LD01985

CONTROL POWER SUPPLY

UNIT VOLTAGE	CONTROL POWER SUPPLY	MIN CIRCUIT AMPACITY	MAX DUAL ELEMENT FUSE SIZE	NON-FUSED DISC. SW. SIZE
Std. Models w/o Transformers	115-1-60	20A	20A, 250V	30A, 240V

INSTALLATION

WARNING:

To protect warranty, this equipment must be installed and serviced by an authorized YORK service mechanic or a qualified service person experienced in chiller installation. Installation must comply with all applicable codes, particularly in regard to electrical wiring and other safety elements such as relief valves, HP cutout settings, design working pressures and ventilation requirements consistent with the amount and type of refrigerant charge.

Lethal voltages exist within the control panel. Before servicing, open and tag all disconnect switches. Refer to WARNINGS on page 2.

INSTALLATION CHECK LIST

The following items, 1 thru 5, must be checked before placing units into operation.

1. Inspect unit for shipping damage.
2. Rig unit per Fig. 3. Remove unpainted shipping braces after installation.

3. Open unit only to install water piping system. Do not remove protective covers from water connections until piping is ready for attachment. Check water piping to insure cleanliness.
4. Pipe unit using good piping practice and consistent with local code requirements.
5. Check to see that unit is installed and operated within LIMITATIONS shown on page 7.

The following pages outline procedures to be followed.

HANDLING

These units are shipped as completely assembled units containing full operating charge, and care should be taken to avoid damage due to rough handling.

The units are shipped without export crating unless it is specified by Sales Order.

A unit should be lifted by inserting hooks through the holes provided in unit top rails.



26195A

FIG. 3 – RIGGING THE CHILLER

INSPECTION

Immediately upon receiving the unit, it should be inspected for possible damage which may have occurred during transit. If damage is evident, it should be noted on the carrier's freight bill. A written request for inspection by the carrier's agent should be made at once. See Instruction 50.15-NM for more information and details.

LOCATION AND CLEARANCES

These units are designed for outdoor installations on ground level, rooftop, or beside a building. The location should be selected for minimum sun exposure and to insure an adequate supply of fresh air for the condenser. The units must be installed with sufficient clearances for air entrance to the condenser coil, for air discharge away from the condenser, and for servicing access.

In installations where winter operation is intended and snow accumulations are expected, additional height must be provided to insure normal condenser air flow. (See DIMENSIONS).

FOUNDATION

The unit should be mounted on a flat and level foundation, floor or rooftop, capable of supporting the entire operating weight of the equipment. See PHYSICAL DATA for operating weight. If the unit is elevated beyond the normal reach of service personnel, a suitable catwalk must be constructed around the unit. The catwalk must be capable of supporting service personnel, their equipment, and the reciprocating compressors.

Ground Level Locations

It is important that the units be installed on a substantial base that will not settle. A one piece concrete slab with footers extended below the frost line is highly recommended. Additionally, the slab should not be tied to the main building foundations as noise and vibration may be transmitted.

Mounting holes are provided in the steel channel for bolting the unit to its foundation. (See DIMENSIONS).

For ground level installations, precautions should be taken to protect the unit from tampering by or injury to unauthorized persons. Screws and/or latches on access panels will prevent casual tampering. However, further safety precautions such as a fenced-in enclosure or locking devices on the panels may be advisable. A tamperproof kit is available as an option. Check local authorities for safety regulations.

Rooftop Locations

Choose a spot with adequate structural strength to safely support the entire weight of the unit and service

personnel. Care must be taken not to damage the roof. Consult the building contractor or architect if the roof is bonded. Roof installations should have wooden beams (treated to reduce deterioration), cork, rubber, or vibration isolators under the base to minimize vibration.

SHIPPING BRACES

Two shipping brackets (typically galvanized steel) which run diagonally along each side of the unit, must be removed once the unit is mounted on its foundation. A third bracket on the right rear of the unit should also be removed. This bracket runs across the bottom right corner of the unit behind the compressors.

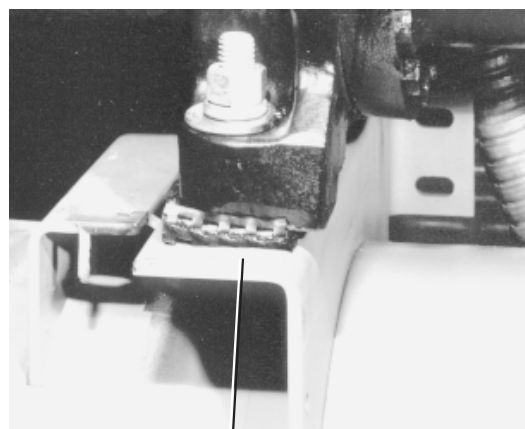
SPRING ISOLATORS (OPTIONAL)

When ordered, four (4) vibration isolators will be furnished.

1. Identify isolator and locate at proper mounting point using table on page 14.
2. Block up equipment so as to install spring mounts with pin on top of housing into Equipment Mounting Holes.
3. Mounting Adjust Nut is inside the isolator mount located just below the top plate of the mount. Turn nut 2 turns clockwise (down) to load spring mount at each location.
4. Take two additional turns on Adjustment Nut of each location.
5. Repeat step No. 3 as many times as necessary to bring height of isolator to proper height.
6. Take additional turns on mounts at low side or corner to level the equipment.

COMPRESSOR MOUNTING

The compressors are mounted on four (4) isolator pads (one under each compressor foot). (See Fig. 4). The mounting bolts are not to be loosened or adjusted at installation.



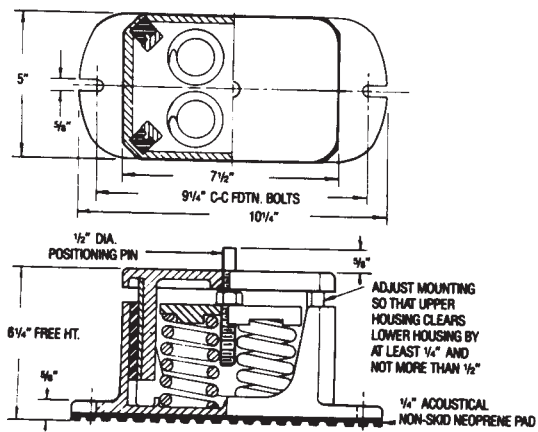
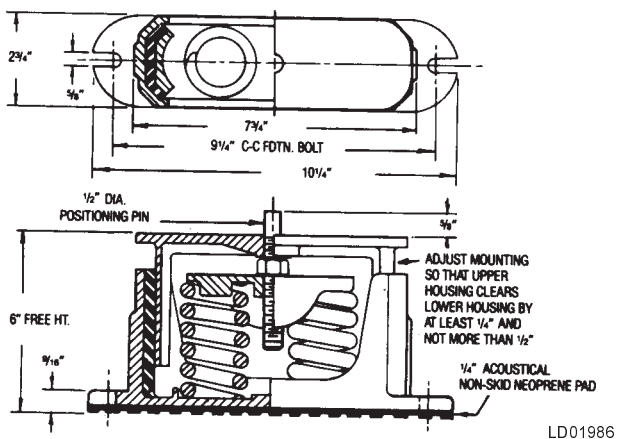
COMPRESSOR MOUNTING PAD

FIG. 4 – COMPRESSOR MOUNTING PAD

25112A

WEIGHT DISTRIBUTIONS AND ISOLATOR LOCATIONS FOR EACH MODEL

MODEL YCA	WEIGHT DISTRIBUTION (LBS.) OPERATING				
	A	B	C	D	TOTAL
CU/AL					
Z33BA3	745	745	1610	1610	4710
Z44BA3	805	805	1700	1700	5010
Z74BB3	875	875	1830	1830	5410
Z77CB3	890	890	1915	1915	5610
Z88DB3	930	930	1980	1980	5820
CU/CU					
Z33BA3	980	980	1650	1650	5260
Z44BA3	1040	1040	1740	1740	5560
Z74BB3	1235	1235	1885	1885	6240
Z77CB3	1250	1250	1970	1970	6440
Z88DB3	1290	1290	2035	2035	6650



VMC ISOLATORS

LD01987

MODEL YCA	WEIGHT DISTRIBUTION (LBS.) OPERATING				
	Isolator	A	B	C	D
CU/AL					
Z33BA3	Mason Ind.	CIP-C-1000	CIP-C-1000	CIP-C-1695	CIP-C-1695
	VMC	CP-2-25	CP-2-25	CP-2-28	CP-2-28
Z44BA3	Mason Ind.	CIP-C-1000	CIP-C-1000	CIP-C-1695	CIP-C-1695
	VMC	CP-2-25	CP-2-25	CP-2-31	CP-2-31
Z74BB3	Mason Ind.	CIP-C-1000	CIP-C-1000	CIP-C-2100	CIP-C-2100
	VMC	CP-2-26	CP-2-26	CP-2-31	CP-2-31
Z77CB3	Mason Ind.	CIP-C-1000	CIP-C-1000	CIP-C-2100	CIP-C-2100
	VMC	CP-2-26	CP-2-26	CP-2-31	CP-2-31
Z88DB3	Mason Ind.	CIP-C-1000	CIP-C-1000	CIP-C-2100	CIP-C-2100
	VMC	CP-2-26	CP-2-26	CP-2-31	CP-2-31

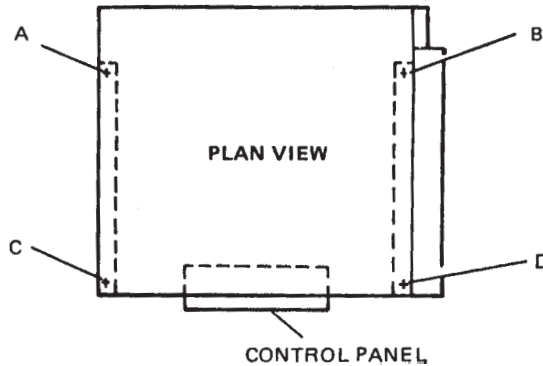
CU/CU					
Z33BA3	Mason Ind. VMC	CIP-C-1000 CP-2-26	CIP-C-1000 CP-2-26	CIP-C-1695 CP-2-28	CIP-C-1695 CP-2-28
Z44BA3	Mason Ind. VMC	CIP-C-1000 CP-2-26	CIP-C-1000 CP-2-26	CIP-C-1695 CP-2-31	CIP-C-1695 CP-2-31
Z74BB3	Mason Ind. VMC	CIP-C-1350 CP-2-27	CIP-C-1350 CP-2-27	CIP-C-2100 CP-2-31	CIP-C-2100 CP-2-31
Z77CB3	Mason Ind. VMC	CIP-C-1350 CP-2-27	CIP-C-1350 CP-2-27	CIP-C-2100 CP-2-31	CIP-C-2100 CP-2-31
Z88DB3	Mason Ind. VMC	CIP -C-1350 CP-2-27	CIP-C-1350 CP-2-27	CIP-C-2100 CP-2-31	CIP-C-2100 CP-2-31

CIP SIZE	RATED CAPACITY (LBS.)	RATED DEFL (IN.)	SPRING CONSTANT (LBS./IN.)	SPRING COLOR
C-1000	1000	1.06	944	BLACK
C-1350	1350	1.00	1350	YELLOW
C-1750	1750	1.00	1750	BLACK ¹
C-2100	2100	1.00	2100	YELLOW ¹
C-2385	2385	1.00	2385	YELLOW ²
C-2650	2650	1.00	2650	RED ¹
C-2935	2935	1.00	2935	RED ²

NOTES:

1. With red spring inside
2. With green spring inside

CIP SIZE	L	W	FREE & OP. HT.	T	MBD	SBC	SW	HCW	HCL	E
C	8-7/8	3-1/2	6-1/8	9/16	3/8	7-7/8	7/16	1-3/4	7-1/4	6-5/8



LD01988

CHILLED LIQUID PIPING

GENERAL – When the unit has been located in its final position, the unit liquid piping may be connected. Normal installation precautions should be observed in order to receive maximum operating efficiencies. Piping should be kept free of all foreign matter. All liquid cooler piping must comply in all respects with local plumbing codes and ordinances.

Since elbows, tees and valves decrease pump capacity, all piping should be kept as simple as possible.

Hand stop valve should be installed in all lines to facilitate servicing.

Piping to the inlet and outlet connections of the chiller may include high-pressure rubber hose or piping loops to insure against transmission of water pump vibration. This is optional and the necessary components must be obtained in the field.

Drain connections should be provided at all low points to permit complete drainage of liquid cooler and piping system.

A small valve or valves should be installed at the highest point or points in the chilled liquid piping to allow any trapped air to be purged. Vent and drain connections should be extended beyond the insulation to make them accessible.

The piping to and from the cooler must be designed to suit the individual installation. It is important that the following considerations be observed:

1. The chilled liquid piping system should be laid out so that the circulating pump discharges directly into the cooler. The suction for this pump should be taken from the piping system return line and not the cooler.
2. The inlet and outlet cooler liquid connection sizes are given on page 9.
3. A strainer, preferably 40 mesh, **MUST** be installed in the cooler inlet line just ahead of the cooler.
4. All chilled liquid piping should be thoroughly flushed to free it from foreign material before the system is placed into operation. Use care not to flush any foreign material into or through the cooler.
5. As an aid to servicing, thermometers and pressure gauges should be installed in the inlet and outlet water lines. One connection point (plugged) is provided in each cooler nozzle. Thermometers and gauges are not furnished with the unit and are to be furnished by other suppliers.
6. The chilled liquid lines that are exposed to outdoor ambients should be wrapped with a supplemental heater cable and insulated to protect against freeze-up during low ambient periods, and to prevent forma-

tion of condensation on lines in warm humid climates.

7. A chilled water flow switch, (either by YORK or others) **MUST** be installed in the leaving water piping of the cooler. There should be a straight horizontal run of at least 5 diameters on each side of the switch. Adjust the flow switch paddle to the size of pipe in which it is to be installed. (See manufacturer's instructions furnished with switch). The switch is to be wired to terminals in the control panel as shown in the **WIRING DIAGRAM**.

WARNING: *Flow switch must not be used to stop and start chiller. It is intended only as a safety switch.*

COMPRESSOR INSULATION

In high humidity environments, compressor sweating may be noted. In most applications, this is of no concern. However, if it is undesirable, it is the responsibility of the installer to make provisions to field insulate the compressor or install a factory insulation kit when they become available. Contact your local YORK Sales Office for availability.

ELECTRICAL WIRING

Liquid Chillers are shipped with all factory mounted controls wired for operation.

Field Wiring – Power wiring must be provided through a fused disconnect switch to the unit terminals (or optional molded case disconnect switch) in accordance with N.E.C. or local code requirements. Minimum circuit ampacity and maximum dual element fuse size are given on pages 10 and 11. A 115-1-60/50, 20 amp source must be supplied for the control panel through a fused disconnect when a control panel transformer (optional) is not provided. Refer to **WIRING DIAGRAM**.

Affiliated apparatus, such as a chilled water flow switch, auxiliary contacts from the chilled water pump starter, alarms, etc., should be interlocked into the control panel circuit. These field modifications may be made as shown on the **WIRING DIAGRAM**.

MULTIPLE UNITS

For increased compressor protection and to reduce power inrush at start-up on multiple chiller installations, provisions must be made to prevent simultaneous start-up of two or more units. Also, some method must be employed to automatically cycle one or more of the units on or off to permit more efficient operation at part load conditions. A sequencing kit may be acquired through your local YORK representative.

WIRING DIAGRAM

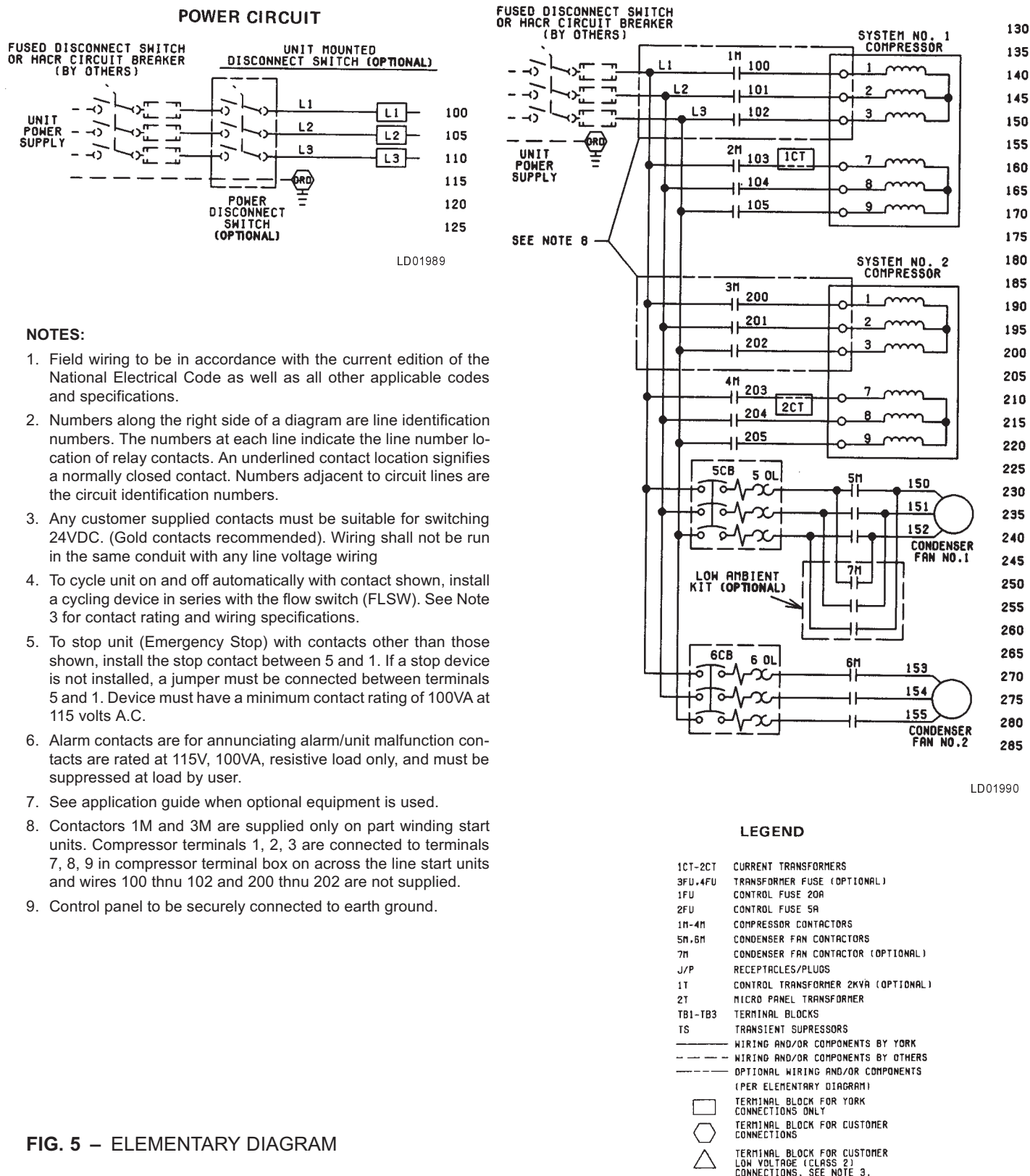


FIG. 5 – ELEMENTARY DIAGRAM

CONTROL POWER SUPPLY

UNIT VOLTAGE	CONTROL POWER SUPPLY	MIN CIRCUIT AMPACITY	MAX DUAL ELEMENT FUSE SIZE	NON-FUSED DISC. SW. SIZE
All Models w/o Transformers	115-1-50/60	20A	20A, 250V	30A, 240A

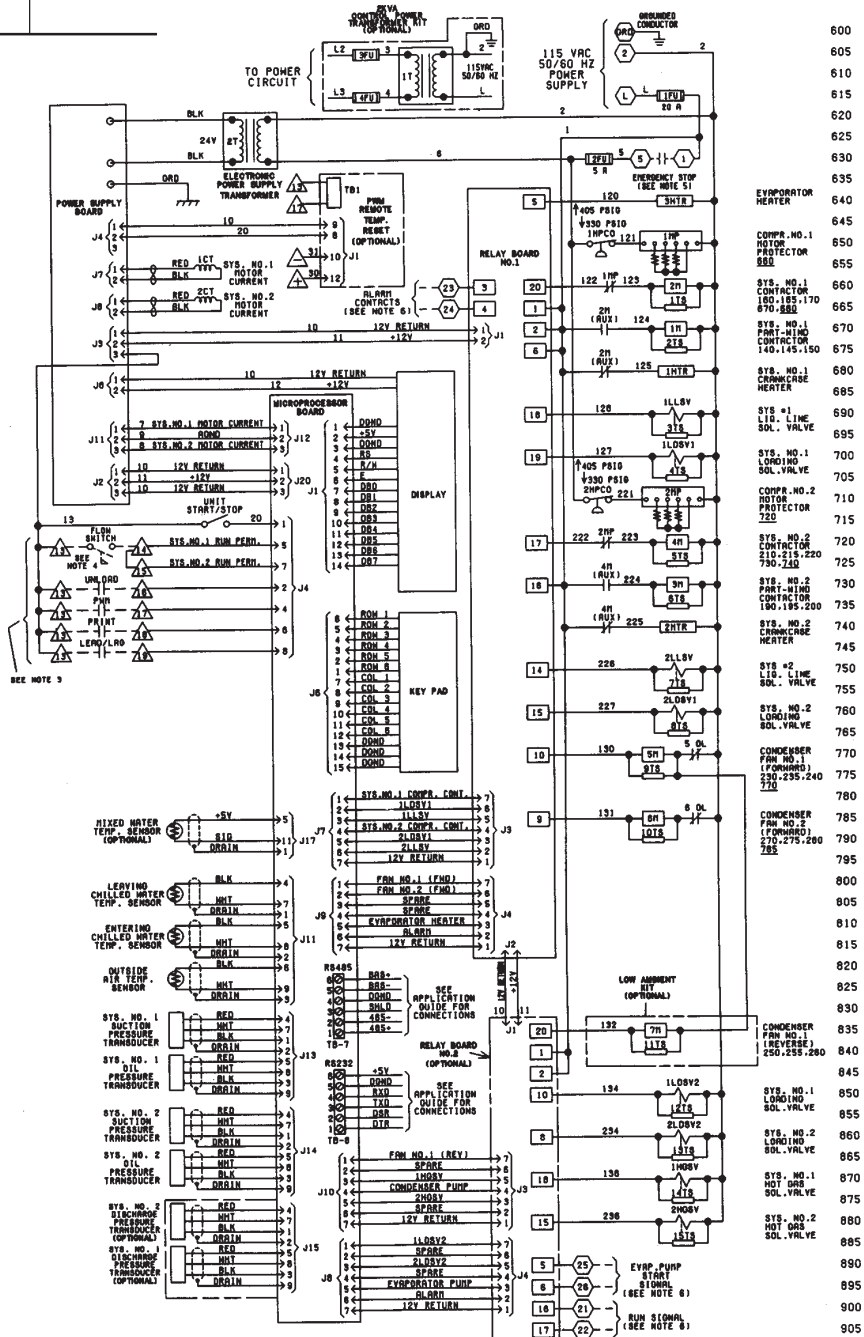
CAUTION: No Controls (relays, etc.) should be mounted in the Smart Panel enclosure or connected to power supplies in the control panel. Additionally, control wiring not connected to the Smart Panel should not be run through the cabinet. This could result in nuisance faults.

CAUTION: Any inductive devices (relays) wired in series with the flow switch for start/stop, into the alarm circuitry, or pilot relays for pump starters wired through motor contactor auxiliary contacts must be suppressed with YORK P/N 031-00808 suppressor across the relay/contactor coil which activates the contacts.

Any contacts connected to flow switch inputs or BAS inputs on terminals 13-19 of TB3 or any other terminals, must be suppressed with a YORK P/N 031-00808 suppressor across the relay/contactor coil which activates the contacts.

CAUTION: Control wiring connected to the control panel should never be run in the same conduit with power wiring.

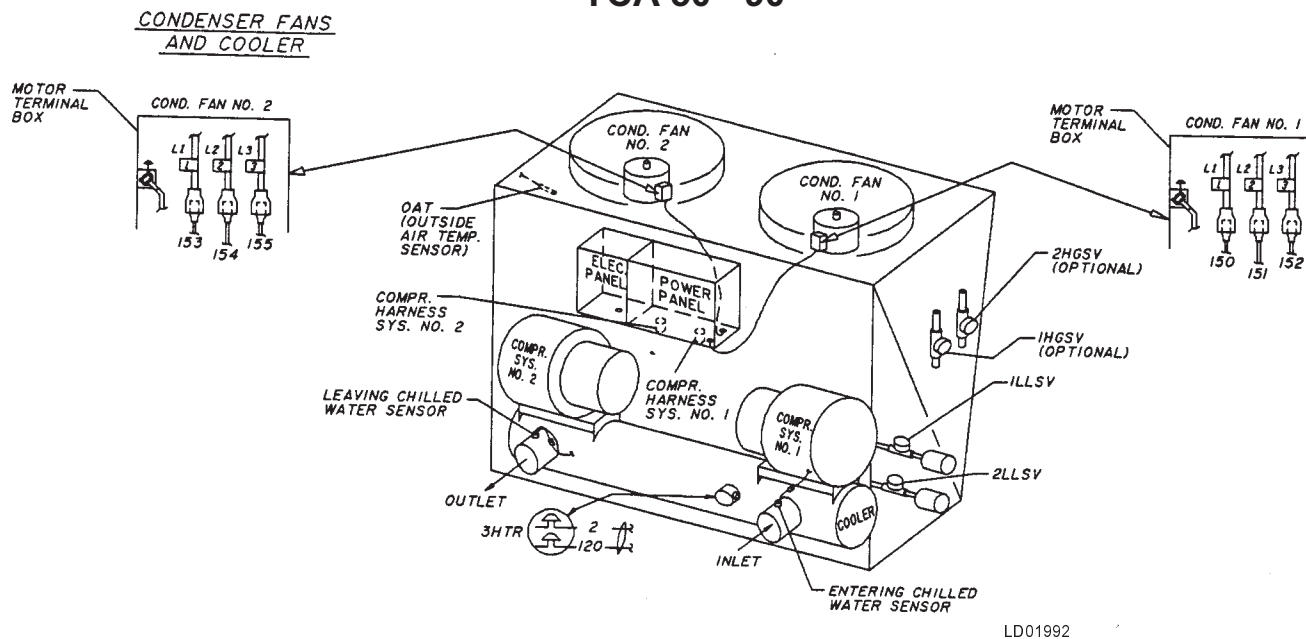
CONTROL CIRCUIT



* Not available for 346-3-50.

FIG. 5 – ELEMENTARY DIAGRAM (Cont'd)

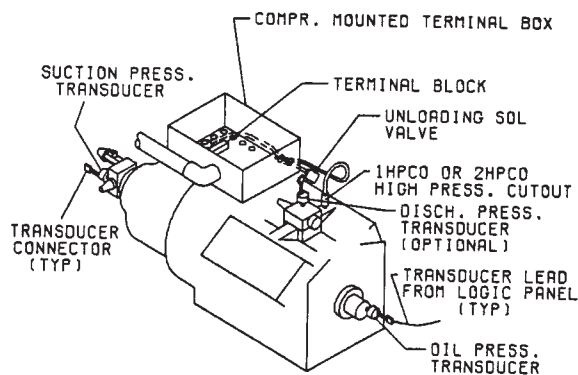
CONNECTION DIAGRAM SYSTEM WIRING YCA 50 - 90



COMPRESSORS (SYSTEM NO. 1 & NO. 2)

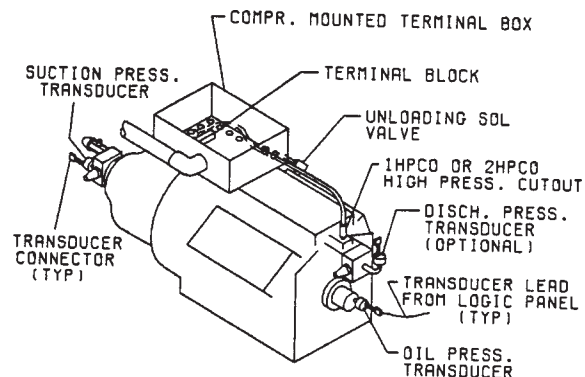
LEGEND

1HPCO, 2HPCO	REFRIGERANT HIGH PRESSURE CUTOUT SYS. NO. 1 & NO. 2
1HTR, 2HTR	COMPR. CRANKCASE HEATER SYS. NO. 1 & NO. 2
3HTR	COOLER HEATER
1LOS1, 1LOS2	UNIT IDENT. COMPR. LOADING SOLENOID VALVE SYS. NO. 1
2LOS1, 2LOS2	UNIT IDENT. COMPR. LOADING SOLENOID VALVE SYS. NO. 2
1LLSV, 2LLSV	LIQUID LINE SOLENOID VALVE SYS. NO. 1 & NO. 2
1MP, 2MP	COMPR. MOTOR PROTECTOR SYS. NO. 1 & NO. 2
1SOL, 2SOL	COMPR. IDENT. LOADING SOLENOID VALVE SYS. NO. 1 & NO. 2
1TS-1ST5	TRANSIENT SUPPRESSION



4 CYLINDER COMPRESSOR

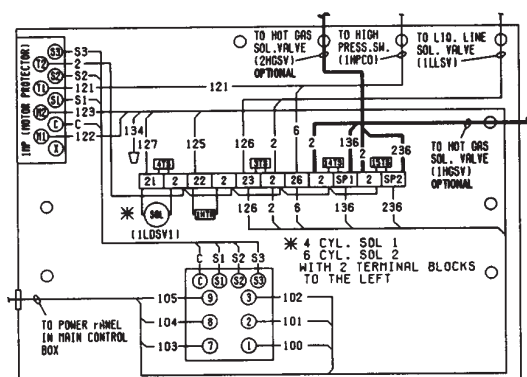
LD01993



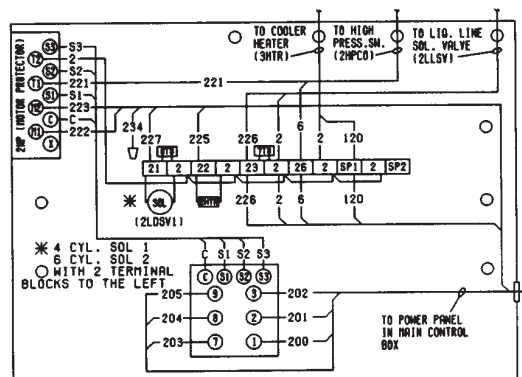
6 CYLINDER COMPRESSOR

FIG. 6 - SYSTEM WIRING

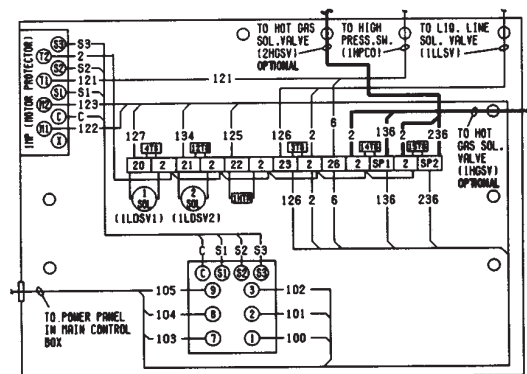
LD01994



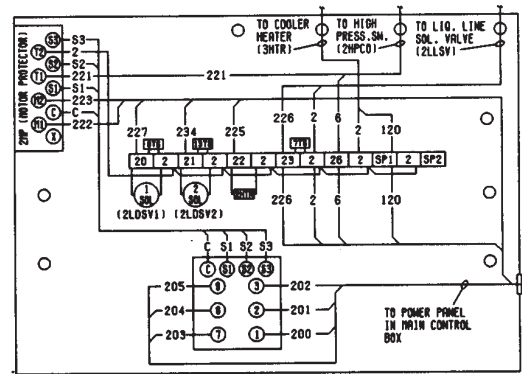
4 & 6 CYL. "Z" COMPRESSOR TERMINAL BOX SYSTEM NO. 1
(PART WIND UNIT WITH STANDARD UNLOADING
WITH OR WITHOUT OPTIONAL HOT GAS)



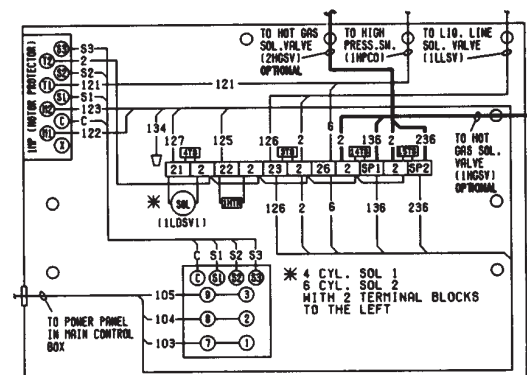
4 & 6 CYL. "Z" COMPRESSOR TERMINAL BOX SYSTEM NO. 2
(PART WIND UNIT WITH STANDARD UNLOADING
WITH OR WITHOUT OPTIONAL HOT GAS)



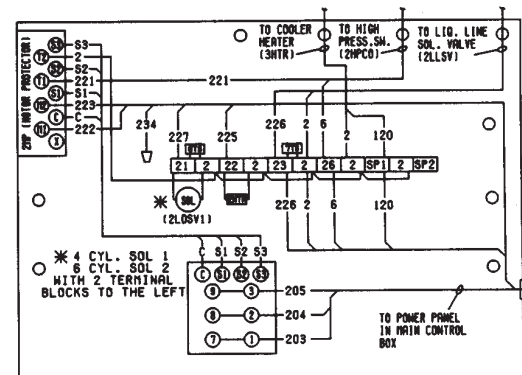
6 CYL. "Z" COMPRESSOR TERMINAL BOX SYSTEM NO. 1
(PART WIND UNIT WITH OPTIONAL STEPS OF UNLOADING
WITH OR WITHOUT OPTIONAL HOT GAS)



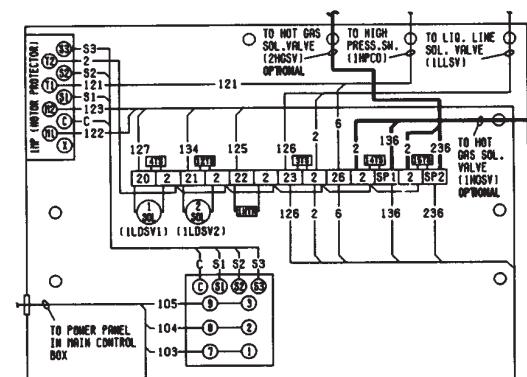
6 CYL. "Z" COMPRESSOR TERMINAL BOX SYSTEM NO. 2
(PART WIND UNIT WITH OPTIONAL STEPS OF UNLOADING
WITH OR WITHOUT OPTIONAL HOT GAS)



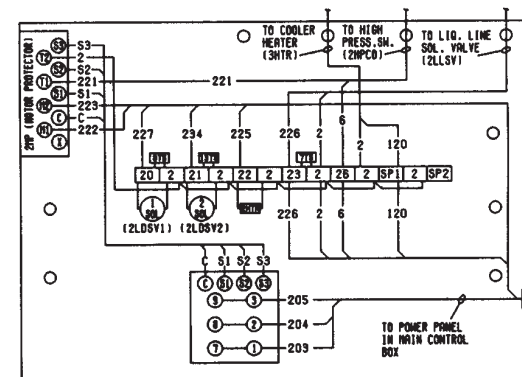
4 & 6 CYL. "Z" COMPRESSOR TERMINAL BOX SYSTEM NO. 1
(ACROSS THE LINE START UNIT WITH STANDARD UNLOADING
WITH OR WITHOUT OPTIONAL HOT GAS)



4 & 6 CYL. "Z" COMPRESSOR TERMINAL BOX SYSTEM NO. 2
(ACROSS THE LINE START UNIT WITH STANDARD UNLOADING
WITH OR WITHOUT OPTIONAL HOT GAS)



6 CYL. "Z" COMPRESSOR TERMINAL BOX SYSTEM NO. 1
(ACROSS THE LINE START UNIT WITH OPTIONAL STEPS OF UNLOADING
WITH OR WITHOUT OPTIONAL HOT GAS)



6 CYL. "Z" COMPRESSOR TERMINAL BOX SYSTEM NO. 2
(ACROSS THE LINE START UNIT WITH OPTIONAL STEPS OF UNLOADING
WITH OR WITHOUT OPTIONAL HOT GAS)

FIG. 6 – SYSTEM WIRING (Cont'd)

CONNECTION DIAGRAM BOX, ELEC. YCA 50 - 90 (ARI) STANDARD AND REMOTE EVAPORATOR UNITS

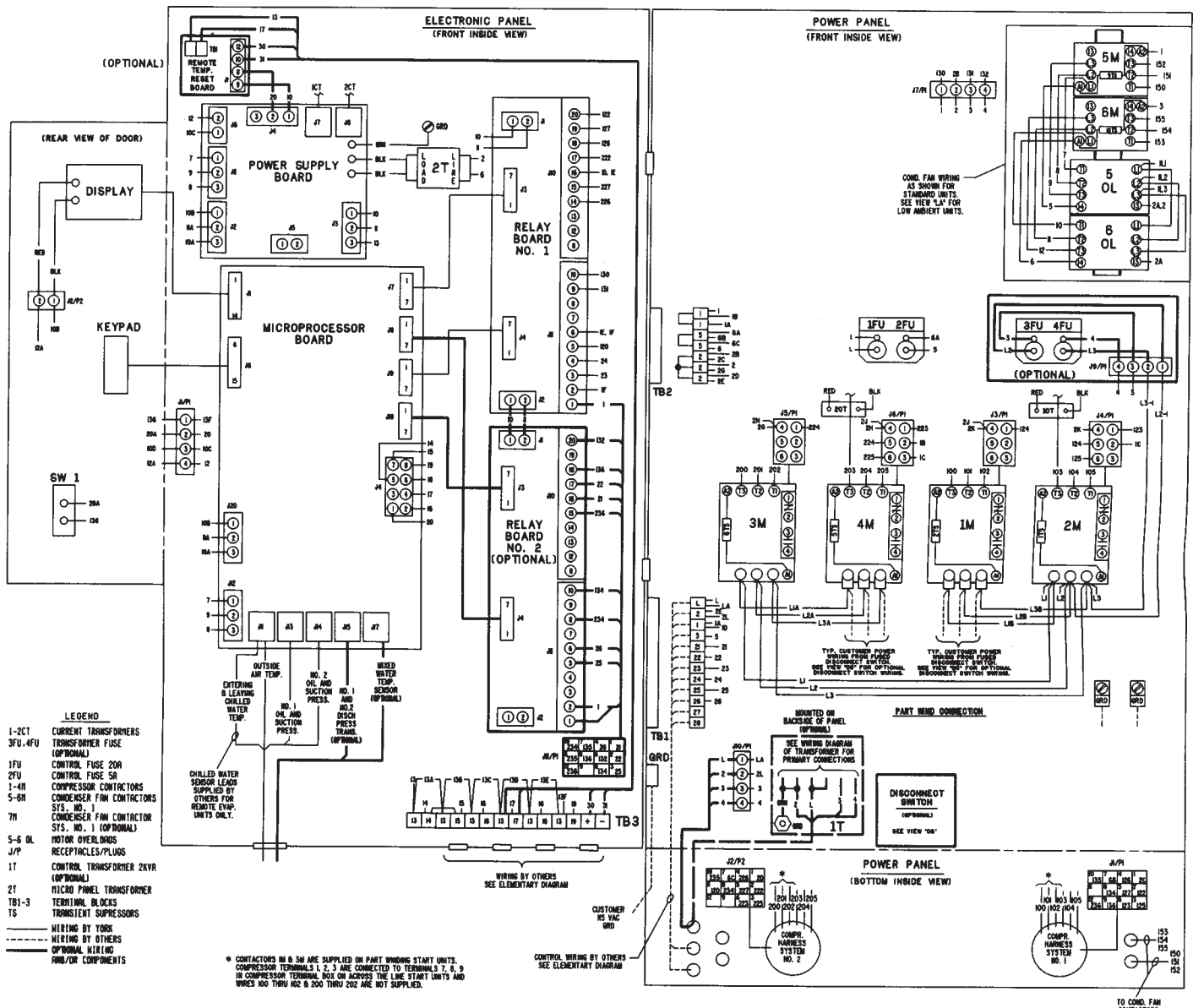
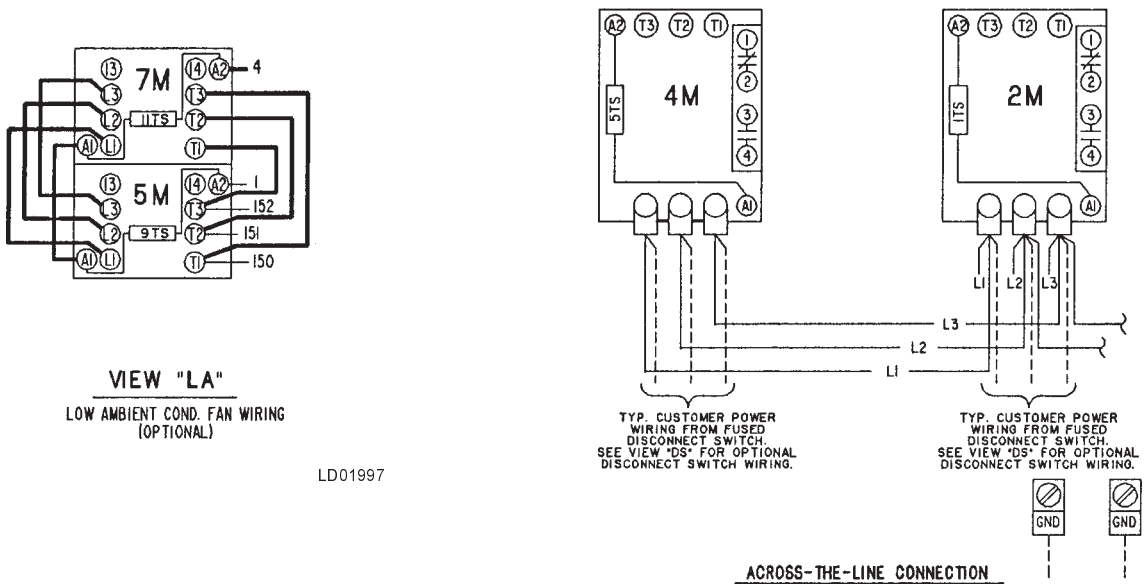
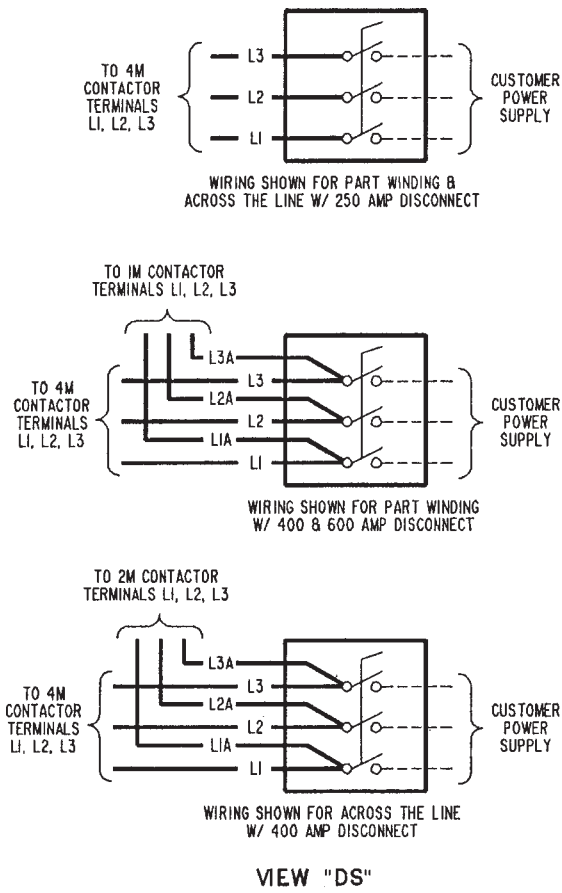


FIG. 7 – CONNECTION DIAGRAM



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LD01998



LD01999

FIG. 7 – CONNECTION DIAGRAM (Cont'd)

UNIT CONTROLS AND OPERATION

YORK MICROCOMPUTER CONTROL CENTER



26572A

FIG. 8 – MICROCOMPUTER CONTROL CENTER

INTRODUCTION

The YORK MicroComputer Control Center is a microprocessor based control system capable of multi-circuit control to maintain chilled liquid temperature.

A 40 character display (2 lines of 20 characters) allows the operator to display system operating parameters as well as access programmed information already in memory. A keypad for programming and accessing setpoints, pressures, temperatures, motor current, cutouts, daily schedule, options, and fault information is provided.

A master ON/OFF switch is available to activate or de-activate the chiller system. Separate system (SYS) switches for each refrigerant system (up to 4) are provided on the Microprocessor Board.

Remote cycling, unloading, and chilled water temperature reset can be accomplished by user supplied dry contacts.

Compressor starting/stopping and loading/unloading

decisions are performed by the Microprocessor to maintain leaving water temperatures. These decisions are a function of temperature deviation from setpoint and rate of change of temperature.

MICROPROCESSOR BOARD

The Microprocessor Board is the controller and decision maker in the control panel. System inputs from pressure transducers, temperature sensors, and C.T.'s are connected directly to the Microprocessor Board. The Microprocessor Board circuitry multiplexes these analog inputs, digitizes them, and constantly scans them to keep a constant watch on the chiller operating conditions. From this information, the Microprocessor then issues commands to the Relay Output Board to control contactors, solenoids, etc. for water temperature control and to react to safety conditions.

Keypad commands are acted upon by the micro to change setpoints, cut-outs, scheduling, operating requirements, and to provide displays.

A +12V REG supply voltage from the Power Supply Board is converted to +5V REG by a voltage regulator located on the Microprocessor Board. This voltage is used to operate integrated circuitry on the board.

Four system switches located on the Microprocessor Board activate or deactivate the individual systems (compressors).

POWER SUPPLY BOARD

The on-board switching power supply converts 24VAC from the 2T transformer to +1 2V REG which is supplied to the Microprocessor Board, Relay Board, and 40 Character Display to operate integrated circuitry.

A rectifier and filtering circuit for each motor current circuit rectifies and filters these signals to variable DC. These signals are then fed to the Microprocessor Board.

RELAY OUTPUT BOARD

This board converts 0-12VDC logic level outputs from the Microprocessor Board to 120VAC levels used by motor contactors, solenoid valves, etc. to control system operation. The common side of all relays on the Relay Output Board is converted to +12V REG.

The open collector outputs of the Microprocessor Board energize the DC relays by pulling the other side of the relay coil to ground. When not energized, both sides of the relay coils will be at +12VDC potential.

CURRENT TRANSFORMER (C.T.)

A C.T. on the 3f power wiring of each motor sends AC signals proportional to motor current to the Power Supply Board which rectifies and filters the signal to variable DC voltage (analog). This analog level is then fed to the Microprocessor Board to allow it to monitor motor current.

40 CHARACTER DISPLAY

The 40 Character Display (2 lines of 20 characters) is a liquid crystal display used for displaying system parameters and operator messages. The display has a lighted background for night viewing as well as a special feature which intensifies the display for viewing in direct sunlight.

KEYPAD

An operator keypad allows complete control of the system from a central location. The keypad offers a multitude of commands available to access displays, program setpoints, and initiate system commands.

BATTERY BACK-UP

The Microprocessor Board contains a Real Time Clock integrated circuit chip with an internal battery back-up. The purpose of this battery back-up is to assure any programmed values (setpoints, clock, cut-outs, etc.) are not lost during a power failure regardless of the time involved in a power outage or shutdown period.

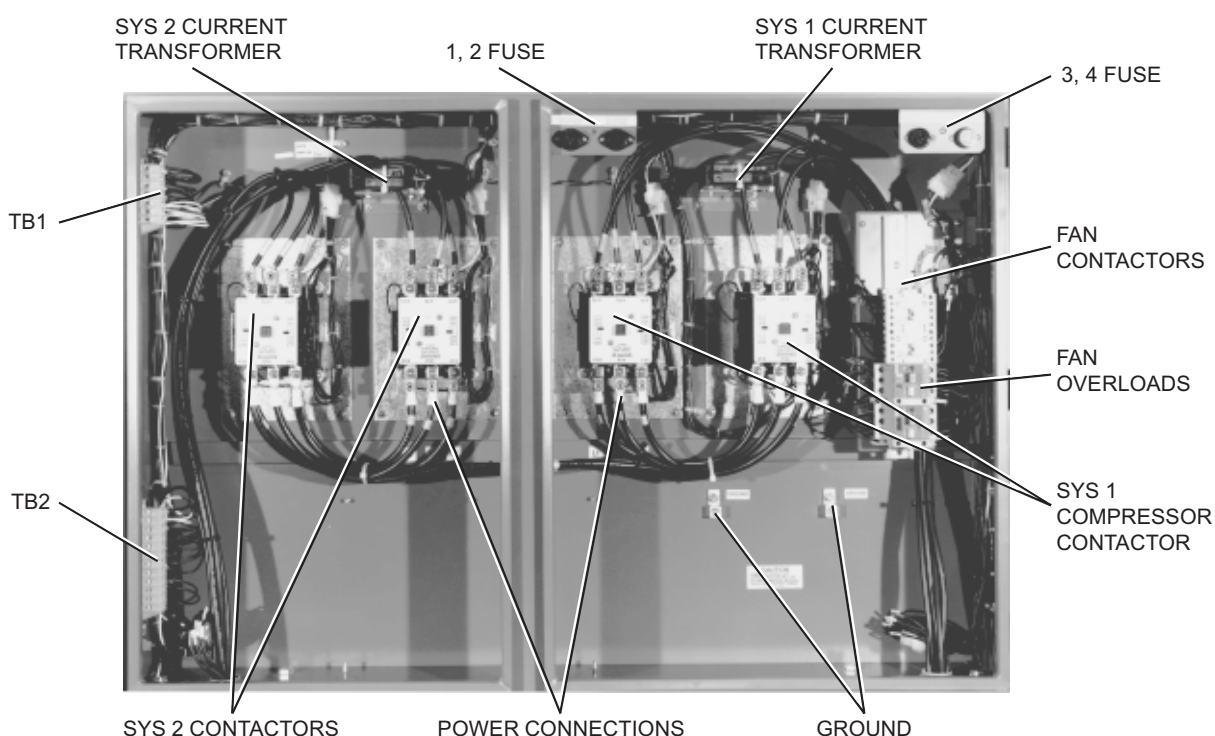


FIG. 9 – POWER PANEL

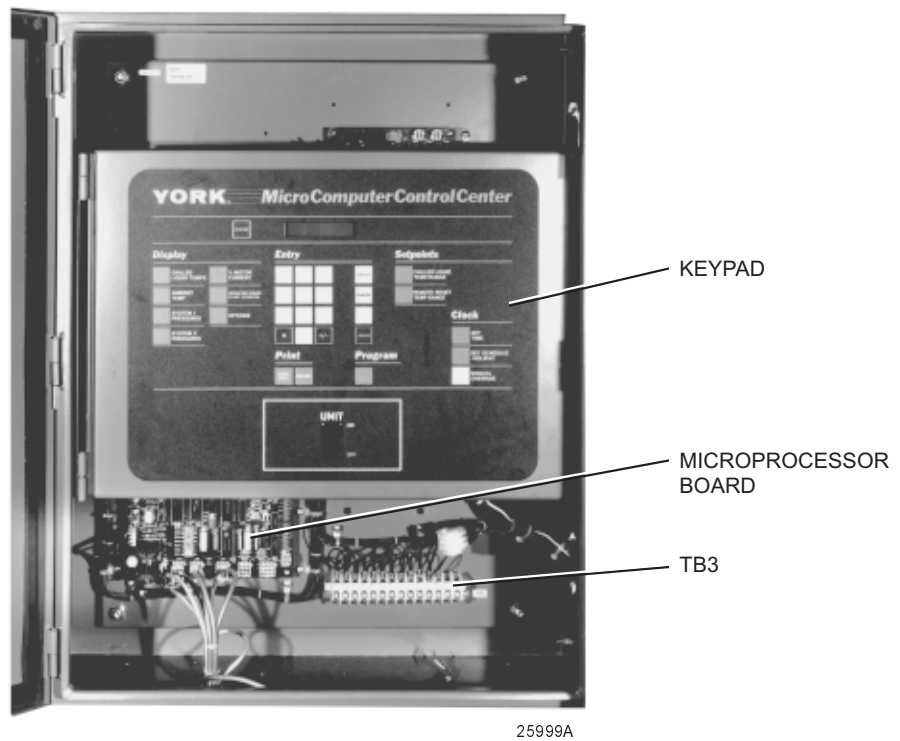


FIG. 10 – CONTROL PANEL (EXTERIOR)

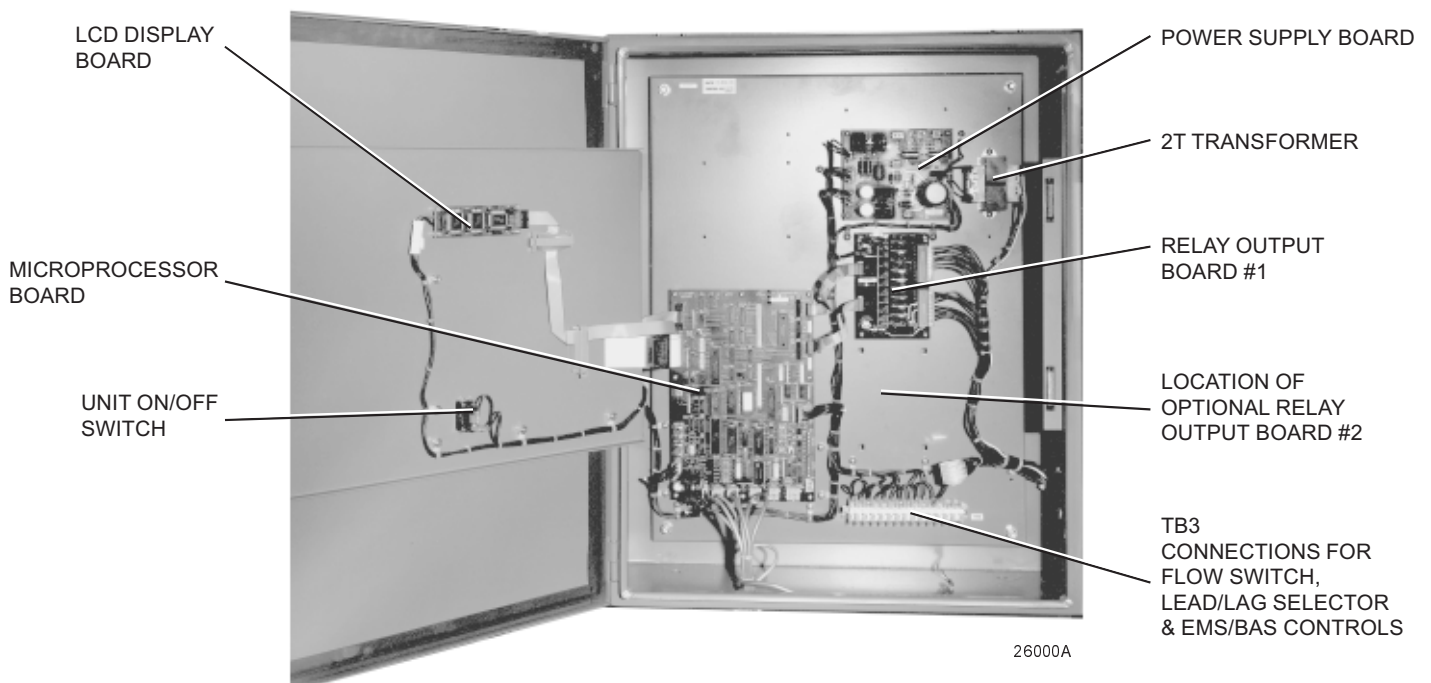


FIG. 11 – CONTROL PANEL (INTERIOR)

“DISPLAY” KEYS



26572A(D)

GENERAL

The DISPLAY keys allow the user to retrieve system pressures, system motor currents, chilled liquid temperatures, outdoor ambient temperature, compressor running times, number of compressor starts, and option information on the chiller package. This data is useful for monitoring chiller operation, diagnosing potential future problems, troubleshooting, and commissioning the chiller.

Displayed data will be real-time data displayed on a “40” character display consisting of 2 lines of 20 characters. The display will update all information at a rate of about “2” seconds.

When a DISPLAY pushbutton is pressed, the corresponding message will be displayed and will remain on the display until another pushbutton is pressed.

Display Messages may show characters indicating “greater than” (>) or “less than” (<). These characters indicate the actual values are greater than or less than the limit values which are being displayed.

If a message is required to be updated faster than every 2 seconds, the appropriate key for the desired display may be pushed and held. Updating will be at .4 second intervals.

Each of the keys and an example of the typical corresponding display messages will be discussed in the text which follows.

* Discharge Pressure Readout is an option. Without this option, the display will read a fixed value.

Chilled Liquid Temps

CHILLED LIQUID TEMPS

A display indicating chiller leaving and return water temperature is provided when this pushbutton is pressed.

```
L W T = 4 9 . 2 D E G F
R W T = 5 2 . 0 D E G F
```

The minimum limit on the display is “8.7 DEG F”. The maximum limit on the display is “84.5 DEG F”.

Ambient Temp

AMBIENT TEMP

The outdoor ambient temperature is displayed when this pushbutton is pressed.

```
O U T S I D E   A M B I E N T   A I R
= 7 5 . 9 D E G F
```

The minimum limit on the display is “0 DEG F”. The maximum limit on the display is “133.8 DEG F”.

System 1 Pressures

SYSTEM 1 PRESSURES

Oil pressure, suction pressure, and discharge* pressure on System 1 will be displayed when this pushbutton is pressed.

SYS	# 1	OIL =	7 2	PSID
SP =	6 0	, DP =	2 2 9	PSIG

The minimum limits are:

Oil Pressure: 0 PSID

Suction Pressure: 0 PSIG

Discharge Pressure: 0 PSIG

The maximum limits are:

Oil Pressure: 200 PSID

Suction Pressure: 200 PSIG

Discharge Pressure: 400 PSIG

System 2 Pressures

SYSTEM 2 PRESSURES

Oil pressure, suction pressure, and discharge* pressure on System 2 will be displayed when this pushbutton is pressed.

SYS	# 2	OIL =	6 3	PSID
SP =	6 1	, DP =	1 3 3	PSIG

The minimum limits are:

Oil Pressure: 0 PSID

Suction Pressure: 0 PSIG

Discharge Pressure: 0 PSIG

The maximum limits are:

Oil Pressure: 200 PSID

Suction Pressure: 200 PSIG

Discharge Pressure: 400 PSIG

% Motor Current

% MOTOR CURRENT

Motor currents for both System 1 and 2 are displayed when this pushbutton is pushed.

The minimum limits on the display is "0% FLA". The maximum limit on the display is 115% FLA".

IMTR 1	=	5 7	% FLA
IMTR 2	=	6 5	% FLA

Operating Hours Start Counter

OPER. HOURS START COUNT.

Accumulated running hours on each compressor is displayed. The counters for an individual system count to accumulated starts on each compressor are also displayed. A total of 99999 starts can be logged on a system before the Counter will rollover.

HRS	1 =	1 4 3	, 2 =	3 8 2
STR	1 =	2 5	, 2 =	3 7

The numbers "1" and "2" on the display message indicate compressor #1 and compressor #2.

These counters are zeroed at the factory or will indicate only run time and number of starts logged during factory testing at the time of shipment.

Options

OPTIONS

The OPTIONS key provides a display of options which have been selected by the user. These options are selected by the S1 Dip Switch on the Microprocessor Board (Fig. 12). Proper programming of the switch is important during commissioning of the chiller. The OPTIONS display allows a means of verifying the Dip Switch positions without looking at or handling the Microprocessor Board. It also eliminates visual inspection of the sometimes difficult to determine Dip Switch position.

When the OPTIONS KEY is pressed, the following message will first be displayed for 3 seconds:

THE FOLLOWING ARE PROGRAMMED

"8" Option Messages will then follow. Each will be displayed for 3 seconds before the next display is automatically indexed. When all messages are displayed, the display message will automatically change to show a chiller "STATUS" message, just as if the Status key was pressed.

Refer to Table 1 for a list of the displays and the corresponding switch positions in the order they appear. Two possible messages may appear for each of the eight messages depending on the Dip Switch position.

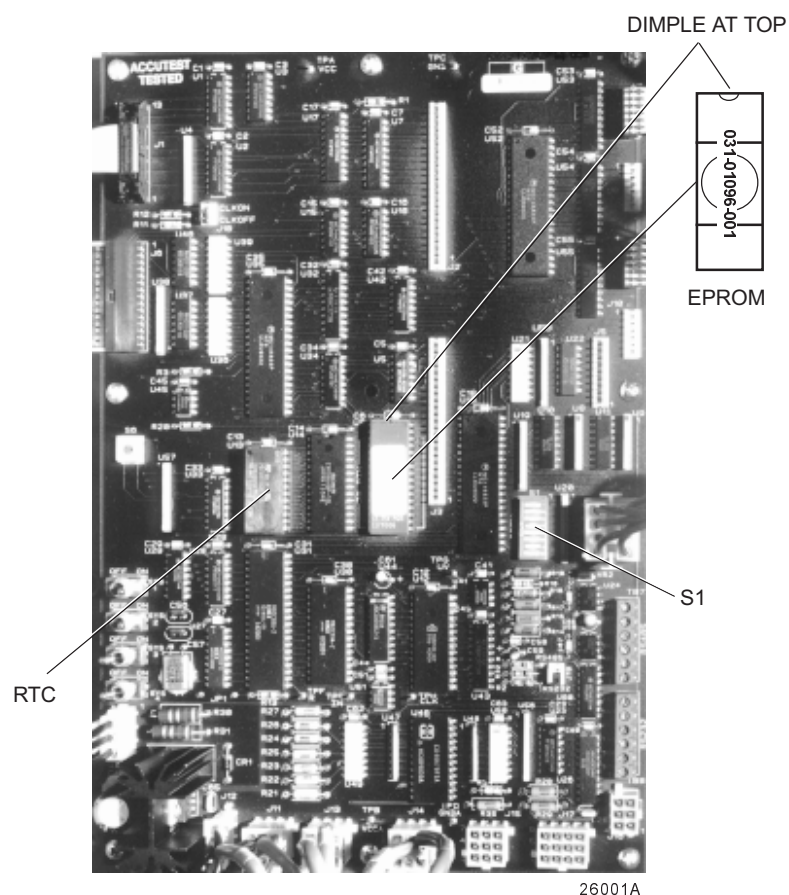
A detailed explanation of the meaning of each message and a guide to programming the associated switch is provided on page 28.

Fig. 12 shows the location and verification of switch positioning of S1.

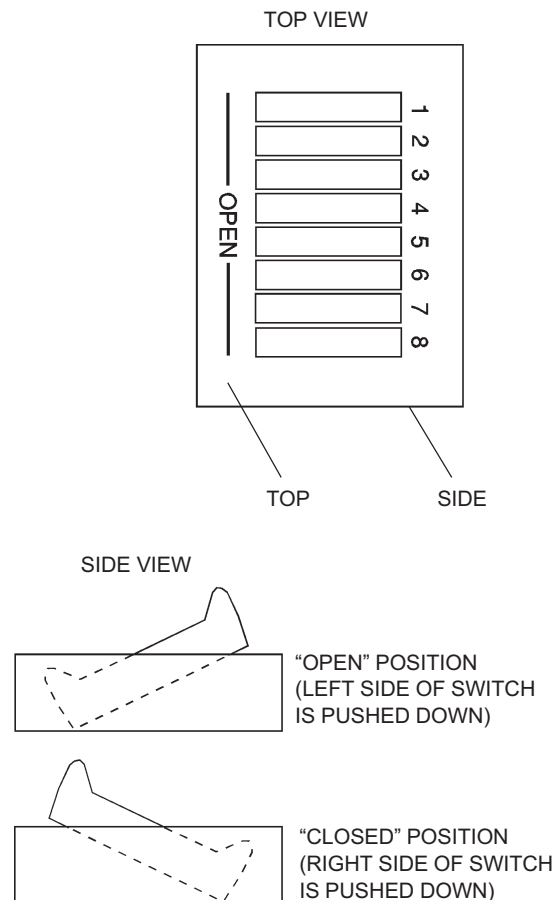
* Discharge Pressure Readout is an option. Without this option, the display will read a fixed value.

TABLE 1 – SWITCH POSITION AND DISPLAY

DISPLAY/ SWITCH	SWITCH “OPEN” MESSAGE	SWITCH “CLOSED” MESSAGE
1	COMFORT COOLING	BRINE & PROCESS DUTY
2	STANDARD AMBIENT	LOW AMBIENT CONTROL
3	LOCAL CONTROL MODE	REMOTE CONTROL MODE
4	RETURN WATER CONTROL	LEAVING WATER CONTROL
5	ENGLISH UNITS READOUT	METRIC UNITS READOUT
6	STANDARD CONDENSER FAN CONTROL	SHARED CONDENSER FAN CONTROL
7	MANUAL LEAD / LAG	AUTOMATIC LEAD / LAG
8	AMBIENT & DISCH PR FAN CONTROL	DISCHARGE PRESSURE FAN CONTROL



26001A

**FIG. 12 – DIP SWITCH S1 AND EPROM LOCATION**

SWITCH 1

OPEN:

COMFORT
COOLING

The chilled liquid temperature setpoint can only be programmed from 40-70°F.*

CLOSED:

BRINE & PROCESS
DUTY

The chilled liquid temperature setpoint can be programmed from 10-70°F. *

SWITCH 2

OPEN:

STANDARD
AMBIENT

The low ambient cut-out is fixed at 25°F.

CLOSED:

LOW AMBIENT
CONTROL

The low ambient cut-out is programmable from 0-50°F. A low ambient kit **MUST** be installed if the switch is placed in this position.

SWITCH 3

OPEN:

LOCAL CONTROL
MODE

DO NOT USE this mode at present.

CLOSED:

REMOTE CONTROL
MODE

This should be selected in all applications, otherwise printer communication problems may result. This mode will also be necessary to allow operation of options to be developed in the future.

SWITCH 4

OPEN:

RETURN WATER
CONTROL

Chiller control will be from return water temperature.

CLOSED:

LEAVING WATER
CONTROL

Chiller control will be from leaving water temperature. This **MUST** be selected.

SWITCH 5

OPEN:

ENGLISH UNITS
READOUT

Display messages will show units of measure in English units (°F, PSI, etc.)

CLOSED:

METRIC UNITS
READOUT

Display messages will show units of measure in Metric units (°C, kPa, etc.)

SWITCH 6

OPEN:

STANDARD CONDENSER
FAN CONTROL

This **MUST** be selected for chillers with “4” or more fans where each refrigerant system will have fans of its own.

CLOSED:

SHARED CONDENSER
FAN CONTROL

This **MUST** be selected for “2” fan chillers where fans are shared by both refrigerant circuits.

* Positioning of this switch also affects the range of adjustments of the Suction Pressure Cut-out (page 37) and the Low Leaving Water Temp Cut-out (page 36).

SWITCH 7**OPEN:**

M A N U A L
L E A D / L A G

SYS 1 can be selected as the lag compressor by closing a user supplied contact between Terminal 13 and 19. See page 61.

CLOSED:

A U T O M A T I C
L E A D / L A G

In this mode the micro determines which compressor is assigned to the lead and the lag. A new lead/lag assignment is made whenever both compressors shut down. The micro will then assign the "lead" to the compressor with the shortest anti-recycle time.

SWITCH 8**OPEN:**

A M B I E N T & D I S C H P R
F A N C O N T R O L

Fan control will be by outside ambient temp. This will be the standard mode of fan control for normal operation. In this mode, maximum chiller efficiency will be achieved. If the Low Ambient option is installed, the fan control will automatically change to pressure control at temperatures below 25°F. See page 66 for fan control sequence.

CLOSED:

D I S C H A R G E P R E S S U R E
F A N C O N T R O L

Fan control is by discharge pressure only. This mode of fan control will increase discharge pressure. It should be used if nuisance low suction pressure faults are experienced. See page 77 for fan control sequence.

NOTE: Discharge pressure transducers **must** be installed. These are optional (Discharge Pressure Read-out Option) unless a Low Ambient Kit is installed.

“STATUS” KEY



26572A(D)

GENERAL

Pressing the STATUS key will enable the operator to determine current chiller operating status as a whole and as individual systems. The messages displayed will include running status, cooling demand, fault status, external cycling device status, and anti-recycle timer status. The display will be a single message relating to the highest priority message as determined by the micro. Status messages fall into the categories of General and Fault Status with each of the categories discussed below.

GENERAL STATUS MESSAGE

Each of the general status messages with a description of its meaning will follow. In the case of messages which apply to individual systems, SYS 1 and SYS 2 messages will both be displayed and may be different. “X”s in the sample displays indicate numerical values will appear in actual displays.

**UNIT SWITCH IS IN
THE OFF POSITION**

This message informs the operator that the “UNIT” switch on the Control Panel is in the OFF position which will not allow the chiller to run.

DAILY SCHEDULE SHUTDOWN

The DAILY SCHEDULE SHUTDOWN message indicates that the schedule programmed into the “CLOCK” “SET SCHEDULE/HOLIDAY” is keeping the chiller from running.

SYS # 1	NO RUN PERM
SYS # 2	NO RUN PERM

Run Permissive is an indicator that an external cycling contact (i.e. flow switch) connected to terminals 13 and 14 is open, or a system switch(es) on the Microprocessor Board is in the OFF position. Whenever the contact is open or a switch is OFF, the NO RUN PERM will be displayed.

SYS # 1	NO COOL LOAD
SYS # 2	NO COOL LOAD

This message informs the operator that the chilled liquid temperature is below the point (determined by the setpoint and control range) that the micro will bring the lead system on, or that the micro has not loaded the system far enough into the loading sequence to be ready to bring the lag system ON. The lag system will

display this message until the loading sequence is ready for the lag system to start (TEMPERATURE DEMAND in the OPER DATA displays must be "5" or above before cooling load is established for the lag system to run).

SYS # 1	COMP	RUNNING
SYS # 2	COMP	RUNNING

The COMP RUNNING message indicates that the respective compressor is running due to demand.

SYS # 1	AR	TMR	XXX	S
SYS # 2	AR	TMR	XXX	S

The anti-recycle timer message shows the amount of time left on the respective anti-recycle timer. This message is displayed when demand requires the respective system to start but is being held off due to the timer.

SYS # 1	AC	TMR	XX	S
SYS # 2	AC	TMR	XX	S

The anti-coincident timer is a software feature that guards against 2 compressors starting simultaneously. This assures instantaneous starting current does not become excessively high due to simultaneous starts. The micro limits the time between compressor starts to 1 minute regardless of demand of the anti-recycle timer being timed out. The time shown on the anti-coincident timer is the time left on the timer before the respective system will start. Demand must be present for the message to be displayed and will only appear when the anti-recycle timer has timed out.

SYS # 1	SUCT	LIMITING
SYS # 2	SUCT	LIMITING

The Suction Pressure Limiting message indicates a system is being unloaded by the micro even though demand requires loading. This safety assures that refrigerant returning to the compressor provides proper motor cooling, assuring that motor life is not compromised. This safety will only activate when the chilled liquid temperature is excessively high. Unloading will take place when suction pressure exceeds the user programmable threshold of 80-105 PSIG. Reloading will take place when suction pressure drops to 10 PSIG below the safety threshold.

SYS # 1	DSCH	LIMITING
SYS # 2	DSCH	LIMITING

Discharge Pressure Limiting takes affect when discharge pressure nears the point at which the high pres-

sure cut-out will shut down causing total loss of cooling. When this message appears, discharge pressure has exceeded the user programmable threshold and the micro is unloading the affected system to prevent shutdown on a manual high pressure cut-out. Reloading will take place when discharge pressure has dropped 60 PSIG below the threshold.

Optional discharge pressure transducers must be installed for this feature to operate. This is accomplished by adding the Discharge Pressure Readout option.

MANUAL OVERRIDE

If the MANUAL OVERRIDE key is pressed, the STATUS display will display the message shown above. This will indicate that the Daily Schedule is being ignored and the chiller will start-up when water temperature allows, UNIT Switch permits, and SYSTEM Switches permit.

This is a priority message and cannot be overridden by anti-recycle messages, fault messages, etc. when in the STATUS Display mode. Therefore, do not expect to see any other STATUS messages when in the MANUAL OVERRIDE mode. MANUAL OVERRIDE is to only be used in emergencies or for servicing.

FAULT STATUS MESSAGES

Fourteen possible fault messages may appear when the STATUS key is pressed. Whenever a fault message appears, the safety thresholds on the chiller have been exceeded and the entire chiller or a single system will be shut down and locked out. A detailed explanation of the shutdown thresholds and associated information related to each fault is covered in the SYSTEM SAFETIES section (Page 50).

Chiller shutdown faults will shut the entire chiller down and lock it out, while system shutdown faults will only shut down and lock out the affected system (compressor).

A list of the fault messages are shown on the next page:

CHILLER FAULTS

CHILLER FAULT :
LOW AMBIENT TEMP

CHILLER FAULT :
LOW WATER TEMP

CHILLER FAULT :
HIGH AMBIENT TEMP

CHILLER FAULT :
115VAC UNDER VOLTAGE

SYSTEM FAULTS

SYS # 1 HIGH DSCH

SYS # 2 HIGH DSCH

SYS # 1 LOW OIL PRESS

SYS # 2 LOW OIL PRESS

SYS # 1 LOW SUCTION

SYS # 2 LOW SUCTION

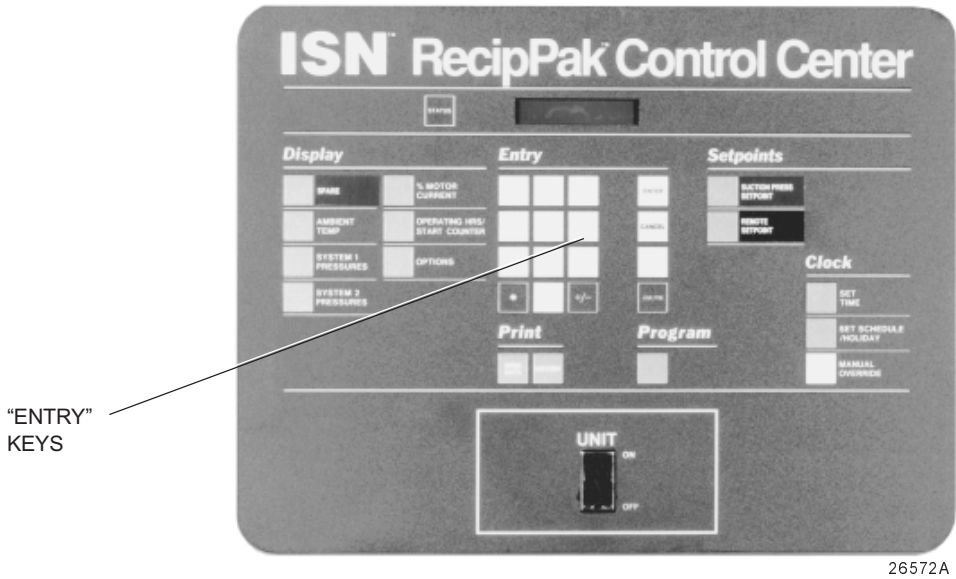
SYS # 1 MOTOR CURRENT

SYS # 2 MOTOR CURRENT

SYS # 1 LLSV NOT ON

SYS # 2 LLSV NOT ON

“ENTRY” KEYS



26572A

GENERAL

The ENTRY key allows the user to change programmed numerical values such as chiller setpoints, cut-outs, clock, etc.

Numerical Keypad

1	2	3
4	5	6
7	8	9
*	0	+/-

The NUMERICAL keypad provides all keys needed to program numerical values as required.

The “*” Key is used to designate holidays when programming special start and stop times for designated holidays in the SET SCHEDULE/HOLIDAY display.

The “+/-” key allows programming -°C setpoints and cut-outs in the metric display mode.

Enter Key



The ENTER key must be pushed after any change is made to setpoints, cut-outs or the system clock. Pressing this key tells the micro to accept the new values into memory.

If this is not done, the new numbers entered will be lost and the original values will be returned.

The ENTER key is also used to scroll through available data after any one of the following keys is pressed:

- PROGRAM
- SET SCHEDULE/HOLIDAY
- OPER DATA
- HISTORY

Cancel Key



The CANCEL key allows the user to change errors in the data being programmed into memory.

When the CANCEL key is pressed, any data which has been keyed in, but not entered, will be erased. The original values will re-appear on the display and the cursor will return to the first character to be programmed in the display message.

AM/PM Key



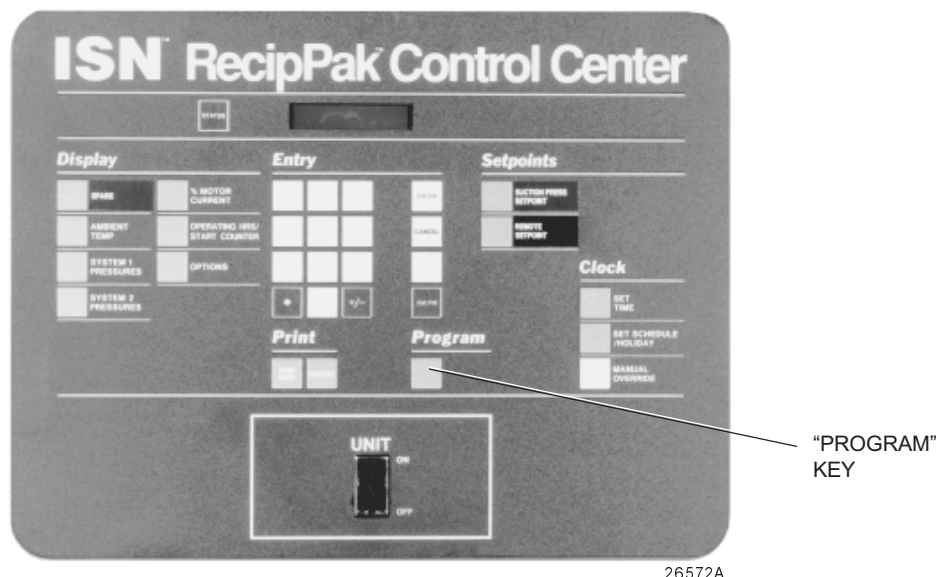
The AM/PM key allows the user to change AM/PM while programming the correct time in the SET TIME display. The same key allows changing the AM/PM schedule while programming daily chiller start and stop times in the SET SCHEDULE/HOLIDAY display.

Advance Day Key



The ADVANCE DAY key advances the day when the SET TIME display is being programmed. The day is normally advanced to correspond to the current day of the week. The day will advance a day at a time, each time the key is pressed.

“PROGRAM” KEY PROGRAMMING USER PROGRAMMABLE SAFETIES & LIMITS



26572A

GENERAL

Pushing the PROGRAM key allows the user to program “11” system operating limits. These limits include cut-out points for safeties, anti-recycle timer duration, and the reaction time of the microprocessor to abrupt changes in the chilled water temperatures.

After the PROGRAM key is pressed, the micro will first respond by displaying the DISCHARGE CUT-OUT. As the “11” limits are displayed, they may be reprogrammed using the “12” ENTRY keys. New values will be programmed into memory when the ENTER key is pushed. The ENTER key must also be used to advance the display as the operator views the “10” system operating limits. Each time the key is pushed, the display will advance to the next limit.

If the operator attempts to enter an unacceptable value, the micro will respond with a momentary message indicating the value selected has been ignored. This error message is shown:

O U T O F R A N G E
T R Y A G A I N !

The “11” programmable limit displays are shown and described below along with the range of values which the microprocessor will accept for each limit. *THESE VALUES MUST BE CHECKED AND PROPERLY PROGRAMMED WHEN COMMISSIONING THE CHILLER. FAILURE TO PROPERLY PROGRAM THESE VALUES MAY CAUSE DAMAGE TO THE CHILLER OR OPERATION PROBLEMS.*

DISCHARGE CUT-OUT

D I S C H A R G E C U T O U T
= 3 9 5 P S I G

The DISCHARGE CUT-OUT is a microprocessor back-up for the mechanical high pressure cut-out located in each refrigerant circuit. Typically, chillers with air-cooled condensers should have the cut-out set at 395 PSIG. Chillers with water-cooled condensers normally require the cut-out to be set at 275 PSIG.

NOTE: In some water cooled condenser installations, the possibility exists for the condenser water pump or the cooling tower to not be in operation when the chiller starts. This causes the discharge pressure to rise so rapidly that even though the mechanical high pressure cut-out is shutting down the compressor, the flywheel effect may cause the pressure to continue to rise causing the relief valve to open with a subsequent refrigerant loss. By programming the cut-out at slightly below the typical manual cut-out of 275 PSIG, refrigerant loss due to system operation problems will be eliminated.

To program the DISCHARGE CUT-OUT, key in the desired value and press the ENTER key. The new value will be entered into memory and the display will advance to the next user programmable limit.

The micro will accept a range of programmable values between 200-399 PSIG for this cut-out. For this cut-out to be functional, the Discharge Pressure Read-out Option must be installed.

NOTE: It is required to first key in a "0" when programming this cut-out (Example: 0395 PSIG).

More details on this safety are outlined in the SYSTEM SAFETIES section.

OUTSIDE AIR TMP LOW CUT-OUT

OUTSIDE AIR TMP LOW
CUT OUT = 25.0 F

The OUTSIDE AIR TMP LOW CUT-OUT allows the user to select the chiller low ambient temperature cut-out point. If the ambient falls below this point the chiller will shut down. Restart can occur, if demand allows, when temperature rises above the cut-out. This only applies to outdoor air-cooled chillers.

For normal ambient applications, the cut-out is set at 25.0°F and is not programmable. However, some users may set the cut-out higher to shut down the chiller and take advantage of other less costly cooling sources. In this case, S1 Dip Switch #2 on the Micro Logic Board must be in the CLOSED position for Low Ambient Control to allow programming the cut-out above 25°F.

Low ambient applications in ambients less than 25.0°F require a low ambient kit to be installed. Otherwise nuisance low pressure and low motor current trips will result. If a low ambient kit is installed, the cut-out may be lowered as needed below 25°F. If operation is occasionally needed below 0°F, the cut-out should be set at 00.0°F. This will allow operation at any temperatures since the micro is only able to recognize temperatures above 1°F, regardless of the display.

NOTE: Operation below 0°F may cause other types of nuisance safety shutdowns, but occasional shutdowns can usually be tolerated since the need for sustained operation at these temperatures is unlikely and temperatures rarely stabilize for any length of time below 0°F.

The micro will accept a range of programmable values between 00.0° - 50.0°F for this cut-out, if S1 Dip Switch #2 on the Micro Logic Board is in the CLOSED position. In the OPEN position, a fixed 25°F cut-out is recognized.

To program the OUTSIDE AIR TMP LOW CUT-OUT, key in the desired value and press the ENTER key. The new value will be entered into memory and the display will advance to the next user programmable limit.

OUTSIDE AIR TMP HIGH CUT-OUT

OUTSIDE AIR TMP HIGH
CUT OUT = 130.0 F

The OUTSIDE AIR TMP HIGH CUT-OUT is selectable to establish the high ambient cut-out point. If the ambient rises above this point, the chiller will shut down. Restart can occur when temperature drops below the cut-out. This only applies to outdoor air-cooled chillers.

This cut-out is normally set at 130.0°F to allow operation to the absolute maximum temperature capability of the electro-mechanical components.

To program the OUTSIDE AIR TMP HIGH CUT-OUT, key in the desired value and press the ENTER key. The new value will be entered into memory and the display will advance to the next user programmable limit.

The micro will accept a range of programmable values between 100.0° - 130.0°F for this cut-out.

DISCHARGE PRESSURE UNLOAD

DISCHARGE PRESSURE
UNLOAD = 360 PSIG

The DISCHARGE PRESSURE UNLOAD point is a programmable limit to keep the system from faulting on the high discharge pressure cut-out should a system problem or chiller problem occur. A typical problem would be if the cooling tower would become dirty on a water-cooled system. Pressure would rise and eventually cause the chiller to fault causing total loss of cooling. By unloading the compressors at high discharge pressures, the chiller is allowed to continue to run automatically at reduced capacity until the dirty cooling tower can be attended to.

When the unload point is reached, the micro will automatically totally unload the affected compressor. Typical maximum programmed limits would be 375 PSIG for air-cooled chillers with 395 or 405 PSIG high pressure cut-outs and 255 PSIG for water-cooled chillers with 275 PSIG cut-outs.

Reloading will occur when the discharge pressure drops to 60 PSIG below the programmed unload pressure and will increment one stage at a time as dictated by the loading timers.

To program the DISCHARGE PRESSURE UNLOAD, key in the desired value and press the ENTER key. The new value will be entered into memory and the display will advance to the next user programmable limit.

The micro will accept a range of programmable values between 200-390 PSIG for the unload point. For this feature to be functional, the Discharge Pressure Read-out Option must be installed.

NOTE: It is required to first key in a "0" when programming this cut-out (Example: 0375 PSIG).

SUCTION PRESSURE UNLOAD

S U C T I O N P R E S S U R E
U N L O A D = 0 9 0 P S I G

The SUCTION PRESSURE UNLOAD point is a programmable limit designed to assure that suction gas returning to the compressor is cool enough to provide adequate compressor cooling.

If the suction pressure rises to the suction pressure unload pressure, the micro will automatically totally unload the affected compressor which reduces motor heating.

Reloading will occur when the suction pressure drops to 10 PSIG below the programmed unload pressure and will increment one stage at a time as dictated by the loading timers.

This safety will only come into action on a very hot water start with related high system suction pressure. Its sole purpose is to prolong motor life.

To program the SUCTION PRESSURE UNLOAD, key in the desired value and press the ENTER key. The new value will be entered into memory and the display will advance to the next user programmable limit.

The micro will accept a range of programmable values between 80-105 PSIG for the unload point.

NOTE: When programming values from 80-99 PSIG, it is required to first key in a "0". Example: 085 PSIG.

RATE CONTROL TEMP

R A T E C O N T R O L T E M P
= 0 8 . 0 F

The RATE CONTROL TEMP establishes a temperature range over which the micro may override normal system loading timers and react to the actual rate of change of return and leaving water temperature. This temperature range is slightly above the setpoint with its band width being programmable. This control works in conjunction with the RATE SENSITIVITY which is also programmable.

These controls allow the chiller to adapt to a full range of applications. Depending on how the controls are set up, the chiller can be adapted to provide maximum response, demand limiting/energy saving, or reduced loader and compressor cycling. **Typically, this value should be programmed for 00.1°F. When programming values like 00.1°F, it is first required to key in "00". Example: 00.1°F.** Additional details for programming this control will be discussed in the SELECTION OF RETURN OR LEAVING CHILLED LIQUID CONTROL Section (Page 40).

ANTI RECYCLE TIME

A N T I R E C Y C L E T I M E
= 6 0 0 S E C S

The ANTI-RECYCLE TIME selection allows the user to select the compressor anti-recycle time to best suit his needs. Motor heating is a result of inrush current when the motor is started. This heat must be dissipated before another start takes place or motor damage may result. The anti-recycle timer assures the motor has sufficient time to cool before it is again restarted.

An adjustable timer allows for the motor cooling required, but gives the user the ability to extend the timer to cut down on cycling. In some applications fast compressor start response is necessary; in others, it is not. These needs should be kept in mind and the timer should be adjusted for the longest period of time tolerable. Although 300 seconds is adequate motor cooling time, longer periods will allow even more heat dissipation, reduce cycling, and possibly increase motor life.

To program the ANTI RECYCLE TIME, key in the desired value and press the ENTER key. The new value will be entered into memory and the display will advance to the next user programmable limit.

The micro will accept a range of programmable values between 300-600 seconds for this operating control.

LEAVING WATER TEMP CUT-OUT

L E A V I N G W A T E R T E M P
C U T O U T = 3 6 . 0 F

The LEAVING WATER TEMP CUT-OUT protects the chiller from an evaporator freeze-up should the chilled liquid temp drop below the freeze point. This situation could occur under low flow conditions or if the micro panel SETPOINT values are improperly programmed. Anytime the leaving chilled liquid temperature (water or glycol) drops to the cut-out point, the chiller will shut down. Restart will occur when temperature rises above the cut-out if the anti-recycle timers are satisfied.

For chilled water applications (comfort cooling, SW1 OPEN), the cut-out is automatically set at 36.0°F. This covers applications where leaving water temperatures are not designed to go below 40.0°F. If chilled liquid (glycol) temperatures are required below 40°F, the cut-out should be programmed for 4°F below the desired leaving chilled liquid temperature.

To program the LEAVING WATER TEMP CUT-OUT the BRINE & PROCESS MODE (SW1, CLOSED) must be selected, key in the desired value and press the ENTER key. The new value will be entered into memory and the display will advance to the next programmable limit.

The micro will accept a range of programmable values between 08.0° - 36.0°F for this cut-out.

SUCTION PRESSURE CUT-OUT

**S U C T I O N P R E S S U R E
C U T O U T = 4 4 P S I G**

The SUCTION PRESSURE CUT-OUT protects the chiller from an evaporator freeze-up should the system attempt to run with a low refrigerant charge. Anytime the suction pressure drops below the cut-out point, the system will shut down.

NOTE: There are some exceptions, where suction pressure is permitted to temporarily drop below the cut-out point. Details are outlined in the SYSTEM SAFETIES section.

For chilled water applications, the cut-out should be set at 44 PSIG. If glycol or brine is utilized with leaving water temperature designs below 40°F, the cut-out should be adjusted according to concentration. A rule-of-thumb cut-out design is to drop the cut-out 1 PSIG below 44 PSIG for every degree of leaving glycol below 40°F. In other words, 30° glycol requires a 34 PSIG suction pressure cut-out.

To program the SUCTION PRESSURE CUT-OUT, key in the desired value and press the ENTER key. The new value will be entered into memory and the display will advance to the next programmable limit.

The micro will accept a range of programmable values between 20-70 PSIG for this cut-out. In the COMFORT COOLING MODE (SW1 OPEN), the cut-out is adjustable from 44-70 PSIG. In the BRINE & PROCESS MODE (SW1 CLOSED), the cut-out is adjustable from 20-70 PSIG.

RATE SENSITIVITY

**R A T E S E N S I T I V I T Y
= 5 . 0 F / M I N .**

The RATE SENSITIVITY establishes the rate of change of return or leaving water temperature where the micro will override the normal 30-150 seconds per stage loading rate which is based on error between setpoint and actual temperature.

The RATE SENSITIVITY is active when the leaving chilled liquid temperature is in the RATE CONTROL TEMP RANGE. In this range, if water temperature is

dropping faster than the RATE SENSITIVITY setting, the micro will not load any more stages because water temperature is dropping quickly. This provides demand limiting and reduces loader/compressor cycling and overshoot. If quick response is needed, RATE SENSITIVITY can be programmed accordingly. When temperatures are in the RATE CONTROL TEMP RANGE, loading will occur in intervals according to both rate of water temperature change and error in water temperature versus setpoint. This will override the typical 30-150 seconds per stage based on error in setpoint versus actual water temperatures. If water temperature is dropping faster than the RATE SENSITIVITY, no further loading will result and in some cases, the chiller will unload to slow temperature drop.

RATE SENSITIVITY is also active in the CONTROL RANGE in RETURN OR LEAVING WATER CONTROL. Further loading will not occur if water temperature is dropping too fast regardless of whether temperature calls for further loading.

Typically, this value should be programmed for 5.0°F. Additional details for programming this control will be discussed in the SELECTION OF RETURN OR LEAVING CHILLED LIQUID CONTROL Section (Page 40).

NUMBER OF LOAD STEPS

**N U M B E R O F L O A D S T E P S
= 1 0 (E N T E R 5 , 7 O R 1 0)**

The number of steps of loading must be programmed to assure proper loading sequence and temperature control. This is done at the factory but should be checked against the table below:

	Z33BA3	Z44BA3	Z74BB3	Z77DB3	Z88DB3
STD.	5 STEPS	5 STEPS	5 STEPS	5 STEPS	5 STEPS
OPT.	N/A	N/A	6 STEPS	7 STEPS	7 STEPS

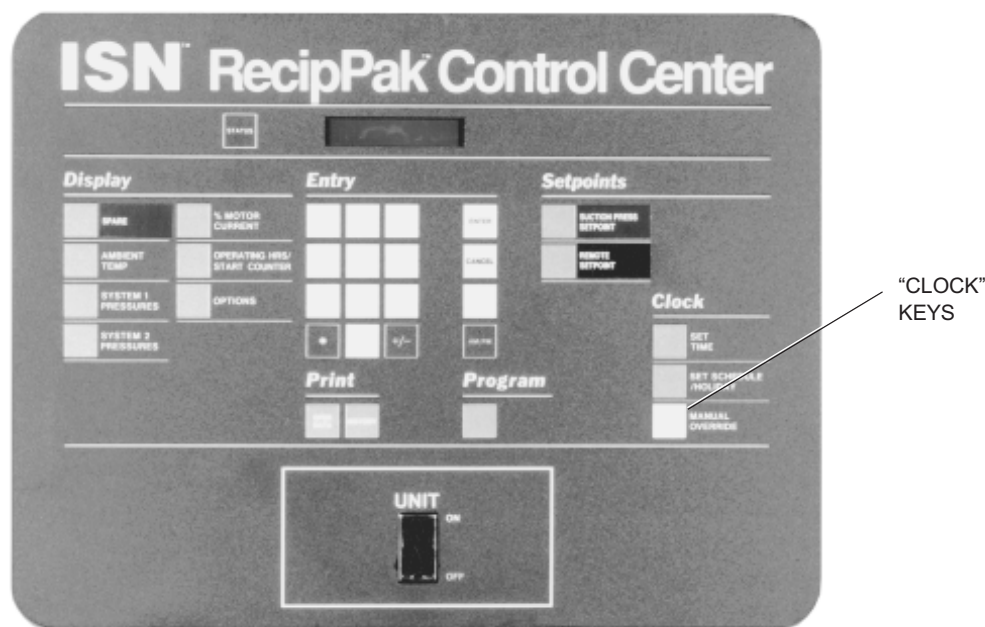
Standard unloading requires programming for "5" steps. Optional unloading requires "7" step selection. The YCAZ74BB3 will actually operate only "6" of the "7" steps since one compressor is a 4 cylinder with only one unloading solenoid.

Optional unloading requires a 2nd Relay Output Board. No compressor changes are required.

NOTE: Hot Gas Bypass (Loadminder) should be counted as a step for programming purposes.

Program the number of steps as required. If 5 or 7 steps is programmed, the "0" key (05 or 07) must be pressed first.

“CLOCK” KEYS PROGRAMMING THE SYSTEM CLOCK AND DAILY START/STOP SCHEDULE



26572A

GENERAL

The “CLOCK” is an internal system feature that allows the microprocessor to continuously monitor the time of the day. The micro will display actual time as well as the day of the week and the date when programmed. This feature allows the microprocessor to provide an internal automatic time clock feature for starting and stopping the chiller for each individual day of the week. Also provided is a “HOLIDAY” feature which allows special start/stop programming for designated holidays.

The internal clock and schedule programming eliminates the need for an external time clock. Automatic chiller start and stop will occur according to the programmed schedule.

If the user desires not to utilize the schedule feature, the SET SCHEDULE/HOLIDAY can be programmed to run the chiller on demand as long as the “UNIT” and “SYS” switches are ON.

Typical display messages will be shown which apply to each key.

PROGRAMMING THE DAY, TIME AND DATE

Set Time



A message showing the day, time, and date will be displayed when the SET TIME key is pressed.

T O D A Y I S S U N 1 1 : 1 2 A M
0 2 / 1 4 / 9 1

To program the day, time and date, first press the ADVANCE DAY key until the appropriate day of the week is displayed. The day will advance each time the key is pressed.

The cursor will already be below the first digit of the time. Key in the new time, if required. Be sure to key in a “0” before the other digits for times before 10 o’clock., i.e. 08:01.

After the time is keyed in, the cursor will advance to the AM/PM designation. To reprogram, press the AM/PM key. When the key is pressed, the display will change to the opposite time period. If no change is required, begin keying in the required date (the cursor will automatically skip to the first digit of the date [month] when a “number key” is pressed and the number will be placed in the first position).

NOTE: The AM/PM key can only be pressed once. If an error is made, press the CANCEL key and begin again.

The date may be keyed in after AM/PM. The sequence of the message display is month, day, and year. Two digits must be entered for each of these items. Therefore, a leading “0” may be required.

Once the desired information is keyed in, it may be stored in memory by pressing the ENTER key. After the ENTER key is pressed, the cursor will move under the "T" of TODAY.

The micro will accept any valid time or date. If an out of range value is entered, the micro will display the following message for 3 seconds before it reverts back to the SET TIME display message to let the user know that another try at reprogramming is necessary.

OUT OF RANGE
TRY AGAIN!

PROGRAMMING THE DAILY START/STOP AND HOLIDAY SCHEDULE

Set Schedule/Holiday

SET SCHEDULE
/ HOLIDAY

Messages showing the start/stop schedule of each day of the week as well as the holiday start/stop schedule can be displayed after the SET SCHEDULE/HOLIDAY key is pressed. The display can be scrolled through day-by-day simply by repetitively pressing the ENTER or ADVANCE DAY key. A typical daily schedule display is shown below:

MON START = 06 : 00 AM
STOP = 05 : 30 PM

To reprogram any of the daily schedules, key in the new START time. To change the AM/PM associated with the START time, press the "AM/PM" key. This will change the AM/PM message to the opposite time period. The "AM/PM" key can only be pressed once. If an error is made, press CANCEL and begin reprogramming again.

After the START time and the associated AM/PM have been programmed, the cursor will move to the STOP time. Key in the STOP TIME and press the "AM/PM" key if AM/PM requires changing.

When the ENTER key is pressed, the new START/STOP time is entered and the display will scroll to the next day. If an unacceptable time is entered, the following message will be displayed.

OUT OF RANGE
TRY AGAIN!

For ease of programming, any values "ENTERED" for MONDAY will **automatically** be put in for the other days of the week. Be aware of this anytime the MONDAY SCHEDULE is changed, since it changes times previously programmed into other days. For scrolling through

the days to view times programmed use the ADVANCE DAY KEY, not the ENTER KEY. This will assure that after viewing MONDAY, that the ENTER KEY is not pressed changing times programmed for the rest of the week.

If the chiller is not cycled by the DAILY SCHEDULE, but is required to run whenever the system switches are on, all 00.00's should be programmed into the daily schedule. This can be done manually for each day or by pressing CANCEL and ENTER when the MONDAY START/STOP schedule appears.

NOTE: This will have no effect on the holiday schedule.

Continue to program each day as needed. After MON through SUN has been entered, the HOLIDAY message will be displayed.

HOL START = 08 : 00 AM
STOP = 12 : 00 PM

The Holiday (HOL) START/STOP allows the user to designate a specific day(s) for special requirements. This is provided so that day(s) needing special start/stop requirements can be programmed without disturbing the normal working schedule.

The start/stop times for the Holiday schedule are programmed just as for any other day.

NOTE: Only one start/stop time can be programmed which will apply to each of the "HOLIDAY" days selected.

After the ENTER key is pressed, a new message will be displayed to designate which days of the week are to be holidays.

S M T * W T F S
HOLIDAY NOTED BY *

In the above sample display, an * designates Tuesday as a holiday.

When the display appears, the cursor will first stop behind Sunday. To designate a day as a holiday, press the "*" key. If a day is not to be a holiday, press the "0" key. Whenever the "*" or the "0" keys are pressed, the cursor will advance to the next day. After all the holiday days are programmed, press ENTER to store the new data into memory. The display will then advance to the beginning of the Daily Schedule (MON).

The Holiday Schedule is only executed once by the micro before it is erased from memory. This is done

because in most cases a special Holiday Schedule is only necessary once in a several month period. It also eliminates the need for operator intervention to erase the schedule after the holiday passes.

If an error is made while programming, press CANCEL. This will clear all programmed (*) "holiday" days. The schedule can then be reprogrammed.

The "0" key will not cancel out a "*" and cannot be used for correcting a programming error.

Manual Override



When the MANUAL OVERRIDE key is pressed, the Daily Schedule programmed into the chiller will be ig-

nored and the chiller will start-up when water temperature allows, unit switch permits, and system switches permit.

Normally this key is not used unless an emergency forces the chiller to require operation during a period where the programmed Daily Schedule is calling for the chiller to be OFF (Daily Schedule Shutdown).

MANUAL OVERRIDE

Once activated, MANUAL OVERRIDE is only active for a period of 30 minutes. It is for servicing only and is designed so that if let on accidentally, the microprocessor will automatically return to the Daily Schedule.

SELECTION OF RETURN OR LEAVING CHILLED LIQUID CONTROL

GENERAL

The user has the ability to select the type of chilled liquid temperature control by choosing either Return or Leaving Temperature Control. This provides the ability to fine tune the method of control for comfort cooling or batch/process cooling loads.

In many cases, comfort cooling will be best controlled by RETURN WATER CONTROL. This will assure a minimum of cycling compressors/loaders with stable leaving chilled liquid temperatures as long as water flow GPM is held constant and the Control Range (CR) is correctly programmed.

LEAVING WATER CONTROL is also suitable for comfort cooling, but may produce slightly more cycling depending upon the RATE SENSITIVITY programmed. Optional stages of loading are recommended to reduce cycling. In most cases, Leaving Water Control will be more precise unless compressor cycling is encountered. "Anticipation" and timers are built into the microprocessor's control algorithms to eliminate compressor and loader cycling enabling LEAVING WATER CONTROL to be used in most applications. The control algorithm utilizes "PID" control.

For batch and process applications, LEAVING WATER CONTROL will allow for precise temperature control. In these applications chilled liquid temperature control is more important than compressor/loader cycling. When LEAVING WATER CONTROL is utilized, it is recommended to have optional steps of loading on each compressor. This assures minimum tonnage per step which reduces the possibility of compressor and loader cycling that is critical to precisely controlling temperature.

RETURN WATER CONTROL may also be used on batch and process application and should provide adequate control. However, it will prove to be less responsive with slightly more leaving chilled liquid temperature variation. RETURN WATER CONTROL may become necessary to use if too much compressor cycling is noted with corresponding water temperature fluctuation when in Leaving Water Control.

After determining the mode of control best suited for the application (RETURN OR LEAVING WATER CONTROL), the micro panel must be interrogated to determine whether it is programmed for RETURN or LEAVING WATER CONTROL. This can be accomplished by pressing the OPTION key in the DISPLAY section of the keypad. This allows the user to determine the present mode of control without gaining access to the Microprocessor Board and visually checking the sometimes difficult to determine Dip Switch position. When the OPTION key is pressed, a message "THE FOLLOWING ARE PROGRAMMED" will appear on the display for 3 seconds. The display will then scroll through the 8 dip switch selections, each appearing for 3 seconds. The 4th display will tell the user whether leaving or return temperature is programmed on Switch 4. The 4th display message will read either "RETURN WATER CONTROL" or "LEAVING WATER CONTROL" and will appear for 3 seconds. The display will then scroll through the 8 dip switch selections, each appearing for 3 seconds.

If a change is required, position Switch #4 on dip switch S1 on the Microprocessor Board (Fig. 12) as indicated:

RWT CONTROL: SW 4 OPEN

(left side pushed down)

LWT CONTROL: SW 4 CLOSED

(right side pushed down)

NOTE: In LWT CONTROL, water temperature may undesirably rise when a compressor cycles off and cannot restart because the anti-recycle timer is still timing out. The effects can be reduced by programming the anti-recycle timer (Page 36) for a minimum of 300 seconds if it isn't already programmed for 300 seconds. If problems still arise, switch to RWT CONTROL.

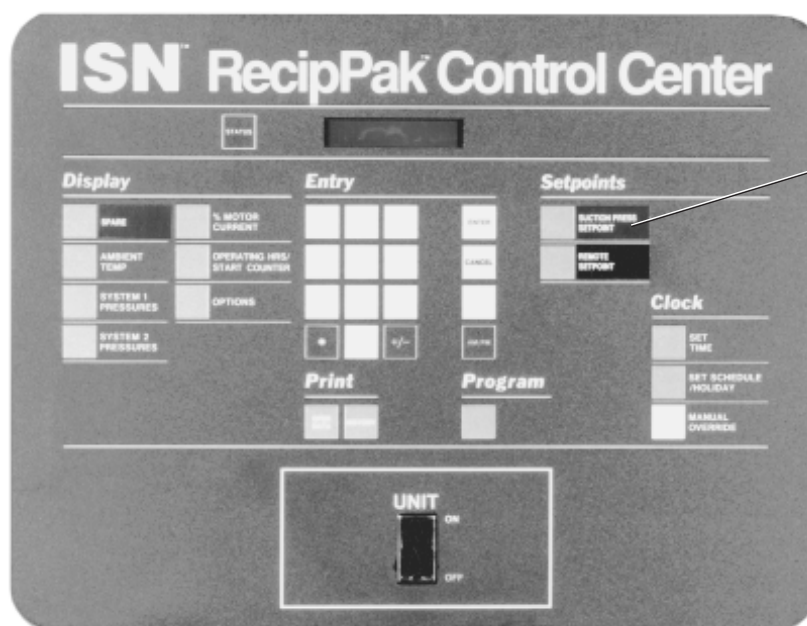
Once the dip switch #4 on the Microprocessor Board is properly positioned, the user will be able to view the

appropriate display when the CHILLED LIQUID TEMP/RANGE is pressed. This display will show one of the following messages depending upon S1 positioning:

RETURN WATER
TEMP CONTROL

LEAVING WATER
TEMP CONTROL

“SETPOINTS” KEYS PROGRAMMING CHILLED LIQUID SETPOINTS & REMOTE RESET TEMP RANGE



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GENERAL

After Return or Leaving Chilled Liquid Control is selected according to the user's application and Switch 4 of Dip Switch S1 on the Micro Board is properly configured to select Return or Leaving control, the chilled liquid setpoints can then be programmed into the control panel. Switch #4 of S1 must be properly programmed or an incorrect display message will appear when the CHILLED LIQUID TEMP/RANGE key is pressed. SEE “SELECTION OF RETURN OR LEAVING CHILLED LIQUID CONTROL” Page 40 if needed.

If remote temperature setpoint is being utilized, the REMOTE RESET TEMP RANGE must be programmed. The following information will cover programming both return and leaving control. Refer to either the RETURN

or LEAVING WATER CONTROL section as required below. Programming the REMOTE RESET TEMP RANGE is discussed later in this manual on Page 65.

PROGRAMMING RETURN WATER CONTROL

Chilled Liquid Temp/Range

CHILLED LIQUID
TEMP / RANGE

When the CHILLED LIQUID TEMP/RANGE key is pressed, the following message will be displayed for 3 seconds indicating Dip Switch S1, Switch #4 on the Microprocessor Board is programmed properly:

RETURN WATER
TEMP CONTROL

If this message is incorrect, see the "SELECTION OF RETURN OR LEAVING CHILLED LIQUID CONTROL" section (Page 40) for instructions to reprogram the Microprocessor Dip Switch S1, Switch #4.

The display will then scroll to a second message & hold:

```

      L W T =   4 4 . 0   F
C R =   4 4 . 0   T O   5 4 . 0   F
  
```

This message will display the user's "Design Leaving Water Temperature" (LWT) setpoint (44.0°F in the sample above). Even though return water temperature control is being utilized, the object is to provide constant design leaving water temperature. It is the "Design Leaving Water Temperature" setpoint (LWT) which must be programmed into the microprocessor.

Also included in this message is the "CONTROL RANGE" (CR). The "CONTROL RANGE" is the temperature range which loading/unloading will take place. The lower limit of the CONTROL RANGE is always equal to the setpoint and automatically appears when the setpoint is keyed in. The upper limit of the CR must be programmed.

In the above sample message, with a "CR = 44.0 to 54.0°F", the chiller will be completely off at a return water temperature of 44.0°F and fully loaded at a return water temperature of 54.0°F. Partial loading will occur in equal temperature intervals between 44° and 54°. Unloading will occur as return temperature drops below 54°F with the chiller cycling completely off at 44°F. These temperatures provide a Control Range differential of 54.0 – 44.0 = 10.0°F.

Once the upper limit of the CR is programmed, the "CONTROL RANGE" (CR) differential **Must Always** equal the actual water temperature drop (DT) across the evaporator with the chiller completely loaded. Keep this in mind when programming the high end of the CR. In many cases, due to improper flows, actual temperature drop occurs across the evaporator (DT) will not equal design. For proper operation, adjust flow as needed or program the "CONTROL RANGE" as needed. However accomplished, the "CONTROL RANGE" differential **Must** equal the evaporator temperature drop when fully loaded or leaving water temperatures well above or well below the desired setpoint will result.

To program the Chilled Liquid Setpoints, press the CHILLED LIQUID TEMP/RANGE key. The display will first exhibit a message that "RETURN WATER TEMP CONTROL" is selected and 3 seconds later automatically scroll to the next display of LWT and CR. The cursor will stop at the first digit of LWT. Key in the "Design Leaving Water Temperature" (LWT) that is required in the system. See the following:

Design Leaving Water Temperature

```

      L W T =   4 4 . 0   F
C R =   4 4 . 0   T O   5 4 . 0   F
  
```

After the Design Leaving Water Temperature (LWT) is keyed in, the lower limit of the CR (Control Range) in the display message will automatically change to a value identical to the "LWT". See below:

```

      L W T =   4 4 . 0   F
C R =   4 4 . 0   T O   5 4 . 0   F
  
```

The lower limit of the CR will always automatically equal LWT

The cursor will advance to the final entry which is the upper limit of the CR (Control Range). This value must be programmed to equal the design LWT plus the CR differential (DT across the evaporator fully loaded). In the above examples it would be 44.0 + 10.0 = 54.0°F.

Key in the upper limit of the CR and press ENTER. Otherwise the new values will not be entered into memory. After pressing the ENTER key, the display will continue to show the LWT and Control Range message until another key is pressed.

The micro will accept a range of programmable LWT values from 10.0 - 70.0°F (See "SWITCH 1", Page 28). It will also accept a value for the upper limit of the CR of 4 - 20°F above the LWT Setpoint.

If brine or glycol is used in the system, chilled liquid temperatures below 40°F may be desired. To program setpoints below 40°F, Dip Switch S1, Switch #1 on the Microprocessor Board must be properly programmed. (See Page 27, Fig. 12). If the switch is incorrect, when setpoints below 40°F are entered as well as when unacceptable values are entered, the following message will be displayed.

```

O U T   O F   R A N G E
T R Y   A G A I N !
  
```

Loading/Unloading is limited by a 30 sec. loading/unloading timer between stages, with loading/unloading occurring according to the difference between return water temperature and the LWT Setpoint. However, on start-up, loading will be limited to a maximum of 1 stage per minute for the first 3 minutes. The 30 sec. loading timer may also be overridden by the micro if temperature is in the Rate Control Range or the Control Range (CR).

Overriding of the timer will depend upon the Rate Control software which is user programmable. The Rate Control software will totally inhibit loading in the CR (CONTROL RANGE) and the Rate Control Range if temperature drop exceeds the rate sensitivity even though temperature may appear to require loading.

Further details of loading/unloading and Rate Control will follow.

PROGRAMMING RETURN WATER RATE CONTROL

Programmable RATE CONTROL is designed to limit compressor/loader cycling thus saving energy and reducing wear on mechanical components. It also reduces the possibility of "overshoot". RATE CONTROL will allow the micro to react to fast changes in water temperature beyond normal responses dictated by the difference between actual return water temperature versus setpoint and the 30 sec. loading/unloading timer per stage.

RATE CONTROL requires programming the temperature range (RATE CONTROL TEMP) above the CONTROL RANGE (CR) where rate control is desired. Additionally, the actual rate of change (RATE SENSITIVITY) of water temperature which the micro uses as a control reference must also be programmed.

Refer to Fig. 13 as you read the following text. A typical leaving water temperature setpoint of 45°F is used with a 45° - 55°F CONTROL RANGE. A RATE CONTROL TEMP OF 65°F, which is typical (10° above the high end of the Control Range), is shown.

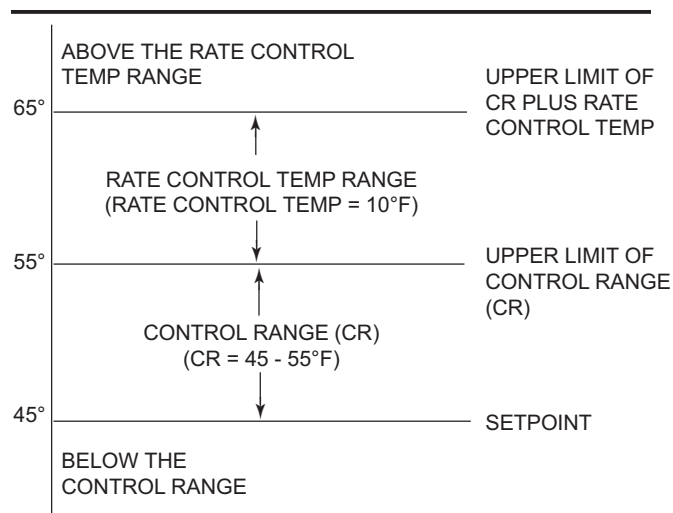


FIG. 13 – RETURN WATER TEMPERATURE CONTROL

The RATE CONTROL TEMP establishes a temperature range (0.1° - 20°F) above the "Upper Limit of CONTROL RANGE" where the micro will limit loading if the rate of change of water temperature exceeds the RATE SENSITIVITY. In Fig. 13 a RATE CONTROL TEMP of 10°F is used.

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In the CONTROL RANGE loading/unloading will normally occur according to deviation from setpoint. "Rate Control" will function to prevent loading if the water temperature change (leaving or return) exceeds the RATE SENSITIVITY, even though deviation from setpoint requires loading. This will reduce the chance of overshoot. Above THE RATE CONTROL TEMP RANGE, the micro will attempt to load the chiller as fast as it can (30 seconds per stage) unless the chiller has not run for 3 minutes. This allows the chiller to gain control of the water temperature as quickly as possible while still avoiding overshoot and limiting pulldown demand as temperature drops and rate control is implemented.

Since RWT Control utilizes the buffering of the water loop and a wide control (loading/unloading) range, compressor/loader cycling is reduced, wear and tear on mechanical parts is reduced, and pulldown demand is automatically limited. This makes the selection of RATE CONTROL TEMP and RATE SENSITIVITY values less critical unless short water loops are encountered.

Before programming the RATE CONTROL TEMP, the user should first determine if typically the fastest allowable pulldowns are required or whether pulldown demand limiting is desired. Programmable values from 00.1° - 20°F are possible.

For normal pulldowns, and quick response, a RATE CONTROL TEMP of 0.1°F is appropriate unless overshoot is noted.

For demand limiting, energy efficiency, and minimum cycling, RATE CONTROL TEMPS of 10° - 20°F are advisable with temperatures around 20°F most appropriate. This will cause the control to react to water temperature rate of change well before the water temperature drops into the CONTROL RANGE. This may be required for small water loops. However, if problems arise where the chiller does not load and pull temperature down, select 0.1°F.

To program the RATE CONTROL TEMP, first press the PROGRAM key. Repetitively press the ENTER key until the display below appears.

R	A	T	E		C	O	N	T	R	O	L		T	E	M	P
=	1	0	.	0	F											

Key in the desired value and press the ENTER key. The new value will be entered into memory and the display will advance to the next user programmable limit.

The micro will accept a range of programmable values between 0.1° - 20°F.

NOTE: When programming values between 0.1°-9.9°F, it is required to first key in a "0" or "00". Example: 05.9°F.

The next item which will require programming is the RATE SENSITIVITY. The RATE SENSITIVITY is a means of “overriding” the loading/unloading timers when water temperatures are in the RATE CONTROL RANGE or the CONTROL RANGE. This allows the micro to react to abrupt downward changes in leaving or return water temperatures. The ability to respond to “rate of change” variations in water temperatures gives the micro “anticipation” capabilities to reduce the possibility of “overshoot” in leaving water temperature.

In demand limiting applications, to avoid cycling or to avoid overshoot, a low RATE SENSITIVITY may be selected. This allows the micro to go into rate control to prevent loading whenever water temperatures drop faster than the programmed RATE SENSITIVITY. Rate Control can go into effect whenever water temperatures are in RATE CONTROL RANGE or the CONTROL RANGE. For these applications, a 3°-5°F/min. RATE SENSITIVITY is recommended. This may be needed for small water loops. However, if problems arise where the chiller does not load and pull temperature down, select 5°F/min.

NOTE: Too small of a RATE SENSITIVITY value selection may prevent loading due to varying flows or if the water system allows a slug of cold water to enter which falsely fools the micro into thinking the RATE SENSITIVITY has been exceeded, preventing loading and allowing leaving water temperature to rise above the desired temperature.

For normal comfort cooling, batch, or process applications, select a high RATE SENSITIVITY of 5°F/min. Before RATE CONTROL can go into effect, the water temperature would have to change at a very high rate to exceed the RATE SENSITIVITY value programmed. This will assure normal loading will occur. 5°F/min. also works well in comfort cooling applications. **If unsure of a RATE SENSITIVITY selection, use 5°F/min.**

To program the RATE SENSITIVITY, first press the PROGRAM key. Repetitively press the ENTER key until the display below appears.

```
R A T E   S E N S I T I V I T Y
=   5 . 0   F / M I N .
```

Key in the desired value and press the ENTER key. The new value will be entered into memory and the display will advance to the next user programmable limit.

The micro will accept a range of programmable values between 0.5° - 5.0°F/min.

PROGRAMMING LEAVING WATER CONTROL

Chilled Liquid Temp/Range

When the CHILLED LIQUID TEMP/RANGE key is pressed, the following message will be displayed for 3 seconds indicating Dip Switch S1, Switch #4 on the Microprocessor Board is programmed properly:

```
L E A V I N G   W A T E R
T E M P   C O N T R O L
```

If this message is incorrect, see the “SELECTION OF RETURN OR LEAVING CHILLED LIQUID CONTROL” Section (Page 40) for instructions to reprogram the Microprocessor Dip Switch S1, Switch #4.

The display will then scroll to a second message and hold:

```
      L W T =   4 4 . 0   F
C R =   4 4 . 0   F   T O   4 6 . 0   F
```

This message will display the Low-Limit Water Temperature (LWT) and the Control Range (CR). In the sample above, the LWT is 44.0°F and the CR is 44° - 46°F.

The Control Range (CR) is the variation in leaving water temperature which is acceptable in the system application. As long as leaving water temperature stays between the low limit and midpoint of the Control Range (CR), the Microprocessor will consider the temperature acceptable and will not initiate any loading/unloading reaction unless “Rate Control” requires. The Low-Limit Water Temperature (LWT) is the minimum acceptable leaving water temperature in the Control Range (CR), not the actual user desired leaving water temperature setpoint.

The desired leaving water temperature is known as the “Target” temperature which is the temperature the micro will attempt to control too. The “Target” temperature is not programmable, but it is always the midpoint of the Control Range (CR). Example: A control range of 44° - 46°F will have a “Target” Temp of 45°F, which should equal the desired system leaving water temperature. As mentioned before, the micro will be satisfied with a leaving temperature between 44° - 45°F unless the rate control is exceeded. The microprocessor’s rate control is designed to be less responsive in the upper half of the Control Range (i.e. 45° - 46°F) than in the lower half (i.e. 44° - 45°F). This is to prevent overshoot.

To program the Low-Limit Water Temperature (LOOT) and the Control Range (CR), press the CHILLED LIQUID TEMP/RANGE key. This display will first exhibit a message that "LEAVING WATER TEMP CONTROL" is selected and 3 seconds later automatically scroll to the next display of LWT and CR. The cursor will stop at the first digit of LWT. Key in the Low-Limit Water Temperature (LWT) that is acceptable in the system. See below:

Low-Limit Water Temperature (LWT)

L W T = 4 4 . 0 F									
C R = 4 4 . 0 T O 4 6 . 0 F									

The micro will accept a range of programmable values from 10.0 - 70.0°F (See "SWITCH 1", Page 28). If brine or glycol is used in the system, chilled liquid temperatures below 40°F may be desired.

To program setpoints below 40°F, Dip Switch S1, Switch #1 on the Microprocessor Board must be properly programmed. (See Page 28). If the switch is incorrect, when setpoints below 40°F are entered as well as when unacceptable values are entered, the following message will be displayed:

O U T O F R A N G E									
T R Y A G A I N !									

After the Low-Limit Water Temperature (LWT) is keyed in, the lower limit of the CR (Control Range) in the display message will automatically change to a value identical to the "LWT". See below:

The lower limit of the CR will always automatically equal LWT

L W T = 4 4 . 0 F									
C R = 4 4 . 0 T O 5 4 . 0 F									

The cursor will advance to the final entry which is the upper limit of the CR (Control Range). This value is programmed for the highest leaving water temperature which is acceptable in the system application. Typically 2°F above the Low-Limit Water Temperature is appropriate. The micro will accept a value 1° - 5°F above the LWT for this value. 2°F above the LWT is the default value.

Key in the upper limit of the CR and press the ENTER key. Otherwise the new values will not be entered into memory. After pressing the ENTER key, the display will continue to show the LWT and Control Range message until another key is pressed.

CAUTION: Too small of a CR selection will cause compressor/loader cycling. If compressor cycling occurs, leaving water temperature may vary considerably as a result of a compressor that cannot restart due to the anti-recycle timer. To eliminate this, increase the DT (temperature differential) of the CR and/or program the anti-recycle timer for a minimum of 300 seconds if it isn't already programmed for 300 seconds.

NOTE: Whenever reprogramming the LWT & CR, keep in mind that the desired leaving water temp. or "target", should be midpoint of the CR.

Normal pulldown loading is limited by a 30 sec. loading timer between stages with loading occurring whenever leaving water temperature is above the RATE CONTROL RANGE.

However, on start-up, loading will be limited to a maximum of 1 stage per minute for the first 3 minutes. The loading timer will be increased by the micro to 150 sec. when temperature falls to within the Rate Control Range or the upper half of the Control Range (Between Target and High Limit of the CR).

The Rate Control software will prevent loading and will cause unloading in the Rate Control Range or Control Range if temperature drops faster than 2X the programmed Rate Sensitivity. This is to prevent overshoot.

In the lower half of the Control Range between the Low Limit and the Target, Rate Control will cause unloading if temperature falls faster than 1X the programmed Rate Sensitivity. As before, this is to prevent overshoot.

Below the Control Range, unloading will be done at 20 sec. intervals until temperatures fall back into the Control Zone. Unloading is controlled by a 20 sec. timer below the Control Zone as well as when Rate Control calls for unloading.

Further details loading/unloading and Rate Control will follow:

PROGRAMMING LEAVING WATER RATE CONTROL

Programmable RATE CONTROL is designed to limit compressor/loader cycling thus saving energy and reducing wear on mechanical components. It also reduces the possibility of "overshoot". RATE CONTROL will allow the micro to react to fast changes in water temperature beyond normal responses dictated by leaving water temperatures, the 150 sec. loading timer, and the 20 sec. unloading temperature when temperatures are in the Rate Control Range or the Control Range.

RATE CONTROL requires programming the temperature range (RATE CONTROL TEMP) above the CONTROL RANGE (CR) where rate control is desired.

Additionally, the actual rate of change (RATE SENSITIVITY) of water temperature which the micro uses as a control reference must also be programmed.

Refer to Fig. 14 as you read the following text. A typical low limit water temperature of 44°F is used with a 44°-6°F CONTROL RANGE (CR). A RATE CONTROL TEMP of 10°F, which is typical (10° above upper limit of the Control Range), is shown.

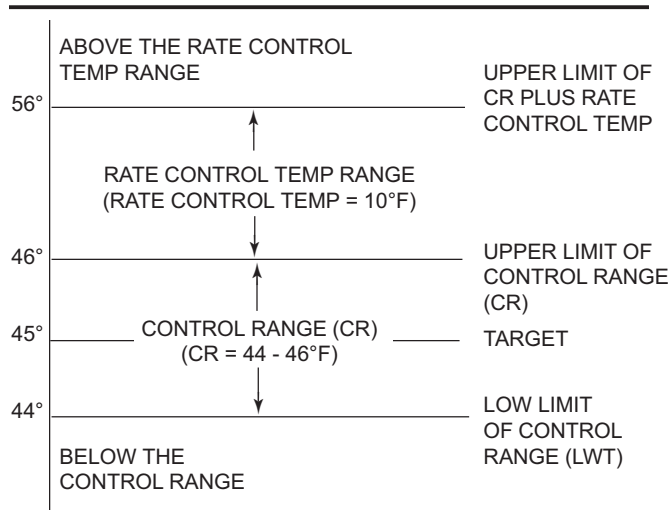


FIG. 14 – LEAVING WATER TEMPERATURE CONTROL

The RATE CONTROL TEMP establishes a temperature range (0.1 - 20°F) above the “Upper Limit of CONTROL RANGE” where the micro will limit loading if the rate of change of water temperature exceeds the RATE SENSITIVITY. In the above example a RATE CONTROL TEMP of 10°F is used. In the Rate Control Range, the micro will prevent loading or may cause unloading if the temperature drop exceeds 2X the Rate Sensitivity regardless of whether the 150 sec. loading timer and the deviation from setpoint is calling for loading.

At temperatures below the CONTROL RANGE, unloading will occur to bring temperatures back to within the CONTROL RANGE. The unloading timer will cause unloading at 20 sec. intervals until temperatures fall back into the CONTROL RANGE.

In the lower half of the Control Range between the Low Limit Water Setpoint (LWT) and the “Target” Temperature (Desired Leaving Water Temperature), Rate Control software will cause unloading if temperature drops faster than 1X the Rate Sensitivity. Otherwise, no other loading or unloading will result in this temperature range.

In the upper half of the Control Range between the TARGET and the High Limit of the Control Range and in the Rate Control Range, loading will take place in 150 sec. intervals until temperature drops below the TARGET temperature. The Rate Control software may prevent loading or possibly initiate unloading if temperature drops faster than 2X the programmed Rate Sensitivity.

Above the RATE CONTROL TEMP RANGE, the micro will attempt to load the chiller as fast as it can (30 seconds per stage) unless the chiller has not run for 3 minutes during which loading will occur at 1 min. intervals. This allows the chiller to gain control of the water temperature as quickly as possible while still avoiding overshoot and limiting pulldown demand as temperature drops and rate control is implemented.

Since LWT Control does not have the water loop for buffering after a load/unload response and utilizes a narrow control (loading/unloading) range, compressor/loader cycling can be a problem. This makes the selection of RATE CONTROL TEMP and RATE SENSITIVITY values very critical.

Before programming the RATE CONTROL TEMP, the user should first determine if typically the fastest allowable pulldowns are required or whether pulldown demand limiting is desired. Programmable values from 0.1-20°F are possible.

For normal pulldowns, and quick response, a RATE CONTROL TEMPS of 0-1°F is appropriate unless overshoot is noted.

For demand limiting, energy efficiency, elimination of overshoot, and minimum cycling, RATE CONTROL TEMPS of 10-20°F are advisable. This will cause the controls to react to water temperature rate of change well before the water temperature drops into the CONTROL RANGE. This may be required for small water loops. However, if problems arise where the chiller does not load and pull temperature down, select 0.1°F.

To program the RATE CONTROL TEMP, first press the PROGRAM key. Repetitively press the ENTER key until the display below appears.

R A T E C O N T R O L T E M P = 1 0 . 0 F

Key in the desired value and press the ENTER key. The new value will be entered into memory and the display will advance to the next user programmable limit.

The micro will accept a range of programmable values between 0.1-20°F.

NOTE: When programming values between 0.1-9.9°F, it is required to first key in a “0” or “00”. Example: 0.5-9°F.

The next item which will require programming is the RATE SENSITIVITY. The RATE SENSITIVITY is a means of “overriding” the loading/unloading timers when water temperatures are in the RATE CONTROL

RANGE or the CONTROL RANGE. This allows the micro to react to abrupt downward changes in leaving or return water temperatures. The ability to respond to "rate of change" variations in water temperatures gives the micro "anticipation" capabilities to reduce the possibility of "overshoot" in leaving water temperature.

In demand limiting applications, to avoid cycling, or to avoid overshoot, a low RATE SENSITIVITY may be selected. This allows the micro to go into rate control to prevent loading or cause unloading whenever water temperatures drop faster than the programmed RATE SENSITIVITY. Rate Control can go into effect whenever water temperatures are in RATE CONTROL RANGE or the CONTROL RANGE. For these applications, a 35°F/min. RATE SENSITIVITY is recommended. This may be needed for small water loops. However, if problems arise where the chiller does not load and pull temperature down, select 5.0°F/min.

NOTE: Too small of a RATE SENSITIVITY Selection may prevent loading due to varying flows or if the water system allows a slug of cold water to enter which falsely fools the micro into thinking the RATE SENSITIVITY has been exceeded, preventing loading and allowing leaving water temperature to rise above the desired temperature.

For normal comfort cooling, batch, or process applications, select a high RATE SENSITIVITY of 5.0°F/min. Before Rate Control can go into effect, the water temperature would have to change at a very high rate to exceed the RATE SENSITIVITY value programmed. This will assure normal loading will occur. In most applications, 5.0°F/min. is suggested. **If unsure of a RATE SENSITIVITY selection, use 5.0°F/min.**

To program the RATE SENSITIVITY, first press the PROGRAM key. Repetitively press the ENTER key until the display below appears.

R A T E S E N S I T I V I T Y = 5 . 0 F / M I N .
--

Key in the desired value and press the ENTER key. The new value will be entered into memory and the display will advance to the next user programmable limit.

The micro will accept a range of programmable values between 0.5-5.0°F/min.

LOADING AND UNLOADING RETURN WATER TEMPERATURE CONTROL

In return water temperature control, loading and unloading will take place according to the difference between the leaving water temperature setpoint and the actual return water temperature. By programming the CONTROL RANGE equal to the actual temperature drop across the

evaporator fully loaded, the microprocessor will be able to maintain the desired leaving water temperature by controlling off of the return water temperature (RWT). Simply, the micro will know that the chiller should be fully loaded when the RWT is equal to the SETPOINT + CONTROL RANGE. As the RWT drops, the micro will unload the chiller which reduces the capacity (temperature drop across the evaporator). This maintains the leaving water temperature at the desired setpoint.

Loading may be prevented due to the rate control circuitry. Anytime the return water temperature falls within the CONTROL RANGE or the RATE CONTROL RANGE, RATE CONTROL is in effect and loading and unloading may be prevented, if water temperature changes faster than the rate sensitivity. Loading and unloading will never occur in intervals faster than 30 sec. under any circumstances. This prevents cycling of the compressors and loaders. For the first 3 minutes after start-up, loading cannot occur in intervals less than 1 minute per step.

Unloading occurs on temperature drop at temperatures determined by the formula below. Internal timers have no effect on unloading.

The micro is capable of providing 5, 7, or 10 steps of loading/unloading although 10 steps is not possible with the type compressors utilized. The chiller **MUST** be programmed for the number of steps which were ordered. Otherwise, improper operation and water temperature control problems will result.

The temperature between stages of loading/unloading is equal to the CONTROL RANGE divided by the number of stages. For example:

$$\text{CONTROL RANGE} = 10^{\circ}\text{F}$$

$$\text{Number of Stages} = 5$$

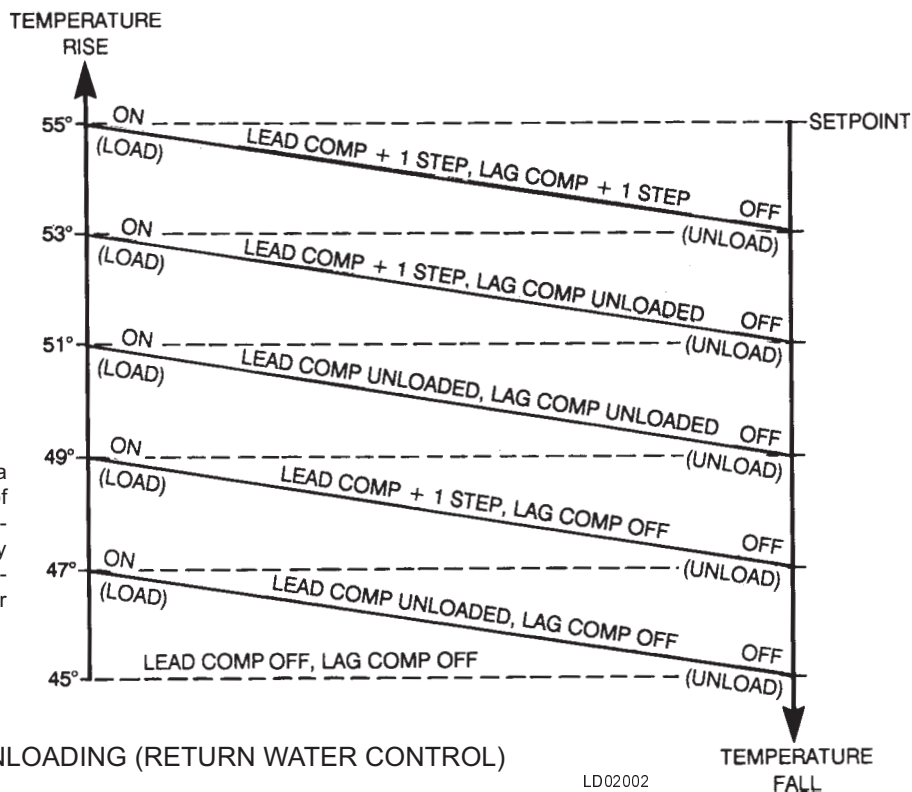
$$10^{\circ}\text{F} \div 5 = 2^{\circ}\text{F} \text{ between stages}$$

In this example, the micro will add a stage of loading each time the return water temperature rises 2°F assuming loading timers and rate control software allows.

The micro will unload a stage 2°F below the temperature at which it was loaded assuming unloading timers and rate control software allows.

Listed in Fig. 15 and 16 are the loading and unloading sequences for 5 and 7 steps of control. A typical setpoint of 45°F with a cooling range of 10°F is shown for example purposes. The chiller will be completely loaded at a return water temperature of 55°F and will be completely off at a temperature of 45°F, thus maintaining a leaving water temperature of 45°F. As mentioned before, loading/unloading timers as well as rate control software must be satisfied before loading/unloading will occur. This reduces the possibility of cycling.

5 STEP (STANDARD)



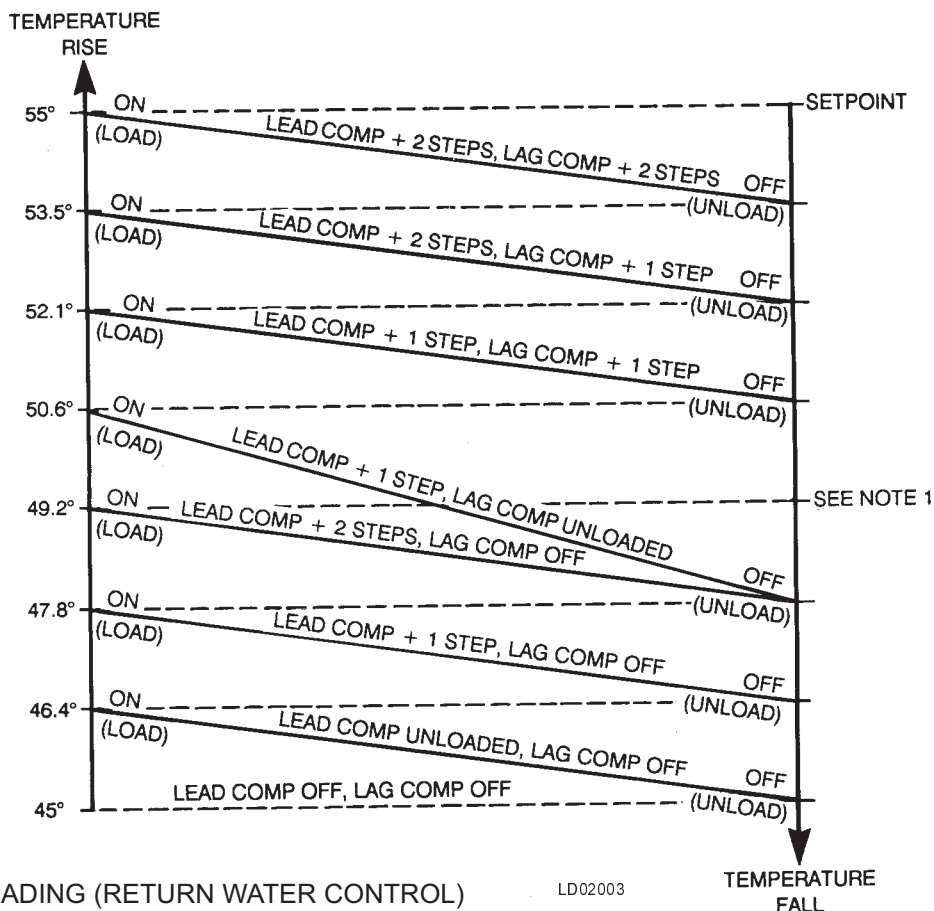
NOTE:

The micro controls loading and unloading on a 10 STEP scale regardless of the number of stages present. Therefore, loading and unloading responses on 5 Step (standard) chillers may appear delayed (time between stages increased) when missing steps are activated or deactivated by the micro.

FIG. 15 – 5 STEP LOADING / UNLOADING (RETURN WATER CONTROL)

LD02002

7 STEP (OPTIONAL)



NOTE:

1. The "Lead Comp + 2 Steps, Lag Comp Off" Step is skipped on a temperature drop.
2. The micro controls loading and unloading on a 10 STEP scale regardless of the number of stages present. Therefore, loading and unloading responses on 7 Step (optional) chillers may appear delayed (time between stages increased) when missing steps are activated or deactivated by the micro.

FIG. 16 – 7 STEP LOADING / UNLOADING (RETURN WATER CONTROL)

LD02003

LOADING AND UNLOADING LEAVING WATER TEMPERATURE CONTROL

In leaving water temperature control, loading and unloading will take place as needed to keep water temperature in the CONTROL RANGE between the TARGET and LOW LIMIT WATER TEMPERATURE. As mentioned earlier in this manual, the CONTROL RANGE is the temperature range of leaving water temperature that is acceptable to the user and has been previously programmed into memory using the CHILLED LIQUID TEMP RANGE KEY. Usually this is a window of water temperatures of about 2 - 3°F. The micro will cause loading and unloading actions to occur as needed to keep leaving water temperatures in the lower half of this range. Refer to Fig. 17 to aid in understanding the loading and unloading scheme performed by the microprocessor.

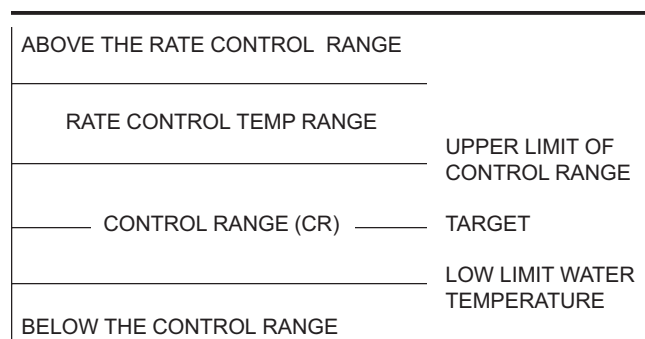


FIG. 17 – LEAVING WATER TEMPERATURE CONTROL

Within the lower half of the CONTROL RANGE, the micro-processor will not call for any further loading or unloading unless the Rate Sensitivity is exceeded. If temperature drop exceeds 1X the Rate Sensitivity, the micro will unload the chiller to prevent overshoot.

If leaving water temperature should fall into the temperature range “BELOW THE CONTROL RANGE” which is below the programmed Low Limit WATER TEMPERATURE, the microprocessor will unload the chiller in 20 sec. intervals until water temperature rises back into the CONTROL RANGE.

If temperature is in the upper half of CONTROL RANGE or in the RATE CONTROL RANGE, the microprocessor will continue loading the chiller as needed in 150 sec. intervals until temperatures pass into the lower half of the CONTROL RANGE. If the rate of drop in water temperature exceeds 2X the programmed Rate Sensitivity, no further loading or unloading will result since the micro sees the temperature dropping at an excessive rate anticipating temperature will soon fall into the CONTROL RANGE.

When temperatures are in the temperature range ABOVE THE RATE CONTROL RANGE, the micro will load the chiller in intervals of 30-150 sec. to bring the temperature down as quickly as possible. The micro is capable of providing 5, 7, or 10 steps of loading/unloading although 10 steps is not available with the compressors utilized. The chiller **MUST** be programmed for the number of steps which were ordered. Otherwise, improper operation and water temperature control problems will result.

NOTE: The micro controls loading and unloading responses on a 10 step scale regardless of the number of stages present. Therefore, loading and unloading responses on 5 & 7 step chillers may appear delayed (time between steps increased) when missing steps are activated or de-activated by the micro, 5 STEP CONTROL IS STANDARD.

Fig. 18 shows the loading and unloading sequences for 5 and 7 steps of control.

5 STEP (STANDARD)					
TEMPERATURE RISE	LOAD			UNLOAD	
5. LEAD COMP +1 STEP,	LAG COMP + 1 STEP	-----		LEAD COMP +1 STEP,	LAG COMP UNLOADED
4. LEAD COMP +1 STEP,	LAG COMP UNLOADED	-----		LEAD COMP UNLOADED,	LAG COMP UNLOADED
3. LEAD COMP UNLOADED,	LAG COMP UNLOADED	-----		LEAD COMP +1 STEP,	LAG COMP OFF
2. LEAD COMP +1 STEP,	LAG COMP OFF	-----		LEAD COMP UNLOADED	LAG COMP OFF
1. LEAD COMP UNLOADED,	LAG COMP OFF	-----		LEAD COMP OFF,	LAG COMP OFF
LEAD COMP OFF,	LAG COMP OFF	-----			
TEMPERATURE FALL					
7 STEP (OPTIONAL)					
TEMPERATURE RISE	LOAD			UNLOAD	
7. LEAD COMP +2 STEPS,	LAG COMP +2 STEPS	-----		LEAD COMP +2 STEPS,	LAG COMP +1 STEP
6. LEAD COMP +2 STEPS,	LAG COMP +1 STEP	-----		LEAD COMP +1 STEP,	LAG COMP +1 STEP
5. LEAD COMP +1 STEP,	LAG COMP + 1 STEP	-----		LEAD COMP +1 STEP,	LAG COMP UNLOADED
4. LEAD COMP +1 STEP,	LAG COMP UNLOADED	-----			
3. LEAD COMP +2 STEPS,	LAG COMP OFF	-----		LEAD COMP +1 STEP,	LAG COMP OFF
2. LEAD COMP +1 STEP,	LAG COMP OFF	-----		LEAD COMP UNLOADED	LAG COMP OFF
1. LEAD COMP UNLOADED,	LAG COMP OFF	-----		LEAD COMP OFF,	LAG COMP OFF
LEAD COMP OFF,	LAG COMP OFF	-----			
TEMPERATURE FALL					

* This step is skipped on a temperature drop.

FIG. 18 – LEAVING WATER CONTROL LOADING / UNLOADING

“SYSTEM SAFETIES”

There are three types of System Safeties: The Manual Reset type, the Automatic Reset type, and Anticipation Safety Controls. These safeties protect the chiller from damage anytime a safety threshold is exceeded by either shutting the system(s) down or by altering system loading. Continuous monitoring by the microprocessor assures that instantaneous reactions result. A status display message will indicate when a system(s) or the entire chiller is shut down due to a fault or when Anticipation safeties are operating.

An explanation of these safeties will follow.

MANUAL RESET SAFETIES

A Manual Reset Safety will shut the affected system down whenever the safety threshold is exceeded. Automatic restart will occur after the first 2 shutdowns when the anti-recycle timer times out, if temperature demand exists. After any combination of 3 Manual Reset Safety in a 90 minute time period, the affected system will shut down and lock out on a FAULT.

After a system has shut down 3 times and locked out, a fault display indicating the last system fault will appear on the STATUS display message. This is accessible by pressing the STATUS key.

To reset a locked out system, turn the affected system switch on the Microprocessor Board (Fig. 22, Page 62) to the OFF position.

CAUTION: *Before returning a locked out system to service, a thorough investigation of the cause of the fault should be made. Failure to repair the cause of the fault while manually allowing repetitive restarts may cause further expensive damage to the system.*

Each of the Manual Reset Safeties will be discussed in detail below.

Motor Current Safety

The Motor Current Safety assures that the motor life is not compromised due to low or high motor current. Low motor current may result from running with low or no refrigerant. The micro looks at motor current to protect against this until the Low pressure bypass is de-activated. High motor current may result from power problems, too much refrigerant, very warm water, or other high pressure situations.

The micro begins monitoring motor current after 3 seconds of operation. If motor current is exceeding 120% FLA at the 3 second point, the compressor will shut down. After 4 seconds of operation, motor current must be greater than 15% FLA but less than 115% FLA as long as the compressor continues to run.

NOTE: *Do not confuse FLA and RLA. FLA (full load amps) is approximately 1.2 x RLA. RLA (running load amps) specified on the motor nameplate, is typical current demand underrated operating conditions in a fully loaded system. Therefore, do not expect to see 100% FLA when the system is fully loaded. In this condition, currents may run approximately 65-85% FLA.*

An example of a motor current fault display message is shown below:

S	Y	S	#	1	M	O	T	O	R	C	U	R	R	E	N	T
S	Y	S	#	2	M	O	T	O	R	C	U	R	R	E	N	T

NOTE: *The Motor Protector and the mechanical High Pressure Cut-out will also cause the MOTOR CURRENT SAFETY to activate. The reason for this is that both devices cause the motor contactor to de-energize. Details of the operation of these devices are provided on page 51.*

Suction Pressure Safety

The Suction Pressure Safety assures that the system is not run under low refrigerant conditions or due to a problem which will not allow proper refrigerant flow.

For the first 30 seconds of operation, the low suction pressure bypass is in operation. After 30 seconds of operation, the micro begins monitoring suction pressure and continues to do so as long as the compressor runs. For operation periods of 30 seconds to 240 seconds, suction pressure must be greater than 50% of the Suction Pressure Cut-out. After 240 seconds, suction pressure must be greater than the cut-out.

NOTE: *A transient timer is built into software to assure that short term fluctuations in suction pressure due to fan cycling, loading, etc. do not cause nuisance trips on low suction pressure.*

After the system has pumped down and suction pressure reaches cut-out plus 5 PSIG, the transient timer is readied for action. If suction pressure drops below the cut-out point, the 120 second transient timer begins timing. As long as suction pressure doesn't drop below 50% of cut-out during the 120 second period and rises above cut-out before the timer times out, the system will continue to run.

The Suction Pressure Safety Cut-out is programmable by the user (Page 37). An example of a suction pressure fault message is shown at the top of page 51.

S Y S # 1	L O W	S U C T I O N
S Y S # 2	L O W	S U C T I O N

Oil Pressure Safety

The Oil Pressure Safety assures that the compressor's mechanical components receive proper lubrication. The micro begins monitoring compressor oil pressure after 4 seconds of operation. For operating periods of 4 seconds to 30 seconds, oil pressure must be greater than 5 PSID. From 30 seconds to 240 seconds, oil pressure must be greater than 20 PSID. After 240 seconds, oil pressure must be greater than 25 PSID for as long as the compressor continues to run. If the required oil pressure limits are not met, the system will shut down.

The micro computes "differential oil pressure" by measuring oil pump pressure and subtracting suction pressure (Oil - Suction = Oil PSID).

An example of an oil pressure fault display message is shown below.

S Y S # 1	L O W	O I L	P R E S S
S Y S # 2	L O W	O I L	P R E S S

Discharge Pressure Safety

The Discharge Pressure Safety assures that the system pressure does not exceed safe working limits which could open a relief valve or other pressure relief device causing refrigerant loss.

This safety is a back-up for the mechanical safety in the system. Anytime the cut-out point is exceeded, the system will shut down.

The Discharge Pressure Safety Cut-out is programmable by the user (Page 34). An example of a discharge pressure fault display message is shown below.

S Y S # 1	H I G H	D S C H
S Y S # 2	H I G H	D S C H

NOTE: This safety is only operable if optional discharge pressure transducers are installed.

Pumpdown Safety

The Pumpdown Safety assures that a compressor does not run unless it completes a proper pumpdown. This prevents operation of a refrigerant system which has a leaking liquid line solenoid valve.

On start-up, the system must pump down to the suc-

tion pressure cut-out within 300 seconds or the system will shut down.

An example of the Pump down fault display message is shown below.

S Y S # 1	L L S V	N O T	O N
S Y S # 2	L L S V	N O T	O N

NOTE: LLSV refers to liquid line solenoid valve.

Motor Protector

Three internal temperature sensors are built into the motor stator. These sensors are wired into the motor protector module located inside the Motor terminal box. As the motor windings heat and cool, the resistance of the motor temperature sensors will change. If the windings overheat, the change in resistance in the sensors will be sensed by the Motor protector module. The module will open its MP contacts breaking the 115VAC fed to the motor contactor. When the motor contactor de-energizes, motor current falls to zero. The low motor current is sensed by the microprocessor and the system is shut down. For more information, see MOTOR CURRENT SAFETY (Page 50).

Auto-restart will be permitted after a shutdown, when the motor sensors cool and the MP contacts close. A fault lock-out will result if safety thresholds are exceeded three times in a 90 minute period.

Mechanical High Pressure Cut-Out (HPCO)

A mechanical high pressure cut-out is located on each compressor discharge or in the compressor head. This is the primary high pressure safety in the system. Any microprocessor controls are secondary.

Anytime discharge pressure exceeds 405 PSIG, the contacts in the high pressure cut-out will open which removes 115VAC from the motor protector module. When 115VAC control power is lost to the module, the module's MP contacts open breaking the 115 VAC fed to the motor contactor. The motor contactor de-energizes and motor current falls to zero. The low motor current is sensed by the microprocessor and the system is shut down. For more information see MOTOR CURRENT SAFETY (Page 50).

Auto-restart will be permitted after a shutdown when discharge pressure drops to below 330 PSIG which allows the mechanical high pressure cut-out to reset and its contacts to close. This re-applies 115VAC to the motor protector closing the MP contact. A fault lock-out will result if safety thresholds are exceeded three times in a 90 minute period.

AUTOMATIC RESET SAFETIES

An Automatic Reset Safety will shut the entire chiller down on a fault when the safety threshold is exceeded and allows automatic restart after the condition causing the shutdown clears. Restart will occur only after antirecycle timers are satisfied and demand requires.

A reset hysteresis is built in so repetitive faulting and clearing will not occur in a short time period. An example would be if ambient temperature dropped below the cut-out, temperature would have to rise 5°F above the cut-out before the fault lockout would clear and restart can occur.

When the chiller is shut down on one of these safeties, a message will appear on the STATUS display informing the operator of the problem. This is accessible by pressing the STATUS key.

Details concerning each of the three Automatic Reset Safeties follow.

Low Water Temperature Safety

The Low Water Temperature Safety assures that the evaporator is not damaged from freezing due to improperly set control points. Whenever the chilled liquid temperature drops below the programmable cut-out, the chiller will shut down. Restart will not occur until temperature rises 5°F above the cut-out point, load demand requires, and anti-recycle timers allow.

The Leaving Water Temperature Safety Cut-out is programmable by the user (Page 36). An example of the Low Water Temperature Fault display message is shown below:

CHILLER FAULT :
LOW WATER TEMP

Low Ambient Temperature Safety

The Low Ambient Temperature Safety assures that the chiller does not run in low ambients where potential damage could result due to low system pressures.

The Low Ambient Cut-out is programmable by the user (Page 35). An example of the Low Ambient Temperature Fault display message is shown below:

CHILLER FAULT :
LOW AMBIENT TEMP

High Ambient Temperature Safety

The High Ambient Temperature Safety assures that the chiller does not run in ambients above 130°F where potential malfunction of system mechanical and electrical components may result. Whenever the outdoor ambient exceeds 130°F (non-programmable) the chiller will shut down. Restart will not occur until temperature drops to 2°F below the cut-out point, load demand requires, and anti-recycle timers allow.

The High Ambient Cut-out is programmable (Page 35) for chiller cut-out at temperatures below 130°F (100°-130°F). An example of the High Ambient Temperature Fault display message is shown below:

CHILLER FAULT :
HIGH AMBIENT TEMP

Under Voltage Safety

The Under Voltage Safety assures that the system is not operated at voltages where malfunction of the microprocessor could result in system damage. Whenever the microprocessor senses an onboard power supply failure, the chiller is shut down. Restart will occur when power is restored. The microprocessor circuitry is capable of operating at voltages 10% below the nominal 115VAC supply to the panel.

An example of the Under Voltage Safety display message is shown below:

CHILLER FAULT
115VAC UNDER VOLTAGE

Flow Switch

The microprocessor monitors the closure of the flow switch to assure that water flow is present in the evaporator which prevents freeze-ups. The flow switch “dry” contacts are connected between terminals 13 & 14 (Fig. 11). If the flow switch opens, the chiller will shut down and the following status message will be displayed.

SYS # 1 NO RUN PERM
SYS # 2 NO RUN PERM

Closure of the flow switch, when flow is present, will cause the message to disappear and auto-restart will occur.

CAUTION: NEVER BYPASS A FLOW SWITCH. THIS WILL CAUSE DAMAGE TO THE CHILLER AND VOID ANY WARRANTIES.

Power Failure Safety

Whenever power is removed or lost and then reapplied, auto-restart will occur after a 2 minute anti-recycle timer elapses. This is the same anti-recycle timer which is programmable from 5-10 minutes, however it automatically is set to 2 minutes after a power failure.

This safety assures that the motor has a minimum of 2 minutes to cool under any circumstances allowing much of the internal heating due to starting to be dissipated before another start occurs.

ANTICIPATION SAFETY CONTROLS

Anticipation controls are built into the software to prevent safety shutdowns by automatically overriding temperature controls if system pressures near safety thresholds. This allows the chiller to continue to run under reduced capacity to avoid total loss of cooling resulting from a lockout on a safety.

Anticipation safeties monitor suction and discharge pressure and unload the compressor's as needed. The micro will display a message on the STATUS DISPLAY whenever these controls are in operation.

Suction Pressure Unloading

If suction pressure exceeds the value programmed by the user (Page 36), the micro will unload the affected compressor. Automatic reloading will occur when pressure drops 10 PSI below the programmed value. This value assures that the motor will receive proper cooling from the refrigerant which promotes longer motor life.

An example of the message displayed when suction pressure unloading is in effect is shown below:

S Y S # 1	S U C T	L I M I T I N G
S Y S # 2	S U C T	L I M I T I N G

Discharge Pressure Unloading

If discharge pressure exceeds the value programmed by the user (Page 35), the micro will unload the affected compressor. Automatic reloading will occur when pressure drops 60 PSI below the programmed value. This feature reduces the chance of faulting on the high discharge pressure cut-out.

On water cooled chillers, this safety reduces the chance of tripping the relief valve due to a very high rate of rise in pressure resulting from a controls problem which would cause condenser water flow to be interrupted.

In this case, the pressure rise is so fast, refrigerant loss may occur through the relief valve even though the high pressure cut-out has opened and the compressor is in the midst of stopping.

An example of the message displayed when discharge pressure unloadings in effect is shown below:

S Y S # 1	D S C H	L I M I T I N G
S Y S # 2	D S C H	L I M I T I N G

INTERNAL TIMERS AND PUMPDOWN CONTROLS

ANTI-RECYCLE TIMER

Anytime a compressor shuts down for any reason, re-start cannot occur until the programmable Anti-recycle Timer (Page 36) has timed out (timer starts with the compressor start). Even though the Anti-recycle timer has timed out, a minimum of 2 minute (2-minute start-up timer) must always elapse after a compressor stop before it may again restart.

If a power failure occurs, the anti-recycle timers will reset to 2 minutes after power is re-applied.

If the anti-recycle timer is preventing a start, the timer position in seconds may be viewed by pressing the STATUS key. A sample display is shown below.

S Y S # 1	A R	T M R	1 0 2	S
S Y S # 2	A R	T M R	1 0 2	S

ANTI-COINCIDENCE TIMER

The Anti-Coincidence Timer assures that 2 compressors can never start simultaneously. This assures that excessive current demand will never result. A one minute time delay will always separate compressor starts.

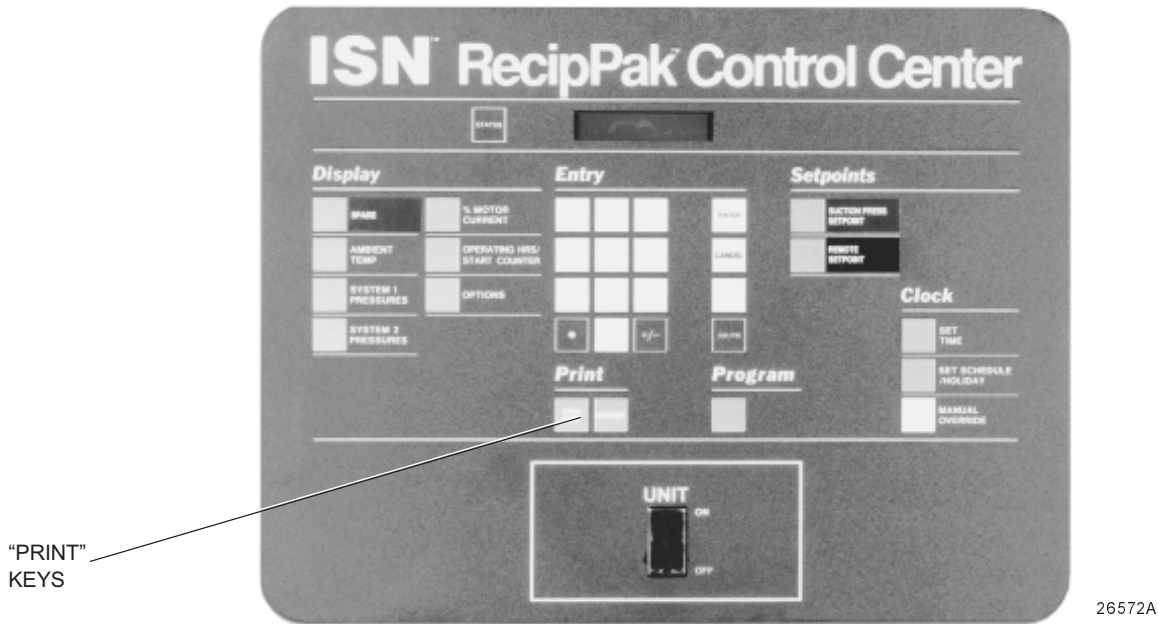
The Anti-Coincidence Timer can be viewed, when it is active, by pressing the STATUS key. A sample display is shown below.

S Y S # 1	C O M P	R U N N I N G
S Y S # 2	A C	T M R 5 6 S

PUMPDOWN CONTROLS

Each compressor is controlled by a pumpdown on start-up feature which eliminates the need for recycling pumpdown. On start-up, the compressor will pumpdown to the programmed suction pressure cut-out before the liquid line solenoid is energized. This assures that liquid slugging does not occur. Manual pumpdown from the keypad is not possible.

“PRINT” KEYS



GENERAL

The PRINT keys allow the operator to obtain a remote print-out of real-time system operating data and a print-out of system data at the “instant of the fault” on the last three faults which occurred on the chiller.

If a remote printer is not being used, or the desire is to obtain data locally at the panel, the same keys allow access to identical fault data. Identical and additional real-time information is available by using a combination of the PRINT keys and the other keys on the keypad.

An explanation of the use of the keys for remote printer or local data retrieval will follow. An optional printer (Page 76) will be required for remote printout.

REMOTE PRINTOUT

Oper Data

OPER
DATA

The OPER DATA key allows the operator to remotely obtain a printout of current system operating parameters. When the key is pressed, a snapshot will be taken of system operating conditions and panel programming selections. This data will be temporarily stored in memory and transmission of this data will begin to the remote printer. As the data is transmitted, it will be erased from memory.

A sample printout is shown in Fig. 19.

History

HISTORY

The HISTORY key allows the operator to remotely obtain a printout of information relating to the last 3

YORK INTERNATIONAL CORPORATION RECIPROCATING WATER CHILLERS

SYSTEM STATUS

8:45AM 4/17/91

SYS 1 COMPRESSOR RUNNING
SYS 2 ANTI -RECYCLE TIMER 119 SEC

RETURN WATER TEMP 65.1 DEGF
LEAVING WATER TEMP 54.0 DEGF
LOW WATER CUTOUT 36.0 DEGF
SETPOINT TEMP 45.0 DEGF
OUTSIDE AIR TEMP 75.0 DEGF
LOW AMBIENT CUTOUT 10.0 DEGF
LOW PRESSURE CUTOUT 44 PSIG
LEAD SYSTEM SYS 1
CONTROL TYPE LCHWT
COOLING RANGE 45.0 TO 47.0 DEGF

SYSTEM 1 DATA

COMPRESSOR STATUS ON
MOTOR AMPS 50 %FLA
SUCTION PRESSURE 61 PSIG
DISCHARGE PRESSURE 143 PSIG
OIL PRESSURE 75 PSID
LIQUID LINE SOLENOID OFF
RUN PERMISSIVE ON
STAGES OF LOADING 1
FORWARD FANS OFF
REVERSE FANS OFF
HOT GAS BYPASS VALVE OFF

SYSTEM 2 DATA

COMPRESSOR STATUS ON
MOTOR AMPS 8 %FLA
SUCTION PRESSURE 61 PSIG
DISCHARGE PRESSURE 80 PSIG
OIL PRESSURE 1 PSID
LIQUID LINE SOLENOID OFF
RUN PERMISSIVE ON
STAGES OF LOADING 1
FORWARD FANS 1
REVERSE FANS OFF
HOT GAS BYPASS VALVE OFF

S M T W T F S * = HOLIDAY
SUN START=00:00AM STOP=00:00AM
MON START=00:00AM STOP=00:00AM
TUE START=00:00AM STOP=00:00AM
WED START=00:00AM STOP=00:00AM
THU START=00:00AM STOP=00:00AM
FRI START=00:00AM STOP=00:00AM
SAT START=00:00AM STOP=00:00AM
HOL START=00:00AM STOP=00:00AM

FIG. 19 – OPERATING DATA PRINTOUT

Safety Shutdowns which occurred. The information is stored at the instant of the fault regardless of whether the fault caused a lockout to occur. The information is also not affected by power failures (long term internal memory battery back-up is built into the circuit board) or manual resetting of a fault lock-out.

When the HISTORY key is pressed, a Printout is transmitted of all system Operating conditions which were stored at the "instant the fault occurred" for each of the 3 SAFETY SHUTDOWN BUFFERS. There is one buffer (storage area) for data related to each of the last 3 safety shutdowns.

The printout will begin with the most recent fault which occurred. The most recent fault will always be stored as SAFETY SHUTDOWN NO. 1 (See printout Fig. 20). Identically formatted fault information will then be printed for SAFETY SHUTDOWN NO. 2 and SAFETY SHUTDOWN NO. 3.

Information contained in the SAFETY SHUTDOWN Buffers is very important when attempting to troubleshoot a system problem. This data reflects the system conditions at the instant the fault occurred and often reveals other systems conditions which actually caused the safety threshold to be exceeded. (See Fig. 20)

YORK INTERNATIONAL CORPORATION RECIPROCATING WATER CHILLERS			YORK INTERNATIONAL CORPORATION RECIPROCATING WATER CHILLERS			YORK INTERNATIONAL CORPORATION RECIPROCATING WATER CHILLERS		
SAFETY SHUTDOWN NUMBER 1 SHUTDOWN @ 8:48AM 4/17/91			SAFETY SHUTDOWN NUMBER 2 SHUTDOWN @ 8:47AM 4/17/91			SAFETY SHUTDOWN NUMBER 3 SHUTDOWN @ 8:47AM 4/17/91		
SYS 1 STATUS:	NO FAULTS		SYS 1 STATUS:	NO FAULTS		SYS 1 STATUS:	NO FAULTS	
SYS 2	MOTOR CURRENT SHUTDOWN		SYS 2	MOTOR CURRENT SHUTDOWN		SYS 2	MOTOR CURRENT SHUTDOWN	
RETURN WATER TEMP	65.0	DEGF	RETURN WATER TEMP	65.0	DEGF	RETURN WATER TEMP	65.0	DEGF
LEAVING WATER TEMP	54.0	DEGF	LEAVING WATER TEMP	54.0	DEGF	LEAVING WATER TEMP	54.0	DEGF
LOW WATER CUTOUT	36.0	DEGF	LOW WATER CUTOUT	36.0	DEGF	LOW WATER CUTOUT	36.0	DEGF
SETPOINT TEMP	45.0	DEGF	SETPOINT TEMP	45.0	DEGF	SETPOINT TEMP	45.0	DEGF
OUTSIDE AIR TEMP	75.0	DEGF	OUTSIDE AIR TEMP	75.0	DEGF	OUTSIDE AIR TEMP	75.0	DEGF
LOW AMBIENT CUTOUT	10.0	DEGF	LOW AMBIENT CUTOUT	10.0	DEGF	LOW AMBIENT CUTOUT	10.0	DEGF
LOW PRESSURE CUTOUT	44	PSIG	LOW PRESSURE CUTOUT	44	PSIG	LOW PRESSURE CUTOUT	44	PSIG
LEAD SYSTEM	SYS 1		LEAD SYSTEM	SYS 1		LEAD SYSTEM	SYS 1	
CONTROL TYPE	LCHWT		CONTROL TYPE	LCHWT		CONTROL TYPE	LCHWT	
COOLING RANGE	45.0 TO 47.0	DEGF	COOLING RANGE	45.0 TO 47.0	DEGF	COOLING RANGE	45.0 TO 47.0	DEGF
SYSTEM 1 DATA			SYSTEM 1 DATA			SYSTEM 1 DATA		
COMPRESSOR STATUS	ON		COMPRESSOR STATUS	ON		COMPRESSOR STATUS	ON	
MOTOR AMPS	50	%FLA	MOTOR AMPS	50	%FLA	MOTOR AMPS	50	%FLA
SUCTION PRESSURE	61	PSIG	SUCTION PRESSURE	61	PSIG	SUCTION PRESSURE	61	PSIG
DISCHARGE PRESSURE	143	PSIG	DISCHARGE PRESSURE	143	PSIG	DISCHARGE PRESSURE	143	PSIG
OIL PRESSURE	75	PSID	OIL PRESSURE	75	PSID	OIL PRESSURE	75	PSID
LIQUID LINE SOLENOID	ON		LIQUID LINE SOLENOID	ON		LIQUID LINE SOLENOID	ON	
RUN PERMISSIVE	ON		RUN PERMISSIVE	ON		RUN PERMISSIVE	ON	
STAGES OF LOADING	1		STAGES OF LOADING	1		STAGES OF LOADING	1	
FORWARD FANS	2		FORWARD FANS	2		FORWARD FANS	2	
REVERSE FANS	OFF		REVERSE FANS	OFF		REVERSE FANS	OFF	
HOT GAS BYPASS VALVE	OFF		HOT GAS BYPASS VALVE	OFF		HOT GAS BYPASS VALVE	OFF	
SYSTEM 2 DATA			SYSTEM 2 DATA			SYSTEM 2 DATA		
COMPRESSOR STATUS	ON		COMPRESSOR STATUS	ON		COMPRESSOR STATUS	ON	
MOTOR AMPS	0	%FLA	MOTOR AMPS	0	%FLA	MOTOR AMPS	0	%FLA
SUCTION PRESSURE	61	PSIG	SUCTION PRESSURE	61	PSIG	SUCTION PRESSURE	61	PSIG
DISCHARGE PRESSURE	80	PSIG	DISCHARGE PRESSURE	80	PSIG	DISCHARGE PRESSURE	80	PSIG
OIL PRESSURE	1	PSID	OIL PRESSURE	1	PSID	OIL PRESSURE	1	PSID
LIQUID LINE SOLENOID	OFF		LIQUID LINE SOLENOID	OFF		LIQUID LINE SOLENOID	OFF	
RUN PERMISSIVE	ON		RUN PERMISSIVE	ON		RUN PERMISSIVE	ON	
STAGES OF LOADING	1		STAGES OF LOADING	1		STAGES OF LOADING	1	
FORWARD FANS	1		FORWARD FANS	1		FORWARD FANS	1	
REVERSE FANS	OFF		REVERSE FANS	OFF		REVERSE FANS	OFF	
HOT GAS BYPASS VALVE	OFF		HOT GAS BYPASS VALVE	OFF		HOT GAS BYPASS VALVE	OFF	

NOTE: In actual printouts, this would be one continuous printout.

FIG. 20 – HISTORY PRINTOUT

Oper Data

When the OPER DATA key is pressed, the following message will appear:

Repetitively pressing the ENTER key allows the operator to scroll through the 20 available displays.

SYS 1 LIQUID LINE
SOLENOID STATUS OFF

“ON”: SYS 1 Liquid Line Solenoid Energized (Open).

2

S Y S 1 F O R W A R D F A N S
S T A T U S

```
SYS 1 REVERSE FAN
STATUS OFF
```

```
SYS 1 HOT GAS BYPASS
VALVE STATUS OFF
```

```
SYS 1 RUN TIME
                200 SECS
```

SYS 2 LIQUID LINE
SOLENOID STATUS ON

“ON”: Sys 2 Liquid Line Solenoid Energized (Open).

SYS 2 STAGES OF
LOADING 1

```
SYS 2 FORWARD FANS
STATUS OFF
```

```
SYS 2 REVERSE FAN
STATUS OFF
```

SYS 2 HOT GAS BYPASS
VALVE STATUS OFF

YORK INTERNATIONAL

SYS 2 RUN TIME
0 SECS

The Run Time for SYS 2 since the last start is displayed.

LOAD TIMER
1 4 0 SECS

This message provides a real time display of the time left on the Load Timer. The Load Timer is a constantly recycling timer that the micro utilizes in conjunction with "rate control" and "temperature deviation from setpoint" to determine when loading should occur. The timer will always start at 150 sec., however it may count to "0" at a rate of up to 5 secs. per actual second of time.

UNLOAD TIMER
1 2 2 SECS

This message provides a real timer display of the time left on the Unload Timer. The Unload Timer is a constantly recycling timer that the micro utilizes in conjunction with "rate control" and "temperature deviation from setpoint" to determine when unloading should occur. The timer will always start at 150 sec., however it may count to "0" at a rate of up to 5 secs. per actual second of time.

TEMPERATURE DEMAND

6

This message informs the operator what stage of loading the chiller system is presently on as a result of commands from the microprocessor. This is a coded number and the steps must be decoded to be meaningful. The decoding varies according to the number of stages programmed (Page 37). Tables for decoding the display message are shown below:

5 STAGE

STEP

- 0: Both Compressors OFF
- *1: Lead Compr Unloaded, Lag Compr OFF
- *2: Lead Compr Unloaded, Lag Compr OFF
- *3: Lead Compr Loaded, Lag Compr OFF
- *4: Lead Compr Loaded, Lag Compr OFF
- *5: Lead Compr Unloaded, Lag Compr Unloaded
- *6: Lead Compr Unloaded, Lag Compr Unloaded
- *7: Lead Compr Loaded, Lag Compr Unloaded
- *8: Lead Compr Loaded, Lag Compr Unloaded
- *9: Lead Compr Loaded, Lag Compr Loaded
- *10: Lead Compr Loaded, Lag Compr Loaded

* On some "STEPS", actual Loading will NOT change.

7 STAGE

STEP

- 0: Both Compressors OFF
- 1: Lead Compr Unloaded, Lag Compr OFF
- *2: Lead Compr 1 Stage Loading, Lag Compr OFF
- *3: Lead Compr 1 Stage Loading, Lag Compr OFF
- 4: Lead Compr 2 Stages Loading, Lag Compr OFF
- 5: Lead Compr 1 Stage Loading, Lag Compr Unloaded
- *6: Lead Compr 1 Stage Loading, Lag Compr 1 Stage Loading
- *7: Lead Compr 1 Stage Loading, Lag Compr 1 Stage Loading
- *8: Lead Compr 1 Stage Loading, Lag Compr 1 Stage Loading
- 9: Lead Compr 2 Stages Loading, Lag Compr 1 Stage Loading
- 10: Lead Compr 2 Stages Loading, Lag Compr 2 Stages Loading

TEMPERATURE RATE
- 1 . 5 DEG F / MIN

This message provides a real time display of the average rate of change of leaving chilled water as seen by the micro. A (-) or (+) sign is also shown to indicate a temperature fall or a temperature rise.

LEAD SYSTEM IS
SYSTEM NUMBER 1

This message informs the operator which system is in the lead.

EVAPORATOR WATER
PUMP STATUS ON

This message informs the operator that the micro has commanded the auxiliary contacts (optional) for the chilled water pump to close.

EVAPORATOR HEATER
STATUS OFF

This message informs the operator that the micro senses the outdoor ambient temperature is below 40°F and is commanding the Evaporator Heater to turn on. Once turned on, the heater will turn off at 45°F.

CONDENSER WATER
PUMP STATUS OFF

This message informs the operator that the micro has commanded the auxiliary contacts (optional) for the condenser water pump to close.

History

The HISTORY key also allows the user to scroll through the SAFETY SHUTDOWN buffers to display information relating to the last 3 Safety Shutdowns which occurred. Information contained in the SAFETY SHUTDOWN Buffers is very important when attempting to troubleshoot a system problem. This data reflects system conditions at the **instant** the fault occurred.

Information is stored in the SAFETY SHUTDOWN Buffers on every fault regardless of whether the fault caused a Lockout to occur. The information is also not affected by power failures (long term internal memory battery back-up is built into the circuit board) or manual resetting of a fault lock-out.

When the HISTORY key is passed, the following message will appear.

DISPLAY SAFETY SHUT-
DOWN NO. 1 (1 TO 3)

The operator must then select which SAFETY SHUTDOWN Buffer which is desired. When deciding this, keep in mind that Buffer No. 1 is always the most recent fault. As new fault information is stored, it is always placed in Buffer No. 1, No. 1 is loaded to No. 2, No. 2 is loaded to No. 3, and information previously in No. 3 is discarded.

To select a buffer, simply press the "1", "2", or "3" ENTRY key and press ENTER. Repetitively pressing the ENTER key will allow the operator to scroll through the information available in the SAFETY SHUTDOWN Buffer.

In the information that follows, a sample message along with an explanation is provided for all available messages.

SHUTDOWN OCCURRED
3 : 2 4 P M 3 / 2 1 / 9 1

This message informs the operator of the time and date of the fault.

SYS # 1 LOW OIL PRESS
SYS # 2 NO FAULTS

This message informs the operator of the nature of the fault which occurred.

RETURN WATER TEMP
5 2 . 7 DEG F

This message indicates the Return Water Temperature at the time of the fault.

LEAVING WATER TEMP
4 4 . 3 DEG F

This message indicates the Leaving Water Temperature at the time of the fault.

LOW WATER CUTOUT
3 6 . 0 DEG F

This display shows the Low Water Cut-out (Leaving) which was programmed at the time of the fault.

SETPOINT TEMP
4 4 . 0 DEG F

This display shows the Setpoint Temp which was programmed at the time of the fault.

OUTSIDE AIR TEMP
7 7 . 6 DEG F

This message indicates the Outdoor Ambient Temperature at the time of the fault.

LOW AMBIENT CUTOUT
3 5 . 0 DEG F

This display shows the Low Ambient Cut-out programmed at the time of the fault.

LOW PRESSURE CUTOUT
4 4 P S I G

This display shows the Low Pressure Cut-out programmed at the time of the fault.

LEAD SYSTEM
SYS 1

This message indicates which system was in the lead at the time of the fault.

CONTROL TYPE
LCHWT

This message indicates the type of chilled water control selected at the time of the fault. LCHWT = Leaving Water Control. ECHWT = Entering or Return Water Control.

COOLING RANGE
45.0 TO 47.0 DEGF

This display shows the Cooling Range (CONTROL RANGE, CR) which was selected at the time of the fault.

ENTERING COND WATER
80.1

This message indicated the entering condenser water temperature at the time of the fault. A fixed value will be displayed if the optional sensor is not installed.

LEAVING COND WATER
90.5

This message indicates the leaving condenser water temperature at the time of the fault. A fixed value will be displayed if the optional sensor is not installed.

SYS 1 COMPRESSOR
ON

This message indicates whether Compressor 1 was ON or OFF at the time of the fault.

SYS 1 COMPRESSOR
ON

This message indicates SYS 1 motor current at the time of the fault.

SYS 1 SUCTION PRESS
59 PSIG

This display shows the suction pressure of SYS 1 at the time of the fault.

SYS 1 DSCH PRESS
220 PSIG

This message indicates SYS 1 discharge pressure at the time of the fault. This display will be a fixed value unless the Discharge Pressure Readout is installed.

SYS 1 OIL PRESSURE
70 PSIG

This display shows the oil pressure of SYS 1 at the time of the fault.

SYS 1 LIQ LINE
ON

This display informs the operator whether SYS 1 liquid line solenoid was energized (ON) or de-energized (OFF) at the time of the fault.

SYS 1 RUN PERMISSIVE
ON

This message informs the operator if SYS 1 Run Permissive (flow switch, remote START/STOP) was in the RUN mode (ON) or (STOP) mode (OFF).

SYS 1 LOADING STAGES
1

This message indicates the number of stages which were loaded on SYS 1 at the time of the fault.

SYS 1 FORWARD FANS
2

This display indicates the number of fans on SYS 1 which were running forward at the time of the fault. *

* The software designed to control fans whether or not they are present on the chiller as is the case on water cooled indoor units. If an indoor unit exists, ignore this display.

SYS 1 REVERSE FANS
OFF

This message indicates the number of fans on SYS 1 which were running in the reverse direction at the time of the fault. *

SYS 1 HOT GAS VALVE
OFF

This display indicates whether the Hot Gas Solenoid Valve was energized on SYS 1 at the time of the fault.

NOTE: The micro will attempt to control the Hot Gas, Solenoid Valve regardless of whether the option is installed.

SYS 2 COMPRESSOR
OFF

This message indicates whether Compressor 2 was ON or OFF at the time of the fault.

SYS 2 MOTOR AMPS
60 % FLA

This message indicates SYS 2 motor current at the time of the fault.

SYS 2 SUCTION PRESS
62 % FLA

This display shows the suction pressure of SYS 2 at the time of the fault.

SYS 2 DSCH PRESS
240 PSIG

This message indicates SYS 2 discharge pressure at the time of the fault. This display will be a fixed value unless the Discharge Pressure Readout is installed.

SYS 2 OIL PRESSURE
74 PSID

This display shows the oil pressure of SYS 2 at the time of the fault.

SYS 2 LIQ LINE
ON

This display informs the operator whether SYS 2 liquid line solenoid was energized (ON) or de-energized (OFF) at the time of the fault.

SYS 2 RUN PERMISSIVE
ON

This message informs the operator if SYS 2 Run Permissive flow switch, remote START/STOP) was in the RUN mode (ON) or STOP mode (OFF).

SYS 2 LOADING STAGES
1

This message indicates the number of stages which were loaded on SYS 2 at the time of the fault.

SYS 2 FORWARD FANS
OFF

This display indicates the number of fans on SYS 2 which were running forward at the time of the fault. *

SYS 2 REVERSE FANS
OFF

This message indicates the number of fans on SYS 2 which were running in the reverse direction at the time of the fault. *

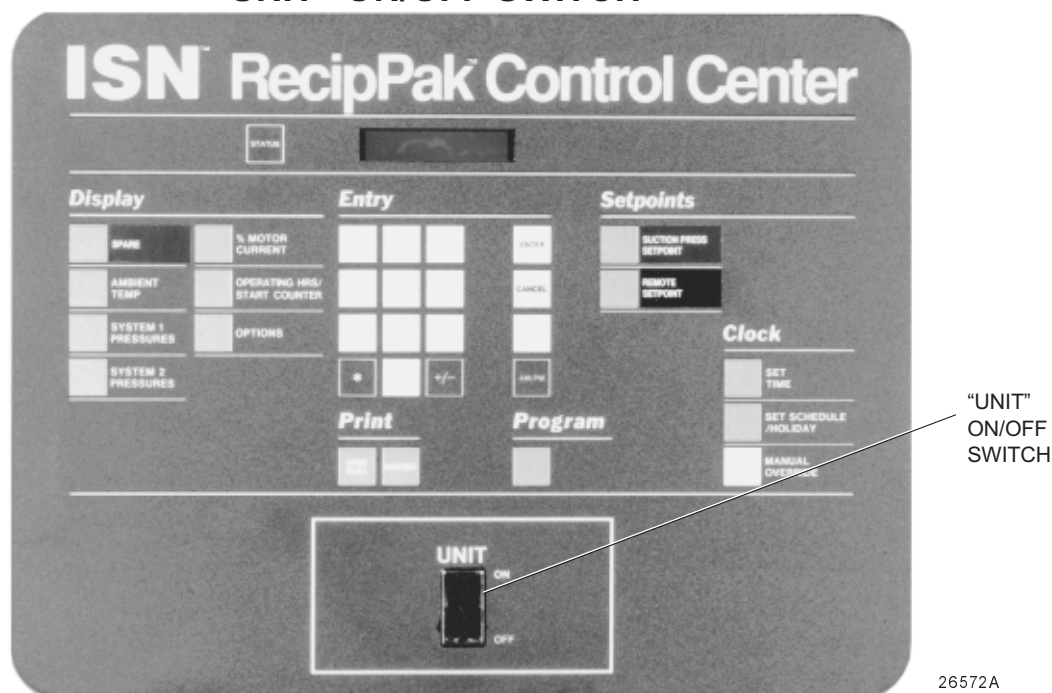
SYS 2 HOT GAS VALVE
OFF

This display indicates whether the Hot Gas Solenoid Valve was energized on SYS 2 at the time of the fault.

NOTE: The micro will attempt to control the Hot Gas Solenoid Valve regardless of whether the option is installed.

* The software designed to control fans whether or not they are present on the chiller as is the case on water cooled indoor units. If an indoor unit exists, ignore this display.

“UNIT” ON/OFF SWITCH



UNIT ON/OFF SWITCH

A master UNIT ON/OFF switch is located on the keypad. This rocker switch allows the operator to turn the entire chiller OFF if desired. The switch must be placed in the ON position for the chiller to operate.

Whenever the switch is placed in the OFF position, a STATUS display indicating the condition will be displayed. This message is shown below.

UNIT SWITCH IS IN
THE OFF POSITION

SYSTEM SWITCHES

SYSTEM SWITCHES 1-4 are located on the Microprocessor Board (See Fig. 21). These allow the operator to selectively turn a given system on or off as desired. On a 2 system chiller, switches 3 & 4 should be OFF. The System Switch for a designated system must be ON (Switch to right) for the system to operate.

Whenever a switch is placed in the OFF position, a STATUS display indicating the condition will be displayed indicating that the system does not have a Run Permissive signal. A sample of this message is shown below.

SYS # 1	NO RUN PERM
SYS # 2	NO RUN PERM

NOTE: This message will not appear if Anti-recycle or Anti-coincident timers are in effect and are being displayed.

ALARM CONTACTS (ANNUNCIATION ALARM)

“Dry” contacts connected to terminals 23 and 24 (Fig. 22) are supplied, which will transition to function as a warning whenever a fault shutdown occurs on any system or if power is lost to the control panel. The dry contacts are normally open (N.O.) and will close when control power is applied to the panel, if no fault conditions are present. If power is lost or a fault lock-out occurs, the contacts will open.

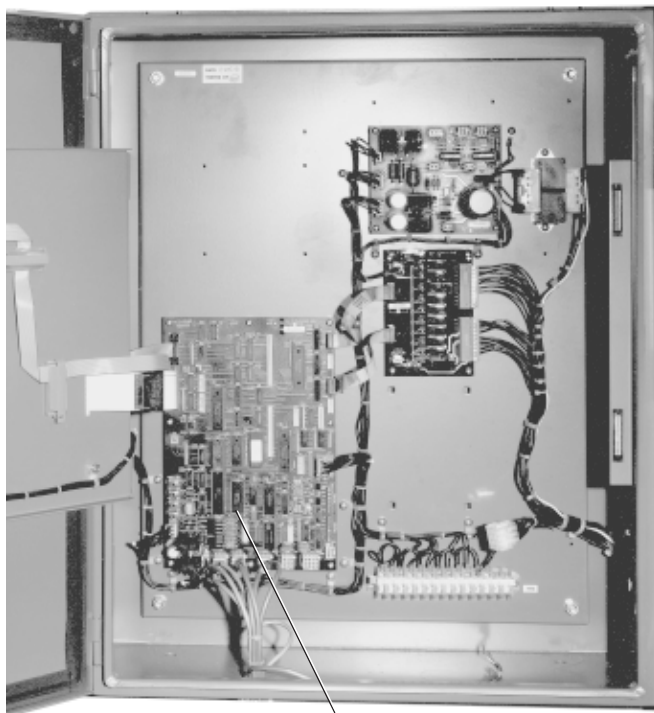
A 28VDC or 120VAC external alarm circuit (by others) may be wired into the YORK supplied alarm contacts. Any inductive load devices (relay, contactor), supplied by the user which are connected to the dry contacts, MUST be suppressed at the load. Use YORK P/N 031-00808-000 suppressor (not supplied). Failure to do this will result in nuisance faults and possible damage to the chiller.

CAUTION: If the alarm circuit is applied in an application used for critical duty (such as process duty or cooling other critical equipment) and the alarm circuit should fail to function, YORK will not be liable for damages.

LEAD/LAG COMPRESSOR SELECTION

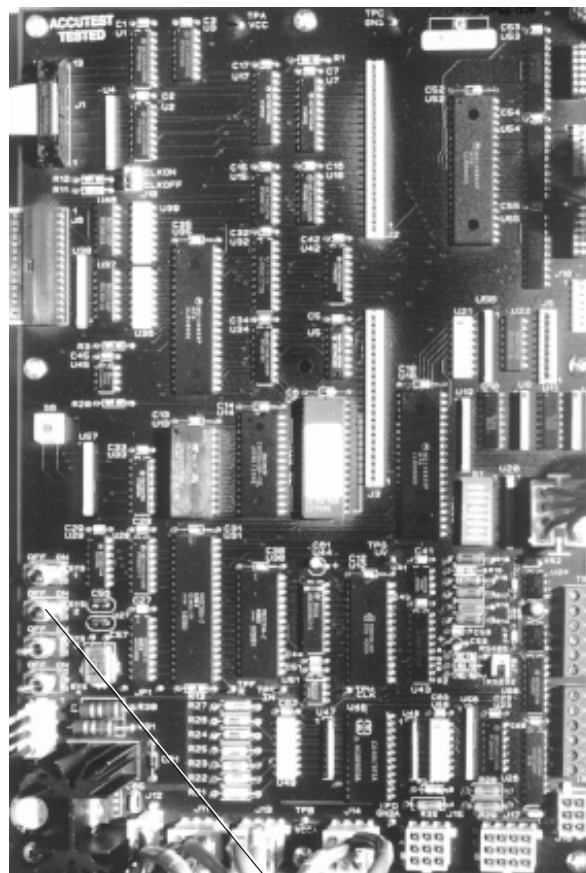
The chiller can be set up for AUTO or MANUAL Lead/Lag. This is accomplished by configuring the S1 Dip Switches properly on the Microprocessor Board. Details for doing this are discussed in the OPTIONS key section.

When AUTO Lead/Lag is utilized, the micro determines which compressor is assigned to the lead and the lag.



26000A

MICROPROCESSOR
BOARD



26001A

SYSTEM SWITCHES 1 - 4
ON MICROPROCESSOR BOARD

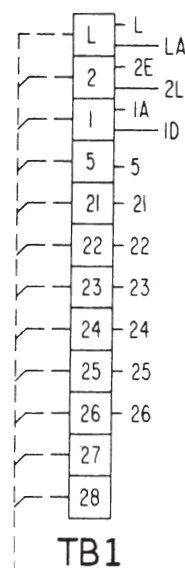
FIG. 22 – LOCATION OF THE MICROPROCESSOR BOARD

A new lead/lag assignment is made whenever both compressors shut down. The micro will assign the “lead” to the compressor with the shortest anti-recycle time. This will tend to balance run time between the two compressors.

AUTO Lead/Lag will cause the lag compressor to automatically become the lead, anytime the compressor currently in the lead shuts down due to a safety threshold being exceeded. This is done to maintain water temperature as close to setpoint as possible. Additionally, the lag system will automatically become the lead anytime the system switch on the Microprocessor Board of the compressor currently in the lead is placed in the OFF position. This is also done to maintain water temperature as close to setpoint as possible.

If MANUAL Lead/Lag is selected, an external “dry” contact (switch) must be wired into the chiller. This contact is supplied by others. When the contact is closed, SYS 2 will be the lead system. With the contact open, SYS 1 is the lead.

Manual Lead/Lag selection can be automatically overridden by the micro to allow the lag compressor to automatically become the lead, anytime the selected lead



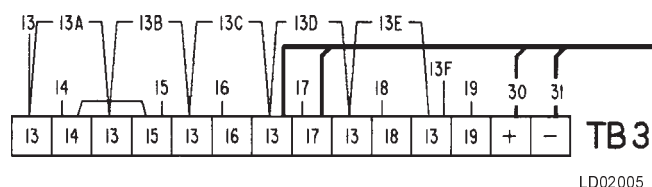
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**FIG. 22 – ALARM CONTACT
CONNECTION LOCATION**

compressor shuts down due to a safety threshold being exceeded. This is done to try to maintain water temperature as close to setpoint as possible. No lead/lag switchover will take place if the system switch

on the Microprocessor of the lead compressor is placed in the OFF position.

The “dry” contact for manual lead/lag selection is wired into terminals 13 and 19. The location of these contacts is shown below in Fig. 23.



LD02005

FIG. 23 – LEAD/LAG CONTACT CONNECTION LOCATION

MEMORY BATTERY BACK-UP

The Microprocessor board contains a Real Time Clock (RTC) I.C. Chip with an internal battery back-up. The battery back-up assures that any programmed values, clock, all fault information, accumulated information such as starts/run time, etc. stored in the RTC memory is not lost when a power failure occurs regardless of the time period.

The battery is a 10-year lithium type. The life of the battery with power removed will depend upon whether the Real Time Clock's internal clock circuit is energized. With the clock OFF, approximately 10 years can be expected, with the clock ON, approximately 5 years.

The clock is turned ON and OFF by a jumper on the Microprocessor Board. While a chiller is operating, the clock must be ON. Otherwise the internal clock on the microprocessor will not be active and the micro cannot keep track of time, although all other functions will operate normally. This could result in the chiller not starting due to the time frozen on the clock falling outside the START/STOP time window that is programmed in the DAILY SCHEDULE.

If the chiller is shut-down for extended periods of months, it may be desirable to disable the clock to save battery life. The clock can then be reactivated and re-programmed when the chiller is returned to service.

NOTE: ALL PROGRAMMED VALUES AND STORED DATA, OTHER THAN THE INTERNAL CLOCK TIME-KEEPING, WILL BE MAINTAINED IN MEMORY REGARDLESS OF WHETHER THE CLOCK IS ON OR OFF AND REGARDLESS OF THE LENGTH OF THE POWER FAILURE.

To disable the clock, place the jumper (Fig. 24) in the OFF positions. To activate it, place the jumper in the ON position.

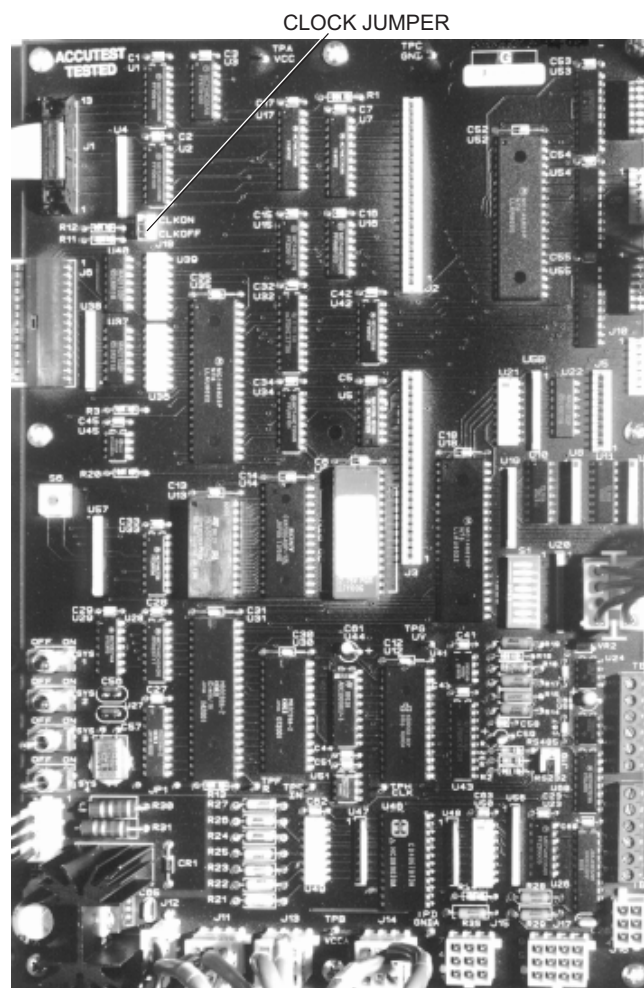


FIG. 24 – CLOCK JUMPER

26001A

On power-up, the microprocessor will check the Real Time Clock (RTC Chip) battery to assure that the internal battery is still operational. This is accomplished by performing an RTC RAM location check. As long as the battery checks out, the microprocessor will continue on with business without interruption.

If a check is made and the battery has failed, the microprocessor will not allow the chiller to run and the following STATUS message will appear:

!! WARNING !!
!! LOW BATTERY !!

The only way to run the chiller is to press the MANUAL OVERRIDE key. Under low battery conditions, the manual override key will function differently than it normally does in service situations where it overrides the daily schedule for only 30 min. In a low battery condition, the MANUAL OVERRIDE key will zero out the daily schedule to allow unlimited operation regardless of the time on the internal clock. Default values will also be loaded into memory for all setpoints and cut-outs. These may require reprogramming to assure they meet chiller

operating requirements. In addition, the low battery message which is displayed for this condition will disappear.

NOTE: If a power failure should again occur, the above process will again need to be repeated to bring the chiller back on line.

In the unlikely event the low battery message should ever appear, it will require the RTC Chip U13 on the Microprocessor Board (Fig. 12) to be replaced. Care should be taken to assure that the chip is properly installed. Pin 1 (dimple in the top of the chip) must be oriented as shown (Fig. 12). The part number for the RTC Chip is 031-00955-000.

CRANKCASE HEATER

The crankcase heater for a compressor will be ON whenever the compressor is not running. The heater is interlocked into the compressor motor contactor and is not controlled by the microprocessor.

The purpose of the crankcase heater is to prevent the migration of refrigerant to the crankcase during shutdown assuring proper lubrication of the compressor on start-up.

Anytime power is removed from the chiller for more than an hour, the crankcase heater should be left on for 24 hours prior to start. This can be accomplished by applying 115VAC to the control panel.

EVAPORATOR HEATER

The evaporator heater prevents water standing in the evaporator from freezing. Whenever outdoor ambient temperature drops below 40°F, the microprocessor will turn the evaporator ON. If temperature rises above 45°F, the heater will be turned off.

METRIC DISPLAY

The control panel is capable of providing displays of pressure and temperature in metric values. Temperatures will be displayed in °C and pressures in kPa.

A Metric to English temperature conversion table is provided on the rear cover of this manual. Pressure can be converted from PSI to kPa using the formula $\text{PSI} \times 6.89 = \text{kPa}$.

To obtain panel displays in metric, Switch 5 of Dip Switch S1 on the Microprocessor Board must be placed in the OPEN position (Page 28). The positioning of this switch can then be verified by pushing the OPTIONS key and verifying that "METRIC UNITS READOUT" is programmed (Page 26).

EMS/BAS CONTROLS

The microprocessor is capable of REMOTE START/STOP, REMOTE UNLOADING (Pulldown demand limiting), and REMOTE SETPOINT RESET. These functions can be easily utilized by connecting user supplied "dry" contacts to the Microprocessor Board.

REMOTE START/STOP BY A CYCLING DEVICE OR TIME CLOCK

Remote START/STOP is accomplished by connecting a time clock or other "dry" contact in series with the flow switch on terminals 13 & 14. See Fig.11 for the location of the terminals. The contact must be closed to allow the chiller to run. Any time the contact opens, the chiller will shut down and the following status message will be displayed.

S Y S # 1	N O	R U N	P E R M
S Y S # 2	N O	R U N	P E R M

Wiring from these contacts should not exceed 25 ft. and should be run in grounded conduit that does not carry any wiring other than control wiring. Additionally, if an inductive device (relay, contactor) is supplying these contacts, the coil of the device must be suppressed with a user supplied YORK P/N 031-00808 suppressor.

REMOTE SETPOINT RESET (REMOTE RESET TEMP RANGE)

Remote Setpoint Reset allows resetting the setpoint upward from the programmed value in memory. This is accomplished by connecting a "dry" contact between terminals 13 & 17. See Fig. 11 for the location of these terminals. Closing the contact for a defined period of time allows reset of the setpoint upward by up to 40°F above the setpoint programmed in memory.

The maximum desired reset must be programmed into memory and can be a value of 02 to 40°F. This value will vary according to the user's requirements. To program the reset, press the REMOTE SETPOINT TEMP RANGE key. The following message will appear.

R E M	S E T P O I N T	=	4 0 . 0
R E M	R A N G E	=	2 0 D E G F

The display will indicate the REM SETPOINT which is always equal to the chilled liquid setpoint plus the offset from the reset signal. The display will also show the REM RANGE which is the same as the maximum reset required. Key in the maximum reset for the REM

RANGE and press the ENTER Key to store the new value in memory.

Once the maximum reset is programmed, it will require a contact closure of 21 seconds to achieve the maximum reset. Closure for less than 21 seconds will provide a smaller reset. For noise immunity, the micro will ignore closures of less than 1 second.

To compute the offset for a given timer closed, use the formula below:

$$1. \frac{\text{Programmed max. reset}}{20 \text{ seconds}} = \text{Reset per sec.}$$

$$2. (\text{Time Closed} - 1) \text{ Reset per sec.} = \text{Reset}$$

Example:

Programmed max reset = 30°; Time Closed = 9 sec.

$$1. \frac{30^\circ}{20 \text{ sec.}} = 1.5^\circ \text{ per sec.}$$

$$2. (9 \text{ sec.} - 1 \text{ sec.}) 1.5^\circ \text{ per sec.} = 12^\circ = \text{Reset}$$

To determine the new setpoints, add the reset to the setpoint programmed into memory. In the example above, if the programmed setpoint = 44°F, the new setpoint after the 9 second contact closure would be 44°F + 12°F = 56°F. This new setpoint can be viewed on the display by pressing the REMOTE RESET TEMP/RANGE key.

To maintain a given offset, the micro must be refreshed every 30 seconds - 30 minutes with a contact closure of the required time period. It will not accept a refresh sooner than 30 seconds after the end of the last PWM signal, but must be refreshed before a period of 30 minutes expires from the end of the last PWM signal.

After 30 minutes, if no refresh is provided, the setpoint will change back to its original value. A refresh is nothing more than a contact closure for the period required for the desired offset.

NOTE: After an onset signal, the new setpoint may be viewed on the REMOTE RESET TEMP RANGE DISPLAY. However, if this display is being viewed when the reset pulse occurs, the setpoint will not change on the display. To view the new onset, first press any other display key on the keypad and then press the REMOTE RESET TEMP RANGE key. The new setpoint will then appear.

Wiring from these contacts should not exceed 25 ft. and should be run in grounded conduit that does not carry any wiring other than control wiring. Additionally, if an inductive device (relay, contactor) is supplying these contacts, the coil of the device must be suppressed with a user supplied YORK P/N 031-00808 suppressor.

NOTE: Remote Setpoint Reset will not operate when a Remote Control Center Option Kit is connected to the Micro Panel. The Remote Control Center will always determine the setpoint.

REMOTE UNLOADING

The microprocessor is capable of remote unloading or pulldown demand limiting in two steps. The first step shuts down the lag system. The second step unloads the lead system to its minimum step of capacity which places the entire system at minimum possible capacity.

To shut down the lag compressor, a "dry" contact should be connected between terminals 13 & 16. See Fig. 11 for the location of these terminals. When the contact is closed, the lag compressor will shut down.

Before the lead system can be unloaded to its minimum step of capacity, the lag compressor must already be disabled with a "dry" contact closure between terminal 13 & 16 as described in the preceding paragraph.

With contacts on Terminals 13 & 16 closed, the lead system can be unloaded to its minimum step of capacity by closing a "dry" contact connected between terminals 13 & 17. See Fig. 11 for location of this terminal. The lead system; will remain totally unloaded as long as the contacts remain closed on both 13 & 16 and 13 & 17. It should be noted that terminals 13 & 17 are normally used for Remote Setpoint Reset. However, it is assumed that if the lag system is purposely being shut down, Remote Setpoint Reset and temperature control is of no importance. This is generally true since capacity control of the load is lost when a large portion of the capacity is disabled.

CAUTION: Two cautions should be observed when using these functions. Observing these cautions will assure that undesirable operation does not result.

1. Terminals 13 & 17 contact should always be closed after or simultaneous with those on 13 & 16, when unloading of the lead system is desired. Otherwise, the microprocessor may mistake the closed contacts on 13 & 17 as a signal for a setpoint reset.
2. Terminal 13 & 17 contact should always be opened before or simultaneous with those on 13 & 16 when loading is desired. Otherwise, the microprocessor may mistake the closed contacts on 13 & 17 as a signal for a setpoint reset.

FAN CONTROL STRATEGY ABOVE 25°F AMBIENT

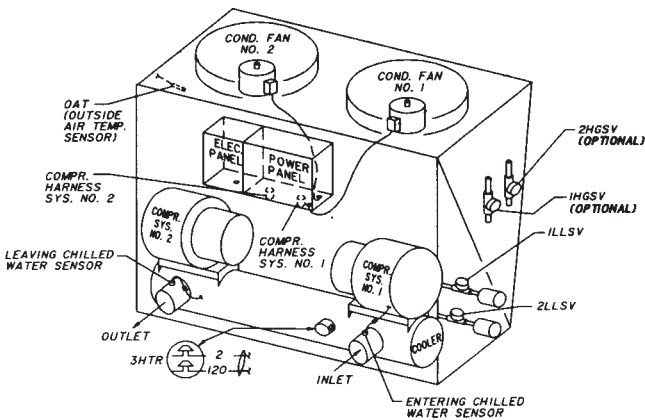
The chiller is equipped with 2 condenser fans. The standard fan control strategy is fan cycling by outdoor ambient temperature, with the low ambient cut-out (chiller shut down) set at 25°F.

Above 25°F ambient, 1 fan will turn on 4 seconds after either compressor starts. This fan will continue to run until both compressors shut down. This fan is designated as Fan 2 (6M).

If the ambient temperature is above 45°F, one more fan will start after either compressor has run for 30 seconds. This fan will continue to run until both compressors shut down or until the ambient temperature drops to 40°F. This fan is designated as Fan 1 (5M).

Locations of the fans and a chart showing the operation outlined above is shown in Fig. 25.

For operation below 25°F, a Low Ambient Kit MUST be installed. See page 7.



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FAN	AMBIENT ON	AMBIENT OFF
2	25°F	24°F
1	45°F	40°F

COMPRESSOR CAPACITY CONTROL

The function of the compressor capacity control system is to automatically adjust the compressor pumping capacity to balance with the cooling load at a predetermined return water temperature.

Capacity is reduced by unloading one or more banks of cylinders. Some cylinder banks are not equipped with unloaders. This prevents the possibility of overheating, since a definite minimum volume of cool refrigerant gas flows through the compressor at all times during operation regardless of load conditions.

Unloading is accomplished by preventing (blocking) the suction gas from entering one or more of the suction plenums of the compressor.

A line, connected to the discharge side of the compressor, supplies high pressure gas to the unloader mechanism which is mounted next to the associated bank of cylinders. The unloader mechanism consists of a solenoid valve integrally mounted on the outside of the cover plate, and an internal spring loaded piston.

UNLOADING

When the solenoid valve is energized, discharge gas pressure is applied to the top of the unloader piston, forcing it down against spring pressure. The bottom end of the piston seats against the recessed opening to the suction plenum, effectively blocking the flow of gas into the cylinders. The cylinders are now unloaded.

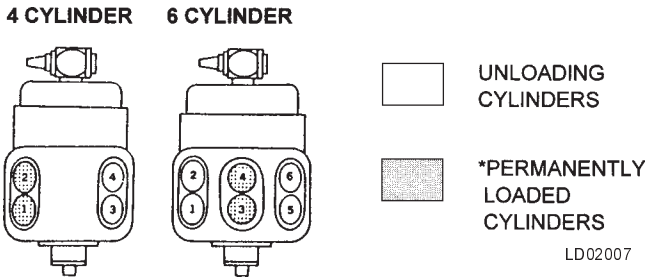
LOADING

When the solenoid valve is de-energized, discharge gas pressure on top of the unloader piston is relieved to the suction plenum. The coil spring forces the piston

up, uncovering the recessed opening which allows the suction gas to flow through the port and into the cylinders. The cylinders are now loaded.

All cylinders equipped with unloaders will remain unloaded on start-up until the oil pressure has built up to normal. On each compressor, certain cylinders do not unload. (See Fig. 26).

CHILLER MODEL	SYS	# OF CYLINDERS	# OF UNLOADING STEPS	
			STD.	OPT.
YCAZ33BA3	1	4		
YCAZ44BA3	2	4	5	N/A
YCAZ74BB3	1	6	5	6
	2	4		
YCAZ77CB3	1	6	5	7
YCAZ88DB3	2	6		



LD02007

* 6 cylinder compressors do not connect the loading solenoid wiring on cylinders 1 & 2, effectively making them permanently loaded in the "standard" unloading scheme. The loading solenoid wiring on these cylinders is connected to additional electronics when "optional" unloading is required. Cylinders 3 & 4 have no loading solenoids and are "truly" permanently loaded.

FIG. 26 – COMPRESSOR UNLOADING SEQUENCE

SYSTEM START-UP CHECKLIST / REPORT

JOB NAME: _____ SALES ORDER#: _____
LOCATION _____
SOLD BY: _____
INSTALLING _____ CONTRACTOR: _____
START-UP: _____ TECHNICIAN/ COMPANY: _____
DATE: _____
CHILLER MODEL #: _____ SERIAL #: _____
COMPRESSOR #1 MODEL #: _____ SERIAL #: _____ COMPRESSOR #2 MODEL #: _____ SERIAL #: _____

CHECKING THE SYSTEM 24 HOURS PRIOR TO INITIAL START-UP (NO POWER)

Unit Checks

- ☐ 1. Inspect the unit for shipping or installation damage.
- ☐ 2. Assure that all piping has been completed.
- ☐ 3. Check that the unit is properly charged and that there are no piping leaks.
- ☐ 4. Suction and discharge stop valves and the refrigerant liquid stop valves are open (ccw).

CAUTION: Compressor lubrication circuit must be primed with YORK "C" oil prior to start-up. Priming should be done through the Schrader fitting at the compressor oil pump. Stroke oil pump 10 times to prime the lubrication circuit.

- ☐ 5. The compressor oil level must be maintained in the sight glass at all operating conditions. At part load operating conditions, it is not abnormal for

the oil level to be in the lower sight glass. If it is necessary to add oil, connect a YORK oil pump to the oil charging valve, but do not tighten the flare nut on the delivery tubing. With the bottom (suction end) of the pump submerged in oil to avoid the entrance of air, operate the pump until oil drips from the flare nut joint, allowing the air to be expelled, and tighten the flare nut. Open the compressor oil charging valve and pump in oil until the oil reaches the proper level as described above. Close the compressor oil charging valve.

- ☐ 6. Assure water pumps are on. Check and adjust water pump flow rate and pressure drop across cooler. GPM = _____
- ☐ 7. Check panel to see that it is free of foreign material (wires, metal chips, etc.).
- ☐ 8. Visually inspect wiring (power & control). Must meet NEC and all local codes. (See Figs. 9 and 11)
- ☐ 9. Check for proper size fuses in main and control power circuits.
- ☐ 10. Verify that field wiring matches the 3-phase power requirements of the compressor. See nameplate. (See Fig. 9)
- ☐ 11. Assure 115VAC Control Power to each TB1 has 30A minimum capacity. (See Fig. 9)
- ☐ 12. Be certain all control bulbs are inserted completely in their respective wells and are coated with heat conductive compound.

PANEL CHECKS

(POWER ON-BOTH SYSTEM SWITCHES "OFF")

- ☐ 1. Apply 3 phase power and verify its value at each pair of compressor contacts. (See Fig. 12)
Record the voltage: fA _____ VAC
fB _____ VAC
fC _____ VAC
- ☐ 2. Apply 115VAC and verify its value on the terminal block in the lower left of each Power Panel. Make the measurement between terminals 5 and 2. Should be 115VAC $\pm 10\%$. (See Fig. 12)
Record the voltage: _____ VAC
- ☐ 3. Assure crankcase heaters are on. Allow crankcase heaters to remain on a minimum of 24 hours before start-up. This is important to assure no refrigerant is in the oil at start-up!

- ☐ 4. Program the Dip Switches on the Microprocessor Board (Page 26) and verify the selection by pressing the OPTIONS key.

Switch 3 should always be closed.

Switch 6 should always be closed.

NOTE: *It is IMPORTANT that all switches are properly programmed. Otherwise, undesirable operation will result.*

- ☐ 5. Press the PROGRAM key and program each of the 11 limits and record them.

They are as follows:

- ☐ • Discharge Cut-out _____ PSIG
- ☐ • Outside Air Temp Low Cut-out _____ °F
- ☐ • Outside Air Temp High Cut-out _____ °F
- ☐ • Discharge Pressure Unload Pressure _____ PSIG
- ☐ • Suction Pressure Unload Pressure _____ PSIG
- ☐ • Leaving Water Temp Cut-out _____ °F
- ☐ • Suction Pressure Cut-out _____ PSIG
- ☐ • Rate Control Temperature _____ °F
- ☐ • Anti Recycle Time _____ SEC.
- ☐ • Rate Sensitivity _____ °F/MIN.
- ☐ • Number of Load Steps _____

See page 34 for assistance in programming these values.

- ☐ 6. Program the date and time by first assuring that the CLK jumper J18 on both Microprocessor Boards (Fig. 24) is in the ON position (Top 2 pins). Press the SET TIME key and set the date and time (Page 38).

- ☐ 7. Program the Daily and Holiday Start/Stop Schedule by pressing the SET SCHEDULE/HOLIDAY key (Page 39).

- ☐ 8. Program the Chilled Liquid Setpoint and Control Range by pressing the CHILLED LIQUID TEMP/RANGE key (Page 41). Record the setpoint and control range: Setpoint: _____ °F
Control Range: _____ °F

- ☐ 9. If the Remote Reset is to be used, the maximum reset must be programmed. This can be programmed by pressing the REMOTE RESET TEMP RANGE key (Page 64).

INITIAL START-UP

After the operator has become thoroughly familiar with the control panel and has performed the preceding checks 24 hours prior to start-up, the unit can be put into operation.

- ☐ Place the System Switches to the ON position. See the OPERATING SEQUENCE for unit operation.

- ☐ The compressor will start and a flow of liquid should be noted in the liquid indicator. After several minutes of operation, the bubbles will disappear and there will be a solid column of liquid when the unit is operating normally. On start-up, foaming of the oil may be evident in the compressor oil sight glass. After the water temperature has been pulled down to operating conditions, the oil should be clear. Normal operation of the unit is evidenced by a hot discharge line (discharge superheat should not drop below 50°F) clear oil in the compressor crankcase, solid liquid refrigerant in the liquid indicator and usually no more than 2 PSIG variation in suction pressure for any given set of operating conditions.

- ☐ Allow the compressor to run for a short time, being ready to stop it immediately if any unusual noise or other adverse condition should develop. When starting the compressor, always make sure the oil pump is functioning properly. Compressor oil pressure must be as described in the SYSTEM SAFETY'S Section, page 50.

- ☐ Check the system operating parameters. Do this by selecting various read-outs such as pressures and temperatures. Compare these to test gauge readings. Record read-outs below:

CHILLED LIQUID TEMPERATURES

Return: _____ °F

Leaving: _____ °F

AMBIENT TEMPERATURE _____ °F

SYSTEM 1 PRESSURES

Suction: _____ PSIG

Oil: _____ PSID

Discharge: _____ PSIG

SYSTEM 2 PRESSURES

Suction: _____ PSIG

Oil: _____ PSID

Discharge: _____ PSIG

MOTOR CURRENT:

SYS 1: _____ %

SYS 2: _____ %

OPTIONS:

OPERATING SEQUENCE

NOTE: The operating sequence described below relates to operation after power has been applied on a hot water start (such as start-up commissioning). Under these circumstances, loading will deviate from normal sequence and timing previously described. When a compressor starts, internal timers limit minimum time before another compressor can start to 1 minute. Time between stages of loading is also limited by internal timers to a minimum of 1 min., although the micro would like to load at 30 sec. intervals which may cause the lag compressor to start before the lead system fully loads optional steps. This also deviates from the normal sequence of loading. If rate control dictates, time between stages of loading may be up to 150 sec. or may not occur at all. This will be determined by rate control programming and actual water temperature rate of change.

1. For the system compressor to run, all Manual Reset Cut-outs must be reset, the Flow Switch must be closed, any remote cycling contacts must be closed, the System Switches must be ON, the Daily Schedule must be scheduling the chiller to run, and temperature demand must be present.
2. As long as power is applied, the Crankcase Heaters will be on and stay on as long as the compressors are not running.
3. When power is applied to the system, the microprocessor will start a two minute timer. This is the same timer that prevents an instantaneous start after a power failure.
4. At the end of the two minute timer, the microprocessor will check for cooling demand as well as check to see if any system safeties are exceeded. If all conditions allow for start, the lead compressor will start unloaded. Coincident with the start, the programmable anti-recycle timer will be set and begin counting downward to "0". The liquid line solenoid valve will open when the system is pumped down to the suction pressure cut-out (Pumpdown on start-up.)
5. **After 4 seconds of run time**, the motor current of the lead compressor must be >14% FLA and <115% FLA. Oil pressure must be 5 PSID or greater. If these conditions are not met, the lead compressor will shut down.
6. **After 30 seconds of run time**, the oil pressure of the lead compressor must be a minimum of 20 PSID and the suction pressure must be a minimum of 50% of cut-out.
7. **After 60 sec. of run time**, if cooling demand requires and no safeties have been exceeded, the lead compressor will load, if cooling demand (temperature and rate control) requires.
8. **After 90 seconds of run time**, if cooling demand requires and no safeties have been exceeded the lag compressor will start unloaded. Coincident with the start, the programmable anti-recycle counter will be set and begin counting downward to "0". The liquid line solenoid will open when the system is pumped down to the suction pressure cut-out.
9. **After 94 seconds of run time**, the oil pressure of the lag compressor must be a minimum of 5 PSID and suction pressure must be greater than 50% of cut-out.
10. **After 2 minutes of run time**, the lead compressor will continue to load, if cooling demand (temperature and rate control) requires and extra steps of capacity are present. The oil pressure of the lag compressor must be a minimum of 20 PSID and the suction pressure must be a minimum of 50% cut-out.
11. **After 2 minutes and 30 seconds of run time**, the lag compressor will load, if cooling demand (temperature and rate control) requires.
12. **After 3 minutes of run time**, the lead compressor will load, if cooling demand (temperature and rate control) requires, and extra steps of capacity are present.
13. **After 3 minutes and 30 seconds of run time**, the lag compressor will load, if optional stages of loading are present and cooling demand requires.
14. **After 4 minutes of run time**, the lead compressor's suction pressure must be greater than the programmed cut-out. In addition, the oil pressure of the lead compressor must be greater than 25 PSID.
15. **After 4 minutes and 30 seconds of run time**, the lag compressor will load, if optional stages of loading are present and cooling demand requires.
16. **After 5 minutes and 30 seconds of run time**, the lag compressor's suction pressure must be greater than the programmed cut-out. In addition, the oil pressure of the lead compressor must be greater than 25 PSID.
17. Operation beyond 6 minutes will be dictated by cooling demand. Anti-recycle timers will time out and system safety thresholds will continue to be monitored.

PREVENTATIVE MAINTENANCE

It is the responsibility of the owner to provide the necessary daily, monthly and yearly maintenance requirements of the system.

IMPORTANT

If a system failure occurs due to improper maintenance during the warranty period, YORK will not be liable for costs incurred to return the system to satisfactory operation. The following is intended only as a guide and covers only the chiller unit components. It does not cover other related system components which may or may not be furnished by YORK. System components should be maintained according to the individual manufacturers' recommendations as their operation will affect the operation and life of the chiller.

DAILY MAINTENANCE

It is recommended that the following items be checked daily.

1. Oil Level – Correct oil level is when oil appears in either of the compressor oil sight glasses after the unit has been in operation for about two hours. If it is necessary to add oil after this operating period, see item #3 under the ANNUAL MAINTENANCE section.
2. Oil Pressure – Oil pressure should be a minimum of 50 psi above suction pressure. Typical pressure is 65-70 psi.
3. Compressor Superheat – Correct superheat is 10-15°F measured at the compressor.
4. Operating Pressures and Temperatures – Check to see that operating pressures and temperatures are within the OPERATIONAL LIMITATIONS shown in this book.

WEEKLY MAINTENANCE

It is recommended that the following items be checked weekly.

1. All items listed under DAILY MAINTENANCE.
2. Color of Compressor Oil – New oil is clear, and if the system is not contaminated with moisture and/or foreign material, should retain its new appearance for a reasonable length of operating time. Discoloration of the oil, either turning darker brown or in some cases lighter, is an indication of contamination, basically due to moisture. If it is necessary to charge oil refer to item #3 under the ANNUAL MAINTENANCE section.

3. Check the refrigerant circuit for leaks.
4. Operating Pressures and Temperatures – Check to see that operating pressures and temperatures are within the LIMITATIONS shown in this book.

ANNUAL MAINTENANCE

It is recommended that the following items be checked annually.

1. All items under WEEKLY MAINTENANCE.
2. Operating Controls – Check to see if controls are set and operating within the proper limits. See Unit Controls and OPERATION section of this book.
3. Compressor Oil – Drain, inspect and refill with new oil. This requires pumping out the compressor. If possible, this should be done after the unit has been in operation for some time, when the oil in the crankcase will contain the least amount of refrigerant. To pump out the compressor, proceed as follows:
 - A. Close the suction stop valve.
 - B. Open the discharge stop valve two turns of the stem.
 - C. Operate the compressor until 15 to 20 inches of vacuum is obtained. Do this by disconnecting the wiring to LLSV and repeatedly starting the compressor. Recycle 115VAC power to the Logic Panel to reduce anti-recycle time to 2 min. if needed. The compressor should in no case be operated under vacuum conditions for longer than 10 to 15 seconds.
 - D. Stop the compressor and immediately close the discharge stop valve. The procedures outlined in steps (b) and (c) above should be repeated if the suction pressure rises rapidly to 15 PSIG or more which would indicate considerable refrigerant remaining in the crankcase oil. Do not expect to retain 0 PSIG since some refrigerant will continually be released from the oil in the crankcase.
 - E. After pumping down the compressor, wait until the pressure builds up to 2 or 3 PSIG before opening up any part of the hermetic compressor.
 - F. Open the coil drain valve slowly and drain as much oil from the compressor as possible.
 - G. Examine the oil for any metal particles which would indicate wear on the bearings, crankshaft or connecting rods. If metal particles are found,

the need for closer examination by factory service personnel is indicated.

H. If the oil is clean and free of metal particles, refill the compressor with YORK oil "C". To add oil or to fill the compressor crankcase, connect the delivery tube of the YORK Hand Oil Pump. YORK Part No. 470-10654 or equal to the compressor oil charging and drain valve. Expel all air from the delivery tube by pumping it full of oil, allowing a few drips to drip out before tightening the flare nut to the oil charging valve. Then open the oil charging valve and pump oil into the crankcase to the proper level. It is necessary that the suction end of the hand oil pump be kept submerged under the oil level in the container at all times, to avoid entrance of air into the compressor.

I. Before opening the suction or discharge stop valves, connect a vacuum pump to the pump-out

port in the discharge stop valve. (Pump-out port is port on valve stem side of valve). With the vacuum line shutoff valve open, run the vacuum pump until a vacuum of at least 1000 microns is reached. Stop the vacuum pump, close the shutoff valve and open the discharge valve fully before disconnecting the line from the vacuum pump. Disconnect the vacuum pump and replace the plug in the pump-out port.

NOTE: If suction or discharge valves are not seated properly, a 1000 micron vacuum can not be obtained. Do not evacuate for long periods of time.

J. Be sure both discharge and suction stop valves are open before operating the unit.

4. Suction and Discharge Valves – The condition of the suction and discharge valves should be checked by YORK service personnel.

OPTIONS

This section is devoted to options which may be ordered or retrofitted to the unit. Listed below are the options which are covered in this section.

- | | | |
|---|---|--|
| 1. CONDENSER WATER PUMP/RUN STATUS CONTACT OPTION | } | Both controls are included as part of the PUMP CONTROL KIT |
| 2. EVAPORATOR WATER PUMP CONTACT OPTION | | |
| 3. LOW AMBIENT ACCESSORY | | |
| 4. HOT GAS BYPASS (LOADMINDER) OPTION | | |
| 5. DISCHARGE PRESSURE READOUT OPTION | | |
| 6. HIGH AMBIENT OPTION | | |
| 7. LOCAL PRINTER OPTION | | |
| 8. OPTIONAL TAMPERPROOF ENCLOSURE (WIRE GRILLE) | | |
| 9. OPTIONAL DECORATIVE TAMPERPROOF ENCLOSURE (LOUVERED & WIRE GRILLE) | | |
| 10. OPTIONAL DECORATIVE TAMPERPROOF ENCLOSURE (LOUVERED) | | |
| 11. BAS INTERFACE OPTION (REMOTE RESET OPTION) | | |

CONDENSER WATER PUMP CONTACT/RUN STATUS OPTION

This option provides a "dry" contact in the Master Panel which can be used to turn on the condenser water pump, other device or indicate run status. The contact closes whenever one of the compressors start.

Connections to this contact can be made on Terminals 21 and 22 of TB1 in the power panel. The location of these terminals is shown in Fig. 27.

This option utilizes a second Relay Output Board and associated wiring. The part number for the Field Mounted Pump Control Kit is 471-01232-101. This kit is not required if a second Relay Output Board is already installed in the Master Panel.

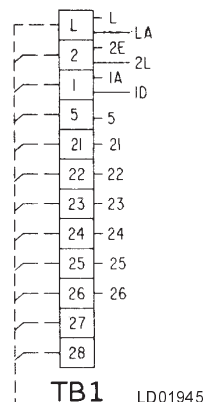


FIG. 27 – CONDENSER WATER PUMP CONTACT CONNECTION POINT

Mounted Pump Control Kit is 471-01232-101. This kit is not required if a second Relay Output Board is already installed.

NOTE: Any inductive devices (contactor/relay coil) connected to these contacts must be suppressed with YORK P/N 031-00808 supplied by others. Otherwise, nuisance faults may occur.

EVAPORATOR WATER PUMP CONTACT OPTION

This option provides a “dry” contact which can be used to turn on the evaporator water pump. The contact will be closed by the micro before the micro brings a compressor on. The micro will not bring a compressor on until a “RUN PERMISSIVE” signal is established by a flow switch contact closure. If no daily schedule is set (all times = 00.00), the evaporator water pump contact will transition as soon as a System Switch on the microprocessor board is placed in the ON position.

If a daily schedule is programmed, the evaporator water pump contacts will transition when the daily schedule dictates.

If MANUAL OVERRIDE is selected, the evaporator water pump contacts will immediately transition.

Connections to this contact can be made on Terminals 25 and 26 of TB1 in the power panel. The location of these terminals is shown in Fig. 28.

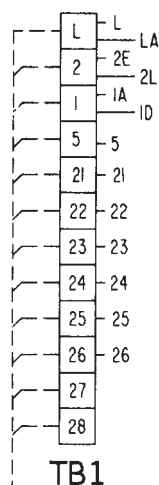


FIG. 28 – EVAPORATOR WATER PUMP CONTACT CONNECTION POINT

If a power failure occurs which shuts the entire chiller down, the contacts will not be allowed to close again until 30 seconds after power is restored. This prevents rapid cycling of the chilled water pump.

This option utilizes a second Relay Output Board and associated wiring. The part number for the Field

Mounted Pump Control Kit is 471-01232-101. This kit is not required if a second Relay Output Board is already installed.

NOTE: Any inductive devices (contactor/relay coil) connected to these contacts must be suppressed with YORK P/N 031-00808 supplied by others. Otherwise, nuisance faults may occur.

0°F LOW AMBIENT OPTION

The standard chiller is designed to operate in an ambient of 25°F or higher. If it is necessary to operate the chiller in an ambient between 0° and 25°F, the chiller should be purchased with the factory installed Low Ambient Option.

NOTE: Occasional operation below 0°F is normally possible. In these cases a low suction pressure shutdowns may sometimes occur, but can usually be tolerated.

Operation

The fundamental purpose of the Low Ambient Option is to reduce the capacity of the condenser when the ambient temperature is in the 0° to 25°F range. This assures that adequate discharge pressures can be maintained at low temperatures which will eliminate low suction pressure faults.

Operation at low ambients is accomplished by cycling fans according to discharge pressure. This requires the addition of discharge pressure transducers which allows the microprocessor to add two additional steps of control to the standard fan control scheme. Fans are now allowed to cycle completely off and a fan is permitted to run in the reverse direction. This reduces the capacity of the condenser as required. Reverse rotation of the fans is accomplished by the addition of reversing contactors.

Components

The Low Ambient Option consists of 3 kits; 371-01287-121 Low Ambient Kit, a 471-01262-111 Discharge Pressure Readout Kit, and also a 471-01232-101 Relay Board Kit. All three kits are required. The Relay Board Kit is not required if two Relay Boards are already present in the panel.

When the Low Ambient Option is installed, the following physical changes are made to the standard chiller:

1. Discharge pressure transducers and wiring are added.
2. Reversing contactors 7M with supporting wiring is added.
3. A second Relay Output Board and wiring is installed.

Programming

The control panel may be programmed for "AMBIENT & DISCH PR FAN CONTROL" (Ambient & discharge pressure fan control) or by "DISCHARGE PRESSURE FAN CONTROL" (fan control by discharge pressure only). This is selected by placing SW. 8 on the Microprocessor to the appropriate position. See page 29.

SW. 2 on the Microprocessor Board must also be programmed for "LOW AMBIENT CONTROL" to allow operation at temperatures below 25°F. To accomplish this, place SW. 2 in the CLOSED position. See page 28. After the switch is properly positioned, the OUTSIDE AIR TMP LOW CUT-OUT in the PROGRAM mode can then be programmed between 0° - 25°F. See page 28.

NOTE: For operation below 0°F, program the cut-out for 0°F. This will cause the microprocessor to ignore the low ambient cut-out regardless of temperature.

Operation of the fans will be discussed in both "Ambient and Pressure Control" as well as "Pressure Only" control in the following text.

Ambient and Pressure Fan Control 0°F - 25°F.

Fan operation below 25°F is controlled only by the discharge pressure. Controlling action of the fans may be dictated by either system. 4 steps of fan control operate as follows:

1. Until discharge pressure reaches 320 PSIG, the fans will be completely off.
2. The second stage of fan control will energize fan 1 (7M) in the reverse direction when the discharge pressure of either system exceeds 320 PSIG. Once the reversing contactor is energized, it will stay on until the discharge pressure of either system falls below 120 PSIG, the ambient temperature exceeds 35°F, or discharge pressure of the system rises above 340 PSIG.

NOTE: The corresponding compressor must be on for a minimum of 4 sec. before the reversing fan is permitted to start.

3. The third stage of fan control will energize fan 2 (6M) as well as turn off the reversing fan 1 whenever discharge pressure of either system exceeds 340 PSIG. This fan will stay on until discharge pressure of either system drops below 120 PSIG.

NOTE: The corresponding compressor must be on for 4 sec. before this fan is permitted to start.

4. The fourth stage of fan control will energize fan 1 (5M) in the forward direction whenever discharge pressure of either system exceeds 360 PSIG. This fan will stay on until discharge pressure of either system drops below 140 PSIG.

NOTE: The corresponding compressor must be on for 4 sec. before this fan is permitted to start. Fan 2 will also be operating.

Ambient and Pressure Fan Control 25° - 45°F

Fan control between 25° and 35°F is controlled by discharge pressure. If the reversing fan is on, the reversing fan will continue to operate until the temperature reaches 35°F or discharge pressure reaches 340 PSIG. At 35°F or 340 PSIG, fan 2 (6M) will energize. Between 25°F and 45°F if the reversing fan is not operating, after 4 seconds of compressor operation, fan 2 (6M) will energize. This is identical to standard fan control by temperature (Page 66). No pressure override exists. If temperature drops below 25°F, this fan will remain on until cycled off by discharge pressure of either system dropping below 120 PSIG.

Ambient and Pressure Fan Control 45°F and Higher

Fan control above 45°F is strictly controlled by temperature with no pressure override.

After 4 seconds of operation, fan 2 (6M) will energize turning the fan in the forward direction.

After 30 seconds of operation, fan 1 (5M) will energize turning an additional fan on in the forward direction. This is identical to standard fan control by temperature (Page 66). Fan 1 will de-energize if ambient temperature drops below 40°F.

Pressure Control Only, Fan Control by Discharge Pressure

Fan control by pressure will operate 4 stages of fan cycling according to the discharge pressure of the corresponding system. Ambient temperature will have no effect.

1. Until discharge pressure reaches 320 PSIG, no system fans will operate.
2. When discharge pressure of either system reaches 320 PSIG fan 1 (7M) will be energized in the reverse direction. This fan will remain energized until discharge pressure of either system drops below 120 PSIG.

3. If discharge pressure of either system reaches 340 PSIG, the reversing fan will be turned off. At the same time, fan 2 (6M) will energize. This fan will remain on until discharge pressure of either system drops below 120 PSIG.
4. If discharge pressure of either system reaches 360 PSIG and compressor run time has exceeded 30 seconds, fan 1 (5M) will energize turning the fan in the forward direction. This fan will remain on until discharge pressure of either system drops to 140 PSIG.

Table 2 shows the operation of both modes of fan control previously discussed.

HOT GAS BYPASS (LOADMINDER) OPTION

General

The Hot Gas Bypass Option is available as a factory installed option to prevent compressor cycling and water temperature fluctuation at low load. This is accomplished by providing further capacity reduction below the last step of compressor cylinder unloading by introducing an artificial load to the cooler, which keeps the compressor on the line. The option will provide hot gas bypass on both compressors enabling hot gas to be active regardless of which compressor is in the lead.

NOTE: The microprocessor will only activate the hot gas on the lead compressor.

The hot gas bypass consists of a pilot operated regulating valve with an integral solenoid. The pilot operated solenoid is controlled by the microprocessor according to water temperature. The regulating valve which becomes activated when the solenoid is energized, is controlled by suction pressure to modulate the flow of gas in a bypass connected from the compressor discharge to the cooler inlet. The following text will explain how the hot gas solenoid is activated by the microprocessor in both return and in leaving water control.

LWT Control Hot Gas Operation

The hot gas solenoid is energized when the leaving water temperature falls below the "Target" water temperature, if the compressor is on its minimum stage of loading. Hot gas may then be fed according to the suction pressure and the pressure regulating valve setting. Once activated, the micro will keep the solenoid energized until the leaving water temperature rises above the high limit of the Control Range or until the load becomes so low that the hot gas can no longer keep temperature within the control range and the micro turns the compressor off. Details for setting the pressure regulator follow.

TABLE 2 – LOW AMBIENT FAN CYCLING

FAN	CONT.	CONTROL BY TEMPERATURE & PRESSURE				CONTROL BY PRESSURE ONLY	
		BELOW 25°F PRESSURE CONTROL ONLY		ABOVE 25°F TEMP. CONTROL ONLY		TEMPERATURE HAS NO EFFECT	
		ON	OFF	ON	OFF	ON	OFF
1 REV	7M	Either System Discharge Press. Exceeds 320 PSIG	Either System Discharge Press. Drops Below 120 PSIG	Will Not Start Above 25°F	35°F or 340 PSIG	320 PSIG	120 PSIG
2	6M	Either System Discharge Press. Exceeds 340 PSIG	Either System Discharge Press. Drops Below 120 PSIG	25°F	Turns OFF Only if Discharge Pressure of Either System Drops Below 120 PSIG	340 PSIG	120 PSIG
1 FWD	5M	Either System Discharge Press. Exceeds 360 PSIG	Either System Discharge Press. Drop Below 140 PSIG	45°F	40°F	360 PSIG	140 PSIG

NOTE:

A fan with a reversing contactor will have the reversing contactor mechanically locked out when Fan 1 is running forward. The forward contactor will also be locked out when the Fan 1 is running in reverse.

RWT Control Hot Gas Operation

The hot gas solenoid is energized if the compressor is on its minimum stage of loading and the return water temperature falls below the following point:

$$\text{ULCR} - \text{CR} + \text{CR}/20$$

Where: ULCR = Upper Limit of Control Range
CR = Control Range Differential

Example:

In a typical system that requires a 45°F leaving water temperature, we will have a 10° Control Range (CR) differential which gives us an Upper Limit of Control Range (ULCR) of 55°F. Therefore, plugging the numbers into the formula:

$$55 - 10 + (10/20) = 45-1/2^\circ\text{F}$$

The hot gas solenoid will be activated at 45-1/2°F in the example above and hot gas may then be fed according to the suction pressure and the pressure regulated valve setting. Once activated, the micro will keep the solenoid energized until the return water temperature rises above the temperature designated by the formula:

$$\text{ULCR} - \text{CR} + \text{CR}/10$$

Where: ULCR = Upper Limit of Control Range
CR = Control Range Differential

$$\text{Example: } 55 - 10 + 10/10 = 46^\circ\text{F}$$

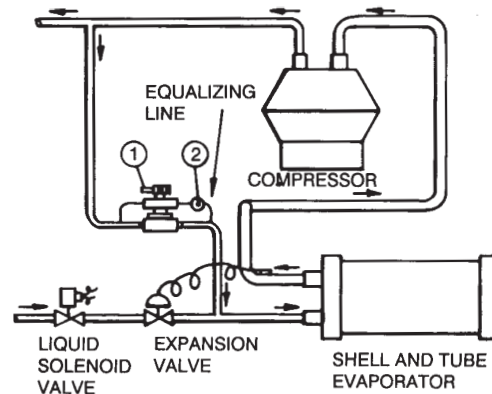
If temperature continues to drop while the Hot Gas is energized, the Hot Gas will be de-energized when the compressor cycles off on temperature.

Procedure For Setting The Hot Gas Regulators (Ref. Fig. 29)

1. If desired, set the control panel data to show suction pressure.
2. Adjust the pilot power assembly adjustment screw (2) to approximately the middle of the adjustment range.
3. The chiller must be running and stabilized on the minimum stage capacity. In establishing this condition it may be necessary to deactivate the regulator by de-energizing the solenoid (1).
4. Adjust the adjustment screw (2) in the clockwise direction to open the valve at a higher pressure (sooner) or in the counterclockwise direction to open the valve at a lower pressure (slower response). The valve is feeding when the valve outlet feels warm to the touch.

The adjustment is correct when system suction pressure rises to a point nearly equal to normal running pressure at the midpoint in the "Control Zone".

5. Further minor adjustment may be necessary to be certain that the valve opens fully before the temperature point at which the compressor stops due to a fall in Return or Leaving Water Temp.



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FIG. 29 – PIPING DIAGRAM

6. Repeat this procedure on the other system.

FIELD INSTALLATION

If it becomes necessary to field install the Hot Gas (Loadminder) Option, two kits are required. The part numbers of the kits are 375-05648-001 and 471-01232-101. The 475-01232-101 kit consists of a second Relay Output Board. It is not required if two Relay Boards are already installed in the control panel. If the 375-05648-001 kit is not available, the following parts should be ordered separately.

Parts List

ITEM	QTY	PART #	DESCRIPTION
1	1	375-00223-012	SOL. VALVE
2	1	066-94986-000	BRACKET
3	3	021-16129-000	SCREW
4	2	066-84635-000	CLAMP
5	1	066-65196-000	CLAMP
6	1	066-38928-000	CLAMP
7	1	066-94250-000	PIPE CONN.
8	4	023-09919-000	REDUCER
9	1	075-05635-000	PIPE CONN.
10	1	066-93940-000	PIPE CONN.
11	1	075-05637-000	BRACKET
12	8	012-16207-000	SCREW
13	2	021-11452-000	CLAMP
15	2	021-16203-000	SCREW
16	1	021-13245-000	CLAMP
19	2	031-01117-000	SUPPRESSOR
22	1	375-00223-013	SOL. VALVE
23	1	075-05841-000	PIPE CONN.
24	1	075-05638-000	PIPE CONN.
25	1	075-05639-000	PIPE CONN.
XX	1	075-05648-000	DRAWING

DISCHARGE PRESSURE READ-OUT OPTION

The Discharge Pressure Read-out Option P/N 471-01262-111 allows the user to obtain control panel displays of discharge pressure. Additionally, other displays such as fault information will then hold relevant discharge pressure information useful in diagnosing problems.

The Discharge Pressure Unloading feature also becomes usable when this option is installed (Page 35) as well as fan cycling by discharge pressure.

Fan cycling by discharge pressure sometimes becomes necessary, if ambient temperature cycling of fans causes low suction pressure faults due to unusual operating conditions or chiller location problems. Fan cycling by discharge pressure only, allows higher discharge pressures which in turn raises suction pressure by permitting better operation of the thermal expansion valve. To convert to discharge pressure cycling, the micro panel must be programmed for DISCHARGE PRESSURE FAN CONTROL (See Page 29). Fan cycling will operate as indicated in Table 3.

TABLE 3 – FAN CYCLING

FAN	CONTACTORS	ON ¹	OFF ²
1 REV (Opt. Low Ambient)	7M	320 PSIG	120 PSIG
2	6M	340 PSIG	120 PSIG
1 FWD	5M	360 PSIG	140 PSIG

NOTES:

- Fans will be activated when either system discharge pressure exceeds the pressure indicated.
- Fans will be deactivated when either system discharge pressure drops below the pressure indicated, if the pressure on the other system does not exceed the ON pressure.

The kit consists of discharge pressure transducers for each system, wire harnesses, and associated mounting hardware.

HIGH AMBIENT OPTION

The High Ambient Option consists of four kits, P/N's 471-01262-111 and 475-05838-000. The option allows operation of the chiller in ambients up to 115°F. Typically, standard operation is limited to 105°F. High ambient operation is accomplished by discharge pressure unloading to assure that the chiller does not fault due to the high pressure cut-out opening during high temperature operation. A sun shield is also installed on the control panel to prevent direct sunlight from overheating the control panel causing subsequent malfunction of the electromechanical and electronic components in the control panel. Additionally, actual discharge pressure read-outs can now be obtained from the micro panel.

Discharge Pressure unloading allows the microprocessor to unload a compressor when the discharge pressure approaches a point nearing the discharge pressure cut-out. This assures that the system does not shut down completely if the cut-out were to open. See page 35 for programming the unloading pressure.

Fan cycling by discharge pressure is also available when this option is installed (See DISCHARGE PRESSURE READ-OUT OPTION, page 77), however it is of little use in areas where ambients are generally high and standard temperature control of the fans provides good control and maximum efficiency.

LOCAL PRINTER OPTION

The Micro Panel is capable of supplying a printout of chiller conditions or fault shutdown information at any given time. This allows operator and service personnel to obtain data and system status with the touch of the keypad. In addition to manual print selection, the micro panel will provide an automatic printout whenever a fault occurs. An explanation of the keypad use to obtain a printout is discussed in the "PRINT" KEY Section on page 54.

YORK recommends the field tested WEIGH-TRONIX IMP-24, Model 2600 printer. This is a compact low cost printer that is ideal for service work and data logging. Paper is in the form of a compact roll and is easily handled compared to other printers using wider business form style paper. The paper is 2.25" wide desktop calculator paper that can be easily and inexpensively purchased at most stationery stores. Shown in Fig. 30 and 31 is the WEIGH-TRONIX printer and a typical sample printout.



FIG. 30 – WEIGH-TRONIX IMP-24 MODEL 2600 PRINTER

**YORK INTERNATIONAL CORPORATION
RECIPROCATING WATER CHILLERS**

**SYSTEM STATUS
8:45AM 4/17/91**

SYS 1	COMPRESSOR RUNNING
SYS 2	ANTI-COIN TIMER 13 SEC
RETURN WATER TEMP	65.0 DEGF
LEAVING WATER TEMP	54.0 DEGF
LOW WATER CUTOUT	36.0 DEGF
SETPOINT TEMP	45.0 DEGF
OUTSIDE AIR TEMP	75.0 DEGF
LOW AMBIENT CUTOUT	10.0 DEGF
LOW PRESSURE CUTOUT	44 PSIG
LEAD SYSTEM	SYS 1
CONTROL TYPE	LCHWT
COOLING RANGE	45.0 TO 47.0 DEGF

SYSTEM 1 DATA

COMPRESSOR STATUS	ON
MOTOR AMPS	50 %FLA
SUCTION PRESSURE	61 PSIG
DISCHARGE PRESSURE	143 PSIG
OIL PRESSURE	75 PSID
LIQUID LINE SOLENOID	OFF
RUN PERMISSIVE	ON
STAGES OF LOADING	1
FORWARD FANS	OFF
REVERSE FANS	OFF
HOT GAS BYPASS VALVE	OFF

SYSTEM 2 DATA

COMPRESSOR STATUS	ON
MOTOR AMPS	0 %FLA
SUCTION PRESSURE	61 PSIG
DISCHARGE PRESSURE	80 PSIG
OIL PRESSURE	1 PSID
LIQUID LINE SOLENOID	OFF
RUN PERMISSIVE	ON
STAGES OF LOADING	1
FORWARD FANS	1
REVERSE FANS	OFF
HOT GAS BYPASS VALVE	OFF

S M T W T F S	* = HOLIDAY
SUN START=06:00AM	STOP=11:00PM
MON START=06:00AM	STOP=11:00PM
TUE START=06:00AM	STOP=11:00PM
WED START=06:00AM	STOP=11:00PM
THU START=06:00AM	STOP=11:00PM
FRI START=06:00AM	STOP=11:00PM
SAT START=06:00AM	STOP=11:00PM
HOL START=00:00AM	STOP=00:00AM

FIG. 31 – PRINT-OUT

The WEIGH-TRONIX IMP-24 Model 2600 printer can be purchased from:

Weigh-Tronix
2320 Airport Blvd.
Santa Rosa, CA 95402

Phone: 1-800-358-9110 or 1-707-527-5555
(International Orders Only)

NOTE: *The printout is made to be universal to all types of chillers, both air and water cooled with or without options. Items may be indicated on the printout which may not be present on the chiller.*

Installation Limitations

The following limitations must be adhered to. Failure to do so may result in improper printer and/or chiller operation.

1. The printer option is adaptable to all versions and revisions of Microprocessor Boards and EPROM's. No modifications are necessary to the panel.
2. Maximum cable length between the printer and the Microprocessor Board is 25 feet. Twisted pair shielded cable is required.
3. The printer must be supplied a 115 VAC source.
4. The printer may be left connected to the micro panel.

Parts

The following parts are required:

1. Weigh-Tronix IMP-24, Model 2600 printer.
2. 2.25" wide desk top calculator paper.
3. 25 ft. Twisted Pair Shielded Cable (minimum 3 conductor), #18 AWG Stranded, 300V min. insulation.
4. (1 ea.) 25-pin Cannon connector and shell. Connector: Cannon P/N DB-25P or equivalent. Shell: Cannon P/N DB-C2-J9.

Assembly and Wiring

All components should be assembled and wired as follows in Fig. 42. Strip the outside insulation back several inches and individual wires about 3/8" to connect the cable at the **Micro Logic Board**. Connect the shield of the cable as shown on the **Micro Logic Board**. Do not connect at the printer end of the cable.

Printer Configuration

2 Switches on the printer must be properly configured. Remove the paper roll to access these switches. Place the switches in the following position:

SW. 1 OFF

SW. 2 ON

Obtaining a Print Out

A printout of current operating data may be obtained by pressing the OPER DATA key. A snap-shot will be taken by the micro of current operating conditions.

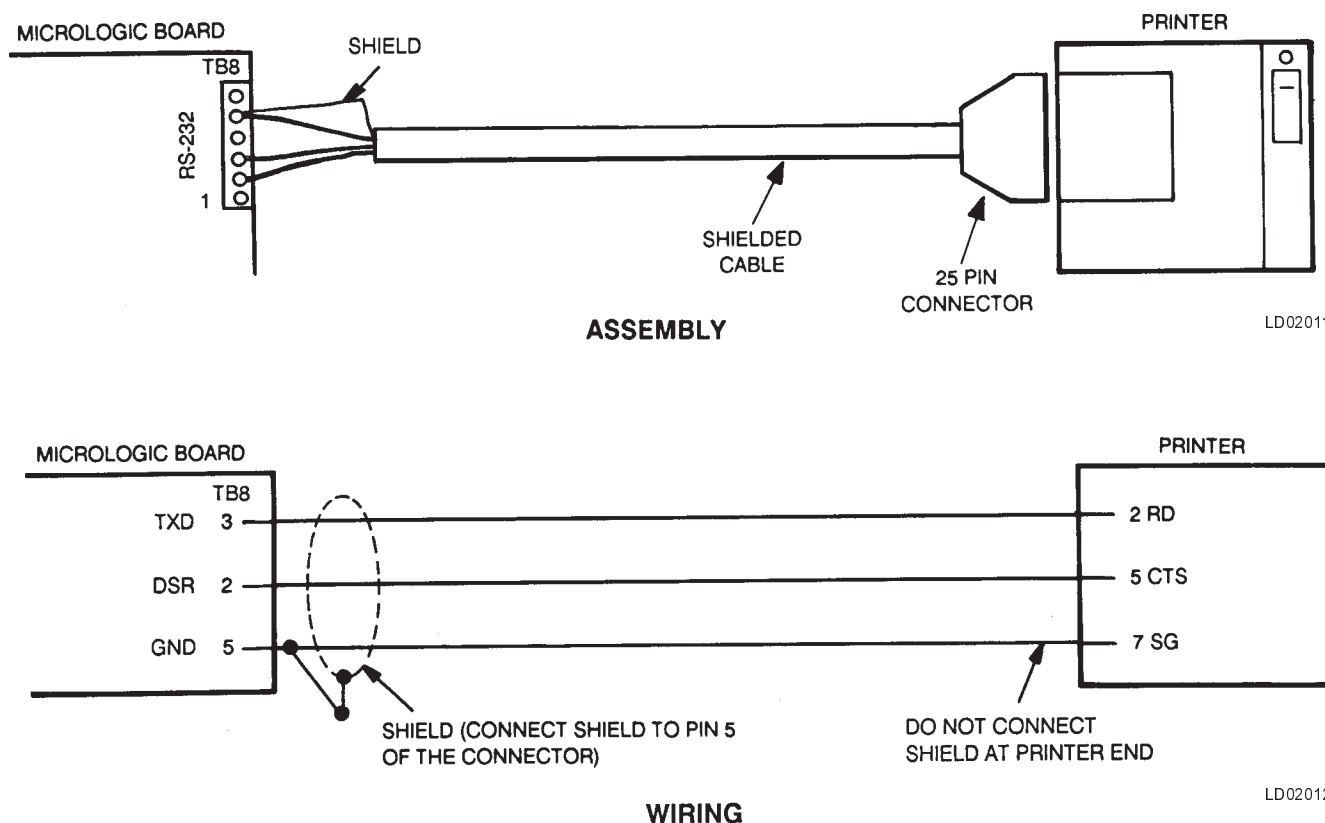


FIG. 32 – ASSEMBLY AND WIRING

These conditions will be stored in memory until they can be transmitted to the printer and printed. A sample printout is shown in Fig. 19 on page 54.

A printout of the fault shutdown history may be obtained by pressing the HISTORY key. A print out showing the last 3 faults with all system conditions at the time of the fault will be transmitted. A sample printout is shown in Fig. 20 on page 55.

An automatic printout will be sent to the printer whenever the chiller shuts down on a fault, regardless of whether the fault causes a system or the entire chiller to lockout or whether restart is permitted. This is the same printout that is obtained when the OPER DATA Key is pressed; however, it will be a snapshot of system operating conditions at the instant that the fault occurred. Additionally, the Status indication that is noted in the printout will note the specific fault that occurred.

Using Other Printers

Control codes vary from printer to printer. This will result in unusual formatting of printed data from many printers. In addition, "handshaking" lines and "handshaking" sequence will differ between printers. This makes the equipment susceptible to operation problems or miswiring which may cause damage to the printer or the Microprocessor Board. YORK assumes no responsibility for assistance or damage in the use of non-specified printers.

Warranty

YORK assumes no warranty responsibility in the use of the printer. This includes damages to the printer and the Microprocessor Board or chiller operation problems which may result.

OPTIONAL TAMPERPROOF ENCLOSURE (WIRE GRILLE)

General

A wire grille tamperproof enclosure is available for the chiller for the prime purpose of deterring unauthorized access to components on the chiller.

Kits 475-04251-002 is the tamperproof enclosure which consists of weather resistant steel grilles as well as the necessary mounting hardware.

Installation

1. Refer to Fig. 33 and the associated parts list. Before starting installation, all of the items in the kit should be identified by comparing with Fig. 34.
2. All holes for mounting kit parts are provided in both the chiller frame and the added supports; therefore, it should be unnecessary to drill holes.
3. Install grilles using the proper hardware and supports. Refer to Fig. 34 and the Parts List for placement of the grilles and the proper hardware required.
4. Notch grilles to suit water connection and wiring harnesses as needed.
5. If the High Ambient Sunshield Kit or Disconnect Option is installed, field adaption will be required where parts of the kits interfere. Touch up exposed metal parts to prevent rust.

Parts List for Each Kit

PART #	ITEM	QTY.	DESCRIPTION
026-32301-000	4	1	Grille, Top L.H.
026-32302-000	5	1	Grille, Top R.H.
026-32303-000	6	3	Grille, Bottom
026-30609-003	7	3	Grille, YCA Units
021-13066-000	17	50	Clamp Tube 1/4 O.D.
021-17239-000	18	50	Screw, Tap Self Drill Hex
021-16161-000	19	26	Screw, Cap Hex 1/4-20
021-16128-000	20	26	Lock Washer TH INT 1/4
021-16151-000	21	26	Nut, Hex 1/4-20
021-16165-000	22	6	Washer PL 5/16 x 3/4
021-16136-000	23	55	Screw, Tap Cut 1/4-20
021-17515-000	24	11	Screw, Tap Cut 1/4-14 x 1
075-05643-000	50	1	Support, Grille Front
066-94648-000	51	4	Support, Grille Rear Vert
075-01670-000	52	1	Panel, Top Decor/Tamper
066-74664-000	53	1	Support, Louver
066-94667-000	54	1	Support, Louver
066-94666-000	55	2	Support, Louver
066-94663-000	56	2	Support, Louver
075-05641-000	58	2	Support, Top R.H. Grille
066-94669-000	59	1	Panel, Louver L.H. Bottom
066-94581-000	60	1	Panel, Louver L.H. Top
066-94671-000	61	1	Panel, Louver L.H. Top
066-94647-000	62	3	Support, Grille Rear, Top
075-05642-000	63	1	Support Top L.H. Grille
075-05645-000	64	1	Support Top L.H. Grille
075-05646-000	65	1	Support, Grille/Panel
075-05647-000	66	2	Support, Grille/Panel



Photo shows different unit with optional wire grilles installed

FIG. 33 – COMPLETED INSTALLATION

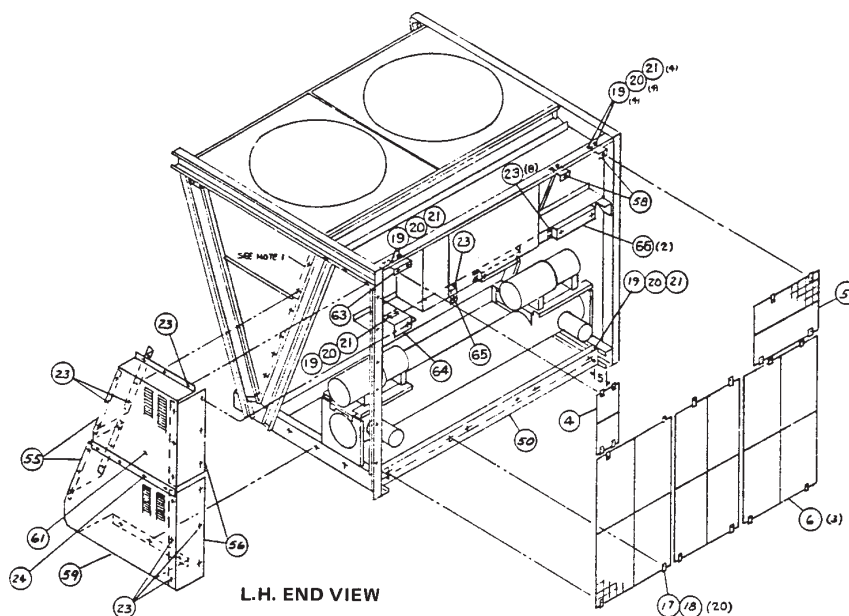


FIG. 34 – WIRE GRILLE INSTALLATION

NOTES:

1. REMOVE HEADER COVERS & DISCARD.
2. ATTACH ITEMS 50, 51, 58, 62, 64, 65 & 66 BEFORE ATTACHING GRILLES.
- 3.
- 4.
5. TRIM GRILLES TO SUIT WIRING, WATER CONNECTIONS ETC.
6. NOTCH OUT GRILLES AS REQUIRED WHEN HIGH AMBI. SUNSHIELD OPTION IS USED.

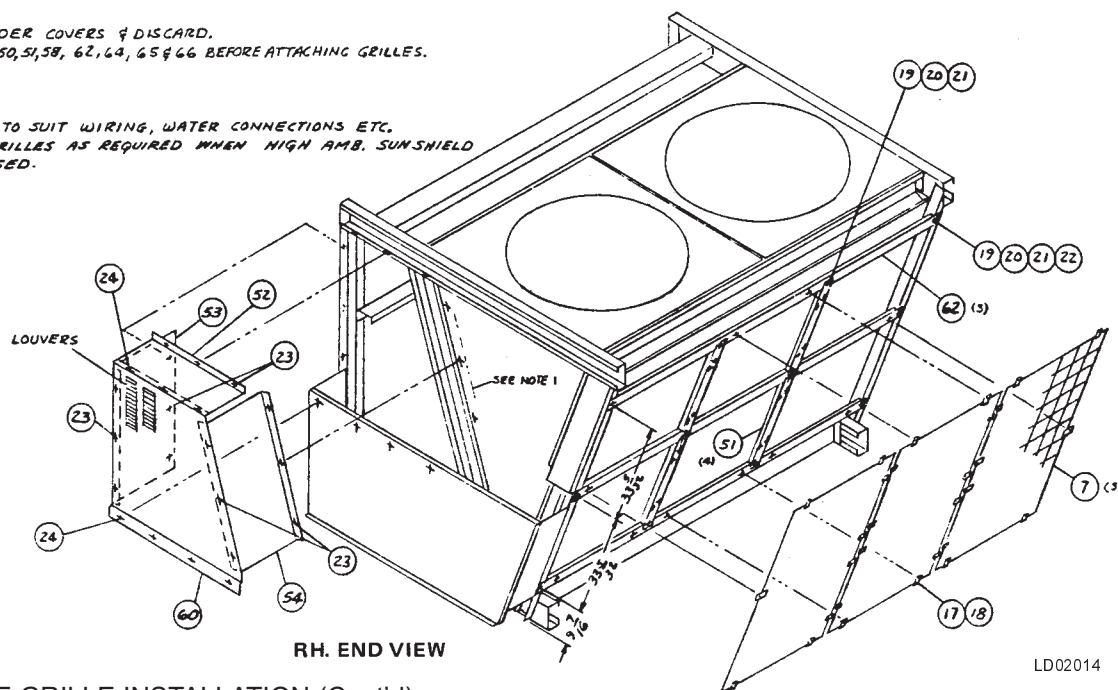


FIG. 34 – WIRE GRILLE INSTALLATION (Cont'd)

OPTIONAL DECORATIVE TAMPERPROOF ENCLOSURE (LOUVERED)

General

A louvered enclosure is available for the chiller for the prime purpose of deterring unauthorized access to components of the chiller.

Kit 475-05661-002 is the decorative / tamperproof enclosure which consists entirely of louvered sheet metal panels along with mounting hardware. This kit has a further purpose of presenting a pleasing appearance to the chiller when it is located in a highly visible area.

Installation

1. Refer to Fig. 35 and the associated parts list. Before starting installation, all of the items in the kit should be identified by comparing with Fig. 36.
2. All holes for mounting kit parts are provided in both the chiller frame and the added supports; therefore, it should be unnecessary to drill holes.
3. Installed the louvered panels using the proper hardware and supports. Refer to Fig. 36 and the Parts List for placement of the grilles / panels and the proper hardware required. Discard existing grilles to attach the louvered panels where necessary.
4. Notch grilles to suit water connection and wiring harnesses as needed.
5. If the High Ambient Sunshield Kit or Disconnect Option is installed, field adaption will be required where parts of the kits interfere. Touch up exposed metal parts to prevent rust.

Parts List

PART #	ITEM	QTY.	DESCRIPTION
021-16161-000	2	18	Screw, Cap Hex 1/4-20
021-16128-000	3	18	Lock Washer TH INT 1/4
021-16151-000	4	18	Nut, Hex 1/4-20
021-16165-000	5	6	Washer PL 5/16 x 3/4
021-16136-000	6	97	Screw, Tap Cut 1/4-20
021-17515-000	7	11	Screw, Tap Cut 1/4-20 x 1
075-05463-000	20	1	Support, Grille Front Bot.
066-94647-000	21	3	Support, Grille Rear Top
075-01700-000	22	6	Panel Louver
075-05660-000	23	1	Panel Louver
075-05659-000	24	1	Panel, Louver
075-05641-000	25	1	Support, Top R.H. Grille
075-05656-000	26	1	Panel, Louver
075-05657-000	27	1	Panel, Louver
075-05658-000	28	1	Panel, Louver
075-01671-000	29	2	Clip, Retainer
066-94664-000	30	1	Support, Louver
066-94667-000	31	1	Support, Louver
075-01655-000	32	1	Panel, Louver
075-01670-000	33	1	Panel, Top
066-94666-000	34	2	Support, Louver
066-94663-000	35	2	Support, Louver
075-01654-000	36	1	Panel, Louver
075-01656-000	37	1	Panel Louver
075-05642-000	38	1	Support, Top L.H. Grille
075-05645-000	39	1	Support, Top L.H. Grille
075-05646-000	40	2	Support, Grille
075-05647-000	41	2	Support, Grille

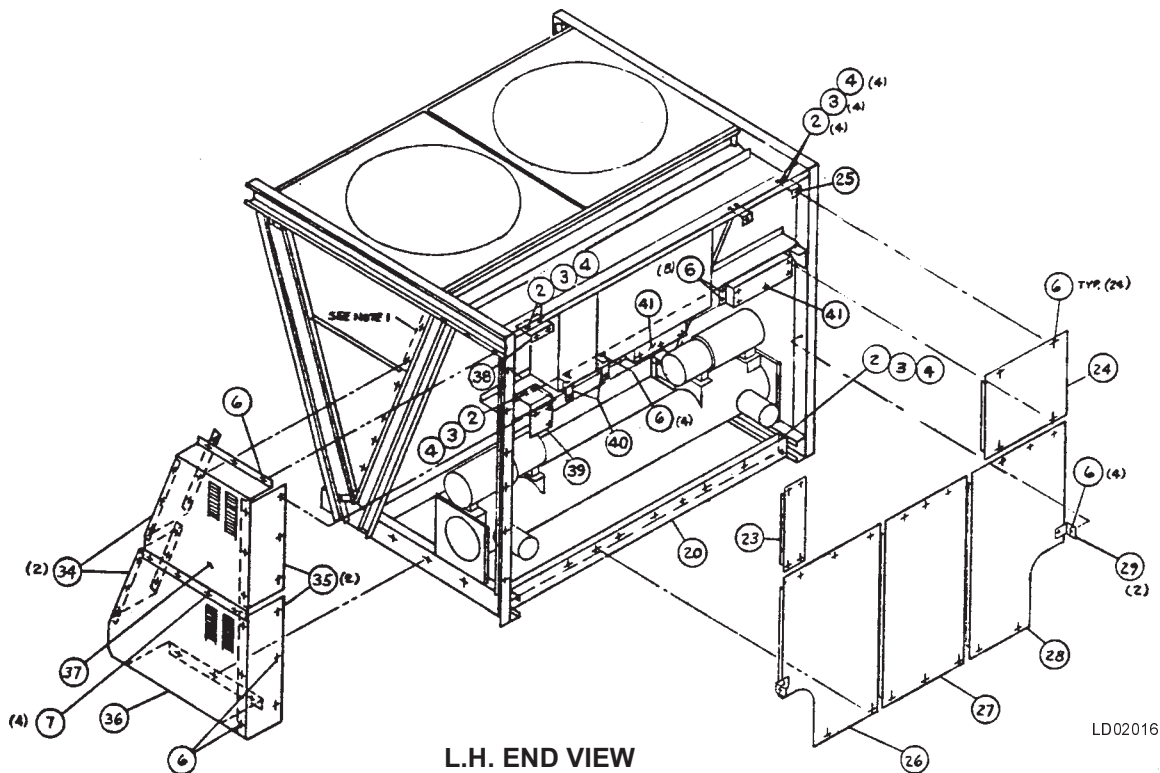
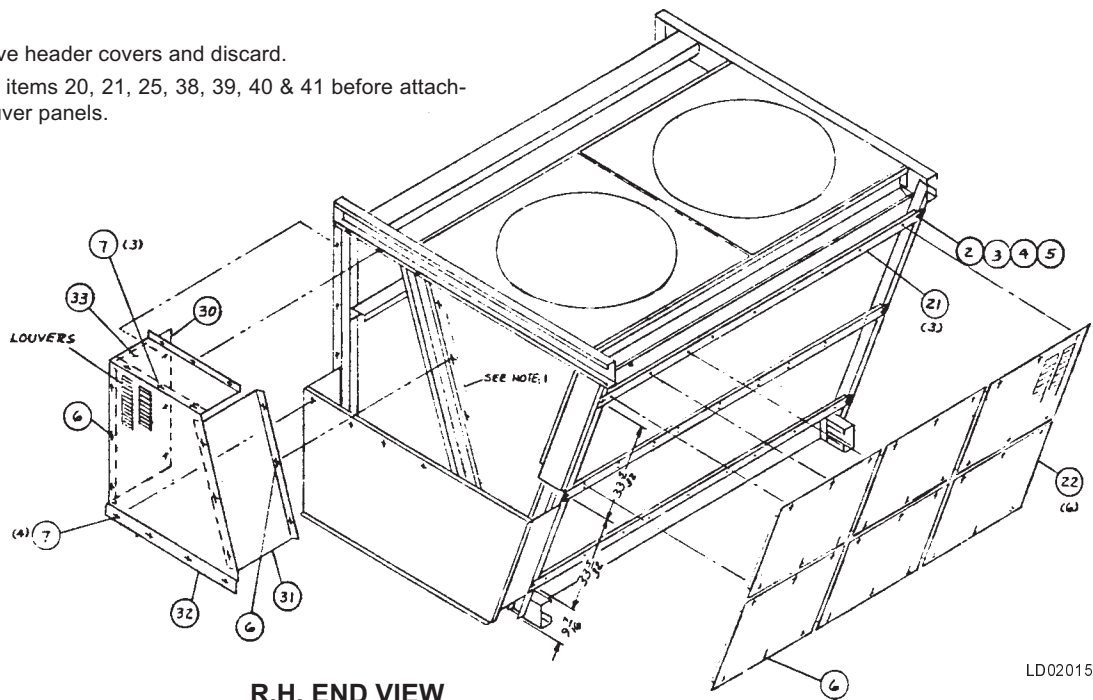


25246A

FIG. 35 – COMPLETED INSULATION

NOTES:

1. Remove header covers and discard.
2. Attach items 20, 21, 25, 38, 39, 40 & 41 before attaching louver panels.



BAS INTERFACE (REMOTE RESET OPTION)

The Remote Reset Option allows resetting of the water temperature setpoint using a 0-10 VDC input, a 4-20mA input, or a dry contact. The electronic circuitry in the option converts the signals mentioned, above into pulse width modulated (PWM) signals which the mi-

croprocessor can understand. Whenever an offset is called for, the change may be noted by the user by pressing the REMOTE RESET TEMP/RANGE key on the keypad. All refresh requirements normally associated with PWM inputs will be automatically taken care of by the electronics in the option.

It is important to note that the maximum offset, when

this option is installed, is 20°F. This is due to the electronics' limitation of maximum 11 sec. pulse. If a greater than 20°F offset is required, a user supplied PWM signal of up to 21 sec. is needed and the Remote Reset Option cannot be installed.

The Remote Reset Option P/N 471-01232-181 consists of a Remote Reset printed circuit board, a mounting bracket and associated wiring. Each of the 3 signal types will require individual jumpering of the printed circuit board. This will be discussed in the following text.

0-10 VDC

Jumpers JU2 and JU4 must be IN. All other jumpers should be OUT. Program the REMOTE TEMP SETPOINT RANGE (page 64) for 40°F which will allow a 20°F offset with an input of 10 VDC. The temperature will be offset linearly according to the voltage (0-10 VDC) applied.

The 0-10 VDC signal should be connected to the + and – terminals on the TB3 Terminal Block at the right of the Microprocessor Board. Be sure polarity is correct.

CAUTION: THE 0-10 VDC INPUT SIGNAL WIRING MUST NOT BE EARTH GROUNDED!

4-20mA

Jumpers JU3 and JU5 must be IN. All other jumpers should be OUT. Program the REMOTE TEMP SETPOINT RANGE (page 64) for 40°F which will allow a 20°F offset with an input of 20mA. There will be no offset with an input of 4mA. The temperature will be offset linearly according to the current (4-20mA) applied.

The 4-20mA input signal should be connected to the + and – terminals on the TB3 Terminal Block at the right of the Microprocessor Board. Be sure polarity is correct.

CAUTION: THE 4-20mA INPUT SIGNAL WIRING MUST NOT BE EARTH GROUNDED!

Dry Contact

A dry contact may also be used to offset temperature. This allows a single offset whenever the contact is closed. The offset is determined by the adjustment of the R11 potentiometer on the Remote Reset Board. Adjust the potentiometer as needed to obtain the desired offset.

Jumper JU1 must be IN. All other jumpers must be OUT. Program the REMOTE RESET TEMP SETPOINT RANGE (page 64) for 40°F which will allow the R11 pot to be adjusted for an offset of as much as 20°F when the contact is closed.

The dry contact should be connected directly to the P1-1 and P1-2 terminals on the Remote Reset Board (Fig. 36).

NOTE: The coil of the controls used for reset must be suppressed. Use YORK P/N 031-00808-000 suppressor.

NOTE: Remote Setpoint Reset will not operate when a Remote Control Center Option is connected to the micro panel. The Remote Control Center will always determine the setpoint.

CAUTION: J1 & TB1 wiring MUST be disconnected from the Remote Reset/BAS Board, if no signal (4-20mA or 0-10 VDC) is connected. Failure to do this will cause a setpoint offset of an undetermined amount.

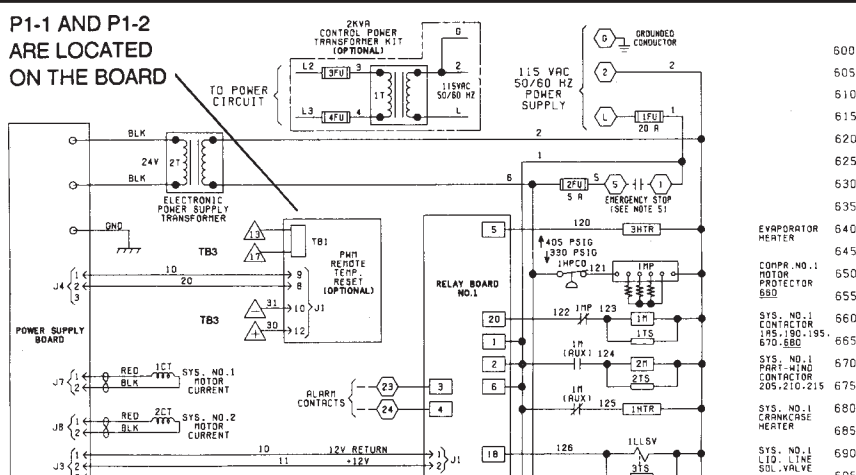


FIG. 36 – REMOTE RESET BOARD

TROUBLESHOOTING CHART

PROBLEM	CAUSE	SOLUTION
No display on panel Unit will not operate	1. No 115VAC to 2T. 2. No 24VAC to Power Supply Board. 3. 2T defective, no 24VAC output. 4. No +12V output from Power Supply Board	1. Checking wiring and fuses (1 FU and 2 FU). Check emergency stop contacts 5 to 1. 2. Check wiring 2T to Power Supply Board. 3. Replace 2T. 4. Replace Power Supply Board or isolate excessive load on the board.
<i>Contact YORK Service Before Replacing Circuit Boards!</i>		
"NO RUN PERM"	1. No flow. 2. Flow switch installed improperly. 3. Defective flow switch. 4. Remote cycling device open. 5. "System" switch in the OFF position	1. Check chilled liquid flow. 2. Check that flow switch is installed according to manufacturer's Instructions. 3. Replace flow switch. 4. Check cycling devices connected to terminals 13 & 14 of the TB3 Terminal Block. 5. Place switches to the ON position.
"MOTOR CURRENT" FAULT Motor Contactor may or may not Energize	CONTACTOR DOES NOT ENERGIZE 1. External high pressure switch tripped. 2. External motor protector tripped. 3. Defective relay output board.	1. Check external high pressure switch, fan operation, and discharge pressure stored in memory. Air flow from fans must be up. 2. Check for defective External motor protector, wiring and motor problems. Assure that motor tripped protector is not due to external high pressure switch. 3. Replace relay output board.
	CONTACTOR ENERGIZES 1. Improper system high voltage. 2. Defective contactor contacts and contactor. 3. Faulty high voltage wiring. 4. High motor current stored in memory. 5. Defective current transformer (CT).	1. Check system high voltage supply. 2. Check contacts and contactor. 3. Check wiring. 4. Loose calibration resistors in J9 (SYS 1) or J10 (SYS 2) of power supply board. 5. CT resistance 42-44 ohms.
<i>Contact YORK Service Before Replacing Circuit Boards or C.T.s!</i>		
"LOW OIL PRESS" FAULT	1. Low oil charge. 2. Too much refrigerant-in oil, particularly on start-up. 3. Liquid Line Solenoid Valve (LLSV) not operating. 4. Suction Press. Transducer or wiring defective. 5. Oil Press. Transducer or wiring defective.	1. Oil level should be visible in either sight glass at all times. Add YORK "C" oil if necessary. 2. Check crankcase oil heater operation. (350 Watt heater should be "ON" when unit is "OFF". Measure heater current. (Should be min. 2 amps.) 3. Check wiring and LLSV. 4. Compare display to a gauge (SYS OFF). Replace defective component. 5. Compare suction and oil gauges to display. Replace defective component.
"LOW SUCTION" FAULT	1. Improper Suction Pressure Cut-out adjustment. 2. Low refriger. charge. 3. Fouled filter drier. 4. Thermal expansion valve adjustment/failure. 5. Reduced flow of chilled liquid through cooler. 6. Defective suction press. transducer. 7. Fouled compressor suction strainer. 8. Faulty wiring to transducer.	1. Adjust per recommended settings and restart unit. 2. Repair leak/add refrigerant. 3. Change drier core. 4. Adjust compressor suction superheat to 11°F (6.1°C) or replace power element (or valve). 5. Check GPM (See OPERATING LIMITATIONS) Check operation of pump. Clean pump strainer, purge chilled liquid system of air. 6. Compare display to gauge. Replace transducer. 7. Remove and clean strainer. 8. Check wiring.

PROBLEM	CAUSE	SOLUTION																																														
“HIGH DSCH” Fault Cuts out on High Discharge Pressure as sensed by Microprocessor via high discharge pressure transducer. <i>NOTE: If external H.P. Cut-out Switch opens, a “Motor Current” Fault will result.</i>	1. Condenser fans not operating or rotating backwards. 2. Too much refrigerant. 3. Air in Refrigerant System. 4. Defective discharge pressure transducer. 5. Assure Programmable H.P. Cut-out is correctly set. 6. Assure OAT sensor is reading properly.	1. Check fans, fuses, and contactors. 2. Remove refrigerant. 3. Evacuate and recharge. 4. Replace discharge pressure transducer. 5. Adjust per recommended settings and restart unit. 6. Place a thermometer next to the sensor and compare reading to the display. Operation should not suffer if thermometer is +/- 10°F.																																														
“CHILLER FAULT: HIGH AMBIENT TEMP” Cuts out on high ambient temperature. (Max. = 130°F will re-start automatically if temperature drops below 128°F)	1. Temperature sensed incorrectly by thermistor. 2. Fans rotating backwards. 3. Air flow to unit restricted (or being re-circulated). 4. High ambient cut-out set too low.	1. Verify actual ambient temperature at probe +/-10°F with a thermometer placed next to the OAT sensor. 2. Air flow must be up. Correct fan rotation. 3. Check installation clearances. (See Page 9). 4. Reprogram cut-out.																																														
“CHILLER FAULT: LOW AMBIENT TEMP” Cuts out on low ambient temperature. (25°F min. for std. adjustable for low ambient unit) <i>NOTE: Operation below 25°F requires low ambient accessory.</i>	1. Temperature of outside air is below cut-out setting. 2. Temperature sensed incorrectly by thermistor. 3. Check low ambient temperature Cut-out setting on the display.	1. No problem exists. 2. Verify actual ambient temperature immediately at probe with thermometer. 3. Adjust if necessary. <i>NOTE: For occasional operation below 0°F set the cut-out at 0°F. The chiller is then allowed to operate regardless of temperature. A low ambient kit must be installed.</i>																																														
“CHILLER FAULT: LOW WATER TEMP” Low water temperature shutdown.	1. RWT Control ONLY: Control range is too small and does not match actual DT across evaporator under full load conditions. 2. Check LWT cut-out point on panel. 3. Defective LWT or RWT sensor. (Assure the sensor is properly installed in the bottom of the well with a generous amount of heat conductive compound.) <i>NOTE: It is not unusual to find up to a +/- 2°F difference between the display and a thermometer located in water piping.</i>	1. Flow is lower than design. Increase flow or increase the control range to match actual evaporator DT. 2. Adjust if necessary and restart unit. (See Page 36). 3. Check according to following table (use digital volt meter)* Replace if necessary. <table><tr><th>TEMP.</th><th>VOLTAGE (DC)</th></tr><tr><td>20.0°F</td><td>1.65</td></tr><tr><td>22.0°F</td><td>1.71</td></tr><tr><td>25.0°F</td><td>1.82</td></tr><tr><td>27.0°F</td><td>1.88</td></tr><tr><td>30.0°F</td><td>1.99</td></tr><tr><td>33.0°F</td><td>2.09</td></tr><tr><td>36.0°F</td><td>2.22</td></tr><tr><td>38.0°F</td><td>2.28</td></tr><tr><td>41.0°F</td><td>2.37</td></tr><tr><td>43.0°F</td><td>2.43</td></tr><tr><td>46.0°F</td><td>2.54</td></tr><tr><td>48.0°F</td><td>2.60</td></tr><tr><td>50.0°F</td><td>2.67</td></tr><tr><td>53.0°F</td><td>2.77</td></tr><tr><td>55.0°F</td><td>2.83</td></tr><tr><td>57.0°F</td><td>2.89</td></tr><tr><td>59.0°F</td><td>2.95</td></tr><tr><td>61.0°F</td><td>3.02</td></tr><tr><td>63.0°F</td><td>3.08</td></tr><tr><td>65.0°F</td><td>3.14</td></tr><tr><td>67.0°F</td><td>3.20</td></tr><tr><td>70.0°F</td><td>3.28</td></tr></table> * Check voltage on Microprocessor Board. LWT: J11-7 to J11-1 RWT: J11-8 to J11-1	TEMP.	VOLTAGE (DC)	20.0°F	1.65	22.0°F	1.71	25.0°F	1.82	27.0°F	1.88	30.0°F	1.99	33.0°F	2.09	36.0°F	2.22	38.0°F	2.28	41.0°F	2.37	43.0°F	2.43	46.0°F	2.54	48.0°F	2.60	50.0°F	2.67	53.0°F	2.77	55.0°F	2.83	57.0°F	2.89	59.0°F	2.95	61.0°F	3.02	63.0°F	3.08	65.0°F	3.14	67.0°F	3.20	70.0°F	3.28
TEMP.	VOLTAGE (DC)																																															
20.0°F	1.65																																															
22.0°F	1.71																																															
25.0°F	1.82																																															
27.0°F	1.88																																															
30.0°F	1.99																																															
33.0°F	2.09																																															
36.0°F	2.22																																															
38.0°F	2.28																																															
41.0°F	2.37																																															
43.0°F	2.43																																															
46.0°F	2.54																																															
48.0°F	2.60																																															
50.0°F	2.67																																															
53.0°F	2.77																																															
55.0°F	2.83																																															
57.0°F	2.89																																															
59.0°F	2.95																																															
61.0°F	3.02																																															
63.0°F	3.08																																															
65.0°F	3.14																																															
67.0°F	3.20																																															
70.0°F	3.28																																															

PROBLEM	CAUSE	SOLUTION
Low Compressor Oil Level (Particularly on start-up)	1. Low oil charge. 2. Excessive flood back of liquid refrigerant.	1. Oil level should be visible in either sight glass at all times. Add YORK "C" oil if necessary. 2. Adjust Thermal Expansion Valve (TXV) or replace power element. Check TXV bulb location. Should be located on suction line at least 8"-10" from nearest elbow. Bulb should be at 4 o'clock or 8 o'clock position, have good contact with suction line and be well insulated.
Crankcase Heater won't Energize (Should energize anytime unit is "OFF") (Min. current draw = 2 amps)	1. Open in 115 VAC wiring to heater. 2. Defective heater. 3. Auxilliary contacts of compressor contactor defective.	1. Check wiring. 2. Replace heater. 3. Replace contactor.
Compressor won't load (Solenoid valve de-energizes to load compressor)	1. Suction pressure > programmed unload point or operating limitations have been exceeded. 2. Discharge pressure > programmed unload point or operating limitations have been exceeded. 3. Demand not great enough. 4. Defective loading solenoid. 5. Faulty wiring to loading solenoid. 6. Defective water temperature sensor. 7. Defective evaporator or optional discharge transducer.	1. Excessive load. Check OPERATING LIMITATIONS. Check programmed unloading point. 2. Check OPERATING LIMITATIONS. Check programmed unloading point. 3. OK. Become familiar with control operation. 4. Replace compressor loading solenoid. 5. Check wiring. 6. Compare sensor with a thermometer. Variation of sensor vs thermometer of +/- 2°F is not unusual. Replace if necessary. 7. Replace transducer after verifying with a gauge.
Lack of Cooling Effect	1. Fouled evaporator surface. 2. Faulty compressor suction and/or discharge valves.	1. Contact the local YORK service representative. 2. Contact the local YORK service representative.

TEMPERATURE CONVERSION TABLES

The numbers in boldface type in the center column refer to the temperature, either in Centigrade or Fahrenheit, which is to be converted to the other scale. Converting Fahrenheit to Centigrade the equivalent temperature will be found in the left column. If converting Centigrade to Fahrenheit, the equivalent temperature will be found in the column on the right.

TEMPERATURE			TEMPERATURE			TEMPERATURE			TEMPERATURE		
°C	°C or °F	°F	°C	°C or °F	°F	°C	°C or °F	°F	°C	°C or °F	°F
-40.0	-40	-40.0	-6.7	+20	+68.0	+26.7	+80	+176.0	+60.0	+140	+284.0
-39.4	-39	-38.2	-6.1	+21	+69.8	+27.2	+81	+177.8	+60.6	+141	+285.8
-38.9	-38	-36.4	-5.5	+22	+71.6	+27.8	+82	+179.6	+61.1	+142	+287.6
-38.3	-37	-34.6	-5.0	+23	+73.4	+28.3	+83	+181.4	+61.7	+143	+289.4
-37.8	-36	-32.8	-4.4	+24	+75.2	+28.9	+84	+183.2	+62.2	+144	+291.2
-37.2	-35	-31.0	-3.9	+25	+77.0	+29.4	+85	+185.0	+62.8	+145	+293.0
-36.7	-34	-29.2	-3.3	+26	+78.8	+30.0	+86	+186.8	+63.3	+146	+294.8
-36.1	-33	-27.4	-2.8	+27	+80.6	+30.6	+87	+188.6	+63.9	+147	+296.6
-35.6	-32	-25.6	-2.2	+28	+82.4	+31.1	+88	+190.4	+64.4	+148	+298.4
-35.0	-31	-23.8	-1.7	+29	+84.2	+31.7	+89	+192.2	+65.0	+149	+300.2
-34.4	-30	-22.0	-1.1	+30	+86.0	+32.2	+90	+194.0	+65.6	+150	+302.0
-33.9	-29	-20.2	-0.6	+31	+87.8	+32.8	+91	+195.8	+66.1	+151	+303.8
-33.3	-28	-18.4	0.0	+32	+89.6	+33.3	+92	+197.6	+66.7	+152	+305.6
-32.8	-27	-16.6	+6	+33	+91.4	+33.9	+93	+199.4	+67.2	+153	+307.4
-32.2	-26	-14.8	+1.1	+34	+93.2	+34.4	+94	+201.2	+67.8	+154	+309.2
-31.7	-25	-13.0	+1.7	+35	+95.0	+35.0	+95	+203.0	+68.3	+155	+311.0
-31.1	-24	-11.2	+2.2	+36	+96.8	+35.6	+96	+204.8	+68.9	+156	+312.8
-30.6	-23	-9.4	+2.8	+37	+98.6	+36.1	+97	+206.6	+69.4	+157	+314.6
-30.0	-22	-7.6	+3.3	+38	+100.4	+36.7	+98	+208.4	+70.0	+158	+316.4
-29.4	-21	-5.8	+3.9	+39	+102.2	+37.2	+99	+210.2	+70.6	+159	+318.2
-28.9	-20	-4.0	+4.4	+40	+104.0	+37.8	+100	+212.0	+71.1	+160	+320.0
-28.3	-19	-2.2	+5.0	+41	+105.8	+38.3	+101	+213.8	+71.7	+161	+321.8
-27.8	-18	-0.4	+5.5	+42	+107.6	+38.9	+102	+215.6	+72.2	+162	+323.6
-27.2	-17	+1.4	+6.1	+43	+109.4	+39.4	+103	+217.4	+72.8	+163	+325.4
-26.7	-16	+3.2	+6.7	+44	+111.2	+40.0	+104	+219.2	+73.3	+164	+327.2
-26.1	-15	+5.0	+7.2	+45	+113.0	+40.6	+105	+221.0	+73.9	+165	+329.0
-25.6	-14	+6.8	+7.8	+46	+114.8	+41.1	+106	+222.8	+74.4	+166	+330.8
-25.0	-13	+8.6	+8.3	+47	+116.6	+41.7	+107	+224.6	+75.0	+167	+332.6
-24.4	-12	+10.4	+8.9	+48	+118.4	+42.2	+108	+226.4	+75.6	+168	+334.4
-23.9	-11	+12.2	+9.4	+49	+120.2	+42.8	+109	+228.2	+76.1	+169	+336.2
-23.3	-10	+14.0	+10.0	+50	+122.0	+43.3	+110	+230.0	+76.7	+170	+338.0
-22.8	-9	+15.8	+10.6	+51	+123.8	+43.9	+111	+231.8	+77.2	+171	+339.8
-22.2	-8	+17.6	+11.1	+52	+125.6	+44.4	+112	+233.6	+77.8	+172	+341.6
-21.7	-7	+19.4	+11.7	+53	+127.4	+45.0	+113	+235.4	+78.3	+173	+343.4
-21.1	-6	+21.2	+12.2	+54	+129.2	+45.6	+114	+237.2	+78.9	+174	+345.2
-20.6	-5	+23.0	+12.8	+55	+131.0	+46.1	+115	+239.0	+79.4	+175	+347.0
-20.0	-4	+24.8	+13.3	+56	+132.8	+46.7	+116	+240.8	+80.0	+176	+348.8
-19.4	-3	+26.6	+13.9	+57	+134.6	+47.2	+117	+242.6	+80.6	+177	+350.6
-18.9	-2	+28.4	+14.4	+58	+136.4	+47.8	+118	+244.4	+81.1	+178	+352.4
-18.3	-1	+30.2	+15.0	+59	+138.2	+48.3	+119	+246.2	+81.7	+179	+354.2
-17.8	0	+32.0	+15.6	+60	+140.0	+48.9	+120	+248.0	+82.2	+180	+356.0
-17.2	+1	+33.8	+16.1	+61	+141.8	+49.4	+121	+249.8	+82.8	+181	+357.8
-16.7	+2	+35.6	+16.7	+62	+143.6	+50.0	+122	+251.6	+83.3	+182	+359.6
-16.1	+3	+37.4	+17.2	+63	+145.4	+50.6	+123	+253.4	+83.9	+183	+361.4
-15.6	+4	+39.2	+17.8	+64	+147.2	+51.1	+124	+255.2	+84.4	+184	+363.2
-15.0	+5	+41.0	+18.3	+65	+149.0	+51.7	+125	+257.0	+85.0	+185	+365.0
-14.4	+6	+42.8	+18.9	+66	+150.8	+52.2	+126	+258.8	+85.6	+186	+366.8
-13.9	+7	+44.6	+19.4	+67	+152.6	+52.8	+127	+260.6	+86.1	+187	+368.6
-13.3	+8	+46.4	+20.0	+68	+154.4	+53.3	+128	+262.4	+86.7	+188	+370.4
-12.8	+9	+48.2	+20.6	+69	+156.2	+53.9	+129	+264.2	+87.2	+189	+372.2
-12.2	+10	+50.0	+21.1	+70	+158.0	+54.4	+130	+266.0	+87.8	+190	+374.0
-11.7	+11	+51.8	+21.7	+71	+159.8	+55.0	+131	+267.8	+88.3	+191	+375.8
-11.1	+12	+53.6	+22.2	+72	+161.6	+55.6	+132	+269.6	+88.9	+192	+377.6
-10.6	+13	+55.4	+22.8	+73	+163.4	+56.1	+133	+271.4	+89.4	+193	+379.4
-10.0	+14	+57.2	+23.3	+74	+165.2	+56.7	+134	+273.2	+90.0	+194	+381.2
-9.4	+15	+59.0	+23.9	+75	+167.0	+57.2	+135	+275.0	+90.6	+195	+383.0
-8.9	+16	+60.8	+24.4	+76	+168.8	+57.8	+136	+276.8	+91.1	+196	+384.8
-8.3	+17	+62.6	+25.0	+77	+170.6	+58.3	+137	+278.6	+91.7	+197	+386.6
-7.8	+18	+64.4	+25.6	+78	+172.4	+58.9	+138	+280.4	+92.2	+198	+388.4
-7.2	+19	+66.2	+26.1	+79	+174.2	+59.4	+139	+282.2	+92.8	+199	+390.2

