M 116

Operation and Maintenance Manuals
Renovate Chapels
H-116 & TC-601
N62470-85-C-6354
R & W Construction Co.
620 Richlands Hwy.
Jacksonville, NC 28540

R & W CONSTRUCTION COMPANY

Welding & Fabrication — Certified Pipe & Structural Steel

620 Richlands Highway — Jacksonville, North Carolina 28540

Russell Pierce
455-1830

Wayne Pierce
455-1830

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R & W CONSTRUCTION COMPANY

Welding & Fabrication — Certified Pipe & Structural Steel

620 Richlands Highway — Jacksonville, North Carolina 28540

Russell Pierce
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Local Supplies List

Air Handling Units

The Trane Co.
5214 Western Blvd.
Raleigh, NC 27606

Pumps

James M. Pleasants
PO Box 18704
Raleigh, NC 27619
PH. (919) 787-7692

Temperature Controls

Triangle Automated Controls
2716 Discovery Drive
Raleigh, NC 27604
PH. (919) 878-8015

TAB PLACEMENT HERE

DESCRIPTION:

Air Handling Units

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TRANE

BTC-M-4
22-5312-1

OPERATION/MAINTENANCE GUIDE

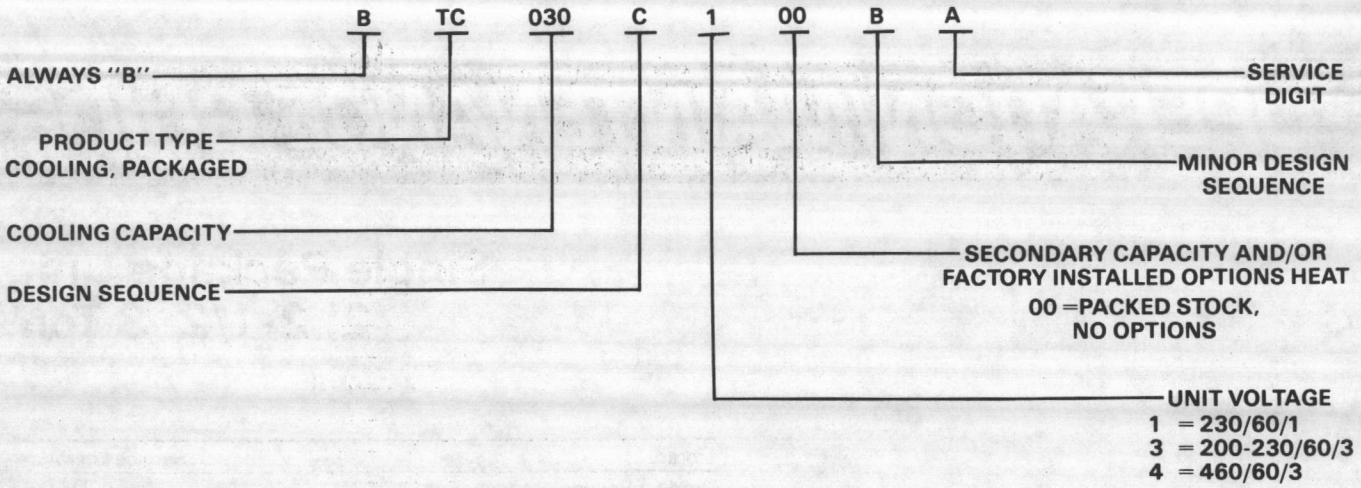
Single Package Unit
2, 2-1/2, 3 Ton

Models:
BTC024C100B
BTC030C100B
BTC036C100B,C300B,C400B

Library	Service Literature
Product Section	Unitary
Product	Rooftop Air Conditioning
Model	BTC
Literature Type	Operation/Maintenance
Sequence	4
Date	August 1985
File No.	SV-UN-RT-BTC-M-4 885
Supersedes	

Since The Trane Company has a policy of continuous product improvement, it reserves the right to change specifications and design without notice. The installation and servicing of the equipment referred to in this booklet should be done by qualified, experienced technicians.

MODEL NOMENCLATURE



Operation

Unit operation is controlled by the remote room thermostat. Once the thermostat is placed in the "Cool" position, unit operation is automatic.

A fan switch on the thermostat also provides for continuous operation of the evaporator fan if desired. This is the "On" position. With the fan switch in the "Auto" position, the fan will operate with the cooling cycle.

COOLING

On a call for cooling the compressor contactor and evaporator fan contactor are energized. The contacts of the compressor contactor close and bring on the compressor and the condenser fan motor. At the same time the evaporator fan contactor closes its contacts to start the evaporator fan.

When the thermostat determines that further cooling is not required the contactors are de-energized.

SHORT DURATION SHUTDOWN

To shut down the unit for a brief period of time, turn the thermostat system switch to "Off" and place the fan switch in the "Auto" position. Leave the system disconnect switch closed to keep the compressor crankcase heater energized.

HEATING

Accessory electric heaters installed with this equipment would operate off the heating contact of a heating/cooling thermostat. A call for heat will energize a set of sequencers which are timed to close the electrical circuit to each heater at approximately 18 second intervals. However there is an initial 35 seconds before the first contact of each sequence closes. This circuit will not close unless the indoor blower relay has closed. Each heater is protected both by a temperature limiting device and separate fuses in each heater bank.

This control system eliminates the possibility of all heaters being energized at the same time and therefore reduces the high initial current draw.

Maintenance

Perform the following inspection and service routine at the beginning of each COOLING SEASON:

1. Clean the condenser coil by hosing with cold water. Do not use hot water. This could cause excessive coil pressures.

2. Remove any accumulation of dust and dirt from the unit casing.

3. Clean or replace the air filters.

4. Inspect the control panel wiring to make sure connections are tight and insulation is intact.

5. Inspect the condensate drain pan and condensate piping to make sure they are clear and will carry away all water.

MONTHLY INSPECTIONS

It is recommended that the following inspections be performed once a month.

1. Clean or replace the air filters.

2. Inspect and clean, if necessary, the condensate drain pan and drain connections.

3. Inspect the condenser coil for foreign material. If dirty, clean with a stream of cold water, an air jet or a vacuum cleaner. DO NOT use hot water or steam which can cause high pressures within the refrigerant system.

MAINTENANCE PRECAUTION

During certain routine maintenance and unit servicing procedures, it will be necessary to open the unit electrical disconnect switch. When this switch is opened, power to the compressor crankcase heater is interrupted. Before operating the unit on a COOLING CYCLE and if the disconnect switch HAS BEEN OPEN FOR MORE THAN TWO HOURS, do the following as a safeguard against damaging the compressor bearings:

1. Set the thermostat system switch at "Off."

2. Close the unit disconnect switch.

3. Wait 8 hours before resetting the thermostat system switch to "COOL" and operating the unit.

SAFETY CONTROLS

Internal overload protectors are provided on the condenser and evaporator motors.

All units are fully protected against the following abnormal operating conditions:

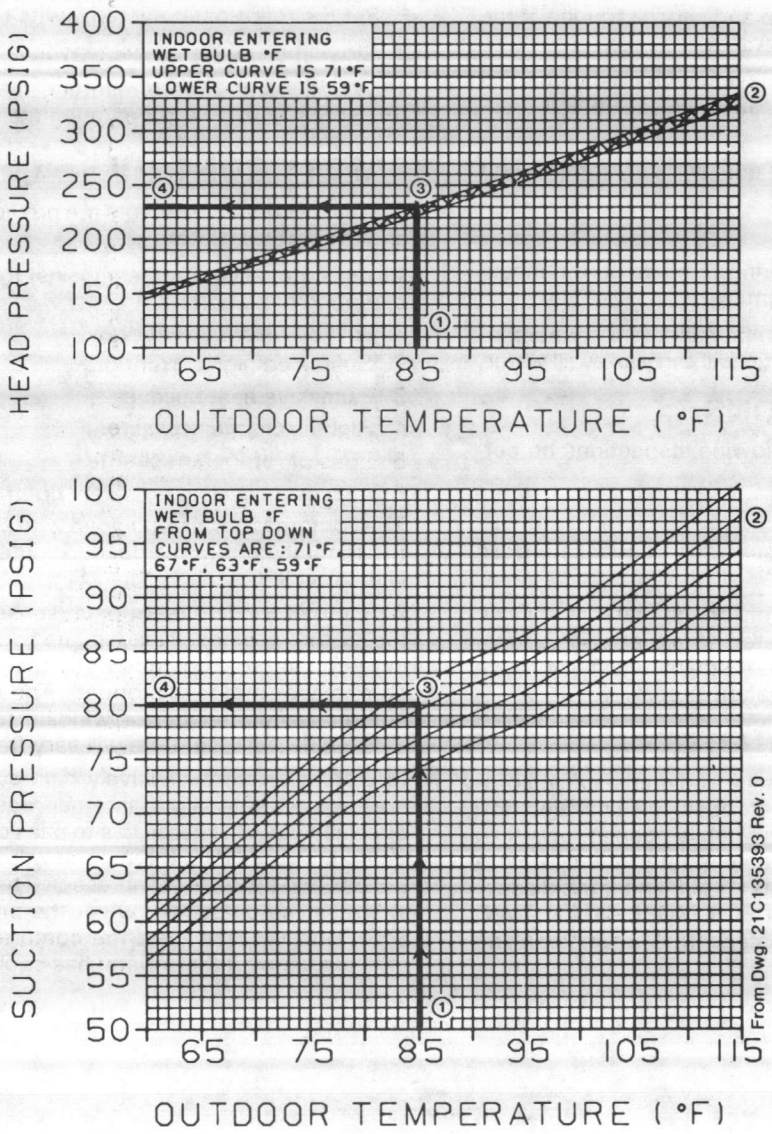
1. Locked rotor current draw.
2. Sustained high current draw.
3. Excessive heat buildup.
4. High discharge pressure.
5. Loss of refrigerant charge.
6. Excessive cycling on safety controls.

The compressors are equipped with a combination winding thermostat/current overload. An internal pressure relief is also provided.

An internal winding thermostat senses the temperature of the motor windings. If inadequate cooling causes the winding temperature to exceed this thermostat's setting, the compressor motor is stopped. The thermostat will reset automatically after motor winding temperature falls to a safe level. The reset time will vary from 15 to 45 minutes.

Operating on an excessively high suction and discharge pressure differential, an internal pressure relief valve will open allowing discharge gas to pass over the winding thermostat. The winding thermostat will sense the presence of hot gas and stop the compressor. The pressure relief valve will reset automatically when the pressure differential is again normal. However, the compressor will not restart until the winding thermostat has cooled sufficiently.

PRESSURE CURVE — BTC024C-B

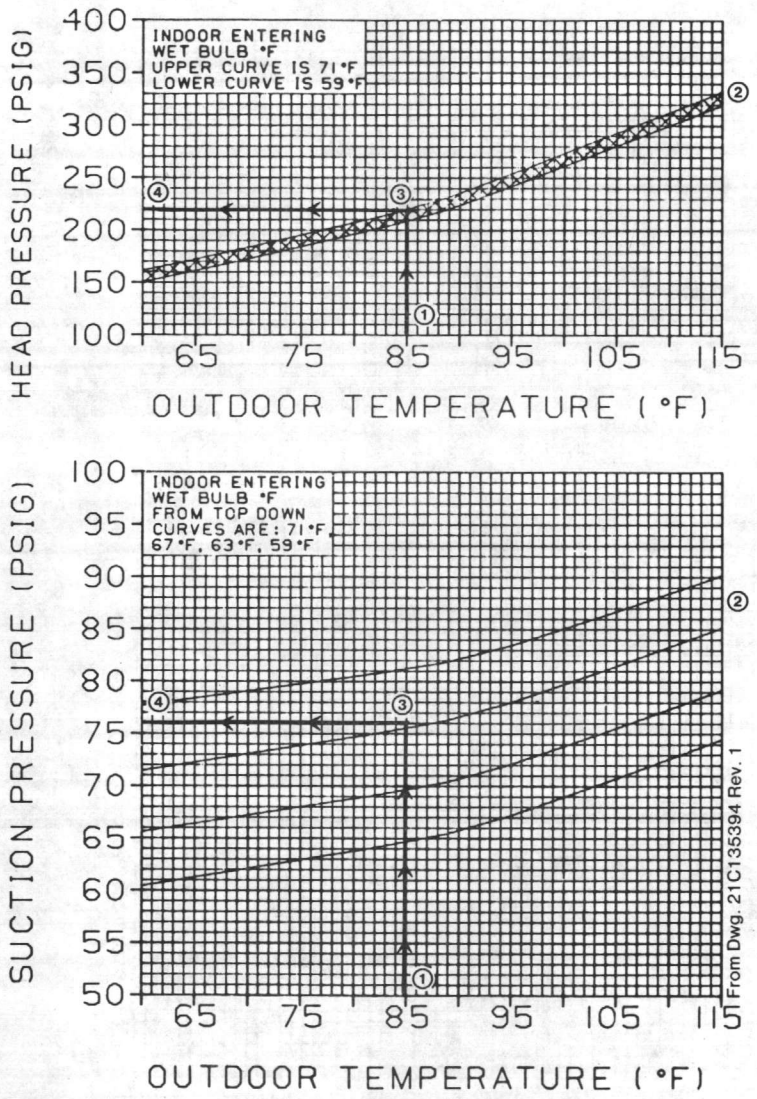


COOLING PERFORMANCE TO BE CHECKED WHEN OUTDOOR TEMPERATURE IS ABOVE 55°F.
AFTER OPERATING PRESSURES HAVE STABILIZED: MEASURE INDOOR WET BULB TEMP. — OUTDOOR TEMP. — HEAD AND SUCTION PRESSURES.
LOCATE OUTDOOR TEMP. ① LOCATE INDOOR WET BULB ② FIND INTERSECTION OF OD TEMP. & ID W.B. ③ READ HEAD OR SUCTION PRESSURE IN LEFT-HAND COLUMN ④ (SELECT PROPER INDOOR CFM)

ACTUAL HEAD PRESSURE SHOULD BE ± 10 PSIG OF CHART
SUCTION PRESSURE SHOULD BE ± 3 PSIG OF CHART

EXAMPLE: ① OUTDOOR TEMP. 85°F., ② INDOOR WET BULB 67°F.,
③ HEAD PRESSURE @ 800 CFM = 230 PSIG ④
③ SUCTION PRESSURE @ 800 CFM = 80 PSIG ④

PRESSURE CURVE — BTC030C-B



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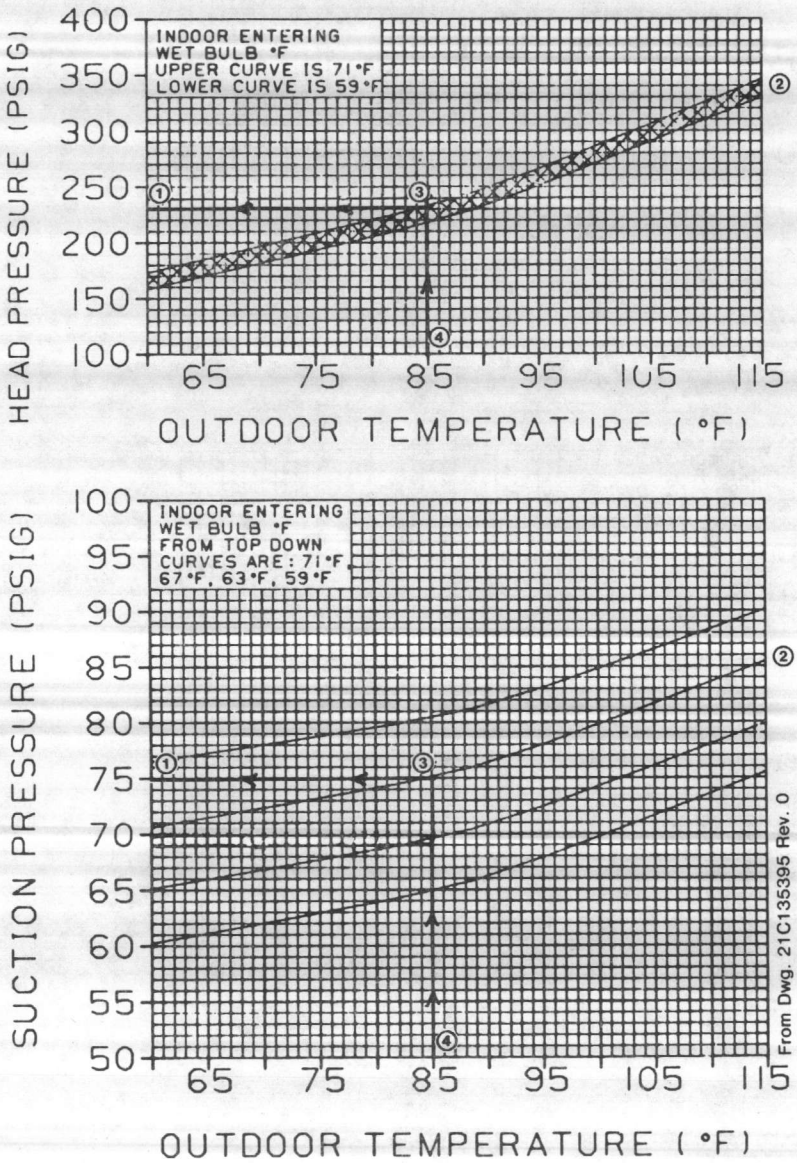
ACTUAL HEAD PRESSURE SHOULD BE ± 10 PSIG OF CHART
SUCTION PRESSURE SHOULD BE ± 3 PSIG OF CHART

EXAMPLE: ① OUTDOOR TEMP. 85°F., ② INDOOR WET BULB 67°F.,
③ HEAD PRESSURE @ 1000 CFM = 220 PSIG ④
③ SUCTION PRESSURE @ 1000 CFM = 76 PSIG ④

PRESSURE CURVE — BTC036C-B



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ACTUAL HEAD PRESSURE SHOULD BE ± 10 PSIG OF CHART
SUCTION PRESSURE SHOULD BE ± 3 PSIG OF CHART

EXAMPLE: ① OUTDOOR TEMP. 85°F., ② INDOOR WET BULB 67°F.,
③ HEAD PRESSURE @ 1200 CFM = 230 PSIG ④
③ SUCTION PRESSURE @ 1200 CFM = 75 PSIG ④

TROUBLESHOOTING CHART — WHAT TO CHECK

SYSTEM FAULTS	HIGH VOLTAGE POWER SUPPLY	LOW VOLTAGE WIRING	COMPR. IOL	RUN CAPACITOR	START CAPACITOR	START RELAY	CONTACTOR CONTACTS	CONTROL TRANSFORMER	LOW VOLTAGE WIRING	CONTACTOR COIL	LOW VOLTAGE FUSE	STUCK COMPRESSOR	INEFFICIENT COMPRESSOR	REFRIGERANT UNDERCHARGE	REFRIGERANT OVERCHARGE	EXCESSIVE EVAP. LOAD	NONCONDENSABLES	RESTRICTED O.D. AIRFLOW	O.D. AIR RECIRCULATION	TXV STUCK OPEN	SUPERHEAT	RESTRICTED I.D. AIRFLOW	REF. CIRCUIT RESTRICTIONS
REFRIGERANT CIRCUIT																							
Liquid Pressure Too High																P		S	P	S			S
Liquid Pressure Too Low														S	P						S	S	S
Suction Pressure Too High														S		P	P				S	P	
Suction Pressure Too Low															S							S	P	S
Liquid Refrig. Floodback TXV System																					S	S	
Liquid Refrig. Floodback Capillary Tube System																P			S	S		S	P
I.D. Coil Frosting															P								P	S
Compressor Runs Inadequate or No Cooling														S	P		P	S				S	P	S
ELECTRICAL																								
Compressor & O.D. Fan Do Not Start	P	P						S	P	P	P													
Compressor Will Not Start But O.D. Fan Runs		P	S	P	P	P						S												
O.D. Fan Won't Start		P		P																				
Compressor Hums But Won't Start		P		P	P	P	S					S												
Compressor Cycles on IOL		P	S	P	P	P	S					P	S	P	S	S		S			S		S
I.D. Blower Won't Start	P	S						S	P		P													

P Primary Causes **S Secondary Causes**

The Trane Company
Light Commercial Unitary Division
Guthrie Highway
Clarksville, TN 37040

Dwg. No. 21A722524 P01
P.I.

TRANE

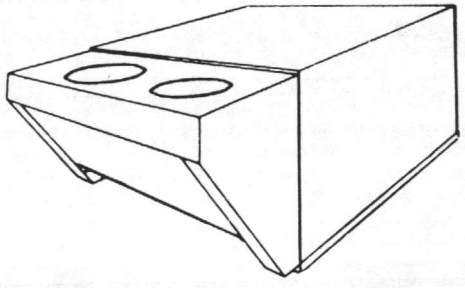
BTC-M-1C

OPERATION/MAINTENANCE GUIDE

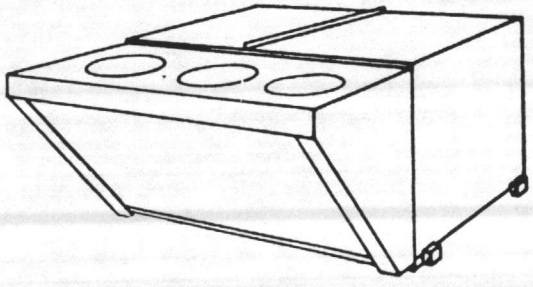
Electric/Electric Rooftop

Library	Service Literature
Product Section	Unitary
Product	Rooftop - Lt. Comm. Single-Zone
Model	BTC
Literature Type	Oper. - Main.
Sequence	1C
Date	September 1986
File No.	SV-UN-RT-BTC-M-1C 9/86
Supersedes	BTC-M-1B 5/86

Midrange Single-Zone Rooftop Air Conditioners



BTC 100



BTC 130, 170 and 200

Models: BTC 100G thru 200G

22-5301-1
4th Printing 1986

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Model Number Description

Trane products are identified by a multiple-character model number that precisely identifies a particular type of unit. An explanation of this multiple-character number is shown below. It will enable the owner or Service Engineer to define operation, components, and applicable accessories for a specific unit.

Model Number:	**B**	**TC**	**130**	**_**	**3**	**__**	**A**	**A**			
Digit Number:	1	2,3	4,5,6	7	8	9,10	11	12			

Digit 1
Always "B"

Digits 2,3
Product Type
TC = Cooling, Packaged

Digits 4,5,6
Cooling Capacity (MBH)
100 MBH = 8.5 Tons
130 MBH = 11 Tons
170 MBH = 14.5 Tons
200 MBH = 17 Tons

Digit 7
Major Design Sequence

Digit 8
Electrical Characteristics
1 = 200-230/60/1
3 = 200-230/60/3
4 = 460/60/3
W = 575/60/3

Digits 9,10
Secondary Capacity And/Or
Factory Installed Options Heat
LO = Low Heat (Gas or Elect.), No Factory Installed Options
HO = High Heat, No Factory-Installed Economizer
HA = High Heat, Factory-Installed Economizer

Digit 11
Minor Design Sequence

Digit 12
Service Digit

Operation

Note: "Warnings and "Cautions" appear at appropriate places in this instruction manual. Your personal safety and the proper operation of this machine require that you follow them carefully. The Trane Company assumes no liability for installations or servicing performed by unqualified personnel.

Literature Change History

BTC-M-1A (December 1985)
Revised manual to incorporate new filter sizes.

BTC-M-1B (May 1986)
Revised manual to incorporate new condenser coil, compressors (BTC130), new evaporator coil, and evaporator motor (BTC100).

BTC-M-1C (September 1986)
Revised to incorporate design changes.

Operation

General

Operation of unit cooling cycles is governed by the position of the system switch on the room thermostat. Once the system switch is placed in the COOL position, unit operation is automatic. Notice that the BTC 100 units provide a single stage of cooling, while BTC 130, 170, and 200 units supply two stages of cooling.

A fan switch on the thermostat can be placed in either ON or AUTO. Fan operation is continuous with the switch set at ON; with the switch in AUTO, operation of the evaporator/furnace fan coincides with unit heating or cooling functions.

Cooling Mode
BTC 100 Units

With the room thermostat system switch positioned at COOL and the fan switch adjusted to AUTO, the compressor contactor energizes on a call for cooling. When the contacts of the compressor contactor close, operation of the compressor begins. The evaporator fan contactor also energizes on a call for cooling and initiates evaporator fan operation.

Note: For units with 11th and 12th digits in model number of AA or BA (Example: BTC100G300AA)

With the thermostat fan switch in the ON position, the evaporator fan will run automatically, regardless of compressor or condenser fan operation. BTC 100 units are equipped with two condenser fans, and the operation of these fans is controlled by a fan limit sensor (FL). See Table 1 for sensor cut-in and cut-out settings. As long as the outdoor temperature is above 70 F, both condenser fans will operate. Should the outdoor temperature fall below 65 F, only one condenser fan will operate.

Table 1
Control Setting

Model	Control	Cut-In Point	Cut-Out Point
BTC 100	Low Pressure	20 ± 5 psig	5 ± 5 psig
	High Pressure	345 ± 10 psig	425 ± 10 psig
	Condenser Fan Limit Sensor (FL)	70 F	65 F
BTC 130 thru 200	Low Pressure	20 ± 5 psig	5 ± 5 psig
	High Pressure	345 ± 10 psig	425 ± 10 psig
	Condenser Fan Limit Sensors		
	FL 1	65 F	60 F
	FL 2	75 F	70 F

Note: For units with 11th and 12th digits in model number of BB, CA or DA.

With the thermostat fan switch in the ON position, the evaporator fan will run automatically, regardless of compressor or condenser fan operation. BTC 100 units are equipped with two condenser fans, and the operation of these fans is controlled by a fan limit sensor (FL). See Table 2 for sensor cut-in and cut-out settings. As long as the outdoor temperature is above 65 F, both condenser fans will operate. Should the outdoor temperature fall below 55 F, only one condenser fan will operate.

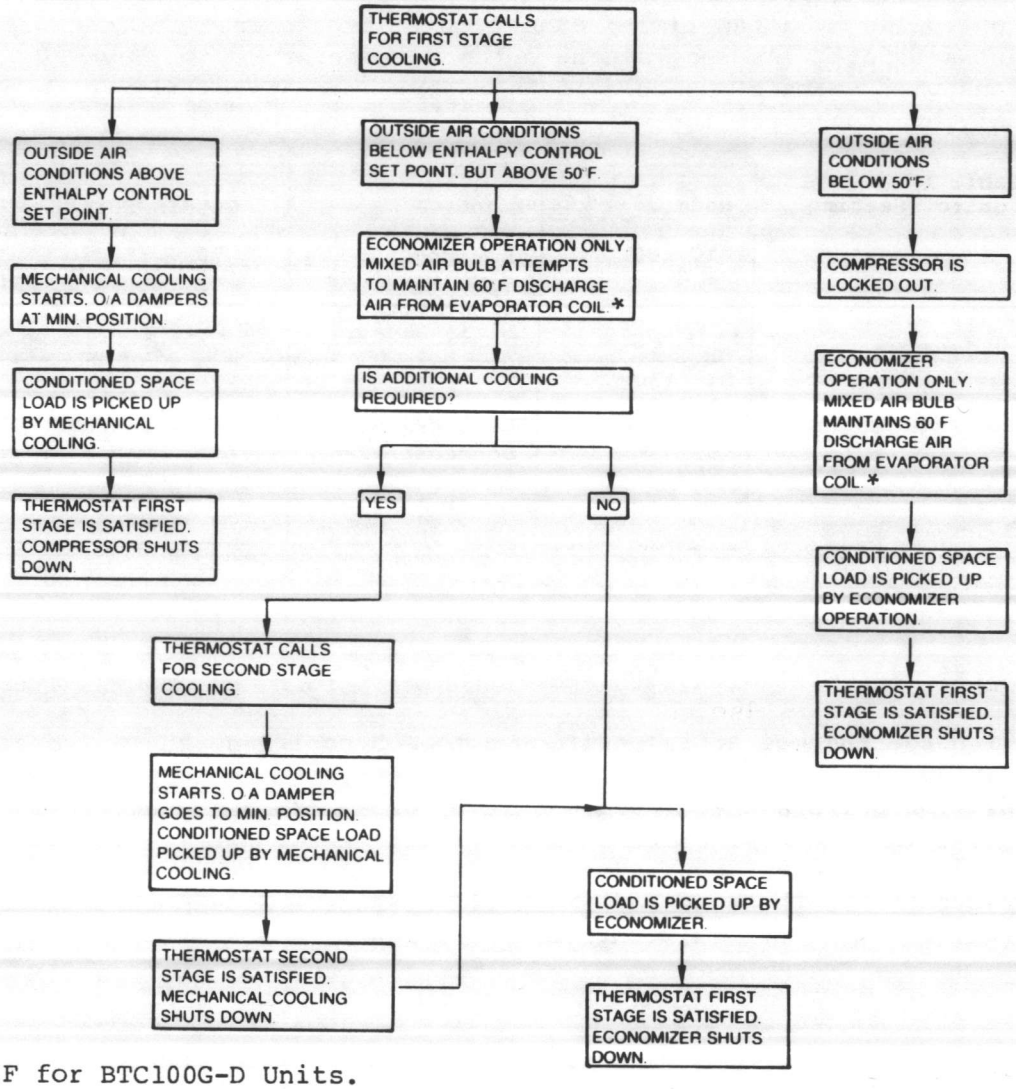
Table 2
Control Setting

Model	Control	Cut-In Point	Cut-Out Point
BTC 100	Low Pressure	20 ± 5 psig	5 ± 5 psig
	High Pressure	345 ± 10 psig	425 ± 10 psig
	Condenser Fan Limit Sensor (FL)	65 F	55 F
BTC 130 thru 200	Low Pressure	20 ± 5 psig	5 ± 5 psig
	High Pressure	345 ± 10 psig	425 ± 10 psig
	Condenser Fan Limit Sensor	65 F	55 F

Economizer Operation

An illustrated sequence of operation for single-compressor units (BYC 100) is found in Figure 1.

Figure 1 Economizer Operation for Single-Compressor Units (BTC 100 Units)



*58 F for BTC100G-D Units.

BTC 130, 170 and 200 Units

BTC 130, 170 and 200 units are equipped with dual compressors, each with its own refrigerant circuit. Two-stage cooling operation is described below.

With the room thermostat system switch positioned at COOL and the fan switch adjusted to AUTO, the evaporator fan energizes on a call for cooling. In addition, the contactor of Compressor No. 1 also energizes through the safety control circuit; as its contacts close, Compressor No. 1 and its refrigerant circuit energize.

If the demand for cooling is satisfied by the first compressor, then Compressor No. 2 will not start. If the cooling demand cannot be satified by one compressor, however, the safety control circuit through the second compressor energizes both Compressor No. 2 and its refrigerant circuit.

Note: For units with 11th and 12th digits in model number of AA or BA (Example: BTC100 G300AA).

When Compressor No. 1 energizes, at least one - and as many as three - Condenser Fan(s) will also start; the actual number of fans which will operate is dependent upon outdoor temperature. Whenever outdoor temperature is below 60 F, Condenser Fan No. 3 will operate. As the temperature rises to 65 F, Condenser Fan No. 3 will stop and Condenser Fans 1 and 2 will begin operation. If the outdoor temperature reaches 75 F, Fan No. 3 energizes and operates in conjunction with Fans 1 and 2.

Note: For units with 11th and 12th digits in model number of BB, CA or DA.

When Compressor No. 1 energizes, at least one - and as many as three - Condenser Fan(s) will also start; the actual number of fans which will operate is dependent upon outdoor temperature. Whenever outdoor temperature is below 55 F, Condenser Fan No. 3 will operate. As the temperature rises to 65 F, Condenser Fans 1 and 2 will begin operation also.

If low ambient cooling is required, a head pressure control device is needed to regulate condenser airflow. Consult your local Trane Sales representative for further information.

Once the demand for cooling is satisfied, the condenser fan (or fans) and compressor(s) are de-energized.

Economizer Operation

An illustrated sequence of operation for dual-compressor units (BTC 130, 170 and 200) is found in Figure 2.

Safety Controls

BTC 100 through 200 units are protected against the following abnormal operating conditions:

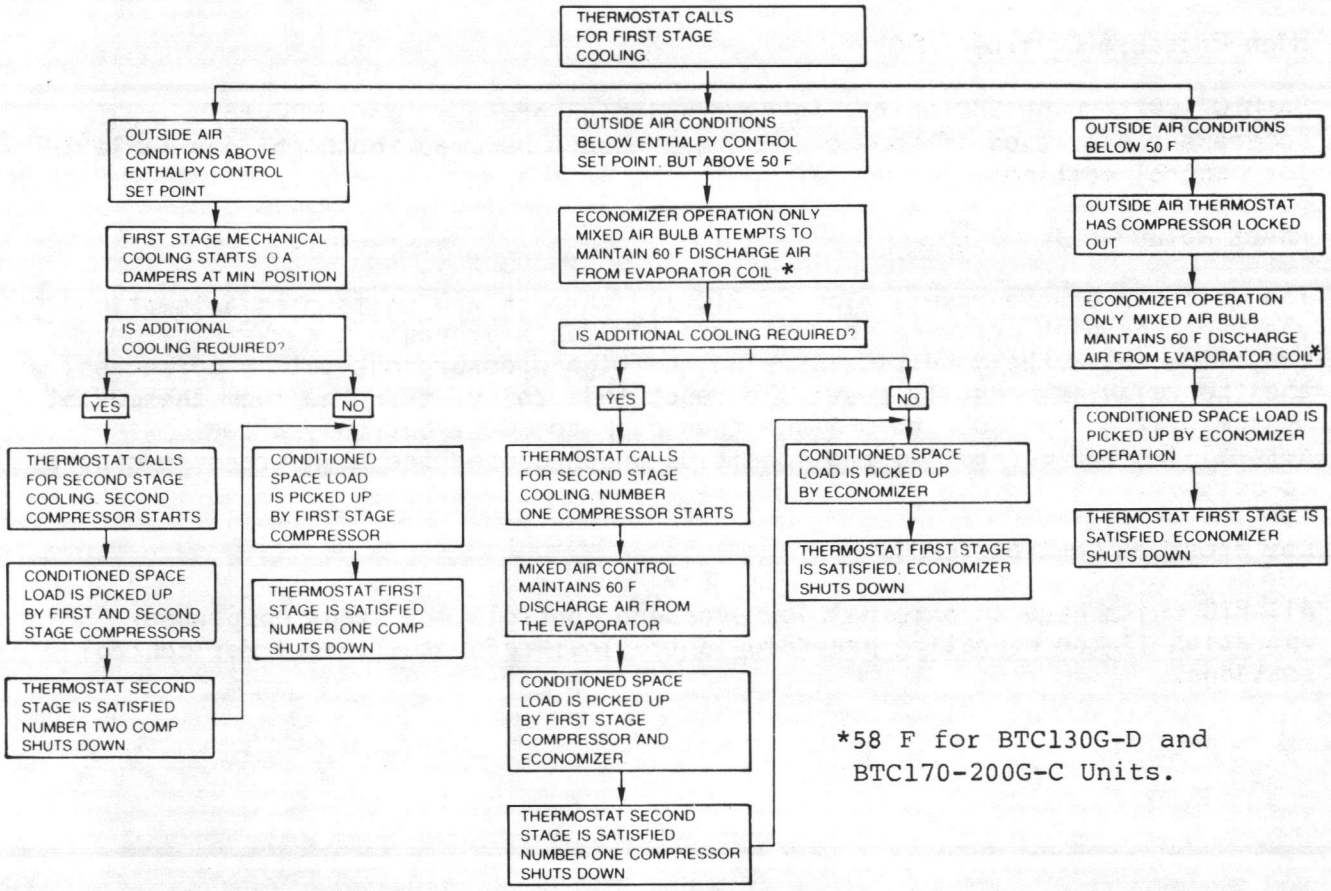
1. Locked rotor current draw.
2. Sustained high current draw.
3. Excessive motor heat build-up.
4. Low suction pressure.
5. High discharge pressure.

The following paragraphs briefly describe the safety controls used to protect the unit from the conditions outlined above. Refer to Table 1 for specific control settings.

Compressor Thermal Overload Control

Each BTC compressor is equipped with a thermal overload control. If inadequate cooling causes the winding temperature to exceed the setting of these thermostats, compresssor motor operation is interrupted. Once motor winding temperature falls to a safe level, the thermostats will automatically reset. A typical reset period varies from 14 to 45 minutes.

Figure 2
Economizer Operation for Dual-Compressor Units (BTC 130 thru 200 Units)



*58 F for BTC130G-D and BTC170-200G-C Units.

NOTES:

1. THE ENTHALPY CONTROL CAN BE ADJUSTED SO ECONOMIZER BEGINS AT VARIOUS OUTSIDE AIR TEMPERATURES AND HUMIDITIES. HOWEVER, THE RECOMMENDED SETTING IS "B" (68 F DB @ 50% RELATIVE HUMIDITY).
2. THE MIXED AIR DIAL ON THE ECONOMIZER CONTROL SHOULD BE SET ON 60 F. THE MIXED AIR BULB SENSES THE AIR LEAVING THE EVAPORATOR COIL AND ADJUSTS THE DAMPERS TO MAINTAIN A 60 F MIXED AIR TEMPERATURE.

(DOES NOT APPLY TO BTC130G-D OR BTC170-200G-C UNITS.)

CAUTION: COMPRESSOR DAMAGE MAY RESULT IF THE MIXED AIR DIAL IS SET LOWER THAN 60 F.

Fan Motor-Winding Thermostat (WT)

A winding thermostat is mounted inside the winding of each condenser and evaporator fan motor. Whenever the motor develops an excessive amount of heat, the thermostat opens and stops the motor; the control will automatically rest itself as soon as the motor and thermostat cool enough for the thermostat contacts to close.

Fan Motor Current Overloads (OL)

All condenser and evaporator fan motors are protected from overload current damage by internal thermal-load devices. Current in excess of design limits produces heat which, in turn, trips the overload and stops the motor.

High Pressure Control (HPC)

On BTC 100 through 200 units, an external high pressure control stops compressor operation if the condensing pressure becomes too high; see Table 1 for control settings.

Reset Relay (RR)

The contacts of the reset relay on BTC 100 through 200 units open automatically whenever the high pressure control cuts out. This prevents the system from recycling until the condition causing the high pressure cut-out is corrected, and the relay is manually reset. To reset this relay, turn the room thermostat system switch from COOL to OFF and then back to COOL, but only after determining and correcting the condition which caused the high pressure control to cut out.

Low Pressure Control (LPC)

All BTC units have an external low pressure control that stops compressor operation if the operating pressure is too low; refer to Table 1 for control settings.

Maintenance

Maintenance

Perform all of the indicated maintenance procedures at the intervals scheduled. This will prolong the life of the unit and reduce the possibility of costly equipment failure.

Monthly

Conduct the maintenance inspections outlined below once each month on a year-round basis:

WARNING: OPEN THE UNIT DISCONNECT SWITCH AND LOCK IT IN THAT POSITION TO PREVENT ACCIDENTAL START-UP, NEVER OPEN AN ACCESS PANEL TO INSPECT OR SERVICE THE UNIT WITHOUT FIRST OPENING THE DISCONNECCT SWITCH; FAILURE TO DO SO MAY RESULT IN INJURY OR DEATH DUE TO ELECTRICAL SHOCK OR CONTACT WITH MOVING PARTS.

WARNING: ONLY TWO POLES OF THE COMPRESSOR AND EVAPORATOR ARE CONTROLLED BY THEIR RESPECTIVE CONTACTOR.

[] Inspect air filters; if necessary, the filters should be cleaned or replaced.

[] Check unit wiring; all connections should be secure.

[] Check drain pans and condensate piping to ensure that they are obstacle-free.

[] Manually rotate the condenser fans to ensure proper operation. Inspect fan mounting hardware for tightness.

[] Inspect the evaporator and condenser coils for dirt and foreign debris. If the coils appear dirty, clean them according to the instructions provided in the "Maintenance Procedures" section of this manual.

[] With the unit operating in the cooling mode, check unit suction and discharge pressures and compare them to the values provided in Table 1. Record the readings observed on the "Maintenance Log."

[] Observe evaporator fan operation; note and correct any unusual or excessive vibration.

Annually: Cooling Season

The following maintenance practices must be performed at the beginning of each cooling season to ensure effecient unit operation:

WARNING: OPEN UNIT DISCONNECT SWITCH AND LOCK IT IN THAT POSITION TO PREVENT ACCIDENTAL START-UP. FAILURE TO DO SO MAY RESULT IN INJURY OR DEATH DUE TO ELECTRICAL SHOCK OR CONTACT WITH MOVING PARTS.

[] Perform all monthly maintenance inspections.

[] With the unit operating, check unit superheat and subcooling (optional) and record the reading in the "Maintenance Log". (In some instances, it may be desirable to check superheat on a more frequent basis.)

[] Remove any accumulation of dust and/or dirt from the unit casing.

[] Remove corrosion from any surface and repaint. Also, check condition of gasket around control panel door: it must fit correctly and be in good condition to prevent water leakage.

[] Inspect evaporator fan belt. If frayed or worn, replace it using the instructions provided in "Maintenance Procedures".

[] Inspect control panel wiring to ensure that connections are tight and that insulation is intact.

Note: No oiling of motors is required under normal operation. However, after extensive use, lubrication of permanently lubricated motors may be beneficial to prolong motor life.

[] Lubricate condenser fan motor bearings with a few drops of non-detergent, 10-weight oil. (To ensure good bearing lubrication, condenser fan motor bearings should be lubricated once every six months. Do NOT over-oil -- a few drops of oil is sufficient.)

[] Lubricate evaporator fan motor bearings with Alvania #2 grease or equivalent. Add only enough lubricant to replace that used by the bearings. (**Note:** Any lubrication instructions provided on the fan motor housing will supersede this general guideline.)

[] Check all refrigerant piping and fittings for leaks.

[] Check all control settings for accuracy; refer to Table 1.

[] Verify that optional economizer operates properly and smoothly.

Maintenance Log1

Date	Ambient Temp. (F)	Evaporator Enter. Air		Compressor No.1		Compressor No. 2		Superheat4 (F)		Subcooling4 (F)	
		Dry Bulb	Wet Bulb	Suction Press.3	Discharge Press.3	Suction Press.3	Discharge Press.3	Circuit No. 1	Circuit No. 2	Circuit No. 1	Circuit No. 2

Notes:

1. Perform each inspection once per month (during cooling season) while unit is operating.

2. BTC 130, 170 and 200 units only.
3. Record operating pressures in psig; compare readings with values in Tables 2 or 2a.
4. Superheat and subcooling (optional) should be checked on an annual basis, but may be checked on a more frequent basis if desired.

Table 2
Operation
Pressures (Psig)

		DB Entering Air To Condenser			
Model	Pressure	85 F	95 F	105 F	120 F
BTC 100	Discharge	239	271	306	344
	Suction	76	78	80	83
BTC 130	Discharge	248	280	313	350
	Suction	74	76	78	81
BTC 170	Discharge	240	273	309	348
	Suction	76	79	81	83
BTC 200	Discharge	255	288	323	362
	Suction	76	78	81	83

Table 2A
Operation Pressures (Psig)
For Model Numbers
BTC100G_ _ _CA, DA
BTC130G_ _ _CA, DA
BTC170G_ _ _CA
BTC200G_ _ _CA

		DB Entering Air To Condenser			
Model	Pressure	85 F	95 F	105 F	120 F
BTC100	Discharge	233	263	297	354
	Suction	75	77	79	82
BTC130	Discharge	246	276	310	367
	Suction	75	77	79	82
BTC170	Discharge	259	288	320	374
	Suction	77	79	81	84
BTC200	Discharge	270	301	334	391
	Suction	77	79	81	84

Notes:

1. Based on nominal CFM (400CFM/ton).
2. Evaporator air is 80 F DB - 67 FWB.
3. Suction pressure is accurate to within ± 2 psig.
4. Discharge pressure is accurate to within ± 7 psig.

Maintenance Procedures

The remainder of this section is devoted to describing specific maintenance procedures which must be performed as a part of the unit's maintenance program. Before performing any of these operations, however, be sure that power to the unit is disconnected unless otherwise instructed.

WARNING: NEVER OPEN AN ACCESS PANEL TO INSPECT OR SERVICE THE UNIT WITHOUT FIRST OPENING THE DISCONNECT SWITCH. FAILURE TO EXERCISE CAUTION WHEN WORKING WITH ELECTRICALLY-POWERED EQUIPMENT MAY RESULT IN POSSIBLE INJURY OR DEATH DUE TO ELECTRICAL SHOCK.

Fan Belt Adjustment

Fan belt(s) on the evaporator fan must be inspected periodically to assure proper unit operation. If frayed or worn, the belts must be replaced. Do not stretch belts over sheaves - instead, loosen the adjustable motor-mounting base.

Adjust fan belt tension using either a Browning or Gates gauge, or equivalent (see Figures 3 and 4). These instruments are used as follows:

Figure 3
Belt Tension Gauge

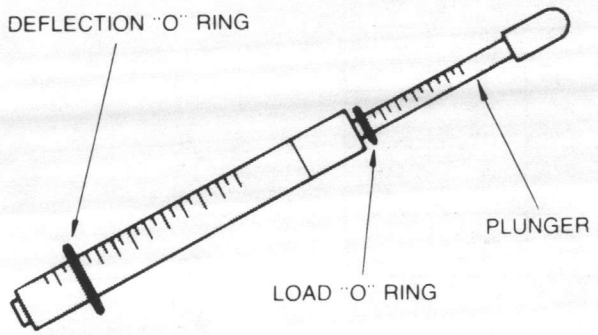
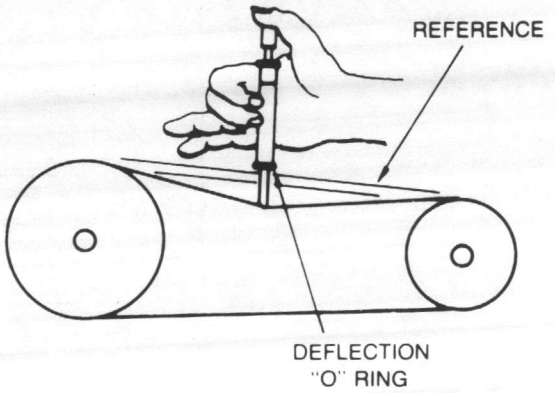


Figure 4
Using Belt Tension Gauge



1. Measure belt span between sheaves and set the large "0" ring at 1/64 inch for each inch of belt span.

2. Set the load "0" ring at zero.

3. Place the large end of the gauge at the center of the belt span. Press down until the large "0" ring is even with the top of the next belt. A straight edge may be placed across the sheaves, if desired, as a reference point; see Figure 4.

5. Check the reading against the "Deflection Force" values shown in Table 3. If necessary, readjust belt tension or call your Trane service representative.

   Note: Whenever new belts are installed, be sure to check belt tension after a few days of running time. This will allow the belt to stretch.

Table 3
Recommended Belt Tension Gauge

BTC Unit	Deflection (Inches)	Deflection Force (Lbs.)
100 - Standard	3/16	3 1/2
100 - Oversize	3/16	4 1/4
130 - Standard	1/8	4 1/4
130 - Oversize	1/8	9 9/16
170 - Standard	1/8	4 1/4
170 - Oversize	1/8	7 9/16
200 - Standard	1/8	7 9/16
200 - Oversize	1/4	7 9/16

Limited-Period Shutdown and Start-Up Procedures

Use the procedure outlined below when the unit must be shut down for no more than two hours:

1. Turn the thermostat system switch to the OFF position.

2. Verify that the unit disconnect switch is closed: this will permit the continued operation of the compressor crankcase heater(s).

   WARNING: THIS PROCEDURE IS NOT APPROVED FOR MAINTENANCE OR SERVICE SHUTDOWN. OBSERVE THE SAFETY WARNINGS PROVIDED IN THE "MAINTENANCE" SECTION OF THIS MANUAL; FAILURE TO DO SO MAY RESULT IN HAZARDOUS CONDITIONS AND POSSIBLE ELECTRICAL SHOCK.

To restart the unit after a brief shutdown, simply adjust the thermostat system switch to the ON position.

Seasonal Start-Up Procedure

Whenever the unit has been inoperative **with the disconnect switch open** for two hours or more, use this procedure to start the BTC unit in the cooling mode:

1. Complete the pre-start-up checks.

2. Adjust the thermostat system switch to the OFF position.

3. Close the unit disconnect switch.

   CAUTION: Whenever the unit disconnect switch is opened during routine maintenance or servicing, power to the crankcase heater(s) is interrupted. If the crankcase heater(s) are NOT recycled before a cooling start-up, compressor bearing damage may result.

4. Allow the compressor crankcase heater(s) to operate for a minimum of eight hours.

5. Set the thermostat system switch to the COOL position.

6. Adjust the thermostat cooling indicator to the desired setpoint.

Trouble Analysis

Trouble Analysis

The charts on the following pages have been provided to serve as an aid for identifying the cause of any system malfunctions that may occur. Each chart is divided into three columns:

- the **"Symptom"** column describes the behavior the unit is exhibiting;
- the **"Probable Cause"** column identifies possible sources of the malfunction; and,
- the **"Recommended Action"** column indicates the procedures required to correct the malfunction.

If used properly, these charts not only enable you to better evaluate causes and consequences of mechanical difficulties, but also arrive at a better understanding of equipment operation.

If operating difficulties are encountered, be sure to make the following preliminary checks **before** referring to the troubleshooting charts:

[] Check the thermostat to ensure that it is properly set, receiving control power, and "making/breaking" on a call for cooling.

[] Verify that the unit is receiving electrical supply power, and that the fuses are intact.

[] Check the filters; they should be positioned properly, and be free of dirt and debris.

After completing the checks listed above, be sure to inspect the unit for other obvious causes of trouble such as broken fan belts, a clogged condenser coil, restricted air ducts, and the like. If everything appears to be in order - but the unit still fails to operate properly - refer to the appropriate troubleshooting charts.

Note: The troubleshooting charts which follow have been provided solely as a guide for determining the cause of mechanical failure or malfunction. When mechanical problems do occur, Trane recommends that trained service personnel be contacted to help ensure proper diagnosis and repair of the unit.

WARNING: OPEN UNIT DISCONNECT SWITCH AND LOCK IN THAT POSITION TO PREVENT ACCIDENTAL START-UP. NEVER OPEN AN ACCESS PANEL TO INSPECT OR SERVICE WITHOUT OPENING THE DISCONNECT SWITCH. ALLOW ROTATING EQUIPMENT, SUCH AS FANS AND BELTS, TO STOP BEFORE SERVICING. FAILURE TO EXERCISE CAUTION WHEN SERVICING THE UNIT MAY RESULT IN INJURY OR DEATH DUE TO ELECTRICAL SHOCK OR CONTACT WITH MOVING PARTS.

UNIT IN COOLING MODE

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
Compressor fails to start.	1. Power failure (electric circuit test shows no voltage on line side of compressor contactors).	1. Check for blown line fuse or broken lead.
	2. Disconnect switch open (electric circuit test shows no voltage on line side of compressor contactors).	2. Determine why switch is open. If system is in working order, close switch.
	3. Blown fuse (electric circuit test shows no voltage on line side of compressor contactors.	3. Replace fuse and check for voltage at compressor contactors.
	4. Low line voltage.	4. Contact power company.
	5. Burned-out motor (full voltage at motor terminals, but motor will not run).	5. Replace compressor.
	6. Open control circuit (compressor contactor holding coil is not energized; or an operating control is open).	6. Locate open control and determine cause. Refer to "Safety Controls".
	7. Frozen compressor due to locked or damaged mechanism (compressor will not operate; draws LRA).	7. Replace compressor.
	8. Suction pressure below cut-in setting of low pressure control (LPC contacts open).	8. Check for refrigerant loss. Repair leak and recharge unit.
	9. Defective thermostat or system controller (system will not start).	9. Determine which control is defective, and repair or replace it.
	10. Faulty compressor contactor (open or shorted coil).	10. Replace compressor contactor.
	11. Discharge pressure above cut-out setting of high pressure control (HPC contacts open, causing unit to be locked out by reset relay).	11. See "Discharge Pressure Too High" of these charts for potential causes. Switch room thermostat to OFF, then COOL to reset unit. See "Unit Locked Out on Reset Relay" in these charts.
	12. Compressor winding thermostat open.	12. Allow compressor to cool down; check unit refrigerant charge and superheat.
	13. In economizer mode.	13. Verify proper econ. operation.
Compressor short cycles.	1. Intermittent contact in electrical control circuit.	1. Repair or replace faulty control.
	2. Unit cycles on low pressure control.	2. Low on refrigerant; or, check low pressure control.
	3. Shortage of refrigerant.	3. Find and repair refrigerant leak; recharge unit.
	4. Restricted liquid-line filter drier (evidenced by low suction pressure and temperature drop across drier).	4. Replace liquid-line filter drier.

UNIT IN COOLING MODE (CONT.)

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
Compressor hums, but will not start.	1. Open motor winding (evidenced by infinite winding resistance).	1. Replace compressor.
	2. Loose or disconnected motor terminal connection (evidenced by high resistance across motor leads).	2. Reconnect terminal.
	3. Low-voltage condition (voltage available to compressor at start-up must be ±10% of nameplate voltage.	3. Check wire size. Contact power company if necessary.
	4. Motor windings shorted or grounded (motor megs low).	4. Replace compressor and clean up system.
	5. All contacts of compressor contactor fail to close simultaneously.	5. Replace contacts or contactor.
	6. Damaged or broken mechanical parts within compressor, causing it to bind (motor draws LRA).	6. Replace compressor.
Compressor runs continuously.	1. Excessive load (evidenced by high supply air temperature).	1. Determine source of added load. Check for excessive airflow through evaporator coil.
	2. Thermostat setpoint too low.	2. Reset or repair thermostat.
	3. Welded contacts on compressor contactor.	3. Repair or replace contactor.
	4. Leaky valves in compressor (evidenced by operation at abnormally low discharge and high suction pressures).	4. Replace compressor.
	5. Defective thermostat (i.e., conditioned space too cold).	5. Replace thermostat.
	6. Shortage of refrigerant (evidenced by reduced capacity coupled with low suction and discharge pressures).	6. Find and repair refrigerant leak; recharge unit.
Compressor is noisy.	1. Internal parts of compressor damaged or broken (compressor knocks).	1. Replace compressor.
	2. Liquid floodback (evidenced by abnormally cold suction line).	2. Check superheat, expansion valve, and contact or location of remote bulb on suction line. Repair or replace as necessary.
	3. Liquid refrigerant in compressor at start-up.	3. Check crankcase heater.

UNIT IN COOLING MODE (CONT.)

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
Compressor loses oil.	1. Insufficient oil charge.	1. Add sufficient amount of proper compressor oil.
	2. Clogged filter drier.	2. Replace filter drier.
	3. Loose expansion valve remote bulb (evidenced by excessively cold suction line).	3. Provide good contact between remote bulb and suction line.
	4. Liquid flooding back to compressor (evidenced by excessively cold suction line and noisy compressor operation).	4. Check superheat setting, or check remote bulb contact. Repair or replace expansion valve if necessary.
	5. Compressor short cycles (i.e., starts and stops too frequently).	5. See "Compressor Short Cycles" in these charts.
System short of capacity	1. Low refrigerant charge (evidenced by low subcooling and high superheat).	1. Add refrigerant.
	2. Clogged filter drier (evidenced by temperature change in refrigerant line through drier).	2. Replace filter drier.
	3. Expansion valve stuck or obstructed (evidenced by high superheat and high space temperature).	3. Repair or replace expansion valve.
	4. Excessive pressure drop in evaporator (evidenced by high superheat).	4. If expansion valve cannot compensate for pressure drop, check evaporator coil for obstruction.
	5. Low evaporator airflow.	5. Check filters; adjust airflow.
	6. Noncondensibles in system (evidenced by high discharge pressure).	6. Evacuate and recharge system.
	7. Overcharged system (evidenced by high operating pressures).	7. Remove excess charge.
Suction pressure too low.	1. Lack of refrigerant (evidenced by low subcooling and high superheat).	1. Find and repair leak and recharge unit.
	2. Light cooling load (compressor short cycles).	2. See "Compressor Short Cycles" in these charts.
	3. Clogged filter drier (evidenced by temperature change through filter drier).	3. Replace filter drier.
	4. Expansion valve power assembly has lost charge (i.e., no flow of refrigerant through valve).	4. Repair or replace expansion valve assembly.
	5. Obstructed expansion valve (evidenced by loss of capacity and high superheat).	5. Clean or replace valve.
	6. Low airflow (evidenced by low evaporator coil pressure drop).	6. Check for clogged filters, incorrect fan speed, or high duct static pressure.
	7. Inadequate or inoperative head pressure control.	7. See "Discharge Pressure Too Low" in these charts.

UNIT IN COOLING MODE (CONT.)

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
Suction pressure too high.	1. Excessive cooling load (evidenced by high supply air temperatures).	1. See "Compressor Runs Continuously" in these charts.
	2. Overfeeding of expansion valve (evidenced by abnormally cold suction line and liquid flooding back to compressor).	2. Check superheat and verify that remote bulb is properly attached to suction line.
	3. Expansion valve stuck open (evidenced by abnormally cold suction line and liquid flooding back to compressor.)	3. Repair or replace valve.
	4. Suction valves broken in open position (evidenced by noisy compressor).	4. Replace compressor.
Discharge pressure too high.	1. Too little or too warm condenser air; restricted airflow (evidenced by excessively warm air leaving condenser; cuts out on HPC).	1. Clean coil; check fan and motors for proper operation.
	2. Air or noncondensible gas in system (evidenced by high subcooling and low superheat).	2. Evacuate and recharge system.
	3. Overcharge of refrigerant (evidenced by exceptionally hot condenser and excessive discharge pressure).	3. Remove excess refrigerant.
	4. Excessive system load (evidenced by high leaving air temperature).	4. Reduce load.
	5. Defective condenser fan control (evidenced by one fan off and high condenser pressure).	5. Repair or replace switch.
	6. Defective or inoperative low ambient dampers (evidenced by closed dampers and high condenser pressure).	6. Repair or replace operator. Check for leak in operator supply line.
Discharge pressure too low.	1. Lack of refrigerant (evidenced by low subcooling and high superheat).	1. Repair leak and recharge system.
	2. Broken or leaky compressor discharge valves (as evidenced by suction and discharge pressures that equalize rapidly after pumpdown).	2. Replace compressor.
	3. Condenser fan control stuck in open position (contacts made when temperature is below 60 F).	3. Replace defective control.
	4. Unit running below minimum operating ambient.	4. Provide adequate head pressure controls, or a unit ambient lockout.
	5. Low ambient damper stuck open.	5. Replace damper operator or repair damper.

UNIT IN COOLING MODE (CONT.)

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
Unit locked out on reset relay.	1. Unit trips out on high pressure control (evidenced by high discharge pressure).	1. See "Discharge Pressure Too High" in these charts.
	2. Defective reset relay (i.e., relay energizes without safety control in reset circuit opening).	2. Replace reset relay.

The Trane Company
Light Commercial Group
Guthrie Highway
Clarksville, TN 37040

Technical Literature Printed in USA

TRANE™

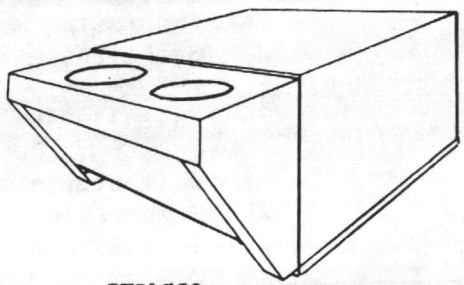
BTC-IN-1D

INSTALLER'S GUIDE

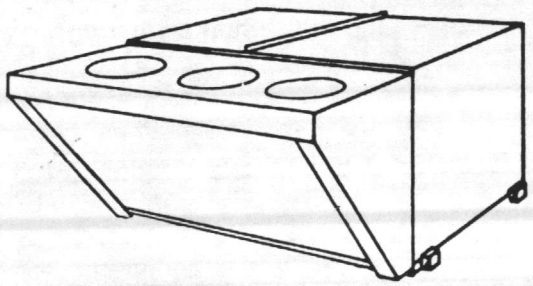
Electric/ Electric Rooftop

Library	Service Literature
Product Section	Unitary
Product	Rooftop-Lt. Comm. Single-Zone
Model	BTC
Literature Type	Installation
Sequence	1D
Date	September 1986
File No.	SV-UN-RT-BTC-IN-1D 9/86
Supersedes	BTC-IN-1C 5/86

Convertible Electric/Electric Rooftop Units



BTC100G Units



BTC130G thru 200G Units

Models:
BTC100G---A, B, C, D
BTC130G---A, B, C, D
BTC170G---A, B, C
BTC200G---A, B, C

18-AB60D1
5th Printing 1986

Table of Contents

Model Number Description

Trane products are identified by a multiple-character model number that precisely identifies a particular type of unit. An explanation of this multiple-character number is shown below. It will enable the owner or Service Engineer to define operation, components, and applicable accessories for a specific unit.

Model Number:	B	TC	100	G	3	00	B	A			
Digit Number:	1	2,3	4,5,6	7	8	9,10	11	12			

Digit 1
Always "B"

Digits 2,3
Product Type
TC = Cooling, Packaged

Digits 4,5,6
Cooling Capacity (MBH)
100 MBH = 8.5 Tons
130 MBH = 11 Tons
170 MBH = 14.5 Tons
200 MBH = 17 Tons

Digit 7
Major Design Sequence

Digit 8
Electrical Characteristics
1 = 200-230/60/1
3 = 200-230/60/3
4 = 460/60/3
W = 575/60/3

Digits 9,10
Secondary Capacity And/Or
Factory Installed Options Heat
LO = Low Heat (Gas or Elect.), No Factory Installed Options
HO = High Heat, No Factory-Installed Economizer
HA = High Heat, Factory-Installed Economizer

Digit 11
Minor Design Sequence

Digit 12
Service Digit

General Information

Note: "Warnings and "Cautions" appear at appropriate places in this instruction manual. Your personal safety and the proper operation of this machine require that you follow them carefully. The Trane Company assumes no liability for installations or servicing performed by unqualified personnel.

Literature Change History

BTC-IN-1 (June 1985)
Original issue of manual.

BTC-IN-1A (September 1985)
Revised manual to incorporate change in evaporator fan motor configuration (Figure 4). Also changed front cover to show major design sequence ("G"), added "Literature Change History", and expanded "Table of Contents".

BTC-IN-1B (December 1985)
Revised manual to incorporate new filter sizes.

BTC-IN-1C (May 1986)
Revised manual to incorporate new condenser coil, compressors (BTC130), new evaporator coil, evaporator motor (BTC100), and new economizer (BTC100-200).

BTC-IN-1D (Sept. 1986) Revised to incorporate design changes.

Unit Features
Trane self-contained, cooling-only rooftop units--as shipped from the factory--are designed for outdoor installation. They are usually installed on a flat roof, but can also be used on a sloping roof with a properly built-up platform (i.e., making a level installation possible). Alternatively, BTC units can be set on concrete slabs at ground level.

While the BTC100 is a single-compressor, single-stage unit, the BTC130, 170 and 200 units are equipped with two hermetic compressors and dual-circuit evaporator and condenser coils to provide two-stage cooling. "Dual-circuiting" means that an independent evaporating and condensing cycle is provided for each compressor.

In addition, each unit also contains a full operating charge of Refrigerant-22. Be sure to refer to the unit nameplate to determine the proper refrigerant charge for your unit.

An adjustable sheave on the evaporator fan motor shaft can be changed to overcome static pressure losses caused either by the use of multiple accessories or duct design. If available sheave adjustment is not sufficient, it may be necessary to replace the original fan motor with an oversized one. To decide whether or not the installation of an oversized motor is desirable, refer to the unit "Service Facts". When required, an oversized motor kit can be obtained through your local Trane sales representative.

Unit Accessories

All units are built for downflow air discharge, but an accessory kit is available to allow conversion to a horizontal supply/return configuration; specific installation instructions accompany this kit. Ductwork can be used to connect the unit directly to the conditioned space. The unit can also be used with various damper and control arrangements.

Note: Factory-installed economizers are provided on some units; for those without, a field-installed economizer may be added if desired.

Accessories--such as roof curbs, fresh air dampers and heating coils--are available for use with BTC units. When planning unit installation, whether at rooftop or ground level, be sure to consider any possible alterations to the standard installation procedures that these accessories may require.

Unit Inspection

When the unit is delivered to the job site, inspect all components for damage. Manually rotate the condenser fans to be sure they revolve freely. Report any damage or material shortage to the carrier and record this information on the bill of lading. File damage claims with the carrier, and notify the appropriate Trane sales office **before** installing a damaged unit. Any material shortages should be reported directly to the Trane sales representative.

Compare the electrical data on the unit nameplate with the ordering and shipping information to verify that the correct unit has been shipped.

Unit wiring diagrams and installer's and operation/maintenance guides are located inside the compressor compartment. Before unit start-up, be sure to read the provided literature to become familiar with the unit and its operation. Notice that an installation checklist is provided at the end of the "Installation" section of this manual; complete it after all the installation procedures described have been accomplished. **Do NOT substitute the checklist for the detailed information found in the appropriate sections of this manual!** In addition, a start-up log has also been included at the end of this booklet to encourage thorough unit checkout at initial start-up.

Uncrating the Unit

To uncrate the **BTC 100,** remove the side crating from the unit. Be sure to leave the top crating and coil guard in place; the top crating will serve as a spreader during the hoist to prevent excessive pressure on the unit's roof assembly. The maximum weight of a BTC 100 unit is 2,800 pounds; because of its size, special precautions should be taken to prevent unit damage during the lift.

To uncrate a **130, 170 or 200 BTC,** remove all crating from the unit while it is still on the ground. Spreaders strong enough to support the weight of the unit (i.e., a maximum of 2,800 pounds) should be used during the hoist to prevent damage to the unit's roof assembly. Again, take special care to protect the unit from any damages which could occur during the lift.

Figure 1
BTC100G-A, B
Unit Dimensions

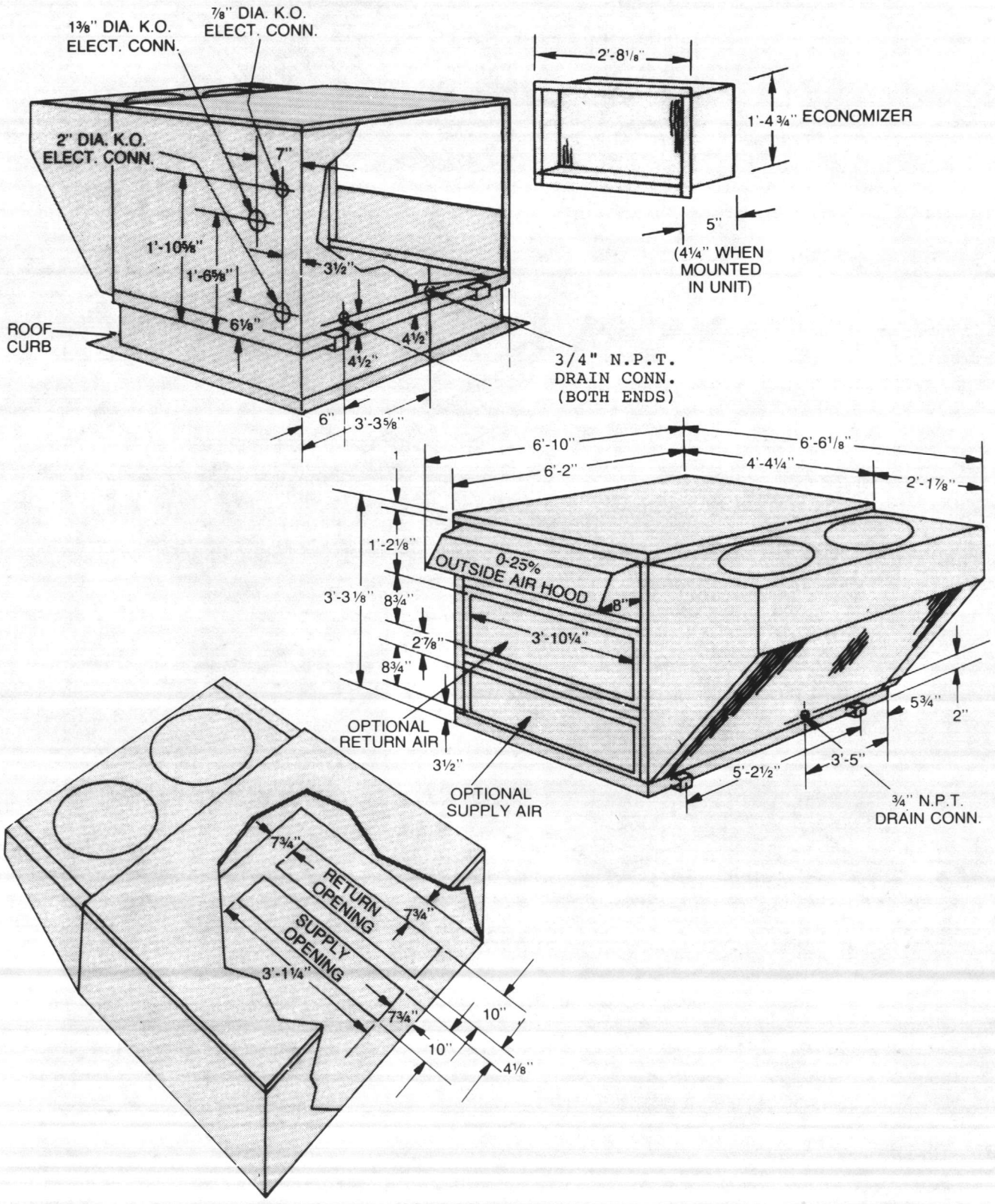


Figure 2
BTC100 G-C
Unit Dimensions

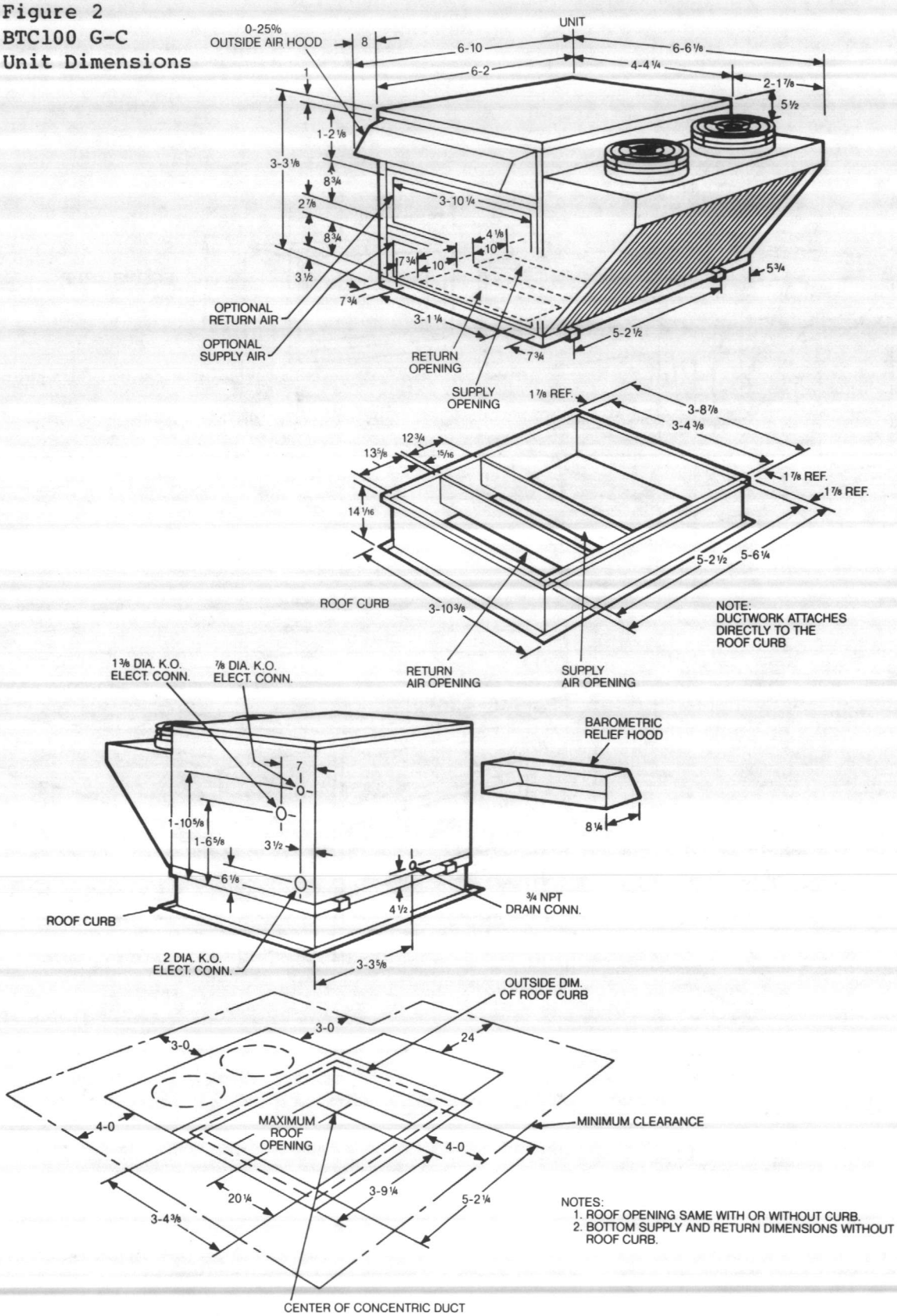
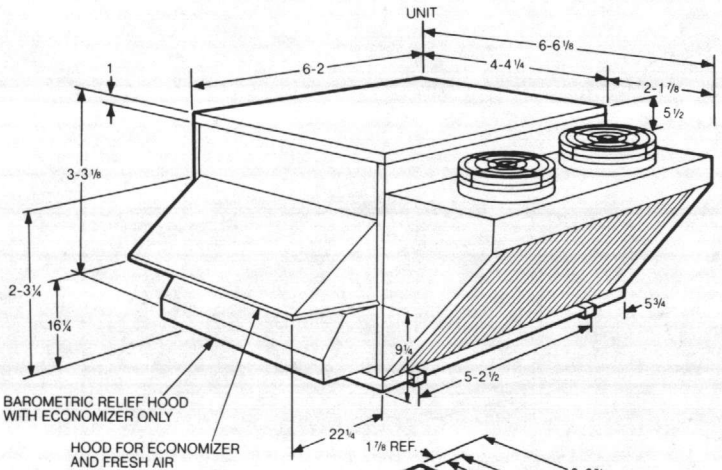
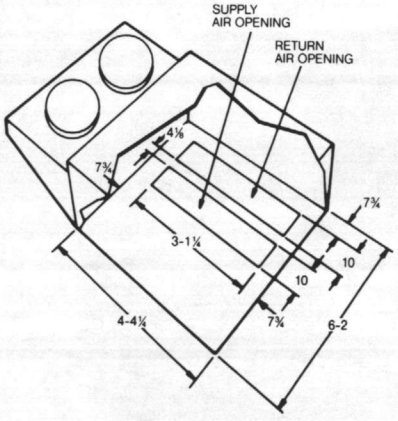
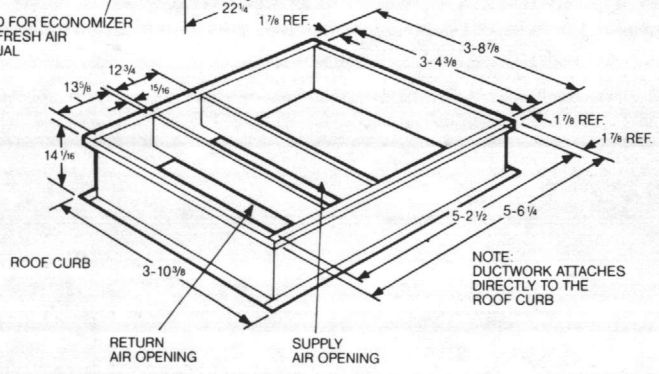
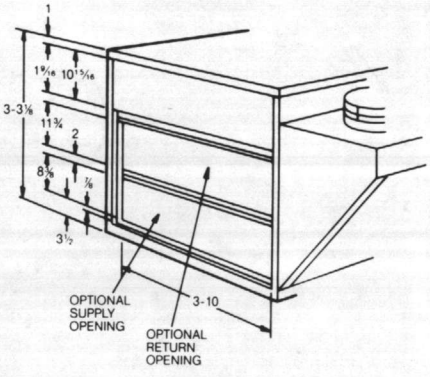


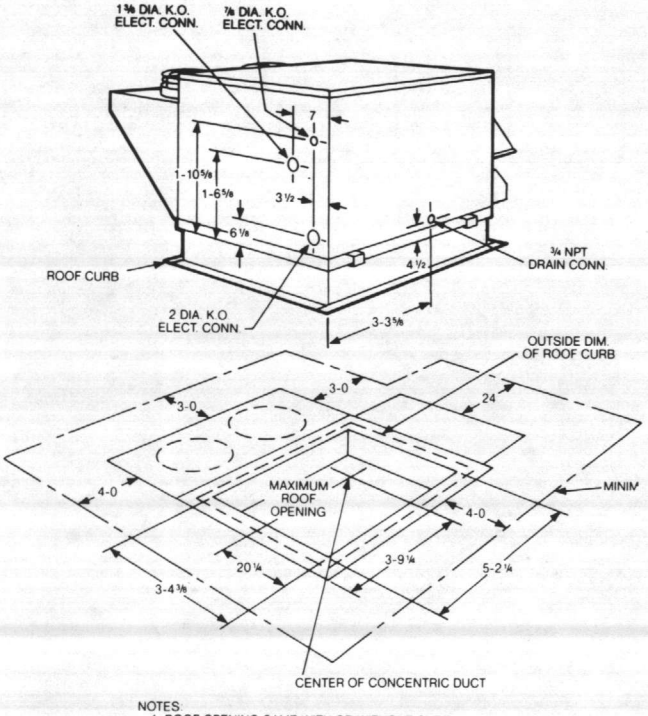
Figure 3
BTC100 G-D
Unit Dimensions





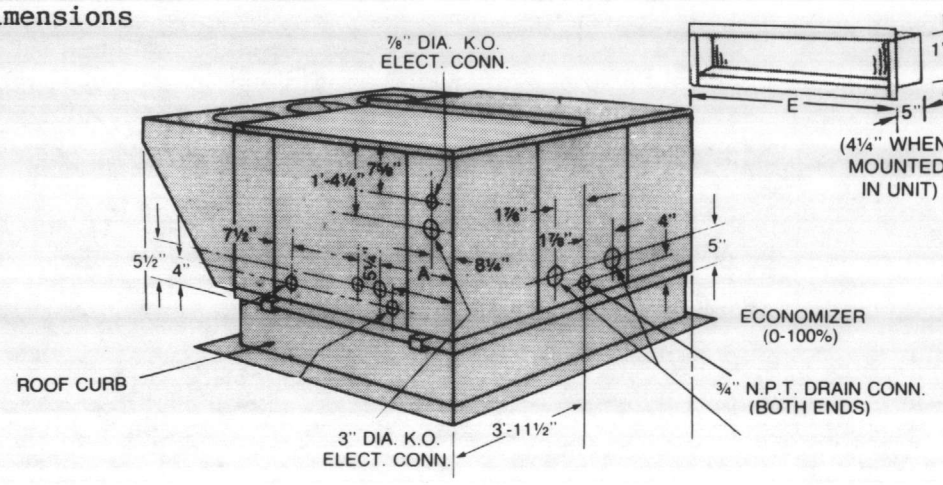






NOTES:
1. ROOF OPENING SAME WITH OR WITHOUT CURB.
2. BOTTOM SUPPLY AND RETURN DIMENSIONS WITHOUT ROOF CURB.

Figure 4
BTC130 thru
200G-A, B Unit
Dimensions

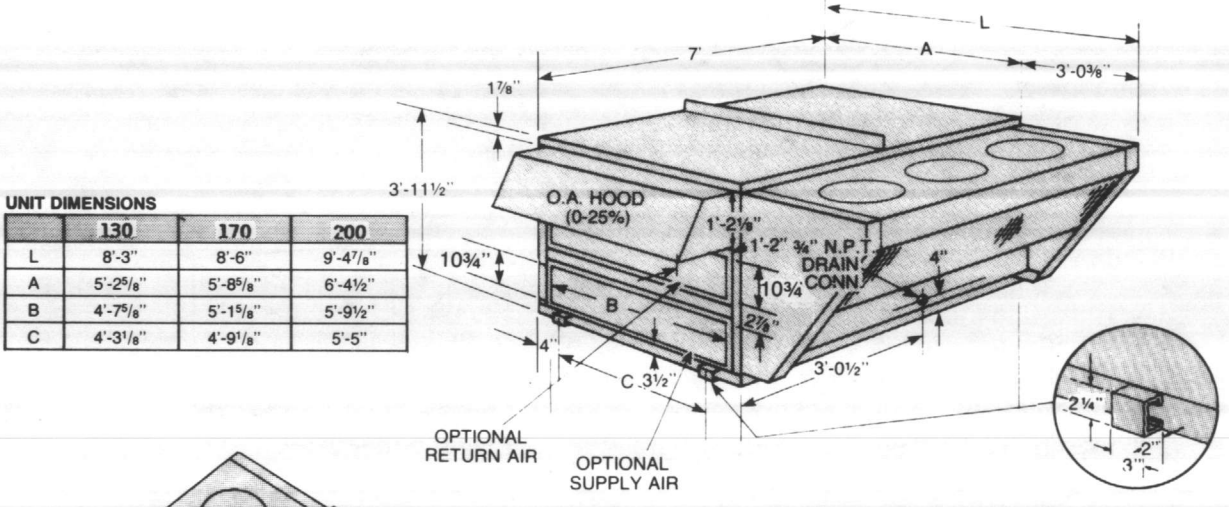


CONNECTIONS

	130	170	200
A	—	1'-10½"	1'-10½"
B	1'-10⅛"	2'-7⅛"	2'-7⅛"
C	1⅜"	1⅜"	2½"
D	1⅜"	1⅜"	2½"

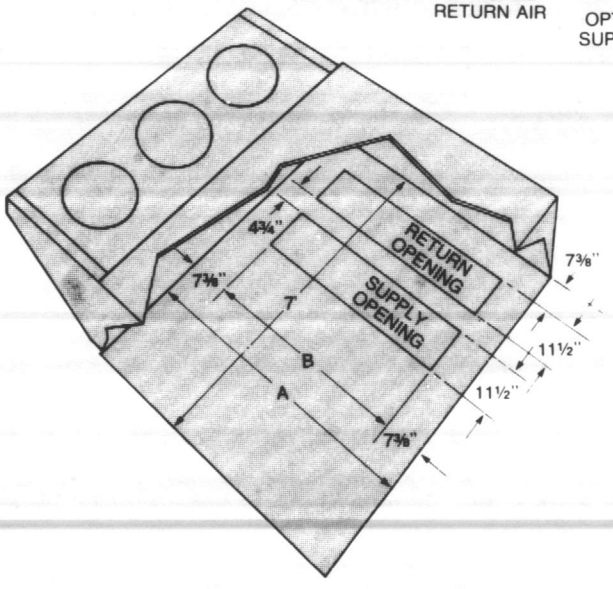
ECONOMIZER

	130	170	200
E	3'-3⅝"	3'-9⅜"	4'-5¼"



UNIT DIMENSIONS

	130	170	200
L	8'-3"	8'-6"	9'-4⅞"
A	5'-2⅝"	5'-8⅝"	6'-4½"
B	4'-7⅝"	5'-1⅝"	5'-9½"
C	4'-3⅛"	4'-9⅛"	5'-5"



SUPPLY & RETURN DIMENSIONS

	130	170	200
A	5'-2⅝"	5'-8⅝"	6'-4½"
B	3'-11⅞"	4'-5⅞"	5'-1¾"

Figure 5
BTC130G-C
Unit Dimensions

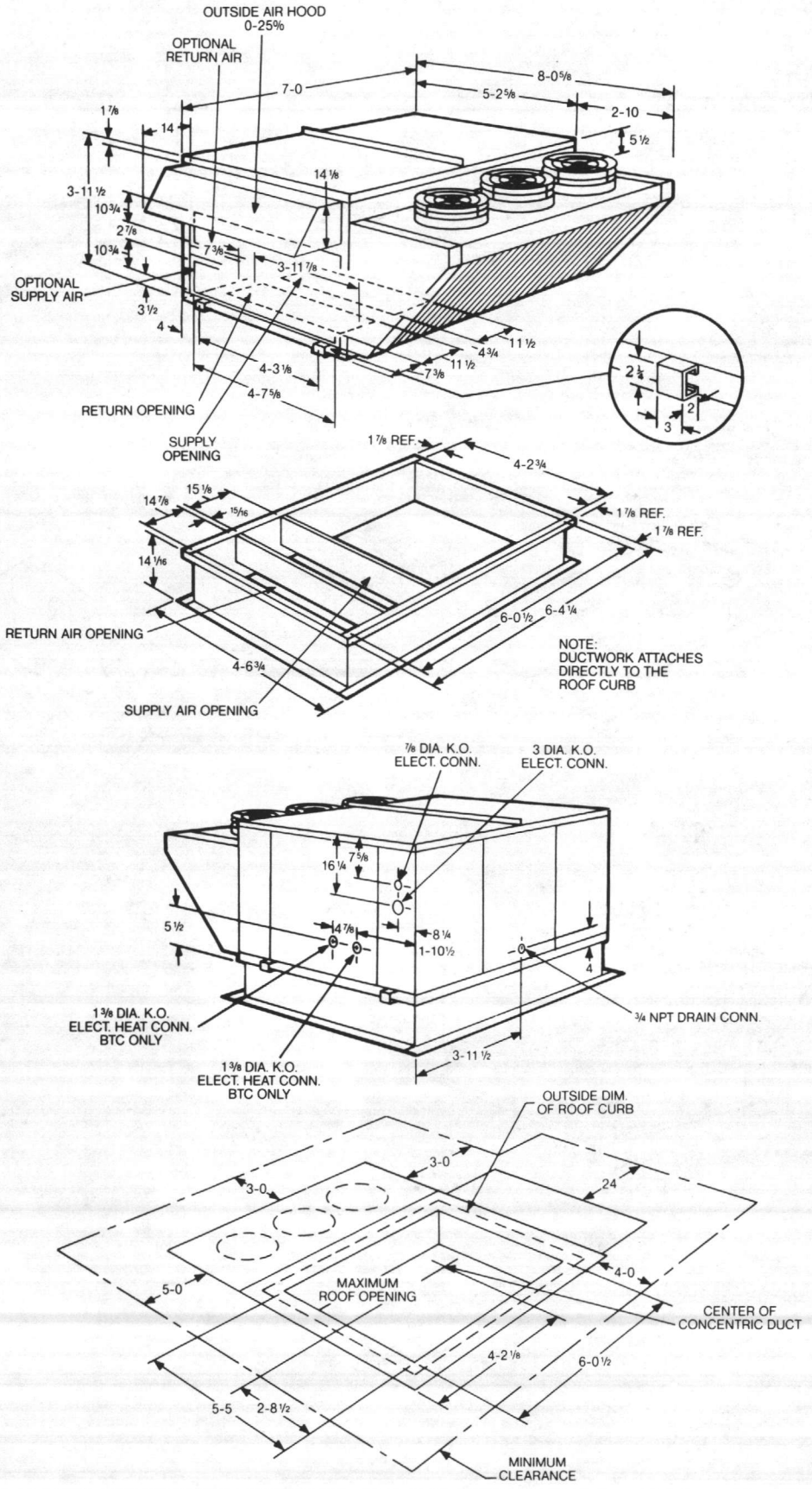
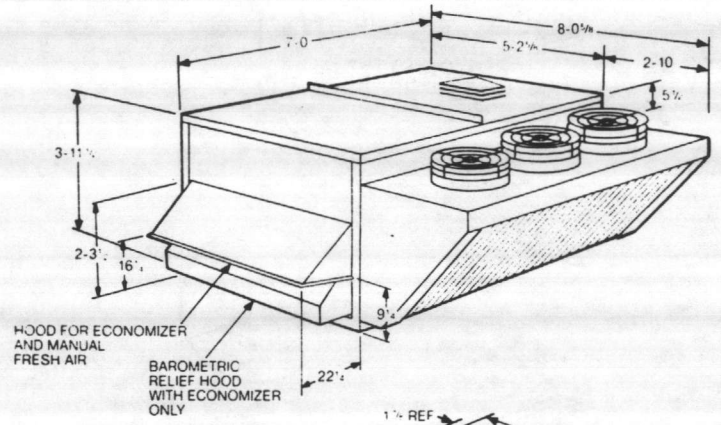
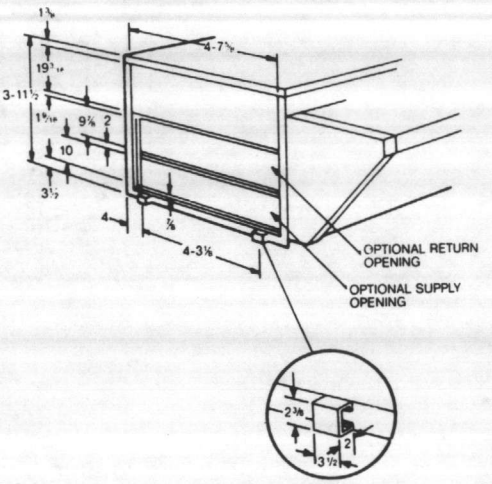
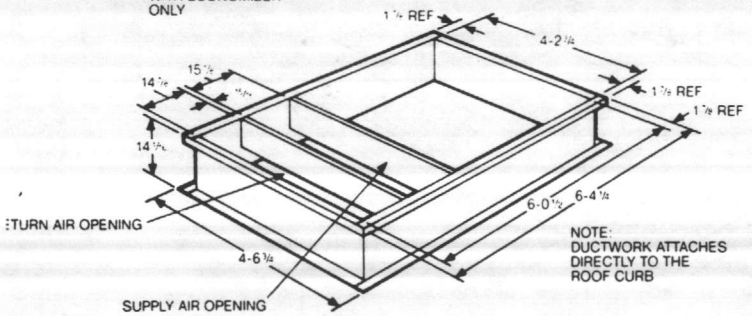
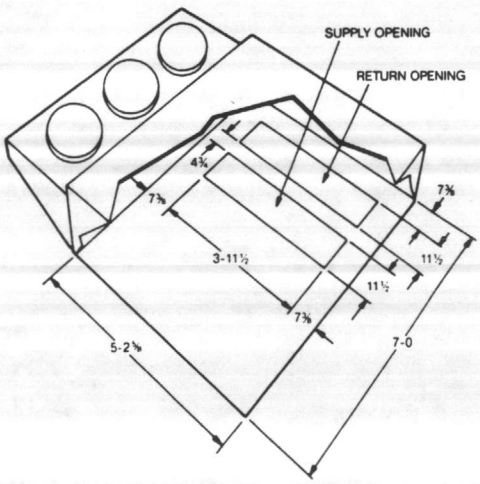


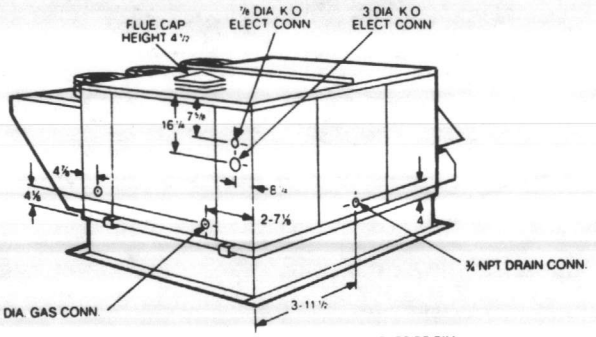
Figure 6
BTC130G-D
Unit Dimensions











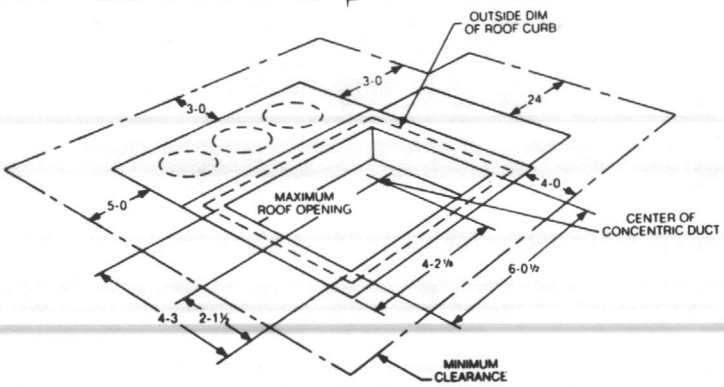
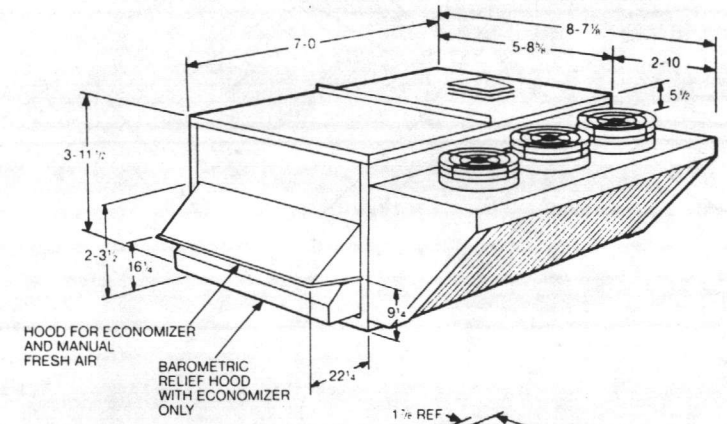
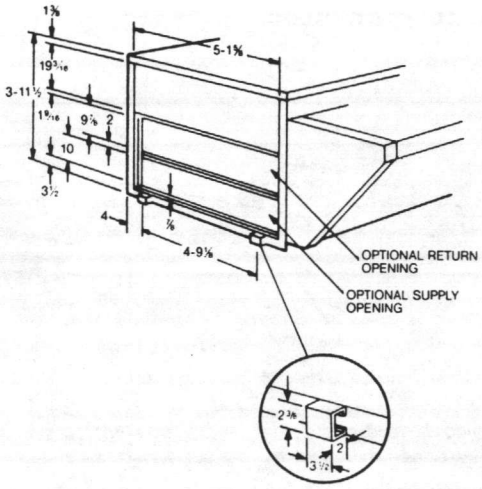
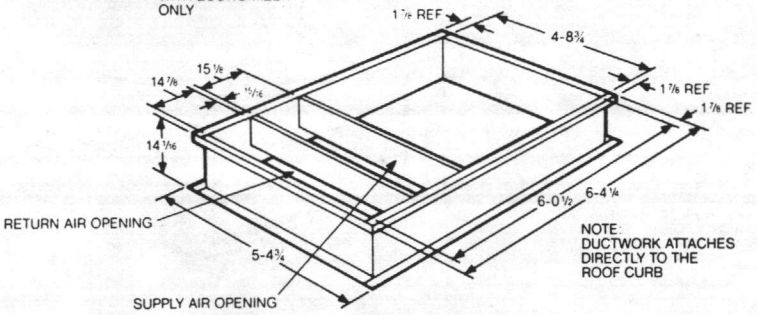
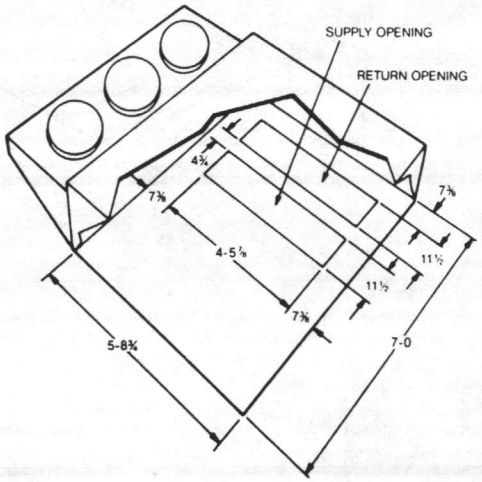


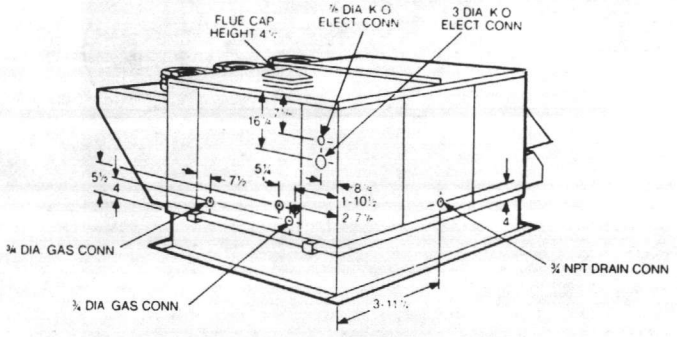
Figure 7
BTC170G-C
Unit Dimensions











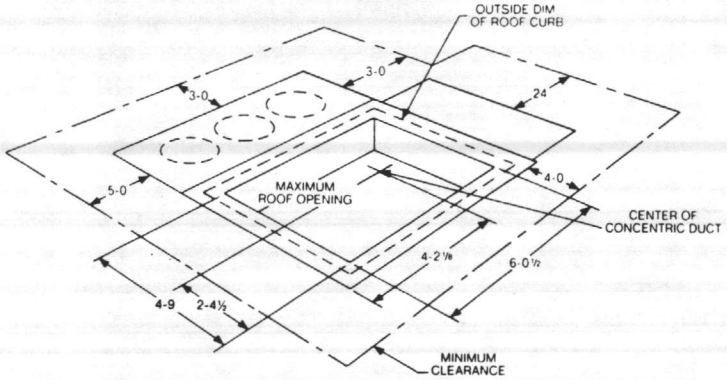
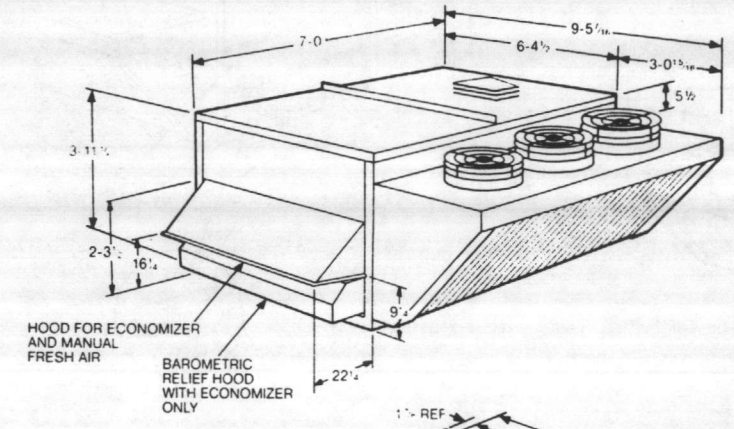
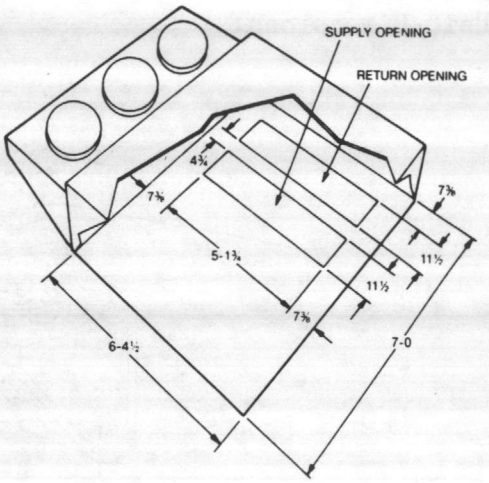
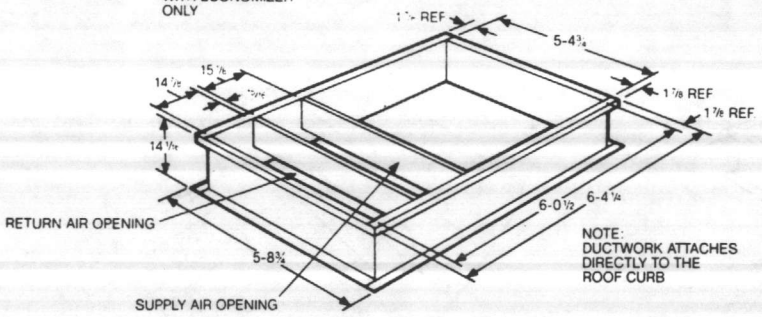
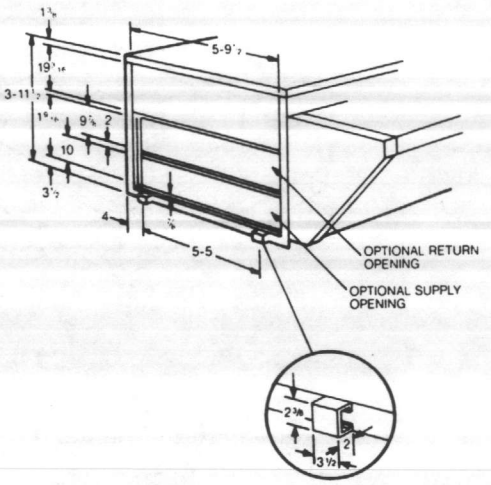


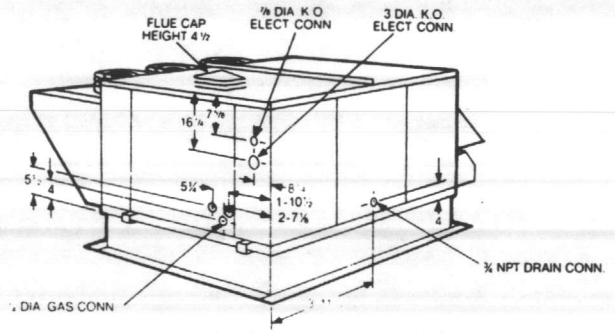
Figure 8
BTC200G-C
Unit Dimensions











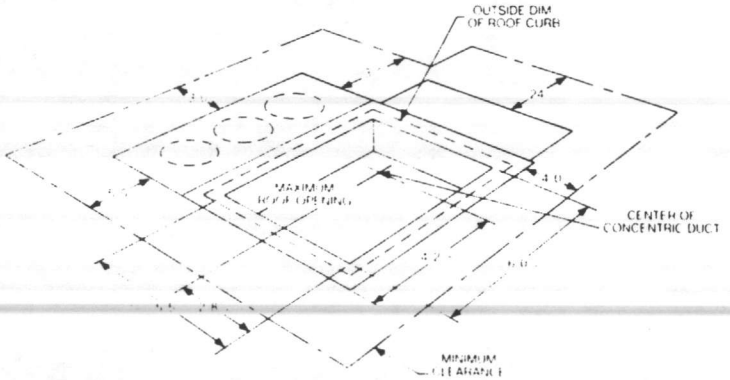


Figure 9
Typical BTC Component Sections (Unit Shown w/Access Panels Removed)

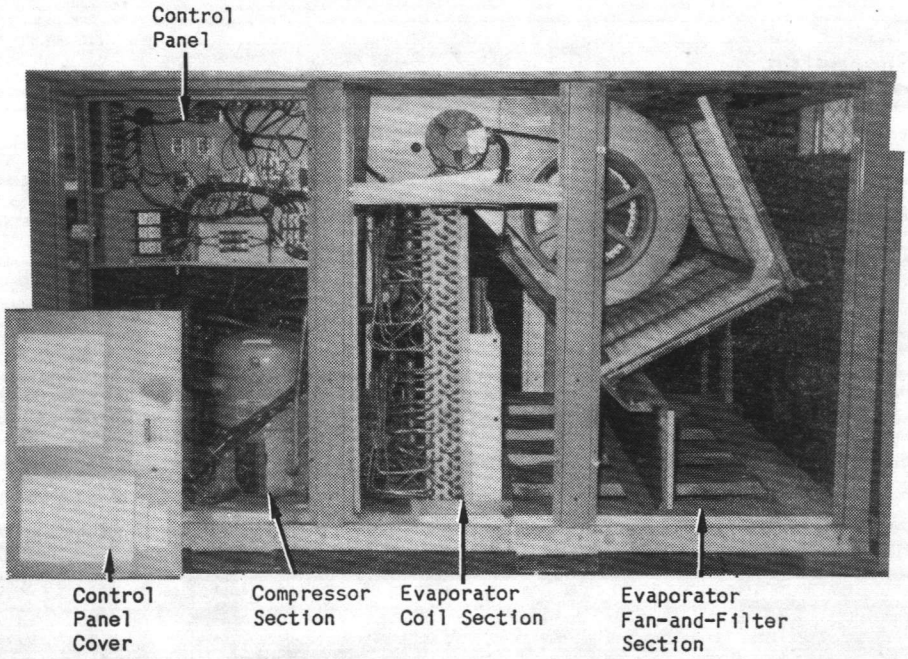
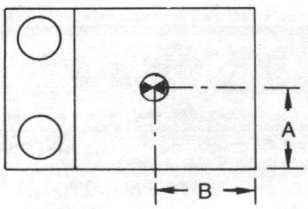


Figure 10
Unit Center-of-Gravity Information



Unit	A	B
BTC 100	26"	37"
BTC 130	39"	38"
BTC 170	39"	42"
BTC 200	39"	45"

Rigging

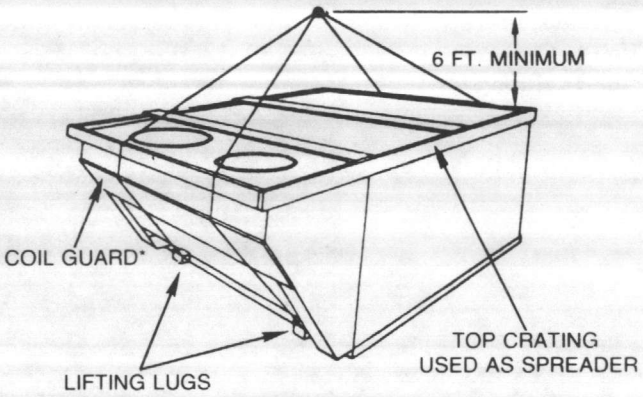
Rig the unit using either belt or cable slings. The slings **must** be placed through the lifting lugs welded to the base rails of the unit. Use the correct spreaders. The point where the slings meet at the lifting hook must be at least six feet above the unit. Refer to Figure 10 for center-of-gravity information: Figure 11 demonstrates proper rigging.

Note: To facilitate proper rigging and prevent unit damage, the top crating and coil guard on BTC 100 units must be left in place.

Leveling

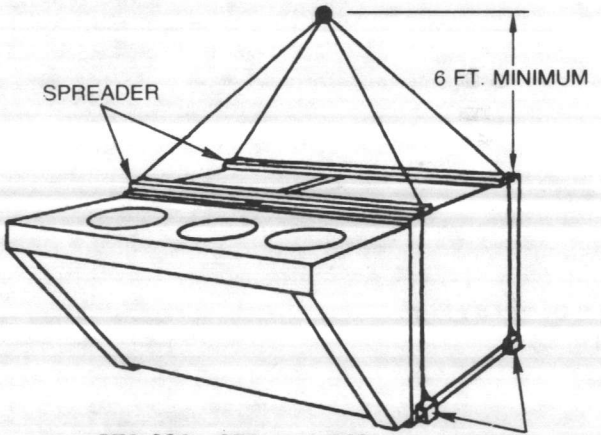
Regardless of where the unit is installed, it must be set level to ensure proper condensate flow from the unit drain pan.

Figure 11
Suggested Rigging Methods



BTC 100

*BE SURE COIL GUARD IS LEFT IN PLACE ON UNIT DURING RIGGING



BTC 130, 170 and 200

Unit Location

Installation of the unit should conform to local building codes or - in the absence of local codes - ANSI Z223.1-1984, and the National Electrical Code. Canadian installations must conform to CSA and local codes.

Select a location that will permit free airflow into and out of the condensing coil, and from the vertical discharge. Refer to Figures 2 thru 8 for specific clearance dimensions.

At least six feet of vertical clearance must be provided above the unit to ensure efficient unit operation. A reduction in this clearance may result in condenser coil starvation, or the recirculation of warm condenser air.

It is recommended that the fresh air intake be protected from direct winds.

Ground Level Installation

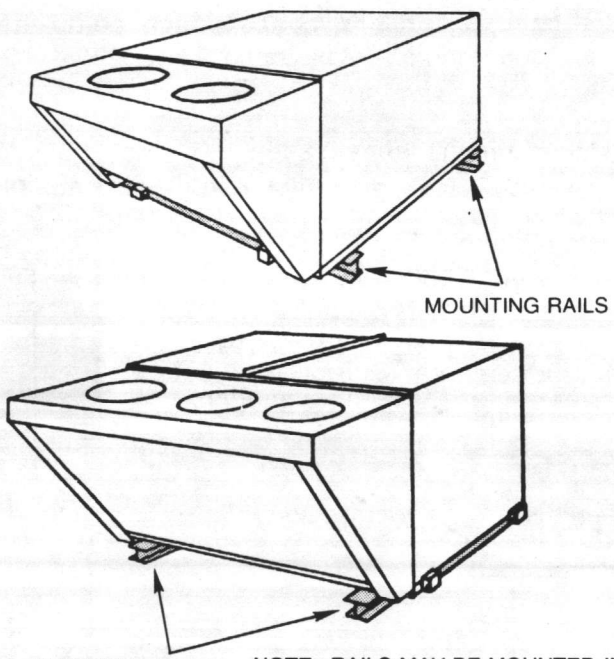
For ground level installation, the unit must be set on a level, reinforced concrete slab which is four inches thick and extends a minimum of two inches beyond the sides of the cabinet. At the condenser end of the unit, the slab should extend below the overhanging coils. Provide a gravel apron at least 12 inches wide on all sides of the slab to prevent vegetative growth close to the unit. While the slab should be located as close to the building as possible, the minimum clearances indicated in Figures 2 thru 8 must be maintained.

Rooftop Installation

For rooftop installations, the unit can be mounted on a roof curb, or on other suitable wood or metal supports. If a roof curb is not used, the unit can be supported anywhere along the base rail. Beams running the full length or width of the unit are recommended; see Figure 12.

If installing the unit on a roof curb, follow the installation instructions accompanying the Trane roof curb kit. On new roofs, the curb should be welded directly to the roof deck; for existing construction, nailers must be installed under the curb if welding is not possible. Be sure to attach the downflow ductwork to the curb before setting the unit into place.

Figure 12
Unit Installed on Mounting Rails



Vibration Isolation

Internal isolation of the compressor(s) and fan motors is usually sufficient to prevent vibration. If the unit is used where vibration is extremely critical, however, it should be entirely isolated from the building structure. Contact your local Trane representative for assistance when selecting spring curbs.

Attaching Horizontal Ductwork

All air ducts must be installed in accordance with the standard established by the National Fire Protection Association for the Installation of Air Conditioning and Ventilation Systems Other Than Residence-Type (NFPA No. 90A), and Residence-Type Warm Air Heating and Air Conditioning Systems (NFPA No.90B).

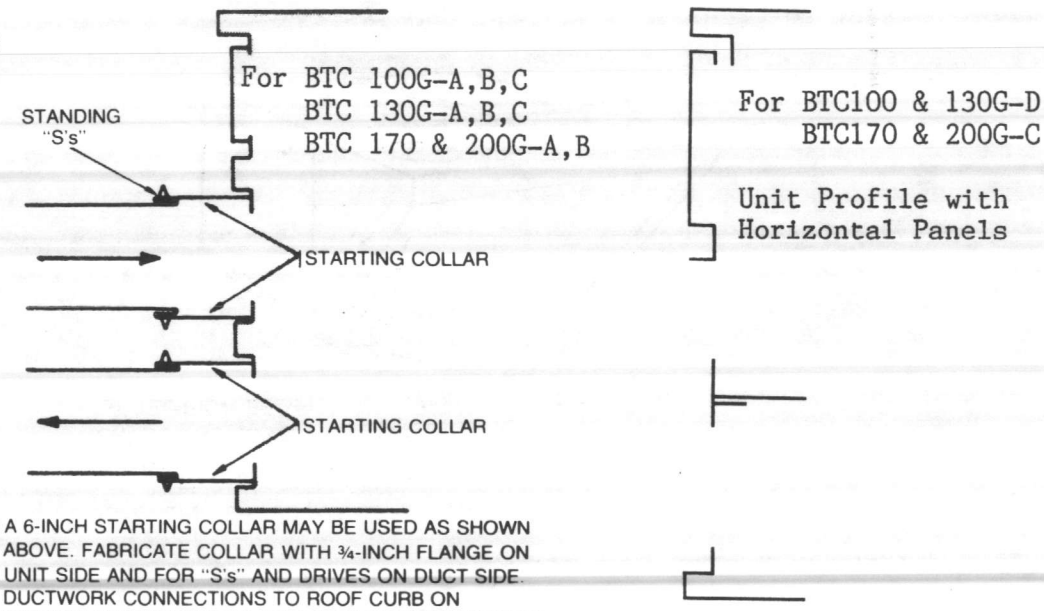
When attaching ductwork to the unit, provide a flexible connection to prevent noise transmission from the unit to the ducts. The flexible connection must be indoors, and is typically made of heavy canvas. Do not draw the canvas taut between the solid ducts; instead, it should have enough play to absorb any vibration.

Whenever ductwork is run through an outside wall or roof, always **waterproof** the opening.

Refer to Figures 1 thru 8 for horizontal duct configurations and dimensions with the horizontal conversion kit installed.

Note: An optional horizontal conversion kit must be ordered to complete a horizontal installation. This includes a horizontal conversion panel and supply and return support.

Figure 13
Attaching Ductwork



NOTE: A 6-INCH STARTING COLLAR MAY BE USED AS SHOWN ABOVE. FABRICATE COLLAR WITH ¾-INCH FLANGE ON UNIT SIDE AND FOR "S's" AND DRIVES ON DUCT SIDE. DUCTWORK CONNECTIONS TO ROOF CURB ON BOTTOM OF UNIT MAY BE MADE IN A SIMILAR FASHION IF NECESSARY.

Condensate Drains (BTC100-200G-B)

If the unit is mounted levelly, condensate will flow properly from the unit drain pan through the condensate drains provided. Two NPT drain connections are included on each BTC unit - one at the condenser end and one at the evaporator end. These connections enable the use of P-traps (when necessary) for condensate drainage from the unit to the ground or roof. Drain lines are not required for proper unit operation, but should be used if local codes (or site conditions) make them necessary. When needed, be sure to install the drain lines in accordance with local codes and standard piping practices.

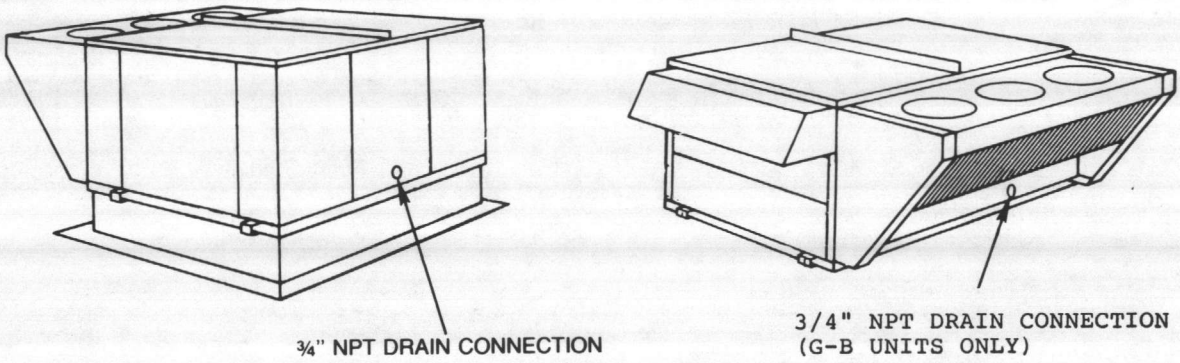
Condensate Drains (BTC100-200G-C)

If the unit is mounted levelly, condensate will flow properly from the unit drain pan through the condensate drains provided. One NPT drain connection is included on each BTC unit at the evaporator end (see Figure 12). This connection enables the use of a P-trap (when necessary) for condensate drainage from the unit to the ground or roof. Drain lines are not required for porper unit operation, but should be used if local codes (or site conditions) make them necessary. When needed, be sure to install the drain lines in accordance with local codes and standard piping practices.

Note: All drain lines must be pitched downward at least 1/2-inch for every 10 feet of horizontal run. Avoid long horizontal runs whenever possible.

CAUTION: During low ambient cooling (compressor) operation in cold climates, preventive measures must be taken to protect the drain lines from freezing. Failure to do so may result in poor equipment operation and/or unit damage due to ice build-up.

Figure 14
Location of Unit Drain Connections



Filters

BTC units ship with one-inch filters, as determined by unit size. To remove unit filters for replacement or cleaning, simply pull on the sheet metal strip found at the bottom of each filter bracket assembly.

Refer to Table 1, 2 or 3 for the filter requirements of each BTC unit.

For units with 11th and 12th digits in model number of AA or BA, refer to Table 1. (Example: BTC100G300AA)

Table 1
BTC Filter
Requirements

Unit Capacity	Number of Filters	Filter Size (H x W)
BTC 100	4	16" x 25"
BTC 130, 170	6	16" x 20"
BTC 200	6	16" x 25"

For units with 11th and 12th digits in model number of BB, refer to Table 2.

Table 2
BTC Filter
Requirements

Unit Capacity	Number of Filters	Filter Size
BTC 100	4	16" x 25"
BTC 130	6	16" x 20"
BTC 170	6	16" x 20"
	2	20" x 20"
BTC 200	6	20" x 25"

For units with 11th and 12th digits in model number of CA, DA, refer to Table 3.

Table 3
BTC Filter
Requirements

Unit Capacity	Number of Filters	Filter Size
BTC 100	4	16" x 25"
BTC 130	6	20" x 20"
BTC 170	6	16" x 20"
	2	20" x 20"
BTC 200	6	20" x 25"

BTC units ship with one-inch filters, as determined by unit size. A filter pull rod is provided, located at the end of the filter rack, to remove filters for cleaning or replacement. To use, simply remove the rod from the locating holes and use the hooked end to pull filters from unit. The rod is also a filter retainer and should be reinstalled after servicing the filters.

1" permanent filters are recommended for use with economizers in very humid or high rainfall locations.

To modify the unit filter racks to accept two-inch filters, the L-shaped angles (which are held in place with screws and formed tabs) on the racks must be rotated. Simply remove the screws, turn the angles 90 degrees, and reinstall the screws.

Note: The fan must be adjusted - before unit start-up - to deliver the required airflow; typically, unit airflow must be within ± 20 percent of the nominal cfm to ensure proper unit operation. The nominal cfm for each unit is indicated below:

BTC 100 = 3000 cfm
BTC 130 = 4000 cfm
BTC 170 = 5000 cfm
BTC 200 = 6000 cfm

Be sure to use the "Service Facts" to ensure proper fan adjustment.

Electrical Wiring

WARNING: OPEN THE ELECTRICAL POWER SUPPLY DISCONNECT SWITCH BEFORE SERVICING ELECTRICAL CIRCUITS. FAILURE TO DO SO CAN RESULT IN PERSONAL INJURY OR DEATH DUE TO ELECTROCUTION.

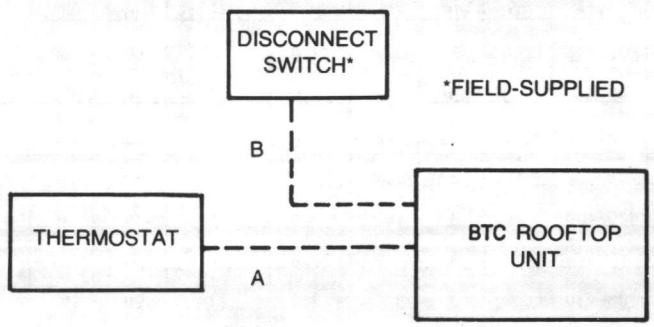
All field-installed wiring - including the electrical ground - must be in accordance with the National Electric Code, ANSI/NFPA No. 70-1984, and applicable local codes. In addition, all field wiring must conform to the Class II temperature limitations described in NEC. Refer to Figure 11 for a schematic of the field connections which must be made by the installing (or electrical) contractor.

The unit wiring diagram is pasted onto the back of the control box cover. Individual wiring diagrams are available for all units from The Trane Company. See Figures 1 and 2 for electrical knockout locations; the locations of the electrical panel components are shown on the unit wiring diagram.

Install a disconnect switch on the unit directly over the main power supply knockout. Refer to Table 2 for the proper disconnect and power wiring size. Local code requirements take precedence over the values provided in the table if discrepancies arise.

CAUTION: Do not use a drill bit longer than four inches to drill the disconnect mounting holes; equipment damage could result.

Figure 15
BTC Field Wiring



A = 0H/2C Auto Changeover — 4 Wires
1H/1C Manual Changeover — 4 Wires
1H/2C Manual Changeover — 4 Wires
(5 Wires on BTC 130, 170 and 200 units)
2H/2C Manual/Auto Changeover — 6 Wires

B = 3 Power Wires

All Wiring — Except Power Wires Is Low Voltage.

NOTE: All customer-supplied wiring to be copper only, and must conform to NEC and electrical codes. Wiring shown dotted is to be furnished and installed by customer.

Use copper wire for the connections from the disconnect to the three-pole terminal block inside the electrical panel of the unit; again, refer to Table 2 or 2a to determine correct wire size.

Note: If the power supply voltage is less than 215 VAC (on 208/240-volt units), disconnect the red control transformer lead wire from the line voltage terminal strip; then attach the blue terminal lead wire in its place. Insulate the exposed end of the red wire and replace it (out of the way) inside the control box.

Table 2
Electrical Characteristics of Standard Motor Sizes

Model	Compressor Motor(s)							Condenser Fan Motors(s)						
						Amps							Amps1	
BTC	HP3	RPM	Volts	CYC	PH	F.L.2	L.R.	HP3	RPM	Volts	CYC	PH	F.L.2	L.R.
100G3	7.5	3450	208-230	60	3	29.1	156	1/3	1075	208-240	60	1	2.7	5.5
100G4	7.5	3450	460	60	3	14.2	79	1/3	1075	440-480	60	1	1.3	2.6
100GW	7.5	3450	575	60	3	11.4	63	1/3	1075	575	60	1	1.1	2.1
130G3	5	3450	208-230	60	3	20.3	124	1/2	1725	208-240	60	1	4.1	9.5
130G4	5	3450	460	60	3	9.4	62	1/2	1725	440-480	60	1	2.1	4.8
130GW	5	3450	575	60	3	7.5	50	1/2	1725	575	60	1	1.6	3.8
170G3	6.25	3450	208-230	60	3	23.9	142	1/2	1725	208-240	60	1	4.1	9.5
170G4	6.25	3450	460	60	3	11.2	71	1/2	1725	440-480	60	1	2.1	4.8
170GW	6.25	3450	575	60	3	9.0	57	1/2	1725	575	60	1	1.6	3.8
200G3	7.5	3450	208-230	60	3	29.2	156	1/2	1725	208-240	60	1	4.1	9.5
200G4	7.5	3450	460	60	3	14.2	79	1/2	1725	440-480	60	1	2.1	4.8
200GW	7.5	3450	575	60	3	11.4	63	1/2	1725	575	60	1	1.6	3.8

Table 2 (Continued)

Model	Evaporator Fan Motor							Minimum Circuit	Fuse Size	
						Amps1				
BTC	HP	RPM	Volts	CYC	PH	F.L.	L.R.	Ampacity	Min.4	Max.
100G3	3	3450	208-230	60	3	8.4	72.0	53	60	80
100G4	3	3450	440-480	60	3	4.2	36.0	26	30	35
100GW	3	3450	575	60	3	3.2	28.8	21	25	30
130G3	3	3450	208-230	60	3	8.4	72.0	69	80	80
130G4	3	3450	440-480	60	3	4.2	36.0	33	35	40
130GW	3	3450	575	60	3	3.2	28.8	26	30	30
170G3	3	3450	208-230	60	3	8.4	72.0	77	90	100
170G4	3	3450	440-480	60	3	4.2	36.0	37	40	45
170GW	3	3450	575	60	3	3.2	28.8	29	35	35
200G3	5	3450	208-230	60	3	12.8	110.0	95	100	120
200G4	5	3450	440-480	60	3	6.4	55.0	46	50	60
200GW	5	3450	575	60	3	6.1	44.0	37	40	45

Notes:
1. Amp draws for each motor; multiply value by number of motors to determine total amps.
2. Rated at UL conditions (i.e., 80 F dry bulb/67 F wet bulb/95 F Ambient for 208 or 460-volt operation.
3. Values provided in these columns are per motor. BTC 100 units have one compressor and two condenser fans; BTC 130, 170 and 200 units have two compressors and three condenser fans.
4. Dual-element (Class K) fuse should be used.

Table 2a
Electrical Characteristic
of Standard Motor Sizes for
Model Numbers BTC100G---CA,DA
and BTC130G---CA,DA

Model BTC	Compressor Motor(s)						
						Amps	
	HP3	RPM	Volts	CYC	PH	F.L.2	L.R.
100G3	7.5	3450	208-230	60	3	29.1	156
100G4	7.5	3450	460	60	3	14.2	79
100GW	7.5	3450	575	60	3	11.4	63
130G3	5	3450	208-230	60	3	21.6	115
130G4	5	3450	460	60	3	9.8	50
130GW	5	3450	575	60	3	7.8	45

Condenser Fan Motors(s)						
					Amps1	
HP3	RPM	Volts	CYC	PH	F.L.2	L.R.
1/3	1075	208-240	60	1	2.7	5.5
1/3	1075	440-480	60	1	1.3	2.6
1/3	1075	575	60	1	1.1	2.1
1/2	1725	208-240	60	1	4.1	9.5
1/2	1725	440-480	60	1	2.1	4.8
1/2	1725	575	60	1	1.6	3.8

Table 2a (cont.)

Model BTC	Evaporator Fan Motor							Minimum Circuit	Fuse Size	
						Amps1				
	HP	RPM	Volts	CYC	PH	F.L.	L.R.	Ampacity	Min.4	Max.
100G3	2	3450	208-230	60	3	6.3	42.0	53	60	80
100G4	2	3450	440-480	60	3	3.1	21.3	26	30	35
100GW	2	3450	575	60	3	2.3	15.8	21	25	30
130G3	3	3450	208-230	60	3	8.4	72.0	73	80	90
130G4	3	3450	440-480	60	3	4.2	36.0	33	35	40
130GW	3	3450	575	60	3	3.2	28.8	26	30	30

Notes:

1. Amp draws for each motor; multiply value by number of motors to determine total amps.
2. Rated at UL conditions (i.e., 80 F dry bulb/67 F wet bulb/95 F Ambient for 208 or 460-volt operation.
3. Values provided in these columns are per motor. BTC 100 units have one compressor and two condenser fans; BTC 130 units have two compressors and three condenser fans.
4. Dual-element (Class K) fuse should be used.

Voltage Requirements

Voltage at the compressor terminals must be within the specified operating range shown on the unit nameplate. The installing contractor should check the voltage at the load side of the contactors according to the instructions provided in the "Starting Unit in Cooling Mode" section of this manual. **Do not attempt to check the compressor voltage until that time.** All other pre-start procedures must be completed first.

Thermostat Mounting and Wiring

An accessory room thermostat - which regulates one or both cooling cycles as needed to balance capacity with system load - is required to control BTC units. Your Trane sales representative will provide the information needed to determine correct thermostat and subbase selection for specific unit applications.

Recommended wire sizes and lengths for installing the unit thermostat are provided in Table 3. **The total resistance of these low-voltage wires must not exceed 1 ohm;** any resistance in excess of 1 ohm may cause the control to malfunction because of the high voltage drop.

Table 3
Recommended Thermostat Wire Size

Wire Size	Maximum Wire Length
22-Gauge	30 Ft.
20-Gauge	50 Ft.
18-Gauge	75 Ft.
16-Gauge	125 Ft.
14-Gauge	200 Ft.

When selecting a thermostat location, be sure to choose a site in a frequently occupied area with good air circulation at an average temperature. The thermostat should be positioned approximately five feet above the floor.

Do **not** mount the thermostat where its sensing element may be affected by:

-drafts or "dead" spots behind doors or in corners;
-hot or cold air from ducts;
-radiant heat from the sun, or from appliances;
-concealed pipes and chimneys;
-vibrating surfaces; or,
-unheated or uncooled areas behind the thermostat (e.g., outside walls).

CAUTION: If an energy management device, time clock or other similar device is used, a separate power supply must be applied for that device. Do not use the unit control circuitry, or damage to the unit may result.

Oversized Motor Kit

Oversized motor kits meeting all applications for the values lying within the tables found in the "Service Facts" are available from the Trane Company. If the calculated performance falls below the limits of the table, contact your nearest Trane service representative for proper selection of a larger motor.

Each oversized motor kit includes the motor, sheaves, and belt (if required) necessary to obtain the desired unit performance.

Installation Checklist

Complete this checklist as the unit is installed to verify that all recommended installation procedures are accomplished before the unit is started. **This checklist does not replace the detailed instructions provided in this manual!** Read the entire section carefully to become familiar with the installation procedures **before** installing the unit.

Receiving

[] Unit nameplate data corresponds with ordering information.
[] Unit inspected for shipping damage; reported any damages found.
[] Unit checked for material shortage; reported any shortages found.

Unit Location

[] Condenser air clearances over unit good.
[] Service clearances around unit good.
[] Unit secured in correct location.
[] Unit set level.

Unit Overview

[] Ductwork properly attached to unit with flexible connection.
[] Condensate drain lines installed where required by local codes.
[] Unit isolated from building if vibration is critical.
[] Evaporator fan properly adjusted for system external static pressure.
[] Oversized motor kit installed if deemed necessary.

Electrical Wiring

[] Field-installed wiring complies with all applicable codes.
[] Disconnect switch installed on unit.
[] Thermostat properly located and installed.

Unit Start-Up

Preparation

Before starting the BTC rooftop unit, use the "Installation Checklist" in conjunction with procedures outlined below to ensure that the unit is completely and properly installed, and ready for start-up.

WARNING: OPEN THE UNIT DISCONNECT SWITCH AND LOCK IT IN THAT POSITION TO PREVENT ACCIDENTAL START-UP. NEVER OPEN AN ACCESS PANEL TO INSPECT OR SERVICE THE UNIT WITHOUT FIRST OPENING THE DISCONNECT SWITCH; FAILURE TO DO SO MAY RESULT IN INJURY OR DEATH DUE TO ELECTRICAL SHOCK OR CONTACT WITH MOVING PARTS.

- [] Inspect all wiring connections; connections should be clean and tight.
- [] Tighten the screws in the control box and check to see that the contactors are free.
- [] Trace unit circuitry to ensure that actual wiring agrees with the "as wired" diagrams provided with the unit. Information in the title block of the wiring diagram should match the data appearing on the unit nameplate.
- [] Rotate all fans manually. They should be free from obstruction and turn freely in the correct direction of rotation.
- [] Inspect fan drives for proper alignment and fan belts for proper tension. Each belt should be checked with a belt tension gauge as described in the Maintenance Manual.
- [] Check refrigeration circuit for leaks; entire refrigerant circuit should be leak-free.
- [] Check unit supply voltage to ensure that it is within the utilization range stamped on the compressor and unit nameplates.
- [] Check condensate lines to ensure that they are not obstructed.
- [] Verify that all filters are clean and properly installed, and that all dampers are set properly.
- [] Ensure that all unit access panels are in place, and that all screws, nuts, and bolts are tight.
- [] Check for interference or binding of damper blades on economizer if so equipped.

Initial Start-Up

Before any unit start-up in the cooling mode, the compressor crankcase heater(s) must be energized for a minimum of eight hours. With the crankcase heater(s) in operation, any refrigerant in the compressor crankcase(s) will vaporize, thereby preventing excessive foaming and compressor bearing damage.

CAUTION: Whenever the unit disconnect switch is opened during routine maintenance or servicing, power to the compressor crankcase heater(s) is interrupted. If the crankcase heater(s) are NOT recycled before a cooling start-up, compressor bearing damage may result.

Use the procedure outlined below to energize the crankcase heater(s):

1. Set the thermostat system switch to OFF.
2. Close the unit disconnect switch.
3. Allow the crankcase heater(s) to operate a minimum of eight hours.

Once eight hours have elapsed, set the thermostat system switch to COOL. Then verify that the fan switch is positioned at either AUTO or ON. Move the temperature control setting lever to a point below room temperature.

The unit will automatically function in the cooling mode in response to the setting on the room thermostat. When a call for cooling is made, the compressor(s), evaporator fan, and condenser fans are energized. Refer to the "Operation" manual for control and electrical sequences of operation. Be sure to verify that the unit airflow rate is adjusted according to the information provided in the "Service Facts".

Operating Pressures

After the unit has operated in the cooling mode for a brief period of time, install pressure gauges on the gauge ports of the discharge and suction line valves located in the compressor compartment. Refer to Figures 16 and 17 for valve locations. Check the suction and discharge pressures and compare them to the approximate operating pressures provided in Table 4 or 4a.

Note: DO NOT USE THESE PRESSURES TO DETERMINE UNIT REFRIGERANT CHARGE. Correct unit operating charge is shown on the unit nameplate. To charge the system accurately, either use a charging cyclinder or weigh the charge.

Table 4
Operation
Pressures (Psig)

Model	Pressure	DB Entering Air To Condenser			
		85 F	95 F	105 F	120 F
BTC 100	Discharge	239	271	306	344
	Suction	76	78	80	83
BTC 130	Discharge	248	280	313	350
	Suction	74	76	78	81
BTC 170	Discharge	240	273	309	348
	Suction	76	79	81	83
BTC 200	Discharge	255	288	323	362
	Suction	76	78	81	83

Table 4a
Operation Pressures (Psig)
for Model Numbers BTC100G---CA,DA
BTC130G---CA,DA
BTC170G---CA
BTC200G---CA

Model	Pressure	DB Entering Air To Condenser			
		85F	95F	105F	120F
	Discharge	233	263	297	354
BTC100	Suction	75	77	79	82
	Discharge	246	276	310	367
BTC130	Suction	75	77	79	82
	Discharge	259	288	320	374
BTC170	Suction	77	79	81	84
	Discharge	270	301	334	391
BTC200	Suction	77	79	81	84

NOTES:

1. Based on nominal cfm (400 cfm/ton).
2. Evaporator air is 80F DB - 67 F WB.
3. Suction pressure is accurate to withing ± 2 psig.
4. Discharge pressure is accurate to within ± 7 psig.

Figure 16
Suction and Discharge Access Valve Locations on BTC 100 Units

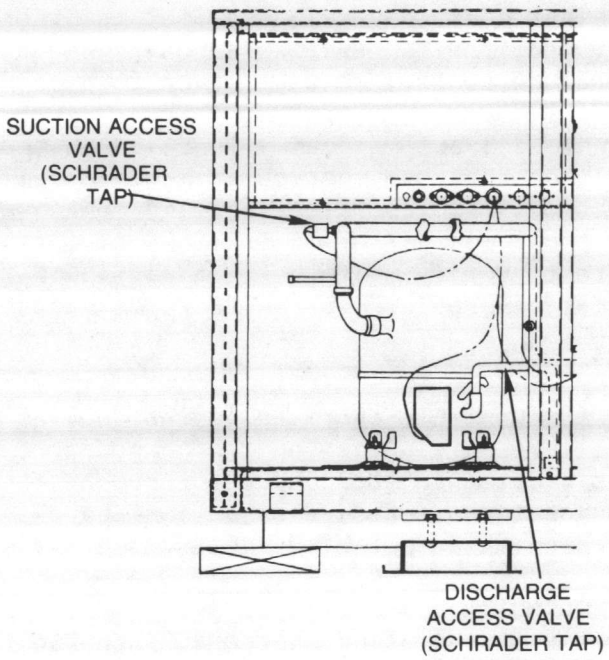
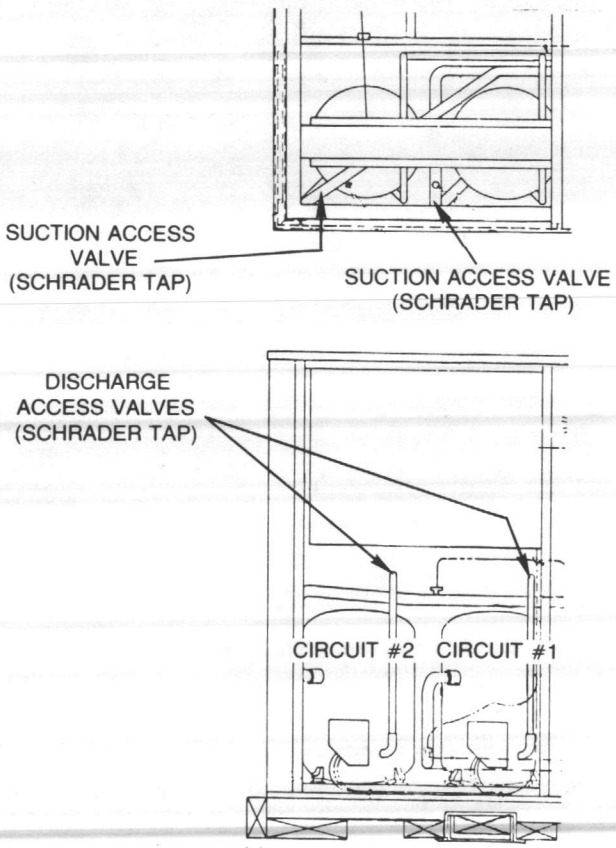


Figure 17
Suction and Discharge Access Valve Locations on BTC 130, 170 and 200 Units



Voltage and Amperage Checks

WARNING: USE EXTREME CARE WHEN CHECKING VOLTAGE AND AMPERAGE AT LIVE TERMINALS. AVOID TOUCHING THE TERMINAL WITH HANDS OR BODY, UNINSULATED TOOLS, OR CLOTHING. BE SURE FLOOR, ROOF OR GROUND SURFACE IS NEITHER DAMP NOR WET. SET THE TEST INSTRUMENT TO THE PROPER MODE AND RANGE. FAILURE TO FOLLOW THESE SAFETY MEASURES COULD RESULT IN SERIOUS INJURY OR DEATH FROM ELECTRICAL SHOCK OR AN EXPLODING TEST INSTRUMENT.

With the compressor operating, check the line voltage at the unit. The voltage should be within the range shown on the nameplate. If low voltage is encountered, check the size and length of the supply line from the main disconnect to the unit; the line may be undersized for the length of run.

Measure the voltage at the load side of the compressor contactors while the compressor is running; the voltage must be within the range stated on the unit nameplate. If low voltage is encountered, check for loose connections, undersized wiring (for the length of run), or low supply voltage from the power company. In addition, verify that the voltage at the load side of these contactors does not fall below the minimum limit during locked rotor current surge (i.e., while the compressor is starting).

Use a clamp-on ammeter to check compressor amperage with the compressors in operation. Amperage draw must not exceed the values shown in Table 2. Voltage imbalance cannot exceed 2 percent; if it does, de-energize the compressor(s) immediately and contact the power company. (To calculate voltage imbalance, refer to the paragraphs which follow.)

Calculating Voltage Imbalance

Voltage imbalance on three-phase systems can cause motors to overheat and eventually fail. The maximum imbalance allowable is two percent, and the readings used to determine it must be measured at the compressor terminals.

Voltage imbalance is defined as 100 times the maximum deviation of the three voltages from the average (without regard to sign) divided by the average voltage. If, for example, the measured voltages are 221, 230, and 227, the average voltage would be:

$$\frac{221 + 230 + 227}{3} = 226 \text{ volts}$$

The percent of voltage imbalance is then:

$$\frac{100 \times (226 - 221)}{226} = 2.2\%$$

In the example above, the 2.2 percent imbalance is not acceptable. Whenever a voltage imbalance of more than 2.0 percent exists, be sure to check the voltage at the unit disconnect switch. If an imbalance is again apparent, the power company should be notified to correct the problem. If the imbalance at the unit disconnect switch does NOT exceed 2.0 percent, the imbalance is caused by faulty wiring within the unit. Be sure to conduct a thorough inspection of the unit electrical wiring connections to locate the fault, and make any repairs necessary.

Economizer Start-Up Adjustments for BTC100-130G-A, B, C Models and BTC170-200G-A, B Models

Be sure to make the operational adjustments described below on those units equipped with factory-installed economizers.

1. Remove the economizer control box cover.

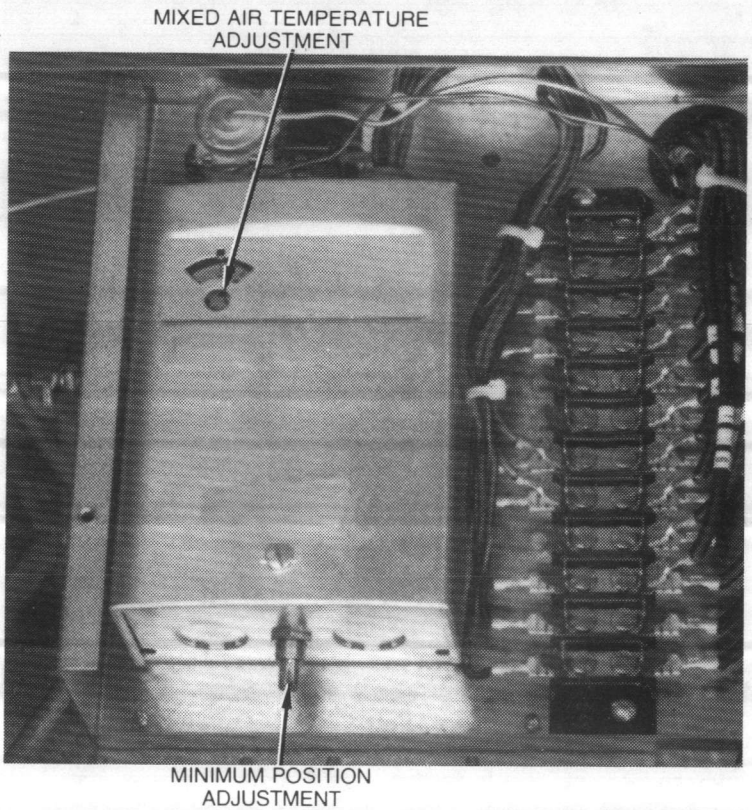
2. **Mixed Air Temperature Adjustment** Mechanical (cap-tube) Economizer Control Only.: Using a screwdriver, set the minimum mixed air temperature setting; see Figure 18.

   CAUTION: Do not set mixed air temperature below 60 F or compressor damage may result.

   Note: Electronic Mixed Air Sensor is not adjustable.

3. **Minimum Position Adjustment:** Energize the evaporator fan. Then set the minimum fresh air damper position with a screwdriver. The dampers should open and close in response to the minimum position adjustment; see Figure 18.

Figure 18
Mechanical Economizer Control Box (Shown with Cover Removed)



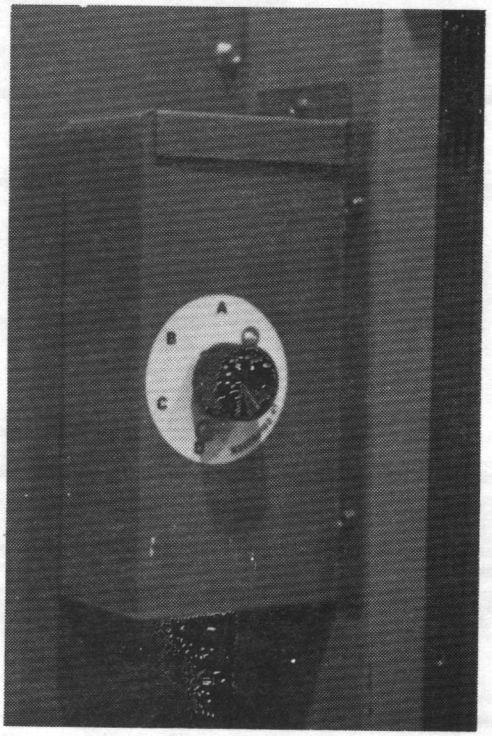
UN/ACC-5034

Note: Electronic Mixed Air Sensor is not adjustable and minimum position potentiometer is mounted on the actuator.

4. Enthalpy Control Adjustment:
   Set the enthalpy control knob to the desired setting. Notice that the enthalpy control (shown in Figure 19) is marked with four settings: A, B, C, and D. The suggested control setting is B. See Figure 20 for temperature and humidity range settings.

5. **Maximum Fresh Air Adjustment:** Because of the length of the return air ducts in some applications, an increase in unit airflow may result when the economizer modulates to full open. This situation can result in increased loads on the evaporator fan motor, and may be detrimental to the air balance of the building.

Figure 19
Enthalpy Control Adjustment



Economizer Start-Up Adjustments for BTC100-130G-D Models and BTC170-200G-C Models

Be sure to make the operational adjustments described below on those units equipped with factory or field installed economizers.

1. Remove the filter access panel.

   Note: Electronic Mixed Air Sensor is set at 58 F and is not adjustable.

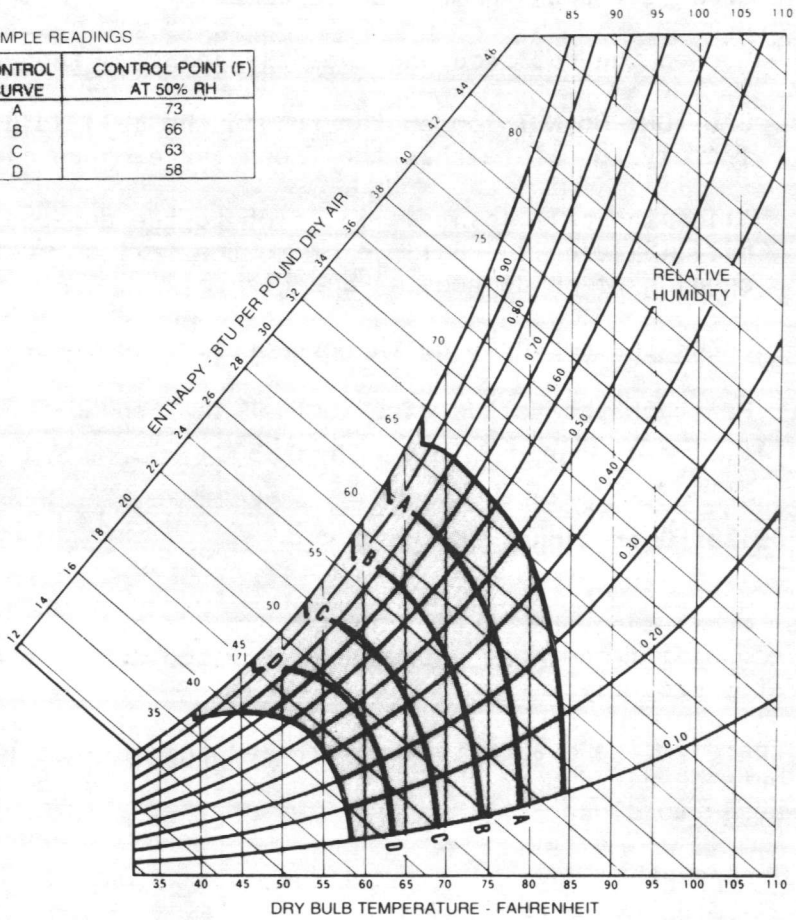
2. **Minimum Position:** The minimum position potentiometer is attached to the terminals on top of the damper actuator. Energize the evaporator fan. Then set the minimum fresh air damper position with a screwdriver. The dampers should open and close in response to the minimum position adjustment.

3. **Enthalpy Control Adjustment:** The enthalpy control knob is located below the damper actuator. Set the enthalpy control knob to the desired setting. The enthalpy control is marked with four settings: A, B, C, and D. The suggested control setting is B. See Figure 20 for temperature and humidity range settings.

Figure 20
Operating Curves for Enthalpy Control Dial Settings

EXAMPLE READINGS

CONTROL CURVE	CONTROL POINT (F) AT 50% RH
A	73
B	66
C	63
D	58



NOTE: THE ECONOMIZER WILL OPERATE AT TEMPERATURE AND HUMIDITY LEVELS IN THOSE AREAS TO THE LEFT OF EACH LINE LABELED A, B, C OR D.

This problem - if it exists - can be corrected by adjusting the full-open position of the fresh air dampers. As shipped from the factory, the fresh air dampers open 60 degrees at the full-open position. To modify the fresh air dampers to open to a lesser extent, proceed as described below:

a. Energize the evaporator fan; check amp draw after the economizer has moved to the minimum position setting. (See note in Step 5c.)

b. Remove the yellow wire from Terminal TS2-12 in the economizer control box; this causes the blades of the fresh air damper to drive full open.

c. Check the evaporator fan motor amp draw.

Note: The economizer control box access panel must be in place to ensure correct readings.

d. If the amp draw noted in Step 5c is greater than that measured in 5a, the fresh air opening must be adjusted.

* Loosen the nut securing the ball joint on the fresh air damper drive.

CAUTION: Do NOT loosen the rod in the ball joint; it is preset in the factory to ensure that the fresh air dampers close tightly.

Slide the ball joint in the slot to the desired position and tighten the nut. (Sliding the ball joint to the maximum position results in a maximum opening of 30 degrees.) See Figure 21.

e. Check the amp draw of the evaporator fan motor to confirm positioning.

f. Reattach the yellow wire removed in Step 5b to Terminal TS2-12.

*Only for models BTC100G thru 130G-A, B, C and BTC170G thru 200G-A, B. Later models have no adjustments.

Economizer Operational Checkout

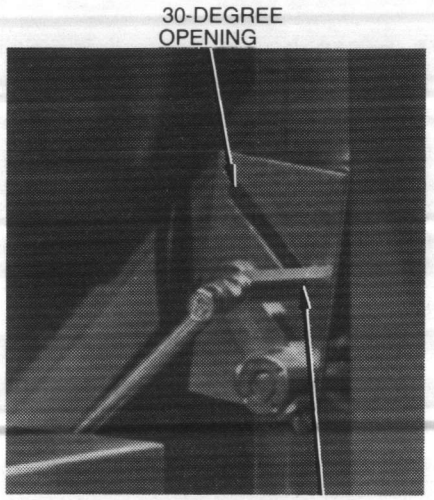
After completing the control adjustments described under "Adjustment", perform the economizer checkout procedure described below to ensure that the economizer operates properly:

1. Energize the evaporator fan; the economizer motor should operate, the outside air damper should begin to open, and the return air damper should begin to close.

   Observe this operation until the motor stops at the minimum air position.

2. Energize the Y1 terminal (i.e., first stage of cooling). If outside air conditions are acceptable for economizer operation, the outside air damper blades will continue to open and the return air damper blades will continue to close.

Figure 21
Fresh Air Damper Adjustment Slot



This operation will continue until the mixed air temperature falls below the 58 F mixed air temperature setting . At this point, the damper blades will modulate to maintain a minimum supply air temperature. Neither the compressor nor the condenser fan should come on at this time. If outside air conditions are not suitable for "economizing", however, both the compressor and the condenser fan will energize.

3. Energize Terminal Y2 to simulate a second-stage cooling command. If outside air conditions are acceptable for economizer operation, the first-stage compressor will energize and the second-stage compressor will remain off (dual-compressor units only). If outside air conditions are not suitable for "economizing", the second-stage compressor will begin operation.

4. De-energize Terminals Y1, Y2, and G. The blades of the economizer (i.e., fresh air) damper will fully close, while those of the return air damper will open to their full extent.

5. Replace the filter access panel.

For detailed economizer operational sequences for BTC 100 through 200 units, see the BTC Operation/Maintenance Manual.

The Trane Company
Light Commercial Group
Guthrie Highway
Clarksville, TN 37040

Technical Literature Printed in USA

TRANE™

BTC-IN-5
18-AB60D6

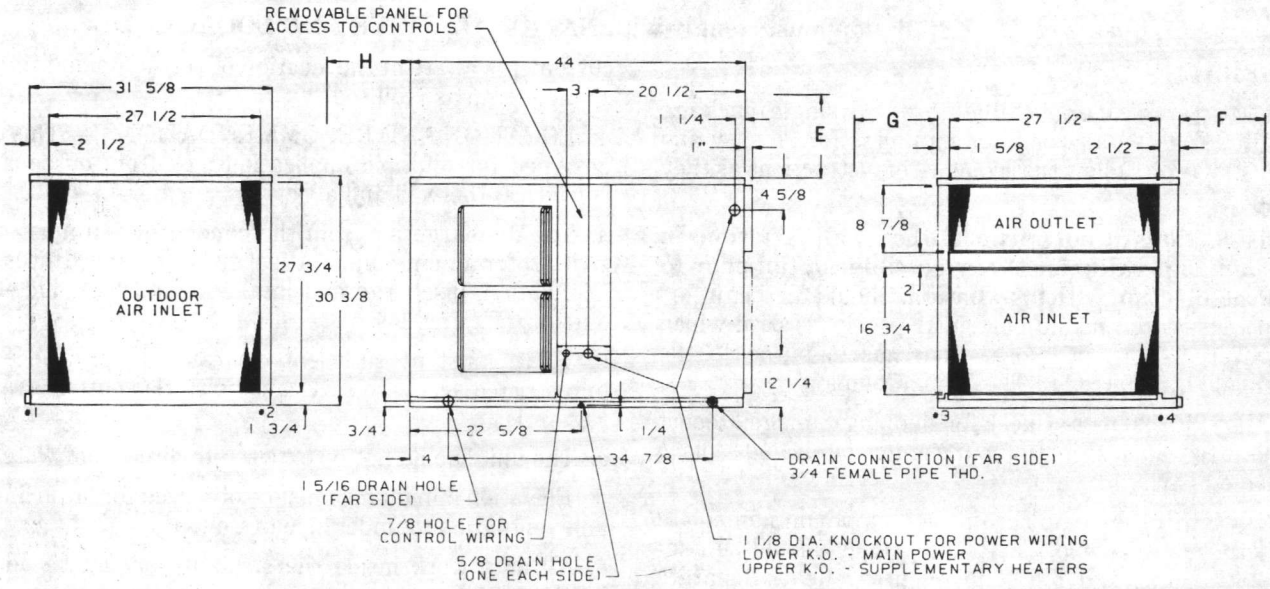
INSTALLER'S GUIDE

Single Package Unit
2, 2½, 3 Ton

Models:
BTC024C100B
BTC030C100B
BTC036C100B, C300B, C400B

Library	Service Literature
Product Section	Unitary
Product	Rooftop Air Conditioning
Model	BTC
Literature Type	Installer's Guide
Sequence	5
Date	August 1985
File No.	SV-UN-RT-BTC-IN-5 885
Supersedes	

1



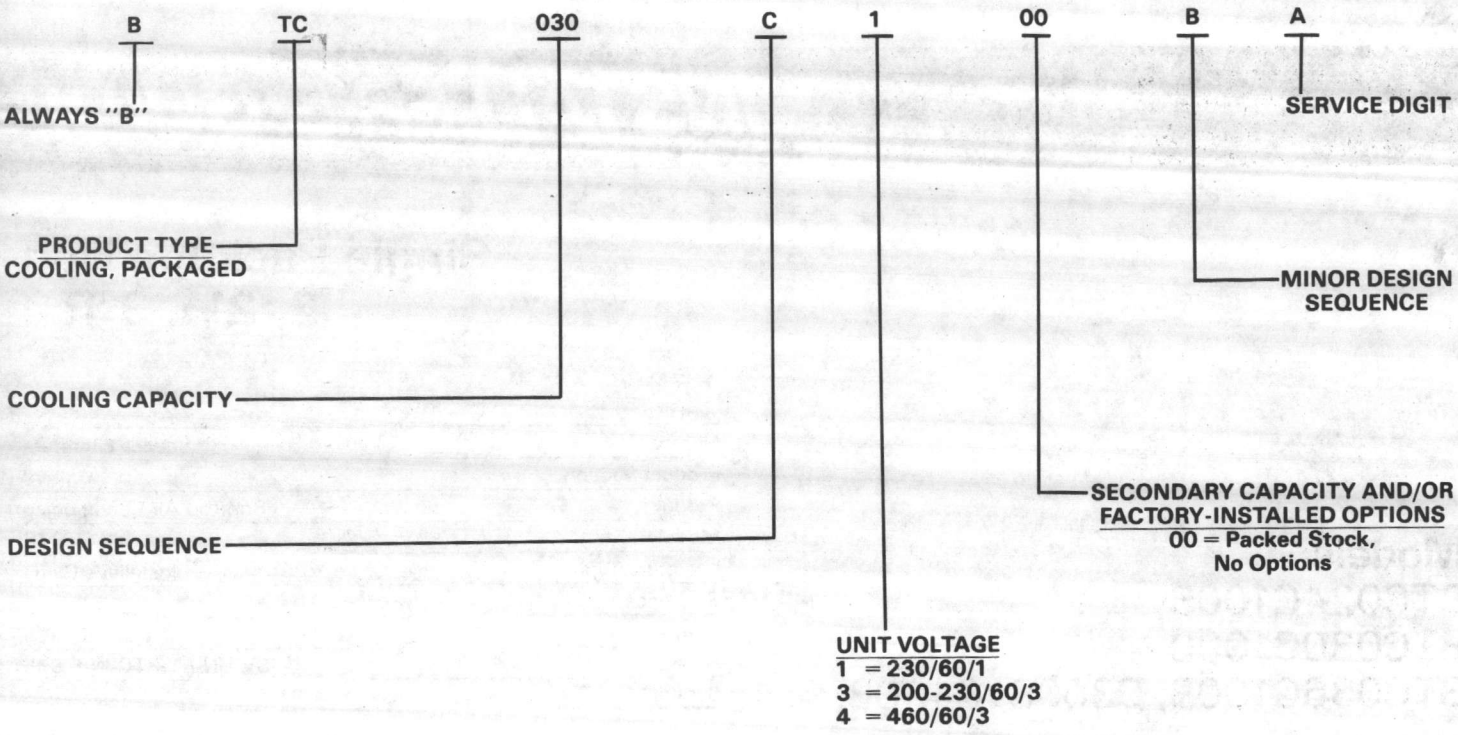
MODEL NO.	APPROXIMATE CORNER WEIGHTS - LB.				MINIMUM INSTALLATION CLEARANCE			
	#1	#2	#3	#4	E	F	G	H
BTC024C — B	68.5	66	65	73	12"	36"	24"	48"
BTC030C — B	74.5	70.5	63.5	66.5				
BTC036C — B	89.5	71.5	68.5	89.5				

From Dwg. 21C134764 Rev. 2

Since The Trane Company has a policy of continuous product improvement, it reserves the right to change specifications and design without notice. The installation and servicing of the equipment referred to in this booklet should be done by qualified, experienced technicians.

dwg. no. 21A722712 P01

MODEL NOMENCLATURE



ALL phases of this installation must comply with NATIONAL, STATE AND LOCAL CODES.

A. GENERAL

These instructions cover installation of all single package BTC024,030-036C-B air conditioning units. For an easy and orderly installation, follow the sequence of instructions as they are outlined.

These instructions do not purport to cover all variations in systems nor to provide for every possible contingency to be met in connection with installation. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to The Trane Company.

1. UNIT INSPECTION — Check for shipping damage. Report any damage to transporting company immediately and replace any damaged parts.

2. POWER SUPPLY — Be sure power supply on nameplate agrees with that available. The power supply should be adequate for the unit and for supplementary heat. Separate branch circuits will be required when adding supplementary heat.

3. FILTERING — Adequate filter area must be provided in the return air duct, (see table below).

UNIT	NO.	HI-VELOCITY ONLY SIZE	AREA
TC024	1	20" x 20" x 1"	400 sq. in.
TC030	1	20" x 25" x 1"	500 sq. in.
TC036	1	20" x 30" x 1"	600 sq. in.

The specific location of the filters will depend upon the type of installation and the layout of the duct system. Be sure the customer is aware of the location of the filters and the need to change them as required.

4. LOCATION AND RECOMMENDATIONS — This unit was designed for multiple applications: rooftop, outdoor ground level, thru-the-wall and attic.

a. The discharge air from the condenser fan must be unrestricted for a minimum of 4 feet from the unit. If it is an attic installation, discharge and intake air must be ducted to the outside, (Figures 1 & 4).

b. There must be sufficient clearance to provide easy and unrestricted access to service panels. (See outline drawing — Figure 1).

c. The unit should not be exposed to direct roof water runoff.

d. Elevation minimums must be observed for drain line "trap" and ventilation to under side of unit.

e. All duct work inside the structure should be adequately insulated. All duct work outside of structure must be insulated and weatherproofed in accordance with local codes. If supplementary heat is added, duct connectors should be of a flame retardant material.

f. Field supplied mounting pads should be used beneath the unit to prevent transmission of vibration to the occupied structure.

5. WEATHER SEALING — After roof mounting supports have been installed, flashing must be installed per local building code. (See Figure 2.)

When going through an exterior wall, the hole must be sealed by flashing or equivalent and in accordance with local building code.

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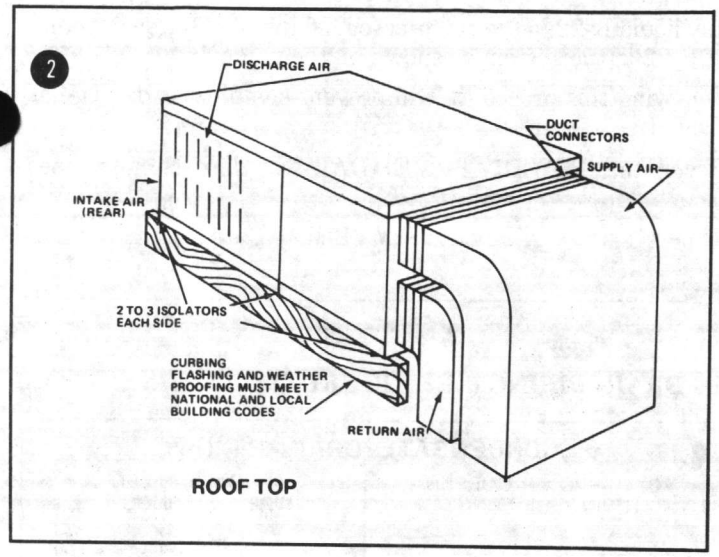

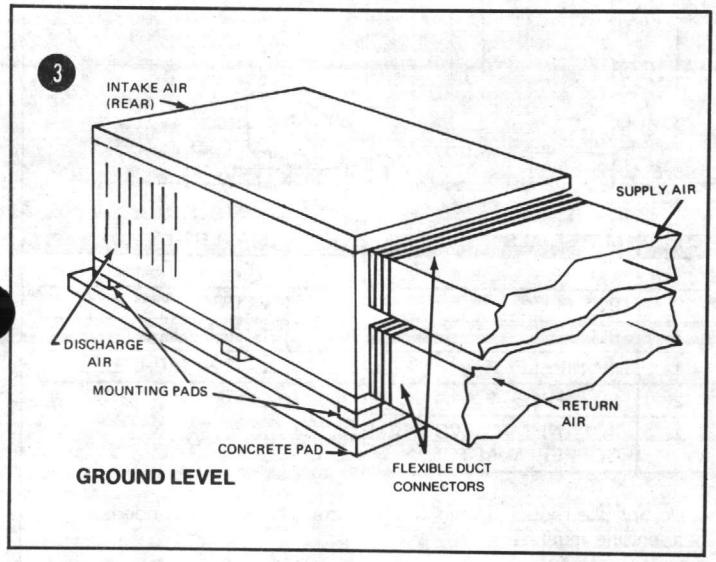

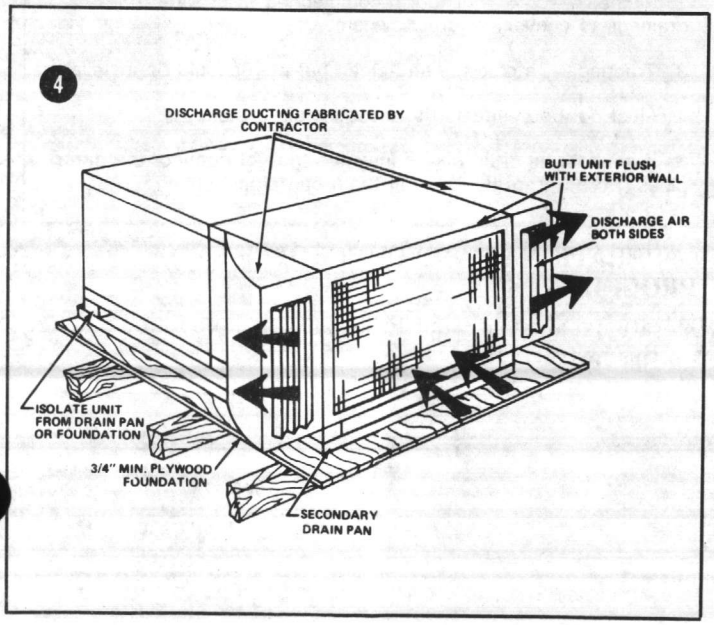

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B. APPLICATIONS

1. ROOF TOP — The roof must have sufficient structural strength to support the load. FHA approved construction and local codes are normally adequate, providing the roof joists and rafters have a proportionally distributed load. (See Figure 2.)

The unit should be positioned for recommended clearances as previously outlined under "Location and Recommendations."

If duct hood or supply and return ducts are fabricated by installing contractor, then be sure that the portion of the supply and return ducts out of doors are as short as possible. The supply duct, return duct and connectors should be insulated with 2" insulation and weatherproofed. Be sure the openings in the structure for the supply and return ducts are large enough to include the insulation.

Vibration isolators are recommended to prevent transmission of vibration to the structure. Isolate with at least four Korfund vibration isolators, or equivalent. The isolators must provide a minimum clearance of 3/4" beneath the unit permitting air to circulate under the unit base.

After unit has been properly positioned, complete installation per instuctions under sections **C. ELECTRICAL, E. DRAIN PIPING** and follow check out procedure and operational check on page 12.

2. GROUND LEVEL - OUTDOOR — When this packaged unit is located outdoors at ground level it should be positioned on a concrete pad 4" thick and 2" larger than the unit on all sides. Position concrete pad so it is level. (See Figure 3.)

The concrete pad must not come in direct contact with the occupied structure. (See Figure 3.)

The unit must be isolated with mounting pads. The mounting pads must provide a minimum of 3/4" clearance beneath the unit to permit air circulation and prevent corrosion of the base. (See Figure 3.)

That portion of the supply and return ducts out of doors must be as short as possible.

The outdoor section of the supply duct, return duct and connectors should be insulated with 2" insulation and then weatherproofed. Be sure the openings in the structure are large enough to include ducts and the insulation.

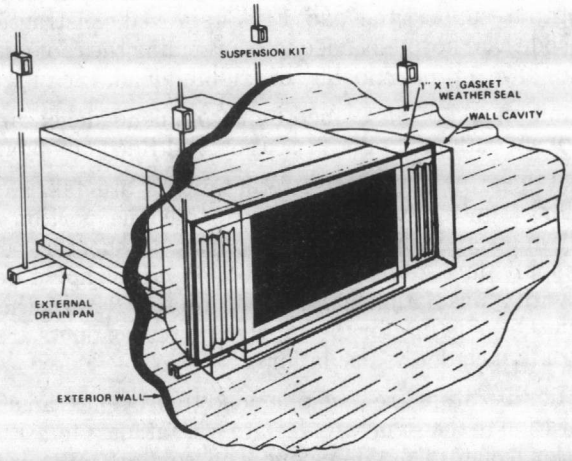
3. INDOORS — Whenever a single package unit is located indoors, the unit must be positioned in such a manner that outdoor air is available to the outdoor coil. For attic type applications, the outdoor coil would be mounted flush with the end of the structure. (See Figure 5.) The discharge air from the condenser section may be returned outdoors by ducting as shown in Figure 4 & 5.

When a unit is mounted on a foundation, it should be isolated with four or six isolators. Be sure the foundation is sufficient. If plywood is used, the thickness must be 3/4" minimum. The foundation must span at least 3 joists as shown in Figure 4. It is recommended that the evaporator section of the cabinet be wrapped with at least one inch of vaporproof insulation.

The unit may be suspended and supported across the base by means of channels. Be sure to provide adequate isolation to prevent vibration transmission to the structure. (See Figure 5.)

For any type of indoor installation, an external drain pan must be mounted under the unit and coated. To provide adequate support, the isolators above and/or below the drain pan should be correctly aligned.

5



C. ELECTRICAL CONNECTIONS

1. To determine the electrical power requirements of the unit, refer to the nameplate of the unit. The electrical power available must agree with that listed on the nameplate.

2. Provide an approved weatherproof disconnect within close proximity of unit.

3. The power supply lines must be run in weathertight conduit to the disconnect and into unit control box. Provide strain relief for all conduit with suitable connectors.

4. Provide flexible conduit supports whenever vibration transmission may cause a noise problem within the building structure. Be sure all connections are made tight and no naked wires are exposed.

5. Ground the unit internally as provided. See wiring diagram for location.

6. All electrical accessories must be installed and wired according to the instructions packaged with that accessory.

7. Use color coded, low voltage, multi-wire cable to simplify circuiting between unit and room thermostat.

8. Refer to the Field Wiring diagrams for electrically connecting unit and room thermostat together.

9. Important — Connect jumper at terminals 1 and 2 of thermostat for fan operation in the heating mode of operation. (See Field Wiring Diagram).

D. COMPRESSOR SUMP HEAT

After all electrical wiring is complete, SET THE THERMOSTAT SYSTEM SWITCH IN THE OFF POSITION SO COMPRESSOR WILL NOT RUN, and apply power by closing the system main disconnect switch. This will activate the compressor sump heat. Do not change the Thermostat System Switch until power has been applied long enough to evaporate any liquid R-22 in the compressor (30 minutes for each pound of R-22 in the system as shown on the nameplate).

Following this procedure will prevent compressor damage at the initial startup.

Record the "POWER APPLIED DATA" on the designated lines below:

Time _____ A.M./P.M. Date _____

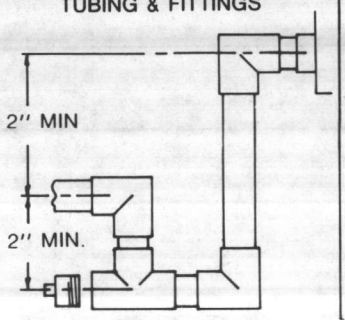
By _____

Electrician

E. DRAIN PIPING (SEE FIGURE 6)

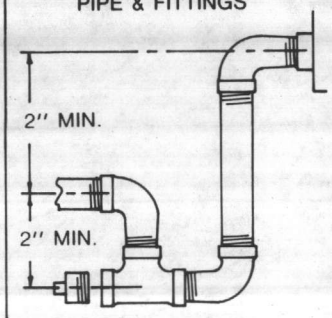
6 **CONDENSATE DRAIN PIPING**

3/4" PVC OR COPPER TUBING & FITTINGS



QTY.	MATERIALS
1	TEE
3	90° ELL
1	PLUG
1	4" NIPPLE
2	2" NIPPLE
1	3/4" NPT TO PVC OR COPPER ADAPTOR

3/4" GALVANIZED PIPE & FITTINGS



QTY.	MATERIALS
1	TEE
1	PLUG
3	STREET ELL
1	3-1/2" NIPPLE

Do not use reducing fittings in the drain lines. The condensate drain line must be:

1. Made of 3/4" pipe size.

2. Pitched — 1/4" per foot recommended to provide free drainage to convenient drain system.

3. Trapped — a pipe tee and clean out plug should be installed.

4. Must not be connected to closed drain system.

5. If an external drain pan is installed, do not connect the drain pipes. Do not trap the external drain pan pipe.

F. OPERATIONAL AND CHECKOUT PROCEDURES

"Operational and Checkout Procedure" will be found on page 12 of this instruction.

ELECTRICAL CHARACTERISTICS:

UNIT MODEL	ELECTRICAL CHARACTERISTICS	ALLOWABLE VOLTAGE RANGE	MCA	MOP	CLIMATUFF™ COMPRESSOR				
					VOLTAGE	HP	RLA	LRA	RPM
BTC024C100B	230/60/1	207-254	16	25	230/60/1	2.2	10.0	44	3450
BTC030C100B	200-230/60/1	180-254	21.9	35	230/60/1	2.8	13.8	58	3450
BTC036C100B	200-230/60/1	180-254	24	35	230/60/1	3.6	15.2	72	3450
BTC036C300B	200-230/60/3	187-254	18.6	30	200-230/60/3	3.6	11.5	85	3450
BTC036C400B	460/60/3	414-506	9.6	15	460/60/3	3.6	5.3	42	3450

UNIT MODEL	INDOOR FAN MOTOR				OUTDOOR FAN MOTOR			
	HP	VOLTAGE	FLA	RPM	HP	VOLTAGE	FLA	RPM
BTC024C100B	1/4	230/60/1	1.8	1075	1/12	230/60/1	0.8	825
BTC030C100B	1/4	200-230/60/1	2.2	1075	1/3	200-230/60/1	1.9	1075
BTC036C100B	1/3	200-230-60/1	2.4	1075	1/3	200-230/60/1	1.9	1075
BTC036C300B	1/3	200-230/60/1	2.4	1075	1/2	200-230/60/1	1.9	1075
BTC036C400B	1/3	460/60/1	1.1	1075	1/2	460/60/1	0.98	1075

INDOOR FAN PERFORMANCE

BTC024C—B

AIRFLOW CFM②	HIGH SPEED PRESS. In. w.g.	HIGH SPEED PWR. WATTS	LOW SPEED① PRESS. In. w.g.	LOW SPEED① PWR. WATTS
500	.95	185	.78	162
600	.83	192	.67	188
700	.75	200	.57	214
800	.66	225	.46	220
900	.56	265	.32	240
1000	.47	300	.13	265
②1100	.36	340	.00	290
1200	.25	380		

① Factory Setting at Low Speed
② Water Blow-Off Limit
③ Wet Coil, No Filter, No Heater.
See Pressure Drop Tables for Installed Electric Heater

From Dwg. 21A135641 Rev. 0

BTC030C—B

AIRFLOW CFM②	HIGH SPEED PRESS. In. w.g.	HIGH SPEED PWR. WATTS	LOW SPEED① PRESS. In. w.g.	LOW SPEED① PWR. WATTS
800	.80	350	.71	335
900	.70	375	.58	345
1000	.61	400	.44	360
1100	.50	425	.30	375
1200	.40	445	.15	390
1300	.28	480	.00	415
②1400	.13	505		
1500	.00	535		

① Factory Setting at Low Speed
② Water Blow-Off Limit
③ Wet Coil, No Filter, No Heater Installed.
See Pressure Drop Tables for Installed Electric Heaters.
The Table Values Are Applicable To Both The Rated And 90% Voltage Taps When Connected To The Proper Motor Tap.

From Dwg. 21A135642 Rev. 0

BTC036C—B

AIRFLOW CFM②	HIGH SPEED PRESS. In. w.g.	HIGH SPEED PWR. WATTS	LOW SPEED① PRESS. In. w.g.	LOW SPEED① PWR. WATTS
800	1.03	390	.98	355
900	.95	415	.88	365
1000	.88	430	.78	380
1100	.80	450	.67	395
1200	.71	475	.54	410
1300	.63	500	.39	435
③1400	.55	525	.25	460
1500	.43	570	.00	
1600	.26	610		
1700	.10	660		

① Factory Setting at Low Speed
② Water Blow-Off Limit
③ Wet Coil, No Filter, No Heater Installed. See Pressure Drop Tables for Installed Electric Heaters. The Table Values Are Applicable To Both The Rated And 90% Voltage Taps When Connected To The Proper Motor Tap.

From Dwg. 21A135643 Rev. 2

PRESSURE DROP CHARACTERISTICS

ELECTRIC HEATERS

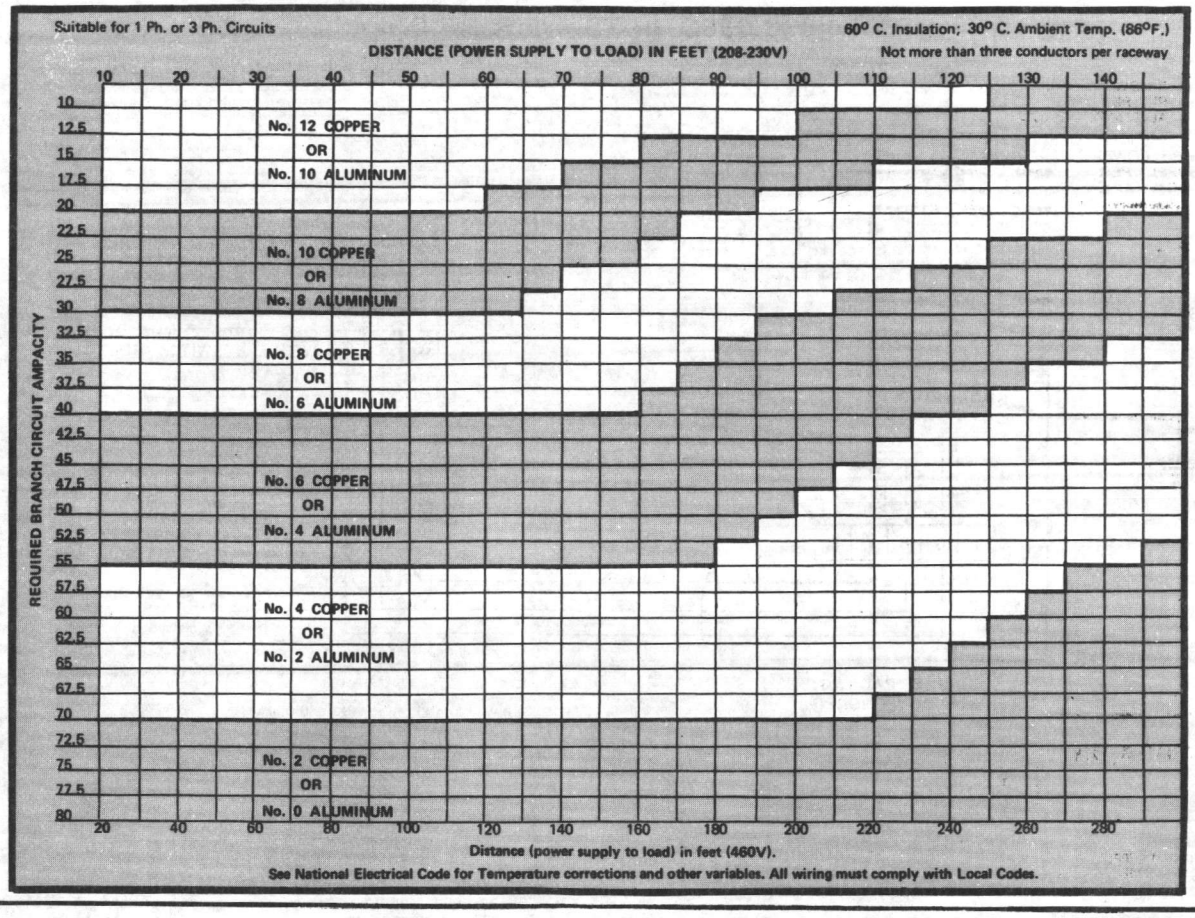
AIRFLOW CFM	NUMBER OF RACKS (SEE TABLE BELOW) 1	2	3
	AIR PRESSURE DROP, INCHES OF W.G.		
600	0.02	0.04	0.06
700	0.03	0.05	0.07
800	—	0.06	0.09
900	0.04	0.08	0.12
1000	0.05	0.10	0.15
1100	0.06	0.12	01.8
1200	0.07	0.14	0.21
1300	0.08	0.17	0.25
1400	0.10	0.20	0.30
1500	0.12	0.23	0.35

HEATER MODEL NO.	NO. OF RACKS
BAY96X261D	1
BAY96X262D & 263D	2
① BAY96X1917,3906,3912,3917, 4906,4912, & 4917	3

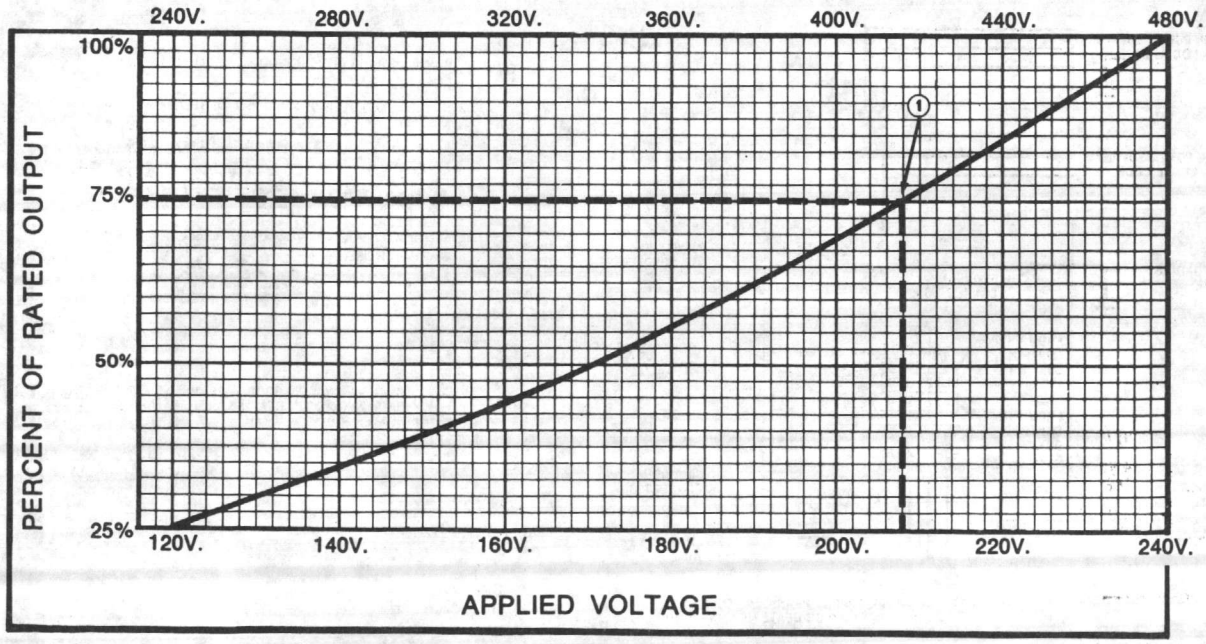
① Install in Heater Enclosure BAYPLNM009

From Dwg. 21A122733 Rev. 0

BRANCH CIRCUIT WIRE SIZING TABLE
(Based on 2% Voltage Drop)



ELECTRIC HEATER DE-RATING CHART
(for 240V or 480V Rated Heaters Installed on Lower Voltage Systems)



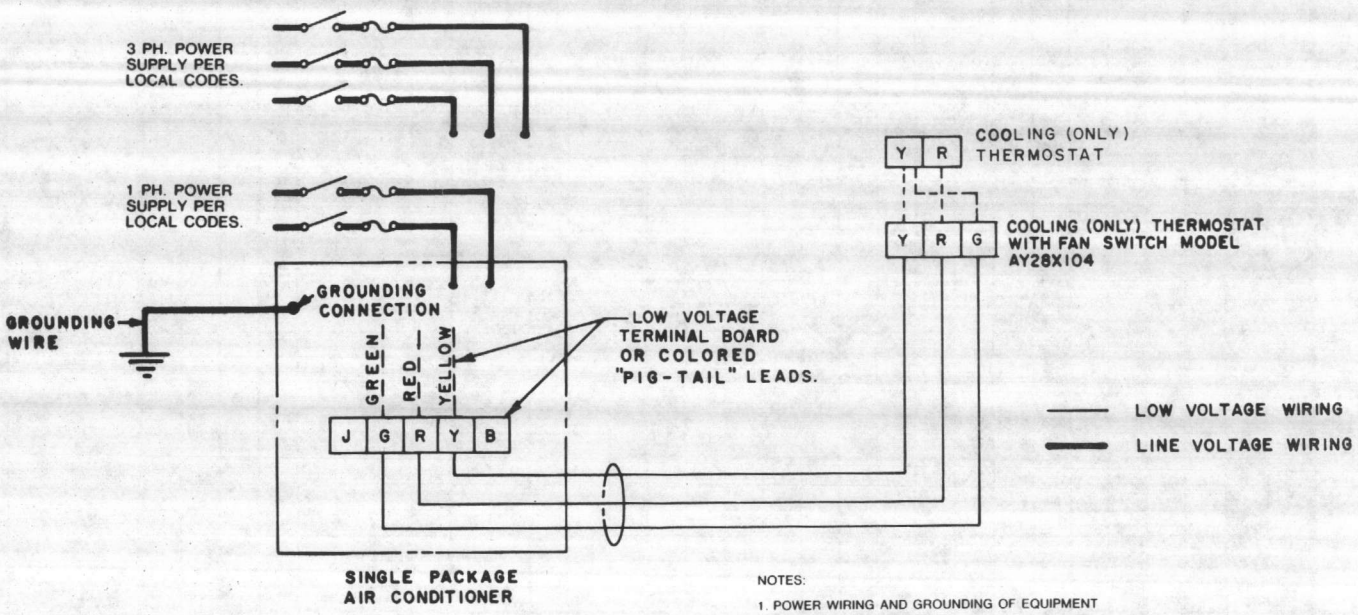
① EXAMPLE: Calculated Heat Loss — 29,200 BTUH Power Supply — 208V.
The chart indicates that any 240V heater will deliver 75% of its rated capacity at 208V.

$$\frac{29{,}200 \text{ BTUH}}{.75} = 39{,}000 \text{ BTUH}$$

Select a heater having AT LEAST 39,000 BTUH capacity at 240V.

TYPICAL FIELD WIRING DIAGRAMS

BTC024,030,036C UNITS, COOLING ONLY

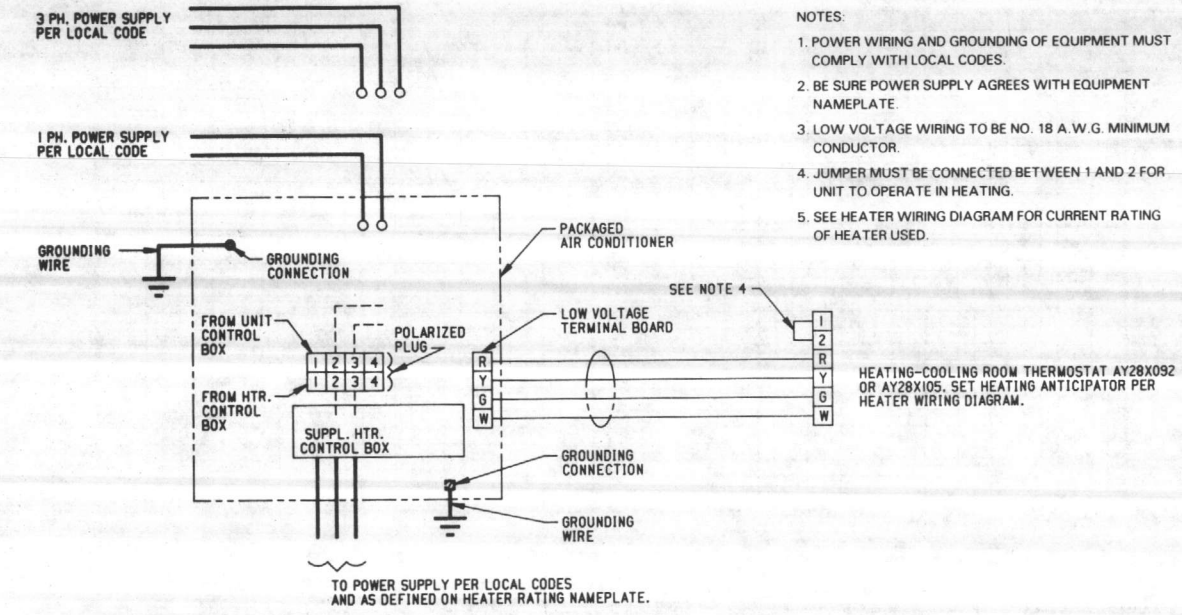


NOTES:

1. POWER WIRING AND GROUNDING OF EQUIPMENT MUST COMPLY WITH LOCAL CODES.
2. BE SURE POWER SUPPLY AGREES WITH EQUIPMENT NAMEPLATE.
3. LOW VOLTAGE WIRING TO BE NO. 18 A.W.G. MINIMUM CONDUCTOR.
4. **USE COPPER CONDUCTORS ONLY.**

From Dwg. 21B111015 Rev. 9

BTC024,030,036C UNIT WITH SUPPLEMENTARY HEATERS BAY96X261D,262D,263D; BAY96X1917; BAY96X3906,3912,3917; BAY96X4906,4912,4917



NOTES:

1. POWER WIRING AND GROUNDING OF EQUIPMENT MUST COMPLY WITH LOCAL CODES.
2. BE SURE POWER SUPPLY AGREES WITH EQUIPMENT NAMEPLATE.
3. LOW VOLTAGE WIRING TO BE NO. 18 A.W.G. MINIMUM CONDUCTOR.
4. JUMPER MUST BE CONNECTED BETWEEN 1 AND 2 FOR UNIT TO OPERATE IN HEATING.
5. SEE HEATER WIRING DIAGRAM FOR CURRENT RATING OF HEATER USED.

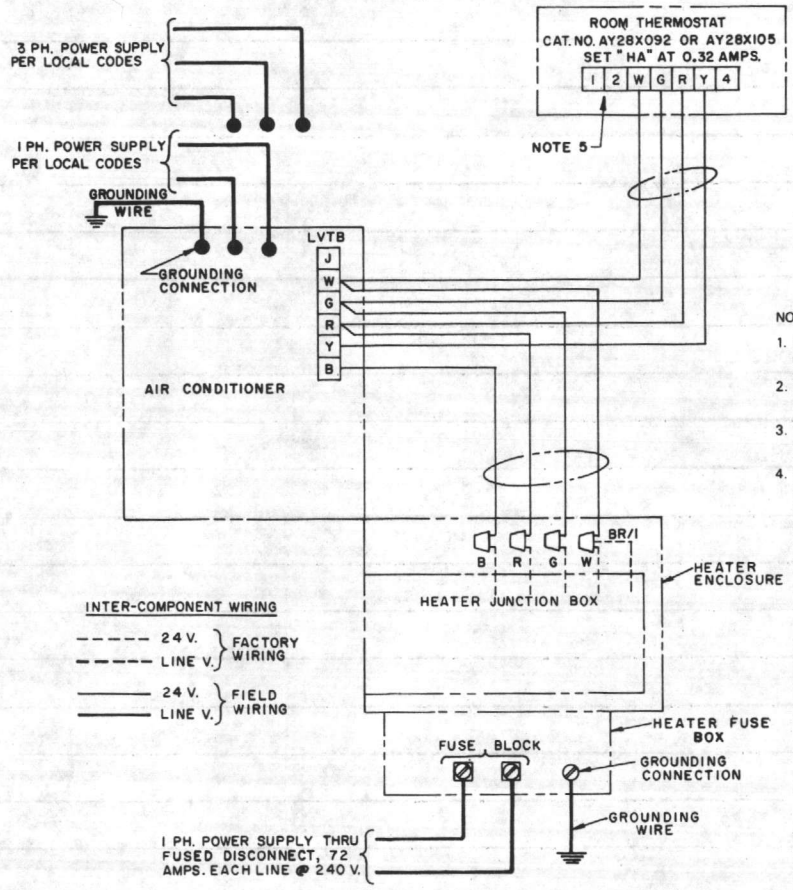
INTER-COMPONENT WIRING

- 24 V. } FACTORY WIRING
- LINE V. } FACTORY WIRING
- 24 V. } FIELD WIRING
- LINE V. } FIELD WIRING

From Dwg. 21B137494 Rev. 0

TYPICAL FIELD WIRING DIAGRAMS

FIELD WIRING — BTC030,036C UNIT WITH SINGLE PHASE SUPPLEMENTARY HEATER BAY96X292B

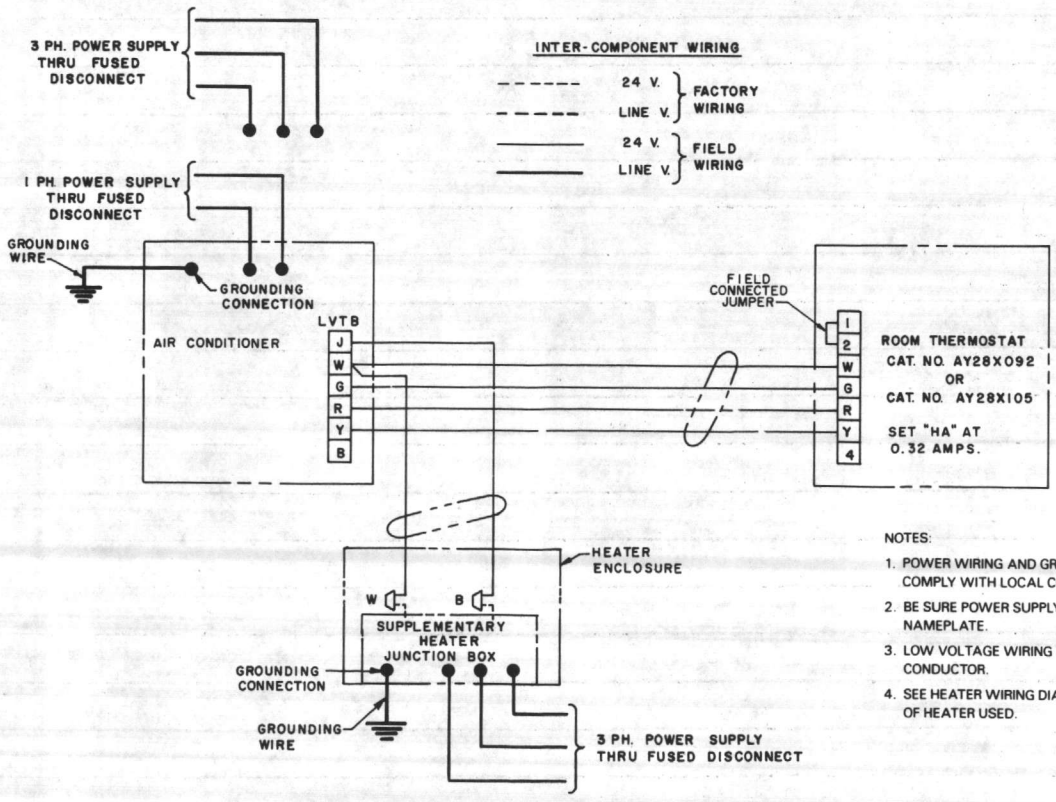


NOTES:

1. POWER WIRING AND GROUNDING OF EQUIPMENT MUST COMPLY WITH LOCAL CODES.
2. BE SURE POWER SUPPLY AGREES WITH EQUIPMENT NAMEPLATE.
3. LOW VOLTAGE WIRING TO BE NO. 18 A.W.G. MINIMUM CONDUCTOR.
4. USE ONLY THERMOSTATS AY28X092 OR AY28X105. DO NOT CONNECT JUMPER TO TERMINALS 1 & 2. TO DO SO WILL LOCK THE HEAT ON WITHOUT BEING CONTROLLED BY THE ROOM THERMOSTAT.

From Dwg. 21B123668 Rev. 2

FIELD WIRING — BTC036C UNIT WITH THREE PHASE SUPPLEMENTARY HEATER BAY96X293A



NOTES:

1. POWER WIRING AND GROUNDING OF EQUIPMENT MUST COMPLY WITH LOCAL CODES.
2. BE SURE POWER SUPPLY AGREES WITH EQUIPMENT NAMEPLATE.
3. LOW VOLTAGE WIRING TO BE NO. 18 A.W.G. MINIMUM CONDUCTOR.
4. SEE HEATER WIRING DIAGRAM FOR CURRENT RATING OF HEATER USED.

From Dwg. 21B123106 Rev. 2

NOTES

CHECKOUT PROCEDURE WITH MAIN POWER DISCONNECT CLOSED (ON)

Step No.	To Check	Indoor Thermostat Switch Setting					Component Operation				
		System Switch ①			Fan Switch		Indoor Blower Runs	Outdoor Fan Runs	Compressor Runs	Comp. Sump Heat	Electric Heaters (Warm Supply Air)
		Off	Cool	Heat	Auto	On					
1	Compressor Heat	X			X					X	
2	Indoor Fan Operation	X				X	X			X	
3	Cooling Operation		X		X		X	X	X	X	
4	Heating			X	X		X			X	X
5	Check Performance & Charge	← USE CHARTS INSIDE UNIT →									
6	Inform owner on how to operate system and what to expect of it. At the same time deliver Owner's Use and Care Booklet. Set thermostat to desired operating position before leaving.										

① Also set thermostat dial to call for cooling or heating as necessary.

CHECKOUT PROCEDURE

After installation has been completed, it is recommended that the entire system be checked against the following list;

1. Check for secure anchoring if it is Roof Top or Ground Level application. If Thru-the-Wall application, make sure bracing has a firm hold to unit and is well anchored to the foundation . . . . . [ ]
2. Check all field wiring to make sure connections are: (1) secured tightly, (2) electrically insulated, (3) isolated from each other and other metal parts, and (4) unit has been properly grounded . . . . . [ ]
3. Check that the space between the unit and structure has been closed with flashing or equivalent in accordance with local building codes . . . . . [ ]
4. Check power supply to see that it is correct for unit requirements . . . . . [ ]
5. Check to be sure all tools and debris around, on top, or under unit have been removed . . . . . [ ]
6. Check thermostat's thermometer accuracy (check against reliable thermometer). Adjust per instruction with thermostat . . . . . [ ]
7. Check for return air filter installation and that the supply and return registers are not blocked . . . . . [ ]
8. Check that drain lines are draining freely. (Pour water in drain pans.) . . . . . [ ]
9. Check that unit panels are in place and secured . . . . . [ ]

SYSTEM OPERATIONAL CHECK

IMPORTANT: To prevent compressor damage which may result from the presence of LIQUID refrigerant in the crankcase these procedures should be followed at initial Start-Up and at anytime the power has been off for 12 hours or more.

1. Before proceeding with this "Operational Check," go to "Electrical Section" of this instruction to determine the time compressor heat has been "ON", and make entry on the designated lines, in Step 2.
2. Start-Up Time _____A.M./P.M. Power Applied Time _____A.M./P.M. Time Lapse _____Hours _____Minutes.
3. Apply power by closing system disconnect switch. The generated compressor heat evaporates the liquid in the crankcase. TO EVAPORATE LIQUID ALLOW AT LEAST ONE-HALF HOUR PER POUND (R-22), AS SHOWN ON UNIT NAMEPLATE.
4. Except as required for safety while servicing: DO NOT OPEN SYSTEM DISCONNECT SWITCH.
5. **After completing above procedures, turn to page 11 for Operational checkout of system(s).**

The Trane Company
Light Commercial Unitary Division
Guthrie Highway
Clarksville, TN 37040

dwg. no. 21A722712 P01
P.I.

TRANE™

ASCT-IN-2A

INSTALLER'S GUIDE

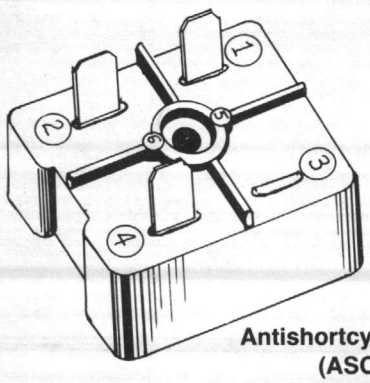
Accessory Antishortcycle Timer And Time Delay Relay Kits

For Use With:

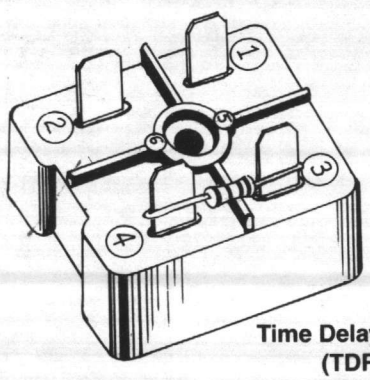
BYC060-200
SFDA-B50
SFCB-B85-C17
BTC070-200
SACC-B50-C17
BWC150-180
SPCC-B50-C15
SRUB, SWUB 3-15
RAUC10-15

Library	Service Literature
Product Section	Unitary
Product	Unitary Accessories
Model	T-Stats, Panels, Timers, Relays
Literature Type	Installer's Guide
Sequence	2A
Date	July 1985
File No.	SV-UN-ACC-ASCT-IN-2A 785
Supersedes	SV-UN-ACC-ASCT-IN-2 585

Table of Contents



Antishortcycle Timer (ASCT) BAYASCT001



Time Delay Relay (TDR) BAYRLAY002

18-HD60D2
2nd Printing 1985

Antishortcycle Timer (ASCT)

General Information

The antishortcycle timer kit contains the ASCT, one mounting screw, three wires, one wire nut and a wiring diagram.

The ASCT is a solid-state device. It protects the compressor from starting too frequently on command of a poorly-controlling thermostat. Compressor short cycling may be caused by poor thermostat control or by sudden and very short duration power outages.

When the thermostat contacts open, or when there is a momentary power outage, the ASCT locks the compressor out of operation for five minutes.

Installation

WARNING: OPEN THE UNIT DISCONNECT SWITCH AND SECURE IT IN THE OPEN POSITION BEFORE INSTALLING THE ANTISHORTCYCLE TIMER. FAILURE TO DO SO MAY RESULT IN SERIOUS INJURY OR DEATH BY ELECTROCUTION.

To install the ASCT, follow this procedure:

1. Remove the unit control box panel, and the dead front panel located inside the control box.
2. Find the set of two holes near the control panel thermostat terminal strip. See Figure 1. These holes are approximately 7/16-inch apart. The larger hole is for the mounting screw that passes through the center of the ASCT. The smaller hole is for the antirotation pin on the base of the timer. Position the timer properly and tighten the single screw.
3. Determine the correct wiring connections for wires 401, 402, and 404. Refer to Figure 2. Terminals 1 and 2 are wired in series with the stage 1 compressor contactor circuit and terminal 4 is connected to the ground side of the 24VAC control circuit.
4. Remove the quick connect from wire 402 in order to splice it to the correct wire from the unit control panel with the provided wire nut.
5. Connect the three wires. Wires 404 and 401 go to the terminal strip. Wire 402 splices to the wire indicated in Figure 2.
6. Replace and secure both access panels and restore power to the unit.

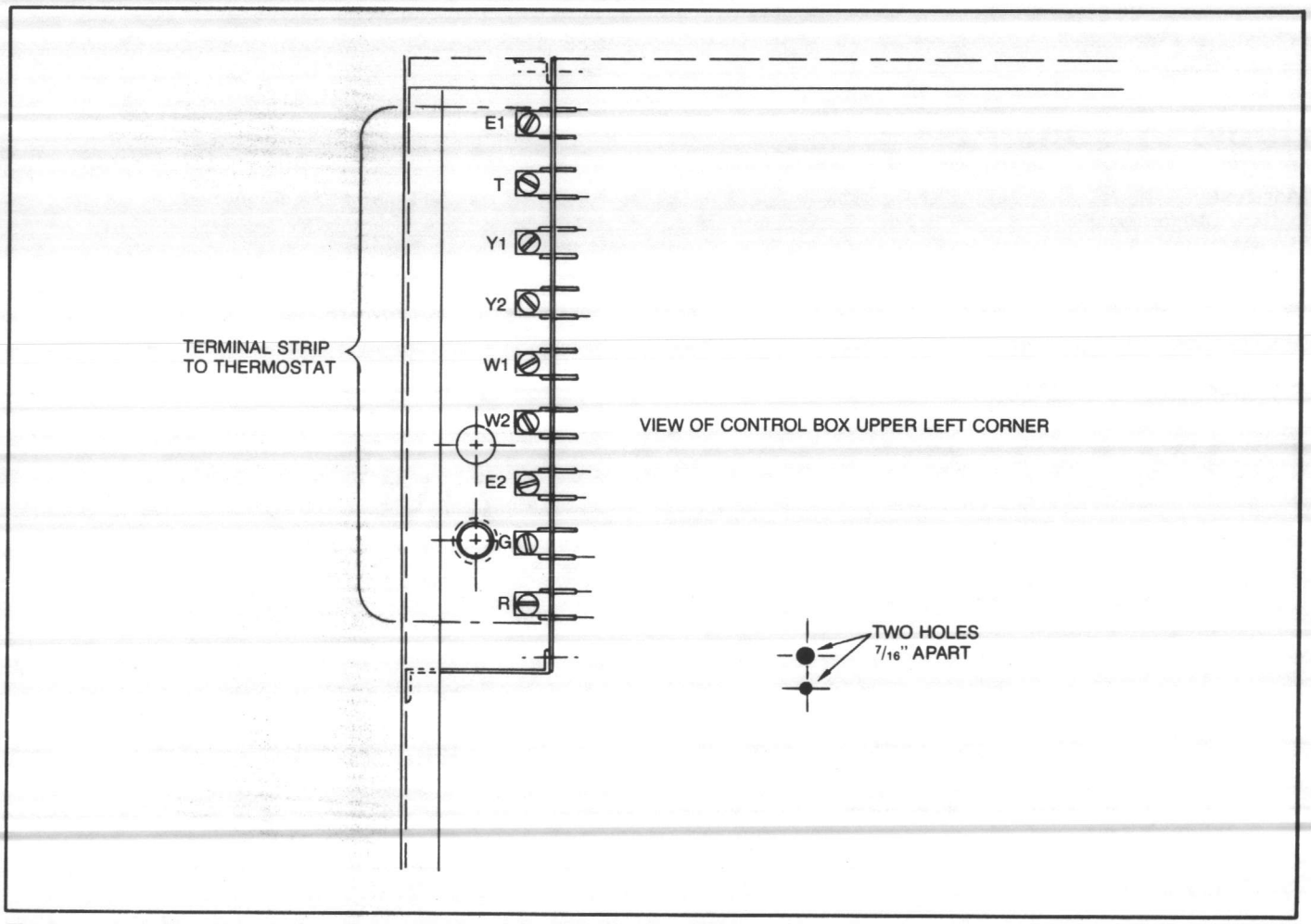


Figure 1 - A Typical View of Two Holes Near Control Box Terminal Strip

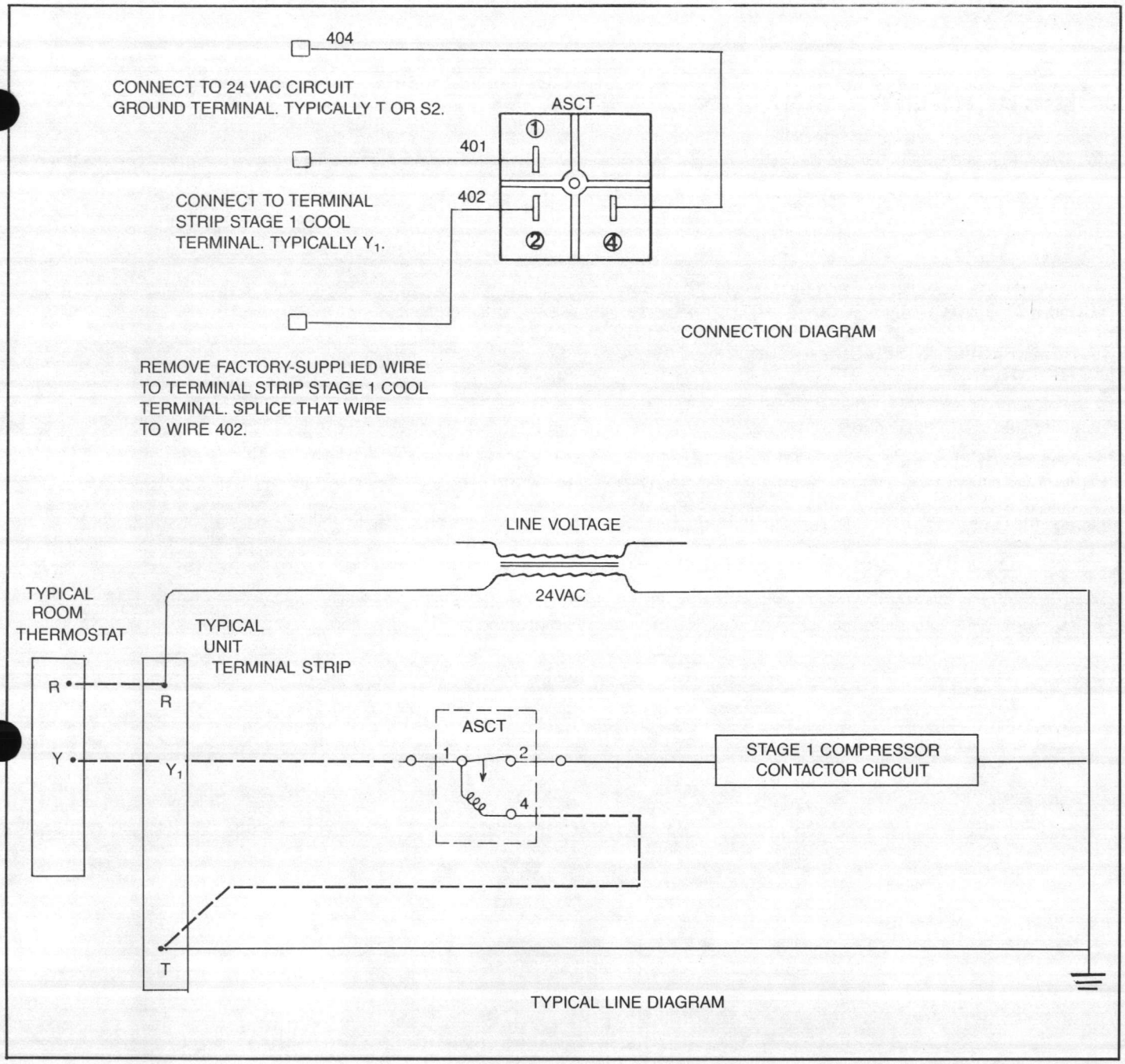


Figure 2 - Typical Antishortcycle Timer Connection and Line Diagram

Operation

Check the operation of the ASCT with the following procedures:

Cooling Mode

1. Start the unit and allow it to run for at least five minutes.
2. Raise the thermostat setting until the unit stops. Then immediately lower the thermostat setting to a point well below the indoor temperature.
3. The unit should restart in five minutes, plus or minus 60 seconds.

If the unit does not restart in five minutes, refer to the TROUBLESHOOTING section of this manual.

Time Delay Relay (TDR)

General Information

The time delay relay kit includes a time delay relay, one mounting screw, two wires, one wire nut and a wiring diagram.

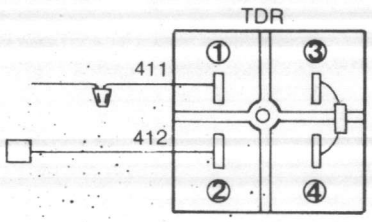
The time delay relay is a solid-state timer. It provides a four minute delay before starting the second compressor, thus preventing power demand surges. This delay occurs whenever the thermostat calls for compressor number two.

Installation

WARNING: OPEN THE UNIT ELECTRICAL POWER SUPPLY DISCONNECT SWITCH AND SECURE IN THAT POSITION BEFORE INSTALLING THIS ACCESSORY. FAILURE TO DO SO COULD RESULT IN SERIOUS INJURY OR DEATH BY ELECTROCUTION.

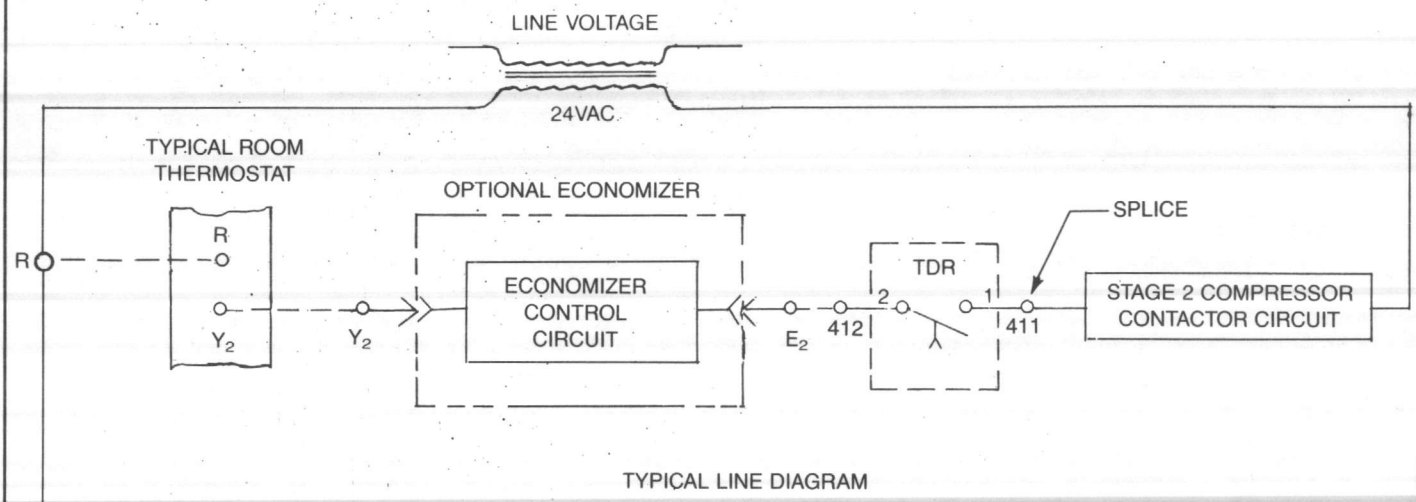
1. Remove the unit control box access panel and the dead front panel located inside the control box.
2. Find the set of two holes near the control box terminal strip. See Figure 1 for typical view. The holes are approximately 7/16-inch apart. The larger hole is for the mounting screw that fits through the center of the TDR. The smaller hole is for the anti-rotation pin on the base of the device. Position the TDR properly and tighten the single screw.
3. Remove the quick connect from Wire 411 in order to splice it to the correct wire from the control panel with the provided wire nut.
4. Connect wires 411 and 412 per figure 3. Wire 412 goes to the terminal strip. Wire 411 splices to the wire to the stage 2 compressor contactor circuit. This puts TDR terminals 1 and 2 in series with the stage 2 compressor contactor circuit.
5. Replace and secure both access panels and restore power to the unit.

A factory-supplied wire to the stage 2 cool compressor contactor circuit is attached either to the stage 2 cooling terminal (typically Y_2) or the stage 2 economizer terminal (typically E_2). Remove this wire from the terminal strip and splice it to wire 411 from the TDR.



CONNECTION DIAGRAM

To terminal strip stage 2 economizer terminal (typically E_2) for units that can use economizer.
To terminal strip stage 2 cooling terminal (typically Y_2) for units that cannot use an economizer.



TYPICAL LINE DIAGRAM

NOTES:
1. TDR terminal 2 connected to E_2 if E_2 exists. Otherwise to terminal Y_2 or equivalent. Connection via wire 412.
2. TDR terminal 1 connected to stage 2 compressor contactor circuit via splice with wire 411.

Figure 3 - Time Delay Relay Typical Connection Diagram and Line Diagram.

Operation

Check the operation of the TDR with the following procedures:

Cooling Mode

1. Shut the unit off for at least five minutes.
2. Lower the thermostat setting to a point well below the indoor temperature. (This ensures that both thermostat stages energize.)
3. Compressor number one should start immediately. After four minutes, plus or minus 48 seconds, compressor number two should also start.

If the unit does not function in this time period, refer to the TROUBLESHOOTING section of this manual.

Troubleshooting

WARNING: OPEN THE UNIT DISCONNECT SWITCH BEFORE CHECKING THE TIGHTNESS OF WIRE SPLICES AND TERMINAL STRIP CONNECTIONS. FAILURE TO DO SO COULD RESULT IN SERIOUS INJURY OR DEATH BY ELECTROCUTION.

WARNING: WHEN ELECTRICAL MEASUREMENTS MUST BE MADE WITH THE POWER ON, CARE MUST BE TAKEN TO AVOID CONTACT WITH EXPOSED, ENERGIZED PARTS. CONTACT WITH ENERGIZED COMPONENTS MAY RESULT IN ACCIDENTAL SHOCK, CAUSING SERIOUS PERSONAL INJURY OR DEATH BY ELECTROCUTION.

1. Check Wire Connections—Both TDR and ASCT

Be sure that terminal connections and splices are electrically and physically tight.

2. Check Wiring Diagrams for Correct Wiring—Both ASCT and TDR

Refer to Figure 2 or 3 for the correct wiring points. Check the wiring to be certain that it is correct.

3. ASCT—Cooling Mode or Heat Pump/ Heating Mode

a. Start the unit. Allow it to run for at least five minutes.

b. Raise (if in COOL) or lower (if in HEAT PUMP/HEAT) the thermostat setting to a point well above or below the indoor temperature. Then immediately lower (if in COOL) or raise (if in HEAT PUMP/HEAT) the thermostat setting to a point well below or above the indoor temperature. This will cycle the unit OFF and then ON again.

c. The ASCT will now be in its time delay period of five minutes, plus or minus 60 seconds. Refer to Figure 2. Read the voltage across ASCT Pins 1 and 2. The reading will be 24 vac if the device is correctly wired.

d. In four to six minutes, a good ASCT will close contacts between Pins 1 and 2 and a voltmeter will read zero volts between Pins 1 and 2. The unit will then start.

e. If there is no closure between Pins 1 and 2 in four to six minutes, replace the ASCT.

f. If there is closure between ASCT Pins 1 and 2, but the unit still does not start, contact the local Trane office.

4. TDR—Cooling Mode or Heat Pump/ Heating Mode

a. Start the unit and allow it to run for at least five minutes.

b. Immediately raise (if in COOL) or lower (if in HEAT PUMP/HEAT) the thermostat setting to a point well above or below the indoor temperature. (This ensures that both thermostat stages energize.)

c. Compressor number one will start right away. The TDR will begin its four minute time delay, plus or minus 48 seconds. During this delay, check for 24 vac control power between TDR Pins 1 and 2. Refer to Figure 3.

d. At the end of the time delay period, a good TDR will close contacts between Pins 1 and 2. The voltmeter will read zero volts from Pin 1 to Pin 2.

e. If there is no closure between Pins 1 and 2 in the allotted time, replace the TDR.

f. If there is a closure between Pins 1 and 2, but compressor number two still does not start, contact the local Trane office.

INSTALLER'S GUIDE

Since The Trane Company has a policy of continuous product improvement, it reserves the right to change specifications and design without notice. The installation and servicing of the equipment referred to in this booklet should be done by qualified, experienced technicians.

Accessory Horizontal Supply/Return Conversion Kit

Accessory:
BAYPANL006
BAYPANL007
BAYPANL008
BAYPANL009

For Use With:
BTC/BYC100G-D
BTC/BYC130G-D
BTC/BYC170G-C
BTC/BYC200G-C

Library	Service Literature
Product Section	Unitary
Product	Unitary Accessories
Model	Roofcurbs, Ducts, Diffusers
Literature Type	Installer's Guide
Sequence	4
Date	September 1986
File No.	SV-UN-ACC-HORZ-IN-4 9/86
Supersedes	New

General Information

All BYC and BTC100G through 200G units are shipped from the factory with downflow ductwork connections. This kit is required to convert a BYC or BTC unit to a horizontal supply/return air configuration. The kit contains a horizontal supply and return panel, a mounting angle, a securing channel, sheet metal screws, and gasketing.

Initial Inspection

Be sure to compare the accessory model number found on the shipping label with the accessory identification information on the ordering and shipping document to verify that the correct accessory has been shipped.

Inspect the packaging of each horizontal conversion kit as it is received at the job site, and before signing the freight bill. Verify that all items have been received and that there is no visible damage; note any shortages or damage on all copies of the freight bill.

In the event of damage or shortage, remember that the purchaser is responsible for filing the necessary claims with the carrier. Concealed damage not discovered until after unloading must be reported to the carrier within 15 days of its receipt.

Installation

WARNING: OPEN UNIT DISCONNECT SWITCH BEFORE INSTALLING THIS ACCESSORY TO PREVENT INJURY OR DEATH DUE TO ELECTRICAL SHOCK OR CONTACT WITH MOVING PARTS.

1. Prepare the unit for installation by removing 2 side panels, 2 end panels, and the shipping support channel. Remove the screws in the separator panel and remove it. See figure 1.
2. The lower horizontal end panel removed and the separator panel will be used to cover the downflow duct openings. Apply gasketing along the length of end panel by folding it on the edge. See figure 2.
3. Position the separator panel (with insulation turned up) over the bottom return opening. Place the lower horizontal end panel over the supply opening (with the insulation turned down) and the gasket pushed up tight against the drain pan. See figure 3.
4. Secure these panels in place with the securing channel by pivoting the end tab under the drain pan lip and pulling the other end down to the base. This will compress the insulation and seal the openings. Fasten the channel in place with a short screw. See figure 4.
5. Install the support angle for the horizontal supply and return panel. Secure with a short screw on each end to the unit corner posts. See figure 5.
6. Slide the horizontal supply and return panel into the compartment with the insulation up. Secure with short screws in the rear flange and to the support angle with screws going up through the angle. See figure 6.
7. Re-position the top end panel with long screws. See figure 6.
8. Re-position the 2 end panels, and the installation is complete.

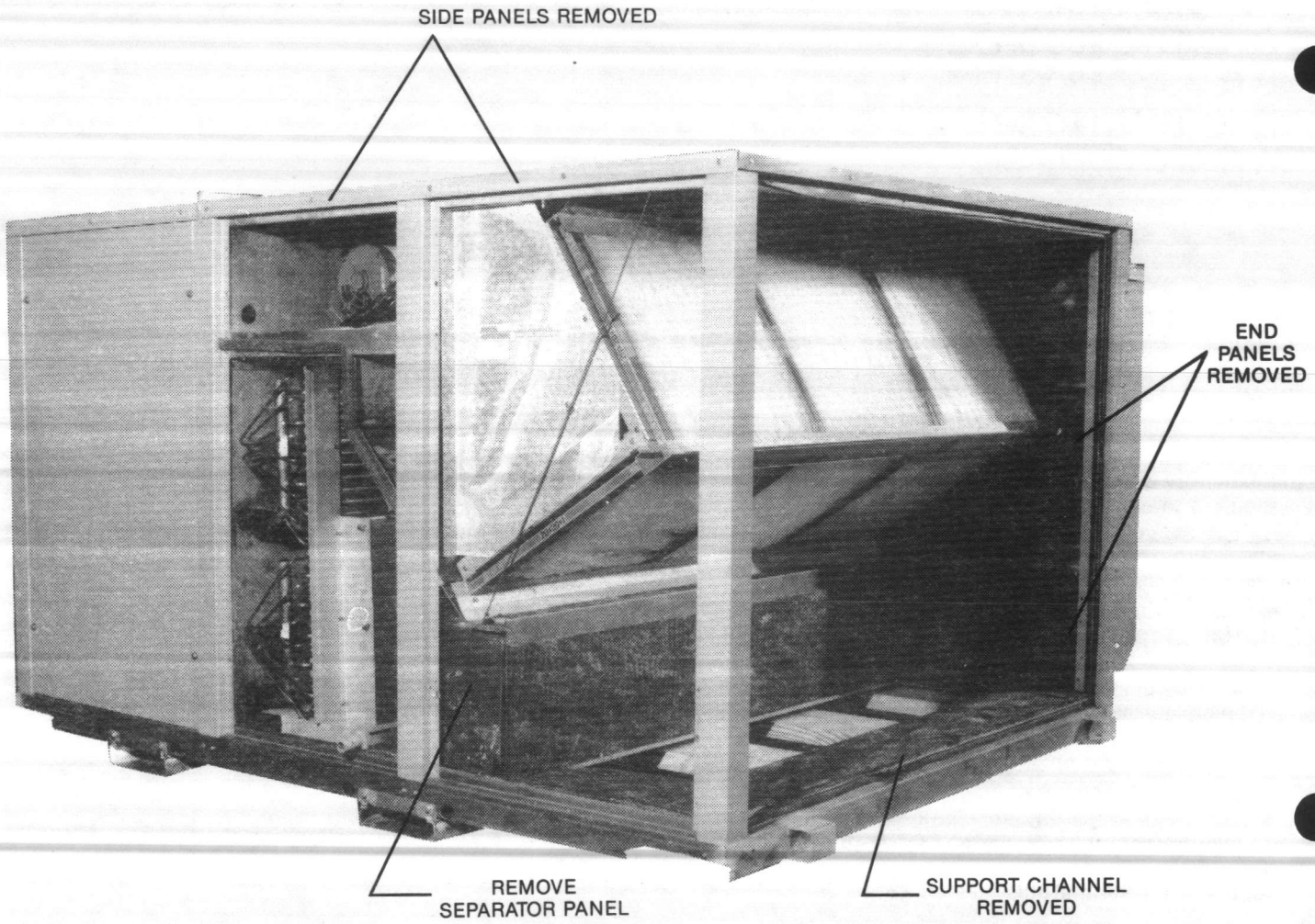


Figure 1 — Removing Unit Panels

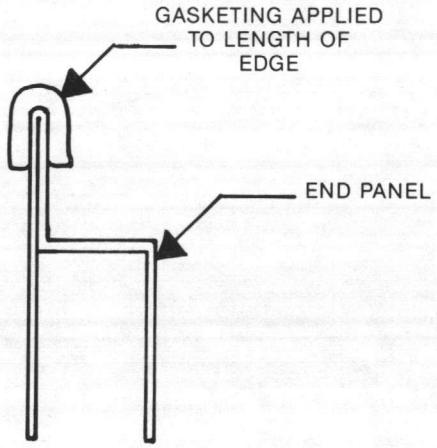


Figure 2 — End Panel Gasket

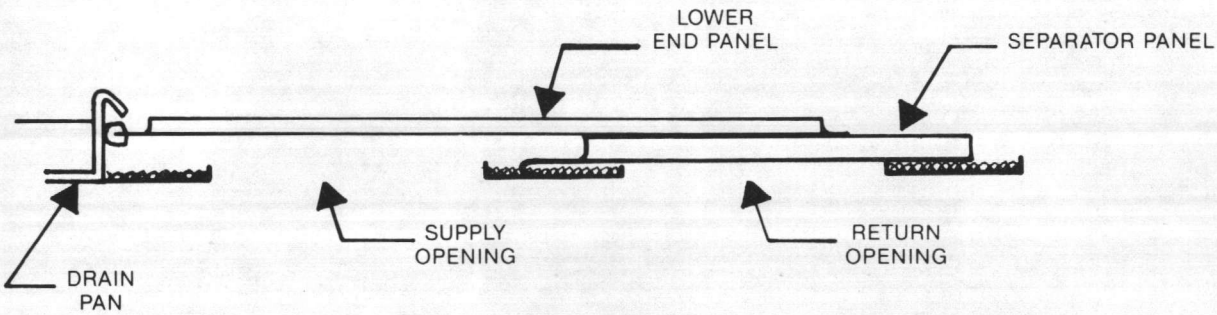


Figure 3 — Covering Bottom Openings

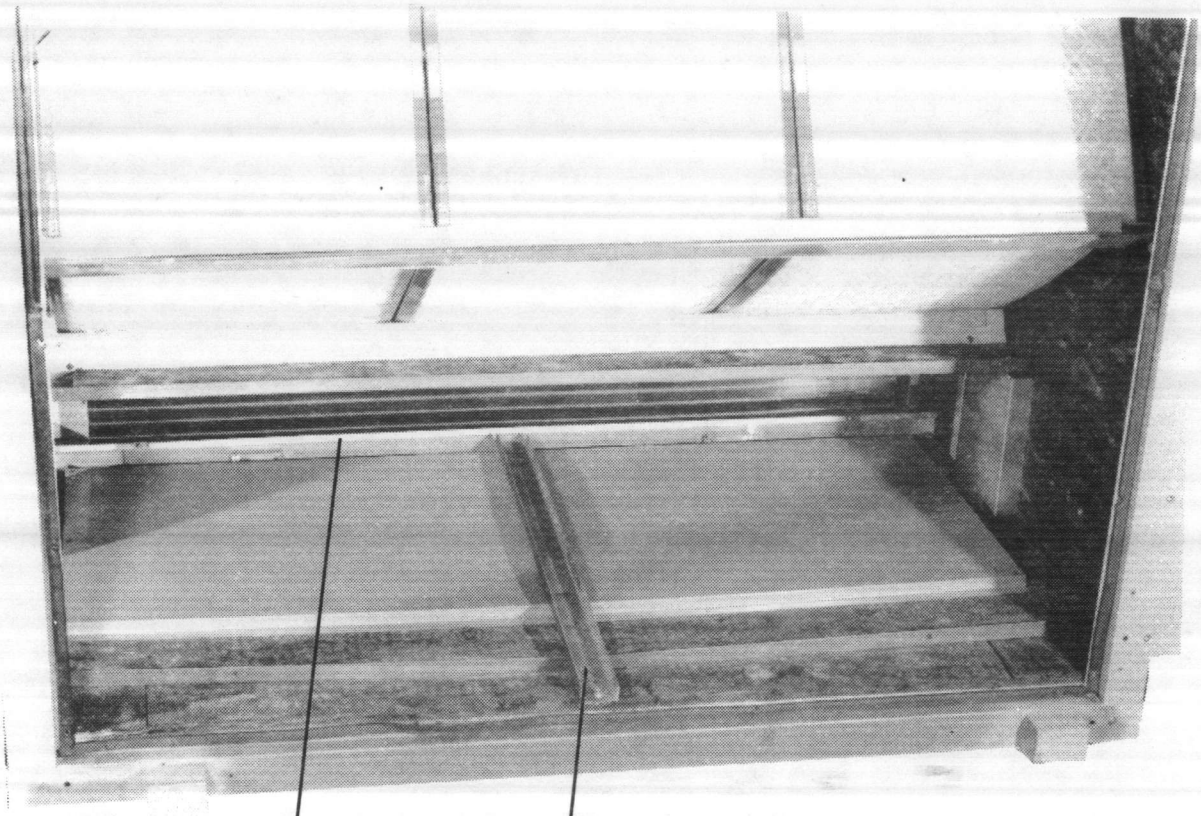


Figure 4 — Securing Channel

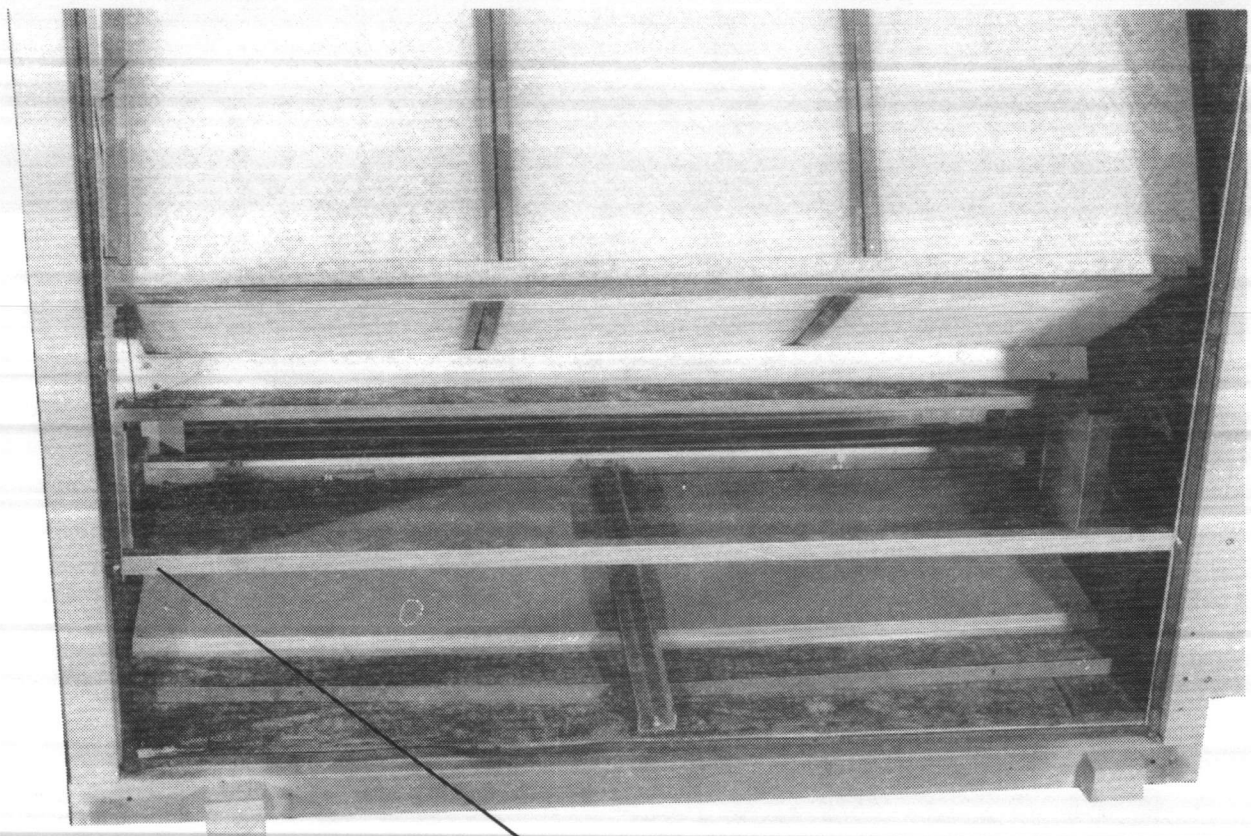


Figure 5 — Support Angle

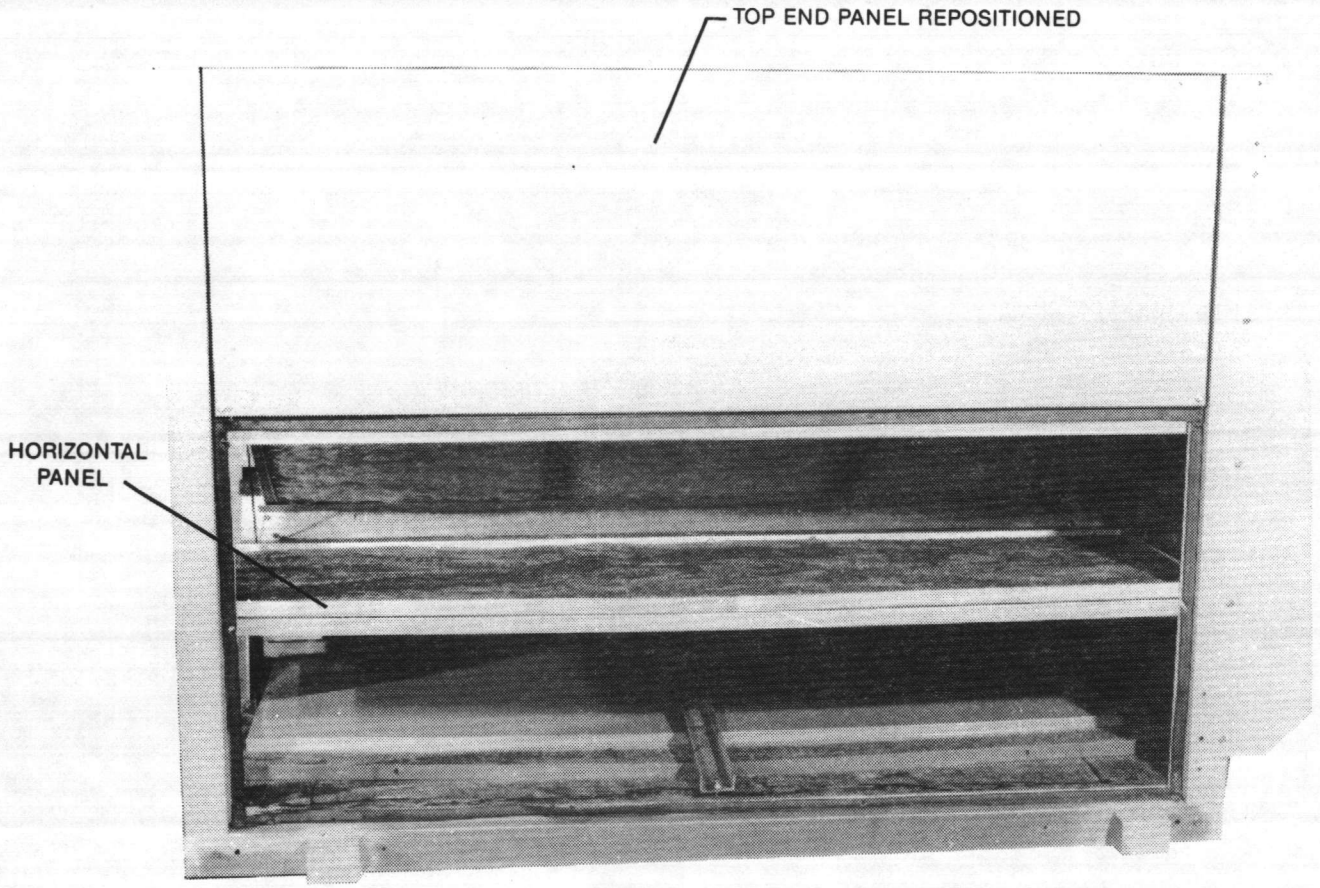


Figure 6 — Horizontal Supply and Return Panel

The Trane Company
Light Commercial Group
Guthrie Highway
Clarksville, TN 37040

Technical Literature Printed in USA

TRANE™

SERVICE FACTS

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Electric/Electric Rooftop

Library	Service Literature
Product Section	Unitary
Product	Rooftop Air Conditioning
Model	BTC
Literature Type	Service Facts
Sequence	10C
Date	September 1986
File No.	SV-UN-RT-BTC-SF-10C 9/86
Supercedes	

Models
BTC200G300CA
BTC200G30ACA

IMPORTANT - This document is customer property and is to remain with this unit. Please return to service information pack upon completion of work.

SAFETY NOTICE

THIS INFORMATION IS INTENDED FOR USE BY INDIVIDUALS POSSESSING ADEQUATE BACKGROUNDS OF ELECTRICAL AND MECHANICAL EXPERIENCE. ANY ATTEMPT TO REPAIR A CENTRAL AIR CONDITIONING PRODUCT MAY RESULT IN PERSONAL INJURY AND/OR PROPERTY DAMAGE. THE MANUFACTURER OR SELLER CANNOT BE RESPONSIBLE FOR THE INTERPRETATION OF THIS INFORMATION, NOR CAN IT ASSUME ANY LIABILITY IN CONNECTION WITH ITS USE.

RECONNECT ALL GROUNDING DEVICES

ALL PARTS OF THIS PRODUCT CAPABLE OF CONDUCTING ELECTRICAL CURRENT ARE GROUNDED. IF GROUNDING WIRES, SCREWS, STRAPS, CLIPS, NUTS OR WASHERS USED TO COMPLETE A PATH TO GROUND ARE REMOVED FOR SERVICE, THEY MUST BE RETURNED TO THEIR ORIGINAL POSITION AND PROPERLY FASTENED.

DISCONNECT POWER BEFORE SERVICING

Accessories

- Roofcurb
- Horizontal Conversion Panels
- Downflow Economizer (Field Installed) with Integral Barometric Relief
- Downflow Economizer Less Controls (Field Installed)
- Remote Mounted Rheostat
- Horizontal Economizer with Low Leak Dampers
- Manual Outside Air Hood
- Anti-short Cycle Timer
- Time Delay Relay
- Low Ambient Two Speed Motor
- Oversize Evaporator Fan Motors
- Electric Heat Modules
- Night Setback Thermostat
- Copper Evaporator Coils
- Copper Condenser Coils

SERVICE PARTS

DESCRIPTION	QTY.	CSG PART #	DPG CAT. #
Compressor, 200-230/50-60/3, CRHH-075J	2	COM-1649	WW77X750
Crankcase Heater, 230 V, 60 WATT	2	HTR-1225	WW8X88
Expansion Valve, ½ Inlet, ⅞" Outlet, 7.5 Ton Capacity	2	VAL-2046	WW51X297
Distributor, used with Indoor Coil	2	DST-120	WW51X302
Filter Drier, Liquid Line, ½ Inlet, ½ Outlet, 8 Cu. In. Vol.	2	DHY-146	WW22X101
Evaporator Fan Motor, 5 HP, 208-240/440-480/60/3, 1800 RPM, 215 TD frame	1	MOT-1232	WW94X618
Fan Wheel, Evaporator, 15 x 9½ x 1	2	FAN-662	WW74X86
Belt	1	B-192	N/A
Condenser Fan Motor, 1/2 HP, 208-230/60/1	3	MOT-2360	WW94X620
Propeller Fan, Condenser, 20" Dia., ½" Bore	3	FAN-661	WW73X77
Reset Relay, SPDT, 24 V Coil Pilot Duty (RR1, RR2)	2	RLY-657	WW24X171
Capacitor, 5 MFD, 440 V (C1, C2, C3)	3	CPT-119	WW20X108
Contactor, 20 A, 24 V Coil, 2 Poles (EFC)	1	CTR-550	WW24X161
Transformer, 240 V PRI, 24 V Sec., 60 VA (T1)	1	TRR-398	WW32X66
Contactor, 30 A, 600 V, 24 V Coil, 3 Poles (CC1, CC2) Includes COL-3601	2	CTR-522	WW30X110
Condenser Fan Limit Control FLT Open 55° ± 3, Close 65° ± 3	1	CNT-959	WW28X238
Low Pressure Control (LPC)	2	CNT-508	WW26X90
High Pressure Control (HPC)	2	CNT-510	WW26X68
Additional Parts For Use With Economizer			
Actuator, Damper Motor	1	MOT-2691	WW94X465
Low Ambient Thermostat, Temp. 50° ± 5	1	THT-484	WW28X243
Economizer Control Relay	1	RLY-797	WG24X33
Enthalpy Control	1	CNT-707	WW26x86

CSG refers to the Commercial Systems Group and DPG refers to the Dealer Product Group of The Trane Company. The CSG and DPG part numbers shown side by side above are not necessarily interchangeable for applications other than documented in this bulletin. Both are approved for service of the product listed. Inventories to support your needs are available to you through both Trane divisions.

Operating Pressures (Psig)

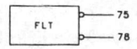
	DB ENTERING AIR TO CONDENSER			
PRESSURE	85 F	95 F	105 F	120 F
Discharge	270	301	334	391
Suction	77	79	81	84

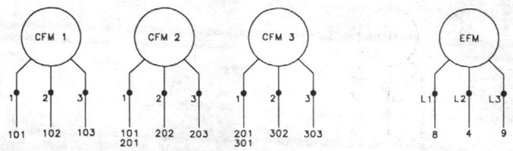
NOTES:
1. Based on nominal cfm (400 cfm/ton).
2. Evaporator air is 80F DB - 67F WB.
3. Suction pressure is accurate to within ± 2 psig.
4. Discharge pressure is accurate to within ± 7 psig.

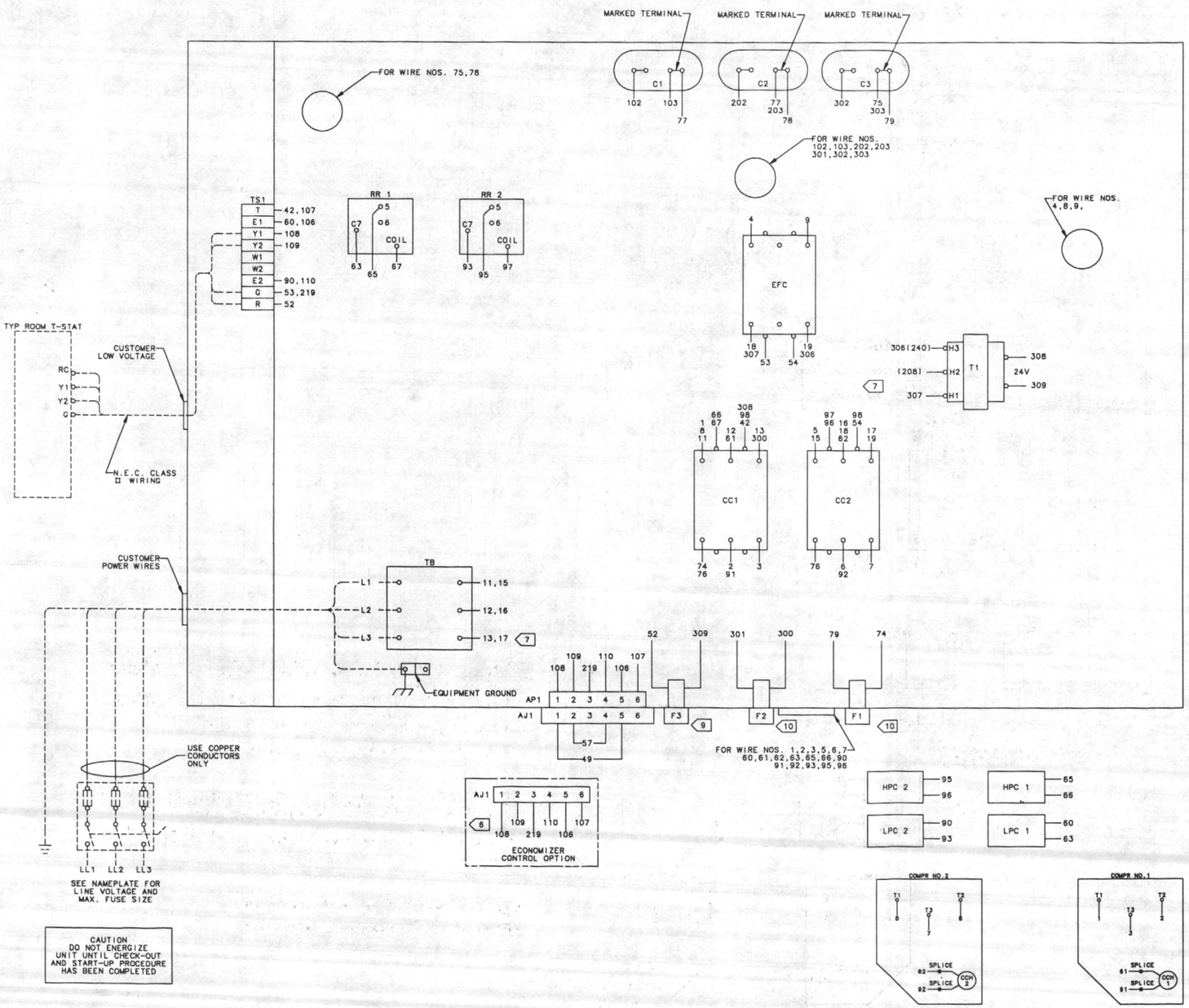
STATIC PRESSURE DROP THROUGH ECONOMIZER (Inches Water Column)

	ECONOMIZER WITH RA DAMPERS
CFM	100% RA
4800	.08
6000	.09
7200	.10

FUSE TABLE		
CONDENSER FAN FUSE		
F1 & F2	TYPE KTK	20 A
CONTROL CIRCUIT FUSE		
F3	TYPE GMQ	3 A







CAUTION
DO NOT ENERGIZE UNIT UNTIL CHECK-OUT AND START-UP PROCEDURE HAS BEEN COMPLETED

NOTES:

1 ALL WIRING AND DEVICES SHOWN DASHED TO BE SUPPLIED AND INSTALLED BY THE CUSTOMER IN ACCORDANCE WITH LOCAL ELECTRICAL CODES. USE COPPER CONDUCTORS ONLY.

2 IF ANY OF THE ORIGINAL WIRE, AS SUPPLIED WITH THIS UNIT, MUST BE REPLACED, IT MUST BE REPLACED WITH APPLIANCE WIRING MATERIAL RATED FOR 105°C OR EQUIVALENT.

3 THREE PHASE MOTORS ARE PROTECTED UNDER PRIMARY SINGLE PHASING CONDITIONS.

4 ALL MOTORS HAVE INTERNAL OVERLOAD PROTECTION.

6 AUXILIARY PLUG/JACK (AP1 AND AJ1 WITH JUMPER WIRE 49,57) CONNECTION AS SHOWN IS FOR UNITS WITHOUT ECONOMIZER CONTROL OPTION. SEE DIAGRAM IN ECONOMIZER FOR CONNECTION WITH ECONOMIZER CONTROL.

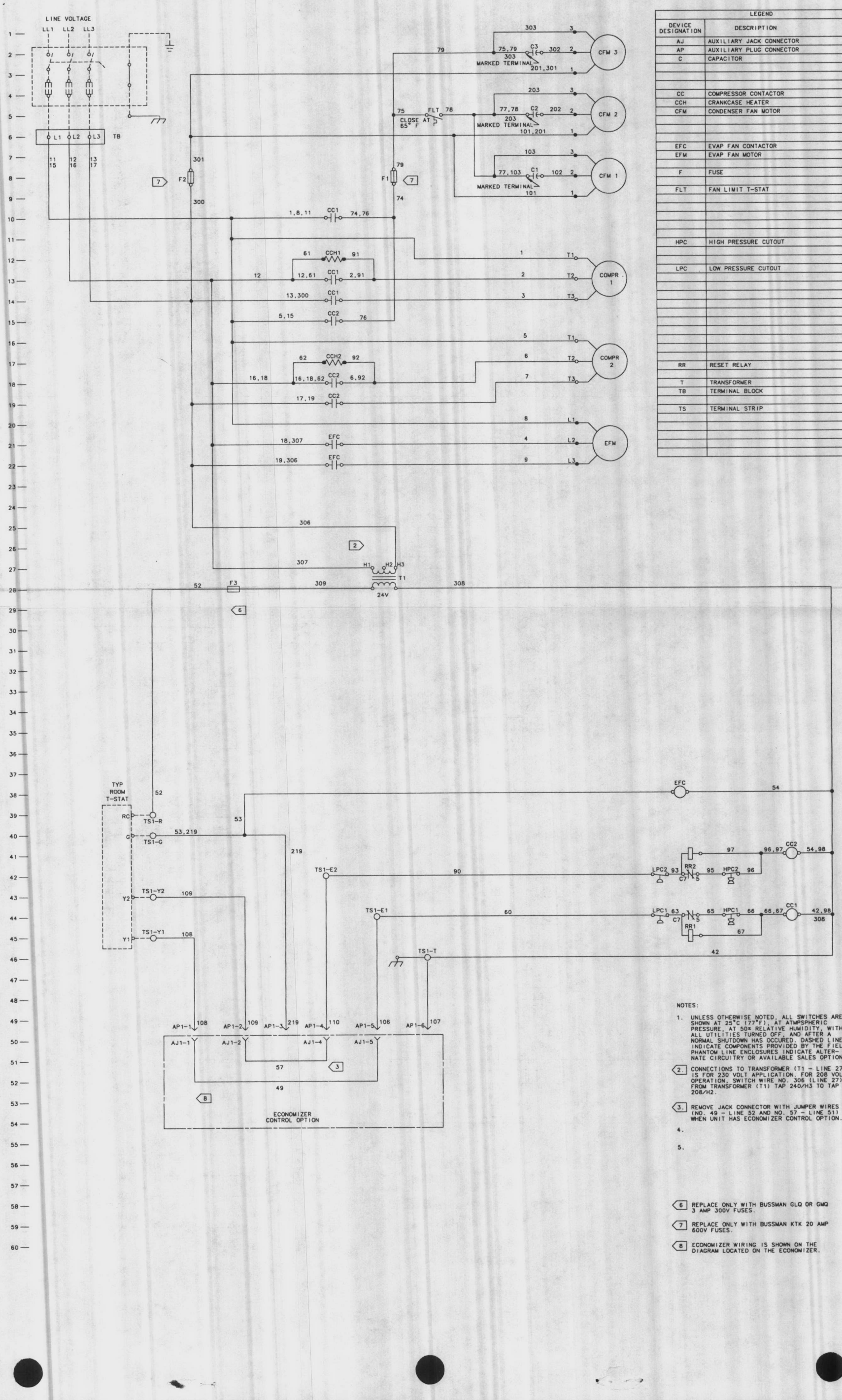
7 UNIT IS WIRED FOR 230 VOLT OPERATION, FOR 208 VOLT OPERATION SWITCH WIRE NO. 306 FROM TRANSFORMER (T1) TAP 240/H3 TO TAP 208/H2.

9 REPLACE ONLY WITH BUSSMAN GMQ OR GLQ 3 AMP 300V FUSES.

10 REPLACE ONLY WITH BUSSMAN KTK 20 AMP 600V FUSES.

2306-3530

BTC-SF-10C



LEGEND	
DEVICE DESIGNATION	DESCRIPTION
AJ	AUXILIARY JACK CONNECTOR
AP	AUXILIARY PLUG CONNECTOR
C	CAPACITOR
CC	COMPRESSOR CONTACTOR
CCH	CRANKCASE HEATER
CFM	CONDENSER FAN MOTOR
EFC	EVAP FAN CONTACTOR
EFM	EVAP FAN MOTOR
F	FUSE
FLT	FAN LIMIT T-STAT
HPC	HIGH PRESSURE CUTOUT
LPC	LOW PRESSURE CUTOUT
RR	RESET RELAY
T	TRANSFORMER
TB	TERMINAL BLOCK
TS	TERMINAL STRIP

NOTES:

1. UNLESS OTHERWISE NOTED, ALL SWITCHES ARE SHOWN AT 25°C (77°F), AT ATMOSPHERIC PRESSURE, AT 50% RELATIVE HUMIDITY, WITH ALL UTILITIES TURNED OFF, AND AFTER A NORMAL SHUTDOWN HAS OCCURED. DASHED LINES INDICATE COMPONENTS PROVIDED BY THE FIELD. PHANTOM LINE ENCLOSURES INDICATE ALTERNATE CIRCUITRY OR AVAILABLE SALES OPTIONS.

2. CONNECTIONS TO TRANSFORMER (T1 – LINE 27) IS FOR 230 VOLT APPLICATION. FOR 208 VOLT OPERATION, SWITCH WIRE NO. 306 (LINE 27) FROM TRANSFORMER (T1) TAP 240/H3 TO TAP 208/H2.

3. REMOVE JACK CONNECTOR WITH JUMPER WIRES (NO. 49 – LINE 52 AND NO. 57 – LINE 51) WHEN UNIT HAS ECONOMIZER CONTROL OPTION.

4.

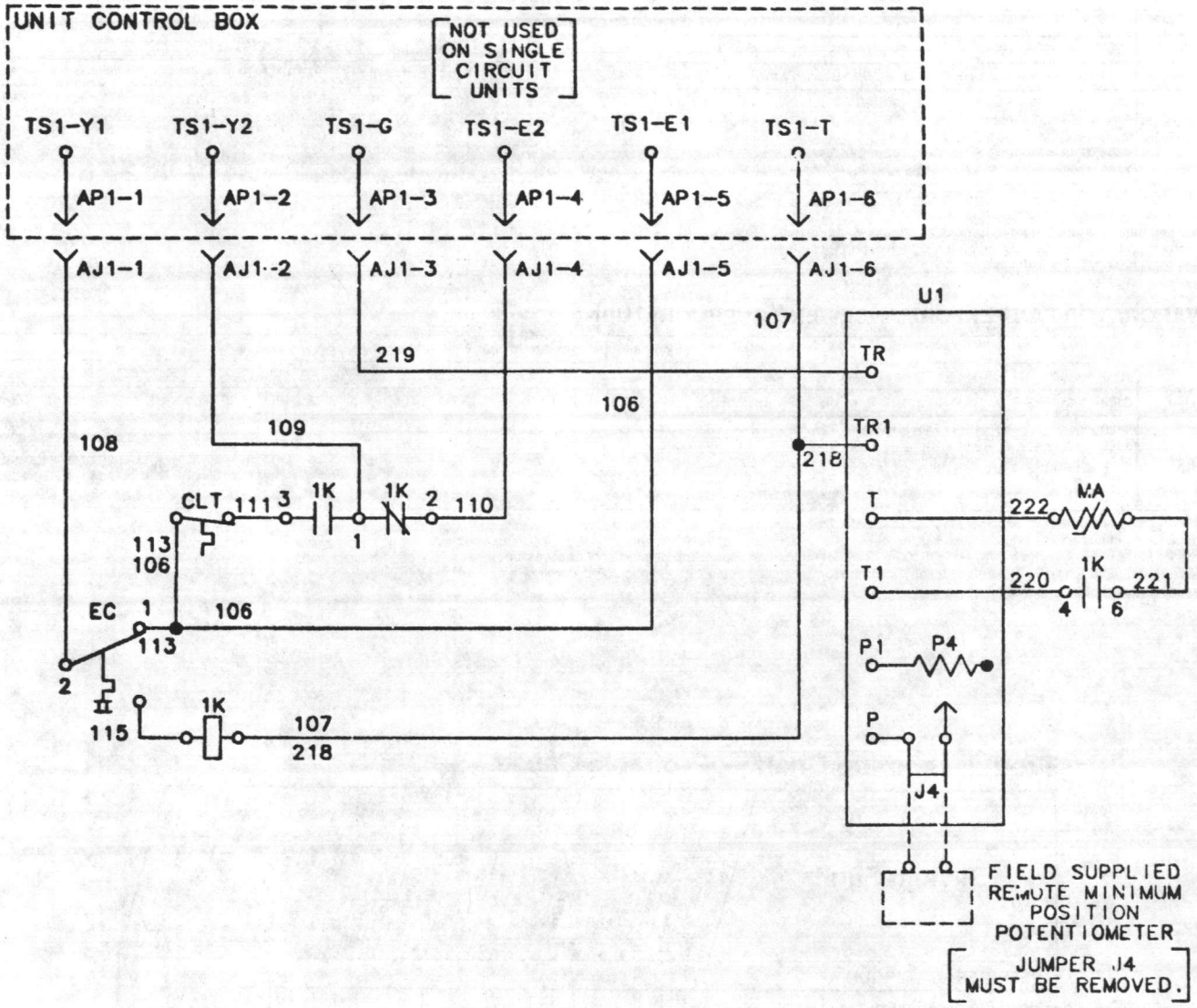
5.

6. REPLACE ONLY WITH BUSSMAN GLQ OR GMQ 3 AMP 300V FUSES.

7. REPLACE ONLY WITH BUSSMAN KTK 20 AMP 600V FUSES.

8. ECONOMIZER WIRING IS SHOWN ON THE DIAGRAM LOCATED ON THE ECONOMIZER.

BTC-SF-10C



LEGEND	
DEVICE DESIGNATION	DESCRIPTION
AJ	AUXILIARY JACK CONNECTOR
EC	ENTHALPY CONTROL
J4	MIN. POT. JUMPER
CLT	COMPRESSOR LOCKOUT THERMOSTAT
1K	ECONOMIZER RELAY
MA	MIXED AIR SENSOR
P4	MINIMUM POSITION POTENTIOMETER
U1	ACTUATOR MOTOR

2306-3557

EVAPORATOR FAN PERFORMANCE—BOTTOM SUPPLY/RETURN

Model (Std. Motor)	External Static Pressure (Inches Of Water)																									
	.10"		.20"		.30"		.40"		.50"		.60"		.70"		.80"		.90"		1.00"		1.25"		1.50"		1.75"		2.00"	
	CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
C17	4800	775	1.98	810	2.17	844	2.36	877	2.57	908	2.78	939	3.00	969	3.23	998	3.46	1027	3.70	1055	3.94	1120	4.49	1181	5.03	1239	5.60	1295	6.22
	5400	863	2.75	895	2.97	926	3.19	956	3.41	985	3.64	1013	3.87	1040	4.12	1067	4.37	1093	4.63	1119	4.90	1183	5.56	1242	6.19	1297	6.80	1350	7.41
	6000	952	3.72	981	3.96	1010	4.20	1037	4.44	1064	4.69	1090	4.94	1115	5.20	1140	5.47	1164	5.74	1188	6.03	1247	6.76	1304	7.50	—	—	—	—
	5500	1042	4.89	1068	5.16	1094	5.42	1120	5.69	1145	5.95	1169	6.22	1193	6.50	1216	6.79	1239	7.08	1261	7.37	—	—	—	—	—	—	—	—
	7200	1131	6.29	1156	6.58	1180	6.87	1204	7.16	1227	7.45	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

NOTES:
1. Shaded area indicates need for oversize motor.
2. Data includes pressure drop due to wet coil. Data does not include pressure drop due to filters or accessories.
3. A correction factor of 1.15 must be multiplied times bhp for voltages outside 440-480 and 208-240-volt range.
4. Fan motor heat (MBh) + 3.15 x bhp.

EVAPORATOR FAN PERFORMANCE—END SUPPLY/RETURN

Unit	External Static Pressure (Inches Of Water)																									
	.10"		.20"		.30"		.40"		.50"		.60"		.70"		.80"		.90"		1.00"		1.25"		1.50"		1.75"		2.00"	
	CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
C17	4800	672	1.77	707	1.96	741	2.15	773	3.35	803	2.54	831	2.74	859	2.93	886	3.13	912	3.33	937	3.54	998	4.07	1055	4.60	1109	5.14	1160	5.68
	5400	746	2.46	779	2.68	810	2.89	839	3.10	868	3.33	894	3.55	920	3.77	945	3.98	970	4.20	994	4.43	1051	5.00	1106	5.59	1158	6.19	1207	6.79
	6000	822	3.32	852	3.56	883	3.79	908	4.03	934	4.27	960	4.52	894	4.77	1108	5.01	1031	5.25	1053	5.49	1107	6.11	1159	6.75	1209	7.40	1257	8.06
	6600	898	4.35	926	4.63	953	4.88	978	5.14	1003	5.40	1027	5.67	1050	5.94	1072	8.22	1094	6.49	1115	6.75	1166	7.42	1215	8.10	1263	8.79	1309	9.51
	7200	975	5.59	1001	5.90	1026	6.18	1050	6.46	1073	6.74	1095	7.02	1117	7.32	1138	7.62	1159	7.91	1179	8.21	1228	8.94	1275	9.66	1320	10.40	1364	11.16

NOTES:
1. Shaded area indicates need for oversize motor.
2. Data includes pressure drop due to wet coil. Data does not include pressure drop due to filters or accessories.
3. A correction factor of 1.15 must be multiplied times bhp for voltages outside 440-480 and 208-240-volt range.
4. Fan motor heat (MBh) + 3.15 x bhp.

Troubleshooting Chart — Probable Cause

System Faults	POWER SUPPLY	GROUND FAULT	HIGH VOLTAGE WIRING	COMPRESSOR IOL OPEN	RUN CAPACITOR	START CAPACITOR	START RELAY	CONTACTOR CONTACTS	LOW VOLTAGE WIRING	CONTROL TRANSFORMER	THERMOSTAT	CONTACTOR COIL	LOW VOLTAGE FUSE	STUCK COMPRESSOR	INEFFICIENT COMP.	REF. UNDERCHARGE	REF. OVERCHARGE	EXCESSIVE EVAP. LOAD	NONCONDENSABLES	RES. O.D. AIRFLOW	O.D. AIR RECIRCULATION	FAULTY TXV	SUPERHEAT	RES. I.D. AIRFLOW	REF. CIR. RESTRICTIONS	LOW PRESSURE CONTROL	HIGH PRESSURE CONTROL
REFRIGERANT CIRCUIT																											
Head Pressure Too High																	P		S	P	S				S		
Head Pressure Too Low																S	P						S	S		S	
Suction Pressure Too High																S		P	P			S	S	S			
Suction Pressure Too Low																	P			S			S	S	P	S	
Liquid Refrig. Floodback (TXV)																							P	S			
Liquid Refrig. Floodback (Cap. Tube)																		P			S	S		S	P		
I.D. Coil Frosting																	P				S	S		S	P		
Compressor Runs Inadequate or No Cooling/Htg.																S	P		S	S				S	P	S	
ELECTRICAL																											
Compressor & O.D. Fan Won't Start	P	P	P					S	S	P	S	P	P													S	S
Compressor Will Not Start But O.D. Fan Runs			P	S	P	S	S	S						P													
O.D. Fan Won't Start		S	P		P			S																			
Compressor Hums But Won't Start		S			P	S	S	S						P	S												
Compressor Short Cycles			P	S	P	S	S	S						P	S	P	P	S		S			S	P	S	S	
I.D. Blower Won't Start	P	S	P						S	P	S		S														
Comp. Runs Continuously								S			P				S	S		P									

S Secondary Causes **P Primary Causes**

The Trane Company
Light Commercial Group
Guthrie Highway
Clarksville, TN 37040

Technical Literature Printed in USA

BTC-SF-10C

SERVICE FACTS

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Air Conditioner
Model: BTC030C100BA

IMPORTANT — This document is customer property and is to remain with this unit. Please return to service information pack upon completion of work.

PRODUCT SPECIFICATIONS

MODEL	BTC030C100BA
RATED Volts/Ph/Hz	200-230/1/60
A.R.I. RATING RATINGS (Cooling) ①	
BTUH	29200
Indoor Airflow (CFM)	1000
Power Input (KW)	3.61
EER/SEER (BTU/Watt-Hr) ⑥	8.10/9.15
Noise Rating No. ②	8.2
POWER CONNS. — V/Ph/Hz	200-230/1/60
Min. Brch. Cir Ampacity ③	23.0
Fuse Size — Max. (Amps)	35
Fuse Size — Recmd. (Amps)	35
COMPRESSOR	Climatuff™
No. Used — No. Speeds	1 — 1
Volts/Ph/Hz	200-230/1/60
R.L. Amps — L.R. Amps	15.1 — 58
OUTDOOR COIL — Type	Plate Fin
Rows /F.P.I.	4 / 15
Face Area (sq. ft.)	5.73
Tube Size (in.)	3/8
INDOOR COIL — Type	Plate Fin
Rows / F.P.I.	4 / 12
Face Area (sq. ft.)	3.44
Tube Size (in.)	3/8
Refrigerant Control	Expansion Valve
Drain Conn. Size (in.)	3/4 NPT
OUTDOOR FAN — Type	Propeller
No. Used — Dia. (in.)	1 — 20
Type Drive — No. Speeds	Direct — 1
CFM @ 0.0 in. w.g. ④	2300
No. Motors — HP	1 — 1/3
Motor Speed R.P.M.	1075
Volts/Ph/Hz	200-230/1/60
F.L. Amps — L.R. Amps	1.9 — 4.1

MODEL	BTC030C100BA
INDOOR FAN — Type	Centrifugal
Dia. x Width (in.)	10 x 9
No. Used	1
Drive / Speeds (No.)	Direct / 2
CFM vs. in. w.g. ⑤	See Fan Perf. Table
No. Motors — HP	1 — 1/4
Motor Speed R.P.M.	1075
Volts/Ph/Hz	200-230/1/60
F.L. Amps — L.R. Amps	2.2 — 2.7
FILTER — Furnished?	No
Type Recommended	
Lo Vel. (No.-Size-Thk.)	- -
Hi Vel. (No.-Size-Thk.)	1 - 20 x 25 - 1 in.
REFRIGERANT	
Charge (lbs. of R-22)	7 lbs. 0 oz.
DIMENSIONS	H x W x D
Crated (in.)	30-5/8 x 33-3/8 x 46
WEIGHT	
Shipping (lbs.) — Net (lbs.)	306 — 290

①**Rated in accordance with A.R.I. Standard 240.**
②**Rated in accordance with A.R.I. Standard 270.**

③Calculated in accordance with Natl. Electric Code. Suitable for use with HACR circuit breakers or fuses. ④Standard Air — Dry Coil — Outdoor. ⑤Standard Air — Wet Coil — Indoor. ⑥Rated in accordance with D.O.E. test procedure.

[*] Power supply voltage limits

Voltage Limits		Max I.D. Temp.	Max O.D. Temp.
Low	High	DB/WB	DB
207 —	254	95/71	115
196 —	207 (a)	95/71	105
187 —	196 (b)	95/71	100

(a) O.D. Fan must be on high speed. Indoor airflow must not exceed 450 CFM/TON. Start kit required.
(b) O.D. fan must be on high speed. Indoor airflow must not exceed 450 CFM/TON. Start kit must be used.
(c) Capacity reduction for unit operation at 208 volts vs. 230 volts is 1% approximately.

SINGLE PACKAGE

OPTIONAL EQUIPMENT

Indoor Thermostats —
- Horizontal, Heat/Cool only w/Manual Switchover AY28X92
- Vertical, Cool only w/Fan Switch . AY28X104
- Vertical, Heat/Cool w/Manual Switchover AY28X105

Evaporator Defrost Control Kit (For Cooling Units) — Needed for Cooling Operation Between 55° and 40° AY28X79

Outdoor Thermostat Kit — Includes Thermostat AY28X125 and Mkg. Brkt. — for 46°F. to −10°F. (Adjustable) BAY28X125A

SUPPLEMENTARY HEATERS

Model Number	Power Supply	KW Rating 208-240 V	Nominal BTUH
BAYHTRC106	208-240/1/60	4.33-5.76	14800-19700
BAYHTRC108	208-240/1/60	6.12-8.16	20900-27900
BAYHTRC111	208-240/1/60	7.93-10.56	27000-36100
BAYHTRC117†	208-240/1/60	12.98-17.28	44300-59000
BAYHTRC306†	208-240/3/60	4.33-5.76	14800-19700
BAYHTRC312†	208-240/3/60	8.65-11.52	29500-39300
BAYHTRC317†	208-240/3/60	12.98-17.28	44300-59000
BAYHTRC406†	480/3/60	5.76	19700
BAYHTRC412†	480/3/60	11.52	39300
BAYHTRC417†	480/3/60	17.28	59000

† Used with BAYPLNMØØ9 heater enclosure.

SAFETY NOTICE

THIS INFORMATION IS INTENDED FOR USE BY INDIVIDUALS POSSESSING ADEQUATE BACKGROUNDS OF ELECTRICAL AND MECHANICAL EXPERIENCE. ANY ATTEMPT TO REPAIR A CENTRAL AIR CONDITIONING PRODUCT MAY RESULT IN PERSONAL INJURY AND OR PROPERTY DAMAGE. THE MANUFACTURER OR SELLER CANNOT BE RESPONSIBLE FOR THE INTERPRETATION OF THIS INFORMATION, NOR CAN IT ASSUME ANY LIABILITY IN CONNECTION WITH ITS USE.

RECONNECT ALL GROUNDING DEVICES

ALL PARTS OF THIS PRODUCT CAPABLE OF CONDUCTING ELECTRICAL CURRENT ARE GROUNDED. IF GROUNDING WIRES, SCREWS, STRAPS, CLIPS, NUTS OR WASHERS USED TO COMPLETE A PATH TO GROUND ARE REMOVED FOR SERVICE, THEY MUST BE RETURNED TO THEIR ORIGINAL POSITION AND PROPERLY FASTENED.

DISCONNECT POWER BEFORE SERVICING

P.I. 11/85

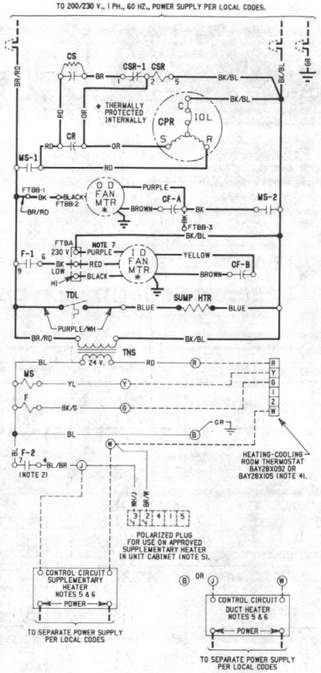
The Trane Company
Light Commercial Unitary Division
Guthrie Highway
Clarksville, TN 37040

REDDI PARTS

COMPONENT	QTY.	DESCRIPTION	DPG CAT. #	CSG MNEMONIC #
Blower Wheel	1	10.62" D x 9.62" W x 1/2" Bore, CW, Concave	WG74X55	WHL-324
Capacitors (CF-A) (CF-B) (CR) (CS)	1 1 1 1	7.5 MFD, 440V 12.5 MFD, 370V 30 MFD, 440V 135 MFD, 320V	WW20X134 WG20X29 WW20X130 WW20X8	CPT-265 CPT-267 CPT-321 CPT-269
Coil, Indoor *	1	Replacement *	WW87X254	COL-3555
Coil, Outdoor *	1	Replacement *	WW88X282	COL-3557
Compressor Internal Line Break (IOL) Internal Press. Relief (IPR)	1	FLA 15.5 LRA 58.0, Wind. res. @ 77°F.: Start 3.5 Ohms — Run .909 Ohms Open on rise in winding temp. - Resets in 30-90 min. Open on 350# diff. between high & low side pressure	Order by unit model #	THT-469
Contactor (MS)	1	Type DPST, Contacts 240V, FLA 25.0, LRA 125.0, Coil 24V, .95 A.In., .53 A.Hld.	WW24X138	CTR-504
Discharge Line Thermostat (TDL)	1	Type SPST, Opens @ 105°F. ± 7°, Closes @ 73°F. ± 3°, FLA 2.9, LRA 17.4 @ 240V	WW28X174	
Distributor (OD) *	1	5/8" Inlet, 4 Outlets @ 3/16" *	WW51X291	DST-160
Distributor (ID) *	1	1/2" Inlet, 3 Outlets @ 1/4" *	WW51X262	DST-159
Drier	1	Suc. Line w/Sweat Fit., 30 Cu. In., 5/8" x 5/8"	WW22X77	DHY-190
Drier	1	Liq. Line w/Sweat Fit., 8 Cu. In., 3/8"x3/8"	WW22X88	DHY-144
Expansion Valve *	1	3/8" In, 1/2" Out, Sweat, * 2 Ton, 30" Cap, Ext. Equal., Superheat 5-1/2 to 9-1/2	WW51X275	VAL-2194
Fan	1	5 Blade, 20" Dia., 1/2" Bore, CCW, 25°	WW73X19	FAN-1128
Motor (ID) *	1	200/230V, 60 Hz., 1 Ph., Open Shell, CCW, 965 RPM, 1/4 HP, 2-speed, FLA 2.2/1.9, LRA 3.0, Sleeve Bearings; Winding Resistance — Ohms @ 77°F.: Blk. to Ylw. 25.6/22.0; Blk. to Brn. 31.5/27.0; Blk. to Red 6.0/5.0; Ylw. to Pur. 4.4/3.8 *	WW94X440	MOT-2599
Motor (OD)	1	200/230V, 60 Hz., 1 Ph., Open Shell, CCW, 1085 RPM, 1/3 HP, 1-speed, FLA 1.9, LRA 4.5, Sleeve Bearings; Wind. Res. — Ohms @ 77°F.: Blk. to Pur. 16.6/14.2; Blk. to Brn. 34.8/29.9	WW94X276	MOT-2304
Relay (CSR)	1	230V, 239-268 Cold Coil P/U Volts, 60-135 Dropout Volts	WW24X6	RLY-896
Relay (F)	1	Type DPST, Contacts 230V, FLA 5.0, LRA 15.0, Coil 24V, 18.7 A.In., 2.0 A. Hld.	WW24X165	RLY-1010
Sump Heater	1	230V, 60 Watts, Resistance Heater, Belly-Band Type	WW08X79	HTR-1224
Thermostat	1 1 1	Heat/Cool, Horizontal Cool only, w/Fan Switch, Vertical Heat/Cool, Vertical	WY28X92 WY28X104 WY28X105	THT-454 THT-455 THT-465
Transformer (TNS)	1	Pri. 230V, 50/60 Cycle, Sec. 24V, Load 35 V.A.	WW32X15	TRR-442

*New Part - Set Up Within The Last 18 Months.

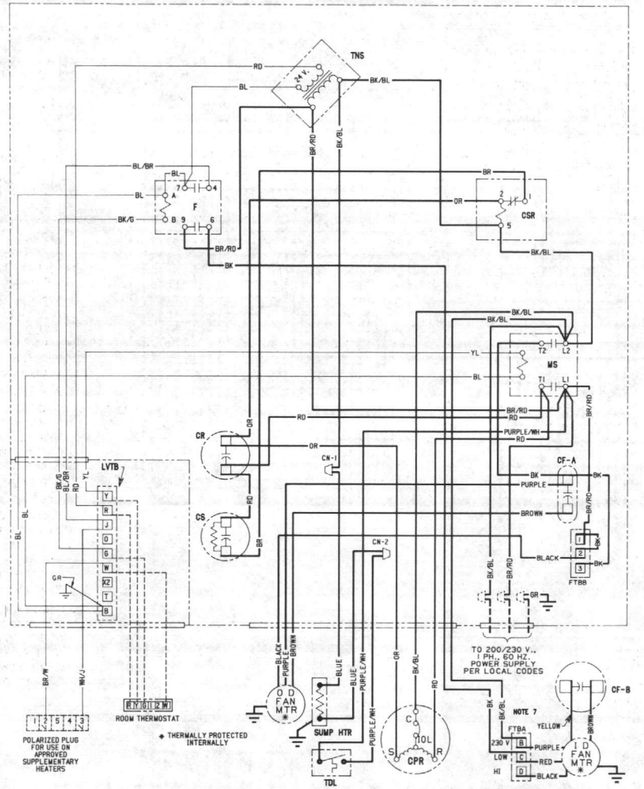
SCHEMATIC DIAGRAM — BTC030C100BA



NOTES:

1. MAXIMUM EXTE[redacted]4 V.A.C. LOA[redacted]NG COOLING OPERATION IS 0.5 AMP, OTHERWISE 1.2 AMP.
2. HEATER INTERLOCK (F-2 CONTACT) IS CLOSED DURING FAN OPERATION.
3. LOW VOLTAGE (24 V.) FIELD WIRING MUST BE 18 AWG MINIMUM.
4. SET "HA" AS FOLLOWS:
   DUCT HEATERS: TO DUCT HEATER CONTROL CIRCUIT CURRENT.
   SUPPLEMENTARY HEATER IN UNIT CABINET: .18.
   SUPPLEMENTARY HEATER IN HEATER ENCLOSURE: TO HEATER CONTROL CIRCUIT CURRENT.
5. APPROVED SUPPLEMENTARY HEATERS FOR FIELD INSTALLATION IN UNIT: DUCT HEATER IN AIR DUCT OR SUPPLEMENTARY HEATER IN APPROVED HEATER ENCLOSURE MAY BE USED WITH UNIT. HOWEVER ONE AND ONLY ONE HEATER MAY BE USED.
6. IF HEATING EQUIPMENT HAS SEPARATE 24 V. CLASS 2 OUTPUT FOR CONNECTION TO THERMOSTAT, THEN USE EITHER THERMOSTAT WITH ISOLATING CONTACTS OR ISOLATING RELAY TO PREVENT INTERCONNECTION WITH 24V. CLASS 2 OUTPUT OF TRANSFORMER IN THIS EQUIPMENT.
7. FOR 200 V. OPERATION MOVE BK/BL LEAD FROM FTB TERMINAL "B" TO YELLOW LEADED SIDE OF CAPACITOR (CF-B). TO CHANGE I.D. FAN MOTOR SPEED MOVE BK/WH WH LEAD FROM TERMINAL "C" (LOW), TO TERMINAL "D" (HI), ON FTB.
8. **USE COPPER CONDUCTORS.** IF ALUMINUM OR COPPER-CLAD ALUMINUM POWER WIRING IS USED, CONNECTORS WHICH MEET ALL APPLICABLE CODES AND ARE ACCEPTABLE TO THE INSPECTI[redacted]HORITY HAVI[redacted] JURISDICTION SI[redacted]SED.

WIRING DIAGRAM



From Dwg. 21D756477 P01

LEGEND

COLOR CODES

BK/BL — WIRE: Black Wire with Blue Marker; MARKER

BK	Black	OR	Orange
BL	Blue	RD	Red
BR	Brown	WH	White
YL	Yellow	PR	Purple
GR	Green		

SYMBOLS

- L.V. Factory Wiring
- H.V. Factory Wiring
- L.V. Field Wiring
- H.V. Field Wiring
- L.V. / H.V. Field Installed Factory Wiring
- Ground
- Junction
- Terminal
- Terminal Board
- Relay Contact (N.O.)
- Relay Contact (N.C.)
- Internal Overload Protector
- Resistor or Heating Element
- Wire Nut or Connector
- Coil
- Capacitor
- Motor Winding
- Transformer
- Temperature Actuated Switch

CF	Fan Capacitor
CN	Wire Nut or Connector
CPR	Compressor
CR	Run Capacitor
CS	Start Capacitor
CRS	Start Capacitor Relay
F	Indoor Fan Relay
FTB	Fan Terminal Board
IOL	Internal Overload Protector
LVTB	Low Voltage Terminal Board
MS	Compressor Motor Contactor
MTR	Motor
TDL	Discharge Line Thermostat
TNS	Transformer

ELECTRIC HEATERS

NUMBER OF RACKS (SEE TABLE BELOW)

AIRFLOW CFM	1	2	3
	AIR PRESSURE DROP, in w.g.		
600	0.02	0.04	0.06
700	0.03	0.05	0.07
800	0.03	0.06	0.09
900	0.04	0.08	0.12
1000	0.05	0.10	0.15
1100	0.06	0.12	0.18
1200	0.07	0.14	0.21
1300	0.08	0.17	0.25
1400	0.10	0.20	0.30
1500	0.12	0.23	0.35

HEATER MODEL NO.	NO. OF RACKS
BAYHTRC106	1
BAYHTRC108,111	2
①BAYHTRC117,306,312,317,406,412,417	3
①Install in Heater Enclosure BAYPLNM009	

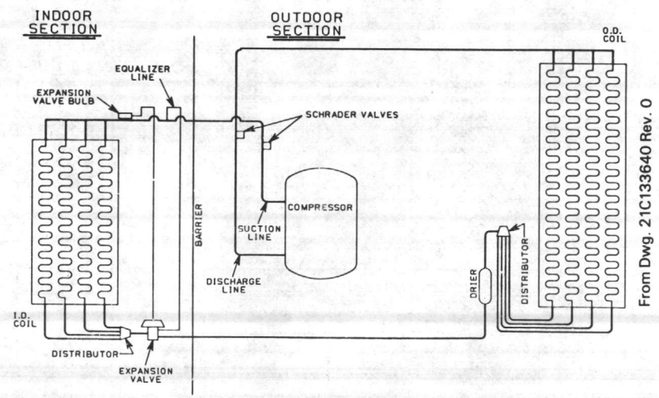
From Dwg. 21A122733 Rev. 2

TROUBLESHOOTING CHART — WHAT TO CHECK

SYSTEM FAULTS	HIGH VOLTAGE WIRING POWER SUPPLY	COMPR. IOL	RUN CAPACITOR	START CAPACITOR	START RELAY	CONTACTOR CONTACTS	LOW VOLTAGE WIRING	CONTROL TRANSFORMER	CONTACTOR COIL	LOW VOLTAGE FUSE	STUCK COMPRESSOR	INEFFICIENT COMPRESSOR	REFRIGERANT UNDERCHARGE	REFRIGERANT OVERCHARGE	EXCESSIVE EVAP. LOAD	NONCONDENSABLES	RESTRICTED O.D. AIRFLOW	O.D. AIR RECIRCULATION	TXV STUCK OPEN	SUPERHEAT	RESTRICTED I.D. AIRFLOW	REF. CIRCUIT RESTRICTIONS
REFRIGERANT CIRCUIT																						
Liquid Pressure Too High															P		S	P	S			S
Liquid Pressure Too Low													S	P						S	S	S
Suction Pressure Too High													S		P	P				S	P	
Suction Pressure Too Low														S							S	P	S
Liquid Refrig. Floodback TXV System																				S	S	
Liquid Refrig. Floodback Capillary Tube System															P			S	S		S	P
I.D. Coil Frosting														P								P	S
Compressor Runs Inadequate or No Cooling													S	P		P	S				S	P	S
ELECTRICAL																						
Compressor & O.D. Fan Do Not Start	P	P						S	P	P												
Compressor Will Not Start But O.D. Fan Runs		P	S	P	P	P																
O.D. Fan Won't Start		P		P																		
Compressor Hums But Won't Start		P		P	P	P	S					S										
Compressor Cycles on IOL		P	S	P	P	P	S					P	S	P	S	S		S			S	S
I.D. Blower Won't Start	P	S						S	P		P											

P Primary Causes S Secondary Causes

REFRIGERANT CIRCUIT

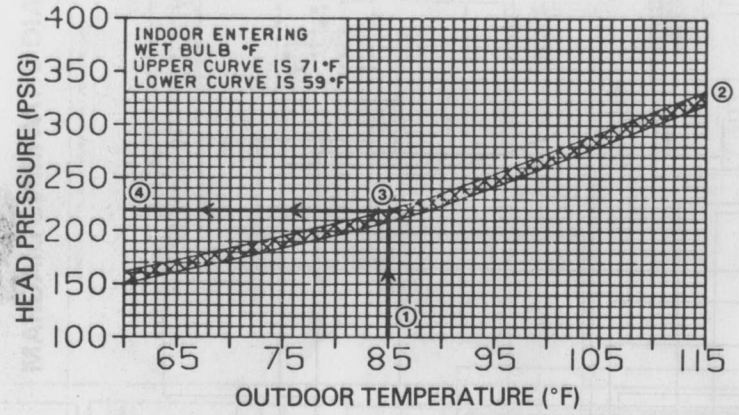


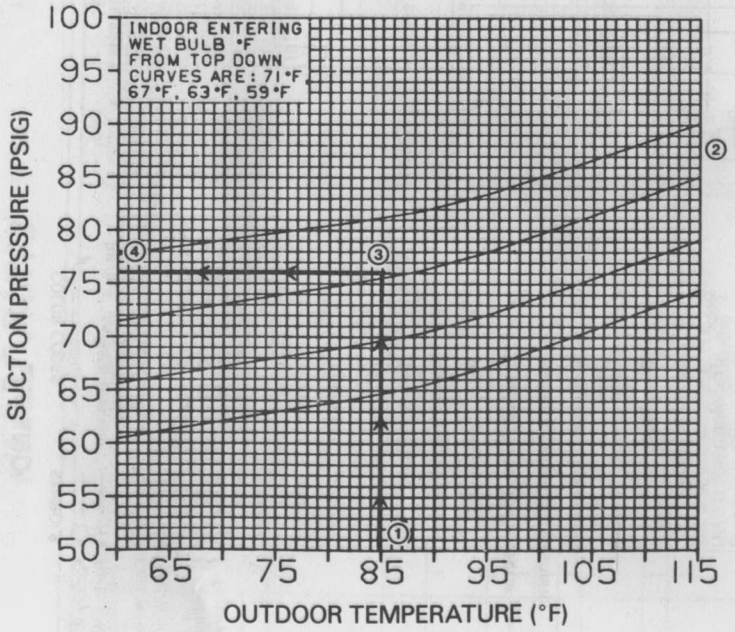
From Dwg. 21C133640 Rev. 0

SERVICE TIPS

On this and other cooling only machines high side pressure is taken downstream of the condenser and liquid line drier. In the event of a restriction of either of these two components, charge can be added to cause the high side press to agree with the performance chart. However, discharge pressure becomes significantly higher, possibly causing the IPR to trip.

PRESSURE CURVE — BTC030C100BA





From Dwg. 21C135394 Rev. 1

INDOOR FAN PERFORMANCE ①

AIRFLOW CFM ②③	HIGH SPEED		LOW SPEED	
	PRESS. In. w.g.	PWR. WATTS	PRESS. In. w.g.	PWR. WATTS
800	0.80	350	0.71	335
900	0.70	375	0.58	345
1000	0.61	400	0.44	360
1100	0.50	425	0.30	375
1200	0.40	445	0.15	390
1300	0.28	480	0.00	415
②1400	0.13	505	—	—
1500	0.00	535	—	—

① Factory Setting at Low Speed
② Water Blow-Off Limit
③ Wet Coil, No Filter, No Heater Installed. See Pressure Drop Tables for Installed Electric Heaters. The Table Values Are Applicable To Both The Rated And 90% Voltage Taps When Connected To The Proper Motor Tap.

From Dwg. 21A135642 Rev. 0

PRESSURE CURVE EXAMPLE

COOLING PERFORMANCE TO BE CHECKED WHEN OUTDOOR TEMPERATURE IS ABOVE 55°F. AFTER OPERATING PRESSURES HAVE STABILIZED: MEASURE INDOOR WET BULB TEMP - OUTDOOR TEMP - HEAD & SUCTION PRESSURES.
LOCATE OUTDOOR TEMP ① LOCATE INDOOR WET BULB ② FIND INTERSECTION OF OD TEMP & ID W.B. ③ READ HEAD OR SUCTION PRESSURE IN LEFT HAND COLUMN ④ (SELECT PROPER INDOOR CFM)

ACTUAL HEAD PRESSURE SHOULD BE ± 10 PSIG OF CHART
SUCTION PRESSURE SHOULD BE ± 3 PSIG OF CHART

EXAMPLE: ① OUTDOOR TEMP 85°F., ② INDOOR WET BULB 67°F.,
③ HEAD PRESSURE @ 1000 CFM = 220 PSIG ④
③ SUCTION PRESSURE @ 1000 CFM = 76 PSIG ④

18-HD10D1
1st Printing, 1986

(AY28X079 & 084) LOW AMBIENT COOLING CONTROL

DFST-IN-1A

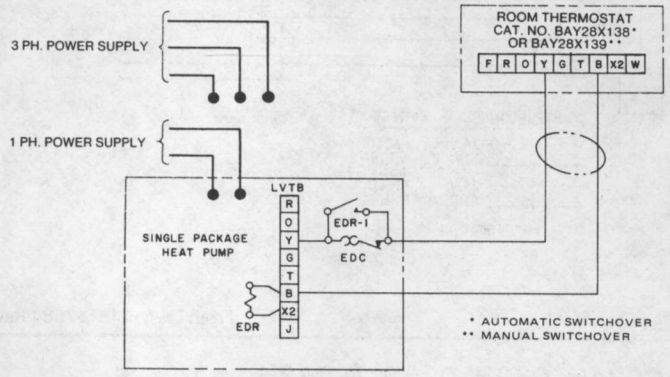
GENERAL:

This control is installed in the evaporator (indoor) coil. Its purpose is to cycle the compressor when the evaporator frosts under low outdoor ambient cooling conditions.

When installed on an "A" Coil, follow procedure below on either bank of the coil. For low ambient cooling performance, consult Service Manual.

NOTE: Hook-up diagrams for heat pumps on this page, hook-ups for cooling on back page.

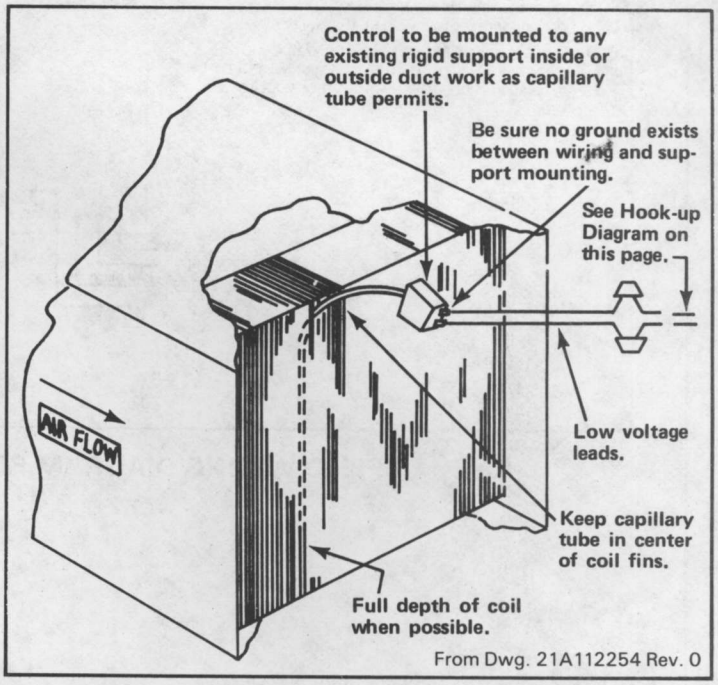
FIELD WIRING FOR SINGLE PACKAGE HEAT PUMP WITH AY28X084



NOTES:

1. SIZE OF POWER WIRING, AND GROUNDING OF EQUIPMENT MUST COMPLY WITH LOCAL CODES.
2. BE SURE POWER SUPPLY AGREES WITH EQUIPMENT NAMEPLATE.
3. LOW VOLTAGE WIRING TO BE NO. 18 A.W.G. MINIMUM CONDUCTOR.

From Dwg. 21B123129 Rev. 1

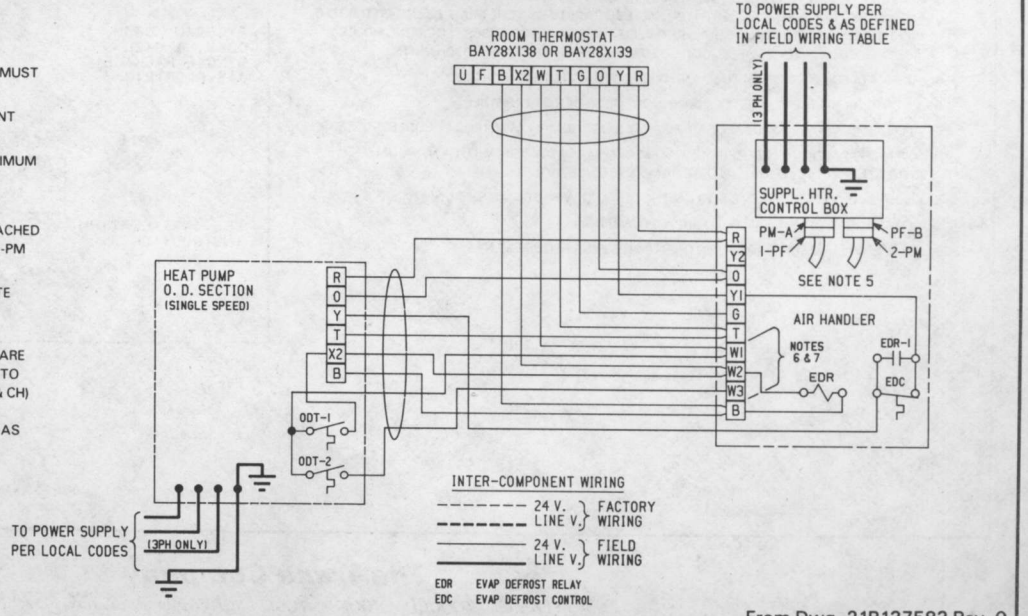


From Dwg. 21A112254 Rev. 0

FIELD WIRING FOR SPLIT SYSTEM HEAT PUMP WITH AY28X084

NOTES:

1. POWER WIRING AND GROUNDING OF EQUIPMENT MUST COMPLY WITH LOCAL CODES.
2. BE SURE POWER SUPPLY AGREES WITH EQUIPMENT NAMEPLATE.
3. LOW VOLTAGE WIRING TO BE NO. 18 A.W.G. MINIMUM CONDUCTOR.
4. **USE COPPER CONDUCTORS ONLY.**
5. POLARIZED PLUG SECTIONS PM-A AND PF-B ATTACHED TO HEATER CONTROL BOX. SECTIONS 1-PF AND 2-PM FACTORY WIRED INTO AIR HANDLER.
6. IF ODT IS NOT USED, THEN CONNECT APPROPRIATE JUMPERS FROM W1 TO W2 AND W3 ON LVTB.
7. TERMINALS W2 AND W3 WILL HAVE INTERNAL CONNECTIONS ONLY IF 2ND & 3RD CONTACTORS ARE USED BY THE HEATER FOR CONTROLLING POWER TO ELECTRIC HEATING ELEMENTS. IF 2ND & 3RD (BH & CH) CONTACTORS ARE NOT USED, THEN FIELD CONNECTIONS TO W2 AND W3 CAN BE OMITTED AS APPROPRIATE.



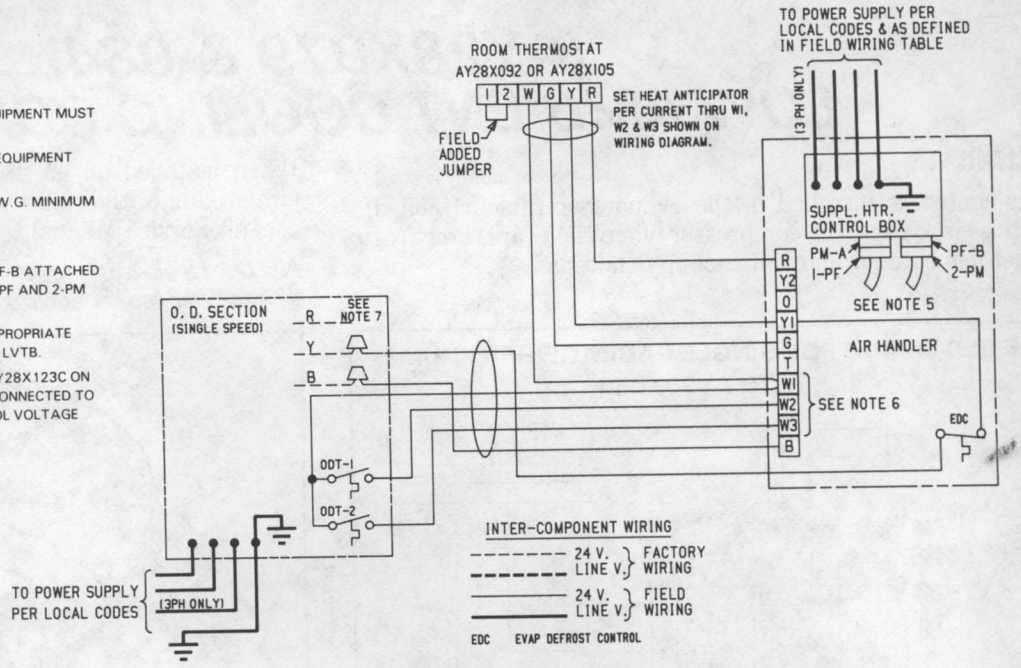
From Dwg. 21B137583 Rev. 0

dwg. no. 21A113215 P06

FIELD WIRING DIAGRAM FOR SPLIT COOLING WITH AY28X079

NOTES:

1. POWER WIRING AND GROUNDING OF EQUIPMENT MUST COMPLY WITH LOCAL CODES.
2. BE SURE POWER SUPPLY AGREES WITH EQUIPMENT NAMEPLATE.
3. LOW VOLTAGE WIRING TO BE NO. 18 A.W.G. MINIMUM CONDUCTOR.
4. **USE COPPER CONDUCTORS ONLY.**
5. POLARIZED PLUG SECTIONS PM-A AND PF-B ATTACHED TO HEATER CONTROL BOX. SECTIONS 1-PF AND 2-PM FACTORY WIRED INTO AIR HANDLER.
6. IF ODT IS NOT USED, THEN CONNECT APPROPRIATE JUMPERS FROM W1 TO W2 AND W3 ON LVTB.
7. TO USE LOW AMBIENT COOLING KIT BAY28X123C ON 3 PHASE MODELS, "R" LEAD MUST BE CONNECTED TO "Y" LEAD IN ORDER TO SUPPLY CONTROL VOLTAGE FOR KIT.

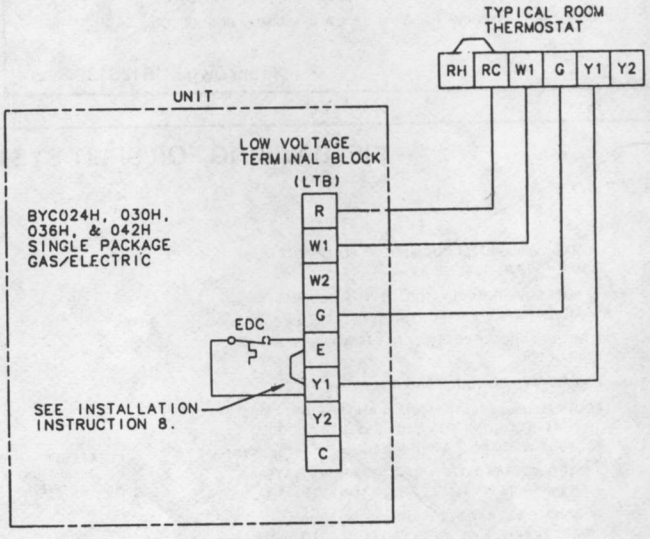


From Dwg. 21B137584 Rev. 0

FIELD WIRING DIAGRAM FOR BYC024H, 030H, 036H, & 042H WITH AY28X079

EDC INSTALLATION INSTRUCTIONS

1. DISCONNECT POWER TO UNIT.
2. REMOVE BOTH TOP COVERS FROM UNIT.
3. SPREAD EVAPORATOR FINS TO ALLOW INSERTION OF EVAPORATOR DEFROST CONTROL (EDC) CAPILLARY TUBE INTO FULL DEPTH OF COIL. EDC CAPILLARY TUBE MUST BE LOCATED 2 TO 6 INCHES FROM HEADER END OF COIL (BETWEEN THE 2 ROWS OF TUBES). LOCATING HOLES ARE PROVIDED ON TOP EVAPORATOR COIL BLOCKOFF ON BYC024H & 030H UNITS.
4. LUBRICATE EDC CAPILLARY TUBE AND INSERT INTO FULL DEPTH OF COIL.
5. MOUNT EDC ON TOP CORNER OF INDOOR/OUTDOOR PARTITION PANEL.
6. ALL WIRING AND GROUNDING OF EQUIPMENT MUST COMPLY WITH LOCAL CODES.
7. WIRING FROM EDC TO LTB TO BE 18 AWG MINIMUM CONDUCTOR, WITH A MINIMUM INSULATION RATING EQUAL TO UNIT NAMEPLATE VOLTAGE.
8. REMOVE JUMPER BETWEEN E & Y1 ON THE LTB AND WIRE EDC AS SHOWN.
9. ALL WIRING SHOWN IS 24V FIELD SUPPLIED WIRING.
10. SEE UNIT INSTALLERS GUIDE FOR OTHER UNIT WIRING REQUIREMENTS.



From Dwg. B2306-356

The Trane Company
Dealer Products Group • Troup Highway • Tyler, TX 75711

dwg. no. 21A113215 P06
P.I.

SERVICE FACTS

Since The Trane Company has a policy of continuous product improvement, it reserves the right to change specifications and design without notice. The installation and servicing of the equipment referred to in this booklet should be done by qualified, experienced technicians.

Air Conditioner
Model: BTC024C100BA

IMPORTANT — This document is customer property and is to remain with this unit. Please return to service information pack upon completion of work.

PRODUCT SPECIFICATIONS

MODEL	BTC024C100BA
RATED VOLTS/PH/HZ	230/1/60
A.R.I. RATING	
Ratings (Cooling)①	
BTUH	23000
Indoor Airflow (CFM)	800
Power Input (KW)	2.66
EER/SEER (BTU/ Watt-Hr.)⑥	8.65 / 9.50
Noise Rating No.②	7.8
POWER CONNS. — V/Ph/Hz	230/1/60
Min. Brch. Cir. Ampacity③	16
Br. Cir. — Max. (Amps)	25
Prot. Rtg. — Recmd. (Amps)	25
COMPRESSOR	Climatuff™
No. Used — No. Speeds	1 — 1
Volts/Ph/Hz	230/1/60
R.L. Amps — L.R. Amps	10.0 — 56
Brch. Cir. Selec. Cur. Amps	10.9
OUTDOOR COIL — Type	Plate Fin
Rows — F.P.I.	3 — 15
Face Area (sq. ft.)	5.73
Tube Size (in.)	3/8
INDOOR COIL — Type	Plate Fin
Rows — F.P.I.	4 — 12
Face Area (sq. ft.)	3.44
Tube Size (in.)	3/8
Refrigerant Control	Expansion Valve
Drain Conn. Size (in.)	3/4 NPT

MODEL	BTC024C100BA
OUTDOOR FAN — Type	Propeller
No. Used — Dia. (in.)	1 — 20
Type Drive — No. Speeds	Direct — 1
CFM @ 0.0 in. w.g.④	1700
No. Motors — HP	1 — 1/12
Motor Speed R.P.M.	825
Volts/Ph/Hz	230/1/60
F.L. Amps — L.R. Amps	0.8 — 0.90
INDOOR FAN — Type	Centrifugal
Dia. x Width (in.)	9 x 9
No. Used	1
Drive — Speeds (No.)	Direct — 2
CFM vs. in. w.g.⑤	See Fan Perf. Table
No. Motors — HP	1 — 1/4
Motor Speed R.P.M.	1075
Volts/Ph/Hz	230/1/60
F.L. Amps — L.R. Amps	1.8 — 3.4
FILTER — Furnished?	No
Type Recommended	
Lo Vel. (No. — Size — Thk.)	— —
Hi Vel. (No. — Size — Thk)	1 — 20 x 20 — 1 in.
REFRIGERANT	
Charge (lbs. of R-22)	5 lbs. 2 oz.
DIMENSIONS	H x W x D
Crated (in.)	30-5/8 x 33-3/8 x 46
WEIGHT	
Shipping (lbs.) — Net (lbs.)	286 — 270

①**Rated in accordance with A.R.I. Standard 240.**
②**Rated in accordance with A.R.I. Standard 270.**
③Calculated in accordance with Natl. Electric Code. Suitable for use with HACR circuit breakers or fuses.
④Standard Air — Dry Coil — Outdoor.
⑤Standard Air — Wet Coil — Indoor.
⑥Rated in accordance with D.O.E. test procedure.
[*] Power supply voltage limits

Voltage Limits Low	Voltage Limits High	Max I.D. Temp. DB/WB	Max O.D. Temp. DB
207	254	95/71	115
196	207 (a)	95/71	105
187	196 (b)	95/71	100

(a) O.D. Fan must be on high speed. Indoor airflow must not exceed 450 CFM/TON.
(b) O.D. fan must be on high speed. Indoor airflow must not exceed 450 CFM/TON. Start kit must be used.
(c) Capacity reduction for unit operation at 208 volts vs. 230 volts is 1% approximately.

SINGLE PACKAGE

OPTIONAL EQUIPMENT

Indoor Thermostats —
Horizontal, Heat/Cool only
w/Manual Switchover AY28X92
Vertical, Cool only w/Fan Switch . .AY28X104
Vertical, Heat/Cool
w/Manual Switchover AY28X105
Thermostat Guard BAY28X190
Evaporator Defrost Control
Kit (For Cooling Units) —
Needed for Cooling Operation
Between 55° and 40° AY28X79

SUPPLEMENTARY HEATERS

BAYHTRC106	208-240/1/60	4.33-5.76	14800-19700
BAYHTRC108	208-240/1/60	6.12-8.16	20900-27900
BAYHTRC111	208-240/1/60	7.93-10.56	27000-36100

SAFETY NOTICE

THIS INFORMATION IS INTENDED FOR USE BY INDIVIDUALS POSSESSING ADEQUATE BACKGROUNDS OF ELECTRICAL AND MECHANICAL EXPERIENCE. ANY ATTEMPT TO REPAIR A CENTRAL AIR CONDITIONING PRODUCT MAY RESULT IN PERSONAL INJURY AND OR PROPERTY DAMAGE. THE MANUFACTURER OR SELLER CANNOT BE RESPONSIBLE FOR THE INTERPRETATION OF THIS INFORMATION, NOR CAN IT ASSUME ANY LIABILITY IN CONNECTION WITH ITS USE.

RECONNECT ALL GROUNDING DEVICES

ALL PARTS OF THIS PRODUCT CAPABLE OF CONDUCTING ELECTRICAL CURRENT ARE GROUNDED. IF GROUNDING WIRES, SCREWS, STRAPS, CLIPS, NUTS OR WASHERS USED TO COMPLETE A PATH TO GROUND ARE REMOVED FOR SERVICE, THEY MUST BE RETURNED TO THEIR ORIGINAL POSITION AND PROPERLY FASTENED.

DISCONNECT POWER BEFORE SERVICING

P.I. 11/85

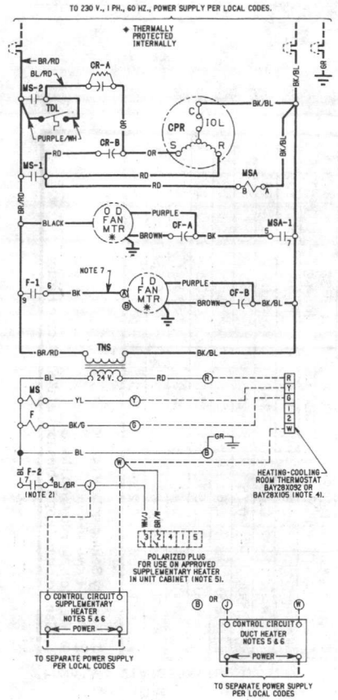
The Trane Company
Light Commercial Unitary Division
Guthrie Highway
Clarksville, TN 37040

REDDI PARTS

COMPONENT	QTY.	DESCRIPTION	DPG CAT. #	CSG MNEMONIC #
Blower Wheel	1	10" D x 9.5" W x 1/2" Bore, Convex, CW	WW74X35	WHL-322
Capacitors (CR-A) (CF-B) (CF-A/CF-B)	1 1 1	15 MFD, 440V 10 MFD, 440V 5 MFD, 440 MFD	WW20X126 WW20X128 WW20X108	CPT-274 CPT-264 CPT-318
Capillary Tube	4	.145" OD x.085" ID x 70.0", Red/White cuts to 20" long	WW62X65	TUB-1353
Coil, Indoor *	1	Replacement *	WW87X254	COL-3555
Coil, Outdoor *	1	Replacement *	WW88X281	COL-3556
Compressor Internal Line Break (IOL) Internal Press. Relief (IPR)	1	FLA 11.0 LRA 44.0, Wind. res. @ 77°F. Start = 4.98 Ohms — Run 1.15 Ohms Open on rise in winding temp. - Resets in 30-90 min. Open on 350# diff. between high & low side pressure	Order by unit model #	COM-2319
Contactor (MS)	1	Type DPST, Contacts 240V, FLA 18.0, LRA 90.0, Coil 24V, .64 A.In., .32 A. HLD.	WW24X26	CTR-503
Contactor (MSA)	1	Type SPST, Contacts 230V, FLA 5.0, LRA 15.0, Coil 230V., 177 A.In., 2.0 A. HLD.	WW24X158	RLY-1001
Discharge Line Thermostat (TDL)	1	Type SPST, Opens @ 105°F. ± 7°, Closes @ 73°F. ± 3°, FLA 2.9, LRA 17.4 @ 240V	WW28X174	THT-469
Distributor (ID) *	1	1/2" Inlet, 3 Outlets @ 1/4" *	WW51X262	DST-159
Distributor (OD) *	1	5/8" Inlet, 4 Outlets @ 3/16" *	WW51X291	DST-160
Drier	1	Suc. Line w/Sweat Fit., 30 Cu. In., 5/8" x 5/8"	WW22X77	DHY-190
Drier	1	Liq. Line w/Sweat Fit., 8 Cu. In., 3/8" x 3/8"	WW22X88	DHY-144
Fan	1	5 Blade, 20" Dia., 1/2" Bore, Hub Up, CCW, 25°	WW73X19	FAN-1128
Motor (ID) *	1	230V, 60 Hz., 1 Ph., Open Shell, CCW, * 1095 RPM, 1/4 HP, 2-speed, FLA 1.8, LRA 3.7, Sleeve Bearings, Term Blk, w/Flex-mount, Winding Resistance — Ohms @ 77°F.: Pur. to Tab B 21.4/20.8; Brn. to Tab B 58.5/50.3; Tab A to Tab B 15.8/13.5	WW94X442	MOT-2579
Motor (OD)	1	230V, 60 Hz., 1 Ph., Open Shell, CCW, 720 RPM, 1/12 HP, 1-speed, FLA .80, LRA 1.0, Sleeve Bearings Winding Resistance — Ohms @ 77°F.: Blk. to Pur. 124.7/107.2 Blk. to Brn. 100.4/86.3	WW94X612	MOT-2306
Relay (F)	1	Type DPST, Contacts 230V, FLA 5.0, LRA 15.0, Coil 24V, 18.7 A.In., 2.0 A. Hld.	WW24X165	RLY-1010
Thermostat	1 1 1	Heat/Cool, Horizontal Cool only, w/Fan Switch, Vertical Heat/Cool, Vertical	WY28X92 WY28X104 WY28X105	THT-454 THT-455 THT-456
Transformer (TNS)	1	Pri. 230V, 50/60 Cycle, Sec. 24V, Load 35 V.A.	WW32X15	TRR-442

*New Part - Set Up Within The Last 18 Months.

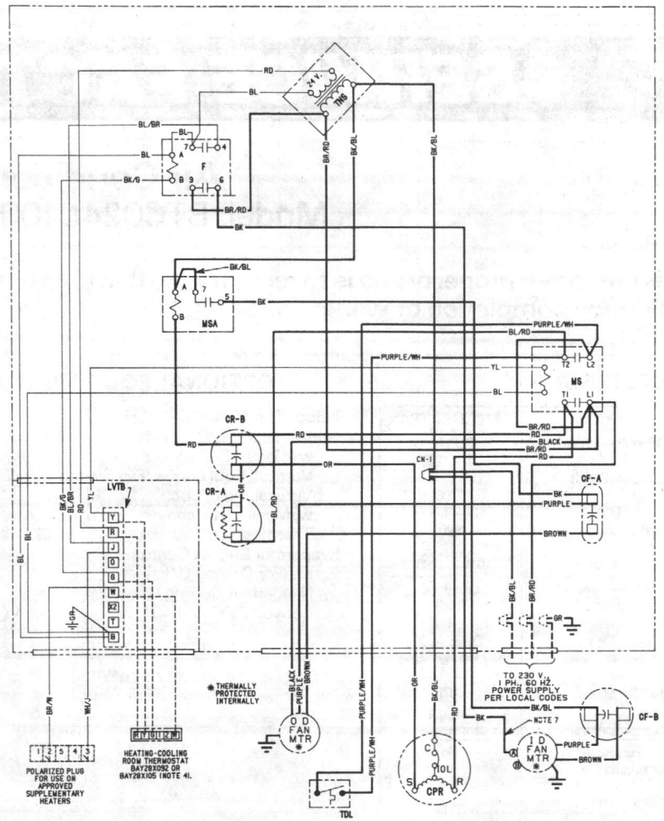
SCHEMATIC DIAGRAM



BTC024C100BA

NOTES:
1. MAXIMUM EXTERNAL 24 V. A.C. LOAD DURING COOLING OPERATON IS 0.5 AMP, OTHERWISE 1.2 AMP.
2. HEATER INTERLOCK (F-2 CONTACT) IS CLOSED DURING FAN OPERATION.
3. LOW VOLTAGE (24 V.) FIELD WIRING MUST BE 18 AWG MINIMUM.
4. SET "HA" AS FOLLOWS:
   DUCT HEATERS: TO DUCT HEATER CONTROL CIRCUIT CURRENT.
   SUPPLEMENTARY HEATERIN UNIT CABINET: .18.
   SUPPLEMENTARY HEATERIN HEATER ENCLOSURE: TO HEATER CONTROL CIRCUIT CURRENT.
5. APPROVED SUPPLEMENTARY HEATERS FOR FIELD INSTALLATION IN UNIT: DUCT HEATER IN AIR DUCT OR SUPPLEMENTARY HEATER IN APPROVED HEATER ENCLOSURE MAY BE USED WITH UNIT. HOWEVER ONE AND ONLY ONE HEATER MAY BE USED.
6. IF HEATING EQUIPMENT HAS SEPARATE 24 V. CLASS 2 OUTPUT FOR CONNECTION TO THERMOSTAT, THEN USE EITHER THERMOSTAT WITH ISOLATING CONTACTS OR ISOLATING RELAY TO PREVENT INTER-CONNECTION WITH 24V. CLASS 2 OUTPUT CF TRANSFORMER IN THIS EQUIPMENT.
7. TO CHANGE I.D. MOTOR SPEED, MOVE BLACK LEAD FROM "A" (LOW SPEED) ON MOTOR TERMINAL BLOCK OR TO "B" (HIGH SPEED).
8. **USE COPPER CONDUCTORS.** IF ALUMINUM OR COPPER-CLAD ALUMINUM POWER WIRING IS USED, CONNECTORS WHICH MEET ALL APPLICABLE CODES AND ARE ACCEPTABLE TO THE INSPECTION AUTHORITY HAVING JURISDICTION SHALL BE USED.

WIRING DIAGRAM



LEGEND

COLOR CODES — COLOR OF WIRE / COLOR OF MARKER
BK/BL — Black Wire with Blue Marker

BK	Black	RD	Red	OR	Orange
BL	Blue	WH	White	GR	Green
BR	Brown	YL	Yellow	PR	Purple

SYMBOLS

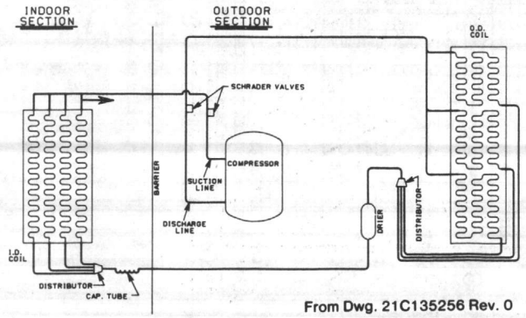
L.V. Wiring	Factory	H.V. Wiring	Factory
L.V. Wiring	Field Installed	H.V. Wiring	Factory Wiring

Ground		Coil	
Junction		Capacitor	
Terminal		Motor Winding	
Terminal Board		Transformer	
Relay Contact (N.O.)			
Relay Contact (N.C.)			
Internal Overload Protector			
Resistor or Heating Element			
Temperature Actuated Switch			
Wire Nut or Connector			

CF	Fan Capacitor
CN	Wire Nut or Connector
CPR	Compressor
CR	Run Capacitor
F	Indoor Fan Relay
IOL	Internal Overload Protector
LVTB	Low Voltage Terminal Board
MS	Compressor Motor Contactor
MSA	Compressor Motor Contactor Auxiliary
MTR	Motor
TDL	Discharge Line Thermostat
TNS	Transformer

From Dwg. 21D756476 P01

REFRIGERANT CIRCUIT



From Dwg. 21C135256 Rev. 0

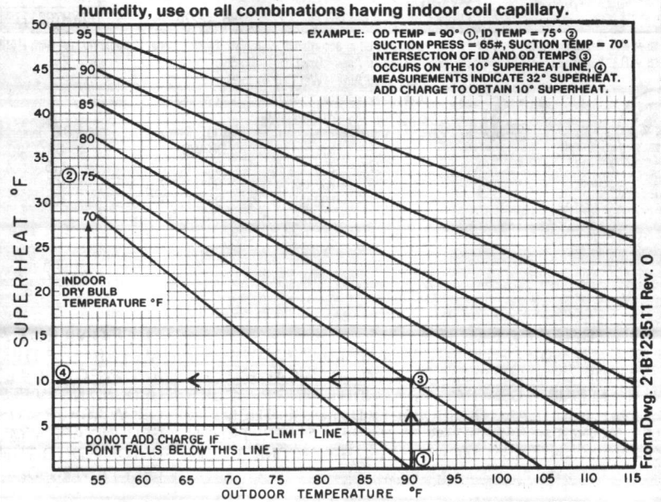
TROUBLESHOOTING CHART — WHAT TO CHECK

SYSTEM FAULTS	HIGH VOLTAGE WIRING POWER SUPPLY	COMPR. IOL	RUN CAPACITOR	START CAPACITOR	START RELAY	CONTACTOR CONTACTS	LOW VOLTAGE WIRING	CONTROL TRANSFORMER	CONTACTOR COIL	LOW VOLTAGE FUSE	STUCK COMPRESSOR	INEFFICIENT COMPRESSOR	REFRIGERANT UNDERCHARGE	REFRIGERANT OVERCHARGE	EXCESSIVE EVAP. LOAD	NONCONDENSABLES	RESTRICTED O.D. AIRFLOW	O.D. AIR RECIRCULATION	TXV STUCK OPEN	SUPERHEAT	RESTRICTED I.D. AIRFLOW	REF. CIRCUIT RESTRICTIONS
REFRIGERANT CIRCUIT																						
Liquid Pressure Too High															P		S	P	S			S
Liquid Pressure Too Low													S	P						S	S	S
Suction Pressure Too High													S		P	P				S	P	
Suction Pressure Too Low														S							S	P	S
Liquid Refrig. Floodback TXV System																				S	S	
Liquid Refrig. Floodback Capillary Tube System															P			S	S		S	P
I.D. Coil Frosting														P								P	S
Compressor Runs Inadequate or No Cooling													S	P		P	S				S	P	S
ELECTRICAL																						
Compressor & O.D. Fan Do Not Start	P	P						S	P	P	P												
Compressor Will Not Start But O.D. Fan Runs		P	S	P	P	P						S											
O.D. Fan Won't Start		P		P																			
Compressor Hums But Won't Start		P		P	P	P	S					S											
Compressor Cycles on IOL		P	S	P	P	P	S					P	S	P	S	S		S			S		S
I.D. Blower Won't Start	P	S						S	P		P												

P Primary Causes S Secondary Causes

SUPERHEAT CHARGING CHART

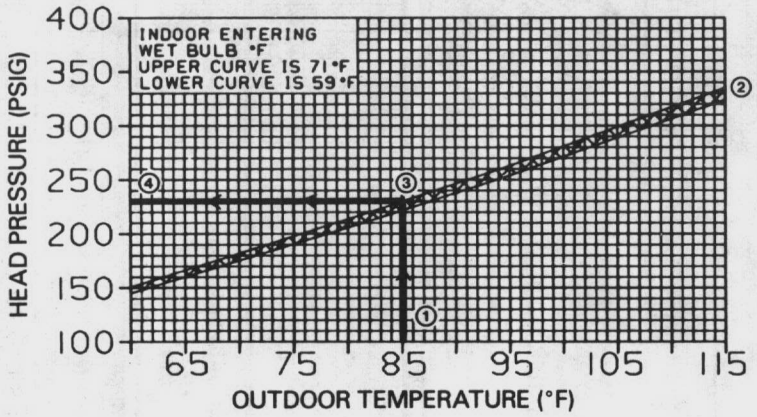
Chart based on 400 CFM/ton indoor air flow and 50% relative humidity, use on all combinations having indoor coil capillary.

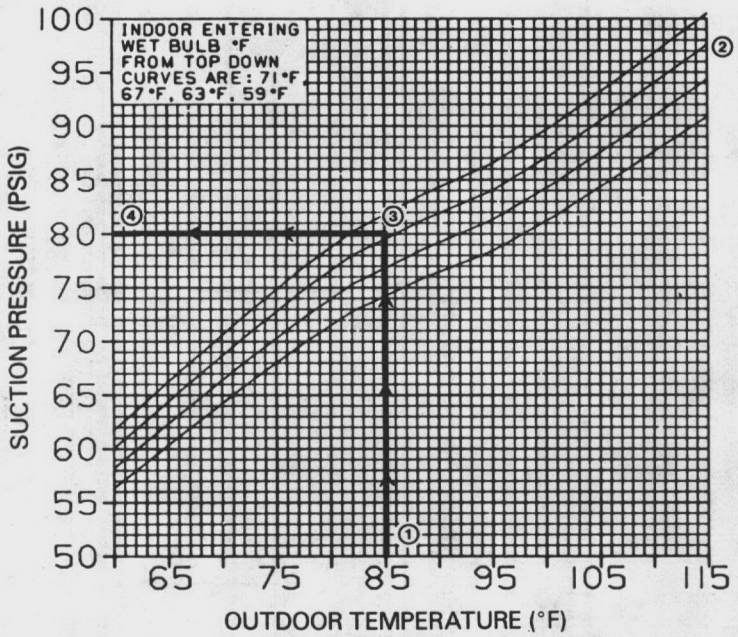


From Dwg. 21B123511 Rev. 0

Measure suction pressure, suction temperature at OD quick attach, ID & OD temps.
Determine from table what superheat should be for the ID & OD Temp.
Example indicates 10° superheat.
Determine operating superheat with stabilized running conditions.
If operating superheat is:
- within 5° chart value charge is OK
- more than 5° above chart value add refrigerant
- more than 5° below chart value remove refrigerant

PRESSURE CURVE — BTC024C100BA





From Dwg. 21C135393 Rev. 0

INDOOR FAN PERFORMANCE ①

AIRFLOW CFM ②③	HIGH SPEED PRESS. In. w.g.	HIGH SPEED PWR. WATTS	LOW SPEED PRESS. In. w.g.	LOW SPEED PWR. WATTS
500	0.95	185	0.78	162
600	0.83	192	0.67	188
700	0.75	200	0.57	214
800	0.66	225	0.46	220
900	0.56	265	0.32	240
1000	0.47	300	0.13	265
②1100	0.36	340	0.00	290
1200	0.25	380	—	—

① Factory Setting at Low Speed
② Water Blow-Off Limit
③ Wet Coil, No Filter, No Heater.
See Pressure Drop Tables for Installed Electric Heater

From Dwg. 21A135641 Rev. 0

SERVICE TIPS

On this and other cooling only machines high side pressure is taken downstream of the condenser and liquid line drier. In the event of a restriction of either of these two components, charge can be added to cause the high side press to agree with the performance chart. However, discharge pressure becomes significantly higher, possibly causing the IPR to trip.

PRESSURE CURVE EXAMPLE

COOLING PERFORMANCE TO BE CHECKED WHEN OUTDOOR TEMPERATURE IS ABOVE 55°F.
AFTER OPERATING PRESSURES HAVE STABILIZED: MEASURE INDOOR WET BULB TEMP - OUTDOOR TEMP - HEAD & SUCTION PRESSURES.
LOCATE OUTDOOR TEMP ① LOCATE INDOOR WET BULB ② FIND INTERSECTION OF OD TEMP & ID W.B. ③ READ HEAD OR SUCTION PRESSURE IN LEFT HAND COLUMN ④ (SELECT PROPER INDOOR CFM)

ACTUAL HEAD PRESSURE SHOULD BE ± 10 PSIG OF CHART
SUCTION PRESSURE SHOULD BE ± 3 PSIG OF CHART

EXAMPLE: ① OUTDOOR TEMP 85°F., ② INDOOR WET BULB 67°F.,
③ HEAD PRESSURE @ 800 CFM = 230 PSIG ④
③ SUCTION PRESSURE @ 800 CFM = 80 PSIG ④

TAB PLACEMENT HERE

DESCRIPTION:

Pumps

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Confidential Records Management, Inc.
New Bern, NC
1-888-622-4425
9/08

DOMESTIC PUMP

INSTRUCTION MANUAL

DNO158A

Condensate Units Type CC, CS, CB, CBE & CL

Installation, Operation & Service Instructions

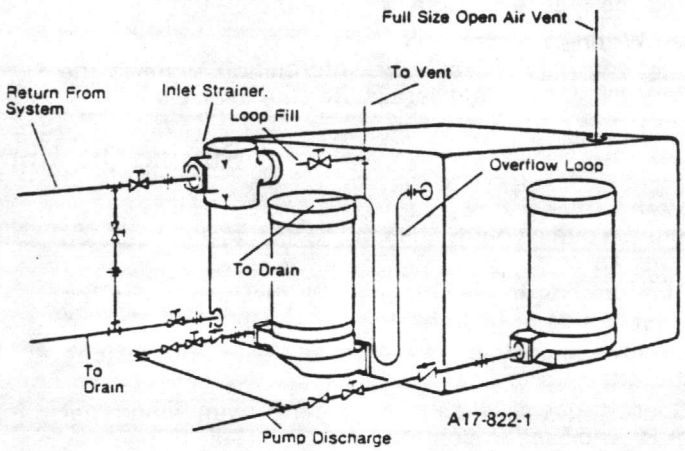


Fig. 1 Elementary Piping Diagram

LEGEND:
- GATE VALVE
- UNION
- PLUG COCK
- CHECK VALVE

Notes:
1. See Order Specification Sheet for Details of Optional Equipment & Pump Capacities.

WARNING: Do not subject cast iron receivers to pressure. Receivers have been tested to assure non-porous castings. Do not restrict or reduce vent opening or overflow connection. **Pressurization of the receiver may damage the receiver and create a hazard.**

Preliminary Inspection

Before installation, be sure the unit is the proper size and discharge pressure to meet requirements. Motor connections, starter operating coils and pump control voltage must agree with power supply voltage.

Location of Unit

Place unit to permit easy access to all working parts. Motor must be protected from coal dust, ashes and moisture as well as from excessive heat. If ambient temperature will exceed 104°F., insulate heat sources and/or ventilate space. Otherwise, motor may be damaged or thermal overload protection may shut off pump(s) with possibly serious results.

Returns

Gravity return lines from system should be properly pitched down to unit inlet. They must also be properly trapped to prevent steam entry in the unit. Furnish gate valve between return line and receiver. A basket strainer is recommended.

Float Switch Setting

Float switch is factory set to provide maximum float capacity in the receiver. Pump will start when condensate rises close to receiver inlet and will stop when level has been pumped down to approximately 2" above pump suction. If readjustment is required, refer to float switch manufacturer's instruction sheet.

Vent Connections

Install full size open vent pipe to atmosphere. See Fig. 1.

Chemical Treatment of Condensate

Feed water is usually chemically treated to remove corrosive gases and impurities. The chemicals should be injected into feed lines to boilers BUT NEVER INTO CONDENSATE RECEIVER. Damage to pump(s) may result if chemicals are allowed to come into contact with internal parts.

Overflow

The overflow connection should be piped to a floor drain using a pipe size equal to the overflow tapping.

Electrical Wiring and Controls

Refer to the motor nameplate and/or underside of terminal box cover plate marking, the connections within the box and the control cabinet nameplate if a cabinet is furnished. Make certain that the motor, starter coils, etc., match the power supply characteristics. If the motor is not connected for the available voltage, reconnect as indicated on the motor wiring diagram. If the control cabinet is furnished with the unit and the nameplate data does not match the power supply, consult factory for further instructions.

All "Domestic" single phase, drip-proof motors 2 HP and smaller have built-in thermal overload protection and magnetic starters are not required. This protector will automatically reset as the motor cools. Consult local codes for starter requirements.

Magnetic starters, with proper size overload relays, must be used with all three phase motors. Starters normally supplied by us when ordered, have overload relays which can be manually reset. Manual reset is furnished as standard. Certain starters may be field converted to automatic reset where preferred. Refer to starter manufacturer's instructions. Overload relays are furnished when starters are supplied. A starter is capable of interrupting several times motor full load current, however, short circuit currents may be many times greater.

Fuses or a circuit breaker must be installed ahead of the starter according to NEC recommendations to clear any such faults that may occur to protect the line wiring.

DOMESTIC PUMP ITT
FLUID HANDLING DIVISION

Maintenance Instructions

Strainer Easily Cleaned
The inlet strainer, when furnished, is intended to protect the pump and system. Periodic cleaning should be included in your regular maintenance several times a week during the first few months of operation.

When Writing Factory
Should you require additional information, write to the factory giving complete details. Be sure to give the Serial No. and other data stamped on the name plate attached to the unit. A simple sketch of the piping will usually enable us to give you a more satisfactory answer. Do not return parts without first consulting the factory.

When Ordering Replacement Parts
Be sure to give the Serial No. and all other data stamped on the name plate attached to the unit.

Putting the Unit Into Service

Caution
Do not run pumps dry. Seals may be damaged if operated without water.

1. Pipe the unit in accordance with instructions on the reverse side of this sheet.
2. Remove shipping bracket from all float switches. (See tag attached to float switch).
3. Connect power leads in accordance with wiring diagram enclosed in control cabinet.
4. Install drain plugs furnished with unit.
5. Fill receiver half full of water to prime pump(s) and prevent possible damage to pump seals. Avoid freezing conditions after unit receiver has been filled.
6. Check for proper rotation of all three phase motors. Rotation must be clockwise looking down on the motor as indicated by directional arrow on pump casting. If pump runs backwards, interchange two wires.
7. Throttle plug cock in discharge line until pressure at pump (while pump is discharging) approaches pump rated pressure. Tighten plug nut to secure adjustment.
8. Set the selector switches at the desired position. Refer to wiring diagram furnished with each unit. Unit is now ready for service.

Trouble Shooting Procedures

All units are thoroughly tested at the factory before shipment. They should operate satisfactorily without further adjustment if properly installed and providing they have not been damaged by rough handling in transit. If system or unit performance is not satisfactory, refer to the following check list.

Pump Will Not Start
1. The power supply has been interrupted, disconnect switch is open, or selector switch is improperly positioned.
2. Incorrect voltage for motor. Check voltage and wiring with motor characteristics.
3. Incorrect starter coil for power supply.
4. The overload relays and the starter have tripped out and must be reset. Ambient temperature may be too high.
5. Check pump controls or other controls for proper operation.
6. Wiring to control cabinet is incorrect or connections are loose.
7. The strainer is dirty thus retarding flow. Clean periodically.

Pump Runs Continuously
1. Pump is running backward. Rotation of three phase motors may be corrected by interchanging any two of the three wires. Rotation should be clockwise looking down on motor.
2. Steam traps are blowing through causing condensate to return at excessive temperatures. This may reduce the capacity of pump below its rating, depending on the unit and type of pump furnished. Traps should be repaired or replaced.
3. The total required pressure at the pump discharge is greater than the pressure for which the pump was designed. Check the total pressure which includes atmospheric pressure, the friction head and the static head.
4. A valve in the discharge line is closed or throttled too tightly. Check valve is installed backwards.
5. The impeller eye is clogged.
6. Pump is too small for system.

Condensate Pump is Noisy
1. The pump is working against a lower pressure than designed for. While pump is discharging, adjust plug cock in discharge line until pressure at pump approaches pump rated pressure.
2. Excessive condensate temperature. Correct system conditions. However, this applies to certain units only; others are designed to handle boiling water.
3. Magnetic hum or bearing noise in motor. Consult motor manufacturer's authorized service station nearest unit location.
4. Starter chatters. Trouble is caused by low line voltage, poor connections, defective starter coil, or burned contacts.
5. Pump is running backward.

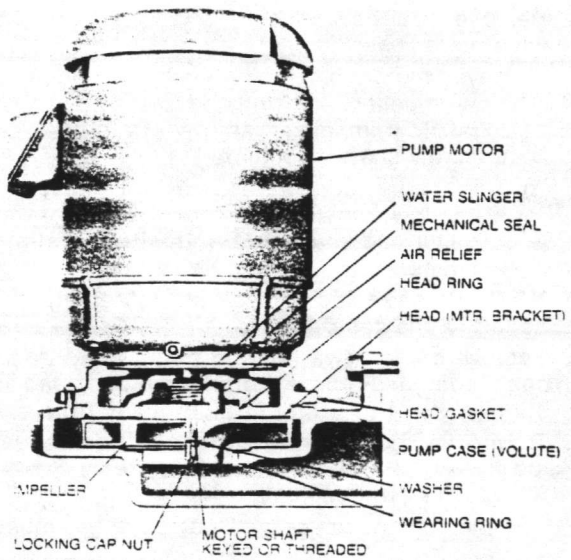
The System is Noisy
1. Banging in the steam mains is usually caused by steam "imploding" in condensate lying in low points in lines. These problems can be eliminated by dripping low points, properly supporting the pipe, or by increasing the pitch of the lines.
2. Improper dripping of the steam mains and risers; where there is a rise in the steam main, or where it branches off into a riser, a drip trap must be installed in the drain line.
3. The piping is too small to drain properly.
4. A defective trap is holding condensate in steam supply line.

Pump Service Instructions for Type CC, CS & CL with Std. Centrifugal Pumps

Vertical Mounting Puts Motor Above Floor Dirt and Water

Close coupled centrifugal pumps are designed for years of trouble free service. Units have mechanical shaft seals.

1. Close suction line gate valve and operate pump momentarily to remove as much liquid as possible from pump. Close discharge line gate valve.
2. Open disconnect switch. Disconnect motor leads and conduit.
3. Remove drain plug in pump case. Remove air relief tubing.
4. Remove cap screws holding pump head and pump case together. Remove motor and pump head assembly from pump case by lifting straight up. Place on work bench.
5. Remove self locking stainless steel cap screw and stainless steel washer (or self locking brass cap nut and washer).
6. To remove impeller from motor shaft proceed as follows:
   (1) Keyed Shafts. Remove impeller with gear puller or other means which will not damage impeller or bend motor shaft.
   (2) Threaded Shafts. Hold end of motor shaft opposite pump with large screw driver or other suitable tool and back impeller off with a rectangular bar or other flat tool inserted between the vanes of the impeller.
7. Remove rotating part of seal from shaft, being careful not to break carbon face.
8. Remove cap screws holding pump head to motor and remove pump head.
9. Remove stationary part of seal assembly, being careful not to chip or break ceramic seal.
10. To install seal proceed as follows:
    (1) Clean recess in head thoroughly. Coat recess and "rubber" portion of seat with thin grease. Press seat into recess firmly by hand making certain both parts bottom evenly. If seal cannot be bottomed with fingers place cardboard shipping disc on ceramic and force into place with flat tool.
    (2) Carefully place head in position on motor shaft without displacing ceramic seat and secure head to motor with cap screws.
    (3) Place motor vertically with pump end up. Do not attempt assembly of seal and impeller with shaft horizontal.
    (4) The "carbon" of rotating part of seal should not be loose. If it is, hold in place with grease. Using clean, lint free cloth, wipe mating surfaces perfectly clean. Oil shaft and push seal onto shaft so that carbon will contact ceramic seal. If spacer is required, use grease to cause spacer to adhere to bottom of seal after seal has been put on shaft. Be sure spacer is on larger diameter of shaft so that it will not catch between shoulder and impeller.
11. Replace impeller on shaft. Replace stainless steel washer and secure impeller with cap screw or cap nut.
12. Place new gasket on pump case and reassemble motor and pump subassembly on pump case.
13. Reconnect air vent line and motor wiring.
14. Replace pump case drain plug and admit liquid opening both inlet and discharge valves. Inlet gate valve should be opened slowly to prevent pressurization of the receiver.
15. Three phase motors should be started momentarily to check rotation. If pump runs backwards, interchange two wires. (Any electrical service should be performed by a qualified electrician.)



Cut-Away View of Mechanical Seal Type Pump

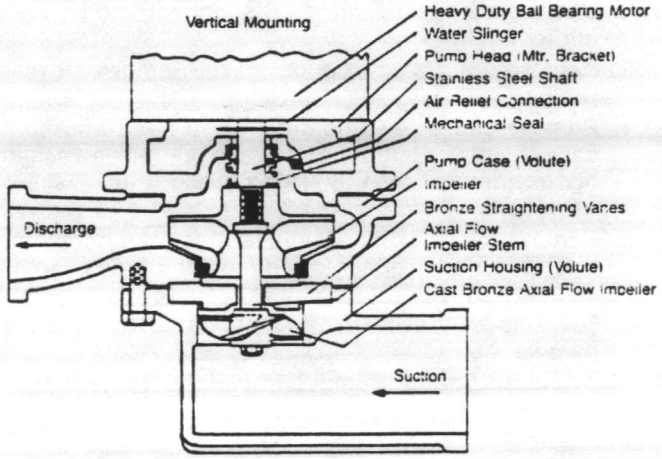
Pump Service Instructions for Type CB, CS, CBE & CL Units with Type B35 Pumps

Vertical Mounting Puts Motor Above Floor Dirt and Water

Vertical close coupled centrifugal pumps are designed for years of trouble free service. All pumps are equipped with mechanical shaft seals which can be repaired as follows:

1. Close return line gate valve and operate pump momentarily to remove as much liquid as possible from pump. Close discharge line gate valve.
2. Open disconnect switch. Disconnect motor leads and conduit.
3. Remove drain plug in suction housing. Remove air relief tubing.
4. Remove discharge connection and remove the capscrews holding suction housing to pump case. Place assembly on work bench.
5. Remove axial flow impeller, shaft and straightening vane as follows:
   (1) Keyed motor shafts (5 HP and over). Remove axial flow impeller lock nut and set screws. Remove axial flow impeller, remove straightening vane, unscrew shaft extension.
   (2) Threaded motor shaft (3 HP and less). Remove axial flow impeller lock nut. Remove axial flow impeller and shaft as a unit with the straightening vane.

   NOTE: When replacing seal, straightening vane can be left in the case.
6. Remove cap screws holding pump head and pump case together. Remove motor and pump head assembly from case by lifting straight away from case.
7. To remove impeller from motor shaft proceed as follows:
   (1) Keyed shafts. Remove impeller with gear puller or other means which will not damage impeller or bend motor shaft.
   (2) Threaded shafts. Hold end of motor shaft opposite pump with large screw driver or other suitable tool and back impeller off with a rectangular bar or other flat tool inserted between the vanes of the impeller.
8. Remove rotating part of seal from shaft, being careful not to break carbon face.
9. Remove cap screws holding pump head to motor and remove pump head.
10. Remove stationary part of seal assembly, being careful not to chip or break ceramic seat.
11. To install seal proceed as follows:
   (1) Clean recess in head thoroughly. Coat recess and "rubber" portion of seat with thin grease. Press seat into recess firmly by hand making certain both parts bottom evenly. If seat cannot be bottomed with fingers place cardboard shipping disc on ceramic and force into place with flat tool.
   (2) Carefully place head in position on motor shaft without displacing ceramic seat and secure head to motor with cap screws.
   (3) Place motor vertically with pump end up. Do not attempt assembly of seal and impeller with shaft horizontal.



PH-0108

   (4) The "carbon" of rotating part of seal should not be loose. If it is, hold in place with grease. Using clean, lint free cloth, wipe mating surfaces perfectly clean. Oil shaft and push seal onto shaft so that carbon will contact ceramic seat. If spacer is required, use grease to cause spacer to adhere to bottom of seal after seal has been put on shaft. Be sure spacer is on larger diameter of shaft so that it will not catch between shoulder and impeller.
12. Replace impeller on shaft.
13. Reassemble pump case to pump head.
14. Install axial flow impeller stem, being careful to locate pin in stem to hole in impeller eye, install locknut & tighten.
15. Set stem to within .004 runout as shown by a dial indicator.
16. Install straightening vanes into pump case.
17. Install axial flow impeller onto stem and tighten set screws.
18. Using a new gasket and being careful to locate straightening vanes properly on pin, assemble unit to suction housing and reconnect discharge.
19. Reconnect air vent line and motor wiring.
20. Replace pump case drain plug and admit liquid opening both inlet and discharge valves. Inlet gate valve should be opened slowly to prevent pressurization of the receiver.
21. Three phase motors should be started momentarily to check rotation. If pump runs backwards, interchange two wires.

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DOMESTIC PUMP
8200 N. AUSTIN AVE. • MORTON GROVE, IL 60053
FLUID HANDLING DIVISION • ITT CORPORATION
ITT

TAB PLACEMENT HERE

DESCRIPTION:

Temperature Controls

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New Bern, NC
1-888-622-4425
9/08

TEMPERATURE CONTROL SUBMITTAL

JOB: Renovate Chapels Buildings M-116, TC-601
Camp Lejeune, NC Contract B-6354

ARCHITECT: Naval Facilities Engineering Command

ENGINEER: Naval Facilities Engineering Command

CONTRACTOR: R & W Construction Co., Inc.

Submitted by:
Triangle Automated Controls, Inc.
2716 Discovery Drive
Raleigh, NC 27604

Sequence

A subbase switch shall manually index the AHU for operation. In the "ON" position, the fan shall run continuously. In the "OFF" position the fan shall be off.

Auxiliary contact of the AHU shall index both heating and cooling for operation. With the space temperature above the setpoint of the cooling thermostat (78°), the outdoor compressor shall be energized to provide cooling.

With the space temperature below the temperature of the heating thermostat (70°), the normally closed steam valve shall modulate to maintain setpoint. The space heating thermostat shall be reset by a duct mounted sensor. For each degree drop in the space, the S.A. is reset up 12.5 degrees (12.5:1).

EQUIPMENT SCHEDULE

JOB: RENOVATE CHAPELS BUILDINGS M-116,TC-601
Contract B-6354 Camp Lejeune,NC

Job #: 20

DATE: 7/14/88

NTY.	IDENTIFIER	PART NUMBER	MANUFACTURER	DESCRIPTION	LOCATION
6		AT-602	Barber Colman	Thermostat subbase Switch fan on/off	At space thermostat
6		AT-1155	Barber Colman	Thermostat guard	At space thermostat
6		691 K 1	Hevi-Duty	Control transformer 24 VAC, 95 VA	At AHU in enclosure
4		TC-1103	Barber Colman	Cooling thermostat set point Range 75-105	In space
6		RH2B	Idec	Control relay DPDT	At condensing unit
4		VS-9223-201-4-4	Barber Colman	Steam control valve, 2 way, N.C. 1/2 "	At steam coil
2		VS-9223-201-4-6	Barber Colman	Steam control valve, 2 way, N.C. 3/4 "	At steam coil
6		TP-8102	Barber Colman	Heating thermostat setpoint Range 45-75	In space
6		TS-8601	Barber Colman	Discharge air reset thermostat, Ratio 12.5:1	In supply air
2		TC-1153-409	Barber Colman	Cooling thermostat	

General Instructions

AT-602, ~~603~~, 607, 608 & ~~609-XXX~~ Selector Switch Sub-Bases and Legend Plates

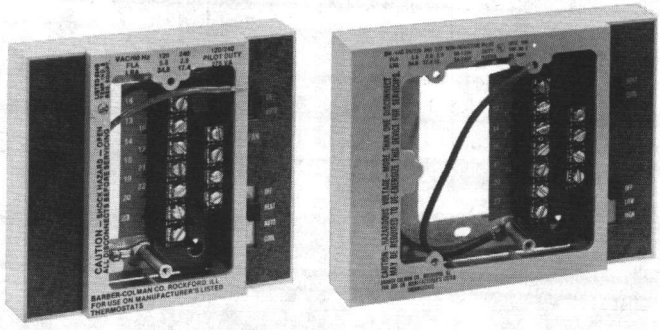
For use at the room thermostat to accommodate switching functions such as heating to cooling, day to night control, etc. **Device:** Rugged one piece molded beige plastic housing. One or two slide switches are double-pole, double throw (DPDT) or double pole-4 position (DP4T) allowing numerous control possibilities. DP4T can be used as two or three position by installing switch legend plates that limit switch travel. Coded screw terminals for the switch contacts are accessible for up to two No. 14 gauge wire connections. See Figure 2.

Installation

Use Class I wiring for all connections to switch subbases and to room thermostat unless all circuits are powered from a Class II source. Make all connections in accordance with national and local codes.

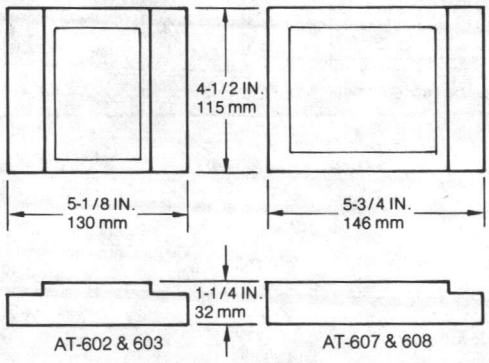
Install subbases on a flush switch box, a surface switch box or directly on a wall (for 24V applications only).

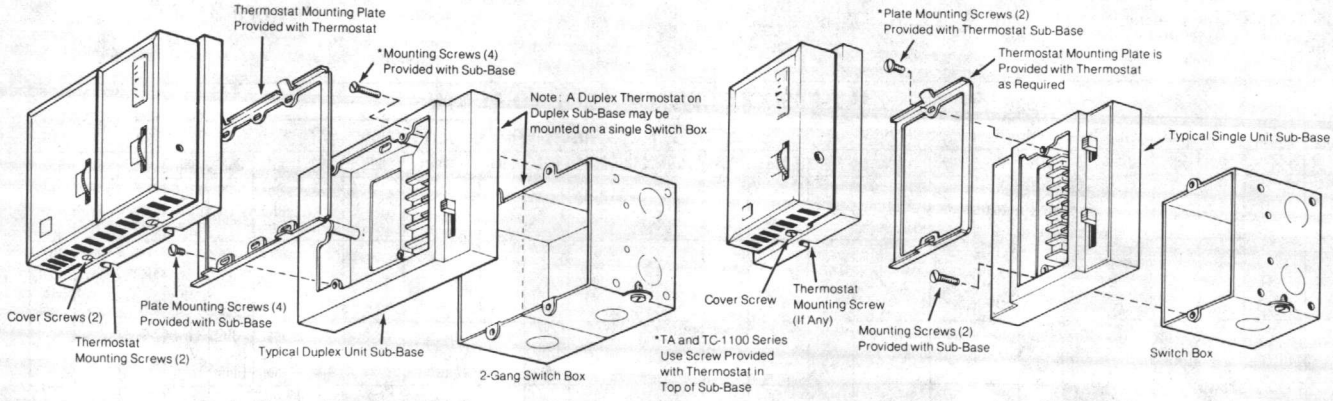
1. Pull the required wires.
2. If plastic conduit box is used, connect green wire from subbase to system ground, otherwise clip out the green wire.
3. Mount the subbase (see Figure 1). Screws are provided for switch box mounting.
4. Connect proper wires to subbase screw terminals. Push excess wire into conduit box, allowing field wires (if any) for room thermostat to project through opening in subbase.
5. Make all electrical connections to thermostats and install any jumpers as required. Refer to job wiring diagram and/or General Instruction Sheet for thermostat.
6. Install thermostat on subbase (see Figure 1).
7. To install switch legend plate on subbase strip the paper backing off and press plate into subbase. Note: Legend plates must be ordered separately.



Typical Single Unit Sub-Base

Typical Duplex Unit Sub-base





Duplex Thermostat on Duplex Sub-Base

Single Thermostat on Single Sub-Base

Figure 1

Part Number	Switch Description		Used With
	Upper Right	Lower Right	
AT-602		DP4T	All Single Room Thermostats Except TK's, TA-115, TA-121, TA-133, TA-134, TC-114, and TC-142.
~~AT-603~~	~~DPDT~~	~~DP4T~~	
AT-607		DP4T	TA-151, 115X, TC-154, 114X, 115X, 116X, 2-Stage and Duplex Thermostats.
AT-608	DPDT	DP4T	

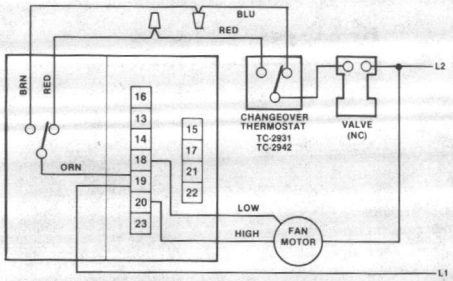
Total Electrical Rating of Each Sub-Base Switch*				
Volts (AC)	Inductive		Non-Inductive Amps	Pilot Duty (VA)
	Full Load Amps	Locked Rotor Amps		
24	5.8	34.8	6	125
120	5.8	34.8	6	125
240	2.9	17.4	3	125

*The total load on both poles of a switch must not exceed the total electrical rating.

LITHO IN U.S.A. 2-84

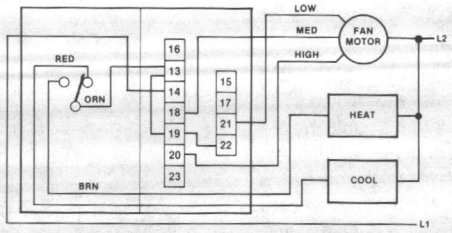
TYPICAL APPLICATIONS

THERMOSTAT CYCLES VALVE, SUMMER/WINTER CHANGEOVER THERMOSTAT, OFF-LOW-HIGH FAN SWITCH



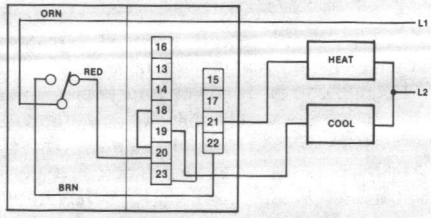
ITEMS: TC-1101, AT-602, AT-609-302

THERMOSTAT PROVIDES SEQUENCED HEAT & COOL, ON-OFF SWITCH, OFF LOCKS OFF SYSTEM & FAN, LOW-MED-HIGH FAN SWITCH



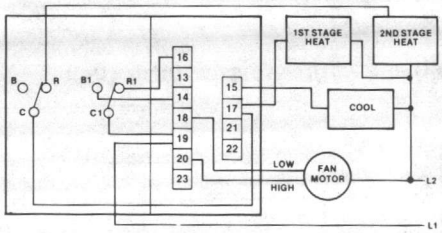
ITEMS: TC-1191; AT-603; AT-609-353

THERMOSTAT PROVIDES SEQUENCED HEAT & COOL OFF-HEAT-AUTO-COOL SWITCH



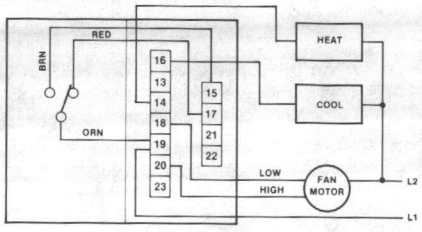
ITEMS: TC-1191, AT-602, AT-609-402

THERMOSTAT CYCLES 2 STAGES HEAT AND 1 STAGE COOL, HEAT-COOL SWITCH, OFF-LOW-HIGH FAN SWITCH



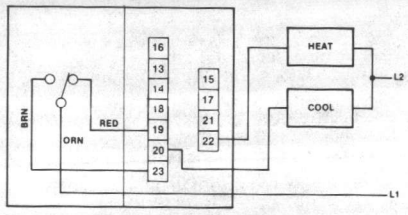
ITEMS: TC-154, AT-608, AT-609-352

THERMOSTAT CYCLES HEAT & COOL, HEAT-COOL SWITCH, OFF-LOW-HIGH FAN SWITCH



ITEMS: TC-1101; AT-603; AT-609-352

THERMOSTAT CYCLES HEAT AND COOL, HEAT-COOL SYSTEM SWITCH



ITEMS: TC-1101, AT-602, AT-609-204

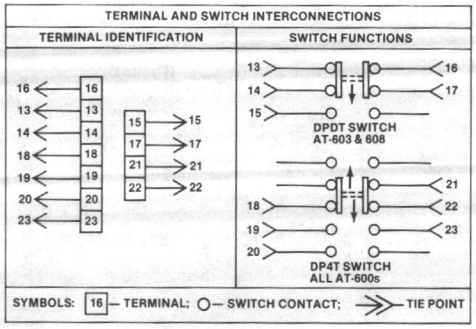


Figure 2

AT-609-XXX
Legend Plates for Switch Sub-Bases

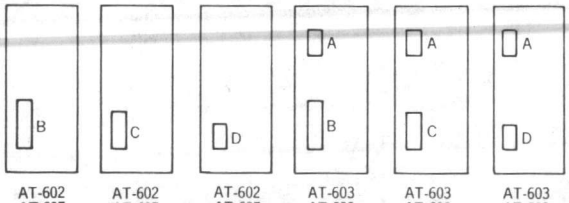
Various switch indicating plates are available and must be ordered separately. These have a brown simulated leather finish with bright letters and pressure sensitive backing for simplified field installation. Blank plate on left side of AT-602 & 603 is factory installed.

AT-609-XXX SWITCH LEGEND PLATES

Switch Position	Switch Action	Blank Plates*						Plates With Legends																		
		201	301	401	250	350	450	202	203	204	205	206	251	252	253†	302	303	305	306	307	351	352	353	402	403	452
A	DPDT				■	■	■						On Off	On Off	On Auto						On Auto Fan	Heat Cool	On Off			On Auto Fan
B	DP4T			■			■																	Off Heat Auto Cool	Off Low Med High	Off Heat Auto Cool
C	** DP3T		■			■										Off Low High	Heat Off Cool	Occu Off Unoccu	Night Off Day	Off On Auto	Heat Off Cool	Off Low High	Low Med High			
D	** DPDT	■			■			On Off	Occu Unoccu	Heat Cool	Night Day	Auto On	Low High	High Low	High Low											

*Special lettering can usually be provided by local nameplate engravers.
**Legend Plate limits travel of DP4T Switch to provide DPDT or DP3T.
†"Fan Operation" legend placed between switches.

SWITCH POSITIONS



AT-602 AT-607 | AT-602 AT-607 | AT-602 AT-607 | AT-603 AT-608 | AT-603 AT-608 | AT-603 AT-608

Barber-Colman Company
ENVIRONMENTAL CONTROLS DIVISION

1354 Clifford Avenue
P.O. Box 2940
Loves Park, IL U.S.A. 61132-2940

BARBER COLMAN COMPANY

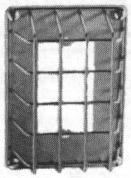
General Instructions

AT-1100 Series Thermostat Guards

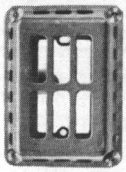
DEVICE INFORMATION

Guards AT-1100 Series

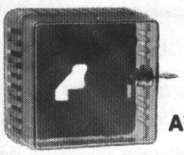
Room thermostat guards are available in plastic, cast aluminum, or wire construction. They protect thermostats from damage and vandalism. The clear plastic guards have tumbler type key locks which protect against unauthorized adjustment of the thermostat. Guards mount to standard outlet box or directly to the wall. AT-1155 and AT-1165 include a mounting ring for installation over already installed thermostats without removal from wall.



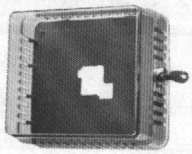
Typical AT-1103 and AT-1163

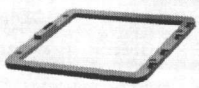


AT-1104



AT-1105





Typical AT-1155 and AT-1165

Part No.	Description	Inside Dimensions mm (inches)		
		Height	Width	Depth
AT-1103	Wire Guard with Steel Base	108mm (4¼″)	67mm (2⅝″)	41mm (1⅝″)
AT-1104	Cast Aluminum Guard w/Steel Base	108mm (4¼″)	70mm (2¾″)	41mm (1⅝″)
AT-1105	Clear Plastic Guard w/Solid Base	98mm (3⅞″)	89mm (3½″)	64mm (2½″)
AT-1155	Clear Plastic Guard w/Solid and Ring Base	133mm (5¼″)	117mm (4⅝″)	76mm (3″)
AT-1163	Wire Guard w/ Steel Base Plate	165mm (6½″)	168mm (6⅝″)	76mm (3″)
AT-1165	Clear Plastic Guard w/Solid and Ring Base	178mm (7″)	127mm (5″)	89 mm (3½″)

Selection Table

Part Number	AE-7208	HC-101 HKS-5033 HS-8101 HSP-6181	TA-101 TA-1501 TC-1100	TA-115 TA-121	TC-142	TA-133 TA-134	TA-151 TC-154 TC-1161	TK-1000 TK-5000 TKS-5001	TP-101 TP-8101	TS-8101 TS-8111
AT-1103		✓	✓					✓	✓	✓
AT-1104		✓	✓					✓	✓	✓
AT-1105		✓	✓		✓①			✓	✓	✓
AT-1155		✓①	✓①		✓①		✓	✓①	✓①	✓①
AT-1163	✓①⑤	✓②⑥	✓②⑥	✓③	✓④	✓	✓①	✓②⑥	✓②⑥	✓②⑥
AT-1165	✓①	✓①	✓①	✓	✓①	✓	✓①	✓①	✓①	✓①

Installation Notes:

① — With or without AT Sub-bases.
② — Requires an AT-504 or AT-600 Sub-base.
③ — Requires an AT-504, auxiliary mounting base.
④ — Requires an AT-144. Can be used with or without AT-142 or AT-143.
⑤ — AE-7208 with AD-8301 on AT-600 Sub-base not applicable.
⑥ — AT-1163 will accept two (2) single stats on an AT-546, auxiliary mounting base.

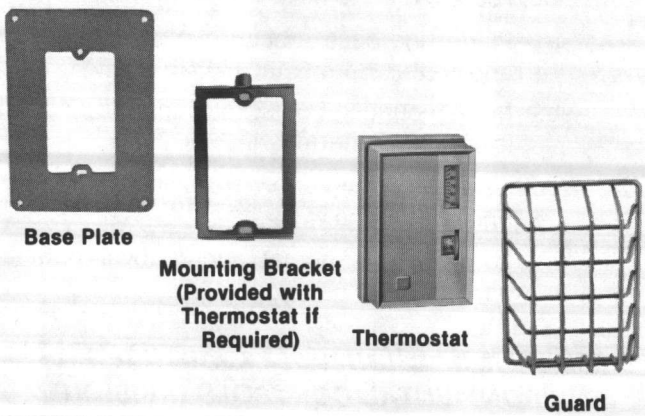


Figure 1.
(Typical of AT-1103, AT-1104 & AT-1163)

INSTALLATION

AT-1103 Wire Guard
AT-1104 Aluminum Guard

1. Thermostats with mounting bracket provided (Figure 1).

   a. Using screws provided with device, attach mounting bracket and base plate to switch box.

   b. Make connections to the device as required.

c. Attach device to mounting bracket.

d. Attach guard to base plate using the four Philips head screws provided with the guard.

2. Thermostats without mounting bracket

a. Make connections to the thermostat as required.

b. Attach thermostat and base plate to switch box using screws provided with thermostat.

c. Attach guard to base plate using the four Philips head screws provided with the guard.

AT-1163 Wire Thermostat Guard

1. Thermostat or AE-7208 that mounts without sub-base or auxiliary mounting base.

a. Using screws provided with device, attach mounting bracket and base plate to switch box.

b. Make connections to the device as required.

c. Attach device to mounting bracket.

d. Attach guard to base plate using the four Phillips head screws provided with the guard.

2. Thermostat that requires auxiliary mounting bases AT-144, AT-504, or AT-546.

a. Attach thermostat bracket as required, auxiliary mounting base, and base plate to switch box with screws provided. Note: When using AT-504, it is necessary to remove threaded mounting screw inserts.

b. Make connections to the thermostat as required.

c. Attach thermostat to guard base plate or thermostat mounting bracket as required using screws provided.

d. Attach guard to base plate using the four Phillips head screws provided with the guard.

3. Thermostat or AE-7208 mounted on AT-600 Series sub-base.

a. Using screws provided with device, attach AT-600 Series sub-base and base plate to switch box.

b. Make electrical connection to sub-base.

c. Attach thermostat or AE-7208 mounting bracket as required.

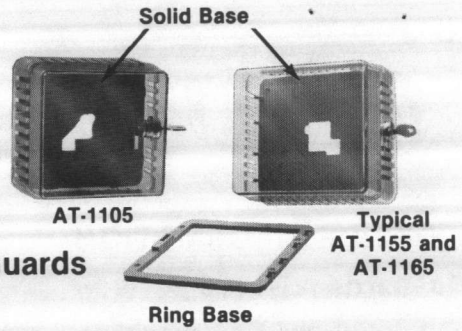
d. Make connections to thermostat or AE-7208 as required.

e. Attach thermostat or AE-7208 to sub-base or mounting bracket on sub-base using screws provided.

f. Attach guard to base plate using the four Phillips head screws provided with the guard.

Figure 2.

AT-1105, 1155 and 1165 Plastic Thermostat Guards



1. Solid bases (Figure 2).

a. Remove thermostat guard cover from the base. Put base down with paper template side up.

b. Center the thermostat (or subbase) and align at least 2 thermostat (or subbase) mounting holes with corresponding holes on the template. Mark them with a pencil.

c. If possible, use the same screws to attach both the guard base and thermostat (or subbase) to the wall or to an outlet box.

d. If the guard and thermostat must mount separately, mark the holes for the thermostat and use the self-tapping screws. Then select 2 other holes for mounting the guard to the wall.

e. Punch out the holes as marked on the template, making the holes large enough for the preselected screws.

f. Pull enough wire from the wall to make connection to thermostat or subbase. Pull wire through opening in the guard subbase.

g. If necessary, connect wires to thermostat before mounting thermostat and the guard base. Then mount thermostat and guard base to wall or outlet box. Otherwise mount guard base to wall or outlet box. Then attach wires to thermostat and mount thermostat to guard base.

h. Lock the thermostat guard cover onto the base.

2. Ring base (AT-1155 & AT-1165 only) (Figure 2).

a. Place ring base around mounted thermostat and center thermostat in the opening.

b. Mark mounting holes, making sure ring base is parallel to thermostat.

c. Using mounting screws provided, mount the ring base to the wall.

d. Lock the thermostat guard cover onto the base.

Barber-Colman Company
ENVIRONMENTAL CONTROLS DIVISION

1354 Clifford Avenue
P.O. Box 2940
Loves Park, IL U.S.A. 61132-2940

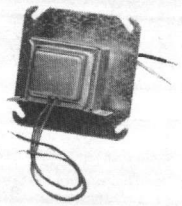
LITHO IN U.S.A.

20/20 INTERFACE PRODUCTS

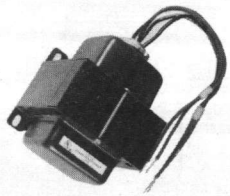
CONTROL TRANSFORMERS

CONTROL TRANSFORMERS

Model: 691-K0
691-K1
691-K2



691-K0



691-K1 / 691-K2
TYPICAL

GENERAL

Stepdown voltage transformers for use in temperature control systems. Transformers are specially designed to provide 24 volts AC control voltage from 120 volts AC primary supply. Transformers are provided with mounting feet for panel mounting.

MOUNTING

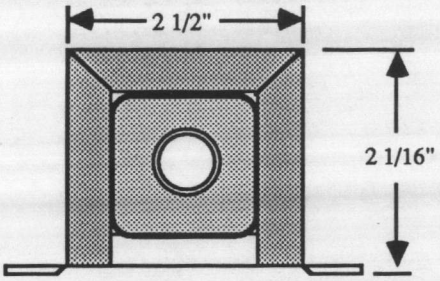
These transformers are designed for NEMA I location. They should be installed in compliance with all national and local electrical codes.

MODEL	VA RATING	PRIMARY WIRES		SECONDARY WIRES	
691-K0	40 VA	120 VAC	Black White	24 VAC	Brown Red
691-K1	100 VA	120 VAC	H1 H2	24 VAC	X1 X2
691-K2	170 VA	120 VAC	H1 H2	24 VAC	X1 X2

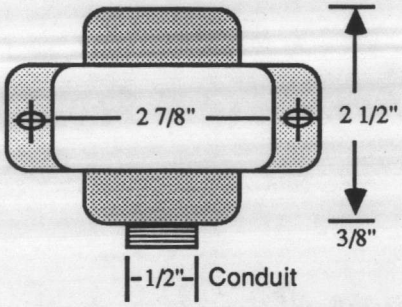
MULTI-TAP 70VA CONTROL TRANSFORMERS ARE
AVAILABLE ON SPECIAL ORDER. CALL FOR AVAILABILITY

691-K0 TRANSFORMER DIMENSIONS

FRONT VIEW TYPICAL



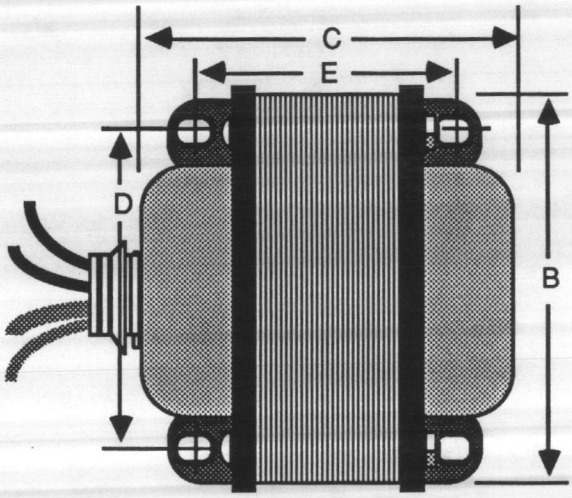
TOP VIEW TYPICAL



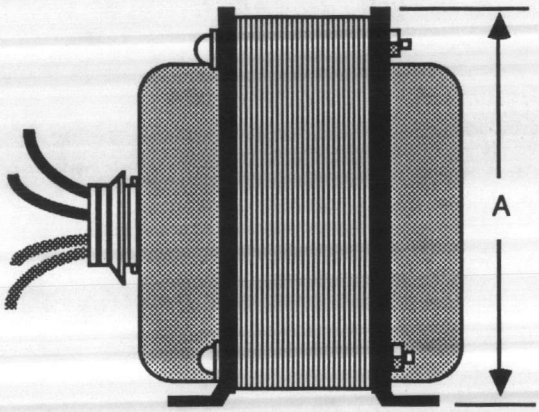
8" COLOR - CODED LEADS

691-K0 TRANSFORMERS INCLUDE:

- 4" X 4" Mounting Plate
- 1/2" Conduit Lock-Nut
- Wire Nuts, Mounting Screws and Instruction Sheet



TOP VIEW TYPICAL



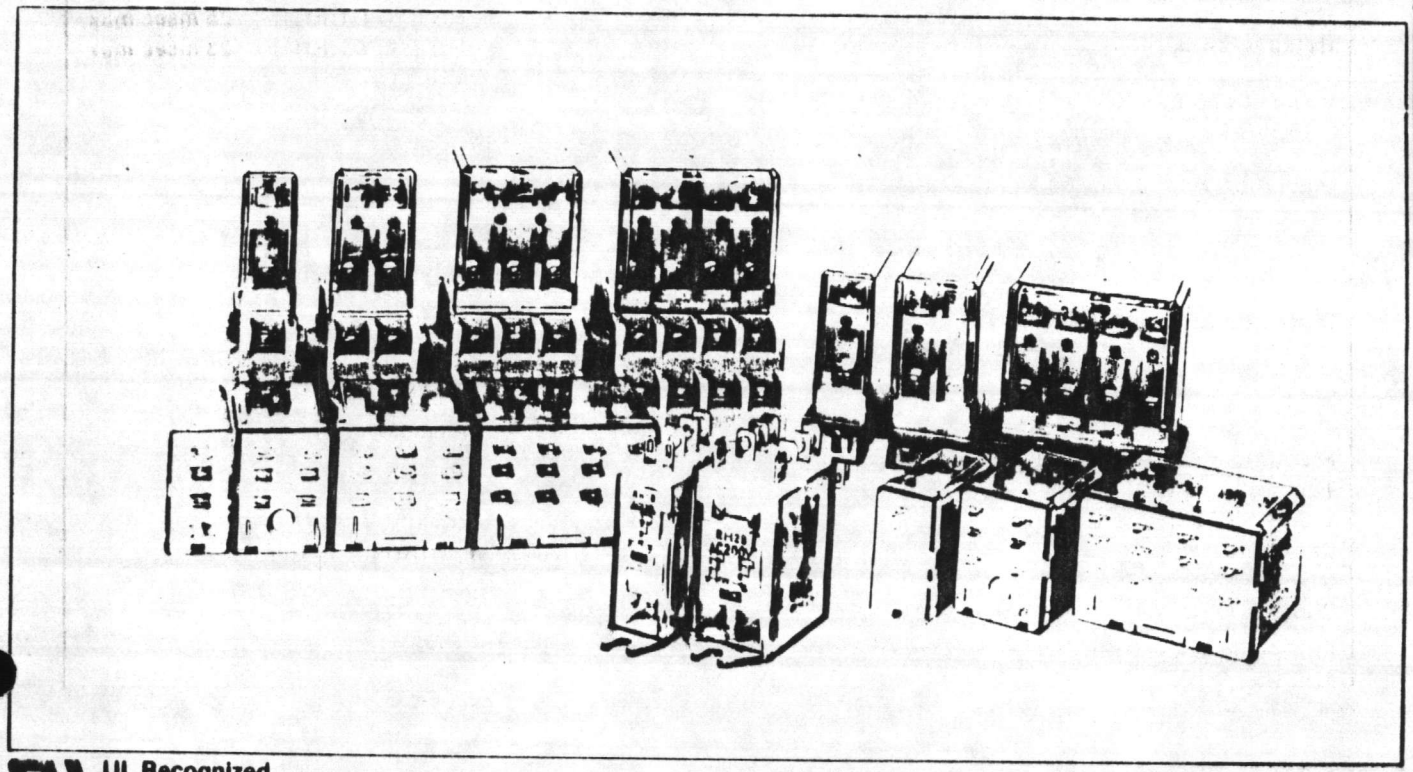
SIDE VIEW TYPICAL

Dimensions - Inches

Model	A	B	C	D	E
691-K1	3 1/16	3 3/8	3 5/8	2 1/2	2 7/16
691-K2	3 1/8	3 3/4	4	3 1/4	2 7/16

* NOTE: Actual dimensions may vary as transformer substitutions occur.

MIDGET POWER TYPE RELAYS
LARGE CAPACITY 10AMP-1, 2, 3, and 4 POLES



UL Recognized
File No. E67770
E59804
E64245

CSA Certified
File No. 35144

GENERAL

IDEC's Midget Power RH relays are similar to our general purpose RR series relays with full 10 amp switching capacity. Compact in size, the RH series relays reduce space requirements which are an important feature in todays downsized equipment.

RH Midget Power relays are available in SPDT, DPDT, 3PDT and 4PDT contact configurations driven by AC or DC coils with a choice of either blade or PCB mount .078 inch(2mm) terminals. Top bracket mounting is available for SPDT, DPDT and 4PDT terminal blade models.

FEATURES

- Miniature size package allows compact system designing.
- 10 amp contact capacity.
- Dielectric strength--up to 2,000 volts.
- UL recognized and CSA certified.
- Indicator light or check button available on 2, 3 and 4-pole models.
- Complete accessories include IDEC's broad line of sockets, hold-down springs and mounting rails.

TYPE LIST

Terminal Style	Contact Configuration	Basic Type	With Indicator Light	With Check Button	Top Bracket Mounting Type
B (Blade)	SPDT	RH1B-U	—	—	RH1B-UT
	DPDT	RH2B-U	RH2B-UL	RH2B-UC	RH2B-UT
	3PDT	RH3B-U	—	—	—
	4PDT	RH4B-U	RH4B-UL	RH4B-UC	RH4B-UT
V2 (PCB 0.078" wide)	SPDT	RH1V2-U	—	—	—
	DPDT	RH2V2-U	RH2V2-UL	RH2V2-UC	—
	3PDT	RH3V2-U	—	—	—
	4PDT	RH4V2-U	RH4V2-UL	RH4V2-UC	—

IDEC RH SERIES MIDGET POWER/GENERAL PURPOSE

SPECIFICATIONS

Contact Material	Silver cadmium oxide (Ag-CdO)
Contact Resistance	50 mΩ max. (initial value)
Operate Time	SPDT(RH1), DPDT(RH2) . . . 20 msec max. 3PDT(RH3), 4PDT(RH4) . . . 25 msec max.
Release Time	SPDT(RH1), DPDT(RH2) . . . 20 msec max. 3PDT(RH3), 4PDT(RH4) . . . 25 msec max.
Power Consumption (Approx.)	SPDT(RH1) . . . AC: 1.1 VA (50 Hz), 1 VA (60 Hz), DC: 0.8W DPDT(RH2) . . . AC: 1.4 VA (50 Hz), 1.2 VA (60 Hz), DC: 0.9W 3PDT(RH3) . . . AC: 2 VA (50 Hz), 1.7 VA (60 Hz), DC: 1.5W 4PDT(RH4) . . . AC: 2.5 VA (50 Hz), 2 VA (60 Hz), DC: 1.5W
Insulation Resistance	100 MΩ min. (measured at 500V DC megger)
Dielectric Strength	SPDT(RH1) Between live and non-live parts: 2000V AC, 1 minute Between contact circuit and operating coil: 2000V AC, 1 minute Between contacts of the same pole: 1000V AC, 1 minute DPDT(RH2), 3PDT(RH3), 4PDT(RH4) Between live and non-live parts: 2000V AC, 1 minute Between contact circuit and operating coil: 2000V AC, 1 minute Between contact circuits: 1500V AC, 1 minute Between contacts of the same pole: 1000V AC, 1 minute
Frequency Response	1800 operations/hour
Temperature Rise	Coil: 85 deg. max., Contact: 65 deg. max.
Vibration Resistance	0 to 6g (55 Hz max.)
Shock Resistance	SPDT(RH1), DPDT(RH2) . . . 20g, 3PDT(RH3), 4PDT(RH4) . . . 10g
Operating Temperature	-22° to +158°F (-30°C to +70°C)
Weight (Approx.)	RH1: 24g, RH2: 37g, RH3: 50g, RH4: 74g
Life Expectancy	Electrical: 500,000 operations or more (120V AC, 10A)* Mechanical: 50,000,000 operations or more

Note.* 200,000 operations or more (120V AC, 10A) in SPDT(RH1), 3PDT(RH3), 4PDT(RH4) types

COIL RATINGS

Rated Voltage (V)		Rated Current (mA) ±15% at 20°C								Coil Resistance (Ω) ±10% at 20°C				Continuous Applied Voltage (Max.) 20°C	Pick up Voltage (min.) at 20°C
		60 Hz				50 Hz									
		SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT		
AC	6V	150	200	280	330	170	238	330	387	18.8	9.6	6.0	5.4	110% of rated voltage without overheating	80% of rated voltage
	12V	75	100	140	165	86	118	165	196	76.8	40.5	25.3	21.2		
	24V	37	50	70	83	42	59.7	81	98	300	156.7	103	84.5		
	120V	7.5	11	14.2	16.5	8.6	12.9	16.4	19.5	7680	4280	2770	2220		
	*240V	—	5.5	7.1	8.3	—	6.5	8.2	9.8	—	15720	12110	9120		
DC		SPDT	DPDT	3PDT	4PDT					SPDT	DPDT	3PDT	4PDT		
	6V	128	150	240	250					47	40	25	24	110% of rated voltage without overheating	80% of rated voltage
	12V	64	75	120	125					188	160	100	96		
	24V	32	36.9	60	62					750	650	400	388		
	48V	18	18.5	30	31					2660	2660	1600	1550		
	110V	8.0	9.1	12.8	15					13800	12100	8600	7340		

Note: Rated voltages marked with * are not available for SPDT models.

CONTACT RATING UL RATINGS (RH1, RH2, RH3, RH4)

VOLTAGE (V)	RESISTIVE (A)				INDUCTIVE (A)				HORSE POWER	
	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	SPDT DPDT	3PDT
120 AC	10	10	10	10	7	7	—	7.5	1/3	1/6
240 AC	10	10	—	7.5	7	7	6.5A/Pole 20A Total	5	1	1/3
30 DC	10	10	10	10	7	7	10	10	—	—

2-WAY VALVES, SCREWED (1/2" TO 2") AND FLANGED (2-1/2" TO 4") WITH HYDRAULIC ACTUATORS

TABLE 1. Select **Valve Body** including **P Code** (Valve Size, Cv Rating, Port Code) or select **Valve Assembly** with correct Input Signal (see Table 3 also) less Actuator Code (XXX) including the **P Code** (Size, Cv Rating, Port Code). (See Pages 331-335 for Valve Sizing.)

		APPLICATION			
		Chilled or Hot Water 281°F Max. 35 psig Steam		Hot Water 300°F Max. 100 psig Steam	Hot Water 366°F Max. 150 psig Steam
		Screwed	Flanged	Screwed	
					
Size		1/2"—2"	2-1/2"—4"	1/2"—2"	1/2"—2"
Normally Open Valves	Valve Body	VB-9213-0-4-P	VB-9213-0-5-P	VB-9253-0-4-P	VB-9273-0-4-P
	Valve Assembly 2-15 Vdc Input, System 8000	VS-9213-XXX-4-P	VS-9213-35X-5-P	VS-9253-XXX-4-P	VS-9273-XXX-4-P
	Valve Assembly, Built-in System 8000 Controller	VS-9213-35X-4-P	VS-9213-35X-5-P	VS-9253-35X-4-P	VS-9273-35X-4-P
	2-Position SPST Valve Assembly	VA-9213-2XX-4-P	—	VA-9253-2XX-4-P	VA-9273-2XX-4-P
Normally Closed Valves	Valve Body	VB-9223-0-4-P	VB-9223-0-5-P	VB-9263-0-4-	VB-9283-0-4-P
	Valve Assembly 2-15 Vdc Input, System 8000	VS-9223-XXX-4-P	VS-9223-35X-5-P	VS-9263-XXX-4-P	VS-9283-XXX-4-P
	Valve Assembly, Built-in System 8000 Controller	VS-9223-35X-4-P	VS-9223-35X-5-P	VS-9263-35X-4-P	VS-9283-35X-4-P
	2-Position SPST Valve Assembly	VA-9223-2XX-4-P	—	VA-9263-2XX-4-P	VA-9283-2XX-4-P
Flow Type		Equal %	Equal %	Equal %	Equal %
Material	Body	Bronze	Cast Iron	Bronze	Bronze
	Seat	Bronze	Bronze	Stainless Steel	Stainless Steel
	Stem	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
	Plug	Brass	Brass	Stainless Steel	Stainless Steel
	Packing	Spring Loaded Teflon Cone	Spring Loaded Teflon Cone	Spring Loaded Teflon Cone	Spring Loaded Teflon Cone
	Disc	Composition	Composition	Teflon	None
STEAM					
Pressure (psig)	Static	250	125	250	250
	Inlet	35	35	100	150
	Recom. Diff.*	20	20	35	50
Fluid Temp. °F (°C)	Max.	281° (138°)	281° (138°)	340° (171°)	366° (180°)
WATER					
Pressure (psig)	Static	250	125	250	250
	Recom. Diff.*	35	35	35	50
Fluid Temp. °F (°C)	Min.	40° (4°)	40° (4°)	40° (4°)	40° (4°)
	Max.	281° (138°)	281° (138°)	300° (149°)	366° (180°)

NOTE: These charts are color coded as shown below to assist valve selection. Note it is possible to select either a valve assembly or component parts (actuator, valve linkage, valve body).

ORDERING EXAMPLES:

1. **Valve Assembly** **VS-9223-212-4-8**
2. **Valve Body** **VB-9223-0-4-8**
   Actuator **MP-5210-500**
   Linkage **AV-600**

- **Valve Body** Data less P Code (Size, Cv Rating, Port Code) or **Valve Assembly** less Actuator Code (XXX) and less P Code (Size, Cv Rating, Port Code)
- **P Code** (Size, Cv Rating, Port Code)
- **Actuator** or **Actuator Code (XXX)** for Valve Assemblies
- **Valve Linkage**

VALVES

TO SELECT A PORT CODE (P)

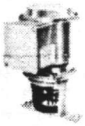
P Code	Valve Size	Cv			
-1**	1/2"	0.4		0.4	0.4
-2**		1.3		1.3	1.3
-3**		2.2		2.2	2.2
-4		3.6		3.6	3.6
-5**	3/4"	5.0		5.0	5.0
-6		6.2		6.2	6.2
-7**	1"	8.2		8.2	8.2
-8		11.0		11.0	11.0
-9	1-1/4"	16.0		16.0	16.0
-10	1-1/2"	25.0		25.0	25.0
-11	2"	40.0		40.0	40.0
-12	2-1/2"		56		
-13	3"		85		
-14	4"		145		

*Maximum recommended differential pressure in full open position. Do not exceed recommended differential pressure (pressure drop) or integrity of parts may be affected.
NOTE: Do not exceed close-off rating.
**NOTE: Factory assemblies are not available for 2-position applications using reduced port valve bodies.

2-WAY VALVES, SCREWED (1/2" TO 2") AND FLANGED (2-1/2" TO 4") WITH HYDRAULIC ACTUATORS

TABLE 2. Select **Actuator Type** or **Actuator Code (XXX)** series with correct Input Signal having sufficient close-off for the application. If selecting Component Parts, select **Valve Linkage.**





Input Signal					Two-Position SPST	2-15 Vdc System 8000	2-15 Vdc System 8000**
Valve Linkage 1/2" — 1-1/4" Valve					AV-600	AV-600	—
Valve Linkage 1/2" — 2" Valve					—	—	AV-430
Valve Linkage 2-1/2" — 4" Valve					—	—	AV-495
Actuator Code (XXX)					2XX	2XX	35X
Actuator Code					MA-521X-XXX	MP-5X1X	MS-8XX1X-XXX
Normal Position	Factory Avail. Valve Assembly	Valve Body	P Code	Size	CLOSE-OFF PRESSURE RATING*		
Normally Open	VA-9213-2XX-4-P VA-9253-2XX-4-P VA-9273-2XX-4-P VS-9213-XXX-4-P VS-9253-XXX-4-P VS-9273-XXX-4-P	VB-9213-0-4-P VB-9253-0-4-P VB-9273-0-4-P	-1-2-3-4	1/2"	180	190	
			-5-6	3/4"	75	85	
			-7-8	1"	40	45	
			-9	1-1/4"	25	30	
			-10	1-1/2"			65
			-11	2"			35
Normally Open	VS-9213-35X-5-P	VB-9213-0-5-P	-12	2-1/2"			20
			-13	3"			12
			-14	4"			6
Normally Closed	VA-9223-2XX-4-P VA-9263-2XX-4-P VA-9283-2XX-4-P VS-9223-XXX-4-P VS-9263-XXX-4-P VS-9283-XXX-4-P	VB-9223-0-4-P VB-9263-0-4-P VB-9283-0-4-P	-1-2-3-4	1/2"	250	220	
			-5-6	3/4"	140	90	
			-7-8	1"	75	50	
			-9	1-1/4"	45	30	
			-10	1-1/2"			65
			-11	2"			35
Normally Closed	VS-9223-35X-5-P	VB-9223-0-5-P	-12	2-1/2"			20
			-13	3"			12
			-14	4"			6

*Close-off pressure ratings apply when valves are installed with pressure under the seat. **Certain models have built-in controller.

TABLE 3. Select exact **Actuator** or **Actuator Code (XXX)** if Factory Assembly is available.

Input Signal	Wiring Figure No.	Voltage Vac 50/60 Hz	VA	Aux. Switch	Actuator Part No.	Actuator Code (XXX) For Factory Available Assy
Two-position SPST	See Figure 1 on Page 336	24	18	No	MA-5213	201
		24		Yes	MA-5213-500	202
		120		No	MA-5210	211
		120		Yes	MA-5210-500	212
		208		No	MA-5212	
		208		Yes	MA-5212-500	
		240		No	MA-5211	221
		240		Yes	MA-5211-500	222
2-15 Vdc, System 8000, Stroke occurs 6-9 Vdc approx., Non-positive positioning	See Figure 12 on Page 339	24	18	No	MP-5213	201
		24		Yes	MP-5213-500	202
		120		No	MP-5210	211
		120		Yes	MP-5210-500	212
		208		No	MP-5212	
		208		Yes	MP-5212-500	
		240		No	MP-5211	221
		240		Yes	MP-5211-500	222
2-15 Vdc, System 8000, start 6 Vdc factory set, Adjustable 2-12 Vdc, 3 Vdc span, Positive positioning	See Figure 12 on Page 339	24	18	No	MP-5413	243
		120		No	MP-5410	240
		208		No	MP-5412	
		240		No	MP-5411	241
	See Figure 12 on Page 339	24	36	No	MS-83013	351
		120	37	No	MS-83010	353
		120	37	Yes	MS-83010-500	
		240	39	No	MS-83011	
		240	39	Yes	MS-83011-500	
Built-in System 8000 controller, Uses TS-8XXX sensor	See Figure 19 on Page 343	120	37	No	MS-84110	354
		120	37	No	MS-84110-011*	
		120	37	Yes	MS-84110-500	
		24	36	No	MS-84113	

*Includes TS-8201-105 sensor.

2-WAY VALVES, SCREWED (1/2" TO 2") AND FLANGED (2-1/2" TO 4") WITH HYDRAULIC ACTUATORS

TABLE 4. Dimensions

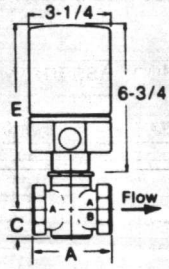
	DIMENSIONS (Inches)					
	Valve Body				Actuator Series	
					200*	350
Part Number	Size	A	B	C	E	E
VA-9213-2XX-4-P VA-9253-2XX-4-P VA-9273-2XX-4-P VS-9213-XXX-4-P VS-9253-XXX-4-P VS-9273-XXX-4-P	1/2"	3		1	8-3/16	
	3/4"	3-5/8		1-3/8	8-11/16	
	1"	4-5/8		1-1/2	9	
	1-1/4"	4-5/8		1-5/8	9	
	1-1/2"	6-1/8		2-1/2		19-1/8
	2"	6-1/8		2-1/2		19-1/8
VS-9213-35X-5-P	2-1/2"	8-1/2		3-1/2		19-13/16
	3"	9-1/2		3-3/4		20-3/16
	4"	11-1/2		4-1/2		21-7/16
VA-9223-2XX-4-P VA-9263-2XX-4-P VA-9283-2XX-4-P VS-9223-XXX-4-P VS-9263-XXX-4-P VS-9283-XXX-4-P	1/2"	3		1-7/16	8-3/16	
	3/4"	3-5/8		1-3/4	8-11/16	
	1"	4-5/8		2	9	
	1-1/4"	4-5/8		2	9	
	1-1/2"	6-1/8		3-3/16		18-5/8
	2"	6-1/8		3-3/16		18-5/8
VS-9223-35X-5-P	2-1/2"	8-1/2		4-1/8		19-7/16
	3"	9-1/2		4-1/8		19-13/16
	4"	11-1/2		5-1/16		20-7/16

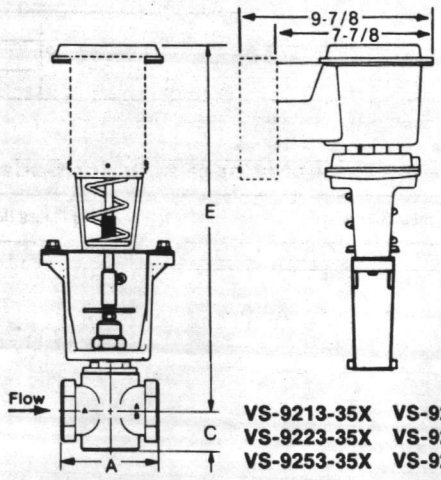
*Add 21/32" (52 mm) to the "E" dimension for a valve assembly using an AV-601 linkage extension that must be purchased separately.

Dimensions in inches (metric conversion 25.4 mm = 1 inch)

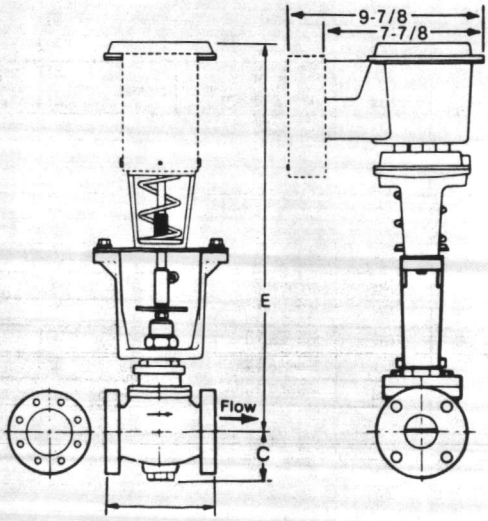
NOTE: Allow 3 inches clearance above actuator for removal. Mount MA/MP-5XXX actuators above the valve body at 45° from vertical on steam applications.

VS-9213-2XX VA-9213-2XX
VS-9223-2XX VA-9223-2XX
VS-9253-2XX VA-9253-2XX
VS-9263-2XX VA-9263-2XX
VS-9273-2XX VA-9273-2XX
VS-9283-2XX VA-9283-2XX

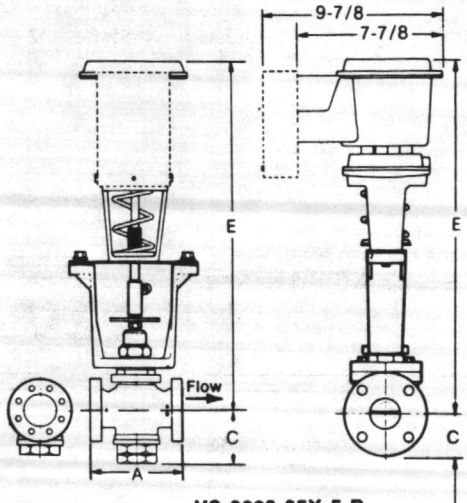




VS-9213-35X VS-9263-35X
VS-9223-35X VS-9273-35X
VS-9253-35X VS-9283-35X



VS-9213-35X-5-P



VS-9223-35X-5-P

See Flange Detail Table on following page

General Instructions

TC-1100 Series, TCR-1101 Two-Position Electric Room Thermostats

APPLICATION

For low or line voltage on-off control of fan coils, fans, motor starters, contactors, two-position electric actuators.

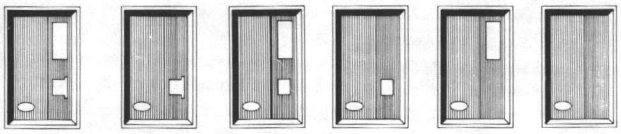
SPECIFICATIONS

Sensing Element: Bimetal.
Differential: 2°F (1°C).
Electrical Switch: Snap action SPDT.
Ratings, See Table 3.
Connections: Color coded 6" (152 mm) leads.
Cover: Beige plastic as standard.
Locations: NEMA Type 1 indoor only.
Mounting: Flush or surface 2 × 4 switch box or directly to wall (24 volt only).
Dimensions: 4-3/8" high × 2-7/8" wide × 1-5/8" deep (111 mm × 73 mm × 41 mm).
Anticipators Are Recommended:
Parallel for cooling. Series or parallel for heating.

OPTIONS

Add "dash-number" (-XXX) suffix to base part number for desired option. For metal covers, specify TC2-110X-XXX.

Anticipators: All thermostats mounted on concrete walls, or other wall surfaces that change temperature slowly, have reduced response time to changes in space temperature. Response time is further reduced for thermostats with guards that restrict air flow over the thermostat. Anticipators are recommended on thermostats that are subjected to restricted air flow conditions and in small spaces intended for human occupancy, i.e., hotel guest rooms and offices.



* Standard
** -116
-400
-410
-401††
-411††
-402††
-412††
-403††
-413††
-404††
-414††

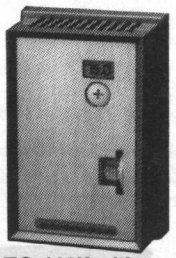
* °F (°C) ** °C

-500 parallel heat or cooling anticipation 24V standard cover
-501 parallel heat or cooling anticipation 120V standard cover
-502 parallel heat or cooling anticipation 240V standard cover
-601 10°F night depression 120V standard cover
-602 10°F night depression 24V standard cover
-603 10°F night depression 240V standard cover

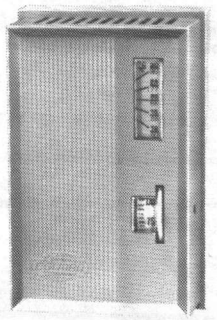
††5/64" Allen screw used to secure cover.

ACCESSORIES

AE-170 Series	Electric time clock
AT-61 Series	Brushed bronze cover plates (except TCR-1101)
AT-82 Series	Digital thermometer cover kit (except TC2-110X)
AT-101	Lock cover kit
AT-104	Dial stop pins (NOTE: Pins included with each unit.)
AT-136	Title plates (day, night, heat, cool)
AT-504	Plaster hole cover kit (small)
AT-505	Surface mounting base
AT-546	Auxiliary mounting plate
AT-602	Selector switch sub-base DP4T
AT-603	Selector switch sub-base one DP4T, one DPDT
AT-1100 Series	Thermostat guards
TOOL-11	Calibration wrench
TOOL-13	Contact burnishing tool



TC-110X with Digital Thermometer Kit Installed



† †

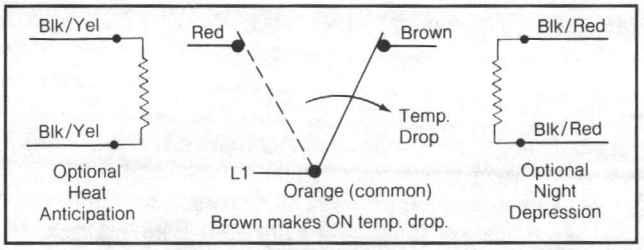


Figure 1. Switch Action and Lead Identification

TABLE 1. SPECIFICATIONS

Part Number	Setpoint Dial Range*		Cover Configurations
	Standard & -40X °F (°C)**	-116 & -41X °C	
TC-1101	55 to 85 (13 to 29)	13 to 29	See Options
TC-1102	45 to 75 (7 to 23)	7 to 23	
TC-1103	75 to 105 (24 to 40)	24 to 40	
TCR-1101	55 to 85 only	—	One Blank Cover Insert & One Cover Insert with Control Dial Cutout***

* Dial stop pins included to limit setpoint range.
** Dual marked (except TCR-1101).
*** One (1) 5/64" Allen head screw and 5/64" Allen wrench for securing cover to thermostat base included along with standard single slotted screw.

TABLE 2. AGENCY APPROVALS†

Configuration	UL	CSA
Metal Case (TC2-110X)	No	Yes
Plastic Cover (TC-110X)	Yes	No
Heat Anticipation or Night Depression (-500 or -600 Series)	No	No

TABLE 3. MAXIMUM ELECTRICAL RATINGS

Switch Action	Full Load Amps		Locked Rotor Amps		Pilot Duty (VA)
	24/120 Vac	240 Vac	24/120 Vac	240 Vac	
Make for Heating	4.4 Orange to Brown Lead	2.2 Orange to Brown Lead	26.4 Orange to Brown Lead	13.2 Orange to Brown Lead	40 @ 24 Vac
Make for Cooling	3.0 Orange to Red Lead	1.5 Orange to Red Lead	18 Orange to Red Lead	9 Orange to Red Lead	210 @ 120/240 Vac

PRE-INSTALLATION

Inspection

Visually inspect the carton for damage. If damaged, notify the appropriate carrier immediately. If undamaged, open the carton and visually inspect the device for obvious defects. Return damaged or defective products.

Required Installation Items

- Wiring diagrams
- Tools (not provided):
  Volt-ohm meter
  Appropriate screwdriver for mounting screws and terminal connections
- Appropriate accessories
- Mounting screws, two (2) provided for securing to a 2 × 4 conduit box

INSTALLATION

CAUTION

1. Installer must be a qualified, experienced technician.
2. Make all connections in accordance with the wiring diagram, and in accordance with national and local electrical codes. Class I wiring is required unless all circuits to contacts are powered from a Class II source. *Use copper conductors only.*
3. Do not exceed ratings of the device.

Mounting

Thermostats require upright mounting on a properly flat vertical surface. Locate the thermostat where it will be exposed to unrestricted circulation of air which represents the average temperature of the controlled space.

CAUTION

Do not locate the thermostat near sources of heat or cold, such as lamps, motors, sunlight or concealed ducts or pipes, or where there is a danger of electrocution (i.e., shower rooms).

The thermostat is designed for service in any normally encountered human environment. Avoid locations where excessive vibration, moisture, corrosive fumes or vapors are present. NEMA Type 1 covers are intended for indoor use primarily to provide a degree of protection against contact with the enclosed equipment.

Thermostats with guards that restrict air flow must have heating or cooling anticipation.

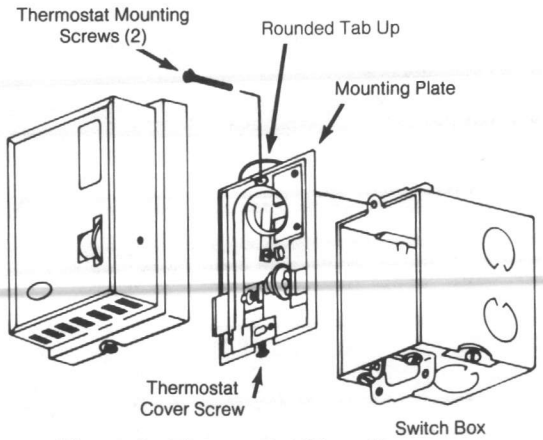


Figure 2. Thermostat Mounting

Procedure

1. Pull all wires.
2. Make electrical connections to thermostat. (Typical heat anticipation and night depression wiring diagrams are shown in Figures 6 through 8.)
3. Remove thermostat cover and fasten thermostat to box or wall.
4. Attach thermostat cover.

CHECKOUT

After installing a thermostat, make an initial check of the switching action. Verify the switch action by listening to and watching the switch contacts or by using a voltmeter between the proper sides of the switch.

1. Run the setpoint dial to a temperature above ambient. This should cause the thermostat to make a circuit between orange and brown leads.
2. Turn the setpoint dial setting down below ambient. This should cause the thermostat to make a circuit between orange and red leads.

CALIBRATION (See Figure 3)

All thermostats are precision calibrated at the factory and normally will not require any further attention. However, if recalibration is necessary, proceed as follows:

1. Turn off control power and power to night depression circuit, where applicable.
2. Set setpoint dial to correspond to actual stable room temperature, as read from an accurate thermometer.
3. Remove thermostat cover. Do not breathe on the thermostat or handle excessively as this will affect the accuracy of the final calibration.
4. If contact blade is made to the left (red) contact, with a small screwdriver, turn calibration screw counterclockwise (looking at head of screw) until blade makes to right (brown) contact.

NOTE

Each complete turn of screw changes calibration approximately 15°F (8°C).

Now turn screw very slowly clockwise until blade just makes the left (red) contact. Thermostat is now properly calibrated.

If contact blade is originally made to the right (brown) contact, turn calibration screw slowly clockwise until element just makes the left (red) contact. Thermostat is now properly calibrated.

5. Replace thermostat cover.
6. Turn on control power.
7. Recheck calibration about 30 minutes later to be sure heat from handling of or breathing on bimetal element did not result in an erroneous setting.

HEAT ANTICIPATION (See Figures 6 and 7)

Heat anticipation, series or parallel, is recommended for:

- Systems with excess heating capacity that can cause objectionable space temperature swings.
- Thermostats mounted on walls (i.e., concrete) that change temperature slowly and/or have insufficient air flow over the device.

COOLING ANTICIPATION (See Figure 8)

Parallel cooling anticipation is recommended for:

- Cooling anticipations where current draw exceeds 1 ampere. Cooling lockout (self heat of the thermostat causing over cooling of the space) can occur on these applications.
- Systems with excess cooling capacity that can cause objectionable space temperature swings.
- Thermostats mounted on walls (i.e., concrete) that change temperature slowly and/or have restricted air flow over the device.

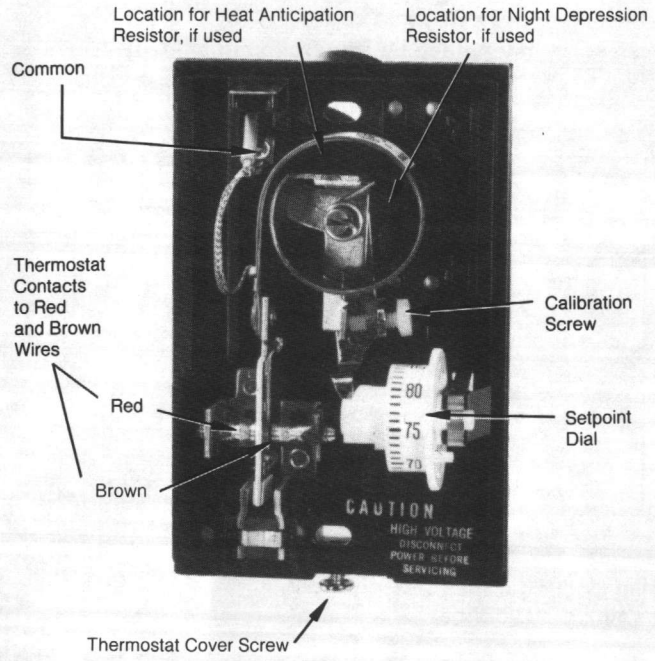


Figure 3.

CONCEALED CONTROL DIAL

Knurled Dial Removal (See Figure 4)

1. Remove thermostat cover.
2. Secure the control dial with hand so that the dial will not rotate.
3. Place needle nose pliers at knurled ring of the control dial at the points where the knurled ring is attached to the control dial.
4. Twist the pliers at each knurled ring attachment point until the entire knurled ring of the control dial is removed.

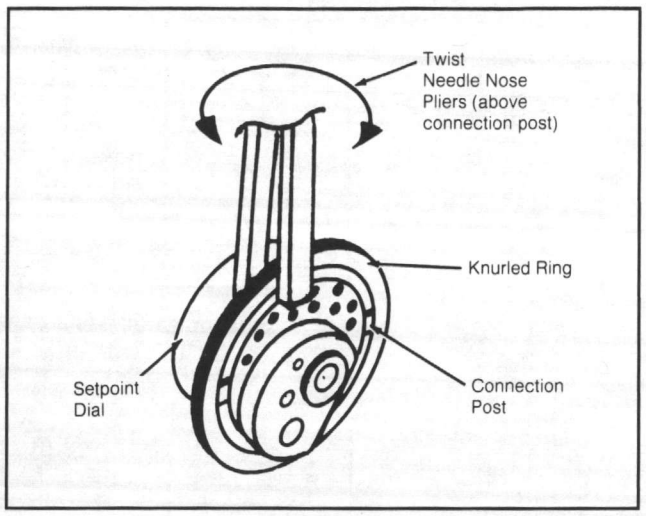


Figure 4. Knurled Dial Removal

LIMIT CONTROL DIAL RANGE

Dial Stop Pin Insertion — Included with Mounting Plate (See Figure 5)

1. Remove thermostat cover.
2. Secure the control dial with hand so that the dial will not rotate.
3. Place a dial stop pin in the jaws of a needle nose pliers.
4. Insert the dial stop pin in the appropriate hole on either (or both) side(s) of the control dial to restrict dial rotation.

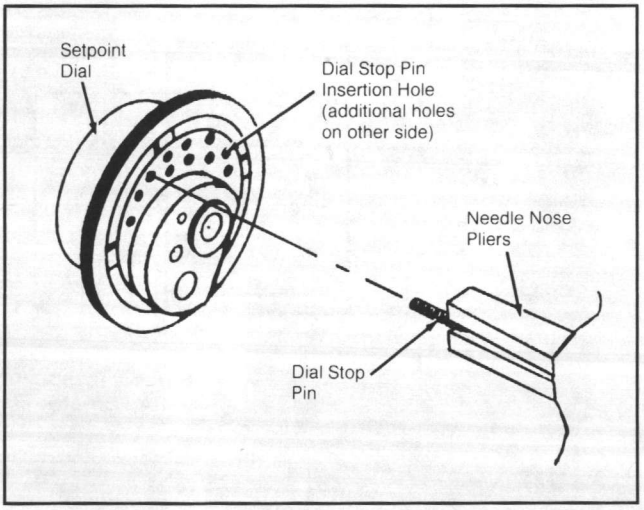


Figure 5. Dial Stop Pin Insertion

MAINTENANCE

Regular maintenance of the total system is recommended to assure sustained optimum performance.

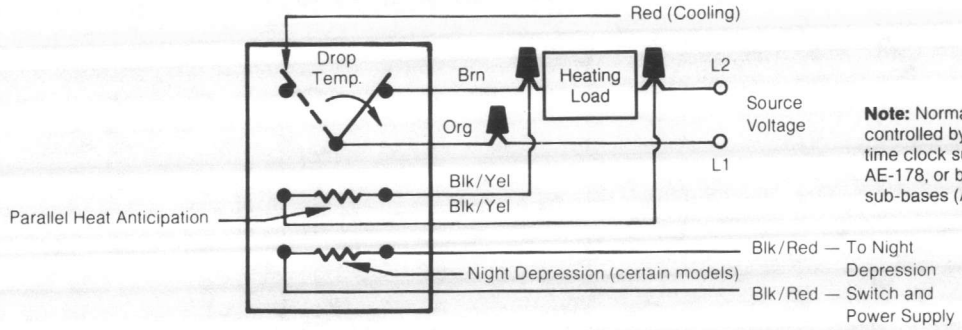
Open areas at bottom and around base of thermostat should be kept clean and free from obstructions to allow proper flow of air. If switch contacts need cleaning, this may be done with TOOL-13 (burnishing tool).

NOTE

Thermostat may require calibration after cleaning the contacts.

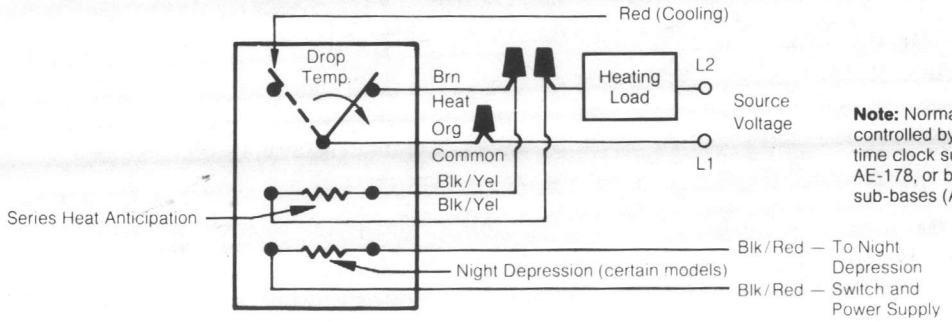
REPAIR

These thermostats are not field repairable. Replace a defective thermostat with a functional unit.



Note: Normally, night depression is controlled by a centrally located time clock such as AE-174 or AE-178, or by selector switch sub-bases (AT-602 or AT-603).

Figure 6. Typical of Parallel Heat Anticipation (heater size determined by voltage) with or without Night Depression



Note: Normally, night depression is controlled by a centrally located time clock such as AE-174 or AE-178, or by selector switch sub-bases (AT-602 or AT-603).

Figure 7. Typical of Series Heat Anticipation (heater size determined by ampere rating of load) with or without Night Depression

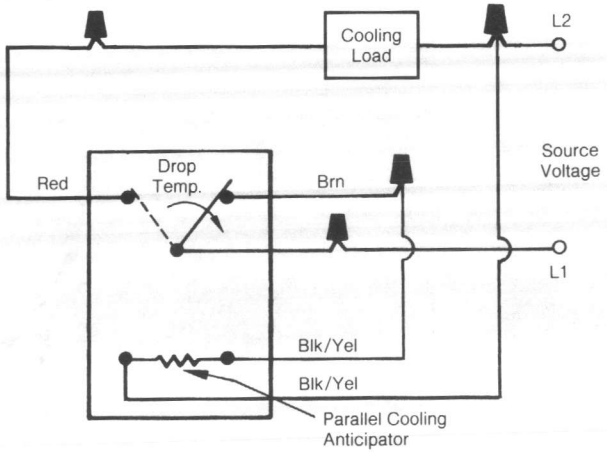
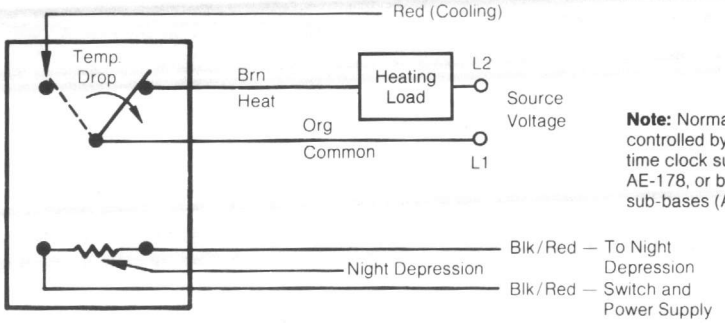


Figure 8. Typical of Parallel Cooling Anticipation (anticipator size determined by voltage)



Note: Normally, night depression is controlled by a centrally located time clock such as AE-174 or AE-178, or by selector switch sub-bases (AT-602 or AT-603).

Figure 9. Typical Night Depression

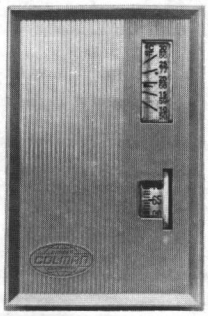
Barber-Colman Company
ENVIRONMENTAL CONTROLS DIVISION

1354 Clifford Avenue
P.O. Box 2940
Loves Park, IL U.S.A. 61132-2940

General Instructions

TP-8101, TP-8102, TP-8103, TP-8124, TP-8125 Electronic Thermostats Proportional Controlling

TP-8101, TP-8102, TP-8103 Single Setpoint Adjustment



TP-8124 & TP-8125 Dual Setpoint Adjustment

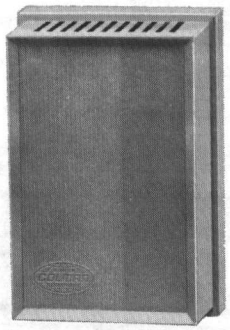


Table 1

Part Number	Dial Marking	Control Dial Range	Throttling Range for 3 Vdc Output Change	Input Voltage	Output Voltage	Control Action	Wiring Connections	Number of Controlled Devices
TP-8101	°F & °C	55-85°F	2, 3, 6 and 20°F Factory Set 3°F By Jumper/Pins	20 Vdc 13 mA	2-15 Vdc or 15-2 Vdc	Factory Set Direct-acting Jumper Terminal 4 to 5 For Reverse-acting Jumper Terminal 4 to 3	3 Color-coded Pigtail Leads Terminals for Options See Figure 2	6 System 8000 Devices or 2 MP-5200 Series Actuators
TP-8101-116	°C	13-29°C						
TP-8102	°F & °C	7-24°C (45-75°F)						
TP-8103	°F & °C	24-41°C (75-105°F)						
TP-8124 Dual Setpoints	°F & °C	Heating 7-24°C (45-75°F) Cooling 21-38°C (70-100°F)	Heating and Cooling 2-10°F Independently Adj. Factory Set 3°F	20 Vdc 23 mA	Heat 2-15 Vdc or 15-2 Vdc Cool 2-15 Vdc	Heating Factory Set Reverse-acting Jumper J7 to pin B for Direct-acting Cooling Direct-acting only	Coded Terminals See Figure 3	6 System 8000 Devices or 2 MP-5200 Series Actuators in both Heating and Cooling
TP-8125 Dual Setpoints	°F & °C	Heating 7-24°C (45-75°F) Cooling 24-41°C (75-105°F)						

DESCRIPTION

TP-8101, TP-8102, TP-8103

These self-contained room temperature controllers conserve energy in heating and/or cooling applications requiring a single setpoint adjustment. See Table 1 for particular characteristics.

The heating and cooling equipment is precisely controlled from a single 1000 ohm Balco sensor operating through a single controller for heating and/or cooling. The controller provides a proportional output to control System 8000 controlled devices for control of valves, dampers, electric heat, DX coils, etc.

TP-8124, TP-8125

These self-contained room controllers conserve energy in heating and/or cooling equipment in applications requiring heating and cooling setpoint adjustment.

See Table 1 for particular characteristics.

The heating and cooling equipment is precisely controlled from a single 1000 ohm Balco sensor operating through independent heating and cooling controllers. These controllers provide proportional outputs to control System 8000 controlled devices for control of valves, dampers, electric heat, DX coils, etc. The heating output (OP1 to COM) can be programmed for direct-acting or reverse-acting operation. The cooling output (OP2 to COM) provides a direct-acting output only.

Features

1. TP-8124 meets ASHRAE 90-75 and DOE requirements. TP-8125 meets DOD requirements.
2. Heating and cooling cannot operate simultaneously.
3. Heating/cooling deadband obtained by adjustable dual setpoints and throttling range.
4. Proportional outputs operate remote System 8000 controlled devices such as valves, dampers, electric heat coils, etc.
5. Concealed adjustments eliminate occupant tampering.

INSTALLATION

Open the carton and visually inspect the device for part number and obvious defects before proceeding with the installation.

Mounting screws are provided.

Locate the controller where it will be exposed to unrestricted natural air circulation and to the average conditions of the controlled space. Do not locate it near sources of heat or cold (such as lamps, motors, sunlight, radiators and concealed pipes or ducts within the wall) which might affect the control point. Avoid locations where excessive vibration, moisture, corrosive fumes or vapors are present, or where high radio frequency or electromagnetic generating devices are near.

Dimensions 111 mm (4-3/8") high × 73 mm (2-7/8") wide × 41 mm (1-5/8") deep.

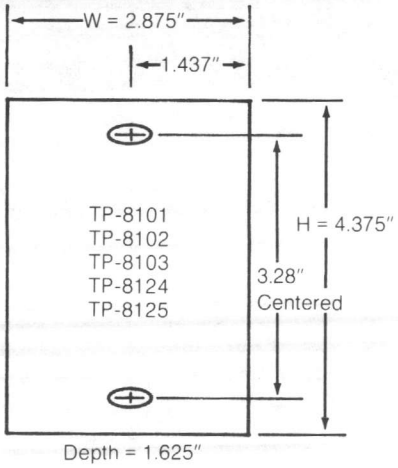


Figure 1

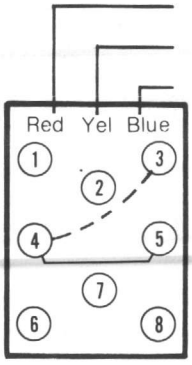
Ambient Limits Operation: 40 to 140°F (4.4 to 60°C). Storage: -40 to 160°F (-40 to 71°C).

MODES OF OPERATION

1. Direct-acting control (DA): Increase in temperature at the sensor causes the controller output signal to increase.
2. Reverse-acting control (RA): Increase in temperature at the sensor causes the controller output signal to decrease.

THROTTLING RANGE

Throttling range (T.R.) is defined as the degrees (°F or °C) change at the temperature sensor in order to cause a 6 to 9 Vdc controller output signal change.



Wire Leads
Red = +20 Vdc (Input)
Yellow = Proportional Output
Blue = Common

Screw Terminals
1 = Common
2 = Auxiliary Input
3,4 = Connect for Reverse-Acting (RA)
4,5 = Connect for Direct-Acting (DA)
7 = 6.2 Vdc
7,8 = Remote Sensor

Figure 2
Terminal Nomenclature
TP-8101, TP-8102 and TP-8103

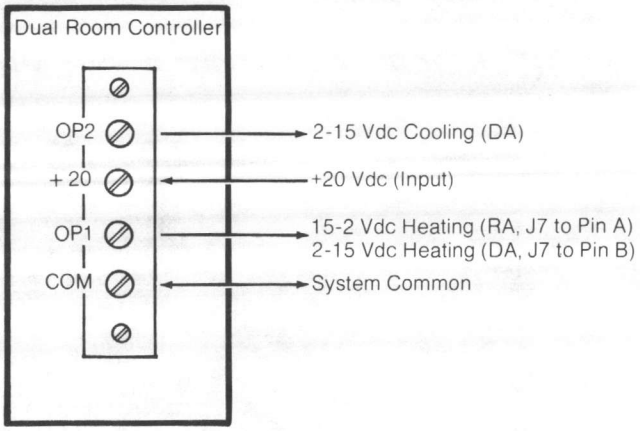


Figure 3
Terminal Nomenclature
TP-8124 and TP-8125

WIRING

Make all electrical connections according to installation wiring diagrams. Comply with national and local electrical codes.

No. 18 multi-conductor thermostat cable may be used. Low voltage Class 2 wire is acceptable, but No. 18 or larger 600V wire should be used if splices are to be made in the same junction box with line voltage wiring.

The controller may be installed on either a 52 mm × 102 mm (2" × 4") flush switch box or a surface switch box. To install, proceed as follows:

1. Wiring for the TP-8101, TP-8102 and TP-8103 is shown in Figures 4 and 5. See Figures 6 and 7 for TP-8124 and TP-8125 typical wiring.
2. "Pull" all wires required.
3. Connect all control wiring to the thermostat.
4. Remove the thermostat cover by loosening the screw at the bottom of the cover. Pull the cover out from the bottom and up to disengage it from the base.
5. Fasten the base to the box with the screws provided.
6. Replace the cover and tighten the cover screw.

WIRING OF CONTROLLED DEVICES TO CONTROLLER

Types of controlled devices and their power supplies:

1. Filtered and regulated power supplies: All System 8000 controlled devices except MP-52XX and MP-54XX series actuators.
2. Filtered and unregulated power supplies: MP-54XX series actuators.
3. Unfiltered and unregulated power supplies: MP-52XX series actuators.

General rules for wiring controllers to controlled devices:

1. Never connect red lead (or +20 terminal) of any controlled device which has a regulated power supply to the red lead (or +20 terminal) of any other controlled device.

2. Controlled devices with unfiltered and unregulated power supplies must be filtered. System 8000 controllers will provide filtering for a maximum of two controlled devices by connecting the two red leads (+20 terminals) together at the controller's red lead (+20 terminal).

3. Controlled devices with filtered and unregulated supplies: Up to six controlled devices with the red leads (+20 terminals) can be connected together. Number of units paralleled depends on the current (mA DC) requirements of the controller or adaptor.

4. Devices and their internal supplies:

FILTERED & REGULATED	FILTERED & UNREGULATED	UNFILTERED & UNREGULATED
CC-8101	MP-54XX	MP-52XX
CC-8102	Actuators	Actuators
CC-8103		
CC-8118 Series		
CC-8218 Series		
CC-8111 Series		
CP-8301 Series		
CP-8161 Series		
CP-8425 Series		
CP-8501 Series		
CP-8502 Series		

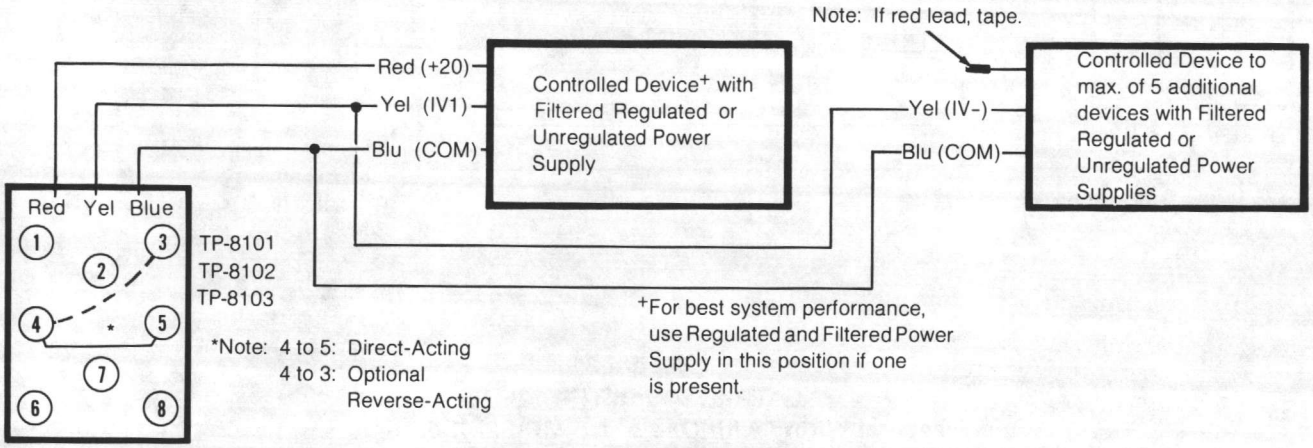


Figure 4
TP-8101, TP-8102 and TP-8103
Typical Wiring *without* MP-52XX Actuators

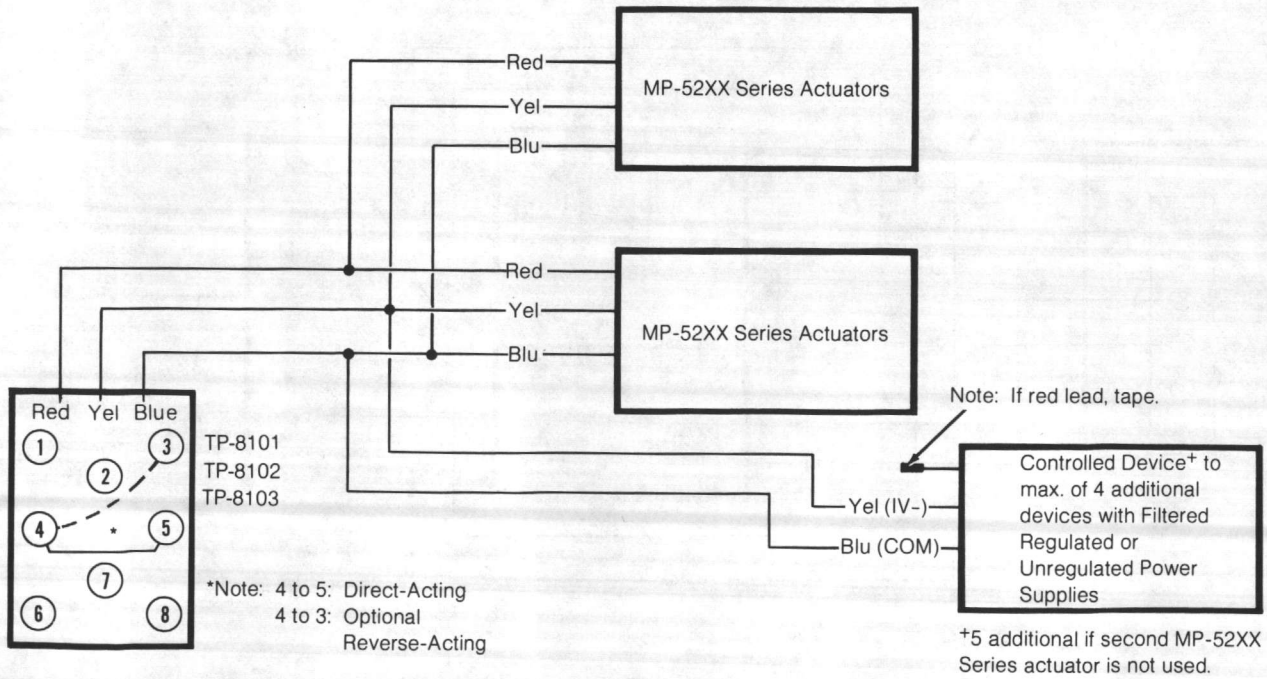


Figure 5
TP-8101, TP-8102 and TP-8103
Typical Wiring *with* MP-52XX Actuators

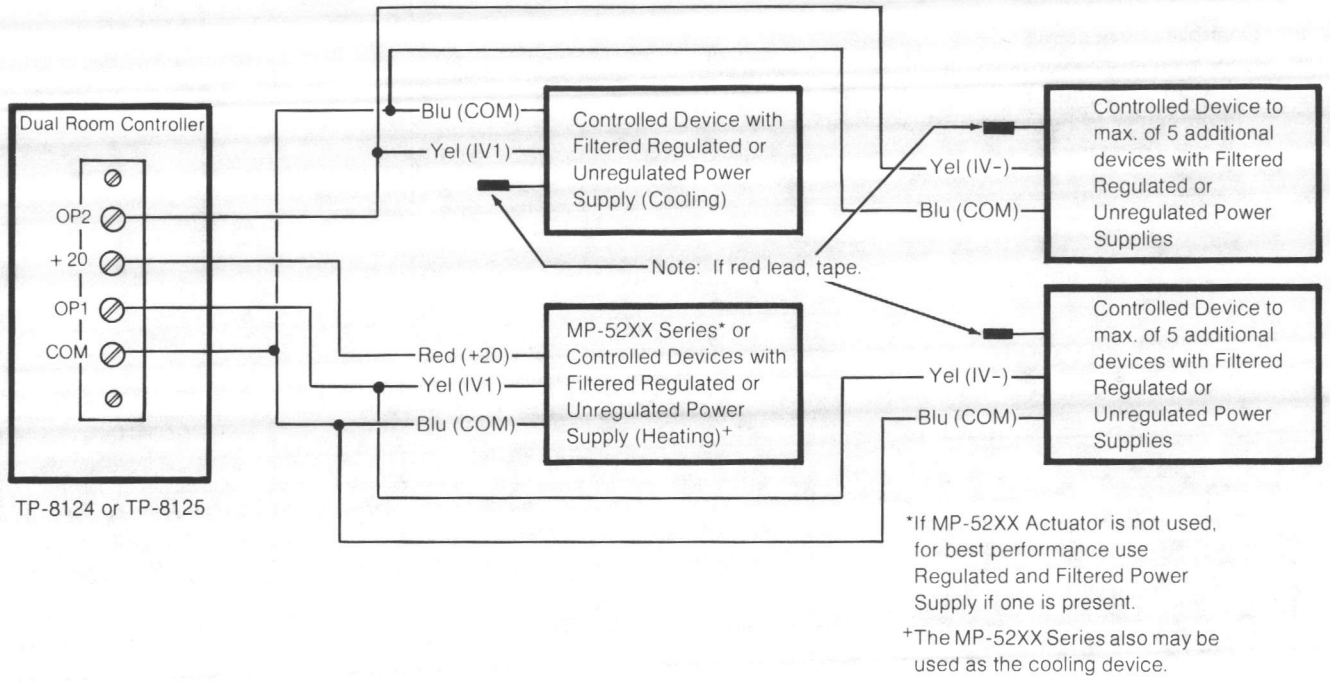


Figure 6
TP-8124 and TP-8125
Typical Wiring with *One or No* MP-52XX Actuators

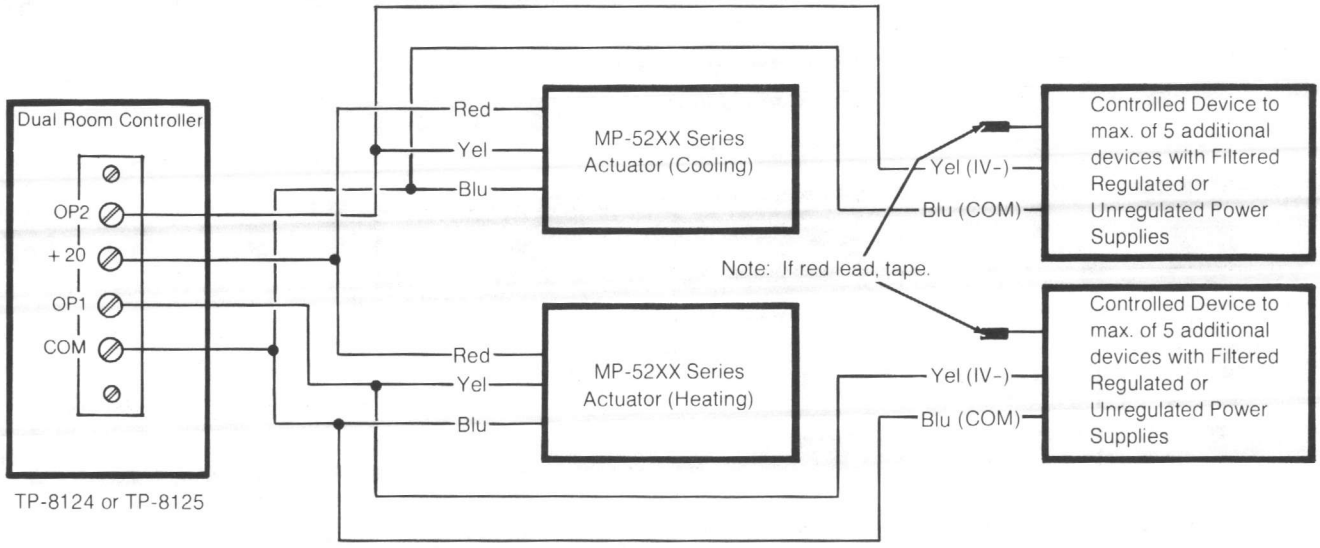


Figure 7
TP-8124 and TP-8125
Typical Wiring with *Two* MP-52XX Actuators

ADJUSTMENTS

TP-8101, TP-8102, TP-8103

1. Turn the setpoint adjuster to the required temperature setting. Normally, no further adjustments are required.
2. Throttling range settings of 2, 3, 6 and 20° are available by placing the T.R. jumper on the proper selector pin. See Figure 8. For other throttling ranges (1 through 60°) add a resistor to the auxiliary pins. Select the resistor from the chart below. Place the T.R. jumper on the auxiliary pin nearest the center of the controller.

Table 2. Throttling Range Resistor Values

°F T.R.	Auxiliary Resistor	Barber-Colman Part Number
1	4.3 Meg. ±5%	E19-23-562
1.5	3.0 Meg. ±5%	
2.0	2.2 Meg. ±5%	CYZR-481-860
2.5	1.8 Meg. ±5%	CYZR-481-580
3.0	1.5 Meg. ±5%	CYZR-481-680
3.5	1.2 Meg. ±5%	CYZR-481-450
4.0	1 Meg. ±5%	CYZR-481-610
4.5	975K, ±1%	CYZR-862-496
5.0	866K, ±1%	
6.0	732K, ±1%	
7.0	619K, ±1%	CYZR-862-477
8.0	549K, ±1%	
9.0	487K, ±1%	
10.0	432K, ±1%	CYZR-862-462
15.0	287K, ±1%	CYZR-862-445
20.0	215K, ±1%	
25.0	174K, ±1%	CYZR-837-913
30.0	143K, ±1%	CYZR-837-130
40.0	107K, ±1%	
50.0	84.5K, ±1%	E19-64-390
60.0	69.8K, ±1%	CYZR-837-890

TP-8124 and TP-8125

1. Remove the cover and turn the setpoint adjuster (SPA) to the required temperature for the heating mode (typically 65°F).

   Turn the setpoint adjuster (SPB) to the required temperature for the cooling mode (typically 78°F).

   The cooling signal is direct-acting, and stages cooling or proportionally opens a normally closed chilled water valve with a temperature increase.

   The heating signal is factory set for reverse-acting. With a temperature decrease, the signal stages electric heat or proportionally increases the electric heat output controlled by a Barber-Colman CP-8400 or CP-80000 Series SCR controller.
2. For applications that require a direct-acting signal in the heating mode, such as a normally open heating valve, move jumper J7 to pin "B".
3. The Temperature Deadband between heating and cooling is the difference in SPB and SPA settings. For example, the deadband is 13°F with SPA at 65°F and SPB at 78°F.
4. The throttling ranges are factory set at 3°F for heating and cooling. These settings should not be changed for normal applications. Increase the throttling range only to achieve control stability (adjustable 2 to 10°F).

   To adjust, turn the T.R. dial to position the required T.R. value closest to the thermostat cover.
5. Replace the cover.

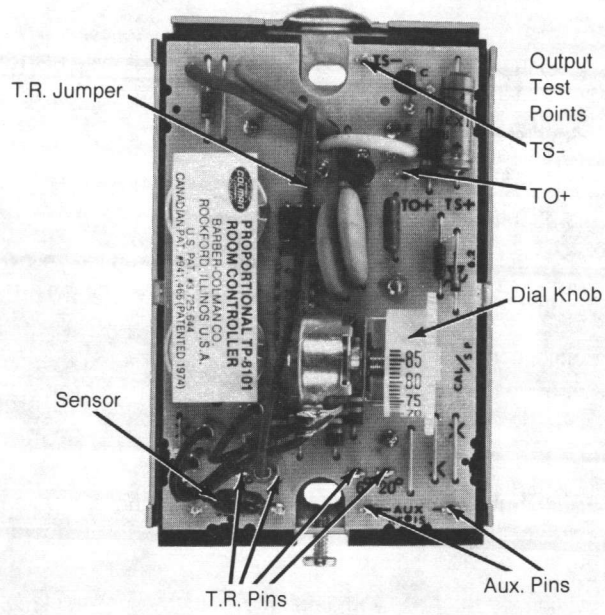


Figure 8
TP-8101, TP-8102 and TP-8103

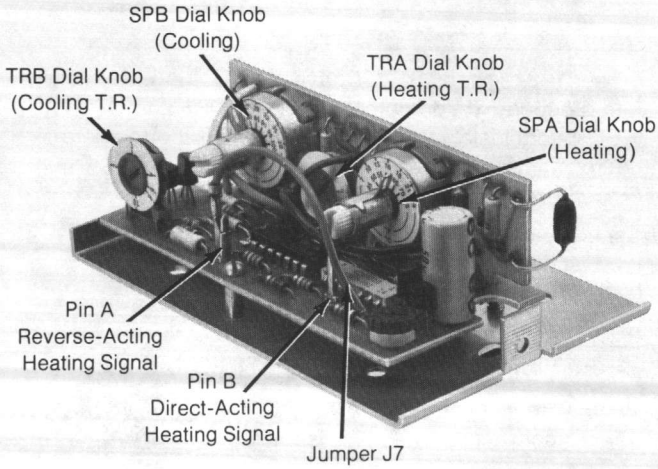


Figure 9a
TP-8124 or TP-8125

SERVICE

TP-8101, TP-8102, TP-8103

NOTE

The TP-8101, TP-8102 and TP-8103 have been factory calibrated to produce a 7.5 Vdc output signal at the yellow and blue leads (TO+ and TS-) when the setpoint and the temperature at the sensing element agree.

1. Verify wiring per job wiring diagram.
2. Measure with a 20,000 ohm per Vdc VOM.
   a. Power supply 20 Vdc: Red (+) to blue (-) wires or test point pins TS- and TS+ (+ end of the 47 μf capacitor).
   b. Output 2 to 15 Vdc: Yellow (+) to blue (-) wires or TO+ and TS- test pins. The voltage varies between 2-15 as the dial knob is rotated.
3. Consult EN 111 for additional service information.
4. Replace the controller if it is defective.

If calibration is necessary, proceed as follows:

1. Connect a 20,000 ohm per Vdc VOM between the yellow (+) and blue (-) leads or TO+ and TS- pins on the thermostat.
2. With the thermostat cover on, insert a 5/64" Allen wrench through the hole on the right-hand side of the thermostat into the setpoint potentiometer shaft.
3. Measure the temperature at the thermostat.
4. Adjust the thermostat setpoint by rotating the Allen wrench until the setpoint dial reading equals the temperature measured in step 3 above.
5. Using the thumb of your left hand, hold the knob in place. Avoid touching the lower left-hand corner of the thermostat where the sensor is located.
6. Rotate the Allen wrench until VOM reads 7.5 ±.3 Vdc.
7. The thermostat is calibrated.

TP-8142 and TP-8125

NOTE

The TP-8124 and TP-8125 have been factory calibrated to produce 6.0 Vdc output signals at OP1 and OP2 to COM terminals when the setpoints and the temperatures at the sensing element agree.

Test the power supply and output as follows:

1. Verify the wiring per the job wiring diagram.
2. Measure with a 20,000 ohm per Vdc VOM:
   a. Power supply 20 Vdc: +20 (+) to COM (-).
   b. Heating output: OP1 (+) to COM (-). Vdc varies between 2-15 as SPA is rotated.
   c. Cooling output: OP2 (+) to COM (-). Vdc varies between 2-15 as SPB is rotated.
3. Replace the controller if it is defective.

If calibration is necessary, proceed as follows:

1. Remove the thermostat cover. Note room temperature.
2. If room temperature is 75°F or greater:
   a. Connect VOM internally to OP2 (+) and COM (-). See Figure 9B for details.
   b. Rotate SPB until VOM reads 6.0 ±.3 Vdc. SPB pointer must indicate the temperature measured. If not, hold SPB shaft and rotate pointer (CCW) until it indicates the temperature measured.

      SPB is calibrated.
   c. Disconnect VOM lead from OP2 and reconnect to OP1. Connect Jumper J7 to Pin A.
   d. Connect 1 MEG ±1% resistor (SYZE-13512 test kit) between AB1 and 6.2 connections.
   e. Rotate SPA until VOM reads 6.0 ±.3 Vdc. SPA should read temperature measured minus 10°F. If not, hold SPA shaft and rotate pointer (CCW) until it indicates temperature measured minus 10°F.

      SPA is calibrated.
3. If room temperature is 74°F or less:
   a. Connect VOM internally to OP1 (+) and COM (-). See Figure 9B for details.
   b. Rotate SPA until VOM reads 6.0 ±.3 Vdc. SPA must indicate the temperature measured. If not, hold SPA shaft and rotate the pointer (CCW) until it indicates the measured temperature.

      SPA is calibrated.
   c. Disconnect VOM lead from OP1 and re-connect to OP2. Connect Jumper J7 to Pin A.
   d. Connect 1 MEG, ±1% resistor (SYZE-13512 test kit) between AB2 and COM connections.
   e. Rotate SPB until VOM reads 6.0 ±.3 Vdc. SPB should read the measured temperature plus 10°F. If not, hold SPB shaft and rotate pointer (CCW) until it indicates the measured temperature plus 10°F.

      SPB is calibrated.

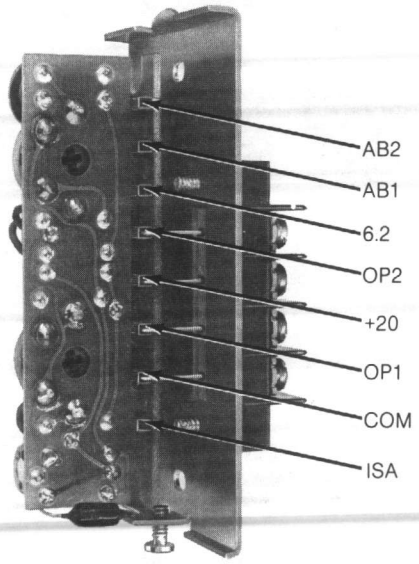


Figure 9b

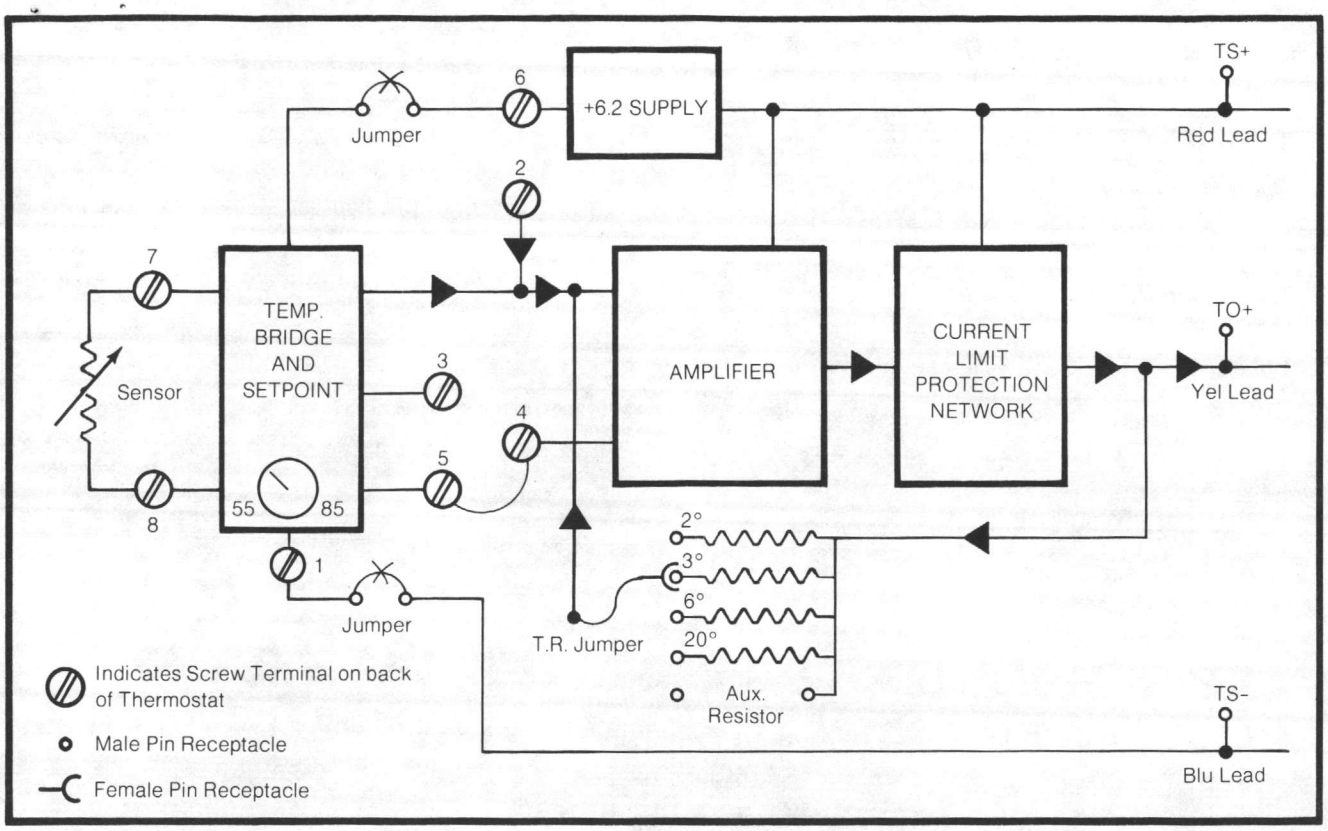


Figure 10
TP-8101, TP-8102 and TP-8103 Block Diagram

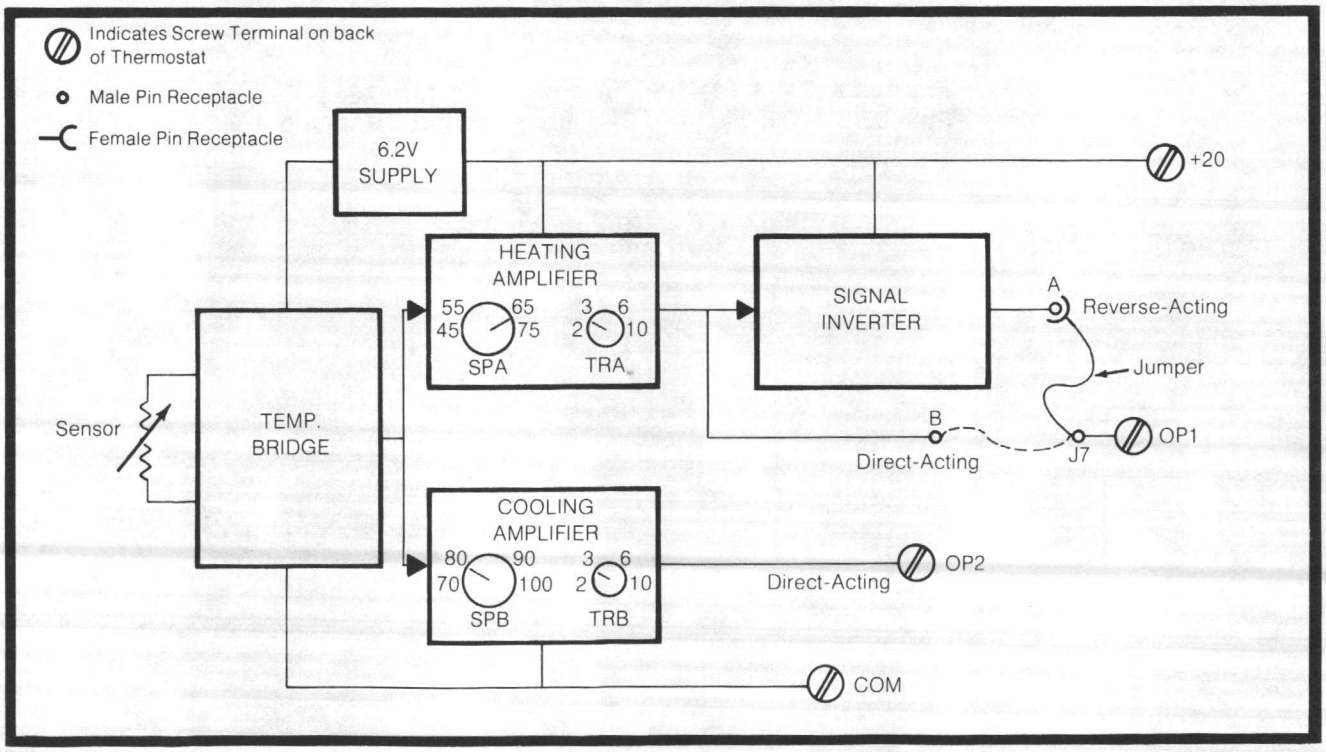


Figure 11
TP-8124 and TP-8125 Block Diagram

OPTIONS

TP-8101, TP-8102, TP-8103
(TP-8124 and TP-8125 have no options.)

Remote Setpoint Install the AT-8100 Series remote setpoint adjuster between terminals 1, 2 and 7. These are used for applications where the setpoint adjustment is mounted remote from the controller. See Figure 14, 15 or 16.

Remove the dial rim from the setpoint knob using wire cutters. Turn the dial to 70°F. The AT-11-404 blank cover is recommended to prevent dust infiltration.

Remote Sensing Remove the internal 1000 ohm sensor and install the remote sensor (TS-8000 Series) between terminals 7 and 8. This is used for applications where the sensor is mounted remote from the controller. See Figure 13.

Summer-Winter Changeover is accomplished without remote setpoints or selective ratio discharge. The controller operates in either the DA or RA mode. See Figure 12.

Jumper 4 to 5 — DA (direct-acting): A temperature increase causes an output voltage increase.

Jumper 3 to 4 — RA (reverse-acting): A temperature increase causes an output voltage decrease.

Selective Ratio Discharge Control Connect the ratio discharge sensor (Figure 19) to the room controller as shown in Figure 14, 15 or 16. This is used for room and discharge control applications.

Winter-Summer Operation is accomplished using selective ratio discharge and/or remote setpoints. For direct-acting, see Figure 14. For reverse-acting, see Figure 15. For winter-summer switching, see Figure 16.

For panel mounting, see Figure 18.

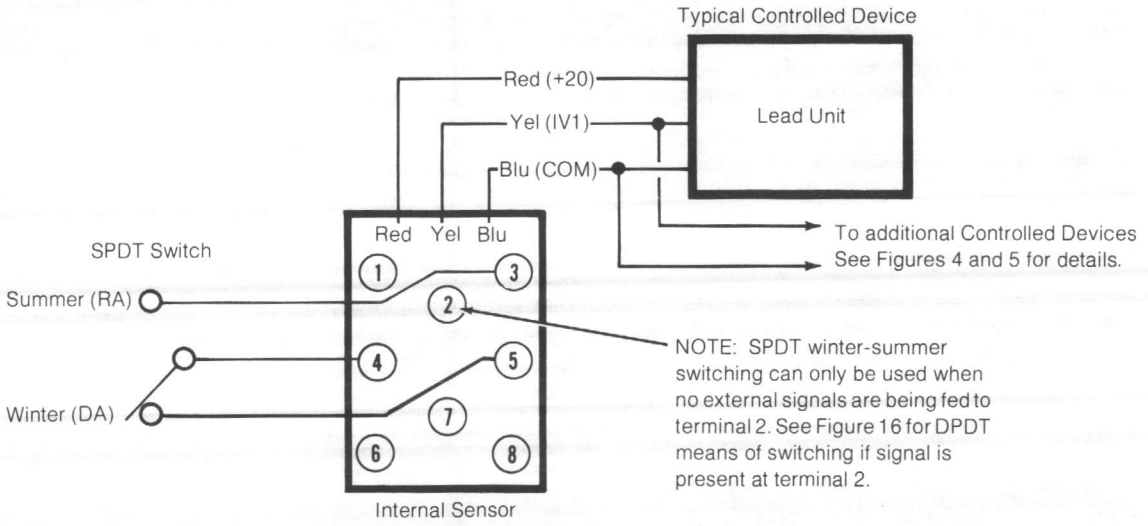


Figure 12. TP-8101, TP-8102 and TP-8103 with Single Pole Double Throw (SPDT) Winter-Summer Switching

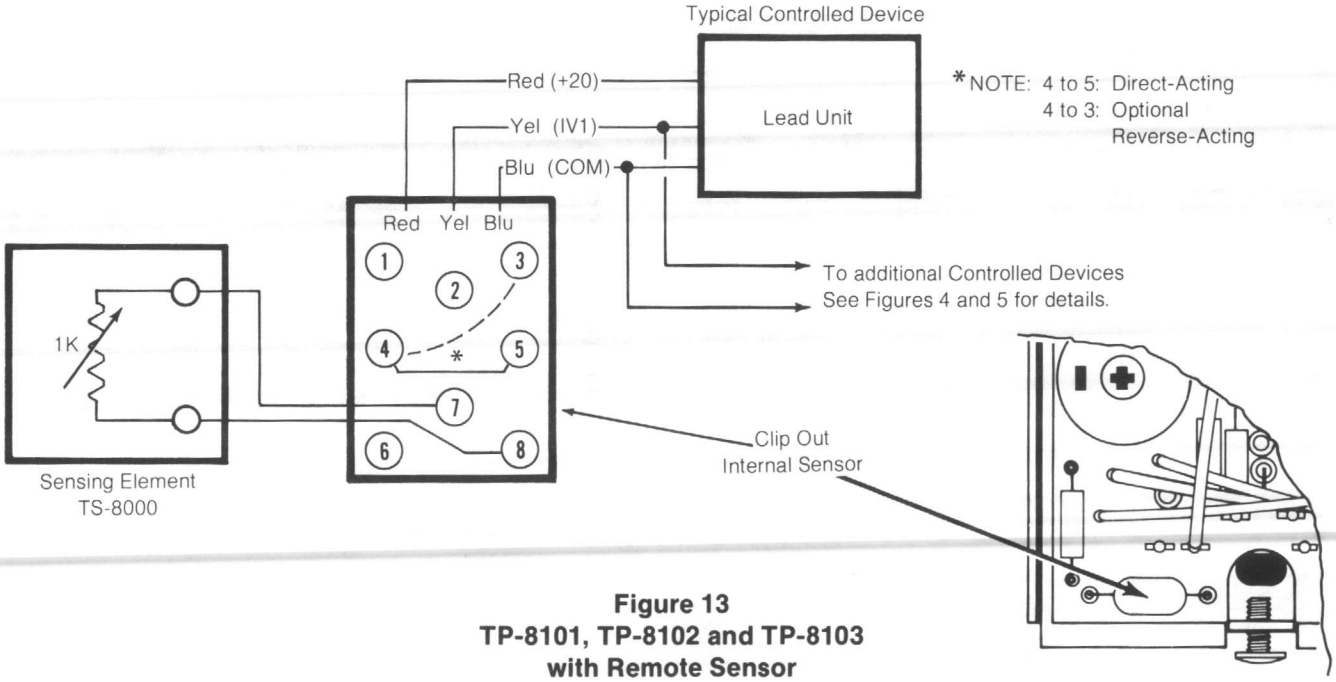


Figure 13
TP-8101, TP-8102 and TP-8103 with Remote Sensor

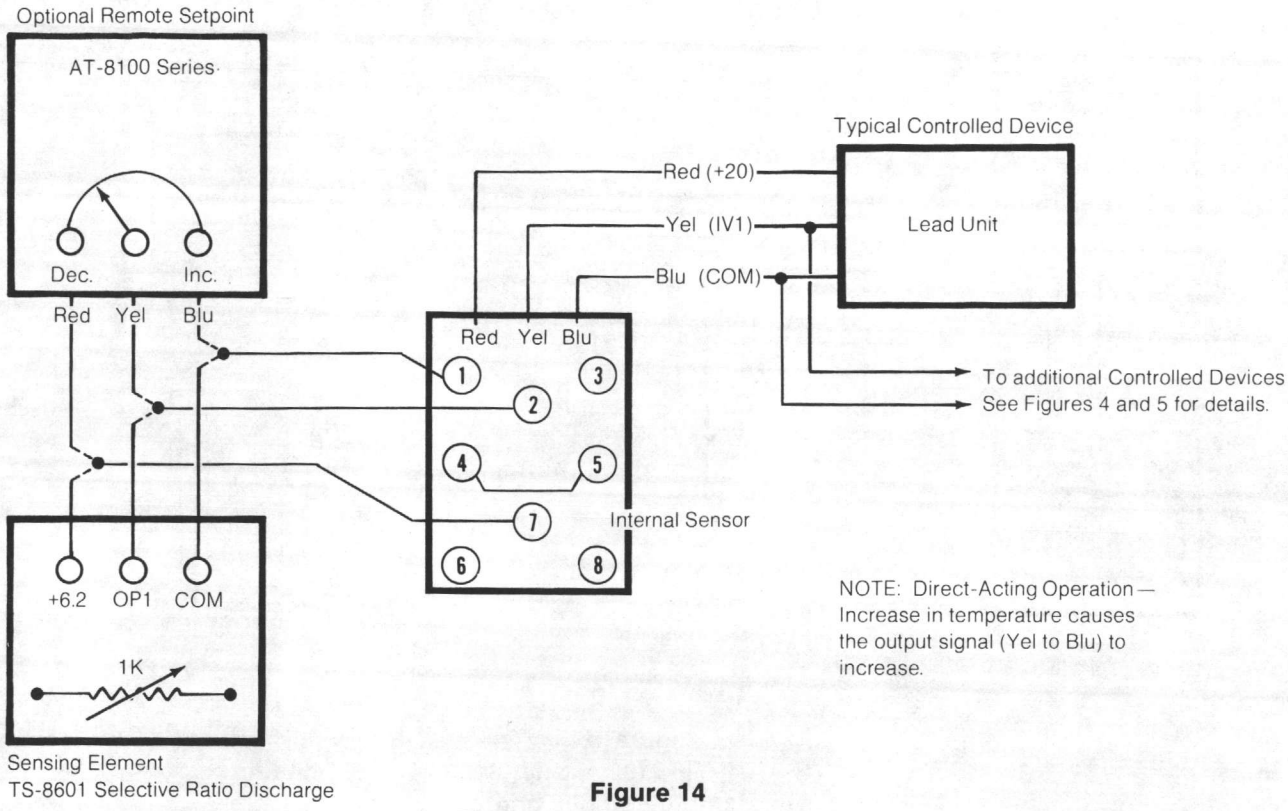


Figure 14
TP-8101, TP-8102 and TP-8103 with Remote Setpoint and/or Selective Ratio Discharge Sensor
Direct-Acting Output Only

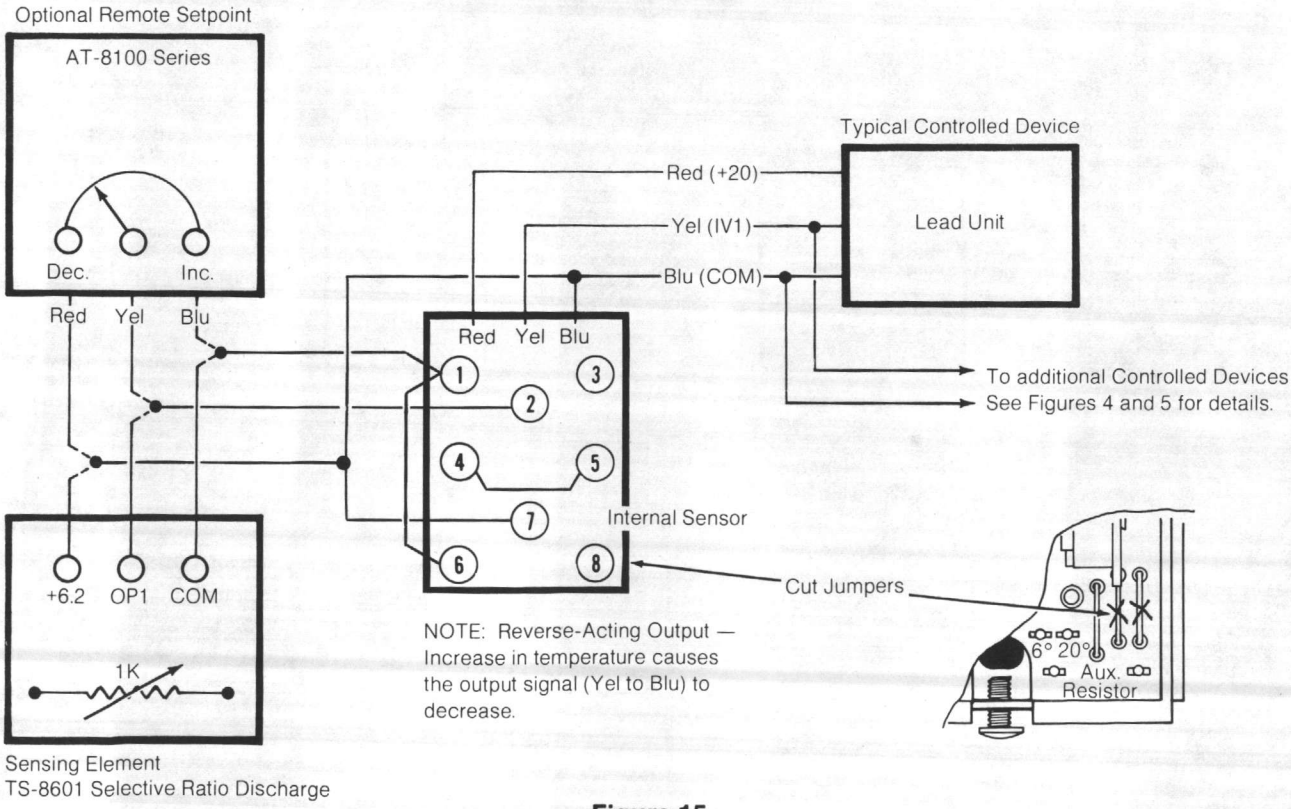


Figure 15
TP-8101, TP-8102 and TP-8103 with Remote Setpoint and/or Selective Ratio Discharge Sensor
Reverse-Acting Output Only

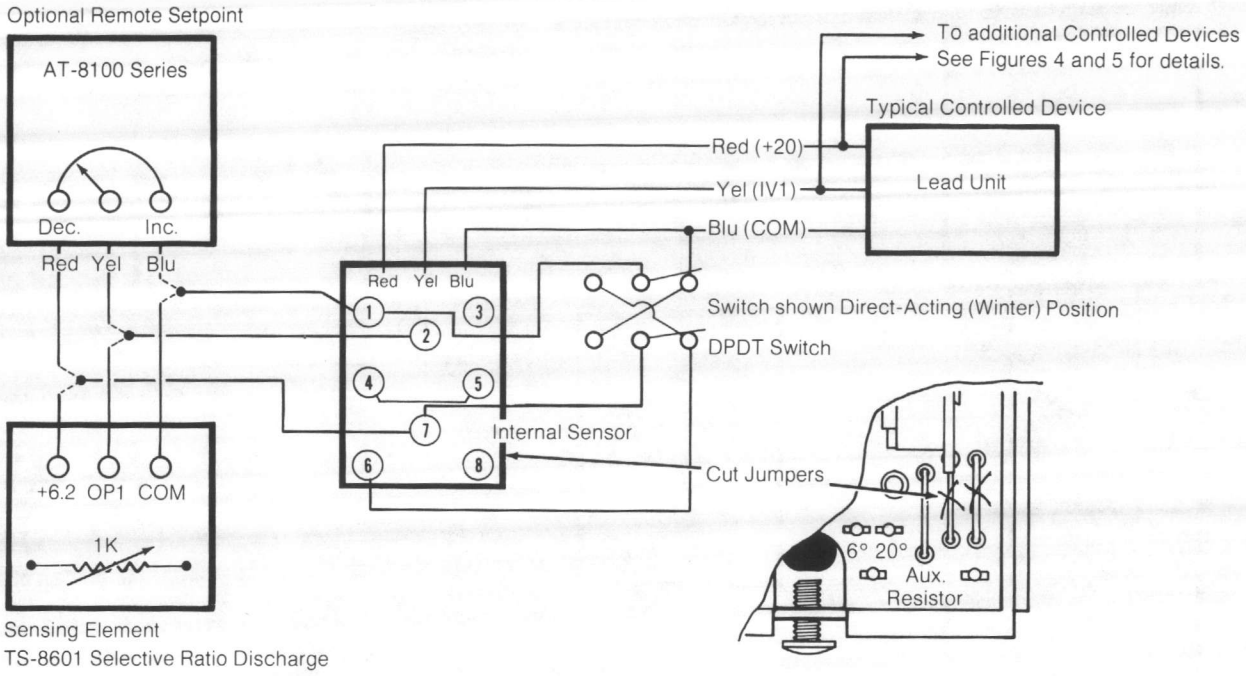
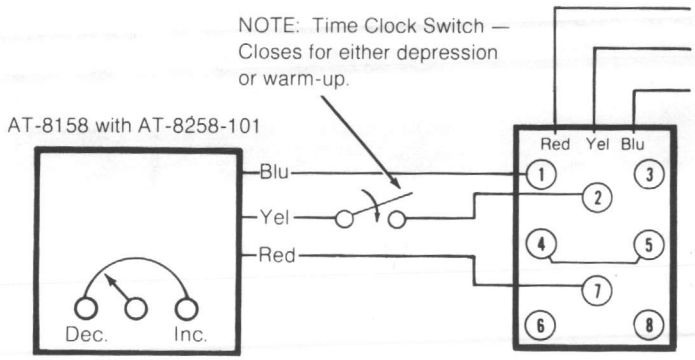
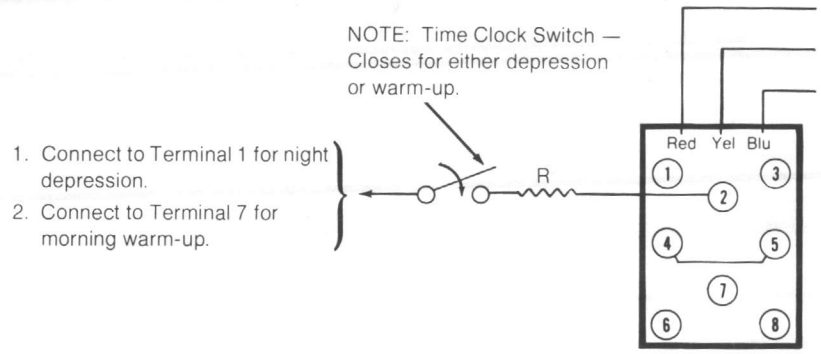


Figure 16
TP-8101, TP-8102 and TP-8103
with Remote Setpoint and/or
Selective Ratio Discharge Sensor
with Double Pole Double Throw (DPDT)
Winter-Summer Switching





RESISTORS		
Degrees	**Resistance**	**B-C Part No.**
5	2.0 MEG, ±5%	CYZR-481-530
10	1.0 MEG, ±1%	CYZR-862-501
15	681K, ±1%, 1/8W	E19-64-481
20	499K, ±1%, 1/8W	CYZR-862-468

Figure 17
TP-8101, TP-8102 and TP-8103
with Night Depression and/or
Morning Warm-Up

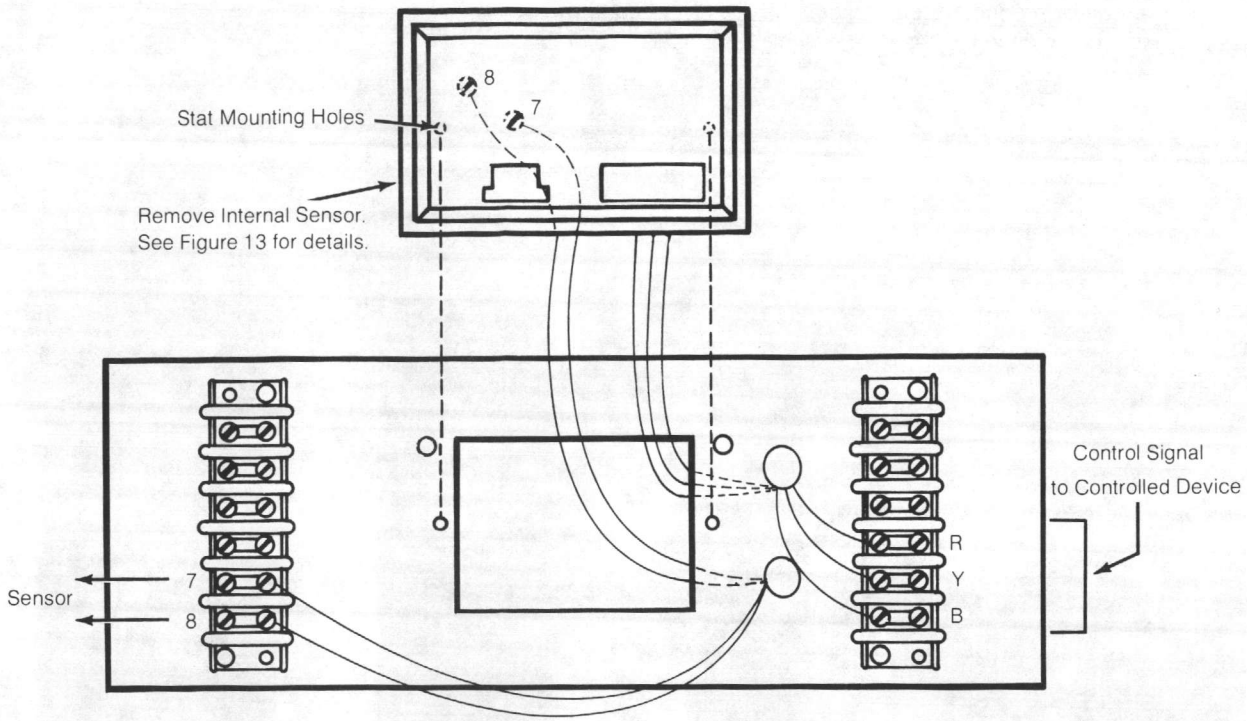
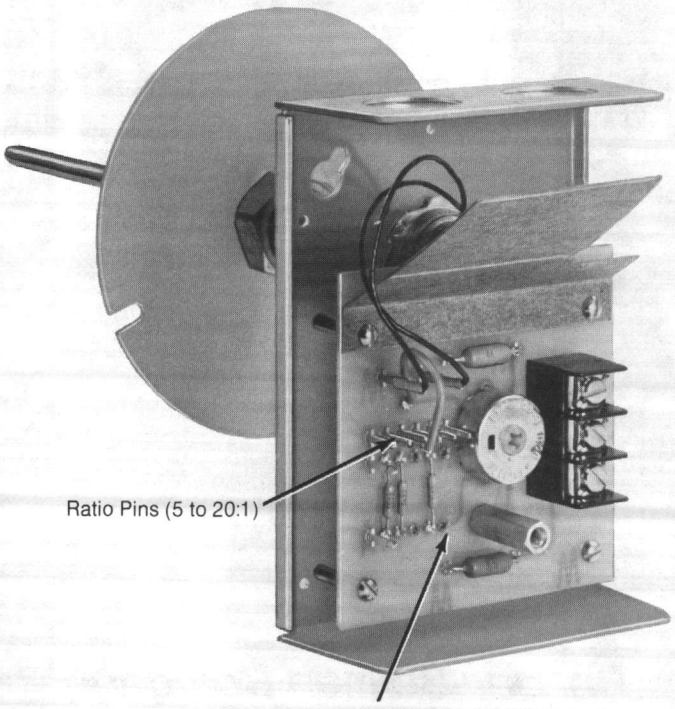


Figure 18
TP-8101, TP-8102 and TP-8103
Mounted on AD-8951



AUXILIARY RESISTORS		
Ratio	**Resistance**	**B-C Part No.**
25:1	59K, ±1%, 1/8W	CYZR-932-66
30:1	71.5K, ±1%, 1/8W	CYZR-868-19
40:1	95.3K, ±1%, 1/8W	E19-29-395
50:1	121K, ±1%, 1/8W	CYZR-788-12

Figure 19
TS-8601 Ratio Discharge Sensor
for use with
TP-8101, TP-8102 and TP-8103

MAINTENANCE

This is a quality product. Regular maintenance of the total system is recommended to assure optimum performance.

Barber-Colman Company
ENVIRONMENTAL CONTROLS DIVISION

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