City of Portland, Maine - Building or Use Permit Application

389 Congress Street, 04101 Tel: (207) 874-8703, Fax: (207) 874-8716

DEPT. OF BUILDING INSPECTION
CITY OF PORTLAND, ME
AUG 8 2005
RECEIVED

Permit No:	Issue Date:	CBL:
05-1046		343 C013001

Location of Construction:	Owner Name:	Owner Address:	Phone:
174 ALLEN AVE	CITY OF PORTLAND	389 CONGRESS ST	
Business Name:	**Contractor Name:**	**Contractor Address:**	**Phone**
	Mechanical Services, Inc	400 Presumpscot St Portland	2077741531
Lessee/Buyer's Name	**Phone:**	**Permit Type:**	**Zone:**
		HVAC	

Past Use:	Proposed Use:	Permit Fee:	Cost of Work:	CEO District:
Commercial/ PATHS	PATHS/ install a Trane Rooftop cooling only w/steam coils	$1,308.00	$143,000.00	5

FIRE DEPT: ☐ Approved ☐ Denied

Signature:

INSPECTION: Use Group: N/A Type: N/A

8/8/05 MECHANICAL

Signature:

Proposed Project Description:

nstall a Trane Rooftop cooling only w/steam coils

PEDESTRIAN ACTIVITIES DISTRICT (P.A.D.)

Action: ☐ Approved ☐ Approved w/Conditions ☐ Denied

Signature: Date:

Permit Taken By:	Date Applied For:
ldobson	08/04/2005

1. This permit application does not preclude the Applicant(s) from meeting applicable State and Federal Rules.
2. Building permits do not include plumbing, septic or electrical work.
3. Building permits are void if work is not started within six (6) months of the date of issuance. False information may invalidate a building permit and stop all work..

Zoning Approval

Special Zone or Reviews	Zoning Appeal	Historic Preservation
☐ Shoreland	☐ Variance	☐ Not in District or Landmark
☐ Wetland	☐ Miscellaneous	☐ Does Not Require Review
☐ Flood Zone	☐ Conditional Use	☐ Requires Review
☐ Subdivision	☐ Interpretation	☐ Approved
☐ Site Plan	☐ Approved	☐ Approved w/Conditions
Maj ☐ Minor ☐ MM ☐	☐ Denied	☐ Denied
Date:	Date:	Date:

PERMIT ISSUED
AUG 10 2005
CITY OF PORTLAND

CERTIFICATION

I hereby certify that I am the owner of record of the named property, or that the proposed work is authorized by the owner of record and that I have been authorized by the owner to make this application as his authorized agent and I agree to conform to all applicable laws of this jurisdiction. In addition, if a permit for work described in the application is issued, I certify that the code official's authorized representative shall have the authority to enter all areas covered by such permit at any reasonable hour to enforce the provision of the code(s) applicable to such permit.

SIGNATURE OF APPLICANT ADDRESS DATE PHONE

RESPONSIBLE PERSON IN CHARGE OF WORK, TITLE DATE PHONE

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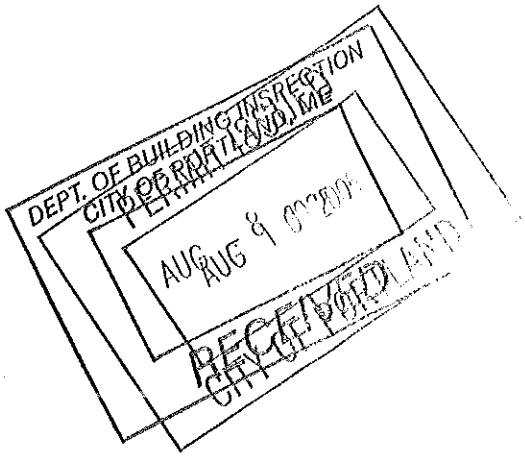
Lessee/Buyer's Name	**Phone:**	**Permit Type:**	
		HVAC	

Proposed Use:	Proposed Project Description:
PATHS/ install a Trane Rooftop cooling only w/steam coils	nstall a Trane Rooftop cooling only w/steam coils

Dept: Building **Status:** Approved with Conditions **Reviewer:** Mike Nugent **Approval Date:** 08/10/2005

Note: **Ok to Issue:** ☑

1) The Design professional must provide Special Inspection Services for the Steel, connections etc.



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INSPECTION:
Use Group: NA Type: NA
8/8/05 MECHANICAL PERMIT

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ldobson	08/04/2005

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SIGNATURE OF APPLICANT ADDRESS DATE PHONE

RESPONSIBLE PERSON IN CHARGE OF WORK, TITLE DATE PHONE

4/13/05
FROM DOUG'S EMAIL

DIVISION 15 MECHANICAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The purpose of this outline specification is to obtain competitive design build quotations from contractors. The contractor shall assume full responsibility for the concept, design, and construction of their proposed system. Contractor shall have design drawings and specifications produced and stamped by a state licensed professional engineer.

B. The contractor shall include, as part of his proposal, a schematic layout of the proposed mechanical system, showing configuration and general parameters for the proposed system. This schematic layout shall be considered by the owner in his final selection of a contractor.

C. The intention of these contract documents is to call for finished work, fully tested and ready for operation. Any components or labor not mentioned in the contract documents but required for functioning systems shall be provided. Should there appear to be any discrepancies or questions of intent, the contractor shall refer the matter to the architect for decision before start of any related work.

D. **The contractor shall include in his proposal, demolition for all existing mechanical equipment currently serving the space, which is not scheduled for re-use. Such equipment shall include but not necessarily be limited to controls, unit ventilators, grilles, piping, heating specialties and hangers. The Portland School Department shall retain the salvage rights on all removed equipment. Coordinate with the owner's representative for turning over the removed items. Specifically, the owner wishes to retain the unit ventilators, metal enclosures at radiation, and intake grilles, intact.**

E. All work, materials, and equipment shall comply with the rules and regulations of all codes and ordinances of the local, state, and federal authorities.

F. All wiring shall be in accordance with the latest issue of the National Electrical Code. Where the edition enforced by the local authority contains more stringent requirements, the more stringent shall apply.

G. All work shall be scheduled and coordinated with the Construction Manager and other contractors to prevent delays to the work.

H. Secure and pay for all permits, fees, licenses, approvals, inspections, etc., required for the work. **The City of Portland will require an HVAC construction permit for this project.**

I. Provide Certificates of Inspection and Approval from all regulatory authorities having jurisdiction.

1.3 DESIGN SPECIFICATION INTENT

A. The purpose of this outline specification is to obtain competitive design-build quotations from qualified contractors. The contractor shall assume full responsibility for the concept, design, and construction of their proposed system.
Contractor shall provide design drawings and specifications produced and sealed by a state of Maine licensed professional engineer with specific experience in the field of Heating, Ventilating and Air Conditioning (HVAC) systems for buildings.

1.4 CODE SUMMARY

A. Building:	International Building Code 2003
B. Mechanical:	As referenced in IBC 2003.
C. Sprinkler:	**Not Applicable, this work shall be by others.**
D. Plumbing:	Not Applicable
E. Ventilation:	ASHRAE 62-2001 – Addendum N
F. Energy:	ASHRAE 90.1-2001
G. Seismic:	Comply with the requirements of IBC 2003

1.5 DESIGN CONDITIONS

A. Winter Outside: -11°F
B. Winter Inside: 72°F
C. Summer **Outside: 83 ° F DB/70° F DB**
D. Summer Inside: 75°F
E. Anticipated building occupancy:

Typical Office	1 Person
Bus. Dir. Office	2 People
Conference Rm #1	16 People
Superintendent's Office	2 People
Open Office Areas	Per Furniture Layout

Actual programming requirements for each space shall be coordinated with the Architect and Owner through the design phase of construction.

1.6 BUILDING ENVELOPE

A. The existing building envelope shall be maintained with respect to walls and windows, unless otherwise noted in the Architectural plans. The walls are uninsulated masonry and the windows are single glazed. The roof will also remain as is, with approximately 1" of fiberboard insulation, a gypsum deck, and a built up membrane. Batt insulation which is currently above the ceiling will be removed and not replaced.

1.7 HEATING, VENTILATING and AIR CONDITIONING SYSTEMS

A. General

1. Ventilating and Air Conditioning: Packaged rooftop HVAC units shall be utilized for ventilation and cooling. The units will incorporate Dx cooling coils. A minimum of four units shall be utilized, separating interior and perimeter zone exposure. Theses units, in general, shall be placed over non-occupied spaces wherever possible, such as corridors to minimize noise transmission to occupied spaces. Additionally, the units shall be placed with one side (minimum) over an existing beam, to minimize structural impact. Coordinate with other trades for roof penetration at the roof deck.
2. Heating: Steam heating coils shall be utilized to provide the main heating duties and shall be served by the existing steam heating plan. Provide all required steam and condensate piping to connect the new equipment to the existing plant.
3. Humidification: None.
4. Dehumidification: **That which is inherent to mechanical cooling.**
5. Overall Building Pressurization: positive.
6. Final Filtration : 30%
7. Max. Acceptable Indoor CO2 level : 850 ppm
8. Max. Acceptable Noise level for occupied spaces: Nc 30.
9. Local exhaust to be provided at all copiers.
10. Ductwork will be furnished installed in accordance with SMACNA requirements. Both the supply and return system shall be ducted-no plenums. Central return locations are acceptable.
11. Insulation shall be provided at all new steam and condensate piping in accordance with ASHRAE 90.1 requirements.
12. Insulation shall be provided at all supply and return ductwork: Supply=2", Return=1 1/2". Provide vapor retarder at all duct insulation.
13. Steam and Condensate return Piping:

    (a) Steam Piping, NPS 2 and Smaller: Schedule 40 steel pipe, with threaded joints using Class 125 cast-iron fittings.

    (b) Steam Piping, NPS 2-1/2 through NPS 12: Schedule 40 steel pipe, with welded joints using Schedule 40 wrought-steel welding fittings and Class 150 wrought-steel flanges.

    (c) Condensate Piping, NPS 2 and Smaller: Schedule 80 steel pipe, with threaded joints using Class 125 malleable-iron fittings.

    (d) Condensate Piping, NPS 2-1/2 through NPS 12: Schedule 80 steel pipe, with welded joints using Schedule 80 wrought-steel welding fittings and Class 150 wrought-steel flanges.

    (e) All piping shall comply with the requirements of ASTM B 16.4.

14. Pipe Hangers:

    (a) Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

(b) The material in contact with the pipe shall be compatible with the piping material so that neither will have a deteriorating action on the other. Provide means of preventing dissimilar metal contact such as plastic coated hangers, copper colored epoxy paint, or non-adhesive isolation tape.

(c) Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems. Field assemble and install according to manufacturer's written instructions.

(d) Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping.

(e) Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

(f) Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

(g) Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

(h) Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.

(i) Install hangers to provide a minimum of 1/2-inch space between finished covering and adjacent work.

(j) Do not support piping from other pipes, ductwork or other equipment that is not building structure.

15. Ductwork shall be supported in accordance with SMACNA standards.

B. Automatic Temperature Controls: A computerized, direct digital control (DDC) will be provided and shall be Seibe, by Maine Controls. This system shall interface seamlessly with the School Departments existing BAS. Provide a local area network connection for communication to the existing system. .
   1. Each packaged HVAC unit shall have factory supplied controls with the following features: heating / cooling set points with an adjustable dead-band, adjustment of the outside air for ventilation control, and economizer controls.
   2. Each air system will have local override capability for off-hours functions. An override button will convert the system to daytime mode for 2-hours (adjustable

time period programmable through the DDC system), with daytime heating / cooling set points.

C. Exhaust
   1. Photocopier areas to be exhausted during occupied hours, energized by the DDC system in accordance with the occupancy schedule of the adjacent air system. Exhaust fans will be ducted to the exterior roof.

END OF DIVISION 15 MECHANICAL

INSTALLER'S GUIDE

CURB-IN-34A
18-HE38D3-3

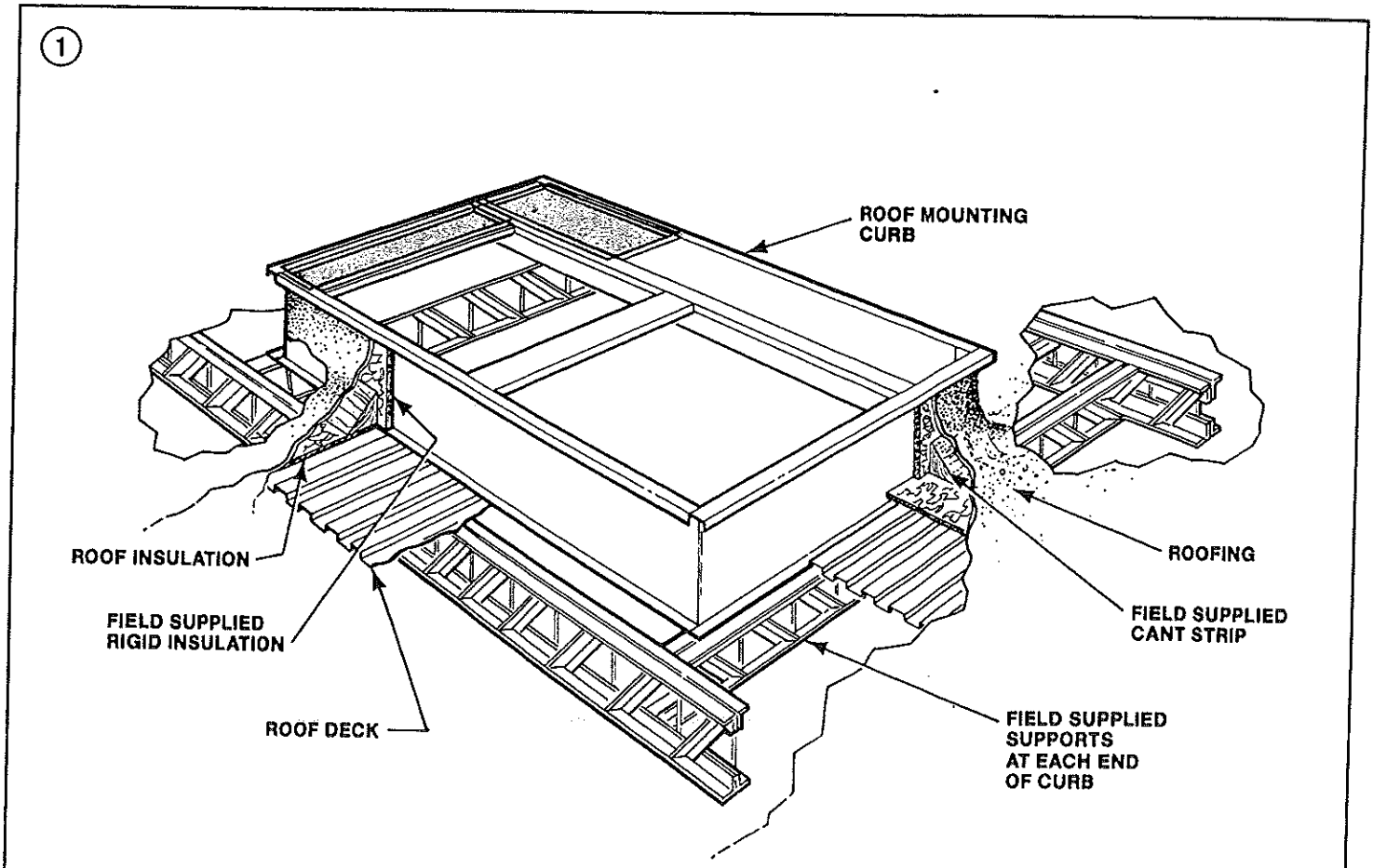
Library	Service Literature
Product Section	Unitary
Product	Unitary Accessory
Model	Roof Curbs, Ducts and Diffusers
Literature Type	Installation
Sequence	34A
Date	February 2001
File No.	SV-UN-ACC-CURB-IN-34A 2/01
Supersedes	CURB-IN-34

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

Model:
BAYCURB034A

Used With:
YCC048F-H,060F
YCP/X048-60G
YCY048-60G
WCP048-60F
WCX/Y048-60G
TCP/X048-60G
TCY048-60G
DCY048-60F
YCZ050-60F
WCZ060F

Full Perimeter Roof Mounting Curb with Insulated Deck Pans



TYPICAL ROOFTOP INSTALLATION

Since the manufacturer has a policy of continuous product and product data improvement, it reserves the right to change design and specification without notice.

ROOF MOUNTING CURB AND SUPPLY/RETURN SIZE REQUIRED AIR OPENING

⚠ CAUTION: The opening must be covered temporarily to prevent anyone or anything from falling thru the opening. Follow this safety precaution when working in other areas of installation, and leaving the job site overnight or for any extended period of time.

1. All duct work must be installed in accordance with the National Fire Protection Association Standards No. 90A and 90B.

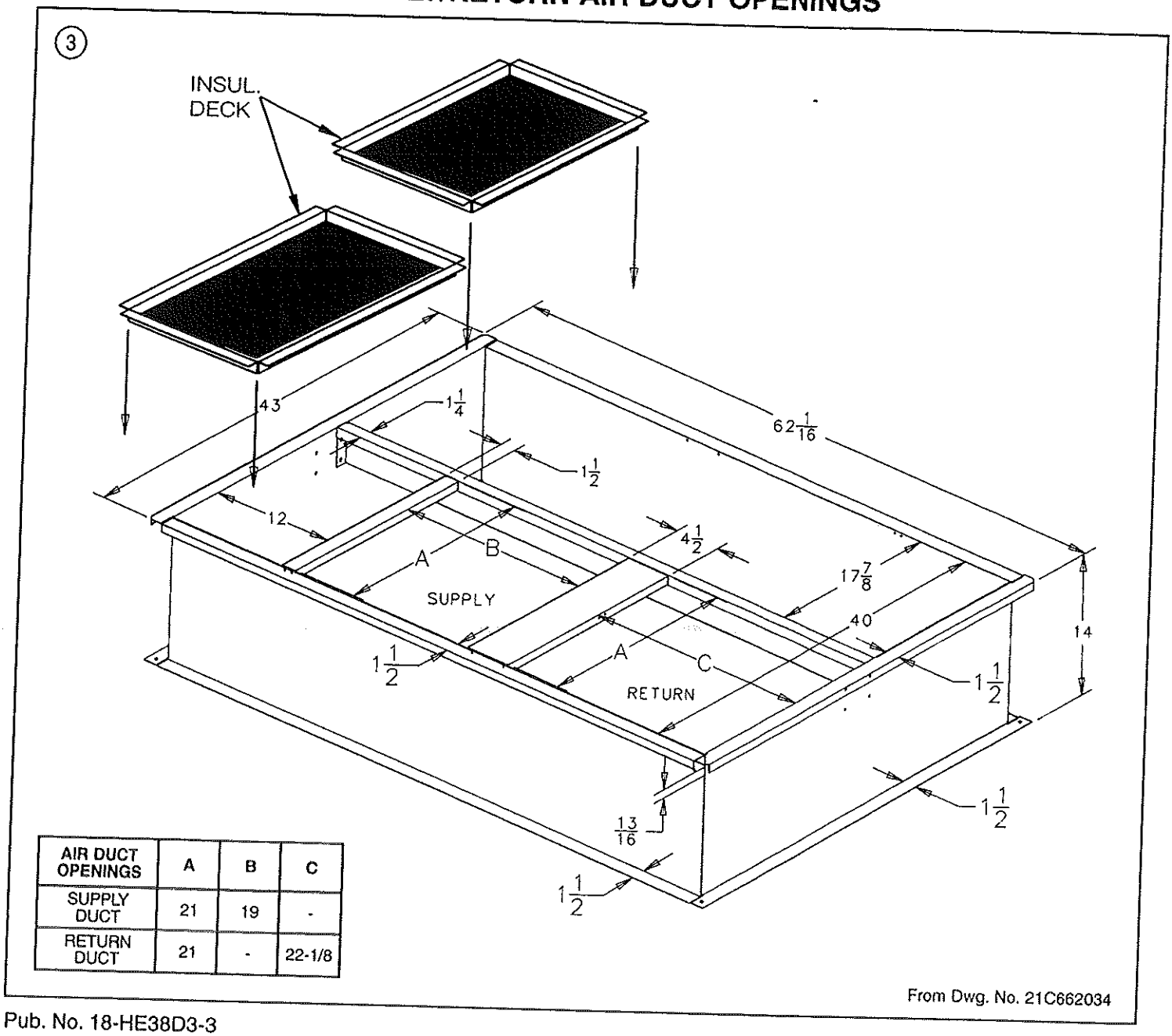
2. Remove only that portion of the roof deck required to permit the installation of field fabricated duct work.

Roof decking remaining beneath unit base pan will reduce sweating on bottom of unit base pan during high humidity conditions.

3. All components for BAYCURB034A are used to assemble roof curb for curb assembly dimensions and models listed in Figure 3.

See Figure 4 for components of curb.

BAYCURB034A ROOF MOUNTING CURB OUTLINE SUPPLY/RETURN AIR DUCT OPENINGS



AIR DUCT OPENINGS	A	B	C
SUPPLY DUCT	21	19	-
RETURN DUCT	21	-	22-1/8

From Dwg. No. 21C662034

ROOF MOUNTING CURB

NOTE: The top of the End Rails, Center Rail, Divider Baffle and Adjustable Duct Flanges must be flush with the top of the Side Rails to insure a good water and air seal against the bottom of the unit. Caulk ends of adjustable duct Flanges and Divider Baffle to prevent air leakage.

5. Secure Mounting Curb assembly to roof structure by welding or bolting.

6. Install flashing and roofing as illustrated in accordance with local codes. A typical section of insulation, roof and mounting curb is shown below.

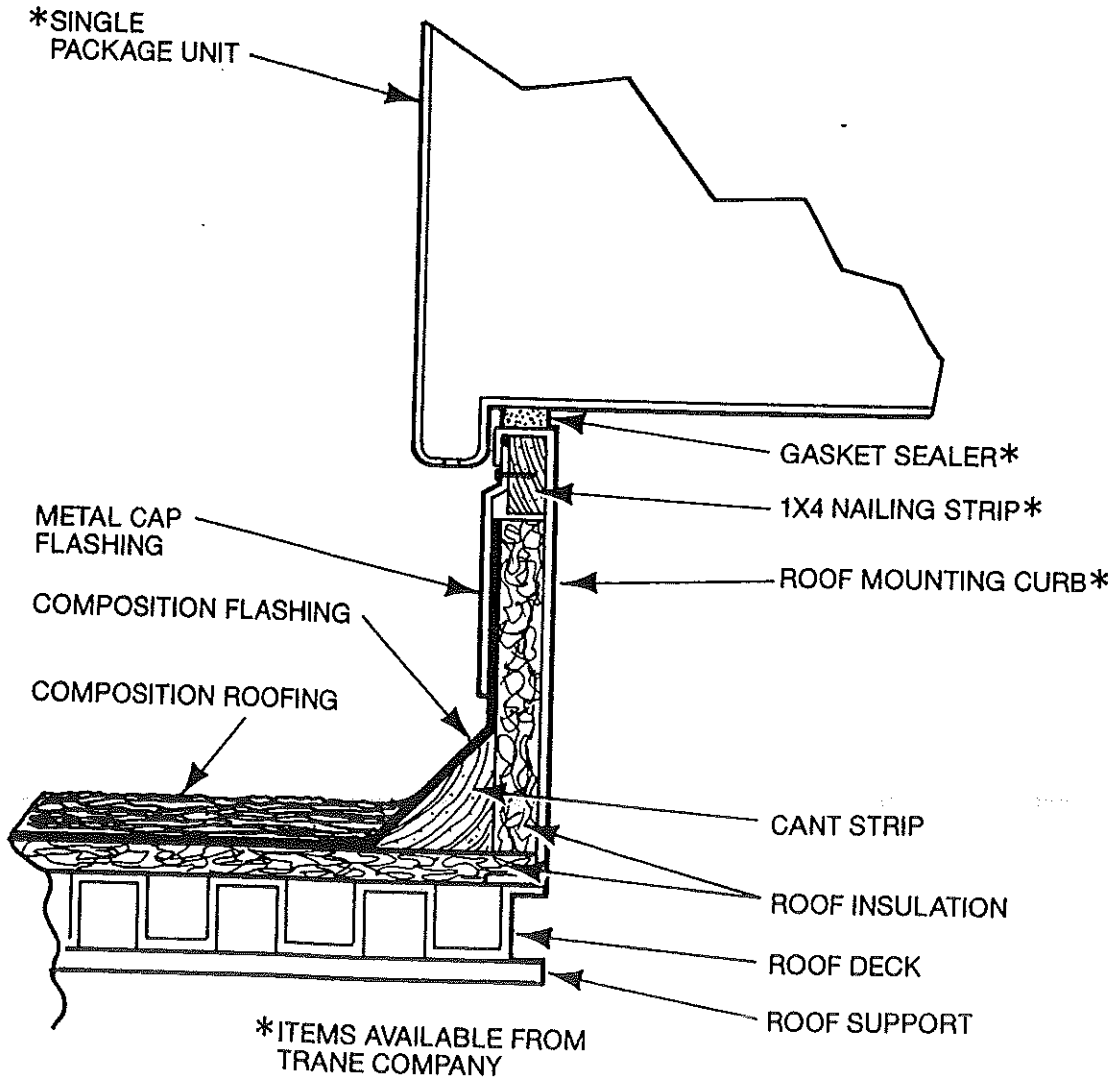
7. Leave the 2 Hold Down Brackets attached to the curb temporarily as they will not be needed until setting the unit.

NOTE: If unit is not ready to be set into position at this time, stop work on mounting curb at this point. When unit is ready to set into position, and just prior to setting unit, complete steps 10 thru 14.

8. Field Fabricated Ducts are to be installed from above mounting curb, they should be installed at this time. See Figures 6 and 7 for installation illustrations.

9. Apply a bead of architectural grade caulking (field supplied) at corners of curb to seal all voids, preventing water leaks.

(5)



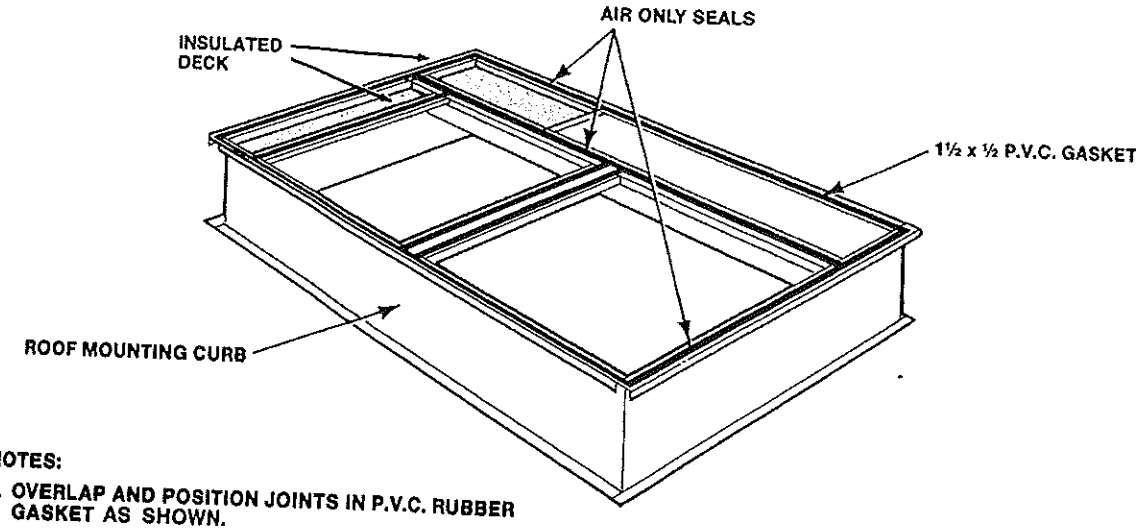
ROOF MOUNTING CURB (CONT.)

P.V.C. RUBBER GASKET
POSITION ON BAYCURB034A FOR UNIT PLACEMENT

1. Install the insulated deck pans on the curb before placing the 1-1/2" x 1/2" P.V.C. rubber tape (gasket) on mounting curb as illustrated. P.V.C. tape to be applied to curb as shown just prior to setting unit on mounting curb.

2. P.V.C. rubber tape (supplied with curb) must be applied in continuous strips of overlapped 1" minimum for complete watertight seal.

(8)



NOTES:

1. OVERLAP AND POSITION JOINTS IN P.V.C. RUBBER GASKET AS SHOWN.
2. AIR SEALS - APPLY P.V.C. RUBBER LAST TO INSURE THERE IS ADEQUATE P.V.C. FOR THE WATER SEAL.
3. USE TYPICAL SEALING METHODS TO PREVENT AIR DUCT LEAKAGE AT CURB-DUCT JOINT.

INSTALLATION OPERATION MAINTENANCE

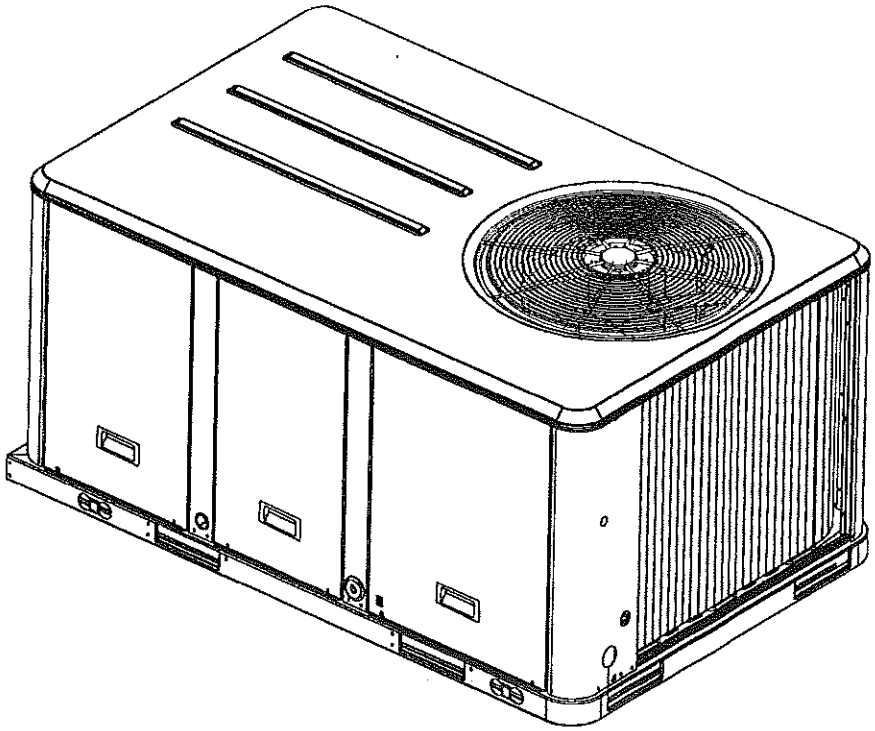
Customer Property — Contains wiring, service, and operation information. Please retain.

T_C-IOM-1B
18-AB60D22-2

Library	Service Literature
Product Section	Unitary
Product	Rooftop AC – Lt. Comm. SZ
Model	T_
Literature Type	Installation/ Oper/ Maint
Sequence	1B
Date	March 2002
File No.	SV-UN-RT-T_C-IOM-1B 3/02
Supersedes	T_C-IOM-1A

Models:
TSC036A - TSC120A
THC036A - THC120A

Packaged Electric/Electric 3 Through 10 Ton



IMPORTANT NOTE: All phases of this installation must comply with the **NATIONAL, STATE & LOCAL CODES.** In addition to local codes, the installation must conform with National Electric Code **-ANSI/NFPA NO. 70 LATEST REVISION.**

Since the manufacturer 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.

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General Information

Literature Change History

T_C-IOM-1B (March 2002)
Added Supply Air Tubing and Smoke Detector information.

T_C-IOM-1A (October 2001)
Added 6 1/4 through 10 Ton models to product offering.

T_C-IOM-1 (May 2001)
Orginal issue 3 through 5 Ton models.

Overview of Manual

Note: One copy of this document ships inside the control panel of each unit and is customer property. It must be retained by the unit's maintenance personnel.

This booklet describes proper installation, operation, and maintenance procedures for air cooled systems. By carefully reviewing the information within this manual and following the instructions, the risk of improper operation and/or component damage will be minimized.

It is important that periodic maintenance be performed to help assure trouble free operation. A maintenance schedule is provided at the end of this manual. Should equipment failure occur, contact a qualified service organization with qualified, experienced HVAC technicians to properly diagnose and repair this equipment.

Note: Do Not release refrigerant to the atmosphere! If adding or removing refrigerant is required, the service technician must comply with all federal, state, and local laws.

Model Number Description

All products are identified by a multiple-character model number that precisely identifies a particular type of unit. An explanation of the alphanumeric identification code is provided below. Its use will enable the owner/operator, installing contractors, and service engineers to define the operation, specific components, and other options for any specific unit.

When ordering replacement parts or requesting service, be sure to refer to the specific model number and serial number printed on the unit nameplate.

General Information

Unit Nomenclature

Digit 1 - Product Type
T = Packaged Cooling

Digit 2 - Unit Efficiency Level
S = Standard
H = High

Digit 3 - Airflow Configuration
C = Convertible

Digit 4, 5, 6 - Cooling Capacity (MBH)
030 = 3 Ton
048 = 4 Ton
060 = 5 Ton
072 = 6 1/4 Ton
090 = 7 1/2 Ton (Single Commpressor)
092 = 7 1/2 Ton (Dual Compressor)
102 = 8 1/2 Ton
120 = 10 Ton

Digit 7 - Major Design Sequence
A

Digit 8 - Electrical Characteristics
1 = 208-230/60/1
3 = 208-230/60/3
4 = 460/60/3
W = 575/60/3

Digit 9 - Unit Control
R = Relia Tel
E = Electro-mechanical

Digit 10 - Heat Capacity
0 = No Heat
A = 5KW
B = 6KW
C = 9KW
D = 10KW
E = 12KW
F = 14KW
G = 18KW
J = 23KW
K = 27KW
N = 36KW
P = 54KW

Digit 11 - Minor Design Sequence
*

Digit 12, 13 - Service Digit Sequence
**

Digit 14 - Factory Installed Options -Fresh Air Section
0 = No Fresh Air
A = Manual OA, 0 - 25%
B = Motorized OA, 0 - 50%
C = Economizer Dry Bulb
D = Economizer with Barometric Relief
E = Economizer, Reference Enthalpy
F = Economizer, Reference Enthalpy, with Barometric Relief
G = Economizer, Comparative Enthalpy
H = Economizer, Comparative Enthalpy, with Barometric Relief

Digit 15 - Factory Installed Options -Supply Fan
0 = Standard Drive
1 = Oversize Motor
2 = Option Belt Drive

Digit 16 - Factory Installed Options -Hinged Service Access
0 = Standard Panels
A = Hinged Service Panels

Digit 17 - Factory Installed Options -Condenser Coil Protection
0 = Standard
1= Hail Guard
2 = Epoxy Coated Condenser Coil
3 = Epoxy Coated Condenser Coil and Hail Guard

Digit 18 - Factory Installed Options -Through The Base
0 = Without Through The Base Connection
A = Through The Base Electrical Connection

Digit 19 - Factory Installed Options -Disconnect Switch/Circuit Breaker
0 = Without Disconnect Switch/Circuit Breaker
1 = Unit Mounted Non-Fused Disconnect Switch
2 = Circuit Breaker

Digit 20 - Factory Installed Options -Convenience Outlet
0 = Without Convenience Outlet
A = Convenience Outlet Powered
B = Convenience Outlet Unpowered

Digit 21 - Factory Installed Options -Communications
0 = Without Communications Options
1 = Trane Communications Interface
2 = Lontalk Communications Interface
3 = Novar Communications Interface

Digit 22 - Factory Installed Options -Refrigeration System
0 = Standard Refrigeration System Option
A = Expansion Valve

Digit 23 - Factory Installed Options -Refrigeration Controls
0 = Without Refrigeration Controls
1 = High Pressure Control
2 = Frostat™
3 = Crankcase Heater
4 = High Pressure Control and Frostat
5 = High Pressure Control and Crankcase Heater
6 = Frostat and Crankcase Heater
7 = High Pressure Control, Frostat and Crankcase Heater

Digit 24 - Factory Installed Options -Smoke Detector
0 = Without Smoke Detector
A = Return Air Smoke Detector
B = Supply Air Smoke Detector
C = Return and Supply Air Smoke Detector

Digit 25 - Factory Installed Options -System Monitoring Controls
0 = Without Monitoring Controls
1 = Clogged Filter Switch
2 = Fan Failure Switch
3 = Air Sensing Tube
4 = Clogged Filter Switch and Fan Failure Switch
5 = Clogged Filter Switch and Discharge Air Sensing Tube
6 = Fan Failure Switch and Discharge Air Sensing Tube
7 = Clogged Filter Switch, Fan Failure Switch and Discharge Air Sensing Tube
8 = Novar Return Air Sensor

General Information

Unit Nameplate

A Mylar unit nameplate is located on the unit's corner support next to the filter access panel. It includes the unit model number, serial number, electrical characteristics, refrigerant charge, as well as other pertinent unit data.

Compressor Nameplate

The nameplate for the compressors are located on the side of the compressor.

Hazard Identification

⚠ WARNING:

Warnings are provided throughout this manual to indicate to installing contractors, operators, and service personnel of potentially hazardous situations which, if not avoided, COULD result in death or serious injury.

⚠ CAUTION:

Cautions are provided throughout this manual to indicate to installing contractors, operators, and service personnel of potentially hazardous situations which, if not avoided, MAY result in minor or moderate injury.

Unit Description

Before shipment, each unit is leak tested, dehydrated, charged with refrigerant and compressor oil, and run tested for proper control operation.

The condenser coils are aluminum fin, mechanically bonded to copper tubing.

Direct-drive, vertical discharge condenser fans are provided with built-in thermal overload protection.

There are two control systems offered for these units.

The electro mechanical control option uses a thermostat to perform unit functions.

The ReliaTel™ Control Module is a microelectronic control system that is referred to as "Refrigeration Module" (RTRM). The acronym RTRM is used extensively throughout this document when referring to the control system network.

These modules through Proportional/Integral control algorithms perform specific unit functions that govems unit operation in response to; zone temperature, supply air temperature, and/or humidity conditions depending on the application. The stages of capacity control for these units are achieved by starting and stopping the compressors.

The RTRM is mounted in the control panel and is factory wired to the respective internal components. The RTRM receives and interprets information from other unit modules, sensors, remote panels, and customer binary contacts to satisfy the applicable request for cooling.

Economizer Control Actuator (Optional)

Electro Mechanical Control
The ECA monitors the mixed air temperature, ambient dry bulb temperature and local minimum position setpoint sensors, if selected, to control dampers to an accuracy of +/- 5% of stroke. The actuator is spring returned to the closed position any time that power is lost to the unit. It is capable of delivering up to 25 inch pounds of torque and is powered by 24 VAC.

ReliaTel™ Control

The ECA monitors the mixed air temperature, return air temperature, minimum position setpoint (local or remote), power exhaust setpoint, CO2 setpoint, CO2, and ambient dry bulb/ enthalpy sensor or comparative humidity (return air humidity against ambient humidity) sensors, if selected, to control dampers to an accuracy of +/- 5% of stroke. The actuator is spring returned to the closed position any time that power is lost to the unit. It is capable of delivering up to 25 inch pounds of torque and is powered by 24 VAC.

RTCI -- ReliaTel™ Trane Communication Interface (Optional)

This module is used when the application calls for an ICS™ building management type control system. It allows the control and monitoring of the system through an ICS panel. The module can be ordered from the factory or ordered as a kit to be field installed. Follow the installation instruction that ships with each kit when field installation is necessary.

RLCI - ReliaTel™ LonTalk Communication Interface (Optional)

This module is used when the application calls for an ICS™ building management type control system that is LonTalk. It allows the control and monitoring of the system through an ICS panel. The module can be ordered from the factory or ordered as a kit to be field installed. Follow the installation instruction that ships with each kit when field installation is necessary.

RTOM – ReliaTel™ Options Module (Optional)

The RTOM monitors the supply fan proving, clogged filter, supply air temperature, exhaust fan setpoint, supply air tempering, Frostat™ and smoke detector. Refer to system input devices and functions for operation.

System Input Devices & Functions

The RTRM must have a zone sensor or thermostat input in order to operate the unit. The flexibility of having several mode capabilities depends upon the type of zone sensor or thermostat selected to interface with the RTRM.

The descriptions of the following basic Input Devices used within the RTRM network are to acquaint the operator with their function as they interface with the various modules. Refer to the unit's electrical schematic for the specific module connections.

The following controls are available from the factory for field installation.

Supply Fan Failure Input (Optional)
The Fan Failure Switch can be connected to sense indoor fan operation:

FFS (Fan Failure Switch) If air flow through the unit is not proven by the differential pressure switch connected to the RTOM (factory set point 0.07 " w.c.) within 40 seconds nominally, the RTRM will shut off all mechanical operations, lock the system out, send a diagnostic to ICS, and the SERVICE output will flash. The system will remain locked out until a reset is initiated either manually or through ICS.

Clogged Filter Switch (Optional)
The unit mounted clogged filter switch monitors the pressure differential across the return air filters. It is mounted in the filter section and is connected to the RTOM. A diagnostic SERVICE signal is sent to the remote panel if the pressure differential across the filters is at least 0.5" w.c. The contacts will automatically open when the pressure differential across the filters decreases to approximately 0.4" w.c. The clogged filter output is energized when the supply fan is operating and the clogged filter switch has been closed for at least 2 minutes. The system will continue to operate regardless of the status of the filter switch.

Compressor Disable (CPR1/2)
This input incorporates the low pressure control (LPC) of each refrigeration circuit and can be activated by opening a field supplied contact installed on the LTB.

If this circuit is open before the compressor is started, the compressor will not be allowed to operate. Anytime this circuit is opened for 1 continuous second during compressor operation, the compressor for that circuit is immediately turned "Off". The compressor will not be allowed to restart for a minimum of 3 minutes should the contacts close.

If four consecutive open conditions occur during the first three minutes of operation, the compressor for that circuit will be locked out, a diagnostic communicated to the remote panel (if installed), and a manual reset will be required to restart the compressor.

Low Pressure Control

ReliaTel Control
When the LPC is opened for 1 continuous second, the compressor for that circuit is turned off immediately. The compressor will not be allowed to restart for a minimum of 3 minutes.

If four consecutive open conditions occur during the first three minutes of operation, the compressor will be locked out, a diagnostic communicated to ICS™ if applicable, and a manual reset will be required to restart the compressor.

Electromechanical Control
When the LPC is opened, the compressor for that circuit is turned off immediately. The compressor will restart when the LPC closes.

High Pressure Control (Optional)
ReliaTel Control
The high pressure controls are wired in series between the compressor outputs on the RTRM and the compressor contactor coils. If the high pressure control switch opens, the RTRM senses a lack of current while calling for cooling and locks the compressor out.

On dual circuit units, if the high pressure control opens, the compressor on the affected circuit is locked out. A manual reset for the affected circuit is required.

Electromechanical Control
When the HPC is opened, the compressor for that circuit is turned off immediately. The compressor will restart when the HPC closes.

Power Exhaust Control (Optional)
The power exhaust fan is started whenever the position of the economizer dampers meets or exceed the power exhaust setpoint when the indoor fan is on.

The setpoint panel is located in the return air section and is factory set at 25%.

Electromechanical Control
The power exhaust fan is started whenever the indoor fan is on.

Lead/Lag Control (Dual Circuit Only)
ReliaTel Control Only
Lead/Lag is a selectable input located on the RTRM. The RTRM is configured from the factory with the Lead/Lag control disabled. To activate the Lead/Lag function, simply cut the wire connected to J3-8 at the RTRM. When it is activated, each time the designated lead compressor is shut off due to the load being satisfied, the lead compressor or refrigeration circuit switches. When the RTRM is powered up, i.e. after a power failure, the control will default to the number one circuit compressor.

Zone Sensor Module (ZSM) (BAYSENS006B)
This electronic sensor features three system switch settings (Heat, Cool, and Off) and two fan settings (On and Auto). It is a manual changeover control with single setpoint. (Cooling Setpoint Only)

Zone Sensor Module (ZSM) (BAYSENS008B)
This electronic sensor features four system switch settings (Heat, Cool, Auto, and Off) and two fan settings (On and Auto). It is a manual or auto changeover control with dual setpoint capability. It can be used with a remote zone temperature sensor BAYSENS017B.

Zone Sensor (BAYSENS010B)
This electronic sensor features four system switch settings (Heat, Cool, Auto, and Off) and two fan settings (On and Auto) with four system status LED's. It is a manual or auto changeover control with dual setpoint capability. It can be used with a remote zone temperature sensor BAYSENS017B.

Programmable Zone Sensor - BAYSENS019B
This 7 day programmable sensor features 2, 3 or 4 periods for Occupied or Unoccupied programming per day. If the power is interrupted, the program is retained in permanent memory. If power is off for an extended period of time, only the clock and day may have to be reset.

The Zone Sensor allows selection of 2, 3 or 4 system modes (Heat, Cool, Auto, and Off), two fan modes (On and Auto). It has dual temperature selection with programmable start time capability.

General Information

The occupied cooling set point ranges between 45 and 98 degrees Fahrenheit. The heating set point ranges between 43 and 96 degrees Fahrenheit.

A liquid crystal display (LCD) displays zone temperature, temperature set points, day of the week, time, and operational mode symbols.

The Option Menu is used to enable or disable applicable functions, i.e.; Morning Warm-up, Economizer minimum position override during unoccupied status, Fahrenheit or Centigrade, Supply air tempering, Remote zone temperature sensor, 12/24 hour time display, Smart fan, and Computed recovery.

During an occupied period, an auxiliary relay rated for 1.25 amps @ 30 volts AC with one set of single pole double throw contacts is activated. Electronic Timeclock (BAYCLCK001A) This electronic timeclock is designed to control the occupied/unoccupied switching of up to four rooftop units. Once the unit(s) has entered an unoccupied status, night setback temperatures can be controlled by utilizing a standard zone sensor wired to the RTRM. The timeclock contains four binary outputs (RE1, RE2, RE3, RE4), a liquid crystal display (LCD), and four programming Keys (Time/Day Key, Occupied/Unoccupied Program Key, Run Key, and an Advance/Override Key). A 18 to 30 VAC power source is required either from one of the units being controlled or from a separate class 2 power source.

Status Inputs (4 Wires Optional)
The ZSM can be wired to receive four (4) operating status signals from the RTRM (HEAT, COOL, SYSTEM "ON", SERVICE).
Four (4) wires from the RTRM should be connected to the appropriate terminals (7, 8, 9 & 10) on the ZSM.

Remote Zone Sensor (BAYSENS013B)
This electronic sensor features remote zone sensing and timed override with override cancellation. It is used with a Trane Integrated Comfort™ building management system.

Remote Zone Sensor (BAYSENS014B)
This electronic sensor features single setpoint capability and timed override with override cancellation. It is used with a Trane Integrated Comfort™ building management system.

Remote Zone Sensor (BAYSENS016A)
This bullet type temperature sensor can be used for; outside air (ambient) sensing, return air temperature sensing, supply air temperature sensing, remote temperature sensing (uncovered. Wiring procedures vary according to the particular application and equipment involved. Refer to the unit's wiring diagrams for proper connections.

Remote Zone Sensor (BAYSENS017B)
This electronic sensor can be used with BAYSENS006B, 008B, 010B, 019B Remote Panels. When this sensor is wired to a BAYSENS019B Remote Panel, wiring must be 18 AWG Shielded Twisted Pair (Belden 8760 or equivalent). Refer to the specific Remote Panel for wiring details.

Electro Mechanical Control
The unit must have a Thermostat to operate.

BAYSTAT036A
Single Stage - 1 Heat/1 Cool

BAYSTAT037A
Multi Stage - 2 Heat/2 Cool - Can be Used for Economizer Operation

BAYSENS025A Remote sensor for BAYSTAT036A, 037A.

High Temperature Sensor (BAYFRST001A)
This sensor connects to the RTRM Emergency Stop Input on the LTB and provides high limit "shutdown" of the unit. The sensor is used to detect high temperatures due to fire in the air conditioning or ventilation ducts. The sensor is designed to mount directly to the sheet metal duct. Each kit contains two sensors. The return air duct sensor (X1310004001) is set to open at 135°F. The supply air duct sensor (X1310004002) is set to open at 240°F. The control can be reset after the temperature has been lowered approximately 25°F below the cutout setpoint.

Evaporator Frost Control (ReliaTel™ Option)
This input incorporates the Frostat™ control (FOS) mounted in the indoor coil and can be activated by closing a field supplied contact installed in parallel with the FOS.

If this circuit is open before the compressor is started, the compressor will not be allowed to operate. Anytime this circuit is opened for 5 continuous seconds during compressor operation, the compressor for that circuit is immediately turned "Off". The compressor will not be allowed to restart for a minimum of 3 minutes should the FOS close.

(Electro Mechanical Option)
This input incorporates the Frostat™ control (FOS)mounted in the indoor coil and can be activated by opening a field supplied contact installed in series with the FOS.

If this circuit is open before the compressor is started, the compressor will not be allowed to operate. Anytime this circuit is opened during compressor operation, the compressor for that circuit is immediately turned "Off". The compressor will restart when the FOS closes.

Smoke Detector Sensor (Optional)
This sensor is only applicable on units equipped with a RTOM. It provides high limit "shutdown" of the unit and requires a manual reset. The sensor is used to detect smoke due to fire in the air conditioning or ventilation ducts.

Important: The supply and return air smoke detectors are designed to shut off the unit if smoke is sensed in the supply air stream or return air stream. This function is performed by sampling the airflow entering the unit at the return air opening. Follow the instructions provided below to assure that the airflow through the unit is sufficient for adequate sampling. Failure to follow these instructions will prevent the smoke detectors from performing it's design function.

Important: Airflow through the unit is affected by the amount of dirt and debris accumulated on the indoor coil and filters. To insure that airflow through the unit is adequate for proper sampling by the return air smoke detector, complete adherence to the maintenance procedures, including recommended intervals between filter changes, and coil cleaning is required.

Pre-Installation Checklist

Important: Periodic checks and maintenance procedures must be performed on the smoke detector to insure that it will function properly. For detailed instructions concerning these checks and procedures, refer to the appropriate section(s) of the smoke detector Installation and Maintenance Instructions provided with the literature package for this unit.

In order for the supply air smoke detector or return air smoke detector to properly sense smoke in the supply air stream or return air stream, the air velocity entering the smoke detector unit must be between 500 and 4000 feet per minute. Equipment covered in this manual will develop an airflow velocity that falls within these limits over the entire airflow range specified in the evaporator fan performance tables.

There are certain models, however, if operated at low airflow, will not develop an airflow velocity that falls within the required 500 to 4000 feet per minute range. For these models, the design airflow shall be greater than or equal to 1000 feet per minute **MINIMUM.**

Unit Inspection

As soon as the unit arrives at the job site

[ ] Verify that the nameplate data matches the data on the sales order and bill of lading (including electrical data).

[ ] Verify that the power supply complies with the unit nameplate specifications.

[ ] Visually inspect the exterior of the unit, including the roof, for signs of shipping damage.

⚠ WARNING:
PRODUCT CONTAINS FIBERGLASS WOOL!

Disturbing the insulation in this product during installation, maintenance or repair will expose you to airborne particles of glass wool fibers and ceramic fibers known to the state of California to cause cancer through inhalation. Glasswool fibers may also cause respiratory, skin or eye irritation.

Precautionary Measures

- **Avoid breathing fiberglass dust.**
- **Use a NIOSH approved dust/mist respirator.**
- **Avoid contact with the skin or eyes. Wear long-sleeved, loose-fitting clothing, gloves, and eye protection.**
- **Wash clothes separately from other clothing: rinse washer thoroughly.**
- **Operations such as sawing, blowing, tear-out, and spraying may generate fiber concentrations requiring additional respiratory protection. Use the appropriate NIOSH approved respiration in these situations.**

First Aid Measures

Eye Contact - Flush eyes with water to remove dust. If symptoms persist, seek medical attention.

Skin Contact - Wash affected areas gently with soap and warm water after handling.

If the job site inspection of the unit reveals damage or material shortages, file a claim with the carrier immediately. Specify the type and extent of the damage on the "bill of lading" before signing.

[ ] Visually inspect the internal components for shipping damage as soon as possible after delivery and before it is stored. Do not walk on the sheet metal base pans.

[ ] If concealed damage is discovered, notify the carrier's terminal of damage immediately by phone and by mail. Concealed damage must be reported within 15 days.

Request an immediate joint inspection of the damage by the carrier and the consignee. Do not remove damaged material from the receiving location. Take photos of the damage, if possible. The owner must provide reasonable evidence that the damage did not occur after delivery.

[ ] Notify the appropriate sales representative before installing or repairing a damaged unit.

Storage

Take precautions to prevent condensate from forming inside the unit's electrical compartments and motors if:

a. the unit is stored before it is installed; or,

b. the unit is set on the roof curb, and temporary heat is provided in the building. Isolate all side panel service entrances and base pan openings (e.g., conduit holes, S/A and R/A openings, and flue openings) from the ambient air until the unit is ready for start-up.

Note: Do not use the unit's heater for temporary heat without first completing the start-up procedure detailed under "Starting the Unit".

The manufacturer will not assume any responsibility for equipment damage resulting from condensate accumulation on the unit's electrical and/or mechanical components.

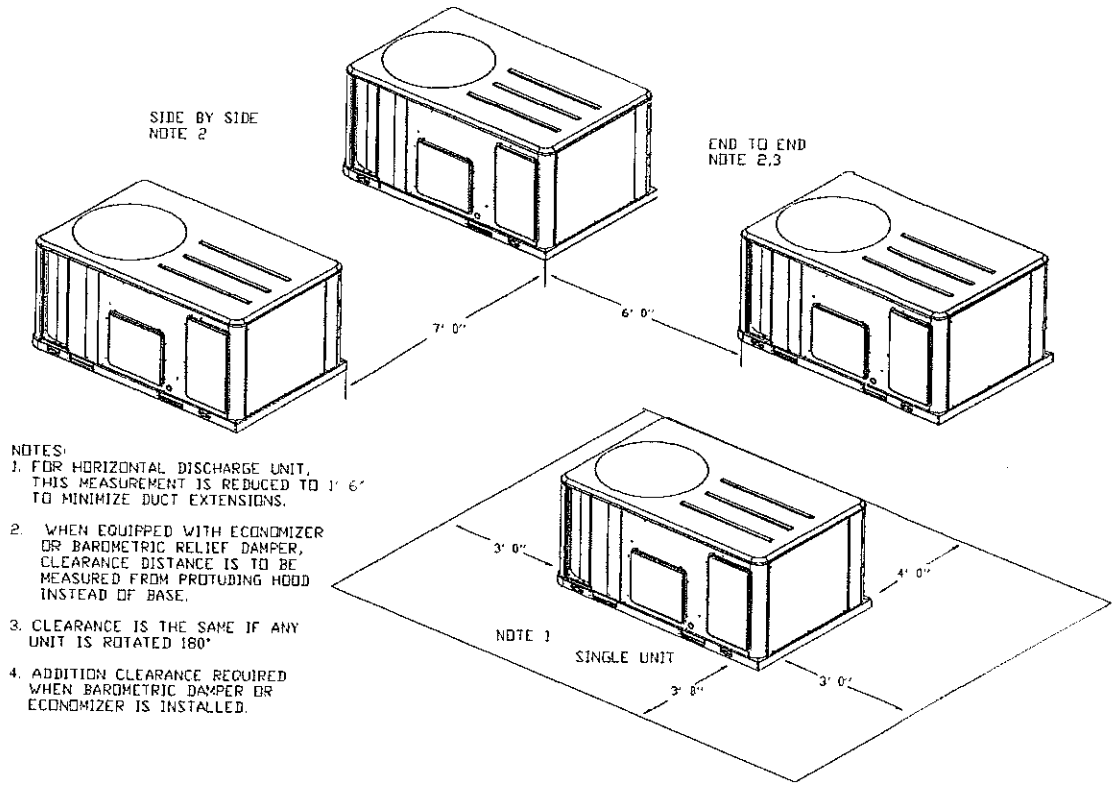
Unit Clearances
Figure 1 illustrates the minimum operating and service clearances for either a single or multiple unit installation. These clearances are the minimum distances necessary to assure adequate serviceability, cataloged unit capacity, and peak operating efficiency.

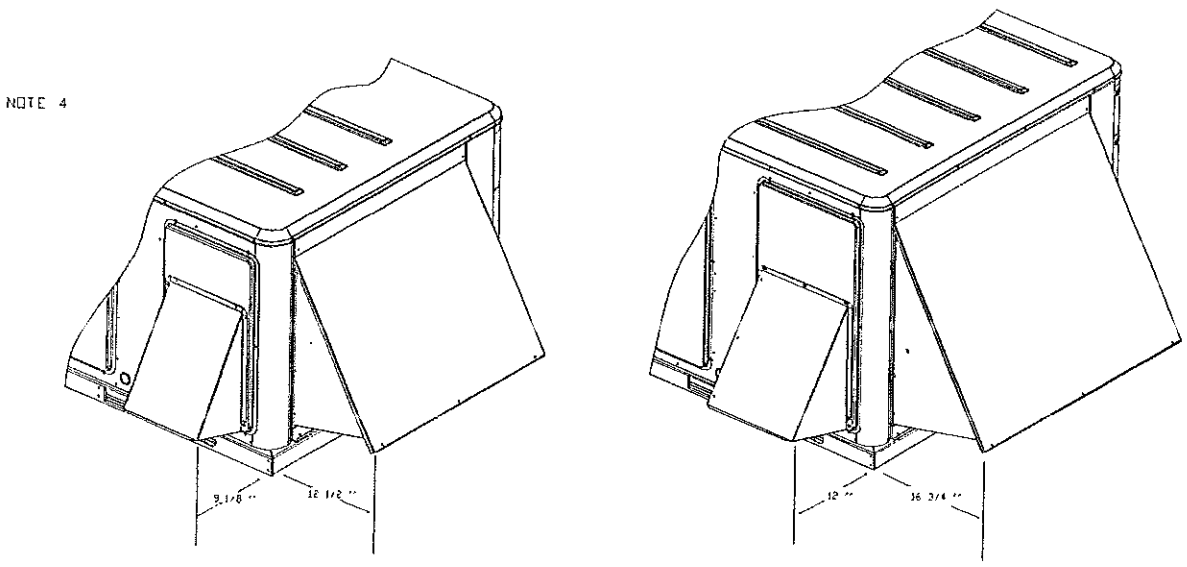
Providing less than the recommended clearances may result in condenser coil starvation, "short-circuiting" of exhaust and economizer airflows, or recirculation of hot condenser air.

Unit Clearances

Figure 1

Typical Installation Clearances for Single & Multiple Unit Applications



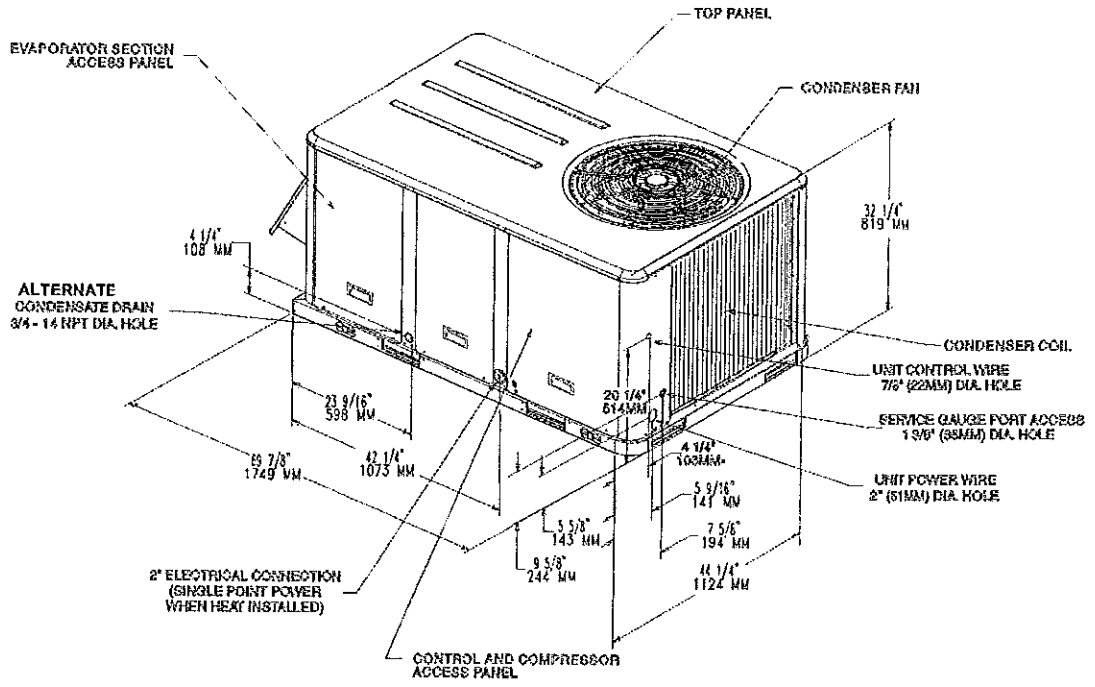


'036 THROUGH 060 UNITS'

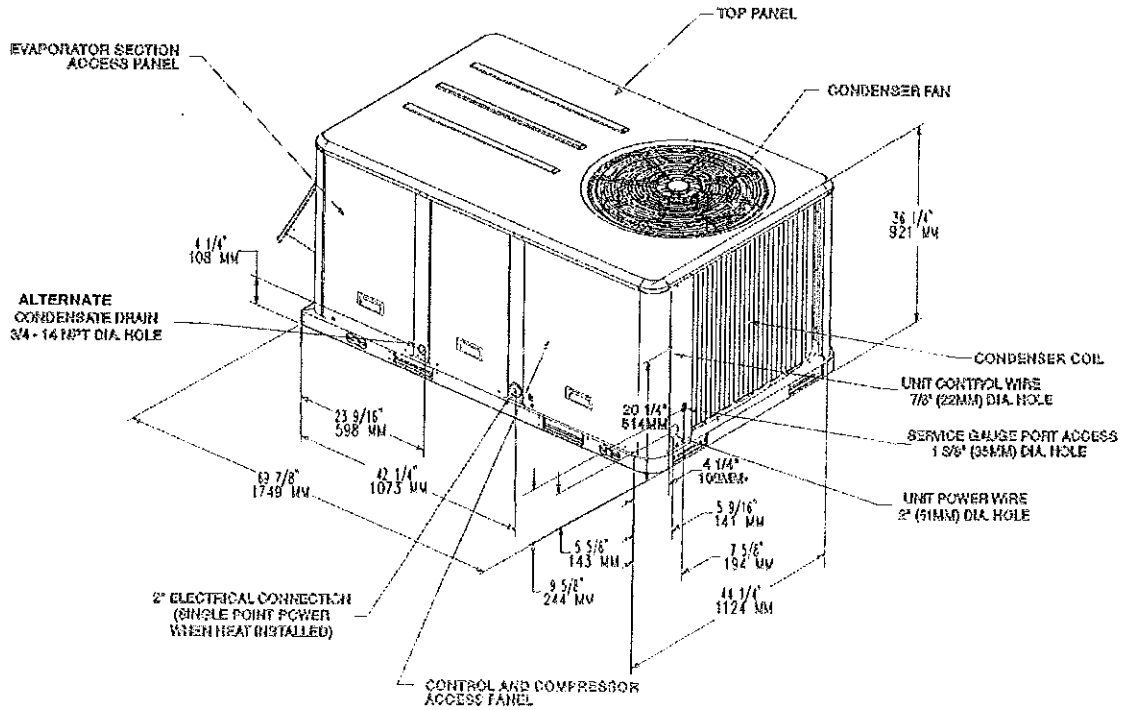
'072 THROUGH 120 UNITS'

Unit Dimensions

Figure 2
Unit Dimensional Data
T(H/S)C036A, T(H/S)C048A
TSC060A



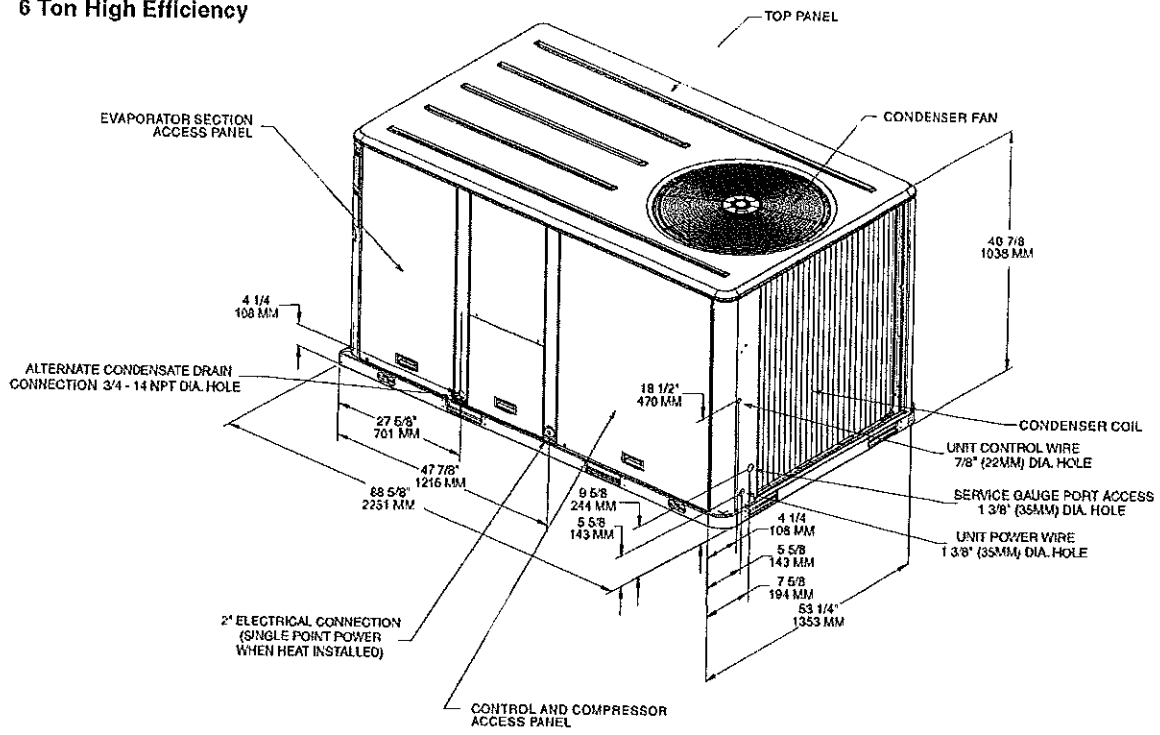
Unit Dimensional Data
THC060A



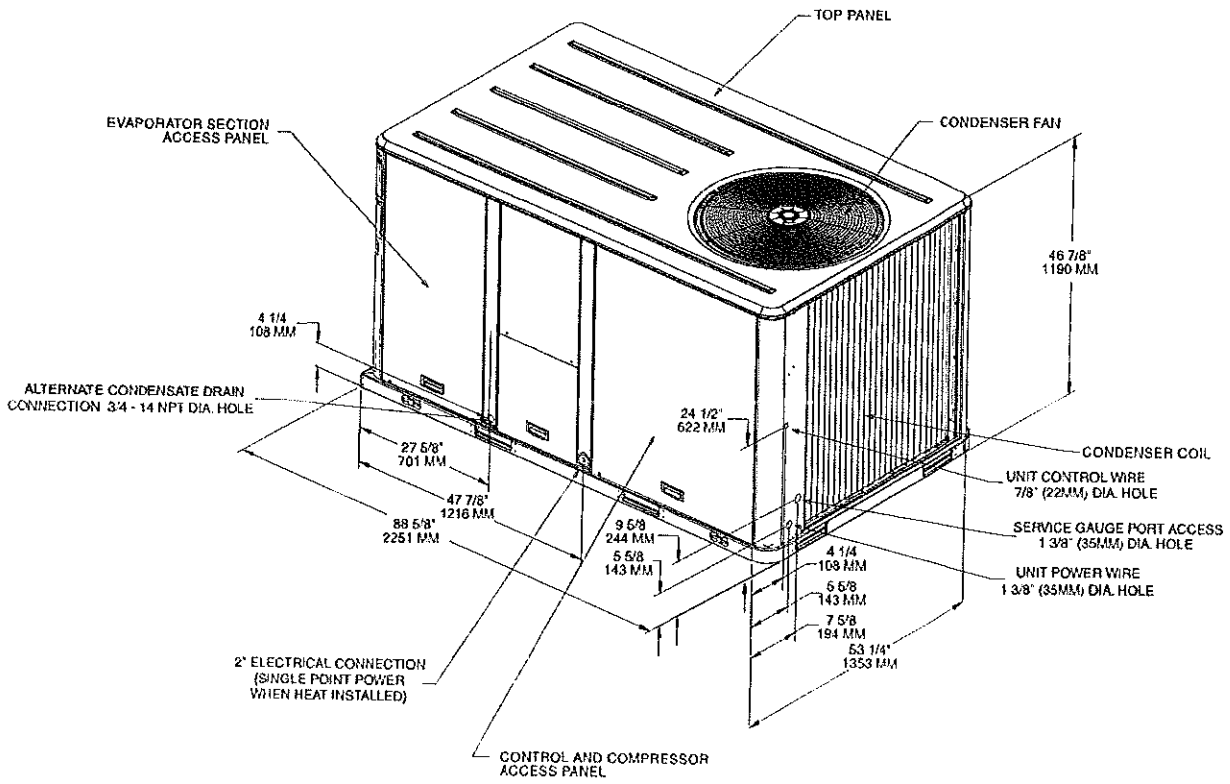
Unit Dimensions

Figure 2 - Continued

Unit Dimensional Data
T(H/S)C072A, TSC090A, TSC092A
6 Ton High Efficiency



Unit Dimensional Data
THC092A, T(H/S)C102A, T(H/S)C120A



Installation

Table 1
Typical Unit Weights & Point Loading Data

Unit Model	Net Weight	Corner Wt. (lbs)				Center of Gravity (in.)	
		A	B	C	D	Length	Width
TSC036A1*	409	132	104	79	94	31	19
TSC036A(3,4,W)*	409	132	104	79	94	31	19
TSC048A1*	434	140	110	91	94	32	19
TSC048A(3,4,W)*	421	135	109	90	88	33	19
TSC060A1*	451	149	114	88	99	31	18
TSC060A(3,4,W)*	451	149	114	88	99	31	18
TSC072A(3,4,W)*	681	236	177	119	150	38	21
TSC090A(3,4,W)*	754	257	188	129	180	37	22
TSC092A(3,4,W)*	756	261	202	131	162	39	21
TSC102A(3,4,W)*	835	281	223	149	181	40	21
TSC120A(3,4,W)*	909	306	241	164	197	40	21
THC036A1*	426	139	108	84	95	32	19
THC036A(3,4,W)*	426	139	108	84	95	32	19
THC048A1*	468	146	113	97	111	31	20
THC048A(3,4,W)*	468	146	113	97	111	31	20
THC060A1*	518	165	124	105	124	31	19
THC060A(3,4,W)*	506	164	121	100	122	31	19
THC072A(3,4,W)*	718	235	182	128	173	38	22
THC092A(3,4,W)*	857	289	222	148	197	38	21
THC102A(3,4,W)*	893	294	233	159	207	39	22
THC120A(3,4,W)*	982	323	253	178	229	39	22

⚠ WARNING:

LIFTING AND MOVING INSTRUCTIONS!

DO NOT USE CABLES (CHAINS OR SLINGS) EXCEPT AS SHOWN. OTHER LIFTING ARRANGEMENTS MAY CAUSE EQUIPMENT DAMAGE OR SERIOUS PERSONAL INJURY.

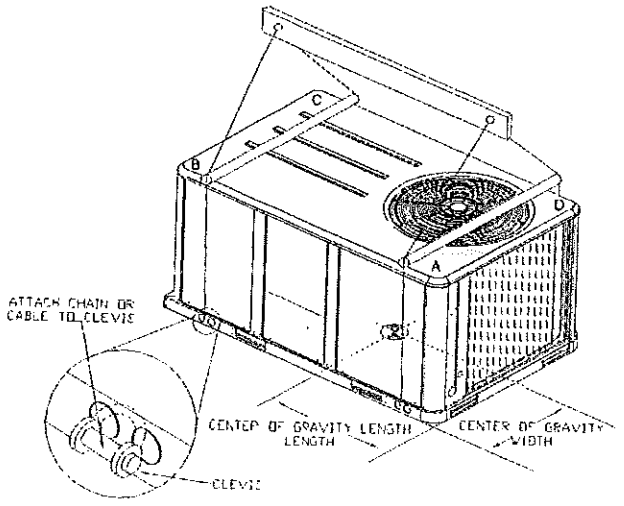
EACH OF THE CABLES (CHAINS OR SLINGS) USED TO LIFT UNIT MUST BE CAPABLE OF SUPPORTING THE ENTIRE WEIGHT OF THE UNIT.

LIFTING CHAINS (CABLES OR SLINGS) MAY NOT BE THE SAME LENGTH. ADJUST AS NECESSARY FOR EVEN LEVEL LIFT.

USE SPREADER BARS AS SHOWN IN DIAGRAM. REFER TO TABLE 1 FOR UNIT WEIGHT.

Option / Accessory Description	Weight - Net lbs	
	TH/TS036-060	TH/TS072-120
Economizer	26	36
Motorized Damper	20	30
Manual Damper	16	26
Barometric Relief	7	10
Power Exhaust	N/A	80
Oversize Motor	5	8
Belt Drive Motor (3 phase only)	31	Standard
Hinged Access	10	12
Hail Guard	12	20
Through the Base: Electrical	8	13
Electric Heat	15	15
Unit Disconnect Switch	5	5
Unit Circuit Breaker	5	5
Conv. Outlet: Unpowered	2	2
Conv. Outlet: Powered	38	38
TCI, LCI	1	1
NOVAR	8	8
HPC	1	1
Frostat	1	1
Crankcase Heater	1	1
Smoke Detector, Return	7	7
Smoke Detector, Supply	5	5
Clogged Filter Switch	1	1
Fan Fail Switch	1	1
Discharge Air Tube	3	3
Roofcurb	70	115
All Zone Sensors	3	1
Hard Start Kit	3	N/A

Figure 3
Rigging and Center-of-Gravity Data



Installation

Foundation

Horizontal Units

If the unit is installed at ground level, elevate it above the snow line. Provide concrete footings at each support location with a "full perimeter" support structure or a slab foundation for support. Refer to Table 1 for the unit's operating and point loading weights when constructing a footing foundation.

If anchoring is required, anchor the unit to the slab using hold down bolts or isolators. Isolators should be installed to minimize the transmission of vibrations into the building.

For rooftop applications, ensure the roof is strong enough to support the combined unit and support structural weight. Refer to Table 1 for the unit operating weights. If anchoring is required, anchor the unit to the roof with hold-down bolts or isolators.

Check with a roofing contractor for proper waterproofing procedures.

Ductwork

Figures 4A & 4B illustrates the supply and return air openings.

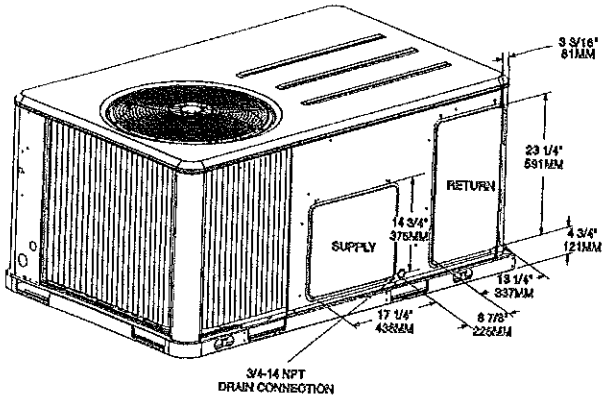
Elbows with turning vanes or splitters are recommended to minimize air noise due to turbulence and to reduce static pressure.

When attaching the ductwork to the unit, provide a watertight flexible connector at the unit to prevent operating sounds from transmitting through the ductwork.

All outdoor ductwork between the unit and the structure should be weather proofed after installation is completed.

Figure 4A

3 through 5 Ton
Horizontal Unit Supply & Return Air Openings



3 through 5 Ton
Downflow Unit Supply & Return Air Openings

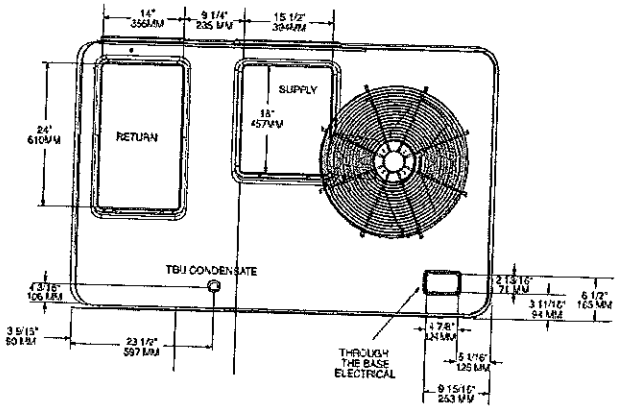
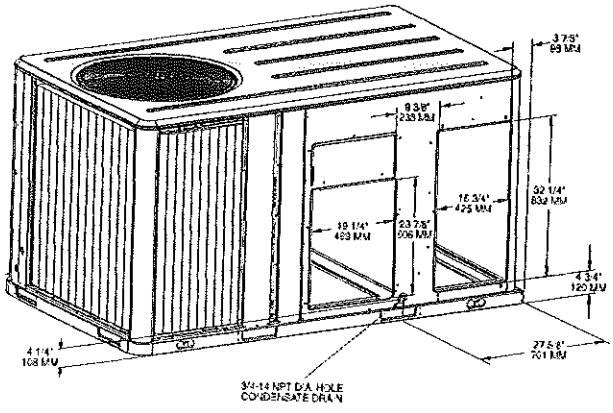
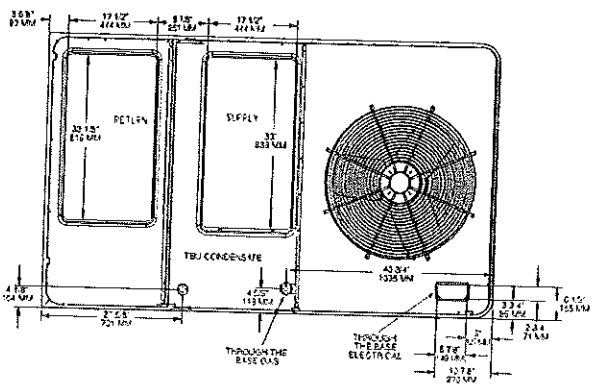


Figure 4B

6 1/4 through 10 Ton
Horizontal Unit Supply & Return Air Openings



6 1/4 through 10 Ton
Downflow Unit Supply & Return Air Openings



Installation

Roof Curb

Downflow

The roof curbs for these units consists of a "full perimeter" enclosure to support the unit.

Before installing any roof curb, verify;

1. That it is the correct curb for the unit,

2. That it includes the necessary gaskets and hardware,

3. That the purposed installation location provides the required clearance for proper operation.

4. Insure that the curb is level and square. The top surface of the curb must be true to assure an adequate curb-to-unit seal.

Step-by-step curb assembly and installation instructions ship with each accessory roof curb kit. Follow the instructions carefully to assure proper fit-up when the unit is set into place.

Note: To assure proper condensate flow during operation, the unit (and curb) must be level.

If the unit is elevated, a field constructed catwalk around the unit is strongly recommended to provide easy access for unit maintenance and service.

Recommendations for installing the Supply Air and Return Air ductwork joining the roof curb are included in the curb instruction booklet. Curb ductwork must be fabricated and installed by the installing contractor before the unit is set into place.

Note: For sound consideration, cut only the holes in the roof deck for the ductwork penetrations. Do not cut out the entire roof deck within the curb perimeter.

If a Curb Accessory Kit is not used:

a. The ductwork can be attached directly to the factory-provided flanges around the unit's supply and return air openings. Be sure to use flexible duct connections at the unit.

b. For "built-up" curbs supplied by others, gaskets must be installed around the curb perimeter flange and the supply and return air opening flanges.

Rigging

A Rigging illustration and Center-of-Gravity dimensional data table is shown in Figure 3. Refer to the typical unit operating weights table before proceeding.

1. Remove the two screws from each end of the unit that secures the wooden shipping top. Remove the wooden top and metal retaining brackets. Remove protective covering from around the unit.

2. Rig the unit as shown in Figure 3. Attach adequate strength lifting slings to all four lifting brackets in the unit base rail. Do not use cables, chains, or slings except as shown.

3. Install a lifting bar, as shown in Figure 3, to protect the unit and to facilitate a uniform lift. The minimum distance between the lifting hook and the top of the unit should be 7 feet.

4. Test-lift the unit to ensure it is properly rigged and balanced, make any necessary rigging adjustments.

5. Lift the unit enough to allow the removal of forklift brackets and hardware. Remove the two screws from each forklift bracket. Remove, brackets, rails and wood.

6. Downflow units; align the base rail of the unit with the curb rail while lowering the unit onto the curb. Make sure that the gasket on the curb is not damaged while positioning the unit.

⚠ WARNING:
LIFTING AND MOVING INSTRUCTIONS!

DO NOT USE CABLES (CHAINS OR SLINGS) EXCEPT AS SHOWN. OTHER LIFTING ARRANGEMENTS MAY CAUSE EQUIPMENT DAMAGE OR SERIOUS PERSONAL INJURY.

EACH OF THE CABLES (CHAINS OR SLINGS) USED TO LIFT UNIT MUST BE CAPABLE OF SUPPORTING THE ENTIRE WEIGHT OF THE UNIT.

LIFTING CHAINS (CABLES OR SLINGS) MAY NOT BE THE SAME LENGTH. ADJUST AS NECESSARY FOR EVEN LEVEL LIFT.

USE SPREADER BARS AS SHOWN IN DIAGRAM. REFER TO INSTALLATION MANUAL OR NAMEPLATE FOR UNIT WEIGHT. REFER TO INSTALLATION INSTRUCTIONS LOCATED INSIDE CONTROL PANEL FOR FURTHER RIGGING INFORMATION.

General Unit Requirements

The checklist listed below is a summary of the steps required to successfully install a commercial unit. This checklist is intended to acquaint the installing personnel with what is required in the installation process. It does not replace the detailed instructions called out in the applicable sections of this manual.

[ ] Check the unit for shipping damage and material shortage; file a freight claim and notify appropriate sales representative.

[ ] Verify correct model, options and voltage from nameplate.

[ ] Verify that the installation location of the unit will provide the required clearance for proper operation.

[ ] Assemble and install the roof curb (if applicable). Refer to the latest edition of the curb installers guide that ships with each curb kit.

[ ] Fabricate and install ductwork; secure ductwork to curb.

Installation

[ ] Rigging the unit.

[ ] Set the unit onto the curb; check for levelness.

[ ] Ensure unit-to-curb seal is tight and without buckles or cracks.

[ ] Install and connect a condensate drain line to the evaporator drain connection.

Factory Installed Economizer

[ ] Ensure the economizer has been pulled out into the operating position. Refer to the economizer installers guide for proper position and setup.

[ ] Install all access panels.

Temperature Limit Switch Usage for Electric Heat Units

Units are factory shipped in the downflow discharge confriguration but can be field converted to a horizontal discharge confriguration. Some, but not all units require a different TCO-A limit switch, which is wire tied near the terminal block in the heater compartment if horizontal discharge confriguration is used.

Note: The following units require a limit switch change out for horizontal discharge. The additional limit switch is shipped attached to the blower housing. Proceed to the Horizontal Discharge Conversion, Step 5 on page 16 for the following model / heater combination.

Unit Model Number	Electric Heater Model Number
WSC072A4, 090A4	BAYHTRS427A, 436A
WSC072AW, 090AW	BAYHTRSW27, W36
WSC120A4	BAYHTRT454A
WSC120AW	BAYHTRTW54A

If any of the units listedin the preceding table are installed in the downflow discharge configuration, remove the wire tied TCO-A near the terminal block in the heater compartment and discard.

Horizontal Discharge Conversion

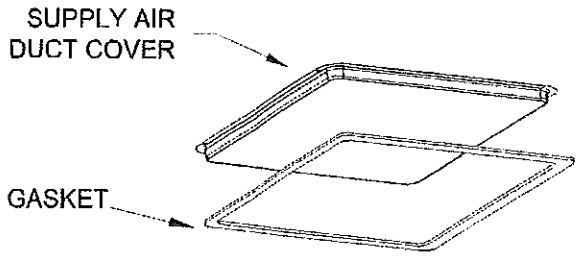
3 through 5 Ton Units

If a unit is to be converted to **Horizontal** discharge, the following conversion must be preformed:

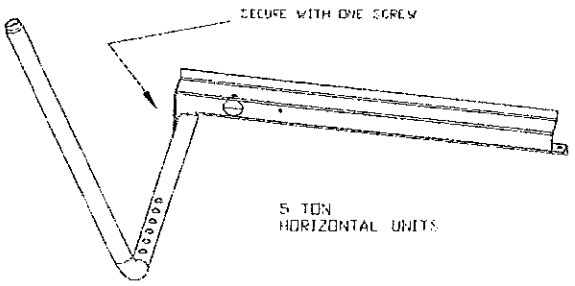
1. Remove the return and supply duct covers.

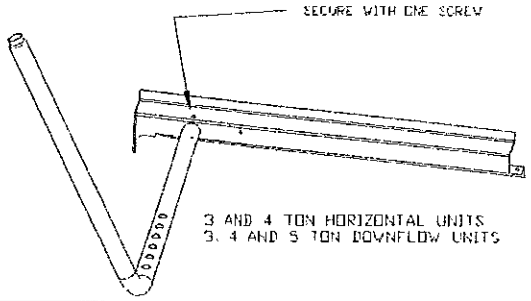
2. Apply gasket to the supply duct cover as shown.

3. Position duct covers as shown below. Rotate supply duct cover 90 degrees to allow it to be slid into supply opening.



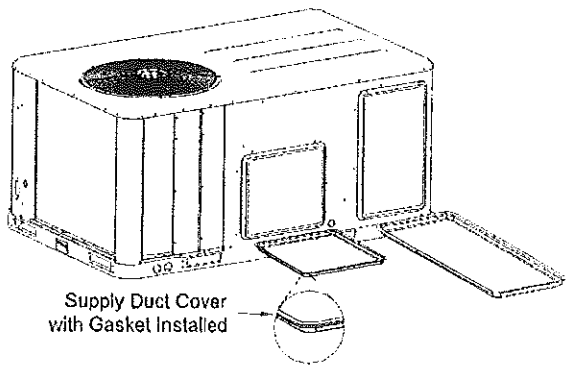
Note: If unit is equipped with Discharge Air Sensing option refer to the following figure for proper tube positioning based on unit tonnage.





Note: If unit is equipped with Return Air Smoke Detector refer to field conversion for horizontal discharge on page 17 before installing return air duct cover.

4. Slide duct covers into duct openings until endward edge of the duct cover engages with the 2 retaining clips on the duct flanges. Secure the outward edge of the each duct cover with 2 screws.



Note: Certain unit/electric heater combinations require a limit switch change out for horizontal airflow applications. Refer to the following instructions to determine if this process is required for the unit undergoing installation.

5. After completing installation of the duct covers for horizontal discharge,proceed to TCO-A instructions.

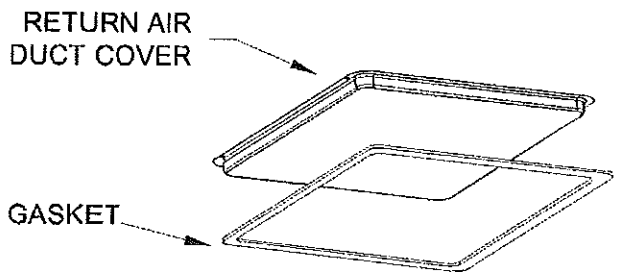
Horizontal Discharge Conversion

6 Through 10 Ton Units

If a unit is to be converted to **Horizontal** discharge, the following conversion must be preformed:

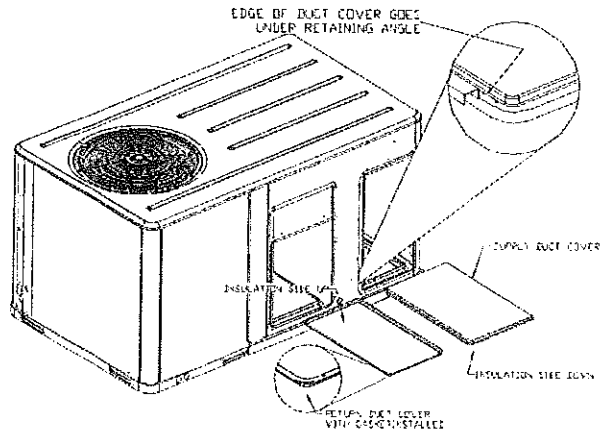
1. Remove the return and supply duct covers.

2. Apply gasket to the return duct cover as shown below.



3. Position duct covers as shown below. The supply duct cover is installed (insulation side down) over the downflow return opening by engaging one side of the panel under a retaining angle and securing the other side with 3 screws.

Note: If unit is equipped with Return Air Smoke Detector refer to field conversion for horizontal discharge on page 17 before installing return air duct cover.



4. Slide return duct cover (insulation side up) into supply openings until endward edge of the duct cover engages with the 2 retaining clips on the duct flanges. Secure the outward edge of the each duct cover with 2 screws.

5. After completing installation of the duct covers for horizontal discharge, proceed to TCO-A instructions.

TCO-A Instructions:

If the unit being installed is listed in the following table and is equipped with the corresponding model number of factory installed electric heater package in the table, the limit control TCO-A must be replaced with the extra limit control shipped in the heater compartment. Replace TCO-A following the instructions in steps 1through 3 below. If the unit being installed does not have a factory installed electric heater package or is equipped with a factory installed electric heater model that does not correspond to any in this table, skip steps1 through 3 and go on to next step in the installation process.

Unit Model Number	Electric Heater Model Number
WSC072A4, 090A4	BAYHTRS427A, 436A
WSC072AW, 090AW	BAYHTRSW27, W36
WSC120A4	BAYHTRT454A
WSC120AW	BAYHTRTW54A

1. Remove the heater section access panel and open the electric heater dead front panel.

2. TCO-A is the limit control located in the central part of the heater mounting plate and that is located on the bottom of the two heater element assemblies. To replace this device, first remove the two wires connected to the terminals. Next, remove the two screws which secure it to the heater element mounting plate. Once TCO-A has been removed form the heater element mounting plate, discard this device.

3. Obtain the replacement TCO-A which is secured by a wire tie near the electric heater terminal block in the heater compartment . Attach it to the heater element mounting plate with the two screws that were removed in step 8 above. Connect the two wires that were unhooked in step 8 to the terminals on the new TCO-A. Refer to the heater package wiring diagram to assure that the wiring is connected properly.

4. Close the electric heater dead front panel and replace heat section access panel.

Installation

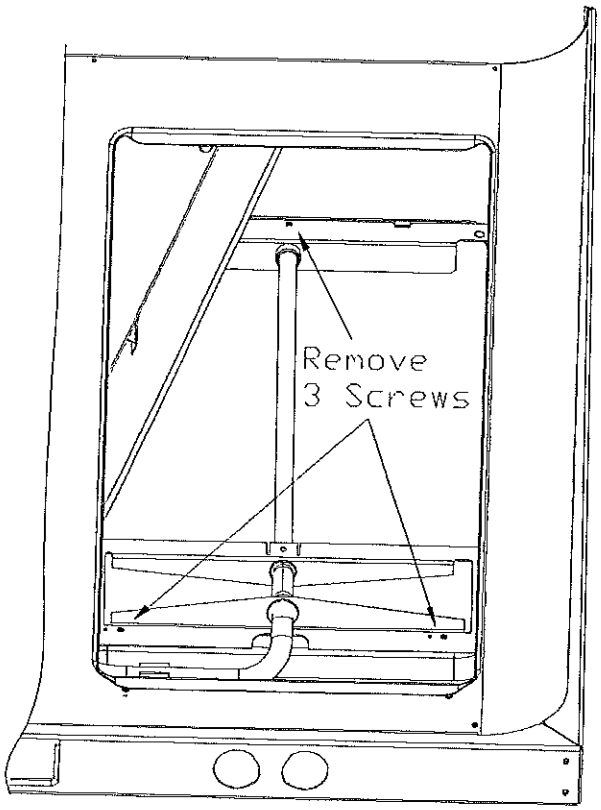
Return Air Smoke Detector

The factory installed Return Air Smoke Detector is installed in the **Downflow** discharge position. No additional field setup is required.

If a unit is to be converted to **Horizontal** discharge, the following conversion must be performed:

1. If the unit has an economizer, it must be pulled out in the operating position.

2. Remove the 3 screws from the mounting brackets. Refer to Downflow View for screw locations.



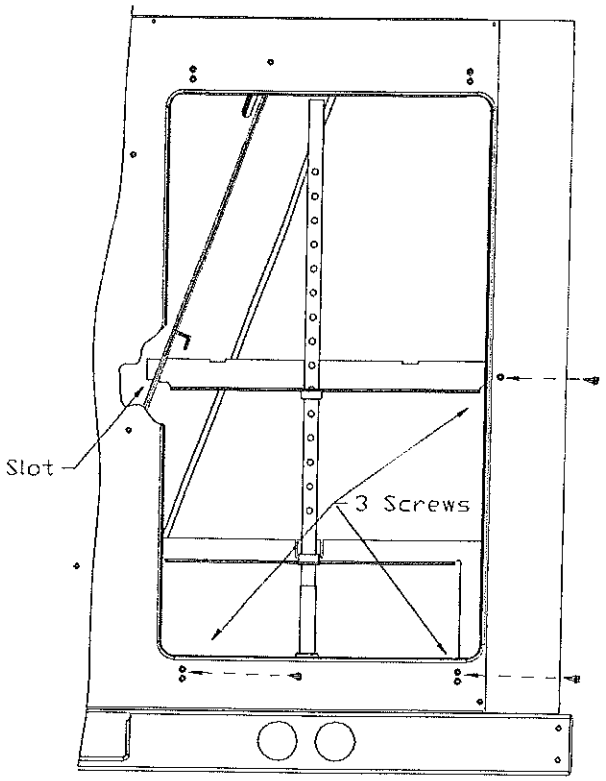
Downflow View

3. Lift the tube and bracket from the downflow duct opening. Rotate the tube and bracket assembly 180° degrees ensuring that the holes on the copper sensing tube face away from the unit and face the return air ductwork. Refer to Horizontal View.

Note: Check to insure that the flexible tubing lies flat on the base pan surface.

4. Slide the top bracket down the copper sensing tube, insert the tab on the left side into the slot on the indoor coil blockoff and secure the right side of the bracket with one of the 3 screws removed in step 2. Refer to Horizontal View.

5. Using the remaining 2 screws removed in step 2, secure the bottom bracket. Refer to Horizontal View.



Horizontal View

Main Electrical Power Requirements

[ ] Verify that the power supply complies with the unit nameplate specifications.

[ ] Inspect all control panel components; tighten any loose connections.

[ ] Connect properly sized and protected power supply wiring to a field-supplied/installed disconnect switch and to the main power terminal block (HTB1) in the unit control panel.

[ ] Install proper grounding wires to an earth ground.

Note: All field-installed wiring must comply with NEC and applicable local codes.

Electric Heat Requirements

[ ] Verify that the power supply complies with the electric heater specifications on the unit and heater nameplate.

[ ] Inspect the heater junction box and control panel; tighten any loose connections.

[ ] Check electric heat circuits for continuity.

Low Voltage Wiring (AC & DC) Requirements

[ ] Install the zone thermostat, with or without switching subbase.

[ ] Connect properly sized control wiring to the proper termination points between the zone thermostat and the unit control panel.

Condensate Drain Configuration

An evaporator condensate drain connection is provided on each unit. Refer to Figure 3 for the appropriate drain location.

The condensate drain pan is factory installed to drain condensate to the back side of the unit. See Figure 3. It can be converted to drain condensate out the front side of the unit or through the base.

To convert drain condensate out the front of unit:

1. Remove evaporator access panel and supply air access panels.
2. Remove the support panel that the condensate drain pan exits through.
3. Slide the condensate drain pan out of the unit and rotate 180°.
4. Slide the condensate drain pan back into the unit, align the drain with the grommeted opening in the rear support panel and push until the coupling is seated in the grommet.
5. Replace the front support panel by aligning the panel with tabs in the raceway. Align the condensate drain pan support in the grommeted hole as the panel is put in place.
6. Replace evaporator access panel and supply air access panels.

To convert drain condensate through the base of unit:

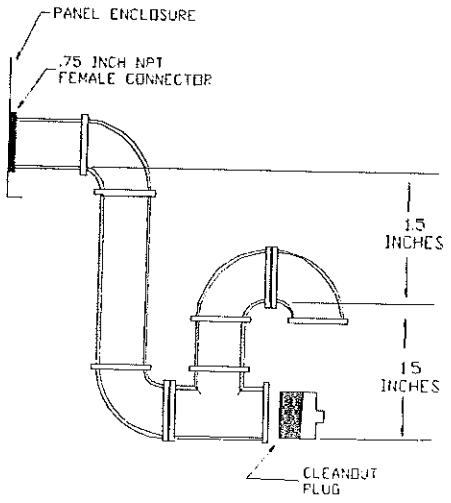
1. Remove evaporator access panel and supply air access panels.
2. Remove the support panel that the condensate drain pan exits through.
3. Slide the condensate drain pan out of the unit.
4. Place on a level surface in the position it was removed from the unit.
5. Remove the plug knockout in the bottom of the drainpan to convert it to through the base drainage.
6. Plug the original condensate drain opening with a field supplied 3/4" NPT plug.
7. Slide the condensate drain pan back into the unit, align the drain support with the grommeted opening in the rear support panel and push until the support is seated in the grommet.
8. Replace the front support panel by aligning the panel with tabs in the raceway. Align the plugged condensate drain pan coupling in the grommeted hole as the panel is put in place.
9. Replace evaporator access panel and supply air access panels.

A condensate trap must be installed at the unit due to the drain connection being on the "negative pressure" side of the fan. Install the P-Trap using the guidelines in Figure 5.

A condensate drain line must be connected to the P-Trap. Pitch the drain lines at least 1/2 inch for every 10 feet of horizontal run to assure proper condensate flow. Do not allow the horizontal run to sag causing a possible double-trap condition which could result in condensate backup due to "air lock".

Figure 5

Condensate Trap Installation



Filter Installation

Each unit ships with filters installed. The quantity of filters is determined by unit size. Access to the filters is obtained by removing the indoor fan access panel. To modify the 3, 4 or 5 ton unit's filter rack to accept two inch filters, remove the L-shaped angle attachment screws and rotate the angles 90 degrees.

Reinstall the screws and insert new filters. Refer to the unit Service Facts (shipped with each unit) for filter requirements.

Note: Do not operate the unit without filters.

Field Installed Power Wiring

An overall dimensional layout for the field installed wiring entrance into the unit is illustrated in Figure 2. To insure that the unit's supply power wiring is properly sized and installed, follow the guidelines outlined below.

Note: All field installed wiring must conform to NEC guidelines as well as State and Local codes.

Verify that the power supply available is compatible with the unit's nameplate ratings. The available supply power must be within 10% of the rated voltage stamped on the nameplate. Use only copper conductors to connect the power supply to the unit.

⚠ CAUTION: USE COPPER CONDUCTORS ONLY! UNIT TERMINALS ARE NOT DESIGNED TO ACCEPT OTHER TYPES OF CONDUCTORS.

Failure to do so may cause damage to the equipment.

Main Unit Power Wiring

1. If the unit is not equipped with an optional factory installed nonfused disconnect switch or circuit breaker, a field supplied disconnect switch must be installed at or near the unit in accordance with the National Electrical Code (NEC latest edition).

2. Location of the applicable electrical service entrance is illustrated in Figure 2. Complete the unit's power wiring connections onto either; the main terminal wire connectors inside the unit control panel, the factory mounted nonfused disconnect switch (UCD) or circuit breaker (UCB). Refer to the customer connection diagram that is shipped with the unit for specific termination points.

3. Provide proper grounding for the unit in accordance with local and national codes.

Field Installed Control Wiring

An overall layout of the various control options available with the required number of conductors for each control device is illustrated in Figure 6.

Note: All field wiring must conform to NEC guidelines as well as state and local codes.

Control Power Transformer

The 24 volt control power transformers are to be used only with the accessories called out in this manual. Transformers rated greater than 50 VA are equipped with internal circuit breakers. If a circuit breaker trips, turn "Off" all power to the unit before attempting to reset it.

⚠ WARNING: HAZARDOUS VOLTAGE DISCONNECT ALL ELECTRIC POWER INCLUDING REMOTE DISCONNECTS BEFORE SERVICING.

Failure to disconnect power before servicing can cause severe personal injury or death.

The transformer is located in the control panel. The circuit breaker is located on the left side of the transformer and can be reset by pressing in on the black reset button.

Controls using 24 VAC

Before installing any connecting wiring, refer to Figure 2 for the electrical access locations provided on the unit and Table 2 for AC conductor sizing guidelines, and;

a. Use copper conductors unless otherwise specified.

b. Ensure that the AC control wiring between the controls and the unit's termination point does not exceed three (3) ohms/conductor for the length of the run.

Note: Resistance in excess of 3 ohms per conductor may cause component failure due to insufficient AC voltage supply.

c. Be sure to check all loads and conductors for grounds, shorts, and mis-wiring.

d. Do not run the AC low voltage wiring in the same conduit with the high voltage power wiring.

e. Route low voltage wiring per illustrations on page 19.

Table 2A - Electromechanical Thermostat 24V AC Conductors with Reliatel

Distance from Unit to Control	Recommended Wire Size
000 - 460 feet	18 gauge
461 - 732 feet	16 gauge
733 - 1000 feet	14 gauge

Table 2B - Electromechanical Thermostat 24V AC Conductors with Electromechanical Unit

Distance from Unit to Control	Recommended Wire Size
0 - 30 feet	22 gauge
31 - 50 feet	20 gauge
51 - 75 feet	18 gauge
76 - 125 feet	16 gauge
126 - 200 feet	14 gauge

Installation

Controls using DC Analog Input/Outputs (Standard Low Voltage Multiconductor Wire)

Before installing any connecting wiring between the unit and components utilizing a DC analog input\output signal, refer to Figure 2 for the electrical access locations provided on the unit.

a. Table 3 lists the conductor sizing guidelines that must be followed when interconnecting the DC binary output devices and the system components utilizing a DC analog input\output signal to the unit.

Note: Resistance in excess of 2.5 ohms per conductor can cause deviations in the accuracy of the controls.

b. Ensure that the wiring between controls and the unit's termination point does not exceed two and a half (2.5) ohms/conductor for the length of the run.

c. Do not run the electrical wires transporting DC signals in or around conduit housing high voltage wires.

d. Route low voltage wiring per illustrations on page 21.

DC Conductors

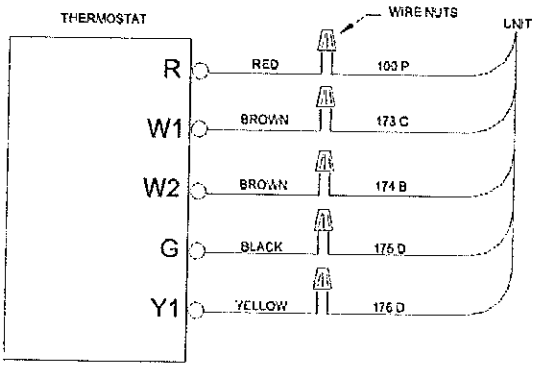
Table 3

Zone Sensor Module wiring

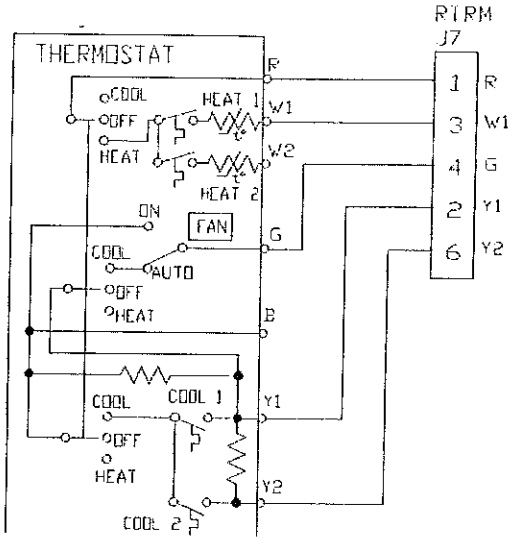
Distance from Unit to Control	Recommended Wire Size
0 - 150 feet	22 gauge
151 - 240 feet	20 gauge
241 -385 feet	18 gauge
386 - 610 feet	16 gauge
611 - 970 feet	14 gauge

Typical Field Wiring Diagrams for Electro Mechanical Thermostat

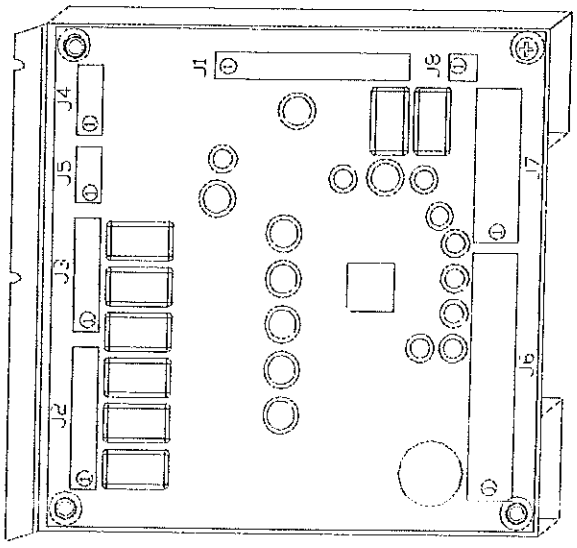
ELECTRO MECHANICAL THERMOSTAT
ELECTRIC / ELECTRIC UNITS



Reliatel Conventional Thermostat Field Wiring Diagrams

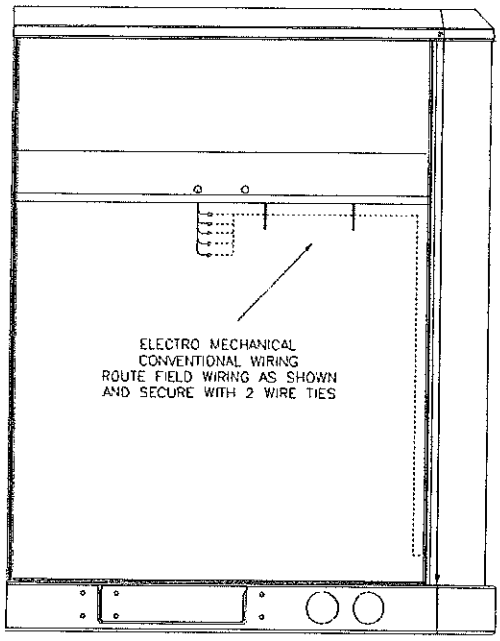


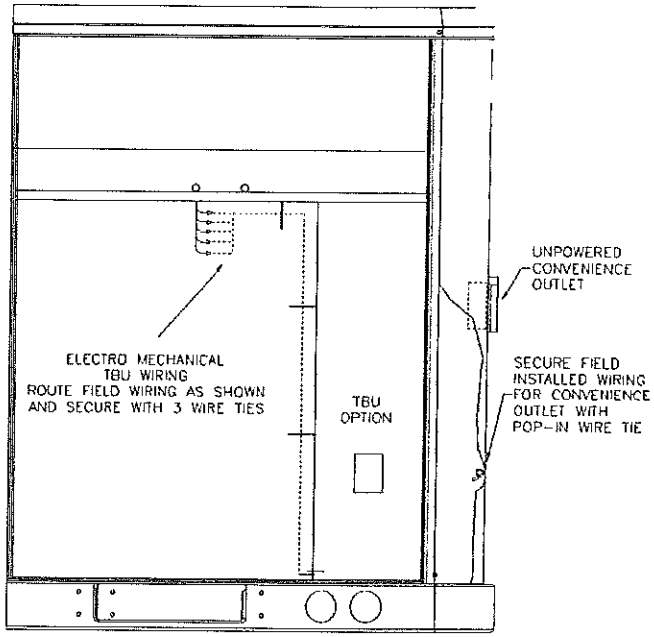
Reliatel Refrigeration Module



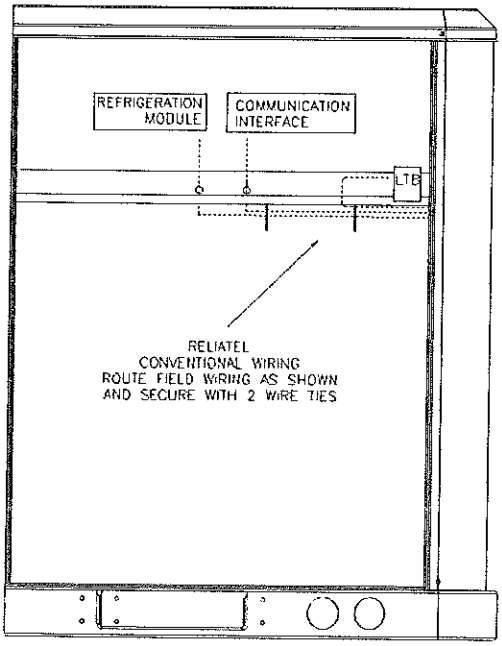
Installation

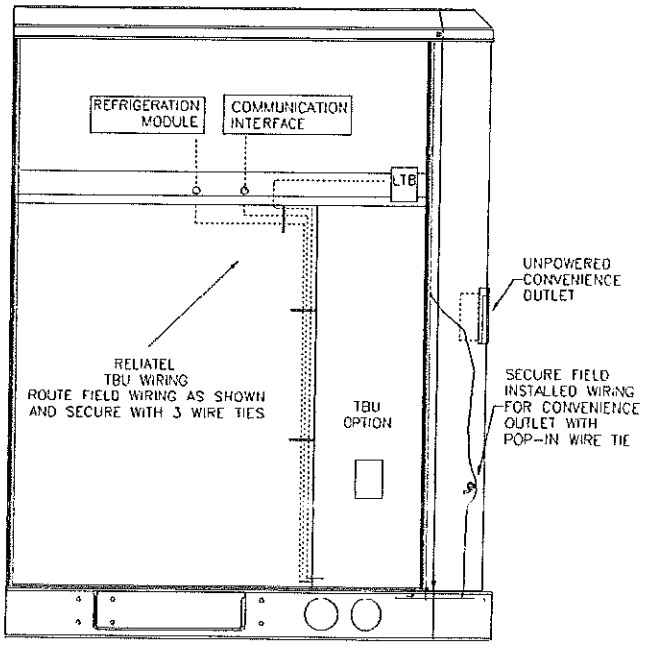
Electro Mechanical Control
Customer Low Voltage Routing-





Reliatel Control
Customer Low Voltage Routing-





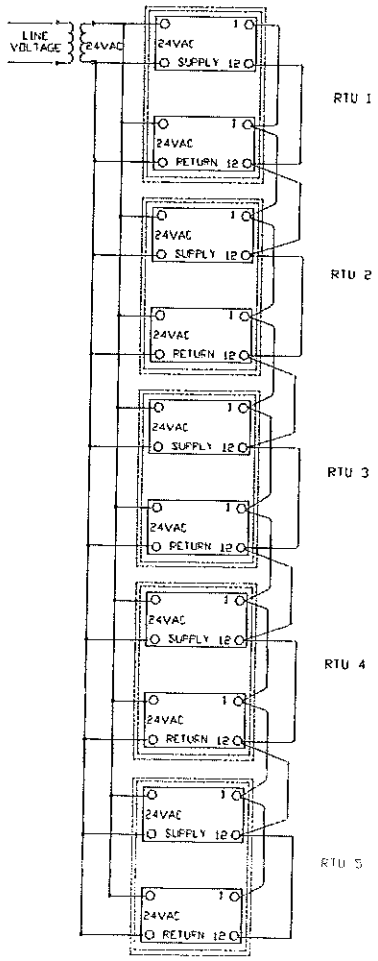
Smoke Detector - (ReliaTel™ only) Customer Low Voltage Wiring-

When interlocking System Sensor smoke detectors together, all of the detectors must be powered from the same power supply. If multiple smoke detectors are required, all detectors must be disconnected from the HVAC unit power supply and connected together from another single source supply.

Note: Do not interconnect smoke detectors together that have separate power supplies. Do not exceed ten smoke detectors on one power supply.

Note: Multiple System Sensor smoke detectors are connected together using terminals 1 and 12 on each detector.

If you have supply and return smoke detectors in all HVAC units, you can connect a maximum of 5 HVAC units (10 detectors) up to one power supply. See the following field wiring example below.



If you have more than 5 HVAC units, you can connect all the supplies together on one power supply (up to 10 HVAC units), and all the returns together (up to 10 HVAC units) on another power supply. See the following field wiring example below.

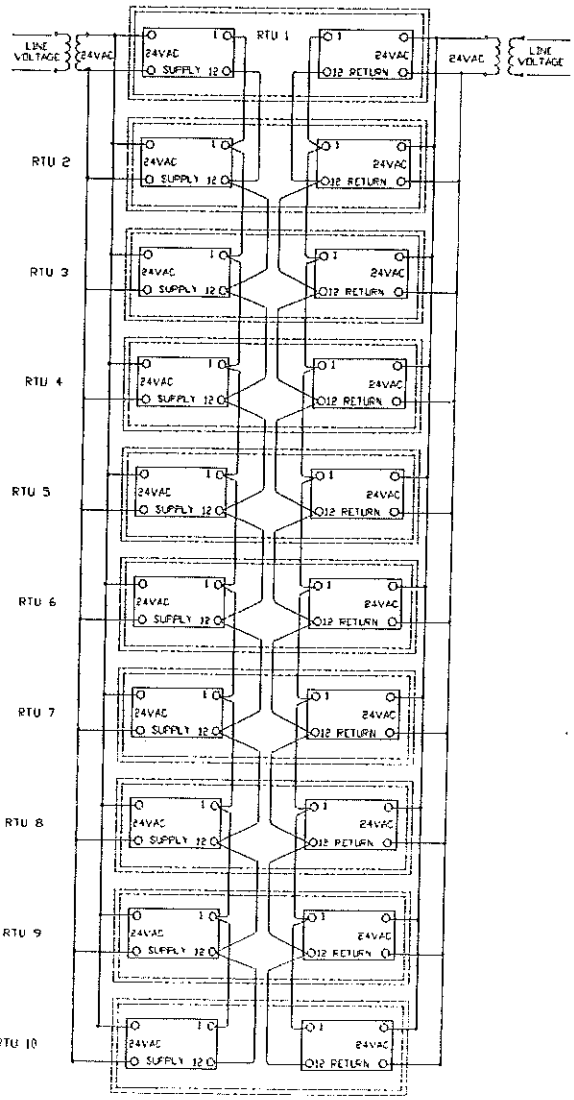
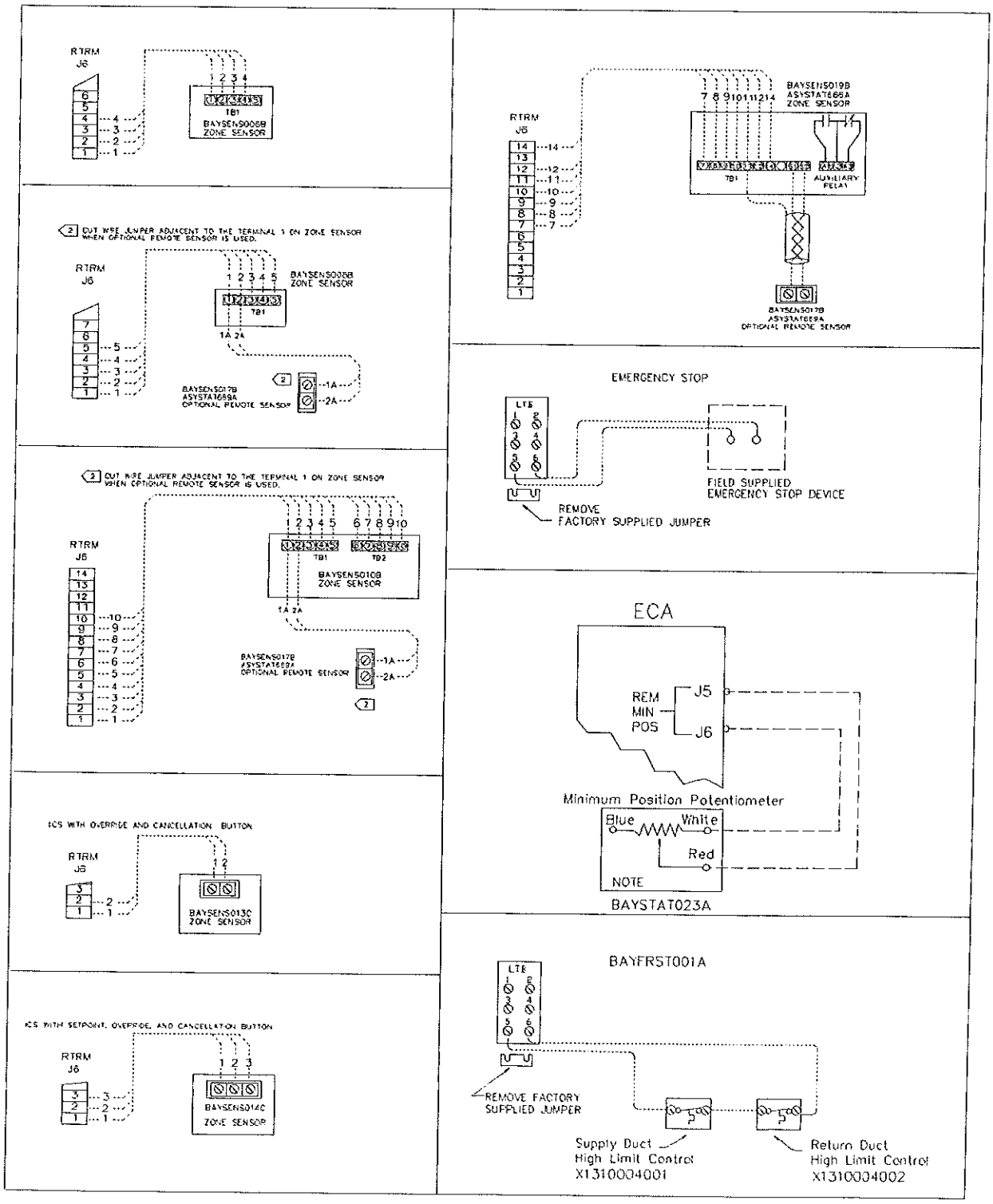


Figure 6
Typical Field Wiring Diagrams for Optional Controls (ReliaTel™ only)

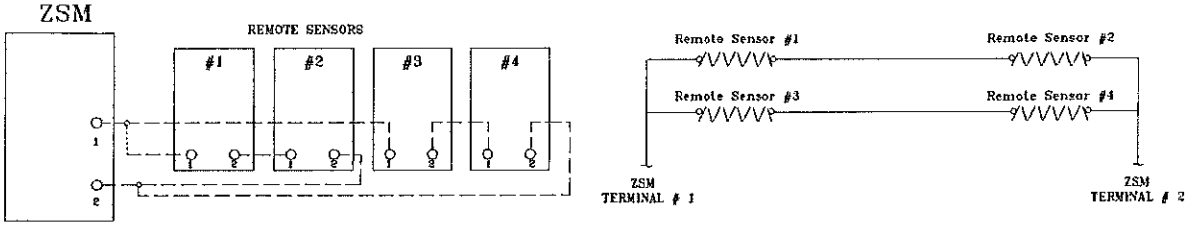


Space Temperature Averaging
(ReliaTel™ only)

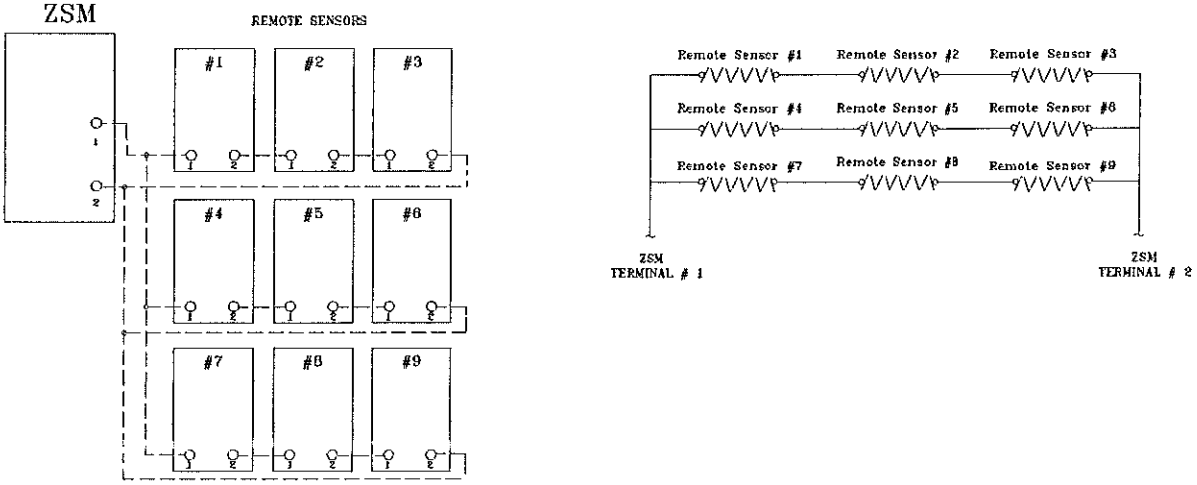
Space temperature averaging is accomplished by wiring a number of remote sensors in a series/parallel circuit.

Using the BAYSENS016* or BAYSENS017*, at least four sensors are required to accomplish space temperature averaging. Example #1 illustrates two series circuits with two sensors in each circiut wired in parallel. The square of any number of remote sensors required. Example #2 illustrates three sensors squared in a series/parallel circuit. Using BAYSENS032*, two sensors are required to accomplish space temperature averaging. Example #3 illustrates the circuit required for this senor. Table 3-7 lists the temperature versus resistance coefficient for all sensing
Use the checklist provided below in conjunction with the "General Unit Requirements" checklist to ensure that the unit is properly installed and ready for operation.

EXAMPLE #1



EXAMPLE #2



EXAMPLE #3

Table 4
Temperature versus Resistance
(temperature vs resistance)

Degrees F°	Nominal Resistance
-20°	170.1 K - Ohms
-15°	143.5 K - Ohms
-10°	121.4 K - Ohms
-5°	103.0 K - Ohms
0°	87.56 K - Ohms
5°	74.65 K - Ohms
10°	63.80 K - Ohms
15°	54.66 K - Ohms
20°	46.94 K - Ohms
25°	40.40 K - Ohms
30°	34.85 K - Ohms
35°	30.18 K - Ohms
40°	26.22 K - Ohms
45°	22.85 K - Ohms
50°	19.96 K - Ohms
55°	17.47 K - Ohms
60°	15.33 K - Ohms
65°	13.49 K - Ohms
70°	11.89 K - Ohms
75°	10.50 K - Ohms
80°	9.297 K - Ohms
85°	8.247 K - Ohms
90°	7.330 K - Ohms
95°	6.528 K - Ohms
100°	5.824 K - Ohms

Pre-start

Use the checklist provided below in conjunction with the "General Unit Requirements" checklist to ensure that the unit is properly installed and ready for operation.

⚠ WARNING: HAZARDOUS VOLTAGE! DISCONNECT ALL ELECTRIC POWER INCLUDING REMOTE DISCONNECTS BEFORE SERVICING.

Failure to disconnect power before servicing can cause severe personal injury or death.

[ ] Check all electrical connections for tightness and "point of termination" accuracy.

[ ] Verify that the condenser airflow will be unobstructed.

[ ] Verify that the condenser fan and indoor blower turn freely without rubbing and are properly tightened on the shafts.

[ ] Check the supply fan belts for proper tension and the fan bearings for sufficient lubrication. If the belts require adjustment, or if the bearings need lubricating, refer to the maintenance section of this manual for instructions.

[ ] Verify that a condensate trap is installed and the piping is properly sized and pitched.

[ ] Verify that the correct size and number of filters are in place.

[ ] Inspect the interior of the unit for tools and debris and install all panels in preparation for starting the unit.

Voltage Imbalance

Three phase electrical power to the unit must meet stringent requirements for the unit to operate properly. Measure each leg (phase-to-phase) of the power supply. Each reading must fall within the utilization range stamped on the unit nameplate. If any of the readings do not fall within the proper tolerances, notify the power company to correct this situation before operating the unit.

Excessive three phase voltage imbalance between phases will cause motors to overheat and eventually fail. The maximum allowable voltage imbalance is 2%. Measure and record the voltage between phases 1, 2, and 3 and calculate the amount of imbalance as follows:

% Voltage Imbalance = $100 \times \frac{AV - VD}{AV}$ **where;**

AV (Average Voltage) = $\frac{Volt\ 1 + Volt\ 2 + Volt\ 3}{3}$

V1, V2, V3 = Line Voltage Readings
VD = Line Voltage reading that deviates the farthest from the average voltage.

Example: If the voltage readings of the supply power measured 221, 230, and 227, the average volts would be:

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

VD (reading farthest from average) = 221

The percentage of Imbalance equals:

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

The 2.2% imbalance in this example exceeds the maximum allowable imbalance of 2.0%. This much imbalance between phases can equal as much as a 20% current imbalance with a resulting increase in motor winding temperatures that will decrease motor life. If the voltage imbalance is over 2%, notify the proper agencies to correct the voltage problem before operating this equipment.

Electrical Phasing
(Three Phase Motors)

The compressor motor(s) and the supply fan motor are internally connected for the proper rotation when the incoming power supply is phased as A, B, C.

Proper electrical supply phasing can be quickly determined and corrected before starting the unit by using an instrument such as an Associated Research Model 45 Phase Sequence Indicator and following the steps below:

[ ] Turn the field supplied disconnect switch that provides power to the main power terminal block or to the "Line" side of the optional factory mounted disconnect switch to the "Off" position.

[ ] Connect the phase sequence indicator leads to the terminal block or to the "Line" side of the optional factory mounted disconnect switch as follows;

Black (phase A)	**to**	**L1**
Red (phase B)	**to**	**L2**
Yellow (phase C)	**to**	**L3**

[ ] Close the field supplied main power disconnect switch or circuit protector switch that provides the supply power to the unit.

⚠ WARNING: HAZARDOUS VOLTAGE! HIGH VOLTAGE IS PRESENT AT THE TERMINAL BLOCK OR UNIT MOUNTED DISCONNECT SWITCH.

To prevent injury or death from electrocution, it is the responsibility of the technician to recognize this hazard and use extreme care when performing service procedures with the electrical power energized.

[ ] Observe the ABC and CBA phase indicator lights on the face of the sequencer. The ABC indicator light will glow if the phase is ABC. If the CBA indicator light glows, open the disconnect switch or circuit protection switch and reverse any two power wires.

[ ] Restore the main electrical power and recheck the phasing. If the phasing is correct, open the disconnect switch or circuit protection switch and remove the phase sequence indicator.

Compressor Crankcase Heaters (Optional)

Each compressor can be equipped with a crankcase heater. The proper operation of the crankcase heater is important to maintain an elevated compressor oil temperature during the "Off" cycle to reduce oil foaming during compressor starts. Oil foaming occurs when refrigerant condenses in the compressor and mixes with the oil. In lower ambient conditions, refrigerant migration to the compressor could increase.

When the compressor starts, the sudden reduction in crankcase pressure causes the liquid refrigerant to boil rapidly causing the oil to foam. This condition could damage compressor bearings due to reduced lubrication and could cause compressor mechanical failures.

Before starting the unit in the "Cooling" mode, set the system switch to the "Off" position and turn the main power disconnect to the "On" position and allow the crankcase heater to operate a minimum of 8 hours.

Before closing the main power disconnect switch, insure that the "System" selection switch is in the "Off" position and the "Fan" selection switch is in the "Auto" position.

Close the main power disconnect switch and the unit mounted disconnect switch, if applicable.

⚠ WARNING: HAZARDOUS VOLTAGE!
HIGH VOLTAGE IS PRESENT AT THE TERMINAL BLOCK OR UNIT MOUNTED DISCONNECT SWITCH.

To prevent injury or death from electrocution, it is the responsibility of the technician to recognize this hazard and use extreme care when performing service procedures with the electrical power energized.

ReliaTel Controls

Upon power initialization, the RTRM performs self-diagnostic checks to insure that all internal controls are functional. It also checks the configuration parameters against the components connected to the system. The Liteport LED located on the RTRM module is turned "On" within one second of power-up if internal operation is okay.

Use one of the following "Test" procedure to bypass some time delays and to start the unit at the control panel. Each step of unit operation can be activated individually by temporarily shorting across the "Test" terminals for two to three seconds. The Liteport LED located on the RTRM module will blink when the test mode has been initiated. The unit can be left in any "Test" step for up to one hour before it will automatically terminate, or it can be terminated by opening the main power disconnect switch. Once the test mode has been terminated, the Liteport LED will glow continuously and the unit will revert to the "System" control.

Test Modes

There are three methods in which the "Test" mode can be cycled at LTB-Test 1 and LTB-Test 2.

1. Step Test Mode - This method initiates the different components of the unit, one at a time, by temporarily shorting across the two test terminals for two to three seconds.

For the initial start-up of the unit, this method allows the technician to cycle a component "On" and have up to one hour to complete the check.

2. Resistance Test Mode - This method can be used for start-up providing a decade box for variable resistance outputs is available. This method initiates the different components of the unit, one at a time, when a specific resistance value is placed across the two test terminals. The unit will remain in the specific test mode for approximately one hour even though the resistance is left on the test terminals.

3. Auto Test Mode - This method is not recommended for start-up due to the short timing between individual component steps. This method initiates the different components of the unit, one at a time, when a jumper is installed across the test terminals. The unit will start the first test step and change to the next step every 30 seconds. At the end of the test mode, control of the unit will automatically revert to the applied "System" control method.

For unit test steps, test modes, and step resistance values to cycle the various components, refer to Table 5.

Table 5
Service Test Guide for Component Operation

TEST STEP	MODE	Fan	Econ (Note 2)	Comp 1	Comp 2	Heat 1	Heat 2	Ohms
1	Fan	On	Minimum Position Setpoint 0%	Off	Off	Off	Off	2.2K
	Minimum Ventilation	On	Selectable	Off	Off	Off	Off	
2	Economizer Test Open	On	Open	Off	Off	Off	Off	3.3K
3	Cool Stage 1	On	Minimum Position	(Note 1) On	Off	Off	Off	4.7K
4 (Note 3)	Cool Stage 2	On	Minimum Position	(Note 1) On	(Note 1) On	Off	Off	6.8K
5 (Note 3)	Heat Stage 1	On	Minimum	Off	Off	On	Off	10K
6 (Note 3)	Heat Stage 2	On	Minimum	Off	Off	On	On	15K

Notes:
1 - The condenser fans will operate anytime a compressor is "On" providing the outdoor air temperatures are within the operating values.
2 - The exhaust fan will turn on anytime the economizer damper position is equal to or greater than the exhaust fan setpoint.
3 - Steps for optional accessories and non-applicable modes in unit will be skipped.

Electro Mechanical Controls Test Procedure

See unit schematic for correct wire numbers.

Fan Test and Minimum Ventilation
Connect red thermostat wire (R) to black thermostat wire (G).

Economizer Cooling
Connect a jumper wire across OTS on Economizer Control (ECA) Connect red thermostat (R) wire to yellow thermostat wire (Y1).

Cool 1
Connect red thermostat wire (R) to yellow thermostat wire (Y1).

Cool 2
Connect red thermostat wire (R) to yellow thermostat wire (Y2).

Heat 1
Connect red thermostat wire (R) to brown thermostat wire (W1).

Heat 2
Connect red thermostat wire (R) to brown thermostat wire (W2).

Verifying Proper Air Flow
(Units with Direct Drive Indoor Fan)

Much of the systems performance and reliability is closely associated with, and dependent upon having the proper airflow supplied both to the space that is being conditioned and across the evaporator coil.

The indoor fan motor is factory wired to operate on low speed in the cooling and heating mode. It can be rewired for high speed operation should the application require it. Refer to the wiring diagram that shipped in the unit.

The indoor fan motors are specifically designed to operate within the BHP parameters listed in the fan performance tables of the unit Service Facts. By understanding that these motors will safely work within these conditions, before an oversized motor is required, will allow the air distribution system to be set up properly and diagnostics enhanced should a problem occur.

When verifying direct drive fan performance, the tables must be used somewhat differently than those of belt driven fans. Fan performance diagnostics can be easily recognized when these tables are used correctly.

Before starting the SERVICE TEST, set the minimum position setpoint for the economizer to 0 percent using the setpoint potentiometer located on the Economizer Control (ECA), if applicable.

ReliaTel Control
Using the Service Test Guide in Table 5, momentarily jump across the Test 1 & Test 2 terminals on LTB1 one time to start the Minimum Ventilation Test.

Electro Mechanical Control
Using the Service Test Guide perform the proper test mode connections.

With the fan operating properly, determine the total system external static pressure (inches w.c.) by;

1. Measuring the supply and return duct static pressure,

2. Using the accessory pressure drop table in the Service Facts, calculate the total static pressure drop for all of the accessories installed on the unit; i.e., curb, economizer, etc.

Note: Static pressure is based on desired CFM and may not be actual static pressure.

3. Add the total accessory static pressure drop (step 2) to the duct external static pressure (step 1). The sum of these two values represents the total system external static pressure.

4. Measure the amperage at the supply fan contactor and compare it with the full load amp (FLA) rating stamped on the motor nameplate.

   a. Calculate the theoretical BHP

$$\frac{\text{Actual Motor Amps X Motor HP}}{\text{Motor Nameplate Amps}}$$

b. Using the fan performance tables in the unit Service Facts, plot the total external static pressure (step 3) and the BHP (step 4a) to obtain the operating CFM.

c. When plotted, if the two values can not be interpolated correspondingly, the static pressure will most likely be the least accurate measurement. Because of the direct drive motor operation, the RPM performance is relatively constant making the operating current a very reliable diagnostic tool.

Example: T_D060 single phase, low speed.

$$\frac{\text{Actual Motor Amp (5.25)}}{\text{Motor Nameplate Amps (5.3)}} = .99\%$$

0.99 X Motor HP (0.6) = .59 BHP

The actual external static pressure is approximately 0.45" w.c., airflow equals 2100 CFM.

If the static pressure reading was higher, motor current would have to be lower proportionately to get an accurate CFM measurement in direct drive applications.

5. If the required CFM is too low, (external static pressure is high causing motor HP output to be below table value),

   a. Relieve supply and/or return duct static.

   b. Change indoor fan speed to "High" and repeat steps 1 through 4.

6. If the required CFM is too high, (external static pressure is low causing motor HP output to be above table value), increase supply and/or return duct static.

7. To stop the SERVICE TEST, turn the main power disconnect switch to the "Off" position or proceed to the next component start-up procedure. Remove electro mechanical test mode connections (if applicable).

Verifying Proper Air Flow
(Units with Belt Drive Indoor Fan)

Much of the systems performance and reliability is closely associated with, and dependent upon having the proper airflow supplied both to the space that is being conditioned and across the evaporator coil.

The indoor fan speed is changed by opening or closing the adjustable motor sheave.

Before starting the SERVICE TEST, set the minimum position setpoint for the economizer to 0 percent using the setpoint potentiometer located on the Economizer Control (ECA), if applicable.

ReliaTel Control
Using the Service Test Guide in Table 5, momentarily jump across the Test 1 & Test 2 terminals on LTB1 one time to start the Minimum Ventilation Test.

Electro Mechanical Control
Using the Service Test Guide perform the proper test mode connections.

Once the supply fan has started, check for proper rotation. The direction of rotation is indicated by an arrow on the fan housing.

With the fan operating properly, determine the total system airflow (CFM) by;

1. Measuring the actual RPM,

2. Measure the amperage at the supply fan contactor and compare it with the full load amp (FLA) rating stamped on the motor nameplate.

   a. Calculate the theoretical BHP

   $$\frac{\text{Actual Motor Amps}}{\text{Motor Nameplate Amps}} \times \text{Motor HP}$$

   b. Using the fan performance tables in the unit Service Facts, plot the actual RPM (step 1) and the BHP (step 2a) to obtain the operating CFM.

3. If the required CFM is too low, (external static pressure is high causing motor HP output to be below table value),

   a. Relieve supply and/or return duct static.

   b. Change indoor fan speed and repeat steps 1 and 2.

1. To Increase Fan RPM; Loosen the pulley adjustment set screw and turn sheave clockwise.

2. To Decrease Fan RPM; Loosen the pulley adjustment set screw and turn sheave counterclockwise.

3. If the required CFM is too high, (external static pressure is low causing motor HP output to be above table value), change indoor fan speed and repeat steps 1 and 2.

4. To stop the SERVICE TEST, turn the main power disconnect switch to the "Off" position or proceed to the next component start-up procedure. Remove electro mechanical test mode connections (if applicable).

Return Air Smoke Detector
The return air smoke detector is designed to shut off the unit if smoke is sensed in the return air stream. Sampling the airflow entering the unit at the return air opening performs this function.

In order for the smoke detector to properly sense smoke in the return air stream, the air velocity entering the unit must be between 500 and 4000 feet per minute. Equipment covered in this manual will develop an airflow velocity that falls within these limits over the entire airflow range specified in the evaporator fan performance tables.

There are certain models however, if operated at low airflow, will not develop an airflow velocity that falls within the required 500 to 4000 feet per minute range. For these models, the design airflow shall be greater than or equal to the minimum CFM specified in the table provided below. Failure to follow these instructions will prevent the smoke detector from performing its design function.

Economizer Start-Up

ReliaTel Control
Using the Service Test Guide in Table 5, momentarily jump across the Test 1 & Test 2 terminals on LTB1 one time to start the Minimum Ventilation Test.

Electro Mechanical Control
Using the Service Test Guide perform the proper test mode connections.

1. Set the minimum position setpoint for the economizer to the required percentage of minimum ventilation using the setpoint potentiometer located on the Economizer Control (ECA).

   The economizer will drive to its minimum position setpoint, exhaust fans (if applicable) may start at random, and the supply fan will start when the SERVICE TEST is initiated.

⚠ WARNING: ROTATING PARTS! UNIT STARTS AUTOMATICALLY

The Exhaust Fan will start anytime the economizer damper position is equal to or greater than the exhaust fan setpoint.

2. Verify that the dampers stroked to the minimum position.

ReliaTel Control
Momentarily jump across the Test 1 & Test 2 terminals on LTB one additional time if continuing from previous component start-up or until the desired start-up component Test is started.

Electro Mechanical Control
Using the Service Test Guide perform the proper test mode connections.

3. Verify that the dampers stroked to the full open position.

4. To stop the SERVICE TEST, turn the main power disconnect switch to the "Off" position or proceed to the next component start-up procedure. Remove electro mechanical test mode connections (if applicable).

Compressor Start-Up

1. Attach a set of service gauges onto the suction and discharge gauge ports for each circuit. Refer to the refrigerant circuit illustration in the Service Facts.

ReliaTel Control
Using the Service Test Guide in Table 5, continue the SERVICE TEST start-up procedure for each compressor circuit.

Momentarily jump across the Test 1 & Test 2 terminals on LTB1 one additional time if continuing from previous component start-up or until the desired start-up component Test is started.

Electro Mechanical Control
Using the Service Test Guide perform the proper test mode connections.

Scroll Compressors
a. Once each compressor has started, verify that the rotation is correct. If a scroll compressor is rotating backwards, it will not pump and a loud rattling sound can be observed.

b. If the electrical phasing is correct, before condemning a compressor, interchange any two leads (at the compressor Terminal block) to check the internal phasing. Refer to the illustration in Figure 5-1 for the compressor terminal/phase identification. If the compressor runs backward for an extended period (15 to 30 minutes), the motor winding can overheat and cause the motor winding thermostat to open.

c. Check the compressor oil levels. The oil level in each compressor sight glass should be 1/2 to 3/4 full when they are "Off".

The scroll compressor uses Trane OIL-42 without substitution. The appropriate oil charge for a 9 and 10 Ton scroll compressor is 8 pints. For a 14 and 15 Ton scroll compressor, use 14 pints.

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2. After the compressor and condenser fan have started and operated for approximately 30 minutes, observe the operating pressures. Compare the operating pressures to the operating pressure curve in the Service Facts.

3. Check system superheat. Follow the instruction listed on the superheat charging curve in the Service Facts.

Superheat should be within ±5 F of the superheat chart value.

4. Repeat steps 1 through 4 for each refrigerant circuit.

5. To stop the SERVICE TEST, turn the main power disconnect switch to the "Off" position or proceed to the next component start-up procedure. Remove electro mechanical test mode connections (if applicable).

Heating Start-Up

1. Clamp an amp meter around one of 1st stage heater power wires at the heater contactor.

2. ReliaTel Control
Using the Service Test Guide in Table 5, continue the SERVICE TEST start-up procedure for each compressor circuit. Momentarily jump across the Test 1 & Test 2 terminals on LTB one additional time if continuing from previous component start-up or until the desired start-up component Test is started.

Electro Mechanical Control
Using the Service Test Guide perform the proper test mode connections

3. Verify that the heater stage is operating properly.

4. Clamp an amp meter around one of 2nd stage heater power wires at the heater contactor (if applicable).

5. ReliaTel Control
Using the Service Test Guide in Table 5, continue the SERVICE TEST start-up procedure for each compressor circuit. Momentarily jump across the Test 1 & Test 2 terminals on LTB one additional time if continuing from previous component start-up or until the desired start-up component Test is started.

Electro Mechanical Control
Using the Service Test Guide perform the proper test mode connections

6. Verify that the heater stage is operating properly

7. To stop the SERVICE TEST, turn the main power disconnect switch to the "Off" position or proceed to the next component start-up procedure. Remove electro mechanical test mode connections (if applicable).

Final System Setup
After completing all of the pre-start and start-up procedures outlined in the previous sections (i.e., operating the unit in each of its Modes through all available stages of cooling & heating), perform these final checks before leaving the unit:

[ ] Program the Night Setback (NSB) panel (if applicable) for proper unoccupied operation. Refer to the programming instructions for the specific panel.

[ ] Verify that the Remote panel "System" selection switch, "Fan" selection switch, and "Zone Temperature" settings for automatic operation are correct.

[ ] Inspect the unit for misplaced tools, hardware, and debris.

[ ] Verify that all exterior panels including the control panel doors and condenser grilles are secured in place.

[ ] Close the main disconnect switch or circuit protector switch that provides the supply power to the unit's terminal block or the unit mounted disconnect switch.

⚠ WARNING: ROTATING PARTS! UNIT STARTS AUTOMATICALLY

Make sure all personnel are standing clear of the unit before proceeding. The system components will start when the power is applied.

Fan Belt Adjustment - Belt Drive Units

The fan belts must be inspected periodically to assure proper unit operation.

Replacement is necessary if the belts appear frayed or worn. Units with dual belts require a matched set of belts to ensure equal belt length.

When removing or installing the new belts, do not stretch them over the sheaves. Loosen the belts using the belt tension adjustment bolts on the motor mounting base.

Once the new belts are installed, using a Browning or Gates tension gauge (or equivalent) illustrated in Figure 7; adjust the belt tension as follows;

1. To determine the appropriate belt deflection;
   a. Measure the center-to-center shaft distance (in inches) between the fan and motor sheaves.
   b. Divide the distance measured in Step 1a by 64; the resulting value represents the amount of belt deflection that corresponds to the proper belt tension.
2. Set the large O-ring on the belt tension gauge at the deflection value determined in Step 1b.
3. Set the small O-ring at zero on the force scale of the gauge plunger.
4. Place the large end of the gauge at the center of the belt span; then depress the gauge plunger until the large O-ring is even with the top of the next belt or even with a straightedge placed across the fan and motor sheaves. Refer to Figure 7.
5. Remove the belt tension gauge. The small O-ring now indicates a number other than zero on the plunger's force scale. This number represents the force (in pounds) required to give the needed deflection.
6. Compare the "force" scale reading (Step 5) with the appropriate "force" value listed in Table 6. If the "force" reading is outside the range, readjust the belt tension.

Note: Actual belt deflection "force" must not exceed the maximum "force" value shown in Table 6.

7. Recheck the belt tension at least twice during the first 2 to 3 days of operation. Belt tension may decrease until the new belts are "run in".

Figure 7
Belt Tension Gauge

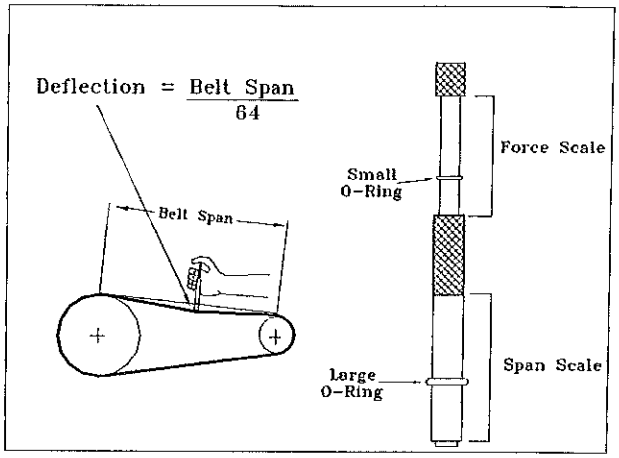

Table 6
Belt Tension Measurement and Deflection Ranges

Belts Cross Section	Small P.D Range	Deflection Force (Lbs.) Super Gripbelts Min.	Super Gripbelts Max.	Gripnotch Min.	Gripnotch Max.	Steel Cable Gripbelts Min.	Steel Cable Gripbelts Max
A	3.0 - 3.6	3	4 1/2	3 7/8	5 1/2	3 1/4	4
	3.8 - 4.8	3 1/2	5	4 1/2	6 1/4	3 3/4	4 3/4
	5.0 - 7.0	4	5 1/2	5	6 7/8	4 1/4	5 1/4
B	3.4 - 4.2	4	5 1/2	5 3/4	8	4 1/2	5 1/2
	4.4 - 5.6	5 1/8	7 1/8	6 1/2	9 1/8	5 3/4	7 1/4
	5.8 - 8.8	6 3/8	8 3/4	7 3/8	10 1/8	7	8 3/4

Monthly Maintenance

Before completing the following checks, turn the unit OFF and lock the main power disconnect switch open.

⚠ WARNING: HAZARDOUS VOLTAGE! DISCONNECT ALL ELECTRIC POWER INCLUDING REMOTE DISCONNECTS BEFORE SERVICING.

Failure to disconnect power before servicing can cause severe personal injury or death.

Filters

[ ] Inspect the return air filters. Clean or replace them if necessary. Refer to the unit Service Facts for filter information.

Return Air Smoke Detector Maintenance

Airflow through the unit is affected by the amount of dirt and debris accumulated on the indoor coil and filters. To insure that airflow through the unit is adequate for proper sampling by the return air smoke detector, complete adherence to the maintenance procedures, including recommended intervals between filter changes, and coil cleaning is required.

Maintenance

Periodic checks and maintenance procedures must be performed on the smoke detector to insure that it will function properly. For detailed instructions concerning these checks and procedures, refer to the appropriate section(s) of the smoke detector Installation and Maintenance Instructions provided with the literature package for this unit.

Cooling Season

[ ] Check the unit's drain pans and condensate piping to ensure that there are no blockages.

[ ] Inspect the evaporator and condenser coils for dirt, bent fins, etc. If the coils appear dirty, clean them according to the instructions described in "Coil Cleaning" later in this section.

[ ] Manually rotate the condenser fan(s) to ensure free movement and check motor bearings for wear. Verify that all of the fan mounting hardware is tight.

[ ] Inspect the F/A-R/A damper hinges and pins to ensure that all moving parts are securely mounted. Keep the blades clean as necessary.

[ ] Verify that all damper linkages move freely; lubricate with white grease, if necessary.

[ ] Check supply fan motor bearings; repair or replace the motor as necessary.

[ ] Check the fan shaft bearings for wear. Replace the bearings as necessary.

[ ] Check the supply fan belt. If the belt is frayed or worn, replace it. Refer to the "Fan Belt Adjustment" section for belt replacement and adjustments.

[ ] Verify that all wire terminal connections are tight.

[ ] Remove any corrosion present on the exterior surfaces of the unit and repaint these areas.

[ ] Generally inspect the unit for unusual conditions (e.g., loose access panels, leaking piping connections, etc.)

[ ] Make sure that all retaining screws are reinstalled in the unit access panels once these checks are complete.

[ ] With the unit running, check and record the: ambient temperature; compressor suction and discharge pressures (each circuit); superheat (each circuit);

Record this data on an "operator's maintenance log" like the one shown in Table 7. If the operating pressures indicate a refrigerant shortage, measure the system superheat. For guidelines, refer to the "Compressor Start-Up" section.

Note: Do Not release refrigerant to the atmosphere! If adding or removing refrigerant is required, the service technician must comply with all federal, state and local laws.

Heating Season

[ ] Inspect the unit's air filters. If necessary, clean or replace them.

[ ] Check supply fan motor bearings; repair or replace the motor as necessary.

[ ] Inspect both the main unit control panel and heat section control box for loose electrical components and terminal connections, as well as damaged wire insulation. Make any necessary repairs.

[ ] Verify that the electric heat system operates properly.

Coil Cleaning

Regular coil maintenance, including annual cleaning, enhances the unit's operating efficiency by minimizing: compressor head pressure and amperage draw; evaporator water carryover; fan brake horsepower, due to increase static pressure losses; airflow reduction.

At least once each year, or more often if the unit is located in a "dirty" environment, clean the evaporator and condenser coils using the instructions outlined below. Be sure to follow these instructions as closely as possible to avoid damaging the coils.

To clean refrigerant coils, use a soft brush and a sprayer (either a garden pump-up type or a high-pressure sprayer). A high-quality detergent is also required; suggested brands include "SPREX A.C.", "OAKITE 161", "OAKITE 166" and "COILOX". If the detergent selected is strongly alkaline (ph value exceeds 8.5), add an inhibitor.

1. Remove enough panels from the unit to gain access to the coil.
2. Protect all electrical devices such as motors and controllers from any over spray.
3. Straighten any bent coil fins with a fin comb.
4. Mix the detergent with water according to the manufacturer's instructions. If desired, heat the solution to 150 F maximum to improve its cleansing capability.

⚠ CAUTION: CONTAINS REFRIGERANT! SYSTEM CONTAINS OIL AND REFRIGERANT

Do not heat the detergent-and-water solution above 150° F. Hot liquids sprayed on the exterior of the coil will raise the coil's internal pressure and may cause it to burst. Failure to follow proper procedures can result in personal illness or injury or severe equipment damage.

5. Pour the cleaning solution into the sprayer. If a high-pressure sprayer is used:

   a. do not allow sprayer pressure to exceed 600 psi.

   b. the minimum nozzle spray angle is 15 degrees.

   c. maintain a minimum clearance of 6" between the sprayer nozzle and the coil.

   d. spray the solution perpendicular (at 90 degrees) to the coil face.

6. Spray the leaving-airflow side of the coil first; then spray the opposite side of the coil. Allow the cleaning solution to stand on the coil for five minutes.

7. Rinse both sides of the coil with cool, clean water.

8. Inspect both sides of the coil; if it still appears to be dirty, repeat Steps 6 and 7.

9. Reinstall all of the components and panels removed in Step 1 and any protective covers installed in step 2.

10. Restore the unit to it's operational status and check system operation.

Final Process

For future reference, you may find it helpful to record the unit data requested below in the blanks provided.

(1) Complete Unit Model Number:

_____

_____

(2) Unit Serial Number:

_____

_____

(3) Wiring Diagram Numbers (from unit control par

— schematic(s)

_____

_____

_____

_____

_____

— connection(s)

_____

_____

_____

_____

Table 7
Sample Maintenance Log

		Refrigerant Circuit #1						Refrigerant Circuit #2					
Date	Current Ambient Temp. (F)	Compr. Oil Level	Suct. Press. (Psig)	Disch. Press. (Psig)	Liquid Press. (Psig)	Super-heat (F)	Sub-cool. (F)	Compr. Oil Level	Suct. Press. (Psig)	Disch. Press. (Psig)	Liquid Press. (Psig)	Super-heat (F)	Sub-cool. (F)
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					
		- ok - low						- ok - low					

Note: Check and record the data requested above each month during the cooling season with the unit running.

Trouble Shooting

ReliaTel Control
The RTRM has the ability to provide the service personnel with some unit diagnostics and system status information.

Before turning the main power disconnect switch "Off", follow the steps below to check the ReliaTel Refrigeration Module (RTRM). All diagnostics & system status information stored in the RTRM will be lost when the main power is turned "Off".

⚠ WARNING: HAZARDOUS VOLTAGE!
HIGH VOLTAGE IS PRESENT AT THE TERMINAL BLOCK OR UNIT MOUNTED DISCONNECT SWITCH.

To prevent injury or death from electrocution, it is the responsibility of the technician to recognize this hazard and use extreme care when performing service procedures with the electrical power energized.

1. Verify that the Liteport LED on the RTRM is burning continuously. If the LED is lit, go to Step 3.

2. If the LED is not lit, verify that 24 VAC is presence between J1-1 and J1-2. If 24 VAC is present, proceed to Step 3. If 24 VAC is not present, check the unit main power supply, check transformer (TNS1). Proceed to Step 3 if necessary.

3. Utilizing "Method 1" or "Method 2" in the "System Status Diagnostic" section, check the following:
   System status
   Heating status
   Cooling status
   If a System failure is indicated, proceed to Step 4. If no failures are indicated, proceed to Step 5.

4. If a System failure is indicated, recheck Steps 1 and 2. If the LED is not lit in Step 1, and 24 VAC is present in Step 2, the RTRM has failed. Replace the RTRM.

5. If no failures are indicated, use one of the TEST mode procedures described in the "Unit Start-Up" section to start the unit. This procedure will allow you to check all of the RTRM outputs, and all of the external controls (relays, contactors, etc.) that the RTRM outputs energize, for each respective mode. Proceed to Step 6.

6. Step the system through all of the available modes, and verify operation of all outputs, controls, and modes. If a problem in operation is noted in any mode, you may leave the system in that mode for up to one hour while troubleshooting. Refer to the sequence of operations for each mode, to assist in verifying proper operation. Make the necessary repairs and proceed to Steps 7 and 8.

7. If no abnormal operating conditions appear in the test mode, exit the test mode by turning the power "Off" at the main power disconnect switch.

8. Refer to the individual component test procedures if other microelectronic components are suspect.

System Status Checkout Procedure

"System Status" is checked by using one of the following two methods:

Method 1

If the Zone Sensor Module (ZSM) is equipped with a remote panel with LED status indication, you can check the unit within the space. If the ZSM does not have LED's, use Method 2. BAYSENS010B, BAYSENS011B, BAYSENS019A, BAYSENS020A, BAYSENS021A & BAYSENS023A all have the remote panel indication feature. The LED descriptions are listed below.

LED 1 (System)
"On" during normal operation.
"Off" if a system failure occurs or the LED fails.
"Flashing" indicates test mode.

LED 2 (Heat)
"On" when the heat cycle is operating.
"Off" when the heat cycle terminates or the LED fails.
"Flashing" indicates a heating failure.

LED 3 (Cool)
"On" when the cooling cycle is operating.
"Off" when the cooling cycle terminates or the LED fails.
"Flashing" indicates a cooling failure.

LED 4 (Service)
"On" indicates a clogged filter.
"Off" during normal operation.
"Flashing" indicates an evaporator fan failure

Below is the complete listing of failure indication causes.

System Failure
Check the voltage between terminals 6 and 9 on J6, it should read approximately 32 VDC. If no voltage is present, a System failure has occurred. Refer to Step 4 in the previous section for the recommended troubleshooting procedure.

Cooling Failure
1. Cooling and heating set point (slide pot) on the zone sensor has failed. Refer to the "Zone Sensor Test Procedure" section.

2. Zone temperature thermistor ZTEMP on ZTS failed. Refer to the "Zone Sensor Test Procedure" section.

3. CC1 or CC2 24 VAC control circuit has opened, check CC1 & CC2 coils, and any of the controls below that apply to the unit (HPC1, HPC2).

4. LPC1 has opened during the 3 minute minimum "on time" during 4 consecutive compressor starts, check LPC1 or LPC2 by testing voltage between the J1-8 & J3-2 terminals on the RTRM and ground. If 24 VAC is present, the LPC's has not tripped. If no voltage is present, LPC's has tripped.

Service Failure
1. If the supply fan proving switch has closed, the unit will not operate (when connected to RTOM), check the fan motor, belts, and proving switch.

2. Clogged filter switch has closed, check the filters.

Simultaneous Heat and Cool Failure
1. Emergency Stop is activated

Method 2

The second method for determining system status is done by checking voltage readings at the RTRM (J6). The system indication descriptions and the approximate voltages are listed below.

System Failure
Measure the voltage between terminals J6-9 & J6-6.
Normal Operation = approximately 32 VDC
System Failure = less than 1 VDC, approximately 0.75 VDC
Test Mode = voltage alternates between 32 VDC & 0.75 VDC

Heat Failure
Measure the voltage between terminals J6-7 & J6-6.
Heat Operating = approximately 32 VDC
Heat Off = less than 1 VDC, approximately 0.75 VDC
Heating Failure = voltage alternates between 32 VDC & 0.75 VDC

Cool Failure
Measure the voltage between terminals J6-8 & J6-6.
Cool Operating = approximately 32 VDC
Cool Off = less than 1 VDC, approximately 0.75 VDC
Cooling Failure = voltage alternates between 32 VDC & 0.75 VDC

Service Failure
Measure the voltage between terminals J6-10 & J6-6.
Clogged Filter = Approximately 32 VDC.
Normal = Less than 1 VDC, approximately 0.75 VDC Fan Failure = voltage alternates between 32 VDC & 0.75 VDC.

To use LED's for quick status information at the unit, purchase a BAYSENS010B ZSM and connect wires with alligator clamps to terminals 6 through 10. Connected each respective terminal wire (6 through 10) from the Zone Sensor to the unit J6 terminals 6 through 10.

Note: If the system is equipped with a programmable zone sensor, (BAYSENS019A, BAYSENS020A or BAYSENS023A), the LED indicators will not function while the BAYSENS010A is connected.

Resetting Cooling and Heating Lockouts

Cooling Failures and Heating Lockouts are reset in an identical manner. Method 1 explains resetting the system from the space; Method 2 explains resetting the system at the unit.

Note: Before resetting Cooling Failures and Heating Lockouts check the Failure Status Diagnostics by the methods previously explained. Diagnostics will be lost when the power to the unit is disconnected.

Method 1

To reset the system from the space, turn the "Mode" selection switch at the zone sensor to the "Off" position. After approximately 30 seconds, turn the "Mode" selection switch to the desired mode, i.e. Heat, Cool or Auto.

Method 2

To reset the system at the unit, cycle the unit power by turning the disconnect switch "Off" and then "On".

Lockouts can be cleared through the building management system. Refer to the building management system instructions for more information.

Zone Temperature Sensor (ZTS) Service Indicator

The ZSM SERVICE LED is a generic indicator, that will signal the closing of a Normally Open switch at any time, providing the Indoor Motor (IDM) is operating. This indicator is usually used to indicate a clogged filter, or an air side fan failure.

The RTRM will ignore the closing of this Normally Open switch for 2 (±1) minutes. This helps prevent nuisance SERVICE LED indications. The exception is the LED will flash 40 seconds after the fan is turned "On" if the Fan Proving Switch is not made.

Clogged Filter Switch
This LED will remain lit the entire time that the Normally Open switch is closed. The LED will be turned off immediately after resetting the switch (to the Normally Open position), or any time that the IDM is turned "Off".

If the switch remains closed, and the IDM is turned "On", the SERVICE LED will be turned "On" again after the 2 (±1) minute ignore delay.

This LED being turned "On", will have no other affect on unit operation. It is an indicator only.

Trouble Shooting

Fan Failure Switch
When the "Fan Failure" switch is wired to the RTOM, the LED will remain flashing the entire time the fan proving switch is closed, indicating a fan failure, and it will shut the unit operations down.

Zone Temperature Sensor (ZTS) Test

Note: These procedures are not for programmable or digital models and are conducted with the Zone Sensor Module electrically removed from the system.

Test 1
Zone Temperature Thermistor (ZTEMP)

This component is tested by measuring the resistance between terminals 1 and 2 on the Zone Temperature Sensor. Below are some typical indoor temperatures, and corresponding resistive values.

Test 2
Cooling Set Point (CSP) and Heating Set Point (HSP)

Zone or Set Point Temperature	Nominal ZTEMP Resistance	Nominal CSP or HSP Resistance
50 F	19.9 K-Ohms	889 Ohms
55 F	17.47 K-Ohms	812 Ohms
60 F	15.3 K-Ohms	695 Ohms
65 F	13.49 K-Ohms	597 Ohms
70 F	11.9 K-Ohms	500 Ohms
75 F	10.50 K-Ohms	403 Ohms
80 F	9.3 K-Ohms	305 Ohms
85 F	8.25 K-Ohms	208 Ohms
90 F	7.3 K-Ohms	110 Ohms

The resistance of these potentiometers are measured between the following ZSM terminals. Refer to the chart above for approximate resistances at the given setpoints.

Cool SP = Terminals 2 and 3
Range = 100 to 900 Ohms approximate

Heat SP = Terminals 2 and 5
Range = 100 to 900 Ohms approximate

Test 3
System Mode and Fan Selection

The combined resistance of the Mode selection switch and the Fan selection switch can be measured between terminals 2 and 4 on the Zone Sensor. The possible switch combinations are listed below with their corresponding resistance values.

Test 4
LED Indicator Test, (SYS ON, HEAT, COOL & SERVICE)

Method 1

Testing the LED using a meter with diode test function. Test both forward and reverse bias. Forward bias should measure a voltage drop of 1.5 to 2.5 volts, depending on your meter. Reverse bias will show an Over Load, or open circuit indication if LED is functional.

Method 2

Testing the LED with an analog Ohmmeter. Connect Ohmmeter across LED in one direction, then reverse the leads for the opposite direction. The LED should have at least 100 times more resistance in reverse direction, as compared with the forward direction. If high resistance in both directions, LED is open. If low in both directions, LED is shorted.

Method 3

To test LED's with ZSM connected to unit, test voltages at LED terminals on ZSM. A measurement of 32 VDC, across an unlit LED, means the LED has failed.

Note: Measurements should be made from LED common (ZSM terminal 6 to respective LED terminal). Refer to the Zone Sensor Module (ZSM) Terminal Identification table at the beginning of this section.

Programmable & Digital Zone Sensor Test

Testing serial communication voltage
1. Verify 24 VAC is present between terminals J6-14 & J6-11.

2. Disconnect wires from J6-11 and J6-12. Measure the voltage between J6-11 and J6-12, should be about 32 VDC.

3. Reconnect wires to terminals J6-11 and J6-12. Measure voltage again between J6-11 and J6-12, voltage should flash high and low every 0.5 seconds. The voltage on the low end will measure about 19 VDC, while the voltage on the high end will measure from approximately 24 to 38 VDC.

4. Verify all modes of operation, by running the unit through all of the steps in the "Test Modes" section discussed in "Unit Start-Up".

5. After verifying proper unit operation, exit the test mode. Turn the fan on continuously at the ZSM, by pressing the button with the fan symbol. If the fan comes on and runs continuously, the ZSM is good. If you are not able to turn the fan on, the ZSM is defective.

Trouble Shooting

ReliaTel Refrigeration Module (RTRM) Default Chart

If the RTCI loses input from the building management system, the RTRM will control in the default mode after approximately 15 minutes. If the RTRM loses the Heating and Cooling setpoint input, the RTRM will control in the default mode instantaneously. The temperature sensing thermistor in the Zone Sensor Module is the only component required for the "Default Mode" to operate.

Unit Operation without a Zone Sensor

This procedure is for temporary operation only. The economizer and condenser fan cycling functions are disabled.

1. Open and Lock the unit disconnect switch.
2. Remove the Outside Air Sensor (OAS) from the condenser section of unit.
3. Use two (2) wire nuts, to individually cap the wires.
4. Locate the RTRM (J6). Connect two (2) wires to terminals J6-1 and 2.
5. Connect the sensor (OAS) using two wire nuts to the two (2) field supplied wires that were connected to terminals 1 and 2 on J6.

Unit Economizer Control (ECA) Troubleshooting ReliaTel Control

Verify Economizer Status by Economizer Actuator (ECA) LED indicator:

OFF:	No Power or Failure
ON:	Normal, OK to Economize
Slow Flash:	Normal, Not OK to Economize
Fast Flash:	Communications Failure
Pulse Flash:	Error Code:
1 Flash:	Actuator Fault
2 Flashes:	CO2 Sensor
3 Flashes:	RA Humidity Sensor
4 Flashes	RA Temp Sensor
5 Flashes:	OA Quality Sensor
6 Flashes:	OA Humidity Sensor
7 Flashes:	OA Temp Sensor
8 Flashes:	MA Temp Sensor
9 Flashes:	RAM Fault
10 Flashes:	ROM Fault
11 Flashes:	EEPROM Fault

Electro Mechanical Control

⚠ WARNING: HAZARDOUS VOLTAGE! HIGH VOLTAGE IS PRESENT AT THE TERMINAL BLOCK OR UNIT MOUNTED DISCONNECT SWITCH.

To prevent injury or death from electrocution, it is the responsibility of the technician to recognize this hazard and use extreme care when performing service procedures with the electrical power energized.

Cooling Failure

1. Cooling and heating set point (slide pot) on the thermostat has failed.
2. CC1 or CC2 24 VAC control circuit has opened, check CC1 & CC2 coils, and any of the controls below that apply to the unit (HPC1, HPC2, LPC1, LPC2, Frostat™).

Resetting Cooling and Heating Lockouts

Cooling Failures and Heating Lockouts are reset in an identical manner. Method 1 explains resetting the system from the space; Method 2 explains resetting the system at the unit.

Method 1

To reset the system from the space, turn the "Mode" selection switch at the thermostat to the "Off" position. After approximately 30 seconds, turn the "Mode" selection switch to the desired mode, i.e. Heat, Cool or Auto.

Method 2

To reset the system at the unit, cycle the unit power by turning the disconnect switch "Off" and then "On".

Unit Economizer Control (ECA) Test Procedures Electro Mechanical Control

This series of tests will allow you to diagnose, and determine where, and if a problem exists in the system economizer operation. Test 1 determines if the problem is in the Unit, or if it is in the ECA. Test 2 tests sensor inputs. Test 3 tests the resistors and sensors. Conduct the tests in numerical order until problem is found.

Test 1
Verifying that the economizer actuator (ECA) is functional:

1. Using the "Test Mode" described in the "System Start-Up" section, put the unit into the economizer mode and verify that the economizer actuator (ECA) drives fully open (approximately 90 seconds).

2. If the ECA is not driving the dampers, verify that 24 VAC is between the ECA terminals TR and TR1 is present. If 24 volts is not present, a wiring or terminal problem exists from the control transformer. Make any necessary repairs, see wiring diagrams to troubleshoot.

3. If 24 VAC is present, adjust the minimum position potentiometer fully clockwise. If the actuator does not drive, the economizer actuator is bad. Replace the ECA.

Test 2

Testing the ECA resistors and sensors

1. Testing the Mixed Air Sensor (MAS). Disconnect the wires connected to T and T1 on the ECA, and;

a. Measure the resistance of the sensor between the wires 180B and 181B.

b. Measure the temperature at the MAS location. Using the Temperature versus Resistance chart, verify the accuracy of the MAS.

Replace the sensor if it is out of range.

2. Testing the Outdoor Air Switch. If the temperature is above 60 degrees, it will need to be chilled. Measure the resistance of the sensor on the ECA SO and +.

The resistance should be approximately 390 Ohms.

Replace the Switch if it is open.

Replace the ECA if it is out of range.

3. Testing the R1 Resistance.

Measure the resistance of the sensor on the ECA SR and +.

The resistance should be approximately 420 Ohms.

Replace the ECA if it is out of range.

4. Testing the R2 Resistance.

Measure the resistance of the sensor on the ECA P and P1.

The resistance should be approximately 130 Ohms.

Replace the ECA if it is out of range.

Limited Warranty

Central Air Conditioner
TCY, TCX, TCC, TCD, TCH, TCM, TCP, TSC and THC (Parts Only)
Models Less Than 20 Tons for Residential Use*

This limited warranty is extended by American Standard Inc., to the original purchaser and to any succeeding owner of the real property to which the Air Conditioner is originally affixed, and applies to products purchased and retained for use within the U.S.A. and Canada.

If any part of your Air Conditioner fails because of a manufacturing defect within five years from the date of the original purchase, Warrantor will furnish without charge the required replacement part. Any local transportation, related service labor, diagnosis calls, refrigerant and related items are not included.

If the sealed motor-compressor fails because of a manufacturing defect within five years from the date of original purchase, Warrantor will furnish without charge the required replacement compressor. Any local transportation, related service labor, diagnosis calls, refrigerant and related items are not included.

This limited warranty does not cover failure of your Central Air Conditioner if it is damaged while in your possession, failure attributable or caused by unreasonable use of the Central Air Conditioner and/or failure to properly maintain the Central Air Conditioner as set forth in the Use and Care manual.

This limited warranty applies to product installed on or after 10/1/2001 where product is manufactured after 1/1/2000. This limited warranty is not retroactive to any installations prior to 10/1/2001 or on product produced prior to 2000.

THE LIMITED WARRANTY AND LIABILITY SET FORTH HEREIN ARE IN LIEU OF ALL OTHER WARRANTIES AND LIABILITIES, WHETHER IN CONTRACT OR IN NEGLIGENCE, EXPRESS OR IMPLIED, IN LAW OR IN FACT, INCLUDING BUT NOT SPECIFICALLY LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR USE, AND IN NO EVENT SHALL WARRANTOR BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.

Some states do not allow limitations on how long an implied limited warranty lasts or do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This limited warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Parts will be provided by our factory organization through an authorized service organization in your area listed in the yellow pages. If you wish further help or information concerning this limited warranty, contact:

American Standard Inc.
2701 Wilma Rudolph Blvd.
Clarksville, TN 37040-1008
Attention: Manager, Product Service

GW-609-4001

* This limited warranty is for residential usage of this equipment and not applicable when this equipment is used for a commercial application. A commercial use is any application where the end purchaser uses the product for other than personal, family or household purposes.

Limited Warranty

Central Air Conditioner
TCY, TCX, TCC, TCD, TCH, TCK, TCM, TCP, TSC and THC (Parts Only)
Models Less Than 20 Tons for Commercial Use*

This warranty is extended by American Standard Inc., to the original purchaser and to any succeeding owner of the real property to which the Air Conditioner is originally affixed, and applies to products purchased and retained for use within the U.S.A. and Canada. There is no warranty against corrosion, erosion or deterioration.

If any part of your Air Conditioner fails because of a manufacturing defect within one year from the date of the original purchase, Warrantor will furnish without charge the required replacement part.

In addition, if the sealed motor-compressor fails because of a manufacturing defect within the second through fifth year from the date of original purchase, Warrantor will furnish without charge the required replacement compressor.
Warrantor's obligations and liabilities under this warranty are limited to furnishing F.O.B. Warrantor factory or warehouse replacement parts for Warrantor's products covered under this warranty. Warrantor shall not be obligated to pay for the cost of lost refrigerant. No liability shall attach to Warrantor until products have been paid for and then liability shall be limited solely to the purchase price of the equipment under warranty shown to be defective.

THE WARRANTY AND LIABILITY SET FORTH HEREIN ARE IN LIEU OF ALL OTHER WARRANTIES AND LIABILITIES, WHETHER IN CONTRACT OR IN NEGLIGENCE, EXPRESS OR IMPLIED, IN LAW OR IN FACT, INCLUDING BUT NOT SPECIFICALLY LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR USE, AND IN NO EVENT SHALL WARRANTOR BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.

Some states do not allow limitations on how long an implied warranty lasts or do specific legal rights, and you may also have other rights which vary from state to state.

American Standard Inc.
2701 Wilma Rudolph Blvd.
Clarksville, TN 37040-1008
Attention: Manager, Product Service

GW-602-4800
* This warranty is for commercial usage of said equipment and not applicable when the equipment is used for a residential application. Commercial use is any application where the end purchaser uses the product for other than personal, family or household purposes.