Installation, Operation, and Maintenance

Blower Coil Air Handler
Air Terminal Devices - 400 cfm to 3000 cfm

Models BCHD and BCVD
"AO" and later design sequence

⚠SAFETY WARNING

Only qualified personnel should install and service the equipment. The installation, starting up, and servicing of heating, ventilating, and air-conditioning equipment can be hazardous and requires specific knowledge and training. Improperly installed, adjusted or altered equipment by an unqualified person could result in death or serious injury. When working on the equipment, observe all precautions in the literature and on the tags, stickers, and labels that are attached to the equipment.

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Warnings, Cautions and Notices

Warnings, Cautions and Notices. Note that warnings, cautions and notices appear at appropriate intervals throughout this manual. Warnings are provided to alert installing contractors to potential hazards that could result in death or personal injury. Cautions are designed to alert personnel to hazardous situations that could result in personal injury, while notices indicate a situation that could result in equipment or property-damage-only accidents.

Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions.

Read this manual thoroughly before operating or servicing this unit.

ATTENTION: Warnings, Cautions, and Notices appear at appropriate sections throughout this literature. Read these carefully:

⚠WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
⚠CAUTION	Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It could also be used to alert against unsafe practices.
NOTICE:	Indicates a situation that could result in equipment or property-damage only accidents.

Important Environmental Concerns!

Scientific research has shown that certain man-made chemicals can affect the earth's naturally occurring stratospheric ozone layer when released to the atmosphere. In particular, several of the identified chemicals that may affect the ozone layer are refrigerants that contain Chlorine, Fluorine and Carbon (CFCs) and those containing Hydrogen, Chlorine, Fluorine and Carbon (HCFCs). Not all refrigerants containing these compounds have the same potential impact to the environment. Trane advocates the responsible handling of all refrigerants-including industry replacements for CFCs such as HCFCs and HFCs.

Responsible Refrigerant Practices!

Trane believes that responsible refrigerant practices are important to the environment, our customers, and the air conditioning industry. All technicians who handle refrigerants must be certified. The Federal Clean Air Act (Section 608) sets forth the requirements for handling, reclaiming, recovering and recycling of certain refrigerants and the equipment that is used in these service procedures. In addition, some states or municipalities may have additional requirements that must also be adhered to for responsible management of refrigerants. Know the applicable laws and follow them.

⚠WARNING

Proper Field Wiring and Grounding Required!

All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state electrical codes. Failure to follow code could result in death or serious injury.

⚠WARNING

Personal Protective Equipment (PPE) Required!

Installing/servicing this unit could result in exposure to electrical, mechanical and chemical hazards.

- **Before installing/servicing this unit, technicians MUST put on all Personal Protective Equipment (PPE) recommended for the work being undertaken. ALWAYS refer to appropriate MSDS sheets and OSHA guidelines for proper PPE.**
- **When working with or around hazardous chemicals, ALWAYS refer to the appropriate MSDS sheets and OSHA guidelines for information on allowable personal exposure levels, proper respiratory protection and handling recommendations.**
- **If there is a risk of arc or flash, technicians MUST put on all Personal Protective Equipment (PPE) in accordance with NFPA 70E or other country-specific requirements for arc flash protection, PRIOR to servicing the unit.**

Failure to follow recommendations could result in death or serious injury.

Table of Contents

Model Number Descriptions

Following is a complete description of the blower coil model number. Each digit in the model number has a corresponding code that identifies specific unit options.

Digits 1, 2, 3, 4 — Unit Model

BCHD = Horizontal Blower Coil
BCVD = Vertical Blower Coil

Digits 5, 6, 7 — Unit Size

012 = Unit size 12 - 1 ton
018 = Unit size 18 - 1 1/2 ton
024 = Unit size 24 - 2 ton
036 = Unit size 36 - 3 ton
054 = Unit size 54 - 4 1/2 ton
072 = Unit size 72 - 6 ton
090 = Unit size 90 - 7 1/2 ton

Digit 8 — Unit Voltage

A = 115/60/1
B = 208/60/1
C = 230/60/1
D = 277/60/1
J = 220/50/1
K = 240/50/1

Digit 9 —Insulation Type

1 = 1 inch Matte-faced insulation
2 = 1 inch Foil-faced insulation

Digits 10, 11 — Design Sequence

** = Factory sets the design sequence

Digit 12 — Motor and Control Box Location

A = Same side as coil connections, horizontal or counterswirl options only
B = Opposite side from coil connections, horizontal or counterswirl options only
C = Same side as coil connections, preswirl option only
D = Opposite side from coil connections, preswirl only

Digit 13 — Coil Connection Side

1 = PVC drain pan right-hand coil and drain connections
2 = PVC drain pan left-hand coil and drain connections
3 = Stainless steel drain pan right-hand coil and drain connections
4 = Stainless steel drain pan left-hand coil and drain connections
0 = None

Digit 14 — Coil #1 First in Airstream

Note: *All coils are hydronic unless stated otherwise.*

0 = No coil 1
A = 1-row preheat
F = 4-row
G = 6-row
J = 4-row with autochangeover
K = 6-row with autochangeover
L = 2-row high capacity preheat
M = 4-row high capacity
N = 6-row high capacity
R = 4-row high capacity with autochangeover
T = 6-row high capacity with autochangeover
1 = 3-row DX coil 3/16-inch (0.032) dist
2 = 4-row DX coil 3/16-inch (0.032) dist
3 = 6-row DX coil 3/16-inch (0.032) dist
4 = 3-row DX coil 3/16-inch (0.049) dist
5 = 4-row DX coil 3/16-inch (0.049) dist
6 = 6-row DX coil 3/16-inch (0.049) dist
7 = 4-row DX coil 3/16-inch (0.049) dist, heat pump
8 = 6-row DX coil, 3/16-inch (0.049) dist, heat pump

Digit 15 — Unit Coil #2

Note: *All coils are hydronic unless stated otherwise.*

0 = No coil 2
A = 1-row reheat
F = 4-row
G = 6-row
J = 4-row with autochangeover
K = 6-row with autochangeover
L = 2-row high capacity reheat
M = 4-row high capacity
N = 6-row high capacity
R = 4-row high capacity with autochangeover
T = 6-row high capacity with autochangeover
1 = 3-row DX coil 3/16-inch (0.032) dist
2 = 4-row DX coil 3/16-inch (0.032) dist
3 = 6-row DX coil 3/16-inch (0.032) dist
4 = 3-row DX coil 3/16-inch (0.049) dist
5 = 4-row DX coil 3/16-inch (0.049) dist
6 = 6-row DX coil 3/16-inch (0.049) dist
7 = 4-row DX coil 3/16-inch (0.049) dist, heat pump
8 = 6-row DX coil, 3/16-inch (0.049) dist, heat pump

Digit 16 — Motor Horsepower

2 = 1/2 hp
4 = 1 hp

Model Number Descriptions

Digit 17 — RPM

A = 500 rpm
B = 600 rpm
C = 700 rpm
D = 800 rpm
E = 900 rpm
F = 1000 rpm
G = 1100 rpm
H = 1200 rpm
J = 1300 rpm
K = 1400 rpm
L = 1500 rpm
M = 1600 rpm
N = 1700 rpm
P = 1800 rpm
R = 1900 rpm
T = 2000 rpm
U = 2100 rpm
V = 2200 rpm
W = 2300 rpm
Z = TOPSS base performance

Digit 18 — Electric Heat Stages

1 = 1-stage
2 = 2-stage
0 = none

Digits 19, 20, 21 — Electric Heat

010 = 1.0 kW	
015 = 1.5 kW	060 = 6.0 kW
020 = 2.0 kW	065 = 6.5 kW
025 = 2.5 kW	070 = 7.0 kW
030 = 3.0 kW	075 = 7.5 kW
035 = 3.5 kW	080 = 8.0 kW
040 = 4.0 kW	090 = 9.0 kW
045 = 4.5 kW	100 = 10.0 kW
050 = 5.0 kW	110 = 11.0 kW
055 = 5.5 kW	000 = None

Digit 22 — Electric Heat Controls

0 = None
A = 24 volt magnetic contactors
B = 24 volt mercury contactors

Digit 23 — Electric Heat Options

0 = None
A = Line fuse
B = Door interlocking disconnect switch
C = A and B

Digit 24 — Filters

0 = None
A = 1-in. throwaway
B = 2-in. MERV 8 throwaway
C = 2-in. MERV 13 throwaway

Digit 25 — Accessory Section

0 = None
A = Mixing box only
B = Angle filter box
C = Angle filter/mixing box
D = Top access filter module
E = Bottom access filter module
F = A and D
G = A and E
H = Steam coil module
J = A and H
K = B and H
L = C and H
M = D and H
N = E and H
P = A, D and H
R = A, E and H

Digit 26 — Control Type

1 = CSTI
2 = Tracer ZN010
3 = Tracer ZN510
4 = Tracer ZN520
5 = UC400
6 = No controls (FSS)

Digit 27 — Coil #1 Control Valve Type

0 = None
A = 2-way, 2-position, N.C.
B = 2-way, 2-position, N.O.
C = 3-way, 2-position, N.C.
D = 3-way, 2-position, N.O.
E = 2-way modulating
F = 3-way, modulating
G = Field-supplied valve, 2-position, N.C.
H = Field-supplied valve, 2-position, N.O.
J = Field-supplied modulating valve
K = Field-supplied analog valve

Digit 28 — Coil #1 Control Valve Cv

0 = None
A = 3.3 Cv, 1/2-in. valve and pipe
B = 3.3 Cv, 1/2-in. valve, 3/4-in. pipe
C = 3.8 Cv, 1/2-in. valve, 3/4-in. pipe
D = 6.6 Cv, 1-in. valve and pipe
E = 7.4 Cv, 1-in. valve and pipe
F = 8.3 Cv, 1 1/4-in. valve and pipe
G = 3.5 Cv, 1/2-in. valve and pipe
H = 4.4 Cv, 1/2-in. valve and pipe
K = 8.0 Cv, 1-in. valve and pipe
Q = 1.3 Cv, 1/2-in. valve, 3/4-in. pipe
R = 1.8 Cv, 1/2-in. valve, 3/4-inc. pipe
T = 2.3 Cv, 1/2-in. valve, 3/4-in. pipe
U = 2.7 Cv, 1/2-in. valve, 3/4-in. pipe

Digit 29 — Coil #1 Piping Package

0 = None
1 = Basic piping package
2 = Deluxe piping package

Digit 30 — Coil #2 Control Valve

0 = None
A = 2-way, 2-position, N.C.
B = 2-way, 2-position, N.O.
C = 3-way, 2-position, N.C.
D = 3-way, 2-position, N.O.
E = 2-way modulating
F = 3-way modulating
G = Field-supplied valve, 2-position N.C.
H = Field-supplied valve, 2-position N.O.
J = Field-supplied modulating valve
K = Field-supplied analog valve

Digit 31— Coil #2 Control Valve Cv

0 = None
A = 3.3 Cv, 1/2-in. valve and pipe
B = 3.3 Cv, 1/2-in. valve, 3/4-in. pipe
C = 3.8 Cv, 1/2-in. valve, 3/4-in. pipe
D = 6.6 Cv, 1-in. valve and pipe
E = 7.4 Cv, 1-in. valve and pipe
F = 8.3 Cv, 1 1/4-in. valve and pipe
G = 3.5 Cv, 1/2-in. valve and pipe
H = 4.4 Cv, 1/2-in. valve and pipe
K = 8.0 Cv, 1-in. valve and pipe
Q = 1.3 Cv, 1/2-in. valve, 3/4-in. pipe
R = 1.8 Cv, 1/2-in. valve, 3/4-in. pipe
T = 2.3 Cv, 1/2-in. valve, 3/4-in. pipe
U = 2.7 Cv, 1/2-in. valve, 3/4-in. pipe

Digit 32 — Coil #2 Piping Package

0 = None
1 = Basic piping package
2 = Deluxe piping package

Digit 33 — Remote Heat Options

0 = No remote heat
1 = Remote staged electric heat
2 = Remote 2-position hot water, N.C.

Digit 34 — Mixing Box Damper Actuator

Note: *The back damper is the control damper when actuators are ordered. The back damper is N.C. or N.O. as selected.*

0 = None
1 = 2-position, N.O., ship loose
2 = Modulating, N.C.
3 = Modulating, N.O.
4 = Modulating, ship loose
5 = Field-supplied 2-position, N.O.
6 = Field-supplied 2-position, N.C.
7 = Field-supplied modulating

Digit 35 — Factory Mounted Control Options

0 = None
C = Condensate overflow
D = Low Limit
K = Condensate overflow and low limit

Digit 36 — Control Options 2

0 = None
A = Outside air sensor, field-mounted
B = Discharge air sensor
C = Outside air and discharge air sensor

Digit 37 — Control Options 3

0 = None
A = Dehumidification with communicated value
B = Dehumidification with local humidity sensor

Digit 38 — Zone Sensors

0 = None
1 = Wall-mounted temp sensor (SP, OA, OCC/UNCOCC, COMM)
3 = Wall-mounted temp sensor (SP, OCC/UNOCC, COMM)
4 = Wall-mounted temp sensor (OCC/UNOCC, COMM
C = Wireless temp sensor, unit-mounted receiver
E = Wall-mounted temp sensor (SP, OALMH, OCC/UNOCC, COMM)
F = Wall-mounted display sensor (SP, OALMH, COMM)
G = Wireless display sensor, unit-mounted receiver (SP, OALMH)
H = Wall-mounted FSS

Digit 39 — Seismic Certification

0 = None

Digit 40 — Extra Filter

0 = None
1 = Ship loose extra 1-in. Throwaway
2 = Ship loose extra 2-in. MERV 8 throwaway
3 = Ship loose extra 2-in. MERV 13 throwaway

Introduction

Overview of Manual

Use this manual to install, startup, operate, and maintain Trane commercial blower coil models BCHD and BCVD. It provides specific instructions for “AO” and later design sequences.

For previous design sequence information, contact your local Trane representative.

Trademarks

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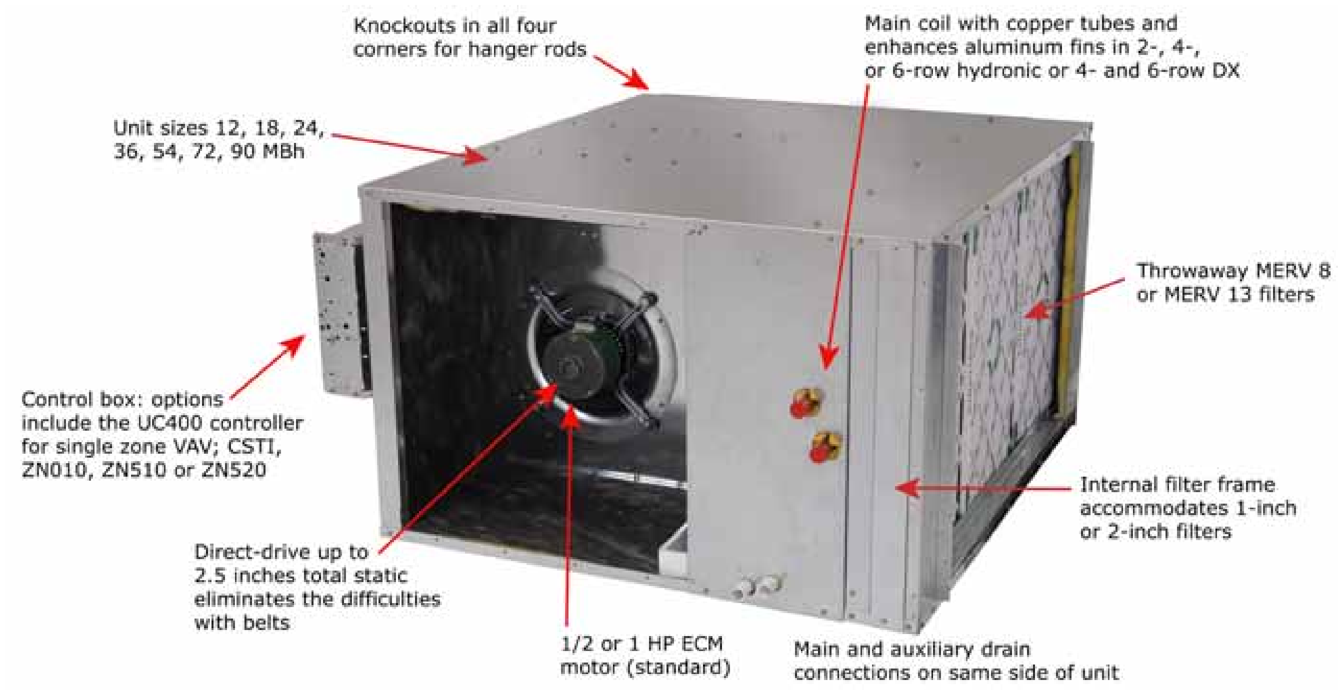
General Information

Blower coil units are draw-thru air handlers for cooling load conditions of 400–3000 cfm. Units are available in either horizontal (model BCHD) or vertical (model BCVD) configurations. Horizontal units are typically ceiling suspended via threaded rods. Knockouts are provided in all four corners to pass the rods through the unit. Horizontal units can also be floor mounted. Vertical units are typically floor mounted. They have a side inlet for easy duct connection, and do not require a field fabricated inlet plenum. Vertical units ship in two pieces and can be set up in either a pre-swirl or counter-swirl configuration.

Basic unit components consist of a water coil, condensate drain pan, filter, duct collars, one fan wheel, and motor with drive. See Figure 1.

Figure 1. Blower coil air handler unit components (model BCHD, horizontal unit)



Two, four, or six-row main coils are available for either hydronic cooling or heating. Three, four, or six-row direct expansion (DX) coils are also available for cooling. An optional one, two, four, or six-row heating coil is available factory-installed in either the preheat or reheat position. Also, a one-row preheat steam is available.

All units have an internal flat filter frame for one or two-inch filters. An optional angle filter box (two inch only), mixing box, bottom/top filter access box, or combination angle filter mixing box is available.

In addition, all units are available with either a basic or deluxe piping package option that includes a variety of control valve sizes in two or three-way configurations. The basic package consists of a control valve and stop (ball) valves. The deluxe package consists of a control valve, a stop (ball) valve, a circuit setter, and strainer.

Direct-drive motors range from 1/2 to 1 horsepower in a wide range of voltages. All motors have internal current overload protection, permanently sealed ball bearings, and rubber grommets on the mounting brackets to reduce noise and vibration transmission.

Motors come factory programmed for specific job requirements or can be programed based on standardized motor speeds. Field adjustment of motor speeds can be adjusted through the Velocitach™ motor control board. This enables the unit to be balanced for changes to design static pressures fast and easy. Refer to the original sales order and Table 40, p. 55 for drive information.

Units may have no controls (fan speed switch - FSS), or any of five different control types:

1. Customer Supplied Terminal Interface (CSTI)
2. Tracer ZN010
3. Tracer ZN510
4. Tracer ZN520
5. Tracer UC400

All control options are factory-installed and tested.

Pre-Installation

Receiving and Handling

Inspection

Upon delivery, thoroughly inspect all components for any shipping damage that may have occurred, and confirm that the shipment is complete. See "Receiving Checklist" section for detailed instructions.

Note: *Delivery cannot be refused. All units are shipped F.O.B. factory. Trane is not responsible for shipping damage.*

Packaging/Shipping

Blower coil units ship assembled on skids with protective coverings over the coil and discharge openings.

Field-installed sensors ship separately inside the unit's main control panel. Piping packages and mixing boxes are packaged separately and ship on the same skid as the unit.

Identification

Each air handler includes a nameplate identifying the customer tagging information, unit serial number, unit order number, and the unit model number.

Handling

The unit ships on skids that provide forklift locations from the front or rear. The skid allows easy maneuverability of the unit during storage and transportation. Trane recommends leaving units and accessories in their shipping packages/skids for protection and handling ease until installation. Remove the skids before placing the unit in its permanent location.

Remove the skids using a forklift or jack. Lift one end of the unit off of the skids. Vibration isolators for external isolation are field supplied.

Receiving Checklist

Complete the following checklist immediately after receiving shipment to detect possible shipping damage.

- ☐ Check to ensure that the shipment is complete. Small components may ship inside the unit or ship separately. Check the parts list to ensure all materials are present.
- ☐ Check all units, components, connections, and piping. Check fan wheel for free rotation by spinning manually. Check all doors, latches and hinges. Inspect interior of each unit or section. Inspect coils for damage to fin surface and coil connections. Check for rattles, bent corners, or other visible indications of shipping damage. Tighten loose connections.
- ☐ If a unit is damaged, make specific notations concerning the damage on the freight bill. Do not refuse delivery.
- ☐ Notify the carrier's terminal of the damage immediately by phone and mail. Request an immediate joint inspection of the damage by the carrier and consignee.
- ☐ Notify your Trane sales representative of the damage and arrange for repair. Do not attempt to repair the unit without consulting the Trane representative.
- ☐ Inspect the unit for concealed damage as soon as possible after delivery. Report concealed damage to the freight line. It is the receiver's responsibility to provide reasonable evidence that concealed damage did not occur after delivery. Take photos of damaged material if possible.

  Note: *Concealed damage must be reported within 15 days of receipt.*

Jobsite Storage

This unit is intended for indoor use only. It is the sole responsibility of the customer to provide the necessary protection to prevent vandalism and weather protection of the equipment. Under no circumstance should the unit be left unprotected from the elements.

NOTICE:

Microbial Growth!

Wet interior unit insulation can become an amplification site for microbial growth (mold), which could result in odors and damage to the equipment and building materials. If there is evidence of microbial growth on the interior insulation, it should be removed and replaced prior to operating the system.

If indoor storage is not possible, Trane makes the following recommendations to prevent damage:

Note: *Keep the equipment on the original wooden blocks/ skid for protection and ease of handling.*

- Select a well-drained area, preferably a concrete pad or blacktop surface.
- Place the unit on a dry surface or raised off the ground to assure adequate air circulation beneath the unit and to assure no portion of the unit will contact standing water at any time.
- Cover the unit securely with a canvas tarp.

NOTICE:

Corrosion!

Use only canvas tarps to cover air handlers. Plastic tarps can cause condensation to form in and on the equipment, which could result in corrosion damage or wet storage stains.

- Do not stack units.
- Do not pile other material on the unit.

Site Preparation

- Ensure the installation site can support the total weight of the unit (see "Unit Dimensions and Weights" on page 13 for approximate section weights; refer to the unit submittals for actual weights).
- Allow sufficient space for adequate free air and necessary service access (see "Service Clearances" on page 13). Refer to submittals for specific minimums.
- Allow room for supply and return piping, ductwork, electrical connections, and coil removal. Support all piping and ductwork independently of the unit to prevent excess noise and vibration.
- Ensure there is adequate height for coil piping and condensate drain requirements. See "Condensate Drain Connections," page 28.
- Confirm the floor or foundation is level. For proper unit operation, the unit must be level (zero tolerance) in both horizontal axis.

NOTICE:

Microbial Growth!

The floor or foundation must be level and the condensate drain at the proper height for proper coil drainage and condensate flow. Standing water and wet surfaces inside the equipment can become an amplification site for microbial growth (mold), which could cause odors and damage to the equipment and building materials.

- If the unit is to be ceiling mounted, the installer/contractor must provide threaded suspension rods. All units must be installed level.

Dimensions and Weights

Service Clearances

Figure 2. Top view of blower coil showing recommended service and code clearances

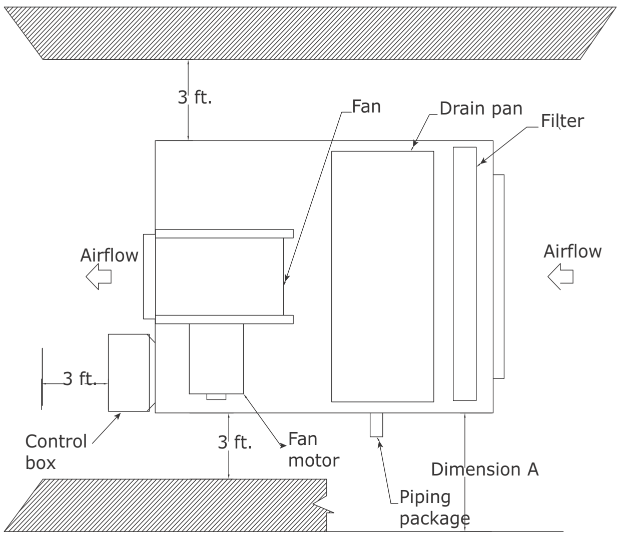


Figure 3. Top view of blower coil showing recommended service and code clearances

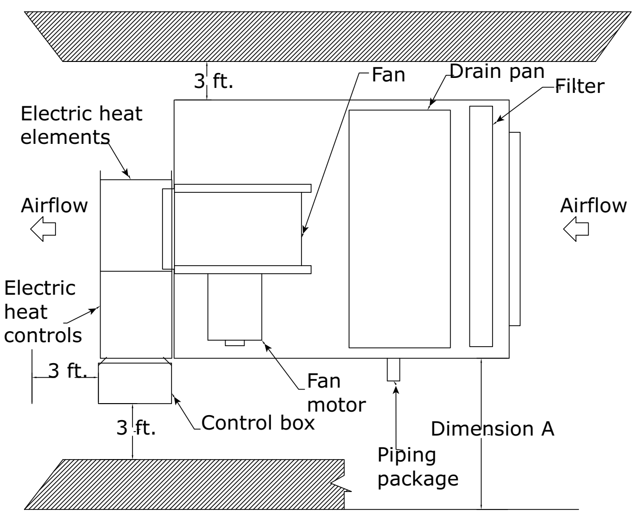


Table 1. Service requirements (inches)

Unit size	Dimension A
12	20
18	25
24	25
36	37
54	37
72	45
90	45

Horizontal Blower Coil

Figure 4. Horizontal blower coil

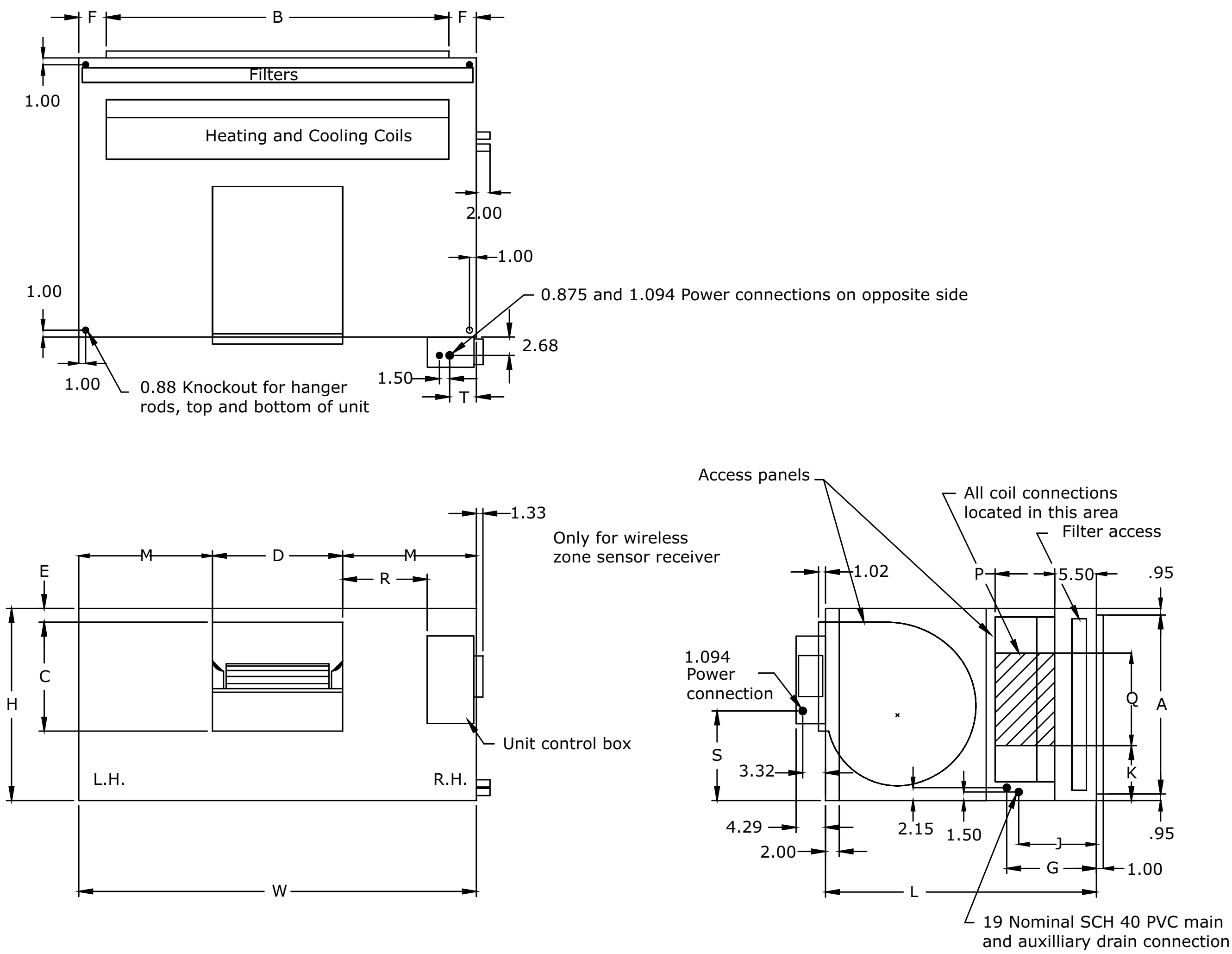


Table 2. Horizontal blower coil dimensions (in.) and weights (lb)

Unit Size	H	W	L	A	B	C	D	E	F	G (RH)	G (LH)	J (RH)	J (LH)	K	M	P	Q	R	S	T	Basic Unit Weight
12	14.00	24.00	31.15	12.09	18.00	10.56	7.47	0.55	3.00	11.42	13.42	9.42	11.42	4.20	8.24	9.00	5.75	1.35	2.91	4.01	64.0
18	14.00	28.00	31.15	12.09	22.00	10.56	7.47	0.55	3.00	11.42	13.42	9.42	11.42	4.20	10.24	9.00	5.75	3.42	2.93	3.94	69.0
24	18.00	28.00	33.72	16.09	22.00	13.57	9.04	1.30	3.00	11.42	13.42	9.42	11.42	6.20	9.68	9.00	5.75	2.73	3.09	3.84	89.6
36	18.00	40.00	33.72	16.09	34.00	13.57	9.04	1.30	3.00	11.42	13.42	9.42	11.42	6.20	15.68	9.00	5.75	8.64	2.93	3.94	104.5
54	22.00	40.00	41.57	20.09	34.00	13.58	12.57	0.72	3.00	11.42	13.42	9.42	11.42	7.43	13.72	11.00	7.27	6.87	6.93	3.94	129.0
72	22.00	48.00	41.57	20.09	40.00	13.58	12.57	0.72	4.00	11.42	13.42	9.42	11.42	7.43	17.72	11.00	7.27	10.87	6.93	3.94	142.0
90	28.00	48.00	43.94	26.09	40.00	13.58	12.57	1.66	4.00	12.79	14.79	10.79	12.79	8.24	17.72	11.25	11.64	10.92	13.06	3.89	162.8

Note:

- All coil connections are sweat style.
- Weight of basic unit includes cabinet, fan, wiring and average filter. It does not include coil, motor or shipping package. Please refer to Table 48 for motor weights. Add to basic unit weight seven pounds for weight of control box.
- Control box factory-mounted on drive side.

Vertical Blower Coil

Figure 5. Vertical blower coil

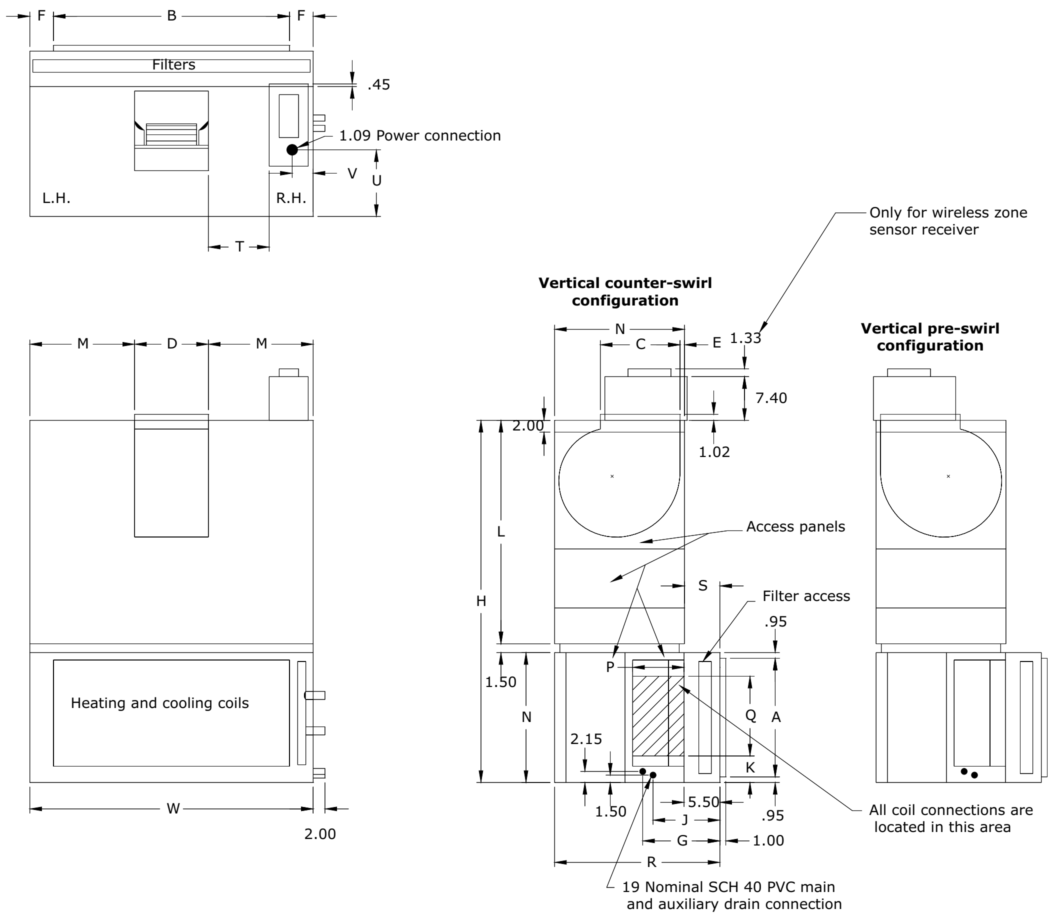


Table 3. Vertical blower coil dimensions (in.) and weights (lb)

Unit Size	H	W	L	A	B	C	D	E	F	G (RH)	G (LH)	J (RH)	J (LH)
24	51.72	28.00	32.22	16.09	22.00	13.57	9.04	1.30	3.00	11.42	13.42	9.42	11.42
36	51.72	40.00	32.22	16.09	34.00	13.57	9.04	1.30	3.00	11.42	13.42	9.42	11.42
54	63.57	40.00	40.07	20.09	34.00	13.58	12.57	0.72	3.00	11.42	13.42	9.42	11.42
72	63.57	48.00	40.07	20.09	40.00	13.58	12.57	0.72	4.00	11.42	13.42	9.42	11.42
90	71.94	48.00	42.44	26.09	40.00	13.58	12.57	1.66	4.00	12.79	14.79	10.79	12.79

Unit Size	K	M	N	P	Q	R	S	T	U	V	Basic Unit Weight
24	6.20	9.68	18.00	9.00	5.50	28.00	10.00	1.96	6.78	3.71	141.1
36	6.20	15.68	18.00	9.00	5.50	28.00	10.00	8.63	6.78	3.04	168.80
54	4.21	13.72	22.00	11.00	7.27	30.00	8.00	6.87	10.78	3.04	197.4
72	4.18	17.72	22.00	11.00	7.27	30.00	8.00	5.83	10.78	8.08	246.4
90	4.81	17.72	28.00	11.25	11.64	30.00	2.00	7.84	16.78	6.07	258.40

Notes:
- All coil connections are sweat style.
- Weight of basic unit includes cabinet, fan, wiring and average filter. Add to basic unit weight seven pounds for weight of control box. Control box factory-mounted on motor side.
- Vertical coil and filter section ships separate for field installation. Refer to installation and maintenance manual for instructions.
- Vertical units provided with 4-inch to 6-inch high mounting legs. Legs are seismic rated.

Angle Filter and Mixing Box

Figure 6. Angle filter and mixing box dimensions

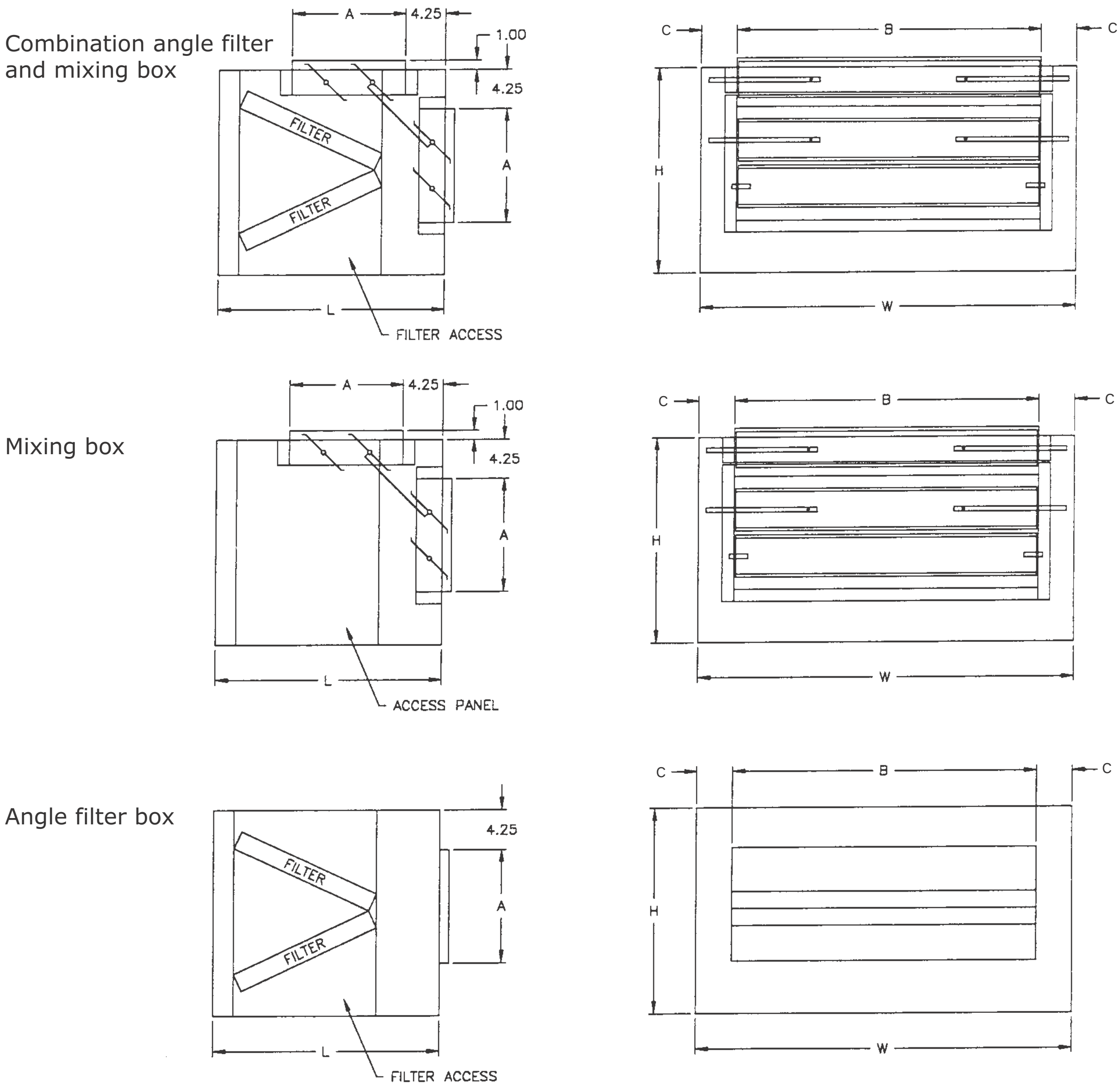


Table 4. Angle filter and mixing box dimensions (in.) and weights (lb)

Unit Size	H	L	W	A	B	C	Weight
12	14.12	22.00	24.11	7.06	15.56	4.28	36.0
16	14.12	22.00	28.11	7.06	19.56	4.28	41.0
24	18.12	19.50	28.11	7.06	19.56	4.28	43.0
36	18.12	24.50	40.11	7.06	31.56	4.28	56.0
54	22.12	23.50	40.11	12.81	31.56	4.28	72.0
72	22.00	23.50	48.00	12.81	31.56	8.22	72.5
90	27.90	27.56	48.00	12.85	31.56	8.22	84.1

Bottom or Top Access Filter Box

Figure 7. Bottom or top access filter box

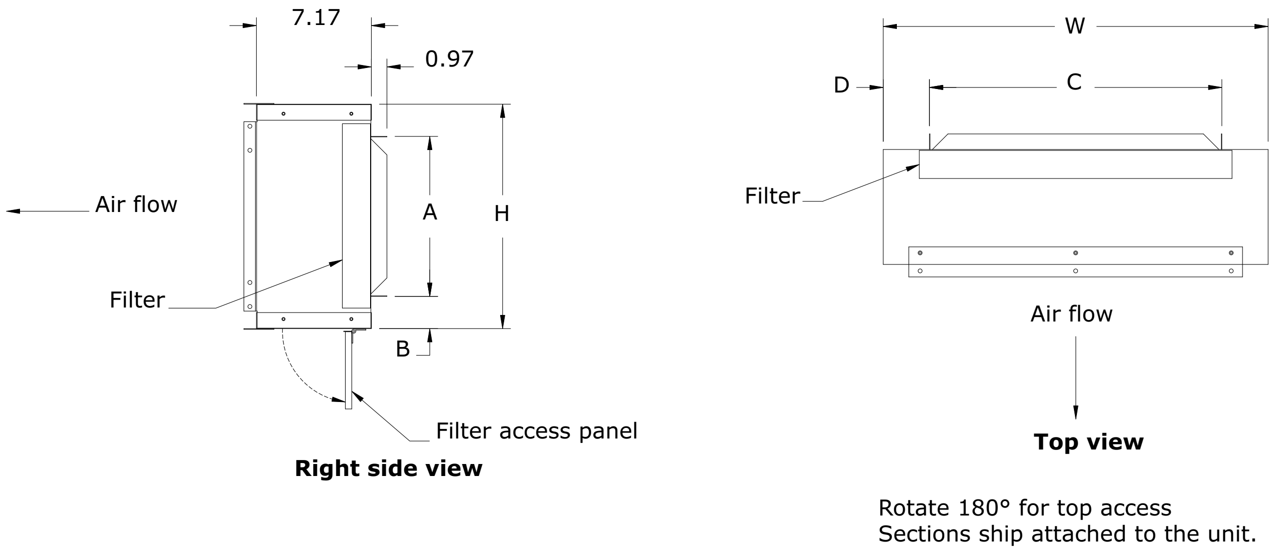


Table 5. Bottom or top access filter box dimensions (in.) and weights (lb)

Unit Size	H	W	A	B	C	D	Weight
12	14.00	24.00	9.98	2.01	18.23	2.88	15
18	14.00	28.00	9.98	2.01	21.98	3.01	17
24	18.00	28.00	14.23	1.89	23.23	2.38	18
36	18.00	40.00	14.23	1.89	33.73	3.13	25
54	22.00	40.00	18.23	1.89	33.73	3.13	28
72	22.00	48.00	18.23	1.89	42.73	2.63	32
90	28.00	48.00	23.23	1.89	41.23	3.38	37

Electric Heat

Figure 8. Blower coils with electric heat

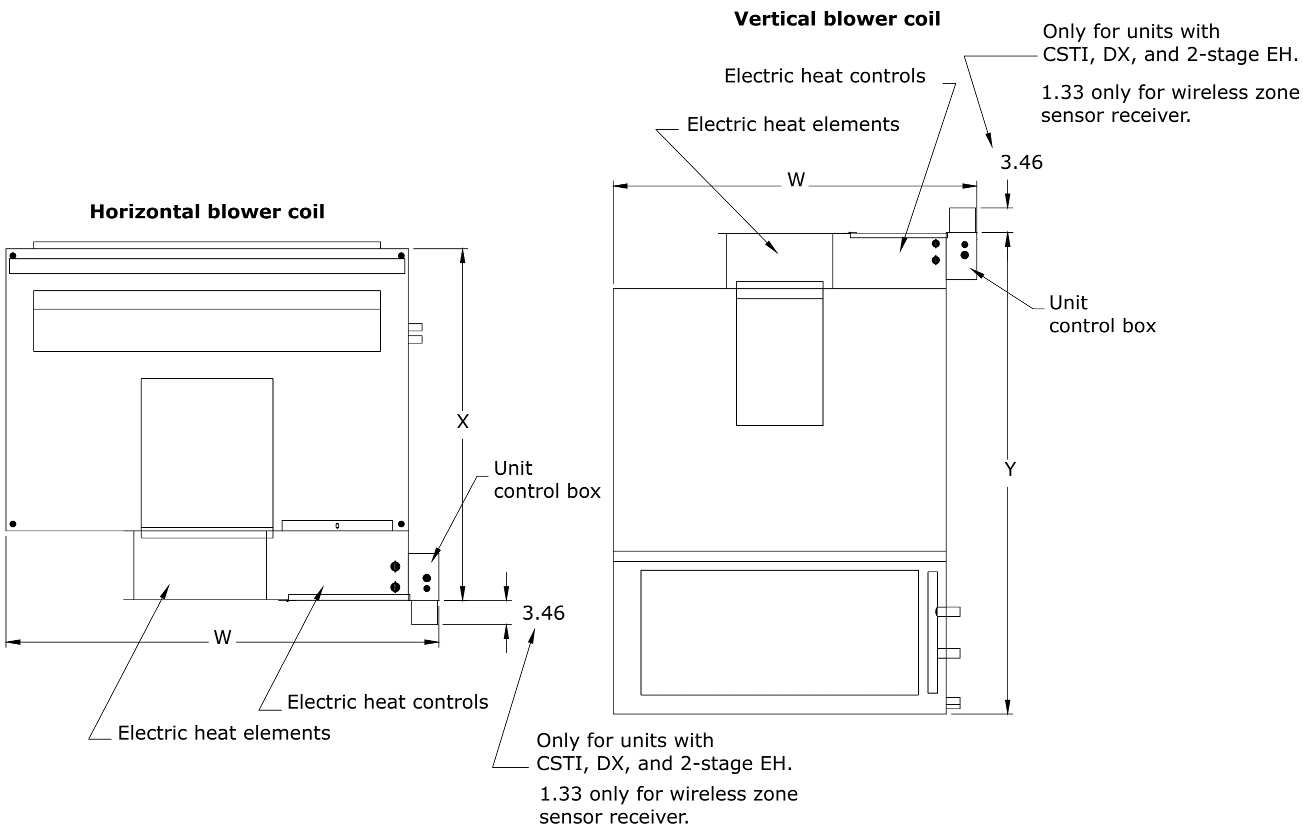


Table 6. Blower coils with electric heat dimensions (in.) and weights (lb)

Unit Size	W	X	Y
12	28.28	37.97	n/a
18	32.29	37.97	n/a
24	30.54	40.75	48.54
36	42.57	40.75	60.57
54	44.32	48.39	66.32
72	48.29	48.60	70.29
90	48.29	50.96	76.29

Figure 9. Electric heat dimensions

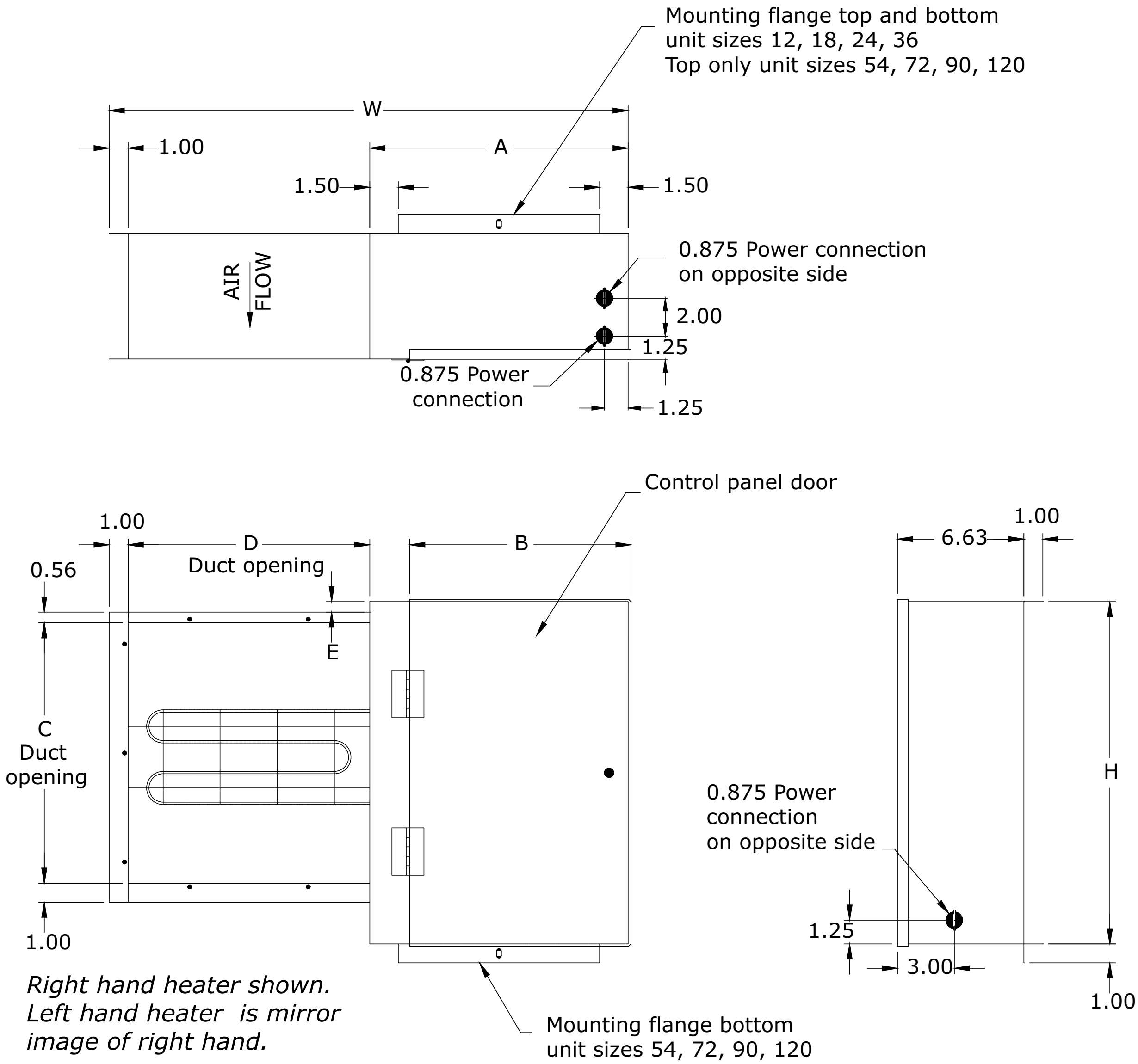


Table 7. Electric heat dimensions (in.) and weights (lb)

Unit Size	H	W	A	B	C	D	E	Weight
12	14.06	17.88	8.13	6.79	10.50	8.75	0.03	10.0
18	14.06	19.88	10.13	8.79	10.50	8.75	0.03	10.8
24	18.06	17.75	7.63	6.29	13.50	9.13	0.80	11.3
36	18.06	23.75	13.63	12.29	13.50	9.13	0.80	12.8
54	18.06	27.25	13.63	11.67	13.50	12.63	0.22	16.0
72	18.06	27.25	13.63	11.67	13.50	12.63	0.22	17.4
90	18.06	27.25	13.63	11.67	13.50	12.63	1.16	19.2

- Electric heater is factory mounted on unit discharge face and wired to unit control box.
- Heater may be mounted with horizontal or vertical up airflow.
- Optional mercury contactors cannot be used with vertical up airflow.
- Electric heat may need field-supplied externally-wrapped insulation if the unit is installed in an unconditioned space or if sweating is an issue.

Steam Coil

Figure 10. Steam coil dimensions

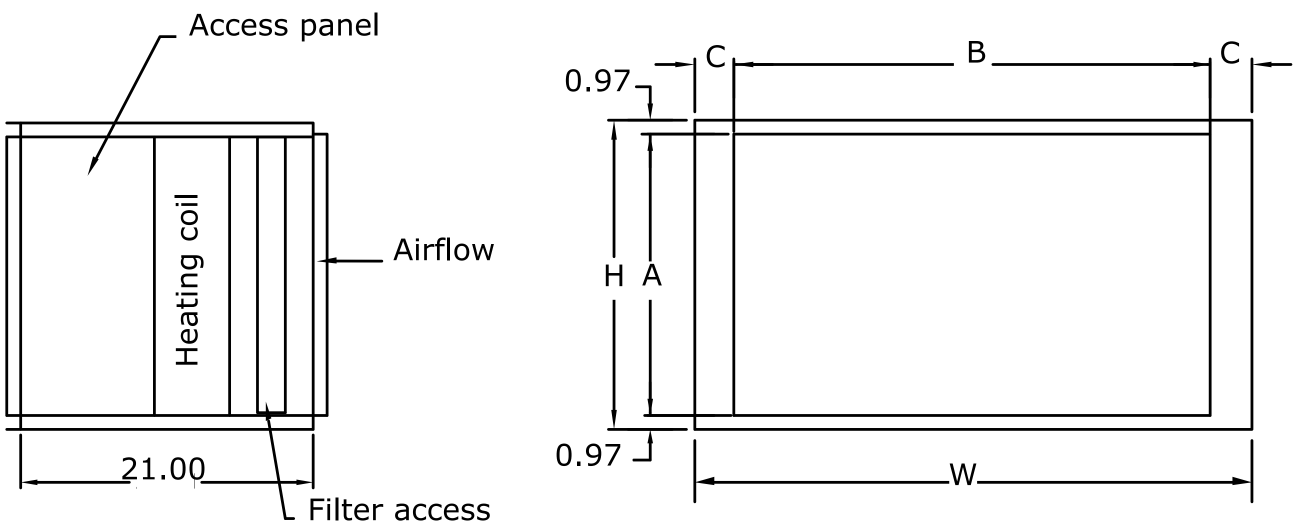


Table 8. Steam coil box dimensions (in.) and weights (lb)

Unit Size	H	W	A	B	C	Weight	Coil Connections, NPT Supply	Coil Connections, NPT Return
12	14.00	24.00	12.06	18.04	2.98	34	1	3/4
18	14.00	28.00	12.06	22.04	2.98	37	1	3/4
24	18.00	28.00	16.06	22.04	2.98	40	1-1/2	1
36	18.00	40.00	16.06	34.04	2.98	48	1-1/2	1
54	22.00	40.00	20.06	34.04	2.98	50	2	1
72	22.00	48.00	20.06	42.04	2.98	56	2	1
90	28.00	48.00	26.06	40.04	3.98	63	2-1/2	1-1/4

Note:
- Filter access and access panel located on both sides.
- Weight includes cabinet with average filter, but does not include coil weight. See general data section for coil weights.

Coil Connections

Table 9. Hydronic coil connection sizes, OD (in.)

	Standard Capacity			High Capacity		
Unit Size	1-Row	4-Row	6-Row	2-Row	4-Row	6-Row
12	5/8	—	—	5/8	7/8	7/8
18	5/8	—	—	5/8	7/8	7/8
24	5/8	—	—	7/8	1-1/8	1-1/8
36	5/8	—	—	7/8	1-1/8	1-1/8
54	1-1/8	1-3/8	1-3/8	1-1/8	1-1/8	1-1/8
72	1-1/8	1-3/8	1-3/8	1-1/8	1-1/8	1-1/8
90	1-1/8	1-5/8	1-5/8	1-1/8	1-1/8	1-1/8

Table 10. DX coil connection sizes, OD (in.)

	3-Row and 4-Row		6-Row	
Unit Size	Suction	Liquid	Suction	Liquid
12	5/8	5/8	5/8	5/8
18	5/8	5/8	5/8	5/8
24	5/8	5/8	7/8	5/8
36	7/8	5/8	7/8	5/8
54	1-1/8	7/8	1-1/8	7/8
72	1-1/8	7/8	1-1/8	7/8
90	1-3/8	7/8	1-1/8	7/8

Table 11. Steam coil connection sizes, female connection, NPT (in.)

Unit Size	Supply	Return
12	1	3/4
18	1	3/4
24	1-1/2	1
36	1-1/2	1
54	2	1
72	2	1
90	2-1/2	1-1/4

Piping Packages

Table 12. Piping package dimensions (in.)

Piping Package	Nominal Tube Size	Actual Size	A	B	C	D	E	F
2-way	1/2	5/8	12.025	2.650	12.625	5.650	n/a	n/a
	1	1-1/8	13.295	4.260	13.220	9.288	3.020	N/A
3-way	1/2	5/8	12.088	2.097	12.688	4.497	6.351	6.351
	3/4	7/8	15.623	1.750	15.313	6.290	6.701	6.701
	1	1-1/8	13.370	3.690	13.210	9.060	9.813	9.813
	1-1/4	1-3/8	16.885	3.738	16.410	10.023	3.052	10.520

Basic Piping

Figure 11. Two-way 1/2-in. and 1-in. valve basic piping package

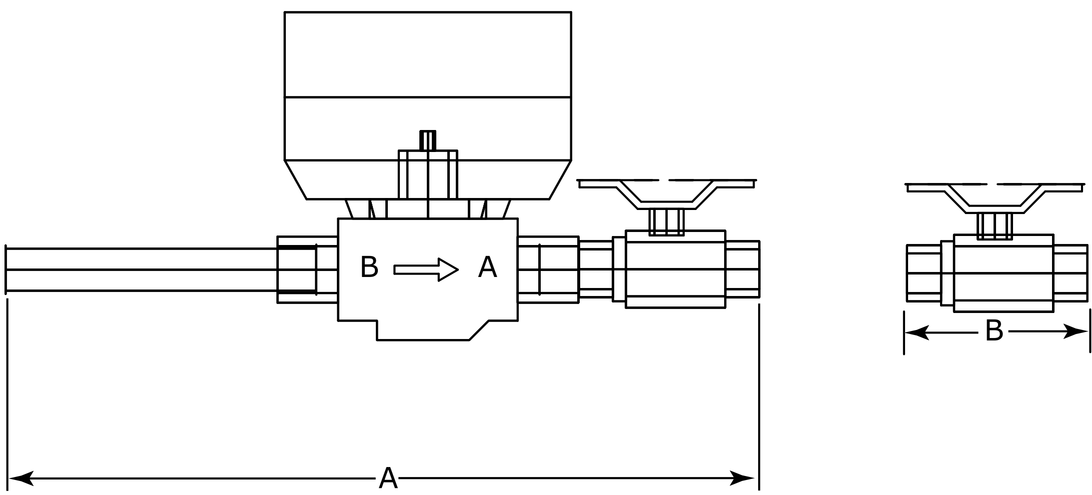


Figure 12. Two-way 1 1/4-in. valve basic piping package

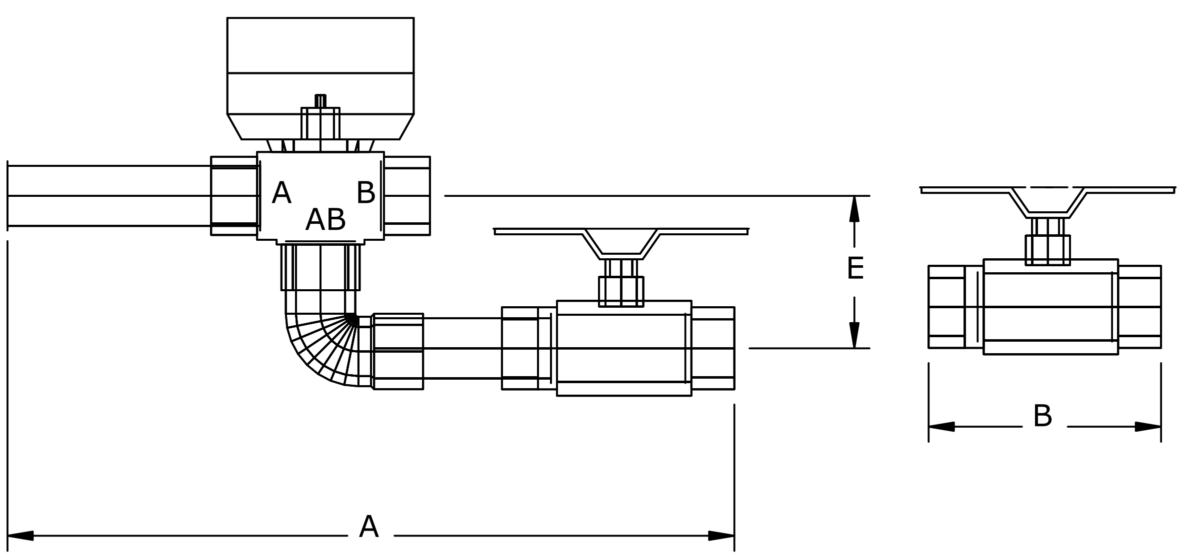
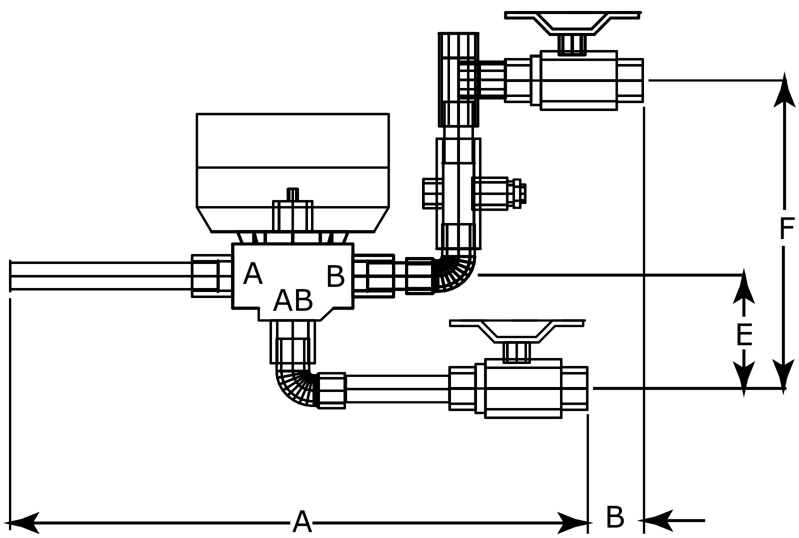


Figure 13. Three-way, 1/2 in. and 1-in. valve basic piping package



Deluxe Piping

Figure 14. Two-way 1/2-in. and 1-in. valve deluxe piping package

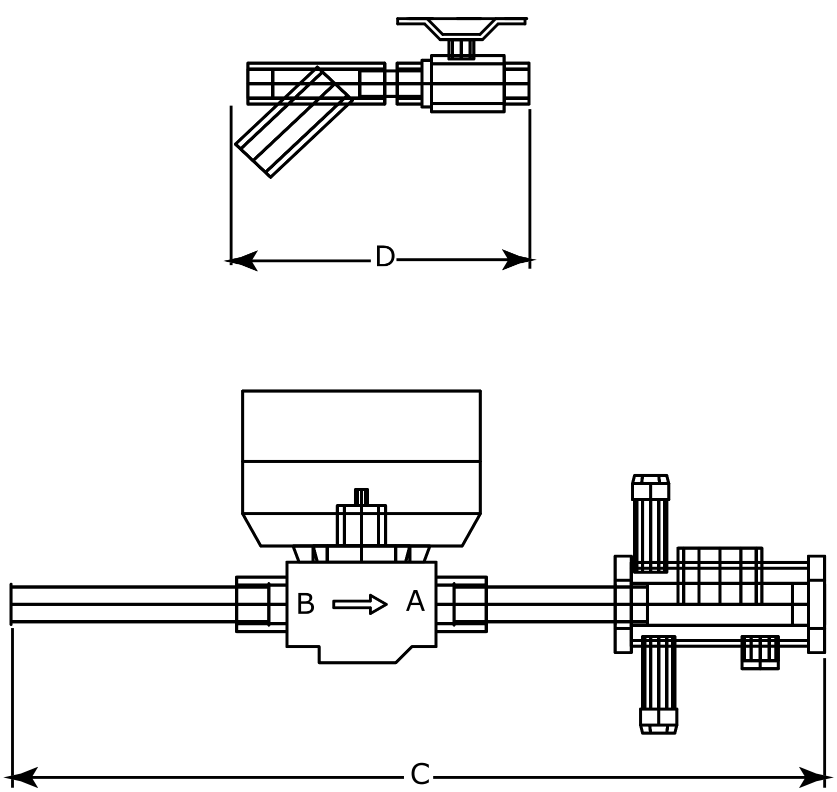
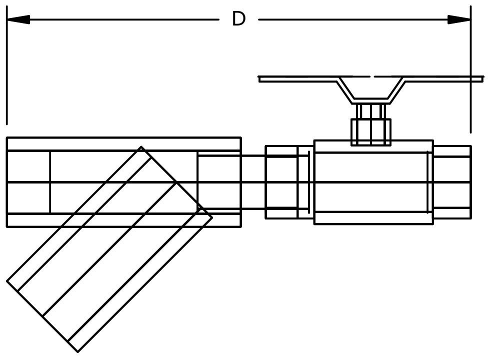


Figure 15. Two-way 1 1/4-in. valve deluxe piping package



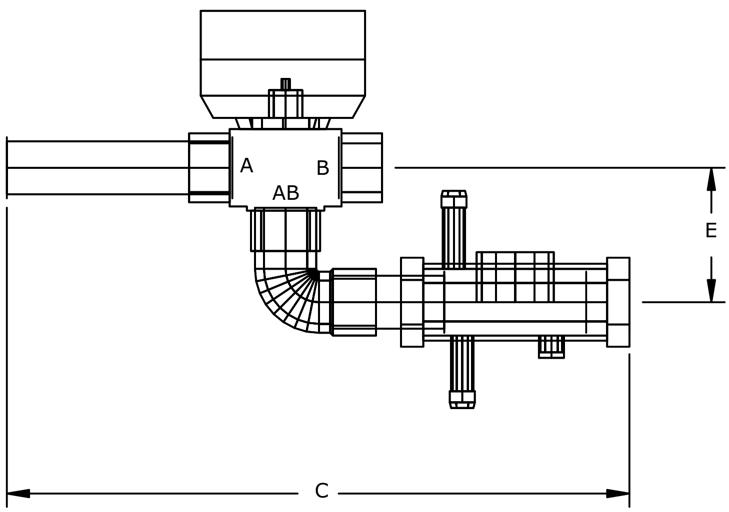
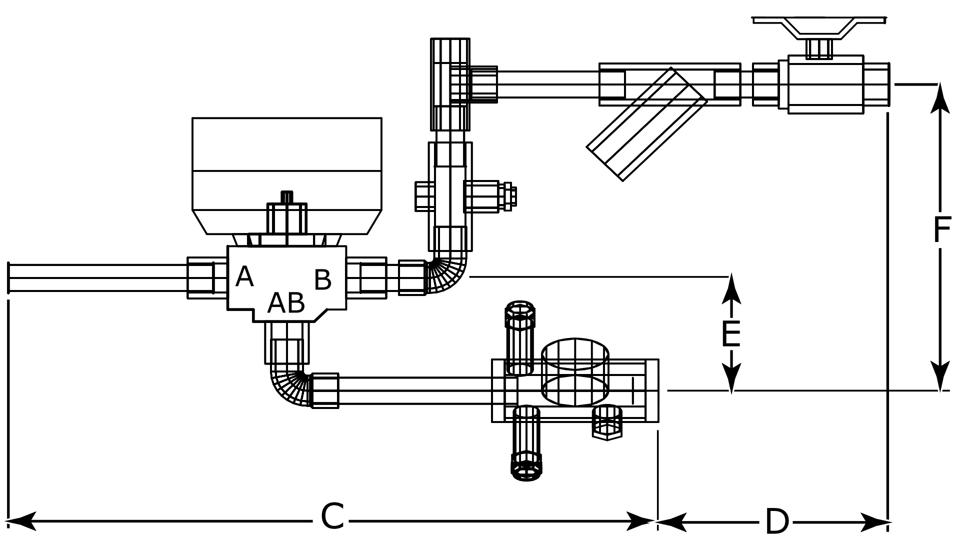


Figure 16. Three-way 1/2-in. and 1-in. valve deluxe piping package



Installation - Mechanical

Lifting and Rigging

⚠WARNING

Improper Unit Lift!

Test lift unit approximately 24 inches to verify proper center of gravity lift point. To avoid dropping of unit, reposition lifting point if unit is not level. Failure to properly lift unit could result in unit dropping and possibly crushing operator/technician which could result in death or serious injury and possible equipment or property-only damage.

:

NOTICE:

Equipment Damage!

Keep skid in place until unit is ready to set. Do not move the unit or subassembly without the skid in place as shipped from the factory. Premature skid removal could result in equipment damage.

General Lifting Considerations

Before preparing the unit for lifting, estimate the approximate center of gravity for lifting safety. Because of placement of internal components, the unit weight may be unevenly distributed, with more weight in the coil and fan areas. Approximate unit weights are provided in "Dimensions and Weights" on page 13. Refer to the unit submittals for actual section weights. Test the unit for proper balance before lifting.

Before hoisting the unit into position, use a proper rigging method such as straps, slings, or spreader bars for protection and safety. Always test-lift the unit to determine the exact unit balance and stability before hoisting it to the installation location.

⚠WARNING

Heavy Objects!

Ensure that all the lifting equipment used is properly rated for the weight of the unit being lifted. Each of the cables (chains or slings), hooks, and shackles used to lift the unit must be capable of supporting the entire weight of the unit. Lifting cables (chains or slings) may not be of the same length. Adjust as necessary for even unit lift. Other lifting arrangements could cause equipment or property damage. Failure to follow instructions above or properly lift unit could result in unit dropping and possibly crushing operator/technician which could result in death or serious injury.

1. Position rigging sling under wood skid using spreader bars to avoid unit damage.
2. Use a forklift with caution to prevent unit damage. The fork length must be at least 68 inches long to safely fork the unit from front or back.
3. The unit center of gravity will fall within the center of gravity block at various locations depending on unit options.
4. See unit nameplate for unit weight.

⚠WARNING

Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

Installation Procedure

Follow the procedures below to install the blower coil unit.

Horizontal Unit Installation

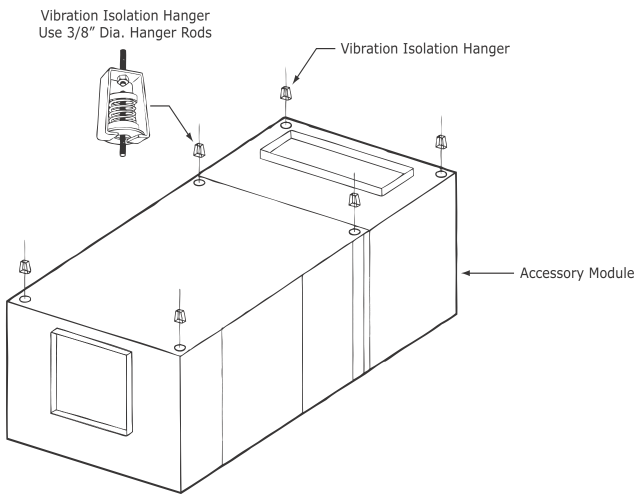
Install horizontal units suspended from the ceiling with 3/8-in. threaded rods that are field-provided. There are two knockouts in each corner of the unit for installation of the threaded rods. Ensure the ceiling opening is large enough for unit installation and maintenance requirements.

Materials needed:

- washers: 3/8-in., 1/2-in., and 3/4-in. (8 total)
- threaded rods, 3/8-in. (4 per unit and 2 per accessory section)
- nuts (8)
- flat washers or steel plates (8)
- vibration isolator hangers or turnbuckles (4 per unit and 2 per angle filter/mixing box/steam coil module)

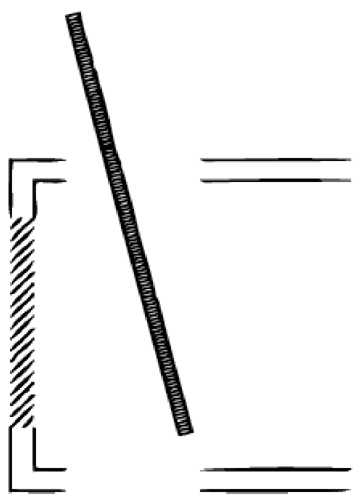
1. Determine the unit mounting hole dimensions. Prepare the hanger rod isolator assemblies, which are field-provided. Add a stack of 3/8-in., 1/2-in., and 3/4-in. washers to the top and bottom of the unit to hold it securely on the 3/8-in. rod, and install them in the ceiling. Trane recommends using threaded rods to level the unit. Consult the unit nameplate or "Dimensions and Weights," page 13 in this manual for the unit weight. See Figure 4 for proper horizontal unit installation.

Figure 17. Ceiling mounted horizontal unit



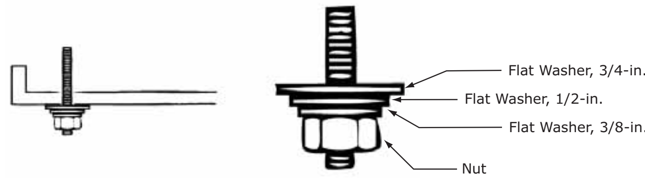
2. Remove motor access panels and filter access panels.
3. Punch out the eight knockouts in the top and bottom panels.
4. Guide the threaded rod through the unit from the top, careful not to damage insulation or wiring. See Figure 18. Insert the threaded rod at an angle to help prevent internal unit damage.

Figure 18. Angle threaded rod through knockouts



5. Put a nut and flat washers or steel plate on the bottom of the threaded rod (see Figure 19).

Figure 19. Add nut and flat washers to threaded rod



6. Put a nut and flat washer or steel plate on the top to prevent air leakage.
7. Thread the top of the rod into the isolator or turnbuckle.
8. Hoist the unit to the suspension rods and attach with washers and lock–nuts (see Figure 19 for details).
9. Level the unit for proper coil drainage and condensate removal from the drain pan. Refer to "Condensate Drain Connections," page 28.
10. Connect the ductwork to the unit. Refer to "Duct Connections," page 28.

Vertical Unit Installation

Materials needed:

- 1/4-inch 20 grade 8 screws, lockwashers, and nuts (8 per mounting leg = 32 per unit, and 16 per accessory section)
- Flat washers (12 per mounting leg = 48 per unit, and 24 per accessory section)

Install vertical units on the floor. Units are provided with legs that are field-installed to help accommodate a U-trap on the drain connection, if necessary. For mounting leg installation, use 1/4-in.-20 grade 8 screws as shown in Figure 22, p. 27. A field-fabricated inlet plenum is not required. The unit is shipped in two pieces, and can be arranged in either a pre-swirl or counter-swirl inlet configuration (see Figure 20).

Figure 20. Typical vertical unit installation

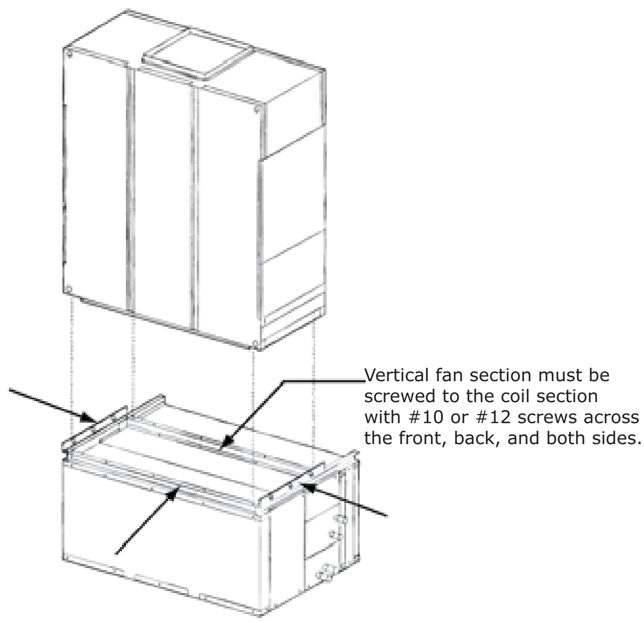


Figure 21. Mounting feet installation for vertical fan kit and steam coil module

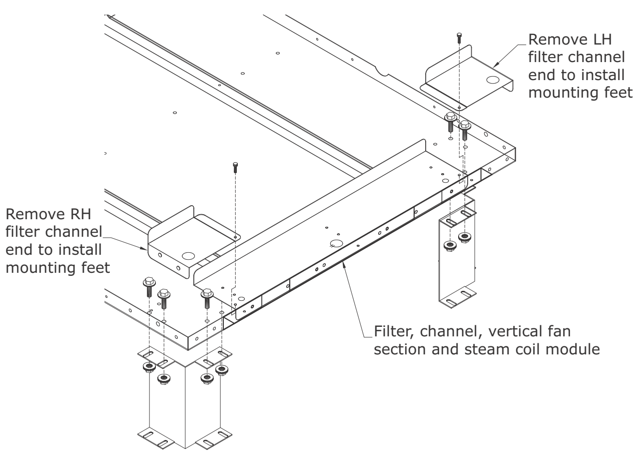
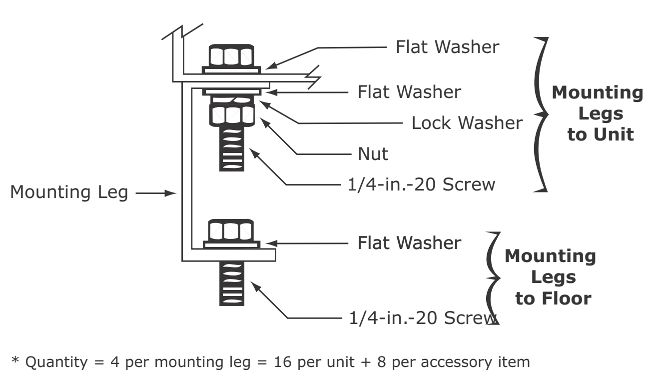


Figure 22. Mounting leg installation



Heating Coil Installation

Note: *The hydronic heating coil option is factory installed in either the reheat or preheat position. Coils can be rotated for either right or left-hand connections.*

If you need to rotate the hydronic heating coil option to change the coil connection side, follow the procedure below.

1. Remove both coil access panels.
2. Remove the coil and rotate to change connection position.
3. Exchange coil patch plates.
4. Knock out drain pipe connections on new coil hand access panel.
5. Plug old drain connections.

Mixing Box Installation

Materials provided:

- Mounting legs (2) for vertical units
- Interconnecting linkage, LH or RH attachment

Materials needed:

- Grooved and extendible drive rods, 1/2-inch O.D. grooved
- #10 screws, for mounting mixing box to unit, steam coil module, or top/bottom access
- 1/4-inch 20 grade 8 screws for mounting leg installation (see Figure 22)

The mixing box option ships separately for field installation. It has two low-leak, opposed blade dampers and all necessary interconnecting linkage components for left or right hand attachment onto 1/2-inch O.D. grooved, extendible drive rods. Also, mounting legs are provided for floor mounting on a vertical unit. Knockouts are provided to suspend the mixing box from the ceiling horizontally.

Installation Procedure

1. Support the mixing box independent of the unit in the horizontal position.
2. Install the mixing box as a sleeve around the duct collar of the filter frame. To attach the mixing box to the filter frame, insert screws through the matching the holes on all sides of the mixing box and filter frame.
3. Install the linkage, following the procedure below.

Linkage Installation Procedure

1. Attach the linkage on either the right or left side of the mixing box following the procedure below.
2. Open the damper blades fully. Locate drive rods on the LH or RH side for linkage attachment. Loosen drive rod set screw, without removing.

3. Remove knockouts on side access panel adjacent to the drive rods.
4. Pierce a hole through the insulation at the knockouts to allow the drive rod to extend freely through side of mixing box. Cut away insulation sufficiently to allow drive rod to turn smoothly.
5. Extend drive rod end at desired position beyond side of unit. Tighten drive rod set screws.
6. Attach linkage and tighten all set screws. Note that neither hand levers are provided. However, mixing box actuators are a factory-provided option that ship inside the mixing box when ordered.
7. Position linkage so both sets of dampers operate freely and so that when one damper is fully open, the other is fully closed.

Condensate Drain Connections

Note: It is the installer's responsibility to provide adequate condensate piping to prevent potential water damage to the equipment and/or building.

Size the main drain lines and trap them the same size as the drain connection, which is 3/4-inch schedule 40 PVC, 1.050 inch O.D. on blower coils.

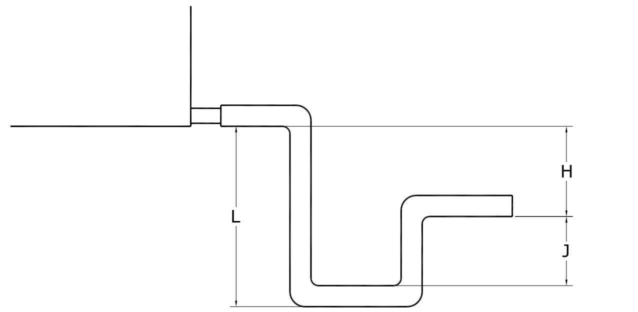
If drain pan removal is required, make the main and auxiliary drain connections with compression fittings. Follow the procedure below to remove the drain pan.

1. Remove the opposite side coil access panel.
2. Remove the drain pan clips.
3. Disconnect drain lines.
4. Remove the sheet metal screw.
5. Pull out drain pan through the opposite side.

Note: Prime drain traps to prevent the drain pan overflow.

Plug or trap the auxiliary connection to prevent air from being drawn in and causing carryover (see Figure 23, p. 28).

Figure 23. Recommended drain trap installation for draw-through units



Drain pan trapping for section under negative pressure

L = H + J + pipe diameter where:
H = 1 inch for each inch of negative pressure plus 1 inch
J = 1/2 H

Drain pan trapping for section under positive pressure

L = H + J + pipe diameter where:
H = 1/2 inch (minimum)
J = 1/2 inch plus the unit positive static pressure at coil discharge (loaded filters)

All drain lines downstream of the trap must flow continuously downhill. If segments of the line are routed uphill, this can cause the drain line to become pressurized. A pressurized drain line may cause the trap to back up into the drain pan, causing overflow.

Duct Connections

Install all air ducts according to the National Fire Protection Association standards for the "Installation of Air Conditioning and Ventilation Systems other than Residence Type (NFPA 90A) and Residence Type Warm Air Heating and Air Conditioning Systems (NFPA 90B).

Make duct connections to the unit with a flexible material such as heavy canvas to help minimize noise and vibration. If a fire hazard exists, Trane recommends using Flexweave 1000, type FW30 or equivalent canvas. Use *three inches* for the return duct and *three inches* for the discharge duct. Keep the material loose to absorb fan vibration.

Run the ductwork straight from the opening for a minimum of 1 1/2 fan diameters. Extend remaining ductwork as far as possible without changing size or direction. Do not make abrupt turns or transitions near the unit due to increased noise and excessive static losses. Avoid sharp turns and use elbows with splitters or turning vanes to minimize static losses.

Poorly constructed turning vanes may cause airflow generated noise. Align the fan outlet properly with the ductwork to decrease duct noise levels and increase fan performance. Check total external static pressures against fan characteristics to be sure the required airflow is available throughout the ductwork.

To achieve maximum acoustical performance, minimize the duct static pressure setpoint.

Coil Piping and Connections

NOTICE:

Connection Leaks!

Use a backup wrench when attaching piping to coils with copper headers to prevent damage to the coil header. Do not use brass connectors because they distort easily and could cause connection leaks.

NOTICE:

Over Tightening!

Do not use Teflon-based products for any field connections because their high lubricity could allow connections to be over-tightened, resulting in damage to the coil header.

NOTICE:

Leakage!

Properly seal all penetrations in unit casing. Failure to seal penetrations from inner panel to outer panel could result in unconditioned air entering the module, and water infiltrating the insulation, resulting in equipment damage.

General Recommendations

Proper installation, piping, and trapping is necessary to ensure satisfactory coil operation and to prevent operational damage:

- Support all piping independently of the coils.
- Provide swing joints or flexible fittings on all connections that are adjacent to heating coils to absorb thermal expansion and contraction strains.
- If the coil was ordered with factory-mounted controls, install the control valves. The valves ship separately.

Note: *The contractor is responsible for supplying the installation hardware.*

- For best results, use a short pipe nipple on the coil headers prior to making any welded flange or welded elbow type connections.
- Pipe coils counterflow to airflow.
- When attaching the piping to the coil header, make the connection only tight enough to prevent leaks. Maximum recommended torque is 200 foot-pounds.
- Use pipe sealer on all thread connections.
- After completing the piping connections, seal around pipe from inner panel to outer panel.

Note: *Water coils and refrigerant coils have stubs for solder/braze connection. Steam coils have female NPT connections.*

Steam Coil Piping

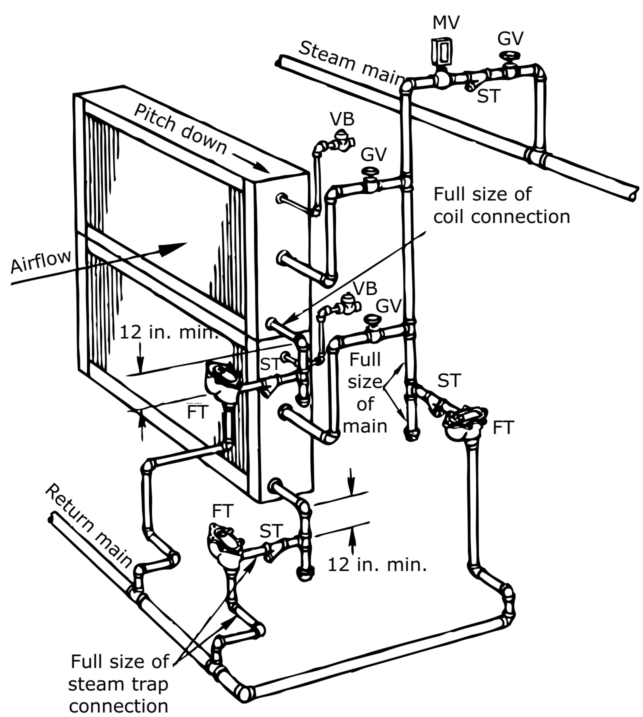
Air handlers fitted with steam coils have labeled holes for piping penetrations. Figure 24 illustrates a typical steam coil piping configuration. See Table 13 for the codes of system components in these figures.

The coil condensate return line must be piped full size of the condensate trap connection, except for a short nipple screwed directly into the coil header’s condensate return tapping. Do not bush or reduce the coil return trapping size.

Table 13. Code of system components for piping figures

Code	System component
FT	Float and thermostatic steam trap
GV	Gate valve
OV	Automatic two-position (ON-OFF) control valve
VB	Vacuum breaker
ST	Strainer
AV	Automatic or manual air vent
MV	Modulating control valve

Figure 24. Typical piping for Type NS steam coils and horizontal tubes for horizontal airflow



To prevent coil damage, complete the following recommendations:

- Install a 1/2-inch NPT, 15 degree swing check valve vacuum breaker with cracking pressure of 0.25 inches Hg (3.4 inches water) or lower at the top of the coil. This vacuum breaker should be installed as close to the coil as possible.

NOTICE:

Breaker Cracking Pressure!

The 1/2-inch NPT, 15 degree swing check valve vacuum breaker is recommended because other vacuum breakers, such as spring-loaded ball-check breakers, have cracking pressures as high as 1.25 inches Hg (17 inches of water). Vacuum breakers with fitting sizes smaller than 1/2 inch NPT are too small to relieve vacuum quick enough to ensure complete condensate drainage. Other types of swing check valve vacuum breakers are acceptable if the fittings size is not smaller than 1/2-inch NPT and the cracking pressure is not larger than 0.25 inches HG (3.5 inches of water). Failure to follow these instructions could result in equipment damage.

- For coil type NS, install the vacuum breaker in the unused condensate return tapping at the top of the coil.
- Vent the vacuum breaker line to atmosphere or connect it into the return main at the discharge side of the steam trap

Note: Vacuum breaker relief is mandatory when the coil is controlled by a modulating steam supply or automatic two position (ON-OFF) steam supply valve. Vacuum breaker relief is also recommended when face-and-bypass control is used.

NOTICE:

Coil Condensate!

Condensate must flow freely from the coil at all times to prevent coil damage from water hammer, unequal thermal stresses, freeze-up and/or corrosion. In all steam coil installations, the condensate return connections must be at the low point of the coil. Failure to follow these instructions could result in equipment damage.

Proper steam trap installation is necessary for satisfactory coil performance and service life. For steam trap installation:

1. Install the steam trap discharge 12 inches below the condensate return connection. Twelve inches provides sufficient hydrostatic head pressure to overcome trap losses and ensures complete condensate removal.
   a. Use float and thermostatic traps with atmospheric pressure gravity condensate return, with automatic controls, or where the possibility of low-pressure supply steam exists. (Float and thermostatic traps are recommended because of gravity drain and continuous discharge operation.)
   b. Use bucket traps only when the supply steam is not modulated and is 25 psig or higher.

Note: Trane steam coils require a minimum of 2 psi of pressure to assure even heat distribution.

2. Trap each coil separately to prevent holding up condensate in one or more of the coils.
3. Install strainers as close as possible to the inlet side of the trap.
4. If installing coils in series airflow, control each coil bank independently with an automatic steam-control valve. Size the traps for each coil using the capacity of the first coil in direction of airflow.
5. Use a modulating valve that has linear flow characteristics to obtain gradual modulation of the coil steam supply.

Note: Do not modulate systems with overhead or pressurized returns unless the condensate is drained by gravity into a receiver, vented to atmosphere, and returned to the condensate pump.

6. Pitch all supply and return steam piping down 1 inch for every 10 feet in the direction of the steam or condensate flow.

Note: Do not drain the steam mains or take-offs through the coils. Drain the mains ahead of the coils through a steam trap to the return line.

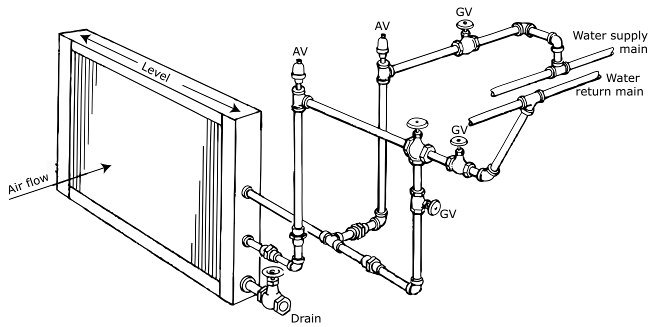
7. Ensure overhead returns have 1 psig of pressure at the steam trap discharge for every 2 feet of elevation for continuous condensate removal.

Water Coil Piping

Figure 25 illustrates a typical water coil piping configuration.

Water coils are self-venting only if the water velocity exceeds 1.5 feet per second (fps) in the coil tubes. See the unit submittals for coil water velocity.

Figure 25. Typical piping for water coil

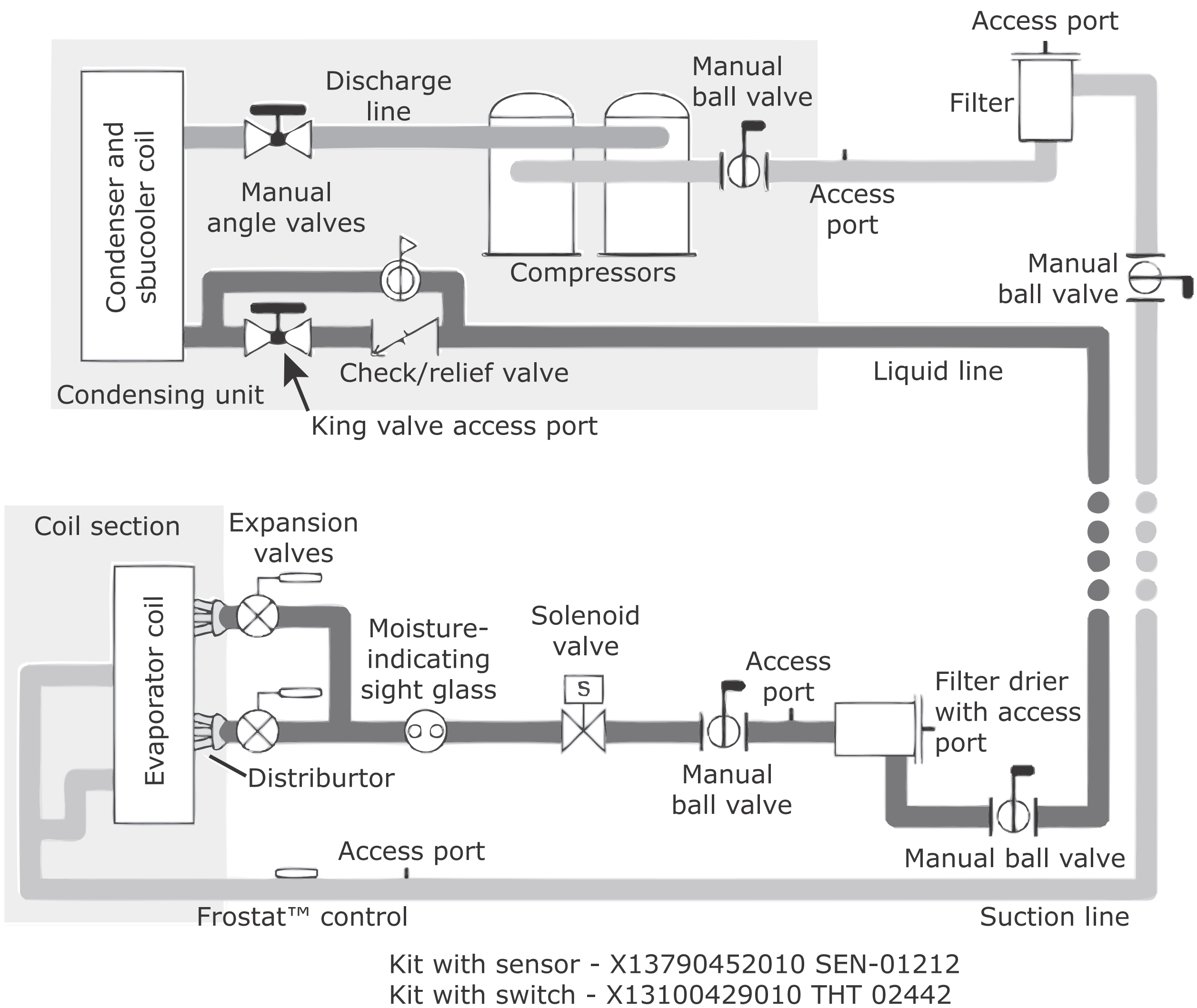


Refrigerant Coil Piping

Note: Refer to for information on handling refrigerants.

Figure 26 illustrates an example of a split-system component arrangement. Use it to determine the proper, relative sequence of the components in the refrigerant lines that connect the condensing unit to an evaporator coil. Refer to "Field-Installed Evaporator Piping Examples," p. 36 for more detailed schematics of evaporator piping.

Figure 26. Example of placement for split-system components



Liquid Lines

Line Sizing

Properly sizing the liquid line is critical to a successful split-system application. The selected tube diameter must provide at least 5°F [2.7°C] of subcooling at the expansion valve throughout the operating envelope. Increasing the size of the liquid line will not increase the available subcooling.

Routing

Install the liquid line with a slight slope in the direction of flow so that it can be routed with the suction line. Minimize tube bends and reducers because these items tend to increase pressure drop and to reduce subcooling at the expansion valve. Liquid line receivers, other than those that are factory-installed, are not recommended.

Insulation

The liquid line is generally warmer than the surrounding air, so it does not require insulation. In fact, heat loss from the liquid line improves system capacity because it provides additional subcooling. However, if the liquid line is routed through a high-temperature area, such as an attic or a mechanical room, insulation would be required.

Components

Liquid-line refrigerant components necessary for a successful job include a filter drier, access port, solenoid valve, moisture-indicating sight glass, expansion valve(s), and ball shutoff valves. Figure 26 illustrates the proper sequence for positioning them in the liquid line. Position the components as close to the evaporator as possible.

- *Filter drier.* There is no substitute for cleanliness during system installation. The filter drier prevents residual contaminants, introduced during installation, from entering the expansion valve and solenoid valve.
- *Access port.* The access port allows the unit to be charged with liquid refrigerant and is used to determine subcooling. This port is usually a Schraeder® valve with a core.
- *Solenoid valve.* In split systems, solenoid valves isolate the refrigerant from the evaporator during off cycles; under certain conditions, they may also trim the amount of active evaporator as compressors unload. Generally, the “trim” solenoid valve is unnecessary for VAV comfort-cooling applications, and is only required for constant-volume applications when dehumidification is a concern.
  In split systems with mircochannel heat exchanger condensers (MCHE), solenoid valves isolate the refrigerant from the evaporator during the off cycles. Trim solenoids cannot be used with MCHE.

Note: *Trane condensing units with MCHE no longer employ pump-down, but isolation solenoids are required. The suggested solenoid uses a 120-volt service and requires code-compliant wiring to the condensing unit.*

- *Moisture-indicating sight glass.* Be sure to install one moisture-indicating sight glass in the main liquid line. The only value of the sight glass is its moisture indication ability. Use actual measurements of temperature and pressure—not the sight glass—to determine subcooling and whether the system is properly charged. The moisture indicator/sight glass must be sized to match the size of the liquid line at the thermal expansion valve.

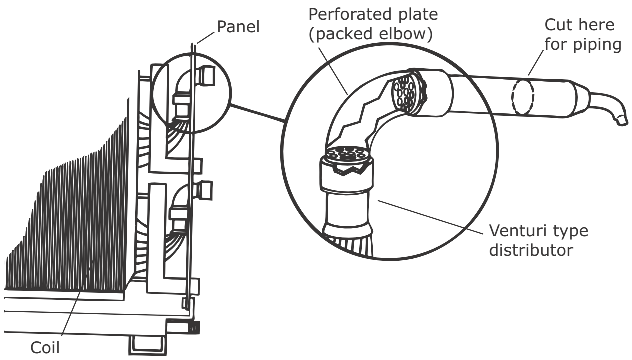
NOTICE:

Valve Damage!

Disassemble the thermal expansion valve before completing the brazing connections. If necessary, wrap the valve in a cool, wet cloth while brazing. Failure to protect the valve from high temperatures could result in damage to internal components.

- *Thermal expansion valve.* The expansion valve is the throttling device that meters the refrigerant into the evaporator coil. Metering too much refrigerant floods the compressor; metering too little elevates the compressor temperature. Choosing the correct size and type of expansion valve is critical to assure it will correctly meter refrigerant into the evaporator coil throughout the entire operating envelope of the system. *Correct refrigerant distribution into the coil requires an expansion valve for each distributor.*
  The thermal expansion valve must be selected for proper size and capacity. The size of the expansion valve should cover the full range of loadings. Check that the valve will successfully operate at the lightest load condition. For improved modulation, choose expansion valves with balanced port construction and external equalization. Cut the process tube and cap assembly from the liquid connection as shown in Figure 27 and install the expansion valve directly to the liquid connections.

Figure 27. Type F refrigerant coil with packed elbow



- *Ball shutoff valves.* Adding manual, ball-type shutoff valves upstream and downstream of the filter simplifies replacement of the filter core.

Suction Lines

Line sizing

Proper line sizing is required to guarantee the oil returns to the compressor throughout the system's operating envelope. At the same time, the line must be sized so that the pressure drop does not excessively affect capacity or efficiency. To accomplish both objectives, it may be necessary to use two different line diameters: one for the horizontal run and for the vertical drops, and another for the vertical lifts (risers).

Routing

To prevent residual or condensed refrigerant from "free-flowing" toward the compressor during the off cycle, install the suction line so it slopes by ¼ inch to 1 inch per 10 feet of run toward the evaporator.

When the application includes a suction riser, oil must be forced to travel the height of the riser. Riser traps are unnecessary in the suction line. They will add pressure drop. Double risers must not be used. They not only add pressure drop, but can hold great amounts of oil - oil better used in the compressor.

Note: *If a suction riser is properly sized, oil will return to the compressor regardless of whether a trap is present. If a suction riser is oversized, adding a trap will not restore proper oil entrainment.*

Avoid Underground Refrigerant Lines

Refrigerant condensation during the off cycle, installation debris inside the line (including condensed ambient moisture), service access, and abrasion/corrosion can quickly impair reliability.

Insulation

Any heat that transfers from the surrounding air to the cooler suction lines increases the load on the condenser (reducing the system's air-conditioning capacity) and promotes condensate formation. After operating the system and testing all fittings and joints to verify that the system is leak-free, insulate suction lines to prevent heat gain and unwanted condensation.

Components

Installing the suction line requires field installation of these components: a filter, access port, and a Frostat™ control when the refrigerant coil is used with Trane condensing units. Position them as close to the compressor as possible.

Note: *Placement of the Frostat control is illustrated in* *Figure 26 on page 32.*

- *Filter.* The suction filter prevents contaminants, introduced during installation, from entering the compressor. For this reason, the suction filter should be the replaceable-core type, *and* a clean core should be installed after the system is cleaned up.
- *Access port.* The access port is used to determine suction pressure. This port is usually a Schraeder valve with a core.
- *Frostat™ coil frost protection.* The Frostat control is the preferred method for protecting evaporator coils from freezing when the refrigerant coil is used with Trane condensing units. It senses the suction-line temperature and temporarily disables mechanical cooling if it detects frost conditions. The control is mechanically attached to the outside of the refrigerant line, near the evaporator, and wired to the unit control panel.
- *Ball shutoff valve.* Adding manual, ball-type shutoff valves upstream and downstream of the filter simplifies replacement of the filter core.

Expansion Valves

Expansion valves meter refrigerant into the evaporator under controlled conditions. If there is too much refrigerant, the refrigerant will not completely vaporize and the remaining liquid will slug the compressor. If there is too little refrigerant, there may not be enough cooling for the compressor.

Expansion valve requirements vary based on condensing unit design. Consult the product literature for the condensing unit to be used for proper valve selection.

Remodel, Retrofit, or Replacement

Inevitably, older condensing units and evaporator systems will need to be replaced or retrofitted. Due to the phase-out of many of these older refrigerants, the major components for those older units or systems may no longer be available. The only option will be to convert the system to R-410A, POE oil, and R-410A components.

When upgrading an existing refrigerant split system due to remodel, retrofit, or replacement, the entire system must be reviewed for compatibility with R-410A and POE oil. Each and every part of the split HVAC system MUST be compatible with the properties of R-410A refrigerant and POE oil. In addition, ensure the existing electrical service is adequate for the product being installed.

⚠WARNING

R-410A Refrigerant under Higher Pressure than R-22!

Failure to use proper equipment or components as described below, could result in equipment failing and possibly exploding, which could result in death, serious injury, or equipment damage. The units described in this manual use R-410A refrigerant which operates at higher pressures than R-22. Use ONLY R-410A rated service equipment or components with these units. For specific handling concerns with R-410A, please contact your local Trane representative.

Every part of an existing split system needs to be analyzed to determine if it can be reused in an R-410A and POE oil system:

- R-22 condensing units will not work with R-410A; they must be replaced.
- Most older evaporator coils were not pressure- and cycle-rated for R-410A pressures. If they weren't, they will need to be replaced. If they were properly pressure-rated for R-410A, existing coils must be modeled to determine if they will meet capacity requirements, are properly circuited, have correctly sized distributor tubes, and employ acceptable distributors and orifices.
- The required R-410A line sizes may be different than the existing line sizes. The lines need to be re-sized and compared to existing lines for reusability.
- Suction lines 2-5/8 OD and smaller of type L copper are suitable for use with R-410A. Suction lines 3-1/8 OD must use type K or thicker wall.
- Discharge lines, liquid lines, heat pump vapor lines, and hot gas bypass lines 1-3/8 OD and smaller of type L copper are suitable for use with R-410A. These same lines sized at 1-5/8 OD or 2-1/8 OD must use type K or thicker wall.
- Expansion valves need to be reselected. Expansion valves are refrigerant specific.
- Any gasket or o-ring should be replaced. Shrinkage of the original seal may occur after an HFC conversion, potentially causing a refrigerant leak. Components commonly affected are Schraeder cores, solenoid valves, ball valves, and flange seals. But *all* external seals in contact with refrigerant should be viewed as potential leak sources after a retrofit.
- All other valves, filters, valve packing, pressure controls, and refrigeration accessories must be researched through their manufacturer for compatibility with the pressures of an R-410A system, and for their compatibility with the newer POE oil.
- For the best performance and operation, the original mineral oil should be removed from the components of the system that are not being replaced. Any component of the system that is suspected of trapping oil (piping, traps, and coil), should be dismantled, drained, and reassembled. After all components have been drained, the amount of residual mineral oil will have a negligible effect on performance and reliability.

NOTICE:

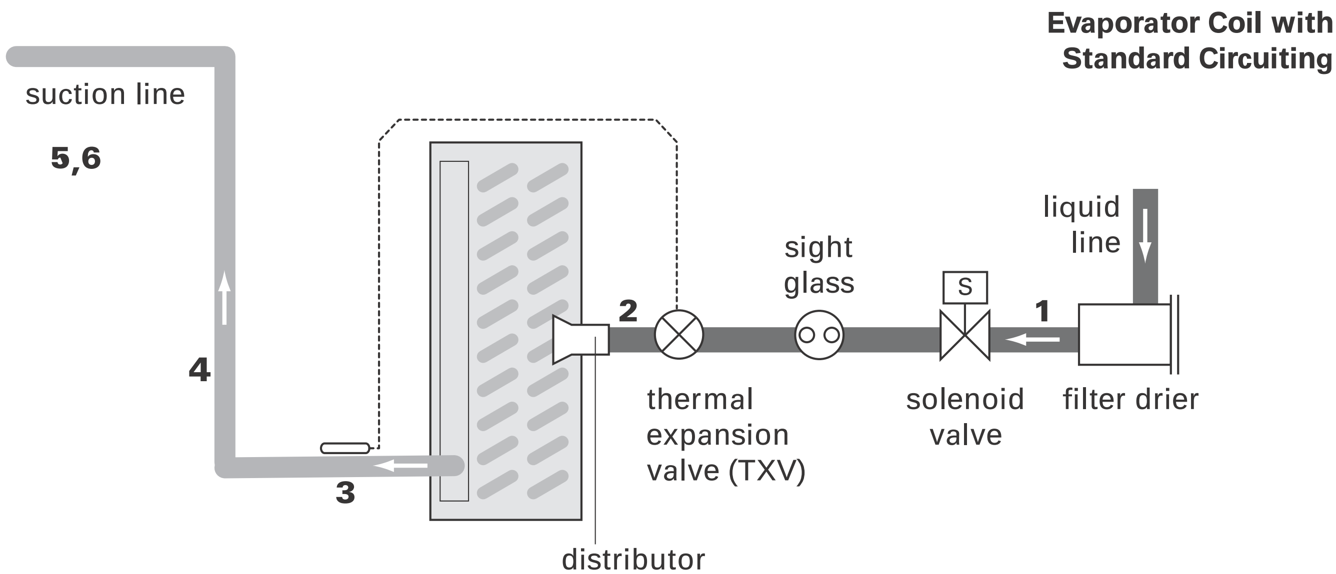
Compressor Damage!

POE oil is hygroscopic – it absorbs water directly from the air. This water is nearly impossible to remove from the compressor oil and can cause compressor failures. For this reason, the system should not be open for longer than necessary, dry nitrogen should flow in the system while brazing, and only new containers of oil should be used for service and maintenance.

All Codes take precedence over anything written here.

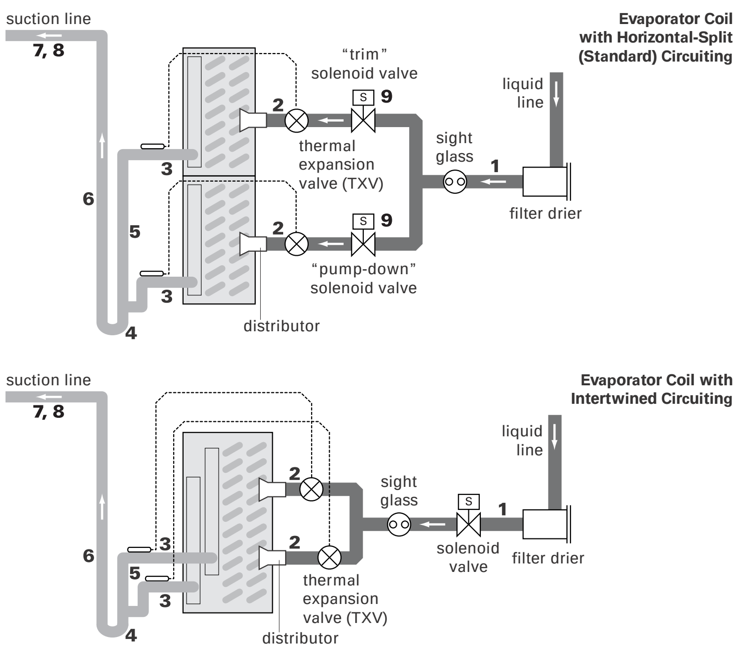
Field-Installed Evaporator Piping Examples

Figure 28. Single-circuit condensing unit: evaporator coil with one distributor



1. Pitch the liquid line slightly—1 inch/10 feet —so that the refrigerant drains toward the evaporator.
2. Provide one expansion valve per distributor.
3. Slightly pitch the outlet line from the suction header toward the suction riser—that is, 1 inch/10 feet in the direction of flow. Use the tube diameter that matches the suction-header connection.
4. Use the tube diameter recommended in the condensing unit application manual for a vertical rise. Ensure that the top of the riser is higher than the evaporator coil.
5. Pitch the suction line slightly—1 inch/10 feet —so the refrigerant drains toward the evaporator.
6. Insulate the suction line.

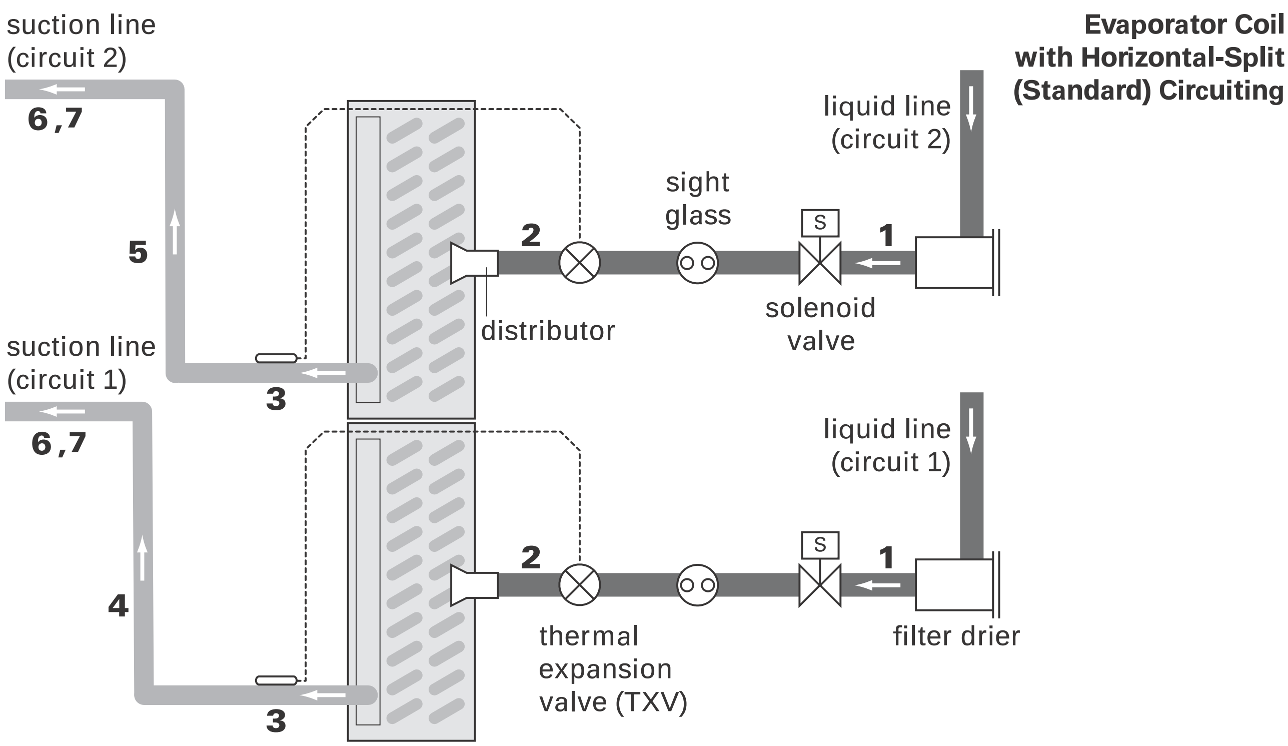
Figure 29. Single-circuit condensing unit: evaporator coil with two distributors



1. Pitch the liquid line slightly—1 inch/10 feet —so the refrigerant drains toward the evaporator.
2. Provide one expansion valve per distributor.
3. Slightly pitch the outlet line from the suction header toward the suction riser— 1 inch/10 feet in the direction of flow. Use the tube diameter that matches the suction-header connection. Use a double-elbow configuration to isolate the TXV bulb from other suction headers.
4. This looks like a trap, but is actually due to the requirement that the refrigerant gas leaving the coil flows downward, past the lowest suction-header outlet, before turning upward.
5. Use the "horizontal" tube diameter as specified in the condensing unit application manual.
6. Use the tube diameter recommended for a vertical rise as specified in the condensing unit application manual. Assure the top of the riser is higher than the evaporator coil.
7. Pitch the suction line slightly—1 inch/10 feet — so that the refrigerant drains toward the evaporator.
8. Insulate the suction line.
9. Only use a "trim" solenoid valve for constant-volume, humidity-sensitive applications. For all other applications, install a single solenoid valve (the "pumpdown" solenoid valve) between the liquid-line filter drier and the sight glass.

Note: Due to reduced coil volume in condensing units with microchannel heat exchanger condenser, do not use trim solenoid valves for these units.

Figure 30. Dual-circuit condensing unit: evaporator coil with two distributors



1. Pitch the liquid lines slightly—1 inch/10 feet —so that the refrigerant drains toward the evaporator.
2. Provide one expansion valve per distributor.
3. Slightly pitch the outlet line from the suction header toward the suction riser—1 inch/10 feet in the direction of flow. Use the tube diameter that matches the suction-header connection.
4. The top of the Circuit 1 suction riser must be higher than the bottom evaporator coil. Use the tube diameter recommended for a vertical rise as specified in the condensing unit application manual.
5. The top of the Circuit 2 suction riser must be higher than the top evaporator coil. Use the tube diameter recommended for a vertical rise as specified in the condensing unit application manual.
6. Pitch the suction lines slightly—1 inch/10 feet —so that the refrigerant drains toward the evaporator.
7. Insulate the suction lines.

Installation - Electrical

Unit Wiring Diagrams

Specific unit wiring diagrams are provided on the inside of the control panel door. Typical unit wiring diagrams are in "Wiring Diagrams," p. 69. Use these diagrams for connections or trouble analysis.

⚠WARNING

Proper Field Wiring and Grounding Required!

All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state electrical codes. Failure to follow code could result in death or serious injury.

⚠WARNING

Hazardous Voltage w/Capacitors!

Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer's literature for allowable waiting periods for discharge of capacitors. Verify with an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

For additional information regarding the safe discharge of capacitors, see PROD-SVB06A-EN

Supply Power Wiring

Refer to the unit nameplate to obtain the minimum circuit ampacity (MCA) and maximum overcurrent protection (MOP) to properly size field supply wiring and fuses or circuit breakers.

Refer to the unit operating voltage listed on the unit wiring schematic, submittal, or nameplate. Reference the wiring schematic for specific wiring connections.

NOTICE:

Use Copper Conductors Only!

Unit terminals are not designed to accept other types of conductors. Failure to use copper conductors may result in equipment damage.

Note: All field wiring should conform to NEC and all applicable state and local code requirements. The control panel box is always on the end opposite the piping connections. Access the control box by removing the two screws that secure the front cover. This will allow the panel to be removed, to provide access to the electrical components.

⚠WARNING

Hazardous Electrical Shorts!

Insulate all power wire from sheet metal ground. Failure to do so may cause electrical shorts that could result in death or serious injury.

If the unit does not have a disconnect switch, the power leads and capped ground wire are inside the control panel.

If the unit has a disconnect switch, the power leads are wired to the junction box switch on the control panel. Pull the capped ground wire into the junction box.

Electrical Grounding Restrictions

All sensor and input circuits are normally at or near ground (common) potential. When wiring sensors and other input devices to the Tracer controller, avoid creating ground loops with grounded conductors external to the unit control circuit. Ground loops can affect the measurement accuracy of the controller.

NOTICE:

Equipment Damage!

Unit transformer IT1 provides power to blower coil unit only. Field connections directly to the transformer IT1 may create immediate or premature unit component failure.

All input/output circuits (except isolated relay contacts and optically isolated inputs) assume a grounded source, either a ground wire at the supply transformer to control panel chassis, or an installer supplied ground.

MCA and MFS Calculations

Minimum Circuit Ampacity (MCA) and Maximum Overcurrent Protection (MOP) Calculations for non-Electric Heat Units

MCA = 1.25 x motor FLAs

MOP = 2.25 x motor FLA

Minimum Circuit Ampacity (MCA) and Maximum Overcurrent Protection (MOP) Calculations for Units with Electric Heat

Heater amps = (heater kW x 1000) / heater voltage

Notes: Use 120 V heater voltage for 115 V units.
Use 240 V heater voltage for 230 V units.
Use 208 V heater voltage for 208 V units.
Use 277 V heater voltage for 277 V units.

MCA = 1.25 x (heater amps + all motor FLAs)
MOP = (2.25 x motor FLA) + heater amps

See Table 16 for motor FLAs.

Select a standard fuse size equal to the calculated MOP. Use the next smaller size if the selected MOP does not equal a standard size. Selected fuse must be larger than the MCA.

Standard fuse sizes: 15, 20, 25, 30, 35, 40, 45, 50, 60 amps

Useful Formulas

kW = (cfm x ΔT) / 3145
ΔT = (kW x 3145) / air flow
Single phase amps = (kW x 1000) / voltage
Electric heat MBh = (Heater kW) (3.413)

Table 14. Available electric heat (kW)

	Voltage					
Electrical heat (kW)	**115/60/1**	**208/60/1**	**220/50/1**	**230/60/1**	**240/50/1**	**277/60/1**
1.0	Sizes 12–90	Sizes 12–90	Sizes 12–90	Sizes 12–90	Sizes 12–90	Sizes 12–90
1.5	Sizes 12–90	Sizes 12–90	Sizes 12–90	Sizes 12–90	Sizes 12–90	Sizes 12–90
2.0, 2.5, 3.0	Sizes 12–90	Sizes 12–90	Sizes 12–90	Sizes 12–90	Sizes 12–90	Sizes 12–90
3.5, 4.0		Sizes 12–90	Sizes 12–90	Sizes 12–90	Sizes 12–90	Sizes 12–90
4.5		Sizes 18–90	Sizes 18–90	Sizes 18–90	Sizes 18–90	Sizes 18–90
5.0		Sizes 18–90	Sizes 18–90	Sizes 18–90	Sizes 18–90	Sizes 18–90
5.5, 6.0		Sizes 18–90	Sizes 18–90	Sizes 18–90	Sizes 18–90	Sizes 18–90
6.5, 7.0, 7.5, 8.0		Size 24-90	Size 24-90	Size 24-90	Size 24-90	Size 24-90
9.0, 10.0, 11.0						Size 36-90

Notes:

- Magnetic contactors are standard. Mercury contactors are available on horizontal units only.
- Units with electric heat are available with or without door interlocking disconnect switch.
- Units with electric heat are available with or without line fuses.
- Units with electric heat must not be run below the minimum cfm listed in “General Data,” p. 20.
- Electric heat is balanced staging: 1 stage = 100 percent, 2 stages = 50 percent/50 percent.

Motor Horsepower and Electrical Data

Table 15. Available motor horsepower

		Motor Horsepower	
Motor	**Unit Voltage**	**0.50**	**1.00**
60 Hz	115/1	•	•
	208/1	•	•
	230/1	•	•
	277/1	•	•
50 Hz	220/1	•	•
	240/1	•	•

Table 16. Motor electrical data

Voltage	Voltage range	RPM	Rated HP	LB	FLA
115/60/1	104–126	1725	1/2	14	7.5
			1.0	19	13.3
208–230/60/1	187–253	1725	1/2	14	4.3
			1.0	19	7.7
277/60/1	249–305	1725	1/2	14	3.8
			1.0	19	6.7
220/50/1	198–242	1725	1/2	14	4.3
			1.0	19	7.7
240/50/1	216–264	1725	1/2	14	4.3
			1.0	19	7.7

ECM Overview and Setup

Overview

This section addresses changes to the blower coil air handler, integrating the new Trane electronically commutated motor (ECM) and VelociTach™ motor control board. This exciting new series delivers outstanding comfort, safety, and performance with greatly reduced energy consumption compared to traditional units with induction AC motors.

The new series of units will provide a long service life with proper installation and operation. The new system provides a high degree of flexibility and configurability, but the simplicity of customized factory configuration appropriate to most installations.

Very little intervention is needed by service and installation personnel in most applications; however, installers must read through the entire document before beginning installation of the new equipment.

This literature focuses on unit motors and controls, including three new circuit modules developed specifically for this series.

Figure 31. Blower coil with Trane ECM

General Information

There are four primary components that enable the technology on your product:

1. Trane ECM
2. VelociTach motor control board
3. Manual fan speed switch (FSS)
4. CSTI adapter board

The motors and modules are combined as systems, and cannot work without each other.

Trane ECM

Figure 32. Trane ECM motor

- The ECM has integrated electronics, overload protection and short circuit protection. The motor contains no user-serviceable components inside.

NOTICE:

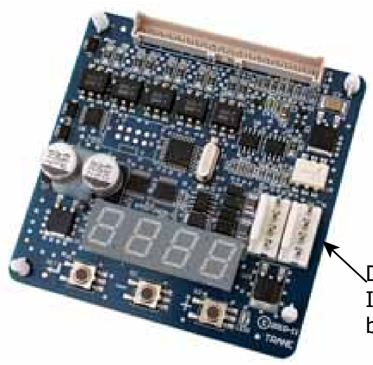
Equipment Damage!

The motor harness attached to the single plug to which the motor mates contains the very important motor voltage jumper and should not be modified or substituted. Failure to follow this instruction could result in equipment damage.

- The motor mates to the unit electrically via a single plug that contains both the operating voltage and the control signals that are needed for correct operation.

VelociTach Motor Control Board

Figure 33. VelociTach motor control board



The motor control board:

- Coordinates the operation of the fan in response to electric heat behavior and electric behavior in response to hydronic heat behavior.
- Incorporates a user interface that allows adjustment of certain unit parameters and provides constant feedback on motor operation.
- Integrates service and troubleshooting tools, including high-precision tachometers, fan status, and electric heat-enabled indicators.
- Integrates a versatile configurable auxiliary temperature sensor.
- Incorporates various safety and lockout features, such as maintaining proper fan speeds if electric heat is called for.

Status Display

Figure 34. Status display

The motor control board contains a four-digit, seven-segment display that is used to present information in a format close to real-world language, while having a small-form factor. Most characters are immediately recognizable; however, please consult Table 17 and Table 18 for the graphical representation of each alphanumeric character.

Table 17. Screen representation of alphabetical characters

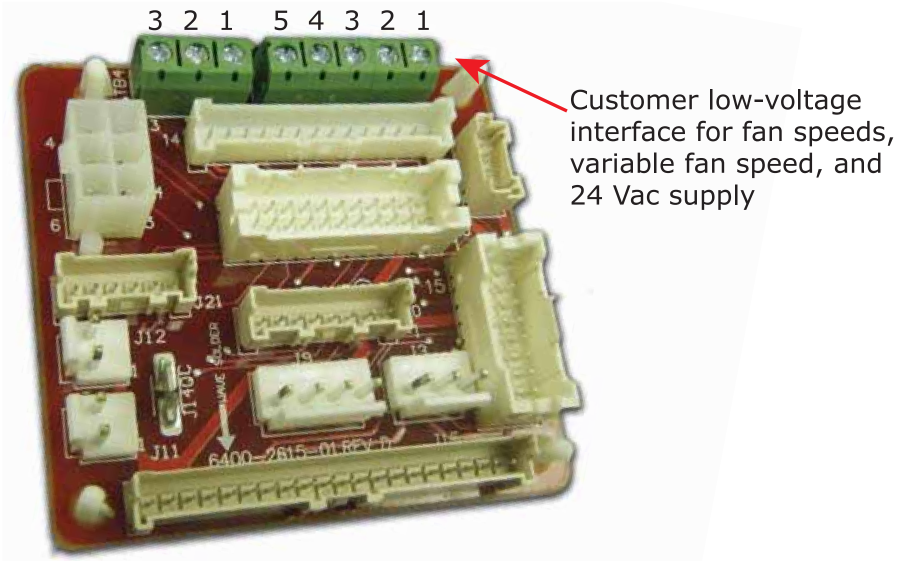
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
A	b	C	d	E	F	9	H	I	J	H	L	M	n	O	P	q	r	S	t	U	u	W	H	Y	Z

Table 18. Screen representation of numeric characters

1	2	3	4	5	6	7	8	9	0
1	2	3	4	5	6	7	8	9	0

Manual Fan Speed Switch (FSS)

Figure 35. Standard adapter board field connections



1. VSP 10V
2. VSP 0–10V
3. VSP DC COM

1. 24 Vac Y (gnd)
2. 24 Vac Y (com)
3. High
4. Medium
5. Low

The adapter allows direct customer interfacing through the use of terminal strips. Standard interfacing includes:

- Fan speeds (H, M, L)
- Variable speed (2–10V) inputs

The standard adapter board eliminates many separate wiring harnesses in the panel and allows simple, mistake-proofed single-plug interfacing of:

- Motor control board
- Transformers
- Motors
- Valves
- Dampers
- Electric heat control
- Fan speed switches

The manual fan mode switch is available for fan-coil units that do not have Trane factory-mounted control packages. This four-position switch (off, high, medium, low) allows manual fan mode selection and is available wall mounted. The wall-mounted option is low-voltage using a factory-wired transformer. A courtesy 10 Vdc supply is provided for use with an external potentiometer or rheostat. The 10 Vdc supply supports up to 10 mA draw.

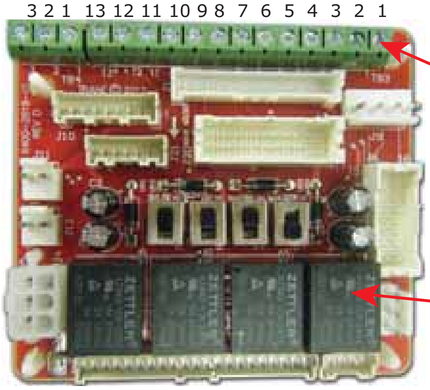
TB3 (right five positions) is normally used to provide 24V hookup to a wall mounted fan speed switch, and to accept the returns from the switch for High, Medium, and Low requests.

TB4 (left three positions) is normally used to control the system with a 0–10 Vdc output from a thermostat/ controller, or a fan control rheostat/potentiometer.

The terminal block functional assignments and polarity are shown for reference only, and the schematics that ship with each unit should be consulted before wiring. Wiring assignments are configured for each unit.

Customer Supplied Thermostat Interface (CSTI)

Figure 36. CSTI adapter board and field connections



1. VSP 10V (TB4)
2. VSP 0–10V (TB4)
3. VSP DC COM (TB4)

1. 24 VAC B (hot) (TB3)
2. 24 VAC Y (gnd) (TB3)
3. Fan High (TB3)
4. Fan Medium (TB3)
5. Fan Low (TB3)
6. V1 Open (Cooling) (TB3)
7. V1 Close (Modulating Cooling) (TB3)
8. Freezestat (TB3)
9. Freezestat (TB3)
10. V2 Open/EH Stage 1 (Heating) (TB3)
11. V2 Close/EH Stage 2 (Heating) (TB3)
12. Damper Open/Condensate Overflow (TB3)
13. Damper Close/Condensate Overflow (TB3)

The control interface is intended to be used with a field-supplied, low-voltage thermostat or controller. The control box contains a relay board which includes a line voltage to 24-volt transformer and disconnect switch (for non-electric heat units). All end devices are wired to a low-voltage terminal block and are run-tested, so the only a power connection and thermostat connection is needed to commission the unit. Changeover sensors and controls are provided whenever a change-over coil is selected. When N.O. valves are selected, inverting relays are provided for use with standard thermostats.

The CSTI adapter board provides all the hookups of the standard adapter board, but in addition, provides hookups for valve control (main and auxiliary coils), electric heat control, and damper control. Screw terminal blocks provide convenient access to fan controls and to end device control. In addition, a courtesy 10-Vdc supply is provided for use with an external potentiometer or rheostat. The 10-Vdc supply supports up to 10 mA draw.

TB3 (right 13 positions) is normally used to provide:

1. 24 Vac supply to a wall fan speed switch or
2. 24 Vac supply to a field-installed unit-mounted controller, or a wall-mounted controller or thermostat
3. Inputs (returns) for thermostatic fan control: High, Medium, and Low
4. Inputs (returns) for cooling/heating requests
5. Inputs (returns) for electric heat requests
6. Inputs (returns) for damper operation requests

TB4 (left three positions) is normally used to control the system with a 0–10 Vdc input from a thermostat/controller with a variable speed output, or a fan control rheostat.

The terminal block functional assignments and polarity are shown for reference only, and the schematics that ship with each unit should be consulted before wiring. Wiring assignments are configured for each unit.

Installation and Initial Setup

⚠WARNING

Hazardous Voltage w/Capacitors!

Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer's literature for allowable waiting periods for discharge of capacitors. Verify with an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

⚠WARNING

Safety Alert!

You MUST follow all recommendations below. Failure to do so could result in death or serious injury.

- **The ECM motors contain capacitors which store residual energy. Please keep clear of the fan wheels for 5 minutes after the power has been removed from the system, as a power request with the motor powered off, could result in a very short period of actuation.**
- **All settings take effect immediately, including fan startup and enabling of electric heat. Caution should be taken to stay clear of hazardous voltages, moving parts and electric heat elements while making adjustments to the VelociTach motor control board. If it is not practical to stay clear of these areas during adjustment of the motor control board, please contact Trane Global Parts for configuration kit that allows easy powering of the motor control board outside of the unit with a 9V battery.**
- **The adapter boards contain high voltage. Configuration adjustments to the motor control board should be made through the SMALLER of the two low-voltage lids on the front of the control panel, through the low-voltage insulation/shielding.**
- **Changes to switch settings on the CSTI adapter board take effect immediately. Changes should be made to the CSTI configuration switches with the power off.**
- **Initial hookups to the CSTI and Standard Adapter board, including low voltage interconnections, must be made with the power off.**
- **Do not make connections to the motors or the adapter boards while power is ON. Do not remove connections to the motor or the adapter boards while the power is ON.**
- **Do not free spin the fan wheels with your hands while the unit is powered on. The system is constantly scanning and responding to the operational status of the motors.**

Note: *Normally, Trane ECMs are configured for soft ramps and transitions between speeds. However, to aid in commissioning of the unit, for approximately 10–15 minutes, the ramps will be shortened to quickly observe proper unit behavior and response to speeds.*

For new installations, all boards and motors are pre-installed and pre-configured according to the unit configuration, indicated by its model number.

Under normal and intended operation, the only required intervention specific to the new ECM units is the wiring of:

- Wall-mounted low-voltage fan speed switch inputs to the adapter boards' terminal strips and 24 Vac tap to field-installed fan speed switch.
- Field-supplied controllers/thermostats to the adapter boards' terminal strips and 24 Vac power tap to field-supplied controller/thermostat.
- Adjustment and calibration of the variable speed inputs (VSP/0–10V) on the system.
- Adjustment, calibration or disabling of the optional auto-changeover function on CSTI units.

Otherwise, proceed with the mechanical, electrical and controls installations as defined in other sections of this manual, following all warnings and cautions.

After installation, turn power on.

Note: *Specifications subject to change without notice. Consult the unit submittals and unit schematics before determining hookup requirements to the blower coil unit. Terminal block positions, polarities and assignments are determined for specific unit configurations only. Signal assignments are indicated, for reference only.*

Both adapter boards come equipped with integrated terminal blocks to hook up to the field supplied/mounted fan speed switches and external controls. Connections should be made to the screw terminals with wires between 16 AWG and 24 AWG, with a ~4–5-mm wire strip length. The terminal blocks have 5-mm spacing, and are equipped with 3-mm screws. The field-supplied wires should have an insulation rating of 600V.

Adjustment and Configuration of the Motor Control Board

⚠WARNING

Safety Alert!

You MUST follow all recommendations below. Failure to do so could result in death or serious injury.

- **All settings take effect immediately, including fan startup and enabling of electric heat. Caution should be taken to stay clear of hazardous voltages, moving parts and electric heat elements while making adjustments to the motor control board. If it is not practical to stay clear of these areas during adjustment of the motor control board, please contact Trane Global Parts for configuration kit that allows easy powering of the motor control board outside of the unit with a 9V battery.**
- **Configuration adjustments to the motor control board should be made through the SMALLER of the two low-voltage lids on the front of the control panel, through the low-voltage insulation/shielding.**

⚠CAUTION

Burn Hazard!

On electric heat units, certain parameter values are locked out to prevent overheating of the unit. These functions will appear to be saved; however, they will not be accepted if the Electric Heat Protection setting is "On". Do not change the Electric Heat Protection setting to "Off" and make changes to the protected settings unless you are programming an unconfigured service replacement board to match the unit settings on a ECM configuration label. Failure to follow this instruction could result in the unit overheating and becoming hot to the touch, which could result in minor or moderate injury, and/or equipment damage.

Note: The motor control board functions and unit specific settings are summarized on the motor control board configuration label affixed to the back side of the control panel low voltage lid on every unit.

To check status, configuration, or to change settings on the motor control board with the power on the unit, detach the low voltage access lid and look or reach through the low voltage access panel. See Figure 37.

Figure 37. VelociTach motor control board

The motor control board features a nested menu integrated user interface (UI) that supports:

1. Status display for instant touch-free confirmation of unit operation.
2. Configuration parameter and value display and modification changes (using integrated menu/set buttons).
3. Error code prioritized reporting.

Note: Characters on the VelociTach motor control board display appear in red, on a black background.

The display contains decimal positions as well that change position with each parameter, as appropriate. Under normal conditions (i.e., with no error code displayed), the status will loop the following message:

Figure 38. Operational Status Codes

RPM Mode ***RUNNING/ FAN STATUS CONTINUOUS LOOP*** Displayed when: 1) No error codes are present 2) Motor has completed ramping	mtr 1 0000 → 2000	Indicates the current rpm of Motor 1 in the system. “0” rpm here indicate that no fan speed has been requested.
	mtr2 0000 → 2000	Indicates the current rpm of Motor 2 in the system. “0” rpm here indicate a fan off condition OR a fan “missing” condition(a).
	FSt 1 YES / no	Indicates the status being calculated or Fan Motor 1. If “off,” this indicates that either: 1) No fan speed is being requested or 2) The fan performance is failing to meet the request; refer to “Troubleshooting (ECM),” p. 126 for additional information. If “on,” this indicates that the fan is performing correctly and will be used to report fan status correctly, depending on FPru mode.
	FSt2 YES / no	Indicates the status being calculated or Fan Motor 2. If “off,” this indicates that either: 1) No fan speed is being requested or 2) The fan performance is failing to meet the request; refer to “Troubleshooting (ECM),” p. 126 for additional information. 3) If the target speed for Motor 2 is “0,” this is used to indicate a missing motor(a). If “on,” this indicates that the fan is performing correctly and will be used to report fan status correctly, depending on FPru mode.
	EhEn YES / no	Indicates that the temperature sensing circuit has calculated a logical “on” based on the settings of the following parameters: Ai2m / Ai2b / AiPU

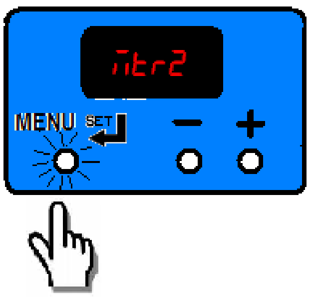
(a) Motor 1 is the only motor in blow coil units.

Configuration Parameter and Value Display and Modification Changes

The VelociTach motor control board's on-board user interface is easy to use and supports:

1. Verification/auditing of on-board parameter settings (read-only)
2. Adjustment of the on-board settings (write)

Figure 39. User interface input buttons



The user interface has three input buttons (see Figure 39), from left to right:

1. "Menu/Set"
2. "Decrement"
3. "Increment"

Each button has several different actuation levels depending on length of press, and what the UI is currently displaying.

Table 19. Button actuation levels

		Menu/Set
Button	**Duration**	**Action**
Short Press in Status Display	<1 sec	None
Short Press in Configuration Display		Toggles between parameter name and value without saving (abandons value if changed).
Long Press/Hold in Status Display	>3 sec	Enters the configuration menu
Long Press/Hold in Configuration Display	>3 sec	If on a parameter name, toggles to the value. If on a parameter value, saves the value settings and returns to the parameter name as confirmation.

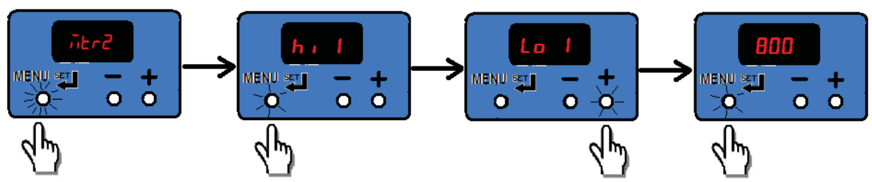
		Decrement
Button	**Duration**	**Action**
Short Press in Status Display	<1 sec	None
Short Press in Configuration Display	<1 sec	Scrolls through parameter names, or decreases value of parameter.
Long Press/Hold in Status Display	>3 sec	n/a
Long Press/Hold in Configuration Display	>3 sec	Faster scroll through parameter name, or faster decrease of values of parameters.

		Increment
Button	**Duration**	**Action**
Short Press in Status Display	<1 sec	None
Short Press in Configuration Display	<1 sec	Scrolls through parameter names, or increases value of parameter.
Long Press/Hold in Status Display	>3 sec	n/a
Long Press/Hold in Configuration Display		Faster scroll through parameter name, or faster increase of values of parameters.

Configuration Use Examples

Example 1. To view the value of parameters without saving. In this case we wish to verify that the "Low Speed Value" for Motor 1 is set correctly to 800 rpm.

Figure 40. Verify low speed value



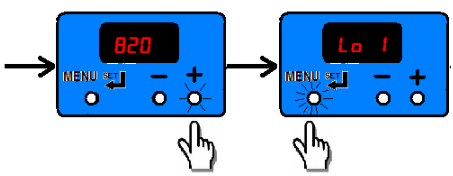
We start with the motor control board scrolling status display and proceed as follows:

Example 2. We wish to change the change the value of Low Speed to 820 rpm:

We will continue from the previous example as shown below, using a long press to "save" the new desired value.

Note: If the display has timed out and returned to the status loop, repeat Example 1 to arrive back at this example's starting point.

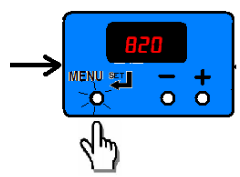
Figure 41. Change value of low speed



Example 3. We wish to double check to see if the value of "820 rpm" has been saved.

Note: If the display has timed out and returned to the status loop, repeat Example 1 and Example 2 to arrive back at this example's starting point.

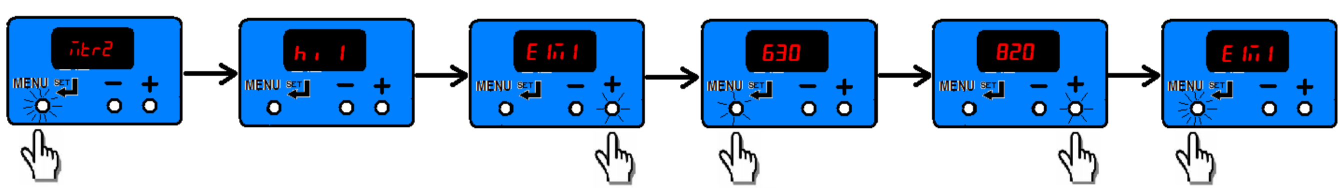
Figure 42. Verify value of 820 rpm



Example 4. We wish to change the value of a protected value on an electric heat unit. See Figure 43.

It would appear that the value has been changed, but if we check the value, we notice that the original value has been retained.

Figure 43. Change value on electric heat unit



Priority / Error Display

Under special conditions, the status display will interrupt briefly to prioritize display of events:

Notes:

- *During error displays, the user interface will be disabled, until the error is removed or resolved.*
- *If changes are made to parameters and saved, most settings take effect immediately. Any change to fan speeds will take effect and cause the configuration menu to exit immediately to begin tracking speeds via the on-board tachometer.*
- *If a error occurs while the configuration menu is in effect, all unsaved values will be discarded and the error codes will be displayed.*

Table 20. Error Codes

Displayed during abnormal operation.	Mtr 1 LOCH	Indicates a locked rotor condition of Motor 1. The motor will be locked out until the cause has been resolved, and the power cycled; refer to "Troubleshooting (ECM)," p. 126 for resolution details. Fan Status function, if being used, will report an inoperative motor. Electric heat and changeover heat will be shut down.
	Mtr2 LOCH	Indicates a locked rotor condition of Motor 2. The motor will be locked out until the cause has been resolved, and the power cycled; refer to "Troubleshooting (ECM)," p. 126 for resolution details. Motor 1 will continue to operate, but will not be monitored. Fan Status function, if being used, will report an inoperative motor. Electric heat and changeover heat will be shut down.
	Mtr 1 OSPd	Indicates that Motor 1 has experienced a run-away or over speed condition, and has been shutdown. The unit will offer limited "limp-in" performance, and Motor 2 will continue to operate, but will not be monitored. Fan Status function, if being used, will report an inoperative motor. Refer to "Troubleshooting (ECM)," p. 126: to reset, the cause must be resolved and the power to the unit cycled. Electric heat and changeover heat will be shut down.
	Mtr2 OSPd	Indicates that Motor 2 has experienced a run-away or over speed condition, and has been shutdown. The unit will offer limited "limp-in" performance, and Motor 1 will continue to operate, but will not be monitored. Fan Status function, if being used, will report an inoperative motor. Refer to "Troubleshooting (ECM)," p. 126: to reset, the cause must be resolved and the power to the unit cycled. Electric heat and changeover heat will be shut down.
	rAMP 0000 → 2000 2000 → 0000	Indicates the motor is transitioning between speeds, ramping up or down. The message "RAMP" is briefly displayed, followed by the target speed for "Motor 1" only. Once the target speed has been reached, the status display will resume operation.
	u 123	On power on, the version of software is briefly displayed, followed by the results of a POST (power on self test).

Note: Blower coil units have only Motor 1 installed.

Initial Setup and Configuration

After connections of power and hookup of customer installed controls/fan speed switches and under normal/operative conditions the only adjustments needed to be made to the motor control board during commissioning of the unit are:

- Adjustment and calibration of the variable speed inputs (VSP/0–10V) on the system, where applicable.
- Adjustment, calibration or disabling of the optional auto-changeover function on CSTI units, where applicable.

In addition, the CSTI adapter board offers configurability that can be used in special cases to adjust the following operation of the unit:

- Courtesy cooling/main valve logic inversion relays for use with normally open valves
- Courtesy heating/auxiliary valve logic inversion relays for use with normally open valves
- Changeover function for use with changeover coils (in conjunction with the motor control board)

The switches are factory-set based on the model number configuration as ordered; however, the information is provided below to aid in the understanding of the operation of the system.

Configuration

Configuring the VelociTach Motor Control Board

Adjustment and Calibration of the Variable Speed Inputs (VSP/0–10V)

⚠WARNING

Hazardous Voltage w/Capacitors!

Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer's literature for allowable waiting periods for discharge of capacitors. Verify with an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

⚠WARNING

Safety Alert!

You MUST follow all recommendations below. Failure to do so could result in death or serious injury.

- **Connections to the adapter boards/changes to the CSTI configuration switches should be made only with the power to the unit disconnected.**
- **All settings take effect immediately, including fan startup and enabling of electric heat. Caution should be taken to stay clear of hazardous voltages, moving parts and electric heat elements while making adjustments to the motor control board. If it is not practical to stay clear of these areas during adjustment of the motor control board, please contact Trane Global Parts for configuration kit that allows easy powering of the motor control board outside of the unit with a 9V battery.**

⚠CAUTION

Burn Hazard!

On electric heat units, certain parameter values are locked out to prevent overheating of the unit. These functions will appear to be saved; however, they will not be accepted if the Electric Heat Protection setting is "On". Do not change the Electric Heat Protection setting to "Off" and make changes to the protected settings unless you are programming an unconfigured service replacement board to match the unit settings on a motor control board configuration label. Failure to follow this instruction could result in the unit overheating and becoming hot to the touch, which could result in minor or moderate injury, and/or equipment damage.

NOTICE:

Equipment Damage!

You MUST follow all recommendations below. Failure to do so could result in equipment damage.

- **Care should be taken in the system to use a single 24 Vac supply system to avoid damage to equipment.**
- **Care should be taken to observe proper polarity and grounding in the hookup of the 0–10V system to avoid damage to equipment.**

Notes:

- *The 0–10V (variable speed) inputs are available for use, but are not mandatory. The ECM system comes standard with three to five field-accessible thermostatic inputs (with adjustable speed), so the use of the 0–10V inputs is optional.*
- *All inputs are independently configurable and simultaneously accessible, and the motor control board will choose the highest user (configured and*

requested) speed. However, care should be taken with customer controls to avoid contention of signals.

The motor control board and adapter boards offer standard, normalizing 0–10V Variable speed fan inputs for use with field supplied controllers or thermostats. These inputs can be used as the only input to the system, used in addition to the thermostatic (H, M, L) inputs, or not used at all. The inputs are accessible via 1TB4 on the adapter boards.

The motor control board is factory configured to drive the unit to a minimum speed (catalogue "low speed" value), defined as ALm1 and ALm2 once the analog (0–10V) input is honored. As a default, the noise floor/threshold is set to 3 percent (0.3V). At 0.3V, the system will drive the motors to the speeds defined in defined as ALm1 and ALm2. If the analogue input goes to 10V, the motor control board will drive the motor to maximum speed (normally catalogue "high speed" value), defined as AHm1 and AHm2, and will change speed in response.

Although the VelociTach motor control board ships with settings that will work with most 0–10 Vdc outputs, calibration should be performed to maximize response range and controller authority. Typically, the only settings needed for the VSP inputs are calibration of the signal to ensure that the system obeys the following rules:

1. The minimum output from the field supplied controller is met with a positive fan response. That is, we do not want the uFLr setting on the motor control board to be higher than the minimum output of the field supplied controller, as the motor control board will "ignore" a portion of the usable range of the customer fan variable speed output.
2. The minimum output from the field supplied controller is not significantly greater than the floor setting uFLr floor. If the minimum output of the controller is significantly greater than the floor setting, the first point that the motor will turn on will be above the ALm1 and ALm2 value. The full range of motor control will not be fully utilized in this case, as the motor will never reach the low speed motor analogue input scaling value for Motor 1 and Motor 2 (ALm1 and ALm2)
3. The maximum output of the controller needs to be 10V, or if lower, needs to be compensated using the analog input scaling value, AISc to normalize the operational range. As a default, the scaling value is set to 1.00 (so a voltage of 5V will be graded as 5V); however, to compensate for long runs or lower max voltages (i.e., lower than 10.00), the scaling value can be increased accordingly to maximize operational range.

   For example, if the voltage is only reaching a value of 9.0V at the adapter boards, then the AISc parameter should be set to (10/9=) 1.111. If left un-calibrated, the unit will never attain maximum speeds, defined as AHm1 and AHm2.
4. The motor control board can accept slightly over-biased inputs up to 12 Vdc, and the AISc parameter can be set to a value less than 1.0 to compensate.

VSP Setup Examples

Figure 44. Example 1: uFLr set too high and AISc set too high

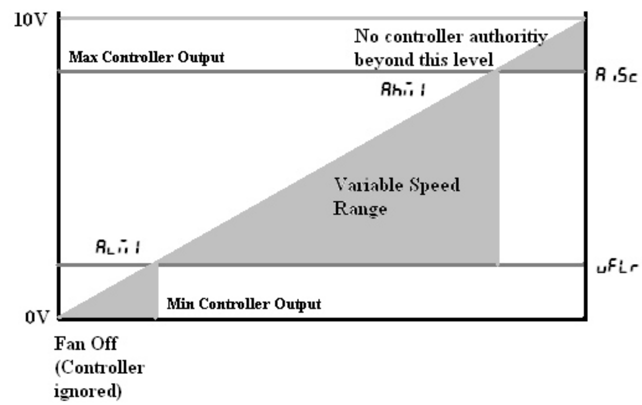


Figure 45. Example 2: uFLr set too high but AISc set correctly

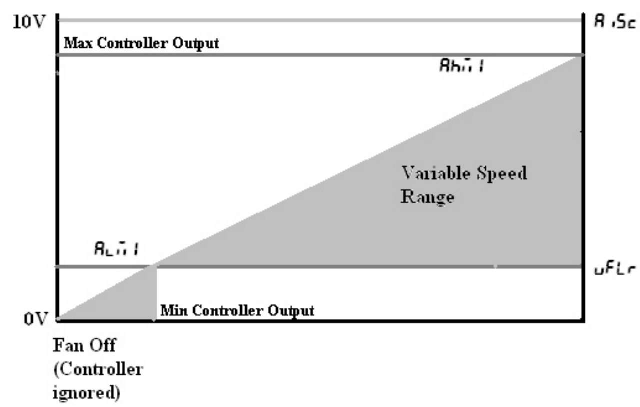
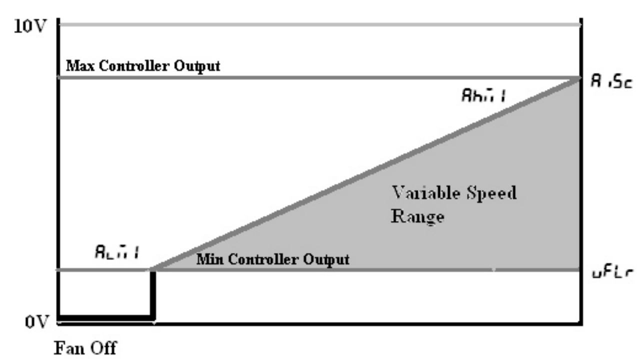


Figure 46. Example 3: uFLr set correctly and AISc set correctly



Use of Potentiometer/Rheostat For VSP

⚠WARNING

Hazardous Voltage w/Capacitors!

Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/ tagout procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer's literature for allowable waiting periods for discharge of capacitors. Verify with an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

⚠WARNING

Safety Alert!

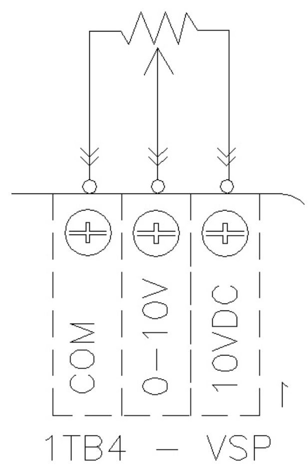
You MUST follow all recommendations below. Failure to do so could result in death or serious injury.

- **Connections to the adapter boards/changes to the CSTI configuration switches should be made only with the power to the unit disconnected.**
- **All settings take effect immediately, including fan startup, enabling of electric heat. Caution should be taken to stay clear of hazardous voltages, moving parts and electric heat elements while making adjustments to the motor control board. If it is not practical to stay clear of these areas during adjustment of the motor control board, please contact Trane Global Parts for configuration kit that allows easy powering of the motor control board outside of the unit with a 9V battery.**

A courtesy 10-Vdc supply is provided that can support a 10-mA draw. The use of a 1K or a 10K potentiometer is recommended, and only a stand-alone potentiometer (not shared with any other electrical system) should be employed. When a simple potentiometer is used as depicted in Figure 47, the uFLr setting will define a null-zone (off).

The typical connection is depicted in Figure 47; however, please consult the unit schematic for the most updated instruction, as Figure 47 is provided as reference only.

Figure 47. Typical connection



Adjustment or Disabling of Optional Auto-Changeover Function on CSTI Units

⚠WARNING

Hazardous Voltage w/Capacitors!

Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/ tagout procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer's literature for allowable waiting periods for discharge of capacitors. Verify with an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

The motor control board provides additional temperature controlled logic to help coordinate certain electric-heat and valve logic functions:

- On units with electric heat and a changeover coil, the motor control board and adapter boards are pre-configured to cause hydronic heat and electric heat to be mutually exclusive:
  - On units with ComfortLink™ controls (Tracer ZN controllers) or BacNet™ controls (UC400), the Tracer ZN controller board will serve as the primary logic to select the electric heat only if hot water is not available, but the motor control board will service as a backup lockout.
  - On units with Customer Supplied Controllers (CSTI units), the motor control board and CSTI board will serve as the primary lockout.
- On CSTI units selected with a changeover coil configuration, the motor control board is factory configured to work in conjunction with the CSTI adapter board to provide a useful auto-changeover

function. Traditionally, a fixed setpoint bi-metallic disc temperature switch is used to provide changeover with customer controls; however, the motor control board has defeatable and configurable bi-metallic disc temperature switch emulation when combined with the CSTI adapter board. The motor control board is preconfigured for typical values, so changeover settings do not necessarily need to be changed.

– An NTC thermistor is supplied and affixed to the supply pipes where applicable. The motor control board has several settings that affect the operation of the changeover function:
  - FPru parameter should normally be set to EHL or EHFS to use the changeover functions.
  - EHL parameter should be chosen if the unit has a changeover coil without electric heat.
  - EHFS parameter should be chosen if the unit has a changeover coil with electric heat. Generally, this will perform the same as the EHL parameter but in addition, will disable heating function on electric heat and on the changeover coil if there are fan failures. The auxillary heating coil function will continue to operate and respond to the customer heating request.

- AiPU parameter should be set to In for CSTI units and to OUt for ComfortLink or BacNet controller units.
- Ai2m parameter defines the temperature at which the motor control board will close the triac onboard the motor control board (if FPru parameter is set correctly).
- Ai2b parameter defines the temperature at which the motor control board will open the triac onboard the motor control board (if FPru parameter is set correctly). By leaving a “gap” between the make and break value, we will simulate hysteresis of a real bi-metallic disc temperature switch.
- When combined with the CSTI adapter board, the bi-metallic disc temperature switch emulation and the electric heat lockout function will work when the switches are set correctly.

Adjustment and Configuration of the CSTI Adapter Board

⚠CAUTION

Burn Hazard!

If SW4 is turned off, the factory/customer controller/ thermostat will be able to actuate the electric heat while hot water is available or if the fans have failed. This switch should NOT be turned off if the unit schematic indicates that it should be on, to prevent overheating of the unit (due to simultaneous electric heat and hydronic heat actuation, or failure of the fan) and to use the preferred hydronic heating over electric heat. Failure to follow this instruction could result in the unit overheating and becoming hot to the touch, which could result in minor or moderate injury, and/or equipment damage.

For CSTI units, the board mounted switches have to be set appropriately to enable the desired functionality.

Figure 48. CSTI adapter board: board-mounted switches

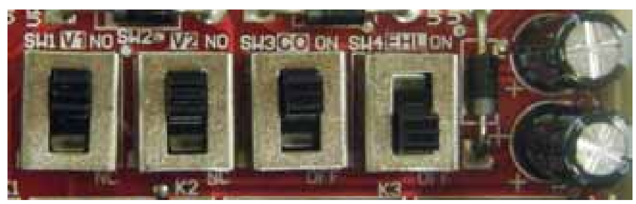


Table 21. CSTI adapter board: switch functions

Switch (L-R)	SW1	SW2	SW3	SW4
Function	Valve one operation logic	Valve two operation logic	Changeover Function	Electric Heat / Fan Proving Function
UP position (towards terminal strip)	Normally Open Valve	Normally Open Valve	Changeover Function ON	Electric Heat / Fan Proving Function
DOWN position (towards black relays)	Normally Closed Valve	Normally Closed Valve	Changeover Function OFF	Electric Heat / Fan Proving Function

Notes:

- *All switches are factory-set based on customer configuration of the unit model number. The unit will function correctly as shipped; however, the switch functions and positions are depicted for customer convenience and for service and troubleshooting aids.*
- *SW3 and SW4 work in conjunction with settings on the motor control board controller. Simple activation of changeover and electric heat lockout function may not work correctly unless the motor control board is configured to perform these functions.*
- *Customers are advised to locate the changeover coil temperature sensor on the bypass line if possible, to avoid measuring standing water temperature.*

- *If a 4-pipe unit with changeover function is selected, the heating input will drive the main coil if hot water is detected, but will always drive the auxiliary coil or electric heat (where available).*
- *Where electric heat is available with a changeover coil, the electric heat is factory-configured to be deactivated if there is hot water available and if there is a fan failure.*

The CSTI board comes with courtesy valve inversion relays that allow both normally open and normally closed two-position valves to be used with simple thermostats that do not have the configurability to adapt to the customer choice of valves. Independent switches, SW1 and SW2, are provided for 2-pipe or 4-pipe units, or 2-pipe units with an optional reheat coil. The functions of SW1 and SW2 is downstream of the changeover function (SW3 and motor control board). Decisions made by the changeover circuits will be flowed to the inversion circuits, if they are selected.

SW3 enables or disables the changeover function for 2-pipe changeover coil units, or 4-pipe units where the coil has both a heating/cooling circuit and a heating circuit piped internally. If SW3 is turned off, the changeover function will be disabled, and the unit will then be configured as a cooling only coil, a heating only coil, or a combination of cooling only/heating only coil. Thus, customer cooling requests will drive the main valve, and heating requests will drive the auxiliary valve.

The changeover function is designed to work with customer controllers that request heating or cooling (based on customer request), but have coil water temperatures that are "changed over" from heating to cooling (or cooling to heating) depending on the season and the building equipment available. Customer thermostats MUST be hooked to the correct terminal strip locations (V1 and V2) for the changeover function to work.

Cooling

In general, the (CSTI) changeover function will provide cooling if:

1. A unit is factory configured with a changeover coil (cooling/heating) as the only coil or as the main coil portion.
2. SW3 on the CSTI adapter board is turned on, and the FPru parameter set to EHL or EhFS to use the changeover functions.
   a. EhL parameter should be chosen if the unit has a changeover coil without electric heat.
   b. EhFS parameter should be chosen if the unit has a changeover coil with electric heat. Generally, this will perform the same as the EhL parameter but will in addition, disable the heating function on electric heat and on the changeover coil heat if there are fan failures. The auxiliary heating coil valve will continue to respond to customer heating requests.
3. The motor control board has sensed that there is cold water available on the supply/bypass line for the changeover coil. In this case, "cold" water is inferred by the motor control board if:
   a. A 10K NTC thermistor (similar to Trane part number X13790374010) is wired properly to the motor control board, through the crossover cables and CSTI adapter boards.
   b. The input impedance of the thermistor circuit must be set correctly (the A iPU parameter should be set to in for CSTI units).
   c. The temperature sensed is lower than the A i2n parameter.
   d. The A i2b parameter is higher than the A i2n parameter.
   e. The temperature is not in the dead-band between the A i2b parameter and the A i2n parameter (in this case, previous state will be retained).
4. The customer thermostat is properly hooked up the input strip 1TB3, and is requesting cooling input (V1) based on the customer cooling setpoint being lower than the space temperature.

Heating

In general, the (CSTI) changeover function will provide heating if:

1. A unit is factory-configured with a changeover coil (cooling/heating) as the only coil or as the main coil portion.
2. SW3 on the CSTI adapter board is turned on, and the FPru parameter set to EHL or EhFS to use the changeover functions.
   a. EhL parameter should be chosen if the unit has a changeover coil without electric heat.
   b. EhFS parameter should be chosen if the unit has a changeover coil with electric heat. Generally, this will perform the same as the EhL parameter but will in addition, disable the heating function on electric heat and on the changeover coil heat if there are fan failures. The auxiliary heating coil valve will continue to respond to customer heating requests.
3. The motor control board has sensed that there is hot water available on the supply/bypass line for the changeover coil. In this case, "hot" water is determined if:
   a. A 10K NTC thermistor (similar to Trane part number X13790374010) is wired properly to the motor control board, through the crossover cables and CSTI adapter boards.
   b. The input impedance of the thermistor circuit must be set correctly (the A iPU parameter should be set to in for CSTI units).
   c. The temperature sensed is higher than the A i2b parameter.
   d. The A i2b parameter is higher than the A i2n parameter.

   e. The temperature is not in the dead-band between the A i2b parameter and the A i2m parameter (in this case, previous state will be retained).
4. The customer thermostat is properly hooked up the input strip 1TB3, and is requesting heating input (V2) based on the customer heating set point being higher than the space temperature.
5. The heating input on 1TB3 will drive the main changeover coil IF conditions 1–4 are satisfied, but will always drive the auxiliary coil valve (if present). Electric heat will be locked out (where present) if hot water is available since SW4 will be factory set to “ON” in these units.

SW4 selects the electric heat lockout function, where we will lock out the electric heat circuit based on either:

1. The presence of hot water in the changeover coil section (if the FPru parameter is set to EHL).
2. Abnormal behavior of the fan/s (if the FPru parameter is set to FnSt).
3. Or a combination of both the presence of hot water or abnormal behavior of the fan/s (if the FPru parameter is set to EHFS).
4. The preceding three examples depend on the inference of the motor control board that hot water is present. In this case, “hot” water is determined if:
   a. The temperature sensed is higher than the A i2b parameter.
   b. The A i2b parameter is higher than the A i2m parameter.
   c. The temperature is not in the dead-band between the A i2b parameter and the A i2m parameter (in this case, previous state will be retained).
   d. The input impedance of the thermistor circuit must be set correctly (the A iPU parameter should be set to in for CSTI units).

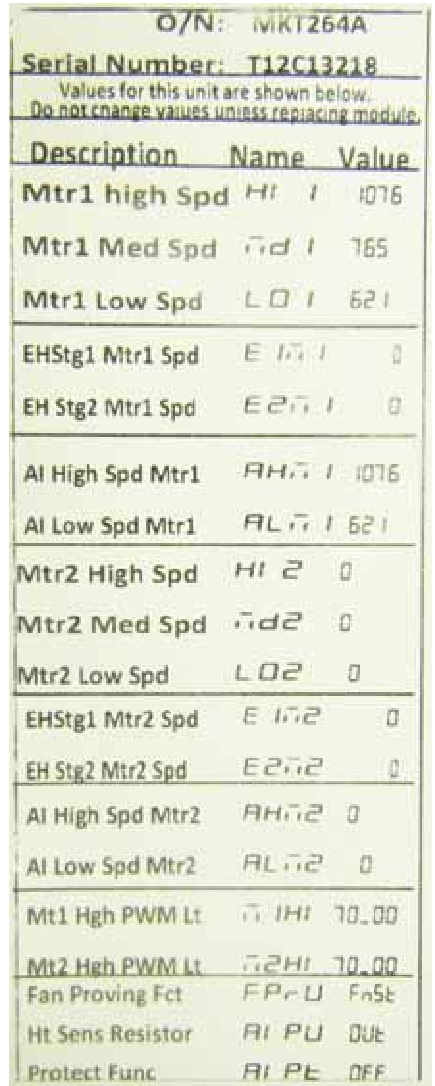
Configuring the VelociTach Motor Control Board

Every Trane unit with ECM motors will have modules specifically configured at the factory for the operation of that unit. The motor control board configuration label is affixed to the low-voltage access lid on the outside of the control panel (see Figure 37, p. 46 and Figure 49, p. 56). The motor control board label may be on the back-side of the low voltage access lid, depending on the unit configuration.

The serial number of each unit and the custom configuration settings specific to that unit will be printed on the label for convenient matching of labels/settings to specific units. Programming a unit with the settings from another unit will result in abnormal operation. The label contains four important sections:

1. How to enter the configuration menu
2. The description and meaning of the Error Codes
3. The description and meaning of the status display
4. The parameter names and values specific to that unit

Figure 49. Motor control board label



O/N: MKT264A

Serial Number: T12C13218

Values for this unit are shown below.
Do not change values unless replacing module.

Description	Name	Value
Mtr1 high Spd	HI 1	1076
Mtr1 Med Spd	md 1	765
Mtr1 Low Spd	LO 1	621
EHStg1 Mtr1 Spd	E 1m 1	0
EH Stg2 Mtr1 Spd	E2m 1	0
AI High Spd Mtr1	AHm 1	1076
AI Low Spd Mtr1	ALm 1	621
Mtr2 High Spd	HI 2	0
Mtr2 Med Spd	md2	0
Mtr2 Low Spd	LO2	0
EHStg1 Mtr2 Spd	E 1m2	0
EH Stg2 Mtr2 Spd	E2m2	0
AI High Spd Mtr2	AHm2	0
AI Low Spd Mtr2	ALm2	0
Mt1 Hgh PWM Lt	m 1HI	10.00
Mt2 Hgh PWM Lt	m2HI	10.00
Fan Proving Fct	FPrU	FnSt
Ht Sens Resistor	AI PU	OUt
Protect Func	AI Pt	OFF

Note: This label is provided for reference only, as an example, and should not be used to configure the unit.

Configuration Settings of the Motor Control Board

⚠WARNING

Safety Alert!

You MUST follow all recommendations below. Failure to do so could result in death or serious injury.

All settings take effect immediately, including fan startup and enabling of electric heat. Caution should be taken to stay clear of hazardous voltages, moving parts and electric heat elements while making adjustments to the motor control board. If it is not practical to stay clear of these areas during adjustment of the motor control board, please contact Trane Global Parts for configuration kit that allows easy powering of the motor control board outside of the unit with a 9V battery.

The adapter boards contain high voltage. Configuration adjustments to the motor control board should be made through the SMALLER of the two low-voltage lids on the front of the control panel, through the low-voltage insulation/shielding.

⚠CAUTION

Burn Hazard!

On electric heat units, certain parameter values are locked out to prevent overheating of the unit. These functions will appear to be saved; however, they will not be accepted if the Electric Heat Protection setting is "On". Do not change the Electric Heat Protection setting to "Off" and make changes to the protected settings unless you are programming an unconfigured service replacement board to match the unit settings on a ECM configuration label. Failure to follow this instruction could result in the unit overheating and becoming hot to the touch, which could result in minor or moderate injury, and/or equipment damage.

NOTICE:

Equipment Damage!

Do not change the PWM output voltage settings as motor damage could occur.

Note: The motor control board functions and unit specific settings are summarized on the motor control board configuration label affixed to the back side of the control panel low voltage lid, on every unit.

The following table lists the parameter names and typical settings of the motor control board, for reference only.

Additional Notes:

1. *This list is applicable only to blower coil products.*
2. *Do not change the electric heat protection settings if your unit has electric heat.*
3. *If the format setting for rpm values are not correct (i.e., not four-digit: XXXX), please check the operation mode of the motor control board* mod 1 *and* mod 2 *and motor signal output format* SIg1 *and* SIg2.

Table 22. Configuration settings of the motor control board

Description on Unit Label	User Interface Name	Typical User Interface Value	Description	**Note:** These notes are provided for reference only, and the motor control board label must be used as the ultimate guide for setting up an motor control board on specific units.
Mtr 1 High Spd	Hi 1	1080	Sets the high-speed rpm for Motor 1.	Do not exceed 2300 rpm.
Mtr 1 Med Spd	md 1	777	Sets the medium-speed rpm for Motor 1.	
Mtr 1 Low Spd	Lo 1	632	Sets the low-speed rpm for Motor 1.	Do not set under 600 rpm.
EHStg1 Mtr1 Spd	E1m1	0	Assigns an rpm to be associated with a call for 1st stage electric heat, for Motor 1 (only on units equipped with electric heat).	E1m1, E1m2, E2m1, E2m2 settings are locked out on units with electric heat.
EH Stg 2 Mtr 1 Spd	E2m1	0	Assigns an rpm to be associated with a call for 2nd stage electric heat, for Motor 1 (only on electric heat equipped units).	
AI High Spd Mtr 1	AHm1	0	Sets the maximum rpm for Motor 1 for the maximum input value of the analog input.	Analog inputs below the uFLr setting will be rejected.
AI Low Spd Mtr 1	ALm1	0	Sets the minimum turn-on rpm for Motor 1, when the analog input becomes active.	
Mtr 2 Hgh Spd	Hi 2	0	Sets the high-speed rpm for Motor 2.	Blower coils have only one motor.
Mtr 2 Med Spd	md 2	0	Sets the medium-speed rpm for Motor 2.	
Mtr 2 Low Spd	Lo 2	0	Sets the low-speed rpm for Motor 2.	
EHStg1 Mtr2 Spd	E1m2	0	Assigns an rpm to be associated with a call for 1st stage electric heat, for Motor 2 (only on electric heat equipped units).	If the unit has only one motor, all seven speed settings for the second motor (Hi 2, md 2, Lo 2, E1m2, E2m2, ALm2, AHm2) should be set to zero.
EH Stg 2 Mtr 2 Spd	E2m2	0	Assigns an rpm to be associated with a call for 2nd stage electric heat, for Motor 2 (only on electric heat equipped units).	
AI High Spd Mtr 2	AHm2	0	Sets the maximum rpm for Motor 2 for the maximum input value of the analog input.	
AI Low Spd Mtr 2	ALm2	0	Sets the minimum turn-on rpm for Motor 2, when the analog input becomes active.	
Op Mode Mtr 1	mod1	rPm	Sets the operational mode for Motor 1.	Must be set to rPm for blower coil units.
Op Mode Mtr 2	mod2	rPm	Sets the operational mode for Motor 2.	Must be set to rPm for blower coil units.
Mtr 1 Out Format	SiG1	PWm	Sets the interface type for Motor 1.	Must be set to PWm for blower coil units.
Mtr 2 Out Format	SiG2	PWm	Sets the interface type for Motor 2	Must be set to PWm for blower coil units.
Mtr 1/2 PWM Freq.	FrEq	100	Sets the PWM frequency, for cases when the PWM outputs are used.	On blower coil units, the PWm must not be changed.
Mtr 1 PWM Volt	m1uL	5	Sets the PWM voltage, for cases when the PWM outputs are used.	This setting must NOT be changed, as damage to the motor may occur!
Mtr 2 PWM Volt	m2uL	5	Sets the PWM voltage, for cases when the PWM outputs are used.	This setting must NOT be changed, as damage to the motor may occur!
Mt1 Hgh PWM Lt	m1Hi	90	Sets the maximum output % that the controller will request from Motor 1.	This envelope protection value should not be altered.
Mt1 Low PWM Lt	m1Lo	14.5	Sets the minimum maximum output % that the controller will request from Motor 1.	This envelope protection value should not be altered.
Mt2 Hgh PWM Lt	m2Hi	90	Sets the maximum output % that the controller will request from Motor 2.	This envelope protection value should not be altered.
Mt2 Low PWM Lt	m2Lo	14.5	Sets the minimum maximum output % that the controller will request from Motor 2.	This envelope protection value should not be altered.
Mt1 Ovspd RPM	rPm1	2500	Selects the rpm above which the Motor 1 will be assumed to be in an overspeed condition and will need to be shut down.	This envelope protection value should not be altered.
Mt2 Ovspd RPM	rPm2	2500	Selects the rpm above which the Motor 2 will be assumed to be in an overspeed condition and will need to be shut down.	This envelope protection value should not be altered.
Fan Proving Fct	FPru	FnSt	Selects which mode should be assigned to the Binary output circuit, depending on unit type.	This setting has to be correct for proper unit operation of electric heat and changeover units.
AI Boost Amp	AiSc	1	Boosts or attenuates the analog input signal to compensate for long wire runs.	A value of 1 should be used if no voltage level compensation is needed (i.e., voltage peak is at 10 Vdc).

Table 22. Configuration settings of the motor control board (continued)

Description on Unit Label	User Interface Name	Typical User Interface Value	Description	**Note:** These notes are provided for reference only, and the motor control board label must be used as the ultimate guide for setting up an motor control board on specific units.
AI Floor	uFLr	0.5	Rejects noise on the analog input lines and sets up the motor control board to turn on if the thermostat or controller is commanding its analog outputs on.	
PulsePerRev	FdbH	18	Sets up the tachometer function to be compatible with the on-board motor and for correct speed calculation and calibration.	Do not change this setting as this is critical to proper unit operation.
P Value Mtr 1	PuL1	0.03	Sets up the on board closed loop control to control Motor 1 with proper stability.	Do not change this setting.
I Value Mtr 1	IuL1	0.03	Sets up the on board closed loop control to control Motor 1 with proper stability.	Do not change this setting.
P Value Mtr 2	PuL2	0.03	Sets up the on board closed loop control to control Motor 2 with proper stability.	Do not change this setting.
I Value Mtr 2	IuL2	0.03	Sets up the on board closed loop control to control Motor 2 with proper stability.	Do not change this setting.
Ht Sens Mk Val F	Ai2M	85	Sets the make value for the motor control board triac output based on the thermistor input.	Operation also depends on FPru, Ai2b, and AiPU settings.
Ht Sens Bk Val F	Ai2b	90	Sets the break value for the motor control board triac output based on the thermistor input.	Operation also depends on FPru, Ai2M, and AiPU settings.
Ht Sens Resistor	AiPU	oUt	Sets the input impedance of the thermistor input.	Should be pre-set to "OUT" for Tracer ZN controllers.
Mt 1 Ramp %/sec	M1rP	3	Sets the ramp rate for Motor 1, in % per second.	
Mt 2 Ramp %/sec	M2rP	3	Sets the ramp rate for Motor 2, in % per second	
EH Ramp Accel	EhrP	2	Sets the acceleration factor for the electric heat inputs.	Is used to force faster ramps when electric heat is requested.
Ramp MAX Time	MhrP	15	Sets the maximum ramp time for both Motor 1 and Motor 2 (in seconds).	Overrides the ramp rates M1rP and M2rP if the calculated ramp time exceeds MhrP.
EH Fan off delay	EHdL	15	Selects how long the fan needs to stay on after an electric heat request has been turned off.	Not used on fan-coil unit.
Lck Rtr Protect	LrPt	on	Selects whether to use the on-board locked rotor protection function.	This will shut down the affected motor, if rotational response is not detected.
Protect Funct	EhPt	on	This function protects settings on the board that affect the safety of the electric heat system.	Do NOT change this setting. This setting locks out the following parameters from being changed, for safe operation of the unit. AiPU FPru AiMH AibH E1M1 E1M2 E2M1 E2M2 Si9 Mod1 Mod2 M1Hi M1Lo
Rmp dft (auto rst)	rPdF	oFF	This function shortens the ramps for faster unit commissioning and auto-resets to off after approximately 15 minutes of power-on operation.	To aid in commissioning of the unit, for approximately 10–15 minutes, the ramps will be shortened to quickly observe proper unit behavior and response to speeds.
Soft Rev	SoFt	u2.00	Displays the software version.	

Fan Speed Response Verification

1. After performing controller specific commissioning, observe the display on the motor control board with the power on, to the unit. The motor control board display should display a looping status indicator as follows:

   mtr 1 → 0 → mtr2 → 0 → FSt 1 → 0
   FF → FSt2 →
   0FF → EhEn → 0n

Notes:

- *The EhEn indicator is unit-specific and may indicate "Off" at this point; refer to thermistor function for more information.*
- *A representative fan speed of "1080" rpm are shown in the example below. Each unit is factory-configured differently and will have different settings for different fan speeds.*

2. While the unit remains on, exercise the fan controls on the unit, either directly or indirectly through request for unit heat/cool. Observe the fan spinning, and then observe the fan display on the motor control board. It should display a looping status indicator as follows:

   For a size 200, 300, 400, 600, or 800 unit (using typical unit operating fan speeds):

   mtr 1 → 1080 → mtr2 → 0 → FSt 1
   → 0n → FSt2 →
   0FF → EhEn → 0n

   For a size 1000 or 1200 unit (using typical unit operating fan speeds):

   mtr 1 → 1080 → mtr2 → 1080 → FSt
   1 → 0n → FSt2 →
   on → EhEn → 0n

Note: The EhEn indicator is unit-specific and may indicate "Off" at this point; refer to thermistor function for more information.

3. *OPTIONAL:*

   While the fan is running, if practical, change the fan speeds and observe the display temporarily indicate: rAmP

   Exercise all fan speeds to ensure positive unit response and to validate any field wiring.

Installation - Controls

Control sensor options include both unit-mounted (factory-installed) and wall-mounted sensors. Installation instructions for the wall-mounted sensors are provided in this chapter.

Zone Sensor Options

Zone sensors are available as wall-mounted options. Wall-mounted zone sensor options have an internal thermistor. Zone sensors operate on 24 Vac.

A variety of wall-mounted zone sensors are available for design flexibility. Zone sensors have an internal thermistor and operate on 24 Vac. Options with setpoint knobs are available in Fahrenheit or Celsius. See Figure 50 through Figure 56 for available options and model number references.

Figure 50. Digit 38 = 1
Wall-mounted zone sensor with setpoint knob, off/auto fan speeds, occupied/unoccupied, and COMM jack.

Figure 51. Digit 38 = 3
Wall-mounted temp sensor with setpoint knob, occupied/unoccupied, and COMM jack.

Figure 52. Digit 38 = 4
Wall-mounted temp sensor with occupied/unoccupied and COMM jack.

Figure 53. Digit 38 = C
Wireless temperature sensor and unit-mounted receiver.

Figure 54. Digit 38 = E
Wall-mounted temperature sensor with setpoint knob, off/auto/low/medium/high fan speeds

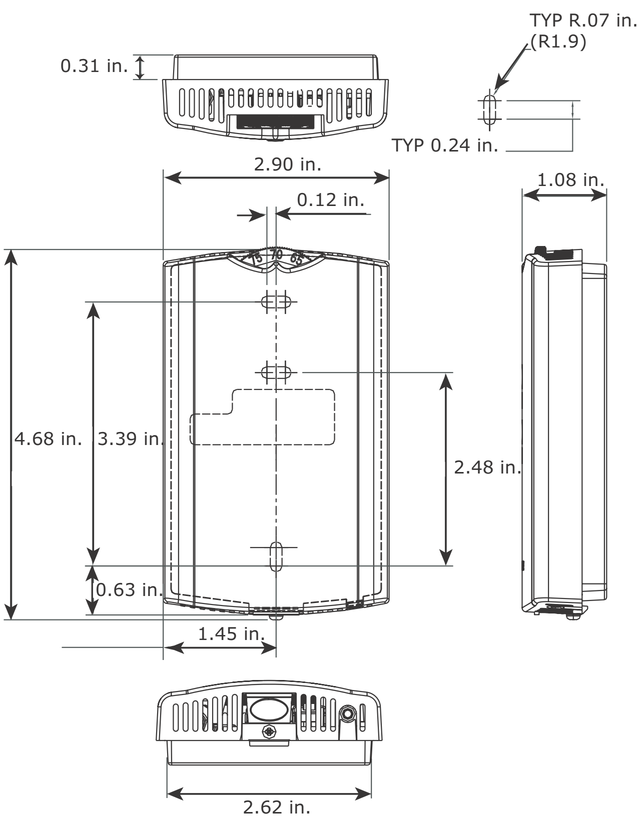
Figure 55. Digit 38 = F
Wall-mounted display temperature sensor with setpoint knob, occupied/unoccupied and COMM jack.

Figure 56. Digit 38 = G
Wireless display sensor, unit-mounted receiver.

Installing Wall-Mounted Wired Sensors

Reference the wall-mounted zone sensor dimensions in Figure 57, p. 63. Position the sensor on an inside wall three to five feet above the floor and at least 18 inches from the nearest outside wall. Installing the sensor at a lower height may give the advantage of monitoring the temperature closer to the zone, but it also exposes the sensor to airflow obstructions. Ensure that air flows freely over the sensor.

Figure 57. Wall-mounted wired and wireless zone sensor dimensions



Sensor

When selecting a sensor location, avoid the following:

- Areas of direct sunlight
- Areas in the direct airstream of air diffusers
- Exterior walls and other walls that have a temperature differential between the two sides
- Areas that are close to heat sources such as sunlight, appliances, concealed pipes, chimneys, or other heat-generating equipment
- Drafty areas
- Dead spots behind doors, projection screens, or corners
- Walls that are subject to high vibration
- Areas with high humidity
- High traffic areas (to reduce accidental damage or tampering)
- Metal barriers between the receiver and the sensor (for example, plastered walls with metal lathe or metal roof decks)
- Thick, solid concrete walls between the receiver and the sensor
- Placing the sensor inside metal enclosures

Height Requirements

It is recommended that you mount the back plate a maximum distance of 54 inches above the floor. If a parallel approach by a person in a wheelchair is required, reduce the maximum height to 48 inches.

Note: Consult section 4.27.3 of the 2002 ADA (Americans with Disability Act) guideline, and local building codes, for further details regarding wheelchair requirements.

Mounting Surfaces

Using the hardware provided, mount the back plate of the sensor to a flat surface such as sheetrock or plaster, or an electrical junction box. The sensor must be mounted plumb for accurate temperature control and to ensure proper air movement through the sensor.

- If mounting onto sheetrock or plaster, use the plastic threaded anchors (pre-drilling holes is not usually necessary) and the two M3.5 x 20 mm mounting screws.
- For mounting onto an electrical junction box, use the two 6-32 x 3/4 in. screws.

Before beginning installation, consider the location considerations below. Also, refer to the unit wiring schematic for specific wiring details and point connections.

Location Considerations

Avoid mounting the sensor in an area subject to the following conditions:

- Dead spots, such as behind doors or in corners that do not allow free air circulation.
- Air drafts from stairwells, outside doors, or unsectioned hollow walls.
- Radiant heat from the sun, fireplaces, appliances, etc.
- Airflow from adjacent zones or other units.
- Unheated or uncooled spaces behind the controller, such as outside walls or unoccupied spaces.
- Concealed pipes, air ducts, or chimneys in partition spaces behind the controller.

Location Considerations for Wireless zone sensors

Placement of the sensor is critical to proper operation (the receiver is factory mounted). For most installations, barriers limit proper radio signal strength more than distance. For best radio transmission range and reliability, mount the receiver and sensor in line of sight. Where this is not possible, try to minimize the number of barriers between the pair of devices. In general, sheetrock walls and ceiling tiles offer little restriction to the transmission range for the sensor is as follows:

- Open range: 2,500 ft (packet error rate = 2%)
- Usable range: 200 ft
- Typical range: 75 ft

Fan Mode Switch Installation

The fan mode switch ships loose inside the unit accessory bag. Follow the steps below to install the fan mode switch.

Items needed:

2 x 4 electrical junction box

1. Remove the brown wire if not using a field-supplied damper.
2. Remove the terminals, cut and strip wires as required for installation.
3. Level and position a 2 x 4 electrical junction box.
4. Follow the instructions given in “Installing Wall-Mounted Wired Sensors,” page 63 and route the wires as shown in the wiring diagram. Refer to the typical wiring diagram or to the unit specific diagram on the unit.
5. Position the fan mode switch over the junction box with the two screws supplied.

Zone Sensor Installation

Follow the procedure below to install the wired zone sensor module.

1. Note the position of the setpoint adjustment knob and gently pry the adjustment knob from the cover using the blade of a small screwdriver.
2. Insert the screwdriver blade behind the cover at the top of the module and carefully pry the cover away from the base.
3. To mount the sensor back plate:
   a. Hold the back plate against the mounting surface and mark the screw locations.
   b. Secure the back plate against the mounting surface using included hardware.
4. To install the zone sensor module to a standard junction box:
   a. Level and install a 2 x 4-in. junction box (installer supplied) vertically on the wall.
   b. Pull the control wires through the cutout. Attach the module to the wall using the screws provided.
5. Strip the insulation on the interconnection wires back 0.25-inch and connect to TB1 (for wired sensors).
6. Screw down the terminal blocks (for wired sensors).
7. To replace the cover:
   a. Hook the cover over the top of the back plate. Apply light pressure to the bottom of the cover until it snaps in place.
   b. Install the security screw into the bottom of the cover (if desired).

If installing a Tracer ZN510 or Tracer ZN520 zone sensor, see “Zone Sensor Installation,” page 64 for more information.

Figure 58. Mounting zone sensor base plate

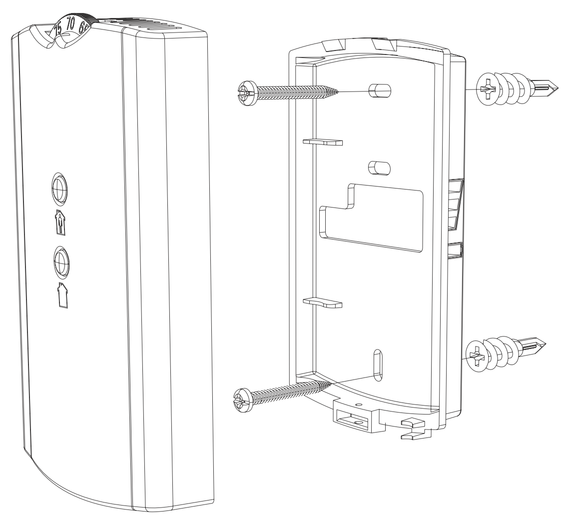
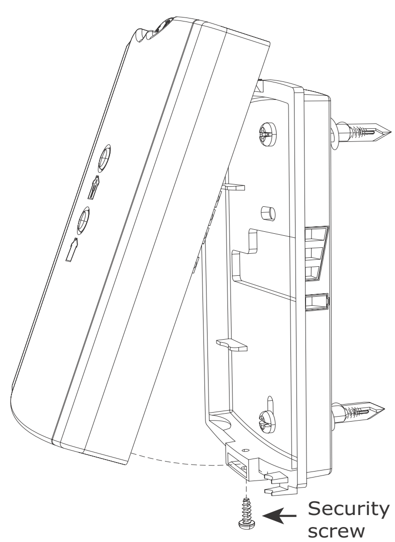


Figure 59. Mounting zone sensor security screw



Start-Up

Pre-Startup Checklist

Complete this checklist after installing the unit to verify all recommended installation procedures are complete before unit startup. This does not replace the detailed instructions in the appropriate sections of this manual. Disconnect electrical power before performing this checklist. Always read the entire section carefully to become familiar with the procedures.

⚠WARNING

Hazardous Voltage w/Capacitors!

Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/ tagout procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer's literature for allowable waiting periods for discharge of capacitors. Verify with an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

For additional information regarding the safe discharge of capacitors, see PROD-SVB06A-EN

General Checks

- Ensure the unit has been installed level.
- Ensure supply-air and return-air ducts have been connected.
- Ensure damper operator motors and connecting linkage have been installed.
- Verify damper operation and linkage alignment.
- Check that air filters are in place and positioned properly.
- Remove any debris from the unit interior.
- Remove all foreign material from the drain pan and check drain pan opening and condensate line for obstructions.
- Inspect electrical connections to the unit and unit controllers.
  - Connections should be clean and secure.
  - Compare the actual wiring with the unit diagrams.
  - Reference the appropriate controller manual for more details about starting units with factory-mounted controls.
- Check piping and valves for leaks. Open or close the valves to check for proper operation. Drain lines should be open.
- Leave this manual with the unit.

Fan-Related Checks

- If using isolators, properly mount unit according to the isolator placement sheet.
- Rotate fan wheel manually to confirm it turns freely in the proper direction.
- Verify the fan and motor are aligned.

Coil-Related Checks

NOTICE:

Proper Water Treatment!

The use of untreated or improperly treated water in coils could result in scaling, erosion, corrosion, algae or slime. It is recommended that the services of a qualified water treatment specialist be engaged to determine what water treatment, if any, is required. Trane assumes no responsibility for equipment failures which result from untreated or improperly treated water, or saline or brackish water.

- Ensure coil and condensate drain piping connections are complete.
- Check the piping and valves for leaks.
  - Open or close the valves to check operation.
  - The drain lines should be open.
- If unit has a refrigerant coil, ensure that it has been charged and leak-tested according to the instructions provided with the condenser equipment. Adjust the superheat setting.
- Remove all foreign material from the drain pan and check the pan opening and condensate line for obstructions.
- For steam coils, slowly turn the steam on full for at least 10 minutes before opening the fresh air intake on units with fresh air dampers.

Electrical Checks

- Check all electrical connections for tightness.
- Verify motor voltage and amps on all phases with the unit nameplate ratings to ensure unit operates correctly.

Ductwork Checks

- If using return ductwork to the unit, secure it with three inches of flexible duct connector.
- Extend discharge duct upward without change in size or direction for at least one and one half fan diameters.
- Use a 3-inch flexible duct connection on discharge.
- Ensure trunk ductwork is complete and secure to prevent leaks.
- Verify that all ductwork conforms to NFPA 90A or 90B and all applicable local codes

Tracer Controller Sequence of Operation

Controller Start-Up

Refer to *Installation, Operation and Programming Guide: Tracer™ ZN.520 Unit Controller* (CNT-SVX04A-EN, or the most recent version) to operate the Tracer controller with Trane Integrated Comfort System (ICS). The factory pre-programs the Tracer controller with default values to control the temperature and unit airflow. Use Tracer Summit building automation system or Rover (used with Tracer ZN010, ZN510, or ZN520 controllers) or Tracer SC system controller and Tracer T (used with Tracer UC400 controllers) software to change the default values.

Follow the procedure below to operate the Tracer controller in a stand-alone operation:

1. Turn power on at the disconnect switch option.
2. Position the fan mode switch to either high, low, or the auto position.
3. Rotate the setpoint dial on the zone sensor module to 55°F for cooling or 85°F for heating.

The appropriate control valve will actuate assuming the following conditions:

1. Room temperature should be greater than 55°F and less than 85°F.
2. For a two-pipe unit with an automatic changeover sensor, the water temperature input is appropriate for the demand placed on the unit. For example, cooling operation is requested and cold water (5° lower than room temperature) flows into the unit.
3. Select the correct temperature setpoint.

Note: *Select and enable zone sensor temperature settings to prevent freeze damage to unit.*

Power-Up Sequence

When 24 Vac power is initially applied to the Tracer controller, the following sequence occurs:

- All outputs are controlled off
- Tracer reads all input values to determine initial values
- Random start time (0–25 seconds) expires
- Normal operation begins

Modes of Operation

Tracer controllers operate the fan in one of the modes listed below as noted:

- Occupied
- Unoccupied
- Occupied standby (Tracer ZN510, ZN520, or UC400 only)
- Occupied bypass
- Tracer Summit with supply fan control (Tracer ZN510, ZN520, or UC400 only)

Note: *The Tracer ZN520 or UC400 controller operates the supply fan continuously when the controller is in the occupied and occupied standby modes, for either heating or cooling. The controller only cycles the fan off with heating and cooling capacity in the unoccupied mode.*

When the communicated occupancy request is unoccupied, the occupancy binary input (if present) does not affect the controller's occupancy. When the communicated occupancy request is occupied, the controller uses the local occupancy binary input to switch between the occupied and occupied standby modes.

Occupancy Sources

There are four ways to control the Tracer controller's occupancy, as noted below:

1. By pressing the zone sensor's timed override "on" button
2. Occupancy binary input, either normally open or normally closed, see Table 23 for occupancy sensor states

Table 23. Occupancy sensor state

Sensor Type	Sensor Position	Unit Occupancy Mode
Normally open	Open	Occupied
Normally open	Closed	Unoccupied
Normally closed	Open	Unoccupied
Normally closed	Closed	Occupied

3. Default operation of the controller (occupied mode)
4. Communicated request, usually provided by the building automation system (BAS) or peer device (available on Tracer ZN510, ZN520, and UC400 only).

A communicated request will control the controller's occupancy. Typically, this request comes from the BAS time-of-day or Tracer SC area scheduling to the controller. However, if a communication request from a BAS, Tracer SC, or peer controller is lost, the controller reverts to the default operating mode (occupied) after 15 minutes (configurable, specified by the "receive heartbeat time"), if no local hard-wired occupancy signal exists.

If the unit is communicating with Tracer Summit or Tracer SC and the supply fan control programming point is configured for BAS (the factory configures as local), then

Tracer Summit or Tracer SC will control the fan regardless of the fan mode switch position.

For complete information about Tracer Summit application setup using the Tracer controller, see the Tracer Summit product literature. For information regarding Tracer SC application and setup, refer to *Applications Guide: Air Systems for Tracer™ SC* (BAS-APG007-EN). For more information on the setup of another BAS, refer to the product-specific literature from that manufacturer.

Occupied Mode

When the controller is in the occupied mode, the unit attempts to maintain the space temperature at the active occupied heating or cooling setpoint, based on:

- Measured space temperature
- Discharge air temperature (Tracer ZN520 and UC400 only)
- Active setpoint
- Proportional/integral control algorithm

The modulating control algorithm used when occupied or in occupied standby is described in the following sections. Additional information related to the handling of the controller setpoints can be found in the previous setpoint operation section.

Note: *Heating and cooling setpoint high and low limits are always applied to the occupied and occupied standby setpoints.*

Unoccupied Mode

When the controller is in the unoccupied mode, the controller attempts to maintain space temperature at the stored unoccupied heating or cooling setpoint based on:

- Measured space temperature
- Active setpoint
- Control algorithm, regardless of the presence of a hard-wired or communicated setpoint

Similar to other controller configuration properties, the locally stored unoccupied setpoints can be modified using Rover service tool (used with Tracer ZN010, ZN510, or ZN520 controllers) or Tracer TU service tool (used with Tracer UC400 controllers).

During cooling mode, when the space temperature is above the cool setpoint, the primary cooling capacity operates at 100 percent. If more capacity is needed, the supplementary cooling capacity turns on (or opens to 100 percent).

During heating mode, when the space temperature is below the heat setpoint, the primary heating capacity turns on. All capacity turns off when the space temperature is between the unoccupied cooling and heating setpoints. Note that primary heating or cooling capacity is defined by the unit type and whether heating or cooling is enabled or disabled. For example, if the economizer is enabled (Tracer ZN520 and UC400 only) and possible, it is the primary cooling capacity. If hydronic heating is possible, it will be the primary heating capacity.

Occupied Standby Mode

Tracer ZN510, ZN520 and UC400 only

The controller can be placed into the occupied standby mode when a communicated occupancy request is combined with the local (hard-wired) occupancy binary input signal.

During occupied standby mode, the Tracer ZN520 or UC400 controller's economizer damper position goes to the economizer standby minimum position.

Note: *The economizer standby minimum position can be changed using Rover service tool (used with Tracer ZN010, ZN510, or ZN520 controllers) or Tracer TU service tool (used with Tracer UC400 controllers).*

In the occupied standby mode, the controller uses the occupied standby cooling and heating setpoints. Because the occupied standby setpoints typically cover a wider range than the occupied setpoints, the controller reduces heating/cooling demand for the space. Also, units with Tracer ZN520 or UC400 and the fresh air economizer damper use the economizer standby minimum position to reduce heating and cooling demand.

When no occupancy request is communicated, the occupancy binary input switches the controller's operating mode between occupied and unoccupied. When no communicated occupancy request exists, the unit cannot switch to occupied standby mode.

Occupied Bypass Mode

Tracer ZN510, ZN520, or UC400 only

The controller can be placed in occupied bypass mode by either communicating an occupancy bypass request to the controller or by using the timed override "on" button on the zone sensor. When the controller is in unoccupied mode, pressing the "on" button will place the controller into occupied bypass mode for the duration of the bypass time (typically 120 minutes).

Tracer Summit With Supply Fan Control

Tracer ZN510, ZN520, or UC400 only

All Tracer lockouts (latching diagnostics) are manually reset whenever the fan mode switch is set to the off position or when power is restored to the unit. The last diagnostic to occur is retained until the unit power is disconnected. Refer to *Installation, Operation and Programming Guide: Tracer™ ZN.520 Unit Controller* (CNT-SVX04A-EN, or the most recent version) for specific Tracer ZN520 operating procedures; refer to *Installation and Operation: Tracer™ UC400 Programmable Controller for Factory- or Field-installed Blower Coil* (BAS-SVX48A-EN, or the most recent version) for specific Tracer UC400 operating procedures.

Cooling Operation

During cooling mode, the Tracer controller attempts to maintain the space temperature at the active cooling setpoint. Based on the controller's occupancy mode, the active cooling setpoint is either the:

- Occupied cooling setpoint
- Occupied standby cooling setpoint (Tracer ZN510, ZN520, or UC400 only)
- Unoccupied cooling setpoint

The controller uses the measured space temperature, the active cooling setpoint, and discharge air temperature (Tracer ZN520 or UC400 only) along with the control algorithm to determine the requested cooling capacity of the unit (0 percent to 100 percent). The outputs are controlled based on the unit configuration and the required cooling capacity. To maintain space temperature control, the cooling outputs (modulating or 2-position hydronic valve, or economizer damper) are controlled based on the cooling capacity output.

Note: *Economizer dampers and modulating valves are only available on units with the Tracer ZN520 or UC400 controller. Two-position dampers are only available on units with Tracer ZN010 and ZN510.*

Cooling output is controlled based on the cooling capacity. At 0 percent capacity, all cooling capacities are off and the damper is at minimum position. Between 0 percent and 100 percent capacity, the cooling outputs are controlled according to modulating valve logic (Tracer ZN520 or UC400 only) or cycled with 2-position valves. As the load increases, modulating outputs open further and binary outputs are energized longer. At 100 percent capacity, the cooling valve or damper is fully open (modulating valves) or on continuously (2-position valves).

Note: *Unit diagnostics can affect fan operation, causing occupied and occupied standby fan operation to be defined as abnormal. Refer to "Troubleshooting," page 58 for more information about abnormal fan operation.*

Economizer Cooling

Tracer ZN520 or UC400 only

The economizer provides cooling whenever the outdoor temperature is below the economizer enable setpoint and there is a need for cooling. The economizer operates to meet the space demand, with other forms of cooling enabling when the economizer cannot meet the demand alone. See economizer air damper operation for additional information.

DX Cooling

Tracer ZN520 or UC400 only

The controller does not use both the DX compressor and the economizer at the same time. This prevents problems where the entering air temperature is too low for the evaporator coil to operate as designed, which leads to compressor short cycling due to low discharge air temperatures.

Discharge Air Tempering

Tracer ZN520 or UC400 only

Cascade cooling control initiates a discharge air tempering function if:

- Discharge air temperature falls below the discharge air temperature control low limit
- All cooling capacity is at minimum, and
- Discharge control loop determines a need to raise the discharge air temperature

The controller then provides heating capacity to raise the discharge air temperature to its low limit.

The discharge air tempering function enables when cold, fresh air is brought in through the fresh air damper and causes the discharge air to fall below the discharge air temperature control low limit. The controller exits the discharge air tempering function when heat capacity has been at 0 percent for five minutes.

Heating Operation

During heating mode, the Tracer controller attempts to maintain the space temperature at the active heating setpoint. Based on the controller's occupancy mode, the active heating setpoint can be:

- Occupied heating
- Occupied standby heating (Tracer ZN510, ZN520, or UC400 only)
- Unoccupied heating

Note: *Unit diagnostics can affect the controller operation, causing unit operation to be defined as abnormal. Refer to "Troubleshooting," page 58 for more information about abnormal unit operation.*

Heating output is controlled based on the heating capacity. At 0 percent capacity, the heating output is off continuously. Between 0 percent and 100 percent capacity, the heating output is controlled according to modulating valve logic (Tracer ZN520 or UC400 only) or cycled with 2-position valves. As the load increases, modulating outputs open further and binary outputs are energized longer. At 100 percent capacity, the modulating valve is fully open (Tracer ZN520 or UC400 only) or on continuously with 2-position valves.

Economizer Damper

Tracer ZN520 or UC400 only

The economizer damper option is never used for as a source for heating, but only for ventilation. Therefore, the damper is at the occupied minimum position in the occupied mode. The damper control is primarily associated with occupied fan operation.

Dehumidification

Tracer ZN520 only

During dehumidification, the Tracer ZN520 controller adjusts the heating setpoint up to the cooling setpoint. This reduces the relative humidity in the space with a minimum of energy usage.

The controller uses the measured space temperature, the active heating setpoint, and discharge air temperature (Tracer ZN520 only) along with the control algorithm, to determine the requested heating capacity of the unit (0 percent to 100 percent). The outputs are controlled based on the unit configuration and the required heating capacity.

Fan Mode Operation

⚠WARNING

Rotating Components!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

For multiple fan speed applications, the Tracer controller offers additional fan configuration flexibility. See Table 24 for fan operation sequences. Separate default fan speeds for heating and cooling modes can be configured using Rover service software (used with Tracer ZN010, Tracer ZN510, or ZN520 controllers) or Tracer TU service software (used with Tracer UC400 controllers).

Table 24. Tracer ZN520 and UC400 fan configuration

	Fan Operation	Fan Speed Default
Heating (primary and secondary)	Continuous	Off Auto Low High
Cooling	Continuous	Off Auto Low High

The fan runs continuously at selected speeds, high or low. When the fan mode switch is in the auto position or a hard-wired fan mode input does not exist, the fan operates at the default configured speed. See Table 25, p. 69 for Tracer ZN520 and UC400 default fan configuration for heating and cooling modes. During unoccupied mode, the fan cycles between high speed and off with heating and cooling fan modes. If the requested speed is off, the fan always remains off.

Table 25. Fan sequence of operation

Fan Speed	Tracer Controller	Sequence of Operation
Off	ZN010, ZN510, ZN520, UC400	• Fan is off • Control valves and damper option are closed • Low air temperature detection open is still active
Low, medium, or high (continuous fan)	ZN010, ZN510	• Fan operates continuously at selected speed • 2-position control valve option cycle as needed • 2-position control valve option opens to an adjustable mechanical stop-position
Low, medium, or high (continuous fan)	ZN520, UC400	• Fan operates continuously at selected speed • Modulating control valve option cycles as needed
Auto (cycling)	ZN010, ZN510	• Fan, 2-position damper cycle, and control valve cycle as needed • In cooling mode, fan cycles from off to high • in heating mode, fan cycles from off to low • When heating/cooling is not required, the fan is off and the 2-position damper option closes
Auto	ZN520	• Fan cycles between high and low, and never turns off unless the controller is in unoccupied mode • modulating or 2-position control open to maintain setpoint
Auto	UC400	• Fan speed will modulate and not cycle between low and high

When the fan is in auto during dehumidification (Tracer ZN520 only), the fan speed can switch depending on the error. The fan speed increases as the space temperature rises above the active cooling setpoint.

Additional flexibility built into the controller allows you to enable or disable the local fan switch input. The fan mode request can be hard-wired to any of the Tracer controllers or communicated to the Tracer ZN510 or ZN520 controller. When both inputs are present, the communicated request has priority over the hard-wired input. See Table 24, p. 69.

Fan Speed Switch

Off. Fan is turned off.

High, Medium, or Low. Fan runs continuously at the selected speed.

Tracer ZN010 and ZN510

Off. Fan is off; control valves and fresh air damper option close. Low air temperature detection option is still active.

Auto (Fan Cycling). Fan and fresh air damper cycle with control valve option to maintain setpoint temperature. In cooling mode the fan cycles from off to high and in heating mode it cycles from off to low (factory default that can be field-adjusted using Rover service software). When no heating or cooling is required, the fan is off and the fresh air damper option closes. Units can also be field-configured using Rover to run at a defined speed when the fan speed switch is in the auto position.

Low or High (Continuous Fan). Fan operates continuously while control valve option cycles to maintain setpoint temperature. Fresh air damper option is open.

Tracer ZN520 and UC400

Off. Fan is off; control valve options and fresh air damper options close. The low air temperature detection option is still active.

Auto. Fan speed control in the auto setting allows the modulating (three-wire floating point) control valve option and single or two-speed fan to work cooperatively to meet precise capacity requirements, while minimizing fan speed (motor/energy/acoustics) and valve position (pump energy/chilled water reset). As the capacity requirement increases at low fan speed, the water valve opens. When the low fan speed capacity switch point is reached, the fan switches to high speed and the water valve repositions to maintain an equivalent capacity. The reverse sequence takes place with a decrease in required capacity.

Continuous Fan Operation

During occupied and occupied standby modes, the fan normally is on. For multiple speed fan applications, the fan normally operates at the selected or default speed (off, auto, low, or high). When fan mode is auto, the fan operates at the default fan speed.

During unoccupied mode, the fan is off. While unoccupied, the controller will heat or cool to maintain the unoccupied heating and cooling setpoints. In unoccupied mode, the fan runs on high speed only, with heating or cooling. See Table 30, p. 71.

The unit fan is always off during occupied, occupied standby, and unoccupied modes when the unit is off due to a diagnostic or when the unit is in the off mode due to the local zone sensor module, a communicated request, or the default fan speed (off).

If both a zone sensor module and communicated request exist, the communicated request has priority. See Table 29, p. 71.

Fan Cycling Operation

Tracer ZN520 and UC400 does not support fan cycling in occupied mode. The fan cycles between high speed and off in the unoccupied mode only. The controller’s cascade control algorithm requires continuous fan operation in the occupied mode.

Fan Off Delay

When a heating output is controlled off, the Tracer controller automatically holds the fan on for an additional 30 seconds. This 30-second delay allows the fan to blow off any residual heat from the heating source, such as a steam coil. When the unit is heating, the fan off delay is normally applied to control the fan; otherwise, the fan off delay does not apply.

Fan Start on High Speed

On a transition from off to any other fan speed, the Tracer controller automatically starts the fan on high speed and runs the fan at high speed for 3.0 seconds. This provides ample torque required to start all fan motors from the off position.

Fan Operation During Occupied Heating Modes

The Tracer ZN520 and UC400 fan output(s) normally run continuously during the occupied and occupied standby modes, but cycle between high and off speeds with heating/cooling during the unoccupied mode. When in the occupied mode or occupied standby mode and the fan speed is set at the high or low position, the fan runs continuously at the selected speed. Refer to "Troubleshooting," page 58 for more information on abnormal fan operation.

Table 26. Fan mode operation, Tracer ZN010 and ZN510

	Heating Mode		Cooling Mode	
Fan Mode	Occupied	Unoccupied	Occupied	Unoccupied
Off	Off	Off	Off	Off
Low	Low	Off/high[a]	Low	Off/high[a]
High	High	Off/high[a]	High	Off/high[a]
Auto continuous	Heat default	Off/high[a]	Cool default	Off/high[a]
Cycling off	Off/heat default[a]	Off/high[a]	Off/cool default[a]	Off/high[a]

Notes:

1. During the transition from off to any fan speed but high, Tracer ZN010 and ZN510 automatically start the fan on high speed and run for one-half of a second before transitioning to the selected speed (if it is other than high). This provides enough torque to start all fan motors from the off position.
2. When the heating output is controlled off, ZN010 and ZN510 automatically control the fan on for an additional 30 seconds. This delay allows the fan to dissipate any residual heat from the heating source, such as electric heat.

(a) Whenever two states are listed for the fan, the first state (off) applies when there is not a call for heating or cooling. The second state (varies) applies where there is a call for heating or cooling. The heat default is factory-configured for low fan speed, and the cool default is high.

Table 27. Valid operating range and factory default setpoints, Tracer ZN010 and ZN510

Setpoint/Parameter	Default Setting	Valid Operating Range
Unoccupied cooling setpoint	85°F	40°F–115°F
Occupied cooling setpoint	74°F	40°F–115°F
Occupied heating setpoint	71°F	40°F–115°F
Unoccupied heating setpoint	60°F	40°F–115°F
Cooling setpoint high limit	110°F	40°F–115°F
Cooling setpoint low limit	40°F	40°F–115°F
Heating setpoint high limit	105°F	40°F–115°F
Heating setpoint low limit	40°F	40°F–115°F
Power up control wait	0 sec	0 sec–240 sec

Table 28. Valid operating range and factory default setpoints, Tracer UC400

Setpoint/Parameter	Default Setting	Valid Operating Range
Unoccupied cooling	85°F	40°F–115°F
Unoccupied heating	60°F	40°F–115°F
Occupied offset	2.5°F	0.90°F–45°F
Standby offset	7.5°F	0.90°F–45°F
Space temperature setpoint default	72.5°F	40°F–115
Power up control wait	N/A (random, not settable)	5–30 seconds

Table 29. Local fan switch enabled[a]

Communicated	Fan Switch (Local)	Fan Operation Fan Speed Input
Off	Ignored	Off
Low	Ignored	Low
High	Ignored	High
Auto	Off	Off
	Low	Low
	High	High
	Auto	Auto (configured default, determined by heat/cool mode)

(a) If the fan switch is not present with Tracer UC400 controls, the fan will operate in Auto mode.

Table 30. Fan operation in heating and cooling modes

	Heating		Cooling	
Fan Mode	Occupied	Unoccupied	Occupied	Unoccupied
Off	Off	Off	Off	Off
Low	Low	Off/high	Low	Off/high
High	High	Off/high	High	Off/high
Auto (continuous)	Default fan speed	Off/high	Default fan speed	Off/high

Two- and Four-Pipe Changeover Operation

Tracer controllers offer accurate and reliable unit changeover using 2-way valves and the controller's entering water temperature sampling function. Only units using the main hydronic coil for both heating and cooling (2-pipe and 4-pipe changeover units) use the entering water temperature sampling function.

Two-pipe and 4-pipe changeover applications require an entering water temperature sensor to allow the main coil to be used for heating and cooling. This sensor is factory-provided and should be field-installed on the entering water pipe.

The entering water temperature sampling function periodically opens the two-way valve to allow temporary water flow, producing reliable entering water temperature measurement. To ensure accurate unit changeover without sacrificing the benefits of 2-way, 2-position valves, Tracer controllers periodically test the entering water temperature on all hydronic main coil changeover units. Hydronic heating/cooling changeover operation requires central plant operation, and the unit controller must use an entering water temperature sensor to verify delivery of the correct water temperature from the central plant.

Entering Water Temperature Sampling Function

The entering water temperature (EWT) must be five degrees above the space temperature for hydronic heating and five degrees below the space temperature for hydronic cooling. When water flows normally and frequently through the coil, the controller does not invoke the sampling function because the EWT is satisfactory.

Table 31. Unit mode as related to water temperature

Unit Type	EWT Sensor Required?	Coil Water Temperature
2-pipe changeover	Yes	• Can cool if: space temp—EWT ≥ 5°F • Can heat if: EWT—space temp ≥ 5°F
4-pipe changeover	Yes	• Can cool if: space temp—EWT ≥ 5°F • Can heat if: EWT—space temp ≥ 5°F
2-pipe heating only	No	Hot water assumed
2-pipe cooling only	No	Cold water assumed
4-pipe heat/cool	No	• Cold water assumed in main coil • Hot water assumed in auxiliary coil

However, when the controller detects an incorrect water temperature based on heating or cooling mode, it invokes the entering water temperature sampling function. For example, when the measured EWT is too cool to heat or too warm to cool. For cooling the EWT needs to be five degrees below the measured space temperature. For heating, the EWT should be five degrees above the measured space temperature.

After the controller invokes the function, the unit opens the main hydronic valve for no more than three minutes before considering the measured EWT. The controller allows an initial stabilization period, equal to 30 seconds plus 1/2 the valve stroke time, to flush the coil. Once the temperature stabilization period expires, the controller compares the EWT against the effective space temperature (either hard-wired or communicated) to determine whether the EWT is correct for the desired heating or cooling mode. If the EWT is not usable for the desired mode, the controller continues to compare the EWT against the effective space temperature for a maximum of three minutes.

The controller automatically disables the entering water temperature sampling and closes the main hydronic valve when the measured EWT exceeds the high EWT limit (110°F). When the EWT is warmer than 110°F, the controller assumes the EWT is hot because it is unlikely the coil would drift to a high temperature unless the actual loop temperature was very high.

If the EWT is unusable—too cool to heat or too warm to cool—the controller closes the hydronic valve and waits 60 minutes before initializing another sampling. If the controller determines the EWT is valid for heating or cooling, it resumes normal heating/cooling control and effectively disables entering water temperature sampling until it is required.

Electric Heat Operation

Tracer controllers support 1-stage electric heat. Also, Tracer ZN520 and UC400 support 2-stage electric heat. Tracer ZN520 and UC400 cycle the electric heat to control the discharge air temperature. The rate of cycling is dependent upon the load in the space and the temperature of the incoming fresh air from the economizer (if any). Two-pipe changeover units with electric heat use the electric heat only when hot water is not available.

Economizer Damper

Tracer ZN520 and UC400 only

With a valid outdoor air temperature (either hard-wired or communicated), Tracer ZN520 and UC400 use the modulating economizer damper as the highest priority cooling source. Economizer operation is only possible using a modulating damper during the occupied, occupied standby, unoccupied, and occupied bypass modes.

The controller initiates the economizer function if the fresh air temperature is cold enough for use as free cooling capacity. If the fresh air temperature is less than the economizer enable setpoint (absolute dry bulb), the controller modulates the fresh air damper (between the active minimum damper position and 100 percent) to control the amount of fresh air cooling capacity. When the fresh air temperature rises 5°F above the economizer enable point, the controller disables economizing and moves the fresh air damper back to its predetermined minimum position based on the current occupancy mode or communicated minimum damper position.

Table 32. Relationship between outdoor temperature sensors and economizer damper position (Tracer ZN520 and UC400 controllers only)

Outdoor Air Temperature	Modulating Fresh Air Damper Occupied or Occupied Bypass	Occupied Standby	Unoccupied
None or invalid	Open to occupied minimum position	Open to occupied standby minimum position	Closed
Failed	Open to occupied minimum position	Open to occupied standby	Closed
Present and economizer feasible	Economizing: minimum position to 100%	Economizing: between occupied standby minimum position to 100%	Open and economizing only when unit operating, closed otherwise
Present and economizer not feasible	Open to occupied minimum position	Open to occupied standby minimum position	Closed

Tracer Dehumidification

Tracer ZN520 only

Dehumidification is possible when mechanical cooling is available, the heating capacity is located in the reheat position, and the space relative humidity setpoint is valid.The controller starts dehumidifying the space when the space humidity exceeds the humidity setpoint. The controller continues to dehumidify until the sensed humidity falls below the setpoint minus the relative humidity offset. The controller uses the cooling and reheat capacities simultaneously to dehumidify the space. While dehumidifying, the discharge air temperature is controlled to maintain the space temperature at the current setpoint.

A typical scenario involves high humidity and high temperature load of the space. The controller sets the cooling capacity to 100 percent and uses the reheat capacity to warm the discharge air to maintain space temperature control. Dehumidification may be disabled via Tracer or configuration.

Note: If the unit is in the unoccupied mode, the dehumidification routine will not operate.

Data Sharing

Notes:

- *Does not apply to the Tracer ZN010 or UC400 controllers.*
- *The Tracer UC400 controller is a BACnet controller and does not support data sharing. However, data sharing with Tracer UC400 controls can be accomplished through custom programming in the Tracer SC system controller.*

Tracer ZN510 or ZN520

Because Tracer ZN510 and ZN520 controllers utilize LonWorks technology, the controller can send or receive data (setpoint, heat/cool mode, fan request, space temperature, etc.) to and from other controllers on the communication link, with or without the existence of a building automation system. This applies to applications where multiple unit controllers share a single space temperature sensor (for rooms with multiple units but only one zone sensor) for both standalone (with communication wiring between units) and building automation system applications. For this application you will need to use the Rover service tool. For more information on setup, refer to EMTX-SVX01G-EN (or the most recent version), *Installation, Operation, and Programming: Rover™ Service Tool*.

Binary Inputs

Tracer ZN010, ZN510, and ZN520 Controller

Tracer ZN010, ZN510, and ZN520 controllers have the following binary inputs, factory-configured for the following functions:

- Binary input 1: low temperature detection (freezestat)
- Binary input 2: condensate overflow
- Binary input 3: occupancy/generic
- Binary input 4: fan status (Tracer ZN520 only)

Note: The generic binary input can be used with a Tracer Summit building automation system only.

BIP1: Low Temperature Detection Option

The factory hard wires the low temperature detection sensor to binary input #1 (BIP1) on the Tracer ZN010, ZN510, or ZN520 controller. The sensor defaults normally closed (N.C.), and will trip off the unit on a low temperature diagnostic when detecting low temperature. In addition, Tracer controls the following unit devices:

Fan: Off
Valves: Open
Electric heat: Off
Damper: Closed

Note: For more information, refer to "Troubleshooting," page 58.

BIP2: Condensate Overflow Detection Option

The factory hard wires the condensate overflow sensor to binary input #2 (BIP2) on the Tracer ZN010, ZN510, or ZN520 controller. The sensor defaults normally closed (N.C.), and will trip off the unit on a condensate overflow diagnostic if condensate reaches the trip point. In addition, Tracer controls unit devices as listed below:

Fan: Off
Valves: Closed
Electric heat: Off

BIP3: Occupancy Sensor

Binary input #3 (BIP3) on the Tracer ZN010, ZN510, or ZN520 controller is available for field wiring an occupancy sensor, such as a binary switch or a timeclock, to detect occupancy. The sensor can be either normally open or normally closed. Reference Table 33, p. 74.

BIP4: Fan Status (ZN520 only)

Binary input #4 (BIP4) on the Tracer ZN520 controller is available for sensor, such as a binary switch or a timeclock, to detect occupancy. The sensor defaults normally open but can be configured as either normally open or closed.

Table 33. Binary input configurations (Tracer ZN010, ZN510, or ZN520 controller)

Binary Input	Description	Config	Controller Operation: Contact Closed	Controller Operation: Contact Open
BI 1	Low temperature detection[(a)]	NC	Normal	Diagnostic[(b)]
BI 2	Condensate overflow[(a)]	NC	Normal	Diagnostic[(b)]
BI 3	Occupancy	NO	Unoccupied	Occupied
BI 3	Generic binary input	NO	Normal[(c)]	Normal[(c)]
BI 4	Fan status[(a)]	NO	Normal	Diagnostic

Notes:

1. The occupancy binary input is for standalone unit controllers as an occupied/unoccupied input. However, when the controller receives a communicated occupied/unoccupied request, the communicated request has priority over the hard-wired input.
2. If the fan mode input is in the off position or the controller is in the unoccupied mode with the fan off, the fan status input will be open. A diagnostic will not be generated when the controller commands the fan off. A diagnostic will only be generated if the fan status input does not close after one minute from energizing a fan output or any time the input is open for one minute. The controller waits up to one minute after energizing a fan output to allow the differential pressure to build up across the fan.

(a) During low temperature, condensate overflow, and fan status diagnostics, the Tracer ZN520 control disables all normal unit operation of the fan, valves, and damper.
(b) The table below shows the controller's response to low temperature detection, condensate overflow, and fan status diagnostics.
(c) The generic binary input does not affect unit operation. A building automation system reads this input as a generic binary input.

Table 34. Manual Reset Diagnostics (Tracer ZN010, ZN510, or ZN520 controller)

BIP	Description	Fan	Valve	Electric Heat	Damper
BI 1	Low temperature detection	Off	Open	Off	Closed
BI 2	Condensate overflow	Off	Closed	Off	Closed
BI 4	Fan status	Off	Closed	Off	Closed

Tracer UC400 Controller

Tracer UC400 controllers have the following binary inputs, factory-configured for the following functions:

- Binary input 1: occupancy
- Binary input 2: condensate overflow
- Binary input 3: low coil temp detect (hydronic/steam coils only)
- Binary input 4: frost detection (DX only)
- Binary input 5: fan status

Note: *Any Tracer UC400 input can be reconfigured to be a generic input.*

BI1: Occupancy

The function of occupancy is to save energy by spreading zone setpoints when the zone is unoccupied. As the occupancy input, BI3 can be used for two related functions. For stand-alone controllers, BI3 can be hard-wired to a binary switch or timeclock to determine the occupancy mode—either occupied or unoccupied. For controllers receiving a BAS-communicated occupancy request, the function of BI3 is to change the mode from occupied to occupied standby.

BI3 is the only binary input that can be configured as generic. If configured as a generic binary input, it can be monitored by a BAS and has no direct effect on UC400 operation.

BI2: Condensate Overflow

The function of condensate overflow is to prevent the condensate drain pan from overflowing and causing water damage to the building. If BI2 is wired to a condensate overflow switch and the level of condensate reaches the trip point, the UC400 will detect the condition and generate a Condensate Overflow diagnostic.

BI3: Low Coil Temp Detection (Hydronic/Steam Coils only)

The function of low-coil-temperature detection is to protect the coil from freezing. If BI1 is wired to a binary low-coil-temperature detection device (freeze-protection switch) and a low-coil-temperature condition exists, the UC400 will detect the condition and generate a Low Coil Temp Detection diagnostic.

BI4: Frost Detection (DX only)

The function of the frost detection sensor is to detect conditions that will produce frost on the coil surface. When these conditions are present, the UC400 detects the condition and generates a Frost Detect Input alarm.

BI5: Fan Status

The fan status input provides feedback to the controller regarding the fan's operating status. If BI4 is wired to a fan status device and the input indicates that the fan is not operating when the controller has the fan controlled to on, the controller will generate a Low AirFlow—Fan Failure diagnostic.

Table 35. Binary input configurations (Tracer UC400 controller)

Binary Input	Description	Out-of-Service Value
BI1	Occupancy (hydronic/steam coils only)	n/a
BI2	Condensate overflow	Inactive
BI3	Low coil temperature detection	Inactive
BI4[(a)]	Frost detection (DX only)	Inactive
BI5[(b)]	Fan status	Active

(a) May be used as analog output 1 (AO1) for frost detection.
(b) May be used as analog output 2 (AO2) for supply fan status.

Analog Inputs

Tracer ZN010, ZN510, or ZN520 Controller

See Table 36 for a complete description of analog inputs for the Tracer ZN010, ZN510, or ZN520 controller.

Table 36. Analog inputs (Tracer ZN010, ZN510, or ZN520 controller)

Analog Input	Terminal	Function	Range	ZN010	ZN510	ZN520
Zone	TB3-1	Space temperature input	5°F to 122°F (-15°C to 50°C)	•	•	•
Ground	TB3-2	Analog ground	n/a	•	•	•
Set	TB3-3	Setpoint input	40°F to 115°F (4.4°C to 46.1°C)	•	•	•
Fan	TB3-4	Fan switch input	4821 Ω to 4919 Ω (Off) 2297 Ω to 2342 Ω (Auto) 10593 Ω to 10807 Ω (Low) 15137 Ω to 16463 Ω (High)	•	•	•
Ground	TB3-6	Analog ground	n/a	•	•	•
Analog Input 1	J3-1 J3-2	Entering water temperature Analog ground	-40°F to 212°F (-40°C to 100°C) n/a	•	•	•
Analog Input 2	J3-3 J3-4	Discharge air temperature Analog ground	-40°F to 212°F (-40°C to 100°C) n/a	•	•	•
Analog Input 3	J3-6	Fresh air temp/generic temp Analog ground	-40°F to 212°F (-40°C to 100°C) N/A			•
Analog Input 4	J3-7	Universal Input Generic 4–20 ma Humidity CO_2	0%–100% 0%–100% 0 ppm–2000 ppm			•
Ground	J3-8	Analog ground	n/a			•
Ground	J3-9	Analog ground	n/a			•

Notes:
1. The zone sensor, entering water temperature sensor, discharge air sensor, and the outside air temperature sensor are 10KΩ thermistors.
2. Zone sensor: Wall-mounted sensors include a thermistor soldered to the sensor's circuit board.
3. Changeover units include an entering water temperature sensor.

Tracer UC400 Controller

The Tracer UC400 controller includes seven analog inputs. Table 37 describes their functions. Each function is explained in the following paragraphs. For an explanation of the diagnostics generated by each analog input, see "Diagnostics (Tracer UC400 Controller)," page 67. For more information about how the controller operates, see "Tracer Controller Sequence of Operation," page 66.

Table 37. Analog and universal inputs (Tracer UC400 controller)(a)

Analog/Universal Input Terminal Label	Function
AI1	Space temperature
AI2	Setpoint local
AI3	Supply fan mode input
AI4	Discharge air temperature
AI5	Entering water temperature
UI1	Universal input
UI2	Outside air temperature or generic temperature

(a) For more information on analog and universal inputs for the Tracer UC400 controller, refer to *Installation and Operation: Tracer™ UC400 Programmable Controller for Factory- or Field-installed Blower Coil* (BAS-SVX48A-EN, or the most recent version).

Ground Terminals

Use a ⏚ terminal as the common ground for all space temperature sensor analog inputs.

Binary Outputs

Tracer ZN010, ZN510, or ZN520 Controller

Binary outputs are configured to support the following:

- Three fan stages
- One hydronic cooling stage
- One hydronic heating stage (dehumidification requires this to be in the reheat position)
- One DX cooling stage
- One or two-stage electric heat (dehumidification requires this to be in the reheat position)
- Modulating fresh air damper (Tracer ZN520 only)
- One-stage baseboard heat (Tracer ZN010, ZN510, and ZN520 only)

Table 38. Binary output configuration (Tracer ZN010, ZN510, or ZN520 controller)

Binary Output Pin Connection	Configuration	ZN010	ZN510	ZN520
J1-1	Fan high	•	•	•
J1-2	n/a	•	•	•
J1-3	Fan low			•
J1-4	(Key) Fan low	 •	 •	•
J1-5	Main valve - open, or 2 pos. valve(a)	•	•	•
J1-6	Aux. valve/elec. ht. Aux. valve - close(a)	• 	• 	 •
J1-7	2-pos. damper	•	•	
J1-9	Heat valve - open, or 2 pos. valve, or first stage elec. ht.(a)			•
J1-10	Heat valve - close or sec. stage elec. ht.(a)			•
J1-11	Fresh air damper - open			•
J1-12	Fresh air damper - close			•
TB4-1	Generic/baseboard heat output			•
TB4-2	24 Vac			•

Notes:

1. If no valves are ordered with the unit, the factory default for Tracer ZN010 and ZN510 controllers are: main valve configured as normally closed and aux. valve configured as normally open.
2. If the fresh air damper option is not ordered on the unit, 2-position damper is configured as none.
3. Pin J1-2 can be configured for an exhaust fan with the use of Rover software. Factory default is none.

(a) Two-pipe hydronic heat/cool changeover units use terminals J1-5 and J1-6 to control the primary valve for both heating and cooling. Units configured and applied as 2-pipe hydronic heat/cool changeover with electric heat, use terminals J1-5 and J1-6 to control the primary valve (for both cooling and heating), and terminals J1-9 and J1-10 for the electric heat stage. For those 2-pipe changeover units, electric heat will not energize while the hydronic supply is hot (five or more degrees above the space temperature). In a 4-pipe application, pin J1-5 is for cooling and pin J1-6 for heating.

Tracer UC400 Controller

The UC400 supports the following blower coil applications:

- Supply fan with up to two speeds
- Hydronic cooling and/or heating coils with two-position or tri-state modulating control valve
- DX cooling (single stage)
- Electric heat (single stage or two stage)
- Baseboard heat (single stage)
- Tri-state modulating outdoor/return air damper

The Tracer UC400 controller includes nine binary outputs. BO1, BO2, and BO3 are relay outputs with a rating of 2.88 amps at 24 Vac pilot duty. BO4 through BO9 are TRIAC outputs with a rating of 12 VA at 24 Vac.

Table 39 describes the function of each output.

Table 39. Binary output functions (Tracer UC 400)

Binary Output Terminal Label	Functions
BO1	Generic
BO2	Generic
BO3	Generic
TRIAC Binary Output	**Functions**
BO4	Cooling; 2-position, Modulating TRIAC Open, DX Cool Output 1
BO5	Cooling; Modulating TRIAC Close
BO6	Heating; 2-position, Modulating TRIAC Open, Electric Heat Stage 1
BO7	Heating; Modulating TRIAC Close, Electric Heat Stage 2
BO8	Outside Air Damper; 2-position, Economizer Modulating TRIAC Open
BO9	Outside Air Damper; Economizer Modulating TRIAC Close

Wiring Requirements and Options

Tracer UC400

Table 40 shows required controller inputs for minimal proper operation of all applications.

Table 40. Required controller inputs for proper operation

Function	Input Source	For More Information, See:
24 Vac power	Terminals: Ground 24 Vac	*Installation, Operation, and Maintenance: Tracer UC400 Programmable Controller* (BAS-SVX20C-EN, or the most recent version)
Space temperature local	Terminals: AI1 Ground	*Installation and Operation: Tracer™ UC400 Programmable Controller for Factory- or Field-installed Blower Coil* (BAS-SVX48A-EN, or the most recent version)
Discharge air temperature	Terminals: AI4	
Entering water temperature - required only for units with auto changeover	Terminal: AI5 or communicated	
Outdoor air temperature local - required only for economizing	Terminals: UI2 or communicated	

For more information, refer to *Installation, Operation, and Maintenance: Tracer UC400 Programmable Controller* (BAS-SVX20C-EN, or the most recent version).

Zone Sensor

The Tracer controller accepts the following zone sensor module inputs:

- Space temperature measurement (10 kΩ thermistor)
- Local setpoint (either internal or external on the zone sensor module)
- Fan mode switch
- Timed override, using “on” and “cancel” buttons (Tracer ZN510, ZN520, and UC400 only)
- Communication jack (Tracer ZN510, ZN520, and UC400 only)

Table 41. Zone sensor wiring connections

TB1	Description
1	Space temperature
2	Common
3	Setpoint
4	Fan mode
5	Communications
6	Communications

Space Temperature Measurement

Zone sensors use a 10 kΩ thermistor to measure the space temperature. Wall-mounted zone sensors include a space temperature thermistor. Unit-mounted zone sensors have a return air sensor mounted in the unit’s return airstream. If both a hard-wired and communicated space temperature value exists, the controller ignores the hard-wired space temperature input and uses the communicated value.

Local Setpoint

The zone sensor may be equipped with a thumbwheel for setpoint adjustment.

Fan Mode Switch

The zone sensor may be equipped with a fan mode switch. The fan mode switch offers selections of off, low, high, or auto.

External Setpoint Adjustment

Tracer ZN010, ZN510, and ZN520

Zone sensors with an external setpoint adjustment (1 kΩ) provide the Tracer controller with a local setpoint (50°F to 85°F or 10°C to 29.4°C). The external setpoint is exposed on the zone sensor’s front cover.

When the hard-wired setpoint adjustment is used to determine the setpoints, all unit setpoints are calculated based on the hard-wired setpoint value, the configured setpoints, and the active mode of the controller. The hard-wired setpoint is used with the controller’s occupancy mode (occupied, occupied standby, or unoccupied), the heating or cooling mode, the temperature deadband values, and the heating and cooling setpoints (high and low limits) to determine the controller’s active setpoint.

All Controllers

When a building automation system or other controller communicates a setpoint to the controller, the controller ignores the hard-wired setpoint input and uses the communicated value. The exception is the unoccupied mode, when the controller always uses the stored default unoccupied setpoints. After the controller completes all setpoint calculations, based on the requested setpoint, the occupancy mode, the heating and cooling mode, and other factors, the calculated setpoint is validated against the following setpoint limits:

- Heating setpoint high limit
- Heating setpoint low limit
- Cooling setpoint high limit
- Cooling setpoint low limit

Note: *Only units with Tracer ZN510, ZN520, or UC400 can receive a communicated setpoint from Tracer Summit, Tracer SC, or other building automation system. However, Rover service software can communicate with Tracer ZN010 or ZN510.*

These setpoint limits only apply to the occupied and occupied standby heating and cooling setpoints. These setpoint limits do not apply to the unoccupied heating and cooling setpoints stored in the controller’s configuration.

When the controller is in unoccupied mode, it always uses the stored unoccupied heating and cooling setpoints. The unit can also be configured to enable or disable the local (hard-wired) setpoint. This parameter provides additional flexibility to allow you to apply communicated, hard-wired, or default setpoints without making physical changes to the unit.

Similar to hard-wired setpoints, the effective setpoint value for a communicated setpoint is determined based on the stored default setpoints (which determines the occupied and occupied standby temperature deadbands) and the controller’s occupancy mode.

Fan Switch

The zone sensor fan switch provides the controller with an occupied (and occupied standby) fan request signal (Off, Low, Medium, High, Auto). If the fan control request is communicated to the controller, the controller ignores the hard-wired fan switch input and uses the communicated value. The zone sensor fan switch input can be enabled or disabled through configuration using the Rover service tool (used with Tracer ZN010, ZN510, or ZN520 controllers) or the Tracer TU service tool (used with Tracer UC400 controllers). If the zone sensor switch is disabled, the controller resorts to its stored configuration default fan speeds for heating and cooling, unless the controller receives a communicated fan input.

When the fan switch is in the off position, the controller does not control any unit capacity. The unit remains powered and all outputs drive to the closed position. Upon a loss of signal on the fan speed input, the controller reports a diagnostic and reverts to using the default fan speed.

On/Cancel Buttons

Momentarily pressing the on button during unoccupied mode places the controller in occupied bypass mode for 120 minutes. You can adjust the number of minutes in the unit controller configuration using Rover service tool (used with Tracer ZN010, ZN510, or ZN520 controllers) or the Tracer TU service tool (used with Tracer UC400 controllers). The controller remains in occupied bypass mode until the override time expires or until you press the Cancel button.

Communication Jack

Use the RJ-11 communication as the connection point from Rover service tool to the communication link—when the communication jack is wired to the communication link at the Tracer ZN010, ZN510, or ZN520 controller (the Tracer UC400 controller connects to the Tracer TU service tool using the Tracer TU adaptor). By accessing the communication jack via Rover (used with Tracer ZN010, ZN510, or ZN520 controllers) or Tracer TU (used with Tracer UC400 controllers), you gain access to any controller on the link.

Note: The preferred connection for Tracer UC400 controllers is via USB; connection speeds are faster via direct USB connection.

Figure 60. Resistance temperature curve for the zone sensor, entering water temperature sensor, and discharge air sensor

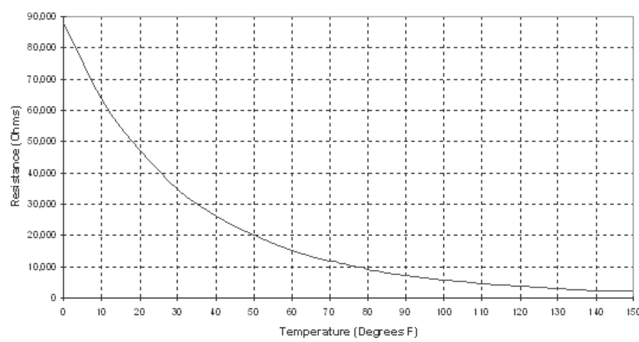


Table 42. Zone Sensor Thermistor Curve (Resistance in Ohms)

°C	°F	R	°C	°F	R	°C	°F	R	°C	°F	R
0	32	32885	25	77	10004	50	122	3759	75	167	1484
1	33.8	31238	26	78.8	9557	1	123.8	3597	76	168.8	1436
2	35.6	29684	27	80.6	9135	52	125.6	3445	77	170.6	1389
3	37.4	28216	28	82.4	8737	53	127.4	3301	78	172.4	1345
4	39.2	26830	29	84.2	8362	54	129.2	3165	79	174.2	1302
5	41	25520	30	86	8007	55	131	3037	80	176	1260
6	42.8	24282	31	87.8	7672	56	132.8	2915	81	177.8	1220
7	44.6	23112	32	89.6	7355	57	134.6	2800	82	179.6	1182
8	46.4	22005	33	91.4	7056	58	136.4	2691	83	181.4	1145
9	48.2	20957	34	93.2	6772	59	138.2	2588	84	183.2	1109
10	50	19966	35	95	6503	60	140	2490	85	185	1074
11	51.8	19028	36	96.8	6248	61	141.8	2397	86	186.8	1041
12	53.6	18139	37	98.6	6006	62	143.6	2309	87	188.6	1009
13	55.4	17297	38	100.4	5777	63	145.4	2225	88	190.4	978
14	57.2	16499	39	102.2	5559	64	147.2	2145	89	192.2	948
15	59	15743	40	104	5352	65	149	2070	90	194	920
16	60.8	15025	41	105.8	5156	66	150.8	1998	91	195.8	892
17	62.6	14345	42	107.6	4969	67	152.6	1929	92	197.6	865
18	64.4	13700	43	109.4	4791	68	154.4	1864	93	199.4	839
19	66.2	13087	44	111.2	4621	69	156.2	1802	94	201.2	814
20	68	12505	45	113	4460	70	158	1742	95	203	790
21	69.8	11953	46	114.8	4306	71	159.8	1686	96	204.8	767
22	71.6	11428	47	116.6	4160	72	161.6	1632	97	206.6	744
23	73.4	10929	48	118.4	4020	73	163.4	1580	98	208.4	722
24	75.2	10455	49	120.2	3886	74	165.2	1531	99	210.2	701

Routine Maintenance

⚠WARNING

Hazardous Service Procedures!

The maintenance and troubleshooting procedures recommended in this manual could result in exposure to electrical, mechanical or other potential safety hazards. Always refer to the safety warnings provided throughout this manual concerning these procedures. Unless specified otherwise, disconnect all electrical power including remote disconnect and discharge all energy storing devices such as capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. When necessary to work with live electrical components, have a qualified licensed electrician or other individual who has been trained in handling live electrical components perform these tasks. Failure to follow all of the recommended safety warnings provided, could result in death or serious injury.

⚠WARNING

Rotating Components!

The following procedure involves working with rotating components. Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power can not be inadvertently energized. Secure rotor to ensure rotor cannot freewheel. Failure to secure rotor or disconnect power before servicing could result in rotating components cutting and slashing technician which could result in death or serious injury.

Maintenance Checklist

Table 43. Maintenance Checklist

Frequency	Maintenance
Every week	Observe unit weekly for any change in running condition and unusual noise.
Every month	• Clean or replace air filters if clogged or dirty.
Every three to six months	• Manually rotate the fan wheel to check for obstructions in the housing or interference with fan blades. Remove any obstructions and debris. • Check motor bracket torque. • Inspect and clean drain pans. • Inspect coils for dirt build-up. Clean fins if airflow is clogged.
Every year	• Inspect the unit casing for chips corrosion. If damage is found, clean and repaint. • Clean the fan wheels. Remove any rust from the shaft with an emery cloth and recoat with L.P.S. 3 or equivalent. • Inspect and clean drain pans. • Check damper linkages, fan set screws, and blade adjustment. Clean, but do not lubricate, the nylon damper rod bushings. • Clean damper operators. • Inspect, clean, and tighten all electrical connections and wiring. • Rotate the fan wheel and check for obstructions. The wheel should not rub. Adjust the center if necessary. • Examine flex connections for cracks or leaks. Repair or replace damaged material.

Air Filters

⚠WARNING

Rotating Components!

The following procedure involves working with rotating components. Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power can not be inadvertently energized. Secure rotor to ensure rotor cannot freewheel. Failure to secure rotor or disconnect power before servicing could result in rotating components cutting and slashing technician which could result in death or serious injury.

Always install filters with directional arrows pointing toward the fan. For units with high efficiency filters (MERV 8 or MERV 13), the filters need to replaced with equivalent MERV-rated filters to maintain unit performance.

Fans

⚠WARNING

Rotating Components!

The following procedure involves working with rotating components. Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power can not be inadvertently energized. Secure rotor to ensure rotor cannot freewheel. Failure to secure rotor or disconnect power before servicing could result in rotating components cutting and slashing technician which could result in death or serious injury.

Inspecting and Cleaning Fans

Fan sections of air handlers should be inspected every six months at a minimum or more frequently if operating experience dictates. If evidence of microbial growth (mold) is found, identify and remedy the cause immediately. Refer to “Troubleshooting” on page 143 for possible causes and solutions. To clean the fan section:

1. Disconnect all electrical power to the unit.
2. Wearing the appropriate personal protective equipment, remove any contamination.
3. Vacuum the section with a vacuum device that uses high-efficiency particulate arrestance (HEPA) filters with a minimum efficiency of 99.97 percent at 0.3 micron particle size.
4. Thoroughly clean any contaminated area(s) with a mild bleach and water solution or an EPA-approved sanitizer specifically designed for HVAC use.
5. Immediately rinse the affected surfaces thoroughly with fresh water and a fresh sponge to prevent potential corrosion of metal surfaces.
6. Allow the unit to dry completely before putting it back into service.
7. Be careful any contaminated material does not contact other areas of the unit or building. Properly dispose of all contaminated materials and cleaning solution.

⚠WARNING

Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

Fan Motors

Inspect fan motors periodically for excessive vibration or temperature. Operating conditions will vary the frequency of inspection.

Torque Rating

Check and adjust fan wheel set screws whenever a component is removed or an adjustment is made. Refer to Table 44 for recommendations.

Table 44. Recommended torques

	Torque (in·lb)	Ft·lb	N·m
Fan wheel screw	120-130	10.0-10.8	13.6-14.7

Table 45. BCHD/BCVD valve package waterflow limits

Tube Size (in.)	GPM
1/2	8.6
3/4	19.3
1	34.3
1-1/4	53.5

Table 46. BCHD/BCVD fan, filter, and mixing box general data

Unit Size Nominal cfm	12 400	18 600	24 800	36 1200	54 1800	72 2400	90 3000
Air flow							
Minimum cfm	250	375	500	750	1125	1500	1875
Maximum cfm	500	675	1000	1600	2400	3000	4000
Fan data							
Fan wheel, in. (dia. x width)	9.5 x 4.5	9.5 x 4.5	9.5 x 6.0	9.5 x 6.0	12.6 x 9.5	12.6 x 9.5	12.6 x 9.5
Maximum rpm	2300	2300	2000	2000	1500	1500	1500
Motor hp	0.50–1.0	0.50–1.0	0.50–1.0	0.50–1.0	0.50–1.0	0.50–1.0	0.50–1.0
Unit flat filter							
(Qty.) Size	(1) 12 x 24	(1) 12 x 24	(1) 16 x 25	(2) 16 x 20	(2) 20 x 20	(1) 20 x 20 (1) 20 x 25	(3) 16 x 25
Area, sq. ft	2.000	2.000	2.778	4.444	5.556	6.250	8.333
Velocity, ft/min.	200	300	288	270	324	384	360
Angle filter							
(Qty.) Size	(2) 12 x 24	(2) 12 x 24	(2) 12 x 24	(2) 20 x 20	(4) 16 x 20	(6) 16 x 16	(6) 16 x 20
Area, sq. ft	4.000	4.000	4.000	5.556	8.889	8.889	11.111
Velocity, ft/min.	100	150	200	216	203	270	270
Bottom / top access filter box							
(Qty.) Size	(1) 12 x 20	(1) 12 x 24	(1) 16 x 25	(1) 16 x 20 (1) 16 x 16	(1) 16 x 20 (1) 20 x 20	(1) 20 x 25 (1) 20 x 20	(1) 16 x 25 (2) 14 x 25
Area, sq. ft	1.700	2.000	2.800	4.000	5.000	6.300	8.000
Velocity, ft/min.	240	300	288	300	360	384	375
Mixing box							
Damper opening width, in.	15.5	19.5	19.5	31.5	31.5	31.5	31.5
Damper opening height, in.	7	7	7	7	12.75	12.75	12.75
Area, sq. ft	0.753	0.948	0.948	1.531	2.789	2.789	2.789
Velocity, ft/min.	531	633	844	784	645	861	1076

Note: Minimum air flow limits apply to units with hot water or electric heat only. There is no minimum airflow limit on cooling on units. Maximum airflow limits are to help prevent moisture carryover.

Table 47. BCHD/BCVD coil general data

Unit Size Nominal cfm	12 400	18 600	24 800	36 1200	54 1800	72 2400	90 3000
Hydronic and DX coil data							
Area - ft^2	0.89	1.11	1.67	2.67	4.00	5.00	6.67
Width - in. (a), (b)	8	8	12	12	18	18	24
Length - in. (d)	16	20	20	32	32	40	40
Velocity - ft/min.	450	540	480	450	450	480	450
Hydronic coil data - high capacity							
Area - ft^2	0.89	1.11	1.67	2.67	3.89	4.86	6.25
Width - in. (a), (c)	8	8	12	12	17.5	17.5	22.5
Length - in. (d)	16	20	20	32	32	40	40
Velocity - ft/min.	450	540	480	450	463	494	480
1-row coil							
Minimum gpm (e)	1.0	1.0	1.0	1.0	6.1	6.1	7.9
Maximum gpm (f)	5.2	5.2	5.2	5.2	32.6	32.6	42.0
Dry coil weight - lb	4.4	5.2	6.6	9.3	17.6	20.4	25.8
Wet coil weight - lb	5.1	6.0	7.8	11.0	22.4	26.0	32.9
Internal volume - in^3	19.4	22.2	33.2	47.1	132.9	155.1	196.6
2-row coil - high capacity							
Minimum gpm (e)	1.0	1.0	2.0	2.0	6.1	6.1	7.9
Maximum gpm (f)	5.2	5.2	10.4	10.4	32.6	32.6	42.0
Dry coil weight - lb	5.9	7.0	9.9	14.1	27.2	32.1	39.4
Wet coil weight - lb (kg)	7.2	8.4	12.3	17.6	36.1	42.5	52.6
Internal volume - in^3	36.0	38.8	66.5	96.9	246.5	288.0	365.5
4-row coil - standard capacity							
Minimum gpm (e)	n/a	n/a	n/a	n/a	8.8	8.8	11.7
Maximum gpm (f)	n/a	n/a	n/a	n/a	47.0	47.0	62.6
Dry coil weight - lb (g)	n/a	n/a	n/a	n/a	37.2	44.5	58.5
Wet coil weight - lb (g)	n/a	n/a	n/a	n/a	48.3	57.7	77.0
Internal volume - in^3 (g)	n/a	n/a	n/a	n/a	307.4	365.5	512.3
4-row coil - high capacity							
Minimum gpm (e)	2.0	2.0	2.9	2.9	6.1	6.1	7.9
Maximum gpm (f)	10.4	10.4	15.7	15.7	32.6	32.6	42.0
Dry coil weight - lb	10.5	12.4	17.7	25.5	47.0	56.3	73.1
Wet coil weight - lb	13.1	15.5	22.5	32.5	62.7	74.9	97.9
Internal volume - in^3	72.0	85.8	132.9	193.8	433.0	516.7	688.3
6-row coil - standard capacity							
Minimum gpm (e)	n/a	n/a	n/a	n/a	8.8	8.8	11.7
Maximum gpm (f)	n/a	n/a	n/a	n/a	47.0	47.0	62.6
Dry coil weight - lb (g)	n/a	n/a	n/a	n/a	52.4	63.1	82.7
Wet coil weight - lb (g)	n/a	n/a	n/a	n/a	68.1	82.0	108.7
Internal volume - in^3 (g)	n/a	n/a	n/a	n/a	434.8	523.4	720.0
6-row coil - high capacity							
Minimum gpm (e)	2.0	2.0	2.9	2.9	6.1	6.1	7.9
Maximum gpm (f)	10.4	10.4	15.7	15.7	32.6	32.6	42.0
Dry coil weight - lb	14.6	17.4	24.7	36.1	65.4	78.6	101.5
Wet coil weight - lb	18.2	21.8	31.5	46.1	87.8	105.6	137.0
Internal volume - in^3	99.7	121.8	188.3	276.9	620.4	745.9	983.1
Steam coil data							
Area - ft^2	0.71	0.88	1.75	2.75	4.13	5.13	6.83
Width - in. (a)	6	6	12	12	18	18	24
Length - in. (d)	17	21	21	33	33	41	41
Velocity - ft/min.	26	25	18	17	17	16	16
1-row coil	3	3	5	5	14	14	9
Minimum steam press - psig	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Maximum steam press - psig	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Dry coil weight - lb	16.7	18.7	32.5	41.1	57.4	64.8	84.9
Wet coil weight - lb	18.2	20.4	36.0	45.8	64.5	73.2	96.1
Internal volume - in^3	41.7	47.7	95.3	130.8	196.1	231.6	308.7

(a) Coil width = Length in the direction of a coil header, typically vertical.
(b) "**Hydronic and DX coil data**" width dimensions apply only to DX coils (all unit sizes), 1-row standard capacity hydronic coils (unit sizes 012 through 036), and 4- and 6-row standard capacity hydronic coils (054 through 090).
(c) "**High-capacity hydronic coil data**" width dimensions apply only to 1-row standard capacity hydronic coils (unit sizes 054 through 090) and 2-, 4-, and 6-row high capacity hydronic coils (all unit sizes).
(d) Coil length = Length of coil in direction of the coil tubes, typically horizontal and perpendicular to airflow.
(e) The minimum waterflow at 1.5 fps tubeside velocity is to ensure the coil self-vents properly. There is no minimum waterflow limit for coils that do not require self venting.
(f) Maximum gpm limits are to prevent erosion and noise problems.
(g) DX coil height and width dimensions are same as comparable hydronic coils. Four- and six-row DX coil dry weight dimensions are same as comparable 4- and 6-row hydronic coils. A 3-row DX coil dry weight is 25% less than a comparable 4-row hydronic coil. Internal volumes are approximately 6% less than comparable hydronic coils.

Coils

All coils should be kept clean to maintain maximum performance.

Steam and Water Coils

⚠WARNING

Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

⚠WARNING

Hazardous Chemicals!

Coil cleaning agents can be either acidic or highly alkaline and can burn severely if contact with skin occurs. Handle chemical carefully and avoid contact with skin. ALWAYS wear Personal Protective Equipment (PPE) including goggles or face shield, chemical resistant gloves, boots, apron or suit as required. For personal safety refer to the cleaning agent manufacturer's Materials Safety Data Sheet and follow all recommended safe handling practices. Failure to follow all safety instructions could result in death or serious injury.

To clean steam and water coils:

1. Disconnect all electrical power to the unit.
2. Wearing the appropriate personal protective equipment, use a soft brush to remove loose debris from both sides of the coil.
3. Install a block-off to prevent spray from going through the coil and into a dry section of the unit and/or system ductwork.
4. Mix a high-quality coil cleaning detergent with water according to the manufacturer's instructions.

Note: *If the detergent is strongly alkaline after mixing (PH 8.5 or higher), it must contain an inhibitor. Follow the cleaning solution manufacturer's instructions regarding the use of the product.*

5. Place the mixed solution in a garden pump-up sprayer or high-pressure sprayer. If a high pressure sprayer is to be used:
   - Maintain minimum nozzle spray angle of 15 degrees.
   - Spray perpendicular to the coil face.
   - Keep the nozzle at least 6 inches from the coil.
   - Do *not* exceed 600 psi.
6. Spray the leaving air side of the coil first, then the entering air side.
7. Thoroughly rinse both sides of the coil and the drain pan with cool, clean water.
8. Repeat steps 6 and 7 as necessary.
9. Straighten any coil fins that may have been damaged during the cleaning process.
10. Confirm the drain line is open following the cleaning process.
11. Allow the unit to dry thoroughly before putting it back into service.
12. Replace all panels and parts and restore electrical power to the unit.
13. Be careful any contaminated material does not contact other areas of the unit or building. Properly dispose of all contaminated materials.

Refrigerant Coils

⚠WARNING

Hazardous Pressures!

Coils contain refrigerant under pressure. When cleaning coils, maintain coil cleaning solution temperature under 150°F to avoid excessive pressure in the coil. Failure to follow these safety precautions could result in coil bursting, which could result in death or serious injury.

To clean refrigerant coils:

1. Disconnect all electrical power to the unit.
2. Wearing the appropriate personal protective equipment, use a soft brush to remove loose debris from both sides of the coil.
3. Install a block-off to prevent spray from going through the coil and into a dry section of the unit and/or system ductwork.
4. Mix a high-quality coil cleaning detergent with water according to the manufacturer's instructions.

Note: *If the detergent is strongly alkaline after mixing (PH 8.5 or higher), it must contain an inhibitor. Follow the cleaning solution manufacturer's instructions regarding the use of the product.*

5. Place the mixed solution in a garden pump-up sprayer or high-pressure sprayer. If a high pressure sprayer is to be used:
   - Maintain minimum nozzle spray angle of 15 degrees.
   - Spray perpendicular to the coil face.
   - Keep the nozzle at least 6 inches from the coil.
   - Do *not* exceed 600 psi.

entering air side.

7. Thoroughly rinse both sides of the coil and the drain pan with cool, clean water.
8. Repeat steps 6 and 7 as necessary.
9. Straighten any coil fins damaged during the cleaning process.
10. Confirm the drain line is open following the cleaning process.
11. Allow the unit to dry thoroughly before putting it back into service.
12. Replace all panels and parts and restore electrical power to the unit.
13. Be careful any contaminated material does not contact other areas of the unit or building. Properly dispose of all contaminated materials and cleaning solution.

Coil Winterization

Water coil winterization procedures consist primarily of draining water from the coil before the heating season. Trane recommends flushing the coil with glycol if coils will be exposed to temperatures below 35 degrees.

NOTICE:

Coil Freeze-up!

Drain and vent coils when not in use. Trane recommends glycol protection in all possible freezing applications. Use a glycol approved for use with commercial cooling and heating systems and copper tube coils. Failure to do so could result in equipment damage.

Install field-fitted drains and vents to permit winterization of coils not in use and to assist in evacuating air from the water system during startup. If draining is questionable because of dirt or scale deposits inside the coil, fill the coil with glycol before the heating season begins.

Individual coil types determine how to properly winterize the coil. To determine the coil type find the "Service Model No of Coil" on the coil section nameplate. The coil type is designated by the second and third digits on that model number. For example, if the model number begins with "DUWB," the coil type is UW; if the model number begins with "DW0B," the coil type is W.

Note: *On many unit sizes, there are multiple coils in the coil section. Be sure to winterize all coils in a given coil section.*

To winterize type D1, D2, WL, LL, UA, UW, UU, W, P2, P4, P8, WD, 5D, and 5W coils:

1. Remove the vent and drain plugs.
2. Blow the coil out as completely as possible with compressed air.
3. Fill and drain the coil several times with full strength glycol so that it mixes thoroughly with the water retained in the coil.
4. Drain the coil out as completely as possible.
5. To ensure no water remains in the coil, do not replace the vent and drain plugs until the coils are put back into service.

Note: *Use care in removing header plugs from Type P2, P4, and P8 coils. Over-torquing may result in twisted tubes.*

Moisture Purge Cycle

By it's very nature, any HVAC unit with a cooling coil serves as a dehumidifier, reducing the surrounding air's ability to hold water vapor as its temperature falls. This normally doesn't present a problem when the unit is running. However, when the fan stops, water vapor condenses on the cold metal surfaces inside the air handler and remains there until the air warms sufficiently to re-evaporate it. This damp, dark environment—though temporary—can encourage the growth of mold, mildew, and other microbial contaminants.

Providing a moisture purge cycle 15 to 30 minutes after shutdown disperses the cold, humid air inside the air-handling system more evenly throughout the building. This four-step cycle:

- Closes the outdoor air dampers.
- Turns off the cooling coil.
- Opens any variable-air-volume terminals connected to the air handler.
- Operates the supply fan for 10 to 15 minutes.

Air movement discourages water condensation and hastens re-evaporation of any condensate that does happen to form. This simple preventative measure effectively combats microbial growth and curbs moisture-related deterioration of air-handling components.

Cleaning Non-Porous Surfaces

⚠WARNING

Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

If microbial growth on a non-porous insulating surface (closed cell insulation or sheet metal surface) is observed:

1. Disconnect all electrical power to the unit.
2. Wearing the appropriate personal protective equipment, use a brush for sheet metal surfaces or a soft sponge on a foil face or closed cell foam surface to mechanically remove the microbial growth.

Note: *Be careful not to damage the non-porous surface of the insulation.*

3. Install a block-off to prevent spray from going into a dry section of the unit and/or system ductwork.
4. Thoroughly clean the contaminated area(s) with an EPA-approved sanitizer specifically designed for HVAC use.
5. Rinse the affected surfaces thoroughly with fresh water and a fresh sponge to prevent potential corrosion of the drain pan and drain line
6. Repeat steps 4 and 5 as necessary.
7. Confirm the drain line is open following the cleaning process.
8. Allow the unit to dry thoroughly before putting it back into service.
9. Replace all panels and parts and restore electrical power to the unit.
10. Be careful any contaminated material does not contact other areas of the unit or building. Properly dispose of all contaminated materials and cleaning solution.

Cleaning Porous Surfaces

⚠WARNING

Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

To clean a porous insulating surface (fiberglass insulation):

1. Disconnect all electrical power to the unit.
2. Wearing the appropriate personal protective equipment, use a vacuum device with a HEPA filter (99.97 percent efficient at 0.3 micron particles) to remove the accumulated dirt and organic matter.

Note: *Be careful not to tear the insulation surface or edges.*

3. Confirm the drain line is open following the cleaning process.
4. Allow the unit to dry thoroughly before putting it back into service.
5. Replace all panels and parts and restore electrical power to the unit.
6. Be careful any contaminated material does not contact other areas of the unit or building. Properly dispose of all contaminated materials and cleaning solution.

Drain Pans

⚠WARNING

Hazardous Chemicals!

Coil cleaning agents can be either acidic or highly alkaline and can burn severely if contact with skin occurs. Handle chemical carefully and avoid contact with skin. ALWAYS wear Personal Protective Equipment (PPE) including goggles or face shield, chemical resistant gloves, boots, apron or suit as required. For personal safety refer to the cleaning agent manufacturer's Materials Safety Data Sheet and follow all recommended safe handling practices. Failure to follow all safety instructions could result in death or serious injury.

The condensate drain pan and drain line must be checked to assure the condensate drains as designed. This inspection should occur a minimum of every six months or more often as dictated by operating experience.

If evidence of standing water or condensate overflow exists, identify and remedy the cause immediately. Refer to "Troubleshooting" on page 143 for possible causes and solutions.

To clean drain pans:

1. Disconnect all electrical power to the unit.
2. Wearing the appropriate personal protective equipment, remove any standing water.
3. Scrape solid matter off of the drain pan.
4. Vacuum the drain pan with a vacuum device that uses high-efficiency particulate arrestance (HEPA) filters with a minimum efficiency of 99.97 percent at 0.3 micron particle size.
5. Thoroughly clean any contaminated area(s) with a mild bleach and water solution or an EPA-approved sanitizer specifically designed for HVAC use.
6. Immediately rinse the affected surfaces thoroughly with fresh water and a fresh sponge to prevent potential corrosion of metal surfaces.
7. Allow the unit to dry completely before putting it back into service.
8. Be careful any contaminated material does not contact other areas of the unit or building. Properly dispose of all contaminated materials and cleaning solution.

Troubleshooting

This section is intended to be used as a diagnostic aid only. For detailed repair procedures, contact your local Trane service representative.

⚠WARNING

Hazardous Service Procedures!

The maintenance and troubleshooting procedures recommended in this manual could result in exposure to electrical, mechanical or other potential safety hazards. Always refer to the safety warnings provided throughout this manual concerning these procedures. Unless specified otherwise, disconnect all electrical power including remote disconnect and discharge all energy storing devices such as capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. When necessary to work with live electrical components, have a qualified licensed electrician or other individual who has been trained in handling live electrical components perform these tasks. Failure to follow all of the recommended safety warnings provided, could result in death or serious injury.

Table 48. Air handler troubleshooting recommendations

Symptom	Probable Cause	Recommended Action
Motor fails to start	Blown fuse or open circuit breaker	Replace fuse or reset circuit breaker.
	Overload trip	Check and reset overload.
	Improper wiring or connections	Check wiring with diagram supplied on unit.
	Improper current supply	Compare actual supply power with motor nameplate recommendations. Contact power company for adjustments.
	Mechanical failure	Check that fan rotates freely.
Motor stalls	Low line voltage	Check across AC line. Correct voltage if possible.
Excessive vibration	Poor fan alignment	Check motor bracket screws. Check fan position on shaft. Align bearing set screws (see Table 38, p. 118). Loosen and retighten bearing set screws.
	Shipping spacers not removed	Remove shipping spacers and/or bolts (see "Fan Isolation," page 64).
Motor runs and then dies down	Partial loss of line voltage	Check for loose connections. Determine adequacy of main power supply.
Motor does not come up to speed	Low voltage at motor terminals	Check across AC line and correct voltage loss if possible.
	Line wiring to motor too small	Replace with larger sized wiring.
Motor overheats	Overloaded motor	Reduce load or replace with a larger motor.
	Motor fan is clogged with dirt preventing proper ventilation	Remove fan cover, clean fan and replace cover.
Excessive motor noise	Motor mounting bolts loose	Tighten motor mounting bolts.
	Rigid coupling connections	Replace with flexible connections.
	Fan rubbing on fan cover	Remove interference in motor fan housing.
Low water coil capacity	Incorrect airflow	Check fan operating condition.
	Incorrect water flow	Inspect the water pumps and valves for proper operation and check the lines for obstructions.
	Incorrect water temperature	Adjust the chiller or boiler to provide the proper water temperature.
	Coil is piped incorrectly	Verify coil piping (see "Coil Piping and Connections," page 29).
	Dirty fin surface	Clean the fin surface.
	Incorrect glycol mixture	Verify glycol mixture and adjust if necessary.
Low refrigerant coil capacity	Incorrect airflow	Check fan operating condition.
	Expansion valve is not operating properly or is sized incorrectly	Check sensing bulb temperature. Verify valve operation. Verify proper valve size.
	Incorrect refrigerant charge	Verify refrigerant charge and adjust if necessary.
	Condensing unit failure	Verify condensing unit operation.
	Coil is piped incorrectly	Verify coil piping (see "Coil Piping and Connections," page 29.)
	Clogged refrigerant line filter	Change filter core.
	Failure of suction/liquid line components	Verify component operation
	Dirty fin surface	Clean the fin surface. Do not use steam to clean refrigerant coils.
	Fin frosting	Verify defrost cycle operation. Verify frostat operation. Verify refrigerant charge.

Table 48. Air handler troubleshooting recommendations

Symptom	Probable Cause	Recommended Action
Low steam coil capacity	Incorrect airflow	Check fan operating condition.
	Coil is piped incorrectly	Verify coil piping (see "Coil Piping and Connections," page 29).
	Incorrect steam pressure	Verify steam pressure and adjust if necessary.
	Excessive steam superheat	Check steam superheat. Steam superheat should not exceed 50ºF.
	Failure of steam line/condensate return components	Verify component operation
	Boiler failure	Verify boiler operation
	Dirty fin surface	Clean the fin surface (see the "Coils" section on page 130).
Drain pan is overflowing	Plugged drain line	Clean drain line
	Unit not level	Level unit
	Improper trap design	Design trap per unit installation instructions
Standing water in drain pan	Improper trap design	Design trap per unit installation instructions
	Unit not level	Level unit
	Plugged drain line	Clean drain line
Wet interior	Coil face velocity too high	Reduce fan speed
	Improper trap design	Design trap per unit installation instructions
	Drain pan leaks/overflows	Repair leaks
	Condensation on surfaces	Insulate surfaces
Excess dirt in unit	Missing filters	Replace filters
	Filter bypass	Reduce filter bypass by ensuring all blockoffs are in place.
Microbial growth (mold) inside air handler	Standing water in drain pan	See "Standing water in drain pan" above

LED Activity for Tracer Controllers ZN010, ZN510, ZN520

Red Service LED

The red LED normally indicates if the unit controller is operating properly or not. Refer to Table 49.

Table 49. Red service LED activity for Tracer ZN010, ZN510, or ZN520 controllers

LED Activity	Description
Off continuously after power is applied to the controller.	Normal operation
On continuously, even when power is first applied to the controller.	Someone is pressing the Service button or the controller has failed.
LED flashes about once every second.	Uninstall (normal controller mode). To restore normal operation, use the Rover service tool.
Black Service push button.	Use the Service button to install the Tracer ZN520 controller in a communication network.

Green Status LED

The green LED normally indicates whether the controller is powered on (24 Vac supplied). Refer to Table 50.

Table 50. Green status LED activity (Tracer ZN010, ZN510, or ZN520 controller)

Green LED Activity	Description
On continuously	Power on (normal operation).
Blinks (one blink)	The controller is in manual output test mode. No diagnostics present.
Blinks (two blinks)	The controller is in manual output test mode. One or more diagnostics are present.
LED blinks (1/4 second on, 1/4 second, off for 10 seconds)	Wink mode.[(a)]
LED off	Power is off. Controller failure. Test button is pressed.

(a) The Wink feature allows you to identify a controller. By sending a request from the Rover service tool, you can request the controller to wink (blink on and off as a notification that the controller received the signal). The green LED blinks (1/4 second on, 1/4 second off for 10 seconds) during Wink mode.

Yellow Comm LED

The yellow comm LED blinks at the rate the controller receives communication. The yellow LED does not blink when the controller is transmitting communication data. Refer to Table 51.

Table 51. Yellow comm LED activity (Tracer ZN010, ZN510, or ZN520 controller)

LED Activity	Description
Off continuously	The controller is not detecting any communication. (Normal for standalone applications.)
LED blinks or flickers	The controller detects communication. (Normal for communicating applications, including data sharing.)
LED on continuously	Abnormal condition or extremely high traffic on the link. High traffic on the link.

Note: If the service push button is held down for more than 15 seconds, the Tracer controller will uninstall itself from the ICS communication network and shut down all unit operation. This mode is indicated by the red Service LED flashing once every second. See the Red Service LED section. Use the Rover service tool to restore the unit to normal operation. Refer to the service tool product literature for more information.

LED Activity for Tracer UC400

There are 15 LEDs on the front of the Tracer UC400 controller. The following table provides a description of LED activity, an indication or troubleshooting tip for each, and any related notes.

Table 52. LED activity and troubleshooting tips (Tracer UC400 controller)

LED Name	Activities	Indication and Troubleshooting Tips	Notes
Marquee LED	Shows solid green when the unit is **powered** and no alarm exists	Indicates normal operation	When powering the UC400 and expansion module, the Marquee LED will blink **RED**, blink **GREEN** (indicating activated and controller/expansion module are communicating), and then stay **GREEN CONTINUOSLY** (indicating normal power operation).
	Shows blinking green during a device reset or firmware download	Indicates normal operation	
	Shows solid red when the unit is **powered**, but represents low power or a malfunction	**If low power**; could be under voltage or the microprocessor has malfunction. Measure for the expected value range. For more information, refer to *Installation, Operation, and Maintenance: Tracer UC400 Programmable Controller* (BAS-SVX20C-EN, or the most recent version). **If malfunction**; un-power and then re-power unit to bring the unit back up to normal operation.	
	Shows blinking red when an **alarm** or fault exists	An alarm or fault condition will occur if the value for a given point is invalid or outside the configured limits for the point. Alarm and fault conditions vary, and they can be configured by the programmer.	
	LED not lit	Indicates power is OFF or there is a malfunction **OFF** or **malfunction**; cycle the power. For more information, refer to *Installation, Operation, and Maintenance: Tracer UC400 Programmable Controller* (BAS-SVX20C-EN, or the most recent version).	
Link and IMC	TX blinks green	Blinks at the data transfer rate when the unit transfers data to other devices on the link	TX LED: Regardless of connectivity or not, this LED will constantly blink as it continually looks for devices to communicate to. LED not lit: Determine if, for example, a Tracer SC or BACnet device is trying to talk to the controller or if it is capable of talking to the controller. Also determine if the communication status shows down all of the time. In addition, check polarity and baud rate. For more information, refer to *Installation, Operation, and Maintenance: Tracer UC400 Programmable Controller* (BAS-SVX20C-EN, or the most recent version).
	RX blinks yellow	Blinks at the data transfer rate when the unit receives data from other devices on the link **ON solid yellow**; indicates there is reverse polarity	
	LED is not lit	Indicates that the controller is not detecting communication **Not lit**; cycle the power to reestablish communication	
Service	Shows solid green when the LED has been pressed		***When the UC400 is placed into boot mode, the system will not run any applications such as trending, scheduling, and TGP2 runtime. The controller will be placed into boot mode if the service pin is held in when power is applied. In boot mode, the controller is non-operational and is waiting for a new main application to be downloaded.***
	LED not lit	Indicates controller is operating normally	
Binary B01 through B09	Shows solid yellow	Indicates a corresponding binary output has been *commanded* **ON** **Relay coil**; indicates that a command has been made to energize **TRIAC**; indicates that a command has been made to turn ON	If the user is currently powering the UC400 from a USB port, the Led lights will turn **ON**. However, the binary outputs *will* *not* be activated. **Commanded ON**; As an example of commanded ON, a command could be a manual command such as an override or a command could be from TGP2 based on a list of conditions that are met telling these outputs to turn ON. LED not lit: Did the user command it to be ON? If yes, see the Marquee LED at the top of this table. For more information, refer to *Installation, Operation, and Maintenance: Tracer UC400 Programmable Controller* (BAS-SVX20C-EN, or the most recent version).
	LED not lit	Indicates that a relay output is de-energized or no power to the board **Not lit**; cycle power to reestablish communication	

Manual Output Test

Tracer ZN010, ZN510, or ZN520

The purpose of the manual output test sequence is to verify output and end device operation. Use the manual output test to:

- Verify output wiring and operation without using the service tool.
- Force the water valve to open and balance the hydronic system.

Note: *The manual output test is not an automatic cycle. You must press the Test button to proceed through each step.*

The controller observes all diagnostics that occur during the test sequence. Although an automatic diagnostic reset sequence exists as part of the controller's normal operation, the automatic diagnostic reset feature is not active during the test sequence.

If left in an individual test step, the controller remains in test mode for 60 minutes and then exits to normal operation.

Many service calls are due to unit diagnostics. The test sequence resets unit diagnostics and attempts to restore normal unit operation prior to testing the outputs. If the diagnostics remain after a reset, the STATUS LED indicates the diagnostic condition is still present (two blinks).

Manual Output Test Procedure

Tracer ZN010, ZN510, or ZN520

Follow the procedure below to test the Tracer ZN010, ZN510, or ZN520 controller.

1. Press and hold the Test button for at least two seconds (not exceeding five seconds), and then release, to start the test mode.
2. The test sequence will turn off all outputs and then attempt to clear all diagnostics.
3. Press the Test button several more times (no more than once per second) to advance through the test sequence.

The outputs are not subject to minimum times during the test sequence. However, the test sequence only permits one step per second which limits minimum output time.

The green LED is turned off when the Test button is pressed. To begin the manual output test mode, press and hold the Test button (turning off the green LED) for at least two seconds. The green LED will begin to blink, indicating the controller is in test mode.

Overriding Outputs

Tracer UC400

Analog and multistate value request points are included in order to safely override outputs without disrupting TGP2 program operation. To override valves and dampers for commissioning or testing purposes, access the following points on the Tracer TU analog or multistate status pages:

- Cool valve request
- DX cool request
- Heat valve request
- Electric heat request
- Economizer request
- Supply fan speed active

For more information, refer to *Installation, Operation, and Maintenance: Tracer UC400 Programmable Controller* (BAS-SVX20C-EN, or the most recent version).

Table 53. Tracer ZN010 and ZN510 test sequence for 1-heat/1-cool configurations

Steps	Fan J1-1, J1-3	Cool Output[(a)] J1-	Heat Output J1-	Damper J1-
1. Off	Off	Off	Off	Closed
2. Fan high	High	Off	Off	Closed
3. Exhaust fan	[(b)]	Off	Off	Closed
4. Fan	Low	Off	Off	Closed
5. Cool	High	On	Off	Closed
6. Heat	High	Off	On	Closed
7. Two-position damper[(c)]	High	Off	Off	Open
8. Exit	[(d)]			

Note: The 2-position damper energizes during this step if the controller is configured for a 2-position damper.

(a) At the beginning of step 2, the controller attempts to clear all diagnostics.
(b) Tracer ZN010 and ZN510 have a binary output default as “none” on J1-X from the factory. If the unit has a 2-speed fan, step 3 will energize the low fan speed. If the unit has a single speed fan, step 3 will continue to energize the high fan speed. This binary output can be reconfigured as an exhaust fan, with the use of Rover software.
(c) After the fresh air damper step, the test sequence performs the exit step.This initiates a reset and attempts to return the controller to normal operation.
(d) For all 1-heat/1-cool applications including 2-pipe changeover, the cooling and heat test stage energize. This occurs even though during normal 2-pipe changeover operation binary output controls the unit valve for both cooling and heating.

Table 54. Tracer ZN520 test sequence

	Fan		Main Valve	Electric Heat or Aux. Valve		Fresh Air Damper	Generic/Baseboard Heat			
Step	J1-1	J1-2	J1-3	J1-5	J1-6	J1-9	J1-10	J1-11	J1-12	TB4-1
1. Off[a]	Off	Off	Off	Off	On EH: off	Off	aux: on	Off	On	Off
2. Fan high[b]	High	Off	Off	Off	Off	Off	Off	Off	Off	Off
3. [c]	Off		Off	Off	Off	Off	Off	Off	Off	Off
4. Fan low	Off	Off	Low	Off	Off	Off	Off	Off	Off	Off
5. Main open	High	Off	Off	On	Off	Off	Off	Off	Off	Off
6. Main close, EH1 on	High	Off	Off	Off	On	On	Off	Off	Off	Off
7. Aux. open	High EH1 on	Exh[d]	Off	Off	Off	On	Off	Off	Off	Off
8. Aux. close, damper open	High	Off	Off	Off	Off	Off EH1 off	On EH2 on	On	Off	Off
9. Damper close	High	Off	Off	Off	Off	Off	Off	Off	On	Off
10. Generic/baseboard heat energized	High	Off	Off	Off	Off	Off	Off	Off	Off	On
11. Exit[e]	Exit									

(a) Upon entering manual output test mode, the controller turns off all fan and electric heat outputs and drives.
(b) At the beginning of Step 2, the controller attempts to clear all diagnostics.
(c) The low fan speed output energizes at Step 3. If the unit is configured for a 1-speed fan, the fan remains on high speed at Step 3.
(d) If the unit is configured for a 1- or 2-speed fan, and BOP2 is configured for an exhaust fan, the exhaust fan output energizes on Step 7. The exhaust fan output is shared with medium speed.
(e) After Step 10, the test sequence performs an exit. This initiates a reset and attempts to return the controller to normal operation.

Diagnostics

Translating Multiple Diagnostics

The controller senses and records each diagnostic independently of other diagnostics. It is possible to have multiple diagnostics present simultaneously. The diagnostics are reported in the order they occur.

Possible diagnostics include:

- Low coil temperature detection
- Condensate overflow
- Low air flow—fan status
- Discharge air temp limit
- Space temperature failure[1]
- Entering water temp failure[1]
- Discharge air temp failure
- Outdoor air temp failure[1]
- Local setpoint failure[1]
- Local fan mode failure[1]
- CO_2 sensor failure[1]
- Generic AIP failure[1]
- Humidity input failure[1]
- Defrosting compressor lockout[1]
- Maintenance required[2]
- Invalid Unit Configuration[2]
- Generic temperature failure[2]
- Discharge air low limit

Resetting Diagnostics

There are seven ways to reset unit diagnostics:

1. Automatically by the controller
2. By initiating a manual output test at the controller (Tracer ZN010, ZN510, or ZN520 only)
3. By cycling power to the controller
4. By using a building automation system
5. By using the Rover or Tracer TU service tool
6. By using any other communicating device able to access the controller's diagnostic reset input (Tracer ZN510 or ZN520 only)
7. By cycling the fan switch from off to any speed setting (Tracer ZN520 only)

Automatic Reset by the Controller

The controller includes an automatic diagnostic reset function which attempts to automatically restore the unit when a low temperature diagnostic occurs.

Note: *The controller implements the automatic diagnostic reset function only once every 24 hours. For the controller to increment the 24-hour timer, you must maintain power to the controller. Cycling power resets all timers and counters.*

After the controller detects the first low temperature diagnostic, the unit waits 30 minutes before invoking the automatic diagnostic reset function. The automatic diagnostic reset function clears the special diagnostic and attempts to restore the controller to normal operation. The

1 Non-latching diagnostics automatically reset when the input is present and valid.
2 Does not apply to the Tracer UC400 controller.

controller resumes normal operation until another diagnostic occurs.

Note: *The automatic diagnostic reset function does not operate during the manual output test sequence.*

If a special diagnostic occurs within 24 hours after an automatic diagnostic reset, the controller must be manually reset. Other possible methods of resetting diagnostics are described in the sections that follow.

Manual Output Test (Tracer ZN010, ZN510, or ZN520 Controller only)

You can use the Test button on the controller either during installation to verify proper end device operation or during troubleshooting. When you press the Test button, the controller exercises all outputs in a predefined sequence. The first and last outputs of the sequence reset the controller diagnostics. See p. 89 for more information about the manual output test.

Cycling Power

When someone turns off the controller's 24 Vac power, then re-applies power, the unit cycles through a power up sequence. By default, the controller attempts to reset all diagnostics at power up. Diagnostics present at power-up and those that occur after power-up are handled according to the defined unit diagnostics sequences (see Table 55, p. 91 and Table 56, p. 92).

Building Automation System

Some building automation systems can reset diagnostics in the Tracer ZN510, ZN520, or UC400 controller. For more complete information, refer to the product literature for the building automation system.

Diagnostic Reset (Tracer ZN510 or ZN520 only)

Any device that can communicate the network variable nviRequest (enumeration "clear_alarm") can reset diagnostics in the Tracer ZN510 or ZN520 controller. The controller also attempts to reset diagnostics whenever power is cycled.

Cycling the Fan Switch (Tracer ZN520 only)

If the user cycles the fan speed switch from off to any speed, the controller resets all diagnostics. Diagnostics may recur immediately if the problem still exists.

The green LED normally indicates whether or not the controller is powered on (24 Vac).

Trane Service Tools

Rover, Trane's service tool for Tracer ZN010, ZN510, and ZN520, can reset diagnostics present in the controller. For complete information about Rover, refer to EMTX-SVX01G-EN (or the most recent version), *Installation, Operation, and Programming: Rover™ Service Tool*.

Tracer TU can be used to reset diagnostics present in a Tracer UC400 controller.

Alarm Reset

Any device that can communicate alarm reset information can reset diagnostics present in the controller.

Table 55. Tracer ZN010 and ZN510 controller diagnostics

Diagnostic	Latching	Fan	Valves	Electric Heat	Damper
Auxiliary temperature failure	No	Enabled	No action	No action	No action
Condensate overflow detection	Yes	Off	Closed	Off	Closed
Entering water temperature	No	Enabled	Enabled	Enabled	Enabled
Fan mode failure	No	Enabled	Enabled	Enabled	Enabled
Invalid unit configuration failure	Yes	Disabled	Disabled	Disabled	Disabled
Low temperature detection	Yes	Off	Open	Off	Closed
Maintenance required	Yes	Enabled	No action	No action	No action
Setpoint	No	Enabled	No action	No action	No action
Zone temperature failure	No	Off	Closed	Off	Closed

Notes:

1. Priority Level: Diagnostics are listed in order from highest to lowest priority. The controller senses and records each diagnostic independently of other diagnostics. It is possible to have multiple diagnostics present simultaneously. The diagnostics affect unit operation according to priority level.
2. Latching: A latching diagnostic requires a manual reset of the controller; while a non-latching diagnostic automatically resets when the input is present and valid.
3. Enabled: End device is allowed to run if there is a call for it to run.
4. Disabled: End device is not allowed to run even if there is a call for it to run.
5. No Action: The diagnostic has no affect on the end device.

Table 56. Tracer ZN520 diagnostics

Diagnostic	Fan	Other Outputs[a]
Condensate overflow	Off	Valves closed, fresh air damper closed, electric heat off, baseboard heat off
Low temperature detection	Off	Valves open, fresh air damper closed, electric heat off, baseboard heat off
Low air flow—fan failure	Off	Valves closed, fresh air damper closed, electric heat off, baseboard heat off
Space temperature failure	Off	Valves closed, fresh air damper closed, electric heat off, baseboard heat off
Entering water temperature failure	On	Valves enabled[b], fresh air damper enabled(b), electric heat enabled(b), baseboard heat off
Discharge air temperature low limit	Off	Valves open, fresh air damper closed, electric heat off, baseboard heat off
Discharge air temperature failure	Off	Valves closed, fresh air damper closed, electric heat off, baseboard heat off
Fresh air temperature failure	On	Valves enabled, fresh air damper minimum position[c], electric heat enabled, baseboard heat enabled
Relative humidity failure[d]	On	Valves enabled, fresh air damper enabled, electric heat enabled, baseboard heat enabled
Generic 4–20 mA failure(d)	On	Valves enabled, fresh air damper enabled, electric heat enabled, baseboard heat enabled
CO_2 input failure	On	Valves enabled, fresh air damper enabled, electric heat enabled, baseboard heat enabled
Maintenance required	On	Valves enabled, fresh air damper enabled, electric heat enabled, baseboard heat enabled
Local fan mode failure	On	Valves enabled, fresh air damper enabled, electric heat enabled, baseboard heat enabled
Local setpoint failure	On	Valves enabled, fresh air damper enabled, electric heat enabled, baseboard heat enabled
Invalid unit configuration(d)	Off	Valves disabled, fresh air damper disabled, electric heat disabled, baseboard heat disabled
Normal—power up	On	Valves enabled, fresh air damper enabled, electric heat enabled

(a) The generic binary output (TB4-1, TB4-2) state is unaffected by all unit diagnostics.
(b) When the entering water temperature is required but not present, the Tracer ZN520 controller generates a diagnostic to indicate the sensor loss condition. The controller automatically clears the diagnostic once a valid entering water temperature value is present (non-latching diagnostic). When the entering water temperature sensor fails, the controller prohibits all hydronic cooling operation, but allows the delivery of heat when heating is required. In the Cool mode, all cooling is locked-out, but normal fan and outdoor air damper operation is permitted.
(c) When the outdoor air temperature sensor has failed or is not present, the Tracer ZN520 controller generates a diagnostic to indicate the sensor loss condition. The controller automatically clears the diagnostic once a valid outdoor air temperature value is present (non-latching diagnostic). When the outdoor air temperature sensor fails or is not present, the controller prohibits economizer operation.
(d) Does not apply to the Tracer UC400 controller.

Common Diagnostics for Tracer ZN010, ZN510, or ZN520 Controllers

Table 57. Fan outputs do not energize (Tracer ZN010, ZN510, or ZN520 controller)

Probable Cause	Explanation
Random start observed	After power-up, the controller always observes a random start that varies between 0 and 30 seconds. The controller remains off until the random start time expires.
Power-up control wait[a]	When power-up control wait is enabled (non-zero time), the controller remains off until one of two conditions occurs: 1. The controller exits power-up control wait once it receives communicated information. 2. The controller exits power-up control wait once the power-up control wait time expires.
Cycling fan operation	When the fan mode switch is in the auto position, the unit fan cycles off when there is no call for heating or cooling. The heating/cooling sources cycle on or off periodically with the unit fan to match the capacity according to pulse width modulation (PWM) logic.
Unoccupied operation	The fan cycles with capacity when the unit is in unoccupied mode. This occurs even if the unit is in continuous fan operation. While unoccupied, the fan cycles on or off with heating/cooling to provide varying amounts of heating or cooling to the space. to match the capacity diagnostics according to pulse-width-modulation (PWM) logic.
Fan mode off	When using the local fan mode switch to determine the fan operation, the off position controls the unit fan to off.
Requested mode: off	It is possible to communicate the operating mode (such as off, heat, and cool) to the controller. When “off” is communicated to the controller, the unit controls the fan to off. The unit is not capable of heating or cooling when the controller is in this mode.
Diagnostic present	A specific list of diagnostics affects fan operation. For more information, see Table 55 and Table 56, p. 92.
No power to the controller	If the controller does not have power, the unit fan does not operate. For the Tracer controller to operate normally, it must have an input voltage of 24 Vac. When the green LED is off continuously, the controller does not have sufficient power or has failed.
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. When the unit configuration does not match the actual end devices, the valves may not work correctly.
Manual output test(a)	The controller includes a manual output test sequence to verify binary output operation and the associated wiring. However, based on the current step in the test sequence, the unit fan may not be powered on. Refer to “Manual Output Test,” page 89.
Unit wiring	The wiring between the controller outputs and the fan relays and contacts must be present and correct for normal fan operation. Refer to the specific unit wiring diagrams on the unit.

(a) Does not apply to the Tracer UC400 controller.

Table 58. Valves stay closed (Tracer ZN010, ZN510, or ZN520 controller)

Probable Cause	Explanation
Normal operation	The controller opens and closes the valves to meet the unit capacity requirements.
Requested mode: off	It is possible to communicate the operating mode (such as off, heat, and cool) to the controller. When off is communicated to the controller, the unit controls the fan to off. The unit is not capable of heating or cooling when the controller is in this mode.
Valve override	The controller can communicate a valve override request.This request affects the valve operation.
Manual output test	The controller includes a manual output test sequence to verify analog and binary output operation and the associated wiring. However, based on the current step in the test sequence, the valves may not be open. Refer to the "Manual Output Test," page 89.
Diagnostic present	A specific list of diagnostics affects valve operation. For more information, see Table 55 and Table 56, p. 92.
Sampling logic	The controller includes entering water temperature sampling logic that automatically invokes during 2-pipe or 4-pipe changeover. It determines when the entering water temperature is either too cool or too hot for the desired heating or cooling mode. Refer to "Entering Water Temperature Sampling Function," page 45.
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. When the unit configuration does not match the actual end device, the valves may not work correctly.
No power to the controller	If the controller does not have power, the unit fan does not operate. For the Tracer ZN010, 510 controller to operate normally, it must have an input voltage of 24 Vac. When the green LED is off continuously, the controller does not have sufficient power or has failed.
Unit wiring	The wiring between the controller outputs and the valve(s) must be present and correct for normal valve operation. Refer to the unit wiring diagrams on the unit.

Table 59. Valves stay open (Tracer ZN010, ZN510, or ZN520 controller)

Probable Cause	Explanation
Normal operation	The controller opens and closes the valves to meet the unit capacity requirements.
Valve override	The controller can communicate a valve override request to affect the valve operation.
Manual output test	The controller includes a manual output test sequence that verifies analog and binary output operation and the associated wiring. However, based on the current step in the test sequence, the valves may be open. Refer to the "Manual Output Test," page 89.
Diagnostic present	A specific list of diagnostics affects valve operation. For more information, see Table 55 and Table 56, p. 92.
Sampling logic	The controller includes entering water temperature sampling logic that automatically invokes during 2-pipe or 4-pipe changeover to determine if the entering water temperature is correct for the unit operating mode. Refer to "Entering Water Temperature Sampling Function," page 45.
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. When the unit configuration does not match the actual end device, the valves may not work correctly.
Unit wiring	The wiring between the controller outputs and the valve(s) must be present and correct for normal valve operation. Refer to the unit wiring diagrams on the unit.

Table 60. Electric heat not operating (Tracer ZN010, ZN510, or ZN520 controller)

Probable Cause	Explanation
Normal operation	The controller cycles electric heat on and off to meet the unit capacity requirements.
Requested mode: off	It is possible to communicate the operating mode (such as off, heat, cool) to the controller. When off is communicated to the controller, the units shuts off the electric heat.
Communicated disable	Numerous communicated requests may disable electric heat, including an auxiliary heat enable input and the heat/cool mode input. Depending on the state of the communicated request, the unit may disable electric heat.
Manual output test	The controller includes a manual output test sequence that verifies analog and binary output operation and associated output wiring. However, based on the current step in the test sequence, the electric heat may not be on. Refer to the "Manual Output Test," page 89.
Diagnostic present	A specific list of diagnostics affects electric heat operation. For more information, see Table 55 and Table 56, p. 92.
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. When the unit configuration does not match the actual end device, the electric heat may not work properly.
No power to the controller	If the controller does not have power, the unit fan does not operate. For the Tracer ZN010, 510 controller to operate normally, it must have an input voltage of 24 Vac. When the green LED is off continuously, the controller does not have sufficient power or has failed.
Unit wiring	The wiring between the controller outputs and the electric heat contacts must be present and correct for normal electric heat operation. Refer to the unit wiring diagrams on the unit.

Table 61. Fresh air damper stays closed (Tracer ZN010, ZN510, or ZN520 controller)

Probable Cause	Explanation
Warm-up and cool-down	The controller includes both a warm-up and cool-down sequence to keep the fresh air damper closed during the transition from unoccupied to occupied. This is an attempt to bring the space under control as quickly as possible.
Requested mode: off	It is possible to communicate the operating mode (such as off, heat, cool) to the controller. When off is communicated to the controller, the unit closes the fresh air damper.
Manual output test	The controller includes a manual output test sequence that verifies analog and binary output operation and associated output wiring. However, based on the current step in the test sequence, the fresh air damper may not be open. Refer to the "Manual Output Test," page 89.
Diagnostic present	A specific list of diagnostics effects fresh air damper operation. For more information, see Table 55 and Table 56, p. 92.
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. When the unit configuration does not match the actual end device, the damper may not work correctly.
No power to the controller	If the controller does not have power, the unit fan does not operate. For the Tracer ZN010, 510 controller to operate normally, it must have an input voltage of 24 Vac. When the green LED is off continuously, the controller does not have sufficient power or has failed.
Unit wiring	The wiring between the controller outputs and the fresh air damper must be present and correct for normal damper operation. Refer to the unit wiring diagrams on the unit.

Table 62. Fresh air damper stays open (Tracer ZN010, ZN510, or ZN520 controller)

Probable Cause	Explanation
Normal operation	The controller opens and closes the fresh air damper based on the controller's occupancy mode and fan status. Normally, the fresh air damper is open during occupied mode when the fan is running and closed during unoccupied mode.
Manual output test	The controller includes a manual output test sequence that verifies analog and binary output operation and associated wiring. However, based on the current step in the test sequence, the fresh air damper may be open. Refer to the "Manual Output Test," page 89.
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. When the unit configuration does not match the actual end device, the damper may not work correctly.
Unit wiring	The wiring between the controller outputs and the fresh air damper must be present and correct for normal damper operation. Refer to the unit wiring diagrams on the unit.

Table 63. Valves stay closed (Tracer ZN010, ZN510, or ZN520 controller)

Probable Cause	Explanation
Requested mode off	You can communicate a desired operating mode (such as off, heat, and cool) to the controller. When off is communicated to the controller, the unit controls the fan off. There is no heating or cooling (valves are closed).
Power-up control wait	When power up control wait is enabled (non-zero time), the controller remains off until one of two conditions occurs: The controller exits power up control wait once it receives communicated information. The controller exits power up control wait once the power up control wait time expires.
Manual output test	The controller includes a manual output test sequence you can use to verify output operation and associated output wiring. However, based on the current step in the test sequence, the valve(s) may not be open. Refer to the "Manual Output Test," page 89.
Fan mode off	When a local fan mode switch (provided on the Trane zone sensor) determines the fan operation, the off position controls the unit off and valves to close.
Sampling logic	The controller includes entering water temperature sampling logic which is automatically invoked during 2-pipe and 4-pipe changeover when the entering water temperature is either too cool or too hot for the desired heating or cooling. Refer to "Entering Water Temperature Sampling Function," page 45.
Diagnostic present	A specific list of diagnostic affects valve operation. For more information, see Table 55 and Table 56, p. 92.
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. When the unit configuration does not match the actual end devices, the valves may not work correctly. Example: A 2-pipe heat/cool changeover unit will not cool if the entering water temperature is too warm for cooling or if the entering water sensor is not present. The unit will not heat if the entering water temperature is too cool for heating.
Unit wiring	The wiring between the controller outputs and the valve(s) must be present and correct for normal valve operation.
Random start observed	After power up, the controller always observes a random start from 0 to 25 seconds. The controller remains off until the random start time expires.

Table 64. DX or electric outputs do not energize (Tracer ZN010, ZN510, or ZN520 controller)

Probable Cause	Explanation
Unit wiring	The wiring between the controller outputs and the end devices must be present and correct for normal operation.
Unit configuration	The controller must be properly configured based on the actual installed end devices and application. When the unit configuration does not match the actual end devices, the unit may not work correctly.
Diagnostic present	A specific list of diagnostic affects valve operation. For more information, see Table 55 and Table 56, p. 92.
Manual output test	The controller includes a manual output test sequence you can use to verify output operation and associated output wiring. However, based on the current step in the test sequence, the valve(s) may not be open. Refer to the "Manual Output Test," page 89.
Freeze avoidance	When the fan is off with no demand for capacity (0%) and the outdoor air temperature is below is below the freeze avoidance setpoint, the controller disables compressors and electric heat outputs. This includes unoccupied mode when there is no call for capacity or any other time the fan is off.
Normal operation	The controller energizes the outputs only as needed to meet the unit capacity requirements.

Diagnostics for Tracer UC400 Controller

Diagnostics are informational messages that indicate the operational status of the controller. In response to most diagnostics, the controller attempts to protect the equipment by enabling or disabling, or opening or closing, specific outputs. Other diagnostics provide information about the status of the controller, but have no effect on outputs. Multiple diagnostics can be present simultaneously. Diagnostic messages are viewed using the Tracer TU service tool or through a BAS.

Note: *Tracer TU reports only active diagnostics.*

Types of Diagnostics

Tracer UC400 Controller

Diagnostics are categorized according to the type of clearing method each uses and the type of information each provides.

The four categories are:

- Manual (latching) diagnostics
- Automatic (non-latching) diagnostics
- Smart reset diagnostics
- Informational diagnostics

Note: *Clearing diagnostics refers to deleting diagnostics from the software; it does not affect the problem that generated the message. For help with diagnosing a problem, refer to the section, Table 65, p. 96.*

Manual (Latching) Diagnostics

Manual diagnostics (also referred to as *latching*) cause the unit to shut down. Manual diagnostics can be cleared from the controller in one of the following ways:

- By using the Tracer TU service tool, latching diagnostics can be reset on the Alarms Status page or by temporarily overriding the Reset Diagnostic Request (bv/2) on the Binary Status page.
- Through a building automation system.
- By cycling power to the controller. When the 24 Vac power to the controller is cycled off and then on again, a power-up sequence occurs.

Automatic (Non-latching) Diagnostics

Automatic diagnostics clear automatically when the problem that generated the diagnostic is solved.

Smart Reset Diagnostics

Smart Reset Diagnostics are latching diagnostics that will auto-recover if the condition is corrected. After the controller detects the first smart reset diagnostic, the unit waits 30 minutes before initiating the smart reset function. If another diagnostic of this type occurs again within 24 hours after an automatic clearing, you must clear the diagnostic manually by using any of the ways shown for "Manual (Latching) Diagnostics."

Informational Diagnostics

Informational diagnostics provide information about the status of the controller. They do not affect machine operation. They can be cleared from the controller using the BAS or Tracer SC.

Table of Diagnostics

Tracer UC400 Controller

Table 65, p. 96 presents each diagnostic that can be generated by the Tracer UC400, its effect on outputs (consequences), and its type.

Note: *The generic binary output is unaffected by diagnostics.*

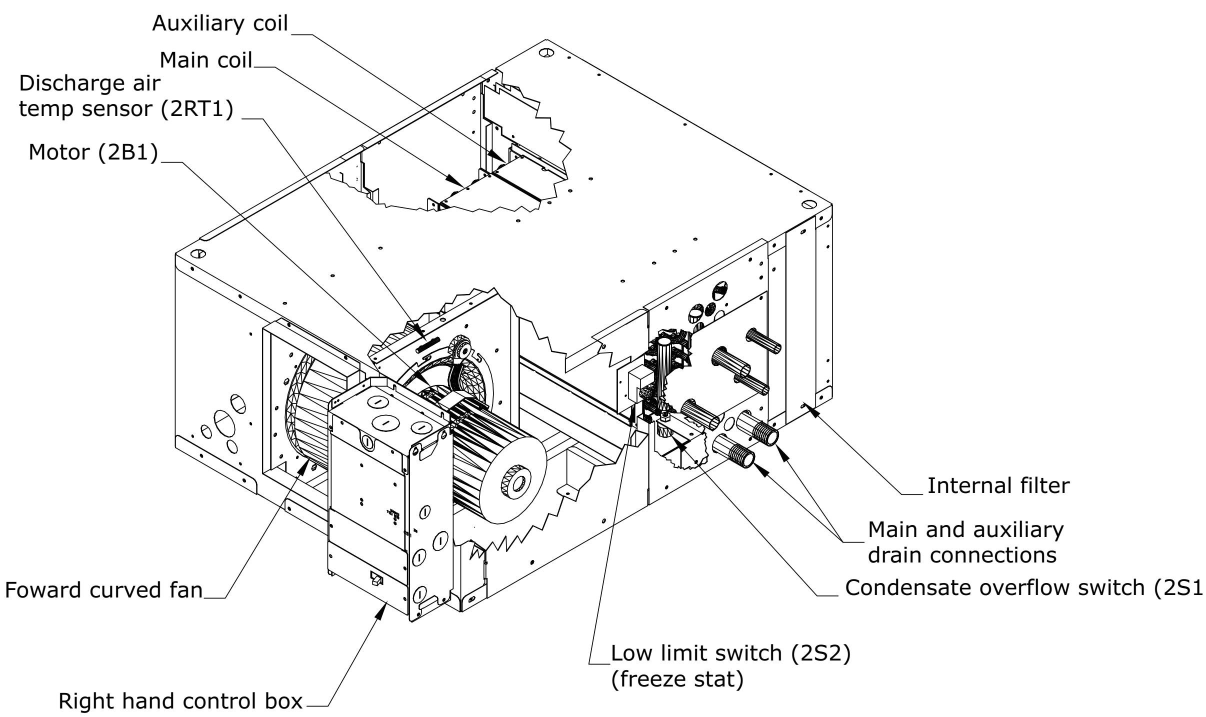
Table 65. Diagnostics (Tracer UC400 controller)

Diagnostic	Probable Cause	Consequences	Diagnostic Type
Filter change required	Fan run hours exceed the time set to indicate filter change	• Fan **unaffected** • Valves **unaffected** • Electric heat **unaffected**	Informational
Condensate overflow	The drain pan is full of water	• Fan **off** • Valves **closed** • Outdoor air damper **closed** • DX/electric heat **off**	Manual
Low coil temp detection	The leaving fluid temperature may be close to freezing	• Fan **off** • Valves **open** • Outdoor air damper **closed** • DX/electric heat **off**	Smart reset/Manual
Low airflow supply fan failure	The fan drive belt, contactor, or motor has failed.	• Fan **off** • Valves **closed** • Outdoor air damper **closed** • DX/electric heat **off**	Manual
Space temperature failure	Invalid or missing value for zone temperature	• Fan **off** • Valves **closed** • Outdoor air damper **closed** • DX/electric heat **off**	Automatic
Entering water temp failure	Invalid or missing value for zone temperature	• Fan **unaffected** (enabled) • Valves **unaffected** • Outdoor air damper **unaffected** • DX/electric heat **unaffected**	Automatic
Discharge air temp low limit	Discharge air temperature has fallen below the Discharge Air Temperature Low Limit	• Fan **off** • Valves **open** • Outdoor air damper **closed** • DX/electric heat **off**	Smart reset/manual
Discharge air temp failure	Invalid or missing value for discharge air temperature	• Fan **off** • Valves **closed** • Outdoor air damper **closed** • DX cooling/electric heat **off**	Automatic
Outdoor air temp failure	Invalid or missing value for outdoor air temperature	• Fan **unaffected** • Valved **unaffected** • Outdoor air damper **minimum position** • DX cooling/electric heat **unaffected**	Automatic
CO_2 sensor failure	Invalid or missing value for CO_2	• Fan **unaffected** • Valves **unaffected** • Outdoor air damper **unaffected** • DX cooling/electric heat **unaffected**	Informational
Generic AIP failure[(a)]	Invalid or missing value for generic analog input	• Fan **unaffected** • Valves **unaffected** • Outdoor air damper **unaffected** • DX cooling/electric heat **unaffected**	Informational
Local fan mode failure	Invalid or missing fan-speed switch (reverts to default fan speed)	• Fan **unaffected** • Valves **unaffected** • Outdoor air damper **unaffected** • DX cooling/electric heat **unaffected**	Automatic
Local setpoint failure	Invalid or missing value for zone temperature setpoint (reverts to default setpoint)	• Fan **unaffected** • Valves **unaffected** • Outdoor air damper **unaffected** • DX cooling/electric heat **unaffected**	Automatic
Generic temperature failure(a)	Invalid or missing generic temperature value	• Fan **unaffected** • Valves **unaffected** • Outdoor air damper **unaffected** • DX cooling/electric heat **unaffected**	Informational

(a) Alarm conditions must be manually configured.

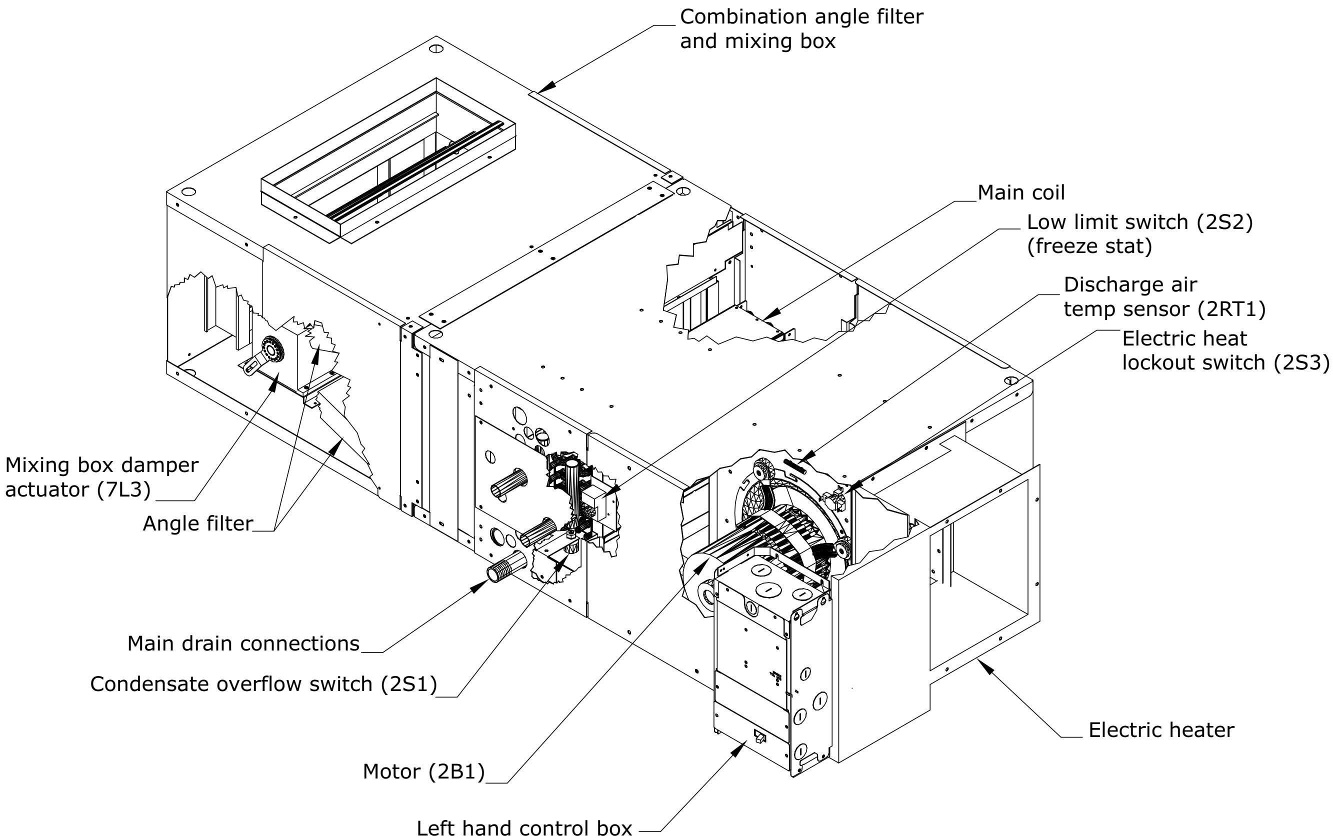
Layout and Control Box Diagrams

Table 66. Right-hand control box with motor, condensate overflow, low-limit switch, outside air temp, fan stat, discharge air temp, and humidity sensor



Outside air temp sensor remote mounted in outside air ductwork
Humidity sensor remote mounted on wall

Table 67. Left-hand control box with motor, electric heat, condensate overflow, low-limit switch, outside air temp, discharge air temp, and angle filter/mixing box actuator



Outside air sensor located in outside air ductwork
Discharge air temp sensor field installed in ductwork

Table 68. Right-hand control box with motor, condensate overflow, low-limit switch, outside air temp, angle filter/ mixing box actuator, and discharge air temp

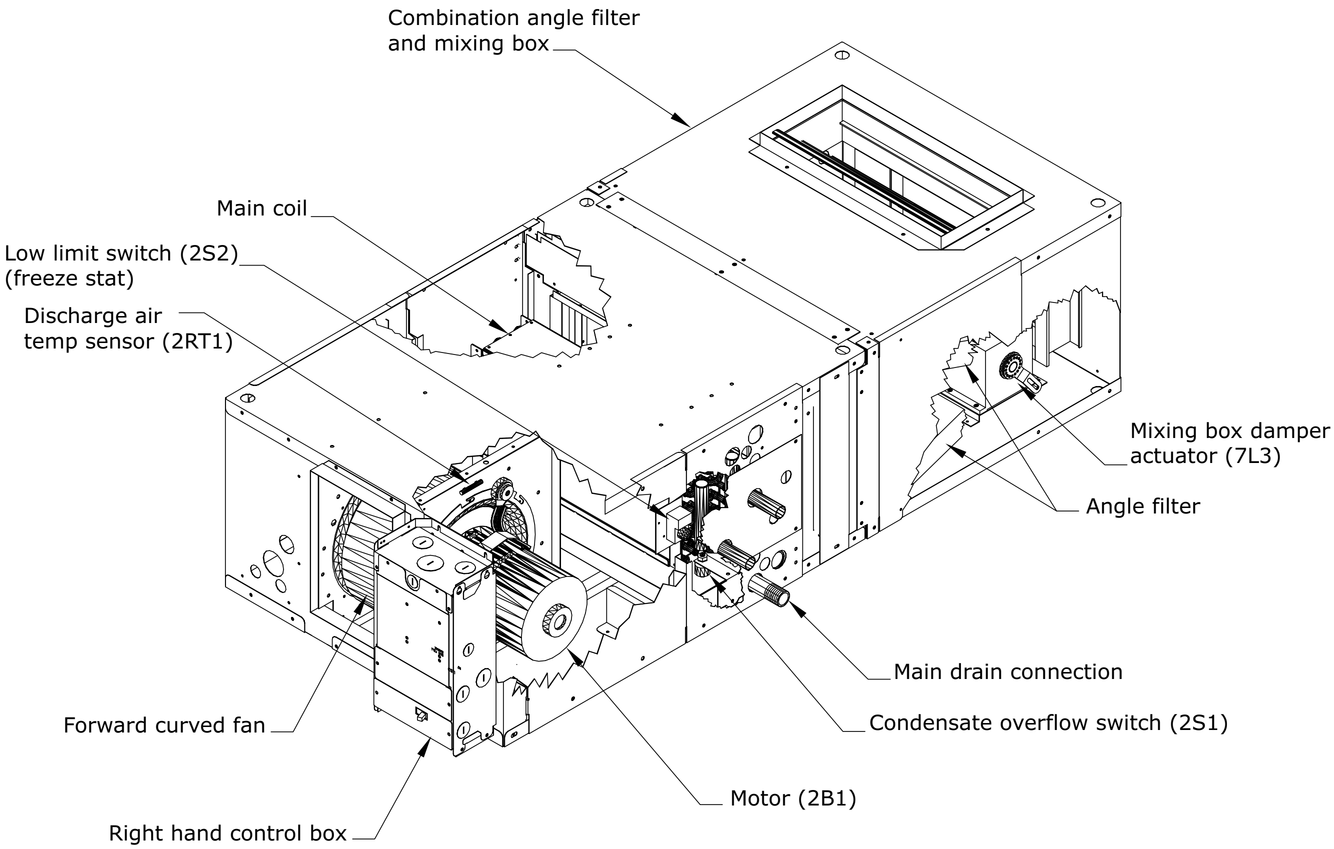


Table 69. Left-hand control box with motor, condensate overflow, low-limit switch, outside air temp, and discharge air temp

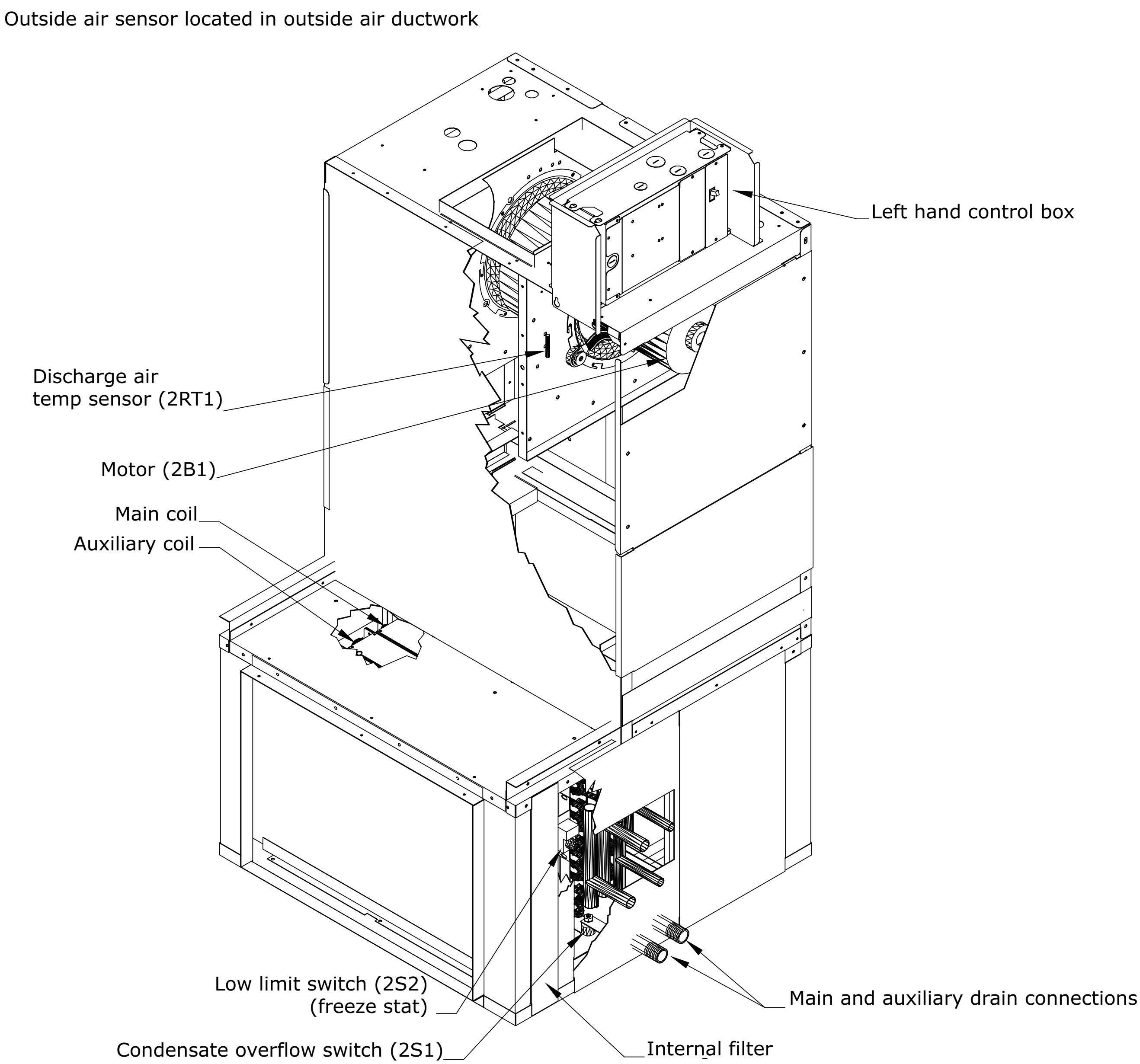
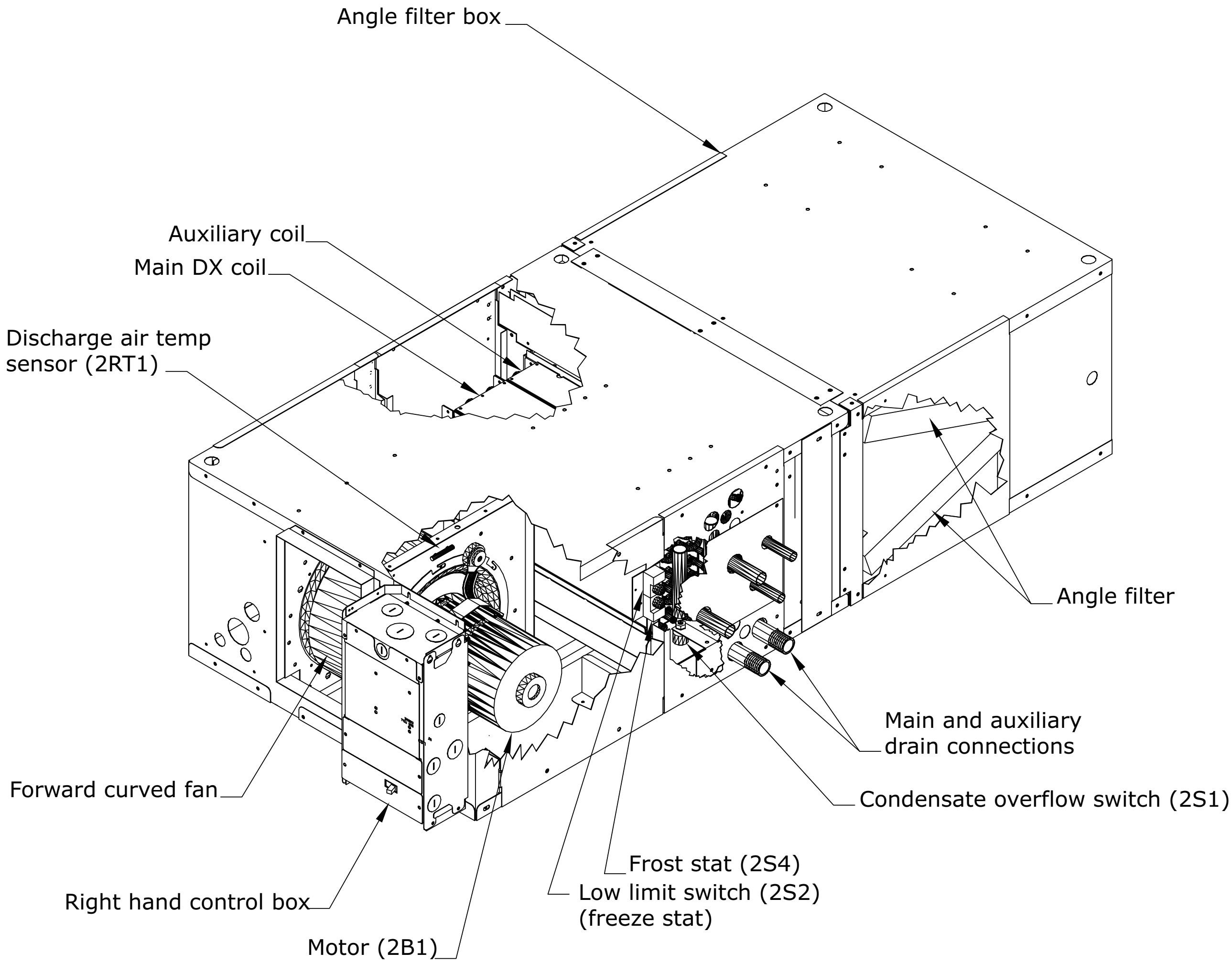
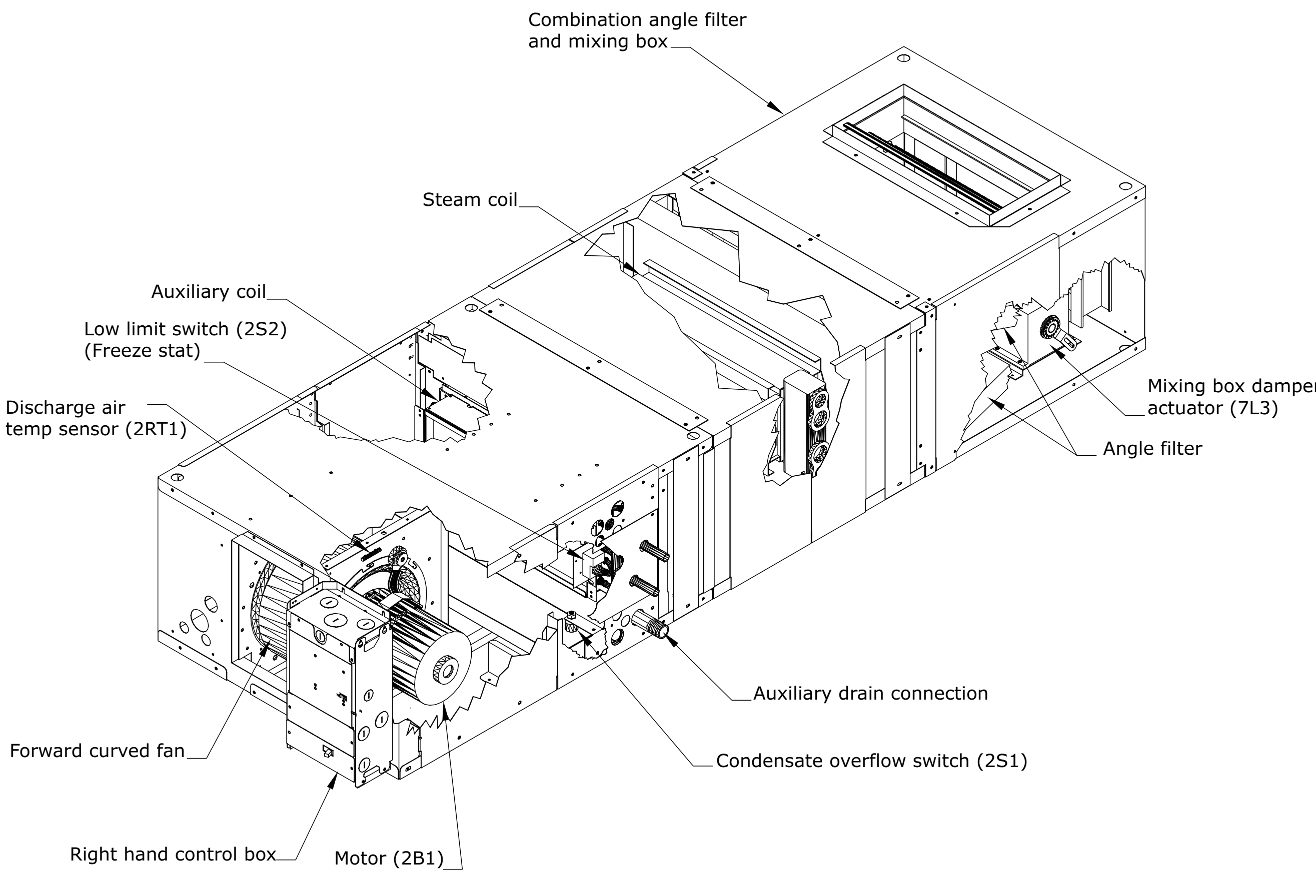


Table 70. Right-hand control box with motor, low-limit switch, froststat, outside air temp, angle filter section, and discharge air temp



Outside air temp sensor remote mounted in outside air ductwork

Table 71. Right-hand control box with motor, two-pipe cooling coil with modulating 2-way control valve, steam coil module with field-supplied 2-position valve/angle filter box/mixing box and actuator, low-limit switch, outside air temp, fan stat, and discharge air temp



Outside air sensor located in outside air ductwork

Table 72. Control box for Tracer ZN010/ZN510/ZN 520, DX coil, wireless zone sensor

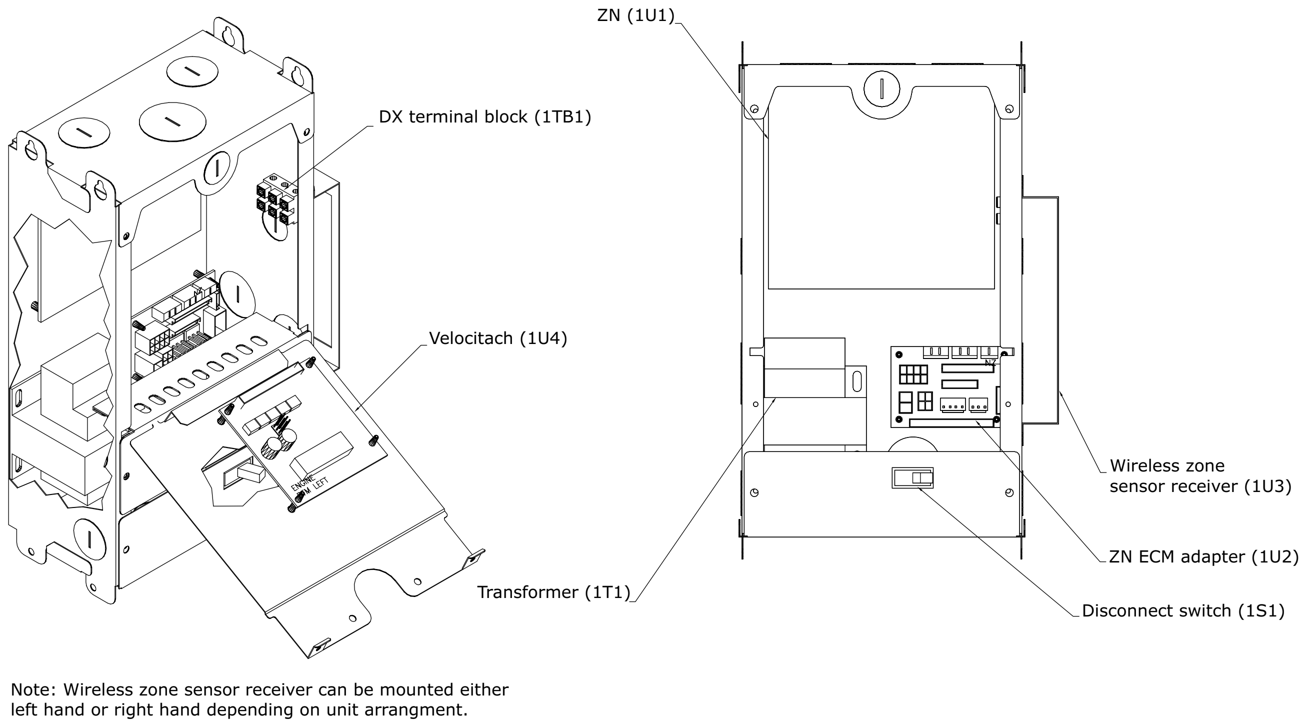


Table 73. Control box for Tracer UC400 with wireless zone sensor, BACnet termination

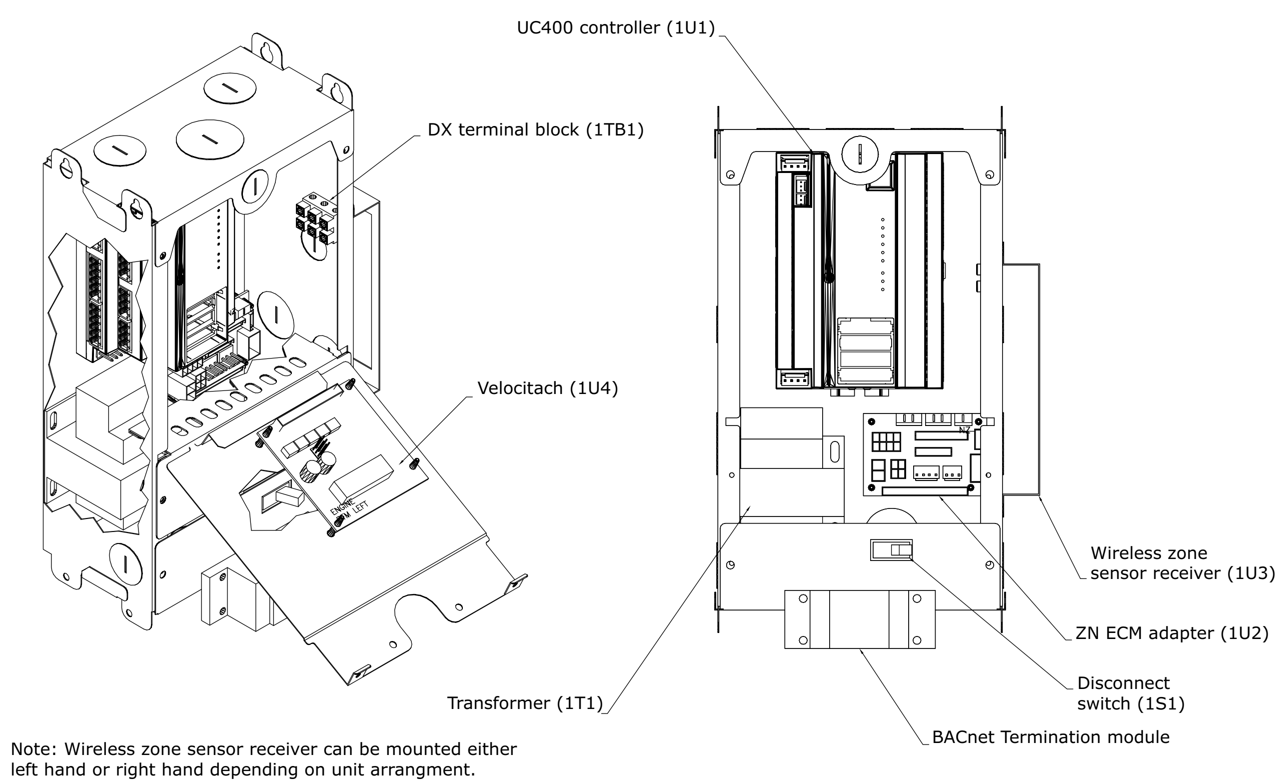
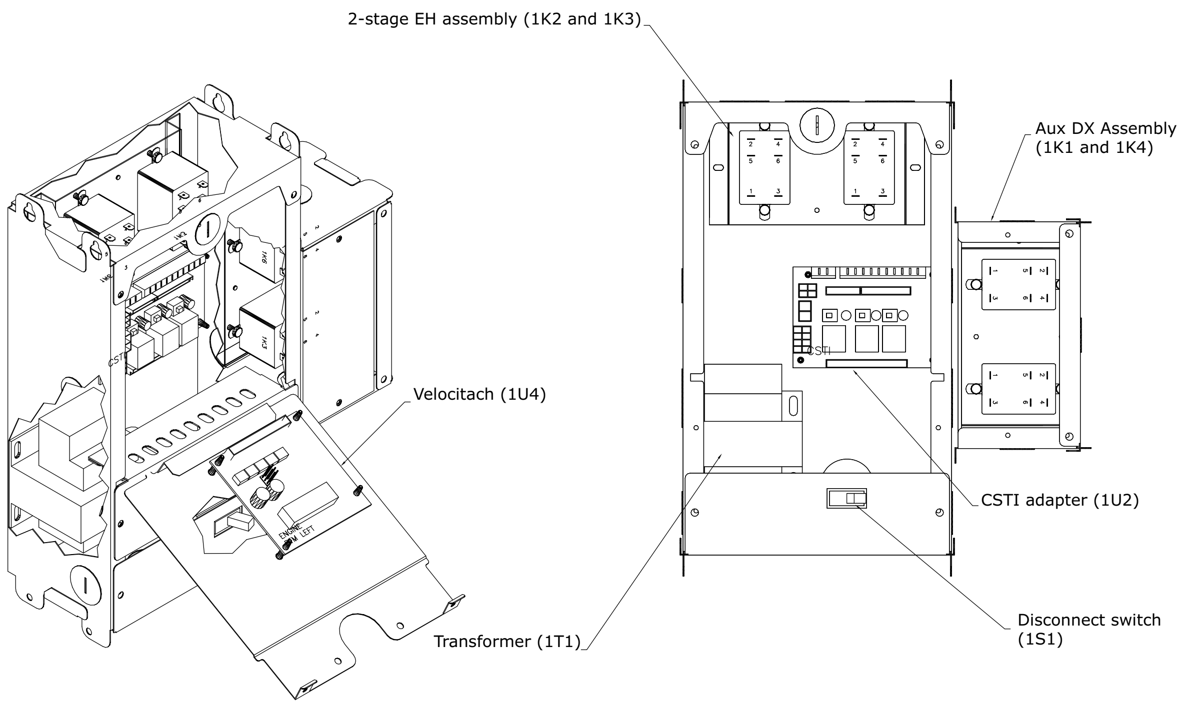
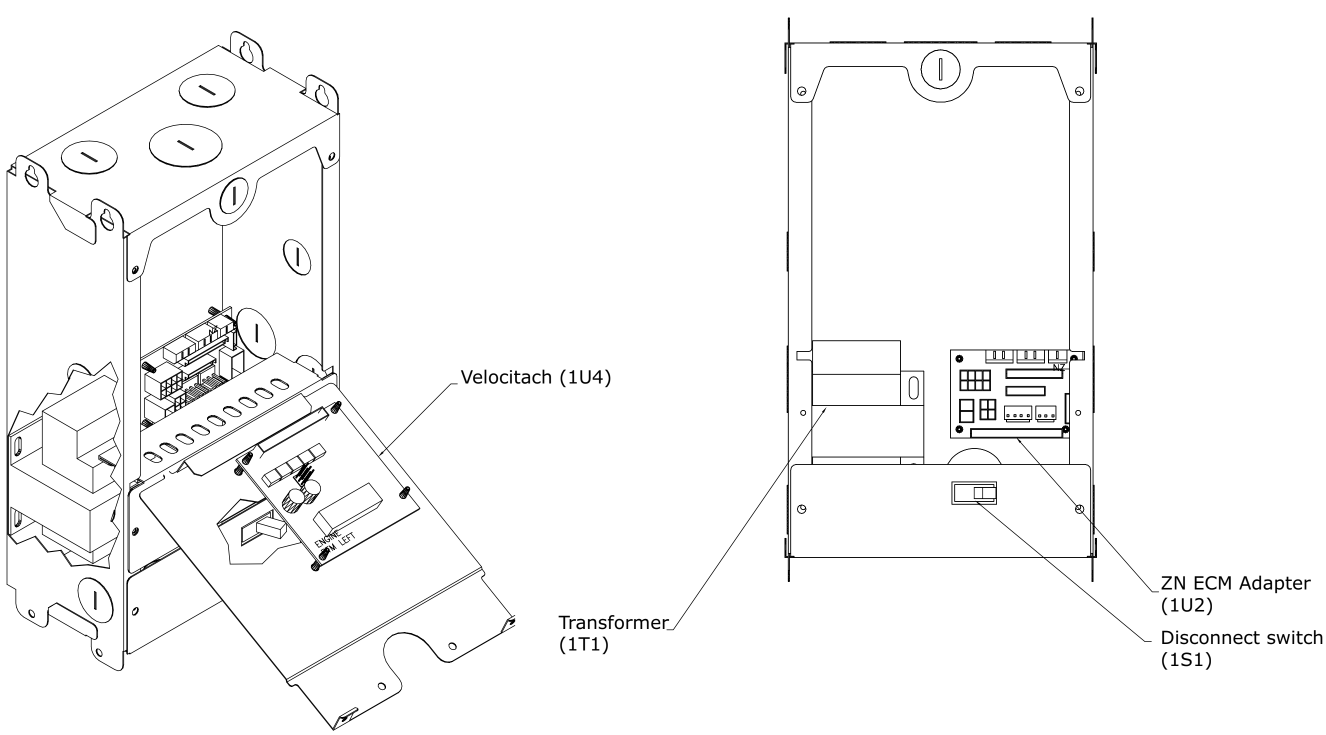


Table 74. Control box for CSTI with 2-stage EH and DX coil



Note: Aux DX assembly can be mounted either left hand or right hand depending on unit arrangment.

Table 75. Control box for FSS

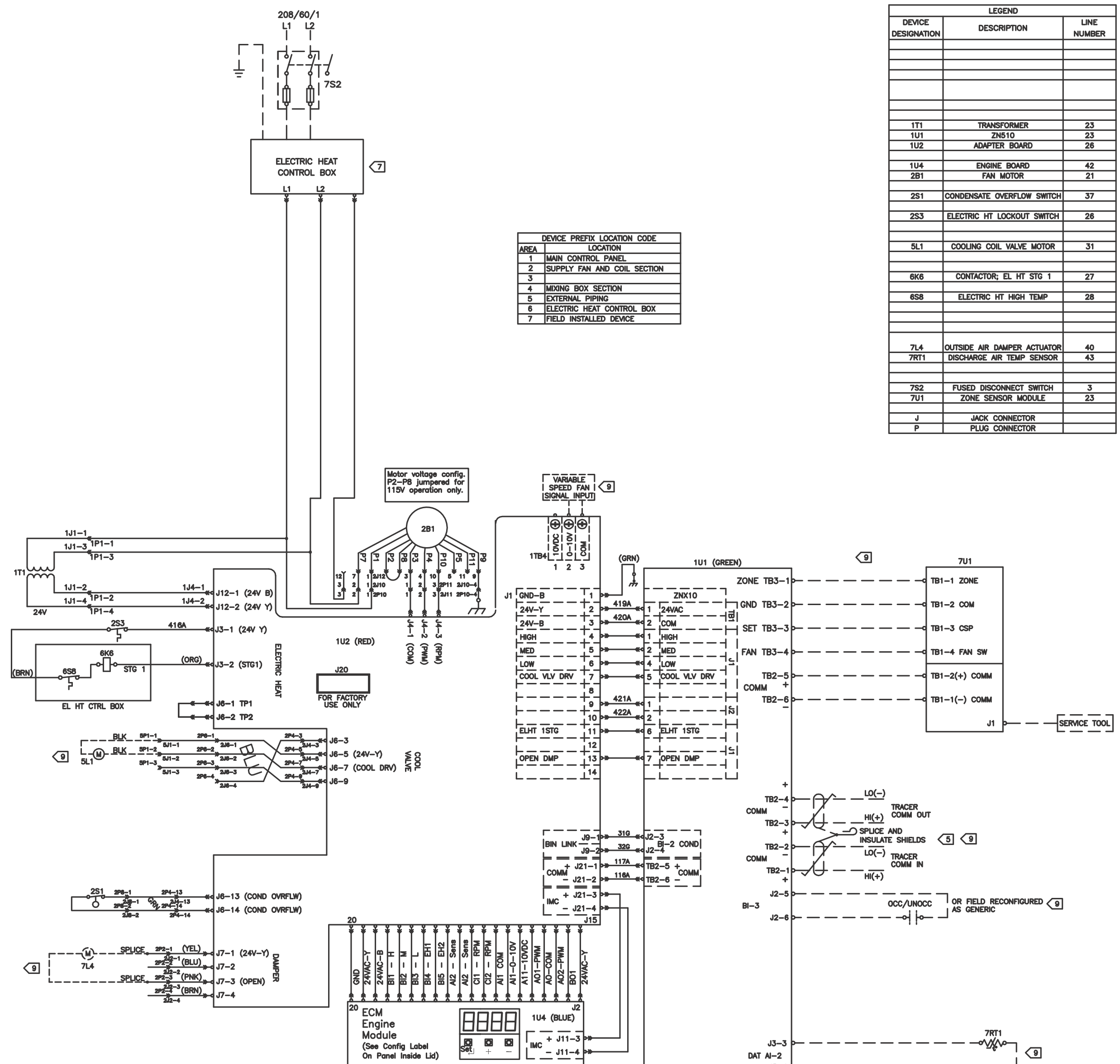


Wiring Diagrams

Two-Pipe BCXD with Tracer ZN510

- 208 volt/3-phase
- 2-position damper
- Single-state electric heat
- Condensate overflow
- Wall-mounted zone sensor

Figure 61. Two-pipe BCXD with Tracer ZN510



LEGEND		
DEVICE DESIGNATION	DESCRIPTION	LINE NUMBER
1T1	TRANSFORMER	23
1U1	ZN510	23
1U2	ADAPTER BOARD	26
1U4	ENGINE BOARD	42
2B1	FAN MOTOR	21
2S1	CONDENSATE OVERFLOW SWITCH	37
2S3	ELECTRIC HT LOCKOUT SWITCH	26
5L1	COOLING COIL VALVE MOTOR	31
6K6	CONTACTOR; EL HT STG 1	27
6S8	ELECTRIC HT HIGH TEMP	28
7L4	OUTSIDE AIR DAMPER ACTUATOR	40
7RT1	DISCHARGE AIR TEMP SENSOR	43
7S2	FUSED DISCONNECT SWITCH	3
7U1	ZONE SENSOR MODULE	23
J	JACK CONNECTOR	
P	PLUG CONNECTOR	

DEVICE PREFIX LOCATION CODE	
AREA	LOCATION
1	MAIN CONTROL PANEL
2	SUPPLY FAN AND COIL SECTION
3	
4	MIXING BOX SECTION
5	EXTERNAL PIPING
6	ELECTRIC HEAT CONTROL BOX
7	FIELD INSTALLED DEVICE

NOTES:

1. UNLESS OTHERWISE NOTED, ALL SWITCHES ARE SHOWN AT 25° C (77° F), AT ATMOSPHERIC PRESSURE, AT 50% RELATIVE HUMIDITY, WITH ALL UTILITIES TURNED OFF, AND AFTER A NORMAL SHUTDOWN HAS OCCURRED.
2. DASHED LINES INDICATE RECOMMENDED FIELD WIRING BY OTHERS. DASHED LINE ENCLOSURES AND/OR DASHED DEVICE OUTLINES INDICATE COMPONENTS PROVIDED BY THE FIELD. SOLID LINES INDICATE WIRING BY TRANE CO.
3. ALL FIELD WIRING MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE (NEC), STATE AND LOCAL REQUIREMENTS. ALL FIELD WIRING MUST HAVE AN INSULATION VOLTAGE RATING THAT EQUALS OR EXCEEDS UNIT RATED VOLTAGΓ

4 BINARY OUTPUT IS RATED 24VAC, 12VA MAX, PILOT DUTY.

5 COMMUNICATION WIRE MUST BE TRANE PART NO. 400–20–28, OR WINDY CITY OR CONNECT AIR "LEVEL 4" CABLE. MAXIMUM OF 4500 FOOT AGGREGATE RUN. CAUTION! DO NOT RUN POWER IN THE SAME CONDUIT OR WIRE BUNDLE WITH COMMUNICATION LINK. FOR ADDITIONAL INFORMATION REFER TO EMTX–EB–68.

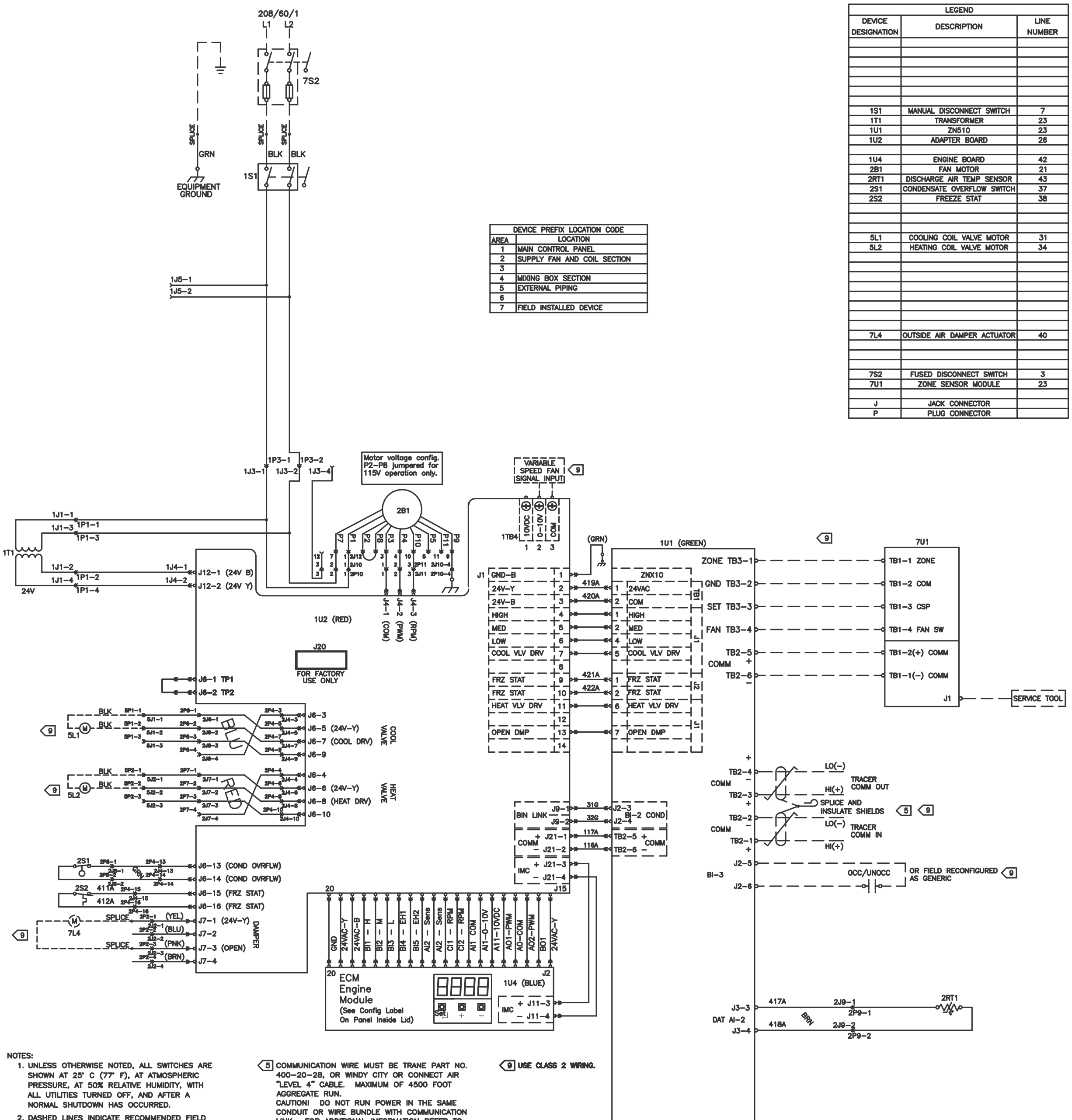
7 ELECTRIC HEAT SCHEMATIC IS LOCATED IN THE ELECTRIC HEAT CONTROL BOX PANEL.

9 USE CLASS 2 WIRING.

Four-Pipe BCXD with Tracer ZN510

- 208 volt/3-phase
- 2-position valves
- 2-position damper
- Condensate overflow
- Low-limit protection
- Wall-mounted zone sensor

Figure 62. Four-pipe BCXD with Tracer ZN510



DEVICE PREFIX LOCATION CODE	
AREA	LOCATION
1	MAIN CONTROL PANEL
2	SUPPLY FAN AND COIL SECTION
3	
4	MIXING BOX SECTION
5	EXTERNAL PIPING
6	
7	FIELD INSTALLED DEVICE

LEGEND		
DEVICE DESIGNATION	DESCRIPTION	LINE NUMBER
1S1	MANUAL DISCONNECT SWITCH	7
1T1	TRANSFORMER	23
1U1	ZN510	23
1U2	ADAPTER BOARD	26
1U4	ENGINE BOARD	42
2B1	FAN MOTOR	21
2RT1	DISCHARGE AIR TEMP SENSOR	43
2S1	CONDENSATE OVERFLOW SWITCH	37
2S2	FREEZE STAT	38
5L1	COOLING COIL VALVE MOTOR	31
5L2	HEATING COIL VALVE MOTOR	34
7L4	OUTSIDE AIR DAMPER ACTUATOR	40
7S2	FUSED DISCONNECT SWITCH	3
7U1	ZONE SENSOR MODULE	23
J	JACK CONNECTOR	
P	PLUG CONNECTOR	

NOTES:

1. UNLESS OTHERWISE NOTED, ALL SWITCHES ARE SHOWN AT 25° C (77° F), AT ATMOSPHERIC PRESSURE, AT 50% RELATIVE HUMIDITY, WITH ALL UTILITIES TURNED OFF, AND AFTER A NORMAL SHUTDOWN HAS OCCURRED.
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4 BINARY OUTPUT IS RATED 24VAC, 12VA MAX, PILOT DUTY.

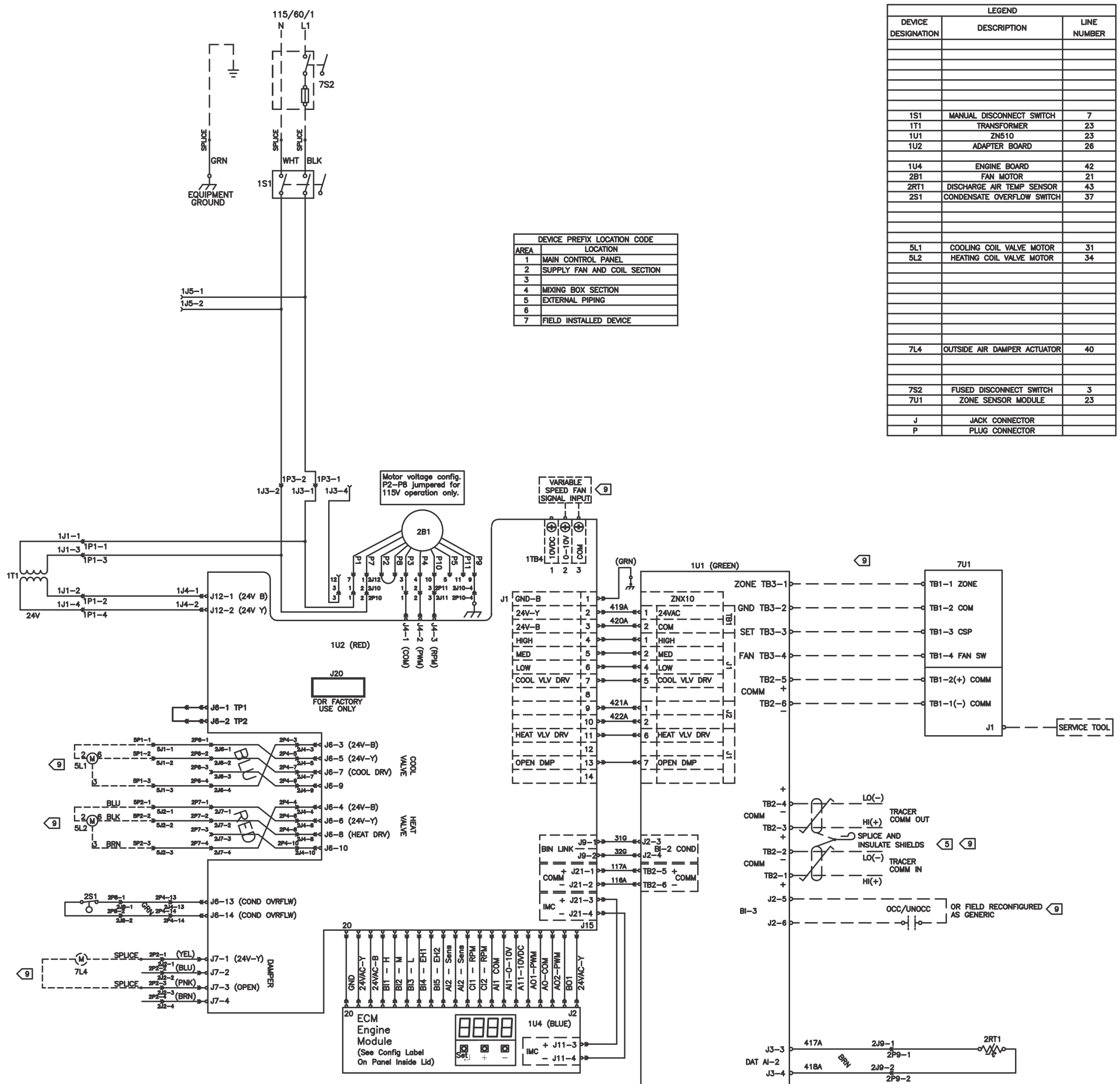
5 COMMUNICATION WIRE MUST BE TRANE PART NO. 400–20–28, OR WINDY CITY OR CONNECT AIR "LEVEL 4" CABLE. MAXIMUM OF 4500 FOOT AGGREGATE RUN.
CAUTION! DO NOT RUN POWER IN THE SAME CONDUIT OR WIRE BUNDLE WITH COMMUNICATION LINK. FOR ADDITIONAL INFORMATION REFER TO EMTX–EB–68.

9 USE CLASS 2 WIRING.

Four-Pipe BCXD with Tracer ZN510

- 115 volt/1-phase
- 2-position valves
- 2-position damper
- 2-speed motor
- Condensate overflow

Figure 63. Four-pipe BCXD with Tracer ZN510



DEVICE PREFIX LOCATION CODE	
AREA	LOCATION
1	MAIN CONTROL PANEL
2	SUPPLY FAN AND COIL SECTION
3	
4	MIXING BOX SECTION
5	EXTERNAL PIPING
6	
7	FIELD INSTALLED DEVICE

LEGEND		
DEVICE DESIGNATION	DESCRIPTION	LINE NUMBER
1S1	MANUAL DISCONNECT SWITCH	7
1T1	TRANSFORMER	23
1U1	ZN510	23
1U2	ADAPTER BOARD	26
1U4	ENGINE BOARD	42
2B1	FAN MOTOR	21
2RT1	DISCHARGE AIR TEMP SENSOR	43
2S1	CONDENSATE OVERFLOW SWITCH	37
5L1	COOLING COIL VALVE MOTOR	31
5L2	HEATING COIL VALVE MOTOR	34
7L4	OUTSIDE AIR DAMPER ACTUATOR	40
7S2	FUSED DISCONNECT SWITCH	3
7U1	ZONE SENSOR MODULE	23
J	JACK CONNECTOR	
P	PLUG CONNECTOR	

NOTES:

1. UNLESS OTHERWISE NOTED, ALL SWITCHES ARE SHOWN AT 25° C (77° F), AT ATMOSPHERIC PRESSURE, AT 50% RELATIVE HUMIDITY, WITH ALL UTILITIES TURNED OFF, AND AFTER A NORMAL SHUTDOWN HAS OCCURRED.
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4 BINARY OUTPUT IS RATED 24VAC, 12VA MAX, PILOT DUTY.

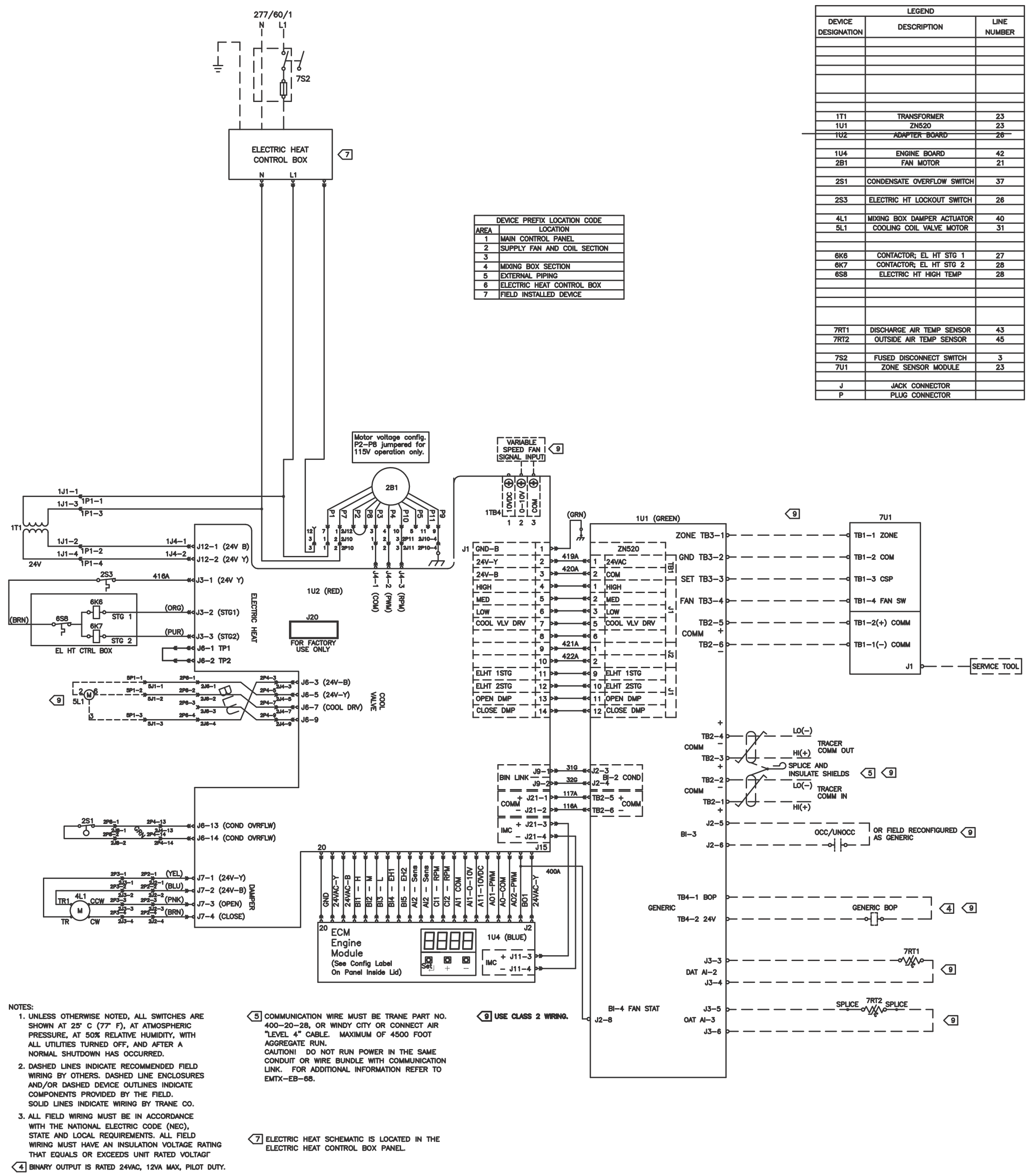
5 COMMUNICATION WIRE MUST BE TRANE PART NO. 400–20–28, OR WINDY CITY OR CONNECT AIR "LEVEL 4" CABLE. MAXIMUM OF 4500 FOOT AGGREGATE RUN. CAUTION! DO NOT RUN POWER IN THE SAME CONDUIT OR WIRE BUNDLE WITH COMMUNICATION LINK. FOR ADDITIONAL INFORMATION REFER TO EMTX–EB–68.

9 USE CLASS 2 WIRING.

Two-Pipe BCXD with Tracer ZN520

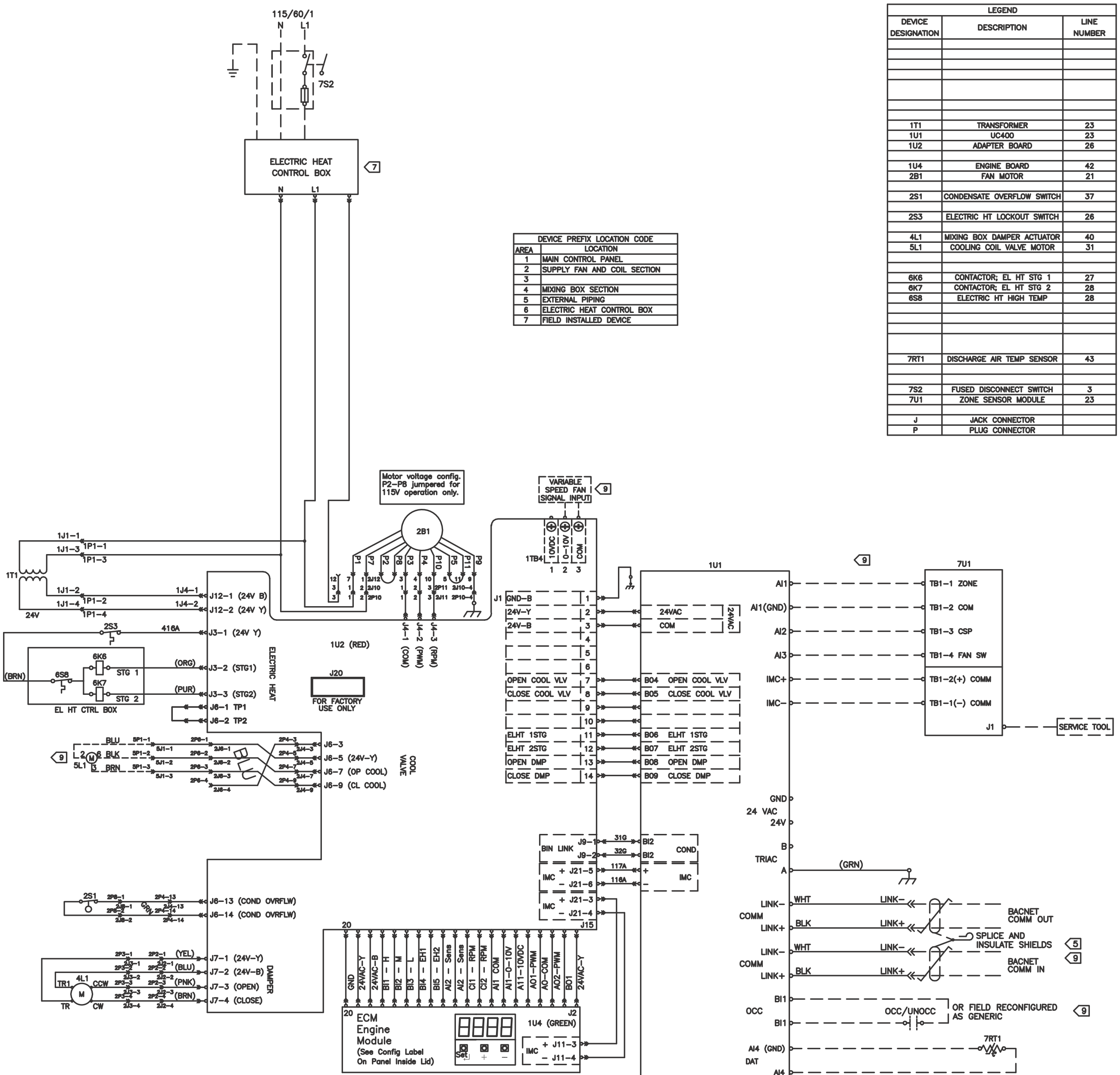
- 460 volt/3-phase
- 2-position valves
- Economizer damper
- 2-stage electric heat
- Fan status switch
- Condensate overflow
- Wall-mounted zone sensor

Figure 64. Two-pipe BCXD with Tracer ZN520



Two-Pipe BCXD with Tracer UC400

Figure 65. Two-pipe BCXD with Tracer UC400



DEVICE PREFIX LOCATION CODE	
AREA	LOCATION
1	MAIN CONTROL PANEL
2	SUPPLY FAN AND COIL SECTION
3	
4	MIXING BOX SECTION
5	EXTERNAL PIPING
6	ELECTRIC HEAT CONTROL BOX
7	FIELD INSTALLED DEVICE

LEGEND		
DEVICE DESIGNATION	DESCRIPTION	LINE NUMBER
1T1	TRANSFORMER	23
1U1	UC400	23
1U2	ADAPTER BOARD	26
1U4	ENGINE BOARD	42
2B1	FAN MOTOR	21
2S1	CONDENSATE OVERFLOW SWITCH	37
2S3	ELECTRIC HT LOCKOUT SWITCH	26
4L1	MIXING BOX DAMPER ACTUATOR	40
5L1	COOLING COIL VALVE MOTOR	31
6K6	CONTACTOR; EL HT STG 1	27
6K7	CONTACTOR; EL HT STG 2	28
6S8	ELECTRIC HT HIGH TEMP	28
7RT1	DISCHARGE AIR TEMP SENSOR	43
7S2	FUSED DISCONNECT SWITCH	3
7U1	ZONE SENSOR MODULE	23
J	JACK CONNECTOR	
P	PLUG CONNECTOR	

NOTES:

1. UNLESS OTHERWISE NOTED, ALL SWITCHES ARE SHOWN AT 25° C (77° F), AT ATMOSPHERIC PRESSURE, AT 50% RELATIVE HUMIDITY, WITH ALL UTILITIES TURNED OFF, AND AFTER A NORMAL SHUTDOWN HAS OCCURRED.
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4 BINARY OUTPUT IS RATED 24VAC, 12VA MAX, PILOT DUTY.

5 COMMUNICATION WIRE MUST BE TRANE PART NO. 400–20–28, OR WINDY CITY OR CONNECT AIR "LEVEL 4" CABLE. MAXIMUM OF 4500 FOOT AGGREGATE RUN. CAUTION! DO NOT RUN POWER IN THE SAME CONDUIT OR WIRE BUNDLE WITH COMMUNICATION LINK. FOR ADDITIONAL INFORMATION REFER TO EMTX–EB–68.

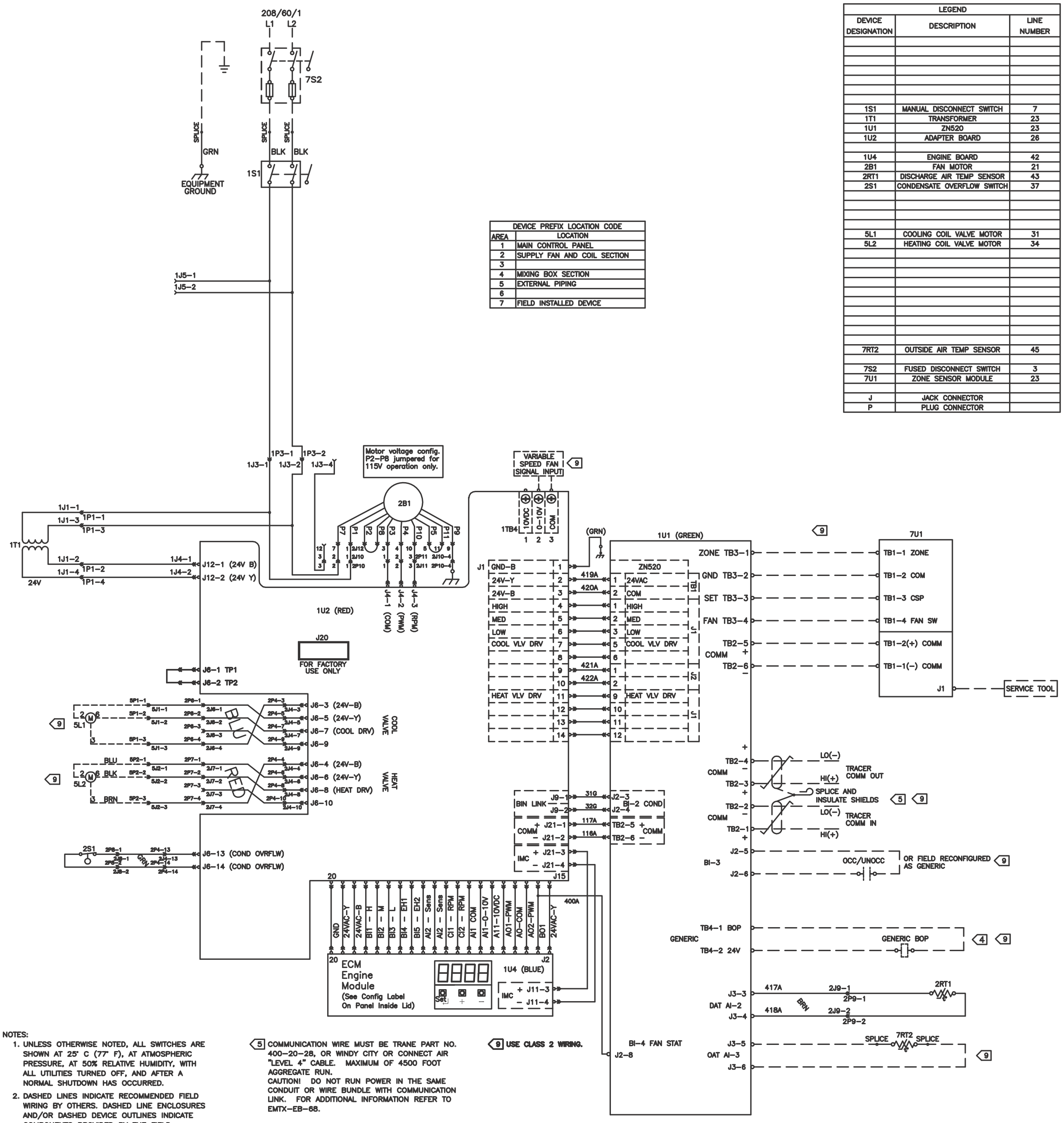
7 ELECTRIC HEAT SCHEMATIC IS LOCATED IN THE ELECTRIC HEAT CONTROL BOX PANEL.

9 USE CLASS 2 WIRING.

Four-Pipe BCXD with Tracer ZN520

- 460 volt/3-phase
- 2-position valves
- Fan status switch
- Condensate overflow

Figure 66. Four-pipe BCXD with Tracer ZN520



DEVICE PREFIX LOCATION CODE	
AREA	LOCATION
1	MAIN CONTROL PANEL
2	SUPPLY FAN AND COIL SECTION
3	
4	MIXING BOX SECTION
5	EXTERNAL PIPING
6	
7	FIELD INSTALLED DEVICE

LEGEND

DEVICE DESIGNATION	DESCRIPTION	LINE NUMBER
1S1	MANUAL DISCONNECT SWITCH	7
1T1	TRANSFORMER	23
1U1	ZN520	23
1U2	ADAPTER BOARD	26
1U4	ENGINE BOARD	42
2B1	FAN MOTOR	21
2RT1	DISCHARGE AIR TEMP SENSOR	43
2S1	CONDENSATE OVERFLOW SWITCH	37
5L1	COOLING COIL VALVE MOTOR	31
5L2	HEATING COIL VALVE MOTOR	34
7RT2	OUTSIDE AIR TEMP SENSOR	45
7S2	FUSED DISCONNECT SWITCH	3
7U1	ZONE SENSOR MODULE	23
J	JACK CONNECTOR	
P	PLUG CONNECTOR	

NOTES:

1. UNLESS OTHERWISE NOTED, ALL SWITCHES ARE SHOWN AT 25° C (77° F), AT ATMOSPHERIC PRESSURE, AT 50% RELATIVE HUMIDITY, WITH ALL UTILITIES TURNED OFF, AND AFTER A NORMAL SHUTDOWN HAS OCCURRED.
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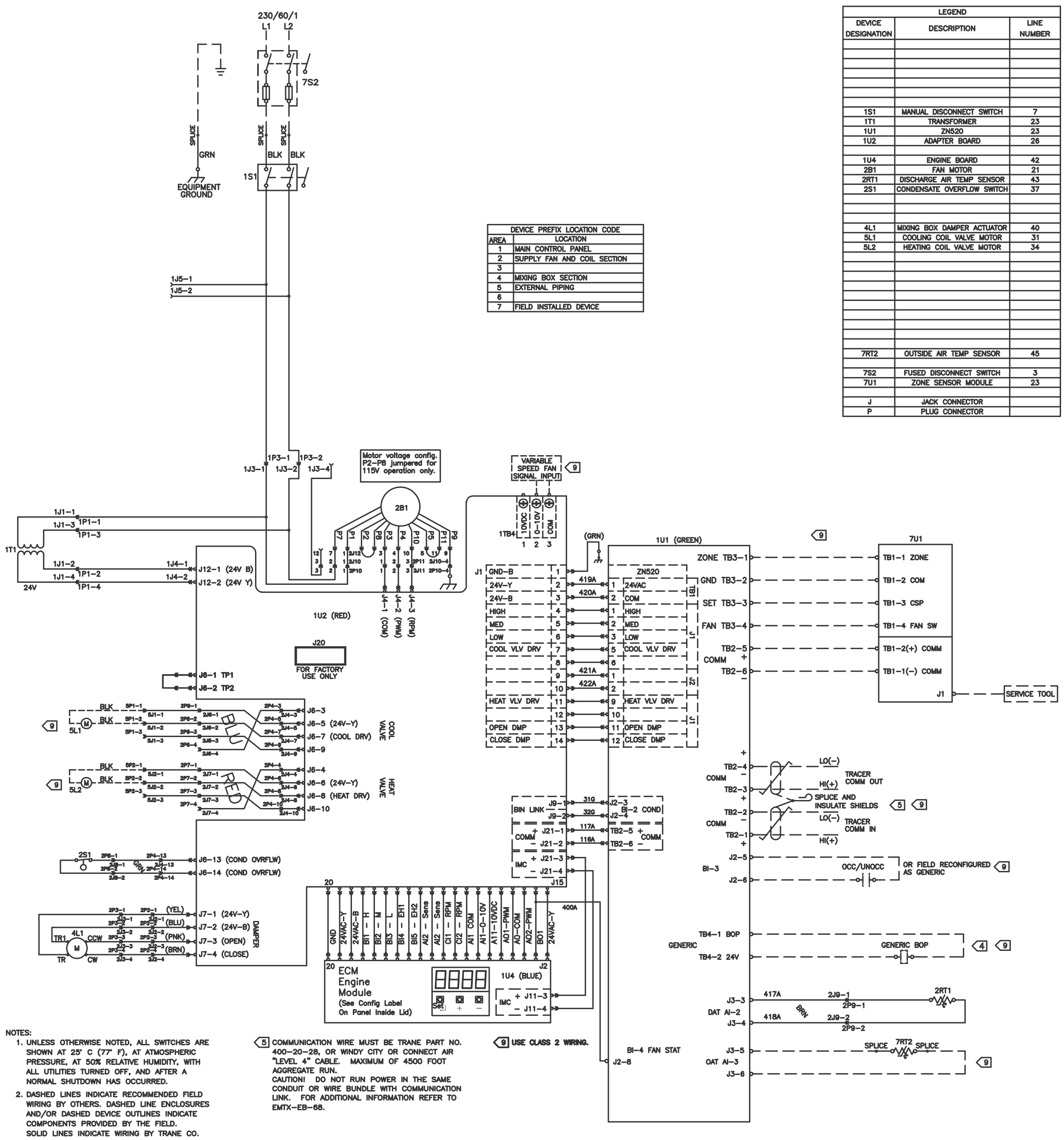
9 USE CLASS 2 WIRING.

Four-Pipe BCXD with Tracer ZN520

- 460 volt/3-phase
- Economizer damper
- Fan status switch
- Condensate overflow
- Wall-mounted zone sensor

Figure 67. Four-pipe BCXD with Tracer ZN520



LEGEND		
DEVICE DESIGNATION	DESCRIPTION	LINE NUMBER
1S1	MANUAL DISCONNECT SWITCH	7
1T1	TRANSFORMER	23
1U1	ZN520	23
1U2	ADAPTER BOARD	26
1U4	ENGINE BOARD	42
2B1	FAN MOTOR	21
2RT1	DISCHARGE AIR TEMP SENSOR	43
2S1	CONDENSATE OVERFLOW SWITCH	37
4L1	MIXING BOX DAMPER ACTUATOR	40
5L1	COOLING COIL VALVE MOTOR	31
5L2	HEATING COIL VALVE MOTOR	34
7RT2	OUTSIDE AIR TEMP SENSOR	45
7S2	FUSED DISCONNECT SWITCH	3
7U1	ZONE SENSOR MODULE	23
J	JACK CONNECTOR	
P	PLUG CONNECTOR	

DEVICE PREFIX LOCATION CODE	
AREA	LOCATION
1	MAIN CONTROL PANEL
2	SUPPLY FAN AND COIL SECTION
3	
4	MIXING BOX SECTION
5	EXTERNAL PIPING
6	
7	FIELD INSTALLED DEVICE

NOTES:

1. UNLESS OTHERWISE NOTED, ALL SWITCHES ARE SHOWN AT 25° C (77° F), AT ATMOSPHERIC PRESSURE, AT 50% RELATIVE HUMIDITY, WITH ALL UTILITIES TURNED OFF, AND AFTER A NORMAL SHUTDOWN HAS OCCURRED.
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4 BINARY OUTPUT IS RATED 24VAC, 12VA MAX, PILOT DUTY.

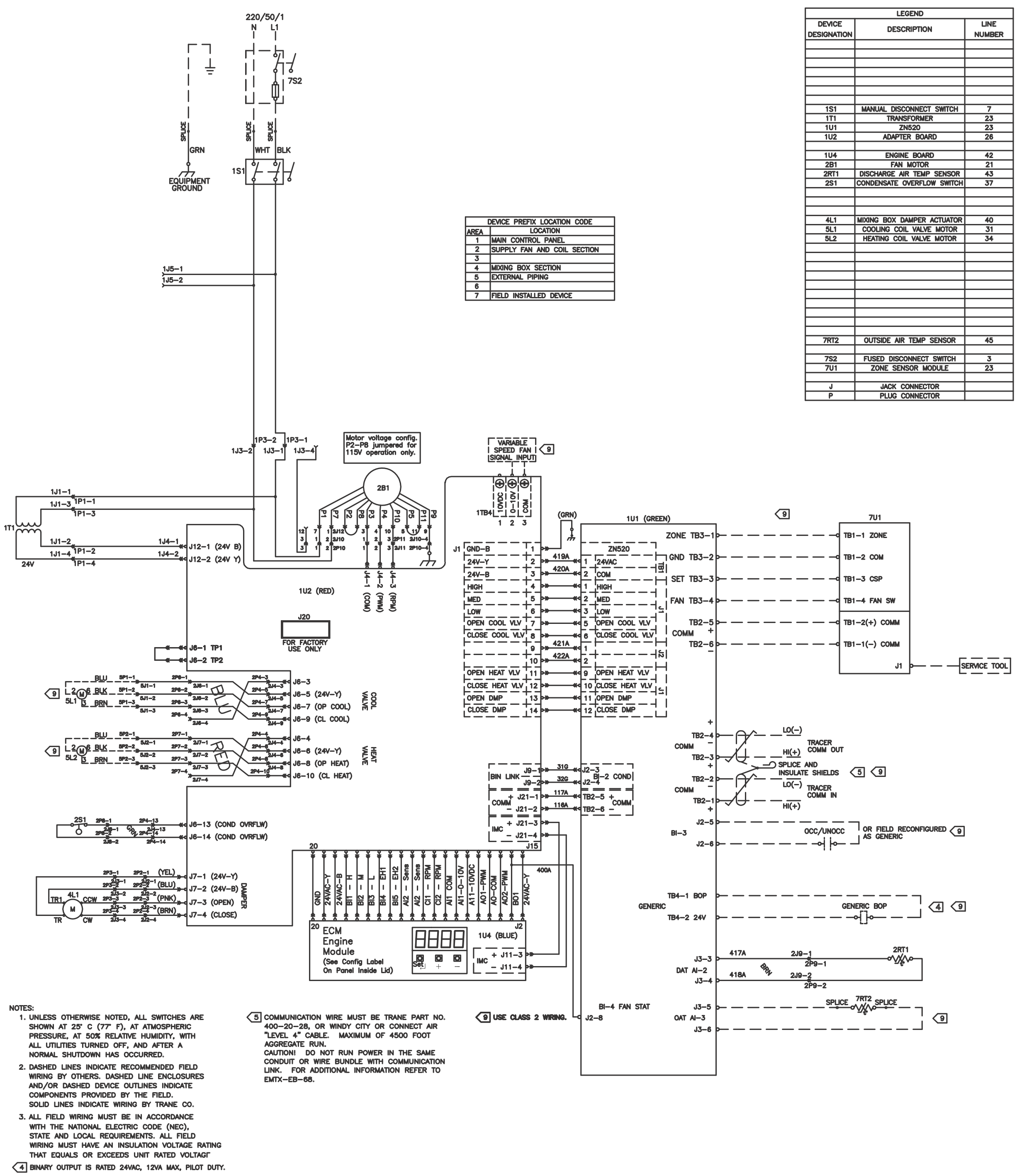
5 COMMUNICATION WIRE MUST BE TRANE PART NO. 400–20–28, OR WINDY CITY OR CONNECT AIR "LEVEL 4" CABLE. MAXIMUM OF 4500 FOOT AGGREGATE RUN. CAUTION! DO NOT RUN POWER IN THE SAME CONDUIT OR WIRE BUNDLE WITH COMMUNICATION LINK. FOR ADDITIONAL INFORMATION REFER TO EMTX–EB–68.

9 USE CLASS 2 WIRING.

Four-Pipe BCXD with Tracer ZN520

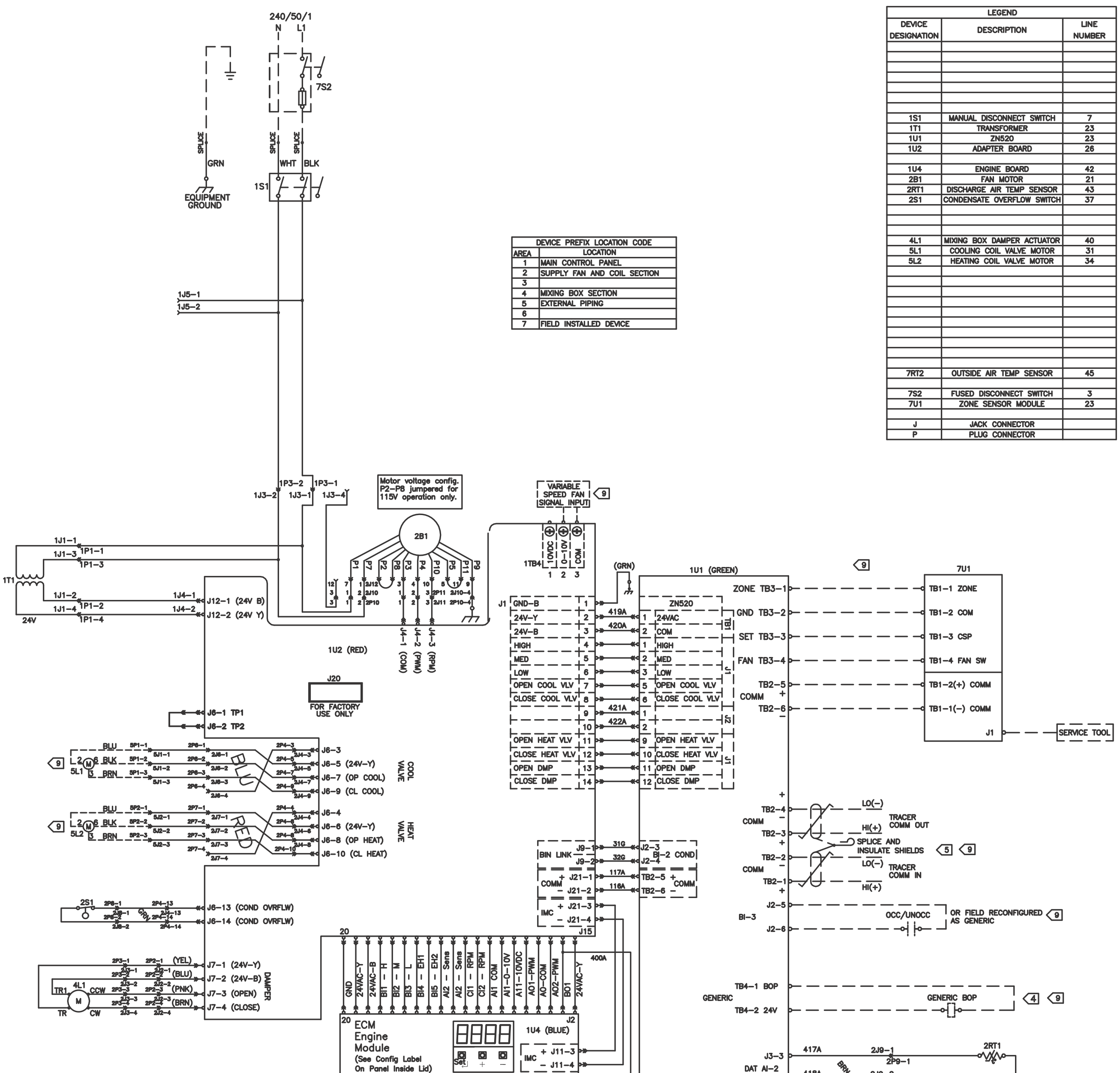
- 460 volt/3-phase
- 3-wire floating point valves
- Economizer damper
- Fan status switch
- Condensate overflow
- Wall-mounted zone sensor

Figure 68. Four-pipe BCXD with Tracer ZN520



Four-Pipe BCXD with Tracer UC400

Figure 69. Four-pipe BCXD with Tracer UC400



LEGEND		
DEVICE DESIGNATION	DESCRIPTION	LINE NUMBER
1S1	MANUAL DISCONNECT SWITCH	7
1T1	TRANSFORMER	23
1U1	ZN520	23
1U2	ADAPTER BOARD	26
1U4	ENGINE BOARD	42
2B1	FAN MOTOR	21
2RT1	DISCHARGE AIR TEMP SENSOR	43
2S1	CONDENSATE OVERFLOW SWITCH	37
4L1	MIXING BOX DAMPER ACTUATOR	40
5L1	COOLING COIL VALVE MOTOR	31
5L2	HEATING COIL VALVE MOTOR	34
7RT2	OUTSIDE AIR TEMP SENSOR	45
7S2	FUSED DISCONNECT SWITCH	3
7U1	ZONE SENSOR MODULE	23
J	JACK CONNECTOR	
P	PLUG CONNECTOR	

DEVICE PREFIX LOCATION CODE	
AREA	LOCATION
1	MAIN CONTROL PANEL
2	SUPPLY FAN AND COIL SECTION
3	
4	MIXING BOX SECTION
5	EXTERNAL PIPING
6	
7	FIELD INSTALLED DEVICE

NOTES.

1. UNLESS OTHERWISE NOTED, ALL SWITCHES ARE SHOWN AT 25° C (77° F), AT ATMOSPHERIC PRESSURE, AT 50% RELATIVE HUMIDITY, WITH ALL UTILITIES TURNED OFF, AND AFTER A NORMAL SHUTDOWN HAS OCCURRED.
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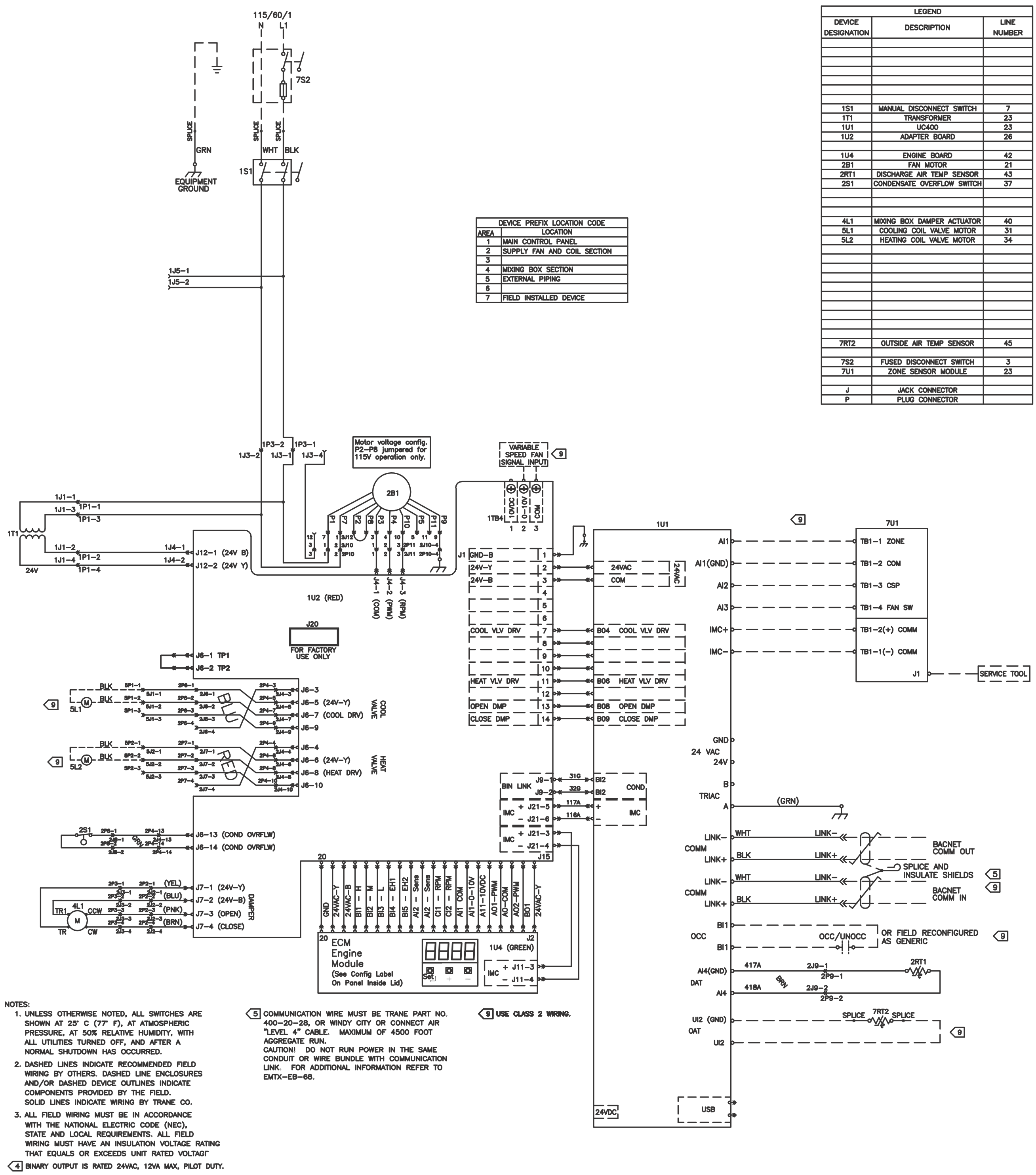
4 BINARY OUTPUT IS RATED 24VAC, 12VA MAX, PILOT DUTY.

5 COMMUNICATION WIRE MUST BE TRANE PART NO. 400–20–28, OR WINDY CITY OR CONNECT AIR "LEVEL 4" CABLE. MAXIMUM OF 4500 FOOT AGGREGATE RUN. CAUTION! DO NOT RUN POWER IN THE SAME CONDUIT OR WIRE BUNDLE WITH COMMUNICATION LINK. FOR ADDITIONAL INFORMATION REFER TO EMTX–EB–68.

9 USE CLASS 2 WIRING.

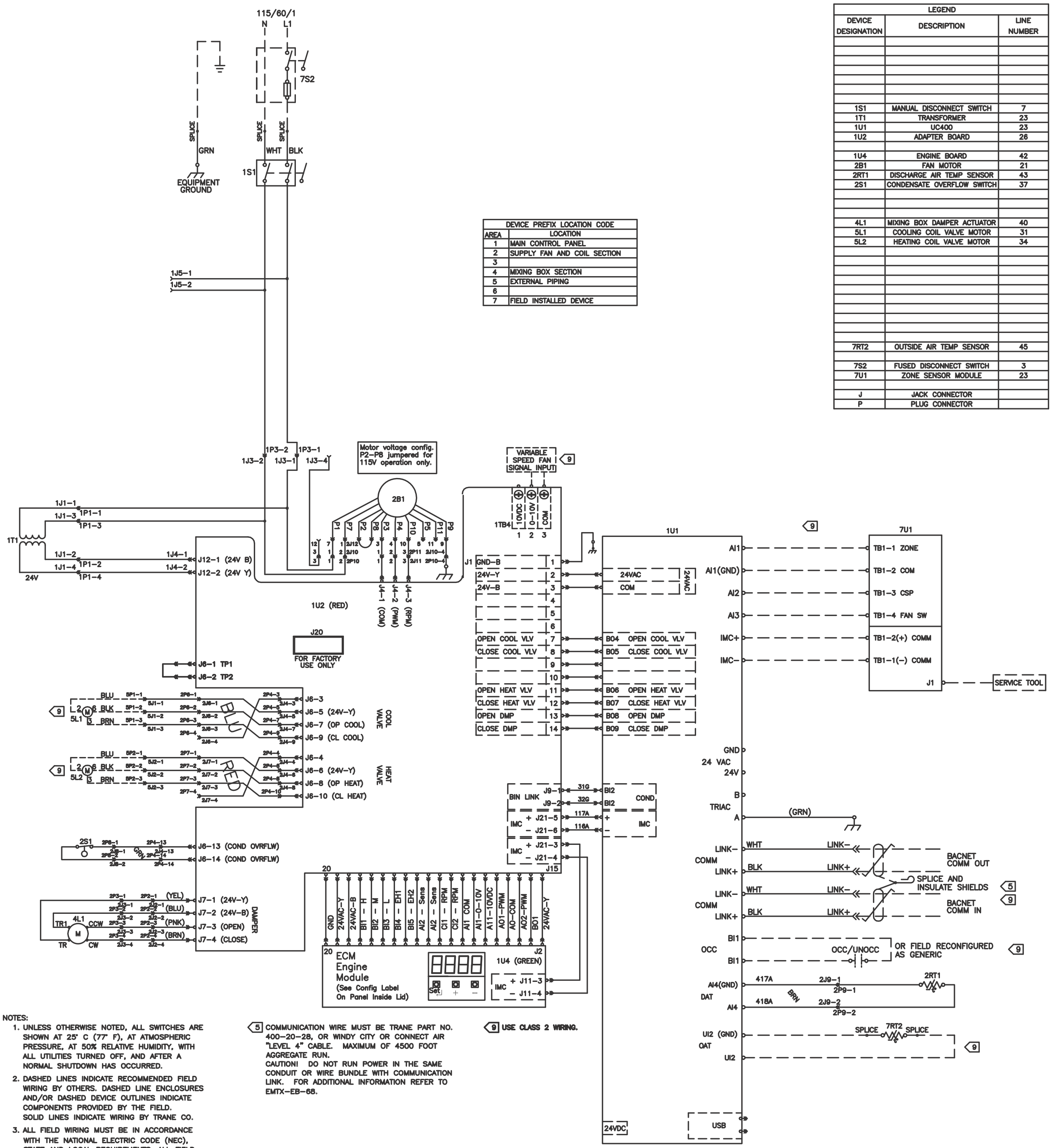
Four-Pipe BCXD with Tracer UC400 and Wall-Mounted Sensor

Figure 70. Four-pipe BCXD with Tracer UC400 and Wall-Mounted Sensor



Four-Pipe BCXD with Tracer UC400 and Modulating Valves

Figure 71. Four-pipe BCXD with Tracer UC400 and Modulating Valves



LEGEND		
DEVICE DESIGNATION	DESCRIPTION	LINE NUMBER
1S1	MANUAL DISCONNECT SWITCH	7
1T1	TRANSFORMER	23
1U1	UC400	23
1U2	ADAPTER BOARD	26
1U4	ENGINE BOARD	42
2B1	FAN MOTOR	21
2RT1	DISCHARGE AIR TEMP SENSOR	43
2S1	CONDENSATE OVERFLOW SWITCH	37
4L1	MIXING BOX DAMPER ACTUATOR	40
5L1	COOLING COIL VALVE MOTOR	31
5L2	HEATING COIL VALVE MOTOR	34
7RT2	OUTSIDE AIR TEMP SENSOR	45
7S2	FUSED DISCONNECT SWITCH	3
7U1	ZONE SENSOR MODULE	23
J	JACK CONNECTOR	
P	PLUG CONNECTOR	

DEVICE PREFIX LOCATION CODE	
AREA	LOCATION
1	MAIN CONTROL PANEL
2	SUPPLY FAN AND COIL SECTION
3	
4	MIXING BOX SECTION
5	EXTERNAL PIPING
6	
7	FIELD INSTALLED DEVICE

NOTES:

1. UNLESS OTHERWISE NOTED, ALL SWITCHES ARE SHOWN AT 25° C (77° F), AT ATMOSPHERIC PRESSURE, AT 50% RELATIVE HUMIDITY, WITH ALL UTILITIES TURNED OFF, AND AFTER A NORMAL SHUTDOWN HAS OCCURRED.
2. DASHED LINES INDICATE RECOMMENDED FIELD WIRING BY OTHERS. DASHED LINE ENCLOSURES AND/OR DASHED DEVICE OUTLINES INDICATE COMPONENTS PROVIDED BY THE FIELD. SOLID LINES INDICATE WIRING BY TRANE CO.
3. ALL FIELD WIRING MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE (NEC), STATE AND LOCAL REQUIREMENTS. ALL FIELD WIRING MUST HAVE AN INSULATION VOLTAGE RATING THAT EQUALS OR EXCEEDS UNIT RATED VOLTAGr

4 BINARY OUTPUT IS RATED 24VAC, 12VA MAX, PILOT DUTY.

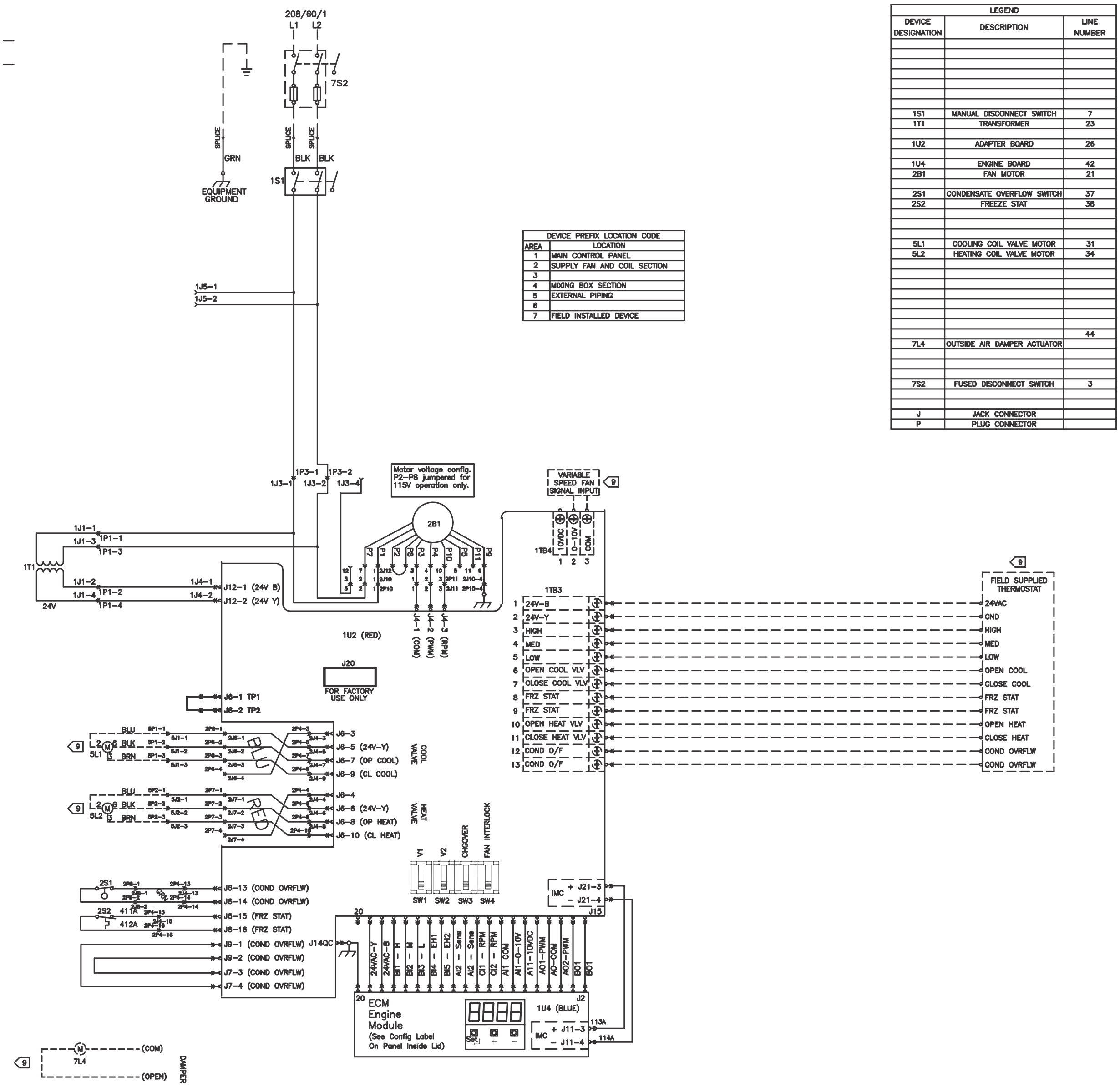
5 COMMUNICATION WIRE MUST BE TRANE PART NO. 400–20–28, OR WINDY CITY OR CONNECT AIR "LEVEL 4" CABLE. MAXIMUM OF 4500 FOOT AGGREGATE RUN.
CAUTION! DO NOT RUN POWER IN THE SAME CONDUIT OR WIRE BUNDLE WITH COMMUNICATION LINK. FOR ADDITIONAL INFORMATION REFER TO EMTX–EB–68.

9 USE CLASS 2 WIRING.

Four-Pipe BCXD with Control Interface

- 208 volt/3-phase
- 3-wire floating point valves
- 2-position damper
- Low limit protection
- Condensate overflow

Figure 72. Four-pipe BCXD with Control Interface



LEGEND		
DEVICE DESIGNATION	DESCRIPTION	LINE NUMBER
1S1	MANUAL DISCONNECT SWITCH	7
1T1	TRANSFORMER	23
1U2	ADAPTER BOARD	26
1U4	ENGINE BOARD	42
2B1	FAN MOTOR	21
2S1	CONDENSATE OVERFLOW SWITCH	37
2S2	FREEZE STAT	38
5L1	COOLING COIL VALVE MOTOR	31
5L2	HEATING COIL VALVE MOTOR	34
		44
7L4	OUTSIDE AIR DAMPER ACTUATOR	
7S2	FUSED DISCONNECT SWITCH	3
J	JACK CONNECTOR	
P	PLUG CONNECTOR	

DEVICE PREFIX LOCATION CODE	
AREA	LOCATION
1	MAIN CONTROL PANEL
2	SUPPLY FAN AND COIL SECTION
3	
4	MIXING BOX SECTION
5	EXTERNAL PIPING
6	
7	FIELD INSTALLED DEVICE

NOTES:

1. UNLESS OTHERWISE NOTED, ALL SWITCHES ARE SHOWN AT 25° C (77° F), AT ATMOSPHERIC PRESSURE, AT 50% RELATIVE HUMIDITY, WITH ALL UTILITIES TURNED OFF, AND AFTER A NORMAL SHUTDOWN HAS OCCURRED.
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3. ALL FIELD WIRING MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE (NEC), STATE AND LOCAL REQUIREMENTS. ALL FIELD WIRING MUST HAVE AN INSULATION VOLTAGE RATING THAT EQUALS OR EXCEEDS UNIT RATED VOLTAGr

4 BINARY OUTPUT IS RATED 24VAC, 12VA MAX, PILOT DUTY.

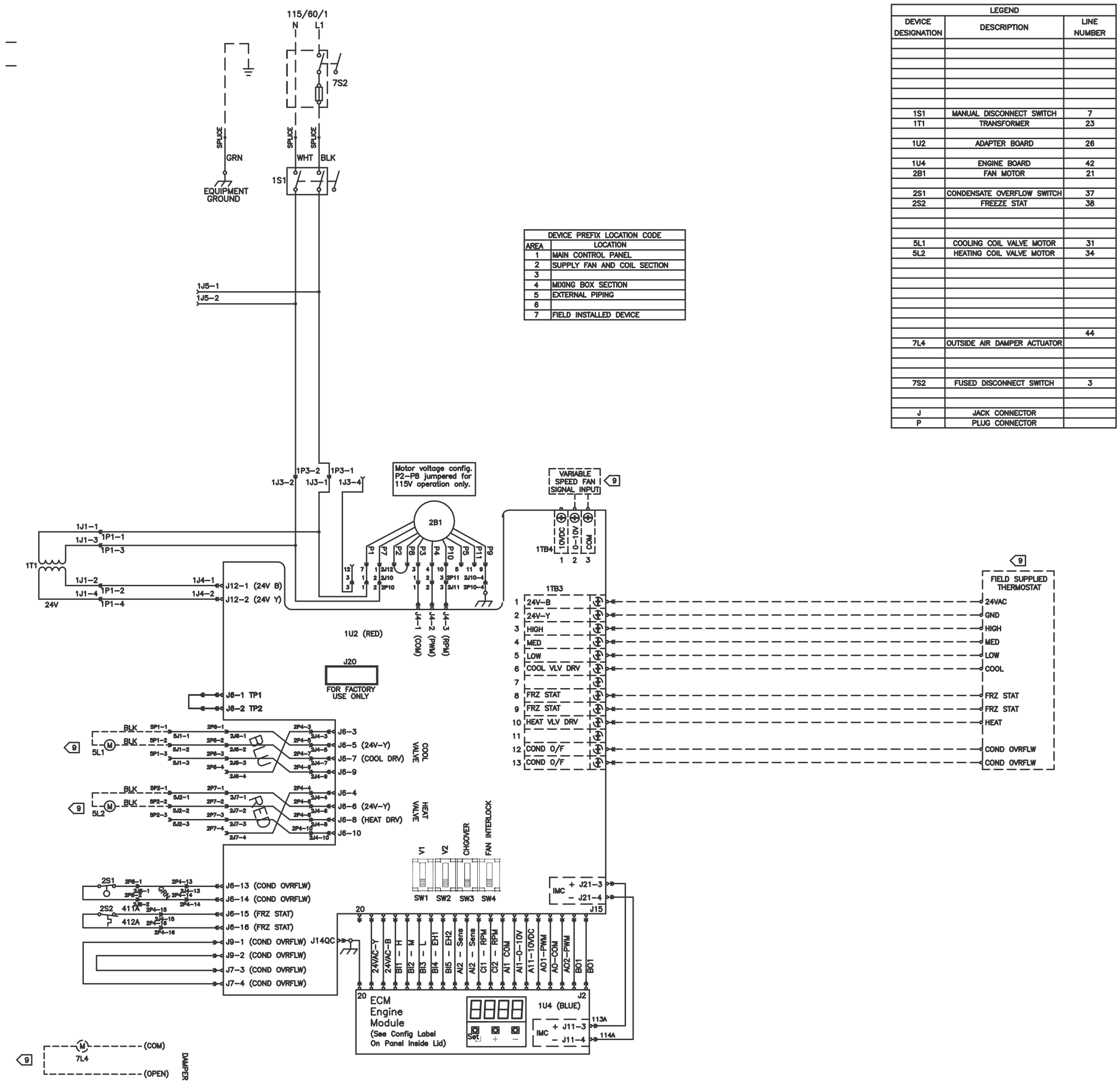
5 COMMUNICATION WIRE MUST BE TRANE PART NO. 400-20-28, OR WINDY CITY OR CONNECT AIR "LEVEL 4" CABLE. MAXIMUM OF 4500 FOOT AGGREGATE RUN. CAUTION! DO NOT RUN POWER IN THE SAME CONDUIT OR WIRE BUNDLE WITH COMMUNICATION LINK. FOR ADDITIONAL INFORMATION REFER TO EMTX-EB-68.

9 USE CLASS 2 WIRING.

Four-Pipe BCXD with Control Interface

- 115 volt/1-phase
- 2-position damper
- 2-speed motor
- Condensate overflow
- Low limit protection

Figure 73. Four-pipe BCXD with Control Interface



DEVICE PREFIX LOCATION CODE	
AREA	LOCATION
1	MAIN CONTROL PANEL
2	SUPPLY FAN AND COIL SECTION
3	
4	MIXING BOX SECTION
5	EXTERNAL PIPING
6	
7	FIELD INSTALLED DEVICE

LEGEND		
DEVICE DESIGNATION	DESCRIPTION	LINE NUMBER
1S1	MANUAL DISCONNECT SWITCH	7
1T1	TRANSFORMER	23
1U2	ADAPTER BOARD	26
1U4	ENGINE BOARD	42
2B1	FAN MOTOR	21
2S1	CONDENSATE OVERFLOW SWITCH	37
2S2	FREEZE STAT	38
5L1	COOLING COIL VALVE MOTOR	31
5L2	HEATING COIL VALVE MOTOR	34
		44
7L4	OUTSIDE AIR DAMPER ACTUATOR	
7S2	FUSED DISCONNECT SWITCH	3
J	JACK CONNECTOR	
P	PLUG CONNECTOR	

NOTES:

1. UNLESS OTHERWISE NOTED, ALL SWITCHES ARE SHOWN AT 25° C (77° F), AT ATMOSPHERIC PRESSURE, AT 50% RELATIVE HUMIDITY, WITH ALL UTILITIES TURNED OFF, AND AFTER A NORMAL SHUTDOWN HAS OCCURRED.
2. DASHED LINES INDICATE RECOMMENDED FIELD WIRING BY OTHERS. DASHED LINE ENCLOSURES AND/OR DASHED DEVICE OUTLINES INDICATE COMPONENTS PROVIDED BY THE FIELD. SOLID LINES INDICATE WIRING BY TRANE CO.
3. ALL FIELD WIRING MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE (NEC), STATE AND LOCAL REQUIREMENTS. ALL FIELD WIRING MUST HAVE AN INSULATION VOLTAGE RATING THAT EQUALS OR EXCEEDS UNIT RATED VOLTAGΓ

4 BINARY OUTPUT IS RATED 24VAC, 12VA MAX, PILOT DUTY.

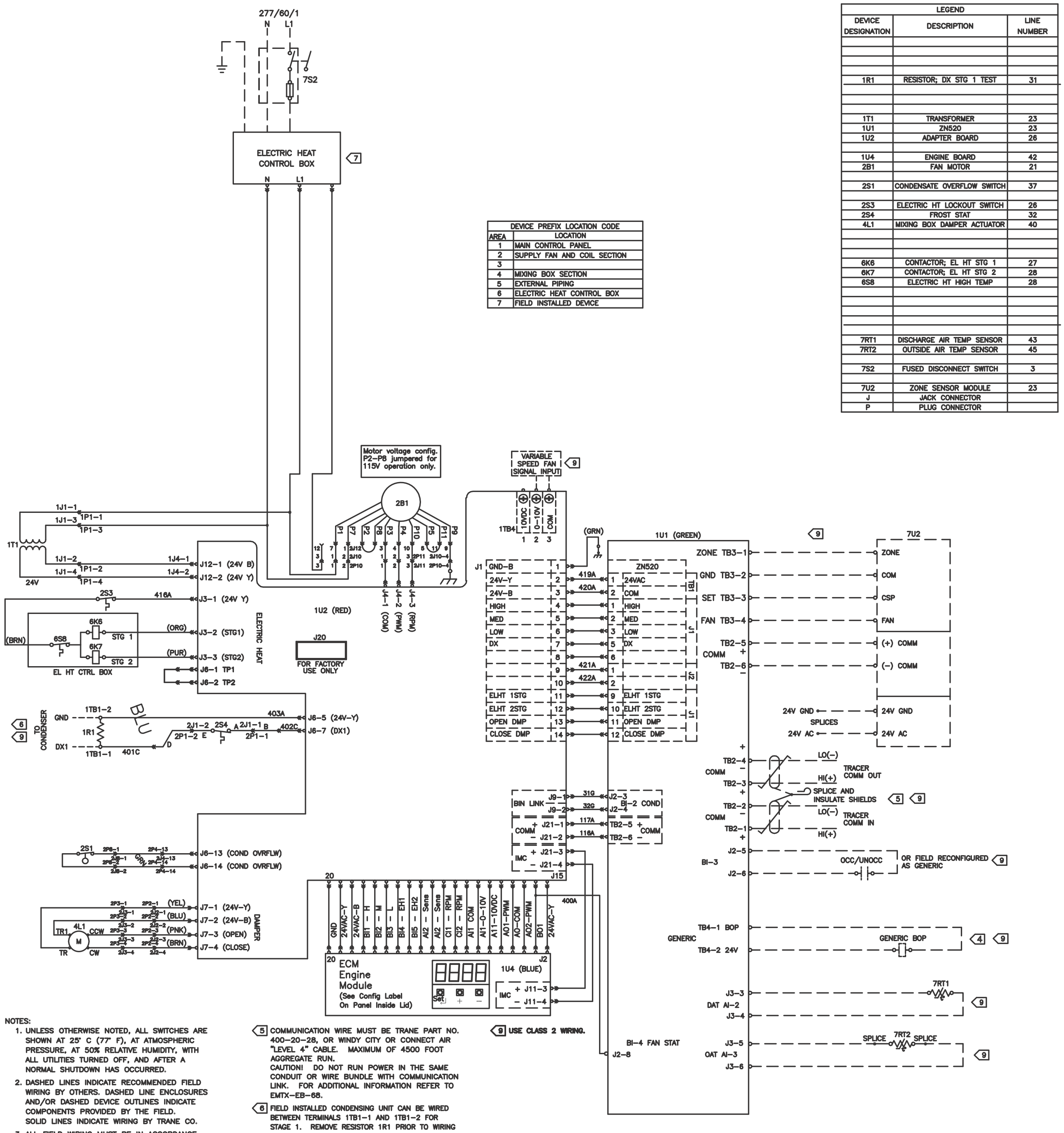
5 COMMUNICATION WIRE MUST BE TRANE PART NO. 400-20-28, OR WINDY CITY OR CONNECT AIR "LEVEL 4" CABLE. MAXIMUM OF 4500 FOOT AGGREGATE RUN. CAUTION! DO NOT RUN POWER IN THE SAME CONDUIT OR WIRE BUNDLE WITH COMMUNICATION LINK. FOR ADDITIONAL INFORMATION REFER TO EMTX-EB-68.

9 USE CLASS 2 WIRING.

BCXD with DX Coil and Tracer ZN520

- 277 volt/1-phase
- Economizer damper
- Condensate overflow
- Wall-mounted zone sensor

Figure 74. BCXD with DX Coil and Tracer ZN520



DEVICE PREFIX LOCATION CODE	
AREA	LOCATION
1	MAIN CONTROL PANEL
2	SUPPLY FAN AND COIL SECTION
3	
4	MIXING BOX SECTION
5	EXTERNAL PIPING
6	ELECTRIC HEAT CONTROL BOX
7	FIELD INSTALLED DEVICE

LEGEND		
DEVICE DESIGNATION	DESCRIPTION	LINE NUMBER
1R1	RESISTOR; DX STG 1 TEST	31
1T1	TRANSFORMER	23
1U1	ZN520	23
1U2	ADAPTER BOARD	26
1U4	ENGINE BOARD	42
2B1	FAN MOTOR	21
2S1	CONDENSATE OVERFLOW SWITCH	37
2S3	ELECTRIC HT LOCKOUT SWITCH	26
2S4	FROST STAT	32
4L1	MIXING BOX DAMPER ACTUATOR	40
6K6	CONTACTOR; EL HT STG 1	27
6K7	CONTACTOR; EL HT STG 2	28
6S8	ELECTRIC HT HIGH TEMP	28
7RT1	DISCHARGE AIR TEMP SENSOR	43
7RT2	OUTSIDE AIR TEMP SENSOR	45
7S2	FUSED DISCONNECT SWITCH	3
7U2	ZONE SENSOR MODULE	23
J	JACK CONNECTOR	
P	PLUG CONNECTOR	

NOTES:

1. UNLESS OTHERWISE NOTED, ALL SWITCHES ARE SHOWN AT 25° C (77° F), AT ATMOSPHERIC PRESSURE, AT 50% RELATIVE HUMIDITY, WITH ALL UTILITIES TURNED OFF, AND AFTER A NORMAL SHUTDOWN HAS OCCURRED.
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3. ALL FIELD WIRING MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE (NEC), STATE AND LOCAL REQUIREMENTS. ALL FIELD WIRING MUST HAVE AN INSULATION VOLTAGE RATING THAT EQUALS OR EXCEEDS UNIT RATED VOLTAGE

4 BINARY OUTPUT IS RATED 24VAC, 12VA MAX, PILOT DUTY.

5 COMMUNICATION WIRE MUST BE TRANE PART NO. 400-20-28, OR WINDY CITY OR CONNECT AIR "LEVEL 4" CABLE. MAXIMUM OF 4500 FOOT AGGREGATE RUN. CAUTION! DO NOT RUN POWER IN THE SAME CONDUIT OR WIRE BUNDLE WITH COMMUNICATION LINK. FOR ADDITIONAL INFORMATION REFER TO EMTX-EB-68.

6 FIELD INSTALLED CONDENSING UNIT CAN BE WIRED BETWEEN TERMINALS 1TB1-1 AND 1TB1-2 FOR STAGE 1. REMOVE RESISTOR 1R1 PRIOR TO WIRING CONDENSER. DX1 OUTPUTS RATED FOR 24VAC 6VA MAXIMUM.

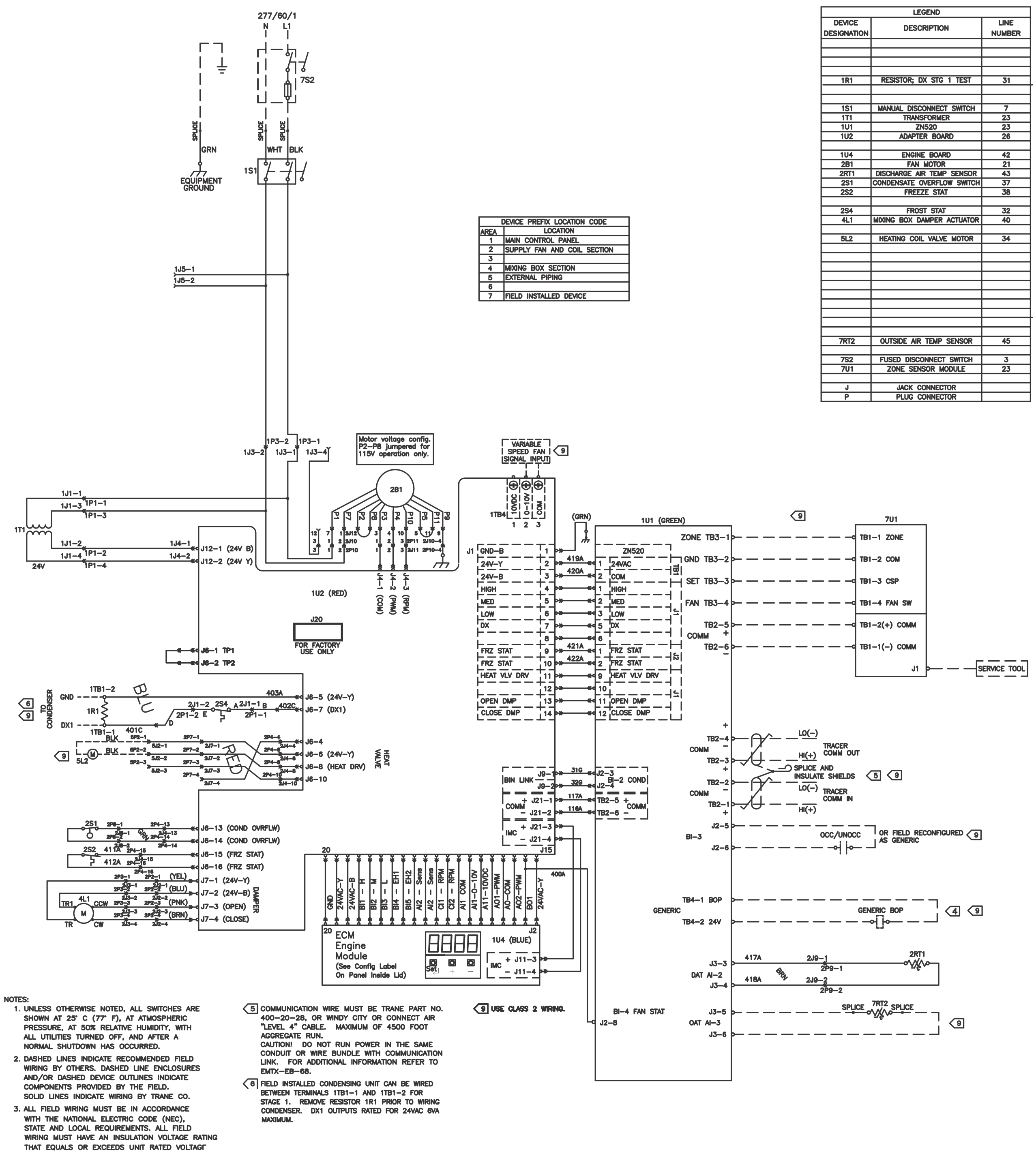
7 ELECTRIC HEAT SCHEMATIC IS LOCATED IN THE ELECTRIC HEAT CONTROL BOX PANEL.

9 USE CLASS 2 WIRING.

BCXD with DX Coil, Hydronic Heating, and Tracer ZN520

- 460 volt/3-phase
- Economizer damper
- Condensate overflow
- Wall-mounted zone sensor

Figure 75. BCXD with DX coil, hydronic heating, and Tracer ZN520



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