Model DSH024C–120C Horizontal R-410A Air Conditioning Units C-Generation Smart Equipment Controller

Installation Guide

Issue date: 2021-03-22

Form number: 145.32-IOM5 (321)

Supersedes: 145.32-IOM5 (1220)

Contents

General safety guidelines

Important!

Read before proceeding!

This equipment is a relatively complicated apparatus. During rigging, installation, operation, maintenance, or service, individuals may be exposed to certain components or conditions including, but not limited to: heavy objects, refrigerants, materials under pressure, rotating components, and both high and low voltage. Each of these items has the potential, if misused or handled improperly, to cause bodily injury or death. It is the obligation and responsibility of rigging, installation, and operating/service personnel to identify and recognize these inherent hazards, protect themselves, and proceed safely in completing their tasks. Failure to comply with any of these requirements could result in serious damage to the equipment and the property in which it is situated, as well as severe personal injury or death to themselves and others at the site.

This document is intended for use by owner-authorized rigging, installation, and operating/service personnel. It is expected that these individuals possess independent training that will enable them to perform their assigned tasks properly and safely. It is essential that, prior to performing any task on this equipment, this individual shall have read and understood the on-product labels, this document and any referenced materials. This individual shall also be familiar with and comply with all applicable industry and governmental standards and regulations pertaining to the task in question.

Safety symbols

The following symbols are used in this document to alert the reader to specific situations:

DANGER

Indicates a possible hazardous situation which will result in death or serious injury if proper care is not taken.

WARNING

Indicates a potentially hazardous situation which will result in possible injuries or damage to equipment if proper care is not taken.

CAUTION

Identifies a hazard which could lead to damage to the machine, damage to other equipment and/or environmental pollution if proper care is not taken or instructions and are not followed.

Note: Highlights additional information useful to the technician in completing the work being performed properly.

⚠ WARNING

External wiring, unless specified as an optional connection in the manufacturer's product line, is not to be connected inside the control cabinet. Devices such as relays, switches, transducers and controls and any external wiring must not be installed inside the micro panel. All wiring must be in accordance with the manufacturer's published specifications and must be performed only by a qualified electrician. The manufacturer will NOT be responsible for damage/problems resulting from improper connections to the controls or application of improper control signals. Failure to follow this warning will void the manufacturer's warranty and cause serious damage to property or personal injury.

⚠ **WARNING:** This product can expose you to chemicals including formaldehyde, which is known to the state of California to cause cancer. For more information, go to www.P65Warnings.ca.gov.

Changeability of this document

In complying with the manufacturer's' policy for continuous product improvement, the information contained in this document is subject to change without notice. There is no commitment to update or provide current information automatically to the manual or product owner. Updated manuals, if applicable, can be obtained by contacting the nearest service office.

It is the responsibility of rigging, lifting, and operating/service personnel to verify the applicability of these documents to the equipment. If there is any question regarding the applicability of these documents, rigging, lifting, and operating/service personnel should verify whether the equipment has been modified and if current literature is available from the owner of the equipment prior to performing any work on the equipment.

Revision notes

Revisions made to this document are indicated in the following table. These revisions are to technical information, and any other changes in spelling, grammar, or formatting are not included.

Affected section	Description	Date implemented
Nomenclature	Updated notes for DSH Nomenclature	March 2020
Figure 14	Figure 14 caption and notes 1 and 2 updated to reflect two-stage discrete heating and single stage cooling.	March 2020
Figure 16	Figure 16 caption and note 3 updated to reflect four-stage cooling	March 2020
Appendix B: SEC parameters for DSH024C–DSH120C units	Added Appendix B: SEC Parameters for DSH024C–DSH120C Units	March/April 2020
Figure 15 and Figure 16	Updated Figure 15 and Figure 16 to remove optional jumper cable, and added note 1 to require installation of a thermostat that supports all stages of operation.	April 2020
Cabinet configuration options	Added a DANGER warning to the Cabinet Configuration Options section.	May 2020
Nomenclature	Updated Nomenclature	November 2020

Associated literature

Manual description	Form number
Mobile Access Portal Gateway Product Bulletin	LIT-12011884
Airside Economizer Kit for Models DSH/DSV Air Cooled Air Conditioning Units, C Generation, Installation and Operation Instructions	145.10-NO2
Low Ambient Damper Kit for Air-Cooled Self-Contained Units DSH/DSV Models, B/C Styles, Installation and Operation Instructions	145.10-IOM4
DSV/DSH and CSV Air and Water-Cooled Self-Contained Units Start-Up and Performance Checklist	145.13-CL1
Variable Frequency Drive for D-Series (DSV/DSH) Air-Cooled Self-Contained Units, C Generation	145.13-NO2
Smart Equipment Controls (SEC) Parameters for DSH Units, Style C	145.32-IOM5 (LS01)
General Piping Recommendations and Refrigerant Line Length for Split-System Air Conditioners and Heat Pumps	247077-UAD-H-0209

Technical support

If Technical Support is required, please contact the Product Technical Support team at 877-329-7430 or AppliedDXTechSupport@jci.com.

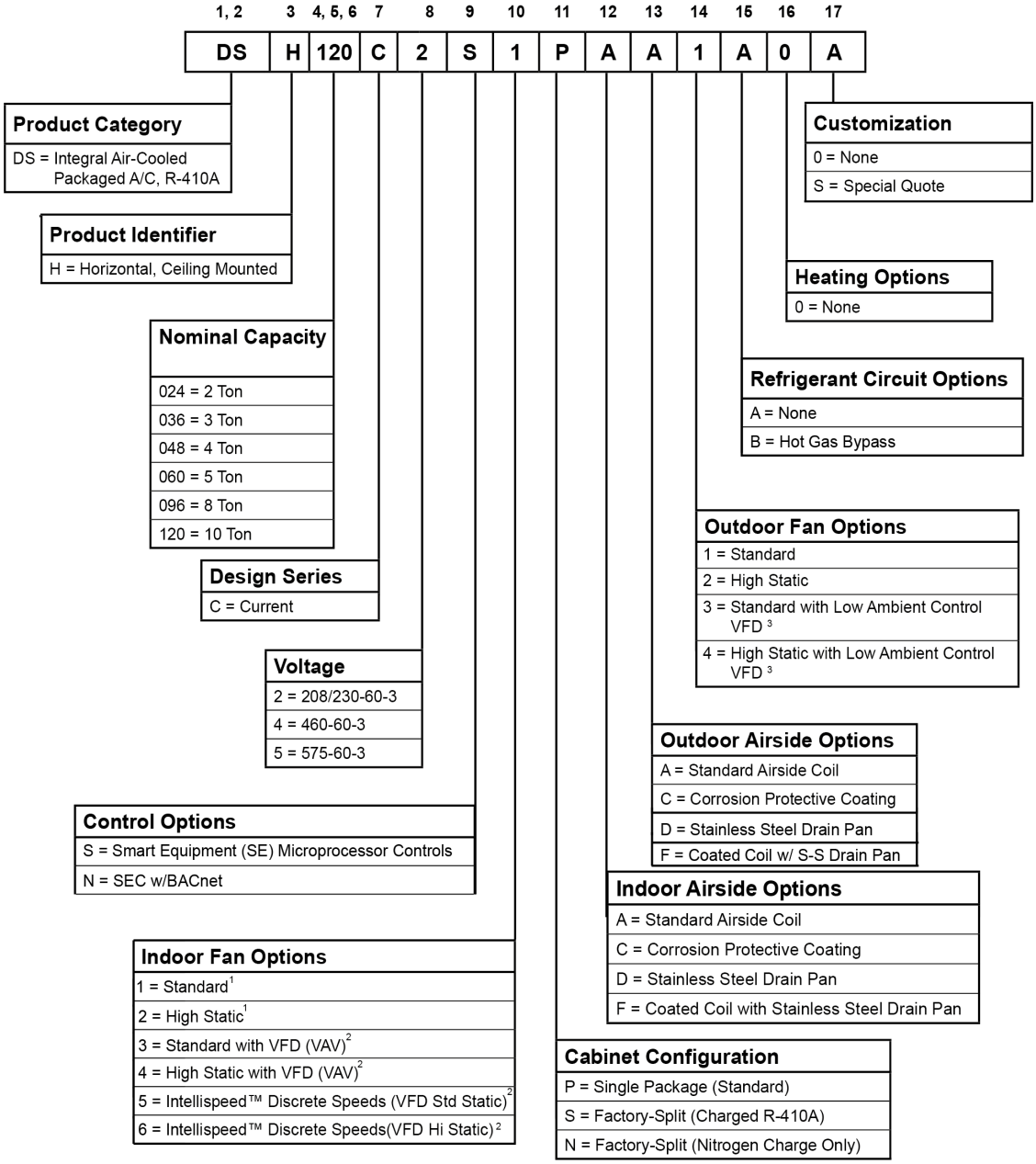
Replacement parts

For replacement parts, please contact your local Source1 Dealer.

Source1 Parts Phone Number: 800-536-6112

Source1 Parts Website: http://www.source1parts.com

Nomenclature



Note:

1. Evaporator and condenser motor VFD option available only on 8 ton units and up.
2. Evaporator motor VFD standard on 8 ton units and up.
3. Condenser VFD not available in 575V.
4. Evaporator motor without VFD available only on 2, 3, 4 and 5 ton.

Installation

Models 2–8 tons can be ordered as packaged, factory-charged unitized packages, or as factory-split. The 10 ton model comes factory-split.

All units are lined with 1/2-inch thick and 2 pound density acoustical insulation to ensure quiet operation. All models are provided with medium-efficiency 2-inch thick throwaway filters rated MERV 7.

The 2–5 ton units use a single scroll compressor. The 8–10 ton units use a dual scroll compressor with two independent refrigerant circuits. The 8 ton unit uses one single speed scroll compressor and one two-stage scroll compressor, giving the unit three effective cooling stages. The 10 ton unit features two 2 stage compressors, which allows for four stage cooling.

All units come standard with a Smart Equipment (SE) microprocessor control board with safety controls and troubleshooting LEDs (see Microprocessor Controller on page 41 for more details).

Units operate reliably at outdoor ambient down to 50.0°F. In applications requiring operation below this temperature, either a low ambient damper field kit accessory or low ambient control featuring a variable frequency drive (VFD) on condenser fan is available (condenser fan VFD is available as a factory installed option only on 8 and 10 ton units).

The damper is installed on the condenser air discharge and is allowed operation to 0.0°F ambient.

The VFD on the condenser is factory installed on the corner post in the condenser section of the unit. The VFD on the condenser allows operation to 0.0°F ambient, which is needed to maintain a proper refrigerant head pressure.

⚠ CAUTION

Only qualified personnel should perform installation and service of this equipment.

Pre-installation inspection of equipment

All units are factory tested to ensure safe operation and quality assembly. The units are packaged and sealed on shipping skids and ship in first class condition. Report to the carrier any torn or broken packaging, or scratched or dented panels.

Prior to installation, internally inspect all units. Remove all the access doors and check for visual defects that can occur during transport. Any problems found internally should be immediately reported to the carrier and the manufacturer. Check the refrigerant circuit to ensure no leaks have occurred during shipment.

Install the gauge set to high and low pressure ports to confirm the pressure has been maintained and no leaks have occurred during shipment. To ensure safe operation, repair any damage.

ⓘ **Note:** Record any unit damage on the Bill of Lading and report to carrier and factory immediately. Shipping and handling damages are not warranty items.

⚠ WARNING

Prior to mounting unit, check individual unit weights (Table 1 on page 11) and verify lifting capacity of lifting equipment exceeds weight of units by safe margins. Failure to do so may result in unit damage, personal injury, or even death.

Rigging

To ensure safe installation of the unit when a ceiling mount application is specified, estimate the unit's approximate center of gravity. The configuration of internal components for each unit is different and the weight is unevenly distributed.

⚠ WARNING

Determine the actual center of gravity of the unit by performing a test lift. Lifting an unbalanced unit can cause personal injury, or even death.

Installation site

⚠ CAUTION

Lock all electrical power supply switches in the OFF position before installing the unit. Failure to disconnect the power supply may result in electrical shock or even death.

Location

To ensure the unit operates at maximum efficiencies, choose a dry indoor area where the temperature is controlled between 50.0°F and 115.0°F. When choosing a location to install the unit, consider the surrounding area. Occupants may object to common vibration and sound levels associated with the unit.

⚠ WARNING

Failure to allow adequate space between units, condenser intake and discharge may result in poor unit performance and possible unit failure.

Install thermostats, air supplies, and returns so that each unit operates only on an individual unit control. To assure fast drainage of the condensate run-off, the unit can be slightly pitched in the same direction as the drain pan outlet.

Cabinet configuration options

Horizontal units have two parts: an evaporator and a condenser section. To minimize installation costs and delays on site, it is recommended to order the units in the appropriate configuration. Units 2–8 tons can be ordered from the factory as either packaged or split. The 10 ton unit only comes factory-split.

Here are examples of cabinet configurations. See Nomenclature for other available options:

<table>
<tr><td>P</td><td>Applies to only 2–8 ton models. The unit comes assembled as a packaged unit and factory charged with R-410A refrigerant.

P is ideal for installations where the unit is installed as a packaged system. While moving the equipment into position or during installation, no separation is required.</td></tr>
<tr><td>S</td><td>The unit is factory-split and factory-charged with R-410A refrigerant. The unit comes with refrigerant shut-off/coupling valves that hold charge in both the condenser and evaporator sections.

S is ideal for installations where the unit is installed as a packaged system. Separate evaporator and condenser sections are required during installation to move the equipment through tight spaces (for example, hallways or elevators).

Both evaporator and condenser sections contain R-410A refrigerant.</td></tr>
<tr><td>N</td><td>The unit is factory-split with a nitrogen-holding charge only. No refrigerant shut-off/coupling valves are included.

DANGER

Factory nitrogen-holding charge is 200 psig. This pressure must be released from the evaporator and condenser section BEFORE cutting any refrigerant lines for installation.

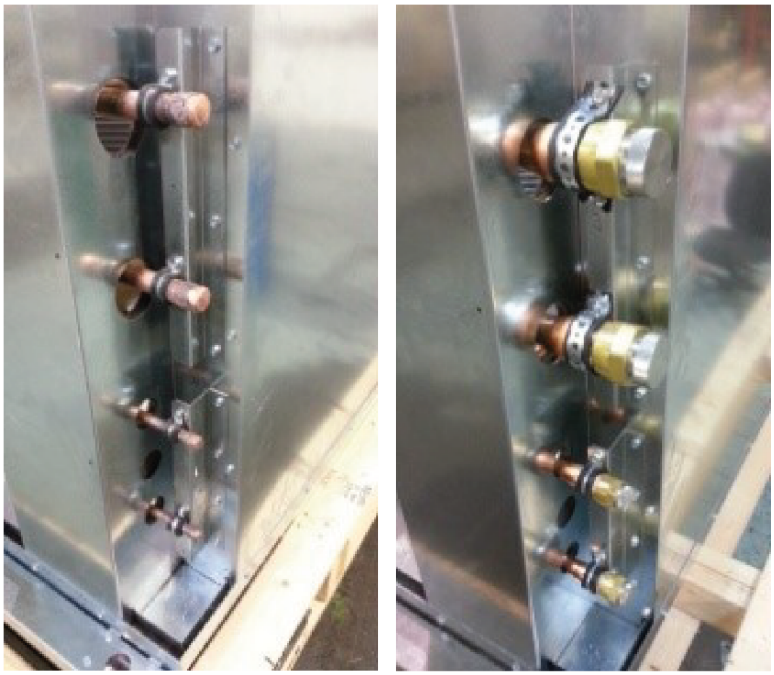
N is for installations where the unit is installed as a split system. Separate condenser and evaporator sections facilitate moving the equipment into position.</td></tr>
</table>

Unit mounting

Flanges for all duct connections, corner securing brackets, and refrigerant tubing couplings (S cabinet configurations only) ship in the condensing section of the unit for field installation. Duct flanges for evaporator return are incorporated into the filter rack.

Before assembling and piping the units, remove the tiedown straps and brackets from the refrigerant piping and couplings. See Figure 1 (8 and 10 ton models are shown).

Figure 1: Securing straps and brackets



LD27691 LD27692

Table 1: Operating weight

Unit	Operating weight (condenser only)	Shipping weight (condenser only)
DSH024C	675 (390)	715 (430)
DSH036C	680 (400)	720 (440)
DSH048C	955 (568)	1015 (608)
DSH060C	995 (593)	1065 (633)
DSH096	1470 (815)	1560 (855)
DSH120C	1800 (1020)	1870 (1060)

Note: All weights are in lbs.

Units may be either hung or floor mounted. If the unit is hung, use all the indicated mounting points, whether the unit is installed as a package or split system (see Figure 4 on page 13 and Figure 5 on page 14). Hanger rods with a minimum 1/2-inch diameter are strongly recommended.

Ensure the attachment point of the rods to the building structure is sufficient to support the unit weight. To ensure efficient condensate drainage, the unit can be pitched towards the evaporator end of the unit.

A minimum of 4-inch clearance is required under the unit to allow for trapping of the evaporator condensate drain. See Typical Service Clearances on page 20 for more unit clearance information.

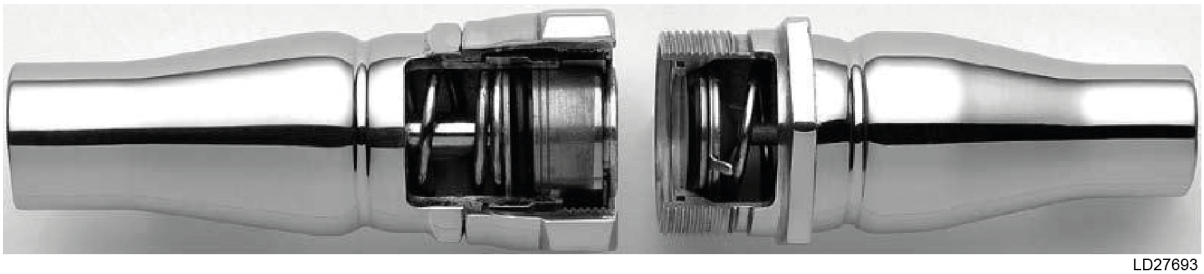
Separation of the units

All models can be ordered with refrigerant shut-off valves or couplings. These components allow the evaporator and condenser sections to ship factory-split. The evaporator and condenser can then be assembled onsite without requiring the entire unit refrigerant charge be reclaimed.

The 2–5 ton models are available with shut-off valves. The 8 and 10 ton models are available with self-sealing brass refrigerant couplings. A field-split coupling kit is available for field-split applications of 8 and 10 ton models ordered with couplings. Refer to *General Piping Recommendations and Refrigerant Line Lengths (Form 247077-UAD-H-0209)*.

The male coupling is fastened to the condenser wall via a mounting bracket. The 8 ton unit ordered as a single packaged unit can be field split. To separate the couplings without stressing the refrigerant piping, use a backup wrench on the female coupling (see Figure 3).

Figure 2: Self-sealing refrigerant couplings



LD27693

Figure 3: Packaged unit with couplings

LD27694

Once the couplings are unscrewed, the female coupling can be pulled away and allowed to rest in the opening. No loss of refrigerant occurs due to the spring-seal mechanism in the couplings.

Separating the units

The evaporator and condenser sections can be separated by performing the following procedures. These procedures are for the 2–8 ton capacities only. On the 8 ton model, unscrew all four couplings (Figure 3) with the aid of a backup wrench to separate the unit.

1. For 2–5 ton models, close all of the refrigerant isolation valves on the suction, liquid, and hot gas bypass line (if applicable). Valves are not a backseating design. Caps are wrench tight.

2. Remove the caps and turn the valve stem clockwise to seat the valve in the closed position.
3. For 2–5 ton models, use the valve access ports to reclaim the refrigerant trapped in the lines between the pairs of shut-off valves.

⚠ CAUTION

Use a TUBING CUTTER ONLY - do not use a hacksaw to cut refrigerant tubing. Otherwise serious damage can occur to refrigeration system!

4. For 2–5 ton models, cut the refrigerant line sections between the pairs of shut-off valves.

   It is recommended to make this cut where accessibility is greatest - in the condensing section of the unit. This allows the best access for reconnection or attachment of an extended line set in the case of a split system.
5. Remove the interconnecting wiring between the evaporator and condenser electrical panel. Disconnect the wire terminations in the condenser electrical panel, and pull the excess wire into the evaporator panel.
6. Remove the threaded wire bushing connecting the two electrical panels.
7. Remove the unit top-joining strip. Take care to remove only those screws that attach the joining strip to the evaporator and condenser cabinets.
8. Remove the two side cross-member angles.
9. Carefully pull the evaporator section away from the condenser section. Take care not to damage the short lengths of refrigerant tubing extending into the condenser section.

The separated evaporator and condenser modules can now be individually moved to the desired location for re-assembly or separately located for split applications. Splitting units with couplings requires a mating coupling kit. See Table 2. For split installations, the cross member angles must be field cut for each section length and re-attached.

Table 2: Field split coupling kits

Model number	Part number
DSH096C***P/DSH096C***S	DSH096B-SPLIT-KIT
DSH096C***P/DSH096C***S with Hot Gas Bypass (HGBP)	DSH096B-SPLIT-HGBP
DSH120C***S	DSH120B-SPLIT-KIT
DSH120C***S with HGBP	DSH120B-SPLIT-HGBP

ⓘ **Note:** The couplings must be protected from any foreign material, dust, or debris if they are left uncapped for any extended period of time.

Figure 4: Single compressor unit – typical installation configuration

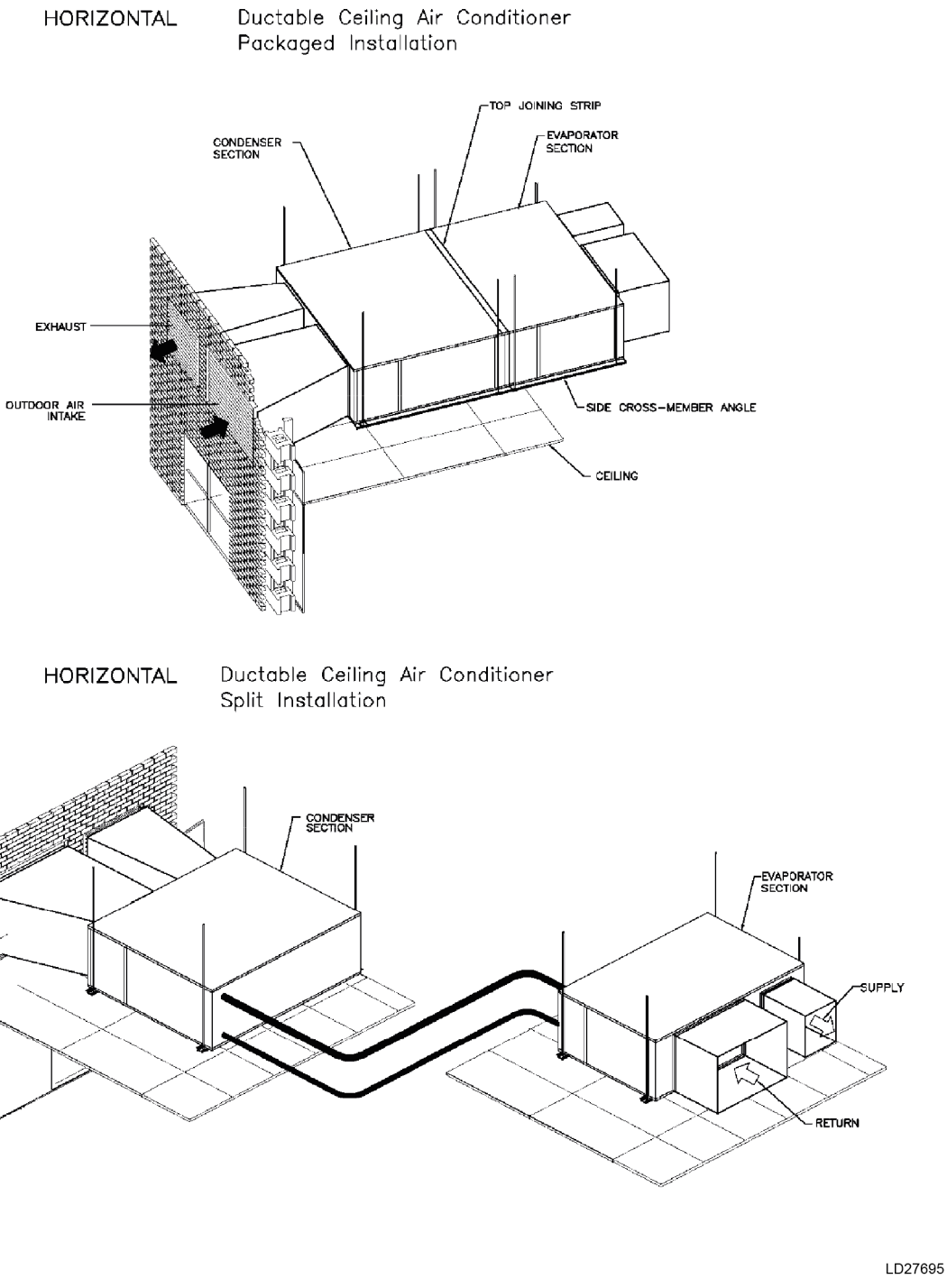
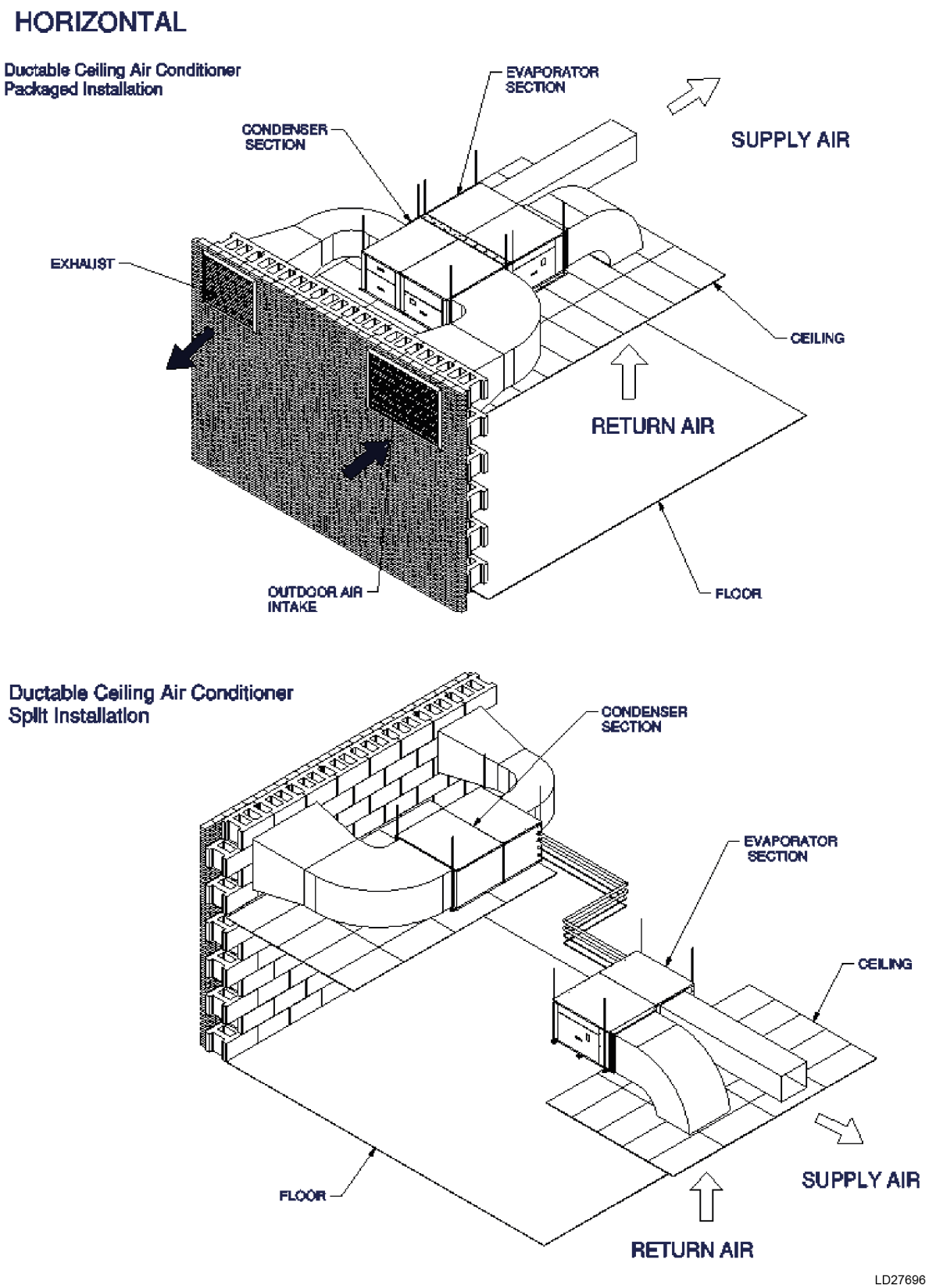


Figure 5: Dual compressor unit – typical installation configuration



When brazing couplings, ensure the following:

1. When applying paste flux to the copper tube, avoid applying excessive amounts. This prevents flux running inside the coupling where it can cause corrosion and damage.
2. Immerse the coupling in a cold water bath, ensuring the diaphragm (threaded) is fully immersed.
3. Double-tipped torches are recommended to reduce brazing time. After brazing, quench the couplings to reduce the temperature.

When assembling the couplings ensure the following:

1. Use clean oil.
2. The refrigerant oil is applied to the entire diaphragm surface, O-ring, and threaded male coupling end.
3. Before starting the threads of the female coupling nut onto the male half, coupling halves must be held in proper alignment with each other. Thread by hand the first three rotations of the union nut. If the nut does not start by hand, adjust the position of the line set or, if necessary, the unit module's position.
4. Use a backup wrench to tighten the female union nut until a definite increase in resistance is felt. At this point, most of threads have been covered by the nut. Ensure that the female and male bodies do not rotate at any point in the wrench installation.
5. Make a note of the location of the female nut to the bulkhead. Use a marker or scribe to mark a line lengthwise. Finally, tighten an additional one wrench flat or 60°. This final tightening is necessary to ensure a proper leakproof seal between the couplings.

Interconnecting refrigerant tubing

After the evaporator and condenser sections are mounted, the interconnecting refrigerant tubing can be fabricated. For cooling systems where the indoor and outdoor sections are installed at the same elevation, the refrigerant line sizes usually can be matched with factory supplied fittings. See Table 3.

ⓘ **Note:** There are exceptions for total line lengths exceeding 75 feet where pressure drop limitations are exceeded. For further information, refer to *General Piping Recommendations and Refrigerant Line Length (Form 247077-UAD-H-0209)*.

The following guidelines apply to field fabricated piping:

- Use hard drawn refrigeration type copper tubing where no appreciable amount of bending around pipes or obstructions is necessary. If soft copper must be used, take care to avoid sharp bends that may cause a restriction. Route refrigerant tubing for minimum linear length and minimum number of bends and fittings. The use of long radius elbows for all 90° bends is recommended.
- Braze all copper to copper joints with brazing rod high in silver or equivalent brazing material. DO NOT USE SOFT SOLDER.
- During brazing operations, flow an inert gas such as nitrogen through the system to prevent internal scaling and contamination.

If the piping is properly sized, traps are not required. They only increase the pressure drop across the system, further reducing capacity.

Once the brazing operation of refrigeration lines is completed, the field-brazed connections must be checked for leaks:

1. Pressurize the system with clean nitrogen 200 and 400 psig.
2. Monitor the pressure for 15–30 minutes. Use soap bubbles or alternate methods of leak-checking for all field brazed joints.
3. After completing the leak check, evacuate the interconnecting lines to hold a 350-micron vacuum for 15–30 minutes.

   If gauge pressure rises above 500 microns in one minute, then evacuation is incomplete or the system has a leak.

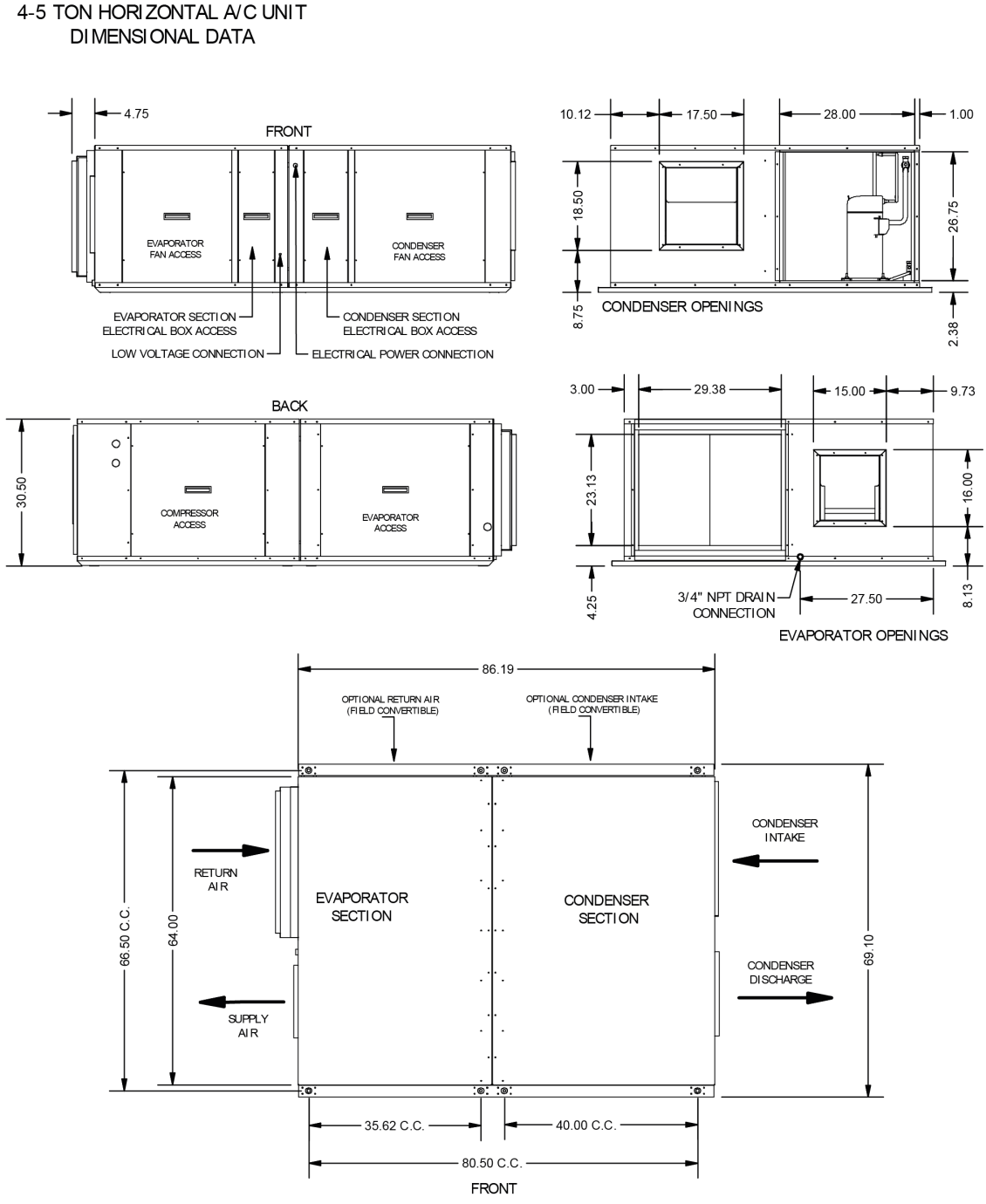
Table 3: Recommended refrigerant line sizes

Model number	Less than 75 linear feet	
	Liquid line	Suction line
DSH024C	3/8	3/4
DSH036C	3/8	3/4
DSH048C	1/2	7/8
DSH060C	1/2	7/8
DSH096C	2 X 1/2	2 X 7/8
DSH120C	2 X 1/2	2 X 7/8

Note: Measurements are in inches

Dimensional data

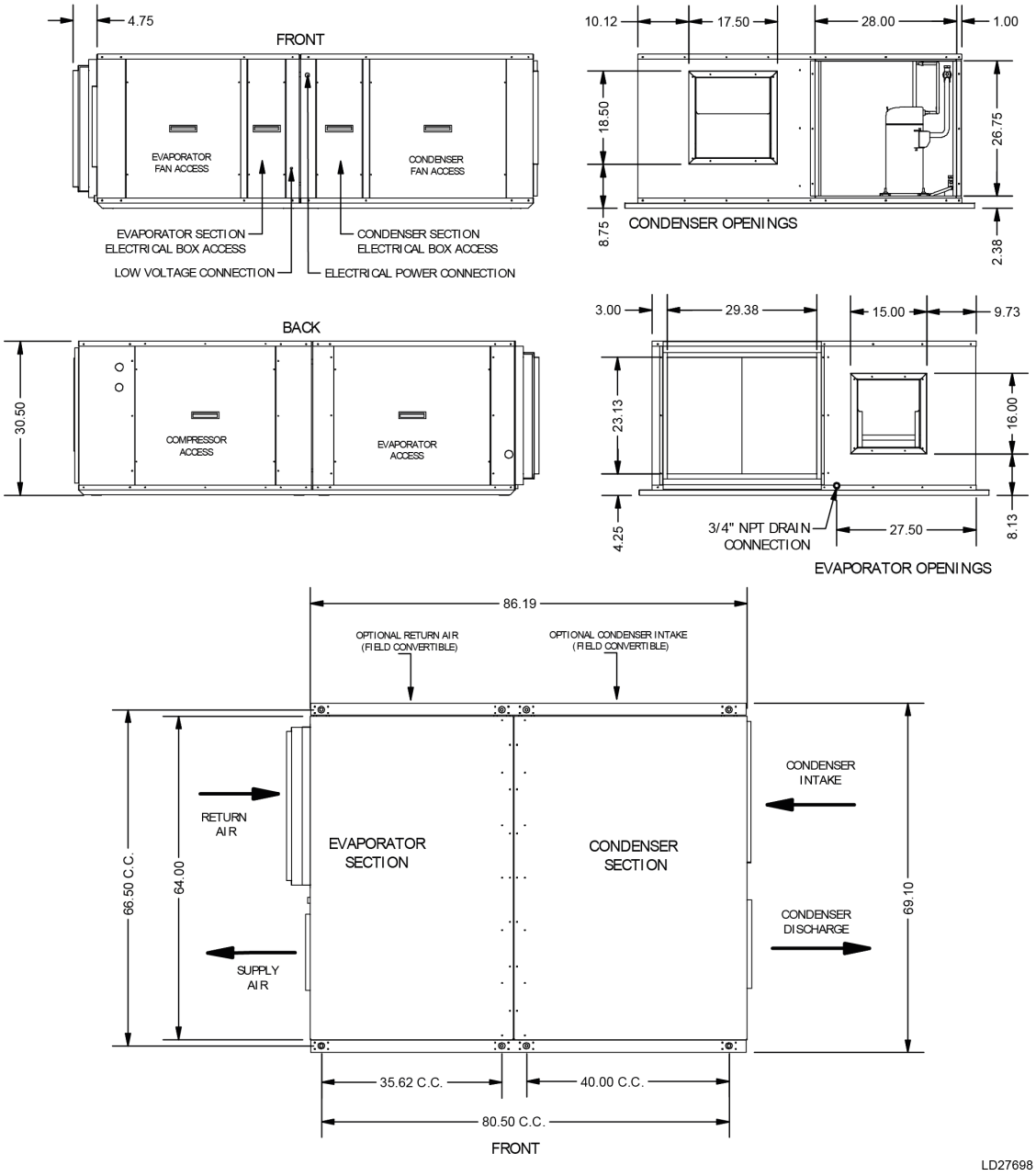
Figure 6: DSH024C and DSH036C dimensional data: 2–3 ton horizontal A/C unit



Note:

1. Dimension tolerance is 1/16 in.
2. Evaporator and condenser duct connections cannot be altered unless noted.

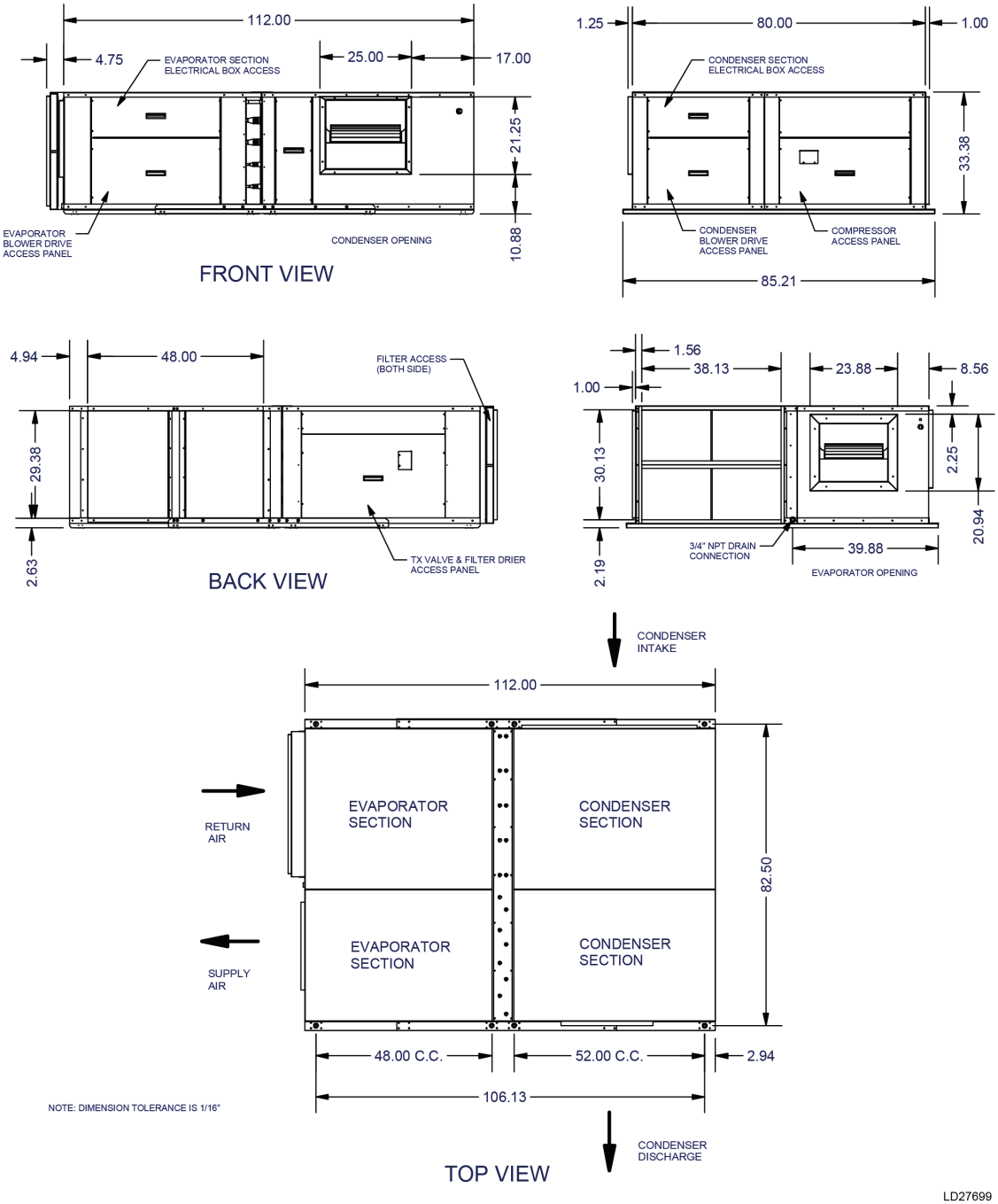
Figure 7: DSH048C and DSH060C dimensional data: 4–5 ton horizontal A/C unit



Note:

1. Dimension tolerance is 1/16 in.
2. Evaporator and condenser duct connections cannot be altered unless noted.

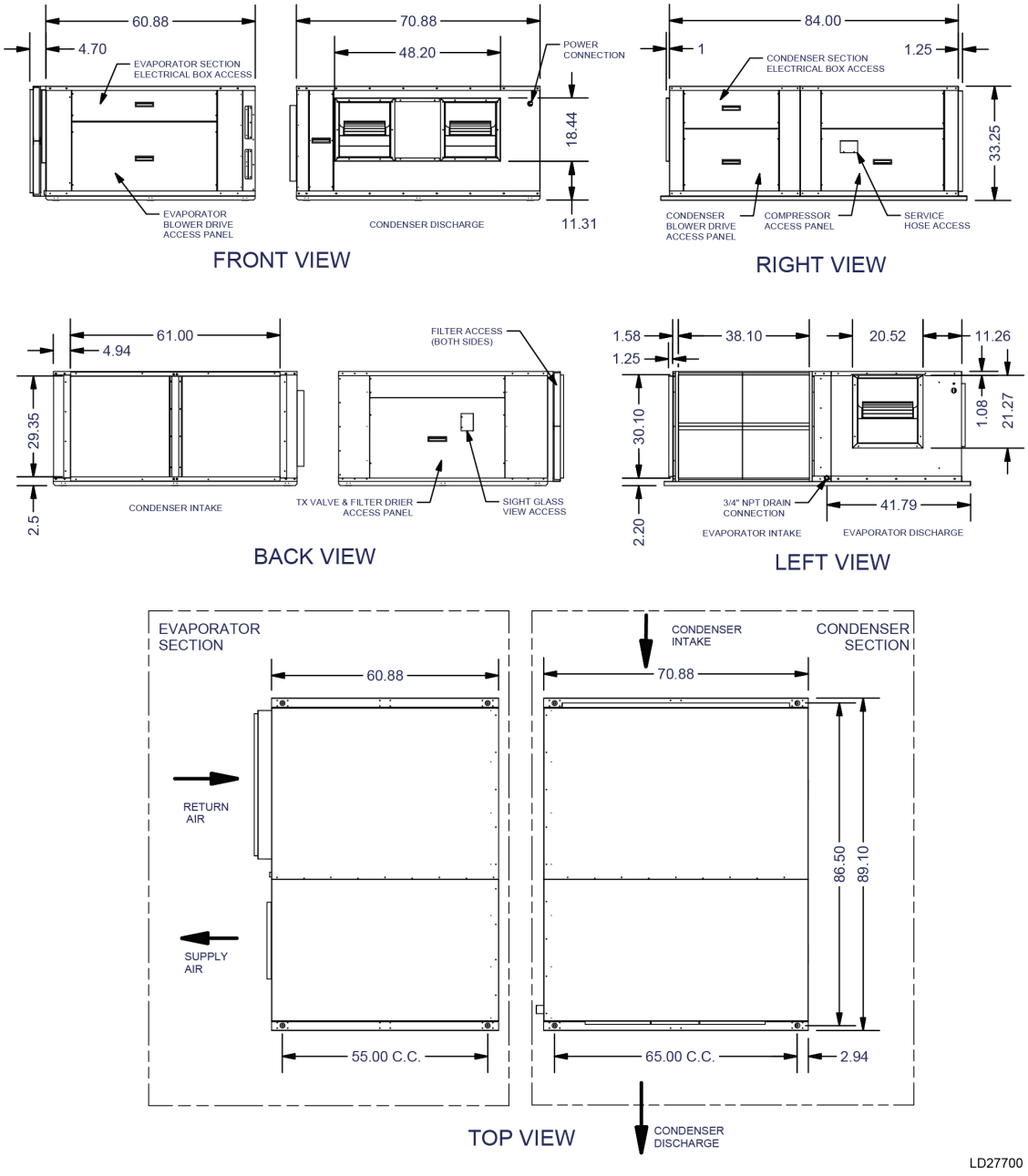
Figure 8: DSH096C dimensional data: 8 ton horizontal A/C unit



Note:

1. Dimension tolerance is 1/16 in.
2. Evaporator and condenser duct connections cannot be altered unless noted.

Figure 9: DSH120C dimensional data: 10 ton horizontal A/C unit



Note:

1. Dimension tolerance is 1/16 in.
2. Evaporator and condenser duct connections cannot be altered unless noted.

Figure 10: 2–5 ton horizontal A/C unit service clearances

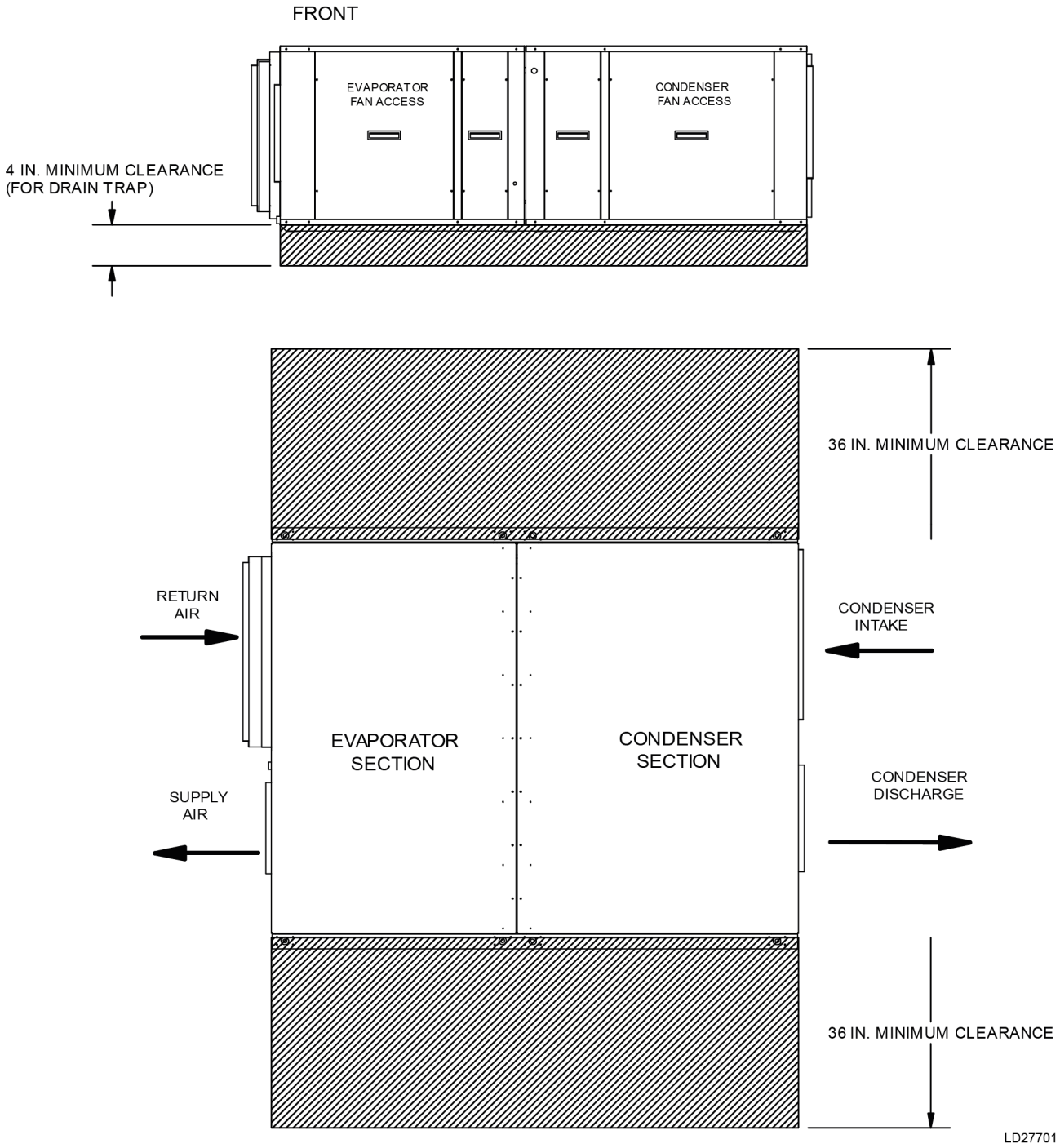
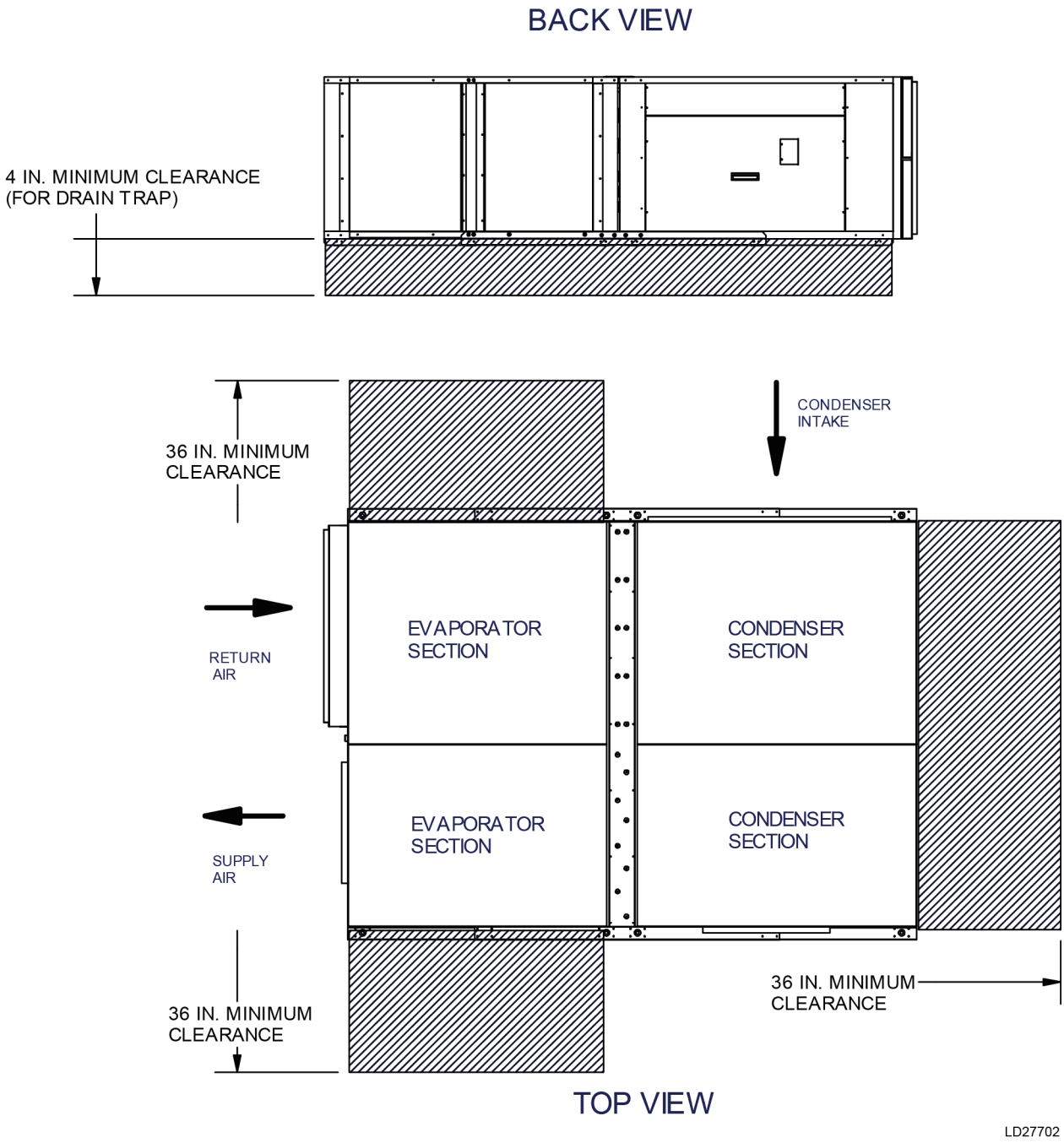


Figure 11: 8–10 ton horizontal A/C unit service clearances



Note: 8 ton packaged unit shown.

Unit corner weights

Figure 12: Packaged unit installation

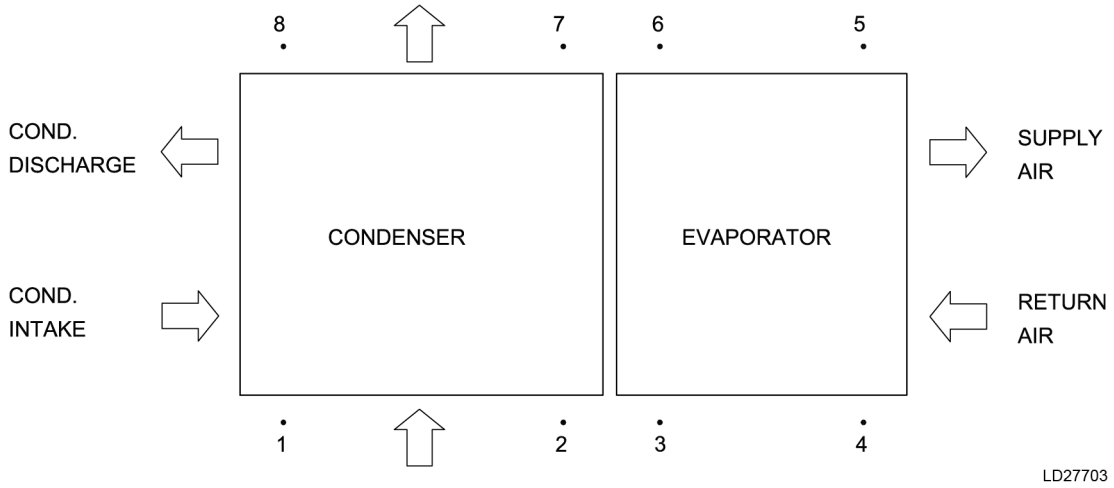


Table 4: Packaged unit installation

Unit	Point weights (lbs)								Total	
	1	2	3	4	5	6	7	8	Operating	Shipping
2 ton	138	75	76	70	72	66	66	112	675	715
3 ton	140	76	76	70	72	67	67	112	680	720
4 ton	151	122	122	93	100	116	116	130	950	1010
5 ton	160	127	127	94	101	122	138	138	990	1060
8 ton	292	163	163	108	140	168	168	270	1470	1560

Figure 13: Split unit installation

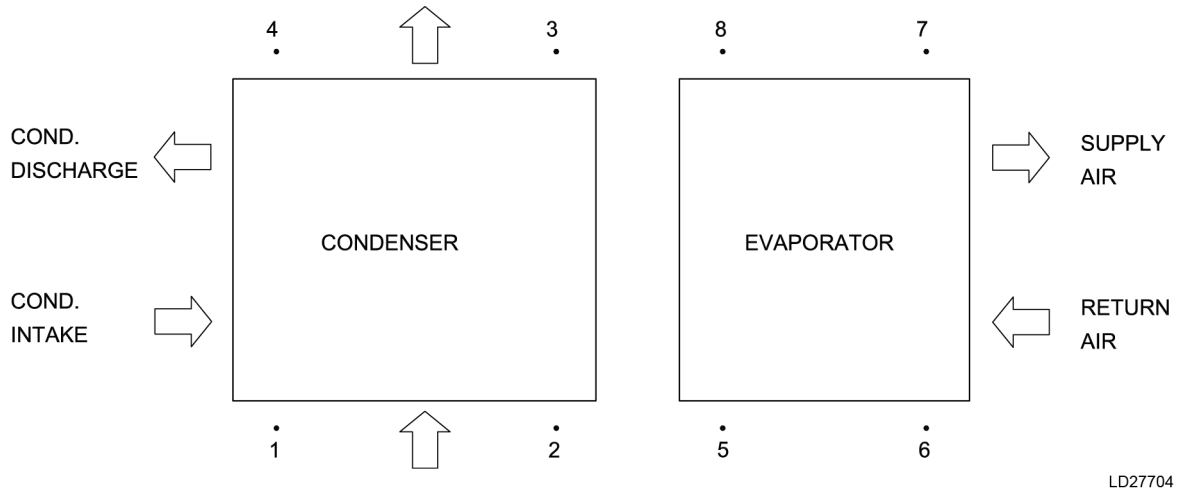


Table 5: Split unit installation

Unit	Point weights (lbs)								Total	
	1	2	3	4	5	6	7	8	Operating	Shipping
2 ton	138	76	66	112	75	70	72	112	675	715
3 ton	140	76	68	113	75	70	72	112	680	720
4 ton	151	147	127	129	97	93	100	130	950	1010
5 ton	160	156	136	138	98	94	101	138	990	1060
8 ton	292	252	236	270	73	108	140	99	1470	1560
10 ton	384	332	302	352	128	163	195	154	1940	2120

Ductwork

When installing ductwork, adhere to local codes. Where possible, minimize duct runs and avoid abrupt changes in direction. Allow ample access space to service the coils and change the filters. Perform regular maintenance on the ducts to increase the unit life, maintain efficient operation, and reduce the accumulation of dust and debris.

To not exceed the maximum external static values, refer to the blower performance charts in Fan Performance on page 28, engineer duct runs, and accessory pressure drop.

Louver sizing guidelines

An important issue in obtaining optimum performance from indoor air conditioners is proper selection of the condenser intake and discharge louvers. In practice, outdoor air-cooled units intake and discharge their cooling without restriction. However, indoor units must first overcome the resistance of grilles or louvers at the outside wall and then the restriction of any interconnecting ductwork.

The DSH's indoor air-cooled air conditioners are designed to accommodate the external static pressure loss associated with properly sized storm proof louvers. A storm proof louver typically has a free area approximately 40–45% of the actual louver size. To determine the free area required for any given unit, adhere to the following guidelines:

- The size condenser air intakes are for 350–600 feet/minute nominal velocity. The maximum recommendation is 700 feet/minute.
- The size condenser air discharge is for 1,200–1,500 feet/minute nominal velocity. The maximum recommendation is 1,700 feet/minute.

Louvers with higher velocities than stated above can be employed. This is at the discretion of the engineer or installer provided that the total air pressure drop does not exceed the capability of the condenser fan and motor.

Low restriction louvers with shallow blade angles can allow higher face velocities without excessive static pressure loss. Exceeding the static pressure capability of the condenser fan results in insufficient condenser air volume. This causes a loss in system capacity and can cause compressor shutdown during high ambient periods. Where applicable in such cases, the installation of an oversize condenser motor/drive may be considered.

ⓘ **Note:** As a general rule, these velocities require an intake louver sized approximately 1.25 to 1.5 times the dimensions of the duct connection on the unit, and a discharge louver sized approximately 1.5 to 2 times the duct connection dimensions

To ensure the unit does not short circuit, only use louver sections that provide different deflection angles for air discharge and air intake. Protect the unit from weather such as rain or snow entering through the condenser air intake.

Pitch all outdoor air ducts away from the unit and toward the outside wall. Connect all ducts to the unit with canvas section duct connectors or choose another suitable noise and vibration absorbing device.

Note: The manufacturer will not accept any liability resulting from incorrect installation of this equipment. Follow installation instructions carefully.

Electrical wiring

Follow local electrical codes when making electrical connections. Units are completely factory wired for normal supply voltages (for example, 208-230/460/575V-3Ph-60Hz). Confirm the unit specifications by checking the nameplate. The factory wiring terminates in two boxes, one in each section of the unit. The electrical control boxes are behind the outer access panels. Each electrical compartment has its own control cover.

Provide individual power disconnects for each unit or, in the case of split applications, each section. Install a secure ground to both evaporator and condenser. If canvas flexible joints are used on the ductwork, install a ground wire to the ductwork as well.

The unit requires the installer to provide a 24V thermostat with appropriate heating and cooling stages. The condenser section electrical cover is installed with wiring diagrams on the inner access door, which must be opened to read the diagrams.

WARNING

Disconnect and lock out power when servicing unit. Unit may start automatically if power is not disconnected. Failure to do so may result in personal injury or death due to electrical shock.

Packaged unit

If the unit is installed as a packaged unit, the thermostat (low voltage) wiring and power wiring are brought through the evaporator section. Check the unit nameplate for minimum circuit ampacity and fuse sizing.

Split system

If the unit is a split system application, the condenser section is remote from the evaporator section. See the wiring diagram in Figure 14 .

WARNING

IMPORTANT: All wiring must comply with applicable local and national electrical codes (NEC). Type and location of disconnect switches must comply with all applicable codes.

Low voltage wiring

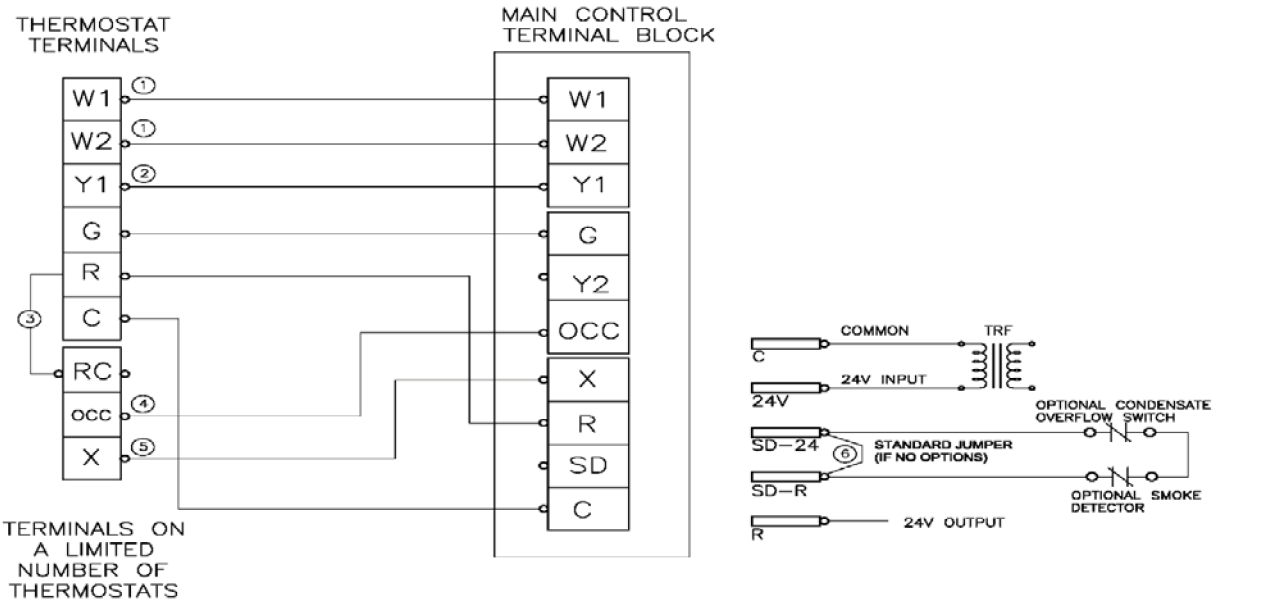
For low voltage thermostat wiring, an 18 gauge wire can be used for up to 100 foot lengths. A single or multiple stage thermostat (up to four cooling stages) must be used depending on size of

the unit. Locate the thermostat on an inside wall approximately 56 inches above the floor. At this location, it is not subject to drafts, sun exposure, or heat from electrical fixtures or appliances.

Follow the manufacturer's instructions enclosed with the thermostat for the general installation procedure. Use the seven color-coded, insulated wires to connect the thermostat to the unit.

Typical wiring schematics

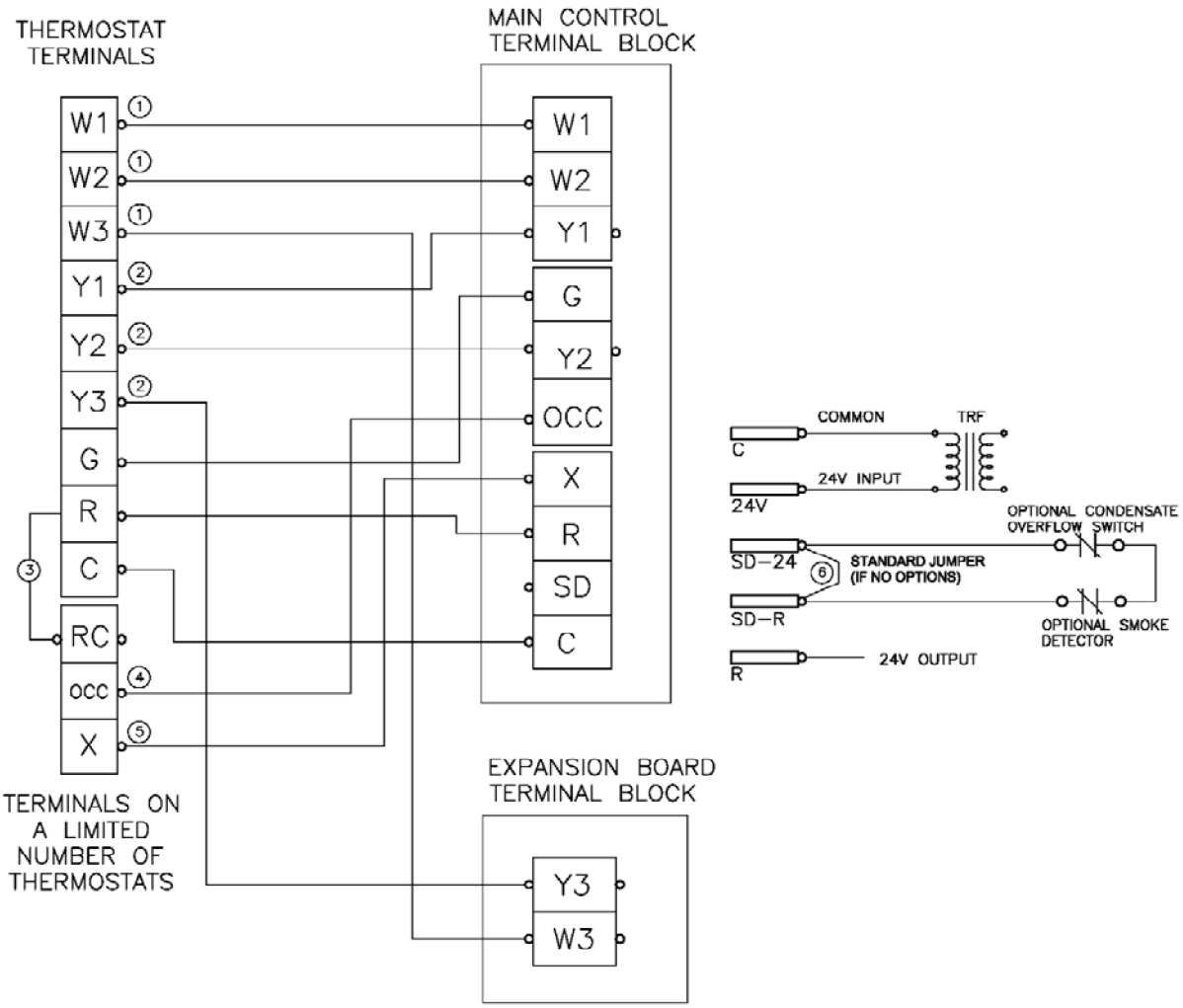
Figure 14: Typical control diagram for single stage cooling (DSH024C, DSH036C, DSH048C, and DSH060C)



Note:

1. Unit is capable of supporting up to two stages of discrete heating.
2. Unit is designed to only support single stage cooling.
3. Jumper is required for any combination of R, RC, or RH.
4. OCC is an output from the thermostat to indicate the occupied condition.
5. X is an input to thermostat to display the error status.
6. Jumper is required if no option is installed between SD-24 and SD-R.

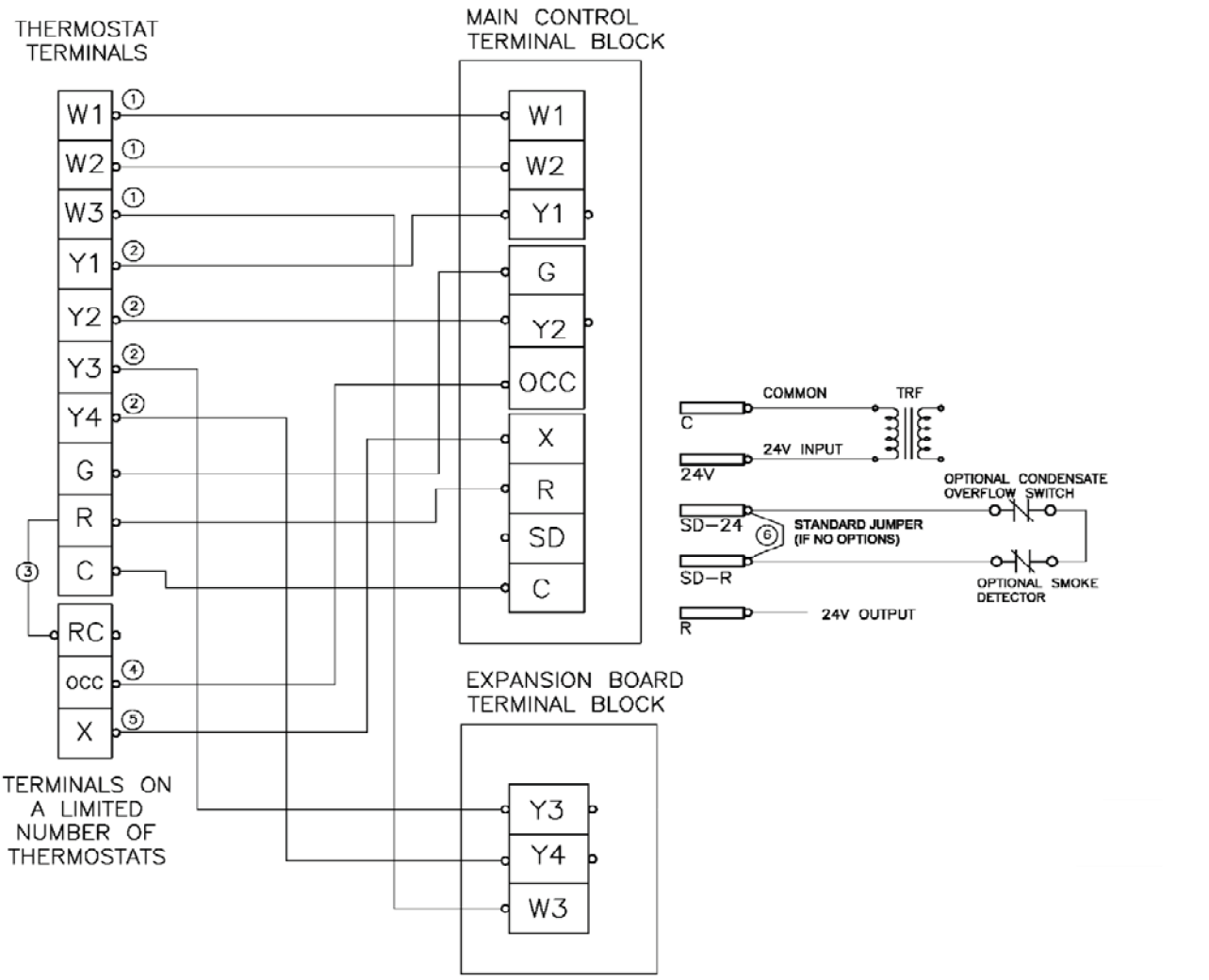
Figure 15: Typical control diagram for three stage cooling (DSH096C)



Note:

1. Units must only be installed with a thermostat that supports all stages of operation.
2. Unit is capable of supporting up to three stages of discrete heating.
3. Unit is designed to support three stages of discrete cooling.
4. Jumper is required for any combination of R, RC, or RH.
5. OCC is an output from the thermostat to indicate the occupied condition.
6. X is an input to thermostat to display the error status.
7. Jumper is required if no option is installed between SD-24 and SD-R.

Figure 16: Typical control diagram for four stage cooling (DSH120C)



Note:

1. Units must only be installed with a thermostat that supports all stages of operation.
2. Unit is capable of supporting up to three stages of discrete heating.
3. Unit is designed to support four stages of cooling.
4. Jumper is required for any combination of R, RC, or RH.
5. OCC is an output from the thermostat to indicate the occupied condition.
6. X is an input to thermostat to display the error status.
7. Jumper is required if no option is installed between SD-24 and SD-R.

Table 6: Electrical data – standard evaporator motor

Model number	Voltage	Compressor #1				Compressor #2				Evaporator fan		Condenser fan		MCA	Max fuse / CCT.BKR. amp
		Qty		RLA	LRA	Qty		RLA	LRA	HP	FLA	HP	FLA		
DSH024C2	208-230/3/60	1	@	7.7	55.4					0.50	1.6	0.50	1.6	12.83	20
DSH036C2	208-230/3/60	1	@	10.4	73.0					0.75	2.1	0.75	2.1	17.20	25
DSH036C4	460/3/60	1	@	5.8	38.0					0.75	1.0	0.75	1.0	9.25	15
DSH036C5	575/3/60	1	@	3.8	36.5					0.75	0.9	0.75	0.9	6.49	15
DSH048C2	208-230/3/60	1	@	13.8	83.1					0.75	2.1	1.50	4.4	23.75	35
DSH048C4	460/3/60	1	@	6.2	41.0					0.75	1.0	1.50	2.2	10.95	15
DSH048C5	575/3/60	1	@	4.9	33.0					0.75	0.9	1.50	1.8	8.80	15
DSH060C2	208-230/3/60	1	@	15.9	110.0					1.00	3.1	1.50	4.4	27.38	40
DSH060C4	460/3/60	1	@	7.1	52.0					1.00	1.5	1.50	2.2	12.58	15
DSH060C5	575/3/60	1	@	5.1	39.5					1.00	1.2	1.50	1.8	9.38	15
DSH096C2	208-230/3/60	1	@	14.0	83.1	1	@	13.8	83.1	1.50	4.4	3.00	8.5	44.20	50
DSH096C4	460/3/60	1	@	6.4	41.0	1	@	6.2	41.0	1.50	2.2	3.00	4.2	20.60	25
DSH096C5	575/3/60	1	@	4.6	33.0	1	@	4.9	33.0	1.50	1.8	3.00	3.4	15.85	20
DSH120C2	208-230/3/60	2	@	16.2	110.0					3.00	8.5	3.00	8.5	53.45	60
DSH120C4	460/3/60	2	@	7.6	52.0					3.00	4.2	3.00	4.2	25.50	30
DSH120C5	575/3/60	2	@	5.3	38.9					3.00	3.4	3.00	3.4	18.73	20

Table 7: Electrical data – oversized evaporator motor

Model number	Voltage	Compressor #1				Compressor #2				Evaporator fan		Condenser fan		MCA	Max fuse / CCT.BKR. amp
		Qty		RLA	LRA	Qty		RLA	LRA	HP	FLA	HP	FLA		
DSH048C2	208-230/3/60	1	@	13.8	83.1					1.00	3.1	1.50	4.4	24.75	35
DSH048C4	460/3/60	1	@	6.2	41.0					1.00	1.5	1.50	2.2	11.45	15
DSH048C5	575/3/60	1	@	4.9	33.0					1.00	1.2	1.50	1.8	9.13	15
DSH060C2	208-230/3/60	1	@	15.9	110.0					1.50	4.4	1.50	4.5	28.78	40
DSH060C4	460/3/60	1	@	7.1	52.0					1.50	2.2	1.50	2.2	13.28	20
DSH060C5	575/3/60	1	@	5.1	39.5					1.50	1.8	1.50	1.8	10.73	15
DSH096C2	208-230/3/60	1	@	14.0	83.1	1	@	13.8	83.1	2.00	5.8	3.00	8.5	45.60	25
DSH096C4	460/3/60	1	@	6.4	41.0	1	@	6.2	41.0	2.00	2.9	3.00	4.2	21.30	30
DSH096C5	575/3/60	1	@	4.6	33.0	1	@	4.9	33.0	2.00	2.3	3.00	3.4	16.35	20

Table 8: Electrical data – oversized condenser motor

Model number	Voltage	Compressor #1				Evaporator fan		Condenser fan		MCA	Max fuse / CCT.BKR. amp
		Qty		RLA	LRA	HP	FLA	HP	FLA		
DSH120C2	208-230/3/60	2	@	16.2	110.0	3.00	8.5	5	14	58.95	70
DSH120C4	460/3/60	2	@	7.6	52.0	3.00	4.2	5	6.6	27.9	35
DSH120C5	575/3/60	2	@	5.3	38.9	3.00	3.4	5	5.3	20.63	25

Fan performance

Table 9: DSH024C – Supply air blower performance

Supply CFM	Available external static pressure – iwg[1]															
	0.0		0.1		0.2		0.3		0.4		0.6		0.8		1.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Low static drive [3]		Factory drive + 0.5 HP						Hi-static drive + 0.5 HP							
600	318	0.03	426	0.04	520	0.06	604	0.08	679	0.10	810	0.14	923	0.19	-	-
700	371	0.04	466	0.06	550	0.08	628	0.10	699	0.13	826	0.18	937	0.23	-	-
800	423	0.06	508	0.08	585	0.10	656	0.13	723	0.15	844	0.20	-	-	-	-
900	476	0.09	552	0.11	622	0.14	688	0.16	751	0.19	866	0.24	-	-	-	-
1000	529	0.11	598	0.14	662	0.18	723	0.20	781	0.23	891	0.29	-	-	-	-

Note:

1. Blower performance includes evaporator coil and 2-inch filters.
2. At higher evaporator airflows and wet bulb conditions, condensate carry-over may occur. Decrease airflow downward as necessary.
3. Field supplied low static drive.

Table 10: DSH024C – Condenser fan performance

Outdoor CFM	Available external static pressure – iwg									
	0.0		0.2		0.4		0.6		0.8	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Standard factory drive				Hi-static drive					
1600	461	0.16	573	0.23	675	0.31	767	0.39	849	0.48

Table 11: DSH036C – Supply air blower performance

Supply CFM	Available external static pressure – iwg[1]															
	0.0		0.1		0.2		0.3		0.4		0.6		0.8		1.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Low static drive [3]		Factory drive + 0.75 HP						Hi-static drive + 0.75 HP							
800	453	0.06	534	0.09	609	0.11	679	0.14	744	0.16	866	0.21	969	0.26	1065	0.33
1000	566	0.13	633	0.16	695	0.19	755	0.21	812	0.24	917	0.30	1016	0.38	-	-
1200	680	0.23	735	0.26	789	0.29	840	0.33	890	0.36	983	0.43	1074	0.50	-	-
1400	792	0.36	841	0.40	887	0.44	932	0.48	977	0.51	1061	0.59	-	-	-	-
1600	906	0.54	948	0.58	990	0.63	1030	0.66	1069	0.71	-	-	-	-	-	-

Note:

1. Blower performance includes evaporator coil and 2-inch filters.
2. At higher evaporator airflows and wet bulb conditions, condensate carry-over may occur. Decrease airflow downward as necessary.
3. Field supplied low static drive.

Table 12: DSH036C – Condenser fan performance

Outdoor CFM	Available external static pressure – iwg									
	0.0		0.2		0.4		0.6		0.8	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Standard factory drive						Hi-static drive			
2100	542	0.31	631	0.40	717	0.49	799	0.58	875	0.68

Table 13: DSH048C – Supply air blower performance

Supply CFM	Available external static pressure – iwg[1]																			
	0.0		0.1		0.2		0.3		0.4		0.6		0.8		1.0		1.2		1.4	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Low static drive [3]				Factory drive + 0.75 HP						Hi-static drive + 0.75 HP									
1200	381	0.11	451	0.14	511	0.16	569	0.20	620	0.24	717	0.30	803	0.36	882	0.44	954	0.51	1023	0.60
1400	447	0.18	506	0.21	561	0.24	612	0.28	660	0.31	750	0.39	831	0.46	906	0.55	977	0.64	-	-
1600	511	0.25	562	0.30	612	0.34	658	0.38	703	0.43	786	0.50	863	0.59	935	0.68	1002	0.78	-	-
1800	575	0.36	621	0.41	666	0.45	708	0.50	749	0.55	826	0.64	898	0.74	967	0.84	-	-	-	-
2000	637	0.50	680	0.55	720	0.60	760	0.65	797	0.70	869	0.80	937	0.91	1001	1.00	-	-	-	-

Note:

1. Blower performance includes evaporator coil and 2-inch filters.
2. At higher evaporator airflows and wet bulb conditions, condensate carry-over may occur. Decrease airflow downward as necessary.
3. Field supplied low static drive.

Table 14: DSH048C – Condenser fan performance

Outdoor CFM	Available external static pressure – iwg													
	0.0		0.2		0.4		0.6		0.8		1.0		1.2	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Standard factory drive						Hi-static drive							
2400	503	0.40	577	0.50	645	0.60	708	0.71	767	0.82	822	0.93	875	1.05

Table 15: DSH060C – Supply air blower performance

Supply CFM	Available external static pressure – iwg[1]																			
	0.0		0.1		0.2		0.3		0.4		0.6		0.8		1.0		1.2		1.4	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Low static drive [3]		Factory drive + 1.5 HP										Hi-static drive + 2.0 HP							
1600	511	0.25	562	0.30	612	0.34	658	0.38	703	0.43	786	0.50	863	0.59	935	0.68	1002	0.78	1066	0.86
1800	575	0.36	620	0.41	666	0.45	708	0.50	749	0.55	826	0.64	898	0.74	967	0.84	1031	0.94	1092	1.04
2000	637	0.50	680	0.55	720	0.60	760	0.65	797	0.70	869	0.80	937	0.91	1001	1.01	1063	1.13	1121	1.24
2200	699	0.66	739	0.71	776	0.78	813	0.83	847	0.89	914	1.00	978	1.11	1039	1.23	1098	1.34	-	-
2400	765	0.86	800	0.93	835	0.99	868	1.04	901	1.10	964	1.23	1024	1.35	1082	1.48	-	-	-	-

Note:

1. Blower performance includes evaporator coil and 2-inch filters.
2. At higher evaporator airflows and wet bulb conditions, condensate carry-over may occur. Decrease airflow downward as necessary.
3. Field supplied low static drive.

Table 16: DSH060C – Condenser fan performance

Outdoor CFM	Available external static pressure – iwg													
	0.0		0.2		0.4		0.6		0.8		1.0		1.2	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Standard factory drive								Hi-static drive					
2800	567	0.60	632	0.71	694	0.83	751	0.95	806	1.08	858	1.21	907	1.33

Table 17: DSH096C – Supply air blower performance

Supply CFM	Available external static pressure – iwg[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Low static drive [3]				Factory drive + 1.5 HP								Hi-static drive + 2.0 HP							
2400	458	0.31	543	0.42	619	0.53	690	0.64	752	0.75	812	0.87	878	1.04	935	1.21	985	1.40	1038	1.51
2800	503	0.44	580	0.57	650	0.69	715	0.83	776	0.97	831	1.11	885	1.27	942	1.45	998	1.65	1045	1.77
3200	542	0.60	613	0.74	678	0.88	739	1.02	796	1.18	847	1.33	903	1.49	960	1.66	1017	1.83	1072	2.01
3600	607	0.85	670	1.00	730	1.16	786	1.32	839	1.48	890	1.66	939	1.83	980	1.99	-	-	-	-
4000	660	1.12	718	1.29	773	1.46	826	1.64	876	1.82	924	2.00	-	-	-	-	-	-	-	-

Note:

1. Blower performance includes evaporator coil and 2-inch filters.
2. At higher evaporator airflows and wet bulb conditions, condensate carry-over may occur. Decrease airflow downward as necessary.
3. Field supplied low static drive.

Table 18: DSH096C – Condenser fan performance

Outdoor CFM	Available external static pressure – iwg													
	0.0		0.2		0.4		0.6		0.8		1.0		1.2	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Standard factory drive +3 HP								Optional hi-static drive +3 HP					
6100	516	1.53	572	1.79	623	2.06	672	2.33	718	2.60	762	2.88	805	3.16

Table 19: DSH120C – Supply air blower performance

Supply CFM	Available external static pressure – iwg[1]																			
	0.2		0.4		0.6		0.8		1.0		1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Standard factory drive +3 HP								Optional hi-static drive +2.0 HP								Field supplied drive [3]			
3200	486	0.60	548	0.73	604	0.87	657	1.01	706	1.15	753	1.30	800	1.48	847	1.68	885	1.89	923	2.07
3600	524	0.79	580	0.94	633	1.09	683	1.24	730	1.40	775	1.56	817	1.73	867	2.13	905	2.29	941	2.45
4000	568	1.05	619	1.21	668	1.37	715	1.54	759	1.71	802	1.88	843	2.06	882	2.24	920	2.43	962	2.76
4400	616	1.37	664	1.54	709	1.72	753	1.90	795	2.08	835	2.27	874	2.46	911	2.66	948	2.86	983	3.06
4800	660	1.72	704	1.91	747	2.10	788	2.29	827	2.49	865	2.69	902	2.90	938	3.11	-	-	-	-

Note:

1. Blower performance includes evaporator coil and 2-inch filters.

Table 20: DSH120C – Condenser fan performance

Outdoor CFM	Available external static pressure – iwg													
	0.0		0.2		0.4		0.6		0.8		1.0		1.2	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Standard factory drive +3 HP								Optional hi-static drive +5 HP					
6400	691	1.98	747	2.24	800	2.52	850	2.80	898	3.08	945	3.36	990	3.66

Motor and pulley data

Table 21: Evaporator – standard blower motor and drive data

Model	Drive range (RPM)	Motor			Adjustable motor pulley	Fixed blower pulley
		HP	Frame size	Efficiency %	Pitch diameter (inches)	Pitch diameter (inches)
DSH024C	416–615	0.5	56	62	2.0–3.0	8.7
DSH036C	541–798	0.75	56	68	2.0–3.0	6.7
DSH048C	505–743	0.75	56	68	2.0–3.0	7.2
DSH060C	552–814	1.0	145	88.5	2.0–3.0	6.7
DSH096C	565–847	1.5	145	88.5	1.9–2.9	6.2
DSH120C	518–686	3.0	184	88.5	2.8–3.8	10.2

Table 22: Evaporator – oversized blower motor and drive data

Model	Drive range (RPM)	Motor			Adjustable motor pulley	Fixed blower pulley
		HP	Frame size	Efficiency %	Pitch diameter (inches)	Pitch diameter (inches)
DSH024C	614–906	0.5	56	62	2.0–3.0	5.9
DSH036C	739–1091	0.75	56	68	2.0–3.0	4.9
DSH048C	697–1028	1.0	145	88.5	2.0–3.0	5.2
DSH060C	784–1158	1.5	145	88.5	2.0–3.0	4.7
DSH096C	734–1016	2.0	145	88.5	2.4–3.4	6.2
DSH120C	640–854	3.0	184	88.5	2.8–3.8	8.2

Table 23: Condenser – standard blower motor and drive data

Model	Drive range (RPM)	Motor			Adjustable motor pulley	Fixed blower pulley
		HP	Frame size	Efficiency %	Pitch diameter (inches)	Pitch diameter (inches)
DSH024C	614–906	0.5	56	62	2.0–3.0	5.9
DSH036C	614–906	0.75	56	68	2.0–3.0	5.9
DSH048C	639–938	1.5	145	88.5	2.0–3.0	5.7
DSH060C	636–938	1.5	145	88.5	2.0–3.0	5.7
DSH096C	603–805	3.0	184	88.5	2.8–3.8	8.7
DSH120C	837–1027	5.0	184	88.5	4.4–5.4	9.2

Table 24: Condenser – oversized blower motor and drive data

Model	Drive range (RPM)	Motor			Adjustable motor pulley	Fixed blower pulley
		HP	Frame size	Efficiency %	Pitch diameter (inches)	Pitch diameter (inches)
DSH024C	442–652	0.5	56	62	2.0–3.0	8.2
DSH036C	503–743	0.75	56	68	2.0–3.0	7.2
DSH048C	470–694	1.0	145	88.5	2.0–3.0	7.7

Table 24: Condenser – oversized blower motor and drive data

Model	Drive range (RPM)	Motor			Adjustable motor pulley	Fixed blower pulley
		HP	Frame size	Efficiency %	Pitch diameter (inches)	Pitch diameter (inches)
DSH060C	525–775	1.5	145	88.5	2.0–3.0	6.9
DSH096C	515–686	3.0	184	88.5	2.8–3.8	10.2
DSH120C	640–854	3.0	184	88.5	2.8–3.8	8.2

Blower speed adjustment

Adjust the blower speed to increase or decrease the unit CFM for both non-VFD and factory installed VFD. The RPM of the supply air (SA) and condenser air blowers depends on the required CFM and the static resistances of both the supply/discharge and the return/intake duct systems. For units with VFD, perform the required static and drive setup at the 100% fan speed condition.

Perform an air balance after installation to verify the airflow and static. This may require adjustments to the drive (refer to Variable Frequency Drive Installation and Operation Instructions (Form 145.13-NO1). Only operate the unit in the regions defined by the fan tables. The units can be ordered with oversized motors or drive kits for high static requirements.

Note: Units with oversized motors or oversized drive kits are designed to operate in the shaded region of the fan table. Otherwise, the motor amp draw exceeds the overload setting resulting in overload trips and possible damage to unit. Refer to fan tables for recommended operating range of standard and oversized motors and drive kits.

Adjusting the blower speed

Determine the RPM for the blowers from the tables in Fan performance. To adjust the blower speed, take the following steps:

1. Loosen the belt tension by moving the motor towards the blower shaft via the adjustable mounting.
2. Loosen the setscrew in the adjustable motor pulley flange.
3. Remove the external key on pulleys that are 4 inches diameter or larger.
4. Open or close the pulley an appropriate number of turns.

   The blower speed increases when the moveable flange is adjusted towards the fixed flange (closed). The blower speed decreases when the moveable flange is adjusted away from the fixed flange (opened).

   Pulleys are adjustable only in half-turn increments. For 4L and A belts, do not open the pulley more than five full turns. For B belts, do not open the pulley more than six full turns.
5. Replace the external key and tighten the adjustment setscrew. Proper torque is 110–130 in-lbs.
6. Install the drive belt and adjust the motor mount to the tension belt (for further information, see Section 3 – Maintenance and Service).

Low ambient damper

If the unit must operate at an outdoor ambient below 50.0°F, install the optional low ambient damper kit. This kit maintains an acceptable condensing pressure. Install the damper directly onto the intake duct connection (see Figure 17 on page 35). Determine the damper position by the refrigerant pressure. Depending on a proportional pressure control module's output signal, a direct-coupled electric damper actuator motor drives the damper open or closed.

A pressure transducer senses the high-side refrigerant pressure through a service access port. The port is located on the liquid refrigerant line leaving the condenser. The pressure controller, complete with terminal connection blocks for wiring, attaches to a field-installed mounting bracket.

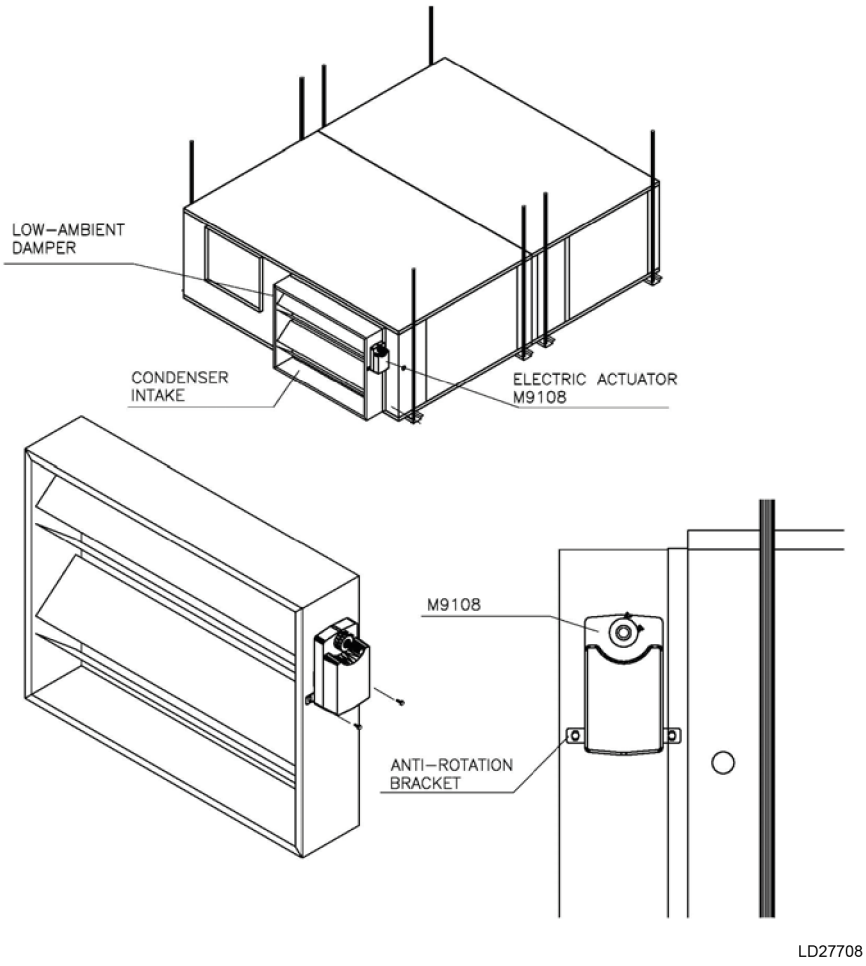
The kit includes an appropriate mounting hardware for the pressure control module and the damper actuator motor. There is also a routing hole in the condenser corner panel, near the actuator mounting location, for installation of the plenum-rated cable between the motor and the control module.

ⓘ **Note:** On dual compressor units, the actuator MUST be connected to the #1 circuit liquid line fitting. Connection to the second stage refrigerant circuit will result in system malfunction.

For detailed installation instructions, refer to the supplementary *Low Ambient Damper Kit Installation and Operation Instructions (Form 145.10-IOM4)*.

Kit #	Model	A	B	C
LADK-036C-1	DSH024C/036C	25.875 inches	5.0 inches	23.625 inches
LADK-060C-1	DSH048C/060C	27.875 inches	5.0 inches	26.625 inches
LADK-100C-1	DSH096C	48.0 inches	5.0 inches	29.25 inches
LADK-120C-1	DSH120C	60.75 inches	5.0 inches	29.125 inches

Figure 17: Low ambient damper



Airside economizer (ASE)

Optional airside economizer mixing box is designed to attach to the return air (RA) side of the evaporator. Mixing comes with low-leakage opposed blade dampers. The economizer is used to provide ventilation and free cooling for the DSH series of horizontal air handlers.

The economizer is setup through the LCD keypad display and joystick located on the unit SE control (SEC) board or through a recommended mobile access portal (MAP) gateway, available for purchase from the factory– see *Mobile Access Portal Gateway Product Bulletin (LIT-12011884)*. The control board is mounted inside of the unit main electrical box. Access to the mixing box is not required to setup ASE sequence of operation. Communication between SEC board and ASE board automatically establishes through an SA bus connection.

The factory supplied economizer includes: economizer module, mixing box, actuator, enthalpy sensor, temperature sensor, dampers, and wiring harness. See Appendix A: Wiring Diagrams for the economizer electrical wiring schematics or *Airside Economizer Kit Installation and Operation Instructions (Form 145.10-NO2)* for more details on installation and application.

Sequences of operation

Several functions can drive the economizer, including minimum position, free cooling, economizer loading, and minimum outdoor air supply.

Economizer minimum position

The outside air (OA) damper minimum position is set during occupied mode when outside air (OA) is not suitable for free cooling and the unit is in economizer mode. The position of the damper is set proportionally between the Economizer Minimum Position and the Economizer Minimum Position Low Speed Fan setpoints in relation to the VFD output percentage.

ⓘ **Note:** On a constant volume single speed supply fan system, both setpoints should be set to the same value.

Free cooling

Four types of free cooling options are available: dry bulb changeover, single enthalpy, dual enthalpy changeover, and auto.

Dry bulb changeover

For dry bulb economizer operation, the outside air is suitable for free cooling if the outside air temperature (OAT) is 1.0°F below the Economizer OAT Enable setpoint and 1.0°F below the RA temperature (RAT). Free cooling is no longer available if the OAT rises above either the Economizer OAT Enable setpoint or the RAT.

Single/dual enthalpy changeover

For single enthalpy economizer operation, the outside air is suitable for free cooling if the OA enthalpy is at least 1 Btu/lb below the economizer OA enthalpy setpoint and the OAT is no greater than the RAT plus 9.0°F.

If the OAT rises above the RAT plus 10.0°F, free cooling is no longer available. The OAT must drop to no greater than RAT plus 9.0°F to enter free cooling again.

Free cooling is no longer available if the OA enthalpy rises above the economizer OA enthalpy setpoint. For dual enthalpy economizer operation, the OA enthalpy must be lower than the RA enthalpy by 1 Btu/lb and the OAT is no greater than the RAT plus 9.0°F.

Auto

The control determines the type of free cooling changeover based on which sensors are present and reliable. Conditions include:

- Return and outside air dry bulb = dry bulb changeover

- Return and outside air dry bulb and outside air humidity = single enthalpy
- Return and outside air dry bulb and return and outside air humidity = dual enthalpy
- If either the return or outside air dry bulb sensors are unreliable, free cooling is not available

For more detailed installation and operation instructions, refer to *Airside Economizer Kit (Form 145.10-NO2)*.

Air temperature sensors

Each unit is equipped with standard SA temperature (SAT) and RAT sensors. Sensors ship inside the electrical box, the wire tied to the wiring. In addition to sensors, 8-foot long wiring extensions also ship inside the electrical box (see Figure 18).

In order to insert a temperature sensor, a 5/16-inch hole must be field drilled in the duct work and the sensor inserted through the hole. Small wings keep the sensor secured in the hole.

The RAT sensor can be installed in a pre-punched hole on the filter frame. There are two holes punched on both sides of the filter frame, halfway through the height of the filter frame. The extension wiring can be easily routed out of the unit through 7/8-inch pre-punched holes that are located on both sides of the unit.

The location of the sensor has to be chosen according to local codes and installation practices.

Figure 18: RAT SAT sensor

LD27722

Figure 19: Extension wiring

LD27710

Variable frequency drive (VFD)

This section discusses variable frequency for only 8 and 10 ton units.

Indoor fan VFD

A standard VFD controller for the evaporator (indoor) fan applies on 8 to 10 ton models. Mounted in the evaporator module section, the VFD allows the operator to set the duct static pressure or to control discrete indoor fan speed steps. To meet the desired supply duct static setpoint or a specific discrete speed step, the VFD controls the evaporator fan motor's frequency (or speed).

For reliable operation, the unit must have a factory installed hot gas bypass (HGBP) circuit on refrigeration circuit #1 for units with a duct pressure control option. Unless requested by the customer as a selectable feature, the unit setup for discrete speed steps does not require HGBP for reliable operation.

In 8 ton units, the standard discrete speed step configuration is that the VFD has been setup for the three discrete speeds, automatically adjusted. The 10 ton unit features 4 discrete speed steps. In both cases, the discrete fan speeds are matched and adjusted automatically based on the active cooling stage.

ⓘ **Note:** The unit does not carry a failsafe circuit to bypass the factory installed VFD and run the evaporator or condenser fan in the event of a VFD malfunction.

The VFD is factory mounted and wired. The installer must provide and field install two sensor tubing lines complete with static pressure probes (except to the configuration for discrete speed application). The installer must field wire the fan power wiring between the evaporator VFD and the unit electrical box (located in the condenser section) because the unit ships factory-split. For units with a static pressure control option, low voltage wiring from the pressure transducer must be connected to the unit controller (see the unit schematic for more details).

The power (and optional low voltage wiring for transducer) wiring can be found inside the VFD enclosure. No extra power wiring is required; sufficient length is provided. The VFD option does not include an evaporator fan bypass circuit in case of microdrive failure. Microdrive must be replaced to re-activate the unit. In case of a VFD failure, the evaporator fan stops running. However, unit compressors continue to run until a low pressure safety trip activates.

For detailed installation and operation instructions, refer to *Variable Frequency Drive manual (Form 145.13-NO1)*.

ⓘ **Note:** Do not run evaporator fan motor below 30Hz. Otherwise, coil freeze-up and nuisance lock outs can occur.

⚠ CAUTION

Building excessive ductwork static pressure can cause damage to unit or personnel.

Outdoor fan VFD (208-230V and 460V only)

If the unit must operate at an outdoor ambient temperature below 50.0°F, install the optional VFD condenser fan option to maintain an acceptable condensing pressure. The optional VFD controller for the condenser fan is available on 8 and 10 ton models (208-230/3/60 and 460/3/60 power supply only).

The purpose of this option is to maintain a proper refrigerant head pressure during low ambient conditions. Using a VFD for controlling the condenser fan speed is an energy and cost effective solution for low ambient control. The VFD for the condenser fan is available as either a factory built option or field installed kit. The field installed kit comes complete with a manual bypass electrical circuit. In the unlikely case of VFD failure, it can be used to revert condenser fan control back to standard starter mode.

Mounted in the condenser corner post (or the special enclosure for a field kit VFD), the VFD allows the operator to set the high head pressure level (the factory default is 320 psig). To meet the desired refrigerant pressure setpoint, the VFD controls the condenser fan motor's frequency (speed). The pressure transducer must be only connected to circuit #1.

The VFD option does not include a condenser fan bypass circuit in the case of a microdrive failure. The microdrive needs to be replaced if a failure occurs to the drive to put the unit back to normal operation. In the case of a VFD failure, the condenser fan stops running. However, the unit compressors continue to run until a low pressure safety trip is activated.

For detailed installation and operation instructions, refer to *Variable Frequency Drive manual (Form 145.13-NO1)*.

Hot gas bypass (HGBP)

To allow for low cooling load operation, a direct-acting pressure-modulating bypass control valve is installed on the system #1 discharge line. To maintain a desired minimum evaporator pressure, use this valve to divert high temperature, high pressure refrigerant around the TXV. HGBP is standard on all units with variable air volume (VAV) and optional on units with constant volume (CV).

Adjusting HGBP setpoint

When the HGBP valve opens, select the coil suction pressure or coil temperature by adjusting the screw on the HGBP valve. To set the load, run the unit and cool down the evaporator coil. To do this, either shut the fans or block the airflow until the suction pressure drops at least 5 psi below the chosen evaporator coil setpoint. Next, allow the bypassed gas to raise the pressure. The screw spring adjustment can be set until the HGBP valve closes at the chosen setpoint.

The pressure of the evaporator coil is set to maintain an evaporator coil temperature above the point that frost and coil freeze-up can form.

Start-up and operation

Start the unit and check the rotation of fans and compressors. Scroll compressors only compress in one rotational direction. Refer to the *Startup and Performance Checklist (Form 145.13-CL1)*.

ⓘ **Note:** Prior to startup, it is important to ensure proper compressor and fan rotation direction is achieved when the system is installed and operated.

To ensure proper unit operation, monitor the microprocessor board for any fault codes. Verify the proper compressor direction by observing that, when the compressor energizes, the refrigerant suction pressure drops and the refrigerant discharge pressure rises. Reverse compressor rotation also results in an elevated sound level and a substantially reduced current draw. Both refrigerant pressures are close to equal pressure.

ⓘ **Note:** Ensure evaporator motor rotation is correct upon unit start-up. Switch any two wires at contactor if blower rotation is not correct.

If opposite rotation is noticed, disconnect and reverse any two leads of the three phase supply. Reconnect the power. If one component is operating in the wrong direction, then all other three phase components on the unit may be operating in the same phase.

ⓘ **Note:** Observe unit operation and check for unusual noise or vibration.

⚠ WARNING

The air conditioning section of this equipment is charged with R-410A, a high pressure refrigerant. Only qualified technicians, using appropriately pressure rated test instruments, should perform troubleshooting or service on this equipment.

Table 25: Settings – all models high low

	High	Low
Cut out (psig)	600	68
Cut in (psig)	450	107

Table 26: Refrigerant charge (lbs)

Unit	Number of circuits	Circuit 1	Circuit 2
DSH024C	1	7.7	-
DSH036C	1	8.9	-
DSH048C	1	11.8	-
DSH060C	1	12.2	-
DSH096C	2	11.4	11.65
DSH120C	2	16	16.2

ⓘ **Note:** Factory split and charged units are charged with two-thirds in condenser and one-third in evaporator module.

ⓘ **Note:** Always charge with liquid when adding R-410A refrigerant. Failure to do so compromises the properties of the refrigerant being added to the rooftop unit and results in substandard performance of the unit.

Checking superheat and subcooling

R-410A temperature charts list the associated saturation temperature in one column and the associated pressure in another column. See Table 25 on page 40.

Subcooling

When the refrigerant charge is correct, there is no vapor in the liquid sight glass with the system operating under full load conditions.

The subcooling temperature of each system can be calculated:

1. Record the temperature of the liquid line at the outlet of the condenser.
2. Subtract it from the saturation temperature listed in Table 27 for the corresponding discharge pressure.
3. If the rooftop unit lacks an access port for liquid access, subtract the condenser coil pressure drop value from Table 25 from the discharge pressure to determine the equivalent saturation temperature.

For example, when the discharge pressure is 388 psig and the liquid line temperature is 95.0°F:

- Liquid Pressure = Discharge Pressure (388 psig) minus 33 psig = 355 psig
- Saturation Temperature for 355 psig = 108.0°F
- Liquid Line Subcooling = Saturation Temperature (108.0°F) minus Liquid Line Temperature (95.0°) = 13.0°F

Subcooling should be 10.0–14.0°F at design conditions.

Table 27: R-410A pressure and temperature chart

PSIG	Temp °F	PSIG	Temp °F
0	-60	78	20
2	-58	80	21
4	-54	85	24
6	-50	90	26
8	-46	95	29
10	-42	100	32
12	-39	105	34
14	-36	110	36
16	-33	115	39
18	-30	120	41
20	-28	125	43
22	-26	130	45
24	-24	135	47
26	-20	140	49
28	-18	145	51
30	-16	150	53
32	-14	160	57
34	-12	170	60
36	-10	180	64

Table 27: R-410A pressure and temperature chart

PSIG	Temp °F	PSIG	Temp °F
38	-8	190	67
40	-6	200	70
42	-4	210	73
44	-3	220	76
46	-2	225	78
48	0	235	80
50	1	245	83
52	3	255	85
54	4	265	88
56	6	275	90
58	7	285	92
60	8	295	95
62	10	305	97
64	11	325	101
66	13	355	108
68	14	375	112
70	15	405	118
72	16	500	134
74	17	600	149
76	19	700	159

Superheat

Only check superheat after establishing the steady state operation of the unit, pulling down the discharge air temperature to within the control range, and running the unit in a fully loaded condition.

The superheat is calculated as the difference between the actual temperature of the refrigerant gas in the suction line and the temperature corresponding to the suction pressure as shown in Table 27.

For example, when the suction pressure is 130 psig and the suction line temperature is 57.0°F:

- Saturation Temperature for 130 psig = 45.0°F
- Evaporator Superheat = Suction Line Temperature (57.0°F) minus Saturation Temperature (45.0°F) = 12.0°F

When adjusting the expansion valve, do not turn the adjusting screw more than one turn at a time This allows sufficient time (approximately 15 minutes) between adjustments for the system and the thermal expansion valve to respond and stabilize.

The superheat setting should be adjusted to 8.0–11.0°F at design conditions.

Leak checking

Leak check compressors, fittings, and piping to ensure there are no leaks. Verify the evaporator distributor tubes do not have bare copper touching each other or are against a sheet metal edge. If leak checking a unit charged with R-410A, ensure the leak test device is capable of sensing refrigerant R-410A.

Startup (cooling)

Prestart checklist

After installation has been completed, make the following checks:

1. Check the electrical supply voltage. Ensure that it is the same as listed on the unit nameplate.
2. Set the room thermostat to the OFF position.
3. Turn ON the unit electrical power.
4. Set the room thermostat fan switch to ON.
5. Check the indoor blower rotation.
6. Check the blower drive belt tension.
7. Check the unit's supply air (CFM).
8. Measure the evaporator fan motor's amp draw.
9. Set the room thermostat fan switch to OFF.
10. Turn the electrical power OFF.

Operating instructions

1. Turn the unit's electrical power ON.
2. Set the room thermostat to lower than the room temperature.
3. After the built-in time delay (5 minutes), the first stage compressors energize.

Post start checklist

1. Verify the proper system pressures.
2. Measure the temperature drop across the evaporator coil.

Microprocessor controller

Units come with the state of the art Smart Equipment control (SEC) system. All units are factory commissioned, configured, and run tested. The SEC can be configured to use with a standard thermostat, a zone sensor, or to communicate with the field controller (FC) bus using BACnet® MS/TP, Modbus™ or N2 protocols.

Temperature sensors

Each unit comes with standard supply air temperature (SAT) and return air temperature (RAT) sensors. The outside air temperature (OAT) is provided with the airside economizer option. All sensors are field wired and installed.

USB port

The controller comes with a long list of features including data logging, current and previous system faults, and software update capabilities using the onboard USB port and a common flash drive. Energy use monitoring capabilities allow custom tailoring. This allows a system to work more efficiently at all times and occupancy levels. Self-test and startup reports are also available from the board through the USB port.

LCD display

The board has an easy to read, built-in LCD display and easy to use buttons and a navigation joystick. These features allow the user to quickly navigate the menus that display the unit status, options, current function, supply, return and outdoor temperatures, fault codes, and other information.

Safety monitoring

The control monitors the following values:

- Outdoor, supply, and return air temperatures
- The high and low pressure switch status on the independent refrigerant circuits
- The voltage supplied to the unit. If the low voltage is due to a brown out, or some other electrical issue occurs, the control protects the unit

Low ambient

With a low ambient damper kit or VFD on the condenser installed, an integrated low ambient control allows units to operate in the cooling mode down to 0.0°F outdoor ambient. Optionally, when the OAT is low and with the airside economizer option installed, the control board can be programmed to lock out the compressors.

Anti-short cycle delay (ASCD) protection

To assist compressor life, the standard control incorporates an ACSD. The compressor reliability is further ensured by programmable minimum runtimes.

Fan delays

Fan on and fan off delays are fully programmable. Furthermore, the heating and cooling fan delay times are independent of one another. All units are programmed with default values based upon their cooling or heating capacity configuration.

Nuisance trip protection and three strikes

To prevent nuisance calls, the control board has three soft faults before a hard lock out operation. The high/low-pressure switch, anti-freeze protection, low voltage, or heating high limit must trip three times within two hours before the unit control board locks out the associated compressor. The LCD screen displays an alarm message.

Lead-lag

An integrated lead-lag option is available However, never enable it on DSH units. This option can be selected on the unit control board. The default factory setup is always disabled.

ⓘ **Note:** Enabling lead-lag function affects logic of DSH unit and disables unit operation.

Condensate overflow switch

A condensate overflow fault occurs when the condensate overflow switch opens for the first time, as the switch is connected to the onboard shutdown (SD) contact. The compressor is shut down regardless of minimum runtime. The ASCD is initiated and the alarm is tripped. The fan continues to operate in its current state. The compressor re-energizes once the condensate overflow switch closes, the ASCD has been satisfied, and a call for cooling is still present.

Operation

Compressor operation

Compressor operation includes the following features:

1. Compressors are controlled by the Y1 through a maximum of Y4 thermostat inputs.

⚠ CAUTION

As lead-lag function must be turned OFF, Y1 input energizes the C1 output when the compressor #1 ACSD is at 0 and all refrigerant safety devices are closed (default 5 minutes).

2. The fan output for indoor fan operation energizes with any cooling output after the indoor fan cool on delay expires.
3. When the thermostat cooling inputs are lost and the minimum runtime expires, the compressor outputs stage off (the default is 3 minutes).
4. A 30 second interstate delay occurs when multiple stages are requested.

Table 28: Compressor control DSH096C

Control	Compressor	Power type	Evaporator fan %
Y1	1	Power	50%
Y2	1	Solenoid	60%
Y3	2	Power	100%

Table 29: Compressor control DSH120C

Control	Compressor	Power type	Evaporator fan %
Y1	1	Power	50%
Y2	2	Power	60%
Y3	2	Solenoid	75%
Y4	1	Solenoid	100%

IntelliSpeed™ supply fan control (8/10 ton unit only)

Setpoints and related data are shown in

Table 30: Setpoints and related data

Fan control type	Fixed	Variable
Occupied, no heat or cool % command	50%	0–100%
Occupied, one stage of cool % command	50%	50–100%
Occupied, two stage of cool % command	60%	50–100%
Occupied, three stage of cool % command	75%, 100%	50–100%
Occupied, four stage of cool % command	100%	50–100%
Occupied, one stage of heat % command		0–100%
Occupied, two stage of heat % command		0–100%
Occupied, three stage of heat % command		0–100%
Economizer minimum position		0–100%
Economizer minimum position for low speed fan		0–100%

The outputs have the following values:

- 24 VAC from fan on the unit control board (UCB) to enable indoor VFD
- 2–10 VDC from VFD terminal on UCB to control the speed of the indoor VFD

The VFD operation has the following values:

- 2–10 VDC output from VFD terminal on UCB operates the supply fan VFD proportional to the minimum and maximum frequency settings of the VFD (the defaults are 30–60hz)

The supply fan only operation is as follows:

- When there is no demand for heating or cooling, to run, the supply fan operates at the percent output of the No Heat or Cool % Command setpoint

The cooling supply fan operation is as follows:

- With a demand for cooling, the VFD operates at the frequency relating to the setpoint Occupied, # Stage of Cool % Command as defined under the Indoor Fan setting menu on the SE controller.

Maintenance and service

⚠ WARNING

Disconnect and lock out power when servicing unit. Failure to do so may result in personal injury or death due to electrical shock.

⚠ CAUTION

Exercise care when working around the sharp metal edges of door panels or door frames, etc. These edges can cause injury.

Evaporator and condenser coils

Inspect the evaporator coil at filter change intervals. Inspect the condenser coil at least semi-annually. A dirty condenser coil results in elevated condensing pressures and poor unit performance. Dirty or clogged evaporator coils cause low suction pressure and lost capacity. If the coils appear dirty, clean them using a mild detergent or a commercial coil cleaning agent.

Refrigerant circuits

During unit operation, check and record the compressor discharge and suction pressures. Also record the compressor running current. A maintenance log of these readings can indicate if the unit is operating within its normal limits. Investigate abnormal readings and correct the cause.

Blowers

Inspect both the evaporator and condenser blowers at each regular service interval. As required, clean the blower wheels. Bearings are a permanently sealed ball type and do not require lubrication. Check the bearings for signs of wear (movement between the inner and outer races). Ensure that the bearing locking collars are secure to the shaft and that the collar locking screw is properly set. Check that the blower wheel is tight on the shaft and that the hub set screws are properly torqued.

Drive belts

Examine the belts periodically for wear. Glazed areas on the drive surfaces indicate overheating due to belt slippage. The ideal tension is the lowest tension at which the belt does not slip under peak load conditions. Over-tensioning shortens the belt and bearing life (see Blower speed adjustment).

Adjust the tension on the belt for a deflection of 1/64-inch per inch of belt span, with the appropriate force applied at the midpoint of the span. Tension new belts at the maximum value indicated. Maintain used belts at the minimum value.

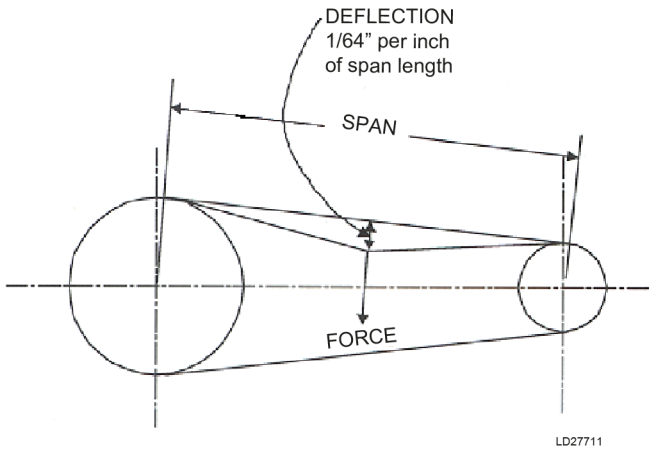
Filters

Inspect the filters monthly and replace them as required. Use UL Class 2 rated filters. Factory supplied filters are the medium efficiency, extended surface pleated type. To maintain optimum airflow performance, ensure the replacements are of the same type. See Table 31 for filter sizes.

Table 31: Filter sizes

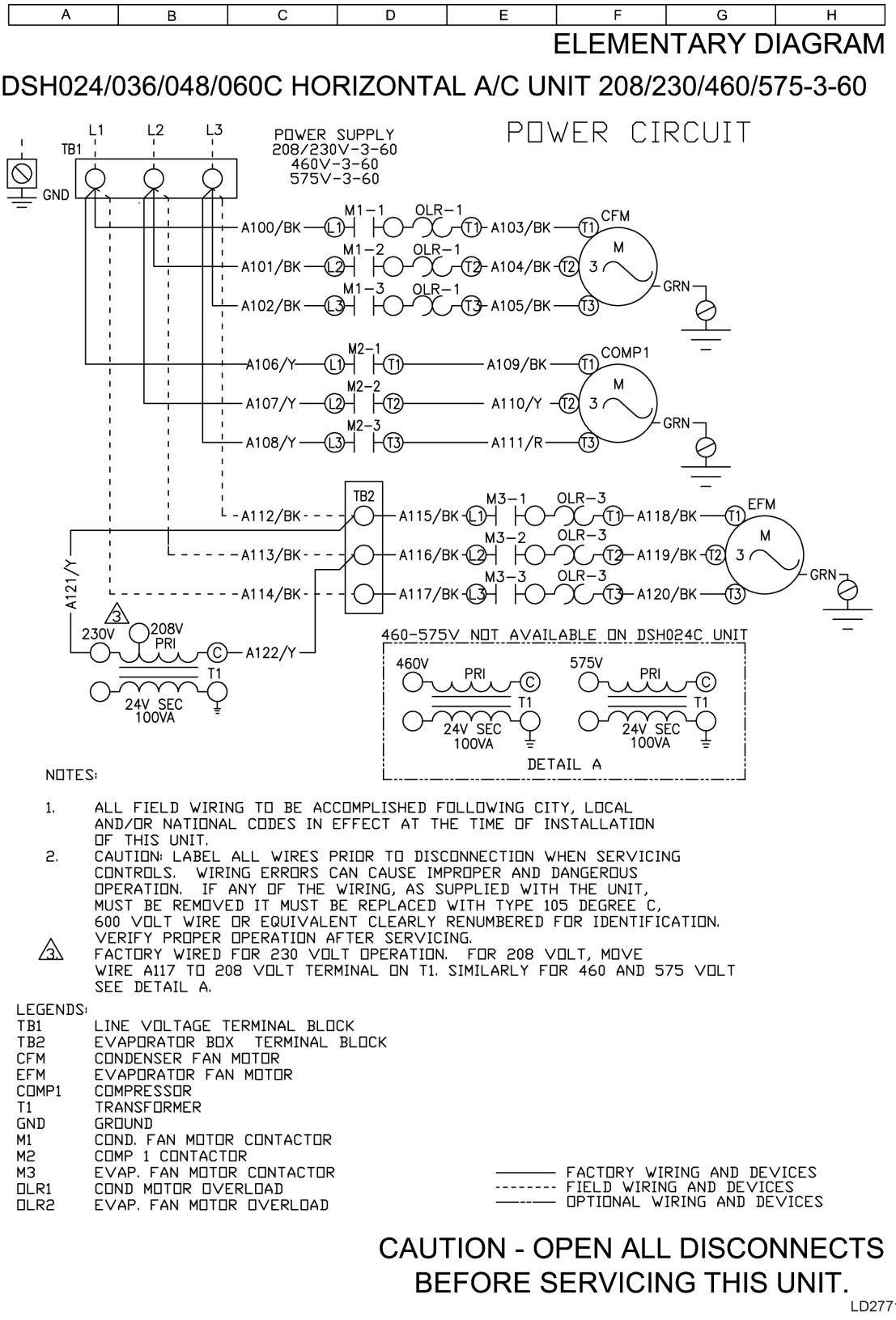
Filters	Quantity/size
DSH024C	2 / 25 x 14 x 2
DSH036C	2 / 25 x 14 x 2
DSH048C	2 / 25 x 16 x 2
DSH060C	2 / 25 x 16 x 2
DSH096C	4 / 20 x 16 x 2
DSH120C	4 / 20 x 16 x 2

Figure 20: Belt tension adjustment



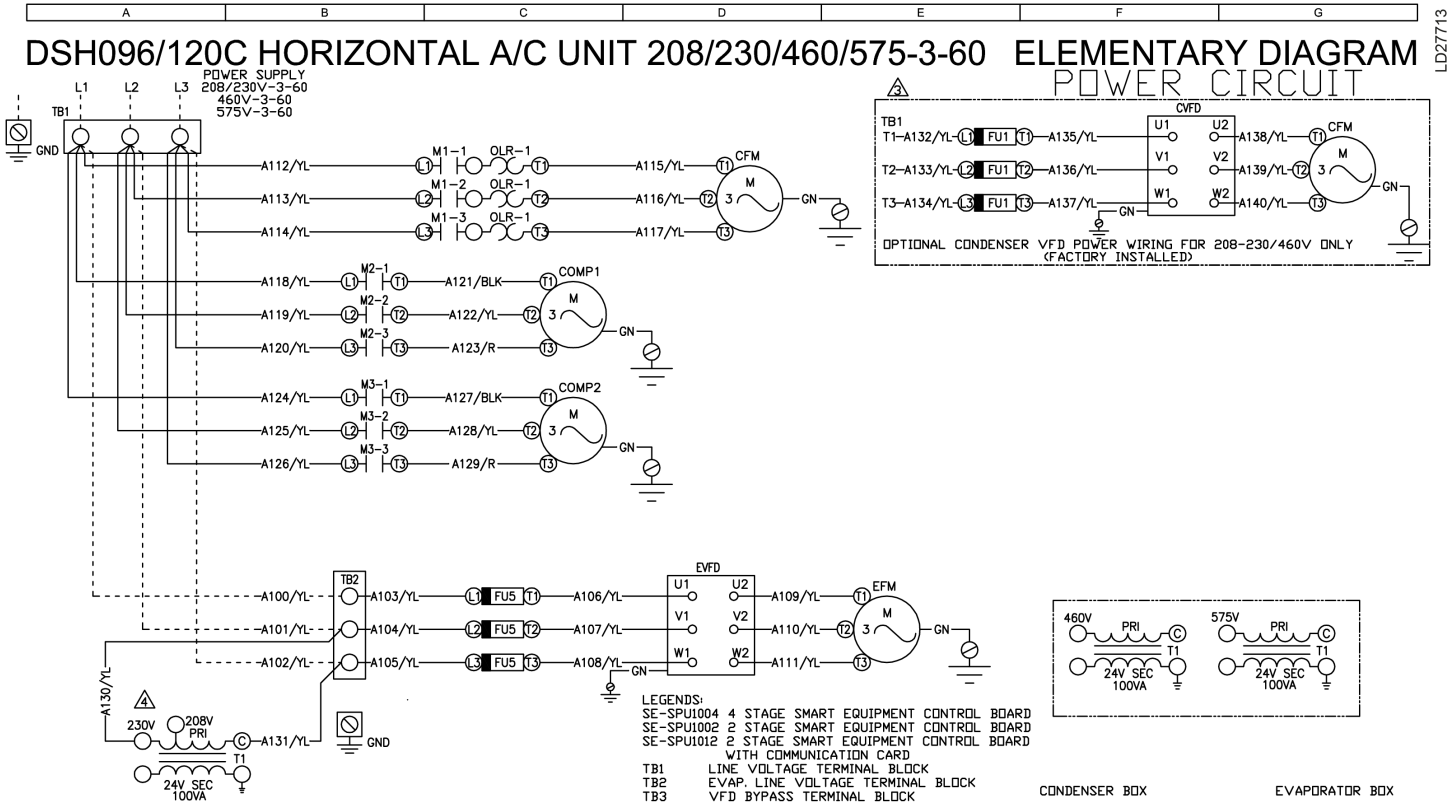
Cross section	Pounds force	
	Minimum	Maximum
4L	1-1/2	2-1/2
A	3-1/2	6-1/2
B	5-1/2	8
BX	8	11

Appendix A: Wiring diagrams



DSH096/120C HORIZONTAL A/C UNIT 208/230/460/575-3-60 ELEMENTARY DIAGRAM

LD27713

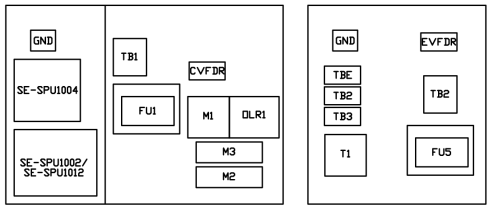


LEGENDS:

SE-SPU1004 4 STAGE SMART EQUIPMENT CONTROL BOARD
SE-SPU1002 2 STAGE SMART EQUIPMENT CONTROL BOARD
SE-SPU1012 2 STAGE SMART EQUIPMENT CONTROL BOARD WITH COMMUNICATION CARD

TB1	LINE VOLTAGE TERMINAL BLOCK
TB2	EVAP. LINE VOLTAGE TERMINAL BLOCK
TB3	VFD BYPASS TERMINAL BLOCK
TBE	ASE TERMINAL BLOCK
CFM	CONDENSER FAN MOTOR
EFM	EVAPORATOR FAN MOTOR
COMP1	COMPRESSOR 1
COMP2	COMPRESSOR 2
T1	TRANSFORMER
GND	GROUND
FU1	COND. FAN MOTOR FUSE
FU4	COND. VFD BYPASS FUSE
FU5	EVAP. FAN MOTOR FUSE
M1	COND. FAN MOTOR CONTACTOR
M2	COMP 1 CONTACTOR
M3	COMP 2 CONTACTOR
M4	COND. VFD BYPASS CONTACTOR
OLR1	COND MOTOR OVERLOAD
CVFD	COND FAN VFD
EVFD	EVAP FAN VFD
CVFDR	COND VFD RELAY
EVFDR	EVAP VFD RELAY

——— FACTORY WIRING AND DEVICES
-------- FIELD WIRING AND DEVICES
——— OPTIONAL WIRING AND DEVICES

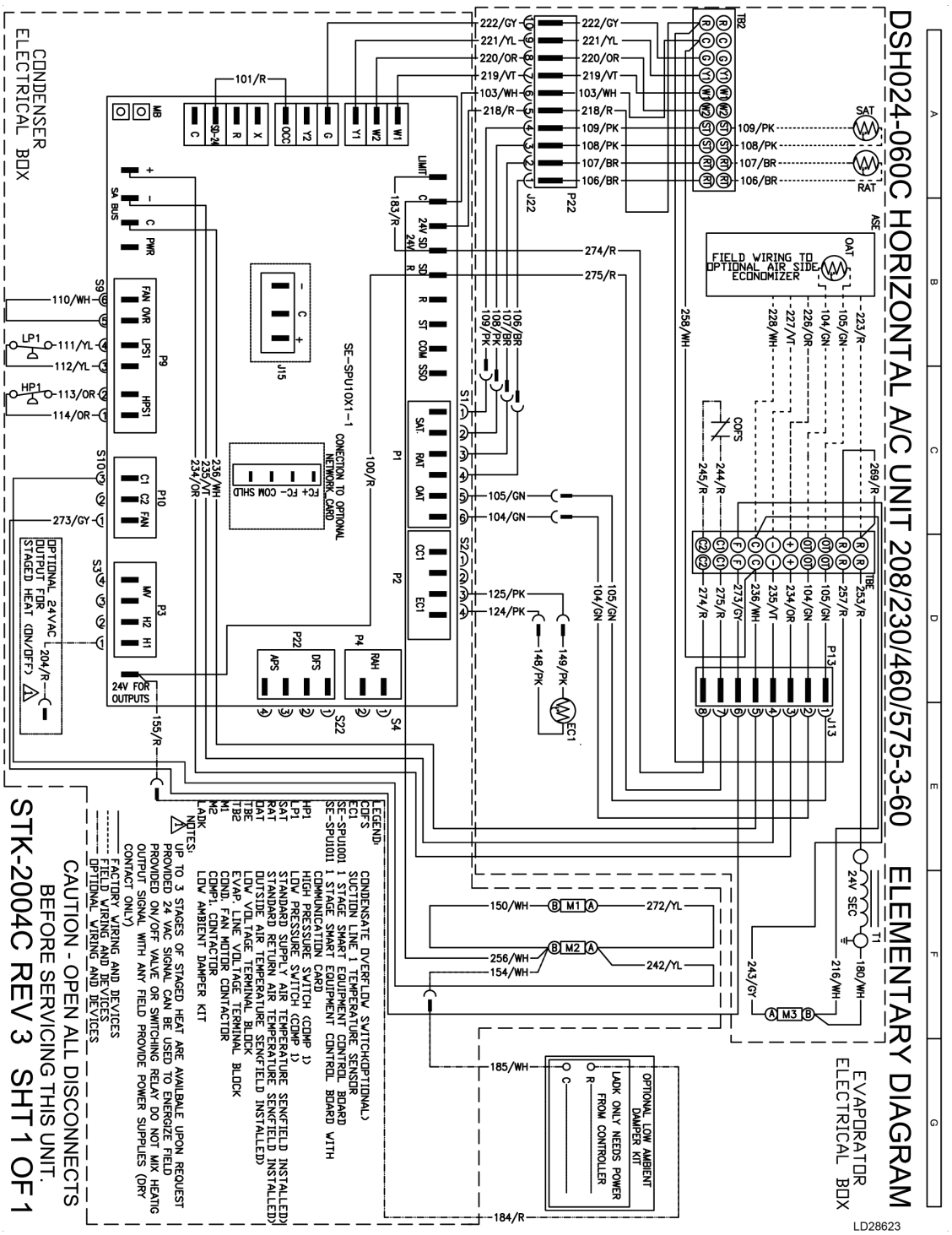


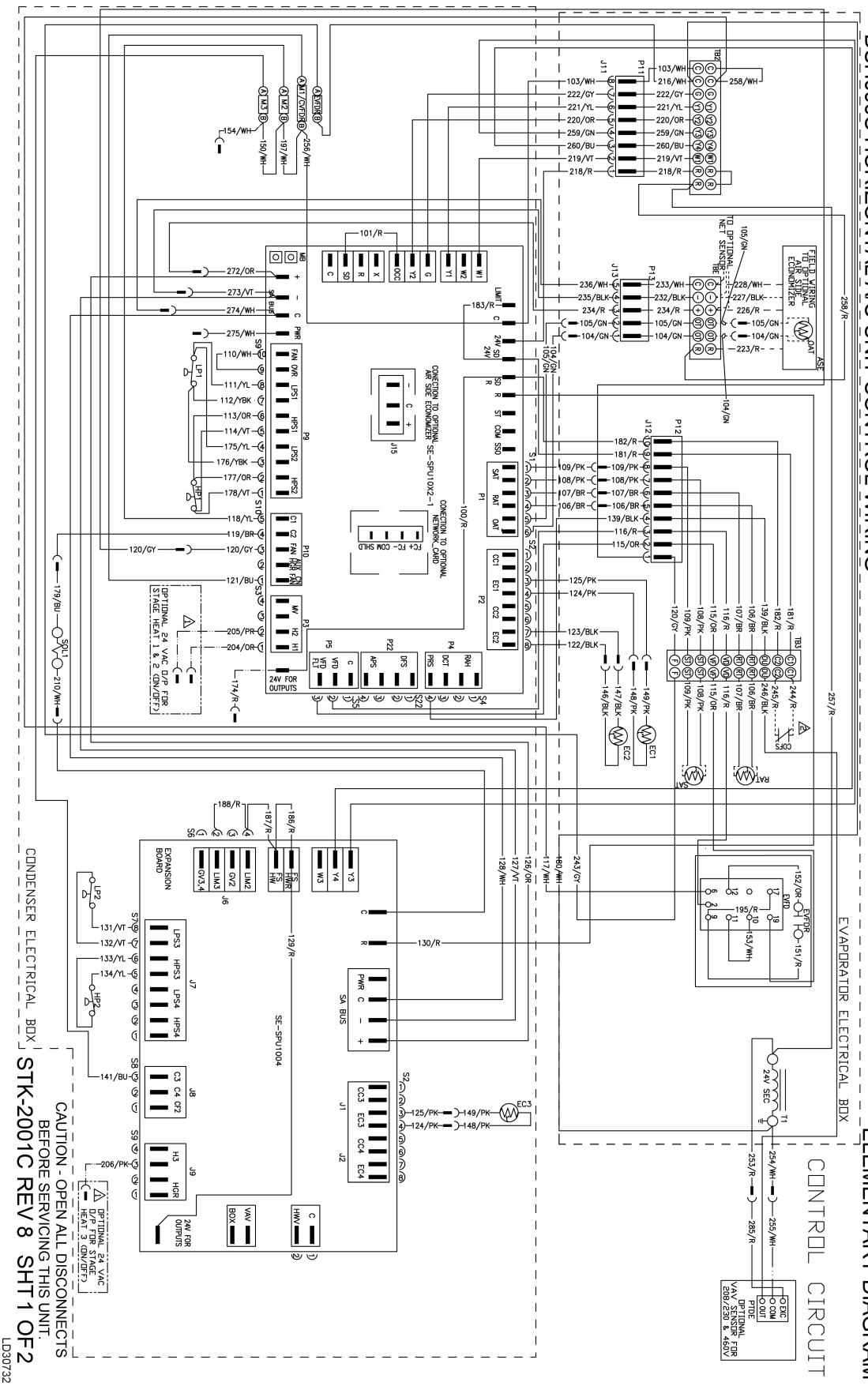
NOTES:

1. ALL FIELD WIRING TO BE ACCOMPLISHED FOLLOWING CITY, LOCAL AND/OR NATIONAL CODES IN EFFECT AT THE TIME OF INSTALLATION OF THIS UNIT.
2. CAUTION: LABEL ALL WIRES PRIOR TO DISCONNECTION WHEN SERVICING CONTROLS. WIRING ERRORS CAN CAUSE IMPROPER AND DANGEROUS OPERATION. IF ANY OF THE WIRING, AS SUPPLIED WITH THE UNIT, MUST BE REMOVED IT MUST BE REPLACED WITH TYPE 105 DEGREE C, 600 VOLT WIRE OR EQUIVALENT CLEARLY RENUMBERED FOR IDENTIFICATION. VERIFY PROPER OPERATION AFTER SERVICING.
3. VFD NON BYPASS OPTION WILL NOT HAVE M1 AND OLR AS MOTOR CONTROL IS HANDELED BY VFD.
4. FACTORY WIRED FOR 230 VOLT OPERATION. FOR 208 VOLT, MOVE WIRE A130 TO 208 VOLT TERMINAL ON T1. SIMILARLY FOR 460 AND 575 VOLT SEE DETAIL A

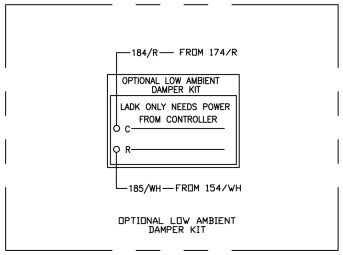
CAUTION - OPEN ALL DISCONNECTS BEFORE SERVICING THIS UNIT.

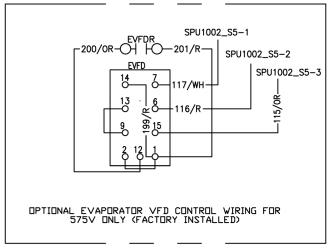
REV 00 SHT 1 OF 1 STK-2002C

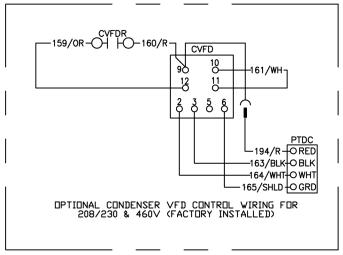

DSH024-060C HORIZONTAL A/C UNIT 208/230/460/575-3-60 ELEMENTARY DIAGRAM
CONDENSER ELECTRICAL BOX
EVAPORATOR ELECTRICAL BOX
FIELD WIRING TO OPTIONAL AIR SIDE ECONOMIZER
OPTIONAL LOW AMBIENT DAMPER KIT
LADK ONLY NEEDS POWER FROM CONTROLLER
OPTIONAL 24VAC OUTPUT FOR STAGED HEAT (ON/OFF)
SE-SPU10X1-1
CONECTION TO OPTIONAL NETWORK CARD
LEGEND:
CDFS CONDENSATE OVERFLOW SWITCH(OPTIONAL)
EC1 SUCTION LINE 1 TEMPERATURE SENSOR
SE-SPU1001 1 STAGE SMART EQUIPMENT CONTROL BOARD
SE-SPU1011 1 STAGE SMART EQUIPMENT CONTROL BOARD WITH COMMUNICATION CARD
HP1 HIGH PRESSURE SWITCH (COMP 1)
LP1 LOW PRESSURE SWITCH (COMP 1)
SAT STANDARD SUPPLY AIR TEMPERATURE SENSFIELD INSTALLED)
RAT STANDARD RETURN AIR TEMPERATURE SENSFIELD INSTALLED)
OAT OUTSIDE AIR TEMPERATURE SENSFIELD INSTALLED)
TBE LOW VOLTAGE TERMINAL BLOCK
TB2 EVAP. LINE VOLTAGE TERMINAL BLOCK
M1 COND. FAN MOTOR CONTACTOR
M2 COMP1. CONTACTOR
LADK LOW AMBIENT DAMPER KIT
NOTES:
UP TO 3 STAGES OF STAGED HEAT ARE AVAILBALE UPON REQUEST PROVIDED 24 VAC SIGNAL CAN BE USED TO ENERGIZE FIELD PROVIDED ON/OFF VALVE OR SWITCHING RELAY DO NOT MIX HEATIG OUTPUT SIGNAL WITH ANY FIELD PROVIDE POWER SUPPLIES (DRY CONTACT ONLY)
FACTORY WIRING AND DEVICES
FIELD WIRING AND DEVICES
OPTIONAL WIRING AND DEVICES
CAUTION - OPEN ALL DISCONNECTS BEFORE SERVICING THIS UNIT.
STK-2004C REV 3 SHT 1 OF 1
LD28623

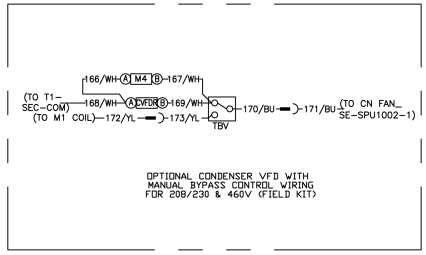

DSH096C HORIZONTAL A/C UNIT CONTROL WIRING
ELEMENTARY DIAGRAM
CONTROL CIRCUIT
EVAPORATOR ELECTRICAL BOX
CONDENSER ELECTRICAL BOX
CAUTION - OPEN ALL DISCONNECTS BEFORE SERVICING THIS UNIT.
STK-2001C REV 8 SHT 1 OF 2
LD30732

DSH096C HORIZONTAL A/C UNIT CONTROL WIRING









ELEMENTARY DIAGRAM

LEGEND:

PTDC	PRESSURE TRANSDUCER CONDENSER
PTDE	PRESSURE TRANSDUCER EVAPORATOR
COFS	OPTIONAL CONDENSATE OVERFLOW SWITCH
EC1	SUCTION LINE 1 (COMP.1) TEMPERATURE SENSOR
EC2	SUCTION LINE 2 (COMP.2) TEMPERATURE SENSOR
EC3	SUCTION LINE 2 (COMP.2) TEMPERATURE SENSOR
H1	AUX HEATING OPTION STAGE 1
H2	AUX HEATING OPTION STAGE 2
H3	AUX HEATING OPTION STAGE 3
SE-SPU1002	2 STAGE SMART EQUIPMENT CONTROL BOARD
SE-SPU10X2	2 STAGE SMART EQUIPMENT CONTROL BOARD WITH COMMUNICATION CARD
SE-SPU1004	4 STAGE EXPAND CONTROL BOARD
HP1	HIGH PRESSURE SWITCH (COMP 1)
LP1	LOW PRESSURE SWITCH (COMP 1)
HP2	HIGH PRESSURE SWITCH (COMP 2)
LP2	LOW PRESSURE SWITCH (COMP 2)
SAT	STANDARD SUPPLY AIR TEMPERATURE (FIELD INSTALLED)
RAT	STANDARD RETURN AIR TEMPERATURE (FIELD INSTALLED)
OAT	OPTIONAL OUTSIDE AIR TEMPERATURE (FIELD INSTALLED)
SOL1	COMPRESSOR1 SOLENOID
SOL2	COMPRESSOR2 SOLENOID
TBV	BYPASS VFD TERMINAL BLOCK
TB2	THERMOSTAT TERMINAL BLOCK
TBE	ASE TERMINAL BLOCK
EVFD	EVAPORATOR VFD
CVFD	COMPRESSOR VFD
EVFDR	EVAPORATOR VFD RELAY
CVFDR	COMPRESSOR VFD RELAY
M1	COND. FAN MOTOR CONTACTOR
M2	COMP1. CONTACTOR
M3	COMP2. CONTACTOR
M4	COND. VFD BYPASS CONTACTOR

SPU1004 J1,J2	SOCKET/PLUG CONNECTION,24V, 8 PIN ON 4 STAGE EXPAND CONTROL BOARD
SPU1004 J6	SOCKET/PLUG CONNECTION,24V, 4 PIN ON 4 STAGE EXPAND CONTROL BOARD
SPU1004 J7	SOCKET/PLUG CONNECTION,24V, 8 PIN ON 4 STAGE EXPAND CONTROL BOARD
SPU1004 J8	SOCKET/PLUG CONNECTION,24V, 3 PIN ON 4 STAGE EXPAND CONTROL BOARD
SPU1004 J9	SOCKET/PLUG CONNECTION,24V, 8 PIN ON 4 STAGE EXPAND CONTROL BOARD
SPU1002 P1/S1	SOCKET/PLUG CONNECTION,24V, 6 PIN ON 2 STAGE SE CONTROL BOARD
SPU1002 P2/S2	SOCKET/PLUG CONNECTION,24V, 8 PIN ON 2 STAGE SE CONTROL BOARD
SPU1002 P3/S3	SOCKET/PLUG CONNECTION,24V, 4 PIN ON 2 STAGE SE CONTROL BOARD
SPU1002 P4/S4	SOCKET/PLUG CONNECTION,24V, 4 PIN ON 2 STAGE SE CONTROL BOARD
SPU1002 P5/S5	SOCKET/PLUG CONNECTION,24V, 3 PIN ON 2 STAGE SE CONTROL BOARD
SPU1002 P9/S9	SOCKET/PLUG CONNECTION,24V, 10 PIN ON 2 STAGE SE CONTROL BOARD
SPU1002 P10/S10	SOCKET/PLUG CONNECTION,24V, 5 PIN ON 2 STAGE SE CONTROL BOARD
SPU1002 P22/S22	SOCKET/PLUG CONNECTION,24V, 4 PIN ON 2 STAGE SE CONTROL BOARD
S13/P13	SOCKET/PLUG CONNECTION 24V, 5 PIN FOR SA BUS OR AIR SIDE ECONOMIZER HARNESS
S12/P12	SOCKET/PLUG CONNECTION 24V, 10 PIN FOR SENSOR HARNESS
P11/S11	SOCKET/PLUG CONNECTION 24V, 8 PIN FOR THERMOSTAT HARNESS

——— FACTORY WIRING AND DEVICES
- - - - - - - FIELD WIRING AND DEVICES
——— OPTIONAL WIRING AND DEVICES

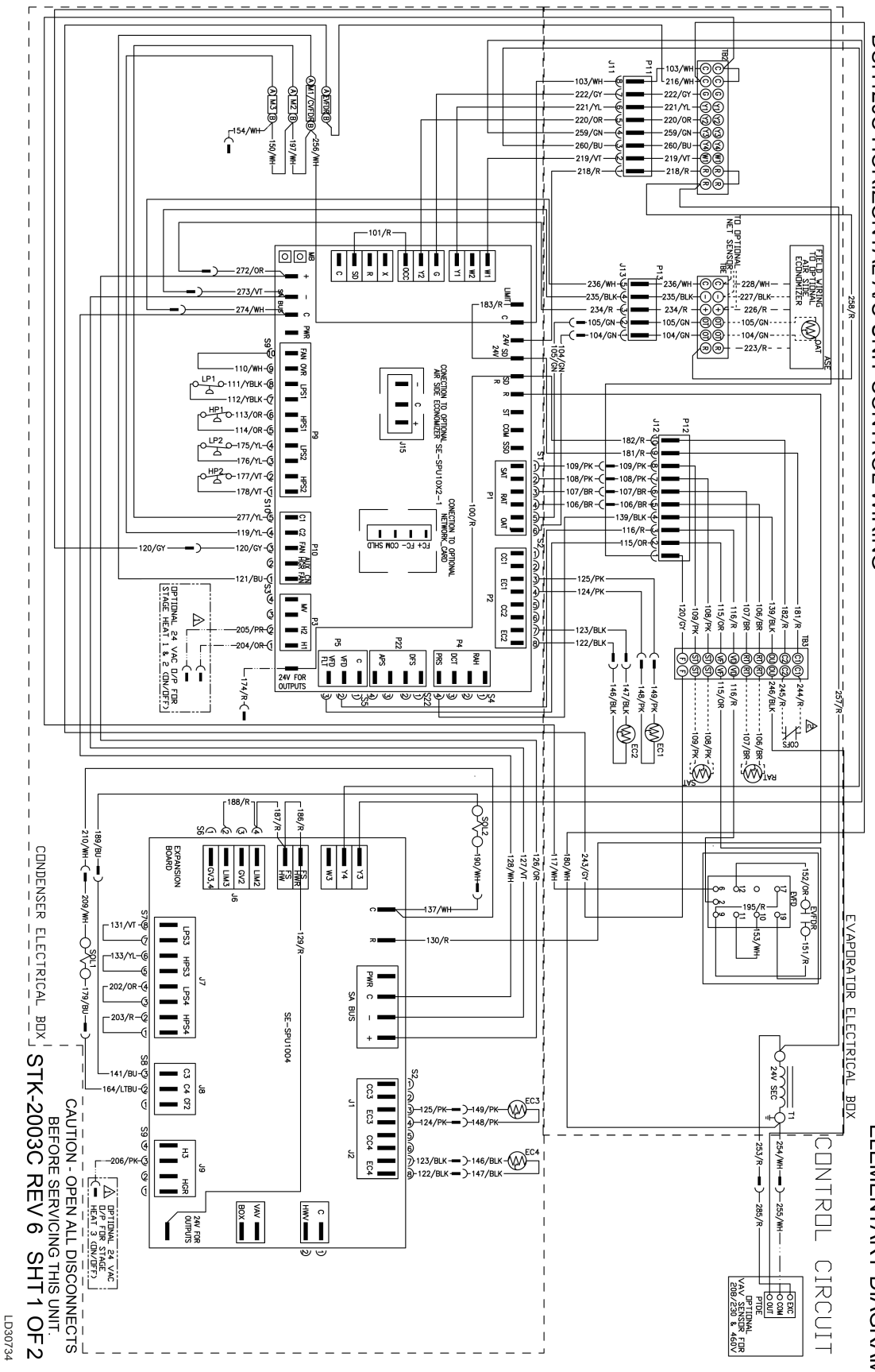
NOTES:

1. UP TO 3 STAGES OF STAGED HEAT ARE AVAILABLE UPON REQUEST. PROVIDED 24 VAC SIGNAL CAN BE USED TO ENERGIZE FIELD PROVIDED ON/OFF VALVE OR SWITCHING RELAY DO NOT MIX HEATING OUTPUT SIGNAL WITH ANY FIELD PROVIDE POWER SUPPLIES (DRY CONTACT ONLY)
2. OPTIONAL CONDENSATE OVERFLOW SWITCH OR SHUT DOWN CONTACT TO BE CONNECTED BETWEEN WIRE NO 244 & 245.

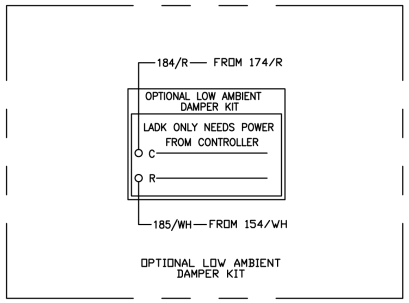
CAUTION - OPEN ALL DISCONNECTS BEFORE SERVICING THIS UNIT.

STK-2001C REV 8 SHT 2 OF 2

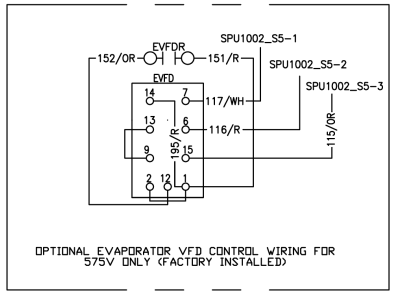
LD30733


DSH120C HORIZONTAL A/C UNIT CONTROL WIRING
ELEMENTARY DIAGRAM
EVAPORATOR ELECTRICAL BOX
CONTROL CIRCUIT
CONDENSER ELECTRICAL BOX
CAUTION - OPEN ALL DISCONNECTS BEFORE SERVICING THIS UNIT.
STK-2003C REV 6 SHT 1 OF 2
LD30734

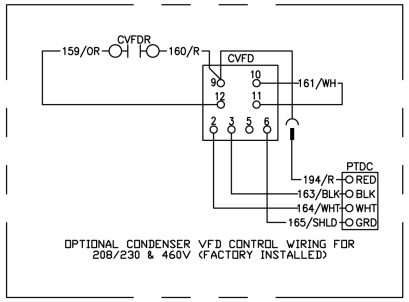
DSH120C HORIZONTAL A/C UNIT CONTROL WIRING



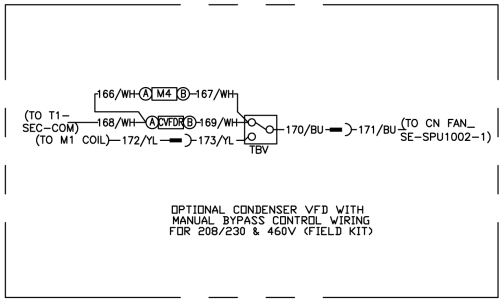
OPTIONAL LOW AMBIENT DAMPER KIT



OPTIONAL EVAPORATOR VFD CONTROL WIRING FOR 575V ONLY (FACTORY INSTALLED)



OPTIONAL CONDENSER VFD CONTROL WIRING FOR 208/230 & 460V (FACTORY INSTALLED)



OPTIONAL CONDENSER VFD WITH MANUAL BYPASS CONTROL WIRING FOR 208/230 & 460V (FIELD KIT)

ELEMENTARY DIAGRAM

LEGEND:

PTDC	PRESSURE TRANSDUCER CONDENSER
PTDE	PRESSURE TRANSDUCER EVAPORATOR
COFS	OPTIONAL CONDENSATE OVERFLOW SWITCH
EC1	SUCTION LINE 1 (COMP.1) TEMPERATURE SENSOR
EC2	SUCTION LINE 2 (COMP.2) TEMPERATURE SENSOR
EC3	SUCTION LINE 2 (COMP.2) TEMPERATURE SENSOR
EC4	SUCTION LINE 1 (COMP.1) TEMPERATURE SENSOR
H1	AUX HEATING OPTION STAGE 1
H2	AUX HEATING OPTION STAGE 2
H3	AUX HEATING OPTION STAGE 3
SE-SPU1002	2 STAGE SMART EQUIPMENT CONTROL BOARD
SE-SPU10X2	2 STAGE SMART EQUIPMENT CONTROL BOARD WITH COMMUNICATION CARD
SE-SPU1004	4 STAGE EXPAND CONTROL BOARD
HP1	HIGH PRESSURE SWITCH (COMP 1)
LP1	LOW PRESSURE SWITCH (COMP 1)
HP2	HIGH PRESSURE SWITCH (COMP 2)
LP2	LOW PRESSURE SWITCH (COMP 2)
SAT	STANDARD SUPPLY AIR TEMPERATURE (FIELD INSTALLED)
RAT	STANDARD RETURN AIR TEMPERATURE (FIELD INSTALLED)
OAT	OPTIONAL OUTSIDE AIR TEMPERATURE (FIELD INSTALLED)
SOL1	COMPRESSOR1 SOLENOID
SOL2	COMPRESSOR2 SOLENOID
TBV	BYPASS VFD TERMINAL BLOCK
TB2	THERMOSTAT TERMINAL BLOCK
TBE	ASE TERMINAL BLOCK
EVFD	EVAPORATOR VFD
CVFD	COMPRESSOR VFD
EVFDR	EVAPORATOR VFD RELAY
CVFDR	COMPRESSOR VFD RELAY
M1	COND. FAN MOTOR CONTACTOR
M2	COMP1. CONTACTOR
M3	COMP2. CONTACTOR
M4	COND. VFD BYPASS CONTACTOR

SPU1004 J1,J2	SOCKET/PLUG CONNECTION,24V, 8 PIN ON 4 STAGE EXPAND CONTROL BOARD
SPU1004 J6	SOCKET/PLUG CONNECTION,24V, 4 PIN ON 4 STAGE EXPAND CONTROL BOARD
SPU1004 J7	SOCKET/PLUG CONNECTION,24V, 8 PIN ON 4 STAGE EXPAND CONTROL BOARD
SPU1004 J8	SOCKET/PLUG CONNECTION,24V, 3 PIN ON 4 STAGE EXPAND CONTROL BOARD
SPU1004 J9	SOCKET/PLUG CONNECTION,24V, 8 PIN ON 4 STAGE EXPAND CONTROL BOARD
SPU1002 P1/S1	SOCKET/PLUG CONNECTION,24V, 6 PIN ON 2 STAGE SE CONTROL BOARD
SPU1002 P2/S2	SOCKET/PLUG CONNECTION,24V, 8 PIN ON 2 STAGE SE CONTROL BOARD
SPU1002 P3/S3	SOCKET/PLUG CONNECTION,24V, 4 PIN ON 2 STAGE SE CONTROL BOARD
SPU1002 P4/S4	SOCKET/PLUG CONNECTION,24V, 4 PIN ON 2 STAGE SE CONTROL BOARD
SPU1002 P5/S5	SOCKET/PLUG CONNECTION,24V, 3 PIN ON 2 STAGE SE CONTROL BOARD
SPU1002 P9/S9	SOCKET/PLUG CONNECTION,24V, 10 PIN ON 2 STAGE SE CONTROL BOARD
SPU1002 P10/S10	SOCKET/PLUG CONNECTION,24V, 5 PIN ON 2 STAGE SE CONTROL BOARD
SPU1002 P22/S22	SOCKET/PLUG CONNECTION,24V, 4 PIN ON 2 STAGE SE CONTROL BOARD
S13/P13	SOCKET/PLUG CONNECTION 24V, 5 PIN FOR SA BUS OR AIR SIDE ECONOMIZER HARNESS
S12/P12	SOCKET/PLUG CONNECTION 24V, 10 PIN FOR SENSOR HARNESS
P11/S11	SOCKET/PLUG CONNECTION 24V, 8 PIN FOR THERMOSTAT HARNESS

——— FACTORY WIRING AND DEVICES
- - - - - - - FIELD WIRING AND DEVICES
——— OPTIONAL WIRING AND DEVICES

NOTES:

1. UP TO 3 STAGES OF STAGED HEAT ARE AVAILABLE UPON REQUEST
   PROVIDED 24 VAC SIGNAL CAN BE USED TO ENERGIZE FIELD PROVIDED ON/OFF VALVE OR SWITCHING RELAY DO NOT MIX HEATING OUTPUT SIGNAL WITH ANY FIELD PROVIDE POWER SUPPLIES (DRY CONTACT ONLY)
2. OPTIONAL CONDENSATE OVERFLOW SWITCH OR SHUT DOWN CONTACT TO BE CONNECTED BETWEEN WIRE NO 244 & 245.

CAUTION - OPEN ALL DISCONNECTS BEFORE SERVICING THIS UNIT.

STK-2003C REV 6 SHT 2 OF 2

LD30735

Appendix B: SEC parameters for DSH024C–DSH120C units

Table 32: SEC parameters for DSH024C-060C units with single speed evaporator fan

Menu/sub-menu			Parameter	Factory value
Commission	**Standard**		T-Stat Only	Yes
	Options		# Refrig Sys	1
			# Ht Pump Stgs	0
Details	**OCC**		Occ Mode[1]	External
			Off Dur Unocc	No
	Cooling	**Setup**	Clg-En	Yes
			# Clg Stgs	1
			C1-En	Yes
			Low Amb-En[2]	No
			Lead Lag-En[3]	No
			Clg OAT Cutout-En	Yes
			Clg OAT Cutout	45
			Clg Adap Tune-En	No
			SAT Cool Limit-En	Yes
			Sat Cool Limit-SP	45
			Freeze-SP	26
	Heating		Htg-En[4]	No
			# Htg Stgs	0
	Fan		Fan Ctl-Type	Single Speed
			Fan On Dly Cool	0
			Fan Off Dly Cool	45

Note:

1. Factory shipped units equipped with Occ jumper on UCB
2. Do not enable low ambient
3. Do not enable LeadLag
4. Field supplied option

Table 33: SEC parameters for DSH096C units with VAV evaporator fan

Menu/sub-menu			Configured parameter default setting and conditions
Commission			Tstat-Only Yes (T-Stat Input Only)
			#HtPumpStgs 0 (# of Heat Pumps)
			#RefrigSys 2 (#Refrig Circuits)
Details	**Occupancy status**		OccMode External Occupancy Mode[1]
			OffDurUnocc Yes (Off During Unoccupied)
	Indoor fan		FanCtl-Type Variable (UnitOpMode)
			FanOnDlyCool 0sec (CoolFanOnDelay)
			FanOffDlyCool 30sec (CoolFanOffDelay)
	Fan VFD		DctPrs-Sp 0.5"/w (DuctPres Setpoint)[2]
			DctShutdownSp 3.0"/w (DuctPressLimit)[2]
	Cooling	**Setup**	#ClgStgs 3 (# of Cooling Stages)
			C1-En Yes (C1 24vacOutputEnabled)
			C2-En Yes (C2 24vacOutputEnabled)
			C3-En Yes (C3 24vacOutputEnabled)
			C4-En No (C4 24vacOutputEnabled)
			Clg-En Yes (Cooling Enabled/Disabled)
			LeadLag-En No (EqualCompRuntime)[3]
			ClgOATCutout-En Yes (LowAmbComp LO)
			ClgOATCutout 45.0°F (LoAmbCompLO StPt)
			ClgAdapTunEn No (Cooling Auto Tune Enable)
			SATCoolLimit-En Yes (Enable SAT Limit)
			SATCoolLimit-Sp 45.0°F (SAT Limit SetPt)
			LowAmb-En No (Low Ambient Enabled)[4]
			Freeze-Sp 26.0°F (Evap Freeze Protect Setpt)
	Heating		Htg-En No (Heating Oper Enabled)[5]
			#HtgStgs 0 (# of Heating Stages)

Note:

1. Factory shipped units equipped with Occ jumper on UCB
2. Field set parameter
3. Do not enable low ambient
4. Do not enable LeadLag
5. Field supplied option

Table 34: SEC parameters for DSH096C units with discrete speeds evaporator fan

Menu/sub-menu			Configured parameter default setting and conditions
Commission			Tstat-Only Yes (T-Stat Input Only)
			#HtPumpStgs 0 (# of Heat Pumps)
			#RefrigSys 2 (#Refrig Circuits)
Details	**Occupancy status**		OccMode External Occupancy Mode[1]
			OffDurUnocc Yes (Off During Unoccupied)
	Indoor fan		FanCtl-Type Variable (UnitOpMode)
			FanOnDlyCool 0sec (CoolFanOnDelay)
			FanOffDlyCool 30sec (CoolFanOffDelay)
			FanOn Occ No (CV ConstantFanOccupied Mode)
			Fan Only-% Cmd 0 % (CV IntelliSpeed Fan Only)
			1ClgStg-% Cmd 50 % (CV IntelliSpeed 1 Stg Cool)
			2ClgStg-% Cmd 60 % (CV IntelliSpeed 2 Stg Cool)
			3ClgStg-% Cmd 100 % (CV IntelliSpeed 3 Stg Cool)
			4ClgStg-% Cmd 100 % (CV IntelliSpeed 4 Stg Cool)
	Cooling	**Setup**	#ClgStgs 3 (# of Cooling Stages)
			C1-En Yes (C1 24vacOutputEnabled)
			C2-En Yes (C2 24vacOutputEnabled)
			C3-En Yes (C3 24vacOutputEnabled)
			C4-En No (C4 24vacOutputEnabled)
			Clg-En Yes (Cooling Enabled/Disabled)
			LeadLag-En No (EqualCompRuntime)[2]
			ClgOATCutout-En Yes (LowAmbComp LO)
			ClgOATCutout 45.0°F (LoAmbCompLO StPt)
			ClgAdapTunEn No (Cooling Auto Tune Enable)
			SATCoolLimit-En Yes (Enable SAT Limit)
			SATCoolLimit-Sp 45.0°F (SAT Limit SetPt)
			LowAmb-En No (Low Ambient Enabled)[3]
			Freeze-Sp 26.0°F (Evap Freeze Protect Setpt)
	Heating		Htg-En No (Heating Oper Enabled)[4]
			#HtgStgs 0 (# of Heating Stages)

Note:

1. Factory shipped units equipped with Occ jumper on UCB
2. Do not enable low ambient
3. Do not enable LeadLag
4. Field supplied option

Table 35: SEC parameters for DSH120C units with VAV evaporator fan

Menu/sub-menu			Configured parameter default setting and conditions
Commission			Tstat-Only Yes (T-Stat Input Only)
			#HtPumpStgs 0 (# of Heat Pumps)
			#RefrigSys 2 (#Refrig Circuits)
Details	**Occupancy status**		OccMode External Occupancy Mode[1]
			OffDurUnocc Yes (Off During Unoccupied)
	Indoor fan		FanCtl-Type Variable (UnitOpMode)
			FanOnDlyCool 0sec (CoolFanOnDelay)
			FanOffDlyCool 30sec (CoolFanOffDelay)
	Fan VFD		DctPrs-Sp 0.5"/w (DuctPres Setpoint)[2]
			DctShutdownSp 3.0"/w (DuctPressLimit)[2]
	Cooling	**Setup**	#ClgStgs 4 (# of Cooling Stages)
			C1-En Yes (C1 24vacOutputEnabled)
			C2-En Yes (C2 24vacOutputEnabled)
			C3-En Yes (C3 24vacOutputEnabled)
			C4-En Yes (C4 24vacOutputEnabled)
			Clg-En Yes (Cooling Enabled/Disabled)
			LeadLag-En No (EqualCompRuntime)[3]
			ClgOATCutout-En Yes (LowAmbComp LO)
			ClgOATCutout 45.0°F (LoAmbCompLO StPt)
			ClgAdapTunEn No (Cooling Auto Tune Enable)
			SATCoolLimit-En Yes (Enable SAT Limit)
			SATCoolLimit-Sp 45.0°F (SAT Limit SetPt)
			LowAmb-En No (Low Ambient Enabled)[4]
			Freeze-Sp 26.0°F (Evap Freeze Protect Setpt)
	Heating		Htg-En No (Heating Oper Enabled)[5]
			#HtgStgs 0 (# of Heating Stages)

Note:

1. Factory shipped units equipped with Occ jumper on UCB
2. Field set parameter
3. Do not enable low ambient
4. Do not enable LeadLag
5. Field supplied option

Table 36: SEC parameters for DSH120C units with discrete speeds evaporator fan

Menu/sub-menu			Configured parameter default setting and conditions
Commission			Tstat-Only Yes (T-Stat Input Only)
			#HtPumpStgs 0 (# of Heat Pumps)
			#RefrigSys 2 (#Refrig Circuits)
Details	**Occupancy status**		OccMode External Occupancy Mode[1]
			OffDurUnocc Yes (Off During Unoccupied)
	Indoor fan		FanCtl-Type Variable (UnitOpMode)
			FanOnDlyCool 0sec (CoolFanOnDelay)
			FanOffDlyCool 30sec (CoolFanOffDelay)
			FanOn Occ No (CV ConstantFanOccupied Mode)
			Fan Only-% Cmd 0 % (CV IntelliSpeed Fan Only)
			1ClgStg-% Cmd 50 % (CV IntelliSpeed 1 Stg Cool)
			2ClgStg-% Cmd 60 % (CV IntelliSpeed 2 Stg Cool)
			3ClgStg-% Cmd 75 % (CV IntelliSpeed 3 Stg Cool)
			4ClgStg-% Cmd 100 % (CV IntelliSpeed 4 Stg Cool)
	Cooling	**Setup**	#ClgStgs 4 (# of Cooling Stages)
			C1-En Yes (C1 24vacOutputEnabled)
			C2-En Yes (C2 24vacOutputEnabled)
			C3-En Yes (C3 24vacOutputEnabled)
			C4-En Yes (C4 24vacOutputEnabled)
			Clg-En Yes (Cooling Enabled/Disabled)
			LeadLag-En No (EqualCompRuntime)[2]
			ClgOATCutout-En Yes (LowAmbComp LO)
			ClgOATCutout 45.0°F (LoAmbCompLO StPt)
			ClgAdapTunEn No (Cooling Auto Tune Enable)
			SATCoolLimit-En Yes (Enable SAT Limit)
			SATCoolLimit-Sp 45.0°F (SAT Limit SetPt)
			LowAmb-En No (Low Ambient Enabled)[3]
			Freeze-Sp 26.0°F (Evap Freeze Protect Setpt)
	Heating		Htg-En No (Heating Oper Enabled)[4]
			#HtgStgs 0 (# of Heating Stages)

Note:

1. Factory shipped units equipped with Occ jumper on UCB
2. Do not enable low ambient
3. Do not enable LeadLag
4. Field supplied option

R-410A Quick reference guide

Refer to the Installation specific installation requirements.

- R-410A refrigerant operates at 50–70% higher pressures than R-22. Ensure that servicing equipment and replacement components are designed to operate with R-410A.
- R-410A refrigerant cylinders are rose colored.
- Recovery cylinder service pressure rating must be 400 psig. DOT 4BA400 or DOT BW400.
- Recovery equipment must be rated for R-410A.
- Do not use R-410A service equipment on R-22 systems. All hoses, gages, recovery cylinders, charging cylinders, and recovery equipment must be dedicated for use on R-410A systems only.
- Manifold sets must be at least 700 psig high side and 180 psig low side with 550 psig retard.
- All hoses must have a service pressure rating of 800 psig.
- Leak detectors must be designed to detect HFC refrigerants.
- Systems must be charged with refrigerant. Use a commercial type metering device in the manifold hose.
- R-410A can only be used with polyester (POE) type oils.
- POE type oils rapidly absorb moisture from the atmosphere.
- Vacuum pumps do not remove moisture from POE type oils.
- Do not use liquid line driers with a rated working pressure rating less than 600 psig.
- Do not install suction line driers in the liquid line.
- A liquid line drier is required on every unit.
- Do not use an R-22 TXV. If a TXV is to be used, it must be an R-410A TXV.
- Never open system to atmosphere when under vacuum.
- If system must be opened for service, evacuate system then break the vacuum with dry nitrogen, and replace filter driers.