Installation, Operation, and Maintenance Manual	IOM 1062-1
	Group: **Chiller**
	Part Number: **331375001**
	Effective: **May 2016**
	Supersedes: **IOM AFSD-2**

Direct Drive Fluid Coolers

Type AFS 005 through AFS 107
Type AFD 046 through AFD 212

DAIKIN

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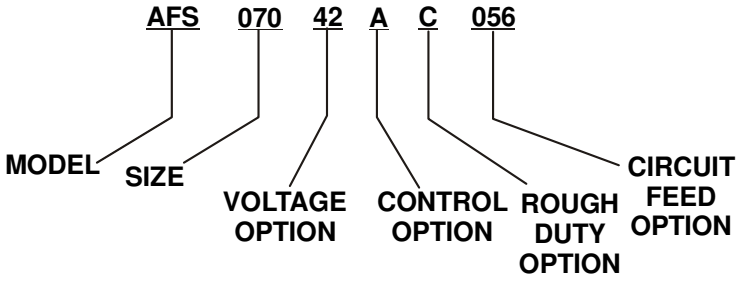
Manufactured in an ISO certified facility

Product Offering



Model
AFS - 1140 RPM fan motors, single-row of fans
AFD - 1140 RPM fan motors, double row of fans

Size
Models 005 through 021 – 1/3 horsepower motors, 1140 RPM fan motors
Models 023 through 212 – 1 ½ horsepower motors, 1140 RPM fan motors

Voltage Option
42 = 208/230 volts / 60 Hertz / 3-phase
27 = 460 volts / 60 Hertz / 3-phase
37 = 575 volts / 60 Hertz / 3-phase
Special – 208 volts / 60 Hertz/ 1-phase, 208/230/380/460 volts/50 Hertz/3-phase

Control Option
A = Fan Cycling Thermostat with Control Transformer (120V)
E = Control Transformer Only (120V)
Y = None

Rough Duty Options
A = Totally enclosed motors
B = Sealtite® Wiring
C = PolyGuard® fin coating with totally enclosed motors and Sealtite wiring
D = ElectroFin™ coating with totally enclosed motors and Sealtite wiring
E = PolyGuard Only
F = ElectroFin Only
G = Copper Fins Only (not available on 5 or 6-fan length models)
H = Copper Fins with totally enclosed motors and Sealtite wiring

Circuit Feed Option
Equals the number of feeds (from the header to the first pass of tubes) from capacity tables.

Introduction

Carefully check each shipment against the bill of lading and account for all items. Report any shortage or damage to the delivering carrier. Damaged material is the delivering carrier's responsibility. Do not return to the manufacturer without prior approval.

Be careful when uncrating, to prevent damage. Heavy equipment should be left on units shipping base until it has been moved to the final location. This equipment must be installed in accordance with accepted industry standards. Failure to meet the following conditions may void the warranty:

1. System piping must be installed following industry standards for good piping practices.
2. Inert gas must be charged into piping during welding.
3. System must be thoroughly leak checked before initial charging.
4. Power supply to system must meet the following conditions:
   - Voltage for 208/230 motors not less than 195 volts or more than 253 volts.
   - All other voltages must be within 10% of nameplate ratings.
   - Phase imbalance not to exceed 2%.
5. All controls and equipment protection circuits properly connected per wiring diagram.
6. Factory installed wiring must not be changed without written factory approval.
7. Relief valves must meet all code requirements.

Installation

Inspection

When the equipment is received, carefully check all items against the bill of lading to check for a complete shipment. Check all units for damage upon arrival. All shipping damage must be reported to the carrier and a claim must be filed with the carrier. Check the unit's serial plate before unloading the unit to be sure that it agrees with the power supply available. Physical damage to unit after acceptance is not the responsibility of Daikin.

Handling

Note: Installation and maintenance are to be performed only by qualified personnel who are familiar with local codes and regulations, and experienced with this type of equipment.

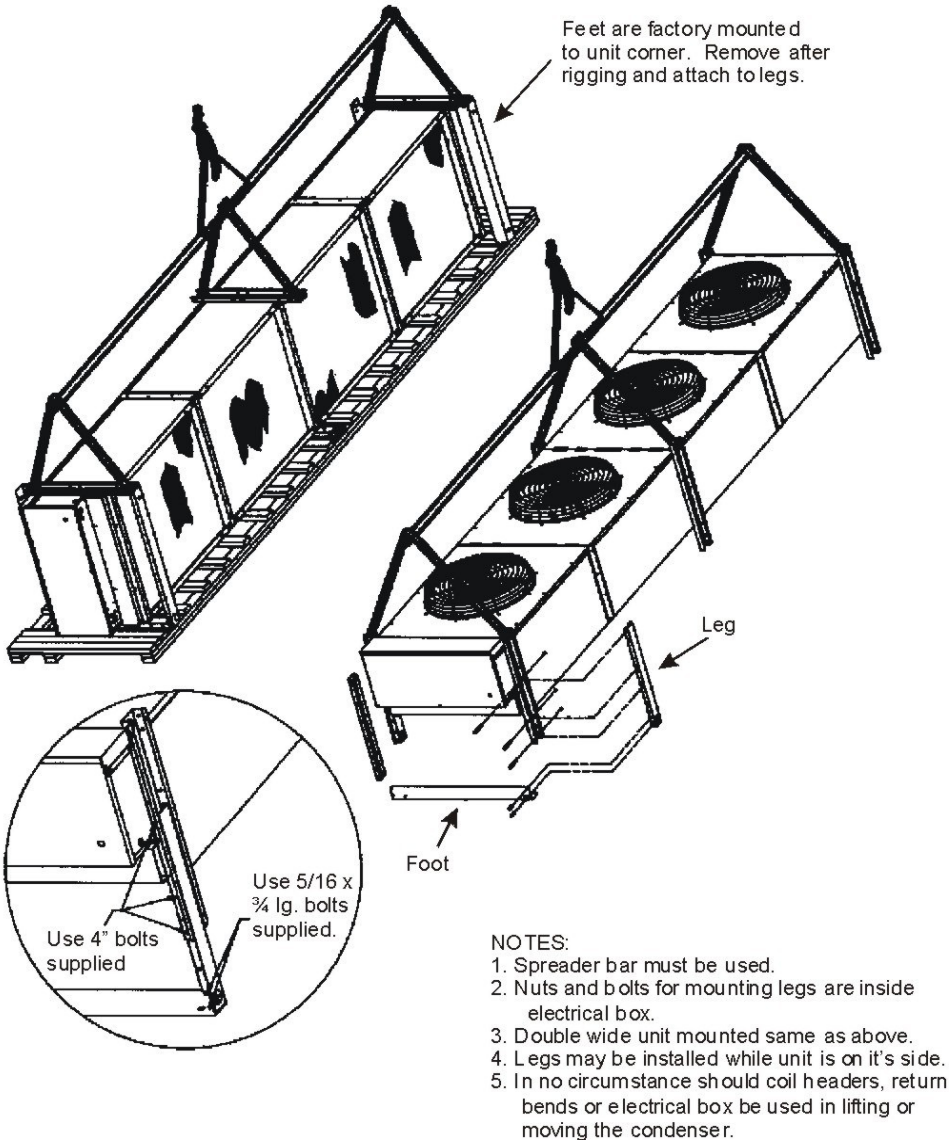
Avoid rough handling shock due to impact or dropping the unit. Do not push or pull the unit.

Never allow any part of the unit to fall during unloading or moving, as this can result in serious damage.

⚠ WARNING

Improper lifting or moving unit can result in property damage, severe personal injury or death. Follow rigging and moving instructions carefully.

Figure 1, Unit Rigging



Unit Location

Units are designed for outdoor application and may be mounted on a roof or concrete slab (ground level installation). Install roof mounted units on steel channels or an I-beam frame to support the unit above the roof. Use of vibration pads or isolators is recommended. The roof must be strong enough to support the weight of the unit. For ground level installation, mount units on a one-piece concrete slab with footings extending below the frost line. Be certain concrete slabs are installed level and are properly supported to prevent settling. Locate the unit far enough away from any wall or other obstruction to provide sufficient clearance for air entrance. Do not attach more than two-feet of ductwork to the fan outlet. Avoid air recirculation conditions that may be caused by sight screening, walls, etc. and keep unit fan discharge away from any building air intakes. Do not install unit where exhaust or ventilation equipment will affect entering air temperature or foul coils.

Holding Charge

The unit is shipped with a holding charge of dry nitrogen under nominal pressure.

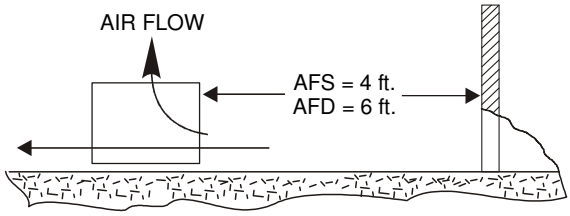
Sound Vibration

Install units away from occupied spaces, utility areas, corridors and auxiliary spaces to reduce the transmission of sound and vibration to occupied spaces. The fluid piping should be flexible enough to prevent the transmission of noise and vibration from the unit into the building. If the fluid lines are to be suspended from the structure of the building, use isolation hangers to prevent the transmission of vibration. Where piping passes through a wall, pack fiberglass and sealing compound around the lines to minimize vibration and retain flexibility. The unit must be secured in its final location. Holes are provided in the base runner for this purpose

Vertical airflow type units should be located no closer than the width of the unit from a wall or other obstruction. It two or more units are to be positioned in the same area, a similar distance should be maintained between adjacent units. Sufficient free area should be left around and below unit to avoid air restriction to coil.

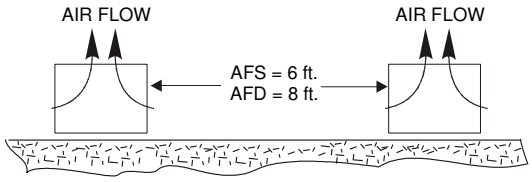
Walls or Obstructions

Locate the unit to ensure that air can circulate freely and not be recirculated. For proper air flow and access, all sides of the unit must be at least the distance shown away from any wall or obstruction. Increase this distance whenever possible. Be sure enough room is left for maintenance through access doors and panels. Overhead obstructions are not permitted. When enclosed by three walls the unit must be installed as indicated for units in a pit.



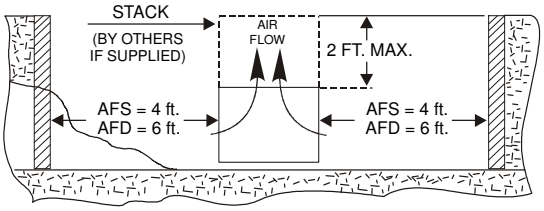
Multiple Units

For units placed side by side, the minimum distance between units is as shown. If units are placed end to end, the minimum distance between units is 4 feet.



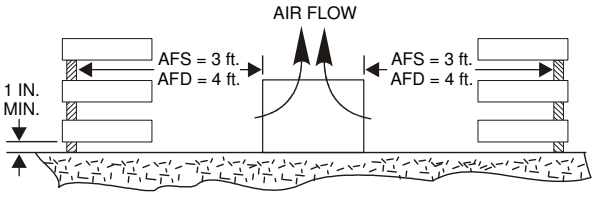
Units in Pits

The top of the unit should not be more than two feet below the top of the pit, and side minimum distance on all four sides as shown.



Decorative Fences

Fences must have 50% free area, with 1 foot undercut, at least the width of condenser minimum clearance, and must not be higher than the top of unit. If these requirements are not met, unit must be installed as indicated for "Units in Pits".



General

1. Structure supporting unit must be designed to support both the unit and the fluid. Table 1 provides weight of fluid per gallon. Provide suitable flashing of the roof, if this is a roof installation. For ground level mounting, a concrete pad is recommended. Mounting holes permit the units to be bolted down to withstand wind pressures. Provide adequate clearance for unobstructed air flow to coils.
2. Level mounting is necessary to ensure proper fluid distribution through the coil as well as flooded suction for the pump.

Table 1, Fluid Weight Per Gallon at 130°F

Percent Glycol	Pounds per Gallon Ethylene Glycol	Pounds per Gallon Propylene Glycol
0 (Water)	8.25	8.22
10	8.33	8.29
20	8.50	8.37
30	8.58	8.42
40	8.80	8.49
50	8.82	8.53

3. Water piping must comply with local codes. Correct pipe sizing will help reduce pumping power and operating costs.
4. In case of doubt, consult the manufacturer for the dry cooler fluid pressure drop at the specific conditions on your job.
5. Provide sufficient valves and unions to permit easy access to parts subject to wear and possible repair or replacement.
6. After fluid piping is completed, all joints should be leak tested.
7. Where city water make-up is required, follow local codes, making certain that disconnecting provisions are provided.
8. Select wire in accordance with nameplate data and local codes.

Piping Installation

The piping system should provide maximum leak prevention. Weld or sweat joints should be used where possible. The fact that glycol solutions or other heat transfer fluids will leak where water will not, must be taken into account.

The glycol system should not employ an automatic fill with a pressure-reducing valve. This is because a slight leak would lead to dilution of the mixture and possible freeze potential. Any refill should be controlled so as to maintain the proper glycol-to-water ratio.

Table 2 shows pressure drops for various pipe sizes at flow rates commonly used with a typical dry cooler. These pipe sizes are not necessarily always correct for the run from the condenser to the dry cooler. Proper pipe size will depend on available pump head. This can be determined by subtracting from the total available pump head at design flow, the condenser pressure drop and the dry cooler pressure drop. Allow some safety factor for last minute pipe fittings added to the system and for eventual fouling of the system.

a) Glycol piping requires no insulation except when fluid temperature will be below ambient dewpoint temperatures.

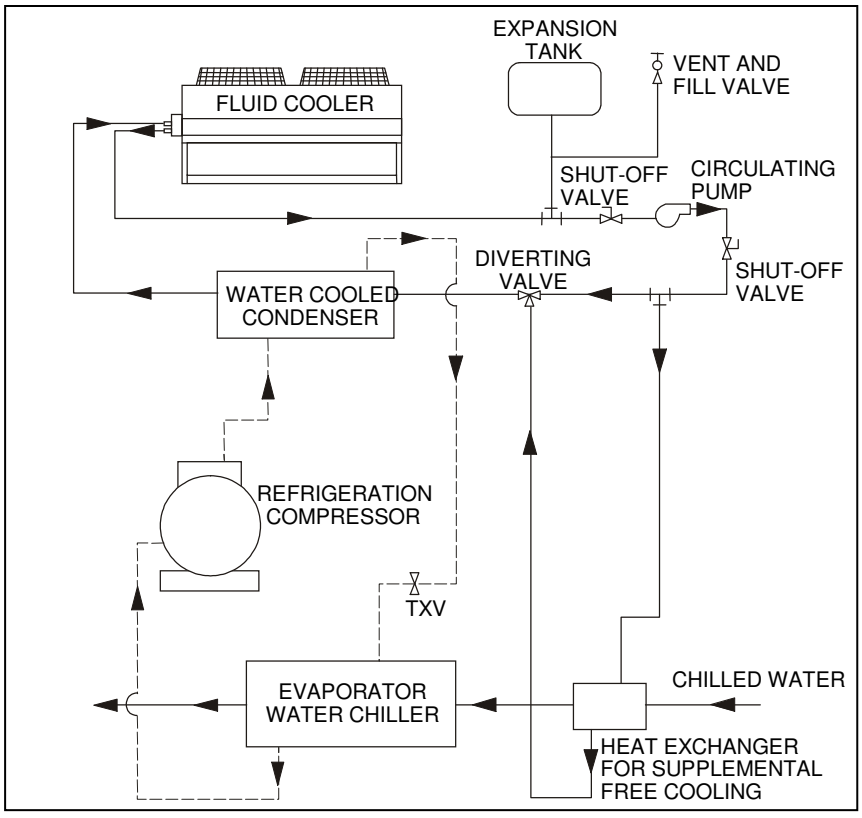
b) Vents are required at all high points in the piping to bleed air when filling the system. If fluid coolers are at high points, vent valves should be installed at each fluid cooler.

c) It is recommended that gate valves be installed on both sides of the pump to prevent loss of fluid in the event the pump should require repair or replacement. Shut-off valves are also recommended at water cooled condensers in case the condensing unit is to be moved or requires maintenance involving the coolant system.

Table 2, Pressure Loss in Feet of Water

Flow gpm	Pipe Size Steel in.	Type "L" O.D. Copper in.	Schedule 40 Steel Head ft/100 ft Equiv. Length	Copper Tube Head ft/100 ft. Equiv. Length
15	1	1 1/8	17.6	15.0
20	1	1 1/6	30.2	23.1
25	1	1 1/8		34.6
25	1 1/4	1 3/8	11.5	12.6
30	1 1/4	1 3/8	16.3	17.4
35	1 1/4	1 3/8	21.8	23.0
40		1 3/8	-	26.3
40	1 112	1 5/8	13.0	12.9
45	1 1/2	1 5/8	16.5	15.7
60	-	1 5/8	-	26.3
60	2	2 1/8	7.9	7.0
80	2	2 1/8	13.7	12.0
100	2 1/2	2 5/8	8.5	6.1
150	2 1/2	2 5/8	18.6	12.9
200	3	3 1/8	10.7	9.1
250	3	3 1/8	16.5	13.7
300	3 1/2	3 5/8	11.1	9.2
300	4	4 1/8	5.9	4.9
350	4	4 1/8	7.9	6.5
400		4 1/8	10.2	8.2

Figure 2, Typical Piping



NOTE: Isolation valves, vents, drains and other piping specialties are not shown, but are required for a fully operational system.

Glycol Charge

The amount of ethylene glycol required depends upon the following:

- The holding volume of the system that includes the holding capacity of the heat source, the interconnecting piping and the dry cooler.
- Percentage of glycol required by volume to provide protection at the design minimum operating temperature.

Table 3, Percentage of Glycol to be Added by Percent Volume

Freeze Point °F (°C)	30 (-1)	20 (-7)	10 (-12)	0 (-18)	-10 (-23)	-20 (-29)	-30 (-34)
Percent Propylene Glycol	4	16	25	32	38	44	48
Percent Ethylene Glycol	5	19	29	36	42	47	51

Use as a guide only. Proper precautions need to be taken to prevent freeze damage during low ambient. Consult glycol vendor recommendations for specific freeze protection for your location.

Mixing Glycol and Water

Regardless of the strength of the mixture, you MUST premix the glycol and water prior to adding it to the system. The chemical reaction between the two will release oxygen, which is extremely undesirable in a close-loop system.

⚠ CAUTION

For dry coolers operating without a glycol mixture, adequate fluid freeze protection of some type is necessary during ambient air temperatures below 32°F

Glycol Sludge Prevention

Glycol systems may be subject to sludge formation in coils, due to one or more of the following causes:

- Reaction of the corrosion inhibitor with galvanized piping (zinc).
- Reaction of the glycol with chromate type water additives.
- Reaction of the glycol with pipe dope, cutting oils, solder flux, and other system dirt.

Glycol manufacturers offer a specially inhibited glycol (formulated for snow melting systems) that does not react with zinc. This glycol is also suitable for heat transfer systems. Glycol manufacturers also provide inhibitor check services on a regular basis.

Consequently, good glycol system design requires the following precautions:

- No galvanized piping is to be used.
- System piping must be thoroughly cleaned and flushed with a heated trisodiurn phosphate solution before filling with the water/glycol mixture.
- Chromate inhibitor treatment must not be used.
- The glycol manufacturer should provide inhibitor check service and supply additional inhibitor as required.

Fluid Circulating Pump

Mechanical seal type pumps must be used for glycol systems. Gland type pumps would cause glycol waste and, if used with a pressure reducing valve, will lead to dilution of the glycol mixture and eventual freeze-up.

Pumps are selected for piping friction loss plus fluid pressure drop through the dry cooler coil, plus pressure drop through the heat source. No allowance for vertical lift is made since in a closed system a counterhead acts on the pump suction.

With glycol solutions the pump performance curve will drift to the right from its design point, due to differences in circuit design, control valve application, pressure drop calculations, etc. The pump should be selected high on the curve so as to provide for the "drift'. The pump curve should be "flat" so that the pump will compensate for the inability to exactly predict the final operating system flow condition and to provide sufficient flow for satisfactory heat transfer and maximum protection against freezing at the far end of the circuit. The pump motor should have sufficient power for operating over the entire pump curve to prevent motor overload at reduced voltages. Paralleled pumps can also be used for good power economy and continuous and automatic standby operation. Properly applied parallel pumps will guard against system breakdown caused by a simple pump failure. Certain older systems have non-operating standby pumps of equal capacity to the operating unit. We recommend parallel pumps in continuous operation because they provide practically the same type of standby, in addition to being completely automatic, at lower initial and operating cost.

Ambient Conditions

Fluid coolers can be operated in an ambient temperature that will not cause freeze-up based on freeze point of the fluid being used. Care must be exercised to maintain the proper antifreeze percentage.

Physical Data

The inlet and outlet connection size will be based on the number of feeds in the fluid cooler circuit. Use the tables below to determine connection sizes.

Table 4, AFS 005 – 021, Connection Sizes

Feeds	Inlet / Outlet, in.	Feeds	Inlet / Outlet, in.
8	1 1/8	24	2 1/8
12	1 3/8	32	2 1/8
16	1 3/8	48	2 5/8
21	1 5/8	64	2 5/8

Table 5, AFS 023 – 107, Connection Sizes (Single-Row of Fans)

Feeds	Inlet / Outlet, in.
14	2 1/8
18	2 1/8
21	2 5/8
28	2 5/8
42	3 1/8
56	3 5/8

Table 6, AFD Connection Sizes (Double-Row of Fans, Dual Fluid Connections)

Feeds	Inlet / Outlet, in.
18	2 @ 2 1/8
28	2 @ 2 1/8
36	2 @ 2 1/8
42	2 @ 2 5/8
56	2 @ 2 5/8
84	2 @ 3 1/8
112	2 @ 3 5/8

Table 7, Model 005 through 021, Physical Data

Model	Fan Data		Approx. Net Weight, lb.	Approx. Shipping Weight, lb.	Approx Operating Weight, lb.
	Fan Configuration	Diameter of Fans			
005	1x1	24	180	325	240
008	1x1	26	260	380	330
010	1x2	24	450	600	537
012	1x2	26	470	620	557
014	1x2	26	510	650	615
016	1x2	26	530	680	635
021	1x3	26	550	725	698

Note; Net weight is dry unit only.

Table 8, Model 023 through 212, Physical Data

Model	Fan Data		CFM	Operating Charge, gal.	Approx. Net Weight, lb.	Approx. Shipping Weight, lb.	Approx. Operating Weight, lb.
	Fan Configuration	Number of Fans					
AFS Single-Row of Fans							
023	1x2	2	23,000	6.7	730	800	788
027	1x2	2	23,200	9.2	790	840	870
031	1x2	2	21,900	9.2	790	860	870
035	1x2	2	20,700	11.8	889	950	992
041	1x3	3	34,800	13.0	1190	1280	1303
045	1x3	3	32,900	13.0	1210	1300	1323
049	1x3	3	31,800	16.7	1240	1330	1385
053	1x4	4	46,400	16.7	1580	1690	1725
061	1x4	4	43,900	16.7	1620	1730	1765
065	1x4	4	42,400	21.7	1650	1760	1839
071	1x4	4	41,500	21.7	1760	1870	1949
075	1x5	5	54,900	20.4	2000	2150	2177
079	1x5	5	54,800	26.6	2020	2150	2251
089	1x5	5	51,800	26.6	2200	2390	2431
097	1x6	6	65,800	31.6	2390	2610	2665
107	1x6	6	62,200	31.6	2630	2850	2905
AFD Double Row of Fans							
046	2x2	4	46,000	13.5	1540	1730	1657
054	2x2	4	46,400	18.5	1580	1770	1741
060	2x2	4	43,900	18.5	1620	1820	1781
066	2x2	4	42,400	23.5	1650	1840	1854
070	2x2	4	41,500	23.5	1760	1950	1964
080	2x3	6	69,700	25.9	2360	2570	2585
086	2x3	6	67,000	25.9	2380	2620	2605
090	2x3	6	65,800	25.9	2420	2630	2645
098	2x3	6	63,600	33.4	2480	2690	2771
106	2x4	8	92,900	33.3	3150	3360	3440
120	2x4	8	87,800	33.3	3230	3420	3520
132	2x4	8	84,800	43.3	3300	3470	3677
140	2x4	8	83,000	43.3	3510	3730	3887
152	2x5	10	190,700	40.7	4040	4290	4394
162	2x5	10	109,700	53.1	3990	4270	4452
168	2x5	10	106,000	53.1	4130	4450	4592
178	2x5	10	103,700	53.1	4390	4680	4852
194	2x6	12	131,600	63.1	4790	5150	5339
202	2x6	12	127,200	63.1	4960	5330	5509
212	2x6	12	124,400	63.1	5270	5670	5819

NOTES:
1. All fans are 30 inches in diameter.
2. Net weight is unit only.
3. Operating weight based on 50% ethylene glycol at 130°F.

Dimensional Data

Figure 3, Dimensions for AFS 005 through AFS 021 with Vertical Flow

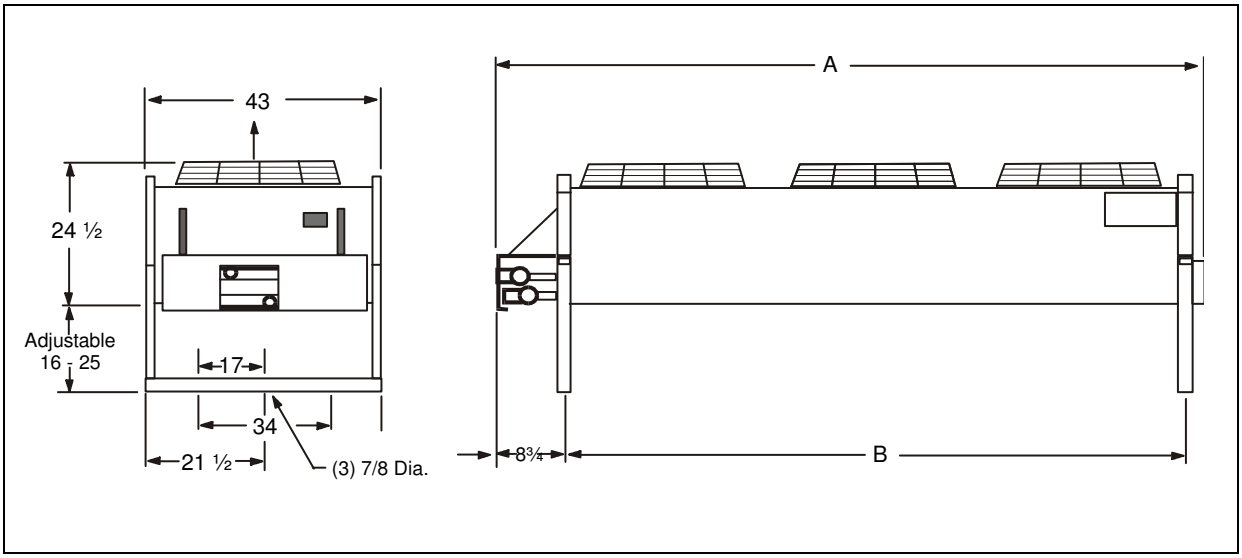
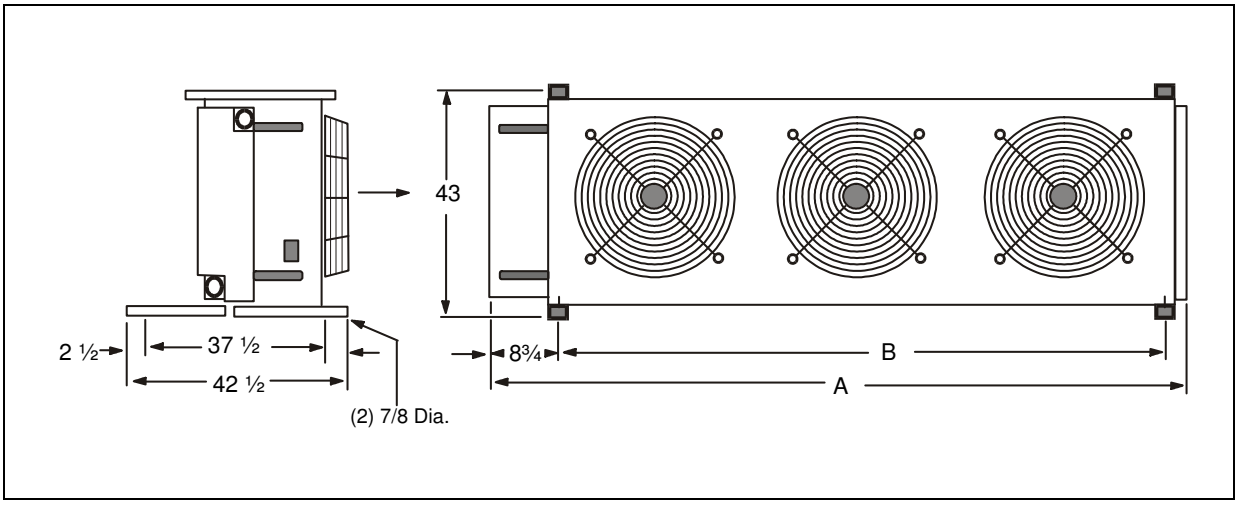


Figure 4, Dimensions for AFS 005 through AFS 021 with Horizontal Flow

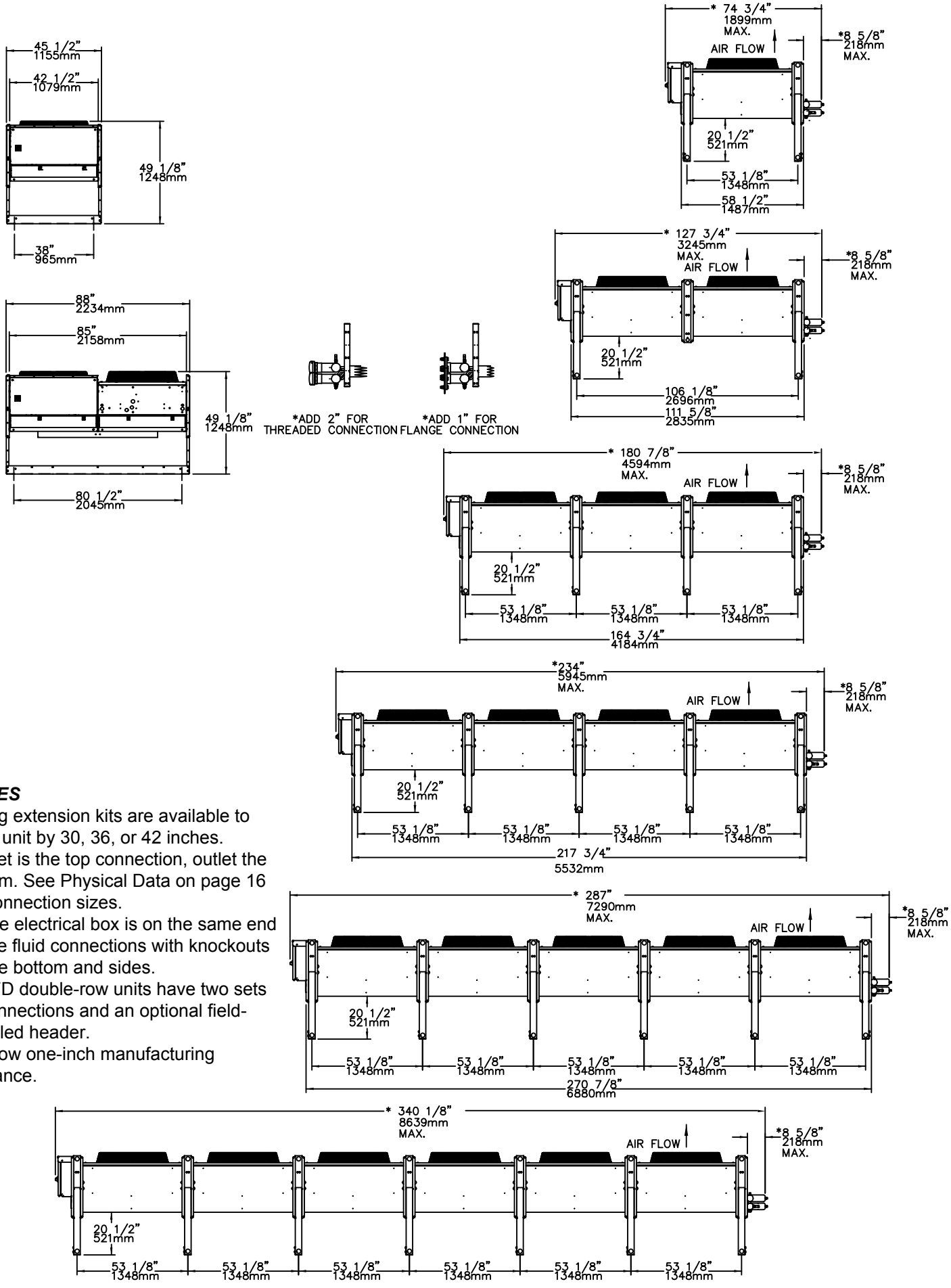


AFS Model	Number of Fans	Dimensions (inches)	
		A	B
005	1	39 ¾	30
008	1	49 ¾	40
010	2	69 ¾	60
012	2	69 ¾	60
014	2	89 ¾	80
016	2	89 ¾	80
021	3	129 ¾	120

NOTES:

1. Inlet is the top connection, outlet the bottom. See Table 4 on page 11 for connection sizes.
2. The electrical box is on the same end as the fluid connections with knockouts on the bottom and sides.

Figure 5, Dimensions for AFS/D 023 through AFS/D 212



NOTES

1. Leg extension kits are available to raise unit by 30, 36, or 42 inches.
2. Inlet is the top connection, outlet the bottom. See Physical Data on page 16 for connection sizes.
3. The electrical box is on the same end as the fluid connections with knockouts on the bottom and sides.
4. AFD double-row units have two sets of connections and an optional field-installed header.
5. Allow one-inch manufacturing tolerance.

Electrical Data

Electrical Wiring

The electrical installation should be in accordance with National Electrical Code, local codes and regulations. Wiring diagrams shown are only basic and do not show fuses, additional disconnect switches, etc., which must be provided in the field.

Units have a disconnect switch, mounted in the electrical box, with a through-the-door handle.

All standard motors have internal inherent overload protectors. Therefore, contactors can be used instead of starters requiring thermal protectors, eliminating the problem of furnishing the proper heating elements.

All fluid coolers are furnished with either single-phase or three-phase fan motors which, are identified by the unit data plate.

Electrical leads from each motor terminate at the unit junction box. Field connections must be made from these leads in accordance with local, state and national codes.

Three-phase motors must be connected to three-phase power of voltage to agree with motor and unit dataplate.

The motors are wired into a common junction box. The motors must be checked for proper rotation. Be sure to check that motor voltage and control connection agree with electric services furnished.

Electrical Data

1140 RPM Motor Data

Table 9, Electrical Data, Model 005 through 021, 1140 RPM

AFS Model	CFM	Fans		208-230/3/60			460/3/60			575/3/60			208-230/1/60			
		No.	Dia. in.	Total FLA	MCA	Max Fuse	Total FLA	MCA	Max Fuse	Total FLA	MCA	Max Fuse	HP	Total FLA	MCA	Max Fuse
005	5,050	1	24	2.6	15	15	1.3	15	15	1.0	15	15	1/3	3.4	15	15
008	6,450	1	26	2.6	15	15	1.3	15	15	1.0	15	15	1/2	3.9	15	15
010	10,100	2	24	5.2	15	15	2.6	15	15	1.9	15	15	1/3	6.8	15	15
012	12,400	2	26	5.2	15	15	2.6	15	15	1.9	15	15	1/2	7.8	15	15
014	13,700	2	26	5.2	15	15	2.6	15	15	1.9	15	15	1/2	7.8	15	15
016	12,900	2	26	5.2	15	15	2.6	15	15	1.9	15	15	1/2	7.8	15	15
021	20,500	3	26	7.8	15	15	3.9	15	15	2.9	15	15	1/2	11.7	15	15

Notes: 1. Standard motor voltage 208-230-460/3/60.
2. Standard motors are 1/3 HP, 208-230/460/3/60 or 575 volt.

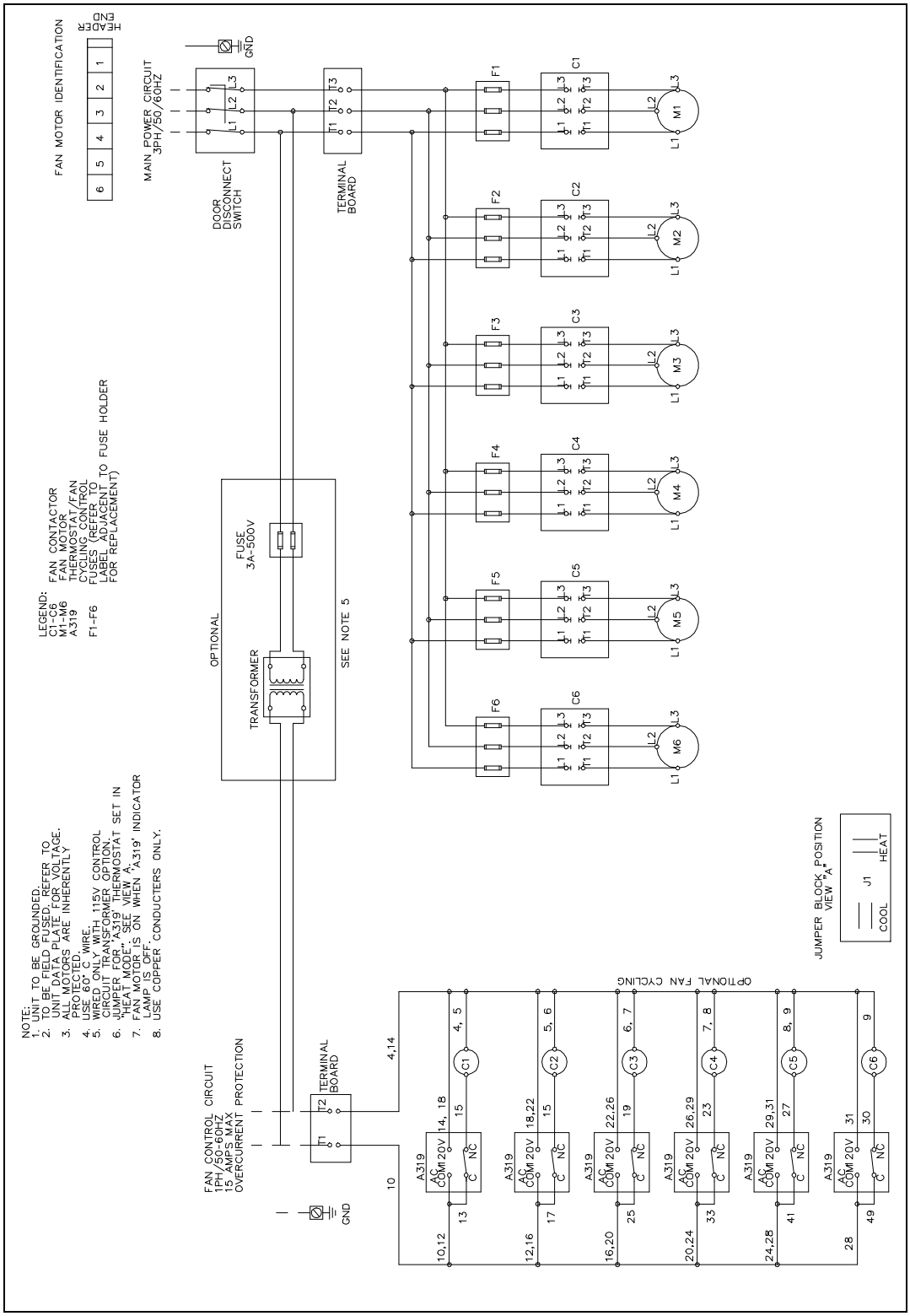
Table 10, Electrical Data, Models 023 through 212, 1140 RPM

Model	Fan Data		cfm	208-230/3/60			460/3/60			575/3/60		
	Fan Config.	No. of Fans		Total FLA	MCA	Max. Fuse	Total FLA	MCA	Max. Fuse	Total FLA	MCA	Max. Fuse
AFS Single-row of Fans												
023	1x2	2	19,780	14.0	20.0	35	7.0	15.0	15.0	5.6	15	15
027	1x2	2	19,800	14.0	20.0	35	7.0	15.0	15.0	5.6	15	15
031	1x2	2	19,110	14.0	20.0	35	7.0	15.0	15.0	5.6	15	15
035	1x2	2	18,340	14.0	20.0	35	7.0	15.0	15.0	5.6	15	15
041	1x3	3	29,700	21.0	22.8	40	10.5	15.0	20.0	8.4	15	15
045	1x3	3	28,600	21.0	22.8	40	10.5	15.0	20.0	8.4	15	15
049	1x3	3	28,070	21.0	22.8	40	10.5	15.0	20.0	8.4	15	15
053	1x4	4	38,600	28.0	29.8	45	14.0	15.0	20.0	11.2	15	15
061	1x4	4	37,250	28.0	29.8	45	14.0	15.0	20.0	11.2	15	15
065	1x4	4	38,020	28.0	29.8	45	14.0	15.0	20.0	11.2	15	15
071	1x4	4	35,710	28.0	29.8	45	14.0	15.0	20.0	11.2	15	15
075	1x5	5	46,610	35.0	36.8	50	17.5	20.0	25.0	14	15	20
079	1x5	5	46,200	35.0	36.8	50	17.5	20.0	25.0	14	15	20
089	1x5	5	44,580	35.0	36.8	50	17.5	20.0	25.0	14	15	20
097	1x6	6	55,400	42.0	43.8	60	21.0	21.9	30.0	16.8	20	25
107	1x6	6	53,460	42.0	43.8	60	21.0	21.9	30.0	16.8	20	25
AFD Double Row of Fans												
046	2x2	4	39,570	28.0	29.8	45	14.0	15.0	20.0	11.2	15	15
054	2x2	4	39,600	28.0	29.8	45	14.0	15.0	20.0	11.2	15	15
060	2x2	4	38,210	28.0	29.8	45	14.0	15.0	20.0	11.2	15	15
066	2x2	4	37,530	28.0	29.8	45	14.0	15.0	20.0	11.2	15	15
070	2x2	4	36,770	28.0	29.8	45	14.0	15.0	20.0	11.2	15	15
080	2x3	6	59,400	42.0	43.8	60	21.0	21.9	30.0	16.8	20	25
086	2x3	6	58,510	42.0	43.8	60	21.0	21.9	30.0	16.8	20	25
090	2x3	6	57,320	42.0	43.8	60	21.0	21.9	30.0	16.8	20	25
098	2x3	6	56,240	42.0	43.8	60	21.0	21.9	30.0	16.8	20	25
106	2x4	8	77,200	56.0	57.8	70	28.0	28.9	35.0	22.4	23.1	30
120	2x4	8	74,500	56.0	57.8	70	28.0	28.9	35.0	22.4	23.1	30
132	2x4	8	72,790	56.0	57.8	70	28.0	28.9	35.0	22.4	23.1	30
140	2x4	8	71,310	56.0	57.8	70	28.0	28.9	35.0	22.4	23.1	30
152	2x5	10	93,120	70.0	71.8	90	35.0	35.9	45.0	28.0	28.7	35
162	2x5	10	92,400	70.0	71.8	90	35.0	35.9	45.0	28.0	28.7	35
168	2x5	10	91,010	70.0	71.8	90	35.0	35.9	45.0	28.0	28.7	35
178	2x5	10	89,170	70.0	71.8	90	35.0	35.9	45.0	28.0	28.7	35
194	2x6	12	110.900	84.0	85.8	100	42.0	42.9	50.0	33.6	34.3	40
202	2x6	12	109,240	84.0	85.8	100	42.0	42.9	50.0	33.6	34.3	40
212	2x6	12	107,020	84.0	85.8	100	42.0	42.9	50.0	33.6	34.3	40

1. All fan blades are 30" in diameter.
2. Standard motors are 1 ½ HP, 208-230/460/3/60 or 575 volt.
3. Optional single-phase motors are ¾ hp, 208/230 volt, 4.8 FLA, 1140 rpm.

Wiring Diagrams

Figure 6, Typical Wiring for AFS Models



NOTE: Unit specific wiring diagrams are shipped with the unit.

Start Up

Prestart

Check for correct dry cooler fan rotation. This can be done by quickly jogging the fan contactor. Be sure that the fans run freely. The same check is recommended for pumps.

Filling and Purging the System

The system should be pressure tested before adding glycol. The system can be tested with air or water, however if the ambient temperature is at or below freezing the use of air is recommended. Test pressure should not exceed 60 psig.

Roof Mounted Fluid Cooler

To fill the system, pour the premixed water and glycol into the expansion tank. Fill the system until the expansion tank is half full, then purge the air from *all* vents. Operate the system for a minute, then purge *all* vents again, and add glycol as required. Repeat the purging of vents after the first hour of operation and again after several hours of operation.

Ground Mounted Fluid Cooler

The fluid cooler may be lowest point in the system; consequently the premixed water and glycol will have to be pumped into the system.

Temperature Control

General

Some method of controlling the fluid temperature is required.

The standard temperature control consists of fan contactors arranged for field-connection to a field-supplied and mounted control system; in other words, no control. Setting and adjusting these controls will depend on the type furnished.

Daikin can furnish an optional control system using Johnson Controls A419 temperature controls. Installation and adjustment are explained in the following paragraphs.

Installation

If the fan cycle thermostat option is provided, the solid state sensors are shipped coiled in the control panel to prevent damages during shipment and installation. Mounted the sensors securely to the fluid cooler header and insulate. Mount sensors on the entering or leaving fluid headers depending on site requirements. Route and secure sensor wiring for protection from vibration and interference.

Setting

The control is a single-stage, electronic temperature control with an SPDT output relay. It has the following features:

- lockable keypad for programming,
- LCD for temperature and status display,
- LED for output relay status
- heating and cooling modes with adjustable setpoint and differential

The electronic temperature control must be set for heating or cooling application by placement of the mode jumper. Temperature setting is selected based on entering or leaving fluid temperature control. Differential settings are selected to prevent excessive fan cycling and fluid temperature swing.

Definitions

- Cut-in: The temperature at which the N.O. (Normally Open) SPDT (Single-Pole, Double-Throw) output relay contact closes.
- Cut-out: The temperature at which the N.O. SPDT output relay contact opens.

Control Functions

The A419 control allows the user to set a variety of functions using the keypad and jumpers. These functions are described below. For instructions on setting function parameters, see the *Adjustments* section.

Keypad Programmable Functions

Setpoint (SP) establishes the temperature at which the equipment is switched on or off, depending on the user selected mode of operation. Setpoint range is -30 to 212°F (-34 to 100°C). See the *Cooling/Heating and Setpoint Modes* section on page 22.

If Setpoint mode is set to Cut-in, the setpoint is the temperature at which the control closes the N.O. contacts. If Setpoint mode is set to Cut-out, the setpoint is the temperature at which the N.O. contacts open. Refer to Figure 9 and Figure 10.

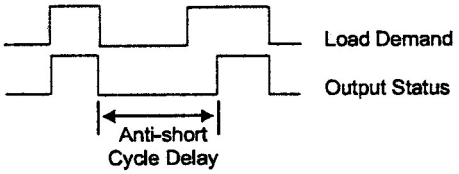
Differential (dIF) establishes the difference in temperature between Cut-in and Cut-out. The differential is set relative to Setpoint and may be set from 1 to 30F° or C. Refer to Figure 9 and Figure 10.

Anti-Short Cycle Delay (ASd) establishes the minimum time that the fan remains off before restarting again. The anti-short cycle delay is activated when the A419 control has cycled the fan off. The delay does not allow the fan to be restarted until the programmed amount of time has elapsed. When the delay is activated, the LCD alternately flashes the sensor temperature and ASd. The anti-short cycle delay may be programmed for 0 to 12 minutes in 1-minute increments.

For example, if the anti-short cycle delay is programmed for 7 minutes, the control will not restart the fan until 7 minutes after the equipment was turned off, regardless of the temperature. During the 7-minute period, if the temperature reaches the cut-in setpoint, the display alternates between the sensor temperature and ASd to indicate that the on cycle is being delayed. After the 7-minute delay has elapsed, the fan is turned on, and ASd stops flashing.

Note: A power interruption to the control will activate the anti-short cycle delay.

Figure 7, Anti-short Cycle Delay



Sensor Failure Operation (SF): establishes how the A419 control operates the fan in the event of a sensor or sensor wiring failure. The user may select either to run the equipment continuously or to shut it down. When the control detects a sensor circuit failure, the LCD flashes SF alternately with OP if the sensor circuit is open, or SH if the sensor circuit is shorted. Before indicating a failure, the control implements a 1-minute delay, which allows verification of failure condition and avoids nuisance failure indications.

Temperature Offset (OFS): establishes the temperature setpoint shift (F° or C°) applied when the binary input (BIN) and common (COM) terminals are connected together. The Temperature Offset may be set from 0 to 50F° or C°. See the *Offset Function* section on page 21.

Temperature Units: establishes the units of temperature (Fahrenheit or Celsius) displayed on the LCD.

Functions Set by Jumper Position

For instructions on positioning jumpers, see *Positioning the Jumpers* on page 23 in the *Adjustments* section. Refer to Figure 12 for jumper locations.

Heating/Cooling: Removing or installing the upper jumper at P4 establishes whether the control operates in the Heating or Cooling mode.

Setpoint Mode: Removing or installing the lower jumper at P4 establishes whether Setpoint is the Cut-in temperature or Cut-out temperature.

Keypad Lock: Removing or installing the jumper at P5 establishes whether the keypad is locked or unlocked. Locking the keypad deters accidental or unauthorized changes to all of the function parameters.

Temperature Offset Function

The Temperature Offset function shifts Heating setpoint lower and Cooling setpoint higher by the value in the Temperature Offset. This function is not normally used on fluid cooler applications.

The Temperature Offset is activated by closing a circuit between BIN and COM. (See Figures 7, 8, or 9.) The BIN and COM terminals may be connected to a user-supplied external switching device, such as a time clock, that has a set of SPST contacts.

This option enables the control to alternate between two temperature setpoints based on the position of the binary input switch. The number of degrees added to, or subtracted from, Setpoint is established in the Temperature Offset function (OFS) using the keypad, as described in *Setting Other Functions* on page 26.

Table 12 shows an example of the effect of the Temperature Offset function when it is active.

Table 12, Sample Offset Function Effect

Mode	Setpoint	Temperature Offset Value	Shifted Setpoint*
Cooling	70°	8°	78°
Heating	70°	8°	62°
*Setpoint when switch is closed.			

When the binary input (BIN) is connected to the common (COM), the Offset function is enabled and ***BIN*** is displayed on the LCD above the °F or °C symbol, as shown in Figure 4.

Display

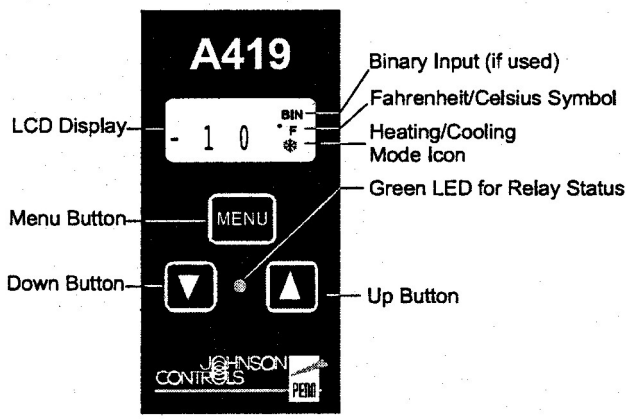
The front panel of the A419 control has a liquid crystal display (LCD) and an output relay status LED (Light-Emitting Diode) indicator.

Liquid Crystal Display

During normal operation, the LCD displays the sensor temperature, a symbol indicating units of temperature (°F or °C), and an icon indicating Heating (🔥) or Cooling (*) mode. See Figure 8.

The temperature value ranges from -30 to 212°F (-34 to 100°C) in 1° increments. The LCD also displays BIN if the Temperature Offset function is activated.

Figure 8, Front Panel and Display



During programming, the LCD displays the control functions and their programmed values. After 30 seconds of inactivity, the display returns to the sensor temperature. See the *Adjustments* section for instructions on using the keypad to change settings.

Output Relay Status Indicator LED

A green LED on the control's front panel illuminates when the output relay is energized and the N.O. contacts are closed.

Cooling/Heating and Setpoint Modes

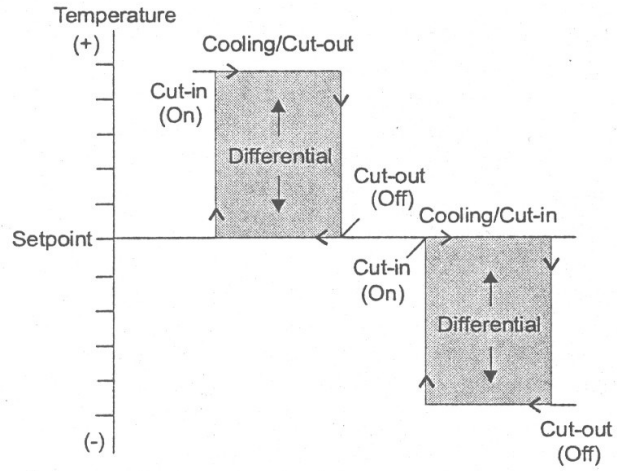
Jumpers are used to place the A419 control in Cooling or Heating mode and set whether Cut-in or Cut-out occurs at Setpoint. Four operating modes are possible: Cooling/Cut-in, Cooling/Cut-out, Heating/Cut-in, and Heating/Cut-out.

Cooling Modes

When Cooling/Cut-in mode is selected, the differential is below Setpoint. The output relay energizes and the LED indicator illuminates when the temperature rises to Setpoint. When the temperature drops to Setpoint minus the differential value, the output relay and LED indicator de-energize.

When Cooling/Cut-out mode is selected, the differential is above Setpoint. The output relay energizes and LED indicator illuminates when the temperature rises to Setpoint plus the differential value. When the temperature drops to Setpoint, the output relay and LED indicator de-energize.

Figure 9, Cooling Modes

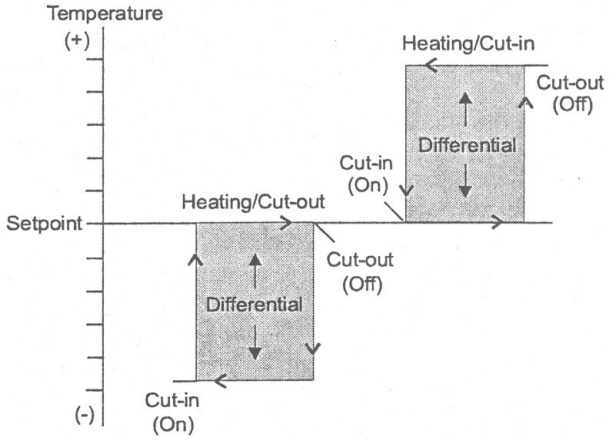


Heating Modes

When the Heating/Cut-in mode is selected, the differential is above Setpoint. The output relay energizes and LED indicator illuminates when the temperature drops to Setpoint. When the temperature rises to Setpoint *plus* the differential value, the output relay and LED de-energize.

When Heating/Cut-out mode is selected, the differential is below Setpoint. The output relay energizes and LED indicator illuminates when the temperature drops to Setpoint *minus* the differential value. When the temperature rises to Setpoint, the output relay and LED indicator de-energize.

Figure 10, Heating Modes



Adjustments

This section provides instructions for adjusting the A419 control using the jumpers and keypad.

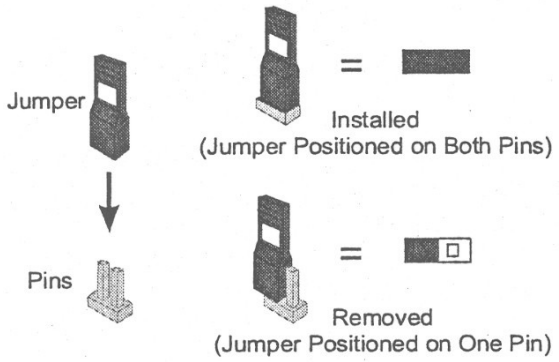
IMPORTANT: Verify that the Cooling/Heating jumper is positioned properly before powering the A419 control, so that the relay operates as intended.

Positioning the Jumpers

The P5 Jumper Pin Block has a single set of jumper pins and is used to lock or unlock the keypad. The P4 Jumper Pin Block has two sets of jumper pins.

The top set of pins at P4, labeled JUMPI, is used to set the control for Heating or Cooling mode. The bottom set of pins, labeled JUMP2, is used to establish Setpoint at cut-in or at cut-out. See Figure 12.

Figure 11, Positioning the Jumpers



To position a jumper in the Installed position, place the jumper on both pins. To position a jumper in the Removed position, place the jumper on only one pin. (Saving the jumper in case it is required in the future.) See Figure 11.

Set the jumpers as follows, using Figure 11 and Figure 12 as guides.

1. Verify that all power to the A419 control has been removed.
2. Remove the control's cover by loosening the four captive cover screws.
3. Position the jumpers to set Cooling/Heating, Setpoint, and Keypad Lock functions.
4. Replace the cover and fasten in place with the four screws.
5. Restore power to the control.

Figure 12, Jumper Positions and Control Settings

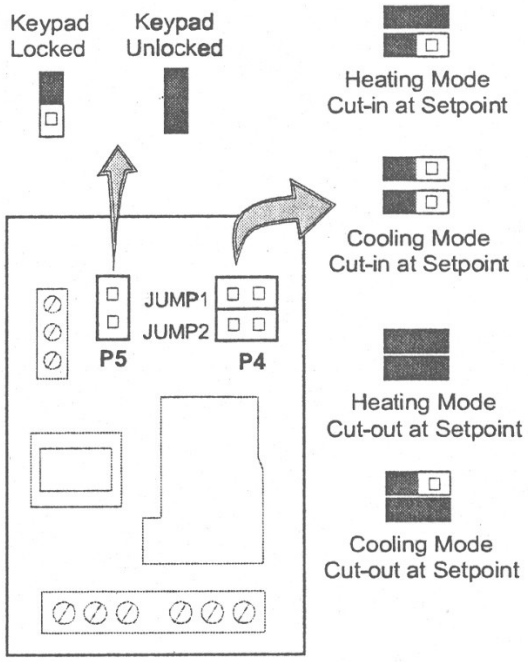


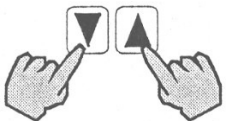
Table 13, Jumper Designations, Positions, and Control Settings

Function	Jumper Pins Designation on Control	Setting	Jumper Position*	Factory Default Setting (and Jumper Position)
Operating Mode Cooling/Heating	JUMP1 (Top Pair of Pins on Block P4)	Cooling	Removed	Cooling (Removed position)
		Heating	Installed	
Setpoint	JUMP2 (Bottom Pair of Pins on Block P4)	At Cut-in	Removed	Cut-in (Removed Position)
		At Cut-out	Installed	
Keypad Lock	P5-Keypad Unlock	Locked	Removed	Unlocked (Installed Position)
		Unlocked	Installed	

*__IMPORTANT__: The keypad cannot be unlocked without a jumper. Do not discard any jumpers in case they are required in the future. To position a jumper in the Removed position, place the jumper on only one pin. (Saving the jumper in case it is required in the future.)

Changing Temperature Units

The A419 control is set at the factory to display in Fahrenheit temperature units.



To convert to Celsius units, press the Up and Down buttons simultaneously. Press them again to return to Fahrenheit units.

Note: Make sure the Keypad Lock jumper is in the unlocked (installed) position before adjusting the control. Verify that the control is displaying the desired temperature units before setting the setpoint.

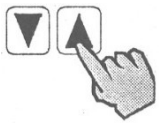
Setting the Setpoint

To view and adjust the setpoint, follow these steps:

1. Press and hold the Menu button until the display changes to flashing SP. This will take about 2 seconds.

Note: If no entries are made for 30 seconds, the control reverts to the temperature display.

2. Press the Menu button again. The current setpoint is displayed.



3. Press the Up or Down button to adjust the setpoint temperature.

4. Press the Menu button to save. The display then returns to the sensor temperature.

Note: If the Menu button is not pressed after changing the setpoint, the control reverts to the setpoint value previously programmed into the A419 control.

Table 14, Function Ranges and Settings

Function	Range	Factory Setting
SP: Setpoint	-30to212°F (-34 to 100°C)	30
dIF: Differential	I to 30° (F or C)	5
ASd: Anti-short Cycle_Delay	0 to 12 minutes	I
OFS: Temperature Offset	0 to 50° (F or C)	0
SF: Sensor Failure Operation	0 = output de-energized 1 = output energized	1

NOTES:

Operation at Extremes: If the combination of setpoint, plus or minus the differential, falls outside the temperature range (-30 to 212°F), the A419 control operates as follows:

Cooling/Cut-in: If the control is operating in Cooling/Cut-in mode and setpoint minus differential is less than -30°F, the control switches on at setpoint and off when the temperature drops below -30°F (-34°C).

Heating/Cut-in: If the control is operating in Heating/Cut-in mode and setpoint plus differential is greater than 212°F (100°C), the control switches on at setpoint and off when the temperature exceeds 212°F (100°C).

Cooling/Cut-out: If the control is operating in Cooling/Cut-out mode and setpoint plus differential is greater than 2 12°F (100°C), the control switches on when the temperature exceeds 212°F (100°C) and off at setpoint.

Heating/Cut-out: If the control is operating in Heating/Cut-out mode and setpoint minus differential is less than -30°F (-34°C), the control switches on when the temperature drops below -30°F (-34°C) and off at setpoint.

Setting Other Functions

To set the Differential (dIF), Anti-short Cycle Delay (ASd), Temperature Offset (OFS), or Sensor Failure (SF) operation, use the following method.

Figure 13, Order of the Functions

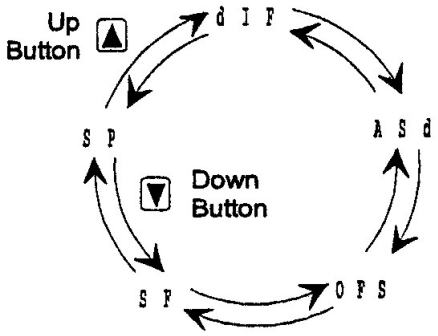
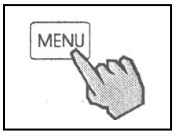
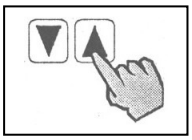


Figure 13 illustrates the order of functions shown using the Up or Down button. The Up button accesses functions in the clockwise direction; the Down button accesses functions in the counterclockwise direction.

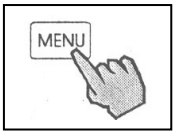


1. Press and hold the Menu button until the display changes to flashing SP. This will take about 2 seconds.

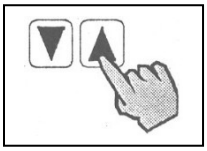
Note: If no entries are made for 30 seconds while programming is in progress, the control reverts to the temperature display.



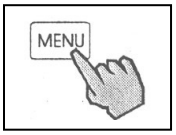
2. Press the Up or Down button repeatedly until the desired function is displayed.



3. Press the Menu button to display the function's current value.



4. Press the Up or Down button until the desired value is displayed.



5. Press the Menu button to save the new value. The display then returns to the sensor temperature.

Note: If you do not press the Menu button after setting the new value, the control reverts to the previously programmed value for that function.

Checkout

Before applying power, make sure installation and wiring connections are according to job specifications. After necessary adjustments and electrical connections have been made, put the system in operation and observe the control for at least three complete operating cycles before leaving the installation.

Troubleshooting

If the control system does not function properly, verify that the unit is wired, configured, and set properly. If the problem persists, use the following procedures to determine the cause of the problem:

1. Check for proper supply voltage to the A419 control.

a) Remove the cover by loosening the four captive cover screws.

⚠ WARNING

Risk of Electrical Shock. High voltages may be present at electrical terminals and other exposed internal metal surfaces. Avoid contact with all metal surfaces on control when cover is removed.

b) Use a reliable AC voltmeter to check the voltage between the COM and I20V or 240V terminals on line voltage models and the two 24V terminals on low-voltage models. Refer to the wiring diagrams furnished with the unit.

c) The voltage must be between 20 and 30 VAC for 24 volt applications, 102 and 132 VAC for 120 volt applications, 177 and 264 VAC for 208/240 volt applications

If the voltage reading is within the required range, proceed to Step 2.

If the voltage reading is not within the required range, check the power source and input power wires for problems.

2. Check for proper sensor operation.

a. Disconnect all power sources to control.

b. Take a temperature reading at the sensor location, using an accurate thermometer.

c. Disconnect the sensor from the control.

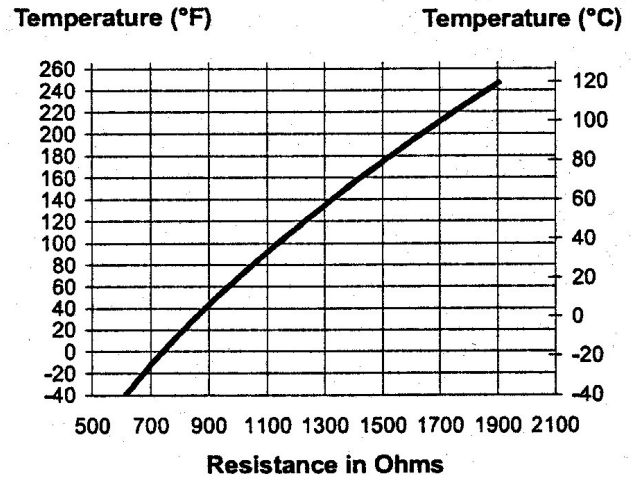
d. Using an ohmmeter, measure the resistance across the two sensor leads while the sensor is at the temperature taken in step b.

e. Consult Figure 14 to verify that the measured temperature and resistance conform to established temperature and resistance values.

f. If the measured values conform to the values in Figure 14, proceed to Step 3.

g. If the sensor's measured resistance value is substantially different from the expected value for that temperature, check the sensor wiring. If sensor wiring is OK, replace the sensor.

Figure 14, Nominal Temperature vs. Sensor Resistance



Check the A419 for proper operation.

Note: Perform *Troubleshooting* Steps 1 and 2 before performing this step.

a. Disconnect the load from the output relay terminals.

b. Check that the Keypad Lock jumper is installed, so that the keypad is unlocked.

c. Reconnect the sensor leads and supply power to the control.

d. Replace the cover.

e. Check the control settings for proper values.

f. Press and hold the Menu button until Setpoint appears (occurs in about 2 seconds).

g. Use the Up and Down buttons to change the Setpoint temperature above and below the current sensor temperature until the output relay energizes and de-energizes as shown in Table 15.
Note: If the anti-short cycle delay has a time greater than 0 minutes, the relay will not energize until the timed delay has elapsed.

h. If the output relay does not perform as indicated in Table 15, replace the A419 control.

i. If proper operation of the A419 control is verified, reconnect the load and consult the equipment manufacturer's instructions for troubleshooting the controlled equipment.

Table 15, A419 Output Relay Operation

Setpoint Mode	Operating Mode	Output Relay Energized at...	Output Relay De-energized at...
Cut-out	Cooling	Setpoint plus differential	Setpoint
	Heating	Setpoint minus differential	Setpoint
Cut-in	Cooling	Setpoint	Setpoint minus differential
	Heating	Setpoint	Setpoint plus differential

Note: When the relay is energized, the N.O. contacts are closed and the LED is illuminated.

Fault Codes

If the LCD displays an alarm or fault code (SF or EE), consult Table 6 for explanation.

Table 6, Fault Codes Defined

Fault Code	Definition	System Status	Solution
SF flashing alternately with Op	Open temperature sensor or sensor wiring	Output functions according to the selected sensor failure mode (SF setting)	See Troubleshooting section. Cycle power to reset the control.
SF flashing alternately with SH	Shorted temperature sensor or sensor wiring	Output functions according to the selected sensor failure mode (SF setting)	See Troubleshooting section. Cycle power to reset the control.
EE	Program failure	Output is off	Reset the control by pressing the Menu button. If problems persist, replace the control.

Maintenance

Fluid coolers require a minimum of maintenance. Electrical connections should be checked on an annual basis. Fan contactors should be inspected and replaced when there is evidence of pitting or burning. Verify controls settings and operation at least on an annual basis. Condenser fan motors have sealed ball bearings that do not require service. Replace bearings when necessary.

The cooling fluid should be checked on a regular basis for proper inhibitors and glycol mix.

The unit coil will require periodic cleaning based on operation and atmosphere conditions. Clean the unit using a brush or commercially available coil cleaners and water. Take care not to deform the fin material. Straighten any bent fins using a fin tool.

Cleaning Instructions

⚠ CAUTION

Never clean this unit with an acid based cleaner.

Clean the finned surface at least every six months; more frequent cleaning may be required if extreme conditions cause clogging or fouling of air passages through the finned surface.

Use Calgon Corporation's CalClean 41352 (or equal). Apply CalClean liberally to entering air and leaving air surfaces of the finned area according to label directions and rinse thoroughly to remove all cleaners.

Daikin Training and Development

Now that you have made an investment in modern, efficient Daikin equipment, its care should be a high priority.
For training information on all Daikin HVAC products, please visit us at www.DaikinApplied.com and click on training, or call 540-248-9646 and ask for the Training Department.

Warranty

All Daikin equipment is sold pursuant to its standard terms and conditions of sale, including Limited Product Warranty. Consult your local Daikin Representative for warranty details. Refer to Form 933-43285Y. To find your local Daikin Representative, go to www.DaikinApplied.com.

This document contains the most current product information as of this printing. For the most up-to-date product information, please go to www.DaikinApplied.com.