LF Series

Air-Cooled Chillers

Air-Cooled Water Chilling Packages
AHRI Standards 550/590 and 551/591

Installation, Operation, & Maintenance

WARNING

If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

WARNING

FOR YOUR SAFETY

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

WARNING

QUALIFIED INSTALLER

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Installation and service must be performed by a Factory Trained Service Technician. A copy of this IOM must be kept with the unit.

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Safety

Attention must be paid to the following statements:

NOTE - Notes are intended to clarify the unit installation, operation and maintenance.

⚠ **CAUTION** - Caution statements are given to prevent actions that may result in equipment damage, property damage, or personal injury.

⚠ **WARNING** - Warning statements are given to prevent actions that could result in equipment damage, property damage, personal injury or death.

⚠ **DANGER** - Danger statements are given to prevent actions that will result in equipment damage, property damage, severe personal injury or death.

⚠ WARNING

ELECTRIC SHOCK, FIRE OR EXPLOSION HAZARD

Failure to follow safety warnings exactly could result in dangerous operation, serious injury, death or property damage.

Improper servicing could result in dangerous operation, serious injury, death, or property damage.

- When servicing controls, label all wires prior to disconnecting. Reconnect wires correctly.
- Verify proper operation after servicing. Secure all doors with key-lock or nut and bolt.

⚠ WARNING

FIRE, EXPLOSION OR CARBON MONOXIDE POISONING HAZARD

Failure to replace proper controls could result in fire, explosion or carbon monoxide poisoning. Failure to follow safety warnings exactly could result in serious injury, death or property damage. Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this appliance.

⚠ WARNING

Electric shock hazard. Shut off all electrical power to the unit to avoid shock hazard or injury from rotating parts.

⚠ WARNING

COMPRESSOR CYCLING

5 MINUTE MINIMUM OFF TIME
To prevent motor overheating compressors must cycle off for a minimum of 5 minutes.

2 MINUTE MINIMUM ON TIME
To maintain the proper oil level compressors must cycle on for a minimum of 2 minutes.

The cycle rate must not exceed 6 starts per hour.

⚠ WARNING

VARIABLE FREQUENCY DRIVES

Do not leave VFDs unattended in hand mode or manual bypass. Damage to personnel or equipment can occur if left unattended. When in hand mode or manual bypass mode VFDs will not respond to controls or alarms.

⚠ CAUTION

PVC (Polyvinyl Chloride) and CPVC (Chlorinated Polyvinyl Chloride) are vulnerable to attack by certain chemicals. Polyolester (POE) oils used with R-410A and other refrigerants, even in trace amounts, in a PVC or CPVC piping system will result in stress cracking of the piping and fittings and complete piping system failure.

1. Startup and service must be performed by a Factory Trained Service Technician.

2. The unit is for outdoor use only. See General Information section for more information.

3. READ THE ENTIRE INSTALLATION, OPERATION AND MAINTENANCE MANUAL. OTHER IMPORTANT SAFETY PRECAUTIONS ARE PROVIDED THROUGHOUT THIS MANUAL.

4. Keep this manual and all literature safeguarded near or on the unit.

LF Series Feature String Nomenclature

Model Options	:	Unit Feature Options

GEN	MJREV	SIZE	SERIES	MNREV	VLT	A1	A2	A3	A4	A5	B1	B2	B3	B4	1	2	3A	3B	3C	3D	4A	4B	4C	4D	5A	5B	5C	5D	6	7	8A	8B	8C
LF	**A**	**-**	**031**	**-**	**D**	**-**	**A**	**-**	**3**	**-**	**G**	**A**	**A**	**0**	**E**	**-**	**0**	**0**	**0**	**0**	:	0	J	-	0	0	0	0	-	0	0	-	0	0	0
			0	-	0	A	0	0	-	0	0	A	0	0	-	0	C	0	0	0	-	0	0	0	0	0	0	-	0	0	0	0	0	-	0	D	0	B
9	10A	10B	10C	10D	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26A	26B	26C	26D	26E	26F	27	28	29	30	31	32	33	34	35

MODEL OPTIONS

SERIES AND GENERATION
LF

MAJOR REVISION
A

UNIT SIZE
004 = 4 ton Capacity
005 = 5 ton Capacity
007 = 7 ton Capacity
008 = 8 ton Capacity
009 = 9 ton Capacity
010 = 10 ton Capacity
011 = 11 ton Capacity
013 = 13 ton Capacity
014 = 14 ton Capacity
015 = 15 ton Capacity
017 = 17 ton Capacity
021 = 21 ton Capacity
022 = 22 ton Capacity
024 = 24 ton Capacity
026 = 26 ton Capacity
031 = 31 ton Capacity
042 = 42 ton Capacity
048 = 48 ton Capacity
055 = 55 ton Capacity

SERIES
A = 4-7 and 9 ton units
B = 8 and 10-13 ton unit
C = 14-17, 22 and 24 ton units
D = 21 and 26-55 ton units

MINOR REVISION
A

VOLTAGE
2 = 230V/3Φ/60Hz
3 = 460V/3Φ/60Hz
4 = 575V/3Φ/60Hz
8 = 208V/3Φ/60Hz

A1: COMPRESSOR STYLE
A = R-410A Scroll Compressors
D = R-410A Variable Capacity Scroll Compressors
E = R-410A Tandem Scroll Compressors
G = R-410A Tandem Variable Capacity Scroll Compressors

A2: CONDENSER STYLE
A = Air-Cooled Microchannel Condenser

A3: EVAPORATOR CONFIGURATION
A = Brazed Plate
B = Oversized Brazed Plate

A4: Coating
0 = Standard
E = Polymer E-Coated Condenser Coil

A5: Staging
0 = Staged On/Off Compressors
E = All Variable Capacity Compressors
G = Half Variable Capacity Compressors

B1: Blank
0 = Standard

B2: Blank
0 = Standard

B3: Blank
0 = Standard

B4: Blank
0 = Standard

LF Series Feature String Nomenclature

Model Options : Unit Feature Options

GEN	MJREV		SIZE		SERIES		MNREV		VLT		A1	A2	A3	A4	A5		B1	B2	B3	B4		**1**	**2**		**3A**	**3B**	**3C**	3D		4A	4B	4C	4D		5A	5B	5C	5D		6	7		8A	8B	8C
LF	A	-	031	-	D	-	A	-	3	-	G	A	A	0	E	-	0	0	0	0	:	**0**	**J**	**-**	**0**	**0**	**0**	0	-	0	0	0	0	-	0	0	0	0	-	0	0	-	0	0	0
				0	-	0	A	0	0	-	0	0	A	0	0	-	0	C	0	0	0	-	0	0	0	0	0	0	-	0	0	0	0	0	0	-	0	0	0	0	0	-	0	D	0	B
				9				10A	10B	10C	10D	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26A	26B	26C	26D	26E	26F	27	28	29	30	31	32	33	34	35			

UNIT FEATURE OPTIONS

1: Unit Orientation

0 = Standard Access End Water Connections

2: Pumping Style

B = Const. Primary Pumping System Large Pipe Size
D = Var. Primary Pumping System Large Pipe Size
J = No Pumping Package - Piping to Connections at Wall Cutouts

3A: Building Pump Configuration

0 = No Building Pumps
A = 1 Pump + High Eff Motor
B = 1 Dual Pump + High Eff Motors
D = 1 Pump + VFD + High Eff Motor
E = 1 Dual Pump + 2 VFD's + High Eff Motors

3B: Building Pump Series and RPM

0 = No Building Pumps
A = 4360 (1,170 nominal rpm)
B = 4360 (1,760 nominal rpm)
C = 4360 (3,520 nominal rpm)
D = 4380 (1,170 nominal rpm)
E = 4380 (1,760 nominal rpm)
F = 4380 (3,520 nominal rpm)
K = 4382 (1,170 nominal rpm)
L = 4382 (1,760 nominal rpm)
M = 4382 (3,520 nominal rpm)

3C: Pump Size

0 = No Building Pumps
A = 1.5B
B = 2B
C = 2D
D = 3D
E = 1.5x1.5x6
F = 2x2x6
G = 3x3x6
H = 4x4x6
J = 6x6x6
K = 1.5x1.5x8
L = 2x2x8
M = 3x3x8
N = 4x4x8
P = 5x5x8
Q = 6x6x8
R = 8x8x8
S = 2x2x10
T = 3x3x10
U = 4x4x10
V = 6x6x10
W = 8x8x10
Y = 4x4x11.5
Z = 5x5x11.5
1 = 6x6x11.5
2 = 8x8x11.5
3 = 4x4x13
4 = 6x6x13
5 = 8x8x13

LF Series Feature String Nomenclature

Model Options : Unit Feature Options

GEN	MJREV	SIZE	SERIES	MNREV	VLT	A1	A2	A3	A4	A5	B1	B2	B3	B4	1	2	3A	3B	3C	**3D**	**4A**	**4B**	**4C**	**4D**	**5A**	**5B**	**5C**	**5D**	**6**	**7**	**8A**	**8B**	**8C**
LF	A	- 031	- D	- A	- 3	- G	A	A	0	E	- 0	0	0	0	: 0	J	- 0	0	0	**0**	**-**	**0**	**0**	**0**	**-**	**0**	**0**	**0**	**-**	**0**	**0**	**0**	**0**
			0	**- 0**	**A**	0	0	-	0	0	A	0	0	-	0	C	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	D	0	B
			9	**10A**	**10B**	10C	10D	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26A	26B	26C	26D	26E	26F	27	28	29	30	31	32	33	34	35

3D: Building Pump Motor Size
0 = No Building Pumps
A = 0.5 hp
B = 0.75 hp
C = 1 hp
D = 1.5 hp
E = 2 hp
F = 3 hp
G = 5 hp
H = 7.5 hp
J = 10 hp
K = 15 hp
L = 20 hp
M = 25 hp
N = 30 hp
P = 40 hp
Q = 50 hp
R = 60 hp
S = 75 hp

4A: Blank
0 = Standard

4B: Blank
0 = Standard

4C: Blank
0 = Standard

4D: Blank
0 = Standard

5A: Blank
0 = Standard

5B: Blank
0 = Standard

5C: Blank
0 = Standard

5D: Blank
0 = Standard

6: Refrigeration Options
0 = None
A = Hot Gas Bypass Non-Variable Capacity Compressor Circuits
B = Hot Gas Bypass - All Circuits

7: Refrigeration Accessories
0 = Standard
A = Sight Glass
B = Compressor Isolation Valves
C = Option A + B
D = Single Circuit 0°F Low Ambient
E = Option A + D
F = Option B + D
G = Option A + B + D
H = Dual Circuits 0°F Low Ambient
J = Option A + H
K = Option B + H
L = Option A + B + H

8A: Unit Disconnect Type
0 = Standard Single Point Power Block
A = Single Point Power Non-fused Disconnect

8B: Disconnect 1 Size
0 = Power Block
N = 100 amps
R = 150 amps
V = 250 amps
Z = 400 amps

8C: Blank
0 = Standard

9: Accessories
0 = None
B = Phase & Brown Out Protection
E = Compressor Sound Blanket
M = Option B + E

10A: Unit Control Sequence
0 = Standard AAON Controls

10B: Unit Control Supplier
A = AAON Controls
E = MCS Controls

LF Series Feature String Nomenclature

Model Options	:	Unit Feature Options

GEN	MJREV	SIZE	SERIES	MNREV	VLT	A1	A2	A3	A4	A5	B1	B2	B3	B4	1	2	3A	3B	3C	3D	4A	4B	4C	4D	5A	5B	5C	5D	6	7	8A	8B	8C
LF	A	- 031	- D	- A	- 3	- G	A	A	0	E	- 0	0	0	0	: 0	J	- 0	0	0	0	- 0	0	0	0	- 0	0	0	0	- 0	0	- 0	0	0
		0	- 0	A	**0**	**0**	-	**0**	**0**	**A**	**0**	**0**	-	**0**	**C**	**0**	**0**	**0**	-	**0**	**0**	**0**	**0**	**0**	-	**0**	**0**	**0**	**0**	**0**	-	0	D	0	B
			9	10A	10B	**10C**	**10D**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26A**	**26B**	26C	26D	26E	26F	27	28	29	30	31	32	33	34	35

10C: Control Supplier Options
0 = None
C = Modem

10D: BMS Connection & Diagnostics
0 = None
A = BACnet IP
B = BACnet MSTP
C = Modbus IP
D = Modbus RTU
E = LonTalk
H = No BMS Connection with Diagnostics
J = BACnet IP with Diagnostics
K = BACnet MSTP with Diagnostics
L = Modbus IP with Diagnostics
M = Modbus RTU with Diagnostics
N = LonTalk with Diagnostics

11: Blank
0 = Standard

12: Vestibule Accessories
0 = None
C = Vestibule Heating (Electric)

13: Maintenance Accessories
0 = None
A = 115VAC Convenience Outlet Factory Wired
B = 115VAC Convenience Outlet Field Wired

14: Blank
0 = Standard

15: Code Options
0 = Standard ETL U.S.A. Listing

16: Shipping Splits
0 = One Piece Unit
B = Crating
C = Export Crating

17: Air-Cooled Chiller Accessories
0 = Standard
A = Cond Coil Guards
C = ECM Condenser Fan Head Pressure Control
E = VFD Condenser Fan Head Pressure Control
G = Option A + C
J = Option A + E
N = Low Sound ECM Cond Fans – Head Pressure Control
S = Option A + N

18: Blank
0 = Standard

19: Blank
0 = Standard

20: Blank
0 = Standard

21: Blank
0 = Standard

22: Blank
0 = Standard

23: Blank
0 = Standard

24: Chiller Accessories 1
0 = None
A = Glycol chiller
C = Thermometers & Pressure Gauges
G = Option A + C

25: Blank
0 = Standard

26A: Blank
0 = Standard

26B: Blank
0 = Standard

LF Series Feature String Nomenclature

Model Options : Unit Feature Options

GEN	MJREV	SIZE	SERIES	MNREV	VLT	A1	A2	A3	A4	A5	B1	B2	B3	B4	1	2	3A	3B	3C	3D	4A	4B	4C	4D	5A	5B	5C	5D	6	7	8A	8B	8C
LF	A	- 031	- D	- A	- 3	- G	A	A	0	E	- 0	0	0	0	: 0	J	- 0	0	0	0	- 0	0	0	0	- 0	0	0	0	- 0	0	- 0	0	0
		0	- 0	A	0	0	- 0	0	A	0	0	- 0	C	0	0	0	- 0	0	0	0	0	- 0	0	**0**	**0**	**0**	**-**	**0**	**0**	**0**	**0**	**-**	**0**	**D**	**0**	**B**
9				10A	10B	10C	10D	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26A	26B	**26C**	**26D**	**26E**	**26F**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**

26C: Blank
0 = Standard

26D: Blank
0 = Standard

26E: Blank
0 = Standard

26F: Blank
0 = Standard

27: Blank
0 = Standard

28: Blank
0 = Standard

29: Blank
0 = Standard

30: Blank
0 = Standard

31: Blank
0 = Standard

32: Blank
0 = Standard

33: Warranty
0 = Standard Warranty
D = Compressor Warranty Years 2-5

34: Cabinet Material
0 = Standard - Double Wall + R-13 Foam Insulation

35: Paint & Special Pricing Authorizations
B = Premium AAON Gray Paint Exterior
E = Option B + Shrink Wrap
X = Special Pricing Authorization + Premium AAON Gray Paint Exterior
1 = Option X + Shrink Wrap

General Description

LF Series air-cooled chillers are complete self-contained liquid chilling units. They are factory assembled, wired, charged and run-tested. Primary pumping package is available as an optional feature.

⚠ WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Installation and service must be performed by a Factory Trained Service Technician.

System must be sized in accordance with the American Society of Heating, Refrigeration and Air Conditioning Engineers Handbook.

Installation of LF Series units must conform to the ICC standards of the International Mechanical Code, the International Building Code, and local building, plumbing and waste water codes. All appliances must be electrically grounded in accordance with local codes, or in the absence of local codes, the current National Electric Code, ANSI/NFPA 70 or the current Canadian Electrical Code CSA C22.1.

⚠ CAUTION

The Clean Air Act of 1990 bans the intentional venting of refrigerant as of July 1, 1992. Approved methods of recovery, recycling, or reclaiming must be followed.

⚠ WARNING

Coils and sheet metal surfaces present sharp edges and care must be taken when working with equipment.

⚠ WARNING

BURNING FOAM INSULATION IS TOXIC! Do not cut holes into any foam insulated panels with any flame producing cutter such as a plasma cutter or cutting torch.

⚠ WARNING

Failure to observe the following instructions will result in premature failure of your system and possible voiding of the warranty.

Receiving Unit

When received, check the unit for damage that might have occurred in transit. If damage is found it must be noted on the carrier's Freight Bill. A request for inspection by carrier's agent must be made in writing at once. Nameplate must be checked to ensure the correct model sizes and voltages have been received to match the job requirements.

If repairs must be made to damaged goods, then the factory must be notified before any repair action is taken in order to protect the warranty. Certain equipment alteration, repair, and manipulation of equipment without the manufacturer's consent may void the product warranty. Contact AAON Technical Support for assistance with handling damaged goods, repairs, and freight claims: (918) 382-6450.

NOTE: Upon receipt check shipment for items that ship loose. Consult order and shipment documentation to identify potential loose-shipped items. Loose-shipped items may have been placed inside the unit cabinet for security. Installers and owners must secure all doors with locks or nuts and bolts to prevent unauthorized access.

Chiller

⚠ WARNING

COMPRESSOR CYCLING

5 MINUTE MINIMUM OFF TIME
To prevent motor overheating compressors must cycle off for a minimum of 5 minutes.

2 MINUTE MINIMUM ON TIME
To maintain the proper oil level compressors must cycle on for a minimum of 2 minutes.

The cycle rate must not exceed 6 starts per hour.

Failure to observe the following instructions will result in premature failure of your system, and possible voiding of the warranty.

⚠ CAUTION

CRANKCASE HEATER OPERATION
Units are equipped with compressor crankcase heaters, which must be energized at least 24 hours prior to cooling operation, to clear any liquid refrigerant from the compressors.

Never cut off the main power supply to the unit, except for complete shutdown. When power is cut off from the unit, any compressors using crankcase heaters cannot prevent refrigerant migration. This means the compressor will cool down, and liquid refrigerant may accumulate in the compressor. Since the compressor is designed to pump refrigerant gas, damage may occur when power is restored.

⚠ CAUTION

Rotation must be checked on all MOTORS AND COMPRESSORS of three phase units. All motors, to include and not be limited to pump motors and condenser fan motors, must all be checked by a qualified service technician at startup and any wiring alteration must only be made at the unit power connection.

Before unit operation, the main power switch must be turned on for at least twenty four hours for units with compressor crankcase heaters. This will give the crankcase heater time to clear any liquid accumulation out of the compressor before it is required to run.

⚠ CAUTION

Scroll compressors are directional and will be damaged by operation in the wrong direction. Low pressure switches on compressors have been disconnected after factory testing. Rotation must be checked by a qualified service technician at startup using suction and discharge pressure gauges and any wiring alteration must only be made at the unit power connection.

Always control the system from the control panel, never at the main power supply (except for emergency or for complete shutdown of the system).

The standard compressors must be on a minimum of 2 minutes and off for a minimum of 5 minutes. The cycle rate must be no more than 6 starts per hour.

The variable capacity compressors must be on a minimum of 3 minutes and off for a minimum of 3 minutes. The cycle rate must be no more than 6 starts per hour.

The chiller is furnished with a pressure differential switch that is factory installed between the chilled water supply and return connections. This sensor must not be bypassed since it provides a signal to the unit controller that water flow is present in the heat exchanger and the unit can operate without the danger of freezing the liquid.

The compressor life will be seriously shortened by reduced lubrication, and the pumping of excessive amounts of liquid oil and refrigerant.

Wiring Diagrams
A complete set of unit specific wiring diagram in point-to-point form is laminated in plastic and located inside the control compartment door.

⚠ CAUTION

FIELD WIRED CONNECTIONS

Some units may require field wired connections. Refer to the wiring diagrams contained within the unit to identify any components or controls requiring additional wiring in the field before placing the unit into service. All additional field wiring must be performed by a Factory Trained Service Technician.

General Maintenance
When the initial startup is made and on a periodic schedule during operation, it is necessary to perform routine service checks on the performance of the chiller. This includes reading and recording suction pressures and checking for normal sub-cooling and superheat.

Primary Pumping Package
Primary pumping uses a single pump to move water (or glycol) through the evaporator and back to the building. This pumping package provides the necessary flow of water to the system. The pump is activated whenever the chiller is given a run signal.

Water enters the unit through the return water piping, and then the water flows through a suction guide with strainer. Some units will not include a suction guide if there is enough straight piping before the pump. The end of the suction guide is removable for strainer access. The strainer assembly is composed of two parts, the operational strainer, and the startup strainer, (located inside the operational strainer) which is to be removed 24 hours after startup. The strainer will be included on all units.

The pump is installed after the strainer, and before a combination valve (Flo-Trex). This combination valve acts as isolation valve, check valve, and flow balancing valve. The shell and tube or brazed plate evaporator, is placed after the combination valve in the water circuit, with a differential pressure switch installed across its inlet and outlet. This pressure switch closes when the differential pressure increases above the set-point, which should be set 1-2 psig below the pressure drop across the heat exchanger at design flow rate. The closing differential pressure switch signals the control system to indicate flow through the heat exchanger and allow cooling to activate as required to maintain the setpoint. The water exiting the shell and tube or brazed plate evaporator, leaves the unit through the water out connection.

Glycol

Glycol units require a glycol feeder field installed to replace fluid that is lost in the system. Water must not be directly added to glycol applications as this would dilute the glycol concentration and thereby increase the freezing temperature of the fluid.

Compression Tank

As the water temperature in the system increases, the volume that water displaces increases. In order to compensate for these forces, AAON recommends a pre-pressurized diaphragm compression tank that is preset for 12 psig.

Pressure Relief Valve

Required pressure relief valve is installed in the unit. This valve is set at 125 psig.

Manual and Automatic Air Vent

A manual air vent is supplied in chillers without pumping packages. The air vent valve must be in the proper position for operation. Ensure that the small vent cap on the automatic air vent is loosened one to two turns from the closed position, allowing air to be vented from the system. It is advisable to leave the cap on to prevent impurities from entering the valve. See appendix for additional information.

Dual Pumps

When redundant pumping is required, a factory installed dualArm pump can be ordered on units 15 tons and larger. A dualArm pump is a pump with two independent motors and pumps in a single casing. This pump has a swing split-flapper valve in the discharge port to prevent liquid recirculation when only one pump is operating. Isolation valves in the casing allow one pump to be isolated and removed for service while the other pump is still operating.

The controls package will activate the pump when the unit is given a run command. If the controls do not recognize flow in 60 seconds, the second pump will be activated and an alarm signal will be generated. If the second pump does not activate, the cooling will be locked out.

Differential Pressure Gauge and Thermometers

A differential pressure gauge and thermometers are available as a factory installed option when using a factory installed pumping package. Thermometers are installed around the evaporator of the unit. A differential pressure gauge is installed at each pump. This pressure gauge is connected in three places to the water piping: before the suction guide/strainer, after the suction guide and before the pump, and after the pump. There is also a needle valve at each of these points to isolate the pressure. To measure the pressure at any given point, open the needle valve at that point and close the other two needle valves. Instead of two

pressure gauges, one pressure gauge is used to minimize calibration and gauge errors.

Pipe Insulation
The evaporator in the LF Series chiller is factory insulated. The water piping, pumps, and other components on units with pumping packages are not insulated at the factory. Insulation should be installed on the water piping after the system has been checked for leaks.

Installation

Forklifting the Unit (4-17, 22 and 24 ton)
4-17, 22 and 24 ton units can be lifted using a forklift. 8, 10-17, 22 and 24 ton units must have forks 72" in length or the forks must have 72" fork extensions. 4-7 and 9 ton units must have forks at least 48" in length. Standard units can be lifted from all sides except the condenser side.

Forks must be perpendicular to the unit and they must be in far enough that the back of the forks are no more than 6" away from the edge of the unit.

⚠ CAUTION

FORKLIFTING
8, 10-17,22 AND 24 TON UNITS

Forks or Fork Extensions must be 72" in length.

⚠ CAUTION

FORKLIFTING
4-7 AND 9 TON UNITS

Forks or Fork Extensions must be at least 48" in length.

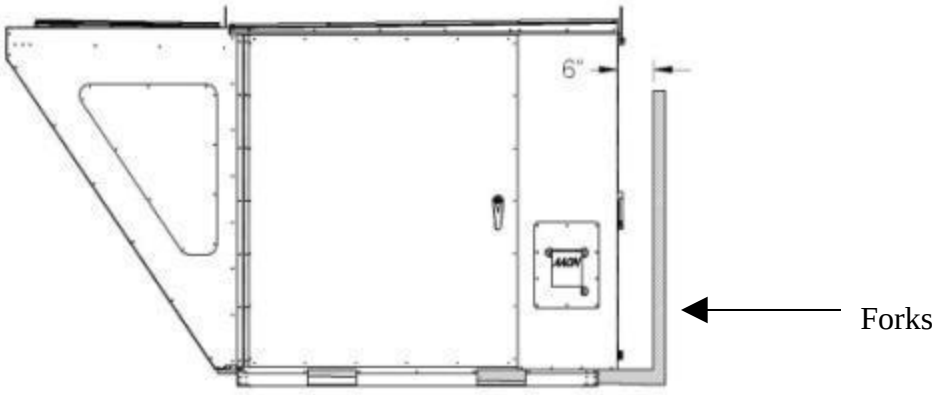


Figure 1 - Forklifting an LF Series A, B and C Cabinet, 4-17, 22 and 24 tons

Lifting the Unit
If cables or chains are used to hoist the unit they must be the same length. Minimum cable length is 99" for 4-17, 22 and 24 ton units and 180" for 21 and 26-55 ton units. Care must be taken to prevent damage to the cabinet, coils, and condenser fans.

Before lifting unit, be sure that all shipping material has been removed from unit. Secure hooks and cables at all lifting points / lugs provided on the unit.

Hoist unit to a point directly above the curb or concrete pad. Be sure that the gasket material has been applied to curb.

Carefully lower and align the unit with utility and duct openings. Lower the unit until the unit skirt fits around the curb. Some units are designed to overhang the curb. Take care that any recessed base rails fit around the curb. Make sure the unit is level and properly seated on the curb or pad.

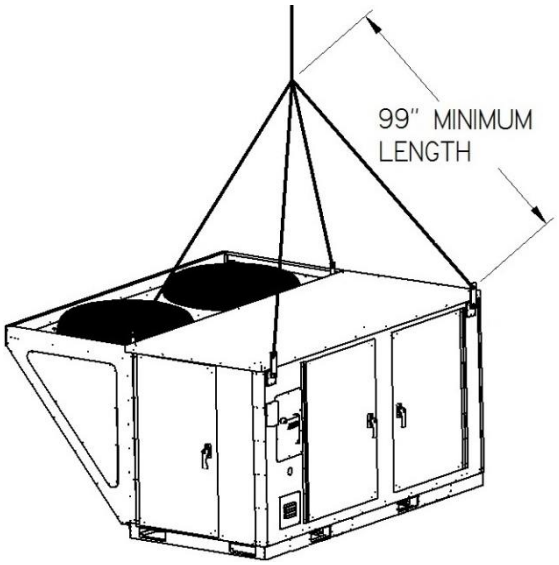


Figure 2 - Lifting Details of a 4-17, 22 and 24 ton Standard Unit

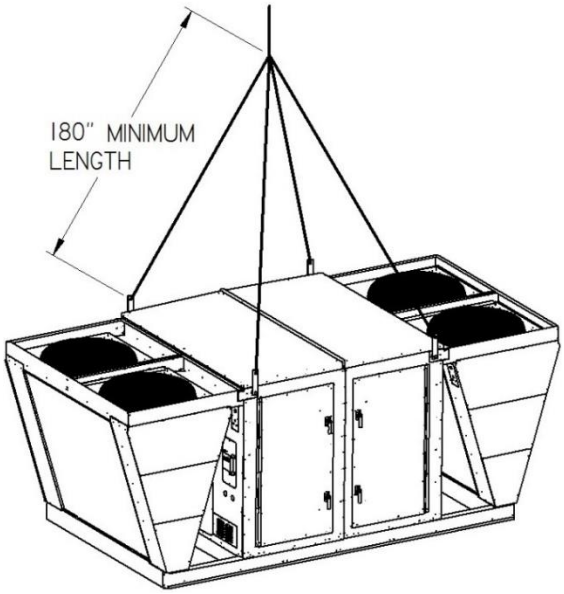


Figure 3 - Lifting Details of a 21 and 26-55 ton Standard Unit

Locating the Unit

The LF Series chiller is designed for outdoor applications and mounting at ground level or on a rooftop. It must be placed on a level and solid foundation that has been prepared to support its weight. When installed at ground level, a one-piece concrete slab must be used with footings that extend below the frost line. Also with ground level installation, care must be taken to protect the coil from damage due to vandalism or other causes. LF Series chillers are available with factory installed louvered sheet metal condenser coil guards.

The placement relative to the building air intakes and other structures must be carefully selected. Airflow to and from the chiller must not be restricted to prevent a decrease in performance and efficiency.

The installation position must provide at least sufficient clearance for proper airflow to the condenser coils. See Table 1 through Table 4 for individual unit clearances. When units are mounted adjacent to each other, the minimum clearance required between the units is 6 feet

Table 1 - 4-7 & 9 ton Service Clearances

Location	Clearance
Left	42”
Right	36”
Compressor End	30”
Chiller HXC End	30”
Top	Open

Table 2 - 8 & 10-13 ton Service Clearances

Location	Clearance
Left	36”
Right	36”
Compressor End	30”
Chiller HXC End	30”
Top	Open

Table 3 - 14-17, 22 & 24 ton Service Clearances

Location	Clearance
Left	42”
Right	36”
Compressor End	36”
Chiller HXC End	30”
Top	Open

Table 4 - 21 & 26-55 ton Service Clearances

Location	Clearance
Left	42”
Right	42”
Compressor End	36”
Chiller HXC End	36”
Top	Open

Units must not be installed in an enclosure or pit that is deeper than the height of the unit. When recessed installation is necessary, the clearance to maintain proper airflow is at least 6 feet.

LF Series chillers have a vertical air discharge. There must be no obstruction above the equipment. Do not place the unit under an overhang.

For proper unit operation, the immediate area around condenser must remain free of debris that may be drawn in and obstruct airflow in the condensing section.

Consideration must be given to obstruction caused by snow accumulation when placing the unit.

Water Connection

Connect the chiller supply and return water lines. See Table 5 for the LF water connection sizes. The water connections are schedule 40 grooved black pipe. The maximum operating pressure for the AAON LF Series chiller is 125 psi.

Table 5 - Water Connection Sizes

Cabinet Size	Model (LF-)	Supply and Return Connection Size
A	004, 005, 007, 009	1-1/2" SCH 40 grooved black pipe
B & C	008, 010, 011, 013, 014, 015, 017, 022, 024	2" SCH 40 grooved black pipe
D	021, 026, 031, 042, 048, 055	3" SCH 40 grooved black pipe

⚠ WARNING

The chiller must be operated only with liquid flowing through the evaporators.

⚠ CAUTION

PVC (Polyvinyl Chloride) and CPVC (Chlorinated Polyvinyl Chloride) are vulnerable to attack by certain chemicals. Polyolester (POE) oils used with R-410A and other refrigerants, even in trace amounts, in a PVC or CPVC piping system will result in stress cracking of the piping and fittings. This will result in complete piping system failure.

⚠ CAUTION

Installing Contractor is responsible for proper sealing of the water piping and electrical entries into the unit. Failure to seal the entries may result in damage to the unit and property.

Mounting Isolation

For roof mounted applications or anytime vibration transmission is a factor, vibration isolators may be used.

Access Doors

Access doors are provided to the compressor and electrical compartment. A separate access door is also provided to the evaporator/heat exchanger compartment.

Low Ambient Operation

During low ambient temperatures, it is difficult to start a system because the refrigerant will migrate to the cold part of the system (condenser) and make it difficult for refrigerant to flow. All chiller compressors are provided with factory installed crankcase heaters. The LF Series chiller must have continuous power 24 hours prior to startup. This ensures the compressor will receive sufficient refrigerant vapor at startup.

The AAON low ambient (condenser flood-back) system is used to operate a refrigerant system below 35°F outside air temperature. As the ambient temperature drops, the condenser becomes more effective therefore lowering the head pressure.

The low ambient system maintains normal head pressure during periods of low ambient by restricting liquid flow from the condenser to the receiver, and at the same time bypassing hot gas around the condenser to the inlet of the receiver. This reduces liquid refrigerant flow from the condenser, reducing its effective surface area, which in turn increases the condensing pressure. At the same time the bypassed hot gas raises liquid pressure in the receiver, allowing the system to operate properly. LF Series chillers use an LAC valve for low ambient operation.

LAC Valve

The LAC valve is a non-adjustable three way valve that modulates to maintain receiver pressure. As the receiver pressure drops below the valve setting (295 psig for R-410A), the valve modulates to bypass discharge gas around the condenser. The discharge gas warms the liquid in the receiver and raises the pressure to the valve setting. The following schematic shows an example system using the LAC valve.

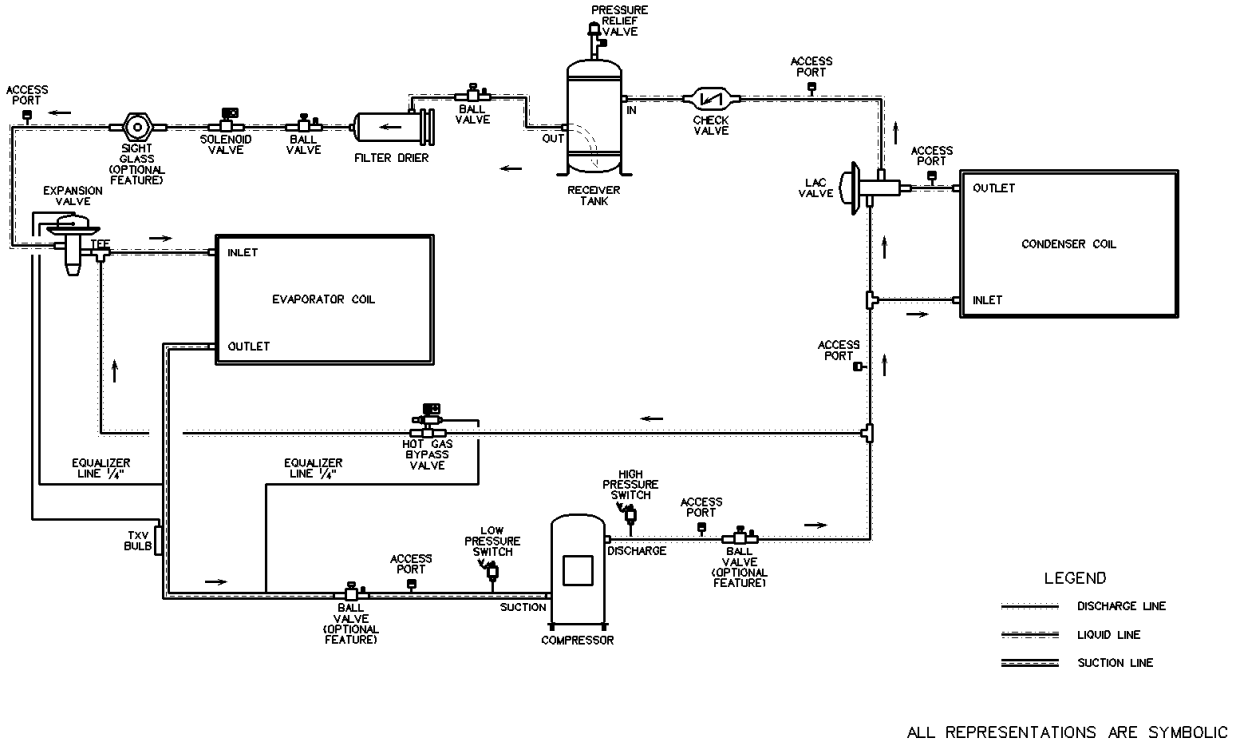


Figure 4 - Piping Schematic of Example System using the LAC Valve

Condenser Flooding

In order to maintain head pressure in the refrigeration system, liquid refrigerant is kept in the condenser to reduce condenser surface. The following chart shows the percentage that a condenser must be flooded in order to function properly at the given ambient temperature.

During higher ambient temperatures the entire condenser is required to condense refrigerant. During these higher ambient temperatures, a receiver tank is used to contain the refrigerant that was required to flood the condenser during low ambient operation. The receiver must be sized to contain all of the flooded volume otherwise there will be high head pressures during higher ambient conditions.

Table 6 - Condenser Flooding

PERCENTAGE OF CONDENSER TO BE FLOODED								
Ambient Temperature (°F)	Evaporating Temperature (°F)							
	0°	**10°**	**20°**	**30°**	**35°**	**40°**	**45°**	**50°**
70°	40	24	0	0	0	0	0	0
60°	60	47	33	17	26	20	10	4
50°	70	60	50	38	45	40	33	28
40°	76	68	60	50	56	52	46	42
30°	80	73	66	59	64	60	55	51
20°	86	77	72	65	69	66	62	59
0°	87	83	78	73	76	73	70	68

Electrical

The single point electrical power connections are made in the electrical control compartment. The microprocessor control furnished with the unit is supplied with its own power supply factory wired to the main power of the chiller.

Check the unit nameplate voltage to make sure it agrees with the power supply. Connect power to the unit according to the wiring diagram provided with the unit.

Table 7 - Nameplate Voltage Markings & Tolerances

Hz	Nameplate Voltage	Nominal System Voltage	Operating Voltage Range [1]		Acceptable Performance Range[2]	
			Min	Max	Min	Max
60	115	120	104	127	108	126
	208/230	208/240	187	254	187	252
	208	208	187	228	187	228
	230	240	208	254	216	252
	265	277	240	293	249	291
	460	480	416	508	432	504
	575	600	520	635	540	630
50	230	230	198	254	208	254
	400	400	344	440	360	440

Notes:

1. Operating voltage is the min and max voltage for which the unit can function. Never operate outside of this min and max voltage.
2. The Acceptable Performance Range is the min and max voltage for which the unit performance is designed and rated to give acceptable performance.

Note: Units are factory wired for 208V, 230V, 460V, or 575V. In some units, the 208V and 230V options may also be provided in single or three phase configurations. The transformer configuration must be checked by a qualified technician prior to startup.

⚠ CAUTION

3-PHASE ROTATION

Rotation must be checked on all MOTORS AND COMPRESSORS of three phase units. Condenser fan motors must be checked by a qualified service technician at startup and any wiring alteration must only be made at the unit power connection. Variable frequency drives are programmed to automatically rotate the fan in the correct rotation. Do not rely on fans with variable frequency drives for compressor rotation.

Size supply conductors based on the unit MCA rating. Supply conductors must be rated a minimum of 167°F (75°C).

Route power and control wiring, separately, through the utility entry. Do not run power and signal wires in the same conduit.

Protect the branch circuit in accordance with code requirements. The unit must be electrically grounded in accordance with local codes, or in the absence of local codes, the current National Electric Code, ANSI/NFPA 70 or the current Canadian Electrical Code CSA C22.1.

Power wiring is to the unit terminal block or main disconnect. All wiring beyond this point has been done by the manufacturer and cannot be modified without effecting the unit's agency/safety certification.

Three phase voltage imbalance will cause motor overheating and premature failure. The maximum allowable imbalance is 2%.

Voltage imbalance is defined as 100 times the maximum deviation from the average voltage divided by the average voltage.

Example:
(221V+230V+227V)/3 = 226V, then 100*(226V-221V)/226V = 2.2%, which exceeds the allowable imbalance.

Check voltage imbalance at the unit disconnect switch and at the compressor terminal. Contact your local power company for line voltage corrections.

⚠ WARNING

ELECTRIC SHOCK

Electric shock hazard. Before attempting to perform any installation, service, or maintenance, shut off all electrical power to the unit at the disconnect switches. Unit may have multiple power supplies. Failure to disconnect power could result in dangerous operation, serious injury, death or property damage.

Note: Startup technician must check motor amperage to ensure that the amperage listed on the motor nameplate is not exceeded.

⚠ CAUTION

SEALING ELECTRICAL ENTRIES

Installing Contractor is responsible for proper sealing of the electrical entries into the unit. Failure to seal the entries may result in damage to the unit and property.

⚠ WARNING

CONVENIENCE OUTLETS AND SERVICE LIGHTS

Convenience outlet and service light circuits are wired to the incoming power side of the disconnect. These circuits will remain powered even when unit disconnect is off.

Startup

(See back of the manual for startup form.)

⚠ WARNING

Electric shock hazard. Shut off all electrical power to the unit to avoid shock hazard or injury from rotating parts.

⚠ WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Installation and service must be performed by a Factory Trained Service Technician.

Before startup of the chiller make sure that the following items have been checked.

1. Verify that electrical power is available to the unit.
2. Verify that any remote stop/start device connected to the chiller controller is requesting the chiller to start.
3. Verify that liquid flow is present through the chiller from the building.
4. There must be a building load of at least 25% of the chiller capacity in order to properly check operation.
5. Using Prism2 set the leaving water temperature setpoint. Setpoints are accessed by clicking on the "Setpoints" at the top left of the LF Chiller Main Controller status screen.
6. Use the general check list at the top of the startup form to make a last check that all the components are in place, water flow is present, and the power supply is energized.
7. Cycle through all the compressors to confirm that all are operating within tolerance.
8. While performing the check, use the startup form to record observations of amps and refrigerant pressures.
9. When all is running properly, use Prism2 to place the controller in the Run mode and observe the system until it reaches a steady state of operation.

⚠ CAUTION

Rotation must be checked on all MOTORS AND COMPRESSORS of three phase units. All motors, to include and not be limited to pump motors and condenser fan motors, must all be checked by a qualified service technician at startup and any wiring alteration must only be made at the unit power connection.

Note: For more information on programming the controller refer to the LF Chiller Controller Technical Guide available online at https://www.aaon.com/ControlsManuals.

⚠ CAUTION

Before completing installation, a complete operating cycle must be observed to verify that all components are functioning properly.

Maintenance

General
Qualified technicians must perform routine service checks and maintenance. This includes reading and recording the condensing and suction pressures and checking for normal sub-cooling and superheat.

Compressors
The scroll compressors are fully hermetic and require no maintenance except keeping the shell clean.

Refrigerant Filter Driers
Each refrigerant circuit contains a filter drier. Replacement is recommended when there is excessive pressure drop across the assembly or moisture is indicated in a liquid line sight glass.

Table 8 - Max Filter Drier Pressure Drops

Circuit Loading	Max. Pressure Drop
100%	10 psig
50%	5 psig

Evaporator
The evaporators are direct expansion type with an electronic expansion valve to regulate refrigerant. Normally no maintenance or service work will be required.

Adjusting Refrigerant Charge
All AAON chillers are shipped with a full factory charge. Periodically additional charge may be required.

Charging a system in the field must be based on determination of liquid sub-cooling and evaporator superheat. On a system with an electronic expansion valve, liquid sub-cooling is more representative of the charge than evaporator superheat but both measurements must be taken.

⚠ CAUTION

The Clean Air Act of 1990 bans the intentional venting of refrigerant (CFC's and HCFC's) as of July 1, 1992. Approved methods of recovery, recycling or reclaiming must be followed. Fines and/or incarceration may be levied for non-compliance.

Before Charging
Refer to the Unit Nameplate as a reference when determining the proper refrigerant charge.

Unit being charged must be at or near full load conditions before adjusting the charge.

After adding or removing charge the system must be allowed to stabilize, typically 10-15 minutes, before making any other adjustments.

The type of unit and options determine the ranges for liquid sub-cooling and evaporator superheat. Refer to Table 9 when determining the proper sub-cooling.

Checking Liquid Sub-cooling
Measure the temperature of the liquid line as it leaves the condenser coil.

Read the gauge pressure at the liquid line close to the point where the temperature was taken. You must use liquid line pressure as it will vary from discharge pressure due to condenser coil pressure drop.

Convert the pressure obtained to a saturated temperature using the appropriate refrigerant temperature-pressure chart.
Subtract the measured liquid line temperature from the saturated temperature to determine the liquid sub-cooling.

Compare calculated sub-cooling to the table below for the appropriate unit type and options.

Checking Evaporator Superheat

Measure the temperature of the suction line close to the compressor.

Read gauge pressure at the suction line close to the compressor.

Convert the pressure obtained to a saturated temperature using the appropriate refrigerant temperature-pressure chart.

Subtract the saturated temperature from the measured suction line temperature to determine the evaporator superheat.

For refrigeration systems with tandem compressors, it is critical that the suction superheat setpoint on the EXV is set with one compressor running. The suction superheat must be 10-13°F with one compressor running. The suction superheat will increase with both compressors in a tandem running. Inadequate suction superheat can allow liquid refrigerant to return to the compressors which will wash the oil out of the compressor. Lack of oil lubrication will destroy a compressor. Liquid sub-cooling must be measured with both compressors in a refrigeration system running.

Compare calculated superheat to Table 9 for the appropriate unit type and options.

Table 9 - Acceptable Refrigeration Circuit Values

Air-Cooled Condenser	
Sub-Cooling[2]	12-18°F
Superheat[1]	10-15°F

[1] One compressor running in tandem

[2] Two compressors running in tandem

Adjusting Sub-cooling and Superheat Temperatures

The system is overcharged if the sub-cooling temperature is too high and the evaporator is fully loaded (low loads on the evaporator result in increased sub-cooling) and the evaporator superheat is within the temperature range as shown in Table 9 (high superheat results in increased sub-cooling)

Correct an overcharged system by reducing the amount of refrigerant in the system to lower the sub-cooling.

⚠ CAUTION

DO NOT OVERCHARGE!

Refrigerant overcharging leads to excess refrigerant in the condenser coils resulting in elevated compressor discharge pressure.

The system is undercharged if the superheat is too high and the sub-cooling is too low.

Correct an undercharged system by adding refrigerant to the system to reduce superheat and raise sub-cooling.

If the sub-cooling is correct and the superheat is too high, the TXV may need adjustment to correct the superheat.

Table 10 - R-410A Refrigerant Temperature-Pressure Chart

°F	PSIG	°F	PSIG	°F	PSIG	°F	PSIG	°F	PSIG
20	78.3	**47**	134.7	**74**	213.7	**101**	321.0	**128**	463.2
21	80.0	**48**	137.2	**75**	217.1	**102**	325.6	**129**	469.3
22	81.8	**49**	139.7	**76**	220.6	**103**	330.2	**130**	475.4
23	83.6	**50**	142.2	**77**	224.1	**104**	334.9	**131**	481.6
24	85.4	**51**	144.8	**78**	227.7	**105**	339.6	**132**	487.8
25	87.2	**52**	147.4	**79**	231.3	**106**	344.4	**133**	494.1
26	89.1	**53**	150.1	**80**	234.9	**107**	349.3	**134**	500.5
27	91.0	**54**	152.8	**81**	238.6	**108**	354.2	**135**	506.9
28	92.9	**55**	155.5	**82**	242.3	**109**	359.1	**136**	513.4
29	94.9	**56**	158.2	**83**	246.0	**110**	364.1	**137**	520.0
30	96.8	**57**	161.0	**84**	249.8	**111**	369.1	**138**	526.6
31	98.8	**58**	163.8	**85**	253.7	**112**	374.2	**139**	533.3
32	100.9	**59**	166.7	**86**	257.5	**113**	379.4	**140**	540.1
33	102.9	**60**	169.6	**87**	261.4	**114**	384.6	**141**	547.0
34	105.0	**61**	172.5	**88**	265.4	**115**	389.9	**142**	553.9
35	107.1	**62**	175.4	**89**	269.4	**116**	395.2	**143**	560.9
36	109.2	**63**	178.4	**90**	273.5	**117**	400.5	**144**	567.9
37	111.4	**64**	181.5	**91**	277.6	**118**	405.9	**145**	575.1
38	113.6	**65**	184.5	**92**	281.7	**119**	411.4	**146**	582.3
39	115.8	**66**	187.6	**93**	285.9	**120**	416.9	**147**	589.6
40	118.1	**67**	190.7	**94**	290.1	**121**	422.5	**148**	596.9
41	120.3	**68**	193.9	**95**	294.4	**122**	428.2	**149**	604.4
42	122.7	**69**	197.1	**96**	298.7	**123**	433.9	**150**	611.9
43	125.0	**70**	200.4	**97**	303.0	**124**	439.6		
44	127.4	**71**	203.6	**98**	307.5	**125**	445.4		
45	129.8	**72**	207.0	**99**	311.9	**126**	451.3		
46	132.2	**73**	210.3	**100**	316.4	**127**	457.3		

Lubrication

All original motors and bearings are furnished with an original factory charge of lubrication. Certain applications require bearings be re-lubricated periodically. The schedule will vary depending on operating duty, temperature variations, or severe atmospheric conditions.

Bearings must be re-lubricated at normal operating temperatures, but not when running.

Rotate the fan shaft by hand and add only enough grease to purge the seals. **DO NOT OVERLUBRICATE.**

Service
If the unit will not operate correctly and a service company is required, only a Factory Trained Service Technician qualified and experienced in both refrigerant chillers and air conditioning is permitted to service the system to keep warranties in effect. If assistance is required, the service technician must contact AAON.
Note: Service technician must provide the model and serial number of the unit in all correspondence with AAON.

Warranties
Please refer to the limitation of warranties in effect at the time of purchase.

Condenser Tube Inspection
It is the responsibility of the installer to verify that the system is sealed before charging with refrigerant.

Pump Operation
Before initial start of the pump, check as follows:

1. Be sure that pump operates in the direction indicated by the arrow on the pump casing. Check rotation each time motor leads have been disconnected.

2. Check all connections of motor and starting device with wiring diagram. Check voltage, phase and frequency of line circuit with motor name plate.

3. Check suction and discharge piping and pressure gauges for proper operation.

4. Turn rotating element by hand to assure that it rotates freely.

Running:
Periodically inspect pump while running, but especially after initial start-up and after repairs.

1. Check pump and piping for leaks. Repair immediately.

2. Record pressure gauge readings for future reference.

3. Record voltage, amperage per phase, and kW.

Pump/Fan Motor Maintenance
Cleaning - Remove oil, dust, water, and chemicals from exterior of motor and pump. Keep motor air inlet and outlet open. Blow out interior of open motors with clean compressed air at low pressure.

Labeled Motors - It is imperative for repair of a motor with Underwriters' Laboratories label that original clearances be held; that all plugs, screws, other hardware be fastened securely, and that parts replacements be exact duplicates or approved equals. Violation of any of the above invalidates Underwriters' Label.

Access Doors
If scale deposits or water is found around the access doors, adjust door for tightness. Adjust as necessary until leaking stops when door is closed.

Pump Bearings - Lubrication
Every 6 months or after a prolonged shut down, use waterproof, lithium based grease. Below 32°F, use Esso Exxon or Beacon 325. Above 32°F, use Mobil Mobilox EP2, Shell Alvania EP2 or Texaco RB2.

Air Inlet
Inspect the air inlet louvers into the condenser section on a monthly basis to remove any paper, leaves or other debris that may block the airflow.

Propeller Fans and Motors
The fans are directly mounted on the motor shafts and the assemblies require minimal maintenance except to assure they are clear of dirt or debris that would impede the airflow.

Recommended Annual Inspection
In addition to the above maintenance activities, a general inspection of the unit surface must be completed at least once a year.

Air-Cooled Condenser
The air-cooled condenser section rejects heat by passing outdoor air over the microchannel coils for cooling of the hot refrigerant gas from the compressors. The heated air will discharge from the top of the section through the axial flow fans.

The condenser coils must be inspected yearly to ensure unrestricted airflow. If the installation has a large amount of airborne dust or other material, the condenser coils must be cleaned with a water spray in a direction opposite to airflow. Care must be taken to prevent bending of the aluminum fins on the copper tubes.

E-Coated Coil Cleaning
Documented routine cleaning of e-coated coils is required to maintain coating warranty coverage for fin and tube and microchannel coils. See the AAON E-Coated Coil Maintenance Record sheet.

⚠ WARNING

Electric shock hazard. Shut off all electrical power to the unit to avoid shock hazard or injury from rotating parts.

Surface loaded fibers or dirt must be removed prior to water rinse to prevent restriction of airflow. If unable to back wash the side of the coil opposite of the coils entering air side, then surface loaded fibers or dirt must be removed with a vacuum cleaner. If a vacuum cleaner is not available, a ***soft non-metallic*** bristle brush may be used. In either case, the tool must be applied in the direction of the fins. Coil surfaces can be easily damaged (fin edges bent over) if the tool is applied across the fins.

Use of a water stream, such as a garden hose, against a surface loaded coil will drive the fibers and dirt into the coil. This will make cleaning efforts more difficult. Surface loaded fibers must be completely removed prior to using low velocity clean water rinse.

A ***monthly*** clean water rinse is recommended for coils that are applied in coastal or industrial environments to help to remove chlorides, dirt, and debris. It is very important when rinsing, that water temperature is less than 130°F and pressure is less than 100 psig to avoid damaging the fin edges. An elevated water temperature (not to exceed 130°F) will reduce surface tension, increasing the ability to remove chlorides and dirt.

⚠ CAUTION

High velocity water from a pressure washer or compressed air must only be used at a very low pressure to prevent fin and/or coil damages. The force of the water or air jet may bend the fin edges and increase airside pressure drop. Reduced unit performance or nuisance unit shutdowns may occur.

Quarterly cleaning is essential to extend the life of an e-coated coil and is required to maintain coating warranty coverage.
Coil cleaning shall be part of the unit's regularly scheduled maintenance procedures. Failure to clean an e-coated coil will void the warranty and may result in reduced efficiency and durability.

⚠ CAUTION

Harsh chemicals, household bleach, or acid cleaners must not be used to clean outdoor or indoor e-coated coils. These cleaners can be very difficult to rinse out of the coil and can accelerate corrosion and attack the e-coating. If there is dirt below the surface of the coil, use the recommended coil cleaners.

For routine quarterly cleaning, first clean the coil with the below approved coil cleaner. After cleaning the coils with the approved cleaning agent, use the approved chloride remover to remove soluble salts and revitalize the unit.

Recommended Coil Cleaner
The following cleaning agent, when used in accordance with the manufacturer's directions on the container for proper mixing and cleaning, has been approved for use on e-coated coils to remove mold, mildew, dust, soot, greasy residue, lint, and other particulate:

Enviro-Coil Cleaner: AAON PN: V82540

GulfClean ™ Coil Cleaner; AAON PN: G074480

Recommended Chloride Remover
GulfClean Salt Reducer™; AAON PN: G074490

GulfClean Salt Reducer™ is used to remove soluble salts from the e-coated coil, follow the manufacturer's instructions. This product is not intended for use as a degreaser. Any grease or oil film must first be removed with GulfClean ™ Coil Cleaner.

Remove Barrier - First ensure the power to the unit is off and locked out. Clean the area around the unit if needed to ensure leaves, grass or loose debris will not be blown into the coil. Soluble salts adhere themselves to the substrate. For the effective use of this product, the product must be able to come in contact with the salts. These salts may be beneath any soils, grease or dirt; therefore, these barriers must be removed prior to application of this product. As in all surface preparation, the best work yields the best results.

Application - Apply GulfClean ™ Coil Cleaner directly onto the substrate. Sufficient product must be applied uniformly across the substrate to thoroughly wet out surface, with no areas missed. This may be accomplished by use of a pump-up sprayer or conventional spray gun. Apply the cleaner to unit interior air exiting side coil surfaces first. Work in sections/panels moving side to side and from top to bottom. Allow the cleaning solution to soak for 5 to 10 minutes. Then move on to the exterior using the same method.

Rinse - Using pressurized potable water such as a garden hose, (< 100 psi), rinse the coils and continue to always work in sections/panels.

Continue until all coil areas on the inside of the unit have been rinsed. ***Note: Coils must always be cleaned / back flushed, opposite of airflow to prevent impacting the dirt into the coil.***

Repeat these steps with GulfClean ™ Salt Reducer. When finished replace all panels and tops that were removed.

Microchannel Coil Cleaning

Cleaning microchannel coils is necessary in all locations. In some locations it may be necessary to clean the coils more or less often than recommended. Condenser coil must be cleaned at a minimum of once a year. In locations where there is commonly debris or a condition that causes dirt/grease build up it may be necessary to clean the coils more often. Proper procedure must be followed at every cleaning interval. Using improper cleaning technique or incorrect chemicals will result in coil damage, system performance fall off, and potentially leaks requiring coil replacement.

Documented routine cleaning of microchannel coils with factory provided e-coating is required to maintain coating warranty coverage. Use the E-Coated Coil Cleaning section for details on cleaning e-coated coils.

Field applied coil coatings are not recommended with microchannel coils.

Allowed Chemical Cleaners and Procedures

AAON recommends certain chemicals that can be used to remove buildup of grime and debris on the surface of microchannel coils. These chemicals have been tested for performance and safety and are the only chemicals that AAON will warrant as correct for cleaning microchannel coils.

There are two procedures that are outlined below that will clean the coils effectively without damage to the coils. Use of any other procedure or chemical may void the warranty to the unit where the coil is installed. **With all procedures make sure the unit is off before starting.**

⚠ WARNING ⚠

Electric shock hazard. Shut off all electrical power to the unit to avoid shock hazard or injury from rotating parts.

The water pressure used to clean must not exceed 100 psi, from no closer than 6 inches from the coils, and with the water aimed perpendicular to the coils.

#1 Simple Green

Simple Green is available from AAON Parts and Supply (Part# T10701) and is biodegradable with a neutral 6.5 pH A 4 to 1 solution is recommended. Use the following procedure.

1. Rinse the coil completely with water. Use a hard spray but be careful not to bend or damage the fins. A spray that is too hard will bend the fins. Spray from the fan side of the coil.
2. With a pump sprayer filled with a mix of 4 parts water to one part Simple Green spray the air inlet face of the coil. Be sure to cover all areas of the face of the coil.
3. Allow the coil to soak for 10-15 minutes.
4. Rinse the coil with water as in step one.
5. Repeat as necessary.

#2 Water Flush

This procedure can be used when the only material to cause the coil to need cleaning is

debris from plant material that has impinged the coil face.

1. Rinse the coil completely with water. Use a hard spray but be careful not to bend or damage the fins. A spray that is too hard will bend the fins. Spray from the fan side of the coil.
2. Spray and rinse the coil from the face.

⚠ CAUTION

Use pressurized clean water, with pressure not to exceed 100 psi. Nozzle must be 6" and perpendicular to the coil face. Failure to do so could result in coil damage.

Application Examples

The two procedures can be used to clean microchannel coils. They will fit with the application depending on the area. In some areas where the spring/summer has a large cottonwood bloom #2 might work fine if the unit is installed on an office building and no other environmental factors apply.

Generally the best and broadest based procedure is #1. The grease cutting effect of the Simple Green is good for restaurant applications.

Other Coil Cleaners

There are many cleaners on the market for condenser coils. Before using any cleaner that is not covered in this section you must get written approval from the AAON warranty and service department. Use of unapproved chemicals will void the warranty.

AAON testing has determined that unless a chemical has a neutral pH (6-8) it must not be used.

Beware of any product that claims to be a foaming cleaner. The foam that is generated is caused by a chemical reaction to the aluminum fin material on tube and fin coils and with the fin, tube, and coating material on microchannel coils.

Microchannel coils are robust in many ways, but like any component they must be treated correctly. This includes cleaning the coils correctly to give optimal performance over many years.

Replacement Parts

Parts for AAON equipment may be obtained by contacting your local AAON representative. When ordering parts, reference serial number and part number located on the external or internal nameplate of the unit.

AAON Technical Support

203 Gum Springs Rd.
Longview, TX 75602
Ph: (918) 382-6450
techsupport@AAON.com
www.AAON.com

Note: Before calling, technician must have model and serial number of the unit available for the customer service department to help answer questions regarding the unit.

Appendix - Water Piping Component Information

Water Pressure Relief Valve

ASME Rated, Design Certified and Listed by C.S.A.

Used for protection against excessive pressure on domestic storage tanks or tank-less water heaters, the pressure relief valve has no temperature relieving element. Standard setting is 125 psi Size 3⁄4" x 3⁄4" (20mm x 20mm). ASME construction and is tested, listed and certified by the National Board of Boiler and Pressure Vessel Inspectors.

ANSI Z21.22 "Relief Valves for Hot Water Supply Systems."

DESIGN CERTIFIED and listed by C.S.A.

Automatic Air Vent Valves

Automatic Air Vent Valves provide air venting for hot or cold water distribution systems. These vents purge air that may be in the water system.

The vent valve utilizes an internal baffle system. The baffles slow water so that entrapped air can separate. Once the air is separated, the air is vented through the factory installed vent.

Pumps: Installation and Operating Instructions

Introduction

This document contains specific information regarding the safe installation, operating and maintenance of Vertical In-Line pumps and must be read and understood by installing, operating and maintenance personnel. The equipment supplied has been designed and constructed to be safe and without risk to health and safety when properly installed, operated and maintained. The instructions following must be strictly adhered to. If clarification is needed on any point please contact Armstrong quoting the equipment serial number.

⚠ WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Installation and service must be performed by a Factory Trained Service Technician.

⚠ WARNING

Installation of this equipment must not take place unless this document has been read and understood.

Where under normal operating conditions the limit of 68°C/155°F (Restricted Zone) for normal touch, or 80°C/176°F (Unrestricted Zone) for unintentional touch, may be experienced, steps must be taken to minimize contact or warn operators/users that normal operating conditions will be exceeded. In certain cases where the temperature of the pumped liquid exceeds the above stated temperature levels, pump casing temperatures may exceed 100°C/212°F and not withstanding pump insulation techniques appropriate measures must be taken to minimize risk for operating personnel.

Storage

Pumps removed from service and stored, must be properly prepared to prevent excessive rusting. Pump port protection plates must not be removed until the pump is ready to connect to the piping. Rotate the shaft periodically (At least monthly) to keep rotating element free and bearings fully functional.

For long term storage, the pump must be placed in a vertical position in a dry environment. Internal rusting can be prevented by removing the plugs at the top and bottom of the casing and drain or air blow out all water to prevent rust buildup or the possibility of freezing. Be sure to reinstall the plugs when the unit is made operational. Rust proofing or packing the casing with moisture absorbing material and covering the flanges is acceptable. When returning to service, be sure to remove the drying agent from the pump.

Handling Large VIL Units

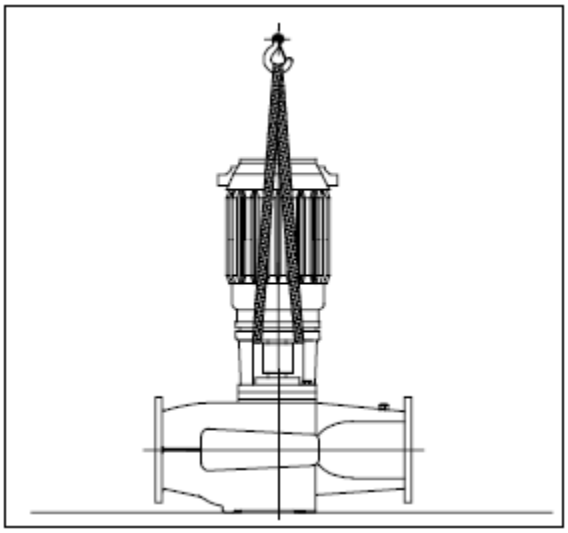
One effective way of lifting a large pumping unit is to place lifting hooks through the motor lifting rings or straps around the upper part of the motor. The pump and motor unit will free-stand on the casing ribs. Remove the coupling guard and place (2) lifting straps through the pump/motor pedestal, one on each side of the motor shaft and secure to the lifting device.

With the straps in place, using a spacer bar if necessary to protect the motor fan cover, the whole assembly can now be lifted securely.

Note: Handling, transportation and installation of this equipment must only be undertaken by trained personnel with proper use of lifting equipment.

Remove coupling guard and place lifting straps on each side of coupling, use spacer bar if necessary to protect motor fan cover.

Vertical Inline Pump Lifting Strap Positioning:



Note:
All split-coupled pumps contain a tapped hole in the motor bracket above the discharge flange for draining the well. Pipe this drain hole to a floor drain to avoid overflow of the cavity caused by collecting chilled water condensate or from seal failure.

Pump Piping - General

⚠ CAUTION

Piping may carry high temperature fluid.

⚠ CAUTION

Discharge valve only is to be used to throttle pump flow.

Caution
The discharge valve only is to be used to throttle pump flow, not the suction valve. Care must be taken in the suction line layout and installation, as it is usually the major source of concern in centrifugal pump applications

Alignment
Alignment is unnecessary on close-coupled pumps as there is no shaft coupling.

Split-coupled units are accurately aligned at the factory prior to being shipped and do not need re-aligning when installed.

Operation

⚠ CAUTION

Do not run pumps with discharge valve closed or under very low flow conditions.

Starting Pump
Ensure that the pump turns freely by hand, or with some mechanical help such as a strap and lever on larger pumps. Ensure that all protective guarding is securely fixed in position.

The pump must be fully primed on start up. Fill the pump casing with liquid and rotate the shaft by hand to remove any air trapped in the impeller. On split coupled units, any air trapped in the casing as the system is filled must be removed by the manual air vent in the seal flush line. Close-coupled units are

fitted with seal flush/vent lines piped to the pump suction area. When these units operate residual air is drawn out of the pump towards the suction piping.

Energize the motor momentarily and check that the rotation corresponds with the directional arrow on the pump casing.

To reverse rotation of a three phase motor, interchange any two power leads.

Start the pump with the discharge valve closed and the suction valve open, and then gradually open the discharge valve when the motor is at operating speed. The discharge valve may be opened slightly at start up to help eliminate trapped air.

When stopping the pump: Close the discharge valve and de-energize the motor.

DO NOT run the pump against a closed discharge valve for an extended period of time (A few minutes maximum).

Star-Delta motor starters should be fitted with electronic/mechanical interlocks that have a timed period of no more than 40 milliseconds before switching from star (Starting) to delta (Run) connection yet allow the motor to reach full star (Starting) speed before switching to delta (Run).

Should the pump be noisy or vibrate on start-up a common reason is overstated system head. Check this by calculating the pump operating head by deducting the suction pressure gauge value from the discharge gauge reading. Convert the result into the units of the pump head as stated on the pump nameplate and compare the values. Should the actual pump operating head be significantly less than the nameplate head value it is typically permissible to throttle the discharge isolation valve until the actual operating head is equal to the nameplate value.

Any noise or vibration usually disappears. The system designer or operator must be made aware of this soon as some adjustment may be required to the pump impeller diameter or drive settings, if applicable, to make the pump suitable for the system as installed.

⚠ CAUTION

Check rotation arrow prior to operating the unit.

Check rotation arrow prior to operating the unit. The rotation of all Vertical In-Line units is “clockwise” when viewed from the drive end. (Looking from on top of / behind the motor)

General Care

Vertical In-Line pumps are built to operate without periodic maintenance, other than motor lubrication on larger units. A systematic inspection made at regular intervals, will ensure years of trouble-free operation, giving special attention to the following:

Keep unit clean. Keep moisture, refuse, dust or other loose particles away from the pump and ventilating openings of the motor

Avoid operating the unit in overheated surroundings (Above 100ºF/40ºC).

⚠ WARNING

Electric shock hazard. Before attempting to perform any service or maintenance on pumping unit, disconnect power source to drive, LOCK IT OFF and tag with the reason.

Any possibility of the unit starting while being serviced must be eliminated.

If mechanical seal environmental accessories are installed, ensure water is flowing through the sight flow indicator and that filter cartridges are replaced as recommended.

Pump Lubrication
Lubrication is not required. There are no bearings in the pump that need external lubrication service.

Motor Lubrication
Follow the lubrication procedures recommended by the motor manufacturer. Many small and medium sized motors are permanently lubricated and need no added lubrication. Generally if there are grease fittings evident the motor needs periodic lubrication, and if there are no grease fittings evident, no periodic lubrication is required.

Check the lubrication instructions supplied with the motor for the particular frame size indicated on the motor nameplate.

Mechanical Seal
Mechanical seals require no special attention. The mechanical seal is fitted with a flush line. The seal is flushed from discharge of the pump casing on split-coupled pumps and is flushed and vented to the suction on close coupled pumps.

The split-coupled pump is flushed from the pump discharge because the mechanical seal chamber is isolated from the liquid in the pump by a throttle bushing. Because the seal chamber is isolated, seal environmental controls such as filters and separators, when installed in the split-coupled flush line are very effective, as only the seal chamber needs cleansing, and will prolong seal life in HVAC systems.

Do not run the pump unless properly filled with water as the mechanical seals need a film of liquid between the faces for proper operation.

Mechanical seals may ‘weep’ slightly at start-up. Allow the pump to continue operating for several hours and the mechanical seal to ‘seat’ properly prior to calling for service personnel.

System Cleanliness
Before starting the pump the system must be thoroughly cleaned, flushed and drained and replenished with clean liquid.

Welding slag and other foreign materials, “Stop Leak” and cleaning compounds and improper or excessive water treatment are all detrimental to the pump internals and sealing arrangement.

Proper operation cannot be guaranteed if the above conditions are not adhered to.

⚠ CAUTION

Double Check Prior to Startup.

Note:
Particular care must be taken to check the following before the pump is put into operation:

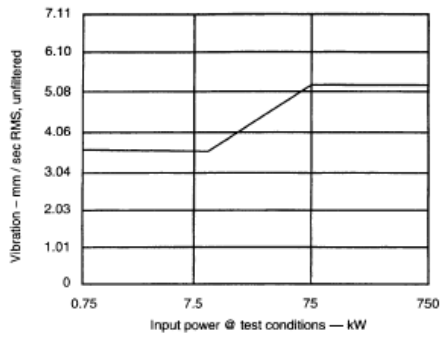
1. Pump primed?
2. Rotation OK?
3. Lubrication OK?
4. Pipe work properly supported?
5. Voltage supply OK?
6. Overload protection OK?
7. Is the system clean?
8. Is the area around the pump clean?

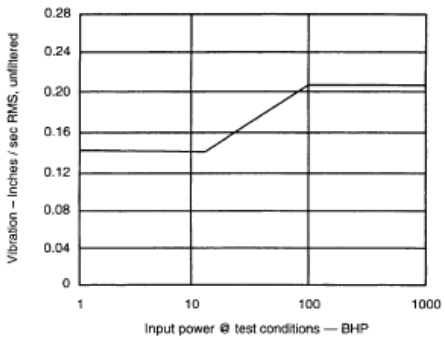
Warranty
Does not cover any damages to the equipment resulting from failure to observe the above precautions.

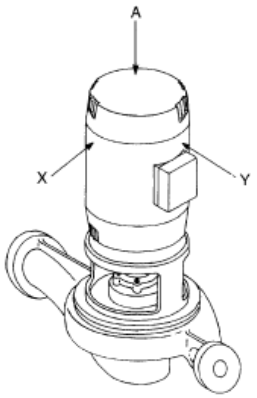
Noise Levels
Estimated Pumping Unit Sound Power Level, (Decibels), A-Weighted, at 1 m (3 ft.) from unit.

Frame Designation	1200 rpm				1800 rpm				3600 rpm			
	ODP		TEFC		ODP		TEFC		ODP		TEFC	
	hp	dB-A	hp	dB-A	hp	dB-A	hp	dB-A	hp	dB-A	hp	dB-A
140	0.75 - 1	65	0.75 - 1	64	1 - 3	70	1 - 2	70	1.5 - 3	76	1.5 - 2	85
180	1.5 - 2	67	1.5 - 2	67	3 - 5	72	3 - 5	74	5 - 7.5	80	3 - 5	88
210	3 - 5	72	3 - 5	71	7.5 - 10	76	7.5 - 10	79	10 - 15	82	7.5 - 10	91
250	7.5 - 10	76	7.5 - 10	75	15 - 20	80	15 - 20	84	20 - 25	84	15 - 20	94
280	15 - 20	81	15 - 20	80	25 - 30	80	25 - 30	88	30 - 40	86	25 - 30	95
320	25 - 30	83	25 - 30	83	40 - 50	84	40 - 50	89	50 - 60	89	40 - 50	100
360	40 - 50	86	40 - 50	86	60 - 75	86	60 - 75	95	75 - 100	94	60 - 75	101
400	60 - 75	88	60 - 75	90	100 - 125	89	100	98	125 - 150	98	100	102
440	100 - 125	91	100 - 125	94	150 - 200	93	125 - 150	102	200 - 250	101	125 - 150	104

Vibration Levels
Vertical In-Line pumps are designed to meet vibration levels set by Hydraulic Institute Standard HI Pump Vibration 9.6.4. Standard levels are as detailed below:







Vertical In-Line

Dual Pump Specific Information

Dual Pump Flapper Valve Operating Instructions
This unit is fitted with internal valves to allow isolation of one pump for service and to automatically prevent recirculation of the flow when only one pump is running.

Procedure for Parallel or Stand-By Pumping:
Discharge and suction valve stems must be locked in the center position. This is indicated by both locking handles in the vertical position and the center pin of the locking arms (4) locked by the handles. This procedure allows the discharge flapper valves to pivot freely and locks the suction valve firmly in the center position.

Procedure for Isolation of One Side:
1. Stop the pump to be serviced.
2. Close and lock the suction and discharge valves: as per instructions below.
3. Ensure seal flush line interconnection valve is closed and drain the isolated casing.
4. Service isolated pump as required.

Procedure for Starting the Pump after Servicing:
1. Ensure serviced pump is fully re-assembled including all seal flush lines and drain plugs.
2. Fill the dry casing with system fluid by opening the seal flush line interconnecting valve and the air vent fitting.
3. Allow the pressure to equalize in the two casings, if necessary, by opening seal flush line interconnected valve.
4. Unlock the discharge valve as per instructions below.
5. Unlock the suction valve as per instructions below.

NOTE: Keep hands and tools away from locked suction valve arm, as the differential pressure may cause the arm to rotate quickly with force when unlocked.

6. Close the seal flush line interconnect valve and restart pump.

Valve Operation
Refer to the valve illustrations on the following pages.

Discharge Valve
This valve performs the dual function of automatically sealing the discharge of the inactive pump when one pump is running and can manually be closed and locked to isolate one pump for service.

Automatic Flapper Operation
In the flapper mode the two halves of the discharge valve are free to pivot independently under normal operating conditions. The locking handle (3) must be secured with the set screw (11) in the vertical position with the center pin of the locking arm (4) trapped by the locking handle (3).

Manual Valve Locking:
The locking feature of this valve is to ensure a positive seal (leak proof) of the discharge port on the pump to be serviced.

Note: Ensure the pump to be isolated is not operating before attempting to release the locking mechanism. Failure to do so may result in injury to the operator and/or damage to the pump.

Locking
1. Loosen discharge side set screw (11) to release the locking handle (3).
2. Rotate the discharge side locking handle (3) so that the handle points toward the pump to be serviced and secure in the horizontal position, using set screw (11). This releases the discharge locking arm (4).

3. Rotate discharge valve shaft (16) towards the pump to be isolated. The orientation of the shaft is indicated by the center pin on the locking arm. (4).
4. Raise the locking handle (3) so that the cam on the base of the handle forces the pin of the locking arm (4) towards the pump to be isolated. The locking handle (3) should be raised to between 45 degrees and the vertical position.
5. Tighten set screw (11) to lock the locking handle (3) in position

THIS HANDLE MUST NOT BE ROTATED PAST THE VERTICAL POSITION.

Note: Ensure the isolated pump is not operating before attempting to release the locking mechanism. Failure to do so may result in injury to the operator and/or damage the pump.

Unlocking:
1. Open the interconnecting valve on the seal flush line to pressurize the serviced pump and vent air through bleeder valve on series 4302. Close these valves once the pressure is equalized and air removed.
2. Loosen set screw (11) and lower locking handle (3) to the horizontal position, secure with set screw (11).
3. Rotate valve to center position so that the center pin of the locking arm (4) locates in the recess on the locking handle (3).
4. Loosen set screw (11) and raise locking arm (3) to the vertical position, locking the center pin in the locking arm recess, secure with set screw (11).

Suction Valve
Manual Operation:
The suction side valve is designed for use as a manually operated isolation valve. This valve is not designed to automatically pivot as the discharge flappers do.

⚠ WARNING

Care must be taken when performing procedures 3 and 4. Read instructions carefully.

Locking:
1. Loosen suction side set screw (11) to release the locking handle (3).
2. Rotate the suction side locking handle (3) so that the handle points towards the pump to be serviced and secure in the horizontal position, using set screw (11). This releases the suction locking arm (4).

Note: The locking handle (3) should only be rotated towards the pump stopped for service. The suction valve is designed to prevent the locking handle (1) from rotating towards the running pump, as the suction of the running pump could cause the valve to slam shut with sufficient force to injure the operator and/or cause damage to the pump. Do not attempt to circumvent this safety feature.

3. Rotate the suction valve towards the pump to be isolated. The orientation of the shaft is indicated by the center pin on the locking arm (4).

4. Loosen set screw (11) and raise the locking handle (3) so that the cam on the base on the handle forces the pin of the locking arm (4) towards the pump to be isolated. The locking handle (3) should be raised to between 45 degrees and the vertical position.

THIS HANDLE MUST NOT BE ROTATED PAST THE VERTICAL POSITION.
5. Tighten set screw (11) to secure the locking handle (3) in position.

⚠ WARNING

Care must be taken when performing procedures 3 and 4. Read instructions carefully.

Unlocking:

1. Open the interconnecting valve on the seal flush line to pressurize the serviced pump and vent air through bleeder valve on series 4302. Close these valves once the pressure is equalized and air removed.

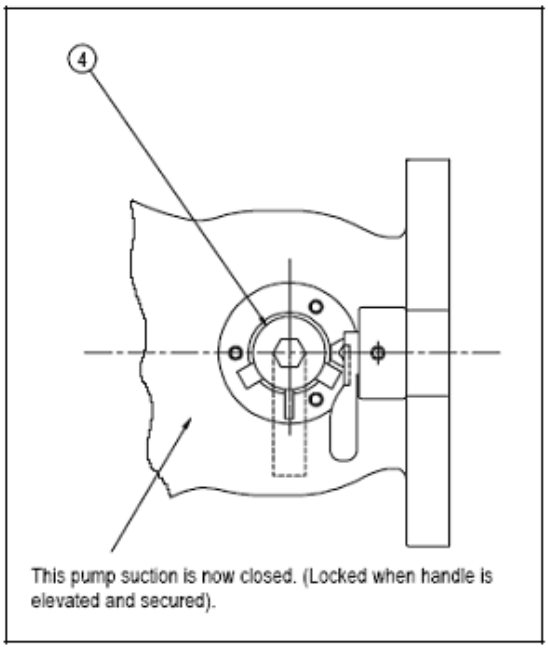
2. Loosen set screw (11) and lower locking handle (3) to the horizontal position, secure with set screw (11).

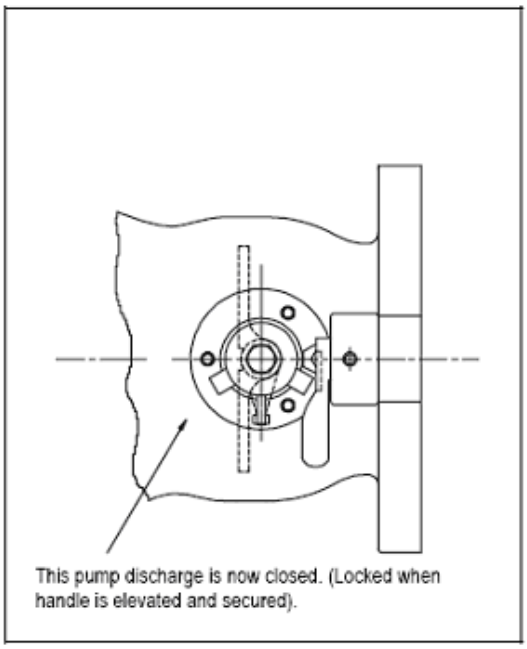
NOTE: Keep hands and tools away from suction valve locking arm when freed by locking handle as differential pressure may cause arm to rotate quickly with force when unlocked.

3. Rotate valve to center position so that the center pin of the locking arm (4) is located in the recess on the locking handle (3).

4. Loosen set screw (11) and raise locking arm (3) to the vertical position, locking the center pin in the locking arm recess, secure with set screw.

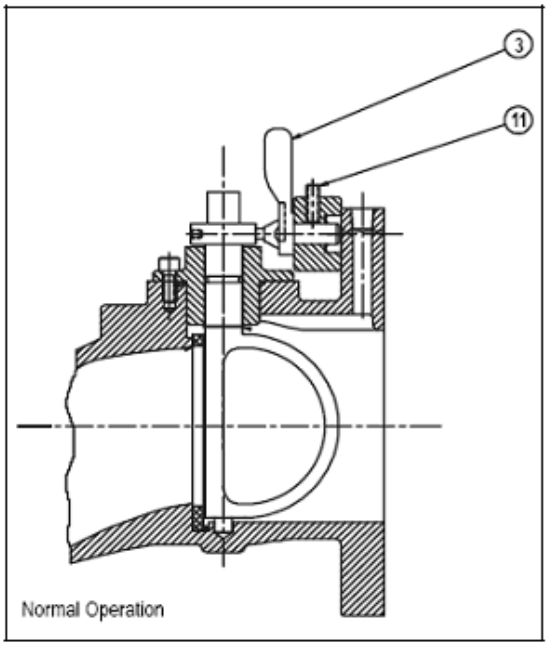
Valve Illustration (3", 4" and 6")

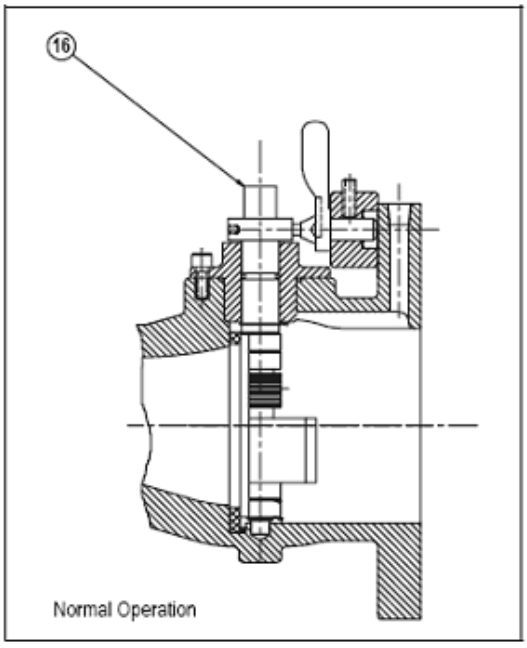




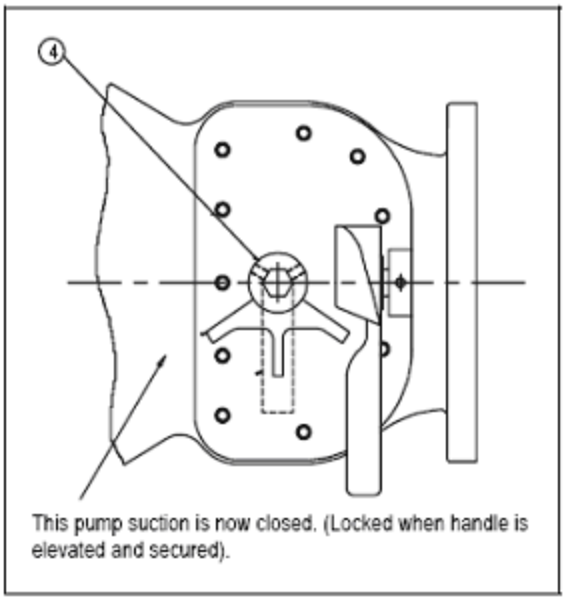
Suction Valve

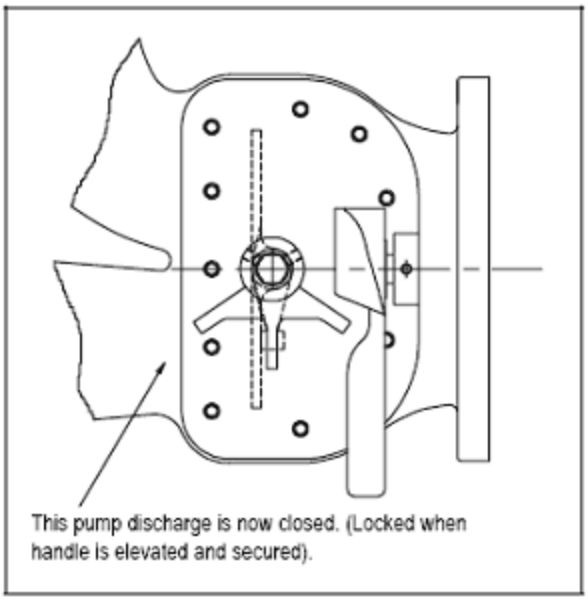
Discharge Valve





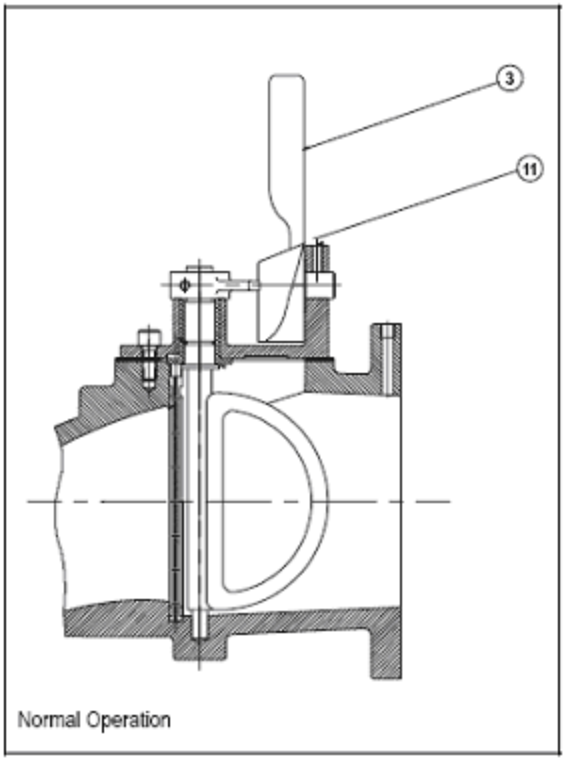
Valve Illustration (8")

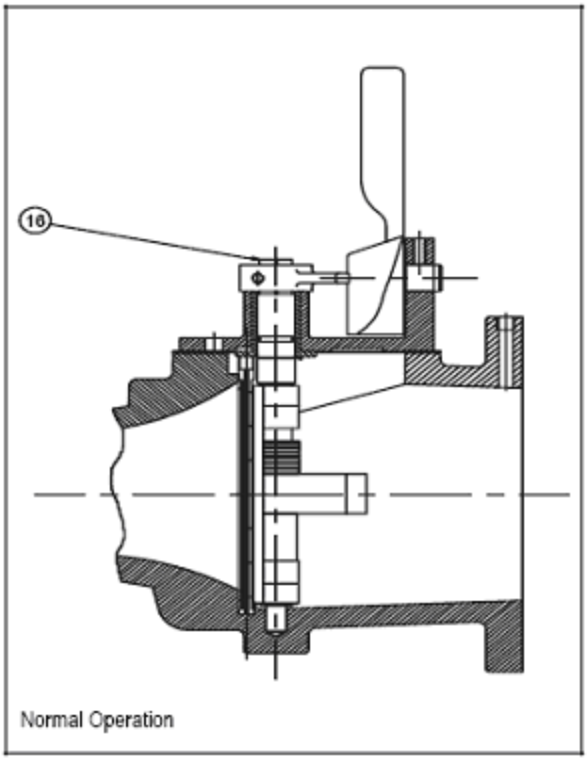




Suction Valve

Discharge Valve

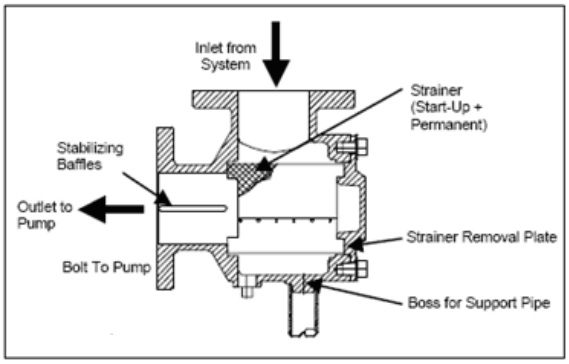




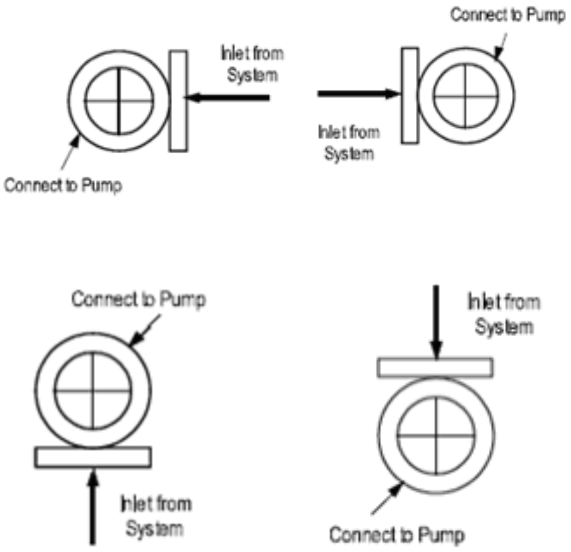
Suction Guides

Introduction
Suction guides are designed for bolting directly onto the suction flange of horizontal or vertical shaft centrifugal pumps.

Operating Limits
The suction guide is designed to be a *four-function* fitting. Each Suction Guide is a 90º elbow, a Pipe Strainer and a Flow Stabilizer. It may also be used as a Reducing Elbow, should the suction piping be larger than the pump inlet.



Installation
The suction guides may be installed in any arrangement feasible the arrangement of the pump flange bolt-holes.



Inspection
Suction guides are thoroughly tested and inspected before shipment to assure they meet with your order requirements. All units must be carefully examined upon arrival for possible damage during transit. Any evidence of mishandling must be reported immediately to the carrier and noted on the freight bill.

Operation
No special attention need be paid to the Suction Guide at start-up. The fitting is stationary and will strain the pumped fluid and stabilize the flow into the pump automatically.

Temporary strainer must be removed following system clean up.

After all debris has been removed from the system, or a maximum of 24 running hours, stop the pump and close the pump isolation valves. Drain the Suction Guide by removing the drain plug or opening the blowdown valve, if installed.

Remove the Suction Guide cover and remove the strainer assembly from the valve body.

A temporary fine-mesh start-up strainer is tack-welded to the permanent stainless steel strainer. This temporary strainer should now be removed from the permanent strainer. The fine-mesh strainer is designed to remove small particulate from new piping systems and could easily clog with debris if left in place. This will be detrimental to the operation of the pump.

Inspect the cover O-ring and replace if necessary.

Replace the permanent strainer into the fitting body, once the temporary strainer is removed.

Replace the cover into the body. Ensuring that the strainer is properly seated, tighten the cover bolts diagonally, evenly and firmly.

Flo-Trex Combination Valve

Introduction

The Flo-Trex combination valves are designed for installation on the discharge side of centrifugal pumps, and incorporate three functions in one valve:

1. Drip-tight shut-off valve
2. Spring closure design, Non-slam check valve
3. Flow throttling valve

Armgrip Flange Adapter Installation

1. Position the two halves of the Armgrip flange adapter on the valve body ensuring that the lugs on each half of the flange adapters are located between the anti-rotation lugs on the valve body (as shown).

Insert two bolts of specified size (Table A1) to secure the halves of the flange adapter to the valve body (as shown).

Table A1. Armgrip Flange Adapter Details

Valve Size	125 psi/150 psi Ductile Iron Bolt		250 psi/300 psi Ductile Iron Bolt	
	No.	Size	No.	Size
2-1/2	4	5/8	8	3/4
3	4	5/8	8	3/4
4	8	5/8	8	3/4
5	8	3/4	8	3/4
6	8	3/4	12	3/4
8	8	3/4	12	7/8
10	12	7/8	16	1
12	12	7/8	16	1-1/8

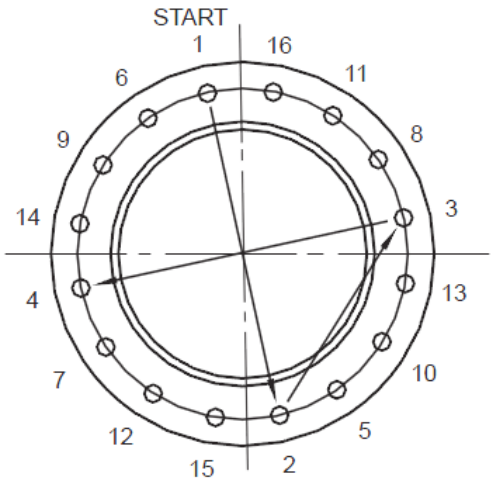
The gasket cavity should face out to the adjoining flange.

2. Lubricate the inner and outer diameter of the gasket with the lubricant provided or a similar non-petroleum based water soluble grease.
3. Press the gasket firmly into the flange cavity ensuring that the sealing lip is pointed outward. When in place, the gasket must not extend beyond the end of the pipe (as shown).

4. Position the adjoining flange or the pipe to the Armgrip flange adapter and install the remaining bolts. The two locking bolts must be tightened first in order to position the flange correctly.

Note: Care must be taken to ensure that the gasket is not pinched or bent between flanges.

5. Tighten remaining nuts evenly by following bolting instructions, so that the flange faces remain parallel (as shown in the figure labeled Recommended Bolt Tightening Procedure). Flange bolts should be tightened to 70 ft-lbs torque minimum to assure firm metal to metal contact. When raised face flanges are used, there will be a gap between the faces of the outer diameter.
6. Flange gaskets are not interchangeable with other mechanical pipe couplings or flange gaskets.



Recommended Bolt Tightening Procedure

Field Conversion (Straight to Angle Pattern Valve:

1. Open valve at least one complete turn.
2. Remove the body bolts from valve body using Allen Key
3. Rotate one half of the valve body 180° making sure the lower valve seat and O ring stay in position. Inspect the O ring for any cuts or nicks and replace if necessary.
4. Replace body bolts and torque evenly to 70 ft-lbs.

Flow Measurement with the valve in the Wide Open position

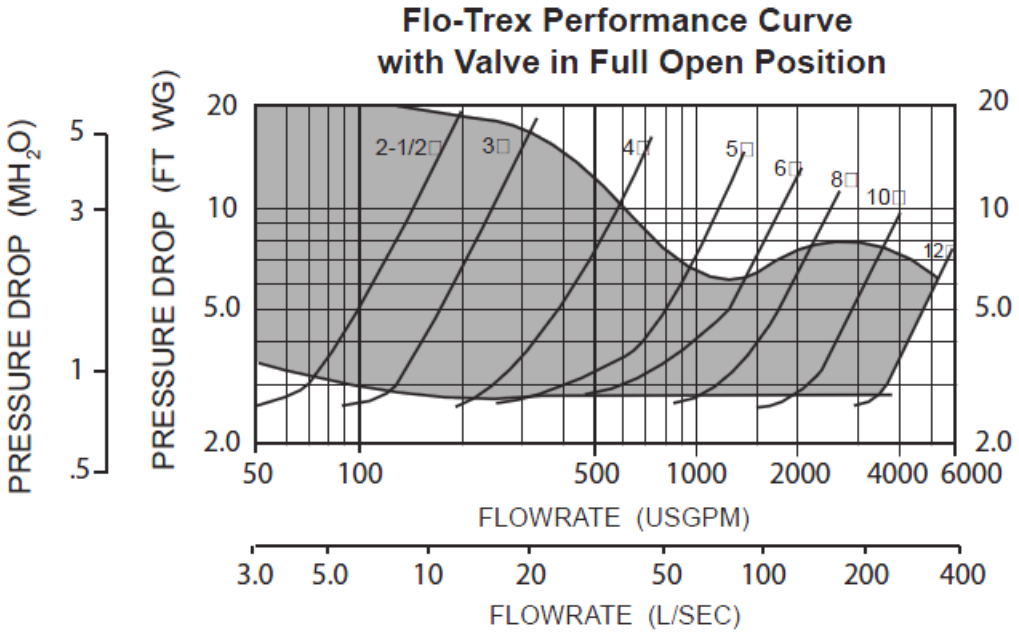
Where approximate indication of flow is acceptable the Flo-Trex valve can be used.

Step 1. Measure and record the differential pressure across the valve.

⚠ CAUTION

Safety glasses must be worn. Probes must not be left inserted into fittings for long periods of time as leakage may result.

Step 2. With valve in fully open position, locate the pressure differential on left hand side of the Flo-Trex Performance Curve with Valve in Full Open Position chart and extend line horizontally across to valve size being used. Drop line vertically down and read flow rate from bottom of chart.



Flow Measurement with the valve in the throttled position

Step 1. The valve stem with its grooved rings and positioning sleeve indicates the throttled position of the valve.

The quarter turn graduations on the sleeve, with the scribed line on the stem provide an approximate flow measurement.

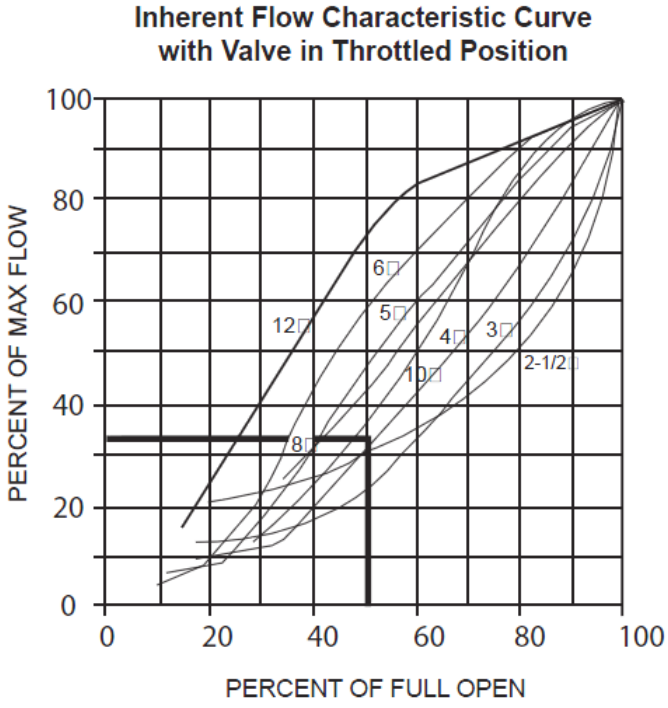
Note: The valve is shipped in closed position. The indicator on the plastic sleeve is aligned with the vertical scribed line on the stem.

Step 2. Record the size of the valve and stem position using the flow indicator scale. Calculate the percentage of valve opening based on the number of rings at the fully open position.

Valve Size	2-1/2	3	4	5	6	8	10	12
Number of Rings (valve fully open)	5	5	6	9	10	12	18	28

Step 3. Measure and record the differential pressure across the valve in the throttled position.

Step 4. Locate percentage of valve opening on the bottom scale of Inherent Flow Characteristic Curve with Valve in Throttled Position. Project line vertically up to intersect with the Valve Characteristic Curve and from this point project line horizontally across to the left of the chart and record the percentage of maximum flow rate.



Step 5. On the Flo-Trex Performance Curve with Valve in Full Open Position locate the differential pressure obtained in Step 3 and project line horizontally across to intercept with Valve Performance Curve. Drop a line vertically down to read the flow rate at the bottom of the chart.

Step 6. Calculate the flow rate of the valve in the throttled position by multiplying the flow rate (Step 5) by the percentage of maximum flow rate (Step 4).

Example:
Valve size: 4 in.
Differential pressure is 5.4 ft
Number of open rings is 3.

From the table, the number of rings for the 4in valve fully open is 6.

Divide open rings by total, 3/6 = 50% throttled.

From the Flo-Trex performance curve, a 4in. valve with 5.4 ft of pressure drop represents a flow of 400 USgpm

From the flow characteristic curve, a 4in valve at 50% open represents 34% of maximum flow.

The approximate flow of a 4in valve with a 5.4 ft pressure drop when 50% throttled is:

$$\frac{(400 \text{ x } 34)}{100} = 136 \text{ USgpm}$$

$$\frac{(25.2 \text{ x } 34)}{100} = 8.57 \text{ L/s}$$

Note: To prevent premature valve failure it is not recommended that the valve operate in the throttled position with more than 25 ft pressure differential. Instead the pump impeller must be trimmed or valves located elsewhere in the system to partially throttle the flow.

Operation
To assure tight shut-off, the valve must be closed using a wrench with 25 to 30 ft-lbs of torque.

To assure trouble free check valve operation and shut-off operation, the valve must be periodically opened and closed to keep valve seat and valve disc guide stem free of buildup of system contaminants.

Repacking of Flo-Trex valve under full system pressure
If it is necessary, the stem O ring can be changed under full system pressure.

⚠ CAUTION

Safety glasses must be worn.

Step 1. Record the valve setting.

Step 2. Turn the valve stem counterclockwise until the valve is fully open and will not turn any further. Torque to a maximum of 45 ft-lbs. This will ensure good metal to metal contact and minimal leakage.

Step 3. The valve bonnet may now be removed. There may be a slight leakage, as the metal to metal backseating does not provide a drip-tight seal.

Step 4. Clean exposed portion of valve stem being careful not to leave scratches.

Step 5. Remove and replace the O ring gasket.

Step 6. Install the valve bonnet.

Step 7. Tightening the valve bonnet is necessary to stop any leaks.

Step 8. Open valve to balance set point as recorded in Step 1.

Note: On valve sizes of 2-1/2 inch and 3 inch, the full open position is 5 turns, though the valve will open to 5-1/2 turns which is just back of seating of valve.

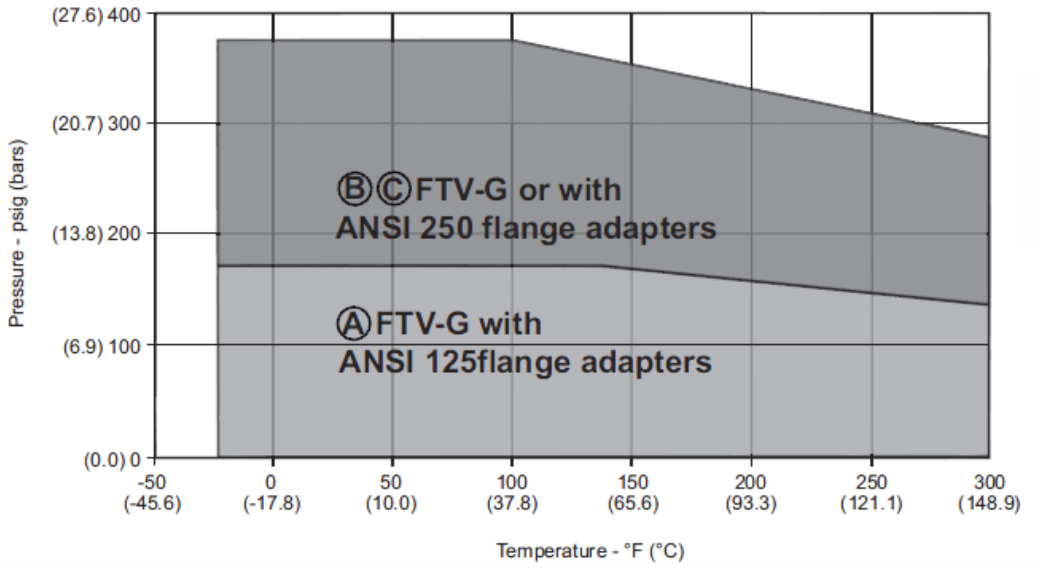
Seat Replacement
Step 1. Drain the system and remove valve from piping.

Step 2. Remove the body bolts from the body using an Allen Key.

Step 3. Remove seat and O Ring. O rings are not used on valves of 8 inches or larger.

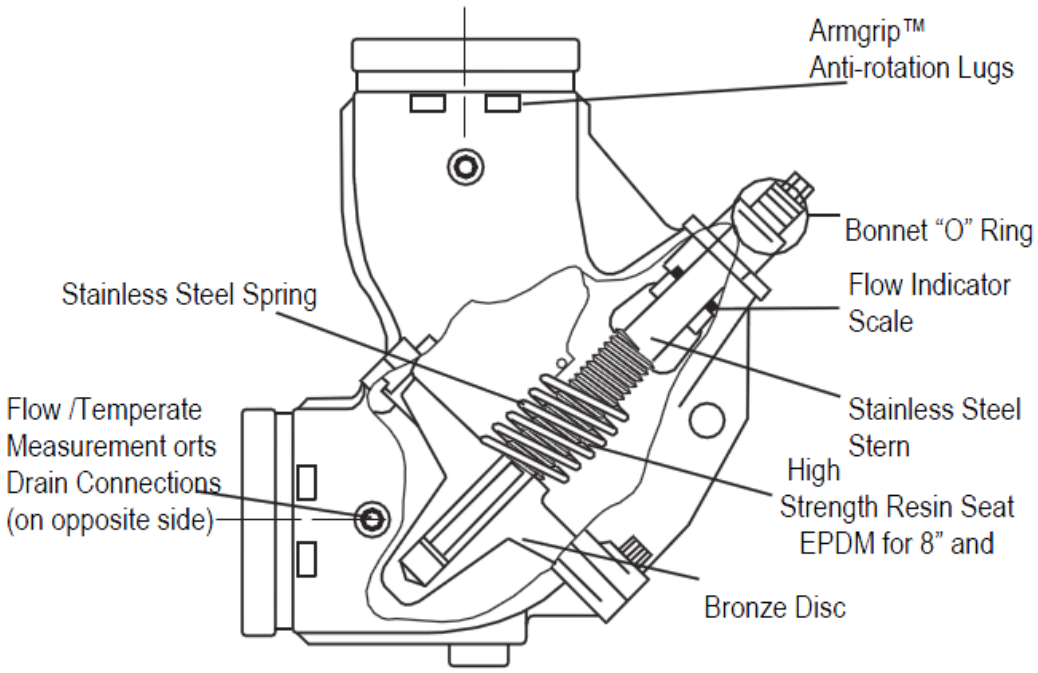
Step 4. Inspect and clean O ring cavity and install new O ring and seat. Valve disc stem must be inspected and replaced if worn. Valve stem O ring must be replaced at this time as discussed under Repacking of Flo-Trex section.

Pressure-Temperature Limits



Ⓐ Armgrip ductile iron flange adapters for ANSI 150# flanges
Ⓑ Armgrip ductile iron flange adapters for ANSI 300# flanges
Ⓒ Grooved end with 375 p.s.i. rated pipe coupling

Flo-Trex Cross Section



LF Series Startup Form

Job Name:_____ Date:_____

Address:_____

_____

Model Number:_____

Serial Number:_____ Tag:_____

Startup Contractor:_____

Address:_____

_____ Phone:_____

Pre Startup Checklist

Installing contractor must verify the following items.	
1. Is there any visible shipping damage?	☐ Yes ☐ No
2. Is the unit level?	☐ Yes ☐ No
3. Are the unit clearances adequate for service and operation?	☐ Yes ☐ No
4. Do all access doors open freely and are the handles operational?	☐ Yes ☐ No
5. Have all shipping braces been removed?	☐ Yes ☐ No
6. Have all electrical connections been tested for tightness?	☐ Yes ☐ No
7. Does the electrical service correspond to the unit nameplate?	☐ Yes ☐ No
8. On 208/230V units, has transformer tap been checked?	☐ Yes ☐ No
9. Has overcurrent protection been installed to match the unit nameplate requirement?	☐ Yes ☐ No
10. Have all set screws on the fans been tightened?	☐ Yes ☐ No
11. Do all fans rotate freely?	☐ Yes ☐ No
12. Does the field water piping to the unit appear to be correct per design parameters?	☐ Yes ☐ No

Ambient Temperature

Ambient Dry Bulb Temperature _____°F	Ambient Wet Bulb Temperature _____°F

Water/Glycol System

1. Has the entire system been flushed and pressure checked?	☐ Yes ☐ No
2. Have isolation valves to the chiller been installed?	☐ Yes ☐ No
3. Has the entire system been filled with fluid?	☐ Yes ☐ No
4. Has air been bled from the heat exchangers and piping?	☐ Yes ☐ No
5. Is there a minimum load of 25% of the design load?	☐ Yes ☐ No
6. Has the water piping been insulated?	☐ Yes ☐ No
7. Is the glycol the proper type and concentration (N/A if water)?	☐ Yes ☐ No
8. What is the freeze point of the glycol (N/A if water)? _____	

Chiller Configuration

Air-Cooled Chiller ☐

Low Ambient Control ☐ Condenser Safety Check ☐

No Water Leaks ☐ Water Flow _____ gpm

Chilled Water In Temperature _____°F Chilled Water Out Temperature _____°F

Compressors/DX Cooling

Check Rotation ☐

Number	Model #	L1	L2	L3	Head Pressure PSIG	Suction Pressure PSIG	Crankcase Heater Amps
1							
2							
3							
4							

Refrigeration System 1 - Cooling Mode

	Pressure	Saturated Temperature	Line Temperature	Sub-cooling	Superheat
Discharge				N/A	N/A
Suction				N/A	
Liquid					N/A

Refrigeration System 2 - Cooling Mode

	Pressure	Saturated Temperature	Line Temperature	Sub-cooling	Superheat
Discharge				N/A	N/A
Suction				N/A	
Liquid					N/A

Condenser Fans

Alignment ☐ Check Rotation ☐ Nameplate Amps_____

Number	hp	L1	L2	L3
1				
2				
3				
4				
5				
6				

Pumping Package

	hp	L1	L2	L3	Flow (gpm)
Chiller Pump #1					
Chiller Pump #2					

Maintenance Log

This log must be kept with the unit. It is the responsibility of the owner and/or maintenance/service contractor to document any service, repair or adjustments. AAON Service and Warranty Departments are available to advise and provide phone help for proper operation and replacement parts. The responsibility for proper start-up, maintenance and servicing of the equipment falls to the owner and qualified licensed technician.

Entry Date	Action Taken	Name/Tel.

AAON E-COATED COIL MAINTENANCE RECORD

Installation Site _____ Installation Date _____
Unit Model # _____ Unit Location _____
Unit Serial # _____ Customer _____

Year 20____	Ambient Temp (°F)	Surface Debris Removed	Coil Cleaned	Approved Cleaner Used	Potable Water Backwash Rinse	Potable Water Frontwash Rinse	Chlorides Removed	Comments
Jan								
Feb								
Mar								
Apr								
May								
Jun								
Jul								
Aug								
Sep								
Oct								
Nov								
Dec								

The following cleaning agents have been approved for use on AAON E-Coated Coils to remove mold, mildew, dust, soot, greasy residue, lint and similar particulate without harming the coated surfaces.

CLEANING AGENT	RESELLER	PART NUMBER
GulfClean ™ Coil Cleaner or Enviro-Coil Cleaner	Rectorseal 2601 Spenwick Drive, Houston, Texas 77055 (P): 713-263-8001	G074480 / 80406 or V82540
GulfClean Salt Reducer™	" "	G074490 / 80408

RECOMMENDED CHLORIDE REMOVER
Rectorseal 2601 Spenwick Drive, Houston, Texas 77055 (P): 713-263-8001

Literature Change History

July 2015
Initial version of document.

August 2016
Removed mention of copper coils and air scoops. Only microchannel coils are used on the LF and air scoops are not factory provided.

October 2017
Added water connection sizes. Added a phase imbalance example.

May 2018
Updated technical support contact information.

June 2018
Clarified piping insulation section. Updated Flo-Trex Combination Valve section. Updated E-coated coil cleaning procedure. Minor Revision changed to "A" because LF is now AHRI certified.

March 2019
Added ECM Low Sound Condenser Fan Head Pressure Control option.

May 2019
Added the minimum/maximum voltage range table in the Electrical section.

February 2020
Updated controls information to AAON Chiller Controls.

April 2022
Updated the Nameplate Voltage Markings & Tolerances table. Updated the E-coated and Microchannel coil cleaning sections, and added e-coating maintenance log. Removed pressure relief valve graph.

AAON
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Longview, TX 75602-1721
www.AAON.com

LF Series
Installation, Operation, & Maintenance
V45070 · Rev. B · 220429
(ACP J00425)

Factory Technical Support: 918-382-6450

Note: Before calling Technical Support, please have the model and serial number of the unit available.

Parts: For replacement parts, please contact your local AAON Representative.

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