AFX Series

Precision Air Conditioning

OPERATION AND MAINTENANCE MANUAL

February 10, 2003

This manual provides information for installation, operation and preventive maintenance. The user should observe the guidelines and procedures presented herein to promote satisfactory performance. Due to an ongoing program dedicated to product improvement, specifications are subject to revision without notice. APC assumes no responsibility, and disclaims all liability for damages resulting from use of this information or for any errors or omissions.

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Introduction

Congratulations on the selection of an APC environmental control system. The unit incorporates the latest system design innovations to provide you with optimum efficiency, reliability and control accuracy.

The AFX Series System will provide years of trouble free service, provided it is installed and maintained by technically qualified personnel in accordance with the guidelines set forth in this manual.

Table of Contents

The AFX Series

The APC AFX series precision air-conditioning system provides compact, quiet, efficient, and reliable system solutions in the expanding precision air-conditioning market. The AFX series is offered in a wide variety of capacities, configurations, and air patterns within an extremely compact cabinet size.

Precision environmental control requirements now reach far beyond the confines of the traditional data or computer room to encompass a larger suite of applications, referred to as technology rooms.

A worldwide network of APC representatives is fully qualified to provide engineering, sales, installation and service for our products.

Capacity

Available are 6 through 28 tons (20 kW–96 kW).

Air Pattern

Downflow units discharge air into the raised floor plenum eliminating the need for air distributing ductwork. Upflow units discharge air into either a plenum or ductwork.

Control

The microprocessor controller provides advanced integrated system operation and management ensuring simple, reliable and precise temperature and humidity control.

Configuration

Air-cooled. Unit used with an air-cooled condenser. Refrigerant lines must be run between the indoor unit and the condenser. Air-cooled units require low maintenance and have low operating costs.

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Water-cooled. Unit used with a cooling tower or other source of water. Field refrigeration piping is eliminated by a factory sealed and tested system. Water piping to and from the unit is required.

Glycol-cooled. Unit used with a drycooler. The need for field refrigeration piping is eliminated by a factory sealed and tested system. The glycol piping is sealed, eliminating costly water treatment often encountered with open cooling towers.

Remote-condensing. Unit used with a remote air-cooled condensing unit, which includes the compressor(s). This allows key maintenance procedures to be located outside the critical environment helping eliminate access by maintenance personnel in high security areas. Available in air, water, and glycol models.

Serviceability

The AFX Series has full service front access for routine servicing of components. Front access also narrows the footprint of the unit making it possible for units to be placed side by side.

Humidity Control

Humidity is managed through a self-contained steam canister humidifier for maximum efficiency and ease of maintenance. Dehumidification control is assured with a split evaporator coil, which decreases the humidity level without over-cooling the space, therefore reducing the need for electric reheat.

Compliance

The AFX Series has received agency approvals by ETL and MEA #223-99-E. Electrical systems comply with NEC and UL 1995 standards.

Standard Features

Overall cabinet

The frame is constructed of heavy gauge steel for maximum strength. The unit has been designed for full service access from the front. The flush mounted panels are removable using quarter-turn fasteners.

Blower Assembly

The AFX series includes multiple, centrifugal blower assemblies that have been engineered for quite, reliable operation. Lower blower speeds reduce noise and extend belt and bearing life to 200,000L_{10}. Permanently lubricated bearings, a single-belt variable pitch drive, and an adjustable motor base insure dependable operation. Air return patterns evenly distribute air across the cooling coil.

Electrical panel

The electrical panel contains the contactors, starters, overload protection devices, and input power disconnects. Each wire (except jumpers) is numbered every 3" (80 mm), or color-coded to facilitate circuit tracing when installing and servicing the unit. Each AC power circuit is individually circuit breaker protected on all three phases. All compressor and motor devices are thermally and short circuit protected. Electrical panel is easily accessible from the front of the unit. All electrical components are UL-listed and-recognized and all wiring conforms to NFPA 70 (NEC) and UL 1995 requirements.

Humidifier

The humidifier utilizes a pure steam generator specifically designed for hi-tech area environmental control. The pure steam eliminates contaminating mineral deposits, potentially deadly bacteria, white dust and excessive humidity. The humidifier requires little or no scheduled maintenance. Automatic flushing combined with an indicator that signals when the canister is to be changed, ensure maintenance free operation.

Electric reheat

A three-phase electrical resistance heater sized to offset the sensible cooling capacity in the dehumidification mode. Reheat elements are low watt density sheathed components. The reheat is three phase to provide even phase loading. Reheat elements are electrically and thermally protected.

Refrigeration system

The refrigeration system consists of a single hermetic compressor, externally equalized expansion valve, filter-dryer, high pressure switch, refrigerant sight glass, and moisture indicator.

Cooling coil

Utilizes dual distributors on one circuit of the refrigeration system. During dehumidification, the smaller distributor is turned off, effectively reducing the active circuits of the evaporator coil resulting in a decreased SHR of the coil and greater percentage of moisture removal.

Air filter

The AFX series uses 30% efficient 4" deep filters, with full depth filter pleats. Filters are easily replaced from the top on downflow units and from the front on upflow units.

Airflow sensor

Upon detection of a loss of air flow the microprocessor will deactivate: cooling, heating, humidification, and dehumidification. After the air flow has been restored for a predetermined period of time, the microprocessor will reactivate functions as needed.

Clogged filter alarm

An adjustable air pressure differential switch senses the pressure drop across the filters. Upon sensing an excessive pressure drop, the switch activates the alarm circuit of the microprocessor and displays a clogged filter message simultaneously with an audible signal.

Emergency drain pan

Systems are provided with two drain pans. A threaded flange is factory supplied for secondary drain connections.

Optional Equipment

Smoke detector(s)

A factory installed smoke detector is designed to sense smoke concentration in the return air stream. Upon detecting smoke concentration an audible and visual alarm will be activated and the unit will immediately shut down.

Firestat

A Firestat is available for installation in the air stream. If the return air temperature reaches 125° F (52° C), the air conditioner will be turned off and both an audible and visual alarm will be activated.

Water detector(s)

The solid-state water detector activates an audible and visual alarm on the microprocessor when moisture is detected. The water detector is provided with 15' of wire.

Remote relay shutdown

A factory installed relay can be ordered with a 24V, 120V, or 240V coil to remotely disable the NetworkAIR system.

Essential/non-essential lockout

When facilities have limited backup power capacity, this lockout prevents the operation of electrical loads that are not *essential* for continued site operation.

Floorstand

The heavy gauge floorstand raises the unit above the subfloor to match the height of the raised floor. Heights are available from 6" to 36" in 3" increments. Adjustment is provided by threaded pedestals.

Air deflector

An air deflector ships loose and attaches to the floorstand for changing air direction from vertical to horizontal.

Plenum

The discharge plenum mounts on top of the upflow unit to direct and distribute conditioned air. Manually adjustable, double deflecting grilles are provided on 3 or 4 sides.

Duct flange

A 1" (25mm) duct flange is installed on a unit to provide convenient connection to external ductwork. The duct flange can be installed at the air outlet on upflow units, at the air inlet on upflow rear return units, or at the air inlet on downflow units.

Dry contact closure alarms

Each unit can be equipped with any or all of the listed dry contact closures. Upon activation of the associated
alarm, a discreet Normally-Open or Normally-Closed contact is available for remote monitoring of that discreet alarm.

- High Temperature Alarm
- Low Temperature Alarm
- High Humidity Alarm
- Low Humidity Alarm
- Fan Status Alarm
- Change Filter Alarm
- Fire Alarm (with addition of optional firestat)
- Smoke Detector Alarm (with addition of optional smoke detector)
- Humidifier Change Canister Alarm
- Water Underfloor Alarm (with addition of water detector)

Redundant group control

Allows up to six NetworkAIR units the ability to communicate with each other to automatically switch upon alarm condition, or timed rotation. Can also allow standby units the ability to assist the running system.

Remote display panel

The microprocessor controller allows facility or building-maintenance personnel to evaluate and control the unit from up to 50 ft. away from the unit, without having to enter the secured space.

Remote sensor(s)

Environmental sensors can be strategically placed, up to 50 ft. from the unit to better meet the sites cooling needs. The sensor must be positioned to permit air movement across the sensors.

Optional Equipment (continued)

Environmental monitoring unit

A stand-alone unit performs continuous temperature and humidity sensing through two available probes (one included) and contact monitoring. The unit is controlled by available web, control console, or SNMP interface with network connection. In the event of an environmental anomaly, notification is sent to the customer via e-mail or SNMP. The unit is 18.25" × 9" × 2.75" (464 mm × 229 mm × 70 mm) and sits in or on top of a rack. The probes extend up to 12' (3.66 m) from the unit.

Hot water or steam reheat

An on/off solenoid valve for steam reheat, or a modulating valve for hot water reheat maintains the dry bulb temperature when the system is in dehumidification and heat mode. Completely factory pre-piped, the system includes a copper tube, aluminum-fin reheat coil, solenoid valve, float, and thermostatic and steam trap for steam reheat only.

Hot gas reheat

The copper tube, aluminum fin hot gas reheat coil maintains the leaving dry bulb temperature when the system is in the dehumidification mode. The coil is controlled by the microprocessor through a factory-piped and wired three-way heat reclaim regulator and check valve (water/glycol only).

High efficiency filter(s)

Pleated final filters with an efficiency of 40% and 60% (ASHRAE 52.2), 4" (102 mm) deep, allow the removal of a greater percentage of airborne particulate contaminates.

Prefilter(s)

Intended to capture large airborne particulate contaminates, thereby extending the life of the high-efficiency filter. Prefilters are 1" (25mm) deep and easily disposable.

Condensate pump

The factory installed and wired condensate pump will pump 36 gal/h (0.06 L/s) at 15ft. (4.6 m) head.

High pressure water regulating valve(s)

Water and glycol systems may utilize an optional regulating valve, which operates with a maximum pressure of 350 psi (2400 kPa), to automatically control condensing temperature.

Hot gas bypass

An auxiliary side-port hot gas bypass circuit. The activation of the hot gas bypass circuit will maintain the evaporator coil temperature during low load conditions will offer longer compressor run times and minimize compressor cycling and temperature fluctuations.

Installation

Computer Room Preparation

During the design of the computer room, consideration should be given to the following factors: ease of entry, floor loading factors and accessibility of piping and wiring.

The room must be sealed with a vapor barrier to minimize moisture infiltration. Polyethylene film (plastic sheeting) is a good vapor barrier for ceiling and wall applications. Rubber or plastic-based paints should be applied to concrete floors and walls.

The room should be thoroughly insulated to minimize thermal loads and make-up air should be kept to a minimum to reduce additional temperature, filtration and moisture loads.

A computer room using a raised floor plenum for air distribution should have at least 12 inches of clear space between the false floor and sub-floor for air conditioners below 15 ton capacities. Pay special attention to the location of pipe chases, electrical conduits and other underfloor obstructions. These objects can block air circulation and increase air pressure drops thus reducing system efficiency and causing possible hot spots in your data processing room. Minimum clear space for larger rooms should be 18 inches when air conditioners of 15 tons capacity and larger are utilized.

Unit Location

Unit location is important for efficient and even environmental control in your data center. The air conditioners should be located as close to the largest heat load as possible. Units should be mounted along the longest walls (in rooms having a high aspect ratio) to ensure even air distribution. Erratic control or mechanical failure can and will result if the unit does not obtain proper air volume and distribution due to improper installation

Service Access

At least 30 inches of clear space must be left in front of the AFX Series unit and at least 24 inches on each side for access through the panels and to facilitate service.

Receiving the Unit

Your AFX unit has been completely tested and inspected prior to shipment from APC. To ensure that you have received the unit in excellent condition, perform a careful inspection of the crating and the unit immediately upon receipt. Verify that all parts ordered were received as specified and that the unit is the correct size and voltage necessary to fulfill your environmental control needs. Report any apparent or concealed damage discovered to the freight carrier for insurance purposes. If necessary, contact APC's technical service department for aid in repairing or replacing damaged parts. While APC is not responsible for exterior or interior damages incurred in transit, we want to make sure that you have no undue delays in your system start-up.

Rigging

The AFX air conditioner is manufactured with a formed steel frame for maximum strength and unit integrity. However, as with all electrical/mechanical equipment, care must be taken in proper rigging of your AFX unit. If you uncrate the unit before moving it into place, we suggest that the panels be removed to prevent damage during handling.

When using a forklift to move the AFX unit, use the shipping skid to protect the bottom of the unit. When using chains, cable or rope to lift the unit, use spreader bars to prevent damage to the finished panels.

Every unit has sockets in the bottom corners sized to accept casters with 7/8" stems (casters are available from the factory, if desired). Casters allow the unit to move through halls and rooms where forklifts are not practical.

Unit Installation

DOWNFLOW DISCHARGE

If your data center has been designed to incorporate a raised floor, the space between the raised floor and subfloor may be used as an air distribution plenum or a chase where ducting to discharge grilles may be installed. Downflow discharge units may be installed directly on the raised floor after ensuring the floor loading factory is satisfactory to support the unit.

Installation (continued)

UPFLOW DISCHARGE
In data processing facilities designed for upflow discharge systems, air distribution is either through a supply duct or through a discharge plenum into the conditioned space. The same unit location considerations for a downflow discharge system also apply to upflow discharge systems.

FLOORSTAND
When using a stand on raised floors, remove or cut the flooring to fit the floor stand dimensions. If the unit is close to a wall at the back, ensure this gap is sealed with flooring or another type of partition. Place the floorstand in the correct location with the pedestals going into the pedestal socket on the floorstand and place the cork-rubber vibration pad under the pedestal. Once you have positioned the floorstand and pedestal arrangement, we suggest you put a small amount of adhesive between the pedestal and the pad, and between the pad and subfloor to keep the unit from moving. Level the floor stand assembly to within ¼" using the adjustment nuts on the threaded pedestal legs. Seal all the way around the upper perimeter of the floor stand with a flexible airtight gasket or sealer to prevent air leakage. Floorstands are available from APC with ?1.5" adjustment range to meet 95% of the installation requirements without any modification to the floorstand assembly. If necessary, the threaded rod may be cut to meet specific installation requirements. We suggest that the leveling nuts be put on the rod before cutting in case the thread is burred or damaged when cut.

PEDESTAL MOUNTS
The unit has been supplied with pedestal sockets so that a floorstand is not necessary for system installation. When using pedestal mounts on a raised floor, cut the floor to fit the unit's frame perimeter. Level the unit to within ¼" using the adjustable nuts on the pedestal legs. Seal the gap between the unit and the raised floor with a flexible air tight gasket. Use a small amount of adhesive between the pedestal, pad and subfloor to preclude pedestal movement.

Supply & Return Air Relief

FLOOR DISCHARGE
An adequate number of perforated panels must be installed in the floor to allow for proper air distribution in the conditioned space. Be sure to allow sufficient relief near heavier heat loads.

FREE DISCHARGE
Free discharge systems provide conditioned air to the data processing facility through a discharge plenum with two-way adjustable grilles located on top of the air conditioners. The discharge plenum is shipped separately from the AFX upflow discharge unit to facilitate handling. After installing the unit, place the discharge plenum on top of the unit and bolt it into place using the hardware supplied.

DUCTED DISCHARGE
A discharge plenum is provided without air grilles for AFX units that are connected to a duct supply distribution system. The ducted discharge plenum is also shipped separately from the unit. Installation for this unit is the same as for a free discharge unit. Ducted discharge units should be located near the heaviest load.

GENERAL – AIR DISTRIBUTION
The AFX direct expansion unit provides full rated air delivery at 0.5 external static pressure. Therefore, the air distribution system (plus the return air duct and grilles if the return air is also ducted) should not exceed 0.5 inches wg. unless the unit has been specially ordered for an increased air pressure drop.

Installation (continued)

Power Connection

The AFX unit uses three phase power for operation. Bring the service cable through the 3/4" bulk head hole near the electric box and connect it to the power distribution block provided on the left side of the electric box. All wiring must be done in accordance with local and national electric codes.

Utility Connections

All connections are made through the side of the mechanical section of the air conditioner for ease of service connection.

Grounding

A ground lug is located next to the high voltage connection. It must be used.

Condensate Drain Connection

Condensation from the evaporator pan and the discharge from the optional humidifier system drains through a drain in the side of the unit. The installing agency should provide a P-trap and the piping for this zero drain with slope to allow for free drainage.

Optional Humidifier Connection

The humidifier inlet connection is in the bottom mechanical section. A 1/4" compression connection is supplied with the unit.

Water Supply to Humidifier Connection

1. The humidifier fill valve(s) orifice is sized for supply water pressure from 30 to 85 psig.
2. For water pressure between 15 and 30 psig, notify the factory and a larger fill valve will be supplied.
3. For installation with less than 15 psig, notify the factory and a fill valve with a specially
4. For applications above 85 psig, install a pressure-reducing valve in the water feed line to the unit.
5. With extremely dirty or muddy water sources, proper filtration is required on the unit's entering water line.
6. DO NOT use softened water with the humidifier because it is too conductive.
7. DO NOT use completely demineralized water with the humidifier. Minerals allow the electrode principle to work.
8. DO NOT use a hot water source. It will cause deposits to eventually block the fill valve orifice.
9. Water supplies with high conductivity (above 700 microhms) must be preconditioned for proper humidifier operation and longevity.
10. Consult the Humidifier Operation & Maintenance Manual included with this AFX unit for more in-depth information and troubleshooting procedures.

Outdoor Heat Exchanger Installation

The Outdoor Heat Exchanger (OHE) should be located in a high security area. Consideration must be given to ensure a minimum of 24” clearance from any adjacent wall. The area should be clear of paper and debris that might be drawn into the coil.

Be aware of air movements that may cause short-circuiting of the entering and leaving condenser air.

The OHE must be mounted on a level surface with sufficient support to carry the unit’s weight when fully charged. The heat exchanger has mounting holes to permit the unit to be bolted down to prevent shifting. Consult the OHE Installation Manual for proper set-up.

Before operating, all OHEs should be checked as follows:

1. Check set screws on all fan hubs.
2. Ensure that fans turn freely and that the blades are not distorted.
3. Ensure that fans rotate in the proper direction.

The installing agency should provide a main power disconnect to isolate the OHE during routine service or an emergency. Consult the OHE electrical data table for specific electrical information

Installation (continued)

Drycooler and Pump Package Connection

Provide sufficient valves and unions to isolate the dry cooler and pump package during routine service or in the event of an emergency.

Pipe should be welded wherever possible to minimize leak possibility.

Pipe and wire the dry cooler/precool system in accordance with local and national codes. A wiring diagram is attached to the inside of each control panel cover. The control enclosures are weather protected and should be mounted close to the header end of the drycooler. All thermostats should be checked for the proper set point per the wiring diagram. Any remote bulb thermostats should be mounted at this time.

The pump package is weather-protected and has been factory wired with branch fusing and pump motor overloads. Consult the nameplate for electrical information on the pump package for disconnect sizing. Your pump size may have been increased or decreased from the standard pump package due to pressure drop requirements.

The pump package should be mounted as close as possible to the drycooler and the glycol solution should flow from the drycooler to the pump package.

The expansion tank with airtrol fitting must be mounted at the highest point in the piping system. A fill hose bib should also be provided to facilitate filling the system.

Installation of an air separator will enhance the ability to remove the air during start-up.

Air Cooled Condenser Installation

All refrigerant piping should comply with ASHRAE, local and national codes. Use only refrigerant grade pipe, and pipe joints should be high temperature brazed.

The discharge line should loop above the hot gas header at the condenser.

The risers must be properly sized to ensure oil return.

Discharge lines should be sized to maintain sufficient return oil to the compressor by maintaining high gas velocity while keeping the refrigerant pressure drop within normal ranges.

Piping should be adequately supported and should allow for normal expansion and contraction.

General Air Distribution

The AFX unit provides full rated air delivery at 0.5 external static pressure. All other AFX units are rated for 0.3” external static pressure

Piping Connections

Refrigerant Pipe Connections; AIR-COOLED

When piping air-cooled systems, care must be taken to use only clean refrigerant grade (Type L) pipe and follow standard procedures for pipe size selection. Maximum recommended distance between the evaporator and condenser is 200 equivalent feet. For any run beyond this distance contact the factory for assistance. Vertical runs (hot gas) require a trap every 20 feet of rise.

Water/Glycol Pipe Connections; WATER-COOLED/GLYCOL-COOLED

Care should be taken in the correct connection of the water/glycol inlet and outlet connections.

It is recommended that shut off valves be installed for use during routine service and emergency isolation of the air conditioner.

RECOMMENDED DISCHARGE LINE SIZES
R-22

Capacity	Equivalent Length, Ft.			
BTU/hr	50	100	150	200
18,000	5/8	5/8	5/8	7/8
24,000	5/8	7/8	7/8	7/8
36,000	7/8	7/8	7/8	7/8
60,000	7/8	1-1/8	1-1/8	1-1/8

Recommended sizes are applicable with evaporating temperatures from -40^{o}F to 45 ^{o}F and condensing temperatures from 80^{o}F to 130^{o}F.

RECOMMENDED LIQUID LINE SIZES
R-22

Capacity	Condenser to Evaporator Equivalent Length, Ft.			
BTU/hr	50	100	150	200
18,000	3/8	3/8	1/2	1/2
24,000	3/8	1/2	1/2	1/2
36,000	1/2	1/2	1/2	1/2
60,000	1/2	5/8	5/8	5/8

Recommended sizes are applicable with evaporating temperatures from -40^{o}F to 45 ^{o}F and condensing temperatures from 80^{o}F to 130^{o}F.

Pre Start-Up

Prior to initial start-up, perform the following checks to ensure proper unit operation:

ELECTRICAL CHECKS

1. Check to make sure that incoming voltages match the nameplate's phase and voltage listings.
2. Make sure that the unit is properly grounded to an earth ground.
3. Check all internal electrical components and terminal blocks for loose connections, which may have been caused by shipping vibrations.
4. Check that all fuses are correct and securely in the fuse blocks.
5. Check the blower motor overload for correct setting (FLA of motor on motor nameplate) and make sure that the overload has not been tripped.

MECHANICAL CHECKS

1. Make sure that all direct expansion and water/glycol isolation valves are open in the system.
2. Check to make sure that water/glycol will flow through the unit for heat rejection.
3. Bleed any air from the unit's cooling system using the internally mounted Schrader valves.
4. Check for water leaks at the humidifier connections.
5. Make sure that the blower belts are adjusted correctly.
6. Before replacing the unit's panels, make sure that the inside of the unit, especially the blower wheels, is free from debris.
7. Make sure that the air filters are in place and clean.

When all of these checks have been performed, replace and secure all of the unit's panels

Start-Up

After all mechanical and electrical service connections have been made and checked, start the unit as follows:

1. Make sure that the power switch is in the OFF position and apply power to the unit. Turn unit disconnect switch to the ON position (if applicable) and verify that line voltage is as specified on the unit nameplate. Check the control transformer secondary voltage. This voltage should be a normal 24 volts, no higher than 26.5 volts and no lower than 23 volts.
2. Check for proper rotation of the blower motors. If rotation is incorrect, depress power switch to turn the unit off and shut off the main power at the source disconnect. Interchange any two of the three main line power leads to the power distribution block in the unit. Return to step one.
3. Acknowledge any alarms that appear on the display at the controller's prompts. The alarms are usually power loss, high or low temperature and high or low humidity.
4. The controller will energize heat, cool, humidification, or dehumidification circuits as required and display the appropriate alphanumerical messages for the unit's mode of operation.
5. The operation of the unit must be checked thoroughly. To accomplish this, the set points on the controller must be set to extreme conditions. Before checking extreme points, the computer equipment (heat load) must be installed. Depending on the temperature and humidity in the space at the time of installation, check either the stages of heating or cooling, or humidification or dehumidification modes.
6. Humidification or dehumidification can be checked by changing the humidity set point in a similar manner.
7. Check that all safety alarms and controls function properly.

Complete the start-up sheet and return it to APC.

Charging the System

The AFX Series Water/Glycol and the integral mounted Air-cooled systems are factory charged with refrigerant. All other direct expansion systems must have the piping evacuated and the system charged.

All refrigerant connections should be leak tested before the system is charged with refrigerant. The complete system should be pressured to 400 psig with refrigerant and dry nitrogen. Use an electronic leak detector to carefully check each joint. Leaks should be repaired and the system pressurized again to 400 psig to double check all joints.

After the leak check has been performed, a vacuum pump should be used to evacuate the total system (the unit, condenser and inter-connecting piping) after the condenser has been installed in the system. Put vacuum on the total system of 29 inches or 50 microhms and hold it for four hours. Then break the vacuum with dry refrigerant. At this point the system can be fully charged.

Follow standard HVAC charging practices but use the following recommendations: when the system is properly charged, the superheat should be nominally 15^{0}F and the subcooling 10^{0}F.

System Function

After connecting all the utilities to the unit and ensuring that the unit is securely mounted in place, start the air conditioner by enabling the ON/OFF switch on the thermostat in the ON position. This will start the evaporator blower. Turn the thermostat to the lowest setting and the compressor will start. After the refrigeration system has functioned for approximately 15 minutes, observe the suction and discharge pressure gauges and inspect the sight glass. The system should be fully charged (sight glass clear). The gauges should indicate between 58-75 psig suction pressure and approximately 225-275 psig discharge pressure. If the unit is functioning properly, the controls may be set at the desired setting and the return air grille closed.

Complete the start-up sheet and return it to APC.

Control/Safety Adjustments

After the installation and start-up of the AFX Series unit has been completed, "fine tuning" of the system's controls and safety systems is necessary, as described below.

Belt Tension

The blower motor is mounted on an adjustable base. Belt tension can be increased or decreased by raising or lowering the base.

A deflection of about 3/4 - 1" per foot of span between the blower and motor pulleys should be obtained by pressing the belt firmly. The adjusting belt should be locked in position after adjustment is made.

WARNING
Too much tension will shorten bearing, shaft and belt life.

For quiet operation, the belt should be as loose as possible without slippage. Slippage may result in belt squeal or insufficient airflow, or both. A simple test for the belt slippage is to check the temperature of the smaller pulley in relation to the larger pulley. If the small pulley is noticeably warmer, this is an indication of belt slippage and the belt should be tightened slightly. Do not test temperature while pulleys are turning.

Belt tension should be readjusted if the variable speed pulley setting is changed or if the belt is replaced.

Motor Pulley

The pulley on the blower motor has a variable pitch diameter to allow the blowers to be sped up or slowed down to compensate for higher or lower external static pressure, or in some cases, high altitude compensation.

The motor pulley has been factory sized and the unit has been factory tested with the pitch in the middle of its adjustment range.

To increase blower speed, remove the belt from the pulley by taking it off the larger non-adjustable blower pulley first. Loosen the set screw on both movable sheaves. Turn them inward toward the center stationary sheave to increase the effective pitch diameter. To decrease the blower speed, spread the sheaves further apart.

Turn both sheaves the same number of times.

This is necessary to maintain uniform tension on both belts.

Tighten the set screws again, making sure that they are not on the threaded portion of the sheave, and put the belts back on.

Check for proper alignment between the driving and driven sheaves (pulleys). Improper alignment will cause premature wear on the blower belts.

Air Pressure Differential (optional)

The CM unit uses an APD switch to sense airflow loss through the unit. The APD is factory set to make the switch close at 0.2" W.G. across the internal APD bellows. The pressure setting is adjustable by turning the adjustment screw clockwise to increase the setting.

Clogged Filter Switch (optional)

The clogged filter switch senses the air pressure drop across the filters. When the pressure drop is too high due to dirty filters, the switch closes and causes an alarm. While the clogged filter switch has been set at the factory for approximately 1.0 of pressure drop across the filters, the setting should be checked at unit start-up. Cover one-third of the filter area and increase or decrease the clogged filter switch sensitivity so that the switch closes when one-third of the filter area is blocked. This procedure can only be used with new, clean filters.

Control/Safety Adjustments

OVERLOAD RELAY

The blower motor starter has an adjustable overload relay. The adjustment dial should be set to correspond to the full load amperes (FLA) on the blower motor. The overload has a manual reset button to prevent the motor from cycling on the overload switch.

FIRESTAT

The firestat used in this unit has a manual reset and an adjustable temperature setting. The firestat is factory set prior to shipment to trip when temperatures above 125?F are detected.

FLOW SWITCH

If the unit is equipped with a flow switch, the sensitivity of the switch must be adjusted for the flow amount. Failure to do so will cause false alarms to occur.

Humidifier Operation

Your AFX Series unit may be equipped with a pure steam generator type humidifier as an option.

Check all electrical connections for wires, which may have become loose in shipping.

Components burnt due to loose connections are NOT covered under warranty.

Check electrode plugs to ensure they are pressed firmly onto the electrode pins.

Important: Loose connections will cause overheating of the cylinder plugs and probable melting of the plugs and/or cylinder.

Turn on the main disconnect in the primary service feeding the unit and check that the unit has power at the primary terminal block.

On the humidifier controller attached to the left side of the humidifier assembly, push the black switch to "AUTO/ON" so that it clicks into the depressed position.

Water will start to enter the cylinder through its bottom port and rise in the cylinder to a point determined by the solid state control circuitry.

It is not unusual upon initial start-up for water to fill the cylinder and cycle on the red change cylinder light. The high level probe simply acts as a safety to shut off the fill valve and prevent overfilling. With the red light on, the water in the cylinder will continue to heat and after a few minutes start to boil. After the boiling action of the water has lowered the water level below the sensor at the top of the cylinder, the red light will go out and the fill solenoid will again open until the cylinder is again full. This cycling of the red light and fill valve will continue until the unit's full output capacity is reached, after which the water level will automatically lower itself in the cylinder. (The increased mineral concentration allows for lower electrode coverage while maintaining the same stream output.) When a stabilized condition is reached, the water will be boiling close to the cylinder seam level. The solid state circuitry will maintain the proper concentration in the cylinder by introducing short drains only when necessary. If the cylinder is manually drained, the above process will repeat itself.

NOTE: The AFX Series unit must be in the humidification mode to fill or to manually drain.

Areas with Low Water Conductivity

Should normalization of the unit be required immediately after start-up, the installer may speed up the process by artificially increasing water conductivity. The installer should dissolve not more than half a teaspoon of table salt in a cup of water and add it to the cylinder by means of the fill cup attached to the plumbing section during a fill cycle.

Excessive amounts of salt will result in erratic operation of the unit; however, normalization of the unit will be obtained automatically through the solid state control sequence.

For further information, consult the Humidifier Operation and Maintenance Manual included with each unit equipped with a humidifier.

Troubleshooting

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
Controls erratic or inoperative	Wiring improperly connected or broken.	Check wiring connections at schematic.
Evaporator coil ices	Usually caused by lack of proper quantity of airflow across coil.	Check filters; clean if necessary.
		Check for obstruction of airflow in duct system. Unit is designed for ½" s.p. (ext.) W.P. approximate.
	Low return air temperature.	Ensure correct rotation of evaporator blowers.
		Check return air temperature setpoint.
	Low refrigerant.	Check DX system for correct operation/leaks.
Blower fails to start	Power failure.	Check power source and input cable.
	Control circuit fuse blown.	Replace fuse.
	Defective contactor.	Repair or replace.
	Overload tripped.	Reset and check cause.
	Controller alarm.	Clear alarm(s).
Compressor fails to start.	Setpoint too high.	None required. Adjust to desired temperature. Check compressor electrical circuit for shorts or loss of phase.
	Complete loss of refrigerant charge.	Repair leak and recharge system.
	Head pressure too high (high pressure switch open).	Check condenser for obstructions. Manually reset switch.
	Liquid line solenoid not opening.	Check for 24 VAC to solenoid coil. If not, check wiring. If 24 VAC is at solenoid, solenoid coil may be bad, or is stuck. Replace or repair as necessary.
	Controller alarm.	Clear alarms.

Troubleshooting

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
Compressor short cycles.	Low line voltage causing compressor electric motor to overheat.	Check power source for cause of variation of line voltage.
	Dirty or icy evaporator (reduce air flow).	Defrost and/or clean.
	Lack of refrigerant (bubbly sight glass).	Repair leak and recharge system.
	Light load.	Configure controller for light load.
	Defective LP switch	Check and/or replace.
Noisy compressor.	Expansion valve stuck in open position (abnormally cold suction line).	Ensure feeler bulb is tight on suction line. Check operation and superheat.
	Broken compressor valve.	Replace compressor.
	Worn or scarred compressor bearings (excessive knocking).	Replace compressor.
	Excessive head pressure (compressor knocks).	Reduce head pressure.
System short of capacity.	Flash gas in liquid refrigerant line (bubbly sight glass).	Repair leak and recharge.
	Expansion valve stuck or possibly obstructed (short cycling or continuous running).	Replace valve.
	Clogged drier-strainer (feels cold).	Replace with new drier-strainer.
	Ice or dirt on evaporator coil (excessively warm air from evaporator blower). See Evaporator coil ices section above.	Defrost and/or clean.

Troubleshooting

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
Head pressure too high.	Condenser clogged or dirty.	Clean condenser.
	Air or other non-condensable gas in system	Evacuate system and recharge. Install new drier strainer.
	O.H.E. air intake blocked.	Clean away debris.
	Overcharge of refrigerant.	Purge or remove excess from high pressure side of system
	Pump overloads tripped (glycol system).	Reset and check cause.
	O.H.E. fans not operating.	Check fuses and motor. Replace as needed. Check thermostat setting.
	Glycol head pressure regulating valve not adjusted.	Adjust as needed to obtain correct pressures.
	Glycol flow too low. Pump cavitating, valve not open.	Check glycol solution level and concentration at pump.
	Glycol % higher than 40%.	Reduce glycol to maximum 40% concentration.
Head pressure too low.	Check water valve. Check settings on condenser ambient sensors. See “System short of capacity” above.	Correct as indicated.
Suction pressure too low.	Flash gas in liquid refrigerant line (bubbly sight glass).	Repair leak and recharge.
	Clogged drier strainer (feels cold).	Replace with new drier strainer.
	Obstructed expansion valve (loss of capacity).	Repair or replace valve.
	Loss of fluid within expansion valve (erratic valve response)	Replace valve and feeler bulb assembly.
	Lack of refrigerant (bubbly sight glass)	Repair leak and recharge system.
	Dirty air filters/clogged filter light on.	Clean as required.
	Clogged or icy coil.	Defrost and/or clean.

Troubleshooting

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
Humidifier inoperative.	Water not hooked up.	Turn on water.
	Electrical connections loose.	Tighten electrical connections
	Humidifier fuse open.	Check for short circuit. Replace if necessary.
	Relative humidity is above the setpoint.	No corrective action needed.
Reheat elements inoperative.	Overheat switch actuated.	Reset and check.
	Fuse open.	Check for short circuit. Replace if necessary.
	Thermostat set too low.	None required. Adjust to required temperature.
	Thermal line in heater open.	Replace line.
Water carryover.	Insufficient air quantity over the evaporator coil.	Load fan to name plate AMPS. Remove discharge air restrictions. Clean filters.
	Liquid line temperature.	Adjust condensing temperature to specifications and reduce excessive subcooling.
	Dirty coil.	Clean the coil.
	Excessive air.	Reduce CFM.
Controller fails to start.	No power to controller.	Check control fuse.

Preventive Maintenance

The operating life of the AFX Series system can be extended by following a simple preventive maintenance schedule. The schedule will reduce the possibility of failure of components and unnecessary malfunction of the system. The service technicians must be thoroughly familiar with the special design features of this equipment before attempting any service or repair.

MONTHLY

1. Check that filters are clean and in place.
2. Check that condensate drain is open.
3. Check that humidifier cylinder replacement light it not on and verify operation of the humidifier.
4. Check that drive belts are in good condition and that the belt tension is correct.
5. Clean inside of unit as necessary.
6. Check that blower bearing/shaft assembly turns freely.
7. Check unit conformance to temperature and humidity set points.
8. Ensure heater operation.
9. Check electrical components and ensure correct amp draws and secure connections.
10. Check the microprocessor configuration.
11. Check the microprocessor for any alarm.

SEASONALLY

1. Check electrical components for loose wire connections.
2. Check fan(s) and drive components.
3. Complete all items listed on the monthly checklist.

ANNUALLY

1. Thoroughly check the system and clean unit interior.
2. Clean the cooling coil.
3. Perform all items listed on the monthly and seasonal checklist.

BI-ANNUALLY

1. Lubricate the blower motor bearings if applicable.
2. Perform all items listed under the preventive maintenance schedules.

Warranty

The limited warranty provided by American Power Conversion Corporation ("APC") in this Statement of Limited Factory Warranty applies only to Products you purchase for your commercial or industrial use in the ordinary course of your business.

LIMITED FACTORY WARRANTY

Terms of Warranty:
APC warrants that the Product shall be free from defects in materials and workmanship, for a period of (1) year from the date of start-up when APC authorized service personnel has performed the start-up of the Product, or a maximum 18 months from the date of Product shipment from APC, when APC authorized service personnel has not performed the start-up of the Product ("Warranty Period".) In the event that the Product fails to meet the foregoing warranty, APC shall repair or replace any defective parts, such repair or replacement to be without charge for on-site labor and travel if APC authorize personnel have conducted start-up of the Product. An APC Start-Up Service must be performed/completed by APC authorized service personnel or replacement of defective parts only will be covered. APC shall have no liability and no obligation to repair the installed Product if non-authorized APC personnel performed the start-up and such start-up caused the Product to be defective. Any parts furnished under this warranty may be new or factory remanufactured. THIS WARRANTY DOES NOT COVER circuit breaker resetting, loss of refrigerant, consumables, or preventative maintenance items. REPAIR OR REPLACEMENT OF A DEFECTIVE PRODUCT OR PART THEREOF DOES NOT EXTEND THE ORIGINAL WARRANTY PERIOD.

Warranty Extends to First Purchaser for Use, Non-transferable:
This Warranty is extended to the first person, firm, association or corporation for whom the APC Product specified herein (herein referred to as "You or Your".) This Warranty is not transferable or assignable without the prior written permission of APC.

Assignment of Warranties:
APC will assign to you any warranties which are made by manufacturers and suppliers of components of the APC Product and which are assignable. Any such warranties are assigned "AS IS" and APC makes NO REPRESENTATIONS as to the effectiveness or extent of such warranties, assumes NO RESPONSIBILITY for any matters which may be warranted by such manufacturers or suppliers and extends no coverage under this Warranty to such components.

Drawings, Descriptions:
APC warrants for the Warranty Period and on the terms of the Warranty set forth herein that the APC Product will substantially conform to the descriptions contained in APC's Official Published Specifications or any the drawings certified and agreed to by an authorized APC representative, if applicable thereto ("Specifications"). It is understood that the Specifications are NOT WARRANTIES OF PERFORMANCE and NOT WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE.

Warranty Claims Procedure:
To obtain service under Warranty contact APC Customer Support at (800) 800-4APC. You will need the model number of the Product, the serial number, and the date purchased. A technician will also ask you to describe the problem. If it is determined that the Product will need to be returned to APC you must obtain a returned material authorization (RMA) number from APC Customer Support. Products that must be returned, must have the RMA number marked on the outside of the package, and be returned with transportation charges prepaid. If it is determined by APC Customer Support that on-site repair of the Product is allowed, APC will arrange to have APC authorized service personnel dispatched to the Product location for repair or replacement, in APC's discretion.

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