Temtrol, Inc.
Phone - 405-263-7286 Fax - 405-263-4924

SERIES FC

INFORMATION COVERING :

AIR HANDLERS
INDOOR - MOUNTED
FC-01

INSTRUCTION

MANUAL

INSTALLATION

"START-UP"

OPERATION -

MAINTENANCE

& INSPECTION

Temtrol

WARRANTIES AND LIMITATIONS OF LIABILITY FOR BREACH OF WARRANTY

Temtrol, Inc., warrants all products to be free from defects in material and workmanship for twelve (12) months from date of shipment unless a start-up form is on file and accepted by Temtrol, in which case the warranty is twelve (12) months from the date of start-up, or eighteen (18) months from date of shipment, whichever is shorter. Said start-up form shall signify that the equipment has been properly started and adjusted, and is operating under normal conditions, prescribed ratings and specifications, and was installed by qualified personnel in accordance with Temtrol instructions and local codes and ordinances. For warranty purposes, start-up occurs when the equipment and/or blowers are started for operation of the equipment regardless of when the building may be ready for operation.

Temtrol's obligation hereunder shall be limited to the exchange of new parts for those returned to Temtrol's factory at buyer's expense and found to be defective, by Temtrol. Replacement parts shall be shipped F.O.B. Temtrol's factory. Replacement of parts hereunder shall not operate to extend the original warranty period as to any part, including replacement parts supplied hereunder.

This warranty does not cover corrosion; normal deterioration; misapplication; labor charges paid for parts replacement; adjustments; repairs or other work; loss of refrigerant; components supplied by others; defects in parts resulting from neglect, negligence, accident, fire, explosion, high or low voltage, jumpering or jamming controls; improper or contaminated fuel; excessive or inadequate fuel pressure; frozen heating coils; war, or any acts of God.

This warranty is void if equipment is misapplied or if any alterations are made to the basic design or operating requirements as listed on the original order and shipped from the factory unless approval is received in writing from Temtrol.

It is expressly understood that this warranty is made IN LIEU OF ALL OTHER WARRANTIES with the exception of those warranties attached hereto, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR ANY PARTICULAR PURPOSE and in consideration of the express warranty herein contained, BUYER EXPRESSLY WAIVES ANY RIGHT TO CLAIM OTHER WARRANTIES, EXPRESS AND IMPLIED.

It is further understood that Temtrol's liability for breach of warranty shall be limited to the terms of this warranty. Buyer agrees that Temtrol SHALL NOT, IN ANY EVENT, BE LIABLE FOR CONSEQUENTIAL DAMAGES and that buyer's sole and exclusive remedy shall be limited to that provided herein.

Temtrol neither assumes nor authorizes any person to assume for it any obligation or warranty other than those stated herein.

Any suggestion to the contrary notwithstanding, Temtrol shall not, in any event have any liability under this warranty unless and until Temtrol has been paid in full for the products supplied. The warranty period shall begin to run as described above, however, whether or not payment has been made.

Temtrol, Inc.
Manufacturers of ..... Customized Air Handling Units

P.O. Box 409 • 15 East Oklahoma Avenue • Okarche, OK 73762 • (405) 263-7286

SERIES FC

INDOOR - MOUNTED AIR HANDLING UNITS

Delivery, Storage, Installation,
"Start-up", Maintenance and Inspection Instructions

(A) DELIVERY

(1) Equipment is purchased F.O.B. Factory and is the responsibility of receiving party to inspect unit upon arrival at the destination before unloading or moving unit to its permanent location; inspect closely for damage which may have been caused in transit. Report damage to delivering carrier promptly (list damage or shortage on freight bill if possible). If damage is noted or discrepancies found, the local Temtrol, Inc. sales representative should be notified immediately so that corrective action may be instigated. Where local repairs or alterations are required, the representative should be fully informed by the contractor as to the extent and expected cost of work required. ***Unauthorized back-charges will not be recognized by Temtrol, Inc.***

(B) STORAGE

(1) Should storage of unit be required caution should be taken to set unit relatively level and in clean location to protect motor, bearings, coils, filters and etc. from excessive dust. Also avoid storage in location where children play and/or public access. **Air handling units should not be used as on site storage for other mechanical trades.** If units are to be stored for an extended period of time the following maintenance procedures must be performed:

a. Fan wheels should be rotated by hand every 30 days.
b. Each month bearings should be purged with new grease to remove condensation.
c. Before start-up new grease must be added to the bearings
d. Belts should be removed, then prior to start-up, inspect and replace if necessary, reinstall belt.
e. All openings and access doors must remain sealed during storage.
f. Dampers must be cleaned and lubricated prior to start-up.
g. Extended storage could result in condensation on the inside of the unit. Affected areas should be cleaned and dried prior to start-up.

(C) INSTALLATION

(1) An experienced, reliable rigger should be selected to handle the unloading and final placement of the equipment. Handle equipment with care during installation to avoid damage due to twisting, bouncing or tilting. Rigger should be advised that the unit contains delicate components and is to be handled in upright position only. Avoid excessive stress to fans, shafts, bearings, coil fin and tubes, dampers, isolators, filter accessories, humidifiers, piping, electrical, motors, drives, access doors and insulation. This will save time and expense during start-up and initial service warranty period.

(2) Lifting brackets are provided on the sides and top of the unit and equal tension of cables at each bracket is essential for weight distribution and safety. Rigging cables should be as long as the longest unit piece dimension at corners to prevent stress on assembly.

(3) The unit foundation must be adequate to support weight of unit without deflection to maintain spirit level of unit after installation.

(4) Steam coils are drainable if unit is level. Water coils are also drainable except for special circuiting. When special circuitry has been furnished coil must be protected from freeze damage by means of anti-freeze liquids or heaters.

(5) Condensate drain lines from pan must be pitched and include a water seal or trap to prevent the passage of air into or out of the unit via the drain in the field by the contractor. Intermediate pans for coils more than one high include downspouts to main pan. A minimum of 2 x (S.P.) trap is required in the condensate line to prevent condensate back up (more trap is required for units with SP higher than 1 1/2" wg).

(6) Observe all pertinent local ordinances and codes covering installation and operation of air handling equipment. Adequate clearance for the service and removal of components should be provided (Do Not install unit in a tight space or dangerously close to other equipment especially on access side).

(D) "START-UP" SERVICE

(1) All plumbing in field should be done with back-up wrenches on stubouts and swing joint piping or flex piping to avoid damage to headers and tubes. If, for any reason, it is necessary to cut a hole in the unit casing, this hole should be cut through a side panel (not through an access door) and then carefully sealed. Access doors should be closed and latched securely to avoid plumbing freeze up.

(2) Southco type door latches provided on access doors. Access door gasketing must not be removable or leakage of air could result.

(3) Check motor mounting to make sure all nuts are tight. Confirm that the motor voltage, phase, and HP size are compatible with wiring. Motor nameplate amperage is maximum. All electrical connections should be tight, complete and properly terminated.

(4) Supply and return air duct flanges are provided and should be attached to ducts with flexible connector unless fans are internally isolated. Multizone units require field zoning of individual zone segments by use of "W" clips which attach to zone separators.

(5) Fan blower wheels should rotate freely. Check motor and fan sheave for proper alignment and make sure set screws are tight. Check bearing-collar set screws on fan shaft and fan hub set screws for tightness. Loose collars and/or set screws will ruin the shaft quickly. Ball bearings have been lubricated at the factory and do not need further attention at start-up. Do Not operate fans with imbalance. During fan (supply and return) start-up observe the rotation and if fan is operatiing backward, reverse two legs of the supply electrical power if three phase.

(6) Rotate damper (Face & Bypass, Outside Air, Return Air, Exhaust and Zone Dampers) shafts to test action; rough handling may have caused damper blades to bind. Damper shaft extension (1/2" shaft) is provided to accept manual or automatic controls. Do Not overdrive damper motors, this will deform dampers and/or linkage.

(7) Filters (when furnished by TEMTROL, INC.) are often furnished and mounted in the racks or in boxes inside the unit. Check to make sure the filter cartridge count is correct. (Filter count is found on the Data Sheet). If filter count is short, the exact number received should be noted on the freight bill at the time of delivery. Check to make sure that filter media has been installed properly in the rails. Check to be sure that the filters called for are used; failure to use the filters that your TEMTROL, INC. Air Handler has been designed for can cause fan motor overload and/or cause the coils to become dirty and restrict airflow. Filter access doors should always be latched firmly to stop air by-pass around filter cartridges.

(8) Check all screws, bolts, nuts and piping connections for tightness.

(9) Supply and return fan drives are provided in the mid-speed adjustment range when variable speed sheaves are furnished. The motor sheave pitch diameter is field adjustable for the required air flow. When final adjustments are complete the current draw of the motor should be checked and compared to full load amperage rating of the motor. After supply fan is set, the return fan drives should be adjustable for proper pressurization of the building. Sheaves with two or more grooves should be adjusted by the same number of 1/2 or full turns from closed position to insure the same pitch diameter so belts bear equal load. DO NOT FORCE BELT OVER THE GROOVES. Hub type fan sheaves are furnished. Sheaves must be tightened securely before drive is operated.

(10) Hinged or slide rail motor mounts are furnished with two adjusting bolts. Bolts must be adjusted equally or so drives maintain proper alignment. Correct belt tension should be acquired by use of belt tension checker tool. Overtightened belts reduce belt and bearing life substantially, yet belts must be tight enough to prevent slippage.

(11) Humidifiers if installed include operator, trap, strainer and manifold mounted or furnished and mounted by contractor. Supply steam connects at top to strainer and return connects at leaving side of trap. Piping to and from humidifier should not be reduced in size with pitch (of 1/2" in 10') length without sag.

(12) After 24 hours operation re-check "start-up" items.

(13) See Prestart and Operation Check Sheet.

(E) MAINTENANCE AND INSPECTION SERVICES

(1) *FAN* - Check blades for dirt and/or grease build-up especially on concave sides. Check set screws and/or set collars of fan wheel and bearings for tightness. Check bearing mounting bolts and fan housing cut off blade bolts and nuts for tightness. If fans are furnished with housing drains, see that "weep holes" in bottom are open. If housing access door is furnished be sure it is properly sealed and latched. Remove all debris from fan section and unit in general.

(2) *BEARINGS AND SHAFT* - Ball or Roller bearings are greased at the factory and therefore ready to run at "start-up"; however routine maintenance and inspection is required there after. Normal operation of bearings are "cool or warm to touch". High bearing temperature accompanied by excessive leakage of grease indicates too much grease. High temperature with no grease showing at the seals, particularly if the bearing seams noisy, indicates too little grease. If running discloses an excessive amount of grease in the bearings the grease fittings should be removed until the excess has escaped. Fan shafts should be coated to prevent corrosion yet check that dirt or debris build-up is not accumulating which could affect balance.

(3) *FAN BEARING LUBRICATION* - Lubrication intervals vary with the period of operation and temperature of the air. Do Not Over-Lubricate. The bearing is factory lubricated with Lithium based grease of NGL1#2 consistency, such as Sinclair Litholene Multipurpose, Avalinia #2, Texaco Multifax #2, Humble Lidok #2, Mobil Armyac#781 or Phillips Philube L2.

START – UP REPORT

Temtrol, Inc.
Manufacturers of ..... Customized Air Handling Units

Start – UP Date: _____

Job Name: _____Unit Serial Number – U _____

A Start- Up report must be submitted for each unit on the job. For warranty purposes, start – up occurs when the equipment and/or blowers are started for operation regardless of when the building may be ready for operation.

GENERAL

	Initials or ✓
1. Inspect the unit for shipping and installation damage.	
2. Check Bill of Lading against material received	
3. Make sure all packing material has been removed from unit.	
4. Inspect unit demounts for proper re-assembly (if unit shipped in sections)	

PRE-START

1. Remove shipping lock down bolts. See drawing on inside Supply Fan access door	
2. Check fan wheel set screws for tightness and motor and fan sheave for proper alignment	
3. Manually rotate fan wheels and motors to assure freedom of movement	
4. Check main supply voltage	
5. Check electrical connections for tightness	
6. Check main fan amp draw (Refer to motor nameplate)	
7. Check condensate drain traps (Separate traps are required for each drain connection)	
8. Inspect system piping for proper installation	
9. Check to see that proper filters are installed	
10. Clean inside of unit of all construction dirt and debris	
11. Adjust access doors for proper alignment if necessary (Series FC – N/A)	

OPERATIONAL CHECK
Warning ! Do not operate unit if system is not properly balanced.

1. Check damper operation to assure freedom of movement	
2. Momentarily start fan motor and assure correct rotation	
3. Check belts for tightness	
4. If unit is equipped with variable frequency drive, refer to enclosed manufacturers recommended start-up procedures.	
5. Record motor rpm / amp: Supply fan # 1 _____ rpm Supply Fan # 1 _____ amps Supply fan # 2 _____ rpm Supply Fan # 2 _____ amps Return Fan # 1 _____ rpm Return Fan # 1 _____ amps Return Fan # 2 _____ rpm Return Fan # 2 _____ amps	
6. Record unit External Static Pressure (esp.) and Total Static Pressure (tsp). Supply fan # 1 _____ esp Supply Fan # 1 _____ tsp Supply fan # 2 _____ esp Supply Fan # 2 _____ tsp Return fan # 1 _____ esp Return Fan # 1 _____ tsp Return fan # 2 _____ esp Return Fan # 2 _____ tsp	
7. Record Unit Supply and Return CFM: Supply air CFM: _____ Return air CFM: _____	
8. Verify unit is operating at design conditions	
9. While unit is in operation verify no excess standing water in drain pan.	

Note: After 24 hours of operation re-check set screws on bearing collar and fan hub for proper tightness.

Ball and Roller Bearing Setscrew Tightening Torque			
Dia.	Hex Size Across Flats	Min. Recommended Torque Valuline	
#10 (109)	3/32	in.lbs	ft.lbs
1/4	1/8	22	1.8
5/16	5/32	40	3.3
3/8	3/16	65	5.4
7/16	7/32	130	10.8
1/2	1/4	200	16.7
5/8	5/16	290	24.2
3/4	3/8	470	39.2

The following table should be used as a relubrication guide:

Conditions

SPEED	TEMPERATURE	CLEANLINESS	GREASE INTERVAL
100 RPM	Up to 120 degrees F	Clean	6 to 12 months
500 RPM	Up to 150 degrees F	Clean	2 to 6 months
1000 RPM	Up to 180 degrees F	Clean	2 wks to 2 months
1500 RPM	Over 210 degrees F	Clean	Weekly
Any Speed	Up to 150 degrees F	Dirty	Daily to 2 wks
Any Speed	Over 150 degrees F	Dirty	Daily to 2 wks
Any Speed	Any Temperature	Very Dirty	Daily to 2 wks
Any Speed	Any Temperature	Extreme Cond.	Daily to 2 wks

Add grease slowly with shaft rotating, until a slight bead forms at the seals.

Start – Up performed by: _____ Date: _____

Notes:

_____

_____

_____

_____

(4) *MOTOR AND MOTOR BEARINGS* - Check for dirt and debris accumulation on "air travel" openings of open type motors to prevent overheating. Relubricate motor bearings every 2000 hours of operation while it is warm and at a stand still. Remove and clean upper and lower grease plugs. Insert grease fittings into upper hole adding a small amount of clean grease with a low pressure gun. Run motor 5 minutes before replacing plugs. Excessive grease will overheat the bearings. Use only high grade mineral grease having a 200 degrees F safe operating temperature. (If special lubrication instructions are shown on the motor nameplate they will supersede all other instructions).

(5) *SHEAVES* - After air balance, require no further adjustment. However, sheave locking devices, wear, alignment and belt tension should be checked on a regular basis.

(6) *DAMPER BLADES AND LINKAGE* - should be inspected regularly for dirt and/or debris build up to insure abnormal wear or damage does not occur. Winterize damper system prior to cold weather to insure that proper sequence of control is being maintained, paying close attention to operation of outside air intake. Outside air damper should be checked closely for minimal leakage when closed.

(7) *WATER COILS* - (Heating and Cooling) if not antifreeze protected or heater protected should be drained as thoroughly as possible and then treated in the following manner:

> Fill each coil independently with an antifreeze solution using a small circulating pump and again drain. Check freezing point of antifreeze before proceeding to next coil. Due to a small amount of water always remaining in each coil, there will be a diluting effect. The small amount of antifreeze solution remaining in coil must always be concentrated enough to prevent freeze-up. Carefully read instruction for mixing antifreeze solution used. Some products will have a higher freezing point in its natural state than when mixed with water.

Failure of controls, outside air dampers and air stratification can cause freeze-up and permanent coil damage if above precautions are not observed. Do Not allow dirt to accumulate between the fins of coils. Use water, steam or air to remove dirt.

(8) *STEAM COIL* - fins should be cleaned in the same manner as Water Coils. Steam lines to and from unit should be checked for pitch, pipe sag and blockage to avoid "Water-hammer". Strainers and traps require annual cleaning minimum.

(9) *CONDENSATE PAN* - should be checked for dirt and debris build-up and cleaned. Trap and drain should also be cleaned especially if blockage is evident.

(10) *FILTER ASSEMBLY* - tracks should be checked for rail seal retention where required and all rails should be cleaned annually to control dirt build-up, filter drag and dust by-pass during change out of media. Dirty filters reduce the air volume handled by the unit, and thereby its capacity. Unit should not be run without proper filters or fan motor overload, dirty coil and restricted air flow will result. Proper media retainers should be used at all times to avoid possible media "blow-out", which can cause blockage of air flow and/or damage rotating fan and motor parts. Do not operate media beyond its rated capacities before change out or "blow-out" damage can result.

(11) *CASING AND ACCESS DOORS* - should be checked for leakage (air and/or water). Door gasket must be in proper alignment and if damaged, should be replaced. Inside access panels must be latched properly to avoid air recirculation.

(12) *COILS* - can be removed from unit through either end of unit. After removing piping and end panels, remove bolts holding coil to structural frame at the air entering side of coil. The coil and casing can then be pulled out.

(13) *WIRING AND COMPONENTS* - should be made and remain in accordance with National, State and local codes that apply to this equipment. Check connections of wiring and retighten so danger of a poor connection causing overheating and component failure through inadequate current handling can be avoided. Good practice and safety indicates that before attempting service to components, de-energize the systems and only after workers are clear of rotating and electrical devices can unit be energized again.

(14) *AIR FILTER GAUGE* - "pick-ups" should point against air flow for best results without restriction. Oil Manometers require split to operate properly (check zero set).

(15) *HUMIDIFIER* - strainer screen in supply line should be cleaned a few days after put in operation and thereafter at least once a season - more often if much dirt is found in the screen. The trap should be inspected at the same time strainer is cleaned.

(16) *UNIT HEATER OR ELECTRIC COIL* - should be checked for dirt on resisters and removed by use of air only. **DO NOT** attempt cleaning without positive shut down.

(17) *PNEUMATIC OPERATORS* - and linkage should be inspected for sequence and travel and vacuum hose leaks especially prior to cold weather usage where furnished.

(18) *OTHER COMPONENTS* - not mentioned should be maintained per instructions attached to component.

(19) *REPLACEMENT PART* - (if required) orders for service or replacement must include serial number, model number and unit tag of unit as stamped on serial plate, attached to unit. If replacement parts are required, state date of installation of unit, date of start-up and date of failure, along with an explanation of the malfunction and a description of the replacement parts required. Goods may not be returned except by permission of authorized factory officials of TEMTROL, INC. at Okarche, Oklahoma and when so returned will be subject to a handling charge and transportation charges prepaid. Following our personal inspection of the returned part and if it is determined that the failure is due to faulty material or workmanship, credit will be issued on customer's purchase order if warranty is still in effect.

INDOOR - MOUNTED
FC-01

CABINET

Panels	FC-0001
Insulation	FC-0002
Neoprene gasketing	FC-0003
Metal flange seal	FC-0004
Lifting lugs	FC-0005
Weatherproof screws	FC-0006
Roof-curb	FC-0007
Curb gasketing	FC-0008
Drain Pan with drain	FC-0009
Pan insulation board	FC-0010

FAN (S/A = Supply Air or R/A = Return Air)

Housing	FC-0101
Cutoff	FC-0102
Inlet funnels	FC-0103
Wheel	FC-0104
Shaft	FC-0105
Bearings	FC-0106
Inlet Vanes	FC-0107
Inlet Vane Linkage	FC-0108
Inlet Screen	FC-0109
Flex Connection	FC-0110
Isolators	FC-0111
Discharge diffuser	FC-0112
Sheave and Bushing	FC-0113
Lubrication fittings	FC-0114

MOTOR (S/A or R/A)

	FC-0201
Horse Power w/ voltage, phase RPM	FC-0202
Mount	FC-0203
Sheave and Bushing	FC-0204
Belts - size and length	FC-0205
Belt guard	FC-0206

DAMPER

Face damper	FC-0301
By-pass damper	FC-0302
Face and ByPass combination	FC-0303
Return air damper	FC-0304
Outside air damper	FC-0305
Relief - exhaust damper	FC-0306
Fan discharge damper	FC-0307
Recirculation damper	FC-0308
Min. outside air damper	FC-0309
Manual quadrant	FC-0310
Interconnecting linkage	FC-0311
Fire damper w/"fuse link"	FC-0312
Operator	FC-0313

COIL

Pre-Cooling	FC-0401
Cooling	FC-0402
Preheat	FC-0403
Heating	FC-0404
Reheat	FC-0405
Balance orifice	FC-0406
Connection grommets	FC-0407
Distributor w/nozzle	FC-0408
Hot gas side-port	FC-0409
Expansion valve	FC-0410
Vent and drain plugs	FC-0411
Top and/or bottom casings	FC-0412
Electric heating	FC-0413

COIL SYSTEMS (Special)

Integral Face & By-pass Heating	FC-0501
Reclaim wheel	FC-0502
Reclaim gas-type	FC-0503
Reclaim fluid run-around type	FC-0504

HUMIDIFIER

Humidifier (Steam)	FC-0601
Water spray	FC-0602
Humidifier pan w/drain	FC-0603

FILTER RACKS

Prefilter	FC-0701
2nd filter	FC-0702
Final filter	FC-0703
Exhaust filter	FC-0704
Roll type	FC-0705
Charcoal type	FC-0706
Retainer frames & clips	FC-0707
Gauges	FC-0708

FILTER MEDIA

Prefilter cartridges	FC-0801
2nd filter cartridges	FC-0802
Final cartridges	FC-0803
Exhaust filter cartridges	FC-0804
Roll media	FC-0805
Charcoal Media or tray	FC-0806

ELECTRICAL

Light fixture	FC-0901
Disconnect(Main or service)	FC-0902
Starter (S/A or R/A)	FC-0903
Panel box	FC-0904
Tranformer	FC-0905
Terminal strip	FC-0906
Fuse block	FC-0907
Fuses	FC-0908
Unit heater	FC-0909

ACCESS

Door	FC-1001
Door hinge	FC-1002
Door latch	FC-1003
Drip gutter	FC-1004
Door gasket	FC-1005

FINISH

Internal coating	FC-1101
Pan Mastic	FC-1102
Touch-up paint (external)	FC-1103

Not all listed parts apply to each unit.
Prices on application and as effective on date of shipment.
Many parts are available on open market.

WHEN ORDERING PARTS the following information must be given:

Unit Serial Number
Unit Model Number
Part Name + Location
Code Number + Place Number

EXAMPLE:

Job Symbol	AC-1	AC-2	AC-3	AC-4
Model No.	DV10S	DH11D	BD12M	BZ51D
Dwg No.	D-00001	D-00002	D-00003	D-00004
Serial No.	00001	00002	00003	00004

Serial No: = 00003
Model = BD12M
Fan sheave and bushing - S/A (Supply Air Fan) BZ-FC-0013

Temtrol, Inc.

INFORMATION COVERING:

AIR HANDLERS
INDOOR - MOUNTED

O & M - 01

PARTS LIST

JOB SYMBOL :				
MODEL NUMBER :				
DRAWING NUMBER:				
SERIAL NUMBER :				
PART NUMBER :				

JOB SYMBOL :				
MODEL NUMBER :				
DRAWING NUMBER:				
SERIAL NUMBER :				
PART NUMBER :				

MAINTENANCE

FREQUENCY SCHEDULE

Recommended Maintenance Service for Temtrol Equipment

Type of Service	Start-Up	Monthly	Every 6 Months	Shutdown	Annually
Inspect General Condition of Unit	X	X			
Clean Debris From Unit	X	X		X	
Check and Adjust Fan Belt Tension	X	X			
Check Unit for Unusual Noise or Vibration	X	X			
Check Fan Bearing Locking Collars	X		X		
Check Motor Voltage and Current	X		X		
Lubricate Fan Shaft Bearings	X		X	X	
Lubricate Motor Base Adjusting Screws	X		X	X	
Check Fan for Rotation Without Obstruction	X				
Check Fan for Proper Rotation	X				
Inspect Protective Finish					X
Replace Filters		X			
Lubricate Damper Linkage			X		
Check Fans for Unusual Vibration	X				X
Clean Outside of Coils			X	X	

IMPORTANT SAFETY NOTES

Before performing any maintenance or inspection, make certain that all power has been disconnected.

Adequate precautions should be taken to safeguard the equipment and the premises from damage, also the public from possible injury as appropriate for the installation of these products.

TROUBLE SHOOTING GUIDES
FANS

PROBLEM	PROBABLE CAUSE	SOLUTION
Noise	Impeller hitting inlet ring	a. Impeller not centered in inlet ring. b. Inlet ring damaged c. Crooked or damaged impeller d. Shaft loose in bearing e. Impeller loose on shaft f. Bearing loose in bearing support
	Impeller hitting cutoff	a. Cutoff not secure in housing b. Cutoff damaged c. Cutoff improperly positioned.
	Drive	a. Sheave not tight on shaft (motor and/or fan) b. Belts too loose. Adjust for belt stretching after 48 hours of operation. c. Belts too tight. d. Variable pitch sheaves not adjusted so each groove has same pitch dia. (multi-belt drives). e. Misaligned sheaves f. Belts worn g. Isolation base shipping restraints not removed. h. Belts oily or dirty
	Bearing	a. Defective bearing b. Needs Lubrication c. Loose on bearing supports d. Loose on shaft e. Seals misaligned f. Foreign material inside bearing g. Worn bearing h. Fretting corrosion between inner race and shaft.
	Shaft Seal Squeal	a. Need lubrication b. Misaligned
	Impeller	a. Loose on shaft b. Defective Impeller *Do not run fan - Contact manufacturer.* c. Unbalanced
Noise (Continued)		d. Worn as result of abrasive or corrosive

TROUBLE SHOOTING GUIDES
FANS

PROBLEM	PROBABLE CAUSE	SOLUTION
		material moving through flow passage
	Housing	a. Foreign material in housing b. Cutoff or other part loose (rattling during operation)
	Electrical	a. AC hum in motor or relay b. Starting relay chatter c. Noisy motor bearings d. Single phasing a 3 phase motor
	High Air Velocity	a. Duct work too small for application. b. Fan selection too small for application. c. Registers or grilles too small for application. d. Heating or cooling coil with insufficient face area for application.
	Pulsation or Surge	a. Restricted system causes fan to operate at poor point of rating. b. Fan too large for application c. Ducts vibrate at same frequency as fan pulsations.
	Rattles and/or Rumbles	a. Vibrating duct work b. Vibrating cabinet parts c. Vibrating parts not isolated from building.
CFM Low - Insufficient Air Flow	Fan	a. Mecanical volume control device is improperly set. b. Fan running backwards c. Cutoff missing or improperly installed. d. Dirty fan blades. e. Loose or slipping belts f. Fan speed too slow
	Duct System	a. Actual system is more restrictive (more resistant to flow) b. Dampers closed c. Registers closed d. Leaks in supply ducts e. Insulating duct liner loose.
CFM Low - Insufficient Air Flow (continued)	Filters	a. Dirty or clogged

TROUBLE SHOOTING GUIDES
FANS

PROBLEM	PROBABLE CAUSE	SOLUTION
	Coils	a. Dirty or clogged
	Obstructed Fan Inlets	a. Elbows, cabinet walls or other obstructions restrict air flow. Inlet obstructions cause more restrictive systems but do not cause increased negative pressure readings near the fan inlet(s). Fan speed may be increased to counteract the effect of restricted fan inlet(s)
	No Straight Duct at Fan Outlet	a. Fans which are normally used in duct system are tested with a length of straight duct at fan outlet. If there is no straight duct at the fan outlet, decreased performance will result. If it is not practical to install a straight section of duct at the fan outlet, the fan speed may be increased to overcome this pressure loss.
	Obstructions in High Velocity Air Stream	a. Obstruction near fan outlet b. Sharp elbows near fan outlet c. Improperly designed turning vanes d. Projections, dampers or other obstructions in part of system where air velocity is high
CFM High - Too Much Air Flow	System	a. Oversized duct work b. Access door open c. Registers or grilles not installed d. Damper set to by-pass coils e. Filter(s) none in place f. System resistance much lower than anticipated
	Fan	a. Fan speed too fast
Incorrect Static Pressure	System, Fan or Interpretation of Measurements	General Discussion: ● The velocity pressure at any point of measurement is function of the velocity of the air or gas and its density ● The static pressure measured in a "loose" or oversized system will be less than the static pressure in a "tight" or undersized system for the same air flow rate
Incorrect Static Pressure - Continue -		● In most systems, pressure measurements are indicators of how the installation is operating. These measurements are the result of air flow and as such are

TROUBLE SHOOTING GUIDES
FANS

PROBLEM	PROBABLE CAUSE	SOLUTION
		useful indicators in defining system characteristics ● Field static pressure measurements rarely correspond with laboratory static pressure measurements unless the fan inlet and fan outlet conditions of the installation are exactly the same as the inlet and outlet conditions in the laboratory
Static Pressure Low, CFM High	System	System has less resistance to flow than expected This is a common occurrence. Fan speed may be reduced to obtain desired flow rate. This will reduce HP (operating cost).
	Fan	a. Backward inclined impeller installed backwards. HP will be high b. Fan speed too high
Static Pressure Low, CFM Low	System	a. Fan inlet and/or outlet conditions not same as tested.
Static Pressure High CFM Low	System	a. Obstruction in system b. Dirty filters c. Dirty coils d. System too restricted
HP High	Fan	a. Backward inclined impeller installed backwards b. Fan speed too high c. Too low system resistance for forward curved fan
	System	a. Oversized duct work b. Face and by-pass dampers oriented so coil dampers are open at same time by-pass dampers are open c. Filter(s) - left out d. Access door open
	Fan Selection	a. Fan not operating at efficient point of rating. Fan size or type may not be best for application
Fan Does Not Operate	Electrical or Mechanical	a. Blown fuses b. Broken belts c. Loose pulleys d. Electricity turned off

TROUBLE SHOOTING GUIDES
FANS

PROBLEM	PROBABLE CAUSE	SOLUTION
		e. Impeller touching scroll f. Wrong voltage g. Motor too small and overload protector has broken circuit h. Optional thermostats, firestats, freezestats may lockout fan operation if set incorrectly

TROUBLE SHOOTING GUIDES
ELECTRIC HEATING COILS

PROBLEM	PROBABLE CAUSE	SOLUTION
Electric Heater Not Operating	Electrical or Mechanical	● Disconnect switch or main circuit breaker may be in the "OFF" position. If heater has built-in disconnect switch, door must be closed and switch turned "ON" before heater will operate ● If the fan and heater are interlocked with a fan relay, the fan must be on before the heater will operate. If an air flow switch is used, air pressure in the duct must be sufficient (at least 0.7" W.C.) to close the switch before the heater will operate ● Automatic (or manual) reset thermal cutout may have opened when overheating resulted from insufficient air flow or poor air distribution. Allow heater temperature to return to normal so that automatic thermal cutout may reset or manual reset thermal cutout may be reset. Correct cause of overheating before proceeding. ● Heat limiter(s) may have opened if local "hot spot" developed or if automatic reset thermal cutout failed to open first, when overheating occurred. Correct cause of overheating and replace heat limiter. ● Check main fuses, if open, correct cause of failure before replacing fuses.
Electric Heater Cycles (Will Not Stay On)	Electrical or Mechanical	● Check air inlet and discharge openings for obstructions. See that filters are not clogged, fire dampers are open and air system is balanced ● Check to see that the heater terminal box is tight against duct and heater safety devices are receiving sufficient air flow. Air flow must be distributed evenly over entire face area. ● Look at heater coils in operation (through observation port in duct); any red area is not receiving enough air. (A small amount of redness is permissible inside the coil insulation bushings). Make sure that air flow through every part of the heater is sufficient. *Coils must not glow.* ● If air flow switch is used, contactors may "chatter" if air flow is not sufficient to keep switch fully on. ● If duct has internal insulation, the insulation may be blocking the safety devices.
Improper Temperature	Electrical or Mechanical	● Make sure associated control equipment, such as

TROUBLE SHOOTING GUIDES
ELECTRIC HEATING COILS

PROBLEM	PROBABLE CAUSE	SOLUTION
Regulation		thermostats, are in the correct location and that all controls are adjusted according to manufacturer's specifications for existing field conditions. ● Check air system balance to see that correct amount of air flow is supplied for proper zone control. ● Automatic thermal cutout may be opening (cycling) before room thermostat is satisfied. (see "Electric Heater Cycles". Insufficient heat may be caused by: 1. Open heat limiter(s) or thermal cutout 2. Incorrect supply voltage 3. Heater too small (in wattage) for application –

TROUBLE SHOOTING GUIDES
HEATING COILS

PROBLEM	PROBABLE CAUSE	SOLUTION
Coil Does Not Operate	Steam valve failure (Steam Coil)	a. Check steam valve. If air operated, check proper air pressure. If electrically operated check for no power or loose connection. If manual valve, check to see if valve is open. If necessary repair or replace valve. b. Defective thermostat or wrong setting
	Steam trap failure (Steam Coil)	Condensate backs up into coil. Check steam trap, repair or replace
	Diverter valve (Hot Water Coil)	a. Check power to valve as above b. Diverter valve piped wrong
Coil Does Not Deliver Adequate Heat	No steam or hot water	Check boiler for proper steam pressure or hot water temperature setting.
	Thermostat	a. Thermostat improperly located, relocate. b. Thermostat defective, replace c. Improper set point, reset d. Defective controls, see above
	Coil undersized	Replace with larger coil
	Insufficient steam pressure	Check boiler controls
	Lack of hot water	Hot water pump undersized or malfunctioning
	Dirty finned tubes	Vacuum or use air hose to gently clean dirt from finned tubes
Coil Leaks	Crack in brazed connection	Repair brazed joint
	Internal corrosion	Replace coil

TROUBLE SHOOTING GUIDES
COOLING COILS

PROBLEM	PROBABLE CAUSE	SOLUTION
Coil Does Not Deliver Adequate Cooling	Lack of chilled water	Chilled water pump undersized or malfunctioning
	Dirty finned tubes	Vacuum or use air hose to gently clean dirt from finned tubes
	Coil undersized	Replace with larger coil
Coil Leaks	Crack in brazed connection	Repair brazed joint
	Internal corrosion	Replace coil
Moisture on Walls Downstream of Cooling Coil	Excess capicity through cooling coil	Check air flow through coil
	Standing water in drain pan	See "Condensate Drain Pan" Section
	V.A.V. unit (Low Volume Air Flow - High Volume Water Flow)	Verify that the air flow and water flow are synchronized

TROUBLE SHOOTING GUIDES
CONDENSATE DRAIN PAN

PROBLEM	PROBABLE CAUSE	SOLUTION
Standing Water in Drain Pan	Unit is not level	Check level of unit, shim if required.
	Drain connection is clogged	Remove dirt or debris from drain pan
	Condensate drain line to drain is not correctly pitched.	Check pitch in line towards floor drain
	Trap is sized incorrectly	● All condensate drain connections and floor drains must be trapped. Failure to properly trap a drain will result in flooding of the drain pan and potential water damage to the air-handling unit and other building facilities.

TROUBLE SHOOTING GUIDES
ELECTRIC MOTORS

PROBLEM	PROBABLE CAUSE	SOLUTION
Motor Fails to Start	Blown fuse or open circuit breaker	Replace fuse or reset circuit breaker
	Overload trips	Check and reset overload
	Improper line connections	Check connections with diagram supplied with motor
	Open circuit in winding or starting switch. Evidence by humming sound from motor when switch is closed	Check inside motor to determine if switch is closed. Check for loose connections.
	Improper current supplied	Check to determine that power supply agrees with motor nameplate specifications.
	Mechanical failure	Determine that motor and drive turn freely. Check bearings and lubrication
	Short circuited stator	Indicated by blown fuses. Motors must be rewound
	Poor stator coil connection	Remove end bells and locate with a test lamp.
	Defective rotor	Look for broken bars or end rings. Replace rotor
	Motor overloaded	Reduce load or replace unit with larger motor
	With a 3 phase power source one phase may be open	Check line for open phase
	Defective capacitor	Replace capacitor
Motor Stalls	Wrong application	Change type or replace unit with a larger motor, consult factory
	Overloaded motor	Reduce load or replace unit with a larger motor.
	Low line voltage	Check across AC line and correct if possible
Motor Runs and Then	Partial loss of line voltage	Check for loose connections. Determine adequacy

TROUBLE SHOOTING GUIDES
ELECTRIC MOTORS

PROBLEM	PROBABLE CAUSE	SOLUTION
Dies Down		of main power supply
	Stator shorts when motor warms up.	Replace stator
Motor Does Not Come Up to Speed	Motor under designed for application	Replace with a larger motor
	Voltage too low at motor terminals	Check across AC line and correct if possible
	Line wiring to motor too small	Install larger line wiring
	Broken rotor bars	Look for broken bars or end rings, replace motor.
	60 cycle motor connected to 50 cycle line supply	Replace unit with a 50 cycle motor.
Motor Takes Too Long to Accelerate	Excessive load	Replace with larger motor
	Loose connection(s)	Check connections and tighten where necessary
Wrong Rotation (3 Phase)	Improperly wired to AC line (Wrong sequence of phases)	Check wiring diagram on motor nameplate and correct. Reverse any two motor leads at line connection
Motor Overheats (Temperature Rise Above Ambient Greater Than Nameplate Specifications)	Motor overloaded	Replace with larger motor.
	Motor fan may be clogged with dirt preventing proper ventilation	Remove fan cover and clean, replace fan cover
	Motor (3 phase) may have one phase open	Check to insure that all connections are tight
	Partially shorted stator coil	Must be rewound
	Line voltage too high	Check across AC line and correct. Step-down transformer may be required
Motor Overheats -Continue-	Line voltage too low	Check across AC line. Consult power company. Step-up transformer may be required

TROUBLE SHOOTING GUIDES
ELECTRIC MOTORS

PROBLEM	PROBABLE CAUSE	SOLUTION
(Temperature Rise Above Ambient Greater Than Nameplate Specifications)	Rotor rubs stator bore	Check motor bearings and replace
	Worn bearings	Replace bearings and seals
Motor Vibrates When Connected to Driven Equipment	Motor mounting bolts loose	Tighten mounting bolts
	Rigid type coupling used to connect motor to driven equipment	Replace coupling with a proper coupling
	Driven equipment unbalanced	Balance driven equipment
	Worn motor bearings	Replace bearings and seals
	Motor (3 phase) running on single phase	Check for open circuit and correct
	Bent motor shaft	Replace shaft or rotor
Rapid Motor Bearing Wear	Excessive overhung load due to over tensioned drive	Check overhung load, retension drive.
	Excessive overhung load due to a smaller diameter sheave than recommended minimum used on motor shaft	Check "NEMA Sheave Selection Guide" in the Browning Catalog. Replace sheave with one of size equal to or greater than listing

TROUBLE SHOOTING GUIDES
VARIABLE SPEED DRIVES

PROBLEM	PROBABLE CAUSE	SOLUTION
Short Belt Life	Spin burns from belt slipping on drive under stalled load conditions or when starting	Tension belts
	Gouges or extreme cover wear caused by belts on drive guard or other objects	Eliminate obstruction or realign drive to provide clearance
	High ambient temperature	a. Use Gripnotch Belts b. Provide ventilation c. Shield belts
	Grease or oil on belts	a. Check for leaky bearings b. Clean belts and sheaves
	Worn sheaves	Replace sheaves
	Center distance shorter than recommended minimum when using standard sheave as a companion sheave	Increase center distance by using longer belts. Replace standard driven sheave with a companion sheave
	Belt misalignment	Realign drive with sheave set at mean pitch diameter
Belts Turn Over in Grooves	Damaged cord section in belts. Frayed or gouged belts.	Replace belts
	Excessive vibration	Tension belts, replace belts if damaged.
	Flat idler pulley misaligned	Realign idler
	Worn sheaves	Realign drive
Belt Squeal	Excessive overload. High starting load. Belts not tensioned properly.	Tension drive or redesign and replace drive.
	Insufficient arc of contact	Increase center distance or use Gripnotch Belts
Belt Breakage	Foreign material in drive	Provide drive guard

TROUBLE SHOOTING GUIDES
VARIABLE SPEED DRIVES

PROBLEM	PROBABLE CAUSE	SOLUTION
	Belts damaged during installation	Replace belts
	Shock or extreme overload	Eliminate overload cause or redesign drive.
Belt Stretch Beyond Take-up	Worn sheaves	Replace Sheaves
	Under designed drive	Redesign and replace drive
	Take-up slippage	Reposition take-up
	Drive excessively tensioned	Properly tension drive
	Damaged cord section during installation	Replace belts and properly install
Excessive Vibration	Damaged belt cord section	Replace belts
	Loose belts	Tension drive
	Belts improperly tensioned	Tension drive with slack of each belt on the same side of the drive
Belts too Long at Installation	Insufficient take-up	Use shorter belts
	Drive improperly set up	Recheck driver and driven machine set up
	Wrong size belts	Use correct size belts
Belts too Short at Installation	Insufficient take-up	Use longer belts
	Drive improperly set up	Recheck driver and driven machine set up
	Wrong size belts	Use correct size belts
Belts Mismatched at Installation	Belts matched by code number only	Replace belts with Machine Matched Belts
Belts Mismatched at Installation	Old belts and new belts used together on the same drive	Replace with new belts

TROUBLE SHOOTING GUIDES
VARIABLE SPEED DRIVES

PROBLEM	PROBABLE CAUSE	SOLUTION
- Continue -		
	Different brand name belts used on same drive	Replace with a set of Machine Matched Belts
	Driver and driven shaft shifted	Realign drive
	Worn sheaves	Replace sheaves
Belts Mismatched After Service	Belts improperly tensioned, causing more stretch of some belts than others	Replace belts and tension drive with slack of each belt on the same side of the drive
	Old belts and new belts used together on the same drive	Replace with new belts
	Different brand name belts used on same drive	Replace with a set of Machine Matched Belts.
	Driver and driven shafts shifted from parallel	Realign drive
	Belt cord section damaged during installation	Replace belts and install properly
Drive Fails to Adjust	Fretting corrosion (drive allowed to operate at one speed over a period of time).	Sheave must be disassembled, cleaned and lubricated, then reassembled.