New Mexico Public School Facilities Authority
1312 Basehart Rd. SE, Suite 200
Albuquerque, NM 87106-4368

TAB Specification 23-0593

TEST, ADJUST, AND BALANCE GUIDE SPECIFICATION

SECTION 23 0593
TESTING, ADJUSTING AND BALANCING

PART 1 GENERAL

1.01 REQUIREMENTS

A. Testing and balancing of the mechanical systems and associated controls shall be under the direction and coordination of the owner. Test and Balance (TAB) Services shall be responsible for coordination, supervision, execution, furnishing the data required by the test procedures, and report preparation for the testing, adjusting, and balancing requirements outlined in this Section.

B. TAB will be provided by the Owner's TAB Services Contractor and paid for by the Owner. This Section serves to clarify the responsibilities of the Contractors, and the Owner's TAB Services Contractor.

C. During the testing, adjusting, and balancing work, the Owner's TAB Services Contractor may identify issues or recommended corrective measures. These will be compiled in the Installation Issues Log maintained by the PAC and RFIs will be created by the PAC as appropriate. The Construction Stage Deficiency Log will be promulgated to responsible parties via the Owner's Representative and the Architect. ***IMPLEMENTATION OF CORRECTIONS SHALL BE PERFORMED BY THE CONTRACTOR AT NO ADDITIONAL CHARGE***. If the Contractor believes recommended corrections are beyond the scope of work specified in the contract, it shall be the Contractor's responsibility to request and receive written change order authorization through the Owner's established process prior to undertaking those recommended corrections.

D. The General Contractor shall provide services of a qualified manufacturer's representative of the Direct Digital Control or Building Automation Systems and qualified representatives of the mechanical and electrical subcontractors as required for the TAB work and ***THE SUB-CONTRACTORS SHALL INCLUDE COST FOR THE CONTRACTOR'S TESTING, ADJUSTING, AND BALANCING REQUIREMENTS IN HIS CONTRACT PRICE. SERVICES OF THE TAB AGENCY SHALL BE PROVIDED BY THE OWNER AND ARE NOT PART OF THE CONTRACT PRICE***.

E. Mechanical system installation, start-up, initial testing, the preparation of Operation and Maintenance Manuals, and operator training are the responsibility of the General Contractor. The testing, adjusting, and balancing requirements in this Section do not relieve the General Contractor from the obligations to complete all portions of the work in a satisfactory and fully operational manner.

F. The Owner's TAB Services Contractor shall include the following in its Scope of Work:
1. Perform Testing and Balancing of the HVAC and Control Systems. Testing to follow successful completion of the PAC's Pre-Functional and Start-Up Checklists.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any), and General Requirements apply to the work specified in this Section.

B. [_____] General Mechanical Requirements

C. 23 0810 Performance Assurance for HVAC

D. *(**NOTE to Design Professional:** INSERT sequentially each Specification Section number that includes equipment subject to testing, adjusting and balancing)*

1.03 REFERENCES

A. AABC – National Standards for Total System Balance

B. ASHRAE 111 – Practices for Measurement, Testing, Adjusting, and Balancing of Environmental Systems

C. NEBB – Procedural Standards for Measurement, Testing, Adjusting, and Balancing of Environmental Systems

D. SMACNA – HVAC Systems Testing, Adjusting, and Balancing

1.04 SUBMITTALS BY OWNER'S TAB SERVICES CONTRACTOR

A. Field Reports indicating deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

B. Report forms or outlines indicating adjusting, balancing, and equipment data required. Submit prior to commencing work.

C. Test Reports including data on forms containing information indicated in Schedules.

D. Draft copies of TAB Report for review prior to Substantial Completion of Project.

E. Copies of final TAB Report.

F. Provide submittals and reports to PAC for transmittal to Owner's Representative and Architect/Engineer.

G. Provide two (2) reports in letter size, 3-ring binders with index page, indexing tabs, and with cover identification at front and side. One (1) Electronic Copy in PDF Format. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat/temperature sensor locations.

1.05 QUALITY ASSURANCE

A. Perform total system balance in accordance with NEBB Procedural Standards.

1.06 SEQUENCING

A. Sequence TAB work in conjunction with work by the Contractor. TAB work and milestones shall be incorporated in the General Contractor's Construction Schedule.

B. Sequence TAB work to commence after completion of systems. TAB work shall be completed as a prerequisite for Substantial Completion of the Project.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 AGENCIES

A. The General Contractor will be responsible for coordination, supervision, execution, and report preparation for the testing, adjusting, and balancing requirements of this Section in coordination with the Owner's Independent Performance Assurance Contractor.

3.02 SYSTEM READINESS

A. The General Contractor shall verify that systems are installed, complete and operable before the commencement of TAB work. The General Contractor and the Owner's Independent Performance Assurance Contractor, shall insure the following conditions:

1. Systems are started and operating in a safe and normal condition.
2. Direct Digital Control System and temperature controls are installed complete and operable including verification of proper end device operation and installation of required software and programming.
3. Proper thermal overload protection is in place for electrical equipment
4. Final filters are new and in place.
5. Coil fins are clean and combed if needed
6. Duct systems are clean of debris.
7. Fans are rotating correctly
8. Motors and bearings are properly lubricated.
9. Any excessive vibration has been corrected.
10. Fire/Smoke and volume dampers are in place, open, and operating properly.
11. All ductwork connections are complete, access doors are closed, and duct end caps are in place.
12. Air outlets are installed and connected.
13. Duct system leakage is minimized per the Specifications.
14. Water systems have been flushed, refilled, and vented.
15. Strainers or filters are in place and clean.

16. Control valves, check valves, and flow meters are installed and operating properly.
17. All manual valves, balancing devices, and control valves are open.
18. Pump rotation is correct and water is flowing.
19. System make-up water pressure is properly adjusted.

NMPSFA Approved Pre-Functional Checklist forms to verify the readiness of systems for TAB work are provided following the end of this Section. The General Contractor shall have personnel with direct knowledge complete the individual checklists to verify that systems are installed, complete and operable prior to the commencement of TAB work. ***These checklists do not replace any manufacturer-recommended procedures***.

B. Prior to commencement of TAB work, the General Contractor shall submit a written request to the Owner, including completed Pre-Functional Checklists forms for mechanical inspection of the project. This inspection shall be conducted by a duly appointed representative of the Mechanical Engineer's office, the Mechanical Contractor's Superintendent, and the Owner's PAC Services Contractor. The inspection shall establish to the satisfaction of all parties that the systems are ready for testing and balancing.

C. Prior to commitment of TAB work, the General Contractor and PAC Contractor shall submit completed documentation of successful Manufacturer's Start-Up of equipment and systems associated with TAB Services.

D. If the Owner's PAC and TAB Services Contractor finds that systems are not ready for TAB, the General Contractor will be subject to charges for the Owner's TAB Services Contractor's lost time and expenses.

3.03 PREPARATION

A. The Owner's TAB Services Contractor shall provide necessary calibrated instruments required for testing, adjusting, and balancing operations. The Owner's TAB Services Contractor shall make instruments available to Architect/Engineer to facilitate spot checks during testing.

B. Additional balancing devices, if required, shall be furnished and installed by Mechanical and Controls Contractors

3.04 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 10 percent of design conditions for supply systems and within plus or minus 10 percent of design conditions for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus or minus 10 percent of design conditions to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design conditions.

C. If tested air quantities are not within the required limits, the Contractor must replace fan pulleys, sheaves, belts, or add balancing dampers, etc. as required to meet the Specifications. If acceptable to Contractor, TAB Agency may install replacement pulleys, sheaves, or belts as required to meet the Specifications. Installation of pulleys, sheaves, or belts by TAB Agency shall have no effect on Contractor's warranty.

D. Water: Adjust to within plus or minus 10 percent of design conditions.

3.05 ADJUSTING BY OWNER'S TAB SERVICES CONTRACTOR

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices to allow settings to be restored. Set and lock memory stops.

C. After adjustments, take measurement to verify balance has not been disrupted or that such disruption has been rectified.

D. Leave systems in proper working order, replace belt guards, close access doors, close doors to electrical switch boxes, restore thermostats to specified settings, and restore Direct Digital Control System to normal operation.

E. At Final Inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

3.06 PROCEDURE BY OWNER'S TAB SERVICES CONTRACTOR

A. Air Handling and Distribution Systems

1. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

2. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

3. The total air volume handled by the system shall be determined by means of a Pitot tube and draft gauge. The total air delivered by each duct shall be measured by Pitot tube traverses.

4. The average velocity in the duct shall be determined by velocity readings which are taken in the center of equally divided areas in the cross section of the duct. The number of areas in which velocity readings are to be taken is determined by the size of the duct, based on a maximum size of equally divided areas of 8 inches.

5. Measure air quantities at air inlets and outlets. The volume dampers, pressure controllers, outlets and other devices shall be adjusted so the air volumes will be as shown on the drawings.

6. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

7. Use volume control devices to regulate air quantities only to the extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

8. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

9. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

10. Measure air static pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

11. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

12. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

13. Where modulating dampers are provided, take measurements and balance at extreme conditions.

14. Measure building static pressure and adjust supply, return, and exhaust systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

15. On completion of the test the Owner's TAB Services Contractor shall prepare a typewritten report showing the tested values for inclusion in the Final HVAC and Controls Performance Assurance Report. This report shall include all flows, temperatures, temperature drops, and motors for the plumbing and mechanical systems. The CFM of each supply outlet with corresponding room number shall be included. This report shall include the fan RPM, nameplate data, the voltage and amperage readings of the fan motors, and the fan suction and discharge static pressure.

B. Water Systems

1. Verify systems have been flushed clean, strainers and filters are in place and clean, and that the system has been refilled and vented.

2. Verify that Contractor has installed all temperature and pressure test plugs as required to obtain a thorough flow test.

3. Balance all water flows using pump curve data. Balance all chilled water coils, hot water coils, heat exchangers, cooling towers, boilers, and chillers to specified flow rates.

4. Provide air and water entering and leaving conditions on all equipment.

5. Record pump flow rates, pressures, running amperage, and full load amperage at design flow and shut off conditions.

3.07 SCHEDULES BY OWNER'S TAB SERVICES CONTRACTOR

A. Equipment Requiring Testing, Adjusting, and Balancing:

1. Air Handling Units
2. Fans
3. Air Filters
4. Air Inlets and Outlets
5. Heating System Pumps and Water Flows

6. Direct Digital Control System
7. Building Automation System

B. The Owner's TAB Services Contractor's report shall contain all test, adjustment, and balance data and information on any discrepancies from the specifications or design conditions. The following should be included as a minimum:

1. Title Page
   a. Name of Owner's TAB Services Contractor
   b. Address of Owner's TAB Services Contractor
   c. Telephone Number(s) of Owner's TAB Services Contractor
   d. Project Name
   e. Project Location
   f. Project Architect
   g. Project Engineer
   h. Project Contractor
   i. Project Altitude
   j. Report Data

2. Summary Comments
   a. Final Performance versus Design
   b. Notable characteristics of systems
   c. Identify any instances where the actual control sequence of operation varies from the designed and submitted sequences.
   d. Summary of outdoor and exhaust air flows to indicate amount of building pressurization
   e. Nomenclature used throughout report
   f. Test conditions

3. Instrument List
   a. Instrument Used
   b. Manufacturer
   c. Model Number
   d. Serial Number
   e. Calibration Date

4. Electric Motors
   a. Manufacturer
   b. Model/Frame
   c. HP/BHP
   d. Phase, voltage, amperage, nameplate, actual, no load
   e. RPM
   f. Service factor
   g. Starter size, rating, heater elements
   h. Sheave make, size, bore (as installed and any replacement)
5. V-Belt Drive
   a. Identification/Location
   b. Required driven RPM
   c. Driven sheave diameter and RPM (as installed and any replacement)
   d. Belt size and quantity
   e. Motor sheave diameter and RPM (as installed and any replacement)

6. Air Moving Equipment
   a. Location
   b. Manufacturer
   c. Model Number
   d. Serial Number
   e. Supply air flow - specified and actual
   f. Return air flow - specified and actual
   g. Outside air flow - specified and actual
   h. Total external static pressure – specified and actual
   i. Inlet pressure
   j. Discharge pressure
   k. Sheave - make/size/bore (as installed and any replacement)
   l. Belts - make/size/quantity
   m. Fan RPM

7. Return Air/Outside Air Data
   a. Identification/location
   b. Design air flow
   c. Actual air flow
   d. Design return air flow
   e. Actual return air flow
   f. Design outside air flow
   g. Actual outside air flow
   h. Return air temperature
   i. Outside air temperature

8. Exhaust Fan Data
   a. Location
   b. Manufacturer
   c. Model Number
   d. Serial Number
   e. Air flow - specified and actual
   f. Total external static pressure – specified and actual
   g. Inlet pressure
   h. Discharge pressure
   i. Sheave - make/size/bore (as installed and any replacement)
   j. Belts - make/size/quantity
   k. Fan RPM

9. Duct Traverse
   a. System zone/branch
   b. Duct size
   c. Area
   d. Design velocity
   e. Design air flow
   f. Test velocity
   g. Test air flow
   h. Duct static pressure
   i. Air Temperature
   j. Air correction factor

10. Water Systems
    a. Location
    b. Pump Manufacturer
    c. Pump Model Number
    d. Pump Serial Number
    e. Water flow - specified and actual
    f. Total pressure – specified and actual
    g. Suction pressure
    h. Discharge pressure
    i. Full load amperage at design flow and shut off conditions

11. Vibration Test (by Owner's TAB Services Contractor if required by Owner)
    a. Location of points
        ii. Fan/pump bearing drive end
        iii. Fan/pump bearing opposite end
        iv. Motor bearing drive end
        v. Motor bearing center (if applicable)
        vi. Motor bearing opposite end
        vii. Casing bottom or top
        viii. Casing side
        ix. Duct after flexible connection (discharge)
        x. Duct after flexible connection (suction)

    b. Test readings
        i. Horizontal - velocity and displacement
        ii. Vertical - velocity and displacement
        iii. Axial - velocity and displacement

    c. Normally acceptable readings, velocity and acceleration
    d. Unusual conditions at time of test
    e. Vibration source if non-complying

12. Life Safety Systems

    a. The Contractor shall be required to demonstrate satisfactory operation of Life Safety Controls and Smoke Damper operation to the Test and Balance Agency unless the appropriate Authority Having Jurisdiction requires separate verification by the local Fire Marshal.

***(NOTE to Design Professional:** The Construction Checklists that follow are examples only. Insert Construction Checklists provided by Owner's Performance Assurance Contractor for specified equipment types at the end of this Section.)*

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New Mexico Public School Facilities Authority
1312 Basehart Rd. SE, Suite 200
Albuquerque, NM 87106-4368

Pre-Functional Checklist

AIR HANDLING UNIT: AHU-XXX

PROJECT:

PROJECT NUMBER:

REPORT ID:

EQUIPMENT DESCRIPTION: Air Handling Unit

TAG NO: AHU-XXX

LOCATION:

This Pre-Functional Checklist is used during the Performance Assurance Process to insure the correct equipment is delivered, installed and properly started in preparation for Functional Testing of related building systems. This checklist does not take the place of the Manufacturer's recommended checkout and startup procedures.

This Checklist is divided into 4 Sections and is to be completed by the Contractor in 4 separate steps. When completing each Section, be sure to check and initial EACH line item as being completed. Each Section's items must ALL be checked complete and initialed before the form is submitted to the PAC. Any item which does not apply can be marked as "N/A" in the initial section. If this form is not used for documenting, one of similar rigor shall be used.

This filled-out checklist has been reviewed with the exceptions noted below.

COMMENTS:

SECTION 1 – EQUIPMENT DELIVERY:

The Contractor shall complete Section 1 of this form when the equipment is delivered to the site. The purpose is to record the actual design parameters listed below along with the checklist items as indicated. Should there be any discrepancy between the Actual and the Submitted information, or any item be checked incomplete, the Contractor shall immediately notify the PAC and RFM.

DESIGN PARAMETERS:

Parameter	Designed	Submitted	Actual
Make			
Model			
Serial	#		
Supply Fan			
Air Flow	X,XXX CFM		
OSA Min	X,XXX CFM		
ESP	X.XX in w.g.		
Fan RPM	XXXX RPM		
Motor HP	XX HP		
Voltage	XXXV / XΦ /XXhz		
Return Fan			
Air Flow	X,XXX CFM		
ESP	X.X in w.g.		
Motor HP	X.X HP		
Voltage	XXXV / XΦ /XXhz		
Cooling Coil			
Capacity (Total)	XXX.X MBH		
Capacity (Sensible)	XXX.X MBH		
Entering DBT/WBT	XX/XX °F		
Leaving DBT/WBT	XX/XX °F		
Entering Water	XX °F		
Leaving Water	XX °F		
Heating Coil			
Capacity (Total)	XXX.X MBH		
Capacity (Sensible)	XXX.X MBH		
Entering DBT/WBT	XX/XX °F		
Leaving DBT/WBT	XX/XX °F		
Entering Water	XX °F		
Leaving Water	XX °F		
Filters			
Pre-Filters	Merv XX		
Final Filters	Merv XX		

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	All related submittals approved by A/E
_____	Yes / No	O&M data provided to PAC agent
_____	Yes / No	Equipment thoroughly inspected for physical damage
_____	Yes / No	The air openings are sealed with durable plastic
_____	Yes / No	The water openings are sealed with plastic plugs
_____	Yes / No	Roof curb installed and dimensions verified
_____	Yes / No	Power supply voltage and phase correct

COMMENTS:

The checklist items of SECTION 1 are all successfully completed……___YES ___NO

SECTION 2 – EQUIPMENT INSTALLATION:

The Contractor shall complete Section 2 of this form when the installation of the equipment is being performed. The purpose of this Section is to insure the equipment is installed to the Project Design and the Manufacturer's recommendations. Immediately notify the PAC and RFM should any item be checked incomplete.

CHECKLIST ITEMS:

Initial	Complete	Description
		General Installation Check
_____	Yes / No	All access door latches are operational
_____	Yes / No	All components are present and in the proper sequence
_____	Yes / No	Installation and startup manual in checklist envelope
_____	Yes / No	Unit identification tags are affixed
_____	Yes / No	The heating coil surface area is free of damage
_____	Yes / No	The cooling coil surface area is free of damage
_____	Yes / No	Location and dimensions of pad or curb verified
_____	Yes / No	Proper clearances around pad/curb verified
_____	Yes / No	All shipping and installation materials removed
_____	Yes / No	Maintenance access acceptable for unit and components
_____	Yes / No	Casing condition good: no dents or leaks
_____	Yes / No	Door and door frame gaskets installed access doors close tightly
_____	Yes / No	Vibration isolation equipment installed & released from shipping locks
_____	Yes / No	Seismic restraints installed at fan(s) and not short circuiting
_____	Yes / No	Filters installed and filter frames are gasketed
_____	Yes / No	VFDs installed in NEMA 3R enclosures
		Valves, Piping and Coils Check (Immediately around unit. See full piping checklist)
_____	Yes / No	Pipe fittings complete and pipes properly supported
_____	Yes / No	Piping properly labeled
_____	Yes / No	Piping properly insulated
_____	Yes / No	Strainers in place and clean
_____	Yes / No	Piping system properly flushed
_____	Yes / No	No leaking apparent around fittings
_____	Yes / No	All coils are clean and fins are in good condition
_____	Yes / No	All cond. drain pans clean and slope to drain, per spec
_____	Yes / No	Dedicated roof receptor for condensate
_____	Yes / No	Valves properly labeled

Initial	Complete	Description
_____	Yes / No	Valves installed in proper direction
_____	Yes / No	Flanges or unions installed for coil removal
_____	Yes / No	Air vents for each coil installed
_____	Yes / No	Coil drain valves for each coil installed
_____	Yes / No	P/T plugs installed per drawings
_____	Yes / No	Instrumentation installed according to drawings and details
		Fans and Dampers Check
_____	Yes / No	Supply fan and motor alignment correct
_____	Yes / No	Supply fan belt tension and condition good
_____	Yes / No	Supply fan protective shrouds for belts in place and secure
_____	Yes / No	Supply fan area clean
_____	Yes / No	Supply fan and motor properly lubricated
_____	Yes / No	Return fan and motor aligned
_____	Yes / No	Return fan belt tension and condition good
_____	Yes / No	Return fan protective shrouds for belts in place and secure
_____	Yes / No	Return fan area clean
_____	Yes / No	Return fan and motor lube lines installed and lubed
_____	Yes / No	All dampers close tightly
_____	Yes / No	All damper linkages have minimum play
_____	Yes / No	Smoke and fire dampers installed properly per contract documents (proper location, access doors, appropriate ratings verified)
_____	Yes / No	Smoke and fire dampers are open
		Ductwork Check (Immediately around unit. See full air distribution checklist)
_____	Yes / No	Sound attenuators installed
_____	Yes / No	Flex between duct and unit installed and in good condition
_____	Yes / No	Insulation installed per specifications
_____	Yes / No	Duct joint sealant properly installed
_____	Yes / No	No apparent severe duct restrictions
_____	Yes / No	OSA intake located away from pollutant sources and exhaust outlets
		Electrical Check
_____	Yes / No	Permanent power verified
_____	Yes / No	Premium efficiency motors verified

Initial	Complete	Description
_____	Yes / No	Power disconnects in place and labeled
_____	Yes / No	All electric connections tight (Torque setting _____)
_____	Yes / No	Proper wire type and size confirmed (Wire Type _____ Size _____)
_____	Yes / No	Proper grounding installed for components and unit
_____	Yes / No	Point to Point, Voltage Checks, and Phase Rotation Verified
_____	Yes / No	Power outlet provided at unit
_____	Yes / No	Starter overload breakers installed and correct size
_____	Yes / No	VFD powered (wired to controlled equipment)
_____	Yes / No	VFD interlocked to control system
_____	Yes / No	Drive location not subject to excessive temperatures
_____	Yes / No	Drive location not subject to excessive moisture or dirt
_____	Yes / No	Drive size matches motor size
_____	Yes / No	Internal setting designating the model is correct
_____	Yes / No	Input of motor FLA represents 100% to 105% of motor FLA rating
_____	Yes / No	Appropriate Volts vs Hz curve is being used
_____	Yes / No	Upper frequency limit set at 100%, unless explained otherwise
		Controls Check
_____	Yes / No	Control panel accessible and properly labeled
_____	Yes / No	Temperature sensors properly located, secure and calibrated
_____	Yes / No	Humidity sensors properly located, secure and calibrated
_____	Yes / No	Filter PD measuring device installed and calibrated across filters
_____	Yes / No	CO2 sensors properly located, secure and calibrated
_____	Yes / No	Duct static pressure sensor properly located, secure and calibrated
_____	Yes / No	Airflow monitoring stations properly located, secure and calibrated
_____	Yes / No	Smoke detectors installed in proper location and functioning
_____	Yes / No	Damper actuators installed and calibrated
_____	Yes / No	Safety items installed (high static pressure, etc)
_____	Yes / No	All control devices and wiring complete
_____	Yes / No	Pilot lights are functioning
_____	Yes / No	Control system interlocks connected and functional

COMMENTS:

The checklist items of SECTION 2 are all successfully completed……___YES ___NO

SECTION 3 – EQUIPMENT START-UP:

The Contractor shall complete Section 3 of this form during the Start-up procedures for the equipment. The purpose of this Section is to document that proper start-up and check-out procedures were completed and documented.

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	PAC and RFM has been notified of start-up
_____	Yes / No	Manufacturers Rep on site for start-up
_____	Yes / No	Air flows and temperatures measured and recorded
_____	Yes / No	Water flows and temperatures measured and recorded
_____	Yes / No	Motors supply voltage balanced and within normal limits
_____	Yes / No	Belts properly aligned and correct tension
_____	Yes / No	Control system operational
_____	Yes / No	All proper operational sequences confirmed
_____	Yes / No	Final filters installed prior to balancing
_____	Yes / No	Extra materials turned over to owner - belts, filters, access door gaskets
_____	Yes / No	Startup report completed **(attach report)**

COMMENTS:

The checklist items of SECTION 3 are all successfully completed……..___YES ___NO

SECTION 4 – NOTIFICATION FOR TESTING:

This piece of equipment is properly installed, has been properly started up and is operational and ready for Functional Performance Testing.

COMMENTS:

ALL LISTED MUST SIGN AND DATE

RESPONSIBLE PARTY	VERIFIED BY (Name)	COMPANY	DATE
Mechanical Contractor			
General Contractor			
Controls Contractor			
PAC Consultant			
NMPSFA RFM			
Manufacturer Rep.			

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New Mexico Public School Facilities Authority
1312 Basehart Rd. SE, Suite 200
Albuquerque, NM 87106-4368

Pre-Functional Checklist

EXHAUST FAN EF-XXX

PROJECT: *(Project Name)*

PROJECT NUMBER: *(Project Number)*

REPORT ID: *(Report ID Number)*

EQUIPMENT DESCRIPTION: Exhaust Fan

TAG NO: *(Equipment Tag #)*

LOCATION: *(Roof)*

AREA SERVED: *(General or Specific Area)*

This Pre-Functional Checklist is used during the Performance Assurance Process to insure the correct equipment is delivered, installed and properly started in preparation for Functional Testing of related building systems. This checklist does not take the place of the Manufacturer's recommended checkout and startup procedures.

This Checklist is divided into 4 Sections and is to be completed by the Contractor in 4 separate steps. When completing each Section, be sure to check and initial EACH line item as being completed. Each Section's items must ALL be checked complete and initialed before the form is submitted to the PAC. Any item which does not apply can be marked as "N/A" in the initial section. If this form is not used for documenting, one of similar rigor shall be used.

This filled-out checklist has been reviewed with the exceptions noted below.

COMMENTS:

SECTION 1 – EQUIPMENT DELIVERY:

The Contractor shall complete Section 1 of this form when the equipment is delivered to the site. The purpose is to record the actual design parameters listed below along with the checklist items as indicated. Should there be any discrepancy between the Actual and the Submitted information, or any item be checked incomplete, the Contractor shall immediately notify the PAC and RFM.

DESIGN PARAMETERS:

Parameter	Designed	Submitted	Actual
Make	*(Make)*		
Model	*(Model Number)*		
Serial	*(Serial Number)*		
Fan Air Flow	*(0000)* cfm		
ESP	*(00.0)* in. wg		
Motor Size	*(00)* HP		
RPM	*(0000)* RPM		
Voltage	*(000)* V / *(0)*Φ / *(00)* Hz		

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	All related submittals approved by A/E
_____	Yes / No	O&M data provided to PAC agent
_____	Yes / No	Equipment thoroughly inspected for physical damage
_____	Yes / No	The air openings are sealed with durable plastic
_____	Yes / No	Power supply voltage and phase correct

COMMENTS:

The checklist items of SECTION 1 are all successfully completed……___YES ___NO

SECTION 2 – EQUIPMENT INSTALLATION:

The Contractor shall complete Section 2 of this form when the installation of the equipment is being performed. The purpose of this Section is to insure the equipment is installed to the Project Design and the Manufacturer's recommendations. Immediately notify the PAC and RFM should any item be checked incomplete.

CHECKLIST ITEMS:

Initial	Complete	Description
		General Installation Check
	Yes / No	Permanent labels affixed
	Yes / No	Casing condition good: no dents, leaks, door gaskets installed
	Yes / No	Mountings checked and shipping bolts removed
	Yes / No	Vibration isolators installed
	Yes / No	Equipment guards installed
	Yes / No	Pulleys aligned
	Yes / No	Belt tension correct
	Yes / No	Plenums clear of debris
	Yes / No	Fans rotate freely
	Yes / No	Backdraft dampers installed, per drawings, and operate freely
	Yes / No	Duct system complete
	Yes / No	Fan and motor alignment correct
	Yes / No	Fan protective shrouds for belts in place and secure
	Yes / No	Fan area clean
	Yes / No	Fan and motor properly lubricated
	Yes / No	All dampers close tightly
	Yes / No	Speed controller installed to achieve schedule CFM and E.S.P.
		Electrical Check
	Yes / No	Permanent power verified
	Yes / No	Power disconnects in place and labeled
	Yes / No	All electric connections tight
	Yes / No	Proper grounding installed for components and unit
		Controls Check
	Yes / No	All control devices and wiring complete
	Yes / No	Control system interlocks connected and functional
	Yes / No	Communication with central system functioning

COMMENTS:

The checklist items of SECTION 2 are all successfully completed……___YES ___NO

SECTION 3 – EQUIPMENT START-UP:

The Contractor shall complete Section 3 of this form during the Start-up procedures for the equipment. The purpose of this Section is to document that proper start-up and check-out procedures were completed and documented.

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	PAC and RFM have been notified of start-up
_____	Yes / No	Startup report completed **(attach report)**

COMMENTS:

The checklist items of SECTION 3 are all successfully completed……___YES ___NO

SECTION 4 – NOTIFICATION FOR TESTING:

This piece of equipment is properly installed, has been properly started up and is operational and ready for performance testing.

ALL LISTED MUST SIGN AND DATE

RESPONSIBLE PARTY	VERIFIED BY (Name)	COMPANY	DATE
Mechanical Contractor			
General Contractor			
Controls Contractor			
PAC Consultant			
NMPSFA RFM			
Manufacturer Rep.			

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New Mexico Public School Facilities Authority
1312 Basehart Rd. SE, Suite 200
Albuquerque, NM 87106-4368

Pre-Functional Checklist

Variable Frequency Drive: VFD-XXX

PROJECT:

PROJECT NUMBER:

REPORT ID:

EQUIPMENT DESCRIPTION: Variable Frequency Drive

TAG NO: VFD-00

LOCATION:

EQUIPMENT SERVED:

This Pre-Functional Checklist is used during the Performance Assurance Process to insure the correct equipment is delivered, installed and properly started in preparation for Functional Testing of related building systems. This checklist does not take the place of the Manufacturer's recommended checkout and startup procedures.

This Checklist is divided into 6 Sections and is to be completed by the Contractor in 6 separate steps. When completing each Section, be sure to check and initial EACH line item as being completed. Each Section's items must ALL be checked complete and initialed before the form is submitted to the PAC Authority. Any item which does not apply can be marked as "N/A" in the initial section. **If this form is not used for documenting, one approved by NMPSFA of similar rigor shall be used.**

This filled-out checklist has been reviewed with the exceptions noted below.

COMMENTS:

SECTION 1 – **EQUIPMENT DELIVERY:**

VFD Information					
Make				**Model Number**	
Serial Number				**Service Area**	
Volts/Phase				**Function**	
Motor HP		**Motor Amps**		**Drive Max Amps**	
Comments:					

Associated Checklists					
Cooling Tower	☐	**Air Handling Unit**	☐	**Exhaust Fan**	☐
Pump	☐	**BAS**	☐	**Other**	☐
Comments:					

Requested documentation submitted	Rec'd	Comments
Manufacturer's cut sheets	☐	
Performance data (pump curves, coil data, etc.)	☐	
Installation and startup manual and plan	☐	
O&M manuals	☐	
Factory test results	☐	
Sequences and control strategies	☐	
Warranty Certificate	☐	
Comments:		

The checklist items of SECTION 1 are all successfully completed…….___YES ___NO

SECTION 2 – INSTALLATION CHECKS:

Installation Checks			
Check if Acceptable; Provide comment if unacceptable		**NA**	**Comment**
General			
Installation per manufacturer's requirements	☐	☐	
Permanent label affixed and UL stamp approved	☐	☐	
Drive location not subject to excessive moisture or dirt	☐	☐	
Drive location not subject to excessive temperatures	☐	☐	
Appropriate Volts vs. Hz curve is being used	☐	☐	
Drive size matches motor size	☐	☐	
Drive independently mounted	☐	☐	
Cooling air flow path clean and unobstructed	☐	☐	
VFD interlocked to control system	☐	☐	
Unit is programmed with full written programming record on site	☐	☐	
Accel time set to _____ and Decel time set to _____	☐	☐	
Coordinated with BAS for all interface ranges and signal isolation	☐	☐	
Restart on Power Failure parameter set to auto	☐	☐	
Drive min and max speed set to _____ Hz min and 60 Hz max	☐	☐	
Security settings set per owner direction and Password documented for owner	☐	☐	
Drive response to loss of signal set to _____	☐	☐	
Output pulse resolution set to _____ MHz. (This is coordinated with the application to minimize audible noise and coordinated with driven bearing allowances.)	☐	☐	
Input of motor FLA represents 100% to 105% of motor FLA rating	☐	☐	
Upper frequency limit set at 100%, unless explained otherwise	☐	☐	
Electrical and Controls			
Power disconnect is located within site of the unit it controls and labeled	☐	☐	
All electric connections tight	☐	☐	
Grounding installed for components and unit	☐	☐	
Safeties installed and operational	☐	☐	
Overload breakers installed and correct size	☐	☐	
All control devices and wiring complete	☐	☐	
Control system interlocks connected and functional	☐	☐	
Installation per manufacturer's instructions	☐	☐	
Rotates in the correct direction (for VFD, check Inverter and BYPASS modes)	☐	☐	
Checked the input voltage with drive disconnected	☐	☐	

The checklist items of SECTION 2 are all successfully completed…….___YES ___NO

SECTION 3 – OPERATIONAL CHECKS:

Operational Checks			
Check if Acceptable; Provide comment if unacceptable		**NA**	**Comment**
Operation checked in HAND, OFF, and AUTO. As applicable operation also checked in BYPASS. Where applicable, ensure safeties are active in all modes	☐	☐	
Specified sequences of operation and operating schedules have been provided with all variations documented	☐	☐	
Specified point-to-point checks have been completed and documentation record submitted for this system	☐	☐	
Start-up complete	☐	☐	

The checklist items of SECTION 3 are all successfully completed……___YES ___NO

SECTION 4 – SENSOR and ACTUATOR CALIBRATION:

Sensor and Actuator Calibration

All field-installed sensors and gages, and all actuators (dampers and valves) on this piece of equipment shall be calibrated in accordance with Specification Section 01810. All test instruments shall have had a certified calibration within the last 12 months: **Y/N_____.** Sensors installed *in* the unit at the factory with calibration certification provided need not be field calibrated.

Sensor or Actuator Tag & Location	**Location OK**	***1st* Gage or BAS Value**	**Instrument Measured Value**	***Final* Gage or BAS Value**	**Pass Y / N**

Comments:

The checklist items of SECTION 3 are all successfully completed……___YES ___NO

SECTION 5 – EQUIPMENT START-UP:

The Contractor shall complete Section 3 of this form during the Start-up procedures for the equipment. The purpose of this Section is to document that proper start-up and check-out procedures were completed and documented per the Manufacturer's Start-Up Proceedure. **Start-Up is to by the Factory Representative, or a designated, Factory Trained Technician.**

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	PAC has been notified of start-up
_____	Yes / No	Manufacturer's Startup report completed with this checklist attached

COMMENTS:

The checklist items of SECTION 3 are all successfully completed……___YES ___NO

SECTION 6 – NOTIFICATION FOR TESTING:

This piece of equipment is properly installed, has been properly started up and is operational and ready for performance testing.

ALL LISTED MUST SIGN AND DATE

RESPONSIBLE PARTY	VERIFIED BY (Name)	COMPANY	DATE
Factory Rep.			
General Contractor			
Controls Contractor			
Plumbing Contractor			
Electrical Contractor			
PAC Contractor			
NMPSFA RFM			
End Of Checklist			

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New Mexico Public School Facilities Authority
1312 Basehart Rd. SE, Suite 200
Albuquerque, NM 87106-4368

PRE-FUNCTIONAL CHECKLIST
HHW / CHW / DHW / SUB

PROJECT NAME:

PROJECT NUMBER:

REPORT ID:

EQUIPMENT DESCRIPTION: PUMP:

TAG NO:

LOCATION:

AREA SERVED:

This Construction Checklist is used during the Performance Assurance Process to insure the correct equipment is delivered, installed and properly started in preparation for Functional Testing of related building systems. *This checklist does not take the place of the Manufacturer's recommended checkout and startup procedures*.

This Checklist is divided into 4 Sections and is to be completed by the Contractor in 4 separate steps. When completing each Section, be sure to check and initial EACH line item as being completed. Each Section's items must ALL be checked complete and initialed before the form is submitted to the PAC. Any item which does not apply can be marked as "N/A" in the initial section. **If this form is not used for documenting, one approved by NMPSFA of similar rigor shall be used.**

This filled-out checklist has been reviewed with the exceptions noted below.

COMMENTS:

SECTION 1 – EQUIPMENT DELIVERY:

The Contractor shall complete Section 1 of this form when the equipment is delivered to the site. The purpose is to record the actual design parameters listed below along with the checklist items as indicated. Should there be any discrepancy between the Actual and the Submitted information, or any item be checked incomplete, the Contractor shall immediately notify the PAC and RFM.

PUMP PURPOSE: HHW ☐ **CHW** ☐ **DHW** ☐ **OTHER** ☐

PUMP ID: _____

DESIGN PARAMETERS:

Parameter	Designed	Submitted	Actual
Make			
Model			
Serial			
Flow	X GPM		
Head	X ft		
Motor Size	XX HP		
Voltage	XXXV / XΦ / XXHz		

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	All related submittals approved by A/E
_____	Yes / No	O&M data provided to PAC Contractor
_____	Yes / No	Equipment thoroughly inspected for physical damage
_____	Yes / No	Power supply voltage and phase correct

COMMENTS:

The checklist items of SECTION 1 are all successfully completed……___YES ___NO

SECTION 2 – EQUIPMENT INSTALLATION:

The Contractor shall complete Section 2 of this form when the installation of the equipment is being performed. The purpose of this Section is to insure the equipment is installed to the Project Design and the Manufacturer's recommendations. Immediately notify the PAC and RFM should any item be checked incomplete.

CHECKLIST ITEMS:

Initial	Complete	Description
		General Installation Check
_____	Yes / No	Label permanently affixed
_____	Yes / No	Installation and startup manual in checklist envelope
_____	Yes / No	Proper clearances around pad/curb verified
_____	Yes / No	Maintenance access acceptable for unit and components
		Piping Check (Immediately around pump. See full piping checklist)
_____	Yes / No	Pipe fittings complete and pipes properly supported
_____	Yes / No	Piping properly labeled
_____	Yes / No	Piping properly insulated
_____	Yes / No	Strainers in place and clean
_____	Yes / No	Piping system properly flushed
_____	Yes / No	No leaking apparent around fittings
_____	Yes / No	Valves properly labeled
_____	Yes / No	Valves installed in proper direction
_____	Yes / No	Instrumentation installed according to drawings and details
		Electrical Check
_____	Yes / No	Permanent power verified
_____	Yes / No	Premium efficiency motors verified
_____	Yes / No	Power disconnects in place and labeled
_____	Yes / No	All electric connections tight
_____	Yes / No	Proper grounding installed for components and unit
_____	Yes / No	Power outlet provided at unit
_____	Yes / No	Starter overload breakers installed and correct size
_____	Yes / No	VFD powered (wired to controlled equipment)
_____	Yes / No	VFD interlocked to control system
_____	Yes / No	Drive location not subject to excessive temperatures
_____	Yes / No	Drive location not subject to excessive moisture or dirt
_____	Yes / No	Drive size matches motor size
_____	Yes / No	Internal setting designating the model is correct
_____	Yes / No	Input of motor FLA represents 100% to 105% of motor FLA rating

Initial	Complete	Description
_____	Yes / No	Appropriate Volts vs Hz curve is being used
_____	Yes / No	Upper frequency limit set at 100%, unless explained otherwise
		Controls Check
_____	Yes / No	Communication with central system functioning

COMMENTS:

The checklist items of SECTION 2 are all successfully completed……___YES ___NO

SECTION 3 – EQUIPMENT START-UP:

The Contractor shall complete Section 3 of this form during the Start-up procedures for the equipment. The purpose of this Section is to document that proper start-up and check-out procedures were completed and documented.

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	PAC and RFM has been notified of start-up
_____	Yes / No	Startup report completed **(attach report)**

COMMENTS:

The checklist items of SECTION 3 are all successfully completed……___YES ___NO

SECTION 4 – NOTIFICATION FOR TESTING:

This piece of equipment is properly installed, has been properly started up and is operational and ready for performance testing.

ALL LISTED MUST SIGN AND DATE

RESPONSIBLE PARTY	VERIFIED BY (Name)	COMPANY	DATE
Mechanical Contractor			
General Contractor			
Controls Contractor			
Plumbing Contractor			
Electrical Contractor			
PAC Consultant			
NMPSFA RFM			

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New Mexico Public School Facilities Authority
1312 Basehart Rd. SE, Suite 200
Albuquerque, NM 87106-4368

Pre-Functional Checklist

CHILLER CH-00

PROJECT:

PROJECT NUMBER:

REPORT ID:

EQUIPMENT DESCRIPTION: Chiller

TAG NO: CH-00

LOCATION:

AREA SERVED:

This Pre-Functional Checklist is used during the Performance Assurance Process to insure the correct equipment is delivered, installed and properly started in preparation for Functional Testing of related building systems. This checklist does not take the place of the Manufacturer's recommended checkout and startup procedures.

This Checklist is divided into 5 Sections and is to be completed by the Contractor in 5 separate steps. When completing each Section, be sure to check and initial EACH line item as being completed. Each Section's items must ALL be checked complete and initialed before the form is submitted to the PAC Authority. Any item which does not apply can be marked as "N/A" in the initial section. **If this form is not used for documenting, one approved by NMPSFA of similar rigor shall be used.**

This filled-out checklist has been reviewed with the exceptions noted below.

COMMENTS:

SECTION 1 – EQUIPMENT DELIVERY:

Chiller Information							
Make		**Model Number**					
Serial Number		**Capacity**		**GPM**			
Volts/Phase		**Refrigerant**		**Charge**			
Comments:							

Associated Checklists					
Condenser Water Pump	☐	**Chilled Water Piping**	☐	**Cooling Tower**	☐
Condenser Water Piping	☐	**Chilled Water Pump**	☐	**BAS**	☐
Comments:					

Requested documentation submitted	Rec'd	Comments
Manufacturer's cut sheets	☐	
Performance data (pump curves, coil data, etc.)	☐	
Installation and startup manual and plan	☐	
O&M manuals	☐	
Factory test results	☐	
Sequences and control strategies	☐	
Warranty Certificate	☐	
Comments:		

The checklist items of SECTION 1 are all successfully completed…….___YES ___NO

SECTION 2 – INSTALLATION CHECKS:

Installation Checks			
Check if Acceptable; Provide comment if unacceptable		**NA**	**Comment**
General			
General appearance good, no apparent damage	☐	☐	
Proper vibration isolators installed and adjusted	☐	☐	
Seismic restraints in place	☐	☐	
Pipe fittings and accessories complete	☐	☐	
Hydronic system flushing complete and strainers cleaned	☐	☐	
Cooling tower or condenser system checked out	☐	☐	
Evaporator air vent provided	☐	☐	
Water cooled condenser air vent provided	☐	☐	
Refrigerant relief pipe extended to outside	☐	☐	
Test plugs (P/T) installed near all control sensors and as per spec	☐	☐	
Flow switch installed as required	☐	☐	
Proper refrigerant level	☐	☐	
Proper oil level	☐	☐	
Purge unit installed, if specified	☐	☐	
Equipment labels affixed	☐	☐	
Oil heater installed properly	☐	☐	
Oil filter clean	☐	☐	
No leaking apparent	☐	☐	
Piping			
Piping installation checked against the drawings and all devices gages and appurtenances are in place	☐	☐	
Piping supported independently of the chiller	☐	☐	
Piping type and flow direction labeled on piping	☐	☐	
Isolation valves, balancing valves and piping specialties installed	☐	☐	
System flushing complete and strainers cleaned	☐	☐	
Hydronic system flushing complete and strainers cleaned	☐	☐	
Electrical and Controls			
Power disconnect is located within site of the unit it controls and labeled	☐	☐	
All electric connections tight	☐	☐	
Grounding installed for components and unit	☐	☐	
Safeties installed and operational	☐	☐	
Starter overload breakers installed and correct size	☐	☐	
All control devices and wiring complete	☐	☐	
Control system interlocks connected and functional	☐	☐	
Size of overcurrent heater in motor starter correct (where applicable)	☐	☐	
HOA Switch installed per manufacturer's instructions (if applicable)	☐	☐	
Operation of HOA switch checked in all positions	☐	☐	
Proper safeties in control when HOA switch in Hand position	☐	☐	
Sensors and Gages			
Temperature, pressure and flow gages and sensors installed	☐	☐	

Installation Checks			
Check if Acceptable; Provide comment if unacceptable		**NA**	**Comment**
Piping gages, BAS and associated panel temperature and pressure readouts match	☐	☐	
TAB			
Installation of system and balancing devices allowed balancing to be completed following specified NEBB or AABC procedures and contract documents	☐	☐	

Operational Checks			
Check if Acceptable; Provide comment if unacceptable		**NA**	**Comment**
Measure line to line voltage phase imbalance for compressor: (%Imbalance = 100 x (avg. - lowest) / avg.) Record imbalance of compressor. Imbalance less than 2%?	☐	☐	
Record full load running amps for compressor. _____rated FL amps x _____srvc factor = _____ (Max amps). Running less than max?	☐	☐	
No unusual noise and vibration when running	☐	☐	
Compressor interlocking with oil pressure	☐	☐	
Adequate oil pressure when compressor shaft is turning	☐	☐	
Pre-rotation vane closed before compressor reaches full speed	☐	☐	
Pre-rotation vane steady when load changes	☐	☐	
Specified sequences of operation and operating schedules have been implemented with all variations documented	☐	☐	
Specified point-to-point checks have been completed and documentation record submitted for this system	☐	☐	
Startup report completed with this checklist attached. (Includes full listing of all internal settings with notes as to which settings are BAS controlled or monitored and which are integral	☐	☐	
Startup report includes written certification from chiller manufacturer that all specified features, controls and safeties have been installed and are functioning properly and that the installation and application comply with the manufacturer's recommendations	☐	☐	
Piping gages, BAS and chiller panel temperature and pressure readouts match (see calibration section below)	☐	☐	

The checklist items of SECTION 2 are all successfully completed…….___YES ___NO

SECTION 3 – SENSOR and ACTUATOR CALIBRATION:

Sensor and Actuator Calibration

All field-installed sensors and gages, and all actuators (dampers and valves) on this piece of equipment shall be calibrated in accordance with Specification Section 01810. All test instruments shall have had a certified calibration within the last 12 months: **Y/N_____.** Sensors installed *in* the unit at the factory with calibration certification provided need not be field calibrated.

Sensor or Actuator Tag & Location	Location OK	*1st* Gage or BAS Value	Instrument Measured Value	*Final* Gage or BAS Value	Pass Y / N

Comments:

The checklist items of SECTION 3 are all successfully completed……___YES ___NO

SECTION 4 – EQUIPMENT START-UP:

The Contractor shall complete Section 3 of this form during the Start-up procedures for the equipment. The purpose of this Section is to document that proper start-up and check-out procedures were completed and documented per the Manufacturer's Start-Up Proceedure. **Start-Up is to by the Factory Representative, or a designated, Factory Trained Technician.**

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	Cx Authority has been notified of start-up
_____	Yes / No	Startup report completed with this checklist attached

COMMENTS:

The checklist items of SECTION 3 are all successfully completed……___YES ___NO

SECTION 5 – NOTIFICATION FOR TESTING:

This piece of equipment is properly installed, has been properly started up and is operational and ready for performance testing.

ALL LISTED MUST SIGN AND DATE

RESPONSIBLE PARTY	VERIFIED BY (Name)	COMPANY	DATE
Factory Rep.			
General Contractor			
Controls Contractor			
Plumbing Contractor			
Electrical Contractor			
PAC Contractor			
NMPSFA RFM			

New Mexico Public School Facilities Authority
1312 Basehart Rd. SE, Suite 200
Albuquerque, NM 87106-4368

Pre-Functional Checklist

BOILER: BO-XXX

PROJECT:

PROJECT NUMBER:

REPORT ID:

EQUIPMENT DESCRIPTION: Boiler

TAG NO: BO-XXX

LOCATION:

This Pre-Functional Checklist is used during the Performance Assurance Process to insure the correct equipment is delivered, installed and properly started in preparation for Functional Testing of related building systems. This checklist does not take the place of the Manufacturer's recommended checkout and startup procedures.

This Checklist is divided into 7 Sections and is to be completed by the Contractor in 7 separate steps. When completing each Section, be sure to check and initial EACH line item as being completed. Each Section's items must ALL be checked complete and initialed before the form is submitted to the PAC. Any item which does not apply can be marked as "N/A" in the initial section. **If this form is not used for documenting, one approved by NMPSFA of similar rigor shall be used.**

This filled-out checklist has been reviewed with the exceptions noted below.

COMMENTS:

SECTION 1 – EQUIPMENT DELIVERY

Make				**Model Number**	
Serial Number				**Service Area**	
Volts/Phase				**BTU**	
Motor HP		**Motor Amps**		**Drive Max Amps**	
Comments:					

The checklist items of SECTION 1 are all successfully completed…….___YES ___NO

SECTION 2 - REQUESTED DOCUMENTATION SUBMITTED

Check **Equip Tag->**	Boiler BO-XXX	**Contr.**
Manufacturer's cut sheets		
Performance data (fan curves, coil data, etc.)		
Installation and startup manual and plan		
Sequences and control strategies		
Point-to-Point checklist		
O&M manuals		

The checklist items of SECTION 2 are all successfully completed…….___YES ___NO

SECTION 3 – INSTALLATION CHECKS:

Check **Equip Tag->**	Int.
General Installation	
General appearance good, no apparent damage	
Site sufficiently clean for testing	
Equipment labels affixed	
Tube pulling, and access door space adequate	
Required seismic restraints in place	
Flue completely installed and sloped properly	
Flue lagging installed properly	
Combustion air supply complete	
System filled	
Thermometers installed	
Pressure gages installed	
P/T plugs installed as per drawings	
Multiple boiler interlocks completed and functional	
Aqueous ammonia system complete	

Check	Equip Tag->	Int.
Gas piping installed and tested (supply is at proper pressure)		
Hydronic piping complete, including blow-down system, condensate system, makeup water piping and safety reliefs		
Hydronic system flushing complete and strainers cleaned		
Steam piping complete, including steam condenser, strainers, and safety reliefs		
Isolation valves and balancing valves installed		
Cooling Tower installation complete, including pumps and strainers.		
Pipe fittings and accessories complete		
Test ports installed near all control sensors and per spec		
Flow switch installed as required		
Flow meters installed as required		
Piping type and flow direction labeled on piping		
Chemical treatment system and/or plan installed		
ASME pressure vessel data sheet or certification tag posted and inspection complete for each expansion tank		
Expansion tanks verified to not be air bound and system completely full of water		
Operating Instructions Posted at unit; automatic, manual, emergency		
Ammonia system piping complete		
Air vents and bleeds at high points of systems functional		
Power to unit and disconnect installed in close proximity		
All electrical components grounded		
Sensors calibrated (see below)		
Control system interlocks hooked up and functional		
All control devices, pneumatic tubing and wiring complete		
Motorized valves, dampers and float switches functional		
Fire / smoke sensing, alarm, and suppression components functional		
Static Startup checklist completed with this checklist attached		
Startup report includes written certification from boiler manufacturer that all specified features, controls and safeties have been installed and are functioning properly and that the installation and application comply with the manufacturer's recommendations.		
Safeties installed and safe operating ranges for this equipment provided to the commissioning agent		
Steam piping, pressure regulators, and isolation valves pre-functional checklists completed		
Boiler Pre-start Checklist complete-Heery form **B-02 (must be completed before continuing)**		
Boiler Boil-Out complete		

The checklist items of SECTION 3 are all successfully completed……___YES ___NO

SECTION 4 – OPERATIONAL CHECKS:

(These augment mfr's list. This is not the functional performance testing.)

Check **Equip Tag->**	Int.
Boiler safeties energized and tested	
Startup report includes optimal and actual percent CO_2, CO, O_2, NOX, VOC, Ammonia, stack temperature, and combustion efficiency	
Specified sequences of operation and operating schedules have been implemented with all variations documented	
Specified point-to-point checks have been completed and documentation record submitted for this system	
Start-up report includes all operating temperatures and pressures for all modes of operation.	
Boiler Capacity Recorded	
Fuel consumption rate recorded	

The checklist items of SECTION 4 are all successfully completed……___YES ___NO

SECTION 5 – SENSOR and ACTUATOR CALIBRATION:

All installed temperature, relative humidity, emissions, and pressure sensors & gages - all actuators (dampers and valves) on the boiler equipment shall be calibrated using the methods and tolerances given in the specification / design documentations. All test instruments shall have had a certified calibration within the last 6 months: Y/N_____. All sensors including those installed at the factory shall be field calibrated.

Sensor or Actuator Identification	Location OK	Test instrument Measured Value	Local gage / meter Value	Preliminary BMS Display Value	Final BMS Display Value	BMS Display Offset Used	% of Accuracy Throughout Operational Range	Pass Y/N?

Gage reading = reading of the permanent gage on the equipment. BAS = building automation system. Test instrument = Certified Calibrated test equipment. Visual = actual observation. The Contractor's own sensor check-out sheets may be used in lieu of the above, if the same recording fields are included and the referenced procedures are followed.

The checklist items of SECTION 5 are all successfully completed……___YES ___NO

SECTION 6 – EQUIPMENT START-UP:

The Contractor shall complete Section 3 of this form during the Start-up procedures for the equipment. The purpose of this Section is to document that proper start-up and check-out procedures were completed and documented per the Manufacturer's Start-Up Proceedure. **Start-Up is to by the Factory Representative, or a designated, Factory Trained Technician.**

CHECKLIST ITEMS:

Initial	Complete	Description
_____	Yes / No	PAC has been notified of start-up
_____	Yes / No	Manufacturer's Startup report completed with this checklist attached

COMMENTS:

The checklist items of SECTION 6 are all successfully completed……___YES ___NO

SECTION 7 – NOTIFICATION FOR TESTING:

This piece of equipment is properly installed, has been properly started up and is operational and ready for performance testing.

ALL LISTED MUST SIGN AND DATE

RESPONSIBLE PARTY	VERIFIED BY (Name)	COMPANY	DATE
Factory Rep.			
General Contractor			
Controls Contractor			
Plumbing Contractor			
Electrical Contractor			
PAC Contractor			
NMPSFA RFM			

-- END OF CHECKLIST --

END OF SECTION 23 0593