

<p>Standard Operating Procedure</p> <p>Start-Up Procedure & Verification of Packaged Air Conditioning Units</p>	<p>SOP No.</p> <p>8.030</p>
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DCR No.: 05005
Revision No.: 1

Effective: 6-14-99
Supersedes: 6-14-99
Revision Date: 03-03-2005
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1 Purpose

- 1.1 Provide a standard procedure for start-up and commissioning of HVAC equipment.
- 1.2 Provide a standard procedure for coordinating selection, receiving, check out, and acceptance of new equipment.

2 Scope

- 2.1 This procedure applies to (but is not limited to) Package Air Conditioning units (constant volume), Package Cooling only Units (constant volume), Package Heating only Units (constant volume), Package Heat Cool Units (constant volume), and Package Variable Air Volume Units.

3 Responsibility

- 3.1 Project Managers have overall responsibility for new equipment from procurement to start-up. To assure optimum selection of equipment and smooth commissioning, the Project Manager is responsible for coordinating the following activities:
 - 3.1.1 Review of customer and specific job specifications.
 - 3.1.2 Review of equipment selected with Service prior to ordering. Assure equipment is on approved list.
 - 3.1.3 Review drawings, assure drawing schedules and equipment details are correct.
 - 3.1.4 Coordinate delivery and commissions schedule with all team members including (but not limited to): Site Foremen, Balance and Service (start-up), Customer, General Contractor, and Safety (as needed).
 - 3.1.4.1 In most cases, Start-up should be scheduled a month in advance.

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3.1.4.2 If exact date is known, Service should be notified with estimated time frame.

3.1.4.3 Communicate specific requirements to all team players in writing and verbally.

3.1.4.4 Provide appropriate job number(s) to team members.

3.2 Therma Service/Start-up has responsibility for the following activities:

3.2.1 Therma will provide a qualified Service Mechanic to perform equipment start-up.

3.2.2 The start-up technician will perform the start-up tasks as specified in the commissioning Standard Operating Procedure for that equipment.

3.2.3 Service will provide estimated time required to Project Manager (PM) prior to start-up. Service will meet agreed upon schedules to assure customer satisfaction.

3.2.4 The start-up technician will fully complete a start-up sheet for each piece of equipment. A copy of this sheet will be provided to the Project Manager with the turnover documents: A second copy will be filed in Service by Customer Name and Address.

3.2.5 All time will be charged to the appropriate job number as specified by the Project Manager. If requested, Time and Material forms shall be completed.

3.3 The Start-up/Commissioning Coordinator has responsibility for the following activities:

3.3.1 Provide a communication path between the Project Manager and the Field Foremen.

3.3.2 Schedule qualified personnel for start-up, balance, test, and room certification as required.

3.3.3 Coordinate punch list completion with Project Managers.

3.3.4 Coordinate start-up, service, balance, and testing report documentation.

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4 Procedures

- 4.1 General: A Service Technician is responsible for filling out start-up sheet FN 8.030.1 for Packaged Air Conditioning Units. A start-up sheet will be completed for each piece of equipment. Each sheet requires the following information:
 - 4.1.1 Job identification: The job name, job number, and job address are to be completed by the start-up/commissioning coordination; these will be provided to the Service Technician.
 - 4.1.2 Section 5 - Equipment Description.
 - 4.1.3 Section 6 - Equipment Pre-Installation Inspection.
 - 4.1.4 Section 7 - Equipment Installation Inspection.
 - 4.1.5 Section 8 - Operational Inspection.
 - 4.1.6 Signature - As each section and page is completed, the Service Technician must print and sign his/her name and record the date. This document should also be signed off by an owner representative.

5 Equipment Description

- 5.1 This section should be completed by the Service Technician or Service Coordinator. Any design documentation specifying equipment should be recorded in this section. This includes: Specification number, Submittal number, Process and Instrumentation Diagram number, and Drawing number. Also, record which area this equipment will be serving.
- 5.2 Fill in the "design" column, record the following information as specified on the design documents. Unit Tag number (per drawings) Manufacturer (per equipment schedule and/or approved submittals) Model number (per equipment schedule and approved submittals).
- 5.3 Fill in filter and belt information.

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6 Equipment Pre-Installation Inspection

For each of the following items: Check Yes, No or N/A for not applicable. If No is checked, describe the difference in the comment section and notify the Project Manager immediately. Initial and date each item as it is checked.

- 6.1 Nameplate data matches vendor specifications. When the equipment is delivered, verify it matches specifications. Complete Section 5. In the "Actual On Site" column, record the actual data as shown on the equipment and verify that it matches the design criteria.
- 6.2 Make sure all parts are received and verify the packing slip(s).
- 6.3 Inspect for visible signs of damage, leak, or defective parts. Note any discrepancies and notify the Project Manager.
- 6.4 Verify electrical service for correct voltage, current and thermal overload protection.
- 6.5 Operation and Maintenance (O&M) manual is available in the field.
- 6.6 Start up technicians reviewed factory start up procedures in the Operation and Maintenance manual.
- 6.7 If Therma provided Variable Frequency Drives (VFDs) that are controlling the fans, complete FN 8.029.1, VFD start up form.
- 6.8 If Therma provided smoke fire dampers, complete form # FN 8.061.1, smoke fire damper start up form.

7 Installation Inspection

For each of the following items: Check Yes, No or N/A for not applicable. If No is checked, describe the difference in the comment section and notify the Project Manager immediately. Lock Out/Tag Out procedures should be observed before most of the following steps.

- 7.1 Unit is installed level. Check Operation and Maintenance literature some equipment needs to be level to 1/8" or better to allow proper drainage and or operation.
- 7.2 Tag number is attached to the unit. Tag should be attached to service disconnect or near unit identification plate, if mounted in a circling system tagging should reflect location above or below.

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- 7.3 Service clearance is adequate for maintenance. Service clearance includes access to the equipment through the ceiling systems, over duct work etc. Filter access for removal and replacement are essential.
- 7.4 Roof curb is installed to mate with the unit. Check for gaps, loss of seal, and improper mating of surfaces.
- 7.5 All access panels and covers are in place. Including: electrical, fan, filter, damper, return air, economizer section, supply air doors and covers.
- 7.6 Vibration isolators are installed and adjusted. Check Operation and Maintenance literature: internal and external isolation skids and springs need to be set properly. Isolators equipped with rubber damper washers on the seismic restraints these must be "just free" not compressed or removed. Isolation springs must not be used as leveling devices: leveling should be accomplished otherwise.
- 7.7 Ductwork and flex connections are connected and sealed. Make sure that roof ductwork has been connected to inside ductwork.
- 7.8 Economizer or outside air damper is installed.
- 7.9 All filters are in place and positioned properly. Pre-filters, bag filters, and post filters are all directional. Seals and surfaces should be correctly mated. Clips, spacers, and retainers should all be in place. Stagger gaps when possible.
- 7.10 Condensate drain and trap are installed. Trap offset distance (inlet height minus outlet height) must be greater than the maximum negative pressure of the Air Handler for the condensate to flow. Trap depth should be at least ½ of the offset distance to keep enough water to provide a seal. Vent is always on outlet of trap.
- 7.11 Gas supply piping is installed.
- 7.12 Gas supply piping has been checked for leaks.
- 7.13 Gas supply piping is bled of air.
- 7.14 Vent stack is proper height and size. Check Operation and Maintenance literature.
- 7.15 Unrestricted vent cap on top to protect from weather and down drafts.
- 7.16 Each fan belt drive tension is correct. Adjust belt tension for optimum performance. Incorrect belt tension causes wear vibration and excess particles.

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- 7.17 Sheaves are aligned. Use string or straight edge method.
- 7.18 Fan hub, sheaves, and bearing sets screws are tight. Check Operation and Maintenance literature: lubricate accordingly prior to use.
- 7.19 Smoke detector is installed. If smoke detectors are the responsibility of Therma, is it installed per manufacturer's specifications? If outside or in an exposed environment (water, rain, chemicals, etc) make sure enclosures are installed.
- 7.20 Motor and blower bearings are lubricated. Check Operation and Maintenance literature: lubricate accordingly prior to use
- 7.21 Crankcase heaters are installed.
- 7.22 Fan bearings angular alignment is correct and bolts are tight. Fan shaft is in 90° alignment with shaft bearings.
- 7.23 Shipping blocks and materials removed from fan section. Check Operation and Maintenance literature: remove all temporary shipping blocks and materials including brackets, bolts, covers etc.
- 7.24 Electrical connections are secure. Check all terminals, with a reliable meter, from line to line and to ground before checking all electrical connections in all panels, motors, and devices. Check wire, wire nuts, spade connectors, and crimps as well.
- 7.25 Thermostat is installed. This maybe a separate controls system insure its connection to the Packaged Air Conditioning Unit is correct and is applicable to unit Operation and Maintenance literature.
- 7.26 Time clock is installed. This maybe a separate controls system insure its connection to the Packaged Air Conditioning Unit is correct and is applicable to unit Operation and Maintenance literature.
- 7.27 Electric heat is installed.
- 7.28 Coils are clean and fins are straight.
- 7.29 All compressor shipping braces and compressor rail isolator sleeves are removed. Check Operation and Maintenance literature: severe vibration will occur if compressor isolation is not set properly.
- 7.30 Compressor oil level is within manufacturer's specification. Check Operation and Maintenance literature.

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7.31 Low ambient control is installed. Check Operation and Maintenance literature: if unit operates 24 hours a day this is necessary for colder outdoor air conditions. Factory mounted or field mounted.

7.32 All condenser fan setscrews are tight.

8 Operational Inspection

Use Operation and Maintenance literature and follow start up procedures the Packaged Air Conditioning Unit form FN 8.030.1 is a general out line and is to provide a quality assured start up when used in conjunction with the Operation and Maintenance literature. If there are any discrepancies notify the Project Manager immediately.

8.1 Unit vibration is acceptable. Check Operation and Maintenance literature for tolerances. Check for vibration at different fan speeds and volumes. Check unit, check around unit and below roof under bit.

8.2 Each fan rotation is correct.

8.3 Natural gas supply pressure is at manufacturers specifications. Check Operation and Maintenance literature: use mag gauge or natural gas pressure gauge to verify. Typically these units require 7"-14" w.c. inlet pressure.

8.4 Manifold pressure is at manufacturers specifications. Check Operation and Maintenance literature: use mag gauge or natural gas gauge to verify. Typically these units run from ½" w.c. on low fire to 5" w.c. on high fire.

8.5 Heating components perform per manufacturers specifications. Check Operation and Maintenance literature: verify all safety controls, operating controls, ignition controls, pilot flames, and vent fans (blowers).

8.6 Cooling components perform per manufacturer's specifications. Check Operation and Maintenance literature: verify all safety controls, operating controls, and refrigeration performance.


8.7 Variable Air Volume components perform per manufacturer's specifications. Check Operation and Maintenance literature: verify all safety controls, operating controls and interlock controls of Variable Frequency Drives, InletVanes, stage controls, operating controls and link cages.

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- 8.8 Economizer components perform per manufacturer's specifications. Check Operation and Maintenance literature: verify all operating controls, linkages, damper motors, min position operation/setting, power exhaust control/ modulation.
- 8.9 Smoke detector is tested and is able to shut the unit down. This may or may not be in Therma scope, either way insure unit shuts down per exact specifications.
- 8.10 Make sure thermostat is set. Operate (or have operated) temperature controls to ensure all functions and set points.
- 8.11 Make sure time clock is set. Set time, set date, check shut down, through time clock.
- 8.12 Crankcase heaters are functional. Check Operation and Maintenance literature: verify voltage, wattage, and amperage.
- 8.13 Fire dampers are functional and open.
- 8.14 Supply, return and outside air dampers are functional. Operate (or have operated) control dampers, check for opened full closing, check if dampers modulate all with out binding.
- 8.15 Record start up operating parameters in the Supplementary Forms, FN 8.028.2 or FN 8.028.3. Use as many of the Supplementary form(s) as necessary to complete Package Air Conditioning Unit start-up form FN 8.030.1.

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Document Approval


 Service Manager

3-3-05
 Date


 Engineering Manager

28 Feb-05
 Date


 Quality Assurance Manager

03-03-2005
 Date

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