UNIVERSITY OF NORTH CAROLINA
SCHOOL OF THE ARTS

Sanford Hall & Moore Hall

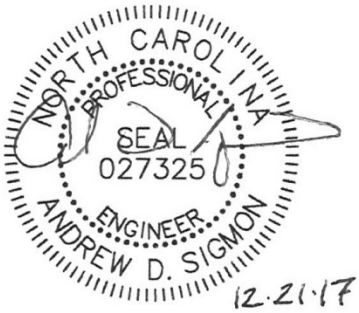
HVAC System Study

RECORD SUBMITTAL

December 28, 2017

M&C Project #: 07130-0002

Mechanical



Electrical

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1) Executive Summary

Sanford – Moore Residence Halls were constructed circa 1966 and are of similar construction (use, size, floors and system type). The residence halls are experiencing high humidity in the residence rooms, common hallways and common bathrooms. Original ventilation systems consisted of unconditioned make-up air via the residence hall room 2-pipe fan coil units and forced exhaust air from the six bathrooms serving each residence hall with no dedicated make-up air. Common areas such as hallways and bathrooms exhibit high humidity conditions and residence hall rooms also have high humidity under certain conditions due to the potential of unconditioned make-up air. McKim & Creed performed a site investigation and conducted a follow-up meeting with UNCSA to discuss potential solutions to improve the humidity in the resident facilities. Based on the age of the facilities and HVAC equipment; a complete HVAC system replacement was considered with comparison among three systems. **Note: Implementation of solutions is to be completed through formal project design (including State Construction Office reviews) and availability of adequate power capacity for each facility needs to be verified based on metered data.**

<u>System replacement options</u>

1) Replace 2-pipe fan coil units with 4-pipe units, install a roof mounted dedicated outdoor air system for each residence hall; replace chillers / heating equipment along with ancillary system components.
2) Replace existing system with a variable refrigerant system (VRF) with dedicated VRF outdoor air units.
3) Replace 2-pipe fan coil units with PTAC's capable of OA dehumidification and install a roof mounted dedicated outdoor air system for common areas in each residence hall.

In addition to the above, DHW generation and bathroom exhaust fans need to be addressed to deliver a complete working system.

Based on the potential solutions outlined above, McKim & Creed (along with discussion with UNCSA staff) recommends the following approach:

1. Replace existing 2-pipe fan coil units along with ancillary support systems (chillers and boiler) with individual room PTAC's capable of conditioning make-up / ventilation air serving each individual living space.
2. Provide dedicated conditioned make-up air to bathrooms and hallways via a roof mounted dedicated outdoor air system.
3. Install new exhaust fans in the bathrooms and clean ductwork.
4. Upgrade electrical system to support the new system(s).
5. Demolish existing chiller yard, remove underground piping (note: portions of piping may be capped and abandoned pending full project design) and disconnect boiler steam supply.
6. Replace electric DHW boiler and DHW storage tank with new gas fired boiler coupled to a smart plate DHW system.

2) Existing Conditions

Sanford & Moore Residence Halls are experiencing high humidity conditions in the hallways, bathrooms and residence hall rooms due to lack of conditioned make-up air. Cleaning of the bathroom exhaust duct and an addition of a third floor exhaust fan were completed by UNCSA to improve the situation, but did not accomplish the task of humidity control. The original facility design did not provide a make-up air system that allowed for conditioned ventilation air in the residence hall rooms and hallways.

Sanford & Moore Residence Halls were constructed circa 1966 and are connected via a common 'connect building' which was constructed circa 1988. The two residence halls have an identical foot print; approximately 24,000 sqft, three stories high, and are used as residence halls. Sanford's first floor is slightly difference since there are multiple full time resident advisor apartments.

HVAC and plumbing system conditions are as follows:

Residence hall rooms are currently cooled and/or heated via a 2-pipe vertical fan coil unit with the cooling source coming from two circa 1988 60 ton air-cooled chillers (one dedicated to each facility), heating source for both buildings is via a central steam boiler plant with domestic hot water generated from either the steam source in winter or an electric boiler in warmer months located in respective mechanical rooms. Control system is obsolete and 2-pipe source change over creates many comfort calls. Resident apartments are similar to residence hall rooms with the exception that some partition walls were removed to make larger living spaces. There are approximately 185 fan coil units in total for the two buildings per 1988 design documents.

HVAC hydronic cooling / heating is delivered to the fan coil units via piping that is installed in chases between each residence hall room. The chase is located behind the sink in each room and contains the following pipes; fcu supply, fcu return and plumbing riser (CW, DHW, sanitary drain). There is no access to these chases and typical internal chase sizes range from 12" X 36", 3" X 36" and 8" X 36". Also, it should be noted that Moore's hydronic supply/return header is located above the 3rd floor drop ceiling and Sanford's supply/return header is located under the building in an accessible crawl space.

The roof consists of three exhaust fans and two air intakes. The exhaust fans on each end of the roof serve the bathroom exhaust riser associated with the stacked bathrooms. The middle exhaust fan was installed after original construction and pulls air from the 3rd floor ceiling to remove some moisture that is present above the drop ceiling. The air intakes are not shown on the original construction plans, and it is unclear how they operate. It is assumed that they terminate above the 3rd floor drop ceiling.

The walls are CMU with a brick exterior and windows are single pane aluminum that have been previously upgraded.

Ceilings for the 1st floor and 2nd floors are not adequate for the addition of ductwork due to clearance between the drop ceiling and overhead floor slab complicated further with clearance issues already present below the drop ceilings. The 3rd floor has a drop ceiling with insulation laid on the ceiling grid; free clearance above the insulation is approximately 18" to 24".

Electrical conditions are as follows:

Sanford:
The existing building is served by a 500kVA pad-mounted transformer located adjacent to the building. The main switchboard is located in the Main Electrical Room. The switchboard was replaced as part of the Connector Addition in 2004 (13 years old) and is in fair condition. The switchboard ("MDP") is a two (2) section Siemens 1200A, 120/208Y, three-phase, four-wire, 1200A main circuit breaker (MCB); The switchboard distribution breakers include the following panels and equipment: CDP (1000A/3P), TS (50A/3P), U (90A/3P), AP103 (100A/2P), AP109 (100A/2P), SPARE (On – Not verified) (50A/3P), V (200A/3P), X-Z (200A/3P), ES (50A/3P), AP129 (100A/2P), AP130 (100/2P), BOILER (100A/3P), ESM (150/3P), Y-W (200/3P). The switchboard also serves the Connector and elevators for Sanford and Moore.

Electrical peak kW demand for the building over the past 12 months is not known based on recent modifications to the electrical MV distribution system. Depending on the mechanical system, the building electrical system will require further evaluation. Metering is required to be performed prior to any electrical additions to confirm the electrical equipment has sufficient capacity for the modifications.

The existing building is also served by a 20kW diesel emergency generator located in the Chiller Yard serving the emergency egress lighting in Sanford and Moore that was added in approximately 1988 (29 years old). It appears the Connector includes emergency battery packs for emergency egress lighting. A 70A automatic transfer switch (ATS) is located in the Main Electrical Room. Panel "ESS" serves the emergency loads for Sanford. This equipment appears to be in fair condition.

The Main Mechanical Room includes Panel "TS", 125A, 120/208Y, three-phase, four-wire, 60A MCB serving pumps P-1A (45A/3P, 5hp), P-3A (30A/3P, 3hp), P-4A, P-1B (45A/3P, 5hp), P-2A, P-2B, Toilet Exhaust, and Air Compressor which serves the majority of the equipment in the room. There is a possible National Electrical Code (NEC) working clearance issues at the panel. The panel is in fair condition. The room also includes a 25kW (69 FLA) electric hot-water boiler that is fed from "MDP".

The majority of each of the three (3) floors' utilization loads including the residence hall room fan coil units is subsequently fed by two (2) panelboards (one (1) located near each end of the corridors) rated 225A, 12/208Y, three-phase, four-wire, MLO (main lug only). These panelboards are in poor condition (original to the building in approximately 1966 (51 years old). In addition, the original panelboard labels do not appear to match the labeling on the switchboard. It is recommended these be upgraded as part of any modifications. There are also four (4) apartments that include individual panelboards serving the

spaces, each are rated 250A, 120/240V, single-phase, three-wire, 100A MCB. Roof mounted exhaust fans are fed from panelboards located on the Third Floor.

Electrical circuits within the resident halls appear to be original. All circuits are 120 V with 15 or 20 A circuit breakers. A typical residence hall room is fed/shared by three (3) circuits; one (1) for FCU blower, one (1) for receptacles and one (1) for lighting. Typically, these circuits are shared among three (3) to four (4) rooms. The fire alarm system and structured cabling has been upgraded and/or added over time.

Moore:
The existing building is served by a 300kVA pad-mounted transformer (size not verified) located adjacent to the building. The main switchboard is located in the Main Electrical Room. The switchboard appears to be original to the building and is in poor condition. The switchboard ("MSB") includes an ITE 30A, three-phase, three-wire, high voltage section (4,160V) with an integral switch and step-down transformer that is no longer in service (switch in "OFF" position). The other section is an ITE 500A, 120/208Y, three-phase, four-wire, and does not include an integral main service disconnect. The switchboard distribution breakers include the following panels and equipment: ESM (50A/3P), Panels Y & W (200A/3P), Panel TM (50A/3P), Panel R (50A/3P), Not Labelled (100A/3P "ON"), Main Breaker for Breakers Below (no rating visible), Panels X & Z (200A), Panel V (150A), Panel U (50A), and Boiler/Water Heater (100A). A separate 800A enclosed circuit breaker (ECB) appears to be serving as Main Service Disconnect. The rating of the ECB is greater than the nameplate rating of the distribution switchboard section it is currently feeding (NEC code violation). The switchboard grounding was not verified.

Electrical peak kW demand for the building over the past 12 months is not known based on recent modifications to the electrical MV distribution system. Depending on the mechanical system, the building electrical system will require further evaluation. Metering is required to be performed prior to any electrical additions to confirm the individual electrical equipment has sufficient capacity for the modifications. In addition, the Code issues related to the switchboard rating will be required to be addressed for any modifications.

The existing building is also served by the same 20kW diesel emergency generator serving the emergency egress lighting in Sanford. A 70A automatic transfer switch (ATS) is located in the Main Electrical Room. Panel "ESM" serves the emergency loads for Sanford. This equipment appears to be in fair condition.

The Main Mechanical Room includes Panel "TM", 125A, 120/208Y, three-phase, four-wire, 60A MCB serving pumps P-1C (45A/3P, 5hp), P-3B (30A/3P, 3hp), P-4B, P-1D (45A/3P, 5hp), P-2C, P-2D, Toilet Exhaust, and Air Compressor which serves the majority of the equipment in the room. There is a possible NEC (National Electrical Code working clearance issues at the panel. The panel is in fair condition. The room also includes a 25kW (69 FLA) electric hot-water boiler that is fed from "MDP".

The majority of each of the three (3) floors' utilization loads including the residence hall room fan coil units is subsequently fed by two (2) panelboards (one (1) located near each end of the corridors) rated 225A, 12/208Y, three-phase, four-wire, MLO (main lug only). These panelboards are in poor condition (original to the building). In addition, the original panelboard labels do not appear to match the labeling on the switchboard. It is recommended these be upgraded as part of any modifications. Roof mounted exhaust fans are fed from panelboards located on the Third Floor.

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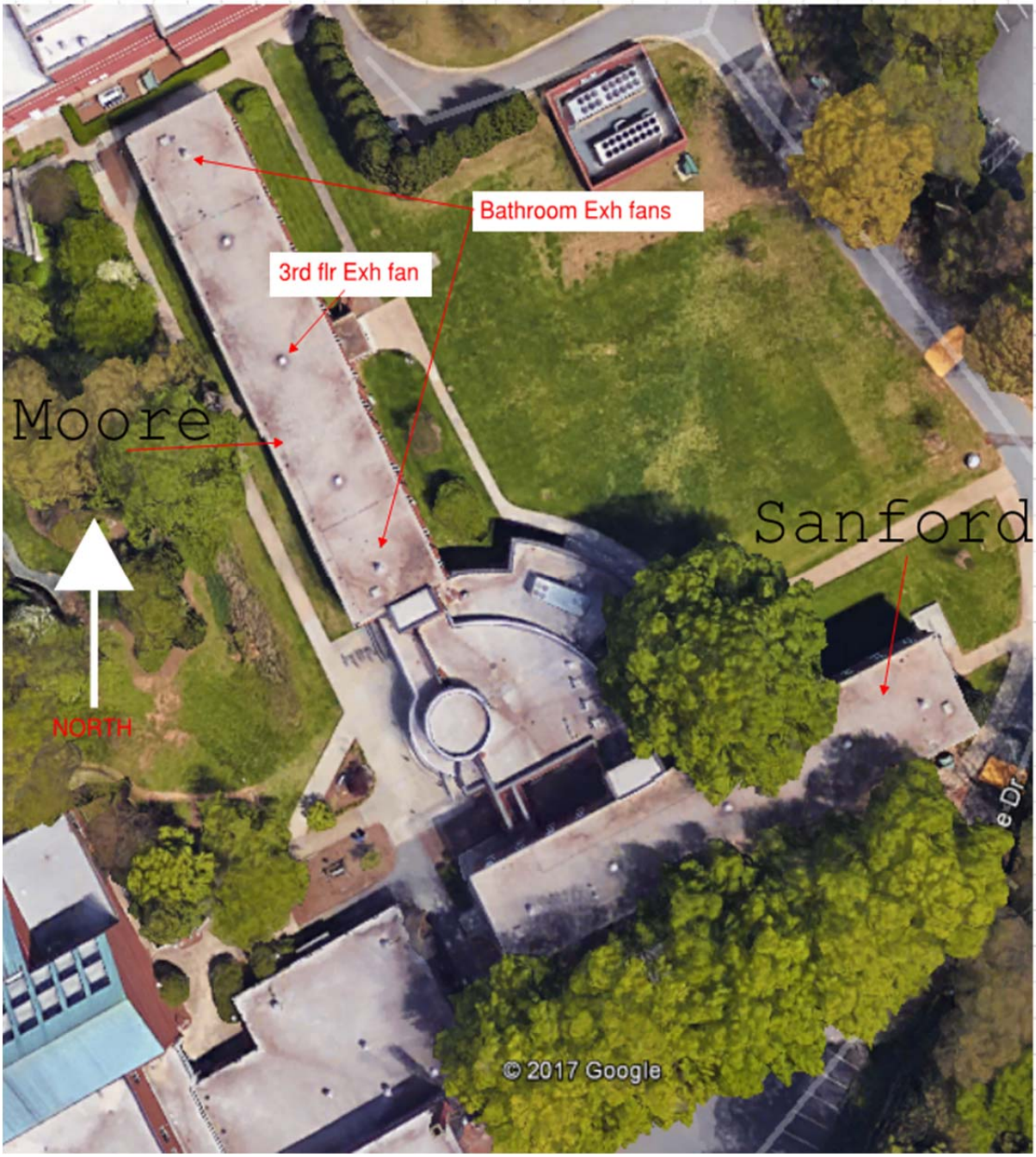
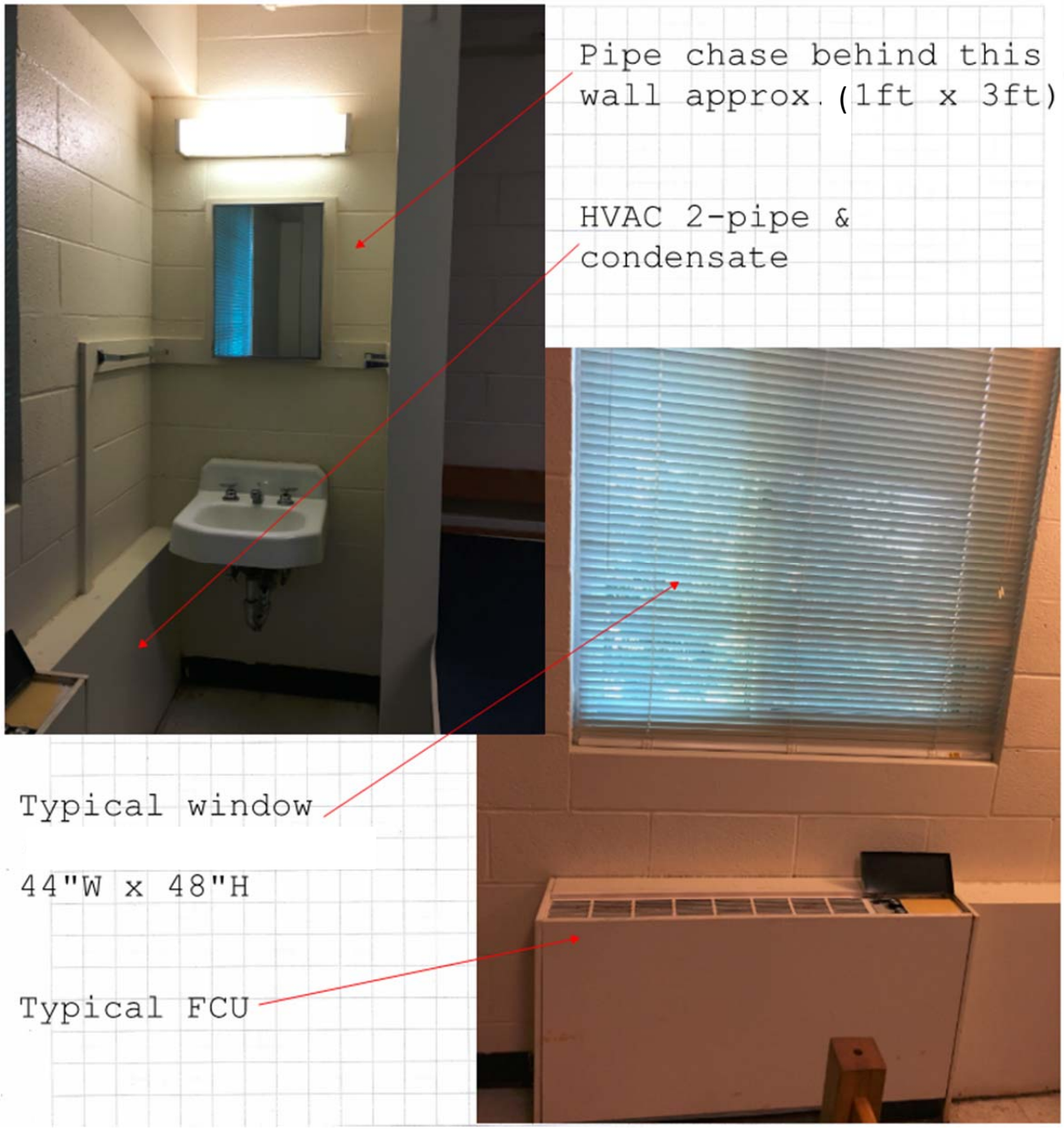
Chiller Yard:
Sanford and Moore Residence Halls both receive chilled water from separate chillers located in the chiller yard adjacent to the Sanford building. The existing chiller yard is served by a 500kVA pad-mounted transformer (size not verified) located in between the two (2) chillers. Separate service laterals feed two (2) 400A fused disconnects that appear to be in fair to poor condition. The yard also includes a 20kW Kohler diesel generator that serves the emergency loads for both Sanford and Moore. The generator appears to be in fair condition and is outside the scope of these renovations.

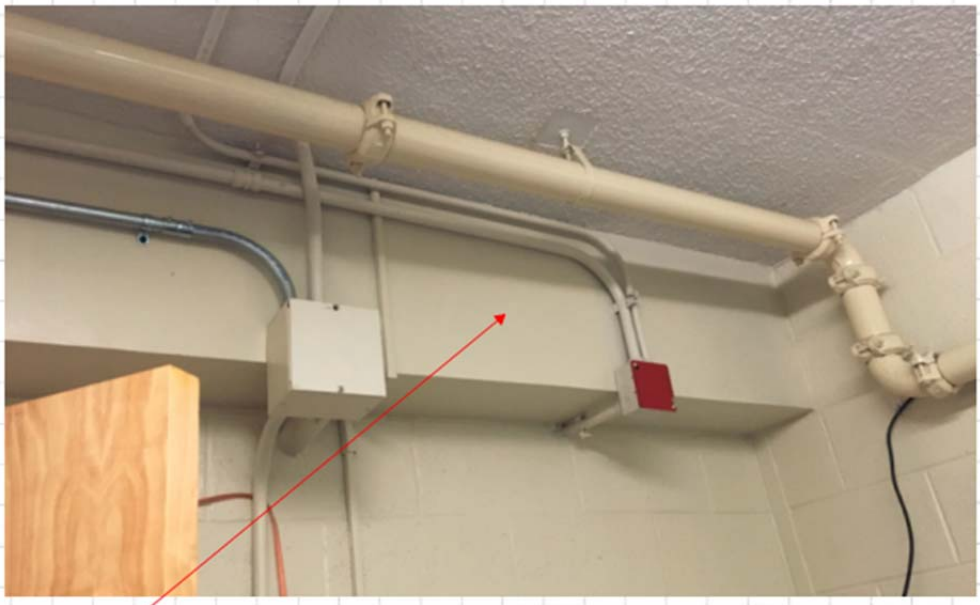
McKim & Creed performed the site investigation on September 28, 2017 in both residence halls. Photos of key site observations are as follows:


Bathroom Exh fans
3rd flr Exh fan
Moore
Sanford
NORTH
© 2017 Google



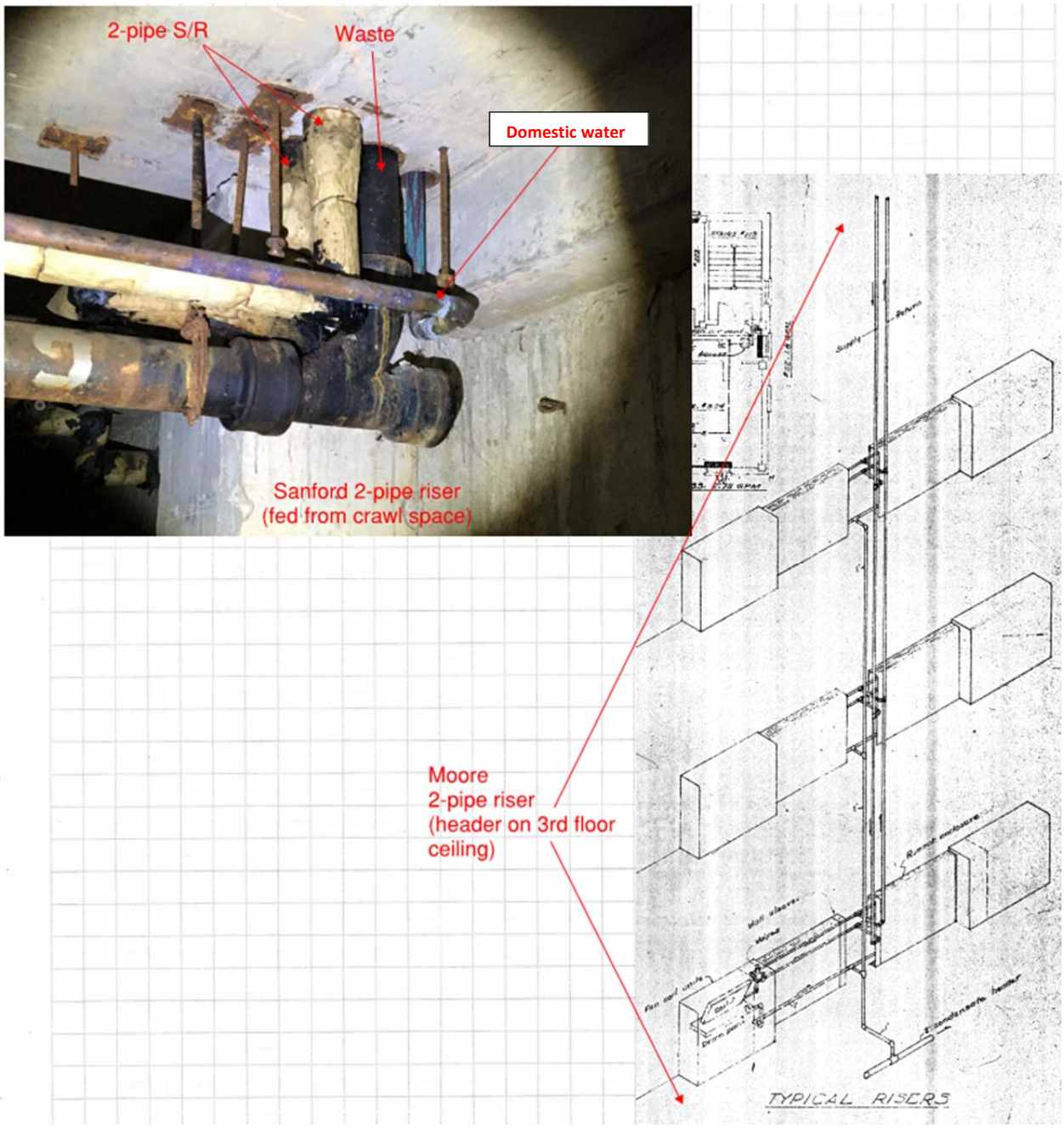
Typical residence hall room is a single 2-pipe fan coil unit located under the window with a 5” x 16” louvered opening to the exterior wall. Ventilation opening does not have any damper and allows un-conditioned air into the room when FCU is not cooling or heating. FCU is connected to vertical chase via exposed horizontal pipe chase.

Windows are not original; have been replaced with operable aluminum framed windows.



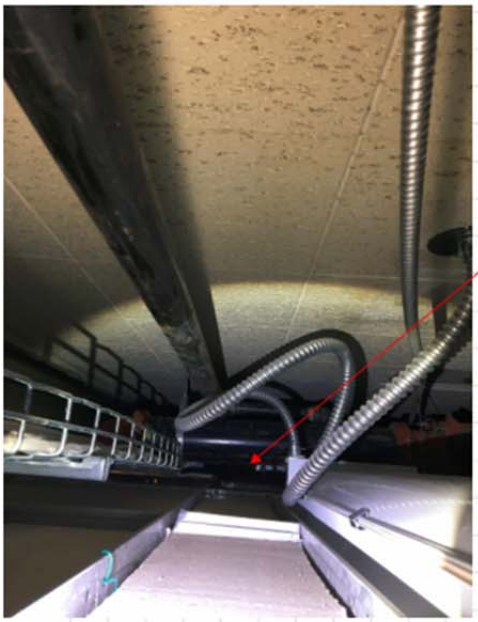
Poured beams between every other room and on each side of hallway; typical installation

Rooms and hall ways are encompassed by poured beams. Retrofitted utilities into rooms must be routed at a height of 88” or lower.

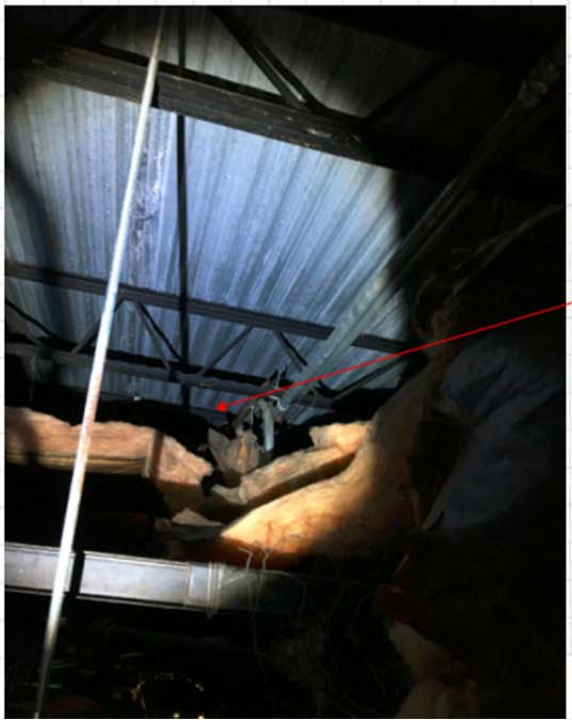


Sanford risers (supply water, return water, domestic water and plumbing stack) are routed from crawl space below the first floor up each riser.

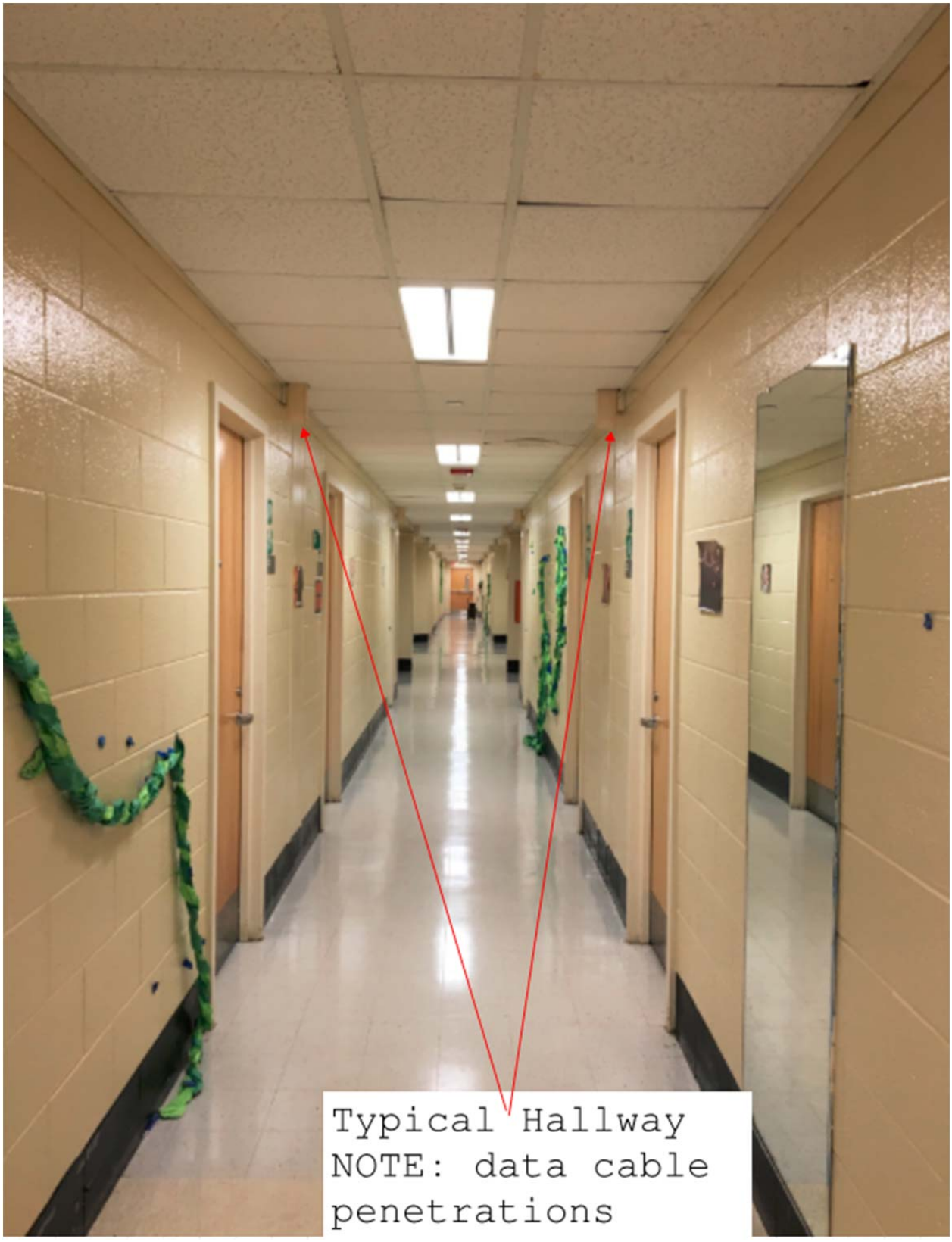
Moore supply water/ return water risers originate from the third floor plenum.

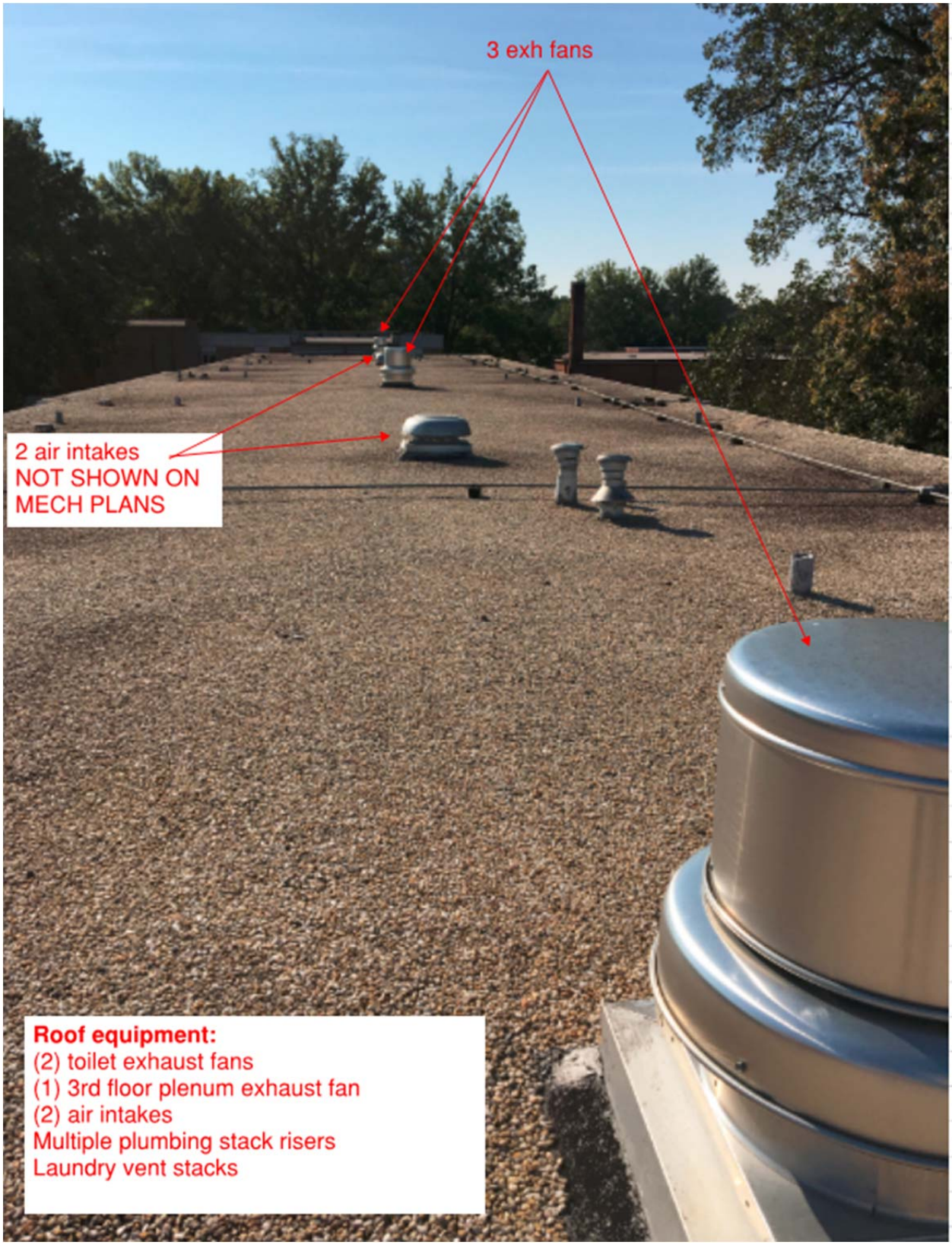


1st floor & 2nd floor clearance (approx. 8"



3rd floor ceiling to roof height approx. 18" to 24" clearance


Typical Hallway
NOTE: data cable
penetrations


3 exh fans
2 air intakes
NOT SHOWN ON
MECH PLANS
Roof equipment:
(2) toilet exhaust fans
(1) 3rd floor plenum exhaust fan
(2) air intakes
Multiple plumbing stack risers
Laundry vent stacks

ELECTRICAL – Existing conditions photos Sanford

ELECTRICAL – Existing conditions photos Moore

ELECTRICAL – Existing conditions photos Chiller Yard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3) Analysis of Preliminary Options

The following potential solutions were compared against each other based on the merits of fixing indoor humidity / pressurization problems, life cycle costs, constructability, energy costs and available system technologies. A brief description of each proposed solution is followed with a system comparison matrix.

In addition to looking for solutions to improve the humidity and building ventilation; we also considered the need to address a solution for DHW which will be the same solution for each building. Note, potential code upgrades may also be required as part of this project. Some of the potential code upgrades that were identified include, but are not limited to:

- Potential asbestos or hazardous material abatement
- Providing ventilation air to the building to meet minimum code requirements and to provide make-up air for the exhaust system(s)
- Upgrade of electrical systems to existing circuits and new service to meet demands of new equipment

System Upgrade Options

1. **4-Pipe fcu replacement with dedicated outdoor air system:**
   Replace existing 2-pipe fan coil units with new 4-pipe fan coil units and install a new dedicated outdoor air system on the roof to provide conditioned make-up air to the bathrooms and hallways. This solution will entail the following:
   - ✓ Retrofit existing air cooled chillers with new scroll type chillers w/ digital turndown for low load conditions
   - ✓ Replace piping between chillers and building MER as required
   - ✓ Gut existing MER's and install new pumps, hot water heater and controls
   - ✓ Run natural gas to MER's for DHW and heating
   - ✓ Install new gas heating equipment
   - ✓ Demolish one side of every vertical pipe chase to install new 4-pipe system and OA ductwork. NOTE: when risers are opened, plumbing and ancillary building conditions may need to be addressed
   - ✓ Install a DOAS system on the roof w/ electric heat capable of delivering conditioned air to bathrooms and hallways.
   - ✓ Install ductwork to each bathroom via a riser in adjacent storage rooms, install ductwork to each hallway via a tap from the riser and install ductwork down each vertical shaft to provide ventilation to each residence hall room.
   - ✓ Provide additional power to the facility and install new circuit to roof to accommodate load requirements of the DOAS. Minimum of an additional 135 amps @ 208Vac (plus 25%) per building will be required. New electrical wiring and circuit breakers are also recommended (at a minimum) for the new fan coil units based on the age of the existing electrical system. In addition, panelboards are also recommended for replacement as part of these upgrades.

2. **VRF with dedicated outdoor air provisions**

   Replace existing 2-pipe fan coil units with new VRF system. VRF system will replace the existing fan coil units with new VRF fan coil units with similar foot print and will included two dedicated VRF outdoor air units; one on each end of the hallway. This solution will entail the following:

   - ✓ Demo existing air-cooled and boiler system for heating
   - ✓ Gut existing MER's and install new provisions for domestic hot water
   - ✓ Run natural gas to MER's for DHW heating
   - ✓ Install new DHW heating system
   - ✓ Demolish one side of every vertical pipe chase to install new refrigerant lines that will terminate on the roof. NOTE: when risers are opened, plumbing and ancillary building conditions may need to be addressed
   - ✓ Install a 1,200 cfm DOAS on the third floor room adjacent to the bathroom and duct ventilation air to each floor and to the hall way (this will be duplicated on each side of the building)
   - ✓ Each VRF terminal unit will require an upgraded circuit to 230V and it is anticipated that 10 units can be tied to one remote rooftop condensing unit. 230V additional power will also need to be provided to the dedicated DOAS units (2 per building) and to approximately 10 remote condensing units that will be located on the roof of each facility.
   - ✓ Minimum of an additional 310 amps @ 208Vac (plus 25%) per building will be required. New electrical wiring and circuit breakers are also required for the new units. In addition, panelboards are also recommended for replacement as part of these upgrades.

3. **PTAC with dedicated outdoor air system**

   2-pipe fan coil units will be replaced with through wall PTAC units. Two units were considered; Amana Digiairx with dedicated make-up air coil and Friedrich PTAC with variable compressor technology that will continually condition ventilation air up to 35 cfm. In addition, install a new dedicated outdoor air system on the roof to provide conditioned make-up air to the bathrooms and hallways. This solution will entail the following:

   - ✓ Demo existing air-cooled chiller system and existing steam heating and DHW equipment
   - ✓ Gut existing MER's and install new provisions for domestic hot water
   - ✓ Run natural gas to MER's for DHW heating
   - ✓ Install new DHW system
   - ✓ Remove existing 2-pipe fan coil unit and associated piping back to vertical riser
   - ✓ Modify existing wall opening under every window; new wall opening will need to be 42.25" X 16.25" to accommodate new sleeve
   - ✓ Install new PTAC that is rated to condition ventilation make-up air
   - ✓ Each new PTAC will require a 230Vac circuit; electrical upgrades will be required
   - ✓ Install a DOAS system on the roof w/ electric heat capable of delivering conditioned air to bathrooms and hallways.
   - ✓ Minimum of an additional 550 amps @ 230Vac (plus 25% capacity AND required DOAS capacity) per building will be required. This option will require modifications to the existing electrical distribution system to support the new mechanical equipment including the possibility of upgrades to the service(s) at each building.

NOTE: All three options will require new bathroom exhaust fans, cleaning of the ductwork and balancing of the exhaust fan system. In addition, domestic hot water will need to be addressed; recommending a localized solution in existing MER.

	McKIM&CREED	Alternate 1 4-pipe w/ DOAS	Alternate 2 100% VRF system	Alternate 3 PTAC w/DOAS	Notes:
System attributes:	Room terminal units provide conditioned make-up air	Y*	Y*	Y**	*Based on FCU running **Based on Friedrich PTAC
	DOAS required for common areas	Y*	Y**	Y*	*RTU DOAS, **1,250 cfm VRF DOAS
	System Amps Required (per building)	169	388	688	208V w/ 25% capacity
	Constructability	Open all chases and roof penetration	Open all chases and multiple roof penetrations	Cut approx. 185 wall openings 16.25" X 42.25" and roof penetrations	PTAC will extend into the room (from finished) wall approx. 14 inches
	System technology	Standard	Many system components	NEW 2018 release	Friedrich and Amana have dedicated make-up ventilation
	Annual energy costs	$106,198	$81,710	$122,298	Block load analysis
	LCCA - Present Worth	$6,141,666	$5,755,031	$5,677,923	See LCCA summary
	System - Pros vs Cons	a) smallest power requirement b) exterior of building remains the same c) minimal equipment on roof d) every chase needs to be opened e) ventilation air must be introduced to bathrooms & hall ways	a) Power requirements manageable b) exterior of building remains the same c) a lot of equipment on roof d) every chase needs to be opened e) ventilation air must be introduced to bathrooms & hall ways f) DOAS blower needs to be installed in building and condenser unit on roof	a) Power requirements are extensive b) exterior of building will have a 16.25" X 42.25" opening under every window c) Minimal equipment on roof d) ventilation air must be introduced to bathrooms & hall ways	NOTE: All three options will require new bathroom exhaust fans, cleaning of the ductwork and balancing of the exhaust fan system. In addition, domestic hot water will need to be addressed; recommending a localized NG fired solution in existing MER.

4) Preliminary Recommendations

Based on the potential solutions outlined above and review with UNCSA facilities organization, McKim & Creed recommends the following approach:

1. Install a dedicated DOAS on each facility roof sized for make-up air / ventilation for 6 gang bathrooms (per building) and positive make-up air for hall ways. Ductwork routing is proposed to be via two new shafts in smaller rooms adjacent to each bathroom. Shaft size anticipated to be 24" x 24". New electrical feeders will need to be provided to equipment located on the roof. DOAS unit and ductwork will be +/- 2,500 pounds; under deck structural modifications and/or bracing will need to be considered.

2. **PTAC w/ DEDICATED CONDITIONED MAKE-UP AIR:** Retrofit approximately 185 (2)-pipe fan coil units with a PTAC solution capable of conditioned make-up air. This upgrade allows UNCSA to upgrade rooms over time and/or in phases and has the least amount of installation risk. This solution also allows maintenance staff to have limited downtime on individual room failures by keeping replacement units in stock. New domestic hot water system will be required with this option. This option has the lowest first cost and best lifecycle cost, but will require a complete upgrade of electrical systems and will not yield itself to a central plant 'plug in' in the future.

3. Bathroom exhaust ductwork should be cleaned and new bathroom exhaust fans should be installed and balanced IAW new DOAS system.

4. System LCCA comparison can be reviewed in Appendix A.

5) Appendix A: Life Cycle Cost Analysis with Probable Costs

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					Alternate 1 FCU w/ RTU DOAS		Alternate 2 VRF w/ VRF DOAS		Alternate 3 PTAC w/DOAS	
Study Title: NCUSA Sanford & Moore Rev0					Estimated Cost	Present Value	Estimated Cost	Present Value	Estimated Cost	Present Value
Discount Rate: 3.0%										
Life Cycle (years): 25										
Capital expenditures		Capital Costs / Construction Costs:								
	A	Dorm room equipment			$249,750	$249,750	$280,000	$250,000	$265,000	$265,000
	B	Dorm room install costs			$131,760	$131,760	$420,000	$420,000	$133,200	$133,200
	C	Dorm room wall modification			$18,500	$18,500	$37,000	$37,000	$555,000	$555,000
	D	Dorm room piping (and riser work)			$864,000	$864,000	$864,000	$864,000	$0	$0
	E	Air-cooled chiller			$75,000	$75,000				
	F	UG Piping			$200,000	$200,000				
	G	DOAS System			$190,000	$190,000	$180,000	$180,000	$190,000	$190,000
	H	Dorm Room Electrical			$80,000	$80,000	$280,000	$280,000	$270,000	$270,000
	I	DOAS Electrical			$15,000	$15,000	$0	$0	$15,000	$15,000
	J	Chiller & MER Electrical			$35,000	$35,000	$35,000	$35,000	$35,000	$35,000
	K	1.5 MMBTU Boiler - htg & DHW(w/ mech room install) x2 MER			$295,000	$295,000				
	L	750 MBTU Boiler - DHW only X2 MER					$140,000	$140,000	$140,000	$140,000
	M	DHW System Installed (Smart Plate connected to ext distribution)			$95,000	$95,000	$95,000	$95,000	$95,000	$95,000
	N	Controls			$327,500	$327,500	$100,000	$100,000	$142,500	$142,500
	O	Contingency (building struct, sys. complexity, req. code upgrades)			$250,000	$250,000	$250,000	$250,000	$100,000	$100,000
	P	Owner's Contingency (10%)			$280,000	$280,000	$268,000	$268,000	$190,000	$190,000
	Total Project Costs:				$3,106,510	$3,106,510	$2,949,000	$2,919,000	$2,130,700	$2,130,700
	Difference between Alternative 1							($187,510)		($975,810)
Replacement / Salvage Costs		Replacement / Salvage (single expenditure)	Year	PW factor						
	A	Dorm room FCU (25 yr life)								
	B	Dorm room VRF (5% repalcement)	5	0.86			$14,000	$12,040		
	C	Dorm room VRF (5% repalcement)	10	0.74			$14,000	$10,360		
	D	Dorm room VRF (20% repalcement)	15	0.64			$56,000	$35,840		
	E	Dorm room VRF (20% repalcement)	18	0.59			$56,000	$33,040		
	F	Dorm room VRF (20 year life)	20	0.55			$250,000	$137,500		
	G	Dorm room PTAC (20% replacement)	10	0.74					$53,000	$39,220
	H	Dorm room PTAC (20% repalcement)	15	0.64					$53,000	$33,920
	I	Dorm room PTAC (25% repalcement)	20	0.55					$66,250	$36,438
	J	RTU DOAS (overhaul)	15	0.64	$47,500	$30,400	$45,000	$28,800	$47,500	$30,400
	K	Salvage / scrap @ year 25	25	0.48	$0	$0	$0	$0	$0	$0
	L									
	M									
	N									
	Total Replacement / salvage costs:					$30,400		$257,580		$139,978
Annual Costs	Annual Costs / Life Cycle PW:		Escal. Rate	PW Factor						
	A	FCU Maintenance	1%	19.569	$13,875	$271,520				
	B	VRF Maintenance	1%	19.569			$21,375	$418,287		
	C	PTAC Maintenance	1%	19.569					$13,875	$271,520
	D	RTU DOAS Maintenance	1%	19.569	$4,000	$78,276	$6,000	$117,414	$4,000	$78,276
	E	Electrical	3%	25	$36,454	$911,360	$39,948	$998,700	$75,336	$1,883,400
	F	Gas	3%	25	$43,744	$1,093,600	$20,962	$524,050	$20,962	$524,050
	G	RTU DOAS electrical	3%	25	$26,000	$650,000			$26,000	$650,000
	H	VRF DOAS electrical	3%	25			$20,800	$520,000		
	I									
	J									
	Total Annual Maintenance / Operational Costs:					$3,004,756		$2,578,451		$3,407,246
Comparison	Total Life Cycle Costs (Present worth)					$6,141,666		$5,755,031		$5,677,923
	Total life cycle costs annualized (PW)					$313,350		$293,624		$289,690

This opinion of probable cost represents the professional's best judgement for estimated costs for this project. Neither the total estimated costs, nor any portion of the total, shall be understood or construed to be a guarantee of actual costs that may be experienced.

6) Appendix B: Example of Equipment Cut-sheets

The following cut sheets were submitted via electronic file, the referenced equipment was used in the analysis of this study for general equipment efficiencies and future load requirements. Final equipment sizing, selection and manufacturer will need to be determined at time of detailed design along with required site requirements:

- ✓ Trane VFR
- ✓ Carrier DOAS w/ electric heat
- ✓ Carrier Air Cooled Chiller
- ✓ Amana Digiair PTAC (conditioned outdoor air)
- ✓ Friedrich Freshaire PTAC (conditioned outdoor air)
- ✓ Aerco condensing boiler for heating and DHW
- ✓ Aerco smart plate for DHW

TRANE®

Trane® VRF

variable refrigerant systems

Ingersoll Rand®

Trane VRF variable refrigerant systems

Exceptionally efficient cooling and heating — from the cooling and heating expert.

When VRF is the right solution for your application, Trane will help you ensure it's the best solution.

Trane® VRF variable refrigerant systems are among the best in the industry. Thoroughly researched. Thoroughly tested. Thoroughly proven to offer exceptional value.

And because Trane offers a full portfolio of heating and cooling solutions, you can be confident that our recommendation of a VRF system for your application is the best solution for your heating and cooling needs.

Performance you can count on. Solutions you can trust. Knowledgeable experts you can believe in. That's the Trane difference.

The economy owners want. The comfort occupants want.

Trane VRF systems can keep energy costs low while delivering different occupant-selected temperatures to multiple zones — a big benefit for buildings with multiple interior spaces and diverse occupancy patterns. For medium-sized buildings, Trane VRF systems are available in outdoor mini heat pump configurations with 3-, 4- or 5-ton capacities. For larger buildings, VRF outdoor units are available in either heat pump or heat recovery configurations ranging in capacities from 6 to 16 ton individual units and system combinations up to 44 tons (air-source) and 48 tons (water-source).

Significant savings on utility bills can be achieved, because areas can be heated or cooled only when they are occupied.

Occupant satisfaction can be increased, because individual areas can be heated or cooled as desired — even if adjacent and nearby areas are at significantly different temperatures.

Tenants can be accurately and fairly billed for system use, because Trane VRF systems can deliver usage reports that allow landlords to calculate the actual amounts of energy used to heat and cool each leased space.

There are VRF systems ... and there are Trane VRF systems.

Expert installation
You can be confident that a Trane VRF installation will be performed in accordance with the industry's latest safety standards, because Trane certified installation technicians follow ASHRAE Standard 15 and the Canadian B 52-M1995 Mechanical Refrigeration Code.

A complete solution — including controls
Trane provides superior controls solutions — solutions that are optimized with specific algorithms to support the unique performance characteristics of individual VRF systems. Programmed to help simplify installations, minimize troubleshooting and deliver dependable, economical heating and cooling performance, Trane controls add real value to our VRF systems.

The science behind the savings

Variable refrigerant flow systems are inherently efficient. So what makes Trane VRF systems really stand out? Superior design strategy. Advanced technology. Outstanding durability. These industry-leading benefits help Trane VRF systems deliver industry-leading energy efficiency.

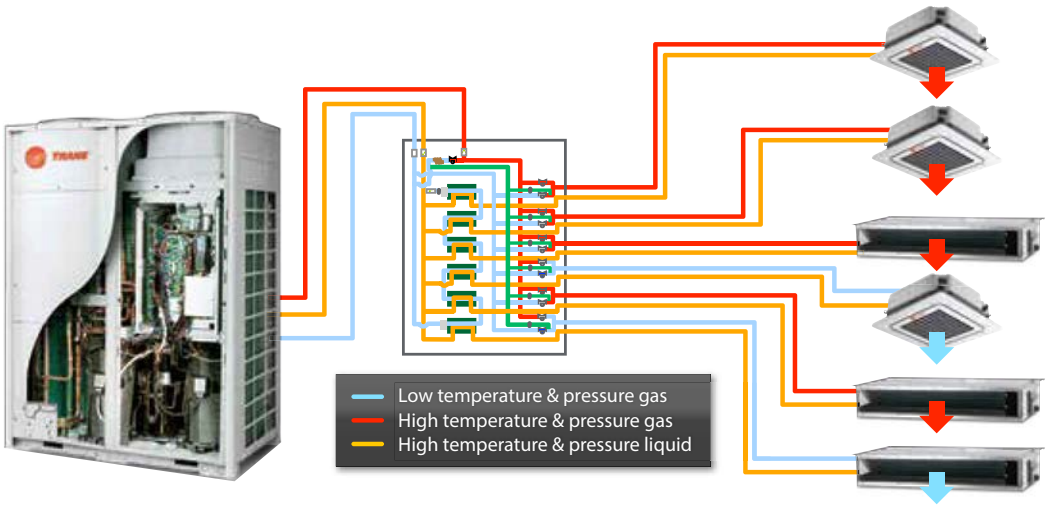
Advanced compressor technology

The compressors at the heart of every Trane VRF system feature multiple technological advantages that help them deliver higher efficiency when cooling or heating.

- **Variable-speed operation —** Precisely matches compressor speed to demand level, maximizing comfort and minimizing energy consumption.
- **Asymmetric scroll design —** Friction-reducing architecture improves both efficiency and longevity.
- **Available dual inverter scroll compressors —** A dual-compressor system can respond to rapid changes in building load during periods of heavy demand, as well as operate both compressors at more efficient speeds throughout the entire demand range.

Intelligent refrigerant flow

Trane VRF heat-recovery systems reduce energy consumption using strategically located mode control units (MCUs), which allow heat energy to be intelligently exchanged between localized zones.



Improved heating performance and efficiency

Through the use of a three-pipe design and vapor-injection technology, Trane VRF heat-recovery systems achieve improved heating performance and overall energy efficiency that competing two-pipe systems simply can't match. Building occupants enjoy more heating comfort, while building owners pay lower utility bills.

Fast, accurate auto-commissioning

Trane VRF systems have a fast, accurate auto-commissioning process, both for initial system installation as well as for applications requiring commissioning on a regular basis. The Trane auto-commissioning process saves time and hassles — and provides proof that your VRF system is delivering the efficient performance you expect. Your Trane VRF system can be up and running quickly — and can stay running at peak performance, year after year.

Extensive self-monitoring capabilities

Trane VRF systems automatically check critical system datapoints every three seconds. In the unlikely event of a performance variation, your Trane VRF system can alert you well in advance of a critical condition.

Best of all … it's a Trane

The Trane network of sales and service offices is one of the most extensive in the industry. Choosing a Trane VRF system means your nearby Trane office can provide all the assistance you need

Full support for specialized applications

Trane® VRF systems can keep energy costs low while delivering different occupant-selected temperatures to multiple zones — a big benefit for buildings with multiple interior spaces and diverse occupancy patterns.

User-selectable night operation mode can reduce sound output by up to 15 dB — ideal for noise-sensitive installations.

Compact, lightweight construction makes Trane VRF units among the smallest and easiest to install in the industry. Existing roofs generally don't require modifications or reinforcements to support the relatively light weight of a Trane VRF unit, and new construction often can be designed with lighter-weight, less-expensive techniques and materials.

Support for 575-volt electrical service is available on Trane VRF systems so they can serve more customers — and eliminate the need for expensive electrical modifications.

Local seismic rating requirements can be addressed with solutions that are available for all Trane VRF systems.

Supports long total piping runs

Tall buildings and structures with large amounts of floor space can benefit from VRF technology — but not all VRF systems can easily support them. Trane variable refrigerant systems can.

- Capable of serving a total pipe run of up to 3,281 feet — one of the longest in the industry.
- Superior technology makes it possible: a combination of up to 8,400 RPM compressor speed and unique electronic expansion valves with a 2,000-step gear-driven design.

Modern heating and cooling for historical structures

For classical architecture, maintaining a period-correct appearance inside and out is vitally important — but so is maintaining comfortable interior temperatures and reasonable utility costs. Which is why Trane VRF systems can be a perfect solution. Using small-diameter pipes instead of large air ducts, Trane VRF systems can be unobtrusively installed, heating and cooling historical buildings with modern energy efficiency — the best of both worlds.

Mini units offer quiet operation.

Compact and lightweight, Trane mini VRF outdoor units deliver efficient cooling and heating with quiet operation — making them perfect for medium-sized office spaces and upscale residences.

- Supports pipe runs of up to 164 vertical feet, 492 feet in a single line and up to 984 total feet.
- Indoor units are available in high-wall, cassette, concealed and floor/ceiling suspended designs.
- Will also support convertible air-handler units.

Advanced controls for every application

Trane VRF systems include a variety of control options, each programmed with unique algorithms to make systems easy to use and comfort easy to achieve, helping to improve the life of your building.

A complete solution includes superior controls, which are optimized with specific algorithms to support the unique performance characteristics of individual VRF systems. Programmed to help simplify installations, minimize troubleshooting and deliver dependable, economical heating and cooling performance, Trane controls add real value to our VRF systems.

Individual zone controls allow management of up to 16 indoor units via a wired or wireless remote control. Each controller can be used to set zone temperature, heating/cooling mode and fan speed. Simple scheduling is also possible for improved energy savings.

Centralized controls allow power and heating/cooling mode management of up to 128 indoor units connected to a central on/off controller. A typical application for this type of control would be an elementary school, with the entire building's group of VRF units monitored and controlled from the principal's office.

System controls provide a higher level of management for multiple-VRF systems, as might be found in a multi-floor building. System controls provide more-advanced scheduling, operation and alarm history management; they can be accessed remotely for monitoring via an Internet connection.

- **Optional BACnet® connectivity** adds the benefit of VRF system integration with Trane Tracer™ controls for a total building management and control solution. One Trane Tracer control system can coordinate the functions of a VRF system, a chiller, an air handler, a VAV system and more. An available Pulse Input Module can be connected to watt-hour meters to allow individual tenant billing.

- **Integrated building control** software is available for large, stand-alone VRF installations. It offers building owners and managers complete control and monitoring capability of all connected VRF systems and units.

- **Internet connectivity** is easy: Communication with the system can take place using any Web-connected computer. From virtually anywhere in the world, system set points can be modified and user-definable alarms can be received to ensure immediate notification when specified events occur.

Trane® ductless portfolio

Single-zone

R-SERIES

R-Series
Outdoor Unit
¾–3 tons

Available Indoor Products:

4MXW2
Ultra-Efficiency High Wall Unit

4MXW8
High-Efficiency High Wall Unit

4MYW6 and 4MXW6
Medium-Efficiency High Wall Unit

C-SERIES

C-Series
Outdoor Unit
1½ ton

C-Series
Outdoor Unit
2–2½ tons

C-Series
Outdoor Unit
3–4 tons

Available Indoor Products:

4-Way Cassette

Mid-Static Pressure Duct

Multi-zone

MZ-SERIES

MZ Series
Outdoor Unit
1½–3½ tons

Available Indoor Products:

High Wall Mounted

Concealed Ducted
(Horizontal)

Cassette

Console

Floor/Ceiling

VRF

MINI

Mini Outdoor VRF
3, 4 and 5 tons

AIR

Air-Source VRF
6 tons

Air-Source VRF
8, 10, 12, 14 and 16 tons

Air-Source VRF
18–44 tons

WATER

Water-Source VRF
6, 8 and 10 tons

Water-Source VRF
16 tons

Water-Source VRF
12–48 tons

INDOOR

Slim One-Way

Mini Four-Way

Four-Way

Slim Duct

Mid-Static Pressure Duct

High-Static Pressure Duct

High Wall

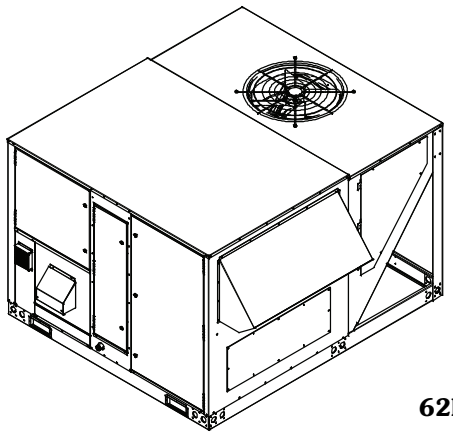
Floor/Ceiling

Convertible Air Handler

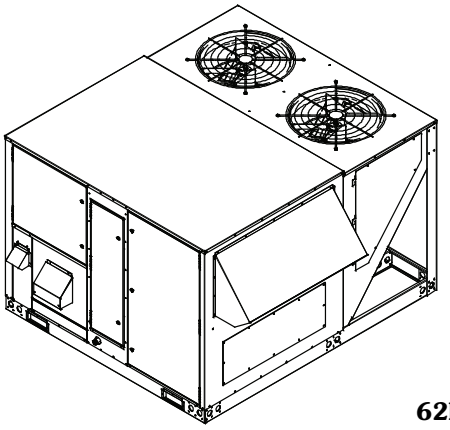
Product Data

62DA,DB,DC,DD07-38 Dedicated Vertical or Horizontal Outdoor Air Unit with Optional Energy Wheel

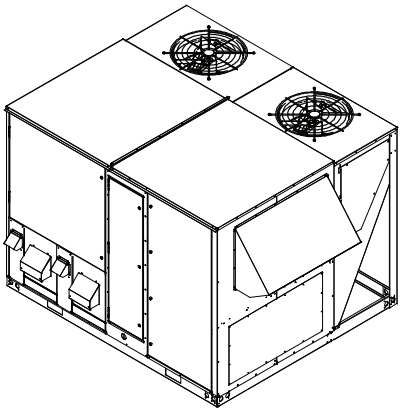
6 to 35 Nominal Tons



62D07-09



62D12-20



62D22-38

Carrier's 62D Series commercial dedicated outdoor air units offer:

- Capacities up to 35 nominal tons
- Vertical or horizontal configurations
- Puron® environmentally balanced refrigerant (R-410A) as standard
- Double wall construction
- Optional AHRI (Air-Conditioning, Heating, and Refrigeration Institute) listed energy recovery wheel
- Multiple heating options
- Multiple fan options
- Microprocessor control with accessory keypad and easy to view display
- Multiple reheat option
- Remote communication capability
- Digital compressor option
- 100% outdoor air operation

Features/Benefits

Carrier's 62D commercial packaged, dedicated, outdoor air unit offers efficiency, application flexibility, quality, reliability and easy maintenance.

High efficiency

The Carrier dedicated outdoor air unit utilizes highly efficient scroll compressors that have been optimally designed for use with Puron refrigerant (R-410A). Operating efficiency of the unit may be increased by adding the optional energy recovery system.

Features/Benefits (cont)

The energy recovery system uses an AHRI listed energy recovery wheel to transfer sensible and latent heat between the incoming air and the exhaust air, reducing energy consumption and improving indoor conditions.

Flexibility to suit many applications

The Carrier 62D units are designed to meet customer's requirements for new construction, replacement opportunities, and special applications. The customer can choose from vertical or horizontal supply configurations and over 6 supply fan motor horsepower ratings, with backward curved, forward curved, airfoil or backward inclined supply fans.

Supply fans may be provided with spring isolation and seismic restraints to address earthquake design requirements.

Staged or modulating heat sources are available, including gas furnace, electric insert, hot water coil or steam coil.

Also available are digital compressor, hot gas reheat, power exhaust, 2 or 4-in. filters, and rotary energy recovery wheel.

Roof curbs that follow the NRCA (National Roofing Contractors Association) guidelines are available for vertical applications in 14-in. and 24-in. heights and are installed and weatherproofed by the roofing contractor. Units with horizontal connections may be either curb or slab mounted.

All 62DA and DB units bring in 100% outdoor air through the outdoor air intake hood and do not have a return air connection. The 62DA units have a vertical supply duct opening in the bottom of the unit. The 62DB units have a horizontal supply duct opening in the side of the unit.

All 62DC and DD units bring in 100% outdoor air through the outdoor air intake hood. They may also be equipped with factory-installed power exhaust and/or an energy conservation wheel. The return air to these units is not re-circulated or mixed with the incoming outdoor air. The return air may be used to transfer energy to the incoming air via the energy conservation wheel and is then exhausted. The 62DC units have a vertical supply and return duct opening in the bottom of the unit. The 62DD units have a horizontal supply duct opening in the side of the unit and a vertical return opening in the bottom of the unit.

Durable construction

Cabinets are constructed of heavy gage galvanized steel with a pre-painted exterior finish to protect the cabinet and preserve the appearance through a long operating life.

The cabinet features a double wall design with a galvanized inner liner. The double wall design is insulated with closed-cell foam which adds rigidity to the structure and resists moisture intrusion.

Quality and reliability

All units are run tested prior to leaving the factory to help ensure proper operation and enhance life expectancy of key components. Components undergo numerous checks and inspections throughout the manufacturing process to eliminate components that do not meet Carrier's high quality standards.

Reliable, hermetic scroll compressors, equipped with crankcase heaters, are mounted on rubber isolation mounts for smooth, quiet operation.

Mechanically and electrically independent dual refrigeration circuits (size 12 and larger) provide redundancy in the event that one circuit should require service. All refrigerant circuits utilize a thermostatic expansion valve (TXV) to ensure proper refrigerant metering throughout the unit's broad operating envelope. The refrigeration circuits are protected by filter driers specifically designed for Puron® refrigerant (R-410A).

Standard warranty coverage provides a one-year parts warranty and 5 years on the stainless steel gas heat exchanger.

Easy to install, maintain and service

Maintaining and servicing a dedicated outdoor air unit is critical in maximizing the life expectancy and efficient operation of the unit. The Carrier unit has been designed for easy access with simple maintenance procedures.

Hinged access panels provide easy access to controls, fans, coils and filters. Slide-out supply fan system allows easy maintenance of belts, bearings, blower wheels and motors.

A dedicated vertical or horizontal design does not require conversion time during the unit installation. Through the curb power connection minimizes roof penetrations.

Power connections are in a protected area, away from harsh environmental conditions. All units feature heavy gage formed galvanized steel base rails with rigging openings to simplify handling and lifting at the job site.

Indoor air quality

The Carrier dedicated outdoor air unit offers 2 and 4-in. filter tracks that accept a variety of filter types and filter MERV ratings.

The condensate drain pan is double sloped to eliminate standing water per ASHRAE (American Society of

Table of contents

Heating, Refrigerating, and Air-Conditioning Engineers) Standard 62-1089R. The drain pan is fabricated of heavy gage stainless steel to resist corrosion and is insulated on the bottom with closed cell insulation.

The double wall design of the unit with galvanized interior liners allows easy cleaning of the interior surfaces.

Energy recovery

The Carrier dedicated outdoor air unit may be optionally equipped with an energy recovery (enthalpy) wheel. The enthalpy wheel meets the requirements of AHRI standard 1060 and is certified by AHRI. This energy recovery wheel is sized to provide increased energy recovery and humidity control based on the application requirements. The energy wheel is mounted in a slide-out cassette for simplified maintenance.

Heating systems

Carrier dedicated outdoor air units may be equipped with a variety of heat system types: gas heat (natural gas or liquefied petroleum gas), electric, steam, or hot water. Precise leaving air temperature control is provided via staged or modulating heat control systems.

The gas heating systems are of the induced-draft design that draws hot combustion gases through the heat exchanger at the ideal rate for maximum heat transfer. Induced-draft systems are an inherently safer design than forced draft, positive pressure designs.

Induced-draft designs operate the heat exchanger under negative pressure, helping to prevent leakage of flue gases into the supply airstream. The gas heat system utilizes a direct-spark ignition and is protected by numerous safety circuits.

Microprocessor control

The microprocessor-based controller provides complete system control of unit operation. The controller monitors all system sensors and makes operating decisions based upon the user's configuration inputs.

Local access to the microprocessor control may be accomplished via the accessory BACview handheld keypad/display unit. The BACview handheld keypad/display features a numeric keypad, direction keys, four programmable function keys, and a backlit LCD (liquid crystal diode) display. The display is a large 4-line by 40-character display that is easy to read, even in low light conditions. Access to the microprocessor may also be accomplished via a PC using Carrier software.

In addition, the microprocessor control has the following features:

- simple access to set points, time schedules, status values, and unit configuration parameters
- supports communications with BACnet*, Modbus†, and optionally with LonWorks** building automation protocols
- alarm conditions are indicated via an alarm LED and an audible signal
- alarm history is recorded and may be accessed via the BACview handheld keypad/display
- password protection
- compressor minimum off time (5 minutes) feature
- service test and a service diagnostic mode

* Sponsored by ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers).
† Registered trademark of Schneider Electric.
** Registered trademark of Echelon Corporation.

Ratings and capacities

GAS HEAT CAPACITIES

UNIT SIZE 62D	INPUT (Btuh)	OUTPUT (Btuh)	NO. OF GAS HEAT SECTIONS	NO. OF STAGES	MODULATION RANGE (%)	MINIMUM ENTERING AIR TEMP (F)	MAXIMUM ENTERING AIR TEMP (F)	MINIMUM TEMP RISE (F)	MAXIMUM TEMP RISE (F)	MINIMUM LEAVING AIR TEMP (F)	MAXIMUM LEAVING AIR TEMP (F)
07-09	75,000	60,000	1	2	25-100	-20	75	25	90	50	165
	100,000	80,000	1	2	25-100						
	150,000	120,000	1	2	25-100						
	200,000	160,000	1	2	25-100						
12-20	150,000	120,000	1	2	25-100						
	200,000	160,000	1	2	25-100						
	250,000	200,000	1	2	25-100						
	300,000	240,000	1	2	25-100						
22-38	300,000	240,000	1	2	25-100						
	400,000	320,000	1	2	25-100						
	500,000	400,000	2	4	12.5-100						
	600,000	480,000	2	4	12.5-100						

HYDRONIC HEATING COIL CAPACITIES

UNIT SIZE 62D	CFM	ENTERING AIR TEMP (F)	STEAM COIL			HOT WATER COIL					
			Steam Temp at 5 psig (F)	Total Btuh (1000)	Leaving Air Temp (F)	Entering Water Temp (F)	Entering Water Flow (gpm)	Total Btuh (1000)	Leaving Air Temp (F)	Leaving Water Temp (F)	Water Pressure Drop (ft wg)
07-09	1,300	70	180	87.7	132.2	180	10.9	106.2	145.3	160.5	1.1
	3,000	70	180	200.0	130.1	180	20.1	200.4	131.6	160.1	1.9
12-20	1,300	70	180	87.7	132.2	180	10.9	106.2	145.3	160.5	1.1
	3,900	70	180	255.0	130.3	180	26.2	260.6	131.6	160.1	2.1
	6,500	70	180	345.2	118.9	180	35.7	346.7	119.2	160.6	3.7
22-38	5,000	70	180	370.3	138.3	180	48.9	475.5	157.6	160.6	1.4
	8,000	70	180	493.9	126.9	180	68.0	662.0	146.3	160.5	2.7
	11,000	70	180	590.2	119.5	180	84.4	810.9	137.9	160.8	3.9

STEAM HEATING COIL CAPACITIES

UNIT SIZE 62D	CFM		ENTERING AIR TEMPERATURE — EDB (F)						
			-20	-10	0	10	20	30	40
07-09	1,300	TC	155.1	148.9	142.6	136.3	130.0	123.8	117.5
		LDB	89.6	95.1	100.7	106.3	111.9	117.4	123.0
	2,100	TC	206.3	197.9	189.6	181.2	172.9	164.6	156.2
		LDB	70.2	76.5	82.9	89.3	95.6	102.0	108.3
	3,000	TC	250.5	240.4	230.2	220.1	210.0	199.9	189.7
		LDB	56.7	63.6	70.5	77.1	84.3	91.2	98.1
12-20	1,300	TC	155.1	148.9	142.6	136.3	130.0	123.8	117.5
		LDB	89.6	95.1	100.7	106.3	111.9	117.4	123.0
	3,900	TC	297.7	286.1	263.0	251.4	239.9	228.3	216.8
		LDB	40.1	47.4	61.9	69.2	76.5	83.8	91.0
	6,000	TC	349.8	335.7	321.5	307.4	293.3	279.1	265.0
		LDB	33.5	41.4	49.2	57.0	64.9	72.7	80.6
22-38	5,000	TC	441.2	423.4	405.5	387.7	369.9	352.0	334.2
		LDB	61.0	67.8	74.5	81.2	87.9	94.7	101.4
	8,000	TC	560.5	537.8	515.2	492.5	469.9	447.2	424.6
		LDB	44.3	51.7	59.1	66.5	73.9	81.3	88.7
	12,000	TC	674.7	647.4	620.1	592.9	565.6	538.3	511.1
		LDB	31.6	39.5	47.5	55.4	63.3	71.2	79.1

LEGEND

EDB — Entering Air Temperature (F)
LDB — Leaving Dry Bulb Temperature (F)
TC — Total Capacity (1000 Btuh)

NOTE: 6500 cfm is 542 ft per minute velocity (face).

ENERGY CONSERVATION WHEEL CAPACITIES

UNIT SIZE 62DC,DD	WHEEL DIAMETER (in.)	WHEEL THICKNESS (in.)	MAXIMUM AIRFLOW (cfm)	AIR PRESSURE DROP (in. wg)	HEATING			
					Return Air Temp (db/wb)(F)	Entering Outdoor Air Temp (F)	Leaving Air Temp (F)	Sensible Btuh
07-09	36	4	3000	1.37	70.0/58.0	0.0	42.5	144,892
12-20	36	4	2700	1.23	70.0/58.0	0.0	42.5	136,215
	48	4	4500	1.15	70.0/58.0	0.0	47.3	233,423
22-38	42	4	3600	1.20	70.0/58.0	0.0	43.1	183,432
	48	4	4500	1.15	70.0/58.0	0.0	47.3	233,423
	54	4	8000	1.15	70.0/58.0	0.0	48.4	368,300

LEGEND

db — Dry Bulb Temperature
wb — Wet Bulb Temperature

ELECTRIC HEAT CAPACITIES

UNIT SIZE 62D	ELECTRIC HEAT kW (240,480 / 208)	AMPS			MINIMUM ENTERING AIR TEMP (F)	MAXIMUM ENTERING AIR TEMP (F)	MINIMUM TEMP RISE (F)	MAXIMUM TEMP RISE (F)	MINIMUM LEAVING AIR TEMP (F)	MAXIMUM LEAVING AIR TEMP (F)
		240 v	480 v	208 v						
07-09	10.0 / 7.5	24.1	12.0	20.8	-20	75	N/A	76	N/A	151
	15.0 / 11.3	36.1	18.0	31.4						
	20.0 / 15.0	48.1	24.1	41.6						
	25.0 / 18.8	60.1	30.1	52.2						
	30.0 / 22.6	72.2	36.1	62.5						
	35.0 / 26.3	84.2	42.1	73.0						
	40.0 / 30.0	96.2	48.1	83.3						
12-20	10.0 / 7.5	24.1	12.0	20.8						
	15.0 / 11.3	36.1	18.0	31.4						
	20.0 / 15.0	48.1	24.1	41.6						
	25.0 / 18.8	60.1	30.1	52.2						
	30.0 / 22.6	72.2	36.1	62.5						
	35.0 / 26.3	84.2	42.1	73.0						
	40.0 / 30.0	96.2	48.1	83.3						
	50.0 / 37.5	120.3	60.1	104.1						
	60.0 / 45.0	144.3	72.2	124.9						
22-38	10.0 / 7.5	24.1	12.0	20.8						
	15.0 / 11.3	36.1	18.0	31.4						
	20.0 / 15.0	48.1	24.1	41.6						
	30.0 / 22.6	72.2	36.1	62.5						
	40.0 / 30.0	96.2	48.1	83.3						
	50.0 / 37.5	120.3	60.1	104.1						
	60.0 / 45.0	144.3	72.2	124.9						

AIRFLOW LIMITS

UNIT SIZE 62D	62DA,DB,DC,DD*		62DC,DD†	
	Min. CFM	Max. CFM	Min. CFM	Max. CFM
07	700	1,500	1,500	2,500
08	800	1,800	1,800	3,000
09	900	2,100	2,100	3,500
12	1,100	2,200	2,200	3,700
14	1,350	2,900	2,900	4,600
15	1,700	3,600	3,600	5,800
16	2,000	4,400	4,400	6,500
20	2,400	4,400	4,400	6,500
22	2,400	4,400	4,400	6,500
24	2,400	6,000	6,000	9,000
30	3,400	9,000	7,000	11,000
34	4,000	8,000	8,000	12,000
38	4,800	9,000	9,000	12,000

*Units without ECW.

† 62DC and DD with ECW.

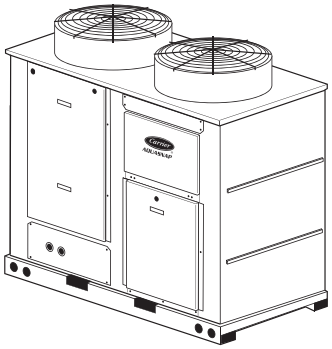
Carrier
United Technologies

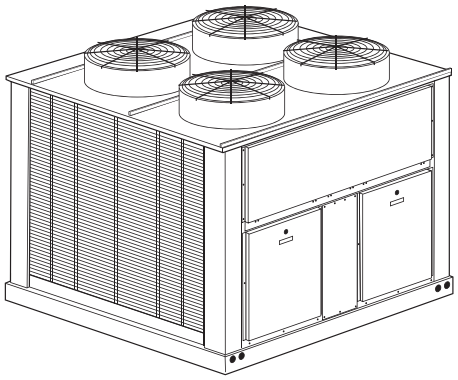
Product Data

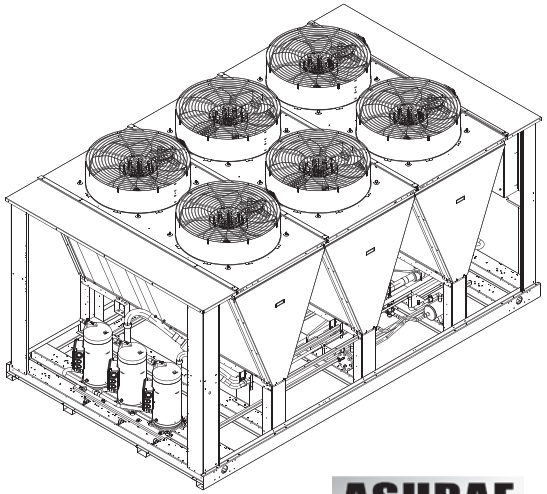
AquaSnap®
30RAP018-150 Air-Cooled Chillers and
30RAP011-060 Air-Cooled Chillers with
Greenspeed® Intelligence
with Puron® Refrigerant (R-410A)
50/60 Hz

11 to 150 Nominal Tons
(39 to 528 Nominal kW)

greenspeed
AQUASNAP®







Puron®

ASHRAE 90.1 COMPLIANT

SEISMICOMPLIANT*

* Meets IBC 2006, ASCE-7-05, CBC 2007, and OSHPD seismic requirements.

The AquaSnap chiller is an effective all-in-one package that is easy to install and easy to own. AquaSnap chillers operate quietly and efficiently. Value-added features include:

- Rotary scroll compression
- HFC Puron® refrigerant (R-410A)
- EERs (Energy Efficiency Ratios) meet ASHRAE (American Society of Heating, Refrigeration and Air-Conditioning Engineers) Standard 90.1-2013
- Low-sound AeroAcoustic™ fan system
- Easy to use *Comfort*Link controls
- Optional integrated hydronic pump package (60 Hz only) with VFD (variable frequency drive) compatible motors, with optional VFD on size 070-150 models
- Coil design flexibility—Microchannel coil technology available on all units, and RTPF coil technology available on sizes 070-150
- Accessory fluid storage tank on size 011-060 models
- Optional digital scroll compressors on size 011-090 models
- Optional high-efficiency, variable-speed condenser fans (30RAP011-060 with Greenspeed® intelligence)

Features/Benefits

Carrier's innovative chiller design provides savings at initial purchase, at installation, and for years afterward.

Costs less right from the start

Carrier's AquaSnap chillers feature a compact, all-in-one package design that installs quickly and easily on the ground or the rooftop. The optional pump and hydronic components (60 Hz only) are already built in; this costs less than buying and installing the components individually. The chiller's fully integrated and pre-assembled hydronic system (60 Hz only) installs in minutes.

Features/Benefits (cont)

Among chillers in its class, the AquaSnap chiller is one of the easiest and least expensive to install.

The preassembled and integrated hydronic module uses high-quality components and pumps to ensure years of reliable operation.

Use of the optional fluid storage tank, available on size 011-060 models, reduces installation costs and ensures that sufficient fluid volume is available for close-coupled and process cooling applications. The AquaSnap unit's high efficiency keeps energy costs down.

AquaSnap® chillers make noise in the marketplace, not the workplace.

The AquaSnap chiller's low-sound AeroAcoustic™ fan produces up to half the sound level of propeller fans. Much of the noise reduction is in frequencies where noise is most annoying, which makes AquaSnap chillers ideal for sound-sensitive environments. When lower ambient temperatures allow part load operation or during scheduled nighttime operation, the units operate with fewer fans and become even quieter. AquaSnap chillers are quiet during the day and even quieter at night.

The savings will continue to mount

Besides costing less to buy and install, AquaSnap chillers are also affordable to operate. Carrier's Aqua Series chillers are our most efficient air-cooled models. The AquaSnap chiller provides full load EER (Energy Efficiency Ratio) up to 10.40 for 60 Hz applications and up to 10.91 for 50 Hz applications. The AquaSnap chiller provides IPLV (integrated part load value) up to 15.79 for 60 Hz applications, and up to 16.64 for 50 Hz applications. When Greenspeed® intelligence is employed, the IPLV values rise to as high as 16.8 for 60 Hz applications and up to 17.4 for 50 Hz applications. AquaSnap chillers use ultra-quiet, high-efficiency rotary scroll compressors, operated in tandem (sizes 011-060) and tandem or trio (sizes 070-150) per independent circuit for greater efficiency at partial loads.

30RAP chillers with Greenspeed intelligence feature a high-efficiency, variable-speed condenser fan option along with fine-tuned *Comfort*Link controls, which together provide premium part load efficiency to facilitate reduced utility costs over the lifespan of the chiller. Additionally, the lower sound levels achieved at part load conditions can be very beneficial for sensitive acoustic applications. NOTE: Unit sizes 011 and 016 are only available with Greenspeed intelligence.

Standard DC link reactor for 30RAP units with Greenspeed intelligence is included in all drives for the fans. The use of this component mitigates customer concern over electrical system harmonics, and therefore AC line reactors should not be required for applications employing 30RAP chillers with Greenspeed intelligence.

Electronic expansion valve (EXV) allows for precise control through all operating ranges, resulting in higher efficiency and improved reliability.

Proven reliability that's built in

Thousands of AquaSnap chillers are already in service around the world. This field-proven design is backed by a 12-month warranty that includes the hydronic system. The compressors are maintenance-free and protected by an auto-adaptive control that minimizes compressor wear. Unit sizes 035 and up have two independent refrigerant circuits. Year-round operation is standard, from –20 F (–29 C) (with optional cooler heater, low ambient control [on units with fixed speed fans], and wind baffles) to 120 F (50 C).

Rotary scroll compressors provide smooth, quiet, and reliable operation.

All-in-one package

AquaSnap chillers provide one of the most comprehensive chilled water circuits available for air-cooled chillers. Included is a brazed plate direct expansion cooler that may be remote-mounted. The cooler is also completely drainable with factory-installed vents and drains.

Strainer included

A 40-mesh strainer is provided with every 30RAP unit, making the chiller installation easier, lower in cost, and eliminating customer concern. Other manufacturers also require the strainer but may not include it with their chillers, giving the impression that they offer a lower pressure drop chiller. It is important to note that the strainer is required for all brazed plate heat exchangers; therefore, not considering it from the beginning may lead to the selection of the incorrect pump for the system and an incorrect evaluation of the overall installation cost.

Electronic thermal-dispersion flow switch is included with the cooler. The switch is factory installed and tested and contains no moving parts for high reliability.

Optional integrated hydronic package (60 Hz chillers only) is more than just a pump; it is an entire chilled-water system, including:

- Single/dual pumps up to 15 hp and 160 ft head
- Strainer
- Flow regulator
- Freeze protection to –20 F (–29 C) (with freeze protection option)
- Heaters
- Required piping
- Pressure/temperature taps
- Isolation valves for dual pump systems

Table of contents

- VFD available on sizes 070-150, and VFD compatibility on all models

The factory-installed and tested hydronic package provides faster, simpler and less expensive installation.

Digital scroll compressors are available as a factory-installed option on sizes 011-090. These allow for incremental unloading with capacity modulation to better match building load when compared to standard scroll compressors.

Environmentally balanced

Carrier's Puron® refrigerant (R-410A) is a responsible choice for protecting the earth's ozone layer. Puron refrigerant is an HFC refrigerant that does not contain chlorine that is damaging to the ozone layer. Puron refrigerant is a safe, efficient, and environmentally balanced refrigerant.

Durable construction

The 30RAP chillers have a structurally sound base that can be point-loaded; therefore, no perimeter base rail is required. All 30RAP units have weatherized cabinets constructed of heavy-duty galvanized steel with exterior panels painted with corrosion-resistant baked enamel. Inside and outside surfaces are protected to ensure long life and good appearance. The durable, galvanized steel, painted components exceed the requirements of the 500-hour salt spray test per ASTM (American Society for Testing and Materials) B117.

*Comfort*Link controls speak your language

The *Comfort*Link controls communicate in plain English, making it as easy as possible to monitor and control each AquaSnap chiller while accurately maintaining fluid temperatures. The large scrolling marquee display acts as a window into the unit's operation, providing easy-to-read information about chiller performance and over 15 diagnostic functions. Carrier's 30 Series chillers' *Comfort*Link controls provide features such as chilled water temperature reset, demand limiting, compressor wear minimization and protection, temperature and pressure displays, and diagnostic functions. These controls result in higher chiller reliability, simplified training, and more productive service calls with correspondingly lower operational and maintenance costs.

Carrier's exclusive accessory handheld Navigator™ display provides convenience and powerful information in the palm of your hand. The Navigator display helps technicians to quickly diagnose problems and even prevent them from occurring.

All AquaSnap units are ready to be used with the Carrier Comfort Network® (CCN) system.

A BACnet* communication option is also available for the i-Vu® Open control system or a third-party BACnet building automation system.

AquaSnap units minimize the impact on your footprint, as well as your bottom line

The integrated hydronics and the chilled fluid storage tank's placement under the chiller minimize the footprint, allowing easy installation almost anywhere.

Seismic certification

A seismic kit is available which will result in a unit SDS (seismic design acceleration parameter) level of 2.5 for 30RAP011-060 units, or a unit SDS level of 2.1 for 30RAP070-150 units.

Novation® heat exchanger technology

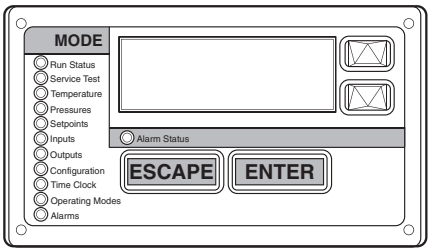
The Novation heat exchanger design with microchannel (MCHX) condenser coil is a robust, cost effective alternative to traditional coil design. These coils are offered coated or uncoated to match coil protection to site conditions. The e-coated version of this coil can withstand an 8,000-hour salt spray test in accordance with ASTM B-117 Standard. The Carrier Electronic Catalog (E-Cat) can be used to determine whether or not corrosion protection is recommended for particular applications in coastal/marine environments. Following the input of the requested data, the E-Cat program output will recommend the appropriate coil to be used. Other factors described in "Selection Guide: Environmental Corrosion Protection" catalog number 04-581061-01 must also be considered to determine if corrosion protection is required.

Microchannel coils are more robust than other coil types, making them easier to clean without causing damage to the coil.

Due to the compact, all-aluminum design, microchannel coils will reduce average unit operating weight by 25% compared to the previous 30RA units. The streamlined MCHX coil design also reduces refrigerant charge by an average of 60% compared to previous 30RA units.

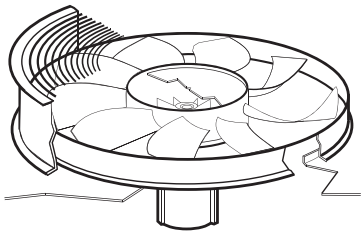
* BACnet is a registered trademark of ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers).

Features/Benefits (cont)

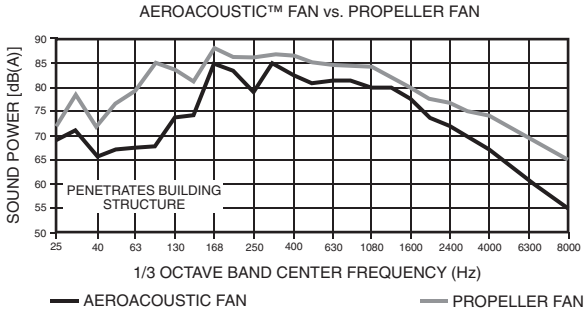


SCROLLING MARQUEE DISPLAY

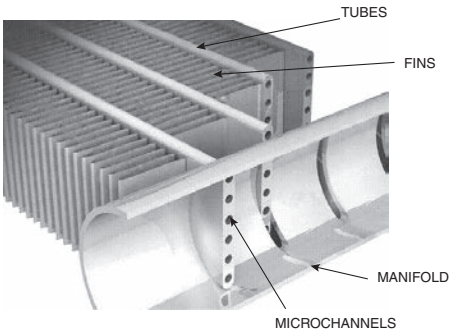
NAVIGATOR™ DISPLAY MODULE



LOW-SOUND AEROACOUSTIC FAN WITH NIGHTTIME LOW SOUND



AEROACOUSTIC FAN VS PROPELLER FAN



NOVATION® HEAT EXCHANGER TECHNOLOGY WITH MICROCHANNEL CONDENSER COILS

AHRI* capacity ratings

30RAP018-150 UNITS WITH FIXED SPEED FANS, 60 Hz

UNIT 30RAP 60 Hz	CAPACITY		COMPRESSOR POWER INPUT (kW)	FAN POWER (kW)	TOTAL POWER (kW)	FULL LOAD		IPLV		COOLER FLOW RATE		CHILLER WATER PRESSURE DROP	
	Tons	kW				EER	COP	EER	COP	GPM	L/s	Ft wg	kPa
018	16.1	56.6	15.6	3.0	18.6	10.36	3.036	14.57	4.269	38.5	2.4	16.7	49.9
020	18.8	66.1	18.9	2.9	21.7	10.40	3.048	14.60	4.279	45.2	2.9	15.2	45.4
025	23.4	82.3	24.5	2.8	27.0	10.40	3.048	15.44	4.526	56.3	3.6	19.1	57.0
030	28.3	99.5	30.7	2.7	33.4	10.18	2.984	15.20	4.454	68.0	4.3	18.0	53.7
035	34.4	121.0	35.9	3.8	39.7	10.39	3.046	14.90	4.366	82.5	5.2	19.1	57.0
040	38.9	136.8	42.3	3.8	46.1	10.13	2.969	15.40	4.514	93.4	5.9	20.0	59.7
045	43.4	152.6	48.1	3.4	51.5	10.11	2.963	15.42	4.519	104.1	6.6	22.5	67.2
050	48.0	168.8	52.6	3.8	56.4	10.20	2.990	15.26	4.473	115.1	7.3	19.6	58.5
055	51.8	182.2	56.4	5.3	61.7	10.07	2.951	14.63	4.286	124.2	7.8	17.6	52.5
060	56.0	196.9	60.8	5.3	66.2	10.16	2.977	14.45	4.235	134.4	8.5	20.5	61.2
070	68.9	242.3	75.0	6.4	81.4	10.16	2.977	15.23	4.462	165.4	10.4	19.6	58.6
080	77.4	272.2	82.3	7.6	89.9	10.33	3.027	15.53	4.551	185.7	11.7	21.2	63.4
090	84.0	295.4	90.2	7.6	97.8	10.30	3.020	15.79	4.627	201.6	12.7	22.7	67.9
100	98.0	344.7	106.8	8.9	115.7	10.16	2.978	15.47	4.533	235.2	14.8	22.0	65.8
115	111.8	392.2	120.0	10.2	130.2	10.31	3.021	15.64	4.583	268.4	16.9	23.6	70.5
130	125.1	439.9	136.8	11.4	148.2	10.13	2.969	15.47	4.535	300.2	18.9	23.5	70.2
150	136.9	481.6	149.3	12.7	162.0	10.14	2.973	15.21	4.456	328.7	20.7	24.2	72.3

30RAP011-060 WITH GREENSPEED INTELLIGENCE, 60 Hz

UNIT 30RAP 60 Hz	CAPACITY		COMPRESSOR POWER INPUT (kW)	FAN POWER (kW)	TOTAL POWER (kW)	FULL LOAD		IPLV		COOLER FLOW RATE		CHILLER WATER PRESSURE DROP	
	Tons	kW				EER	COP	EER	COP	GPM	L/s	Ft wg	kPa
011	9.7	34.1	9.8	1.2	11.0	10.60	3.107	16.77	4.916	23.4	1.5	12.9	38.5
016	13.6	47.8	14.9	1.3	16.1	10.10	2.961	16.23	4.756	32.6	2.1	12.1	36.1
018	16.1	56.6	15.6	3.0	18.6	10.36	3.036	16.03	4.699	38.5	2.4	16.7	49.9
020	18.8	66.1	18.9	2.9	21.7	10.40	3.048	15.94	4.673	45.2	2.9	15.2	45.4
025	23.4	82.3	24.2	2.8	27.0	10.40	3.048	16.36	4.795	56.3	3.6	19.1	57.0
030	28.3	99.5	30.7	2.7	33.4	10.18	2.984	16.31	4.780	68.0	4.3	18.0	53.7
035	34.4	121.0	35.9	3.8	39.7	10.39	3.046	16.23	4.757	82.5	5.2	19.1	57.0
040	38.9	136.8	42.3	3.8	46.1	10.13	2.969	16.34	4.788	93.4	5.9	20.0	59.7
045	43.4	152.6	48.1	3.4	51.5	10.11	2.963	16.48	4.830	104.1	6.6	22.5	67.2
050	48.0	168.8	52.6	3.8	56.4	10.20	2.990	16.34	4.789	115.1	7.3	19.6	58.5
055	51.8	182.2	56.4	5.3	61.7	10.07	2.951	16.00	4.689	124.2	7.8	17.6	52.5
060	56.0	196.9	60.8	5.3	66.2	10.16	2.977	16.01	4.691	134.4	8.5	20.5	61.2

LEGEND

COP — Coefficient of Performance
EER — Energy Efficiency Ratio
IPLV — Integrated Part Load Value

* Air-Conditioning, Heating, and Refrigeration Institute.

NOTE: Based on AHRI-550/590 standard rating conditions. All ratings in the above table were generated in Packaged Chiller Builder version 3.49q, using uncoated condenser coils and no additional chiller options. Refer to the most current version of the Packaged Chiller Builder to obtain the most up-to-date data.

AHRI* capacity ratings (cont)

30RAP018-150 UNITS WITH FIXED SPEED FANS, 50 Hz

UNIT 30RAP 50 Hz	CAPACITY		COMPRESSOR POWER INPUT (kW)	FAN POWER (kW)	TOTAL POWER (kW)	FULL LOAD		IPLV		COOLER FLOW RATE		CHILLER WATER PRESSURE DROP	
	Tons	kW				EER	COP	EER	COP	GPM	L/s	Ft wg	kPa
018	13.5	47.6	12.8	2.1	14.9	10.91	3.197	15.48	4.536	32.5	2.0	12.0	35.8
020	15.9	55.8	15.4	2.2	17.6	10.81	3.168	15.62	4.579	38.1	2.4	10.9	32.5
025	19.8	69.5	19.8	2.2	21.9	10.80	3.166	16.39	4.804	47.4	3.0	13.7	40.9
030	23.6	83.0	25.0	2.3	27.3	10.36	3.037	16.14	4.731	56.6	3.6	12.8	38.2
035	28.6	100.7	28.8	2.8	31.6	10.89	3.191	15.83	4.639	68.7	4.3	13.4	40.0
040	32.1	112.8	34.0	2.8	36.8	10.45	3.063	16.12	4.724	77.0	4.9	14.1	42.1
045	35.7	125.6	38.5	2.7	41.2	10.40	3.048	16.02	4.695	85.7	5.4	15.6	46.6
050	39.8	140.0	42.1	2.7	44.8	10.66	3.124	15.88	4.653	95.4	6.0	13.7	40.9
055	43.1	151.6	45.4	3.7	49.1	10.54	3.088	15.35	4.499	103.5	6.5	12.4	37.0
060	45.5	160.2	48.1	4.0	52.1	10.49	3.073	15.38	4.506	109.3	6.9	13.8	41.1
070	59.2	208.2	61.9	4.8	66.7	10.64	3.120	15.76	4.619	143.1	9.0	14.6	43.6
080	65.8	231.4	68.0	5.5	73.5	10.74	3.149	16.64	4.877	157.9	10.0	15.0	44.8
090	71.3	250.8	75.0	5.5	80.4	10.64	3.119	16.55	4.850	171.2	10.8	16.9	50.5
100	81.6	287.0	85.7	6.4	92.1	10.63	3.114	16.25	4.763	195.8	12.4	16.4	49.0
115	93.2	327.8	98.8	7.3	106.2	10.54	3.089	16.32	4.784	223.8	14.1	17.7	52.9
130	103.9	365.4	110.7	8.2	119.0	10.48	3.071	16.05	4.704	249.3	15.7	16.7	49.9
150	114.6	403.0	122.6	9.1	131.8	10.44	3.059	15.78	4.626	275.0	17.3	17.4	52.0

30RAP011-060 WITH GREENSPEED INTELLIGENCE, 50 Hz

UNIT 30RAP 50 Hz	CAPACITY		COMPRESSOR POWER INPUT (kW)	FAN POWER (kW)	TOTAL POWER (kW)	FULL LOAD		IPLV		COOLER FLOW RATE		CHILLER WATER PRESSURE DROP	
	Tons	kW				EER	COP	EER	COP	GPM	L/s	Ft wg	kPa
011	8.0	28.1	7.9	0.9	8.8	10.88	3.189	17.43	5.109	19.2	1.2	8.8	26.3
016	11.2	39.4	11.9	0.9	12.8	10.46	3.066	16.81	4.926	26.8	1.7	8.4	25.1
018	13.5	47.6	12.8	2.1	14.9	10.91	3.197	16.54	4.847	32.5	2.0	12.0	35.8
020	15.9	55.8	15.4	2.2	17.6	10.81	3.168	16.50	4.836	38.1	2.4	10.9	32.5
025	19.8	69.5	19.8	2.2	21.9	10.80	3.166	17.05	4.996	47.4	3.0	13.7	40.9
030	23.6	83.0	25.0	2.3	27.3	10.36	3.037	16.86	4.940	56.6	3.6	12.8	38.2
035	28.6	100.7	28.8	2.8	31.6	10.89	3.191	16.87	4.944	68.7	4.3	13.4	40.0
040	32.1	112.8	34.0	2.8	36.8	10.45	3.063	16.81	4.925	77.0	4.9	14.1	42.1
045	35.7	125.6	38.5	2.7	41.2	10.40	3.048	16.86	4.940	85.7	5.4	15.6	46.6
050	39.8	140.0	42.1	2.7	44.8	10.66	3.124	17.04	4.995	95.4	6.0	13.7	40.9
055	43.1	151.6	45.4	3.7	49.1	10.54	3.088	16.61	4.867	103.5	6.5	12.4	37.0
060	45.5	160.2	48.1	4.0	52.1	10.49	3.073	16.48	4.831	109.3	6.9	13.8	41.1

LEGEND

COP — Coefficient of Performance
EER — Energy Efficiency Ratio
IPLV — Integrated Part Load Value

* Air-Conditioning, Heating, and Refrigeration Institute.

NOTE: Based on AHRI-550/590 standard rating conditions. All ratings in the above table were generated in Packaged Chiller Builder version 3.49q, using uncoated condenser coils and no additional chiller options. Refer to the most current version of the Packaged Chiller Builder to obtain the most up-to-date data.

AHRI CERTIFIED®
www.ahridirectory.org
Air-Cooled Chillers
AHRI Standards 550/590 and 551/591

Heating & Air Conditioning

Amana®

DigiAIR®

Your PTAC Make-up Air Solution

Dehumidify your make-up air when you really need to, with the new Amana® brand PTAC DigiAIR® module.

When you need the ability to bring in outside make-up air into your room through the PTAC — the Amana brand DigiAIR can assist with up to 75 CFM of outside air.

The Amana brand DigiAIR® module is a factory-installed make-up air system with configurable dehumidification. The DigiAIR system, in conjunction with constant negative room air pressure, will allow dehumidified outside make-up air to be introduced into the guest rooms at rates up to 75 CFM. An optional 250 Watt supplemental heater, to warm the incoming air in colder climates, can be factory installed in every DigiAIR system.

DigiAIR's adaptive dehumidification process activates dehumidification using a 3 tier temperature and outdoor relative humidity system. The dehumidification activation point is configurable, using the PTAC touch pad, between 15% and 60% outdoor relative humidity.

DigiAIR's relative humidity setting can also be viewed and configured remotely through the optional DigiSmart control system.

- Dehumidification configurable to activate when outdoor RH is between 15% and 60%
- Configurable via PTAC touch pad or optional web interface
- Permanent washable filter
- Up to 75 CFM outdoor make-up air
- Assembled in Fayetteville, TN, USA
- 250 Watt supplemental heater (optional)
- Amana Brand PTAC is AHRI certified

Premium Amana® Brand Quality

Heating & Air Conditioning
Amana®
LASTS AND LASTS AND LASTS.®

DigiAIR®
Your PTAC Make-up Air Solution

DigiAIR® Technical Specifications

Dehumidification Operation	
Out Door Air Temperature	Out Door RH % *
≥ 80 F	≥ 25% RH
≥ 70 F & < 80 F	≥ 40% RH
≥ 48 F & < 70 F	≥ 50% RH

Compressor	
Voltage	230/208 volt 60 Hz, 1Ø
Refrigerant	R134A
Watts	225
Rated Load Amps	1.05
Locked Rotor Amps	3.3
Psig (high side)	200 psi
Psig (low side)	60 psi

Electric Heater (optional)	
Voltage	230/208 v 60 hz, 1Ø
Watts	250/205
Amps	1.1 / 1.0

Make-up Air Fan	
Voltage	24 volt
Watts	16
Amps	0.09
CFM	up to 75

Miscellaneous	
Outside air filter	Yes, permanent & washable
RH % Configuration	Yes, via touch pad or optional Web UI interface
RH% configuration range	15% to 60%
Uninstall PTAC to change RH %	No
PTAC AHRI certification	Yes
Assembled in USA	Yes
Country of Origin (COO)	USA
DigiAIR monitoring	Yes, via optional Web UI

* Can be configured from 15% RH to 60 % RH

Model	PMH073G		PMH093G		PMH123G		PMC073G	PMC093G	PMC123G	PMC153G
Operation	Cooling	Heating	Cooling	Heating	Cooling	Heating	Cooling	Cooling	Cooling	Cooling
Volt	230 / 208	230 / 208	230 / 208	230 / 208	230 / 208	230 / 208	230 / 208	230 / 208	230 / 208	230 / 208
Rated BTU	7600 / 7600	6800 / 6800	9000 / 9000	8300 / 8100	12000 / 12000	11500 / 11300	7700 / 7700	9000 / 9000	12000 / 12000	15000 / 14700
Rated EER	11.8 / 11.8	3.3 / 3.3	11.3 / 11.3	3.3 / 3.3	10.4 / 10.4	3.1 / 3.1	11.7 / 11.7	11.3 / 11.3	10.4 / 10.5	9.5 / 9.6

Design and construction considerations:

1. Makeup air will increase room BTUH load requirements and may require additional PTAC cooling and or heating BTU/H supply. For instance, 55 CFM exhaust air, will bring in 79,200 cubic feet of outside makeup air daily. This can impact the building electrical design needs.
2. With the added condensate volume generated by the DigiAIR system, it is highly recommended that a piped condensate drain system be used.
3. With added condensate generated by the DigiAIR module and increased make-up air volumes coming through the DigiAIR module; units and filters will need to be inspected and cleaned more frequently. It is highly recommended that a manufactured approved time-activated condensate/algaecide pads be used regularly.
4. In seacoast installations some of the salt will be removed from the air when passing through the DigiAIR dehumidification module, but salt air will still be introduced into the conditioned space.
5. DigiAIR module is intended to work in conjunction with negative building pressure created by a building exhaust system operating continuously (24/7/365).
6. Consult your design and/or specifying engineer to discuss construction and maintenance considerations.

Limited warranty:

- First-Year Warranty: Parts & Labor
- Second through Fifth Year: Parts & Labor on certain sealed system components (PTAC's primary sealed system)
- Second through Fifth Year: on certain functional parts only

* Complete warranty details available from your local dealer or at www.amana-ptac.com

PTAC Heating & Air Conditioning Amana PROUDLY ASSEMBLED IN THE USA FOR OVER ★40★ YEARS

AHRI CERTIFIED® www.ahridirectory.org Packaged Terminal HP AHRI Standard 310/380

INTERTEK ETL LISTED C US

Call your Amana brand PTAC sales representative at 800-647-2982 for complete details.

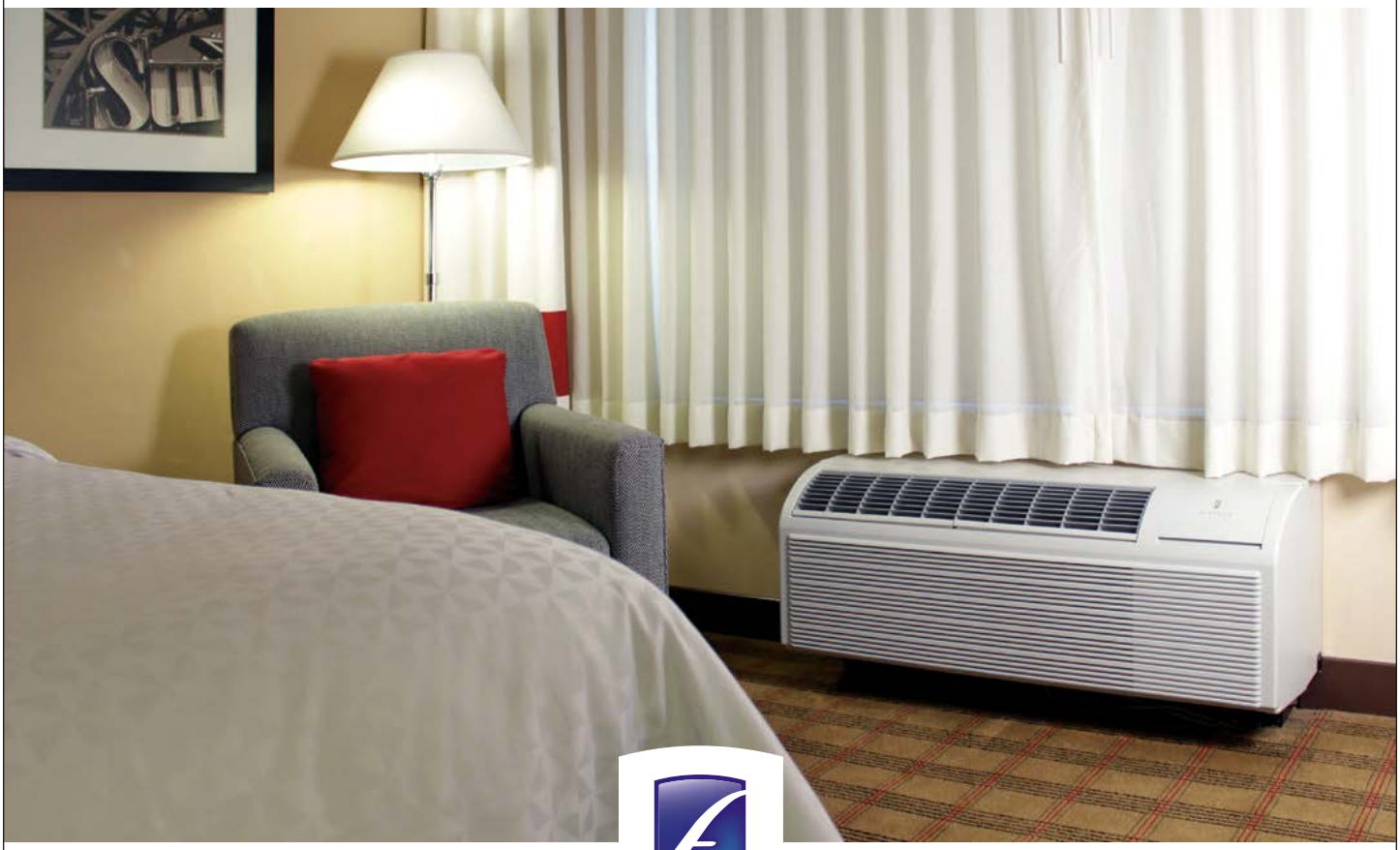
Before purchasing this appliance, read important information about its estimated annual energy consumption, yearly operating cost, or energy efficiency rating that is available from your retailer.

www.amana-ptac.com

CB-DIGIAIRX 03-16

FRESHAIRE® SERIES

PTACs



FRIEDRICH

1883

PRELIMINARY

FreshAire™ SERIES

Fully integrated FreshAire system complies with ASHRAE 62.1-2013 requirements

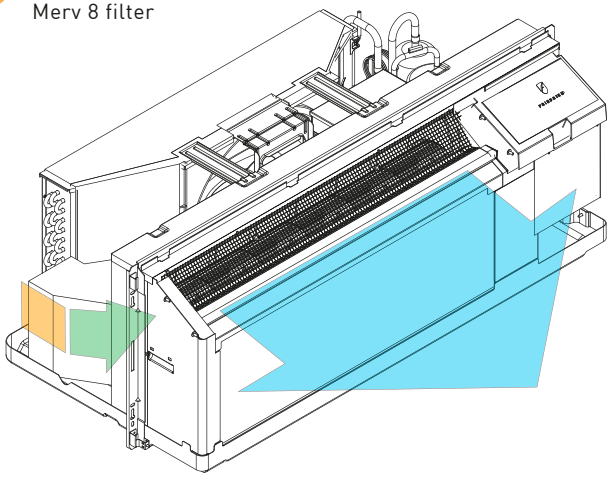
The new Friedrich FreshAire PTAC helps you meet stringent ASHRAE 62.1-2013 requirements by bringing up to 35 CFM of conditioned, MERV 8 filtered outside air into the space.

Patents-pending technology uses the inverter compressor and main cooling system to optimize temperature and humidity level of incoming air.

By introducing makeup air directly into the guestroom, rooftop central fresh air systems can be considerably downsized to service only the common areas of the property.

This greatly reduces the cost and complexity of hotel design and construction. Unlike other PTACs, the FreshAire PTAC utilizes the main evaporator coil and MERV 8 filters to truly condition and filter the outside ventilation air.

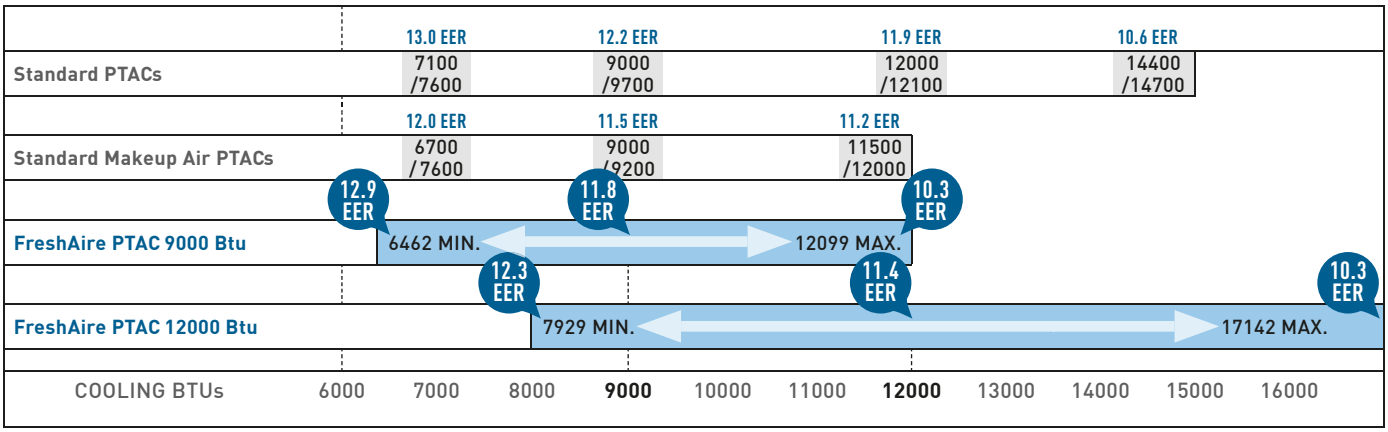
Makeup air passes through Merv 8 filter



The widest cooling & heating range in the industry with only two models

Variable speed technology gives you the flexibility of a full line of PTACs with only two models, and offers the highest available capacity of any 42x16 PTAC on the market at over 17,000 BTUs.

The Friedrich Inverter variable speed compressor matches the unit output to the actual demand of the space for increased comfort and lower energy consumption. This allows the 9,000 Btu FreshAire PTAC to operate as low as 6,462 Btus and as high as 12,099 Btus. The 12,000 Btu model can operate as low as 7,929 Btus and as high as 17,142 Btus. That's like getting multiple PTACs in one.



Values at 95˚DB/75˚WB 80˚DB/67˚WB.

Friedrich's inverter compressor offers many advantages over traditional PTACs

ADVANTAGES INCLUDE

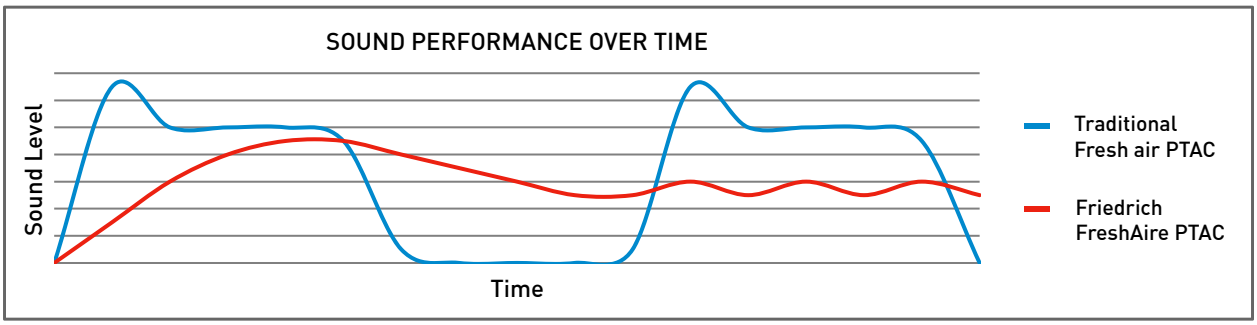
- Improved dehumidification
- Quieter start-up and operation
- Better efficiency during part load hours of cooling & heating
- Reduced temperature swings improve guest comfort

TRADITIONAL PTAC SYSTEM	INVERTER PTAC SYSTEM
At initial start up, a fixed capacity system slowly reaches the set temperature.	At initial start up, utilizes variable capacity to quickly reach the set temperature.
Complete shutdown once set temperature is achieved.	Reduces capacity as set temperature is achieved.
Temperature within the space rises until 2nd system start up.	Variable capacity maintains set temperature keeping space comfortable with reduced energy consumption.
System works at full capacity to again reach set temperature.	
System cycles on and off continually to maintain the set temperature.	Variable capacity operation provides improved humidity control in the guestroom.

Friedrich's soft-start technology provides the smoothest PTAC sound available

The variable-speed operation of the Freshaire PTAC allows the unit to work at the optimal speed to match the true load of the room. This not only provides the best energy consumption curve it also adds to guest comfort by eliminating the harsh start-ups associated with single speed compressors.

The curves below illustrate the different sound characteristics of a single-speed PTAC versus a Freshaire model.



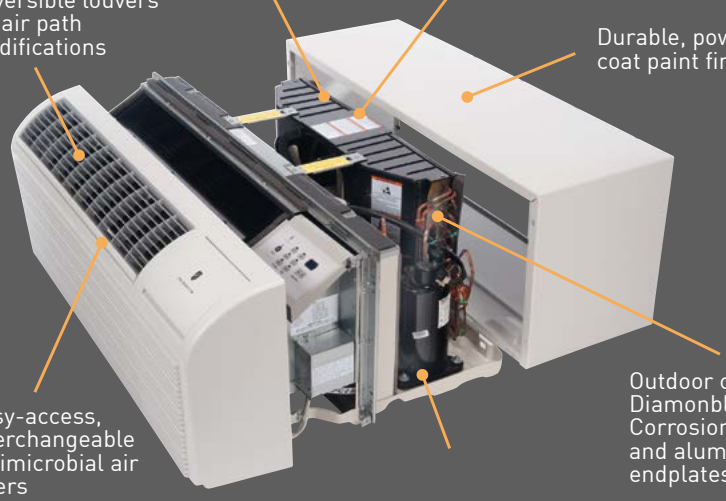
INVERTER

FreshAire™ SERIES

The first PTAC that meets ASHRAE 62.1 and delivers best-in-class efficiencies, trusted performance and low sound levels.

Convenient modular design provides easy access to key components

The time required to maintain and service units is greatly reduced so rooms can be back up and operational faster.



230V Fresh Air Inverter

COOLING

PVH09K

STANDARD RATING 9000 Btu
EXTENDED RATING 6,462 - 12099 Btu

PVH12K

STANDARD RATING 12000 Btu
EXTENDED RATING 7,929 - 17142 Btu

Up to 12.8 EER

HEAT PUMP

PVH09K

STANDARD RATING 8500 Btu
EXTENDED RATING 5606 - 11745 Btu

PVH12K

STANDARD RATING 11800 Btu
EXTENDED RATING 6995 - 16187 Btu

Up to 3.58 COP

BACK UP ELECTRIC HEAT

2.5 kw, 3.5 kw and 5.0 kw* heater options
*5.0 kw heater cannot be used on PV09K

IMPORTANT NOTE: Sleeves are sold and shipped separately to accommodate new construction and replacement requirements. Fits other PTAC sleeves without the added expense of a baffle kit.

FRESHAIRE SYSTEM

Dedicated fan delivers 35 CFM of outside air into the room

MERV 8 filter is washable and replaceable.

Does not rely on separate refrigeration system like competitor's units

DURABLE CONSTRUCTION

Aluminum endplates reduce outdoor coil corrosion.

Galvanized zinc coated steel wall sleeve and steel base pan undergo an 11-step preparation process, are powder coated with a polyester finish and cured in an oven for exceptional durability.

Factory run-tested units reduce problems in the field.

Internal diagnostic program can alert maintenance to component failures or operating problems. Fourteen numeric service error codes stored in memory facilitate rapid unit diagnostics.

Easy access anti-microbial filters simplify maintenance and extend the life of the product.

Room freeze protection initiates heat if temperature falls to 40°F in an unoccupied room.

Random compressor restart protects electrical systems from overload when power is restored.

Tamper-resistant, anodized stamped aluminum grille withstands chalking and oxidation.

DIAMONDBLUE
Advanced Corrosion Protection®

Break proof control door design maintains the integrity of the unit.

Indoor coil frost sensor protects the compressor to lengthen the life of the unit.

DiamonBlue Advanced Corrosion Protection® comes standard on all PTACs for long life in harsh coastal environments.

ENERGY EFFICIENT & ENERGY SMART

Variable speed Inverter compressor delivers EERs up to 12.87 at part load conditions (9000 Btu model operating at 6462 Btu).

Exceptional FriedrichLink® energy management thermostats available (wired & wireless) with integrated occupancy sensor, five distinct energy presets and comprehensive remote management capability.*

Energy efficient heat pump models available in our complete line.

Electronic defrost control ensures more run time in efficient heat pump mode.

Electronic temperature limiting to adjust low/high temperature range limits for reduced energy usage.

Slinger ring technology in condensate removal system cools the coil and increases efficiency.

Central desk control ready to allow hotel owners to control units from a central location.

COMFORT, HEALTH & IAQ

Dehumidification removes moisture in cool mode to improve comfort and reduce the chance of mold and mildew growth.

Integrated Fresh air housing effectively conditions outside air and meets ASHRAE 62.1 standard for IAQ

Intuitive unit controls are user friendly with easy-to-read LED display that can show either set-point or actual room temperature as selected by owner.

Anti-microbial air filters are easy to access and washable.

Instant Heat heat pump mode quickly heats a room to the desired temperature for increased comfort.

Even-heat monitoring checks room temperature and automatically adds heat boost if necessary.

Automatic periodic sampling of room temperature to ensure desired conditions are maintained.

Reversible indoor air louvers to easily change direction of airflow.

SOUND REDUCTION FEATURES

Two permanently lubricated fan motors for added durability and reduced sound levels indoors.

Quiet, efficient inverter compressor mounted with vibration isolators to keep the compressor running smoothly and quietly.

High-density insulation and steel inner wall block outdoor noise

Tangential blower wheel creates a wide path air flow that reaches the furthest corner of the guest room more quietly than conventional fans.

EASE OF MAINTENANCE & INSTALLATION

Modular product design ensures easy access to key components for cleaning and repairs, including washable, lift-out air filters.

Faultless Sure-hold front cover system securely attaches the front each time.

May be installed low on the floor.

WARRANTY AND SERVICE

2 year full warranty on parts and labor and 5 year limited warranty.

Nationwide service network and U.S.-based Friedrich expert technical team ensures you get fast, knowledgeable service.

See warranty documentation for full details

INVERTER

* Energy management capability requires purchase of additional hardware and service fee.

OPTIONAL ACCESSORIES

WALL SLEEVE

PDXWSA

Galvanized steel is prepared in a multi-step process for stronger paint adhesion, then powder coated with a polyester finish and cured in an oven for exceptional durability. The wall sleeve is insulated for thermal efficiency and noise reduction.

SLEEVE DIMENSIONS: 16" H x 42" W x 13 3/4" D
CUT OUT DIMENSIONS: 16 1/4" H x 42 1/4" W
FRONT COVER DIMENSIONS: 16" H x 42" W x 7 3/4" D

PDXWSA

DEEP WALL SLEEVES

PDXWSEXT18
For walls up to 17 1/2" deep.

PDXWSEXT24
For walls up to 23 1/2" deep.

PDXWSEXT (Custom depth wall sleeve)
One-piece, extended wall sleeve with built-in baffle for walls from 13 1/4" to 25 1/2" deep are available by special order.

Deep wall sleeve extension PDXWSEXT18 shown with weather panel in place

SLEEVE EXTENSION RETROFIT KIT

PXSE

2 1/4" sleeve extension attached to the room side of the sleeve to allow for the installation of a PD-series Friedrich PTAC in an 11 1/2" deep T-series sleeve.

PXSE

INTELLIGENT WALL CONTROLLER*

PFAXWC1
Wired wall-mounted controller (battery powered).

PFAXWC1

DIGITAL REMOTE THERMOSTAT

RT6P
Wired, single stage, wall-mounted programmable thermostat has two fan speeds and backlight.

RT6
Wired wall-mounted thermostat (can be unit powered).

WRT1
Wireless wall-mounted thermostat (battery powered).

RT6P, RT6

WRT1

FRIEDRICHLINK® ENERGY MANAGEMENT THERMOSTATS

EMRT1
Wired thermostat with occupancy sensor.

EMWRT1
Wireless thermostat with occupancy sensor.

EMOCT
Online connection kit.

EMRAF
Remote access fee.

EMRHCF
Remote humidity control fee.

EMRT1, EMWRT1

EMOCT

REMOTE THERMOSTAT ESCUTCHEON KIT

PDXRTB
Kit contains escutcheons that can be placed over the factory control buttons (recommended when a remote wall mounted thermostat is used as controls become inoperable). The escutcheon directs the user to the wall thermostat for operation and retains the LED window to display error codes and diagnostic information. 10 pack.

PDXRTB

CONDUIT KIT /JUNCTION BOX

PXCJA
Hard wire conduit kit with junction box for 208/230V and 265V units (subbase not required). Kit includes a means of quick disconnect for easy removal of the chassis.

PXCJA

SUBBASE DISCONNECT SWITCH

PXDS

PXDS

*NOTE: The FreshAire PTAC must be paired with wall controller PFAXWC1 to operate as a fully variable speed unit. When used with other compatible thermostats, the unit will operate at multiple speeds.in either cooling or heating mode.

OPTIONAL ACCESSORIES

STANDARD GRILLE

PXGA

Standard, stamped, anodized aluminum to resist chalking and oxidation.

PXGA

ARCHITECTURAL GRILLES

Architectural grilles consist of heavy gauge 6063-T5 aluminum alloy.

PXAA Clear extruded aluminum.
PXBG Beige acrylic enamel.
PXSC Available in custom colors.

PXAA

DECORATIVE SUBBASE (black)

PXSBA

Provides unit support for walls less than six inches thick. Includes leveling legs, side filler panels and mounting brackets for electrical accessories. Accepts circuit breaker, power disconnect switch and conduit kit.

PXSBA

ELECTRICAL SUBBASE

Provides unit support for walls less than six inches thick. Includes leveling legs, side filler panels, mounting brackets, a plug-in receptacle and field-wiring access. The sub-base also includes electrical knockouts for power disconnect switch or circuit breaker.

PXSB23020	Electrical Subbase - 230V 15 & 20A
PXSB23030	Electrical Subbase - 230V 30A
PXSB26515	Electrical Subbase - 265V 15A
PXSB26520	Electrical Subbase - 265V 20A
PXSB26530	Electrical Subbase - 265V 30A

PXSB

POWER CORDS

Universal power cords enable properties to select the appropriate heater size. Reference the adjacent table for power cord options.

*Cannot be used on PVH09K3FA

		Length
PXPCFA23015	LCDI 230V 15A Cord - 2.5 kW	67 in.
PXPCFA23020	LCDI 230V 20A Cord - 3.5 kW	67 in.
PXPCFA23030*	LCDI 230V 30A Cord - 5.0 kW	67 in.
PXPCFA26515	Non-LCDI 265V 15A Cord - 2.5 kW	27 1/2 in.
PXPCFA26520	Non-LCDI 265V 20A Cord - 3.5 kW	27 1/2 in.
PXPCFA26530*	Non-LCDI 265V 30A Cord - 5.0 kW	27 1/2 in.

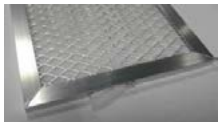
PXFTB

Antimicrobial air filters. 10 pack. Each PTAC requires 2 filters.

PXFTB

PXFAFT10

Replacement Merv 8 filters. 10 pack. Each PTAC requires 1 filter.



PXFAFT10

CONDENSATE DRAIN KIT

PXDR10

Attaches to the bottom of the wall sleeve for internal draining of condensate, or to the rear wall sleeve flange for external draining. Recommended for all units to remove excess condensate. 10 pack.

PXDR10

LATERAL DUCT ADAPTER

PDXDAA

Attaches to the Friedrich PTAC/PTHP unit to direct up to 35% of the total airflow to a second room. The unit-mounted duct plenum features a front-mounted aluminum grille that has two positions to provide the most optimal air direction. The air may be directed to either the left or the right of the unit through the supplied 3 1/2" H x 7" W x 47" L plenum. Plenum may be cut to length by the installer. Kit includes duct plenum, front grille, 47" duct extension, duct discharge grille, duct end cap and all necessary mounting hardware.

LATERAL DUCT EXTENSION

PDXDEA

Additional 3 1/2" H x 7" W x 47" L plenum used with the LATERAL DUCT ADAPTER. A maximum of three duct extensions may be used together. Note: Ducted airflow is reduced as duct length is increased.

PDXDAA and PDXDEA ship together

PRELIMINARY SPECIFICATIONS

PVH Series Cooling with Heat Pumps

Model		PVH09K	PVH12K
PERFORMANCE DATA:			
Cooling Capacity	Btu	9600/9400	12000/11800
Cooling Capacity Min./Max	Btu	6462-12099	7929-17142
Cooling Watts		815/800	1050/1035
Energy Efficiency Ratio	EER	11.8/11.8	11.4/11.4
Reverse Heating Capacity	Btu	8200/8500	11600/11800
Reverse Heating Capacity Min./Max.	Btu	5606-11475	6995-16187
Heating Watts		710/685	970/950
COP		3.51/3.51	3.57/3.58
Moisture Removal	Pts./Hr.	0.8	1.1
Sensible Heat Ratio		80%	78%
ELECTRICAL DATA:			
Voltage (1 PHASE, 60 Hz)		230/208	230/208
Volt Range		253-187	253-187
Current	Amps	4.4/4.5	4.5/5.0
Reverse Heat	Amps	4.0/4.1	4.6/4.9
Power Factor		0.80	0.96
Compressor LRA		N/A	N/A
Compressor RLA		3.2	4.1
Outdoor Fan Motor	HP	1/14	1/12
AIRFLOW DATA:			
Indoor CFM, HIGH		400	470
Indoor CFM, LOW		250	360
Vent CFM		N/A	N/A
PHYSICAL DATA:			
Sleeve Dimensions H x W x D		16" x 42" x 13 3/4" (all models)	
Dimensions with front H x W x D		16" x 42" x 21" (all models)	
Cut Out Dimensions H x W		16 1/4"x 42 1/4" (all models)	
Net Weight	Lbs.	114	121
Shipping Weight	Lbs.	136	133
R-410A Charge	Oz.	30.34	32.80

265V MODELS
expected March 2018

Power Cord/Heater Ratings

		230/208V ELECTRIC HEATER RATING (CONFIGURATION BASED ON POWER CORD)		
POWER CORD #	VOLTAGE	BRANCH CKT AMPS	MCA	WATTS
PXPCFA23015	230/208	15	13.9	2500
PXPCFA23020	230/208	20	19.9	3600
PXPCFA23030*	230/208	30	27.5	5000

*Cannot be used on PVH09K3FA
PXPCFA23020 comes standard on PTAC

Receptacles and Fuse Types

VOLTAGE	230V		
AMPS	15	20	30
HEATER SIZE	2.5 KW	3.5 KW	5.0 KW
RECEPTACLES			
NEMA# RECEPTACLE	6-15R	6-20R	6-30R
NEMA# PLUG	6-15P	6-20P	6-30P

Operating range 0˚ to -115˚ F.
Due to continuing research in new energy-saving technology, specifications are subject to change without notice.
Warranty limited to installations in the United States, Puerto Rico, Mexico and Canada only.
See warranty documentation for full details.

DDC CERTIFIED LAB PERFORMANCE TESTED ULCDTP

c UL us LISTED

AHRI CERTIFIED

AHRI CERTIFIED

FRIEDRICH

Friedrich Air Conditioning Co. I 10001 Reunion Place, Suite 500 I San Antonio, TX 78216 I 877.599.5665 www.friedrich.com

Benchmark

High-Efficiency Boilers

AERCO.com

AERCO®
A WATTS Brand

The Benchmark: Unmatched Reliability and ROI

More than 25 years ago, AERCO introduced the first condensing and fully modulating boiler for the commercial market. Building on that leadership and experience, AERCO launched the Benchmark family of boilers in 1997. Ever since, Benchmark boilers have been considered the gold standard in hydronic heating and have set the bar for high efficiency. More importantly, they continue to deliver significant ROI to thousands of customers including increased energy savings, reliable heat, and lower installation and operational costs — all in a space-saving, compact footprint.

Saves Space, Easy to Install

The Benchmark is a powerful boiler packed into a small footprint. Each stainless steel unit fits through standard 36" doorways and can travel via elevators – no need to tear down walls, use cranes or other expensive tools. In fact, our Benchmark 6000 is the smallest of its kind – up to a third the size of the competition.

Simple to Service

Removable enclosure panels provide easy access to all piping making the Benchmark extremely easy to service which simplifies lifetime maintenance. It's also compatible with popular EMS software, and can be remotely controlled providing detailed LCD diagnostics that can help prevent any issues from developing.

Superior Construction for Greater Uptime Reliability

AERCO's 439 stainless steel heat exchanger delivers a longer life through a simplified design that has only two moving parts. The condensing heat exchanger design is built to withstand thermal shock and eliminates the need for traditional boiler pumping equipment. The forced draft, modulating burners operate with unmatched turndown to minimize cycling and maximize seasonal efficiency while simplifying the venting system. AERCO's patented air/fuel delivery system and fully modulating burner reduces cycling losses, as well as wear and tear.

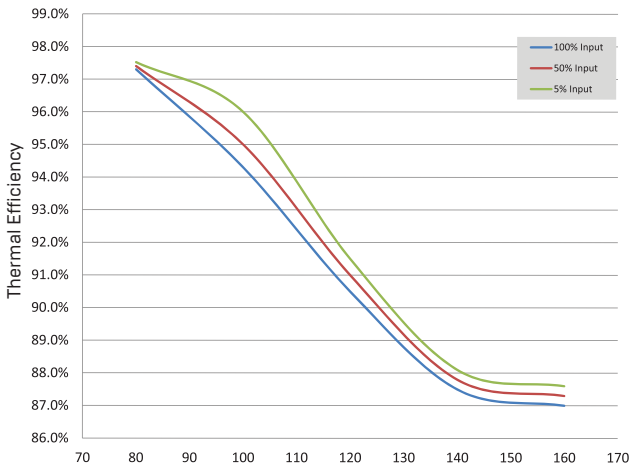
10-year Warranty

AERCO stands behind its products. The heat exchanger in the Benchmark boilers have a 10-year full (non-prorated) warranty.

High Efficiency, Increased Energy Savings

Benchmark Models as approved and listed on the AHRI Directory (with exception of the BMK 5000)	Thermal Efficiency, 100% Input (High Fire) 100°F Temperature Differential (80°F-180°F)
BMK750	95.6%
BMK1000	96.8%
BMK1500	94.6%
BMK2000	94.6%
BMK2500	93.5%
BMK3000	93.5%
BMK5000	93.9%
BMK6000	94.5%

Thermal Efficiency Curves



*For BMK1000

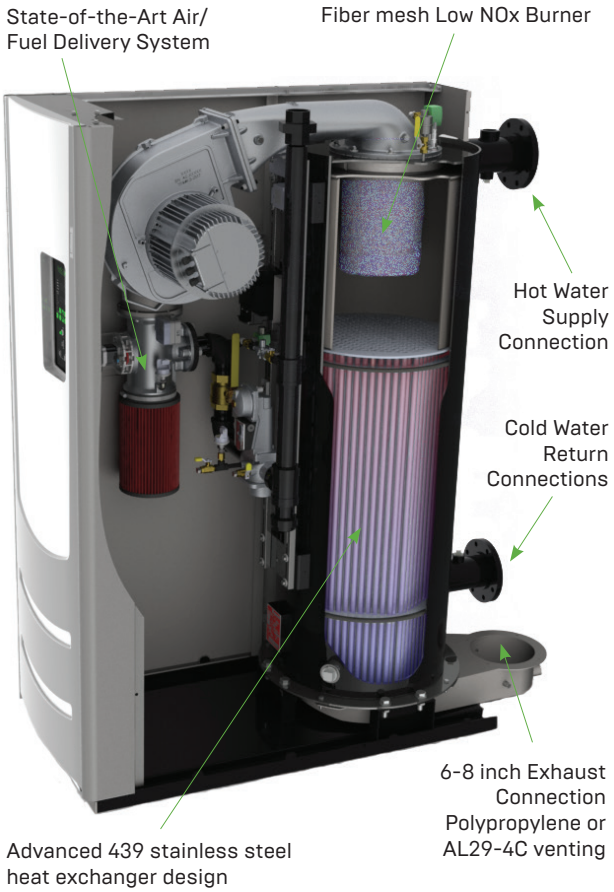
State of the Art Technology and Features

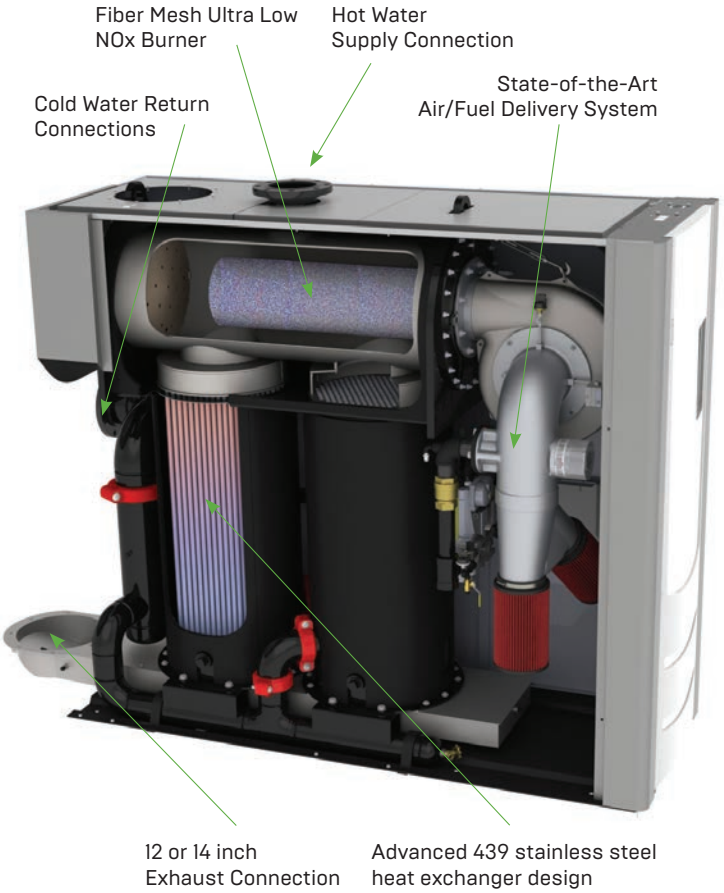
Benchmark 750, 1000, 1500, 2000, 2500, 3000

- 15:1-20.1 turndown
- Oxygen level (O_2) monitoring
- Durable and reliable 439 Stainless Steel firetube heat exchanger
- Capable of variable primary flow installations
- Low NOx emissions (20 ppm or less at all firing rates)
- 9 ppm optional calibration*
- Compact footprint – all models fit through standard doorway
- Ducted combustion air capable
- Venting versatility with AL29-4C, Polypropylene, CPVC**, or PVC**
- Available in Natural Gas, Propane, and Dual Fuel (1500, 2000, 2500, 3000)

Benchmark 5000, 6000

- 12.5:1-15:1 turndown
- Oxygen level (O_2) monitoring
- Durable and reliable 439 Stainless Steel firetube heat exchanger
- Capable of variable primary flow installations
- Low NOx emissions (20 ppm or less at all firing rates)
- 9 ppm optional calibration (BMK6000 requires 14" exhaust venting)
- Compact footprint – up to a third the size of the competition
- Ducted combustion air capable
- Venting versatility with AL29-4C, Polypropylene
- Available in Natural Gas and Dual Fuel





*BMK 750-2000 only **BMK 750/1000 only

Optimizing Your System

To optimize your system, Benchmark boilers come standard with our Boiler Sequencing Technology (BST) which shares the load between a few units to maximize energy efficiency. An additional way to ensure your system operates at peak performance is through our onAER Remote Monitoring Service detailed below.

Boiler Sequencing Technology (BST) Maximizes Energy Efficiency
It requires less energy for a group of modulating boilers, each firing at "part load," to heat a building, than for a single boiler operating at "full fire" to carry the entire workload. That's why Benchmark boilers come standard with our Boiler Sequencing Technology (BST) enabling the load to be shared between a few units in order to maximize your system's energy efficiency.

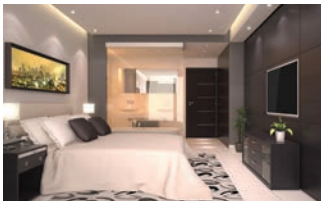
How it Works
To meet building demand, the BST employs as many boilers as available, each operating at its most efficient firing rate. Because the BST reacts in real-time (up to 8 boilers), users can take a unit offline for maintenance at any time or bring on back-up boilers for extremely cold conditions without changes to your system's performance. And as individual boilers are added or deleted, the energy delivered is automatically adjusted to prevent fluctuations in the header temperature of the plant.

AERCO's BST optimizes your system's performance to increase uptime reliability, the longevity of your units and your Return on Investment.

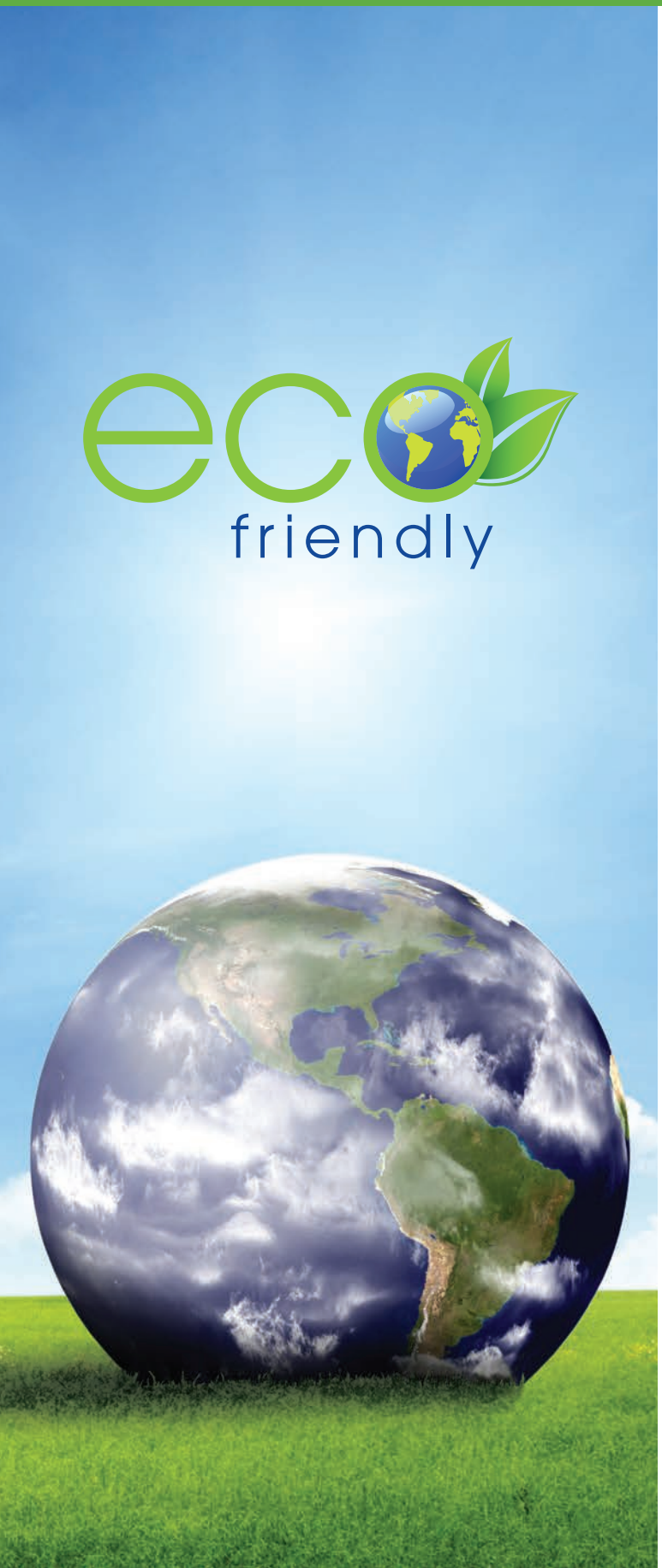
Office Buildings | Education | Government | Multifamily Housing | Lodging







Environmental Stewards



The Greenspec® Listed Benchmark boilers are perfect for "green" designs. Their small footprint, flexible venting/piping options, high efficiency and lower operating costs can help facilities earn LEED points. Benchmark has been designed with several environmental advantages:

O_2 Monitoring System
Benchmark units are available with AERCO's proprietary O_2 monitoring system, which displays the oxygen level directly on the C-More controller in real time. It can be monitored via Modbus, so customers can measure emission levels and fuel combustion efficiency to maximize fuel economy.

Low NOx Burner
Benchmark boilers are fitted with a low NOx burner whose emissions consistently meet the highest regulatory standards. Ultra low NOx (9 ppm or less) calibrations are available.*

C-More Advanced Controls
The C-More Control System optimizes the efficiency and operation of your system by combining temperature and operating controls, combustion safeguards and fault enunciator functions – all at your fingertips.

Benefits include:

- Simplifies diagnostic troubleshooting
- User-friendly intuitive control
- Full integration with BAS and EMS systems
- Supports remote data monitoring and control
- Integrated Boiler Sequencing Technology (BST)
- Ensures fail-safe boiler operation (if external building controls fail)

*See tech data sheets for model specs.

Specifications and Dimensions

	750	1000	1500	2000
Adjustable Temp. Control	50°F to 190°F	50°F to 190°F	50°F to 190°F	50°F to 190°F
Ambient Temperature	0°F to 130°F	0°F to 130°F	0°F to 130°F	0°F to 130°F
Accuracy	+/-4°F	+/-4°F	+/-4°F	+/-4°F
Input	750,000 BTUH (Natural Gas)	1,000,000 BTUH (Natural Gas)	1,500,000 BTUH (Natural Gas)	2,000,000 BTUH (Natural Gas)
Net Output	697,000 BTUH (Natural Gas)	930,000 BTUH (Natural Gas)	1,395,000 BTUH (Natural Gas)	1,860,000 BTUH (Natural Gas)
Turndown Ratio	15:1	20:1	20:1	20:1
Flue Size	6" Diameter	6" Diameter	6" Diameter	8" Diameter
Flue Material (per local code)	PVC, CPVC, PP or AL29-4C	PVC, CPVC, PP or AL29-4C	AL29-4C, PP	PP or AL29-4C
Water Inlet and Outlet	3" 150# Flange	3" 150# Flange	4" 150# Flange	4" 150# Flange
Gas Connection	1" NPT Male	1" NPT Male	2" NPT Male	2" NPT Male
Gas Pressure Requirements*	14" WC Maximum, 4" WC Minimum at Full Load	14" WC Maximum, 4" WC Minimum at Full Load	14" WC Maximum, 4" WC Minimum at Full Load	14" WC Maximum, 4" WC Minimum at Full Load
Min/Max Water Flow	12-175 GPM	12-175 GPM	25-250 GPM	25-350 GPM
Condensate Connection	3/4" NPT Female	3/4" NPT Female	1.5" Tube	1.5" Tube
Max. Condensate Flow	6 GPH	8 GPH	9 GPH	10 GPH
Pressure Rating	160 PSIG at 210°F	160 PSIG at 210°F	160 PSIG at 210°F	160 PSIG at 210°F
NOx Emissions Certifications	SCAQMD, TCEQ	SCAQMD, TCEQ	SCAQMD, TCEQ	SCAQMD, TCEQ
Standard Listing and Approvals	UL, CUL, ASME	UL, CUL, ASME	UL, CUL, ASME	UL, CUL, ASME
Gas Train Options	FM Compliant or Factory Installed, Double Block and Bleed (Formerly IRI)	FM Compliant or Factory Installed, Double Block and Bleed (Formerly IRI)	FM Compliant or Factory Installed, Double Block and Bleed (Formerly IRI)	FM Compliant or Factory Installed, Double Block and Bleed (Formerly IRI)
Electrical Requirements	120/1/60 20 AMP (13 AMP FLA)	120/1/60 20 AMP (13 AMP FLA)	120/1/60 20 AMP (16 AMP FLA)	120/1/60 20 AMP (16 AMP FLA)
Water Pressure Drop at 20°ΔT	1.5 psi	3 psi	2.8 psi	3.4 psi
Water Volume	16.25 gallons	14.25 gallons	44 gallons	40 gallons
Weight, Installed	669 lbs. (dry), 802 lbs. (wet)	700 lbs. (dry), 817 lbs. (wet)	1,406 lbs. (dry), 1,654 lbs. (wet)	1,500 lbs. (dry), 1,760 lbs. (wet)

*Values are for Natural Gas FM Compliant gas trains only. See Benchmark Gas Components & Supply Design Guide GF-2030 for Propane, DBB & Duel Fuel gas train gas pressure requirements.

Benchmark 750 / 1000 / 1500 / 2000 / 2500 / 3000 / 5000 / 6000

Specifications and Dimensions

	2500	3000	5000	6000
Adjustable Temp. Control	50°F to 190°F	50°F to 190°F	50°F to 190°F	50°F to 190°F
Ambient Temperature	0°F to 130°F	0°F to 130°F	0°F to 130°F	0°F to 130°F
Accuracy	+/-4°F	+/-4°F	+/-4°F	+/-4°F
Input	2,500,000 BTUH (Natural Gas)	3,000,000 BTUH (Natural Gas)	5,000,000 BTUH (Natural Gas)	6,000,000 BTUH (Natural Gas)
Net Output	2,325,000 BTUH (Natural Gas)	2,790,000 BTUH (Natural Gas)	4,650,000 BTUH (Natural Gas)	5,580,000 BTUH (Natural Gas)
Turndown Ratio	15:1	15:1	12.5:1	15:1
Flue Size	8" Diameter	8" Diameter	12" or 14" Diameter	12" or 14" Diameter
Flue Material (per local code)	PP or AL29-4C	PP or AL29-4C	PP or AL29-4C	PP or AL29-4C
Water Inlet and Outlet	4" 150# Flange	4" 150# Flange	6" 150# Flange	6" 150# Flange
Gas Connection	2" NPT Male	2" NPT Male	2" NPT Male	2" NPT Male
Gas Pressure Requirements*	14" WC Maximum, 4" WC Minimum at Full Load	14" WC Maximum, 4" WC Minimum at Full Load	2" PSI Maximum, 14" WC Minimum at Full Load	2" PSI Maximum, 14" WC Minimum at Full Load
Min/Max Water Flow	25-350 GPM	25-350 GPM	75-600 GPM	75-600 GPM
Condensate Connection	1.5" Tube	1.5" Tube	1.5" Tube	1.5" Tube
Max. Condensate Flow	17 GPH	20 GPH	40 GPH	40 GPH
Pressure Rating	160 PSIG at 210°F	160 PSIG at 210°F	80 PSIG at 210°F / 150 PSIG at 210°F	80 PSIG at 210°F / 150 PSIG at 210°F
NOx Emissions Certifications	SCAQMD, TCEQ	SCAQMD, TCEQ	SCAQMD, TCEQ	SCAQMD, TCEQ
Standard Listing and Approvals	UL, CUL, ASME	UL, CUL, ASME	UL, CUL, ASME	UL, CUL, ASME
Gas Train Options	FM Compliant or Factory Installed, Double Block and Bleed (Formerly IRI)	FM Compliant or Factory Installed, Double Block and Bleed (Formerly IRI)	FM Compliant or Factory Installed, Double Block and Bleed (Formerly IRI)	FM Compliant or Factory Installed, Double Block and Bleed (Formerly IRI)
Electrical Requirements	208-230/3/60 20 AMP (10 AMP FLA) 460-230/3/60 15 AMP (5 AMP FLA)	208-230/3/60 20 AMP (10 AMP FLA) 460-230/3/60 15 AMP (5 AMP FLA)	208-230V/3/60 30 AMP (19 AMP FLA) 460/3/60 15 AMP (12 AMP FLA) 575/3/60 15 AMP (9 AMP FLA)	208-230V/3/60 30 AMP (19 AMP FLA) 460/3/60 15 AMP (12 AMP FLA) 575/3/60 15 AMP (9 AMP FLA)
Water Pressure Drop at 20°ΔT	2.9 psi	4 psi	6.2 psi	6.2 psi
Water Volume	58 gallons	55 gallons	110 gallons	110 gallons
Weight, Installed	2,000 lbs. (dry), 2,332 lbs. (wet)	2,170 lbs. (dry), 2,364 lbs. (wet)	3,000 lbs. (dry), 3,920 lbs. (wet)	3,000 lbs. (dry), 3,920 lbs. (wet)

Model	Width	Depth	Height
BMK 750	28"	25"	78"
BMK 1000	28"	25"	78"
BMK 1500	28"	43.6"	78"
BMK 2000	28"	43.6"	78"

Model	Width	Depth	Height
BMK 2500	28"	56"	78"
BMK 3000	28"	56"	78"
BMK 5000	34"	89.3"	79.4"
BMK 6000	34"	89.3"	79.4"

Please find complete dimensions on the Benchmark tech data sheet.

Technical Data Sheet

SmartPlate Single Wall Water-to-Water Heater

The AERCO SmartPlate water heater is designed to satisfy potable water heating needs in commercial and institutional environments.
The packaged system incorporates simple, easy to understand, real-time, load tracking and responsive controls to maintain accurate hot water temperatures under diversified load patterns.

Packaged with a PID temperature controller and a 3-way electronic control valve, the heater maintains outstanding temperature control when operated under constant load conditions with variances held to ±4°F under normal load changes.* An integrated load monitoring system and high turndown electronic control valve deliver accurate temperature control without the need for storage tanks, blending valves or other temperature averaging components. The heater can be remotely monitored and/or fully integrated with BAS software via Modbus communications protocol.

The packaged heater consists of a counter flow, stainless steel, plate and frame heat exchanger – the most efficient water-to-water heat exchanger design available for potable water heating. Ideal for use with condensing boilers, the SmartPlate heater utilizes boiler water as little as 5°F above the required potable water temperature, resulting in the highest possible boiler efficiency and minimal radiation losses. To ensure longevity, all water wetted (potable water side) parts are stainless steel, copper or copper alloy materials.

The unit's instantaneous design is compatible with low temperature boiler water. And installation is easy because of its small footprint and doorway size. Single point header connections for Domestic Hot Water, Cold Water, Boiler Water Inlet, Boiler Water Outlet, and electrical power supply are all that is required for a fully functional, safe, and efficient system. Tight temperature control, high thermal efficiency, low maintenance, longevity and overall reliability make the SmartPlate heater the most logical choice for any commercial or institutional domestic water-to-water heating installation.

Features

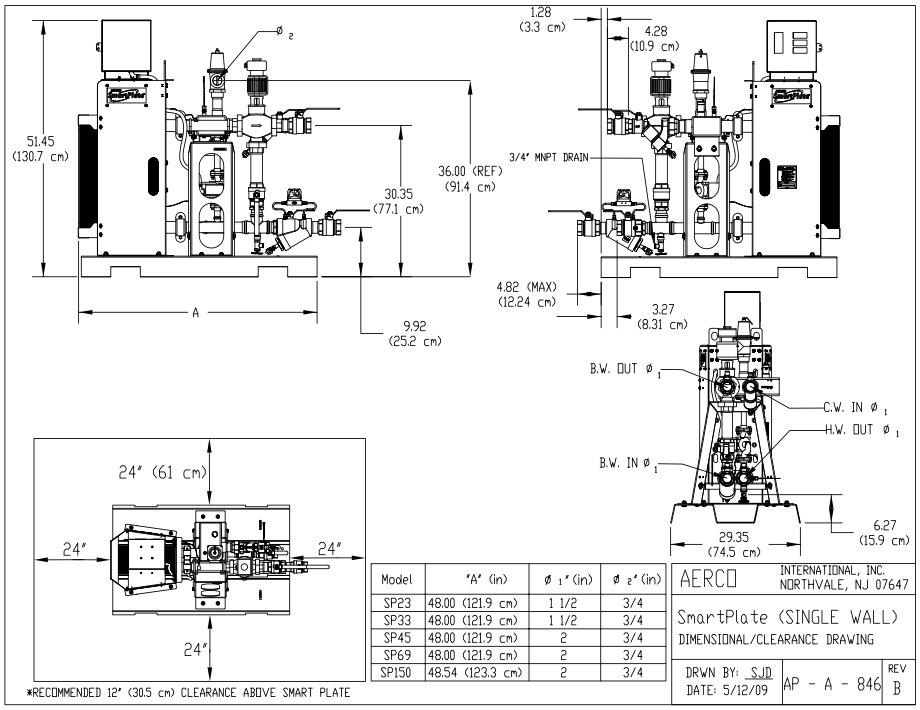
- Accurate Temperature Control ±4°F*
- Packaged with 3-Way Electronic Control Valve
- Fully Modulating Variable Primary Input
- Compact Footprint <10 ft2
- All Stainless Steel, Copper or Copper Alloy Wetted (Potable Water Side) Surfaces
- Integral Constant Speed Domestic Water Recirculation Pump
- ASME B&PV Code Section VIII Division 1 Stamped

Supports Multiple Applications

- LTBW; Up to 150 PSIG, 250°F
- DHW: Up to 200 psig
- Set Point Range 50°F to 180°F
- Single or Multiple Installations
- Supports 2-Way or 3-Way Applications
- Ideal for New or Retrofit
- Swimming Pool Applications (maximum 2ppm free chlorine)

*Incremental change in flow that does not exceed 50% of total capacity; i.e., demand change from 0 to 50% or 20 to 70%

Dimensions



Model	"A" (in)	Ø 1" (in)	Ø 2" (in)
SP23	48.00 (121.9 cm)	1 1/2	3/4
SP33	48.00 (121.9 cm)	1 1/2	3/4
SP45	48.00 (121.9 cm)	2	3/4
SP69	48.00 (121.9 cm)	2	3/4
SP150	48.54 (123.3 cm)	2	3/4

AERCO INTERNATIONAL, INC. NORTHVALE, NJ 07647

SmartPlate (SINGLE WALL)
DIMENSIONAL/CLEARANCE DRAWING

DRWN BY: SJD
DATE: 5/12/09
AP - A - 846
REV B

Specifications

Domestic Water Pressure Drop	8PSIG @ max. rated flow
Ambient Operating Temperature	0°F to 131°F
Electrical Requirements	120/1/60 Hz 2 Amp, 220/1/50 Hz 2 Amp, 220/1/60 Hz 2 Amp
Standby Amperage Draw	2 Amp
High Limit "Tripped" Amperage Draw	2 Amp
Max. Continuous Water Flow Rate	90 GPM
Max. Boiler Water Pressure & Temperature	150 PSIG @250°F
Max. Domestic Water Operating Pressure	200 PSIG
Adjustable Temperature Control	up to 180°F
Adjustable High Limit Control	up to 200°F
Water Connection Inlets/Outlets	1.5" FNPT (Models SP23 & SP33), 2" FNPT (All other models)
Weight (lbs.)	SP23 320 (dry), 340 (installed), SP33 340 (dry), 370 (installed) SP45 400 (dry), 440 (installed), SP69 450 (dry), 500 (installed) SP150 610 (dry), 710 (installed)

Available Options

Dry contacts for remote "High Limit Tripped Status" indication.

Represented by:

Specifications subject to change without prior notice.
Consult aerco.com or contact AERCO.
SmartPlate SW 11/2016

AERCO®
A WATTS Brand