

HVAC LEGEND	
SYMBOL	DESCRIPTION
	SUPPLY DUCT
	RETURN OR EXHAUST DUCT
	RECTANGULAR DUCT UP (SUPPLY SHOWN)
	RECTANGULAR DUCT DOWN (SUPPLY SHOWN)
	RECTANGULAR DUCTWORK - 20" SIDE SHOWN X 12" SIDE NOT SHOWN
	DUCTWORK LINED WITH FIBERGLASS DUCT LINER - INSIDE DIMENSION SHOWN
	EXISTING DUCTWORK OR DEVICE TO REMAIN-SIZE REFERENCED FROM ORIG. EXISTING DUCTWORK OR DEVICE TO BE REMOVED
	MITERED ELBOW WITH DOUBLE THICKNESS TURNING VANES
	FULL RADIUS ELBOW
	FLEXIBLE DUCTWORK
	SPIN-IN FITTING WITH SCOOP AND MANUAL DAMPER
	SPIN-IN FITTING WITH MANUAL DAMPER
	SPIN-IN FITTING WITH SCOOP
	ROUND DUCT UP
	ROUND DUCT DOWN
	ACCESS PANEL (AP) OR ACCESS DOOR (AD) - ACCESS PANEL SHOWN
	1-1/2 HOUR FIRE DAMPER (IL 555) WITH ACCESS DOOR OR PANEL
	3 HOUR FIRE DAMPER (IL 555) WITH ACCESS DOOR OR PANEL
	SPLITTER DAMPER
	SMOKE DAMPER (IL 555S) WITH ACCESS DOOR OR PANEL
	BACK-DRAFT DAMPER WITH ACCESS DOOR OR PANEL
	MANUAL VOLUME DAMPER WITH ACCESS DOOR OR PANEL
	MOTOR OPERATED DAMPER WITH ACCESS DOOR OR PANEL
	DUCT MOUNTED SMOKE DETECTOR, FURNISHED BY ELECTRICAL, INSTALLED BY HVAC CONTRACTOR
	REFRIGERANT SUCTION PIPING
	REFRIGERANT LIQUID PIPING
	HOT WATER SUPPLY PIPING
	HOT WATER RETURN PIPING
	CONDENSATE DRAIN PIPING
	CIRCULATING WATER SUPPLY PIPING
	CIRCULATING WATER RETURN PIPING
	COOLING TOWER WATER SUPPLY PIPING
	COOLING TOWER WATER RETURN PIPING
	COLD WATER PIPING
	PIPE TURNING DOWN
	TEE CONNECTION IN SIDE OF PIPE
	TEE CONNECTION IN BOTTOM OF PIPE
	TEE CONNECTION IN TOP OF PIPE
	UNION
	END CAP
	CONCENTRIC INCREASER/REDUCER
	BALL VALVE
	BUTTERFLY VALVE
	GATE VALVE
	CHECK VALVE
	THREE WAY CONTROL VALVE
	MOTOR OPERATED BUTTERFLY VALVE
	MOTOR OPERATED CONTROL VALVE
	BALANCING VALVE
	FLOW CONTROL VALVE
	PRESSURE REDUCING VALVE
	PRESSURE RELIEF VALVE
	BACKFLOW PREVENTER
	STRAINER
	STRAINER WITH BLOW-OFF VALVE
	MANUAL AIR VENT
	AUTOMATIC AIR VENT
	PRESSURE GAUGE
	MINI BALL VALVE IN 1/4" GAUGE LINE
	PRESSURE TAP
	THERMOMETER
	THERMOMETER WELL IN PIPING
	FLOOR DRAIN LOCATION FOR REFERENCE
	CONDENSATE P-TRAP LOCATION FOR REFERENCE
	FLOW SWITCH
	PRESSURE DIFFERENTIAL SWITCH
	DUCTLESS SPLIT SYSTEM UNIT CONTROLLER
	EWS TEMPERATURE SENSOR
	EWS SPACE HUMIDITY SENSOR
	EWS OVERRIDE
	OCCUPANCY SENSOR, SEE ELECTRICAL & EWS (REMOVE EXIST)
	IONIZATION UNIT
	MOTOR STARTER
	VARIABLE FREQUENCY DRIVE
	ABOVE FINISHED FLOOR
	ABOVE FINISHED GRADE
	ABOVE CEILING
	OUTSIDE AIR
	RETURN
	SUPPLY
	NOT IN CONTACT
	WALL OPENING
	THERMOSTAT
	RISE IN DIRECTION OF ARROW
	DROP IN DIRECTION OF ARROW
	ZONE DAMPER, Ø DIAMETER INDICATED
	BYPASS DAMPER, Ø DIAMETER INDICATED

EXHAUST FANS									
FAN DESIG.	TYPE	CFM	EXT. SP. HGT.	MOTOR POWER	DRIVE TYPE	MAX. RPM	MAX. SONES	MANUFACTURER & MODEL NO.	CONTROL SEQUENCE
EF-E1	POWER ROOF VENTILATOR	300	1/25	80 W	DIRECT	1300	4.0	PENN DX103	EH5T
EF-E2	POWER ROOF VENTILATOR	650	1/25	1/6 HP	DIRECT	1550	7.0	PENN DX103	EH5T
EF-M1	POWER ROOF VENTILATOR	2570	1/25	1/2 HP	DIRECT	1650	17.0	PENN DX1601	EH5TM

ENERGY RECOVERY UNITS	
UNIT DESIGNATION	ERU-123
MANUFACTURER	AAON
MODEL NUMBER	RN-007
OUTSIDE AIR SUPPLY SIDE	
AIR QUANTITY (CFM)	1500
EXTERNAL STATIC PRESSURE (H ₂ O)	.40
FAN MOTOR HORSEPOWER	2
EXHAUST AIR SIDE	
AIR QUANTITY (CFM)	1300
EXTERNAL STATIC PRESSURE (H ₂ O)	.30
FAN MOTOR HORSEPOWER	1
DESICCANT WHEEL PERFORMANCE - SUMMER	
EXHAUST ENTERING AIR TEMP. (°F/°RH)	70 / 50%
OUTSIDE ENTERING AIR TEMP. DB / WB (°F)	44 / 74
OUTSIDE LEAVING AIR TEMP. DB / WB (°F)	68.9 / 69.3
TOTAL HEAT TRANSFERRED (BTUH)	31,470
SENSIBLE EFFECTIVENESS (ASHRAE 64-1991)	75
LATENT EFFECTIVENESS (%)	56
DX COOLING COIL PERFORMANCE	
ENTERING AIR TEMP. (DB / WB)	69.9 / 69.3
LEAVING AIR TEMP. (DB / WB)	58.2 / 52.7
TOTAL CAPACITY (BTUH)	66,500
SENSIBLE CAPACITY (BTUH)	47,930
EER	14.5
HOT GAS REHEAT PERFORMANCE	
ENTERING AIR TEMP. (DB / WB)	58.2 / 52.7
LEAVING AIR TEMP. (DB °F / °RH)	75 / 45%
SENSIBLE HEAT TRANSFERRED (BTUH)	95,000
DESICCANT WHEEL PERFORMANCE - WINTER	
EXHAUST ENTERING AIR TEMP. (DB °F / °RH)	72 / 30%
OUTSIDE ENTERING AIR TEMP. DB / WB (°F)	17 / 14
OUTSIDE LEAVING AIR TEMP. DB / WB (°F)	52.9 / 42.1
SENSIBLE HEAT TRANSFERRED (BTUH)	56,750
GAS HEAT PERFORMANCE - WINTER	
ENTERING AIR TEMP. (DB °F)	53
LEAVING AIR TEMP. (DB °F)	72
INPUT (BTUH)	90,000
OUTPUT (BTUH)	72,400
CONTROL	MODULATING
ACCESSORIES	
SLOPED ROOF CURB	YES

AIRFLOW MEASUREMENT DEVICES				
DESIG.	SERVES	DUCT SIZE	AIRFLOW (CFM)	MANUFACTURER & MODEL NUMBER
AFM-S	ERU-1-3 OA SUPPLY	24 x 12	1500	EBTRON STC116-PA
AFM-E	ERU-1-3 EXHAUST	24 x 12	1500	EBTRON STC116-PA

IONIZATION UNITS	
DESIGNATION	B-1 & 2
MANUFACTURER	AERCO
MODEL NUMBER	BHK 1000
HEATING INPUT (BTUH)	1,000,000
HEATING OUTPUT (BTUH)	460,000
MIN. EFFICIENCY @ HIGH FIRE, 60°F ENT	96%
FUEL TYPE	NATURAL GAS
WATER FLOW / PRESSURE DROP	84 GPM / 3'
ENTERING / LEAVING WATER TEMP	60°F / 40°F
POWER CIRCUIT	120V / 1Ø
FLUE VENT SIZE / AIR INTAKE SIZE	6"
WATER CONNECTIONS	3"
BOILER DIMENSIONS H" x D"	26" x 25"

AIR DISTRIBUTION DEVICES						
MARK	TYPE	NOMINAL SIZE	NECK SIZE	FLEXIBLE DUCT SIZE	SERVICE	
A	LGD	9 x 9	6"	6" - MAXIMUM 5 FT LONG	SUPPLY	
B	LGD	12 x 12	10"	10" - MAXIMUM 5 FT LONG	SUPPLY	
C	LGD	15 x 15	12"	12" - MAXIMUM 5 FT LONG	SUPPLY	
D	LGD	12 x 24	10 x 22	---	RETURN	
E	LGD	24 x 24	22 x 22	---	RETURN	
O	OAD	DUCT SIZE	DUCT SIZE	---	O.A.	
ED	EXISTING DEVICE, REBALANCE TO CFM SHOWN					SUPPLY
RD	RELOCATED DEVICE, REBALANCE TO CFM SHOWN					SUPPLY
ER	EXISTING DEVICE, REBALANCE TO CFM SHOWN					EXHAUST
EG	EXISTING DEVICE					RETURN

AIR DISTRIBUTION DEVICES LEGEND	
SYMBOL	DESCRIPTION
LGD	LAY-IN CEILING SUPPLY DIFFUSER - KRUEGER 55H SQUARE LOUVER FACE ALUMINUM DIFFUSER WITH 24"x24" LAY-IN FRAME, SQUARE TO ROUND ADAPTER, WHITE BAKED ENAMEL FINISH. DIFFUSER SHALL BE FOUR WAY THROW UNLESS OTHERWISE NOTED.
LGD	LAY-IN CEILING RETURN GRILLE - KRUEGER EG65 GRILLE, 1/2"x1/2"x1/2" ALUMINUM GRID CORE WITH 24"x24" OR 24"x12" LAY-IN FRAME AND DUCT CONNECTION FLANGE, AND WHITE BAKED ENAMEL FINISH.
OAD	OUTSIDE AIR DAMPER - ROUND SPIN-IN CONNECTOR W/ SCOOP AND DAMPER FOR ROUND DUCT AS INDICATED.

NOTE: MANUFACTURER SHALL FURNISH FINISHED SCREWS FOR ALL AIR DISTRIBUTION DEVICES TO MATCH FINISH OF THAT DEVICE.

DUCTLESS SPLIT SYSTEM UNITS	
UNIT DESIGNATION	FC/2H (12)
MANUFACTURER	MITSUBISHI
FAN-COIL UNIT MODEL NUMBER	FLA-A1ZEAT
FAN-COIL UNIT TYPE	WALL MOUNTED
CONDENSING UNIT MODEL NUMBER	FUY-A12NH44
HEAT PUMP UNIT MODEL NUMBER	---
SUPPLY FAN PERFORMANCE	
SUPPLY AIR (CFM)	380
EXTERNAL STATIC PRESSURE (H ₂ O)	---
COOLING PERFORMANCE	
TOTAL CAPACITY (BTUH)	12,000
ENTERING AIR TEMPERATURE DB/WB (°F)	80/67
OUTSIDE AMBIENT TEMPERATURE (°F)	45
MIN. SEER AT ARI CONDITIONS	21.0
REFRIGERANT LINE SIZE LIQUID/SUCTION	1/4" / 1/2"
HEATING PERFORMANCE	
HEAT PUMP OUTPUT (BTUH)	---
ENTERING AIR TEMPERATURE (°F)	---
OUTSIDE AMBIENT TEMPERATURE (°F)	---
HEATING SEASONAL PERFORMANCE FACTOR	---
ACCESSORIES	
WALL-MTD, HARD-WIRED CONTROLLER (PAR-SHMA)	YES
MAC-3941 ADAPTER FOR EMS START/STOP	YES
PAC-TISAD ADAPTER FOR EMS START/STOP	NO
LOH AMBIENT CONTROL CRANKCASE HEATER	YES
CONDENSATE PUMP	
GE-1, 60 GPH @ 5', 24" SHUT-OFF W/SAFETY SWITCH	YES

DESIGN CONDITIONS	
SUMMER OUTSIDE	49.4°F DB, 74.2°F WCB 71.3°F WB, 68.5°F MCOB
- INSIDE	78°F DB, 50% RH
WINTER OUTSIDE	21.5°F
- INSIDE	72°F

OUTSIDE DESIGN CONDITIONS ARE BASED ON ASHRAE GUIDE, HANDBOOK OF FUNDAMENTALS, 2019 EDITION. SUMMER CONDITIONS ARE FROM COLUMN. WINTER CONDITIONS ARE FROM 98 COLUMN.

BOILERS	
DESIGNATION	B-1 & 2
MANUFACTURER	AERCO
MODEL NUMBER	BHK 1000
HEATING INPUT (BTUH)	1,000,000
HEATING OUTPUT (BTUH)	460,000
MIN. EFFICIENCY @ HIGH FIRE, 60°F ENT	96%
FUEL TYPE	NATURAL GAS
WATER FLOW / PRESSURE DROP	84 GPM / 3'
ENTERING / LEAVING WATER TEMP	60°F / 40°F
POWER CIRCUIT	120V / 1Ø
FLUE VENT SIZE / AIR INTAKE SIZE	6"
WATER CONNECTIONS	3"
BOILER DIMENSIONS H" x D"	26" x 25"

PUMPS									
PUMP DESIG.	SERVICE	GPM	HEAD FT H ₂ O	PUMP EFF.	HP	RPM	MIN. GPM	TYPE	MANUFACTURER & MODEL NUMBER
P-1 & 2	CIRCULATING WATER	680	95	81	25 (1D)	1750	120	FRAME MOUNTED	B16 1510 4EB 5 x 4 x 10
P-3 & 4	COOLING TOWER	680	55	84	15 (1D)	1750	230	FRAME MOUNTED	B16 1510 4EB 5 x 4 x 8
P-B1 & B2	BOILER WATER	64	9	---	1/2	2nd speed	---	IN-LINE	GRUNDFOS UPS 40-20/4

NOTE: (1D) INDICATES INVERTER DUTY MOTOR
NOTE: P-1 THRU 4 SHALL HAVE MINIMUM INLET SIZE OF 5".

VARIABLE FREQUENCY DRIVES							
DRIVE DESIG.	DRIVE SERVES	VOLTAGE/PHASE	MOTOR HP	FRAME SIZE	ENCLOSURE	MANUFACTURER & MODEL NUMBER	
V-P1, P2	PUMPS P-1 & P-2	480V-3Ø	25	R3	UL TYPE 1 VERTICAL	ABB ACH550	
V-P3, P4	PUMPS P-3 & P-4	480V-3Ø	15	R2	UL TYPE 1 VERTICAL	ABB ACH550	
V-C11	COOLING TOWER FAN CT-1	480V-3Ø	15	R2	UL TYPE 1 VERTICAL	ABB ACH550	

NOTES:
1. FURNISH ENHANCED BYPASS SYSTEM WITH DISCONNECT & FUSES.
2. FURNISH CONNECTION FOR COMMUNICATION WITH BUILDING CONTROLS.
3. MOUNT DRIVE WITH TOP 6"-Ø AFF.
4. VFD'S ARE FURNISHED UNDER THE CONTROLS SECTION OF THE SPECIFICATIONS.

ELECTRIC UNIT HEATERS				
HEATER DESIG.	TYPE MOUNTING	H/ V / Ph.	MANUFACTURER & MODEL NUMBER	ACCESSORIES
EH-1	CEILING SUSPENDED BOTTOM Ø AFF	5/0 / 2T / 1Ø	QHARK MH	INTEGRAL DISCONNECT, 24V CONTROL TRANSFORMER & RELAY, HALL/CLG BRACKET

ROOF-TOP A.C. UNITS	
UNIT DESIGNATION	RTU-123 (R60)
MANUFACTURER	CARRIER
MODEL NUMBER	48HC06
EVAPORATOR FAN PERFORMANCE	
TOTAL SUPPLY AIR (CFM)	1940
MINIMUM OUTSIDE AIR (CFM)	200
EXTERNAL STATIC PRESSURE (H ₂ O)	.40
FAN MOTOR HORSEPOWER	1.0
COOLING PERFORMANCE	
TOTAL CAPACITY (BTUH)	59,300
SENSIBLE CAPACITY (BTUH)	44,700
ENTERING AIR TEMPERATURE DB/WB (°F)	80/67
OUTSIDE AMBIENT TEMPERATURE (°F)	45
MINIMUM SEER AT ARI CONDITIONS	(15.2) 12.4
HEATING PERFORMANCE	
HEATING INPUT (BTUH)	15,000
HEATING OUTPUT (BTUH)	43,000
AFUE @ EFFICIENCY (%)	82
TEMPERATURE RISE (°F)	44
FUEL TYPE	NATURAL GAS
ACCESSORIES	
DEHUMIDIFICATION CYCLE	YES
SLOPED ACCESSORY ROOF CURB	YES

WATER SOURCE HEAT PUMP UNITS				
UNIT DESIGNATION	WLS1	WLS2	WLS3	WLS4
MANUFACTURER	CLIMATE MASTER	CLIMATE MASTER	CLIMATE MASTER	CLIMATE MASTER
MODEL NUMBER	TGH024	TGH036	TGH036	TGH036
TYPE	HORIZONTAL	HORIZONTAL	HORIZONTAL	HORIZONTAL
SUPPLY FAN PERFORMANCE				
SUPPLY AIR (CFM)	600	800	1000	1200
EXTERNAL STATIC PRESSURE (H ₂ O)	.30	.30	.30	.30
FAN MOTOR HORSEPOWER	1/6	1/4	3/4	1/2
COOLING PERFORMANCE				
TOTAL HEATING CAPACITY (BTUH)	17,200	29,400	28,300	39,500
SENSIBLE HEATING CAPACITY (BTUH)	13,000	17,500	20,300	24,500
ENTERING AIR TEMPERATURE DB/WB (°F)	80/67	80/67	80/67	80/67
ENTERING WATER TEMPERATURE (°F)	40	40	40	40
MINIMUM SEER AT ARI (15256-1) CONDITIONS	14.3	13.4	13.4	13.5
HEAT REJECTED	21,800	30,200	36,300	43,400
HEATING PERFORMANCE				
TOTAL HEATING CAPACITY (BTUH)	19,800	21,800	33,800	42,900
ENTERING AIR TEMPERATURE (°F)	70	70	70	70
ENTERING WATER TEMPERATURE	60	60	60	60
MINIMUM COP AT ARI (15256-1) CONDITIONS	5.0	4.7	4.6	4.4
HEAT ABSORBED (BTUH)	15,400	21,200	25,600	32,100
WATER FLOW				
WATER COIL FLOW (GPM)	4.0	6.0	7.0	9.0
COIL PRESSURE DROP (FT)	1.7	12.6	6.3	9.3
CONTROL VALVE Cv / P.D. (FT)	2.8 / 4.6	4.2 / 4.6	5.0 / 4.6	6.4 / 4.6
FLEXIBLE HOSE & PIPE DIAMETER	3/4"	3/4"	3/4"	1"
UNIT DIMENSIONS (H" x L" x H')	20 x 49 x 17	20 x 49 x 18.3	20 x 49 x 18.3	20 x 41 x 21
UNIT PRICES				
CONTRACTOR PRICE PER UNIT (U.S. \$)	1,622.14	1,720.24	1,829.14	1,846.14

NOTES:
1. INCLUDE SPARE WHP'S TO BE TURNED OVER TO GC'S. THE SIZE AND QUANTITY ARE AS FOLLOWS: 2 - WLS2'S AND 4 - WLS3.
2. OMIT CONTROL VALVES ON WHP UNITS AT THE END OF ALL CORRIDORS.
3. MINIMUM STRAINER SIZE FOR FLEXIBLE HOSE ASSEMBLY IS 1". SEE DETAIL 6/2Q1.
4. EXISTING WHP UNITS IN BLDG-4010 ALREADY HAVE CONTROL VALVES FOR UNITS EQUIVALENT TO 70% FLOW IN THAT BLDG.