Sigler Commercial

INNOVATION IS IN THE AIR

Representing Industry Leading Manufacturers of Commercial HVAC Products & Solutions

Carrier® turn to the experts℠

Water Cooled Chillers

AquaEdge® 19XRV
- Variable-Speed Centrifugal
- 200 to 3,000 Tons
- HFC-134a
- IPLV to .31 kW/Ton

AquaEdge® 23XRV
- High Efficiency Variable Speed Positive Displacement
- 175 to 550 Tons
- HFC-134a
- IPLV to .299 kW/Ton

Evergreen® 30HX/XW Screw
- 75 to 400 Tons
- HFC-134a
- Small Footprint
- Heat Recovery Option

AquaForce® 30XV
- Variable Frequency Drives
- Greenspeed® Intelligence
- Next-Gen Rotary Screw Compressor
- 140 to 325 Tons, Nominal

Air Cooled/Modular Chillers

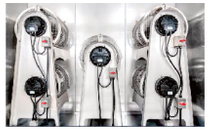
AquaSnap® 30RAP Scroll
- 10 to 150 Tons
- Digital Scroll Compressor
- Up to 16.8 IEER
- Variable Speed Condenser Fans

AquaSnap® 30RB Scroll
- 60 to 390 Tons
- Variable Speed Condenser Fans
- Up to 17.1 IEER
- Factory Hydronic Package Option

AquaForce® 30XA Screw
- 80 to 500 Tons
- Up to 15.5 IEER
- Variable Speed Compressor

AquaSnap® 30MP Scroll
- 15 to 71 Tons
- Up to 8 Connected Modules
- Heat Recovery Option

Air Handling Units



Fully Custom
- 2,000 to 200,000 CFM
- ECM Fan Array
- Indirect/Direct Evapor. Cooling
- Energy Recovery
- Made in the USA

Semi-Custom
- 400 to 60,500 CFM
- Direct Expansion, CHW Cooling
- Hot Water, Gas Heat
- Energy Recovery

Packaged Rooftop Units

WeatherExpert™ 48LC/50LC
- 3 to 23 Tons
- Up to 21 IEER
- Multi-Zone VAV

WeatherMaster™ 48/50 A, P, N Series
- 20 to 150 Tons
- VAV, CV, SAV
- Evaporative Condenser Option

WeatherExpert™ 48/50 TCQ/HCQ
- 3 to 20 Tons Air-Cooled Heat Pump
- Up to 15.8 SEER

Gemini® Condensing Units
- 18 to 130 Tons
- Small Footprint
- Single & Dual Circuit

Variable Refrigerant Flow

3 Pipe Heat Recovery/ Heat Pump
- 3 to 38 Tons
- Inverter Twin Rotary Compr.
- Turndown to 3,500 BTUH
- Flow Box Powered via FCU

2 Pipe Heat Recovery/ Heat Pump
- 6 to 36 Tons
- Inverter Twin Scroll Compressor
- Single Point Piping & Wiring on All Condensing Unit Sizes

Pumps • Heat Exchangers • Booster Systems

Kelvion

• Plate and Frame Heat Exchangers

• Cooling Towers

100% Outside Air & Energy Recovery

100% Outside Air Units
- 1.5 to 75 Tons
- SAT or Space RH/T Control
- Energy Recovery

Energy Recovery Ventilators
- Indoor & Outdoor Installation
- 40 to 13,200 CFM
- Demand Controlled Ventilation
- ECM Fan Motors

Water-Source Heat Pumps & Indoor Self-Contained

AquaZone® 50PTV/PTH
- Vertical/Horizontal
- 2 to 30 Tons
- EER up to 37
- Exceeds ASHRAE 90.1

OmniZone® 50XC/BV
- Packaged Air/Water-Cooled
- CAV/VAV
- 5-60 Tons

Fan Coil Units & Coils

AirStream® 42D
- 300 to 4,000 CFM
- Fully Modulating ECMs
- OSHPD Seismic Certified

Coils
- CHW/HW, DX
- Distributed Steam
- Copper, Stainless Steel, Aluminum

Packaged Central Plants & Controls

Modular & Custom CHW/HW Plants
- 150 to 6,000 Tons
- Integrated Controls
- Redundant CHW/CW Pumps

Building Automation
- Factory Engineered & Optimized Programs
- Graphical User Interface
- Open Protocol

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Sigler Commercial

CONTINUING **A LEGACY OF INNOVATION** SINCE 1902

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Carrier® turn to the experts℠

THERMODYNAMIC CALCS

$Q\ (Btu/h) = U\ (Btu/h \cdot ft^2 \cdot °F) \times A\ (SF) \times \Delta t\ (°F) \quad U = 1/R$

CAPACITY CALCULATIONS

Sensible Heat: $q_S\ (Btu/h) = 1.08 \times CFM \times \Delta t\ (°F)$
Total Heat: $q_T\ (Btu/h) = 4.5 \times CFM \times \Delta h\ (Btu/lb)$
Water (no glycol): $q\ (Btu/h) = 500^* \times GPM \times \Delta t\ (°F)$
*- For Glycol: • use 475 for 20%, • use 464 for 30%,
• use 449 for 40%, • use 433 for 50%

INFILTRATION/EXFILTRATION CALCS

$CFM = 2610 \times A\ (sf) \times \sqrt{\Delta p\ (in.\ H_2O)}$

Standard Pressure Differences:

- *Building* = +0.01 in. H_2O to ambient
- *Stair Vestibule* = +0.05 in. H_2O to fire floor only
- *Stairwell* = +0.05 in. H_2O to Vestibule (all floors)
- *Underfloor Plenum* = +0.08 in. H_2O to space

Leakage Rates (from IBC 909.5 Smoke Barrier Construction):
Walls : $A/A_w = 0.00100$
Exit Enclosures : $A/A_w = 0.00035$
All Other Shafts : $A/A_w = 0.00150$

Rule of Thumb:
Facade Exfiltration (CFM) = 0.06 CFM/sf x Envelope Area (SF)

Crack Method:

- *Window Tight Fit, caulk* : 0.25 CFM/ft of crack
- *Window Tight Fit, not caulked* : 0.50 CFM/ft of crack
- *Window Loose Fit, (i.e. operable)* : 1.00 CFM/ft of crack
- *Door Loose Fit* : 2.00 CFM/ft of crack

ELECTRICAL COORDINATION

volts x amps = watts
Motor 1/2 HP and larger typically 480V/3ø

Typical Voltages & Phases
120V/lø, 208/lø, 277/lø, 208/3ø, 480V/3ø
Low Voltage (i.e. BMS, Telecom, Data)= 24V

MEDIUM PRESSURE DUCTS

All ductwork from fan to a terminal unit and all ductwork operating at ±3" pressure class or higher

Velocity Range (Alt.1)	*2,400 - 2,800 FPM (shafts & mech rooms)*
	2,000 - 2,200 FPM (above occupied areas)
CFM Range (Alt.2)	*<1,500 CFM Size at 0.5" per 100ft H_2O*
	>1,500 CFM Size at 2,000 FPM

At connections to shafts, reduce velocity to 1,200 - 1,500 FPM for accoustics

FAN LAWS

Q = Capacity (CFM)
SP = Total Static Pressure (in)
N = Fan Speed (RPM)
$Q_1/Q_2 = N_1/N_2$
$SP_1/SP_2 = (N_1/N_2)^2$
$BHP_1/BHP_2 = (N_1/N_2)^3$

MINIMUM VENTILATION

Toilet Exhaust = greater of 2 CFM/SF, or 15 AC's/hr
Storage Rooms = 4 AC's/hr
Mech. Rooms = 6 AC's/hr
Chiller Rooms = 12 AC's/hr
Fan Rooms = 4 AC's/hr
Parking Garage = 1.5 CFM/SF
Kitchens = 30 AC's/hr
Locker Rooms = 6 AC's/hr (0.5 CFM/SF OA)
Residential Corridors = 2 AC's/hr 100% OA
Residential Bathrooms = 5 AC's/hr exhaust

ENERGY EFFICIENCY FORMULAS

EER = Btu/h (Cooling Output) / Watts (Input)

COP = Btu/h (Heating) / [watts x 3.412]

EER (Energy Efficiency Ratio) ; COP (Coefficient of Performance); SEER (Seasonal EER)

LOW PRESSURE DUCTS

Low Pressure Supply Ductwork (Ductwork downstream of terminal units and constant volume ductwork. Less than +2" pressure class and below.

CFM (FROM)	CFM (TO)	FRICTION PER 100 FEET OF DUCT
0	100	0.04
101	200	0.05
201	400	0.06
401	700	0.07
701	1000	0.08
1001	1500	0.09
1501	2000	0.1
2001	8000	1800 ft per minute

Low Pressure Return / Exhaust Ductwork (Ductwork downstream of terminal units and constant volume ductwork. Less than -2" pressure class and below.

CFM (FROM)	CFM (TO)	FRICTION PER 100 FEET OF DUCT
0	100	0.04
101	200	0.05
201	600	0.06
601	1000	0.07
1001	12000	0.08
12001	above	1800 0 ft per minute

SOUND RATING

	Sone Rating	dbA	Noise Criteria
Extremely Quiet	*1.0 to 3.0*	*28 - 43*	*22 - 37*
Quiet	*3.1 to 6.0*	*44 - 53*	*38 - 47*
Moderately Quiet	*6.1 to 9.0*	*54 - 59*	*48 - 53*
Average	*9.1 to 13.0*	*60 - 64*	*54 - 58*
Commercial	*13.1 to 18.0*	*65 - 69*	*59 - 63*
Industrial	*18.1 +*	*70+*	*64+*

PIPE SIZING TABLES (WATER)

Steel Pipe (New Schedule 40)

Pipe Size (in.)	Occupied Areas: GPM Range (@5ft/s max)	Occupied Areas: Head Loss (ft/100 ft max.)	Shafts and Mech Rooms: GPM Range (@5ft/s max)	Shafts and Mech Rooms: Head Loss (ft/100 ft max.)
3/4	3 - 4.9	5	3 - 4.9	5
1	5 - 8.9	5	5 - 8.9	5
1-1/4	9 - 17.9	5	9 - 17.9	5
1-1/2	18 - 27.9	5	18 - 27.9	5
2	28 - 50.9	5	28 - 50.9	5
2-1/2	51 - 75.9	4.5	51 - 80.9	5
3	76 - 115.9	3.5	81 - 145.9	5
4	116 - 200.9	2.6	146 - 300.9	5
5	201 - 310.9	2	301 - 550.9	5
6	311 - 450.9	1.5	551 - 900.9	5
8	451 - 800.9	1.3	901 - 1600.9	4.5
10	801 - 1225.9	0.9	1601 - 2500.9	3
12	1226 - 1760.9	0.6	2501 - 3500.9	2.5
14	1761 - 2150.9	0.55	3501 - 4250.9	2
16	-	-	4251 - 5500.9	1.8
18	-	-	5501 - 7000.9	1.5
20	-	-	7001 - 9000	1.4

Copper Tubing (Type K)

Pipe Size (in.)	GPM Range (@5ft/s max)	Head Loss (ft/100 ft max.)
3/4	0 - 3.5	5
1	3.6 - 7.5	5
1-1/4	7.6 - 13.9	5
1-1/2	14 - 23.9	5
2	24 - 50.9	5
2-1/2	51 - 75.9	4.2
3	76 - 105.9	3.5
4	106 - 180.9	2.4
5	181 - 280.9	1.5
6	281 - 400.9	1.5

Notes:

- *Typically copper pie is used for sizes less than 3" and steel is used for size 3" and greater.*
- *Design velocity is dictated primarily from noise considerations mostly caused by air entrainment*
- *Special precautions to eliminate free air may allow greater design velocities*

Typical Design Velocities:
< 7FPM over occupied spaces
< 9FPM in unoccupied spaces

TYPICAL SPACE NC LEVELS

Auditorium & TV Studio = NC 25 to 30
Audio Studio = NC 25 to 25
Kitchen = NC 50
Public Dining Area = NC 45
Classrooms & Conf. Rooms = NC 30
Labs w/ Fume Hoods = NC 50
Labs w/o Fume Hoods = NC 40
Executive Offices = NC 30 to 35

Note: These criteria should be confirmed with the project acoustical consultant.

OTHER AIR VELOCITIES

	Max Velocity (FPM)	P.D. in (H2O/100')
Grease Kitchen Hood Exhaust	*1,800 - 2,200*	*N/A*
Intake Louvers	*600 through NFA**	*0.25*
Exhaust Louvers	*1,000 through NFA**	*0.25*
Transfer Ducts	*300*	*-*
Transfer of Relief Grille	*300*	*-*
Cooling Coils (CHW)	*500*	*1.0*
Cooling Coils (DX-VAV)	*600*	*1.0*
Heating Coils	*700 - 800*	*0.4*
Door Louvers	*50*	*-*
Return Air Inlet	*1,000*	*-*
Filters	*500*	*1.0 (dirty)*
Sound Traps	*1,000 **	*0.3*

** Net Free Area (NFA) is a % of the gross louver area, typically 40-50%, verifiy with architect*
*** Verifiy with acoustical consultant*

INTERNAL HEAT GAIN RULES OF THUMB

Space	Lighting (watts/SF)	Equip. (watts/SF)	People (SF/Person)*
Open Spec. Office	*1.0*	*2 to 2.5*	*140*
Conference Room	*1.0 to 3.0*	*0.5 to 1.5*	*20*
Retail	*5.0 - 8.0*	*0.5*	*33-50*
Server Room	*1.0*	**	*no people*
Data Center	*1.0*	**	*600*
Full Kitchen	*1.0*	*25*	*50*
Classrooms	*1.0*	*0.5 to 3*	*20*
Hotel Room	*-*	*500 watts*	*2 to 4 people*
Ball Room	*3.0 to 4.0*	*0.5*	*10*

** Refer to ASHRAE Std. 62-2001 Table 2 for a complete list of occupancy and outdoor air ventilation requirements.*
*** Server and Data rooms are difficult to group under an averaged W/SF number because of the wide variety of computer and equipment densities (30 W/SF up to 500 W/SF). It is better to ask the IT consultant, or owner, what the load will be. One method is to count the number of racks. Some racks can range from 8kW to 22kW of cooling.*

Note: As "Rules of Thumb" these values should be verified for EVERY project. Especially in spaces like Data Centers and other unique spaces driven by the special equipment places in those rooms.

CONVERSIONS

1 watt = 3.412 Btu/h
1 Ton = 12,000 Btu/h
1 Ton (CT) = 15,000 Btu/h
1 psi = 2.31 ft H_2O
1 Atm - 14.7 psi
1 gal. water = 8.3 lbs
1 ft^3 = 7.3 gal.
1 therm = 100,000 Btu
1 MBH = 1,000 Btu/h

METRIC CONVERSIONS

1 m^3/s = 2,118.9 CFM
1 CFM = 0.472 L/s
1 m/s = 196.8 FPM
1BHP = 0.746 kW
1 (US) GPM = 0.063 L/s
1 (US) gal = 3.785 L
1 Newton = 4.45 lb force
1m = 3.281 feet
1 in = 24.5mm
°C = 5/9 (°F-32)

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