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Helpful Information

VERIFY ALL RESULTS AND DATA WITH OTHER SOURCES.
CHECK ALL NATIONAL AND LOCAL BUILDING CODES

Operating Diagnostics of DX Split Systems

	↑ = Higher than normal ↓ = Lower than normal	Overcharge	Undercharge	Restriction	Low indoor airflow	Dirty condenser	Low ambient temp	Bad compressor valves	TXV bad bulb	Loose TXV bulb
Head Pressure	↑	↓	↑	↓	↑	↓	↓	↓	↑	
Suction Pressure	↑	↓	↓	↓	↑	↑	↑	↓	↑	
Superheat	↓	↑	↑	↓	same	same	↑	↑	↓	
Subcooling	↑	↓	↑	↑	↓	↑	↓	↑	↓	
Amps	↑	↓	↓	↓	↑	↓	↓	↓	↑	

RULES OF THUMB (estimates only):

Every "ton" of conditioned air requires 400 CFM of air flow
 30 x 6 return grille = 400 CFM 14 x 6 return grille = 165 CFM
 Residential supply registers should be sized at 700 FPM velocity
 Residential return grilles should be sized at 400-600 FPM

IRON PIPE NAT GAS CAPACITIES IN THOUSANDS OF BTU/HR

Size	LENGTH OF PIPE								
	10'	20'	30'	40'	50'	60'	70'	80'	100'
1/2	132	92	73	63	56	50	46	43	38
3/4	278	190	152	130	115	105	96	90	79
1	520	350	285	245	215	195	180	170	150
1-1/4	1050	730	590	500	440	400	370	350	305
1-1/2	1600	1100	890	760	670	610	560	530	460

Electric Strip Heaters:

1 kW = 3,414 btu/HR
 5 kW = 17,070 btu/HR
 10 kW = 34,140 btu/HR
 15 kW = 51,210 btu/HR
 20 kW = 68,280 btu/HR

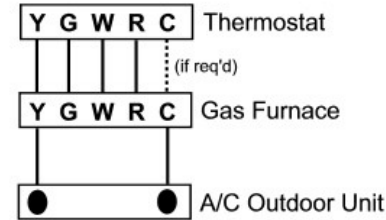
Wire Size

Based on 100' - 3% Voltage Drop

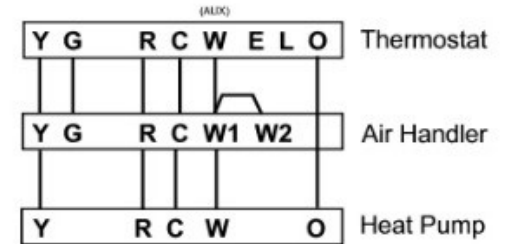
15 Amp	14 Gauge
20 Amp	12 Gauge
25 - 30 Amps	10 Gauge
35 - 45 Amps	8 Gauge
50 - 60 Amps	6 Gauge

Examples of Low Voltage Wiring

Heat & Cool with Gas Furnace



Heat Pump



Hot Water Heat

Universal Hydronics Formula:

$$\text{GPM} = \frac{\text{BTU/hr}}{\Delta T \times 500} \quad \text{(Example)} \quad \frac{100,000}{20^\circ \times 500} = 10 \text{ GPM}$$

Boiler Piping Sizes:

2-4 GPM = 3/4"
 4-9 GPM = 1"
 8-14 GPM = 1-1/4"
 14-22 GPM = 1-1/2"

Copper tubing will be at the high end of these ranges

Easy way to estimate "head loss":

1. Measure longest circuit (from boiler to furthest point and back).
2. Multiply this X 1.5
3. Multiply this X .04
4. Result is estimated head loss in feet.

Baseboard Basics:

3/4" Baseboard = approximately 600 btu per ft
 Maximum 3/4" baseboard circuit length = 67'

Expansion Tank Sizing for Residential Boilers

Boiler Output 1000's BTUH	Type of Radiation			
	Copper Baseboard & Radiant	Convectors & Unit Heaters	Cast Iron	
			Radiators	Baseboard
50m	#15	#30	#30	#30
75-100m	#30	#30	#60	#60
125m	#30	#60	#60	#60
150m	#30	#60	#90	#90
175-200m	#60	#60	#90	#90