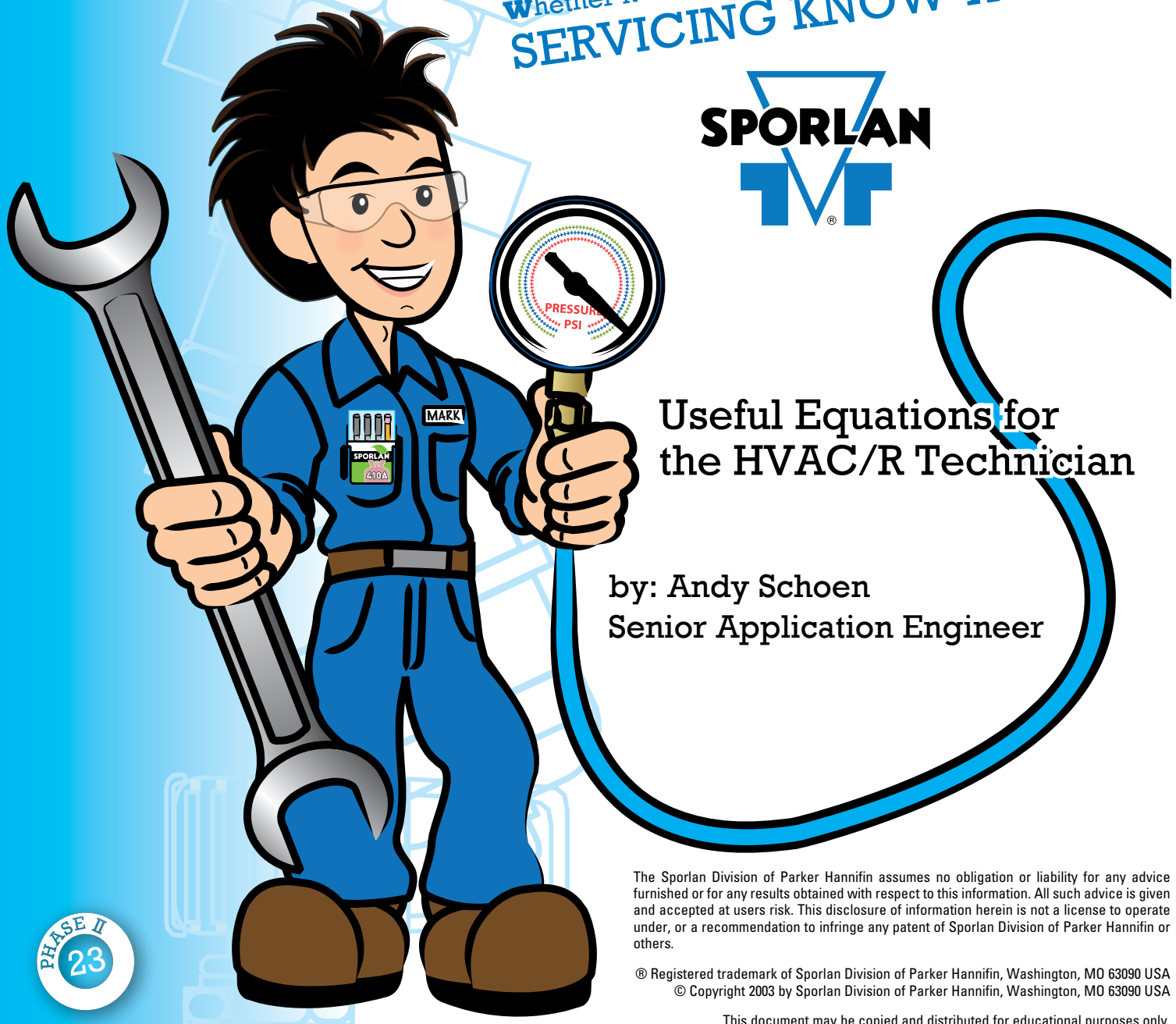
A collection of short pointed topical papers.

July 2009

Cold W·A·R·

Whether it's Air Conditioning or Refrigeration
SERVICING KNOW-HOW

SPORLAN



Useful Equations for the HVAC/R Technician

by: Andy Schoen
Senior Application Engineer

PHASE II 23

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Useful equations for the HVAC/R technician

Airflow - Definitions

CFM = cubic feet per minute

D = fan diameter

HP = horsepower (power used by fan)

RPM = revolutions per minute (fan motor)

SP = static pressure

TP = total pressure

VP = velocity pressure, in H_2O

V = air velocity, ft/min

ρ = density of air

ΔH = enthalpy change, Btu/lb

ΔT_{DB} = dry bulb temperature change, °F

ΔT_{WB} = wet bulb temperature change, °F

ΔW_{GR} = humidity ratio change, grains water/lb dry air

ΔW_{LB} = humidity ratio change, lb water/lb dry air

Airflow - Equations

$$CFM_2 = CFM_1 \times \left(\frac{RPM_2}{RPM_1}\right) \times \left(\frac{D_2}{D_1}\right)^3$$

$$SP_2 = SP_1 \times \left(\frac{CFM_2}{CFM_1}\right)^2 \times \left(\frac{D_2}{D_1}\right)^2 \times \left(\frac{\rho_2}{\rho_1}\right)$$

$$HP_2 = HP_1 \times \left(\frac{CFM_2}{CFM_1}\right)^3 \times \left(\frac{D_2}{D_1}\right)^5 \times \left(\frac{\rho_2}{\rho_1}\right)$$

$$VP = \left(\frac{V}{4005}\right)^2 ; TP = SP + VP$$

$$Btu/h(sensible) = 1.08 \times CFM \times \Delta T_{DB}$$

$$Btu/h(latent) = 0.68 \times CFM \times \Delta W_{GR} = 4840 \times CFM \times \Delta W_{LB}$$

$$Btu/h(total) = Btu/h(sensible) + Btu/h(latent) = 4.5 \times CFM \times \Delta H ; \Delta H \approx \Delta T_{WB}$$

Subscripts

$_1$ = beginning state

$_2$ = ending state

Useful equations for the HVAC/R technician

Hydronic - Definitions

m = mass flow rate, lb/h

C_V = flow coefficient

GPM = gallons per minute

SG = specific gravity, SG = 1 for water at 60°F

ρ = fluid density, lb/ft^3

ΔP = pressure drop, psi

ΔT = temperature change, °F

Hydronic - Equations

$$Btu/h = 500 \times GPM \times \Delta T$$

$$GPM = C_v \sqrt{\frac{\Delta P}{SG}}; SG = \frac{\rho}{62.367}$$

$$m = 500 \times C_v \times \sqrt{\Delta P \times SG}$$

Useful equations for the HVAC/R technician

Vacuum Pressure Equivalents

Absolute Pressure				Vacuum Below One Atmosphere		
microns	psia	atm	Pa	mm Hg	in Hg	Boiling Point H_2O, °F
0	0	0	0	760.00	29.921	---
50	0.0010	0.00007	6.6661	759.95	29.919	-50
100	0.0019	0.00013	13.332	759.90	29.917	-40
150	0.0029	0.00020	19.998	759.85	29.915	-33
200	0.0039	0.00026	26.664	759.80	29.913	-28
250	0.0048	0.00033	33.331	759.75	29.911	-24
300	0.0058	0.00039	39.997	759.70	29.909	-21
500	0.0097	0.00066	66.661	759.50	29.902	-12
1000	0.0193	0.00132	133.32	759.00	29.882	1
2000	0.0387	0.00263	266.64	758.00	29.843	15
3000	0.0580	0.00395	399.97	757.00	29.803	29
5000	0.0967	0.00658	666.61	755.00	29.724	34
10,000	0.1934	0.01316	1333.2	750.00	29.528	52
15,000	0.2901	0.01974	1999.8	745.00	29.331	63
20,000	0.3867	0.02632	2666.4	740.00	29.134	72
30,000	0.5801	0.03947	3999.7	730.00	28.740	84
50,000	0.9668	0.06579	6666.1	710.00	27.953	101
100,000	1.9337	0.13158	13,332	660.00	25.984	125
200,000	3.8674	0.26316	26,664	560.00	22.047	152
500,000	9.6684	0.65789	66,661	260.00	10.236	192
760,000	14.696	1	101,325	0	0	212

Ohm's Law Pie Chart