

CALCULATING SENSIBLE BTU OUTPUT

IN THE FIELD OF HVAC, A COMMON METHOD OF CONDITIONING A SPACE IS TO HEAT OR COOL THE AIR IN THE ROOM. THIS IS TYPICALLY DONE BY CIRCULATING THE AIR IN THE SPACE ACROSS A HEAT EXCHANGER. IF THE HEAT EXCHANGER IS AT A TEMPERATURE THAT IS ABOVE THE TEMPERATURE OF THE AIR PASSING OVER IT, THE AIR WILL PICK UP SOME OF THE HEAT WHICH WILL CAUSE THE AIR TEMPERATURE TO RISE. THE OPPOSITE IS TRUE WHEN THE HEAT EXCHANGER IS COLDER THAN THE AIR. THE AMOUNT OF HEAT REQUIRED TO RAISE 1 POUND OF AIR 1 DEGREE FAHRENHEIT IS 0.24 BTU. THIS IS KNOWN AS THE SPECIFIC HEAT OF AIR. THE AMOUNT OF HEAT BEING TRANSFERRED BETWEEN THE HEAT EXCHANGER AND THE AIR IS MEASURED IN BTU PER HOUR (BTUH). WHEN WE DEAL WITH DRY BULB TEMPERATURE CHANGE ONLY, THE QUANTITY OF HEAT IS KNOWN AS BTUH SENSIBLE (BTUHs). BY KNOWING THE QUANTITY OF AIR THAT IS MOVING ACROSS THE HEAT EXCHANGER AND IT'S CHANGE IN DRY BULB TEMPERATURE, THE BTUHs CONTENT CAN BE EASILY CALCULATED. THE FOLLOWING FORMULA IS USED FOR THIS CALCULATION:

$$\text{BTUHs} = \text{POUNDS OF AIR PER HOUR} \times \text{CHANGE IN AIR TEMPERATURE} \times 0.24$$

SINCE WEIGHING THE ACTUAL AIR IS NOT VERY PRACTICAL, WE WILL SIMPLIFY OUR FORMULA BY CONVERTING 1 POUND OF STANDARD AIR TO 1 CUBIC FOOT. STANDARD AIR IS AIR THAT IS AT A TEMPERATURE OF 70 °F AND AT AN ATMOSPHERIC PRESSURE OF 14.7 PSIA. 1 POUND OF STANDARD AIR HAS BEEN DETERMINED TO HAVE A VOLUME OF 13.34 CUBIC FEET. SINCE WE MEASURE QUANTITIES OF AIR IN CUBIC FEET PER MINUTE (CFM) WE CAN NOW CONVERT THE WEIGHT OF AIR PER HOUR TO CFM BY THE FOLLOWING CALCULATIONS:

$$\begin{aligned} \text{POUNDS OF AIR PER HOUR} &= \frac{60}{13.34} \times \text{CFM} \\ \text{POUNDS OF AIR PER HOUR} &= 4.5 \times \text{CFM} \end{aligned}$$

THIS CAN NOW BE USED TO CHANGE OUR ORIGINAL FORMULA AS FOLLOWS:

$$\text{BTUHs} = 4.5 \times \text{CFM} \times \text{CHANGE IN AIR TEMPERATURE} \times 0.24$$

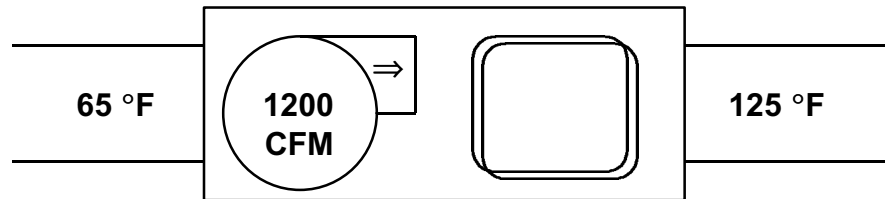
AND FINALLY, THIS CAN BE FURTHER SIMPLIFIED TO PRODUCE THE FOLLOWING FORMULA FOR CALCULATING THE SENSIBLE HEAT BEING TRANSFERRED TO OR FROM THE AIR WHICH IS BEING CONDITIONED:

$$\text{BTUHs} = 1.08 \times \text{CFM} \times \text{CHANGE IN AIR TEMPERATURE}$$

EXAMPLES

$$\text{BTUHs} = 1.08 \times \text{CFM} \times \text{CHANGE IN AIR TEMPERATURE}$$

HEATING

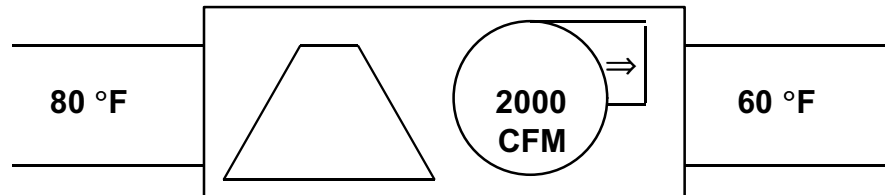


$$\text{BTUHs} = 1.08 \times 1200 \text{ CFM} \times (125 \text{ °F} - 65 \text{ °F})$$

$$\text{BTUHs} = 1.08 \times 1200 \times 60$$

$$\text{BTUHs} = 77,760$$

COOLING



$$\text{BTUHs} = 1.08 \times 2000 \text{ CFM} \times (80 \text{ °F} - 60 \text{ °F})$$

$$\text{BTUHs} = 1.08 \times 2000 \times 20$$

$$\text{BTUHs} = 43,200$$