

Nelson, Dan

From: Nelson, Dan
Sent: Friday, November 30, 2018 9:08 AM
To: 'Erick Powell'
Cc: Edl, Michele
Subject: Water Right Permit 37-22783
Attachments: Heating Memo 37-22783.pdf

Hello Erick,

Unfortunately, we were forced to put a hold on the review of the additional information requested for this field report due to numerous reasons, and I apologize for the delay in reviewing your response to our questions concerning the heating and cooling system. I have attached to this email a memo composed by our heating and cooling specialist Michele Eld. Before moving forward with processing the license on this permit, I wanted to give you the opportunity to review and comment or supply additional information if needed. At this time, we are considering following Ms. Eld's suggestions for the annual volumes for heating and cooling regarding this permit.

Due to the holiday season, I have decided to hold the processing of this permit until **January 4th, 2019**, to allow you time to respond to the information in the email. Please feel free to contact either Ms. Eld or myself concerning this matter. If I do not hear from you before January 4th, 2019, I will move forward with licensing this permit with the values discussed in the attached memorandum.

Thank you for your patience, and please don't hesitate to contact us if you have any further questions.

Respectfully,

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MEMORANDUM

Date: October 4, 2018
To: Water Right File 37-22783
From: Michele Edl
Re: license rate and volume

I was asked to provide an additional review or check on the rate and volume recommended by the examiner for the heating and cooling system.

Rate

The field examiner recommended rates based on the measurements that he took while the system was operating. The flows are within acceptable parameters provided by the manufacturers spec sheets. I concur with his rate recommendations.

Volume

To arrive at a volume for heating and for cooling, the examiner provides two tables of average monthly temperatures for the area with calculations of the heating and cooling loads in BTU/hr and calculations of the monthly volumes of water that could be used. I was not provided the calculations behind the tables but I found the information provided in them to be problematic in at least three areas:

- The examiner gives the livable floor space for the heating and cooling place-of-use as 3997 ft². However, available records from Blaine County show the square footage as ~3840 total for the primary home and the garage. The county records also show that there is a second home and garage on the property. The examiner doesn't document the true size of the conditioned space so it's not clear if the system supplies heating and cooling to both homes.
- The examiner gives the peak loads that the units can supply. (For heating: 75000 BTU/hr + 18750 BTU/hr = 93750 BTU/hr) But the calculated average monthly heat load requirements for January, February and December exceed the peak load of the system. No explanation was given for the heating supply and heating demand inequality.
- The examiner appears to estimate the monthly heating or cooling volumes by assuming a number of hours that the system runs. However, the calculated monthly volumes exceed the volume that could be used during continuous running of the system. (For January, continuous running at 26 gpm is ~0.11AF/day x 31 days = 3.41 AF which less than 3.56 AF recommended. No explanation was given for the difference.

The Department doesn't have an approved method for examiners to use to determine a volume for these uses. So, although I disagree with the examiner's method and the lack of boundary checks within his tables, he did provide the required recommendation for a volume and it was based on his best judgement and understanding of the system.

Because we did not have any operation data, neither the examiner nor I were able to correlate this specific HVAC system's response to the occupant's requirements or to the weather. At minimum the Department should ask for a minimum of a days-worth of operation data. Without it, we must rely on estimates of varying quality. I used a very different method to estimate the volumes than the field examiner did.

The method I used is an adaptation of an ASHRAE heating degree day, energy estimation method. It employs this equation:

$$\text{Vol} = (\text{HL} \times \text{HDD} \times \text{hr/day} \times \text{Cd}) / (\text{deltaT1} \times \text{K} \times \text{C} \times \text{deltaT2})$$

Where:

HL = design heat load (93750 BTU/hr given by the examiner and based on equipment size. This means that the HVAC system provides less than 25 BTU/hr-ft² and is on the low end of the scale.)

HDD = heating degree day (8688.5 the max annual HDD for Hailey 3 NNW (NWS Co-op station 103942); occurred in 1971)

Hr/day (24)

Cd = correction factor for standard construction and HDD range (0.65)

deltaT1 = design indoor temperature minus design outdoor temperature (70 - (-1.7) = 71.7° F) (a local mechanical engineer uses -20° but -1.7° F is used by the examiner)

K = correction factor to account for losses (0.9)

C = constant to correct for units (2.72 x 10⁶ BTU/AF-°F)

deltaT2 = temperature change of incoming water minus temperature of outgoing (range 1-10° F is typical) I chose 5° F.

The result is an estimate for the volume of water used in a very cold year. I also calculated the likely cooling requirement for that same very cold year using the same equation but with a few different parameters.

The broader range of possible volumes resulting from this energy equation does include the examiner's estimate. In heating mode, the system could use from 9 to 55 AF depending on the requirements of the occupant or less than perfectly functioning heat pumps. But because of unexplained inconsistencies in the tables and a discrepancy in the square footage, I am recommending smaller volumes for both uses.

My calculations indicate that the heating use volume is ~16 AF. An additional cooling volume of ~2 AF yields a total volume of 18 AF for both heating and cooling use. I believe that these are more realistic numbers for licensing the heating and cooling uses in this residence and are based on parameter values that I support.

Recommendations

I recommend 16 AF for heating use, 2 AF for cooling use and 18 AF total for heating and cooling combined.