

Short description of changes in the calculation procedure for gas boilers with modulating low-energy circulation pumps

Some changes are made to implement the calculation of electricity consumption in the current calculation procedure. Changes are made on the following points in the Excel spreadsheet for calculating annual efficiency using the Boilsim model:

1. Use Boilsim Excel spreadsheet, version 2.05
2. Electricity consumption data input to the calculations:
 - *Total electricity consumption, P_{max} heating (W)*: The total electricity consumption for the boiler, i.e. circulation pump, combustion air fan and basic electronics at nominal burner fuel input. Up to three different heating system flows are possible as input. If the input is available for a single flow only, the electricity consumption is assumed constant with no flow dependence.
 - *Total electricity consumption, P_{min} heating (W)*: The total electricity consumption for the boiler, i.e. circulation pump, combustion air fan and basic electronics at minimum burner fuel input. Flow dependence possibility as above. The actual electricity consumption is interpolated using the correlations for flow and burner input.
 - *Total electricity consumption, after run time (W)*: The sum of pump input during the after-run time and the boiler stand-by electricity consumption. Flow dependence based on maximum three different flows is possible.
 - *Total electricity consumption, P_{max} hot water (W)*: Same as above, but for hot water production.
 - *Electricity consumption, pump after-run hot water (W)*: The electricity consumption at burner after-run. i.e the circulation pump and the basic electronics. The after-run time can be separately specified for hot water and heating.
 - *Burner fan max/min (W)*: The electricity input to the combustion fan at the maximum and minimum input limits of a modulating burner.
 - *Standby electricity consumption (W)*: No changes.
3. Use variable flow in the heating system. The number of start/stops is kept unchanged at 6. Maximum temperature difference between forward and return temperature is set to 30 K. If the temperature difference exceeds this value the flow is adjusted for this.
4. Electricity consumption during burner operation is linearly interpolated between the total electricity consumption at nominal and minimum burner input with the flow as a possible

parameter (in data input). In case the pump data provided is not sufficient, the calculations are made with fixed maximum electricity input to the circulation pump. The calculations will then not be different compared to previous calculation procedure.

The pump power is calculated and used for calculation of “effective pump output” and “pump corrected efficiency”.

5. Pump after-run period is possible to use in the calculations. The calculations assume 6 cycles per hour, i.e. 10 minutes each when the heat demand is lower than the minimum load. The pump operation part of the burner-off period can then be calculated. Pump electricity input during the after-run time can also be put into the spreadsheet calculations. The after-run time for heating and hot water production in the calculations can be separately specified if necessary.
6. The limits for the overall energy label have been reduced by 400 kWh per year in order to take into account the higher efficiency that lower return temperature imply. Since only condensing gas boilers today are sold for single family houses in Denmark this limit adjustment is not relevant for non-condensing gas boilers.
7. The circulation pump adjustments etc that are assumed for the calculations shall be stated and also put as footnote on the public web site <http://www.dgc.dk/privat/kedelooversigt.htm>