International Journal of Research in Engineering and Science (IJRES)
ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
www.ijres.org Volume 4 Issue 5 ǁ May. 2016 ǁ PP. 18-22

Influence Of Meteorological Parameters On Heat Recovery Of Condensing Gas Boiler

Wang Xinpei[1], Hang Xin[1], Liu Tuo[1], Chen Yu[1]

(College Of Mechanical Engineering, Shanghai University Of Engineering Science, Shanghai 201620, China)

Abstract:- For the analysis of the influence of meteorological parameters on the condensation type wall mounted gas furnace flue gas waste heat recovery, according to the Shanghai area of a typical South to the room, floor heating system design, and the experimental and analysis different outdoor meteorological parameters, different water temperature of condensing gas wall hanging furnace flue gas waste heat recovery, obtained under different temperature and humidity conditions make the room comfortable degree better condensation type wall mounted gas furnace flue gas waste heat recovery efficiency of different. The results show that when the water temperature is 63 degrees room comfort is the best, 6.5 and 8.5 DEG C for the outdoor temperature and humidity of outdoor meteorological conditions of 38.000%RH-41.000%RH range, the condensation type wall mounted gas boiler not only embodies the characteristics of the high efficiency and energy saving and the room heating effect is better, to bring better comfort.
Key words:- The condensation heat recovery type boiler, and condensed water

I. INTRODUCTION

Ordinary wall mounted gas boiler is to the family home as a unit can also meet the needs of living hot water and heating, which occupies small space, safety, comfort, convenience of installation and operation of flexible advantages, has been relatively smooth promotion and application. With the development of wall mounted boiler technology, condensation type wall hanging furnace in ordinary gas wall hanging furnace based on research and development has gradually become the development direction of the industry. Condensation type wall hanging furnace not only has the characteristics of ordinary gas wall hanging furnace, highlight the advantages of the performance in the recovery of the waste heat of flue gas, the wall hanging furnace thermal efficiency has been greatly improved, and boiler flue gas condensing heat recovery technology is also in recent years boiler energy saving technology research hot spot. Scholars both at home and abroad have made a series of achievements in both theory and experiment [1-8].

The for a complete heating season in Shanghai, to low temperature radiant floor heating as heating terminal, operating characteristics of condensing wall hung boilers were experimental research, analysis of the variation of the condensation rate. As for the hot summer and cold winter, provide the basis for such characteristics of condensation boiler in actual operation process.

II. EXPERIMENT SYSTEM

1.1 Introduction Of Experimental System

Experiment system of the principle as shown in Figure 1, heating water and natural gas burning heating, through the water supply pipe, water separator into heating coil, mainly with radiation heating indoor air, through the return device and a return pipe flows back to the wall hanging furnace to be heated again.

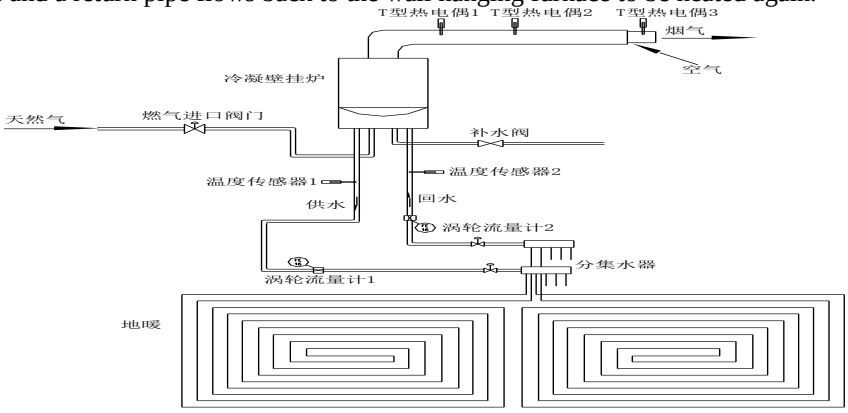


Fig.1.Experiment system diagram

A temperature sensor is arranged on the water supply pipe, which is used for measuring the temperature of the water supply and the water supply pipe is provided with a flow meter. When the system is running, the temperature sensor and the turbine flowmeter transfer temperature signal and the flow signal to the PLC control transmission unit, as shown in figure 2. PLC converts the two kinds of signals to the proportional change of digital quantity by analog quantity input module, which can be used to measure the temperature and the flow rate of the water supply. The outdoor meteorological parameters are measured by the temperature and humidity sensors, as shown in figure 3. The flue gas temperature and the indoor temperature are measured by the T type thermocouple and the indoor temperature measuring point which are arranged in the flue.

Fig.2.PLCPhysical connection diagram

Fig.3.Temperature and humidity sensor

1.2 Temperature Measuring Point Setting

The wall hanging condensing gas furnace floor heating system based on, factors affecting condensation wall hanging furnace condensation rate is mainly the exhaust gas temperature, main parameters characterizing the condensation effect for condensation water condensation volume. Around the two key parameters of experimental design and quasi by changing the wall hanging condensing gas furnace temperature of supply water to determine the variation of exhaust gas temperature and condensation of water. The measurement of boiler condensate water temperature was 50℃, 55 ℃, 60℃, 63 ℃. In the experiment, the flue gas temperature measurement by using T type thermocouple connected to the Agilent data acquisition instrument for temperature measurement signal. The measurement frequency is measured in accordance with the experimental setup of each 1min measurement data, and the temperature data of the flue gas in an experimental period is obtained.

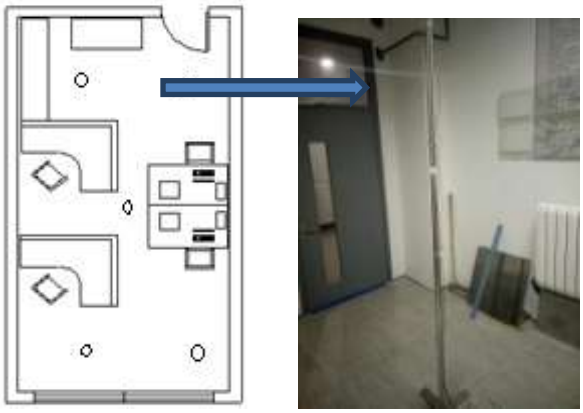
1.3 Temperature Measuring Point Setting

The wall hanging condensing gas furnace floor heating system based on, factors affecting condensation wall hanging furnace condensation rate is mainly the exhaust gas temperature, main parameters characterizing the condensation effect for condensation water condensation volume. Around the two key parameters of experimental design and quasi by changing the wall hanging condensing gas furnace temperature of supply water to determine the variation of exhaust gas temperature and condensation of water. The measurement of boiler condensate water temperature was 50℃, 55 ℃, 60℃, 63 ℃. In the experiment, the flue gas temperature measurement by using T type thermocouple connected to the Agilent data acquisition instrument for temperature measurement signal. The measurement frequency is measured in accordance with the experimental setup of each 1min measurement data, and the temperature data of the flue gas in an experimental period is obtained.

III. EXPERIMENTAL STUDY ON THE CONDENSINGWALL-HUNGBOILER IN THE TYPICAL HEATING SEASON IN SHANGHAI

2.1Building conditions

For the test of hot summer and cold winter area of Shanghai is a typical room. Experimental heating room indoor space size of long 8.4m, wide 4m, a total area of 33.6 square meters, high 3.05m.Wall for cast-in-situ concrete porous brick wall, 240mm thick, in-plane whitewashed, outside wiping cement mortar and 240mm thickness in the interior walls, double-sided plaster.The room whose window faces south, the single Aluminum Alloy flat open window. The room door opened to the corridor, as the single entity of wood. Room plane sketch and indoor temperature measuring rod position as shown in Figure 4 (a), (b) shown in.



(a) (b)

Fig.4.Sketch map of the room and the indoor temperature measuring plane

There are 5 temperature measuring rods were arrangedat different locations in the room. 3 thermocouples were tied up at different height of the rod, respectively from the ground 0.5m, 1.0m and 1.5m, mainly used for measuring thedistribution of temperaturein the room. The measurement results from the room temperature can determine whether the indoor temperature is comfortable, so that the experiment has more practical significance.

2.2 Experimental Program

When the outdoor temperature is 6.5 and 8.5℃ and the humidity is 38%RH-41%RH, the experiment is carried out in the typical heating season for a period of one week. The experimental time is 15:25-18:05 every day. Experimental data recording interval for 20min, namely every 20 min recording a condensing water formed, gas consumption, gas temperature, indoor temperature, sorting dataand experimental system reaches a steady state, changing the water temperature from the boiler and recorded the changes in experimental data. The energy recoveredfrom the smoke is calculated and analyzed according to the different water temperature and outdoor meteorological parameters.

IV. THERMAL EFFICIENCY ANALYSIS OF THE BOILER IN THE TYPICAL HEATING SEASON IN SHANGHAI

3.1Condensate Water And Gas Temperature Change

By condensing wall hung boilers turned to run to the end of the experiment, in an experimental cycle changing the water temperature, record the corresponding condensation of water and flue gas temperature, and carries on the statistics, the time-varying curve as shown in Figure 5, shown in Figure 6

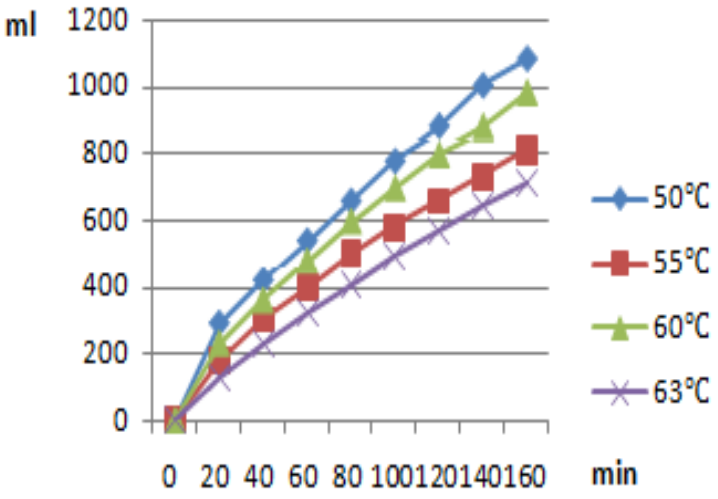


Fig.5 Different water temperature measuring condensed water cumulant changes with time

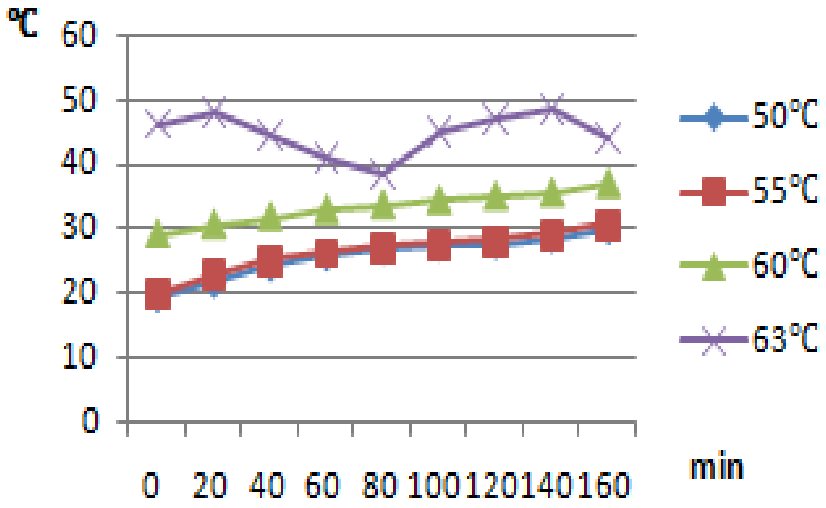


Fig.6 Temperature change of flue gas temperature with differentwater supply

3.2Indoor Temperature Change

With the condensation of wall mounted boiler water temperature rise at the same time, the average indoor heating temperature rises change curve as shown in Figure 7.

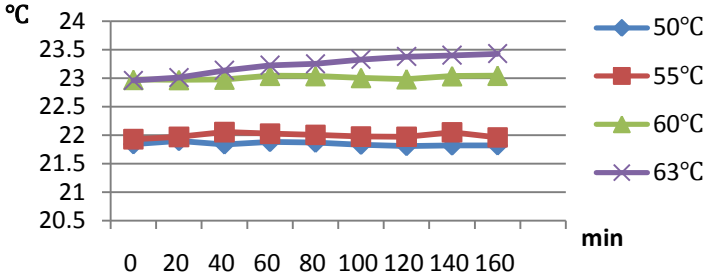


Figure 7 Indoor temperature changes with time in different water supply temperature

3.3 Condensation Heat Calculation

Condensations heat is mainly condensing wall hung boilers by latent heat recovery water vapor in flue gas, water vapor condenses to form condensed water absorption and the heat of condensation. The latent heat of condensation recovery can be obtained according to the collection of condensation water, and the calculation formula for the latent heat recovery of flue gas is as follows:

$Q_{潜}=m_y \cdot r_y$ (1)

Type：$Q_{潜}$Heat transfer for latent heat， kJ

M_y Quality of condensed water， kg

R_yLatent heat of vaporization for water， kJ/ kg

Experimental parameters	Experimental date						
	first day	the second day	on the third day	the forth day	Fifth days	Sixth days	Seventh days
Outdoor temperature/ ℃	10.7	11.6	12.2	13.1	13.8	12.5	8.8
Outdoor humidity/ % RH	57.8	58.1	57.4	59.6	56.6	62.7	56.4

Temperature of water supply/℃	50	50	55	55	60	60	63
Flue gas temperature/℃	35.3	36,5	38.2	37.4	38.5	37.9	36,9
Condensation water/ml/20min	40	35	50	60	40	35	60
Heat recovery/kJ	0.90	0.79	1.13	1.35	0.90	0.79	1.35

Experimental data record

From table 1 shows, in unit time recovery of condensation latent heat of water with flue gas temperature rise, gradually decreased; exhaust gas temperature from 30 DEG C up to 40 DEG C, rose 1 per degrees, each minute recovery of latent heat quantity is decreased about about 0.25kJ; when the temperature reached 50 DEG C, per minute recovery of the latent heat of the minimum, is about 0.79kJ; temperature continues to rise, the recovery of latent heat over 1kj; 63 DEG C temperature and heat recovery up, thermal efficiency high.

V. CONCLUSION

This paper according to the experiment, in the outdoor temperature 8-15 degrees, the outside humidity is from 30 to 70 outdoor meteorological parameters, condensation type wall hanging furnace - low temperature radiant floor heating system in natural gas use, condensation of water and exhaust temperature parameters were measured, so as to obtain the temperature condition of different water temperature conditions extremely flue gas condensation rate changes. The condensation efficiency is mainly affected by the condensation of the boiler exhaust temperature, exhaust gas temperature is higher, the lower the rate of condensation.

REFERENCE

[1]. RanChunyu. Heating project [M]. Beijing: Chemical Industry Press, 2009.
[2]. S.Sattari, B.Farhanieh. A Parametric study on radiant floor heating system performance. Renewable Energy 31 (2006):1617–1626
[3]. Gook-Sup Song. Buttock temperature in a sedentary posture on plywood flooring of varying thickness over the ONDOL heating system. J Wood SCI (2004)50:498–503.
[4]. ZhouXinghong. Numerical simulation of low temperature floor radiant heating and its performance analysis [D]. Nanjing: Nanjing University of Science and Technology, 2004
[5]. ZhaoLeilei. Study on the heat transfer performance of low temperature radiant floor heating system [D]. Beijing: Beijing University of Chemical Technology.2010.
[6]. DongWeimin. New control strategy for low temperature radiant floor heating system [D]. Hebei: Yanshan University.2010.
[7]. Wu Lei of [D]. research and development of low temperature radiant floor heating thermostat.2010. Hebei: Yanshan University
[8]. YuanQingtao, Xiao Yongquan, Zhao Ju. Determination of the optimum return water temperature of geothermal heating supply and return water temperature [J]. Journal of Shandong University, 2007,22 (3): 226~229.