iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 8 **Issue:** X **Month of publication:** October 2020

DOI: https://doi.org/10.22214/ijraset.2020.31853

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue X Oct 2020- Available at www.ijraset.com

Waste Heat Recovery from CNC Machine Control Panel

Akshay D. Meshram[1], Dr. Ashish Raut[2]
[1]M.Tech. (Heat Power Engineering) Student, Department of Mechanical Engineering, G.H. Raisoni College of Engineering, Nagpur
[2]Assistant Profesor, Department of Mechanical Engineering, G.H. Raisoni College of Engineering, Nagpur

Abstract: Heat is a form of energy, in which loss of energy is supplied by various means such as industrial waste, temperature, humidity and moisture of heat. It is efficient that remarkable and continuous efforts should be taken for recovery the waste heat so more heat is generated.
So waste heat recovery from the control panel of CNC machine creating a great impact on the materials which produced in the industry. A trial has been used to recover waste heat from the control panel of CNC machine. Waste heat from the control panel used in various purpose such as industrial and domestic.
The main aim of this research is to control the heat losses from the control panel and to improve the performance of CNC machine so that jobs should be in proper condition. So that there is minimum constructional value, maintenance and running cost used for industrial and domestic purpose.
The overall temperature of control panel is13°C so that waste heat is determined and production of jobs quality is mentioning in these project thesis. The main motive to use the waste heat for improving the efficiency and overall heat is generated in control panel is determined for the production of jobs. Such that study is shown in that system where it is designed, constructed and other technical concepts.
Keyword: waste heat, control panel, CNC machine

I. INTRODUCTION

In this paper , we are studying how much waste heat can be calculated at suitable temperature with the reference of CNC machine. More study is performed in waste heat treatment that at 15°c gases doesn't consume as per requirement it can calculate waste heat from control panel.

A. Concept of Control panel of CNC machine

Waste heat recovery is the key method to consume less energy of fuel, harmful emitted gas present in surroundings and improving overall efficiency. Waste heat usually useful for generating heat the industrial work for mechanical and electrical working conditions under these system. The testing of control panel is humanly important because lots of manpower is consumed enough for particulates
the energy gases present inside the control panel. The exact quantity of industrial waste heat is poorly quantified, but various studies have estimated that as much as 20 to 50% of industrial energy consumption is ultimately discharged as waste heat. While some waste heat losses from industrial processes are inevitable, facilities can reduce these losses by improving equipment efficiency or installing waste heat recovery technologies.
Waste heat losses arise both from equipment inefficiencies and from thermodynamic limitations on equipment and processes. For example, consider oil fired furnaces frequently used in steel melting operations. Exhaust gases immediately leaving the furnace can have temperatures as high as 300°C.
Gases have high heat content, carrying away as much as 60% of furnace energy inputs. Efforts can be made to design more energy efficient reverberatory furnaces with better heat transfer and lower exhaust temperatures; however, the laws of thermodynamics place a lower limit on the temperature of exhaust gases. The gas temperature in the furnace will never decrease below the temperature of the molten steel, since this would violate the second law of thermodynamics. In this scenario, at least 40% of the energy input to the furnace is still lost as waste heat.

Fig.1: Layout of CNC machine

II. PROBLEM IDENTIFICATION:

In many of the cases that CNC and VMC machine is producing more jobs as per the requirement so when the jobs are produced inside the CNC machine they create huge heat on the jobs so they use coolant to cool the job. So they used an indicator how much jobs are produced and the amount of energy consumed to ensure the particular operation. At the back side of the CNC machine control panel components gets heated such as sensors and lubricator and the filter get damaged.

So they used air conditioner and heat exchanger and heat the amount of heat is recovered using waste heat recovery treatment. So we also use an indicator in which we going to identify the heat get possibly extract from the machine, and hence we used that heat for overall energy for required purpose.

III. COPONENTS USED

A. Run Around Coil

It comprises two or more multi-row finned tube coils connected to each other by a pumped pipe work circuit. A run-around coil is a type of energy recovery. Heat Exchanger most often positioned within the supply and exhaust air streams of an air handling system, or in the exhaust gases of an industrial process, to recover the heat energy. Generally, it refers to any intermediate stream used to transfer heat between two streams that are not directly connected for reasons of safety or practicality. It may also be referred to as a run-around loop, a pump-around coil or a liquid coupled heat exchanger.

Fig.2: Run-around Coil

B. Thermal Wheel

Rotary heat exchanger: consists of a circular honeycomb matrix of heat absorbing material, which is slowly rotated within the supply and exhaust air streams of an air handling system. A thermal wheel, also known as a rotary heat exchanger, or rotary air-to-air enthalpy wheel, or heat recovery wheel, is a type of energy recovery. Heat Recovery positioned within the supply and exhaust air streams of an air-handling system or in the exhaust gases of an industrial process, in order to recover the heat energy. A cooling-specific thermal wheel is sometimes referred to as a Kyoto wheel.

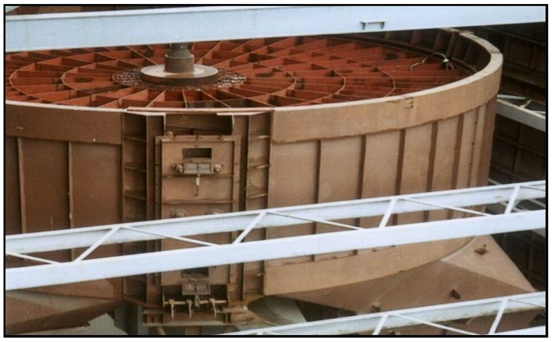


Fig.3: Thermal Wheel

C. Recuperators

It consisting of metal tubes that carry the inlet gas and thus preheating the gas before entering the process. The heat wheel is operates on the same principle as a solar air conditioning unit. A recuperator is a special purpose counter-flow energy recovery heat exchanger positioned within the supply and exhaust air streams of an air handling system, or in the exhaust gases of an industrial process, in order to recover the waste heat. Generally, they are used to extract heat from the exhaust and use it to preheat air entering the combustion system. In this way they use waste energy to heat the air, offsetting some of the fuel, and thereby improve the energy efficiency of the system as a whole.

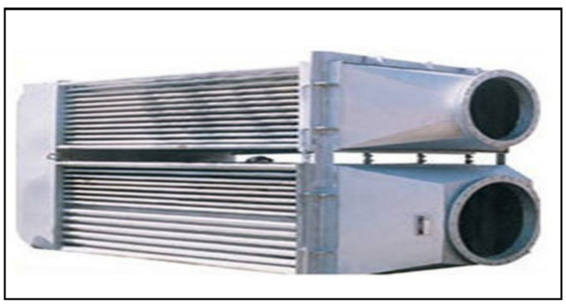


Fig.4: Recuperator

D. Particulate Filters

Particulate Filters (DPF) to capture emission by maintaining higher temperatures adjacent to the converter and tail pipes to reduce the amount of emissions from the exhaust.

E. Indicator

It indicates electricity consumed for the production of the jobs and hence it removes the gases present in the system. It regulates the overall efficiency present in the control panel so that it removes the moisture present in the panel.

Fig.5: Indicator

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue X Oct 2020- Available at www.ijraset.com

IV. METHODLOGY

The main objective to develop these project and to fabricate a new machine that is used for testing the waste gases present in the control panel which is maintained temperature of 13-15 °C. The following methods are taken for purposed work.

Fig.6:Control Panel

The CNC machine has containing 4 operations drilling, finishing, cutting, shaping and winding. Hence that machine consuming more energy as per jobs requirement. An indicator is used to see how much electricity is consumed for overall jobs. Control panel consists of lubricator, sensors, air conditioner, wiring to sockets, connector, power supply, servomotor, transformer these components are in the back side of the control panel. So it regrets the VMC machine for there overall use of heat which is supplied at several interval of times. Filter is damaged and the adorable temperature of the CNC machine filter is 33-35 °C.

Diagram

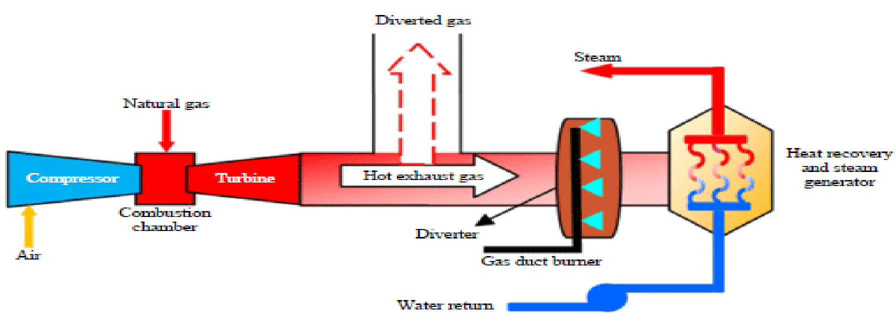


Fig.7: Waste Heat Recovery from Control Panel by Pipe

An extra study is done for conserving the heat so that particular amount of waste heat gases is passed through the panel and hence it can be examined by waste heat indicator. Then huge amount of energy is passes through the blower which can be extracted by inside temperature of CNC machine whereas it overlaps the overall efficiency. The flue gases can passes through the pipe where it can save the energy so the CNC machine cannot go to maintenance anymore.

V. DEVELOP SOLUTIONS

It is functional that the components of control panel such as servomotor, and windings of CNC machine it get burnt. Hence particular amount of heat energy is available at hose pipe so that waste heat gases can be calculated which can be heated to sink the energy level. It implies the several parameters can be taken that energy which is available inside CNC machine with coolant it can cool the jobs where it require 15°C of minimum temperature to cool the jobs which present in the machine.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue X Oct 2020- Available at www.ijraset.com

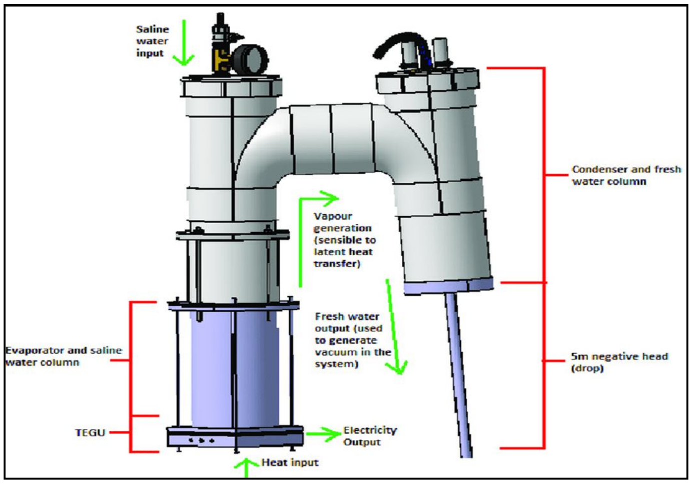


Fig.8 :Projected Layout for Control Panel of CNC

These design can be taken where amount of heat is available fins can be used under conduction examination through sudden amount of energy is used where it decomposes required heat gases. At 15°C control panel efficiency can be maintained so that it cannot be goes in maintenance work. It explains that how much energy gases are consumed according to the production where it can be tested the heat produced in the pipe.

VI. RESULTS AND CALCULATIONS

A. Transformation Effect

After the transformation, the exhaust temperatures of the inlet and outlet of the composite phase change heat exchanger were tested in the summer and winter by grid method. The data are summarized in Table 1 and Table 2:

Table 1. After the transformation (Summer test).

Measuring hole Number	Phase change heat exchanger inlet exhaust temperature °C	Phase change Heat exchanger outletexhaust temperature °C
1	34.5	29.5
2	34.0	29.2
3	33.6	29.4
4	33.2	27.1
Avg. value	34.33	29.30

Table 2. After the transformation (Winter test).

Measuring hole Number	Phase change heat exchanger inlet exhaust temperature °C	Phase change heat exchanger outlet exhaust temperature °C
1	34.5	20.6
2	34.4	20.2
3	34.7	20.3
4	34.3	20.4
Avg.value	34.48	20.38

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue X Oct 2020- Available at www.ijraset.com

It can be seen from the test data after the transformation that the outlet temperature of the summer phase change heat exchanger is 25.0°C lower than the inlet temperature, and the outlet temperature of the winter phase change heat exchanger is 24.1°C lower than the inlet temperature, and the exhaust gas temperature is successfully controlled at the design value. In the range of 130°C, the cooling effect after the transformation is remarkable.

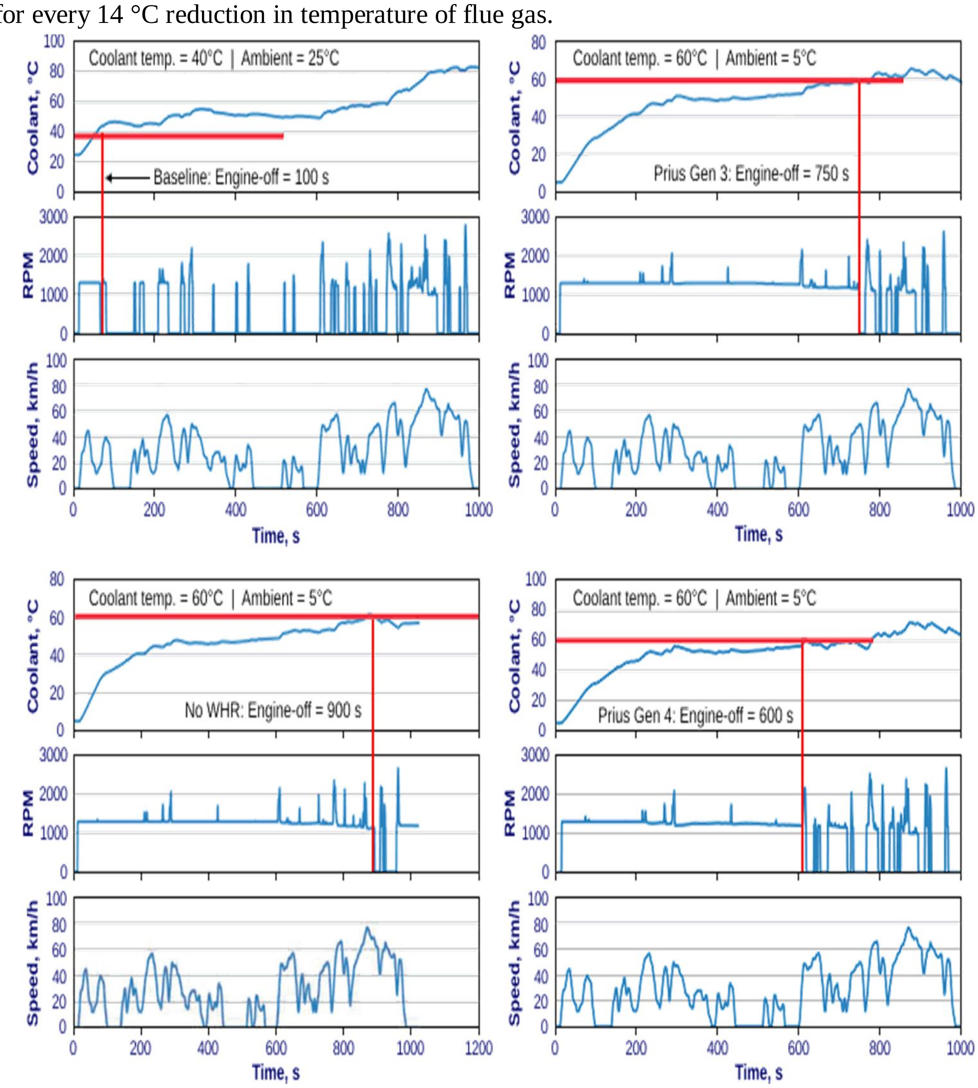
Heat recovery from control panel In a CNC control panel, the exhaust gases are leaving the furnace at 900 °C at the rate of 2100 m3/hour. The total heat recoverable at 180^0C.

final exhaust can be calculated as

$Q = V \times \rho \times Cp \times \Delta T$

Where,

1) Q = Heat content in kCal
2) V = Flow rate of the substance in m3/hr
3) ρ = Density of the flue gas in kg/m3
4) Cp= Specific heat of the substance in kCal/kg °C
5) ΔT= Temperature difference in °C
6) Cp (Specific heat of flue gas) = 0.24 kCal/kg/°C
7) Heat available (Q) = 2100 × 1.19 × 0.24 × ((900-180) = 4,31,827 kCal/hr
8) By installing a recuperator, this heat can be recovered to pre-heat the combustion air. The fuel savings would be 33% (@ 1% fuel reduction for every 14 °C reduction in temperature of flue gas.



Graph when production of jobs

REFERENCES

[1] Rakesh Jain, "Performance Improvement of Waste Heat Recovery from an Air Conditioning Unit", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 2.
[2] Satish K. Maurya, "Analytical study on the waste heat recovery Combined Ejector And Vapour Compression Refrigeration System", International Journal of Engineering Sciences & Research Technology, page no.1422-1425.
[3] S.Umamaheswari, "Growing Trend of Process off Gas and Waste Heat Recovery in Captive Power Generation", International Journal Of Scientific Research, Volume:2, Issue: 11, November 2013, ISSN No 2277 – 8179.
[4] Yogendra Saidawat, "Power Generation From Waste Heat Extracted Through Clinker Production In Cement Industry", International Journal in IT and Engineering, Vol.03, Issue-06, (June, 2015) ISSN: 2321-1776.
[5] Zhongyi Su, "Analysis of energy utilization and waste in China's processing industry based on a case study", 7th International Conference on Applied Energy – ICAE2015, Energy Procedia 75 (2015) 572 – 577.
[6] Liang-Chen Wang, "Analysis of the reusability of the energy of the exhaust gas from the calciner for the production of carbon", International Journal of Energy Science Direct Energy 78 (2014), 439-450.