Engine Conditioning Air Handling Unit

Siddhaling Hulgutte[1], Moresh Mukhedkar[2], Vijay Walunjkar[3]
[1, 2]Dept of Electronics and Telecommunication
[3]Director,Inspired Control System Pvt. Ltd., Pune, India.
[1, 2] Dr.D. Y. Patil College of Engineering & Technology, Talegaon, Ambi, India

Abstract- *Emission standards are the legal requirements governing air pollutants released into the atmosphere. Emission standards set quantitative limits on the permissible amount of specific air pollutants that may be released from specific sources over specific timeframes. They are generally designed to achieve air quality standards and to protect human life. Diesel/Gasoline driven engine emission measurements are performed on an engine or vehicle dynamometer, over a standardized emission test cycle.*

Emission test cycles are repeatable sequences of engine operating conditions, designed to simulate real-life operation in the laboratory. In the sampling system, exhaust gases are most commonly diluted with air using the CVS method for this all one of the major components is air inlet to the engine so for repeatable sequence of engine emission results the inlet air should be well conditioning as per the government testing standards. This conditioning air handling unit is capable to meet those requirements in all steady state as well as transient test.

This unit is very helpful for engine development to meet future emission norms as engine inlet air condition plays crucial role while developing engine emissions.

Keywords- AirCon, CAHU, Conditioning system for engine testing, Engine inlet air dynamic control unit.

I. INTRODUCTION

Automotive field is very big and now days many research is going on and also the engine exhaust pollutants are also crucial which directly impact on environment so now very stringent emission norms are coming into the world wide also Indian government also shows positive intend towards emission norms so meet such emission norms engine air inlet and fuel is the main two inputs to engine and of course there are other factors too but in this paper we will concentrate on engine air inlet. This Conditioning Air Handling Unit (CAHU) permits the operation of combustion engines with conditioned intake air to obtain reproducible test results

The following parameters of the supplied air can be set:
Pressure range: 950 – 1050 mbar (abs) (+/- 1 mbar)
Specific humidity range: 6 – 20 g/kg (+/- 1g/kg)
Temperature range: 15 - 30°C (+/- 1°C)

The unit is operated and controlled from an integrated Touch-Panel where set values and actual values are displayed.

Actual values for temperature, humidity and pressure can be transferred to a test bench computer via a serial interface for automation-reasons. Set values for temperature, humidity and pressure can be obtained from a test bench computer via a serial interface for automation-reasons. All states of the CAHU, including errors are being displayed on the touch panel with explanation and help on how to fix them.

An error-list is being kept on the touch panel and can be used to trace back any occurring error. The main goal of this paper is to present a description and implementation of an air conditioning system to simulate atmospheric conditions in house to test and validate the engine emission and also other requirement of such as low temperatures, pressure and humidity control.

This is the working model helps to all automotive OEM's to developed their engine in house for simulate various atmospheric conditions.

II. EASE OF USE

The intake air temperature and humidity of an internal combustion engine has an influence on the engines performance and on the exhaust gas composition. Test results obtained on engine test beds can only be reproduced and clearly interpreted. If the intake air temperature and -humidity can be held at a constant value, if necessary, it can be changed in a presupposed way. The device has been constructed to hold constant temperature and humidity values or to change these values in a presupposed way. Independent of climatic conditions, the temperature in the test room and the engine data the values are adjusted automatically. The set point values can be selected by hand at the front of the control unit or automatically via the computer interface. The actual values are shown on digital displays in [°C] for temperature, [mbar]

for pressure and [% r.H.] for relative humidity. Also for automatic data processing the computer interface is available.

III. BLOCK DIAGRAM

The device consists of a microprocessor-controlled regulator mounted in a 19“standard rack and a temperature- / pressure regulating device. The following schematic picture shows the principle structure of the system.

A side channel compressor with a higher air capacity than the tested combustion engine blows air through a smoothing tank with an air/water heat exchanger. At the cooling water inlet, the enclosed strainer has to be installed in order to avoid dirty water damaging the machinery.

The pre-selected intake air temperature in front of the air filter of the combustion engine is regulated by changing the temperature of the heat transfer fluid passing through the air/water heatexchanger. This fluid is only water. The temperature of the fluid is influenced by the water/water heat exchanger and the electrical heating.

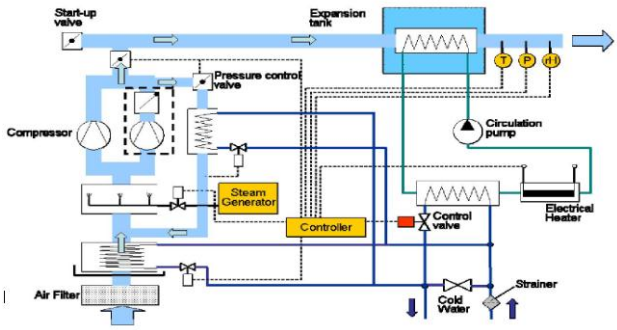

Figure 1: Standard Block Diagram

Description

The adjustment of the air pressure is done via throttling in intake air duct. The required air pressure before throttle valve is reached by selective blow-by. The device can be operated also with constant flow rate. In that case the maximally possible flow rate with a small positive pressure is supplied constantly to the engine intake. A starting protection prevents development of inadmissibly high or low pressures in the air intake system of the engine, after switching on the device. For this a third throttle valve (starting flap) is inserted. This throttle valve is always opened in case of switched off plant. When switching on the device it is slowly closed (closing duration approx. 1 min).

The humidifying is arranged either by a steam generator or (in case of installation sizes from 2400 m3/h) by spraying nozzles.

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Water Condition

The following requirements to the cooling water must be ensured to guarantee the efficiency of the machinery:

- Water, quality recommendation according to VDI 2035, or
- Water- / glycol mixture, containing max. 50% of glycol.

Requirements to Water Condition

- 1° dH = 10 mg CaO/l = 17,9 mg/l CaCO3 (ppm)
- 1,787° French hardness
- 1,25° English hardness
- 1,05° American hardness

The components of the valves are not resistant to seawater! The indicated numerical values refer to concentrated recycling water and do not refer to make-up water which is to be demineralized.

Strainer

The accurate service of the machinery demands its protection from dirt. The installation of the enclosed strainer in front of the machinery provides the cleaning of the streaming cooling fluid. The connection is of R 1½ “female thread design. The strainer must be installed horizontally in front of the machinery, ensuring the streaming direction is as noted on the strainer. Otherwise the strainer will not work adequately.

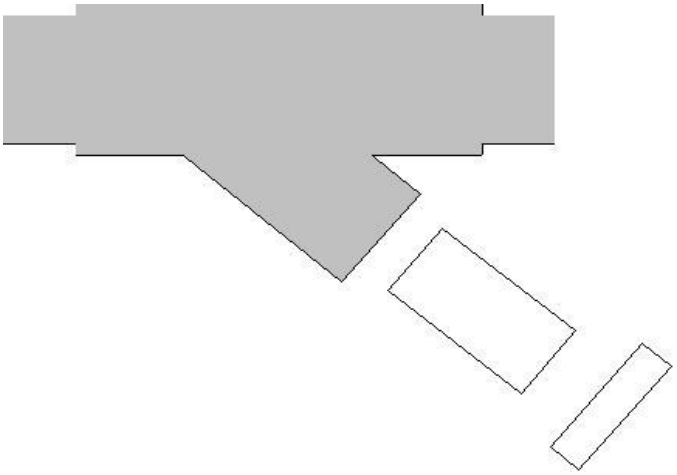


Figure 2: Strainer in streaming direction

After the first implementing of the machinery, the cleaning of the strainer should take place weekly. In the following time, the cleaning depends on the speed of becoming dirty, and the cleaning intervals can be determined as needed.

For the cleaning procedure, unscrew the filter cap and remove and clean the sieve insert.

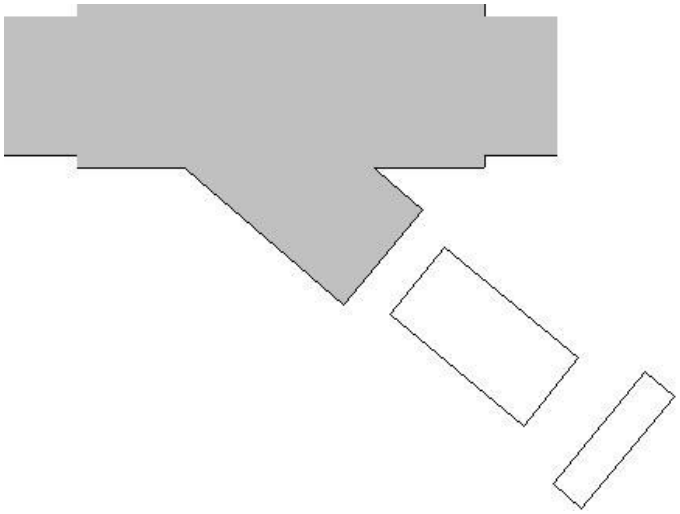


Figure 3: Strainer with its removable sieve insert

Cold water connection

The cold-water connections of the AirCon are ball valves with 1 1/2"female pipe thread (Pos.18). The AirCon should be connected to a chiller-circuit with flexible tubes. The cold water has to be at least 10 K cooler than the required intake air temperature.

Air connections

The air connection is based on a standard flange connection DN 125.

Pressurized air connection

For actuating the flaps and the optional humidity spray, clean, dry and oil free compressed air, 6barg, is necessary.

Connection for water (at option humidity control)

The water drain of the AirCon (see drawing „connections ") should be connected to the sewerage systems by means of a flexible hose, because the steam generator will be pressure relieved, when it is turned off. In that process a few liters of water are drained.

Devices with spraying nozzles (>2400m3/h) also should be connected to the sewerage systems. The drain connection of these installation types is placed beneath the switch cabinet!

IV. MECHANICAL DESIGN

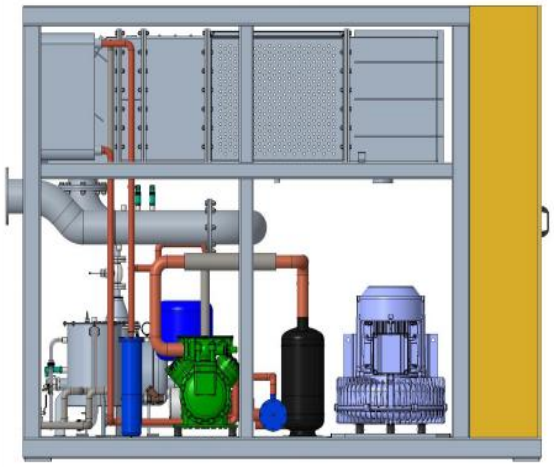


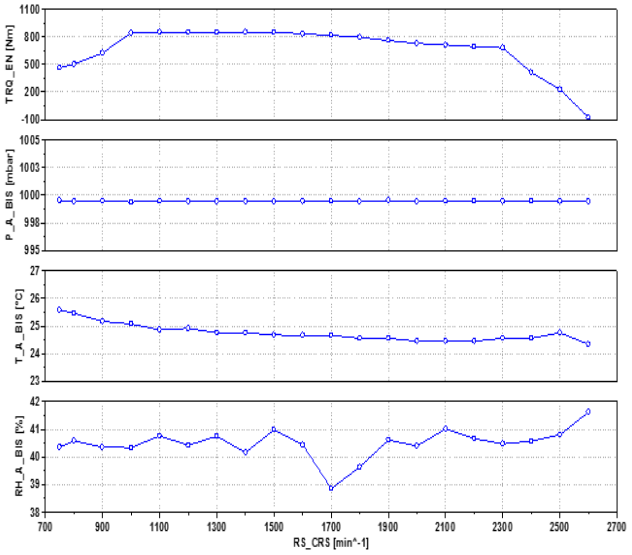
Figure 4: Mechanical design of system

V. STUDIESAND OUTPUT

This unit is interfaced with engine test bench for verification of all component like temperature, pressure and humidity for various tests cycles like steady state and transient namely as below.

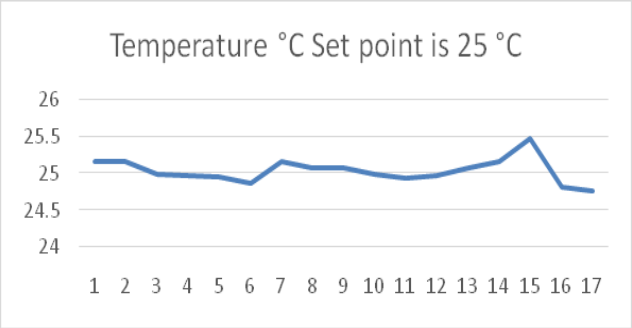
A.FTP (Full Throttle Performance)

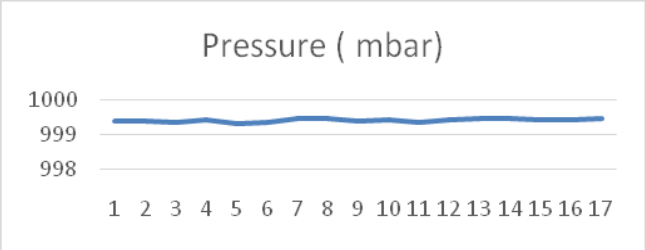
Inthiscycle we checked all engine parameters for set conditions and we found very good result and this cycle is basically used for to optimized engine performance over all speed points here we checked commercial vehicle engine i.e. 700 rpm to 2650 rpm.

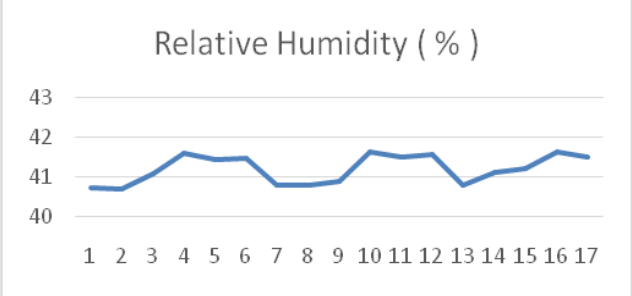


B.WHSC (World Harmonized Steady Cycle)

Inthiscycle we checked all engine parameters for set conditions and we found very good result and this cycle is basically used for to optimized engine emission and PM over standard speed and load points.





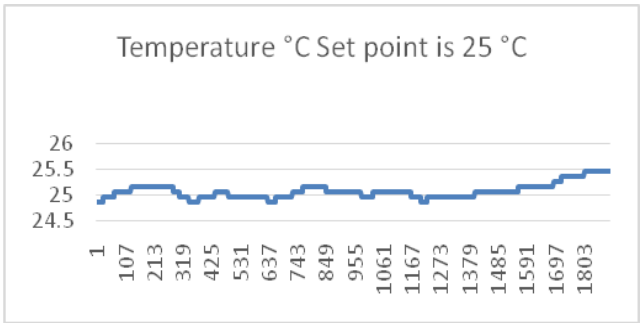


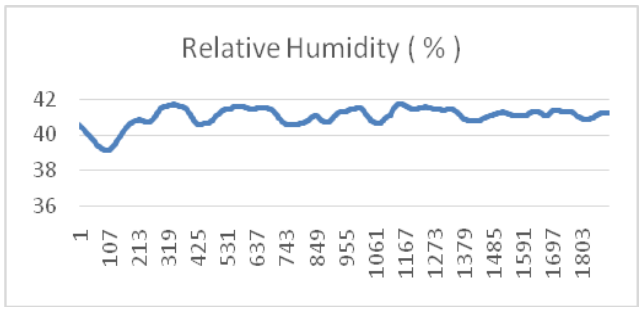
C.WHTC (World Harmonized Transient Cycle)

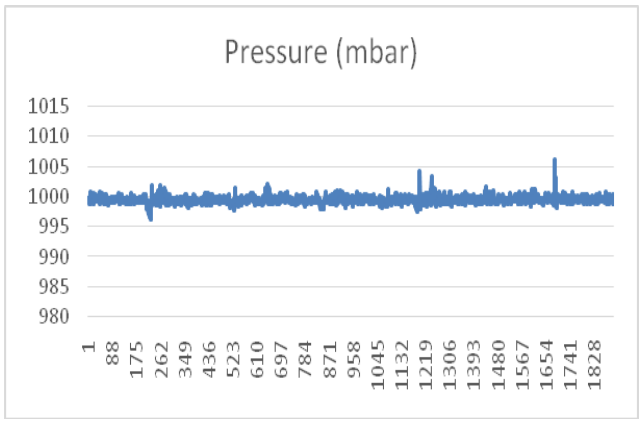
This is the transient cycle and in this engine performance and emission values are observed and PM over standard speed and load points.

Engine run on engine dyno meter over 1806 different points during this temperature, pressure and humidity are important parameters.

All parameter should be constant to validate accurate result as here in this paper we are not able to show complete performance due to space constraint but we can focus on air conditioning parameters.







From the result we can see in all mentioned above three cycle all parameters are in well controlled condition.

VI. TEST DATA ON ENGINE

To verify functionality of the device we have connected out unit with engine test bench.

We ran all the cycle/test (FTP, WHSC and WHTC) on Diesel engine 5.9L, 6 Cylinder and 135Kw engine.

VII. CONCLUSION

In this paper work this unit mainly aim to clean air so to test and developed more clean engines for future generation.

Also planning to file Patent of this work. This unit is used in any application where condition of air is concern e.g. Automotive engine.

VIII. ACKNOWLEDGMENT

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[1] www.inspiredcontrolsystem.com