

PARAMETER DETERMINATION OF HYDRAULIC DYNAMOMETER

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Abstract:

The project is basically based upon the determination of parameters of Hydraulic Dynamometer using LabVIEW. LabVIEW is the programming tool that is used for automation purposes mainly in industries. Herein, we will be judging the various parameters like Load Cell, Temperature Sensors etc, by interfacing the digital set-up with our manual set-up. The Load Cell that will be used is the S-shaped Load Cell and the various temperature sensors are used to determine temperatures like water inlet temperature, water outlet temperature, air temperature etc. After measuring these parameters we will be interfacing these devices with the manual dynamometer system. After interfacing, there will be separate meters installed wherein we will be view parameters measured by the system.

The study that was conducted resulted in following results that are mentioned in the graphs and tables below. We have tried to mention more and more tables and graphs related to our study so that it can be possible to figure out the exact motive behind the research conducted.

Keywords: Load Cell; Sno2 Sensor; Temperature Sensor; Labview; Air Pressure Concept; Strain Type Load Cell.

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1. Introduction

The following project deals with the parameters determination of Hydraulic Dynamometer using the Virtual Instruments LabVIEW. Herein, we will be determining the hydraulic parameters using components like Load Cell, SnO₂ sensors, LabVIEW. These components will be determining the load applied on the device and the temperatures like water inlet temperature, water outlet temperature, air temperature etc. There after we will be interfacing our device with the manual dynamometer and then we will be installing the meters to view the readings that will be measured by the device.

The project will finally help in formation of the digital dynamometer that will be controlled by the LabVIEW software. The main problem behind conducting the research was that to test the efficiency of the motors as far as accurately.

We have mentioned the figures and the tables below in the paper that can view a clear picture to our readers. We are also mentioning that after measuring the related parameters of our designed

machine, we went for it's comparison with the machine that needs to be tested and hence we could get the clear view that our designed system was far more accurate and hence we could easily measure the desired parameters that is required.

The tables and the graphs that are mentioned below shows the relationship between fuel consumption rate and corrected brake power.

There are other graphs that show the same relation in different conditions that when the temperature of the air is high i.e. when the air is hot or cold, then how does the graph varies. When a particular parameter is decreased then the other corresponding to it increases. Hence, accordingly we obtain the graph of the experiment that we have conducted.

2. Ease of Use

The following project has great ease for it will be beneficial for the comparison of the various default engines with our standard engine because as per our purpose, we will be making our hydraulic dynamometer at very precise and accurate by judging it's parameters at various levels using different components for the measurement.

The Hydraulic Dynamometer that will be finally set-up will help in determination of the applied load on it. Also, we would be measuring the various temperatures like the water inlet temperature, water outlet temperature, air temperature etc. In many ways it will help in judging the accuracy of default device when it will be compared with our device.

2.1. Abbreviations and Acronyms

The basic abbreviations are used in the above paragraphs that are mentioned below:-

LabVIEW- It is defined as the "laboratory virtual instrument setup engineering and workbench."
SnO₂ sensors are basically the sensors that can be used to measure the temperature parameters.

2.2. Units

The Load Cell is going to measure the applied load in Kg.

The temperature that will be used herein will be in degree Celsius.

3. Materials and Methods

The materials that were required mainly was a motor or say dynamometer which is having a load cell as its main component. A Load Cell is a device that is basically a sensor which acts like a thermocouple and that the thermocouple shows the value of applied load on it. Whatever Load is applied on the Load Cell, it takes that weight and electronically gives the value corresponding to it.

There are different types of Load Cell that are mentioned below:-

- Hydraulic type Load Cell
- S-shaped Load Cell

- Piezoelectric Load Cell
- Pneumatic Load Cell
- Strain type Load Cell

We have mainly used S-type Load Cell and the main advantage behind using this type of Load Cell is that whatever amount of load is applied on the this device, then it will not break due to extra load.

Thus this type of Load Cell has both the longitudinal and latitudinal property in it. Behind this we are also using different types of sensors basically here we have used temperature sensors and SnO2 sensor.

3.1. Method

The main method employed here is that we will be first taking the applied load on the Load Cell and then through the LabVIEW programming we have connected the manual system with our personal computer but before that we will be firstly interfacing the manual motor with the personal computer through the help of DAQ card. The DAQ card is mainly data acquisition card that takes the data from the system and then feeds it into our personal computer.

There are many other data that needs to be feed into our system through the help of DAQ card and the data include mainly the temperature sensor and the pressure sensors that needs to feed into the device with help of the DAQ card.

Finally we have installed the digital meters that will take the readings digitally from the measured device and then we can view it through the meters. There are graphs and the figures mentioned in the topics below:-

We can easily view it the variations that are occurring into the device when various values are applied to it.

4. Diagrams and Graphs

The diagrammatic and graphical structure of the project is mentioned in the picture below as shown:-

Name of the Engine Manufacturer: PRANSHI DIESELS PVT. LTD.

Type:			
Model:	EPB-24	Engine No.:	E10428
No. of Cylinders:	2		
Rated Speed (rpm):	1500		
Rated Brake Power (kW):	16.72		
Rated Capacity (liters):	182	Stroke (mm):	115
Caloric Capacity (liters):	1.871		
Mechanical Efficiency (%):	83.33		
Place of Test:	Agre	Date:	27.04.2018

Serial No.:	455
Rated Compression Ratio (C _r):	16.5:1
Rated Speed (RPM):	1500
Rated Brake Power (kW):	16.72
Rated Capacity (liters):	1.871
Manufacturer's Recommended Grade of Oil:	Multi-Grade 20W40
Dimensions: Type:	Roll Over / Hydraulic / Electrical
Stroke (mm):	
Rated Capacity (liters):	1.871
Production Control Number:	
Engine No. (After Engine has passed the test):	

Sl. No.	Time (min)	Temp. (°C)	Temperature					Estimated Friction Power (kW)	Estimated Friction Torque (Nm)	Estimated Friction Coefficient (μ)	Estimated Friction Coefficient (%)	Estimated Friction Coefficient (g/kWh)	Total Correction Factor (%)	Corrected Brake Power (kW)
			Water Inlet (°C)	Water Outlet (°C)	Oil Inlet (°C)	Oil Outlet (°C)	Exhaust Gas (°C)							
1	12:18:01	91.00	200	295	294.46	425.56	0.00	61	16.12	3.16	0.53	0.96	0.51	
2	12:25:01	91.00	200	295	294.80	423.35	0.00	61	15.94	3.25	1.37	0.96	1.32	
3	12:33:01	91.00	200	295	294.71	465.47	0.00	61	15.71	16.9	2.78	0.96	2.68	
4	12:40:01	91.00	200	295	294.59	514.93	0.00	61	15.59	25.25	4.12	0.96	3.96	
5	12:50:01	91.00	200	295	295.33	564.89	0.00	61	15.43	33.91	5.48	0.96	5.27	
6	01:00:01	91.00	200	295	295.71	622.68	0.00	61	15.22	42.1	6.71	0.96	6.66	
7	01:10:01	91.00	200	295	296.58	661.12	0.00	61	15.11	45.43	7.25	0.96	6.99	

Note 1: For points of measurement of air intake temperature, exhaust gas temperature and exhaust back pressure reference shall be made to IS:10000 (Part)-1 (1991).

Note 2: Lubricating oil pressure (See col 24) shall be measured whenever possible.

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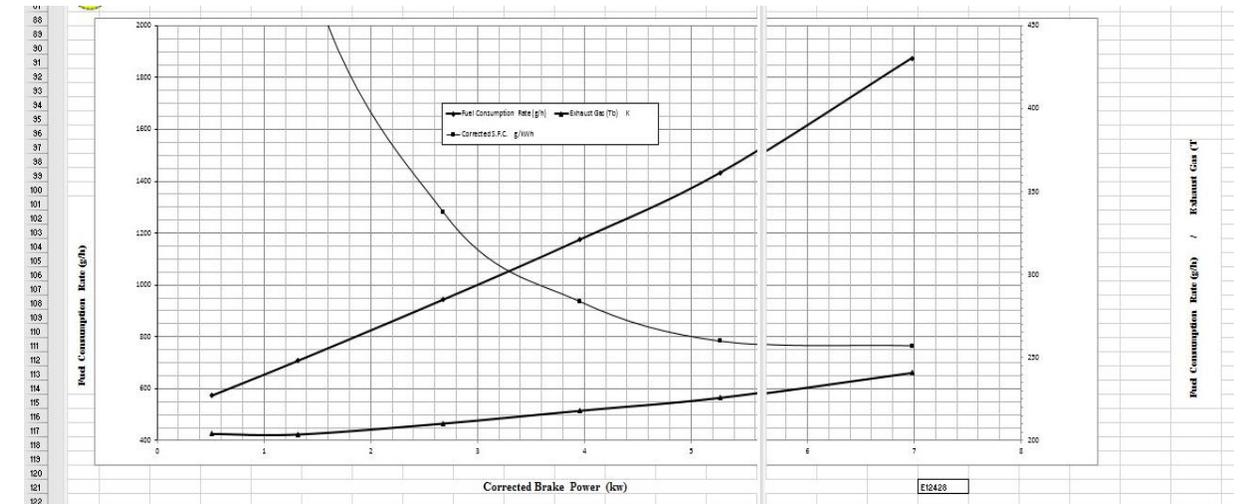
Corrected Brake Power (kW)	Fuel Consumption Rate (g/h)	Corrected S.F.C. (g/kWh)	Exhaust Gas (T _g) (K)
0.51	573	1063.8	425.56
1.32	708	534.2	423.35
2.68	944	337.5	465.47
3.96	1176	283.7	514.93
5.27	1433	253.9	564.89
6.38	1875	257.1	661.12

20 HP

Fuel Consumption					Cooling Water			Lubricating Oil	
Rated	Actual	Corrected	Exhaust Gas	Exhaust Gas	Water Inlet	Water Outlet	Water Inlet	Water Outlet	Oil Inlet
41	257.49	573.23	1076.08	1.0100	1069.8	294.53	322.41	331.11	0
41	248.4	708.25	517.20	1.0100	514.18	297.53	322.66	330.99	0
41	154.35	944.81	339.46	1.0100	337.48	297.4	322.29	329.99	0
41	125.54	1175.71	285.34	1.0100	283.67	297.4	322.91	328.86	0
41	103.03	1432.57	261.42	1.0100	259.9	298.15	323.16	331.11	0
41	86.75	1701.44	253.56	1.0100	252.88	298.83	322.91	331.35	0
41	78.71	1875.3	258.58	1.0100	257.87	297.9	322.41	331.11	0

GOVERNING	Speed	Rated	Temp.	Perm.	Speed Band
	1500	1500	1550	1550	1500-1550
	1500	1500	1550	1550	1500-1550

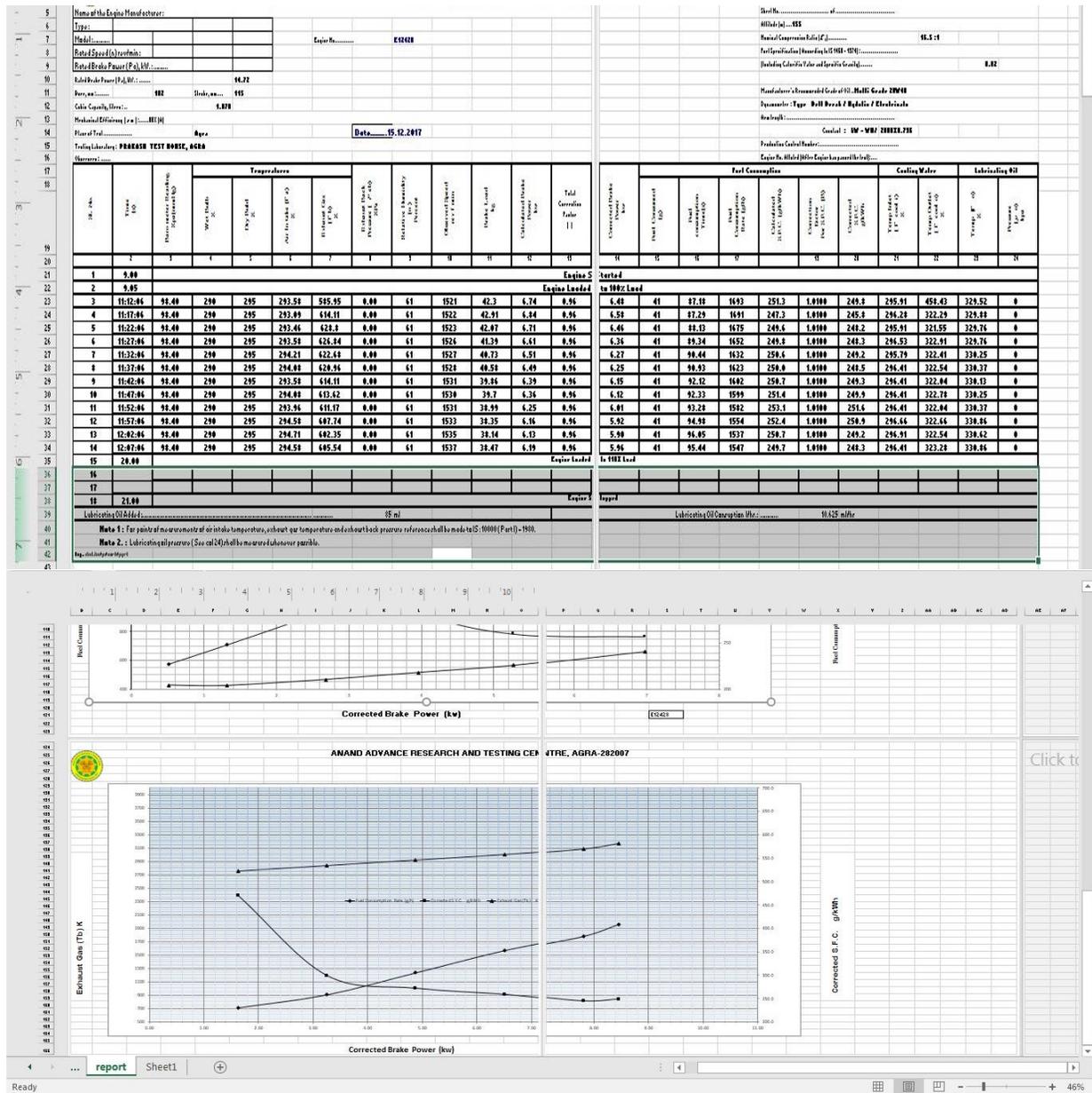
Herein, we have the table that is shown above and through the table we come to know that the relation is shown between the fuel consumption rate and the brake power and we can view that when we increase the value of the fuel consumption rate then the brake power decreases and vice versa i.e. upon decreasing the fuel consumption rate then the brake power is increased.



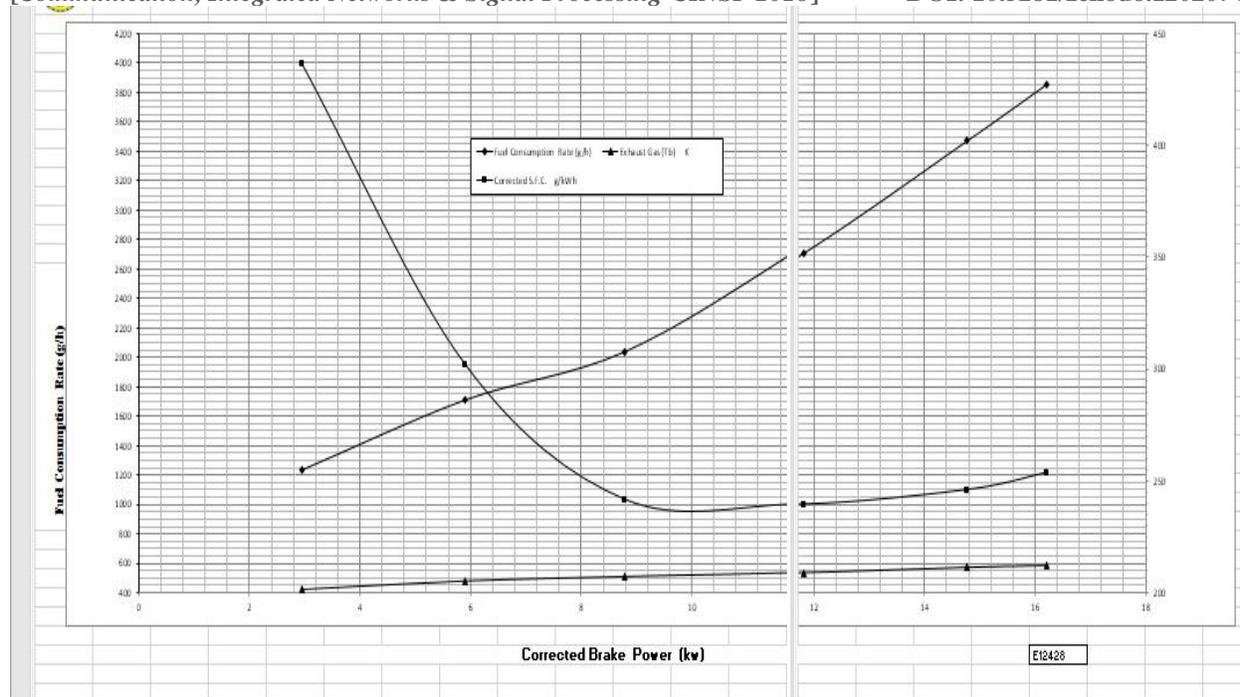
The following graph shows the relation between the combustion fuel and the brake power rated. There are few more graphs and the diagrammatic figures that will be shown in the diagram above and below.

The curves obtained below in the graph are not linear with the time which shows that how our system varies with the time. We also find the relation between various parameter as shown and is clarified from the graph above.

There are some more tables and the graphical structures that has been created corresponding to the functioning of the system. We have also tried to mention the figures related to the experiments that has been conducted.



There are few more relations as shown below in the figure. We are showing few more diagrammatic structures as shown below. Since, the test organized again consists of numerous



As shown in the table or chart we see that for the machine through which we have performed the experiment, the mechanical efficiency of that mechanical set-up is 80%.

These relations are shown between fuel combustion rate and corrected brake power. There are mainly three major points that consists of mainly three major points :-

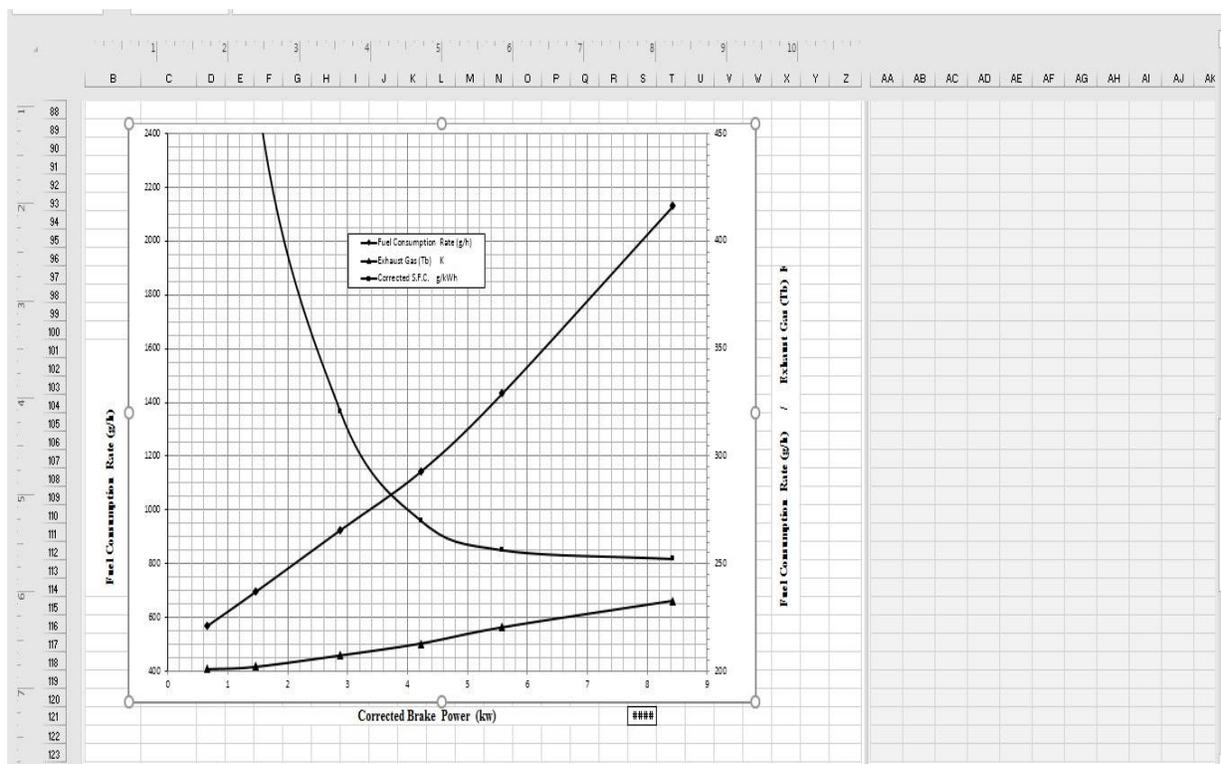
- When we increase the corrected brake power then initially the graph is constant.
- Secondly, when we increase the corrected brake power than the fuel combustion rate decreases as shown in the graph.
- At last, when we increase fuel combustion rate then the corrected brake power also increases.



5. Conclusions

Finally we can conclude that the results that are obtained are correspondingly very accurate to our measurement.

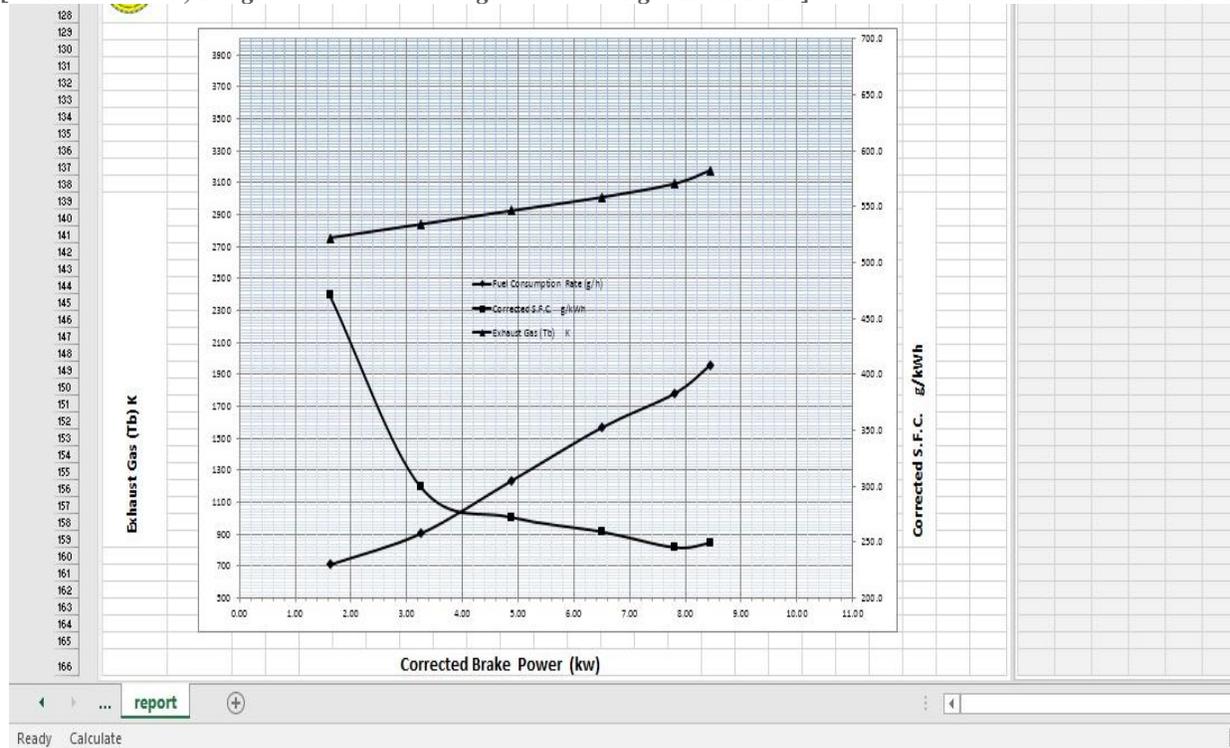
We also mention that the how with change in one of the parameter, the other parameter is also affected.



When we increase the value of the fuel consumption rate then the correct brake power decreases. However, basically it the device that is going to consume the fuel and not we are going to increase it's value.

The table that is shown shows the value of both the parameters and the parameters are corrected brake power and the fuel consumption rate. We are also taking those values directly into the meter that we have installed.

These values are taken after interfacing our dynamometer with the personal computer. This process is mainly done with help of the data acquisition card. The DAQ card are basically used for providing the values that is measured from the manual device directly.



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