Quick Power Generation in Bangladesh to Reduce the Crisis of Electricity

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Abstract— Bangladesh is an agricultural as well as developing country. In irrigation process and industrial sector, we need more electric power for better production. For this reason the demand of electrical power is increase day by day. But in present time generating electrical power is not enough for fill up this amount of demands. Here presents how the way fulfills the demand by generating quick electrical power without any environmental impact as well as by the using very less amount of fuel. How the way it will be very effective and helpful by producing electricity in our future life.

Index Terms— Detail, Working Principle, Coupling, Single Line Diagram, Control

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1 INTRODUCTION

Electricity is very important element in modern life but it is very significant for a developing country because of increasing industry day by day. So demand of electricity is very high for these types of countries. In case of Bangladesh the demand of consumer electric power is greater than the producing of electric power [1]. So, we have to produce more and more electricity to get better life. To produce more electric power, we need to use Quick Power Generation. For Quick Power Generation, it's better to use GE JENBACHER GAS ENGINE. By coupling same rating GE JENBACHER GAS ENGINE, we can get more power. If here coupling two or more GE JENBACHER GAS ENGINE then will get more electric power.

2 DETAILS OF GE JENBACHER GAS ENGINE

The GE JENBACHER GAS ENGINE (JGS 420 GS-N.L) works on the 4-stroke principle and is a water-cooled 20 cylinder V-engine (60°) with an exhaust gas turbo-charger for pressure charging of the intake mixture. GE JENBACHER GAS ENGINE uses the LEANOX method, which is a further development of the lean-mix engine principle. Here the engine is supplied with a mixture of gas and a surplus of air to minimize emissions already at the combustion stage in the engine [2][3].

3 WORKING PRINCIPLE OF GE JENBACHER GAS ENGINE

We know that the working principle of generator depends on Faraday's Law. For moving a generator or alternator, needs two portions: one is prime mover another one is rotor and prime mover and rotor are in the same shaft [4]. Engine and generator are connected by flexible coupling. Here we use gas/air mixture as engine fuel. The gas/air mixture creates high pressure by ignition system (the mechanism that ignites the fuel in an internal combustion engine), for this pressure the prime mover starts to rotate. The prime mover and generator are connected by flexible coupling as a result prime mover starts to rotate generator rotor. Control supply voltage from starter and control panel batteries 24 V DC (Direct Current). In this engine the maximum speed is 1500 rpm and finally we get maximum 1415 KW electrical out from every generator [5].

Figure: Jenbacher Engine (J 420 GS N.L)

3.1 Fuel System

Fuel system is combustion air/fuel gas system and motorized carburetor for automatic adjustment according to fuel gas characteristic. Exhaust driven turbocharger, mixture manifold with bellows, water-cooled intercooler, throttle valve and distribution manifolds to cylinders [6].

3.2 Lube Oil System

Lube oil system is automatic lube oil replenishing system. It includes float valve in lube oil feed line, including inspection glass. Electric monitoring system will be provided for engine shut-down at lube oil levels "MINIMUM" and "MAXIMUM".

Solenoid valve in oil feed line is only activated during engine operation. Manual override of the solenoid valve, for filling procedure during oil changes is included [7].

3.3 Cooling System

The electric pump pumps engine cooling water through the two main water ducts in the engine block, and from there through the cylinder block cooling jacket. Vertical bores supply engine cooling water to the cylinder heads. Water flows through the heads, cools them and is then fed back through the engine cooling water return line to the pump.

3.4 Ignition System

GE JENBACHER GAS ENGINE is equipped with a microprocessor-controlled capacitor discharge ignition system. The ignition system is run with a supply voltage of 24 V DC (Direct Current) [8].
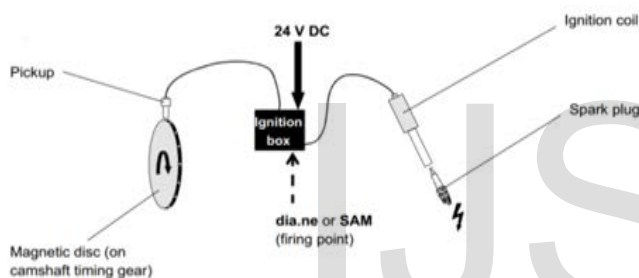

Figure: Function of Flexible Coupling

Figure: Ignition System

4 FLEXIBLE COUPLING

A flexible coupling is used to connect two shafts, end-to-end in the same line, for two main purposes. The first purpose is to transmit power that is torque from one shaft to another. The second purpose is to compensate for small amounts of misalignment and random movement between two shafts. The generator housing and the gearbox (engine) are rigidly bolted together via the coupling housing. The gear on the coupling element (generator) engages with the one on the coupling flange (engine), and power is transferred from the engine to the generator by positive locking. The flexible coupling is designed to transmit power up to a certain nominal torque. If this nominal torque is exceeded by a factor of about 5 – 6, then the external teeth (rubber disc) slip to protect the engine and the generator against temporary overloading. Temporary overloading can be caused by incorrect synchronization or a short circuit [9][10].
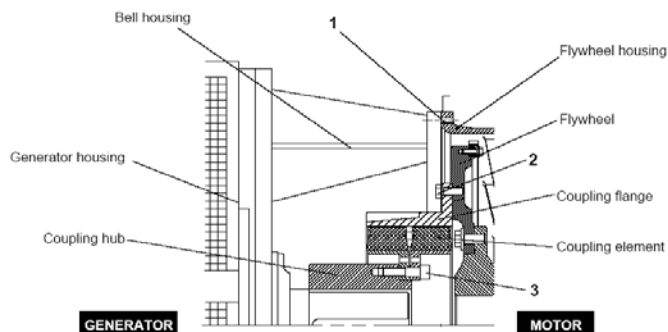
4.1 Engine Side

The internal-geared coupling flange (light metal ring) is bolted onto the flywheel.

Figure: Coupling Flange (Engine side)

4.2 Generator Side

The coupling hub is mounted onto the generator shaft using a feather key and a set screw. The coupling element, which consists of a steel disc onto which a rubber disc has been vulcanized, is bolted to the coupling hub.
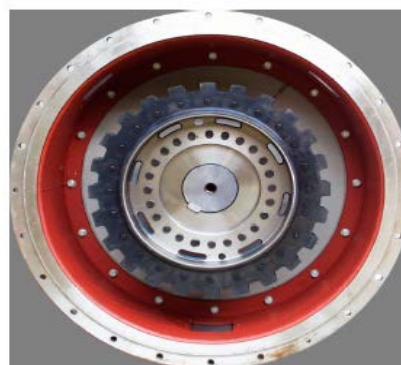
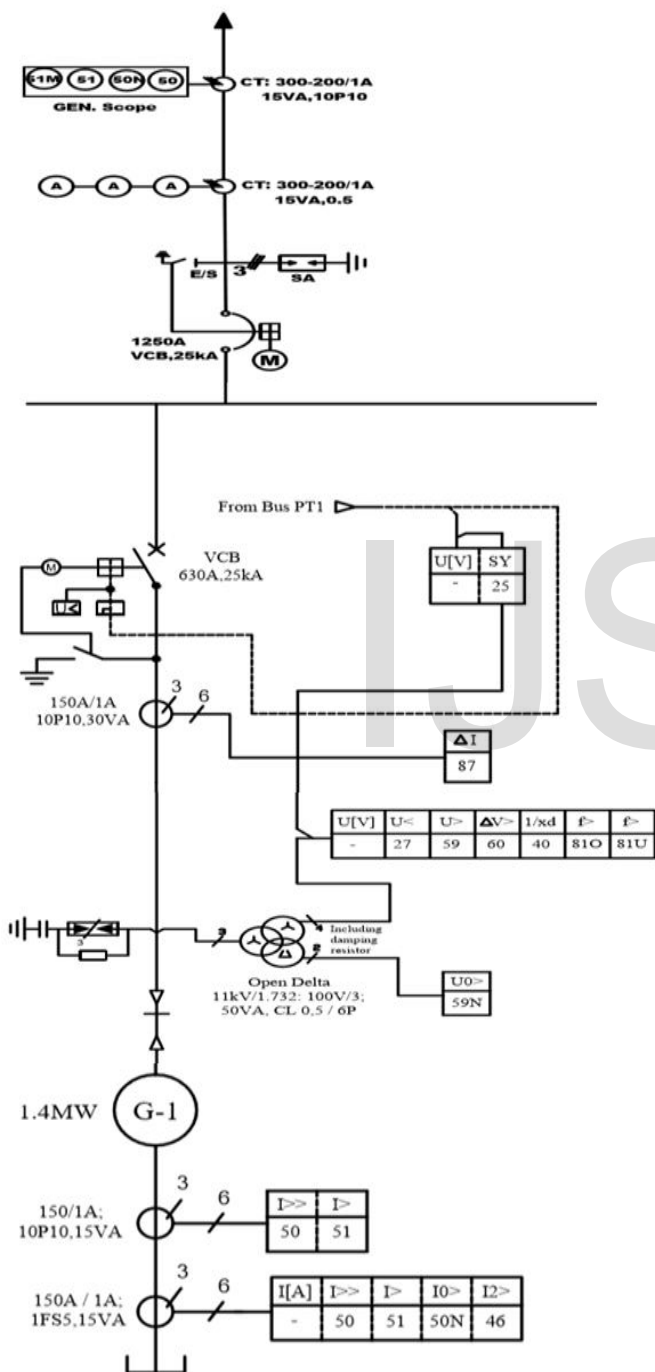Figure: Coupling Hub (Generator side)

5 SINGLE LINE DIAGRAM

Figure: Single Line Diagram

6 CONTROL BY AUTOMATION

Plant automation system consists of Programmable logic controller DIA.NE XT 3. DIA.NE XT 3 is the engine embedded control system, handling all the control, monitoring and protection functions of the engine, together with the PLC [11].

- DIA.NE WIN is the windows based "man-machine interface" for GE JENBACHER gas engine for service and monitoring, trend analysis, alarm management, parameter management, long-term data analysis, multi-user system, remote control, print and export function, operating data protocols.
- PLC based process control system handles all the control, monitoring and control functions of the GENSET and plant equipment
- Remote connection provides a secure internet or satellite link, to give remote access to the information in the DIA.NE WIN systems.
- HERMES is the remote data transfer solution for DIA.NE XT.
- The systems have been developed with complete integration, and have clear and easy user interfaces providing a uniform interface and logic for the operators [12].

7 ADVANTAGES

- Highest electrical efficiency in power class
- No environmental impact
- Maximum levels reliability and availability
- Efficiencies with GE's solutions can reach 90% or more with CHP. That's more than 40% higher than with thermal energy alone
- CHP systems help commercial and industrial businesses, municipalities, and a wide range of energy-intensive institutions get the most out of their facilities
- CHP results in cost savings, reduced CO_2 emissions, resiliency from grid disturbance, and takes advantage of lower-priced natural gas vs. diesel fuel
- We can easily operate it by using PLC program

8 CONCLUSION

GE JENBACHER GAS ENGINE uses the LEANOX method

by using less fuel creates more pressure [2]. In this engine use coupling process for more produce as well as here use PLC for controlling this engine. By using small amount of fuel we can get the more power. We use gas/air mixture as engine fuel and this mixture creates high pressure by ignition system. The producing electricity by using this engine is very low cost also efficiency is good. Producing electricity by using this process there have no environmental impact. So it is very effective in our future life.

ACKNOWLEDGMENT

REFERENCES

[1] https://energypedia.info/wiki/Bangladesh_Energy_Situation

[2] https://www.clarke-energy.com/gas-engines/

[3] https://en.wikipedia.org/wiki/GE_Jenbacher

[4] https://www.google.com/search?q=%5BPDF%5DBasics+of+Electricity+Generator+Theory+-+PJM.com&ie=utf-8&oe=utf-8&client=firefox-b-ab

[5] Poiner Denim Limited Horitola, Madhobpur, Hobigonj, 17 MW power plant under Denim Project (textaile)

[6] north-tec-shop.de/media/pdf/jms_420_gs_bl_b28.pdf

[7] https://www.tricocorp.com/wp-content/uploads/Trico-Catalog_2015.pdf

[8] S Georg, K Wilhelm - US Patent 2,924,633, 1960 - Google Patents

[9] E Hernandez, E Avellanet - US Patent 5,094,247, 1992 - Google Patents

[10] https://books.google.com.bd/books?isbn=9325982277

[11] https://dspace.cvut.cz/.../F3-BP-2017-Hanak-Miroslav-Advanced_PLC_Programming.

[12] GE Energy - 2010 - iwk.ch

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