Study on Operation and Maintenance of a Power Plant

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ABSTRACT
For generating power and purpose of distributing, we have used generator, switchgear, circuit breaker, transformer etc. Most important things used to engine, alternator, substation, fuel for power generation. Some of this are cylinder head, cylinder linear, cylinder block, rocker arm, crank shaft cam shaft, spark plug, piston, piston ring, connecting rod, main bearing, turbocharger etc. Besides that we have learned the method of ignition system, fuel system, air starting system, air inlet and exhaust system, lubricating system, engine cooling system, starter system etc. Also besides that we have learned about current transformer (CT), potential transformer (PT), radiator, earth switch, isolator, surge counter, different types of relay, sensor etc.

Keywords: Engine, Miller valve timing, cooling water analysis, I/P converter, Principle of preventive maintenance, Company total cost, Reduced production losses, Power plant operating cost.

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INTRODUCTION

This system provides a display of parameters of engine operation. The system generates warnings when one or more parameters are outside acceptable limits. The system can stop the engine if the engine operation reaches a set point that is programmed for shutdown. The system can prevent the engine from starting if certain parameters are outside of acceptable limits. Some of the components within the ESS perform more than one function. For example, the Engine Control Module (ECM) is involved with starting the engine, stopping the engine, monitoring the engine, and controlling the engine.

EXPERIMENTAL APPARATUS

ENGINE

1. All the data of the engine have to be comparing continuously with standard factory test data prescribed in Technical Data-Engine of Description & Operation Manual for individuals' engine.
2. Check the operating hours.
3. Gauges.
4. Read the load at the same time.
5. Check the ventilation of the engine cooling water system.
6. Check that the crank case breather is functioning properly.

7. Observe the Turbocharger sound. 8. Check the power swing character of the GENSET.
8. Check the phase current of the generator.
9. Check the power factor of the generator.
10. Check the generator winding temperatures.
11. Check the oil level in the sump the engine sump and add if necessary as per instruction in the manual.
12. Ensure that there are sufficient quantities of lubricating oil in stock.
13. Check the cooling efficiency (inlet and outlet temperatures).
14. Check and record all temperature of the engine like exhaust gas, along with all temperature of the gen sets.
15. Check the oil level in the sump the engine sump and add if necessary as per instruction in the manual.
16. Ensure that there are sufficient quantities of lubricating oil in stock.
17. Check the cooling efficiency (inlet and outlet temperatures).
18. Check and record all temperature of the engine like exhaust gas, along with all temperature of the gen sets.

MILLER VALVE TIMING

- The process is based on shorter compression stroke and lower charge temperature cylinder.
- Miller process means early inlet valve closure, normally before BDC.
- Shorter compression stroke compared to STD timing. Expansion remains unchanged.
  -lower fuel consumption
- Process gas temperature lower
  -lower NOX
  -lower component temperatures
  -lower cooling losses
  -lower exhaust temperature
- Higher boost required

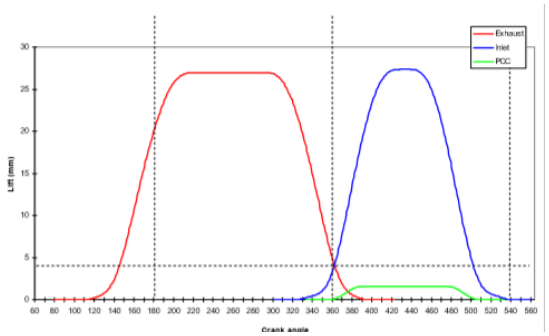


Fig: Miller valve timing

COOLING WATER ANALYSIS

ACIDITY:

The pH value expresses the alkalinity or acidity of water indicates the concentration of hydrogen [H+] ions pH value is the negative value of the Briggs logarithm, -log [H+]

[H+]=10-7=>pH=-log[10-7]=7

-pH< 7=> acid water

-pH=7> neurtral water

-pH>=7> alkaline water

Corrosion rate of cast iron / copper is the lowest

When pH is 8-10

HARDNESS:

Typical hardness water is present as calcium [Ca] and Magnesium [Mg] Salts, like bicarbinates [HCO3]2.

- Too high hardness leads to scale formation in coolers engine component, water pump surfaces etc.
- Ca and Mg salts in small amounts as such protect component surfaces against corrosion.

Several scale exist,

how to measure hardness. Wärtsilä refers to hardness measured in German degrees [°dH].

- Classification of hardness:
  - 0-4 °dH => Very soft water
  - 4-8 °dH => soft water
  - 8-20 °dH=> Hard water

- >20 °dH=> very hard water

CHLORIDES:

- Orinate from sea water
- Enter cooling water:
  Through the leakage in a central cooler.
  If water produced with reverse osmosis plant contains still chloride in extenssive amounts.
- Increases corrosion rate.

SULPHATES:

- Originate from exhaust gas
- Enter cooling water from through the leakage in exhuast valve seats.
- Increases corrosion rate.

BASE NUMBER DEPLETION

- The BN value of the lubricant fall in use as the alkanility is needed to neutralize the acid formed during cmbustion.
- The rate of BN depletion depends on the flowing factors:
  1. Fuel sulfur content
  2. Initial BN of the lubricant
  3. Lubricating system capacity
  4. Lubricating oil consumption
- The BN will dropover an initial engine operayting period. It will then stabilize at a normal operating value.

I/P CONVERTER

4…..20 mA simulator

1. Adjust the gas pressure to zero at 4 mA by using the pilot valve adjustment screw.
2. Adjust the pressure to 0,5 bar at 5,3 mA by using the I/P converter zero adjustment screw.
3. Set the pressure to 3 bar at 12 mA by using the I/P converter span adjustment screw.

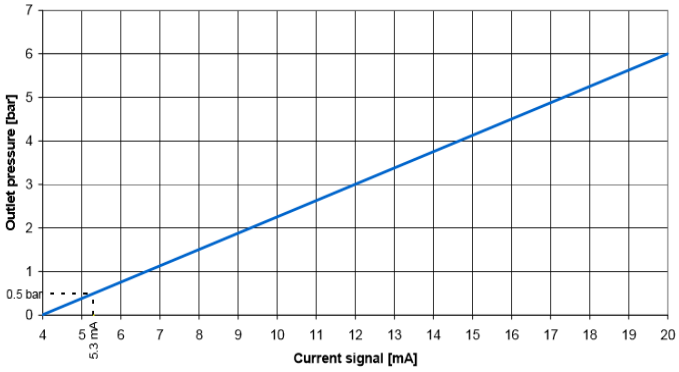


Fig: I/P converter setting

PRINCIPLE OF PREVENTIVE MAITENANCE

Factoring affecting necessary or optimal maintenance:

- Experience with engine
- Control and monitoring system
- Servicebility
- Auxiliary equipment in stand by
- Availability and price of spare parts
- Availability of tools

Operation and daily watch in order to avoid failures and expensive repairs:

- Clean inlet air to the engine
- Fuel handling and filtering
- Lubricating oil; filtering, analyzing, oil changes
- Cooling water of good quality + inhibitor
- Washing of turbocharger
- Running parameters
- Leakage's

Maintenance

Preventive Maintenance

Scheduled Maintenance

Mama

Maintenance

Based on Condition Monitoring

FAKS

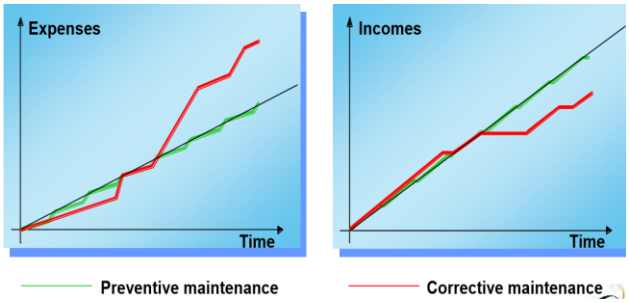
Alarms

Shut down

Corrective Maintenance

(Repair)

Preventive maintenance vs. corrective maintenance



AVAILAOF SPARTS PARTSBILTY

To consider when planning spare part stock:

- Wear parts consumables, based on scheduled maintenance.
- Safety parts in case of unexpected failure.
- Exchange in the order to reduce down time.
  - Set of fuel injection values for the engine.
  - Set of fuel injection pumps for the engine.
  - Set of cylinder heads for the engine.
  - Charge air cooler
  - Two for V- engines
- Delivery times.

COMPANY TOTAL COST

- Reduced production in the factory, cost × USD
- Increased power price, cost × USD
- Reduced production to the grid, cost × USD
- No influence, 0 USD
- Spare parts
- Safety parts
- Maintenance
- Operation
- Fuel

REDUCED PRODUCTION LOSSES

Cylinder head overhaul:

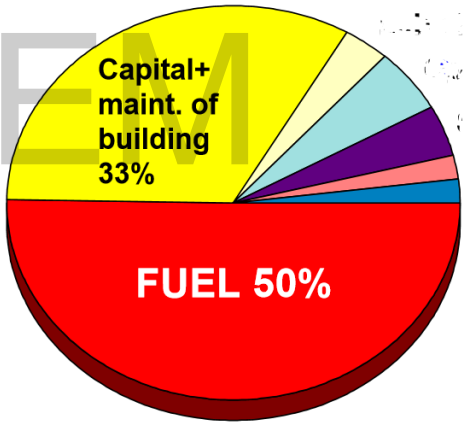
- Production loss- overhaul of cylinder head reinstallation: 5 days.
- Production losses-change to spare cylinder head: 10h

Spare charge air cooler:

- Production loss- cleaning bath at least 24h + installation 3h : 27h
- Production loss change to spare coolers: 3h

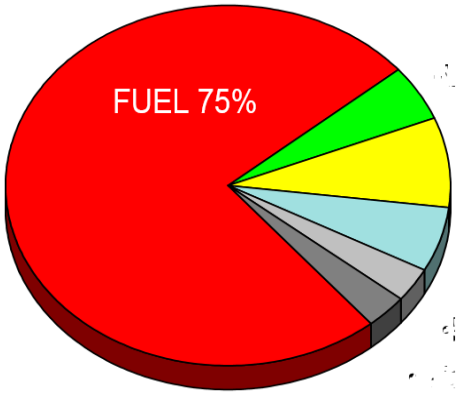
POWER PLANT COST

- Lub oil + chemicals 3.3%
- Operation and maintenance at site 5.3 %
- Spare 4%
- Maint. and Training by eng. Maker 2%
- Miscalculations 2%



POWER PLANT OPERATING COST

- Lub oil + chemical 5%
- Operation and Maintenance 8%
- Spares 6%



- Maintenance and Training by engine Maker 3%
- Miscalculation 3%

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