RENOVATION OF TURBINE GOVERNING SYSTEM

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INTRODUCTION

The development of technology is increasing day by day towards high availability of closed and open loop in critical control. Previously mechanical hydraulic control was used very extensively & now because of the development of electronics, reliability of electronic control has increased many folds. This resulted in replacement of hydraulic control by electronic control.

In view of above philosophy, up -gradation of our existing Turbine Governing system was carried out and new EHTC was commissioned in Unit 1 and 2.

BRIEF DESCRIPTION OF EXISTING GOVERNING SYSTEM

Mechanical centrifugal type hydraulic governing system.
Two nos. of ESVs and Four nos. of governing CVs.
Hydraulic oil system consisting of Lube oil, Relay oil, Sensitive oil, and Central safety oil line.
Hydro mechanical governing system utilises Speeder gear,Follow up Piston and centrifugal governor.
Mechanical overspeed tripping device.
Turbine protection system consists of trip gear which by releasing the oil from central safety line.

FIGURE: 1: OLD GOVERNING SYSTEM

OVERVIEW OF THE MODIFICATION

The mechanical-hydraulic speed governor replaced by EHC and new speed sensors.
All the following limiters isolated and replaced
ACC limiter by I&C system.
Vac. Limiter by 3 Pr. Swith,1 Pr. Tx. and I&C system
Live steam Limiter by 2 Pr. Tx. and I&C system
Load Limiter by I&C system
Mechanical Protection System replaced by TTB with 2oo3 regarding to 3 corresponding trip solenoid valves.
Functionality of online turbine test program to check the status of healthiness of safety system will be conserved by I&C and new solenoid valves (LUBE oil ATT and ESV ATT)

FIGURE: 2: MODIFIED SYSTEM

FIGURE: 3: NEW EHG RACK AND EXISTING LINE MODIFICATION

FIGURE:4: SPEED SENSOR MOUNTING

TURBINE CONTROLLER CONCEPT

The Turbine controller software runs in an automation system, where the Turbine control comprises all control functions required for valve control.

Turbine Controller fulfils the following tasks:

1)Acceleration of the turbine generator from turning speed to nominal speed in manual or auto mode
2)Synchronisation with the grid
3)Loading and unloading of the turbine generator between zero load and nominal load
4)Handling of full load rejection and load rejection to house load (initiation of fast closure)
5)Speed/admission control (Process controller)
6)Load control (Process controller)

7)Live Steam pressure limit control
8)Vacuum limit control
9)Load limit control
10)Acceleration limiter
11)Admission setpoint formation

1.Speed Control:

The speed controller is always active during start-up and in island mode. As long as no limit control is active, speed control is the backup control if another active process controller fails. Following synchronisation, the speed controller serves as a power output adjuster for loading the steam turbine.

If load control is active, the speed controller is tracked to the active process controller to ensure a Bumpless switchover.

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1.Speed Sensor

Three speed sensors are used for speed acquisition. The median value from the three speeds will be selected and for Turbine Control operation, two speed probes are required and the highest value is selected. An alarm will be issued for a channel fault or a tolerance band fault in each individual speed measurement. The monitoring function forms the speed limits for synchronisation and overspeed, while taking the hysteresis into account.

2.Load Control

After synchronisation and first loading in speed control, load control is activated automatically to increase load until minimum load is reached. This is designed to prevent tripping of the generator protection system (reverse power mode).The controller output is automatically set to 0% during a turbine trip.

Load measurement

Electrical power is measured using redundant analogue signals and a MAX selection is applied to both measurements. If one of the measurements fails, the remaining valid measurement is used. If both measurements fail, the fault is signalled and the load control is automatically deactivated.

Switchover to speed controller (power output adjuster)

If load control mode was previously active, an automatic switchover to speed controller is performed.

3. Limit Controller

Pressure Limiter: Inlet Pressure Limit Control Closes the control valves if inlet pressure falls below the set limit.

Vacuum Limiter: Vacuum Limit Control Closes the control valves if the condenser pressure exceeds the set limit.

Load Limiter: Electrical Power Limit Control Closes the control valves if the load exceeds the set limit.

Acceleration Limiter: Speed Acceleration Limit Throttles the control valves if the maximum allowable speed acceleration is exceeded.

PROCESS SIGNALS FOR PROTECTION

Inputs from field :

1)3 nos new Turbine Speed probes supplied 0-4000 rpm for over speed trip
2)3 nos contacts from new PB supplied for EMPB (local) Turbine Trip
3)3 contacts of MFT from existing SIS Panel for MFT to Turbine trip
4) 3 contacts of Gen. protection from ECR for Generator Electrical trip
5) 3 contacts of 3 nos pressure switch supplied for Condenser Vacuum Low Trip
6) 3 contacts given from existing Turbine trip relay in SIS panel for I&C Turbine Trip that includes Damper tank low, H/W level HI, and Fire Protection desk PB
7)3 signals from 3 Transmitters(2 supplied,1 existing) for Lub Oil Pressure Low Prot.
8)3 signals from 3 MS temp. for Wet steam protection and MS Temp. HI Prot.
9)3 contacts from Turbine Trip PB at UCR desk
10)3 signals from 3 nos existing MOT level Tx for MOT Level Low protection
11)2 signals for Axial Shift from existing TSI for Axial Shift Protection

Inputs from System:
1)3 contacts from EHC Controller Tripped

PROCESS SIGNALS FROM FIELD FOR EHG AND INDICATION

1)Trip Oil Pressure (3 nos transmitters supplied)
2)Gov. Oil pr. Before EHG (1 no transmitter supplied)
3)Gov. Oil pr. After EHG (1 no transmitter supplied)
4)DP across Gov. Oil Filter (1 no transmitter supplied)
5)Lub oil Pr. Before bearing (3 no. transmitter out of 2 supplied)
6)MS pressure (3 no. transmitter out of 2 supplied)
7)MOT level (3 no. existing transmitters)
8)Condenser vacuum (1 no transmitter supplied)
9)Live Steam flow to turbine (1 no. existing transmitter)
10)MS Temp. before turbine (3 no. existing transmitters)
11)HPCV 1,2,3,4 position (4 nos position transducers supplied)
12)All turbine metal temperatures(existing temp. Transmitters)
13)All TSI parameters (from existing TSI signals)
14)Actual Load (2 signals from Electrical ECR)

POWER SUPPLY DISTRIBUTION

1)220V DC @10A ----2 nos feeders for redundant supply of 24V DC to controllers, IM, ADDFEM, I/O Modules
2)230 V AC @20A----2 nos UPS sources for
A) Application server, Network attached storage, Network switch (via mini UPS)
B) Time server, Router
C) HMI, printer, EWS
3)230V AC @6A---- 2 nos non-UPS feeder for fan and lights

FIGURE: 5: SYSTEM ARCHITECTURE

FIGURE: 6: OPERATION CONTROL MIMIC

PRE SHUTDOWN ACTIVITIES

Trip oil, Sensitive oil and power oil, QSV test line to be installed upto formerly erected oil pipe lines.

Drain oil from rack to return oil header to be made ready
Steam flushing and hydro test of all fabricated pipes
Flushing of drain valves
Mounting of all local Tx and switches (LIR)
Cabling from field JB to marshalling panel
Cabling from marshalling to UCR (Cable gallery)
Mounting of all local JBS
Software loading in OWS and EWS
Cable continuity checking from JB to EHTC panel and UCR/SIS panel

MILESTONE

Unit 1 de-synchronised on 01-09-2016 and synchronised on 15-09-2016 and Unit 2 de-synchronised on 05-07-2016 and synchronised on 20-07-2016

No additional time taken for EHTC commissioning

No forced outage during commissioning and till date due to EHTC

ADVANTAGES ACHIEVED

Increases the life of turbo set by conservative operation with the aid of TSE
Reliable operation of isolated power grid by automatic switch over of the load controller to frequency control
Low speed deviation under all operational conditions
Maintenance time reduced
No Lube oil as security oil required
CV calibration more accurate
Checking of trip solenoid valves one by one possible without stopping turbine.
Automatic Turbine Testing for ESV and Lube oil
Overspeed testing at lower speed
Overspeed mechanical sensor replaced with more advanced electronic sensor
All Turbine protection replaced with 2oo3 logic(except Hotwell level high,Fire in MOT,Damper tank level low)
Fault finding easier with new Trend History and alarm history
Turbine rolling much accurate and timely

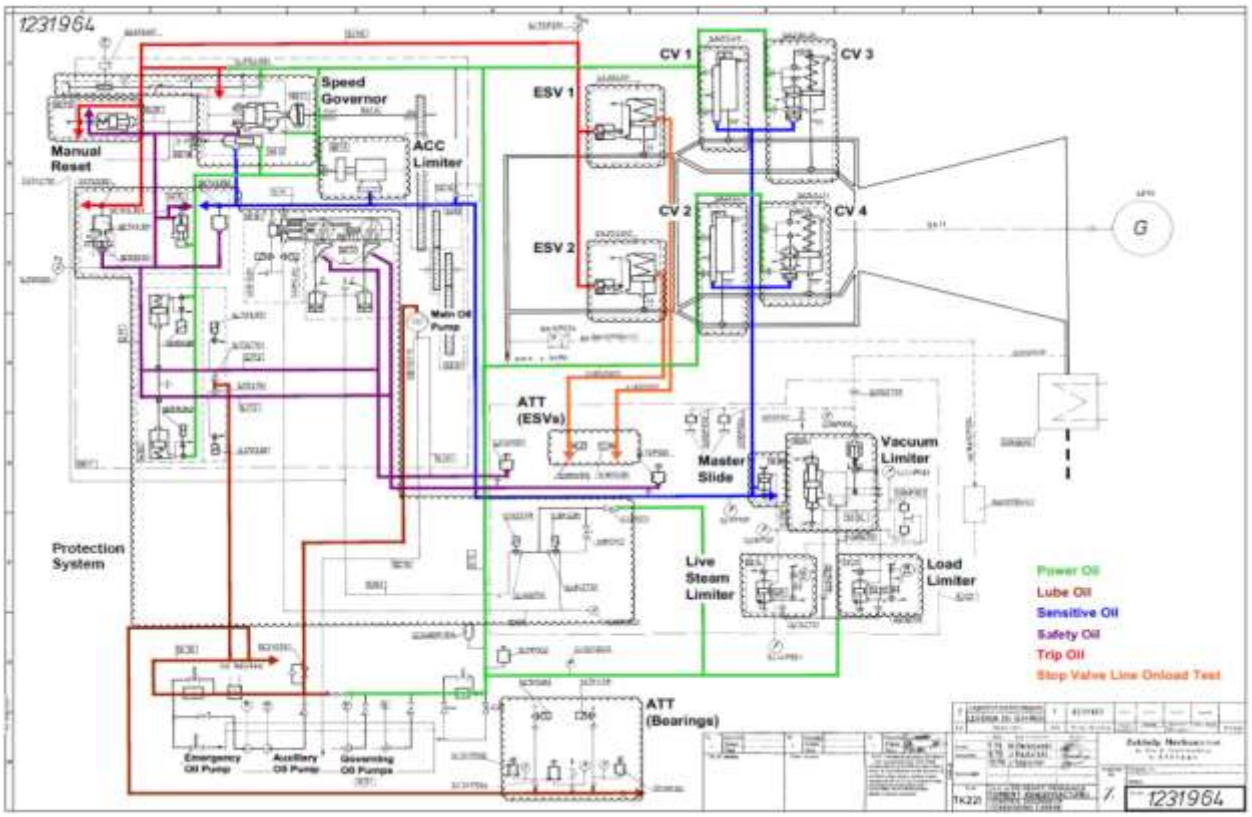

FIG.1: OLD GOVERNING SYSTEM

FIG.2: MODIFIED SYSTEM

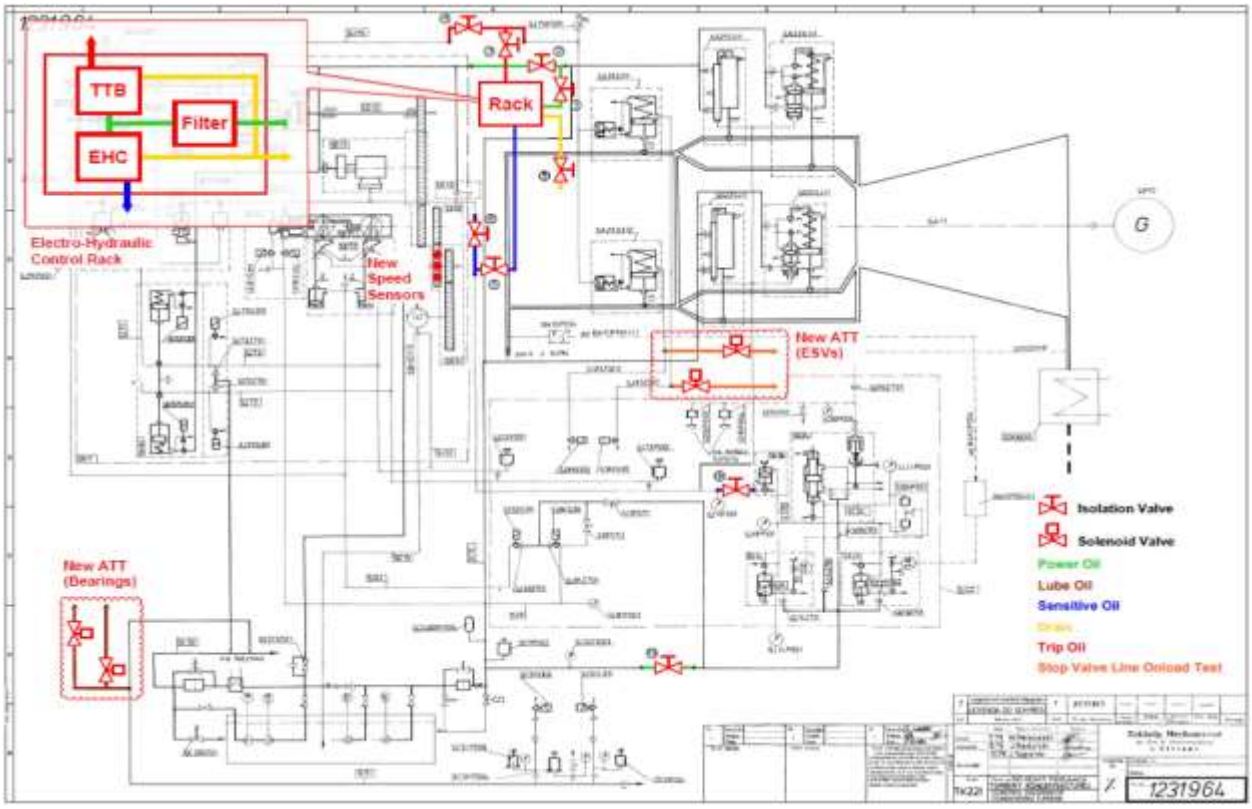

FIGURE: 3: NEW EHG RACK AND EXISTING LINE MODIFICATION


Mounting plate
4x pressure transmitter
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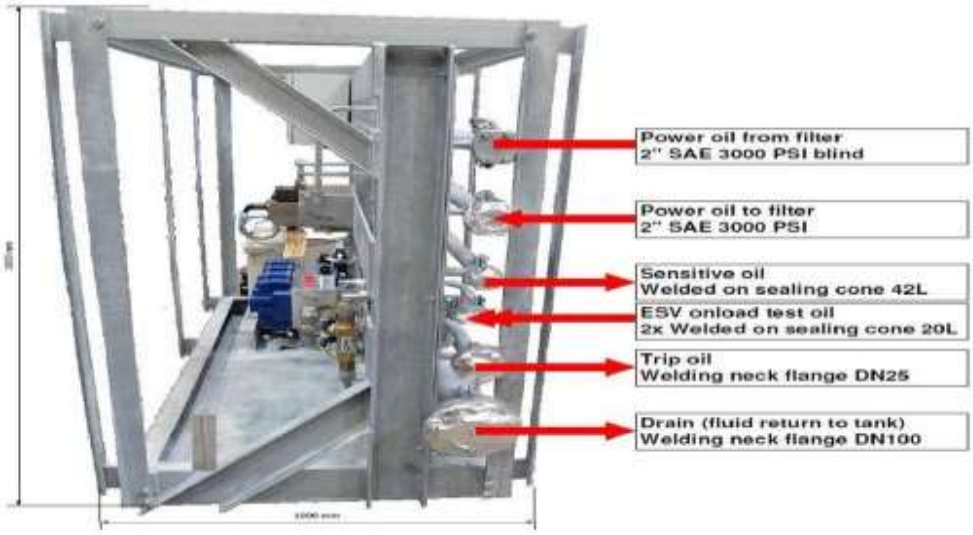
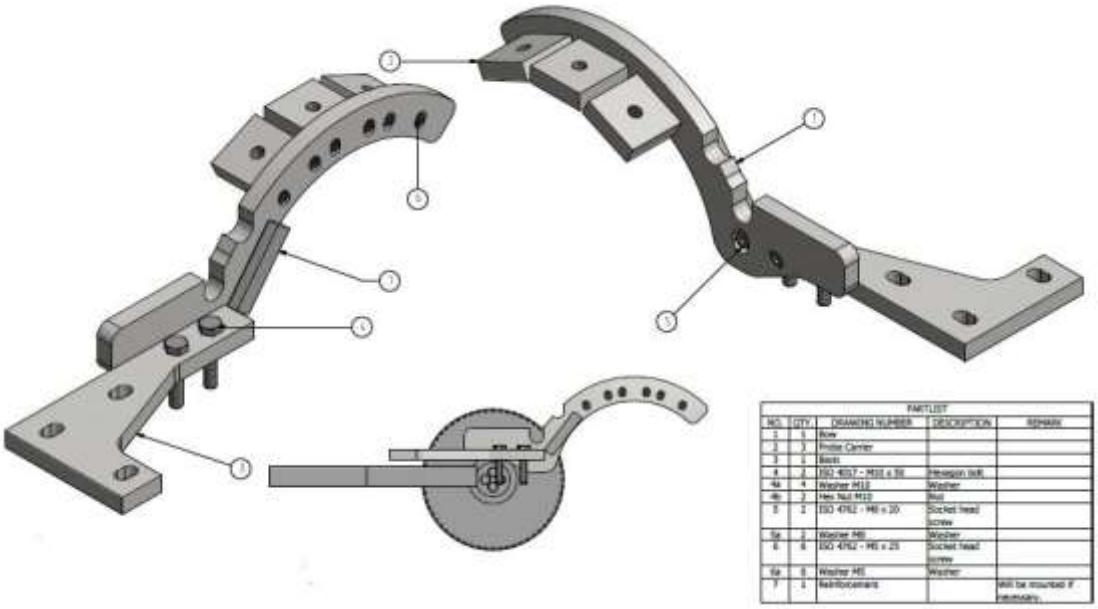
4x pressure transmitter
EHC block (electric
hydraulic converter)
Mounting area
2nd EHC block
2x ESV onload test
valves
Turbine Trip Block
(TTB)
Junction box
Oil filter
Clogging indicator


Power oil from filter
2" SAE 3000 PSI blind
Power oil to filter
2" SAE 3000 PSI
Sensitive oil
Welded on sealing cone 42L
ESV onload test oil
2x Welded on sealing cone 20L
Trip oil
Welding neck flange DN25
Drain (fluid return to tank)
Welding neck flange DN100


Sensitive Oil Line
Relay Oil Line
Power Oil Line

FIGURE:4: SPEED SENSOR MOUNTING



PART LIST				
NO.	QTY.	DRAWING NUMBER	DESCRIPTION	REMARK
1	1	Bow		
2	1	Probe Carrier		
3	1	Basis		
4	4	ISO 4017 - M10 x 30	Hexagon bolt	
4a	4	Washer M10	Washer	
4b	2	Hex Nut M10	Nut	
5	1	ISO 4762 - M6 x 20	Socket head screw	
5a	1	Washer M6	Washer	
6	6	ISO 4762 - M6 x 25	Socket head screw	
6a	6	Washer M6	Washer	
7	1	Reinforcement		Will be mounted if necessary

FIGURE: 5: SYSTEM ARCHITECTURE

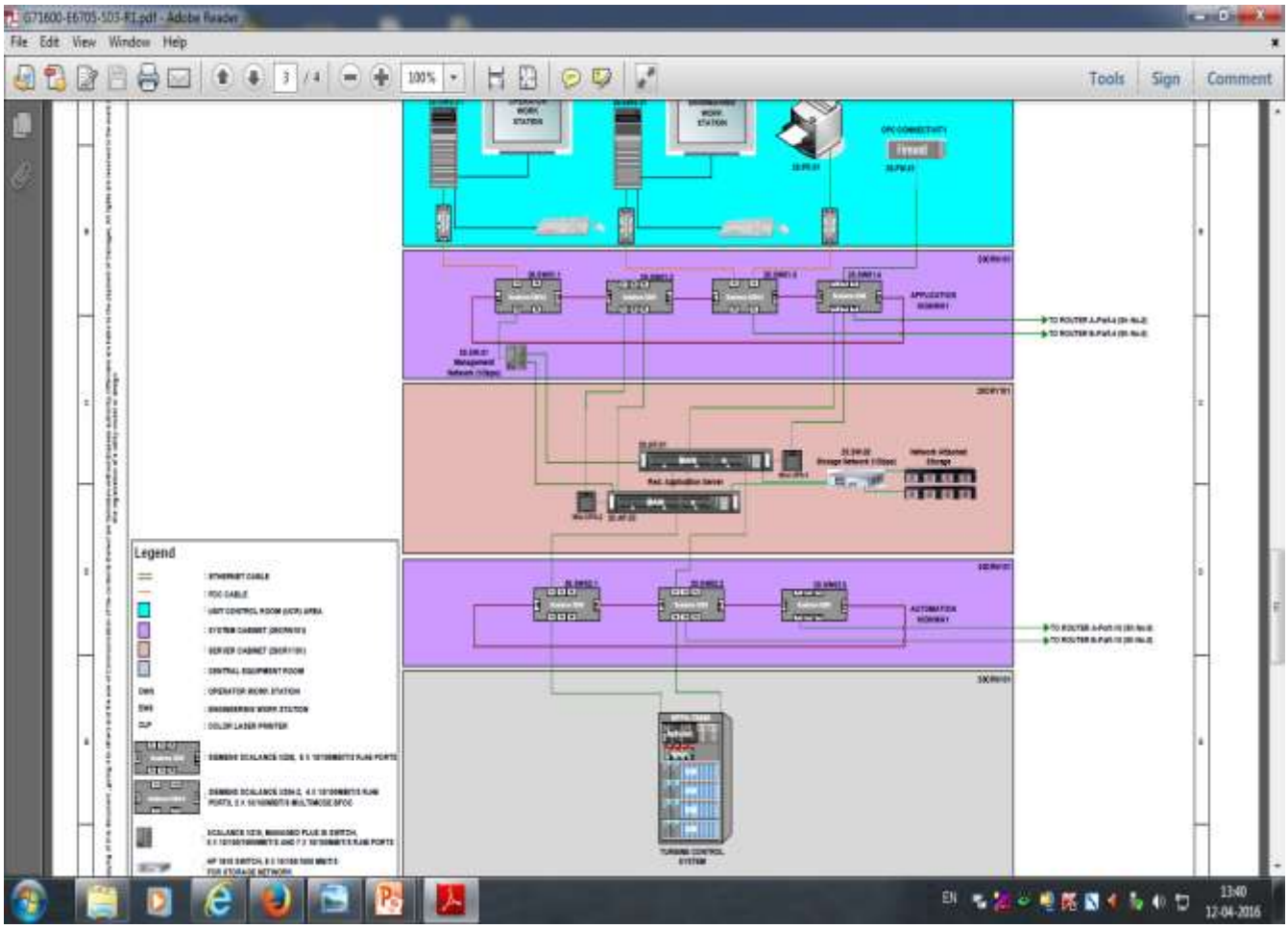


FIGURE: 6: OPERATION CONTROL MIMIC