Eskom	Scope of work	Technology

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1. INTRODUCTION

This document contains the scope of work for the replacement of the fuel oil pressure control valves at the South and North fuel oil plant at Duvha power station.

2. SUPPORTING CLAUSES

2.1 SCOPE

This document covers the applicable work to be done, as well as the requirements and specifications regarding the work.

2.1.1 Purpose

The aim of this document is to provide the *Contractor* with all the details required to perform the work as defined in the scope. Details include special requirements.

2.1.2 Applicability

This document shall apply to Duvha Power Station

2.2 NORMATIVE/INFORMATIVE REFERENCES

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

2.2.1 Normative

[1] Required Operational Capability: 240-58479576

[2] ISO 9001 – Quality Management Systems.

[3] 36-680 – Fossil Fuel Fired Regulations

[4] Engineering Change Management procedure (240-53114002)

[5] Local operating procedures applicable to individual power stations.

[6] 36-731 – Specifications for Fuel Oil

[7] NWS 1414 – Fuel Oil Plants for Fossil Fired Power Stations

[8] 36-486 – Standard for Fossil Fired Boiler Protection Functions; Requirements and Control Measure.

2.2.2 Informative

[9] Pressure Equipment Regulations (PER 2009)

[10] SANS 0347 – Categorization and conformity assessment criteria for all pressure equipment

[11] SANS 10108 – The classification of hazardous locations and the selection of apparatus for use in such locations

[12] SANS 1314 [Edition 1] – Industrial fuel oil for burner applications

[13] BS EN 60534 Industrial Process Control valves

[14] BS EN 1092-1 Circular Flanges for pipes, valves and fittings

[15] BS EN 12952-8 Requirements for firing systems for liquid and gaseous fuels for the boiler

[16] BS EN 1759-1:2004 Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, class-designated Steel flanges, NPS 1/2 to 24

[17] ANSI B16.34 Valves – Flanged, Threaded, And Welding End

[18] OHSA – Occupational health and safety act

2.2.3 Disclosure Classification.

Controlled disclosure: controlled disclosure to external parties (either enforced by law, or discretionary).

2.3 ABBREVIATIONS

Abbreviation	Description
AC	Alternating Current
AKZ	(Locally known as Alpha Numeric) Anlagen Kennzeichnungs System – German abbreviation for (Plant Identification Code)
cSt	CentiStokes
DC	Direct Current
DOL	Direct on Line
HP	High Pressure
KW	Kilo Watt
mA	Milliampere
MPa	Mega Pascal
PER	Pressure Equipment Regulations
PF	Pulverised Fuel
PLC	Programmable Logic Control
RPM	Revs Per Minute

3. WORKS INFORMATION

3.1 DESCRIPTION OF THE WORKS

3.1.1 Executive overview

The fuel oil plant's main function is to provide the necessary energy for the PF burners to attain self-sustained combustion during start-ups of mills. Secondly it will help to assist combustion during periods of instability.

The fuel oil is heated to 100°C (North plant only) before the pressure is raised to 4,8 MPa by one of two high pressure pumps. This temperature and pressure is essential to ensure a fine atomised spray into the boiler via the fuel oil lances. This condition will ensure complete ignition of the oil.

Light fuel oil is used on the South fuel oil plant which is not necessary to be heated, but the same principle of sufficient pressure apply to ensure a fine atomised spray into the boiler via the fuel oil lances.

The function of the pressure control valves on all the units is to maintain this pre-set pressure. It is done on the principle of a bleed-off valve, - as the pressure rises above the set point (4.8 MPa) the controller will open the valve and the flow of oil will increase thus lowering the system pressure. The same will happen with a low pressure condition, only now the controller will close the valve more. The motive power for the controller is supplied by a small electrically driven hydraulic pump. On the North fuel oil plant the electric actuators perform the above mentioned function of the pressure control valves. /

Since the original commissioning of Duvha Power Station the fuel oil pressure control are still performed by the same control valves and hydraulic actuators on the South and North fuel oil plant.

On the North Fuel Oil Plant a modification was done to replace the hydraulic controllers to electric actuators, but this modification was not successful due to slow response of electric actuators to control the fuel oil pressure.

The current controllers and valves are obsolete. The valves are worn (spindles and seats) and the refurbishment efforts to date were not successful.

The hydraulic controllers on the South Plant are starting to malfunction and this is affecting the performance and reliability of the fuel oil plant negatively.

The new project is to replace 6 fuel oil pressure control valves and actuators on Units 1 to 6. Each Unit has 1 fuel oil pressure control valve and an actuator.

3.1.2 Employer's objectives and purpose of the works

The *Employer*'s objective is to install new fuel oil pressure control valves and hydraulic actuators on the North and South Fuel Oil Plant.

The objective is to ensure that the fuel oil pressure on all Units will be properly and reliably controlled at 4.2MPa to the oil burners with the new installed globe pressure reducing valves with quick acting hydraulic actuators. The Contractor ensures that the new equipments are properly installed and commissioned and training to the trainer (Duvha P/S training department) is provided.

It is the Contractors responsibility to ensure that the new equipment will operate properly and comply with all the design requirements to the satisfaction of the Client.

The modification must ensure that the fuel oil pressure on all Units will be properly controlled by new globe pressure reducing valves with quick acting hydraulic actuators.

- Valves must provide quick, reliable fuel oil pressure control for Units 1 to 6.
- Pressure control must be regulated at 4.8 MPa at discharge of HP pumps.
- The valve must always regulate the HP pumps discharge pressure at 4.8 MPa while 3 or all 6 row oil burners are in-service or when a second pump is started the pressure must not exceed 5MPa or when second pump is shutdown pressure must not drop below 4.3MPa for 3 seconds.
- In case of power failure or hydraulic failure, the valve must remain in last position with manual override available to drive the valve to a desired position.
- Fluid flow rate: North plant 622 l/min and South plant 568 l/min (these flowrates are for 1 pump only, the valve design must be able to handle double the flowrate)

- Fluid viscosity: North plant 12 to 15 cSt and South plant 3 cSt
- Valve seat faces must be hardened to prevent erosion due to fuel oil contaminants or cavitation

3.1.3 Contractor's supply scope of work

Design, manufacture, supply, installation and commissioning of Fuel Oil Pressure Control Valves and Hydraulic Actuators as per below specification:

The valve design must be able to handle the following 8 plant conditions for both South and North plants to establish the correct valve sizing selection and operating conditions.

Under normal conditions, the flows would be as follows:
Each LP pump flow – 654 l/min
Each HP pump flow – 630 l/min

1. One pump in service and all oil burners on recirculation, then 61.9% (390 l/min) of the pumps flow must go through the pressure control valve
2. One pump in service and all oil burners on low fire, then 16.5% (104 l/min) of the pumps flow must go through the pressure control valve
3. One pump in service and all oil burners on high fire, then 8.4% (52.8 l/min) of the pumps flow must go through the pressure control valve
4. One (1) HP pump flow – 630 l/min. Oil supply to all oil burners isolated and interconnector open
5. Two pumps in service and all oil burners on recirculation, then 81% (1020 l/min) of the pumps flow must go through the pressure control valve
6. Two pumps in service and all oil burners on low fire, then 58.3% (734 l/min) of the pumps flow must go through the pressure control valve
7. Two pumps in service and all oil burners on high fire, then 54.2% (682.8 l/min) of the pumps flow must go through the pressure control valve
8. Normal light up with 3 rows oil burners on high fire, then 247 l/min of the pumps flow must go through the pressure control valve.

The worst case condition is considered to be condition 5 when 2 HP pumps are in service.

According to BS EN 12952 – 8 paragraph 4.3.5: To protect fuel lines against unacceptable high pressure, automatic control shall be provided.

- The modification must ensure that the fuel oil pressure on all Units will be properly controlled with installation of the new globe pressure reducing valves with quick acting hydraulic actuators.
- Valves must provide quick, reliable fuel oil pressure control for Units 1 to 6.
- Pressure control must be regulated at 4.8 MPa at discharge of HP pumps.
- The valve must always regulate the HP pumps discharge pressure at 4.8 MPa while 3 or all 6 row oil burners are in-service or when a second pump is started the pressure must not exceed 5MPa or when second pump is shutdown pressure must not drop below 4MPa. This requirement will be waivered if it can be proven the valve was not passing any significant oil before the pressure dropped below 4 MPa. This would be due to either the pumps not performing or oil flow through other areas like safety valves.
- In case of power failure or hydraulic failure, the valve must remain in last position with manual overwrite available to drive the valve to a desired position.
- Fluid flow rate: North plant 622 l/min and South plant 568 l/min (these flowrates are for 1 pump only, the valve design must be able to handle double the flowrate)

- Fluid viscosity: North plant 12 to 15 cSt and South plant 3 cSt
- The valve downstream pressure is the piping system resistance plus the LP pump discharge pressure that is normally regulated at 600 kPa.
- Valve seat faces must be hardened with suitable stellite material to prevent erosion due to fuel oil contaminants or cavitation during normal plant operation.

3.1.3.1 Valve (x6) technical specifications:

Valves must provide quick, reliable fuel oil pressure control

- Max pressure (Upset conditions) = 4.8 MPa
- Normal pressure = 4.5 MPa
- Min (Start up or upset condition) = 4.2 MPa (upstream pressure to burners should be maintained at 4.2MPa or 4.3 MPa, but not below 4.2MPa. 4.2 MPa is the design oil supply pressure to burners and must be maintained at all times.)
- Pressure control must be regulated at 4.8 MPa at discharge of HP pumps.
- Fuel oil pressure must be controlled between 4.1 to 4.3 MPa with 3 row oil burners in-service or when a second pump is started the pressure must not exceed 5MPa unless the flow rate is more than specified or when second pump is shutdown pressure must not drop below 4MPa, unless the control valve reached minimum before the pressure reduced below 4 MPa.
- Valve flanges shall be in accordance with BS EN 1759-1 Class 600 table 11 DN80 raised face (type B).
- Contractor to comply to PER regulations 3, 4 and 5.
- The supplier to ensure they meet the Eskom procurement standards during manufacturing and supply of the control valves (240-128557196 & 240-129365689).

3.1.3.2 Electro Hydraulic Power Pack (x6) technical specifications:

- Hydraulic power pack must be sized according to the selected valve.
- Electric motor = 4 pole 380V AC IP65 IE1

3.1.3.3 Electrical Inputs:

- 380V AC for the electric motor
- 24V DC for the solenoid operated dump valve and proportional control valve
- 4-20mA to control the direction and speed of the cylinder

3.1.3.4 Electronic outputs:

- Analogue: 4-20mA position feedback from cylinder linear position transmitter
- Analogue: 4-20mA power pack pressure feedback from pressure transmitter
- Digital: oil loss warning from level switch

A terminal box terminating all instrumentation and valves must be provided. The enclosure must be made of mild steel powder coated B26 orange and must have dust ingress and water injection rating of IP65.

3.1.3.5 Limit of supply for each unit 1 to 6

The terminal points of supply are as follows:

Start	End	Inclusion	Exclusion
Valve inlet Piping Flange	Valve outlet piping flange	Pressure control Valve Electrohydraulic actuator Instruments	

3.1.3.6 Control Panel

- Electric Motor DOL, Selector switch for PLC/Local (Electric Motor only)
- Running, Stop & Trip lights, Lockable isolator, Mushroom type, E-stop

  - **NB**: All new instruments will be coded through the Duvha AKZ standard by Employer (C&I engineering), but the Contractor must supply and attach the AKZ aluminium tags to all the field instruments on the new valve and hydraulic actuator.
  - It is the Contractor's responsibility to ensure that all supplied equipment functions properly and meet the design requirements to the satisfaction of the Employer.

3.1.3.7 Piping Design

Details of current installed piping on Units 1 to 6:

- Pipe size: 3" (80NB)
- Pipe schedule: 40
- Original Material: SA 106 Gr. B (Carbon Steel-Seamless)
- Original Piping design code: BS 806
- System design pressure: 6.4 MPa
- System design temperature: 150°C
- KLINGER top graph-2000 steel wire gaskets are installed between flanges of valves and pipework. Gasket dimension shall be according to BS EN 12560-1 Table 3 Class 600 DN80, IBC gasket.
- Thermal insulation is installed on North plant (Units 4, 5 and 6) as per the Thermal Insulation Standard 240-56247004 requirements.

The current installed pipe flanges at the control valves have the following dimensions:

Description	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
Pipe flange OD (mm)	200	200	200	215	215	215
Pipe flange thickness (mm)	21	21	21	27	27	27
Pipe flange holes	8	8	8	8	8	8
Pipe flange PCD (mm)	160	160	160	170	170	170
Pipe flange material	C22.3	C22.3	C22.3	C22.8	C22.8	C22.8
Askania v/v flange OD (mm)	201	201	201	216	216	216
Askania v/v flange thickness (mm)	21	21	21	27	27	27
Askania v/v flange holes	8	8	8	8	8	8
Askania v/v flange PCD (mm)	160	160	160	170	170	170
Askania v/v length (mm) - (flange to flange)	305	305	305	382	382	382

Table 1: Current installed piping flanges and Control Valve flanges

Piping flanges on Units 1, 2 and 3 are as per BS EN 1092-1Table 15 Weld neck (type 11) DN80 raised face (type B) and Units 4, 5 and 6 are as per BS EN 1092-1Table 16 Weld neck (type 11) DN80 raised face (type B).

The current installed valves have the following dimensions as also illustrated in table 1 above:

South plant (Unit 1 to 3) valve lengths (face to face) = 305 mm
North plant (Unit 4 to 6) valve lengths (face to face) = 382 mm

Figure 1: Arrangement drawing for current installed control valves on Units 1, 2 and 3

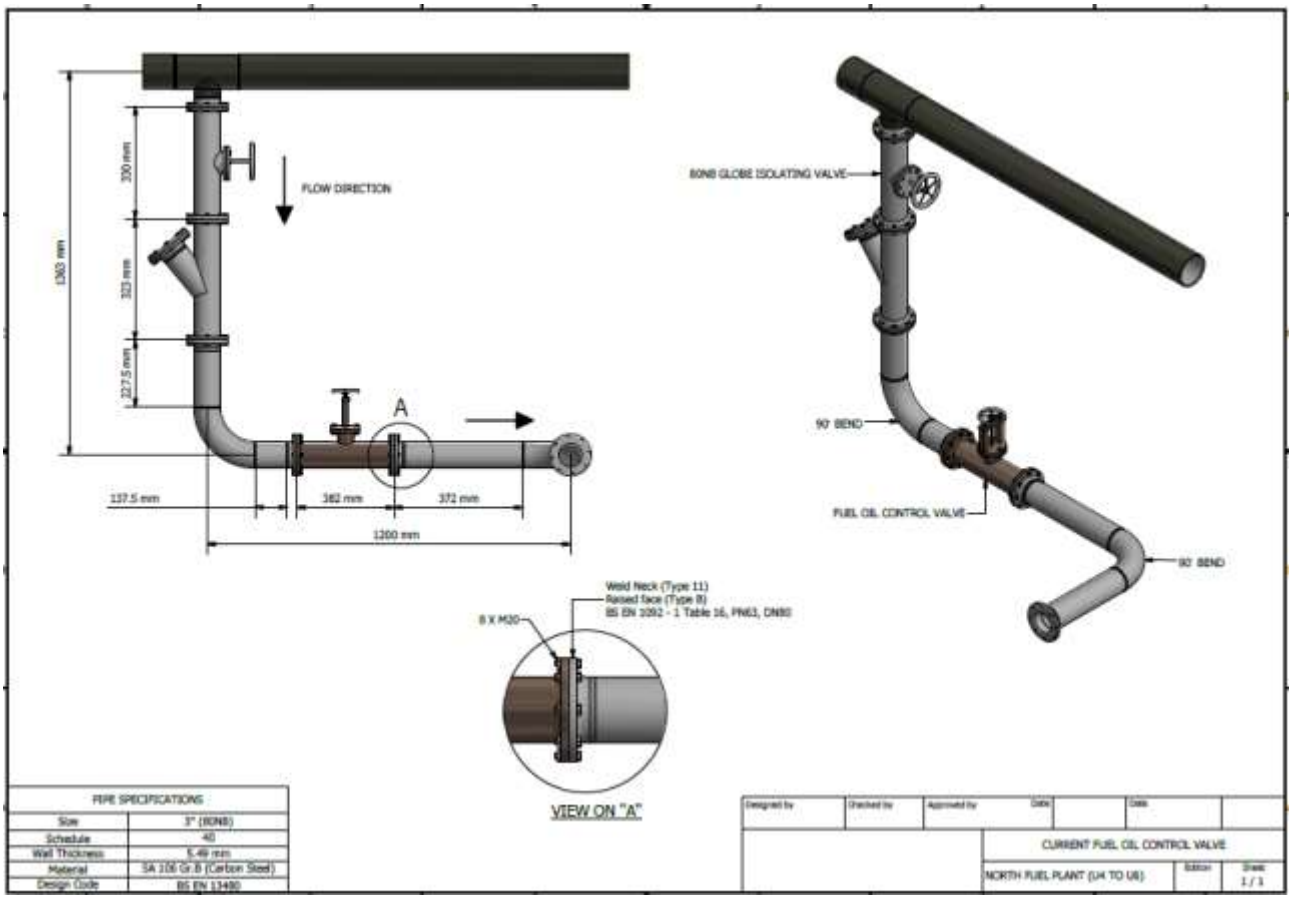

Figure 2: Arrangement drawing for current installed control valves on Units 4, 5 and 6

3.1.3.8 South plant (Unit 1 to 3) scope of work

Contractor scope of work

- Take PTW
- Request Employer to drain fuel oil system.
- Remove old control valves and hydraulic actuators
- Install new control valve
- Install 2mm KLINGER top graph-2000 steel wire gaskets between flanges of valves and pipework. Gasket dimension to be according to BS EN 12560-1 Table 3 Class 600 DN80 IBC gasket.
- Install new hydraulic actuator and connect motor and also earth motor.
- Connect hydraulic hoses from actuator to hydraulic cylinder on top of valve
- Clear PTW
- Request Employer to make plant standby
- Assist with commissioning

3.1.3.9 North plant (Unit 4 to 6) scope of work

Contractor scope of work

- Take PTW
- Request Employer to flush and drain fuel oil system.
- Request Employer to arrange onsite insulation Contractor to remove thermal insulation from valves and pipes
- Remove old control valves and electrical actuators
- Install new control valve
- Install 2mm KLINGER top graph-2000 steel wire gaskets between flanges of valves and pipework. Gasket dimension to be according to BS EN 12560-1 Table 3 Class 600 DN80 IBC gasket.
- Install new hydraulic actuator and connect motor and also earth motor.
- Connect hydraulic hoses from actuator to hydraulic cylinder on top of valve
- Request Employer to arrange onsite insulation Contractor to install new thermal insulation according Eskom standard 240-56247004
- Clear PTW
- Request Employer (Operating) to make plant standby
- Assist with commissioning

Contractor scope of work (Welding)

- Cut out the existing old hydraulic actuator mounting base
- Measure mounting hole distance on new hydraulic actuator and install new mounting stubs onto the steel base. The new mounting stubs must be welded onto the steel base.

3.1.3.10 Structural Scope of Work

- The *Contractor* uses the existing supports when mounting the new Hydraulic actuators on the steel base, ensuring the equipment's load path onto the foundations is as per the original design.
- The *Contractor* installs appropriate holding down bolts that comply with the equipment manufactures requirements and are compatible with the existing fuel oil plant ground slab
- The *Contractor* works in accordance with the latest SANS standards.

3.1.3.11 Control and Instrumentation System Design

1. Current design

Duvha was built with self-contained hydraulic control valves. These valves are controlled by means of a hydraulic balanced beam concept. These hydraulic actuators were replaced in 2000 on the North Fuel Oil Plant (Units 4, 5 and 6) with electric actuators controlled by a PLC.

2. New design

The new hydraulic control valves will be controlled from a S7-300 PLC for units 4 to 6 in the following manner:

- Fuel oil pressure after pump will be sensed by means of an existing pressure transmitter which will be compared with an internal fuel oil pressure set point in the PLC. A valve position set point signal in the form of a 4 – 20mA signal will be send to the integrated electronic valve position control module on the hydraulic actuator and will open or close the hydraulic servo valve to restore the pressure to set point.
- The valve will respond back with a position feedback signal of 4-20mA to the PLC. Both valve position set point and position feedback is existing signals in the PLC configuration.

- A separate 24Vdc supply from a spare circuit breaker in the PLC cubicle will power to the onboard hydraulic valve position control module which is driving the open and close solenoids on the hydraulic actuator.
- New signals to monitor the new hydraulic unit is oil tank level low switch and filter A & B differential pressure high switches will be feedback to the PLC for alarming in the control room on the SCADA screen for fuel oil plant. A hydraulic after pump pressure transmitter with a 4-20mA signal will give feedback to the PLC to confirm that the hydraulic system is running and healthy.
- The hydraulic pump system is not making use of an accumulator, thus once the valve is not driven actively a bleed back to tank solenoid needs to be activated to ensure that the hydraulic oil have a flow path and does not overheat. This new solenoid will be activated by the PLC with a 24Vdc signal.
- All signals will be added to the site historian (VA) and the new information will be displayed to the unit controller on the SCADA system in the control room.
- PLC and DCS connection will be the responsibility of the Employer.

New Fuel oil hydraulic control valve concept for Unit 1 to 6

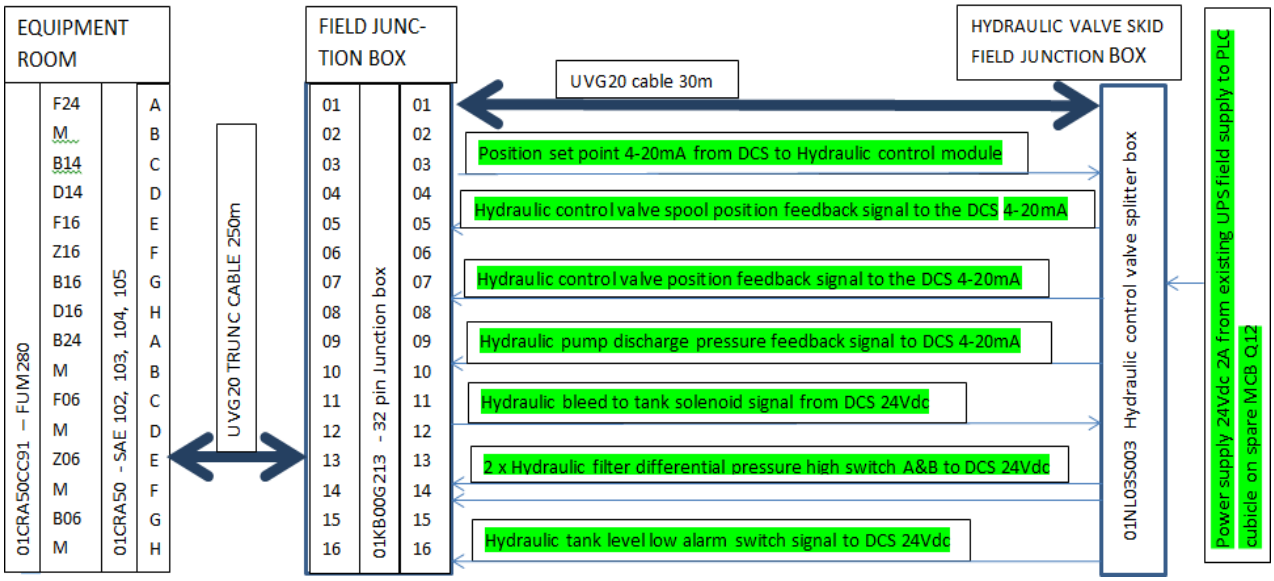

Figure 5: New Fuel oil hydraulic control valve concept for Unit 1 to 6

3. Contractor Control and Instrumentation design scope of work

Contractor New fuel oil control valve C&I scope unit 1- 2

The following cable and junction box work needs to be contracted out by this project for supply and installation per unit:

- UVG 20 halogen free 40 core trunk cable between each unit's DCS cubicle CRA50 in the equipment room in the auxiliary bay 22m level to new field junction box with new junction box stand installed next to the set of C&I junction boxes in front of the South fuel oil pump house on the concrete slab. Cable length +- 330m

- UVG 20 halogen free 40 core trunk cable between new field junction box and new control valve skid junction box:

DCS modules:

From the project ERA, the Employer will draw from the store 3 x Siemens SPPA T3000 FUM 280 analog input/output DCS module.

Software engineering and commissioning:

All software engineering and commissioning will be done by Employer (Siemens onsite engineering team) under the existing Siemens maintenance and support contract.

Historian signals:

All additional signals will be added on the VA database by Employer (C&I engineering).

Drawings:

All DCS drawings will be updated and stored on the online system as the software engineering is done. All field drawings will be done on TECH4FDE the field software package. All this drawings will be done by Siemens during the engineering phase.

Cable numbers:

All new cable numbers will be given by TECH4FDE the field software package. The cable contractor will be responsible to install cable numbers as per cable list supplied by Employer (C&I engineering).

AKZ coding:

All new instruments will be coded through the Duvha AKZ standard by Employer (C&I engineering) and the cable Contractor will be responsible to attach these AKZ aluminum tags to the field instruments.

3.1.3.12 Contractor New fuel oil control valve C&I scope unit 4-6

The following cable and junction box work needs to be contracted out by this project for supply and installation per unit:

- UVG 20 halogen free 40 core trunk cable between each unit's Fuel oil PLC cubicle in the fuel oil switch gear room at the North fuel oil plant to the new field junction box with new junction box stand installed next to the set of C&I junction boxes in front of the North fuel oil HP pump sets on the concrete slab. Cable length +- 60m
- UVG 20 halogen free 40 core trunk cable between new field junction box and new control valve skid junction box:

PLC modules:

- PLC modules will be supplied by Employer (C&I maintenance) from the retired spares generated by the C&I Major Refurbishment project for unit 1, 2, 5&6.

Software engineering and commissioning:

- All software engineering and commissioning will be done by Employer (C&I engineering).

Historian signals:

- All additional signals will be added on the VA database by Employer (C&I engineering) and SCADA changes by the maintenance Contractor.

Drawings:

- All existing PLC drawings will be redlined and sent to Mega Watt Park for updating by Employer (C&I engineering).

Duvha cable database:

- All new cable numbers will be given by Employer (C&I engineering) and added to the cable database. The cable Contractor will be responsible to install cable numbers as per cable list supplied by Employer (C&I engineering).

AKZ coding:

- All new instruments will be coded through the Duvha AKZ standard by Employer (C&I engineering) and the cable Contractor will be responsible to attach these AKZ aluminum tags to the field instruments.

3.1.3.13 Electrical System Design

Background

- There is an existing 380V AC power supply available on all 380V Unit Board *B, circuit 29 (figure 7) and cabling to supply power to the hydraulic actuator motor. The cable coding for the existing cable is BVX03GCV i.e. 3 core, 10mm2 (individual core area). The electrical power supplies available at Duvha Power Station for the Fuel Oil Plant are: 400V – 3 phase – 50Hz and 230 V – single phase – 50 Hz. The Contractor shall ensure that the hydraulic actuator motor is connected to the existing cables and also ensure interface to the existing electrical network.

- The existing motor is rated 0.38kW, 1A, 380V AC and the specification for the proposed new electric actuator motor is 0.75kW 4 pole 380V AC IP65 IE1.

Electrical design scope of work:

Note: The scope of work will be executed under supervision of the *Employer* (Electrical and Boiler Engineering) during Outage opportunities or as specified by the Employer.

- The Contractor shall design, manufacture, construct, tests, transport and commission the actuator motor and also ensure that the hydraulic motor can interface with the existing electrical supply available on all Units. Any modifications required on the 380V Unit Boards *B shall be presented to the Employer for approval before implementation.

- The North plant (Units 4, 5 and 6) is an open plant, thus the Contractor shall ensure that the hydraulic power pack and motor IP rating is sufficient for all weather conditions. Preferably IP65.

- The Contractor shall disconnect the existing motor and terminate the new actuator motor on the existing cables. The existing cables are recommended to be tested before they can be re used.

- The Contractor shall ensure that the new actuator motors are properly earthed to the existing earth mat to maintain the earth bonding of all electrical equipment. Earth resistivity and earth continuity tests of the existing earthing system shall be performed to determine the status of the earthing point used. The earthing and lightning protection will comply with the Earthing and Lightning Protection Standard (240-56356396). In addition the lightning protection must comply to SANS 61024 and SANS 10313.
- The Contractor shall install the new valves and hydraulic actuators.

- It is the responsibility of the Contractor to ensure that the actuator motor is interfaced to the existing electrical network and properly earthed before the motor is commissioned. The existing cable racks shall be used and modified where necessary.

- The Contractor shall submit to the Employer all the affected marked-up electrical drawings, and the Employer will be responsible to update the drawings.

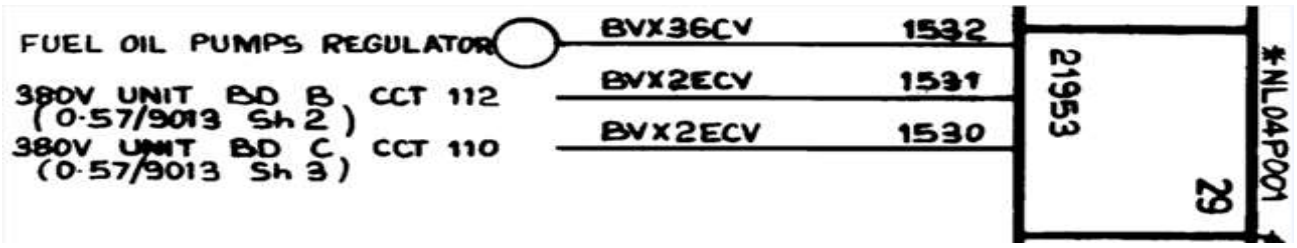

Figure 7: Actuator motor supply point on Unit Board B

3.2 TEST AND COMMISSIONING STRATEGY

Testing and commissioning of the new valves and actuators will be conducted by the **Contractor** and Employer's Engineering (Boiler, C&I and Electrical departments), HMD Oil Burners and OPS during Outage opportunities before Unit return to service or as specified by the Employer.

On completion of the installation, the following steps must be followed:

1. Employer (C&I maintenance) to connect valve position indicator and set control valve control set-point to 4.8 MPa (with assistance of Contractor' competent personnel)
2. Contractor to connect power supply to actuator motor and earth motor.
3. Contractor to verify oil level in actuator
4. Contractor permit holder to clear permit to work (PTW)
5. Start hydraulic power pack motor to build-up pressure and check for any leaks. Drive the hydraulic valve open and close to check functionality.
6. Employer (C&I maintenance) to set-up 4-20mA position feedback transmitter (with assistance of Contractor' competent personnel)
7. Employer (C&I Engineering and Maintenance) to verify if valve opening and closing position signals are displaying on VA View
8. Employer to verify with Unit controller if any oil burners are in service on that specific Unit and also the interconnecting Unit before interconnector can be closed (if interconnected).
9. Employer to verify plant set-up and ensure that system pressure relief valves are not isolated and in working condition.
10. Employer (OPS) to open control valve isolating valves and slowly close interconnector valve (if interconnected).
11. Once HP pumps discharge pressure increases above 4.8 MPa, monitor if control valve start opening to control pressure.
12. Employer (C&I Engineering) to adjust control set point from 4.8 MPa to 4.5 MPa to create a small step change to test the response of the new control starting with 1 oil burner in-service until all 24 are in service.
13. Employer to request the Unit controller to put 3 row oil burners in service and monitor if control valve control the pressure to ensure 4.2 MPa oil burner pressure

14. Employer to request the Unit controller to put all 6 row oil burners in service and monitor if control valve control the pressure to ensure 4.2 MPa oil burner pressure
15. Employer to request Unit controller to start standby (2nd) HP pump and monitor control valve opening speed to reduce the HP pumps discharge pressure before it increases above 5 MPa as per design criteria.
16. Employer to request Unit controller to shut down one HP pump and monitor control valve closing speed to ensure pressure does not drop below 4 MPa as per design criteria.
17. Employer to request Unit controller to start standby (2nd) HP pump again and monitor control valve opening speed to reduce the HP pumps discharge pressure before it increases above 5 MPa as per design criteria.
18. Contractor to ensure control valve settings are correct to ensure design criteria are met.
19. Employer and Contractor to check hydraulic power pack for any leaks

3.3 DESIGN DOCUMENTATION

The *Contractor* supplies the following documentation for acceptance prior to the works commencing:

- Design documentation for the valves and hydraulic power packs, including drawings.
- Quality control plan and all documentation stated in the quality control plan.
- Welder qualification certificate and welding procedure specification.
- Valves and hydraulic actuator operating, maintenance and commissioning manuals including pre-commissioning performance curves.

All required documents must be submitted, reviewed and approved before installation can commence.

The *Employer* has ownership to all drawings produced by the *Contractor*.

3.4 PARTS OF THE WORKS WHICH THE CONTRACTOR IS TO DESIGN

The *Contractor* shall submit a detailed design report for the valves and actuator designs. The design should be reviewed by the *Employer*. The *Employer* should be given at least 21 days to review the design.

The design includes the following documentation:

- Detailed design and drawings
- Manufacturing program/schedule
- QCP for all planned activities
- Detailed risk assessment to mitigate identified risks

The *Contractor* supplies the following documentation for review and approval 4 weeks prior to commencing installation work:

- Complete and comprehensive manufacturing data pack for new valves and hydraulic actuators inclusive of all relevant certificates (3.2 material certificates etc.)
- Valves and hydraulic actuators operating and maintenance manuals
- Valves and hydraulic actuators detailed specifications and drawings inclusive of part list with detailed part specifications.
- Recommended spares list with budget prices, detailed specifications and lead times
- Valves and hydraulic actuators installation requirements/procedures or recommendations
- Detailed control philosophy document

- Detailed safe plant operating philosophy document
- Testing and commissioning requirements/procedures or recommendations
- Training Schedule and training documentation to train onsite staff
- Compliance documents as per PER, regulations 3,4 and 5

NOTE: An additional 10% retention on top of the normal 5% retention will be kept until all documentation is submitted and training is completed. The Contractor takes full responsibility for the design and will be responsible to make any corrections if required at its own cost.

3.5 PROCEDURE FOR SUBMISSION AND ACCEPTANCE OF *CONTRACTOR*'S DESIGN

The design must be submitted to the *Employer* after compilation, 30 days after contract award for review. The *Employer* should be given at least 21 days to review the design. The work does not proceed until the design is approved by the *Employer*

1) The design must be approved as per the requirements of the Engineering Change Management Procedure 240-53114002
2) The *Contractor* allows 21 days in the project programme for review, clarification and approval of the *Contractor*'s design by the *Employer*.
3) Design is approved when the *Project Manager* certifies sectional completion of the design activity.
4) The C*ontractor* informs the project engineer and project manager in writing of any variance from the detailed design and user requirements that will not be met.
5) The project engineer accepts/rejects variance from design.
6) The *Contractor* alters and resubmits design to the project engineer and project manager if it was rejected until both parties are satisfied.

3.6 OTHER REQUIREMENTS OF THE CONTRACTOR'S DESIGN

Supplies all the plant specified in the approved design required to provide a complete system to meet the *Employer's* requirements. This includes:

- Valve drawings and part list including detailed specifications
- Hydraulic actuator drawings and part list including detailed specifications
- Recommended spares list

The *Employer* inspects all equipment supplied before installation takes place.
Factory acceptance test must be done.

Transportation of all material and equipment to site is the responsibility of the *Contractor.*

3.7 USE OF CONTRACTOR'S DESIGN

The Contractor has to supply the *Employer* with the drawings of the new plant which will become the property of the *Employer*.

3.8 EQUIPMENT REQUIRED TO BE INCLUDED IN THE WORKS

The *Contractor* must supply all required equipment and it will be the responsibility of the Contractor to deliver any outstanding equipment to no additional cost to the Employer.

3.9 AS-BUILT DRAWINGS, OPERATING MANUALS AND MAINTENANCE SCHEDULES

The *Contractor* has to supply the *Employer* with the followings documents of the new plant which will become the property of the *Employer:*

- Detailed valve and hydraulic actuator assembly drawings, hydraulic flow diagrams, maintenance manuals, operating manuals, specification sheets, cable schedules and list of recommended spares holding.
- Programme
- Quality plan

4. AUTHORISATION

This document has been seen and accepted by:

Name & Surname	Designation
Tobie Strohmenger	Senior advisor- C&I Engineering
Msizi Ngcoya	Boiler Maintenance manager
Peter Simelane	HMD-Oil burner team supervisor
Alex Zikalala	Senior technologist C&I Engineering
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Moses Sibiya	Shift manager operating
Dumisani Thabang	EMD Maintenance Manager
Fhatu Tshisikhawe	C&I maintenance manager

5. REVISIONS

Date	Rev.	Compiler	Remarks
09 July 2020	0.1	T Ziqubu	1st draft
June 2022	1	T Ziqubu	Final version technical specification to develop works information

6. DEVELOPMENT TEAM

The following people were involved in the development of this document:

- Tobie Strohmenger
- Mxolisi Nhlengethwa
- Ivan Hartman