

ELECTRICAL ENGINEERING SOLUTIONS FOR HIGH VOLTAGE NETWORKS

CONTRACT: TPPS-04
 SCOPE OF WORK: Transformer Installation Works
 CONTRACTOR: SPIEWS Ltd (formerly EIWS Ltd)
 DURATION: February 2008 to December 2009
 VALUE: £ 1,247,000 GBP

SUMMARY:

SPIEWS Ltd were confirmed as the nominated E&I Contractor at Langage Energy Centre; a new build power station being built by Alstom Power Ltd for British Energy in 2008. TPPS negotiated the successful award for the erection, installation and commissioning of the Generator, Station and Auxiliary Transformers. The scope of works included the supply of labour, plant and equipment for the erection and installation of ancillary equipment, oil filling and processing, final testing and pre-commissioning. Success on this project meant Alstom awarding SPIEWS Ltd the same works at Staythorpe Power Station on behalf of RWE Npower, and Isle of Grain Power Station on behalf of E-On in 2009, and subsequently awarded TPPS Ltd the transformer installation works, meaning that TPPS Ltd installed and pre-commissioned 21 units from February 2008 to December 2009.

Throughout the delivery of works on behalf of SPIEWS Ltd the company completed a number of corrective actions on behalf of the vendor as part of the warranty offered. TPPS Ltd established and has maintained excellent working relationships with these vendors and continues to complete warranty works on their behalf at other sites. During installation of the 21 units across the 3 sites TPPS identified hundreds of non-conformances on free-issue equipment and implemented corrective actions to remedy all faults for handover. The client issued detailed erection, inspection and test plans to be completed on each unit, however these were not as detailed as our own and the client requested our QA system become the standard for the installation of all units.

MATERIAL HANDLING & LOGISTICS:

A total of 1,300 tonnes of equipment in 450 crates were delivered to storage areas as big as 3 square miles on sites, and unloaded in no specific order. TPPS were faced with the logistics of finding, requesting and collecting the correct crates to correspond with a specific installation sequence. Individual crates had to be picked using telehandlers or hiab vehicles and transported to the transformer compound for unloading by crane and installation by engineers. It was often the situation that 3 crates not required until the latter stages of installation needed to be moved to get to a single crate needed immediately, and when each crates was unloaded, it needed to be unpacked and each component inspected before use, with any defects communicated to the client, and corrective actions agreed and implemented.

Such a vast logistical challenge balanced with minimising delays on site demanded effective planning to ensure ancillary equipment was available. Once the crates for the first unit on each site had been picked and space available in the storage area, additional resources were dedicated to organising the crates the correct sequence to ensure equipment could be picked and transported to each transformer compound within a matter of hours.



LIST OF TRANSFORMERS INSTALLED:

- 3 off 515 MVA, 400 kV, OFAF - Areva Generator Transformers – Isle of Grain PS
- 4 off 500 MVA, 400 kV, OFAF - Areva Generator Transformers – Staythorpe PS
- 1 off 415 MVA, 400 kV, OFAF - Areva Generator Transformers – Langage EC
- 2 off 345 MVA, 400 kV, OFAF - Areva Generator Transformers – Langage EC
- 1 off 40 MVA, 19 kV, ONAF – Pauwels Station Transformer – Langage EC
- 4 off 40 MVA, 21 kV, ONAF - Hyundai HI Station Transformers – Staythorpe PS
- 3 off 35 MVA, 21 kV, ONAF – Hyundai HI Station Transformers – Isle of Grain PS
- 1 off 12 MVA, 19 kV, ONAF – Pauwels Auxiliary Transformer – Langage EC
- 1 off 5 MVA, 19 kV, ONAF – Pauwels Auxiliary Transformer – Langage EC
- 1 off 5 MVA, 11kV, ONAN – ABB Maintenance Transformer – Staythorpe PS



ERECTION & OIL PROCESSING:

Generator transformers were delivered to site filled with nitrogen and once located in their final position, IR and Dew Point tests completed to check the integrity of the unit before erection. TPPS Ltd used our Oscott dry air machine to purge the transformer and minimise the absorption of moisture into the core and windings where equipment, such as the headers, cooling pipework, pumps and turrets, required the removal of cover plates and exposed the main tank to the moist atmosphere during mounting. The cooling system was completed with the addition of radiators, conservator and connecting pipework, and each unit received full vacuum for 12 hours and purged with nitrogen until oil filling. Over the 21 units completed, TPPS Ltd installed over 1,300 tonnes of ancillary equipment including 120 cooling headers, 40 oil pumps, 500 radiators, 230 fans, 90 turrets and 150 bushings.

Strict guidelines were implemented to maintain the integrity of all units during the oil filling process, but especially the 400 kV units, which would be subjected to a full vacuum for 72 hours before any oil entered the transformer. GT's held up to 105,000 litres delivered to site by road tankers, with the contents of each tanker tested to ensure moisture content was below 10 ppm and dielectric strength above 60 kV before it even entered the transformer, before being decanted into the transformer through the oil processing plant. Once completely filled the entire oil volume was processed again over a period of 24 hours, which could deliver oil integrity for operation of 4 ppm and 80 kV. Final oil samples were taken for a complete dissolved gas analysis (DGA) and integrity reports issued for commissioning. A total of 1.2 million litres of mineral insulating oil were received, tested, filled and processed between the 21 units and took 85 days to complete.



INSTALLATION & COMMISSIONING:

All transformers were subject to a rigorous inspection and testing programme to ensure operational, monitoring, control and protection systems were pre-commissioned ready for service. The majority of components within these systems had to be installed by TPPS Ltd as units could not be transported with these in place. Once each component was installed, connected and tested for functionality; all alarm, trip and control settings had to be tested back to each unit's marshalling kiosk and the stations control room. The work and equipment included:

- Installation, connection and calibration of winding and oil temperature indicators and oil level indicators
- Installation, connection and testing of Morgan Schaeffer Calisto online oil monitoring units
- Installation, connection and mechanical operation of pressure relief devices (PRD's)
- Mounting of Alstom Drycol, control kiosk, wiring and operational testing
- Inspection, manual and automatic testing of the Reinhausen OLTC drive mechanism & control kiosk
- Mounting, wiring, IR test and operational check of radiator cooling fans and control setting checks
- Erection, wiring and operational testing of oil pumps, flow indicators and control setting checks
- Removal, switching, re-wiring and testing of Current Transformers with HV turrets for National Grid protection



NON-CONFORMANCE & CORRECTIVE ACTIONS:

TPPS Ltd had to inspect all free-issue components for integrity and report any defects to the client for corrective actions to be identified and implemented. Whilst some of these were simple, such as touching up damaged paintwork on components, others were more complicated and time consuming to complete. Examples include:

- Core to Earth fault on GSUT – physical inspection of core and windings within main tank and action implemented
- HV Neutral Line End on GSUT – line end was 4 ft too short to install the bushing and new section braised on site
- Fans not to IEC standards on ST – fans supplied by vendor not 3 phase with earth and 30 fans were replaced.
- Wiring not to IEC standards on ST – existing wiring not to IEC standards, all existing wiring on tanks replaced
- Defective buchholz relay on GSUT – a defective mechanism required replacement of unit under warranty
- CT boards on GSUT – multiple CT termination boards cracked due to over tightening at the factory were replaced
- Oil cooling pipework on GSUT – multiple sections would not align correctly and were modified by TPPS

