Project Scope Description

for

Machine Protection Rejuvenation Project

Basic Design Engineering Package

Project 1084CC

Bintulu, Malaysia

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Basic Design Engineering Package for Machine Protection System Rejuvenation Project

Thirteen (13) machines in Bintulu, Malaysia, are equipped with a Machine Protection System (MPS). The current MPS consists of dedicated control and protection modules predominantly of Woodward and Bently Nevada make for all or a combination of the purposes speed control, overspeed protection, machine monitoring, antisurge control and surge tripping. The MPS for eleven (11) of the thirteen (13) machines have been declared obsolete and shall be upgraded.

The main drive for the upgrade is obsolescence; their manufacturers stated most of the modules to be obsolete. Spares and support for the existing hardware are no longer available in the market. Consequently, in the event of a system component failure, the site faces a serious risk of plant outage and a substantial production loss.

The upgrade Project objective is to ensure reliability, availability and maintainability of the complete machinery MPS over the next 15 years. The intent is to realize the upgrade with as little modifications to the existing installation as possible. Dedicated systems for each control/protection algorithm are incorporated; integration of controls for different purposes is not an option.

The MPS Rejuvenation Project was executed in three (3) phases:

- Phase I: K-1401, K-3201, PT-7001 and TG-7601
- Phase II: K-1803, K-3021 and K-3041
- Phase III: K-4011, K-5101, P-7002A and P-7002B

The Control Care scope of supply for this project is to provide the Basic Design Engineering Package (BDEP) for Phase I of the total MPS Rejuvenation Project. Standards, technologies and design and control philosophies shall be defined and shall be valid throughout the entire MPS Rejuvenation Project, i.e. including phase II and phase III. The BDEP Phase I provides a detailed technical proposal along with a +/-10% cost estimate.

Table I summarizes the machinery and its corresponding MPS subject to upgrade. Figure 1 show the block diagram of the existing MPS subject to upgrade. Speed control, antisurge instrumentation and control and trip philosophy of each unit shall be upgraded. Mechanical overspeed systems of each unit are removed and are to be replaced by independent electronic overspeed devices; speed probes must be added in order to realize two (2) independent speed measurements for speed control purposes and three (3) independent speed measurements for 2003 overspeed protection purposes. Machine motoring system (MMS; machine vibration and temperatures) are to be upgraded for each unit. Dedicated workstations for speed controllers and MMS (to provide conditioning monitoring and diagnostics) shall be furnished.
Table 1: Summary of the machinery subject to MPS Rejuvenation Phase 1

<table>
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<tr>
<th>Tag</th>
<th>Description</th>
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<th>OEM driver load</th>
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<tr>
<td>K-1401</td>
<td>Steam turbine (35MW) driven 2-stage air compressor</td>
<td>Siemens</td>
<td>MAN Turbo</td>
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<tr>
<td>K-3201</td>
<td>Steam turbine driven single stage regeneration gas compressor</td>
<td>Shin Nippon Machinery</td>
<td>Hitachi</td>
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<tr>
<td>PT-7001</td>
<td>Steam turbine driven water pump compressor</td>
<td>Elliott</td>
<td>Elliott</td>
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<tr>
<td>TG-7601</td>
<td>Steam turbine (25MW) driven generator for plant power back-up</td>
<td>Hitachi</td>
<td>Hitachi</td>
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Figure 1: Block diagram of existing MPS subject to MPS Rejuvenation Phase 1
The BDEP Phase I deliverables are:

1. BDEP report, describing:
   a. Technical outline of existing situation.
   b. Technical outline on proposed upgrades.
   c. Basis of design.
   d. Functional design specifications.
   e. Hardware and software design requirements.
   f. Responsibilities of the applicable parties.
   g. Testing requirements (Internal Acceptance Tests (IAT), Factory Acceptance Tests (FAT), Integrated Factory Acceptance Tests (IFAT), Site Acceptance Tests (SAT)).
   h. Scheduling (detailed engineering, pre shutdown workscope, shutdown and commissioning).
   i. Logistics.
   j. Start-up support.
2. Project Execution Plan (PEP).
6. Project Costs Phasing.
7. Project Risk Register.
8. Level 1 and level 2 schedules.