1. **PURCHASER:** The Israel Electric Corporation Limited (I.E.Co).

2. **NAME OF ITEM:** Electrical Retrofit Of Two 1800 MTPH Coal Ship Unloaders #91 and #92 for Rutenberg Power Station.

3. **LOCATION OF ITEM:** Near Ashkelon, at the Mediterranean Seashore.

4. **SCOPE**

The scope of work includes Engineering, Equipment and services for the Electrical and Control Retrofit Of Two (2) 1800 MTPH Coal Ship Unloaders

4.1 **Project description**

Upgrading of the existing control system and part of the electrical system, described in item 10.2.

The operational parameters shall remain unchanged (see item 10.2.4). and Annex. D

4.2 **Scope of supply and work**

The scope of work shall include, but shall not be limited to the following:

Within the scope of engineering and supply the contractor shall, as applicable, design, develop, engineer, manufacture, simulate, preserve, assemble, tune, shop test, pack and furnish with export packing, deliver, install, commission and test the following:

4.2.1 **Basic Scope of Engineering, supply and services, for Electrical Retrofit Of Two 1800 MTPH Coal Ship unloaders:**

a.1. Following arrival of the components in Israel the Contractor shall install, test and put the complete ship unloaders into operation, all as specified in item 10.4.1
a.2. The Contractor shall supply, replace, retrofit and incorporate all herein specified, as well as existing equipment, instruments, appurtenances, etc., in order to improve the operation of the ship unloaders and to achieve modern crane management system. All necessary activities for the above shall be included in the Scope of Supply.

a.3. The Contractor shall furnish electrical items to complete system for the unloaders including, but not limited to:

a.3.1 Reserved

a.3.2. Replacement of two Main 690VAC Circuit Breakers by a single new one.

a.3.3. Replacement of Long Travel Drives Circuit Breakers as to fulfill the requirements of item a.3.5 below.

a.3.4. An automatic transfer switch between the two (100% standby) Long Travel Converters will be provided.

a.3.5. Replacement of Converters for Holding, Closing, Trolley, Belt feeder, Long Travel (100% standby, as described in item 10.4.1.2.C), including their brake resistor batteries. Completely new cabinets fully equipped will be provided

a.3.6. Replacement of Converter(s) for the Operator Cabin drive(s)

a.3.7. Replacement of the existing Programmable Logic Controller including Inputs-Outputs Cards and the existing LOGIDYN by an unified Crane Control System, as described in item 10.4.3.

a.3.7.1. Replacement of the existing Remote I/O Cabinet in the Hooper area by a new one

a.3.7.2. Refurbishment of the existing PLC Cabinet in the E-House according to the new design

a.3.8. Replacement of the existing HMI System – software and hardware - by the new one according to the requirements of item 10.4.3.9.2. The existing PC cabinet in E-House will be replaced by a new one see supplement 8.7.3

a.3.9. Replacement of the existing encoders, geared rotary limit switches and the related cables connecting to the Control System by new FO type ones
a.3.10. Replacement of two Main Incoming MD2000 1400/1600-690 AC/DC Inverters by new one(s). If the Contractor will use full inverters AC/DC/AC type for each drive the two Main incoming AC/DC inverters are not required. This solution will be preferred. Circuit breakers shall be built-in.

a.3.11. Replacement of the Festoon System by new one

a.3.12. Reserved

a.3.13. Replacement of all overload protection/weighing provisions for all mechanisms and the hopper by new ones

a.4. Contractor will provide an approval of the authorized organization to operate the retrofitted cranes according to Israeli law.

The unloaders will be retrofitted on the existing pier with minimum perturbation of the work.

4.2.2 Optional scope of Engineering, supply and services

Replacement of the Operator Cabin, including dismantling of the existing one and mounting/erecting the new one.

4.2.3 The Equipment for each Unit shall be supplied complete with appurtenances and accessories as specified herein, to form a complete system which will achieve and assure safe and reliable operation with best overall performance at all loads and modes of operation. All components, appurtenances and accessories shall be of proven design, verified by Power Plant Operation.

4.2.4 Components that are herein specified in regard to manufacturer brand and model or type shall be considered the standard of supply. It is not intended that the Contract be limited solely to such characteristics. The Contractor may make an appropriate substitution, but all substituted Components offered shall be noted as EXCEPTIONS to this Specification and are subject to review, comment, and approval by the Purchaser.

Additionally, while everything else being equal and without derogating from Contractor's responsibilities under the Contract, the Contractor shall endeavor to include in the scope of design and supply, components and accessories manufactured in Israel.
4.2.5 Contractor shall provide, in the required format and form and in a timely manner, all documentation required by this Specification and/or required by applicable Standards and Codes and/or as specifically detailed in the Documentation Submission Schedule (DSS), Annexure "J". A consistent nomenclature shall be used project-wide in naming all component parts within the Scope of Work. This shall apply to all drawings, Instruction Books, Bill of Materials, special instructions, etc. Engineering design shall commence immediately after Contract award. The cost of correcting inconsistent nomenclature shall be borne by the Contractor.

4.2.6 Changes in design already approved by the Purchaser are normally unaccepted. However, should such changes become necessary on an exceptional basis, the Contractor shall obtain the Purchaser's approval prior to introducing any such change.

4.3 Special Equipment, Tools and Instruments

4.3.1 Contractor shall provide all special equipment, tools and instruments required for safe and secure transport of all components from ex works to final destination, and for test and maintenance of Equipment provided under this Contract. Said equipment, tools, and instruments should be in Contractor's Proposal where it should be stated which are provided on a loan basis and which are included in the Contract Price.

4.3.2 The Contractor shall furnish all necessary special tools, instruments and/or test equipment which are required to fulfill the approved test procedure for equipment tested by Purchaser.

4.3.3 Maintenance equipment and tools provided under this specification shall be new and of best quality. They shall be shipped to the job site in a suitable separate box, clearly marked with the name of the equipment they are intended for.

4.4 Contractor Services

The Contractor shall provide the services listed in the following sub-articles as part of the basic Scope of Work or as Purchaser's option, at the per diem or lump sum rates, all as stated in the Summary of Prices and Delivery Schedule, Annexure “C1”. Field personnel provided by the Contractor shall be capable and qualified to perform the required duties to the satisfaction of the Purchaser and shall be from their arrival to site in possession of all necessary tools and/or special tools, except the ones specified in the contract as being provided by
Purchaser. They shall be vested with authority to make decisions that could affect the status of the Equipment and which are binding on the Contractor.

Before erection Purchaser will operate the crane, to prove that the crane and its installations are performing properly. Components not included in the Scope of Work and found out as being defective before erection works began, will be on Purchaser responsibility.

After above the crane will pass over to Contractor for retrofit work. During the work the responsibility will be on Contractor till the acceptance test of the retrofitted crane.

4.4.1 Erection Services:

Contractor shall provide the services of competent advisors and erection personnel for erection, including, without limitation, identifying the equipment, unpacking, intermediate storing, erection (incl. dismantling and installation) as may be required to assure proper and successful erection and installation of the Equipment provided under this Specification.

4.4.2 Commissioning and Start-Up Services:

Contractor shall provide the services of competent advisors to direct Purchaser's personnel and assure proper, complete and successful commissioning, starting, tuning and placing into service of the Equipment provided under this Contract with the balance of equipment at the related power station Unit(s).

4.4.3 Training:

Contractor's personnel shall conduct a thorough training course pertaining to the equipment furnished under this Specification, for Purchaser's personnel, covering, without limitation, correct start-up, safe operation at all modes of operation, safe shutdown and maintenance. The Contractor shall verify that the trainees are completely familiar with all phases of such procedures and are capable of operating and maintaining the equipment successfully.

- One training course held in Contractor's laboratories for maintenance staff prior commissioning
- One training course at site for operators

4.4.4 Field Performance Test
Contractor shall delegate at its own cost, qualified test engineer(s), to witness Equipment field performance tests necessary to establish compliance with this Specification, and to satisfy that the Equipment fulfills the performance guarantees, and other Contract requirements.

Field performance tests shall be carried out by the Purchaser, using procedures provided by the Contractor and approved by the Purchaser according to ASME PTC and EPA codes, all as further detailed in Annexure "D" – Equipment Performance Guarantees.
Detailed description see in item 10.3.

4.5 Work by Others (Facilities and Services to be provided by the Purchaser)

In performing its duties the Contractor shall not be required to provide facilities, services and equipment as detailed below [further details with respect to Purchaser's undertaking regarding qualifications, quality, quantities and scheduling should be stated in Contractor's proposal]:

4.5.1 On site and Engineering Services

4.5.1.1 Erection Services

Purchaser will provide all the necessary labor force, general purpose tools and facilities in order to handling the Equipment provided under this Specification, as well as the dismantled Equipment from the ground to the entrance of the E-Room and vice versa, following Contractor's instructions and according to Contractor's plans, procedures and supervision.
All necessary (if any) structure works (reinforcements) of the E-Room flooring, according with Contractor's drawings.

4.5.1.2 Commissioning, Start-up and Performance Test Services

Purchaser shall provide all the necessary labor force, general purpose tools and facilities in order to perform commissioning and start-up of the Unit and to perform performance tests following Contractor's instructions.

5 TERMINAL POINTS AND TERMINAL CONNECTIONS

Contractor shall terminate the supply of the equipment provided under this Specification. Contractor shall include in the Proposal a definition of terminal connections.
6 CYBER & INFORMATION SECURITY

Not applicable

7 QUALITY ASSURANCE AND QUALITY CONTROL

7.1 Without derogating from the provisions of the General Conditions, Contractor's quality system shall meet the requirements of Purchaser's Standard Q-APP-02-PR, "Quality Requirements" (Supplement 8.7.1.2), and of the requirements of the Inspection and Test Plan, all as further detailed in Annexure "M" to the Contract.

7.2 The Contractor and the main subcontractors shall be certified to ISO-9001-2000 by a certification body qualified to EN-45004 levels A or C or otherwise as may be acceptable to the Purchaser.

7.3 The Contractor shall submit upon request a copy of its Quality Assurance Manual including Quality Procedures.

7.4 The choice of main subcontractors shall be subject to Purchaser's approval and the Contractor shall be responsible for assuring that their quality assurance/quality control programs, including their organizations, procedures, personnel qualifications, etc., meet Purchaser's quality requirements. Contractor [also Suppliers at the first stage of proposal evaluation] may propose possible sub-suppliers by submitting to the Purchaser a formal request for approval with sufficient details for evaluation including country of origin for design and manufacturing, proven experience with respect to equipment of the same size and functionality, quality assurance, catalogues, functional parameters and technical data.

7.5 Reserved.

8 STANDARDS AND SUPPLEMENTS

8.1 Standards and Codes referenced in this Specification and in the Supplements to this Specification, form an integral part of this Specification - to the extent their requirements are consistent and conform with the requirements specifically set forth herein. All such Standards and Codes are to the issue, including all amendments, supplements, etc., current as of the date of the Contract, unless indicated otherwise. In the event of a variance between the requirements of the
Standards and Codes and the particular requirements set forth in the Specification, the requirements specifically set forth in the Specification shall take precedence.

8.2 The Equipment to be provided under this Specification, including all appurtenances and accessories, shall be designed, fabricated, inspected, tested, stamped and preserved to the extent indicated in said referenced Standards and Codes. Where this Specification does not include such reference, The Equipment, or any of its components, shall be designed, fabricated, inspected, tested and preserved, as applicable, to comply with currently recognized International and/or Contractor's Standards, whichever are tighter and more restrictive.

8.3 The Contractor may propose Standards and Codes as alternates for, or additions to those specified herein. A copy of each proposed Standard and code, if any, shall be submitted (in English) for Purchaser's approval. In case Purchaser's approval is granted, the Contractor shall remain responsible for the compatibility of the design and the physical interfaces between the supplied Equipment and the equipment supplied by others.

8.4 The Purchaser shall assist Contractor in identification of Israeli codes and standards applicable to the Work. In all cases Contractor shall adhere to and comply with the requirements of Israeli official standards found to be more restrictive than those specified herein.

8.5 Subject to the provisions stated above, the equipment shall be designed, manufactured, erected, tested operated and maintained in accordance with the standards, regulations, directives and publications of the following agencies and organizations:

ANSI: American National Standards Institute, Inc.
ASME: American Society of Mechanical Engineers.
NEMA: National Electrical Manufacturer's Association.
AWS: American Welding Society.
ISA: Instrumentation, Systems and Automation society
IEEE: Institute of Electrical and Electronics Engineers
NEC: National Electrical Code
8.6 Furthermore, without derogating from the technical requirements stipulated in this specification, the items listed bellow shall be designed in accordance with the standards specified herein or their equivalents:

8.6.1 General codes:
   a. Israeli Regulations for Business (Dangerous Factories), 1993 or later.
   b. Israeli Regulations for Business (Disposal of Dangerous Materials), 1990 or later.

8.6.2 Metallic materials:
   ASTM standards

8.6.3 Hoisting Appliances and cranes:

8.6.4 Fire detection and protection:
   a. National Fire Protection Association Standards (NFPA) or
   b. British Standards (Great Britain)
   c. Local industry standards

8.7 Supplements

The following supplements are attached hereto and their requirements form an integral part of this specification - to the extent they are consistent and conform with the requirements specifically set forth herein. In the event of a variance between the requirements of the Supplements and the particular requirements set forth in the Specification, the requirements specifically set forth in the Specification shall take precedence.

8.7.1 Purchaser's general documentation, quality assurance, quality control and RAM requirements:

8.7.1.1 Standard 01-1E Standard Specification for Contractor’s Drawing and Data Transmittal.

8.7.1.2 Q-APP-02-PR: Quality requirements from suppliers.
8.7.2 Purchaser’s standard electrical requirements and data sheets:

8.7.2.1 EPD-A.03 Control Cubicles – Electrical wiring Requirements
8.7.2.2 EPD-A.05 Low Voltage Switchgear and Controlgear Assemblies
8.7.2.3 EPD-A.14 PLC Based Control Systems
8.7.2.4 EPD-2/99 Standard Requirements for Painting and Corrosion Protection of Electrical Equipment

8.7.3 Drawings:

8.7.3.1 504078-SUL-E.004-005 E-House&HV-Section Layouts;
8.7.3.2 592.000143.STR-3 Single Line Diagram.

8.7.4 Supplement 1 Equipment and Instrumentation Data
8.7.5 Supplement 2 Cable Festooned System

9 TECHNICAL DOCUMENTATION

The Contractor shall submit technical documentation in accordance with the provisions of Annexure "J" – Documentation Submission Schedule.

10 TECHNICAL REQUIREMENTS

10.1 Environmental considerations & Site Conditions

10.1.1 Noise

The noise level of the supplied Equipment shall not exceed an A-weighted sound level of eighty (80) dB(A) at a distance of one (1) meter from any major surface.

10.1.2 Environmental Data

Should the equipment to be furnished by the Contractor have discharge points to the environment and/or generate waste materials that must be discharged to the environment, the Contractor shall provide, upon Purchaser's request, a plan for the treatment of the discharge/waste to meet current regulations of the U.S. Environmental Protection Agency (EPA).
The Contractor shall submit, within thirty (30) days of demand, additional information on noise and/or other environmental data. All information shall be prepared in a manner acceptable to Israeli licensing authorities.

10.1.3 Wind Load

The calculation of wind loads in Israel is governed by the provisions of the Israeli Standard 414 (latest edition at contract signing) “Characteristic Loads in building: Wind Load”.

The calculation shall be accomplished using the basic design wind velocity, defined below.

According to this Israeli Standard, the basic design wind velocity is defined as the average velocity for ten (10) minutes, with an average return period of fifty (50) years, at an altitude of ten (10) meters above ground level, and in an open terrain with only a few obstacles”.

The maximum upper gust velocity (three (3) seconds average) can be calculated by multiplying the basic design wind velocity (ten (10) minute average) by a factor of 1.50.

The basic design wind velocity shall be taken from the velocity map which forms an integral part of the standard.

10.1.4 Earthquake Loads

10.1.4.1 General


According to this Standard, the seismicity of the site is expressed by the expected horizontal ground acceleration coefficient Z.

The expected horizontal ground acceleration coefficient Z expressed as:

\[ Z = ah_{\text{max}}/g. \]
The maximum expected ground acceleration \( a_{h,\text{max}} \) has the meaning of peak horizontal ground acceleration, expressed in \( \text{m/sec}^2 \), with a 90% probability not to be exceeded over a 50 years period. The gravity acceleration \( g = 9.81 \text{ m/sec}^2 \).

The expected horizontal ground acceleration coefficient \( (Z) \), per provisions of the Amendment 2 (2004) to the Israeli Standard 413 is indicated in table 13.3.2. for Rutenberg Power Station.

10.1.4.2 **Seismic environment for electrical equipment**

The seismic environment is defined according to IEC Publication 60068-3-3 ("Seismic Tests methods for equipment"), for "General Seismic class".

1. For the scope of work the peak acceleration of the ground level shall be taken 2 \( \text{m/sec}^2 \).

2. The value of superelevation factor \( (k) \) shall be:
   - \( K = 1 \) for equipment mounted on rigid foundation.
   - \( K = 1.5 \) for equipment rigidly connected to buildings.
   - \( K = 2 \) for equipment installed on stiff structure connected rigidly to building.

3. The equipment shall comply with the relevant qualification criterion, according to paragraph 4.3 of IEC Publication 60068-3-3, which fulfils the required functionality statements.

10.1.4.3 **Load Combination**

Design wind and design earthquake shall not be considered to act at the same time and their respective effects on the buildings and structures shall not be combined.

10.1.5 **Site conditions for design**

a. Atmosphere: humidity (100%) sea air, polluted by coal dust

b. Ambient temperature: Max. 40°C; Min. 4°C.

c. Max. tide: ± 0.6M.

d. Wind Loads - as per existing cranes

- Cranes should be designed to operate at max. wind velocity of 72Km/hr.
- Cranes in stowed condition should be designed to withstand a max. wind velocity of 150Km/hr.

All electrical devices or enclosures of devices, motors and wirings will be exposed to the following atmosphere conditions:

In the Mediterranean Sea on a manmade pier, two km from the seashore.

Up to 100% air humidity.

Ambient temperature between +4°C to +40°C, i.e. 40°F to 103°F.
Salt laden atmosphere.
Coal dust in atmosphere.

Exposure to strong sunshine of the Middle East.

All electrical devices or enclosures of devices, motors, cables and wirings should be designed in such a manner to guarantee a life time reliable operation including the above conditions.

10.2 **Existing Equipment**

10.2.1 **Voltages, Supplies**
**Power Supply (4 wire)**
- **Incoming Power Supply**: 6,6 kV, +1-5%, 3 pH. AC,
- **Frequency**: 50 Hz, +1- 1 Hz

10.2.2 **Operating Voltages**
- **Secondary Distribution Voltage**: 690 V, 3 pH., +10% - 15%
- **DC Bus**: 980V
- **Main AC Motors**: 690 V, 3 pH., +10% - 15%
- **AC Motors and aux. supplies**: 400 V, 3 pH.
- **Lighting, Control Power**: 240 V, 1 pH.
- **Signal voltage**: 24VDC
10.2.3  **Short Circuit Conditions**

10.2.3.1 In the supply point, at 6,600 volt: the short circuit current will be 31,000Amps (250MVA).

10.2.3.2 The electrical equipment cable and wiring shall be sized to withstand in safety and good operational conditions, the short circuit current will result in the utilization point.

10.2.4  **Working Speeds (existing, will not be changed)- contractual ratings**

<table>
<thead>
<tr>
<th>Operation</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoisting full load</td>
<td>150 m/min</td>
</tr>
<tr>
<td>Lowering empty grab</td>
<td>230 m/min – by field weakening</td>
</tr>
<tr>
<td>Closing</td>
<td>150 m/min</td>
</tr>
<tr>
<td>Trolley</td>
<td>260 m/min</td>
</tr>
<tr>
<td>Boom raise</td>
<td>within 6 min</td>
</tr>
<tr>
<td>Travel gantry</td>
<td>20 m/min</td>
</tr>
<tr>
<td>Cabin travel</td>
<td>25 m/min</td>
</tr>
<tr>
<td>Belt feeder</td>
<td>0.5 m/min</td>
</tr>
<tr>
<td>Transfer conveyor</td>
<td>3.15 m/min.</td>
</tr>
</tbody>
</table>

These values will be validated on site prior to erection.

10.2.5  **HIGH VOLTAGE SECTION AND POWER SUPPLY**

High Voltage Switchgear 6.9/6.6KV will be enclosed in an air-conditioned housing by Purchaser. Not in the Scope of Supply of this project.

10.2.6 High Voltage Transformer 2800KVA, 6.9KV (±2x2.5%)/0.69KV/04KV Existing, not in scope of refurbishment project.

10.2.7  **DRIVES, MOTORS, RELATED ACCESSORIES**

See Supplement 1, item 8.7.4.

10.2.8  **LV Distribution E - House**

See Supplement 1, item 8.7.4.
10.2.9 **LV Distribution drivers cabin**  
See Supplement 1, item 8.7.4.

10.2.10 **Connection boxes**  
Existing, will not be changed or modified in this project.

10.2.11 **Local Control Station for Boom Hoist**  
Existing, will not be changed or modified in this project.

10.2.12 **Festoon System**  
See supplement 2, item 8.7.5

10.2.13 **General Functional Description of the System**

Coal is delivered to the coal yard of Rutenberg Station by 40000 to 200000 DWT bulk carriers which are moored on the Northern side of the pier. The pier is located about 2300m from the seashore and is connected by a bridge (jetty) for conveyors, cables, pipes and a road. The pier is provided with two 1800t/h grab ship unloaders. The Electrical Retrofit of the 1800 t/h unloaders #91 and #92 is the scope of this specification. The unloaded coal is discharged from each existing unloader onto conveyor via hopper and variable rate belt feeder that are located on the unloader itself.

10.3 **Functional testing, Commissioning and Performance Requirements**

The performances of the Equipment shall be verified by a site test in accordance with the provisions set forth in Annexure “D” to the Contract – Equipment Performance Guarantees.

10.3.1 **Factory Acceptance Test**  
Software simulation and hardware FAT will be performed prior shipment and witnessed by Purchaser's personnel.

10.3.2 **Site Acceptance and Performance Tests**

10.3.2.1 The Contractor shall be responsible for proper protection of instruments and devices that may be damaged during commissioning and tests
10.3.2.2 The Contractor shall inspect board-mounted devices to ensure that they are securely attached.

10.3.2.3 The Contractor shall inspect terminal blocks and interconnecting wiring.

10.3.2.4 The Contractor shall perform 100% point-to-point continuity tests and electrical insulation tests. Megger or other high voltage tests shall be applied to any coaxial and triaxial cables. Solid state components shall be tested in accordance with Section 09-1-109.05 of NEMA ICS.

10.3.2.5 The Contractor shall perform control circuit function tests as far as possible by actuating control switches and push buttons during application of appropriate signals while observing the functioning of all associated panel and console devices and checking for proper output signals at terminal blocks.

10.3.2.6 Written tests procedures shall be prepared by the Contractor. The test procedures shall include the records to be taken during the tests. A written report shall be provided. The owner shall be given the opportunity to witness all Contractor's activities on site.

10.3.2.7 Commissioning

Installation and commissioning activities will not exceed 12 weeks per unloader. A 3-4 months gap before second retrofitted unloader a.m. activities will be necessary in order to refill the Power Station coal storage. The commissioning and tuning of the Equipment shall be conducted in accordance with the provisions set forth in Annexure “D” to the Contract – Equipment Performance Guarantees.

10.4 Electrical Technical Requirements

10.4.1 Content of the Retrofit

10.4.1.1 The retrofit will be designed by the Contractor in such a way that all the existing operational sequence and functions will remain as present.

10.4.1.2 The Contractor shall retrofit the electrical part of the existing unloaders in the Rutenberg Power Plant. They are as follows:

A) A unified control system to replace both existing PLC and LOGIDYN controllers including I/O (Inputs/outputs)
B) The new system will be compatible to highway data bus communication system. Connection to the existing Landside Station, which controls both existing cranes on the pier shall be ensured.

C) All the speed regulating drives will be retrofitted:

- replacing the electronics cards to enable control thru the new Control System (4-20 mA signal is preferred),
- replacement the existing units as to enable the a/m control,
- replacement of all the brake resistor batteries.

The List of the Existing Speed Control Regulating Units are as , as specified in item 4.2.1.a.3.5.

The Holding, Closing and Trolley Drives will be provided completely new including enclosures.

The existing two Long Travel drives will be replaced by new ones in such a way as to enable operation at nominal speed (100%) of the Crane, in case of one of the drives failure, as well as the operation of the Boom Hoist. For the Boom Hoist Drive one of the Long Travel Drives will be used, with automatic changeover, enabling the transfer of the loads to the second Long Travel Drive, in case of failure of the first one.

D1) Replacement of Main Motor Operated Incoming Circuit Breakers 690VAC.

D2) Replacing of Long Travel Drives Circuit Breakers.

D3) An automatic transfer switch between the two (100% standby) Long Travel Converters will be provided in order to ensure operation, as described above.

E) The encoders and the appropriate interconnection cables with the Control System will be replaced.

F) The Gear Rotary Limit Switches with indication modules next to the switches will be provided.

G) Replacement of the existing HMI System by the new one.
H). Replacement of the whole existing Festoon System and appropriate cables

I). The replacement of the Operator Cabin.

J). Display of the HMI and parameters of Ship Unloader #91 on the monitor of Shipunloader #92 and vice versa will be enabled.

K). Replacement of the existing Crane Management, TDE (PC) cabinet by a new one.

L). The HV Cabinet will be relocated in the E-House.

M). Overload protection of all mechanisms and hopper will be refurbished.

10.4.2 ELECTRICAL GENERAL REQUIREMENTS

10.4.2.1 All the electrical equipment, controls, instruments, etc. and their components provided under this Specification should be of heavy duty industrial type and of the best quality.

All the electrical equipment, instruments, controls, etc., located in the Electrical Equipment Room, shall be IP43 enclosed, unless otherwise specified, adequately-corrosion protected as to withstand ambient conditions.

10.4.2.2 All the electrical equipment, instruments, controls, etc., located outside shall be NEMA Type 4X or at least equivalent IP56 enclosed, unless otherwise specified, weatherproof and dust-tight, marine type, with all external surfaces and components made of corrosion resistant material or adequately corrosion protected.

10.4.2.3 All the electrical equipment, instruments and their components, junction boxes, control cabinets, panels and all other enclosed equipment shall be provided with metallic housings.

10.4.2.4 Junctions boxes, medium voltage cubicles, low voltage MCC and distributions, and enclosures containing controls, relays or electronic elements, etc., located inside or outside, shall be provided with anti-condensation heater(s) and thermostatic control, to prevent moisture.
10.4.2.5 Available nominal voltages in the plant for the unloader supply will be 6,600 VAC, +10% - 10% voltage deviation, 3phase 50Hz.

10.4.2.6 All power and control cables supplied by the Contractor for Festoon System, shall be extra flexible upon Purchaser's approval.

10.4.2.7 Where available, tropicalized equipment and instruments shall be preferred.

10.4.2.8 Variable Speed Drive
New variable speed drives shall be of IGBT type. The existing drives are thyristor adjustable frequency and field weakening.

a. Total voltage distortions, harmonics and inter- harmonics will not exceed 5% on the feeding lines and 3% on the motor side, in accordance with IEC standard 61000.

b. Line, RFI and motor filters and dv/dt filters will be provided for suppression of radio interference, distortions and harmonics, according to all relevant EMC and RFI regulations as well.

10.4.2.9 AC Drives
Modular type power units will be preferred.

AC drives will include 3-phase, optimized pulse-width modulated, sine wave shaped inverter with full digital/regulator, system communication interface to the Crane Control and all required protection and control devices, including but not limited to:

- Speed control:
  Stepless speed control from essentially zero speed to (motor inverter only) full speed with constant torque from 0 to nominal speed and constant nominal speed.

- Protection features:
  - external error, over-/undervoltage protection
  - rectifier overload protection by fused disconnect switch with fast acting SCR fuses
  - electronic instantaneous over-current (overload) protection
- earth fault (output)
- phase failure (the rectified mains voltage fell below 70%)
- wire break 4-20 mA, field bus and encoder loss
- protection encoder tracking error
- over-/underfrequency protection
- du/dt filter (motor inverter)

Control Features:
- Communication/Fieldbus Interface, Feedback interface
- Fault display for each element of power modules

Metering:
- selectable on LCD display on micro operator unit

Provisions of easy and quick replacement of the power elements will be ensured.

10.4.2.10 Main Circuit Breakers

10.4.2.10.1 Main LV circuit breakers shall be provided for connecting the output of the power transformer to each motor control center bus.

10.4.2.10.2 The main circuit breakers shall be furnished in the form of 690V metal enclosed drawout switchgear assemblies of IP43 dust-tight construction. Throat or bus duct connections with copper bar bus shall be provided for coupling to the transformer and motor control centers.

10.4.2.10.3 Main circuit breaker shall be motor operated, drawout type air circuit breaker with spring operated, stored energy closing mechanisms, and emergency trip push-button.

10.4.2.10.4 Main circuit breaker overcurrent protection shall be three-pole, long time delay, with short time selective trip attachment to provide selective tripping with motor control center molded case circuit breakers.

10.4.2.11.5 Main circuit breaker rating shall include the following requirements:
- Design voltage 690 volts.
- Operating voltage 690 and 400 volts.
- Interrupting capacity According to the short circuit that will result but not less than: 22,000 symmetrical amperes.

10.4.2.12 Reserved.
10.4.2.13 The wiring shall satisfy the following conditions:
A. Instruments shall be wired separately from the power.

B. For each instrument each terminal shall be wired separate to an individual terminal point in the junction box.

C. Separate junction boxes shall be provided for power and for control wiring.

D. Wiring shall be installed in hot dipped galvanized steel conduit for each individual equipment or instrument, and on cable trays for common cable routing. Discrepancies or deviations from this requirement will be subject to Purchaser's approval.

E. All electrical control components, wiring and conduit shall be suitable for use in marine atmosphere.

F. The control wiring shall be in accordance with the attached standard specification EPD- A.03

G. The power wiring conductors shall have a minimum cross section of 6.0 sq.mm. and insulation class of 1000 volts. If the connection to certain equipment is not possible with 6sqmm, a smaller cross section may be used.

10.4.2.14 All controls panels, relay cabinets, PLC's, etc., except controls in operator's cabin, should be installed in the Electrical Equipment Room, provided with anti-condensation heaters, IP43 enclosed.

10.4.2.15 All electrical equipment, controls, drives, instruments and installation shall be in accordance with the specification requirements and Standard Specification.

The Project Specification requirements shall take precedence.
10.4.2.16 **Festoon System**

10.4.2.16.1 Power supply to the cabin and transmission of control signals will be via heavy-duty cable carriers and flexible type cable of sufficient length as well as fiber optical cable. Any deviation from the general requirements of the specification will be subject to Purchaser's approval. The connection of the electrical festoon cable system which supplies the controls, electric power and communication from the electrical house or structure to the movable part will be provided in a junction box which is mounted in a position which gives easy access for maintenance. Power and control cables are separated in the junction box. Metallic or rubber ropes in order to prevent stresses due to accelerations will be provided, if necessary.

10.4.2.16.2 Type of used cables will be of EPR type and as specified below or equivalent to them:

- single power conductors – NSSHOU.

- screened control cables – PUROSIL with separate copper screen for each group and sheath, stranded acc. to Class 6, outer sheath – POLYURETHANE

- fiber optic cable - OPTOFLEX

10.4.2.17 **Operator Cabin** (optional scope)

10.4.2.17.1 The Mobile Operator's Cabin is mounted on independent trolley that runs under one of the main girders. The crane operator shall be able to move his cabin into the most favourable position, giving him the best view over the operating site of the unloader.

10.4.2.17.2 The cabin shall be of a Fire-proof, dust and gas proof construction.

10.4.2.17.3 The cabin shall have good visibility in all directions.

10.4.2.17.4 Windows: front-hinged, all other windows double sliding to provide easy access for cleaning by operator.

10.4.2.17.5 The operator's cabin shall be provided with tinted glass (sun shade glass).
10.4.2.17.6 Windshield wiper with washer for lower cab window shall be provided.

10.4.2.17.7 The cabin shall be slightly over pressurized, air conditioned (heating and cooling) and of sufficient size to contain all necessary equipment along with free movements of operator.

10.4.2.17.8 The entire cabin and equipment shall be free of sharp corners and projections.

10.4.2.17.9 The Contractor shall propose a solution to manually remove the cabin to the parking position in case of operation stopping as a result of an electrical failure.

10.4.2.17.10 The cabin shall be parked within the tower when crane is "stowed" (if possible).

10.4.2.17.11 The sound level inside the cabin shall be below 70dB.

10.4.2.17.12 The controls, signal lamps, push buttons and alike, shall be arranged so to be within the reach and field of operator's view.

10.4.2.17.13 Visually and Audibly advance alarm shall be provided in operator's cab actuated when wind speed reaches close to critical level.

10.4.2.17.14 When wind speed reaches critical level unloader shall automatically come to a stand still, including effecting of unloader travel braking. Long travel will be provided with overriding button in Oper. cabin to enable moving of the crane to the park position.

10.4.2.17.15 The cabin shall be equipped with a telephone system.

10.4.2.17.16 The cabin shall be fitted to the existing emergency escape ladder.

10.4.2.17.17 The cabin shall be equipped fire detection provisions and fire extinguisher.

10.4.2.17.18 Rear-view mirrors through which protruding parts of the ship unloader can be seen will be installed

10.4.2.18 Reserved
10.4.2.19 **ELECTRICAL WIRING AND INSTALLATION FOR POWER, CONTROL, LIGHTING AND COMMUNICATION PURPOSES**

10.4.2.19.1 All power, control and lighting wire and cable shall be provided by the Contractor in accordance with the following requirements:

10.4.2.19.2 All general power cable 400V, three phase, 50Hz service shall be of stranded copper, with 1000Volt insulation. Cables shall be single conductor or multi-conductor, as required. Individual conductors shall be insulated with Ethylene Propylene Rubber, suitable for use at 80°C conductor temperature in dry or wet locations. The outer cable jacket shall be of fire resistant Neoprene or Hypalon.

10.4.2.19.3 All general control cable shall be of stranded copper with 1000V insulation. Conductor shall be smaller than 2.5sqmm, Cables will normally be multi-conductor. Individual conductor shall be insulated with Ethylene Propylene Rubber suitable for use at 80°C conductor temperature in dry or wet locations. The outer cable jacket shall be fire resistant Neoprene or Hypalon.

10.4.2.19.4 All lighting distribution wire shall be of NYAF type (VDE-IEC) or SIS (NEC) copper wire. Branch circuit distribution wire shall not be smaller than 4sqmm or 2.5sqmm, extra flexible.

10.4.2.19.5 All cable types not herein listed shall be Contactor's best recommendation for the application.

Single conductor cables shall be of NSSHOU type.

Conduits shall be UL Listed of flexible plastic type, PMA or HELUKABEL, or equal.

10.4.2.19.6 The Contractor shall furnish weatherproof, duplex convenience receptacles for 230V service in the electrical equipment room, operator's cab, and at approximately 15m spacings through out the accessible portions of the machine.

10.4.2.19.7 Sizing of cables and wires shall be made according and derated to the following conditions:

- the load current
- the short circuit current and duration
- cable enclosure under sunshine
- mounting conditions
- cable characteristics

10.4.2.19.8 The cable and conductor sizes shall assure starting and running permissible voltage drop for all electrically operated motors and devices.

10.4.2.19.9 Cable and conductor sizes shall have the required thermal short circuit stability.

10.4.3 UNLOADER CONTROL SYSTEM

10.4.3.1 An unified complete control system, that will control the operation of all of the unloader equipment, will be provided

10.4.3.2 The Control System shall be designed in such a way that all existing modes of operation, as well as all the functional (operational) commands they include, will remain unchanged

10.4.3.3 The control shall guaranty the prevention of starting out of sequence and stopping the operation of the necessary equipment in the event of a failure of one element.

10.4.3.4 Automatically in sequences and manual starting of the equipment should remain functionally as per the actual design.

10.4.3.5 Safety devices shall be added if necessary in order to guarantee safe and good operation.

10.4.3.6 All air conditioned indoor mounted devices should be IP43, enclosed, adequately corrosion protected for ambient conditions, unless otherwise specified.

10.4.3.7 All outdoor mounted devices should be IP65 enclosed, adequately corrosion protected for ambient conditions.

10.4.3.8 Requirements of Electronic Components

a. Electronic components shall be industrial robust construction and shall satisfy but not be limited to NEMA and IEEE standards, environmental and physical test as follows:
- Temperature
- Humidity
- Dust level
- Corrosion
- EMI/RFI
- Shock
- Vibration

b. Electronic components should be mounted on printed drawable cards, i.e. plug-in construction.

c. Non-interchangeable printed cards should be constructed to prevent replacing in wrong plug.

d. Printed cards with components, mounted and tested, shall be treated as to withstand moisture, i.e. tropicalized equipment, and shall be treated antifungus.

e. Disconnect contacts of the withdrawal cards, and stationary contacts should be gold coated or made of gold.

f. Electronic equipment shall be tested for Surge Withstand Capability (SWC) as defined in ANSI C-37.90a (IEEE STD. 472 or equal VDE Standard.

g. Each module with electronic components shall be provided with minimum 2 (two) self-diagnostics lights unless otherwise specified.
One of them shall indicate presence of module logic power and, when inserted by Purchaser, module within the structure is properly seated and locked.
The second "fault" light shall indicate any module outputs

h. All withdrawal modules as well as their position in the structure shall be colour coded and titled with a distinctive label. Interchangeable modules may have the same sign.

10.4.3.9 Control System General Requirements

10.4.3.9.1 In accordance with the Standard Specification EPD-A.14 requirements
10.4.3.9.2 **Industrial HMI (Human-Machine Interface)**

10.4.3.9.2.1 The Control System shall be able to generate the necessary signals to produce a monitor based on HMI to the operator.

10.4.3.9.2.2 The HMI system, both hardware and software shall to be the last up-to-date products of a well-known trade mark manufacturer in this field and will be provided with full licenses for each existing location.

10.4.3.9.2.3 One additional license for maintenance purposes will be provided on a flash memory (DOK or similar).

10.4.3.9.2.4 The HMI will include all the existing operating, maintenance, diagnosis and post mortem (sequence event recorder) analysis functions, detailed at least as the existing one.

10.4.3.9.2.5 The text on the HMI screens will be both in English and Hebrew interchangeable. The necessary translations will be done by the Purchaser and implemented by the Contractor.

10.4.3.9.2.6 Three high performance LAPTOPs, one for engineering and two for maintenance purposes will be provided.

10.4.3.9.2.7 The Alarm and Annunciating System shall be integrated in the HMI. In addition all the hardwired annunciating signals will remain unchanged (i.e. wind warning).

10.4.3.9.2.8 The following features apply to the system and the development:

The Crane Management System is a high level solution to monitor and diagnose the cranes.

The system will be built on top of the latest Microsoft operating systems and advanced technologies.

High speed logging of signals / events / alarms / faults to a database, called the historical database. The database stores all signals ever logged.

Real-time signal monitoring.

Post mortem analysis going back to the first data ever recorded.

Animated HMI representing the current status of the crane, including the positions of the movements, production information, etc.

Trend analysis capabilities for analog and digital signals.
The HMI can be switched between English and Hebrew. The operators can read the status, events, alarms and faults of the cranes in Hebrew.

Custom made solution including full source code of the developed parts.

Cooperation of IEC in design and development. License granting the IEC the rights to modify the source code in anyway they please for use on the cranes and control room.

Analysis of production related information. E.g. unloaded tonnage in a period of time for each crane, average unload cycle.

TCP/IP communication over Industrial Ethernet between all communication partners, a highly fault tolerant configuration.

Redundancy on several levels in the configuration for maximum reliability. Easy backup of the historical database for the maintenance crew, crane operators and control room operators.

Documentation of the project for future reference.

10.4.4 **MISCELLANEOUS**

10.4.4.1 Delicate equipment shall be mounted on shock absorbers to avoid damages or malfunction caused by vibration or acceleration of the unloader.

10.4.4.2 All cable entrances to and from enclosures junction boxes etc. should be provided with means to make it water and dust-tight.

10.4.4.3 The number of individual equipment and device types should be reduced to a minimum.

10.5 **Painting requirements**

Surface preparation, corrosion protection, painting and preservation systems shall be according to Supplement 8.7.2.4 painting specification.

Without derogating from the above, all equipment shall be supplied painted with prime and top coating (final paint).
**10.6 Maintenance requirements**

10.6.1 **Spare and Renewal Parts**

The Contractor shall provide upon purchaser's request as purchaser's option spare parts at their itemized prices, subject to the applicable terms and conditions, all as further detailed in Annexure "C1"- Summary of Prices and Delivery Schedule.

**10.7 Reliability, Availability, Maintainability (RAMS)**

Reserved

**10.8 Safety**

The Equipment supplied under this Specification shall meet the U.S. "OCCUPATION, SAFETY, AND HAZARD ADMINISTRATION" (OSHA) requirements or equivalent.

**11 TEST AND INSPECTIONS**

11.1 **I&TP (Inspection & Test Plan)**

Will be provided by Contractor according to requirements of item 7 above.

**12 PACKAGING & DELIVERY**

The Contractor shall comply with the requirements for Shipment and Handling of Equipment set forth in Annexure "R" to the Contract and additionally with the following supplementary requirements:

12.1 All components or accessories shipped detached for field mounting or field assembly shall be suitably tagged to allow easy identification. Tags shall be stamped with cross reference data such as Manufacturer’s Name, Contract No., Power Station, Unit No., reference drawing and Equipment Designation, and shall be exceptionally durable and securely tied to items by wire or other methods approved by Purchaser.
12.2 Major pieces of Equipment shall be supplied with securely tied nameplates (Adhesive fastening is not acceptable) including manufacturer’s name, model number, serial number and additional information, such as voltage, frequency, etc.

12.3 Unless specially designated, all Equipment and other items shall be packaged for outdoor storage until erection. Where required by the nature of the Equipment, the Contractor shall furnish and install necessary covers to protect the Equipment from sand, rain, hail, wind, dust and salt spray. Equipment shall be adequately sealed and protected during shipment to prevent corrosion and entrance of foreign matter. All exposed machined surfaces shall be protected where required with a suitable antirust compound or covers before shipment, for shipment and storage until erection.

12.4 All temporary supports, lifting lugs and other temporary parts shall be painted in yellow.

12.5 The equipment components shall be supplied as large as possible to reduce field welds and erection time.

12.6 Contractor shall submit, prior to erection, a detailed tabulation of all field mounted items with at least the following information:

Item number, consistent with Contractor's Bill of Materials.

Contractor's shop order numbers (if any).

Number of items.

Manufacturer and/or Supplier, if other than Contractor.

Type or catalogue number if listed.

Short description including service and on what device it is mounted.

Date shipped.

Shipping details.
13 STORAGE & HANDLING

13.1 Before packing, the equipment shall be cleaned to remove all dirt and waste material left for fabrication to the extent that it can be put into service without further cleaning.

13.2 The top, back, ends and bottom of the control panels shall be provided with temporary enclosure, tightly sealed to prevent entry of foreign matter during shipment and storage at the job site. The entire panel or console shall be adequately protected to prevent damage to components during handling and shipping.

13.3 The control panels and all equipment shall be packaged so that they will arrive at the plant site undamaged, either by handling and/or due to weather conditions.

13.4 The Contractor shall be responsible for, and shall repair or replace at his expense damaged equipment where damage was due to improper preparation for shipment of goods.

13.5 Detailed storage requirements for short term (up to 6 months) and long term (greater than 6 months) shall be provided. Special handling provisions shall be transmitted to the owner prior to shipment. Storage and handling requirement data shall be attached to each package when shipped.

13.6 Prior to preparing the system for shipment, all accessories which may be subject to damage either during shipment or during handling at the job site shall be removed. Each item removed shall be clearly labeled as to the equipment with which it is associated and in accordance with a drawing showing its exact location and configuration on that equipment to facilitate reassembly in the field. This drawing shall be placed in a suitably marked envelope and shall accompany the equipment and disassembled components.
NAMEPLATE & MARKING

- The Contractor shall use a nameplate (Manufacturer’s marking) in reference to an instrument or a device on drawings, correspondence and manuals, where applicable.

- The nameplate (Manufacturer’s marking) tag shall include the following identifying data:
  * manufacturer’s name,
  * model number,
  * serial number;
  * additional information, such as voltage, frequency, etc.

- Construction of nameplate (Manufacturer's marking):

  For field mounted instruments the Manufacturer’s Marking Data shall be stamped on a tag fastened permanently to the instrument. Adhesive fastening is not acceptable.

  Name plate material will be stainless steel.

– F I N A L –