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|--|--|----------------|
| <b>KLM Technology Group</b><br><br>Project Engineering Standard  | <br><br><a href="http://www.klmtechgroup.com">www.klmtechgroup.com</a> | Page : 1 of 52 |
|  |  | Rev: 01        |
|  |  | July 2012      |
| KLM Technology Group<br>#03-12 Block Aronia,<br>Jalan Sri Perkasa 2<br>Taman Tampoi Utama<br>81200 Johor Bahru<br>Malaysia | <b>SPECIFICATION FOR CATHODIC PROTECTION<br/>(PROJECT STANDARDS AND SPECIFICATIONS)</b>  |                |

## TABLE OF CONTENT

|  |           |
|--|-----------|
| <b>SCOPE</b>   | <b>3</b>  |
| <b>REFERENCES</b>                                      | <b>3</b>  |
| <b>DEFINITION AND TERMINOLOGY</b>                      | <b>6</b>  |
| <b>DOCUMENT PRECEDENCE</b>                             | <b>7</b>  |
| <b>SPECIFICATION DEVIATION/ CONCESSION CONTROL</b>     | <b>7</b>  |
| <b>QUALITY ASSURANCE/ QUALITY CONTROL</b>              | <b>7</b>  |
| <b>DOCUMENTATION – GENERAL</b>                         | <b>7</b>  |
| <b>CONTRACTORS/ VENDORS</b>                            | <b>8</b>  |
| <b>HANDLING</b>  | <b>9</b>  |
| Packaging and Shipping                                 | 9         |
| Preservation and Storage                               | 9         |
| <b>EXECUTION</b>                                       | <b>10</b> |
| Responsibility of Contract                             | 10        |
| <b>DESIGN BASIS</b>                                    | <b>11</b> |
| General Basis  | 11        |
| Schedule of Cathodic Protection Systems                | 12        |
| Current Requirements                                   | 13        |
| Performance Criteria                                   | 15        |
| <b>SITE SURVEY</b>                                     | <b>15</b> |
| General Terrain  | 16        |
| Soil Resistivity Measurements for Groundbed Site       | 16        |
| Chemical Properties of Soil                            | 17        |
| <b>EQUIPMENT AND MATERIALS</b>                         | <b>17</b> |
| Schedule of Equipment and Materials                    | 17        |
| Impressed Current Anodes                               | 19        |
| Sacrificial Anodes                                     | 20        |
| Backfill Materials for Pre-Packaged Sacrificial Anodes | 21        |

|  |  |                |
|--|--|----------------|
| <b>KLM Technology Group</b><br><br>Project Engineering Standard  | <br><br><a href="http://www.klmtechgroup.com">www.klmtechgroup.com</a> | Page : 2 of 52 |
|  |  | Rev: 01        |
|  |  | July 2012      |
| KLM Technology Group<br>#03-12 Block Aronia,<br>Jalan Sri Perkasa 2<br>Taman Tampoi Utama<br>81200 Johor Bahru<br>Malaysia | <b>SPECIFICATION FOR CATHODIC PROTECTION<br/>         (PROJECT STANDARDS AND SPECIFICATIONS)</b>   |                |

|  |           |
|--|-----------|
| <b>Backfill Materials for Impressed Current Beds in Soil</b> | <b>21</b> |
| <b>Cables</b>  | <b>21</b> |
| <b>Transformers/ Rectifiers</b>                              | <b>23</b> |
| <b>Anode Terminal Boxes</b>                                  | <b>25</b> |
| <b>Test Stations</b>   | <b>26</b> |
| <b>Polarization Coupons</b>                                  | <b>26</b> |
| <b>SYSTEMS ENGINEERING AND INSTALLATION</b>                  | <b>27</b> |
| <b>Qualification of Design Personnel</b>                     | <b>27</b> |
| <b>Tank Bottoms</b>  | <b>27</b> |
| <b>Buried Tanks</b>  | <b>29</b> |
| <b>Tank Internals</b>  | <b>30</b> |
| <b>Buried Piping System</b>                                  | <b>32</b> |
| <b>Sacrificial Anode Beds</b>                                | <b>34</b> |
| <b>Impressed Current Anode Beds</b>                          | <b>34</b> |
| <b>Connection of Cables</b>                                  | <b>36</b> |
| <b>Electrical Earthing</b>                                   | <b>40</b> |
| <b>Electrical Continuity</b>                                 | <b>40</b> |
| <b>Electrical Isolation</b>                                  | <b>41</b> |
| <b>Stray Currents</b>  | <b>43</b> |
| <b>Installation of Junction Boxes and Test Stations</b>      | <b>43</b> |
| <b>Remote Monitoring and System Control</b>                  | <b>46</b> |
| <b>SPECIAL FACILITIES</b>                                    | <b>47</b> |
| <b>Temporary CP Systems</b>                                  | <b>47</b> |
| <b>Designs near High Voltage Power Lines</b>                 | <b>47</b> |
| <b>Designs in Areas of Lightning Activity</b>                | <b>48</b> |
| <b>DOCUMENTATION REQUIREMENTS</b>                            | <b>48</b> |
| <b>Design Documents</b>                                      | <b>48</b> |
| <b>Material Schedules</b>                                    | <b>49</b> |
| <b>Installation Procedures</b>                               | <b>49</b> |

|  |  |   |
|--|--|---|
| <p><b>KLM Technology Group</b></p> <p>Project Engineering Standard</p>   |  <p><a href="http://www.klmtechgroup.com">www.klmtechgroup.com</a></p> | <p>Page : 3 of 52</p> <hr/> <p>Rev: 01</p> <hr/> <p>July 2012</p> |
| <p>KLM Technology Group<br/>#03-12 Block Aronia,<br/>Jalan Sri Perkasa 2<br/>Taman Tampoi Utama<br/>81200 Johor Bahru<br/>Malaysia</p> | <p><b>SPECIFICATION FOR CATHODIC PROTECTION</b></p> <p><b>(PROJECT STANDARDS AND SPECIFICATIONS)</b></p>   |   |

|   |           |
|---|-----------|
| <b>Pre-commissioning Testing and Inspection</b> | <b>50</b> |
| <b>Cathodic Protection Manual</b>               | <b>51</b> |
| <b>Training</b>                                 | <b>51</b> |
| <b>SAFETY</b>                                   | <b>52</b> |

|   |   |              |
|---|---|--------------|
| <b>KLM Technology<br/>Group</b><br><br>Project Engineering Standard | <b>SPECIFICATION FOR<br/>CATHODIC PROTECTION</b>  | Page 4 of 52 |
|   | <b>(PROJECT STANDARDS AND<br/>SPECIFICATIONS)</b> | Rev: 01      |
|   |   | July 2012    |

## SCOPE

This Project Standard and Specification covers the minimum requirements for cathodic protection of the following steel items:

- Buried steel piping
- Bottom surfaces of on-grade storage tanks in contact with soil.
- Bottom surfaces of on-grade storage tanks in contact with soil.
- Interior surfaces of water boxes and tanks, which are in contact with water.

Cathodic protection (CP) systems can be utilized for corrosion control of ferrous metals in contact with soil, buried concrete and water. For this specification, only the components listed above are given the requirements for CP. Internal cathodic protection for water tanks and water boxes shall be installed only if indicated on the Equipment data sheets.

## REFERENCES

The following codes and standards shall, to the extent specified herein, form a part of this specification.

### 1. American Society for Testing and Materials (ASTM)

|           |  |
|-----------|--|
| ASTM G57  | Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method |
| ASTM B418 | Cast and Wrought Galvanic Zinc Anodes  |

### 2. International Electrotechnical Commission (IEC)

|         |  |
|---------|--|
| IEC 146 | Semiconductor Converters                               |
| IEC 269 | Low Voltage Fuses                                      |
| IEC 529 | Degrees of Protection Provided by Enclosures (IP Code) |

### 3. International Standards Organization (ISO)

|                     |   |
|---------------------|---|
| ISO 8501-1 (Part 1) | Preparation of Steel Substrate Before Application Of Paints And Related Products-Visual Assessment Of Surface Cleanliness |
| ISO 9001-2000       | Quality Management System Requirements  |
| ISO 9004-2000       | Quality Management Guidelines for Performance Improvement System  |

|   |   |              |
|---|---|--------------|
| <b>KLM Technology Group</b><br><br>Project Engineering Standard | <b>SPECIFICATION FOR CATHODIC PROTECTION</b><br><br><b>(PROJECT STANDARDS AND SPECIFICATIONS)</b> | Page 5 of 52 |
|   |   | Rev: 01      |
|   |   | July 2012    |

ISO 19011 Guidelines for quality and/or environmental management systems auditing

#### 4. British/European Standard

BS 7361 Cathodic Protection - Part 1, Code of Practice for Land and Marine Applications  
BS EN 12499 Internal Cathodic Protection of Metallic Structures  
BS EN 12954 Cathodic Protection of Buried or Immersed Metallic Structures — General Principles and Application for Pipelines  
BS EN 13636 Cathodic Protection of Buried Metallic Tanks and Related Piping  
BS EN 13509 Cathodic Protection Measurement Techniques  
BS EN 14505 Cathodic Protection of Complex Structures

#### 5. National Association of Corrosion Engineers (NACE)

NACE SP0169 Control of External Corrosion on Underground or Submerged Metallic Piping Systems.  
NACE SP0177 Mitigation of Alternating Current and Lightning Effects on Metallic Structures and Corrosion Control Systems  
NACE RP0193 External Cathodic Protection of On-Grade Metallic Storage Tank Bottoms  
NACE SP0286 The Electrical Isolation of Cathodically Protected Pipelines.  
NACE SP0572 Design, Installation, Operation, and Maintenance of Impressed Current Deep Ground Beds.  
NACE RP0196 Galvanic Anode Cathodic Protection of Internal Submerged Surfaces of Carbon Steel Water Storage Tanks  
NACE RP0285 Corrosion Control of Underground Storage Tank Systems by Cathodic Protection  
NACE SP0387 Metallurgical and Inspection Requirements for Cast Sacrificial Anodes for Offshore Applications  
NACE SP0388 Impressed Current Cathodic Protection of Internal Submerged Surfaces of Carbon Steel Water Storage Tanks  
NACE SP0187 Design Considerations for Corrosion Control of Reinforcing Steel in Concrete

#### 6. National Electrical Code

NEC NFPA-70 National Electrical Code  
(ANSI-C1)

|   |   |              |
|---|---|--------------|
| <b>KLM Technology Group</b><br><br>Project Engineering Standard | <b>SPECIFICATION FOR CATHODIC PROTECTION</b><br><br><b>(PROJECT STANDARDS AND SPECIFICATIONS)</b> | Page 6 of 52 |
|   |   | Rev: 01      |
|   |   | July 2012    |

## DEFINITIONS & TERMINOLOGY

For the purposes of this specification, the following definitions shall apply:

### CONCESSION REQUEST

- A deviation requested by the CONTRACTOR, usually after receiving the contract package or purchase order. Often, it refers to an authorization to use, repair, recondition, reclaim, or release materials, components or equipment already in progress or completely manufactured but which does not meet or comply with COMPANY requirements. A CONCESSION REQUEST is subject to COMPANY approval.

### SHALL

- The use of the word “shall” indicates a mandatory requirement.

### SHOULD

- The use of the word “should” indicates a strong recommendation to comply with the requirements of this document.

### DEEPWELL/ DEEPGROUND BED

- One or more anodes installed vertically at a depth of 15 meters or more below the earth’s surface in a drilled hole.

### ELECTROLYTE

- Moist soil and water in contact with the STRUCTURE.

### PARALLEL BED

- When used in the matters related to pipe, wire or cable type anode placed parallel to the pipe run. When used in the matters related to tank bottoms, wire or cable type anode in a coil or grid form in a plane parallel to the tank bottom at a specified depth under the tank bottom.

### SHALLOW BED

- One or more anodes installed vertically at a depth of 5 to 15 meters below the earth’s surface.

### STRUCTURE

- The surface to which cathodic protection is being applied. A foreign structure means a surface to which cathodic protection is being provided unintentionally.

|   |   |              |
|---|---|--------------|
| <b>KLM Technology Group</b><br><br>Project Engineering Standard | <b>SPECIFICATION FOR CATHODIC PROTECTION</b><br><br><b>(PROJECT STANDARDS AND SPECIFICATIONS)</b> | Page 7 of 52 |
|   |   | Rev: 01      |
|   |   | July 2012    |

#### STRUCTURE-TO-ELECTROLYTE POTENTIAL

- The voltage difference between a buried (or immersed) metallic surface and the electrolyte which is measured with reference to an electrode (such as copper/copper sulfate and silver/silver chloride electrodes) in contact with the electrolyte.

#### SURFACE BED

- One or more anodes installed horizontally or vertically at a depth of 5 meters or less, below grade.

#### DOCUMENT PRECEDENCE

The CONTRACTOR shall notify the COMPANY of any apparent conflict between this specification, the related data sheets, the Codes and Standards and any other specifications noted herein. Resolution and/or interpretation precedence shall be obtained from the COMPANY in writing before proceeding with the design/manufacture.

In case of conflict, the order of precedence shall be stated in the AGREEMENT or other PROJECT documents as applicable.

#### SPECIFICATION DEVIATION/CONCESSION CONTROL

Any technical deviations to this specification shall be sought by the CONTRACTOR only through CONCESSION REQUEST format. CONCESSION REQUESTS require CONTRACTOR'S and COMPANY'S review/approval, prior to the proposed technical changes being implemented. Technical changes implemented prior to COMPANY approval are subject to rejection.

#### QUALITY ASSURANCE/QUALITY CONTROL

APPLICATOR'S proposed quality system shall fully satisfy all the elements of ISO 9001. The quality system shall provide for the planned and systematic control of all quality related activities performed during design/development, production, installation or servicing (as appropriate to the given system). Implementation of the system shall be in accordance with the Quality Manual and Project Specific Quality Plan, which shall both together with all related/referenced procedures be submitted to COMPANY for review, comment and approval as required by purchase/contract documents.

|   |   |              |
|---|---|--------------|
| <b>KLM Technology<br/>Group</b><br><br>Project Engineering Standard | <b>SPECIFICATION FOR<br/>CATHODIC PROTECTION</b><br><br><b>(PROJECT STANDARDS AND<br/>SPECIFICATIONS)</b> | Page 8 of 52 |
|   |   | Rev: 01      |
|   |   | July 2012    |

## **DOCUMENTATION - GENERAL**

CONTRACTOR shall submit the type and quantity of drawings and documentation for authorization or information as listed in the individual Material Requisitions, Purchase Orders and Document Requirement Section of this Specification.

Mutual agreement on scheduled submittal of drawings and engineering data shall be an integral part of any formal Purchase Order.

Comments made by COMPANY on drawing submittal shall not relieve CONTRACTOR of any responsibility in meeting the requirements of the specifications. Such comments shall not be construed as permission to deviate from requirements of the Purchase Order unless specific and mutual agreement is reached and confirmed in writing.

Each drawing shall be provided with a title block in the bottom right-hand corner incorporating the following information:

- Official trade name of the company.
- CONTRACTORs drawing number.
- Drawing title giving the description of contents whereby the drawing can be identified.
- A symbol or letter indicating the latest issue or revision.
- PO number and item tag numbers.

Revisions to drawings and documents shall be identified with symbols adjacent to the alterations, a brief description in tabular form of each revision shall be given, and if applicable, the authority and date of the revision shall be listed. The term "Latest Revision" shall not be used.

## **CONTRACTORS/VENDORS**

The CONTRACTOR shall assume unit responsibility and overall guarantee for the equipment package and associated equipment.

The CONTRACTOR shall transmit all relevant purchase order documents including specifications to his SUBCONTRACTORS.

It is the CONTRACTOR'S responsibility to enforce all Purchase Order and Specification requirements on his SUBCONTRACTORS.



|   |   |              |
|---|---|--------------|
| <b>KLM Technology Group</b><br><br>Project Engineering Standard | <b>SPECIFICATION FOR CATHODIC PROTECTION</b><br><br><b>(PROJECT STANDARDS AND SPECIFICATIONS)</b> | Page 9 of 52 |
|   |   | Rev: 01      |
|   |   | July 2012    |

The CONTRACTOR shall obtain and transmit all SUBCONTRACTOR warranties to the CONTRACTOR and COMPANY, in addition to the system warranty.

## **HANDLING**

### **Packaging and Shipping**

Preparation for shipment shall be in accordance with the CONTRACTOR'S standards and as noted herein. CONTRACTOR shall be solely responsible for the adequacy of the preparation for shipment provisions with respect to materials and application, and to provide equipment at the destination in ex-works condition when handled by commercial carriers.

Adequate protection shall be provided to prevent mechanical damage and atmospheric corrosion in transit and at the job site.

Preparation for shipment and packing will be subject to inspection and rejection by COMPANY'S/CONTRACTOR'S inspectors. All costs occasioned by such rejection shall be to the account of the CONTRACTOR.

Equipment shall be packed, securely anchored, and skid mounted when required. Bracing, supports, and rigging connections shall be provided to prevent damage during transit, lifting, or unloading. All temporary bracing/supports shall be marked "REMOVE BEFORE EQUIPMENT COMMISSIONING AND START-UP."

Separate, loose, and spare parts shall be completely boxed. Pieces of equipment and spare parts shall be identified by item number and service and marked with Contractor's order number, tag number, and weight, both inside and outside of each individual package or container. A bill of material shall be enclosed in each package or container of parts.

One complete set of the installation, operation, and maintenance instructions shall be packed in the boxes or crates with equipment. This is in addition to the number called for in the Purchase Order.

### **Preservation and Storage**

Equipment and materials shall be protected to withstand ocean transit and extended period of storage at the jobsite for a minimum period of 18 months. Equipment shall be protected to safeguard against all adverse environments,

|   |   |               |
|---|---|---------------|
| <b>KLM Technology Group</b><br><br>Project Engineering Standard | <b>SPECIFICATION FOR CATHODIC PROTECTION</b><br><br><b>(PROJECT STANDARDS AND SPECIFICATIONS)</b> | Page 10 of 52 |
|   |   | Rev: 01       |
|   |   | July 2012     |

such as: humidity, moisture, rain, dust, dirt, sand, mud, salt air, salt spray, and seawater.

All equipment and material shall be preserved and export packed in accordance with Project Preservation and Export Packing Specification.

## **EXECUTION**

### **Responsibilities of Contractor**

CONTRACTOR shall supply all labor, supervision, installed and consumable materials, services, equipment, tools, and each and every item of expense necessary for the design, procurement, installation and commissioning of cathodic protection systems for ferrous materials in contact with soil (buried piping, buried tanks and tank bottoms), and interiors of water tanks and water boxes in contact with the electrolyte herein after called WORK.

The WORK shall include the following, by way of example but not by limitation, the following tasks:

- Obtain, generate and evaluate necessary information to perform complete design, installation, testing, commissioning and documentation of the cathodic protection systems including a predesign site survey.
- Design and implementation of appropriate measures to ensure reinforcement of concrete foundation walls of on-grade storage tanks is not exposed to stray currents generated by tank cathodic protection systems.
- Provide detailed design for temporary and permanent cathodic protection systems in compliance with this Specification and referenced standards and suitable for the PROJECT environmental conditions.
- Supply and install fully operational temporary and permanent cathodic protection systems for the STRUCTURES identified by the COMPANY.
- Supply and install permanent testing facilities and remote monitoring capabilities to monitor the cathodic protection systems using latest proven technology available at the time of system design.
- Commission, test and adjust the newly installed temporary and permanent cathodic protection systems.
- Test for, locate and mitigate any shorts in the cathodic protection systems.
- Test for, evaluate and mitigate possible interference caused by cathodic protection system on communication and low energy control systems.
- Test for, evaluate and mitigate stray currents generated by newly installed cathodic protection systems.
- Provide documentation for system design and installation.