

## Basic Engineering Study for Aung Sinkha Development Project Phase 1A

### MATERIAL SPECIFICATION FOR CATHODIC PROTECTION SYSTEM

|                                                                                                                                                                                                                                                      |                                                                                                                                             |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| <br><b>PTTEP</b>                                                                                                                                                    | <b>PTT Exploration and Production Public Company Limited</b><br><b>Aung Sinkha Development Project Phase 1A</b><br><b>Basic Engineering</b> |
| <input checked="" type="checkbox"/>                                                                                                                                                                                                                  | 1. APPROVED                                                                                                                                 |
| <input type="checkbox"/>                                                                                                                                                                                                                             | 2. APPROVED with comments (Proceed to IFB)                                                                                                  |
| <input type="checkbox"/>                                                                                                                                                                                                                             | 3. Review with comments                                                                                                                     |
| <input type="checkbox"/>                                                                                                                                                                                                                             | 4. Rejected to be reissued                                                                                                                  |
| <input type="checkbox"/>                                                                                                                                                                                                                             | 5. Not APPROVED                                                                                                                             |
| COMPANY'S APPROVAL shall not relieve CONTRACTOR from his obligation under the CONTRACT.<br>COMPANY'S failure not to comment or only partially comment any CONTRACT DOCUMENT shall not be construed as an acceptance of the content of the documents. |                                                                                                                                             |
| Signed: <i>Petch Janbojorn</i>                                                                                                                                                                                                                       |                                                                                                                                             |

|     |           | <i>Jatthap J.</i> |                   | <i>Petch Janbojorn</i> |       |                  |       |
|-----|-----------|-------------------|-------------------|------------------------|-------|------------------|-------|
| C3  | 14-Jul-22 | JUJ               | Issued for Bid    | TRG                    | CJ    | PJ               | SA    |
| C2  | 18-Apr-22 | JUJ               | Issued for Bid    | TRG                    | CJ    | PJ               | SA    |
| C1  | 11-Feb-22 | JUJ               | Issued for Bid    | TRG                    | CJ    | PJ               | SA    |
| A1  | 12-Jan-22 | JUJ               | Issued for Review | TRG                    | CJ    | PJ               | SA    |
| REV | DATE      | BY                | DESCRIPTION       | CHECK                  | APPR. | CHECK            | APPR. |
|     |           |                   |                   | ENGINEERING APPROVAL   |       | COMPANY APPROVAL |       |

REVISION CODE: A = Issued for Review – B = Issued for Approval – C = Issued for Bid

TOTAL OR PARTIAL AND / OR UTILIZATION OF THIS DOCUMENT ARE FORBIDDEN WITHOUT PRIOR WRITTEN  
AUTHORIZATION OF THE OWNER

|                                                                                                     |                                                                      |            |                                                                                                                      |
|-----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|------------|----------------------------------------------------------------------------------------------------------------------|
| <br><b>PTTEP</b> | <b>PTTEP INTERNATIONAL LIMITED</b>                                   |            | <br><b>TEN</b> TECHNIP ENERGIES |
|                                                                                                     | Basic Engineering Study for Aung Sinkha Development Project Phase 1A |            |                                                                                                                      |
|                                                                                                     | <b>MM-ASK-1A-APF-COR-SPE-0003</b>                                    | <b>REV</b> |                                                                                                                      |
|                                                                                                     |                                                                      | <b>C3</b>  |                                                                                                                      |

|                                                                      |                                                                  |                |                            |                                                                                                                                                                                                                   |                                   |
|----------------------------------------------------------------------|------------------------------------------------------------------|----------------|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| DOCUMENT<br>TITLE                                                    | MATERIAL SPECIFICATION FOR CATHODIC PROTECTION SYSTEM□<br>Rev.C2 |                |                            | PTTEPI DOC.<br>NO.                                                                                                                                                                                                | MM-ASK-1A-APF-COR-SPE-0003 Rev.C2 |
| Aung Sinkha Development Project PROJECT: Review Commen               |                                                                  |                |                            | PTTEPI RETURN STATUS                                                                                                                                                                                              |                                   |
| PTTEPI                                                               |                                                                  | T.EN           |                            | Aung Sinkha Development Project PROJECT<br>  |                                   |
| Date issued:                                                         | 27-Apr-2022                                                      | Date Received: | 27-Apr-2022                |                                                                                                                                                                                                                   |                                   |
| Issued by:                                                           | petchj                                                           | Action on:     | JUJ                        |                                                                                                                                                                                                                   |                                   |
| Approval by:                                                         | sarana                                                           | Approval by:   | TRG                        |                                                                                                                                                                                                                   |                                   |
| DO NOT DELETE OTHER REVIEWERS COMMENTS WITHOUT DISCUSSING WITH THEM! |                                                                  |                |                            |                                                                                                                                                                                                                   |                                   |
| COMMENT NO.                                                          | SECT.                                                            | PAGE & REF.    | CLIENT COMMENTS (REVIEWER) | T.EN RESPONSE                                                                                                                                                                                                     | COMMENT STATUS<br>OPEN/CLOSED     |

Comment by\*

## CONTENTS

|                                                      |          |
|------------------------------------------------------|----------|
| <b>1. INTRODUCTION .....</b>                         | <b>3</b> |
| 1.1 Project Overview .....                           | 3        |
| 1.2 Abbreviation .....                               | 4        |
| 1.3 The Parties Involved .....                       | 5        |
| <b>2. GENERAL INFORMATION .....</b>                  | <b>5</b> |
| 2.1 Purpose of Document .....                        | 5        |
| 2.2 Language .....                                   | 6        |
| 2.3 Reference Document .....                         | 6        |
| 2.4 Regulation, Standards and Code of Practice ..... | 8        |
| 2.5 CONTRACTOR/ SUPPLIER's Responsibility .....      | 8        |
| <b>3. CODES, STANDARDS AND REGULATIONS.....</b>      | <b>9</b> |
| <b>4. MATERIAL SPECIFICATION .....</b>               | <b>9</b> |

## ATTACHMENT

|                                              |           |
|----------------------------------------------|-----------|
| <b>ATTACHMENT 1: MATERIA L CATALOGS.....</b> | <b>11</b> |
|----------------------------------------------|-----------|

## LIST OF FIGURES

|                                                                  |   |
|------------------------------------------------------------------|---|
| Figure 1-1: Block M3 – Aung Sinkha Field, Offshore Myanmar ..... | 3 |
| Figure 1-2: Field Block Flow Diagram .....                       | 4 |

## 1. INTRODUCTION

### 1.1 Project Overview

PTTEP International Limited (PTTEPI) intends to develop and produce hydrocarbon from the offshore Block M3 named Aung Sinkha (ASK) field. The project is under Production Sharing Contract (PSC) with Myanmar Oil & Gas Enterprise (MOGE) signed on 7<sup>th</sup> August 2004 while the PSC effective date was on 1<sup>st</sup> November 2004.

PTTEPI as an Operator had performed 2,842 line-km of 2D seismic, 619 km<sup>2</sup> of 3D seismic, and drilled 11 Exploration and Appraisal wells. After successful exploration and appraisal drilling campaigns in 2015, PTTEPI completed the ASK Field Development Plan and submitted it to MOGE for approval. MOGE approved ASK Field Development Plan in April 2021.

The ASK field is located offshore in the Gulf of Moattama, Myanmar, as illustrated in Figure 1-1. The field is located approximately 70 km from Land Fall Point (LFP) at Daw Nyein village and 200 km south-west of Yangon with a water depth range of 15 - 25 meters.

The feed gas will be transported from two (2) offshore wellhead platforms through an offshore export pipeline to ASK Onshore Processing Facilities (APF) located in Daw Nyein village for processing. The sales gas after processing will be exported to the tie-in point at Gas Receiving Station no. 2 (GRS#2), of Domestic Gas to Power Pipeline Development Project, nearby the APF. The condensate will be kept in onshore storage tanks before loading, transporting/ offloading to customers. The design of the surface facilities will be based on a Contractual Daily Capacity (CDC) of 60 MMscfd with provision for future expansion to 100 MMscfd. The gas production is planned to start up by Q4 of 2025.

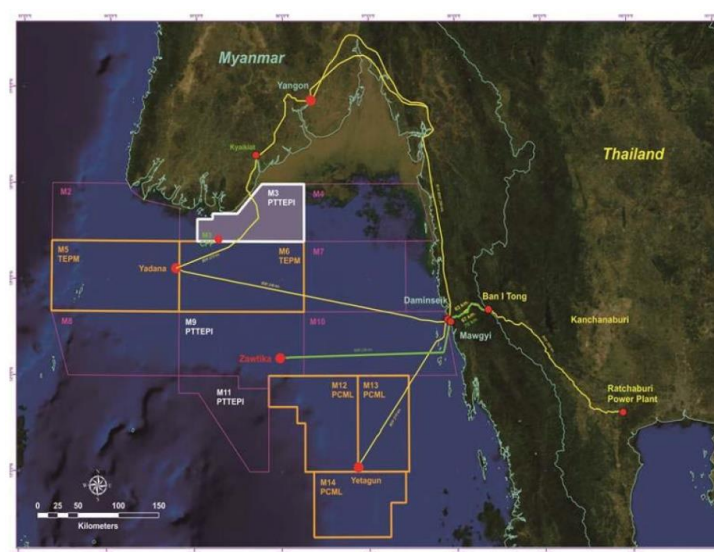


Figure 1-1: Block M3 – Aung Sinkha Field, Offshore Myanmar

The development of Phase 1A consists of the following facilities, as illustrated in Figure 2.0.

- 2 Wellhead Platforms (WPA-1 and WPA-2)
- 1 Intra-field pipeline which links between WPA-1 and WPA-2
- 1 Multiphase export pipeline to transport combined fluid of WPA-1 and WPA-2 to ASK Onshore Processing Facilities (APF)
- ASK Onshore Processing Facilities (APF)
- Onshore pipelines from APF to Gas Receiving Station#2 (GRS#2)
- Onshore infrastructure i.e. condensate offtake facilities, accommodation, Personal Material Transfer Facilities, telecommunication system, roads, etc.
- APL01 Onshore pipeline from landfall to APF

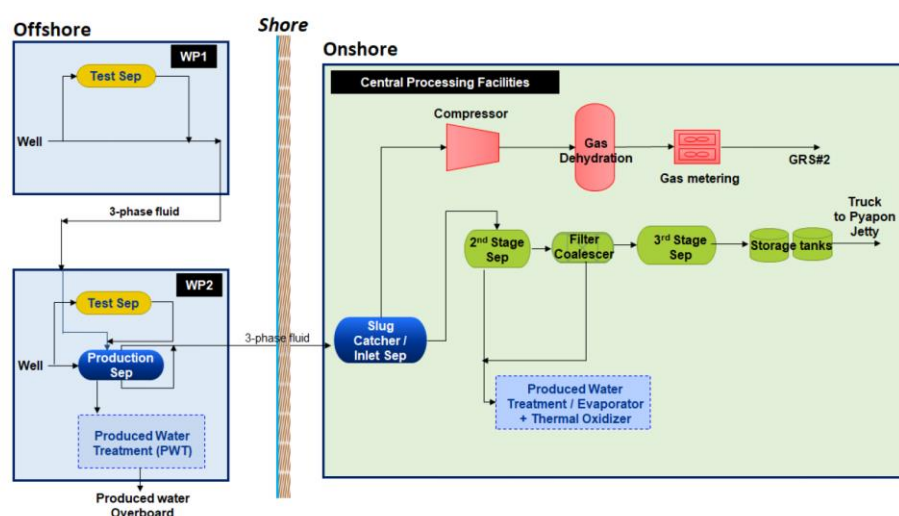


Figure 1-2: Field Block Flow Diagram

## 1.2 Abbreviation

|       |                                            |
|-------|--------------------------------------------|
| AC    | Alternating Current                        |
| ASTM  | American Society for Testing and Materials |
| CP    | Cathodic Protection                        |
| CSE   | Copper/Copper Sulphate Reference Electrode |
| DC    | Direct Current                             |
| HHVAC | High Voltage Alternating Current           |
| ICCP  | Impressed Current Cathodic Protection      |
| KP    | Kilometre Point                            |
| LEF   | Longitudinal Electric Field                |

|                 |                                                       |
|-----------------|-------------------------------------------------------|
| PPE             | Personal Protective Equipment                         |
| PTTEP           | PTT Exploration and Production Public Company Limited |
| PVC             | Polyvinyl Chloride                                    |
| QA              | Quality Assurance                                     |
| QC              | Quality Control                                       |
| ROW             | Right of Way                                          |
| V <sub>oc</sub> | Open Circuit Voltage                                  |

### 1.3 The Parties Involved

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| COMPANY            | PTTEP International Limited                                                                                                                                                                                                                                                                                                                                                                                                      |
| CONTRACTOR         | For the purposes of this document, CONTRACTOR shall mean any person who has entered into a formal written contract with the COMPANY for the performance of work and or services for and or in connection with the COMPANY for and or in connection with ASK Development Project, or any part thereof.                                                                                                                            |
| SUBCONTRACTOR      | For the purposes of this document, SUBCONTRACTOR shall mean any person to whom the performance of any part of the WORK is subcontracted including subcontractors of any tier.                                                                                                                                                                                                                                                    |
| SUPPLIER or VENDOR | For the purposes of this document, SUPPLIER or VENDOR shall mean a supplier of any of; skid mounted assembly, packaged equipment and associated items, itemized (tagged) materials and equipment, linepipe and associated materials, non-itemized (bulk) materials and all other materials and things, for use in the ASK Development Project or for handover to the COMPANY. The term VENDOR shall include vendors of any tier. |

## 2. GENERAL INFORMATION

### 2.1 Purpose of Document

Purpose of this specification of cathodic protection is to define the type, size, details, etc. of cathodic protection system for Aung Sinkha Development Project Phase 1A.

## 2.2 Language

The English Language shall be used in all project communications, reports, correspondences, drawings, specifications, calculations, and invoices etc., submitted to COMPANY. All drawings and documents shall be annotated in S.I. units with other units in parenthesis, where applicable.

In this document, the words should and shall have the following meanings:

|                |                                                                                                                                                                                                                                                                                                                                                                             |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Approval       | The authorization in writing given by the COMPANY to the Contractor on a procedure or to proceed with the performance of a specific part of the work without releasing in any way the Contractor from any of his obligations to conform with the technical specifications, requisitions, etc. The words "Approve", "Approved" and "Approval" shall be construed accordingly |
| Purchase Order | The order issued by Purchaser consisting Terms and Conditions and attachments thereto including but not limited to Data Sheets and Drawings, Specifications including referenced documentation therein, and all other documents and attachments.                                                                                                                            |
| Shall          | Used to indicate that a provision is mandatory.                                                                                                                                                                                                                                                                                                                             |
| Should         | Used to indicate that a provision is not mandatory but is recommended as good practice.                                                                                                                                                                                                                                                                                     |
| May            | Used to indicate that a provision is optional                                                                                                                                                                                                                                                                                                                               |
| PPS            | Designates Project Particular Specification detailing the additional tests and requirements or the possible modifications to the present specification, based on the particular design conditions or the local legislation of the project.                                                                                                                                  |

## 2.3 Reference Document

This specification defined as the Project Particular Specification (PPS) shall be read jointly with the following COMPANY's general specification:

|                            |                                                            |
|----------------------------|------------------------------------------------------------|
| MM-ASK-1A-APF-COR-SPE-0001 | Specification for DC Decouplers and Over Voltage Protector |
|----------------------------|------------------------------------------------------------|

|                            |                                                                                     |
|----------------------------|-------------------------------------------------------------------------------------|
| MM-ASK-1A-APF-COR-SPE-0002 | Specification for Insulating Flange Kits and Monolithic Isolation Joint             |
| MM-ASK-1A-APF-COR-SPE-0004 | Specification for Cathodic Protection System Installation                           |
| MM-ASK-1A-APF-COR-SPE-0005 | Specification for Onshore Cathodic Protection                                       |
| MM-ASK-1A-APF-COR-SPE-0006 | Specification for Soil Resistivity Survey & Testing                                 |
| MM-ASK-1A-APF-COR-SPE-0007 | Specification for Internal Corrosion Monitoring                                     |
| MM-ASK-1A-APF-COR-PHI-0001 | Cathodic Protection Design Philosophy                                               |
| MM-ASK-1A-APF-COR-RPT-0002 | Cathodic Protection System Conceptual Design Report                                 |
| MM-ASK-1A-APF-COR-MTO-0001 | Provisional Material Take Off for Cathodic Protection System                        |
| MM-ASK-1A-APF-COR-DTS-0001 | Datasheet for Cathodic Protection System DC Decoupler and Over Voltage Protector    |
| MM-ASK-1A-APF-COR-DTS-0002 | Datasheet for Cathodic Protection System Pipeline Insulation Joints and Gasket Kits |
| MM-ASK-1A-APF-COR-TYP-0001 | Typical Installation Details for Cathodic Protection System Cover Sheet             |
| MM-ASK-1A-APF-COR-TYP-0002 | Typical Installation Details for Cathodic Protection System Index                   |
| MM-ASK-1A-APF-COR-TYP-0003 | Typical Exothermic Welding Installation Details                                     |
| MM-ASK-1A-APF-COR-TYP-0004 | Typical Test Station Installation Details (Type A)                                  |
| MM-ASK-1A-APF-COR-TYP-0005 | Typical Test Station Installation Details (Type F)                                  |
| MM-ASK-1A-APF-COR-TYP-0006 | Typical Test Station Installation Details (Type D)                                  |
| MM-ASK-1A-APF-COR-TYP-0007 | Typical Test Station Installation Details (Type CR for Foreign Pipeline)            |
| MM-ASK-1A-APF-COR-TYP-0008 | Typical Test Station Installation Details (Type E)                                  |
| MM-ASK-1A-APF-COR-TYP-0009 | Typical Test Post Guard Rail                                                        |
| MM-ASK-1A-APF-COR-TYP-0010 | Typical Sacrificial Anode Installation Details (Type AM)                            |
| MM-ASK-1A-APF-COR-TYP-0011 | Typical DC Decoupler Installation Details                                           |
| MM-ASK-1A-APF-COR-TYP-0012 | Typical Test Station and Bond Box Details                                           |
| MM-ASK-1A-APF-COR-SCH-0001 | CP/AC Schematic Diagram and Test Facility Schedule                                  |

#### 2.4 Regulation, Standards and Code of Practice

The Aung Sinkha Development Project shall be designed primarily in accordance with PTTEP's general specifications (PEGSs) and corporate specifications, as appropriate, and the applicable Myanmar legislative requirements. Where such standards are not applicable, accepted international codes/industry good engineering practices will be adopted. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published on the effective date of a contract.

Any deviation from the standard shall be documented for derogation and proper permission from PTTEP in writing.

The order of precedence of the applicable documents shall be:

- 1) Government Laws, Rules and Regulations
- 2) Purchase Order/ Service Order/ Contract Documents
- 3) Data Sheet, Drawings and Project Particular Specification (PPS)
- 4) PTTEP Engineering General Specification (PEGS)
- 5) Other COMPANY specifications, standards, and documents
- 6) International Codes and Standards

In case of conflicts/contradictions between the various codes, standards, regulations and specifications, unless otherwise agreed or decided by COMPANY, it is understood that the more stringent requirement shall apply.

Exceptions to or deviations from this specification are not permitted unless they have been raised during the bidding stage and previously accepted in writing by the COMPANY. For this purpose, requests for substitutions or changes of any kind shall be completed with all pertinent information required for COMPANY assessment. COMPANY's approval, nevertheless, will not, in any way, relieve the SUPPLIER's responsibility to meet the requirements of the industry Codes and Standards referred to and amended herein, in the event of a conflict.

#### 2.5 CONTRACTOR/ SUPPLIER's Responsibility

All work shall be carried out in compliance with this specification, reference documents, Codes and Standards, and Specifications listed unless otherwise stated. The SUPPLIER's submissions should provide sufficient data to allow the equipment to be evaluated against the total life and field costs estimated to be incurred. In this respect, equipment capital cost,

weight, size, cost of spares, utility and power requirements, maintenance, reliability and production downtime costs may be considered.

SUPPLIER is required to have relevant proven prior experience in the fabrication and testing of line pipes, which is to be supplied.

### 3. CODES, STANDARDS AND REGULATIONS

The following codes, standards and specifications (latest edition) have been used or/are referred to in this specification. In the event of conflict the Contractor shall inform Owner/Consultant.

|                         |                                                                                                                                    |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| NACE SP0169             | Recommended Practice "Control of External Corrosion on Underground or Submerged Metallic Piping Systems"                           |
| NACE SP0177             | Recommended Practice "Mitigation of Alternating Current and Lightning Effects on Metallic Structures and Corrosion Control System" |
| NACE SP0286             | Recommended Practice "The Electrical isolation of Cathodically Protected Pipelines"                                                |
| NACE TM0497             | Measurement Techniques Related to Criteria for Cathodic Protection on Underground or Submerged Metallic Piping Systems             |
| 10008-STD-6-COR-022-R00 | Design of Cathodic Protection of Buried Pipelines                                                                                  |
| 10008-STD-6-COR-023-R00 | Design of Cathodic Protection of Onshore Facilities                                                                                |

### 4. MATERIAL SPECIFICATION

#### A. DELETED

#### B. PRE-PACKAGED ZINC ANODE

|          |   |                                        |
|----------|---|----------------------------------------|
| Type     | : | 14.5 Kg pre-packaged zinc anodes       |
| Material | : | High Purity Zinc                       |
| Cable    | : | 10 sq.mm. XLPE/PVC insulated, 5 m long |

#### C. TEST STATION

|          |   |                            |
|----------|---|----------------------------|
| Material | : | Fiberglass                 |
| Support  | : | 1 x 2" NPT c/w PVC conduit |

|            |   |                     |
|------------|---|---------------------|
| Terminals  | : | Bus bar terminal    |
| Dimensions | : | 200 x 120 x 100 mm. |

**D. TEST CABLE**

|            |   |                                    |
|------------|---|------------------------------------|
| Type       | : | Single core, XLPE/PVC cable, Black |
| Test cable | : | 10 mm <sup>2</sup>                 |

**E. POLARIZATION CELL REPLACEMENT CABLE**

|            |   |                                    |
|------------|---|------------------------------------|
| Type       | : | Single core, XLPE/PVC cable, Black |
| PCRH cable | : | 35 mm <sup>2</sup>                 |

**F. THERMIC WELD MOULD**

|         |   |                                                               |
|---------|---|---------------------------------------------------------------|
| Purpose | : | For 10 mm <sup>2</sup> to 16 mm <sup>2</sup> cable connection |
| Model   | : | KB15                                                          |
| Size    | : | 15 grams                                                      |

**G. THERMIC WELD CHARGERS**

|           |   |                                         |
|-----------|---|-----------------------------------------|
| Materials | : | A mixture of copper oxide and aluminium |
| Size      | : | 15 grams                                |

**H. COATING REPAIR KITS**

|              |   |                                         |
|--------------|---|-----------------------------------------|
| Manufacturer | : | Stopaq Europe B.V.                      |
| Model        | : | Wrapping band CZH and PVC covering tape |
| Size         | : | Various                                 |

**I. POLARIZATION CELL REPLACEMENT**

|                         |   |                           |
|-------------------------|---|---------------------------|
| Threshold Voltage       | : | -3/+1V (standard)         |
| AC Steady-State Current | : | 50/60 Hz, 45 A (standard) |
| Lightning Surge Current | : | 100 kA                    |
| AC Fault Current Rating | : | 3.7 kA                    |

**ATTACHMENT 1: METERIAL CATALOGS**



## MAGNESIUM ANODE-DURAMAG

Magnesium anode is the most common material used as sacrificial anode in cathodic protection system because of its higher driving voltage, easy installation and limited maintenance. It is typically used for buried transmission oil&gas pipelines, and also can be used to protect structures in fresh water.

Our DuraMag anodes all manufactured and tested according to latest international standards, such as ASTM B843 and ASTM G97, it is available from both M1C (high potential) or AZ63B (Std potential) alloy with annual capacity 8,000 metric tons. In the past decade our anodes were widely used in North America, Europe, Middle East and Asia markets, and we have been approved vendor by Saudi Aramco since 2006.

### Features:

- High purity raw material.
- Rigid process control.
- Automatic production.
- Advanced testing facilities.

### Specification:

#### ■ High Potential Magnesium Anode

Alloy: ASTM B843-M1C

#### Chemical composition:

| Aluminum  | Manganese | Copper     | Silicon   | Nickel     | Fe        | Single Impurity | Total Impurity | Remaining |
|-----------|-----------|------------|-----------|------------|-----------|-----------------|----------------|-----------|
| 0.01% Max | 0.50-1.30 | 0.005% Max | 0.05% Max | 0.001% Max | 0.01% Max | 0.05% Max       | 0.30% Max      | Magnesium |

#### Electrochemical properties:

| Open Voltage (-V) | Closed Voltage (-V) | Actual capacity A.h/kg | Efficiency % |
|-------------------|---------------------|------------------------|--------------|
| 1.70-1.75(-V) SCE | 1.58-1.62(-V) SCE   | 1100                   | 50%          |

#### ■ Standard Potential Magnesium Anode

Alloy: ASTM B843-AZ63B

#### Chemical composition:

| Aluminum     | Manganese | Copper     | Silicon   | Nickel     | Fe        | Single Impurity | Total Impurity | Remaining |
|--------------|-----------|------------|-----------|------------|-----------|-----------------|----------------|-----------|
| 5.3-6.7% Max | 2.5-3.5   | 0.005% Max | 0.05% Max | 0.001% Max | 0.01% Max | 0.05% Max       | 0.30% Max      | Magnesium |

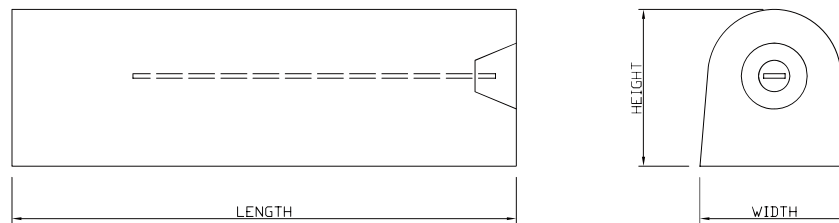
#### Electrochemical properties:

| Open Voltage (-V) | Closed Voltage (-V) | Actual capacity A.h/kg | Efficiency % |
|-------------------|---------------------|------------------------|--------------|
| 1.50-1.55(-V) SCE | 1.45-1.50(-V) SCE   | 1230                   | 55%          |



## ■ “D” Shape Anode

### Dimension and Weight:



| 'D' Type    | High Potential(-1.7V) |        |        |        | Standard Potential(-1.5V) |        |        |        | Item No. |
|-------------|-----------------------|--------|--------|--------|---------------------------|--------|--------|--------|----------|
|             | Width                 | Length | Height | Weight | Width                     | Length | Height | Weight |          |
| YX-MG-5D2   | 70                    | 310    | 76     | 2.3    | 70                        | 305    | 76     | 2.3    | 1        |
| YX-MG-9D2   | 70                    | 545    | 76     | 4.1    | 70                        | 540    | 76     | 4.1    | 2        |
| YX-MG-9D2-1 | 63.5                  | 705    | 67     | 4.1    | 63.5                      | 640    | 67     | 4.1    | 3        |
| YX-MG-20D2  | 70                    | 1524   | 76     | 9.1    | 70                        | 1495   | 76     | 9.1    | 4        |
| YX-MG-14D2  | 70                    | 850    | 76     | 6.36   | 70                        | 815    | 76     | 6.36   | 5        |
| YX-MG-17D2  | 63.5                  | 1210   | 67     | 7.7    | 63.5                      | 1188   | 67     | 7.7    | 6        |
| YX-MG-5D3   | 89                    | 190    | 95     | 2.3    | 89                        | 180    | 95     | 2.3    | 7        |
| YX-MG-9D3   | 89                    | 345    | 95     | 4.1    | 89                        | 325    | 95     | 4.1    | 8        |
| YX-MG-17D3  | 89                    | 645    | 95     | 7.7    | 89                        | 610    | 95     | 7.7    | 9        |
| YX-MG-35D5  | 140                   | 498    | 146    | 14.5   | 140                       | 472    | 146    | 14.5   | 10       |
| YX-MG-48D5  | 140                   | 750    | 146    | 21.8   | 140                       | 710    | 146    | 21.8   | 11       |
| YX-MG-17D4  | 102                   | 525    | 108    | 7.7    |                           |        |        |        | 12       |
| YX-MG-60D4  | 112                   | 1524   | 112    | 27.3   | 114                       | 1485   | 114    | 27.3   | 13       |

\*All dimensions and weights shown are nominal (mm/kg). actual dimensions/weight will be adjusted according to drawings



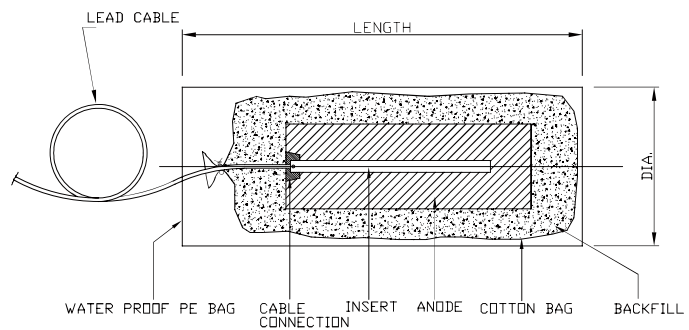
### ■ Pre-packaged Magnesium Anode

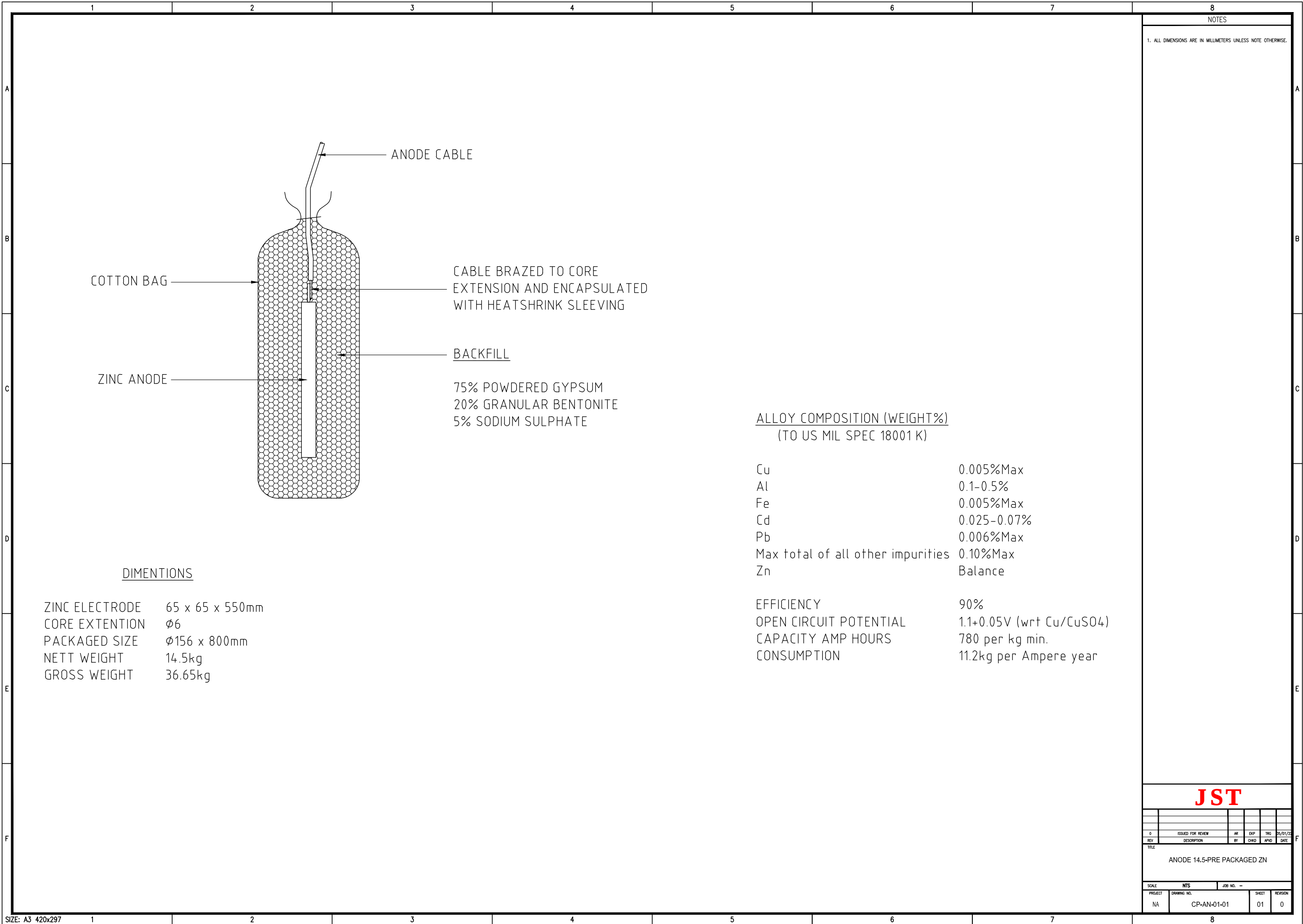
YUXI pre-packed anodes are made of recyclable material and easily decomposable material, the content of harmful element in the backfill is lower than safety standards, which is absolutely environmental friendly.

The available cables type are PVC/PVC, XLPE/PVC, HMWPE, THHN, TW at any required size.

| Backfill Element |     |
|------------------|-----|
| Gypsum           | 75% |
| Bentonite        | 20% |
| Sodium Sulphate  | 5%  |

| Harmful Elements |                     |
|------------------|---------------------|
| Cadmium (Cd)     | $\leq 1\text{ppm}$  |
| Arsenicum (As)   | $\leq 1\text{ppm}$  |
| Mercury (Hg)     | $\leq 1\text{ppm}$  |
| Phosphorus (Pb)  | $\leq 10\text{ppm}$ |





# SPECIFICATION

## LOW VOLTAGE POWER CABLE 0.6/1(1.2) KV CU/XLPE/PVC (CV CABLE)

Copper Conductor, Cross-Linked Polyethylene Insulation  
and Polyvinyl Chloride Sheathed Cables

| REVISION | ISSUED DATE     |
|----------|-----------------|
| 03       | 9 November 2016 |

## CONTENTS

|                                                                           |          |
|---------------------------------------------------------------------------|----------|
| <b>1. SCOPE .....</b>                                                     | <b>3</b> |
| <b>2. REFERENCE STANDARDS .....</b>                                       | <b>3</b> |
| <b>3. DEFINITIONS .....</b>                                               | <b>3</b> |
| <b>4. APPLICATION / SERVICE CONDITIONS .....</b>                          | <b>3</b> |
| <b>5. CABLE CONSTRUCTION .....</b>                                        | <b>4</b> |
| 5.1 CONDUCTOR .....                                                       | 4        |
| 5.2 INSULATION .....                                                      | 4        |
| 5.3 CORE IDENTIFICATION .....                                             | 4        |
| 5.4 CORE LAY UP .....                                                     | 5        |
| 5.5 OVERSHEATH .....                                                      | 5        |
| <b>6. CABLE MARKING AND IDENTIFICATION .....</b>                          | <b>5</b> |
| <b>7. TESTS AND INSPECTIONS .....</b>                                     | <b>6</b> |
| 7.1 ROUTINE TESTS .....                                                   | 6        |
| 7.2 SAMPLE TESTS .....                                                    | 6        |
| <b>8. PACKING AND LABELING .....</b>                                      | <b>6</b> |
| <b>ANNEX A - CABLE DRAWING AND TECHNICAL DATA .....</b>                   | <b>7</b> |
| Figure 1 – Cable drawing of 0.6/1 KV CU/XLPE/PVC 1-Core .....             | 7        |
| Figure 2 – Cable drawing of 0.6/1 KV CU/XLPE/PVC 2-Core .....             | 9        |
| Figure 3 – Cable drawing of 0.6/1 KV CU/XLPE/PVC 3-Core .....             | 11       |
| Figure 4 – Cable drawing of 0.6/1 KV CU/XLPE/PVC 4-Core .....             | 13       |
| Figure 5 – Cable drawing of 0.6/1 KV CU/XLPE/PVC 2-Core with ground ..... | 15       |
| Figure 6 – Cable drawing of 0.6/1 KV CU/XLPE/PVC 3-Core with ground ..... | 17       |
| Figure 7 – Cable drawing of 0.6/1 KV CU/XLPE/PVC 4-Core with ground ..... | 19       |
| Table 1 – Technical data of 0.6/1 KV CU/XLPE/PVC 1-Core .....             | 8        |
| Table 2 – Technical data of 0.6/1 KV CU/XLPE/PVC 2-Core .....             | 10       |
| Table 3 – Technical data of 0.6/1 KV CU/XLPE/PVC 3-Core .....             | 12       |
| Table 4 – Technical data of 0.6/1 KV CU/XLPE/PVC 4-Core .....             | 14       |
| Table 5 – Technical data of 0.6/1 KV CU/XLPE/PVC 2-Core with ground ..... | 16       |
| Table 6 – Technical data of 0.6/1 KV CU/XLPE/PVC 3-Core with ground ..... | 18       |
| Table 7 – Technical data of 0.6/1 KV CU/XLPE/PVC 4-Core with ground ..... | 20       |

## 1. SCOPE

This specification specifies the construction, dimensions and test requirements of electric cables which the manufacturer shall comply in order to supply copper conductor, XLPE insulation and PVC outer sheathed cables for 0.6/1 (1.2) kV rated voltage conforming to IEC60502-1.

## 2. REFERENCE STANDARDS

Except otherwise specified elsewhere in this specification, the cable shall be manufactured and tested in conformity with the latest edition of the standards listed below:-

IEC 60228, *Conductors of Insulated Cables*

IEC 60502-1, *Power cables with extruded insulation and their accessories for rated voltages from 1 kV ( $U_m = 1.2$  kV) up to 30 kV ( $U_m = 36$  kV) - Part 1: Cables for rated voltages of 1 kV ( $U_m = 1.2$  kV) and 3 kV ( $U_m = 3.6$  kV)*

## 3. DEFINITIONS

### 3.1 nominal cross-sectional area

value that identifies a particular size of conductor but is not subject to direct measurement

### 3.2 nominal value

value by which a quantity is designated; it is checked by measurements taking into account specified tolerances

### 3.3 approximate value

value which is only indicative; it is neither guaranteed nor checked

### 3.4 routine tests

tests made by the manufacturer on all production lengths of cable to demonstrate their integrity

### 3.5 sample tests

tests made on samples of completed cable or components taken from a completed cable, adequate to verify that the product meets the designed specifications

## 4. APPLICATION / SERVICE CONDITIONS

These cables are designed to be suitable for fixed installations in duct, conduit, ladder, tray and direct burial in ground.

The insulation and other components are capable of operation continuously at a maximum conductor temperature of 90°C for normal operation and 250°C for short circuit conditions.

## 5. CABLE CONSTRUCTION

The general construction of the cables is shown as cable drawing in Figure 1 to Figure 7 and consists of the followings

### 5.1 CONDUCTOR

The conductor shall be plain annealed copper. Conductor size up to 6 sq.mm. shall be concentric stranded circular construction and conductor size above 6 sq.mm. shall be compact stranded circular construction. All various conductor constructions shall be conformable to IEC 60228 Class 2. Minimum number of wires and diameter of conductor shall be complying with IEC 60228.

### 5.2 INSULATION

The insulation shall be cross-linked polyethylene (XLPE) whose properties meet electrical requirements, mechanical requirements and particular requirements specify in IEC 60502-1.

The average thickness of insulation shall be not less than the nominal value specified in Table 1 to Table 7. The minimum thickness shall not fall below 90% of the nominal value by more than 0.1 mm.

$$t_m \geq 0.9t_n - 0.1$$

where

$t_m$  is the minimum thickness (mm)

$t_n$  is the nominal thickness (mm)

### 5.3 CORE IDENTIFICATION

If there is not any other requirement specified in tender documents, each insulated core shall be identified by color as below

|                   |                             |
|-------------------|-----------------------------|
| 1-core:           | Natural XLPE color          |
| 2-core:           | Brown and Blue              |
| 3-core:           | Brown, Black, and Grey      |
| 4-core:           | Brown, Black, Grey and Blue |
| Ground core (PE): | Green with Yellow strip     |

## 5.4 CORE LAY UP

The insulated cores of multi-core cables shall be laid up together with left-hand lay. Fillers may be used to fill interstices of the multi-core cables where necessary to give the completed cable a substantially circular cross section.

Fillers shall be polypropylene filament or yarn or other non-hygroscopic materials that is suitable for the operating temperature of the cable and compatible with the insulating material. The suitable binding tape shall be applied over the laid up cores.

## 5.5 OVERSHEATH

The oversheath shall be an extruded layer of polyvinyl chloride (PVC) whose properties meet mechanical requirements and particular requirements of PVC sheath type ST2 specified in IEC 60502-1.

The nominal thicknesses of oversheath are specified in Table 1 to Table 7. The minimum thickness of oversheath shall not fall below 80% of the nominal value by more than 0.2 mm.

$$t_m \geq 0.80t_n - 0.2$$

where

$t_m$  is the minimum thickness (mm)

$t_n$  is the nominal thickness (mm)

The color of the oversheath shall be Black.

## 6. CABLE MARKING AND IDENTIFICATION

The oversheath of the cables shall be legibly marked with the following information throughout the length of the cables by printing method.

" 0.6/1 KV CV A X B + C SQ.MM., PHELPS DODGE "

Note A : specify the number of conductor

B : specify the nominal cross-sectional area of phase conductor

C : specify the nominal cross-sectional area of ground conductor (If require)

Sequential length number shall be marked on the oversheath of cable at 1 meter intervals.

## **7. TESTS AND INSPECTIONS**

### **7.1 ROUTINE TESTS**

The following routine tests shall be carried out in accordance with IEC 60502-1 on each manufactured length of cable.

- a) Measurement of the electrical resistance of conductors
- b) High voltage test

### **7.2 SAMPLE TESTS**

The following sample tests shall be carried out in accordance with IEC 60502-1. The number of test sample shall be in accordance with IEC 60502-1.

- a) Conductor examination
- b) Check of dimensions
  - i) measurement of thickness of insulation and non-metallic sheath
  - ii) measurement of external diameter
- c) Hot set test for XLPE insulation

## **8. PACKING AND LABELING**

The cable shall be packed on non-returnable wooden reel or returnable steel reel which covered with suitable covering to provide the cable with physical protection during storage and transportation.

Following description shall be marked on a flange of the reel.

- a) Direction of rotation of the reel
- b) Type of cable, Voltage grade
- c) Number of conductors and size
- d) Length
- e) Net weight
- f) Gross weight
- g) Manufacturer's name
- h) Year of manufacturing
- i) Reel No.

Each end of cable shall be hermetically sealed with cap.

ANNEX A - CABLE DRAWING AND TECHNICAL DATA

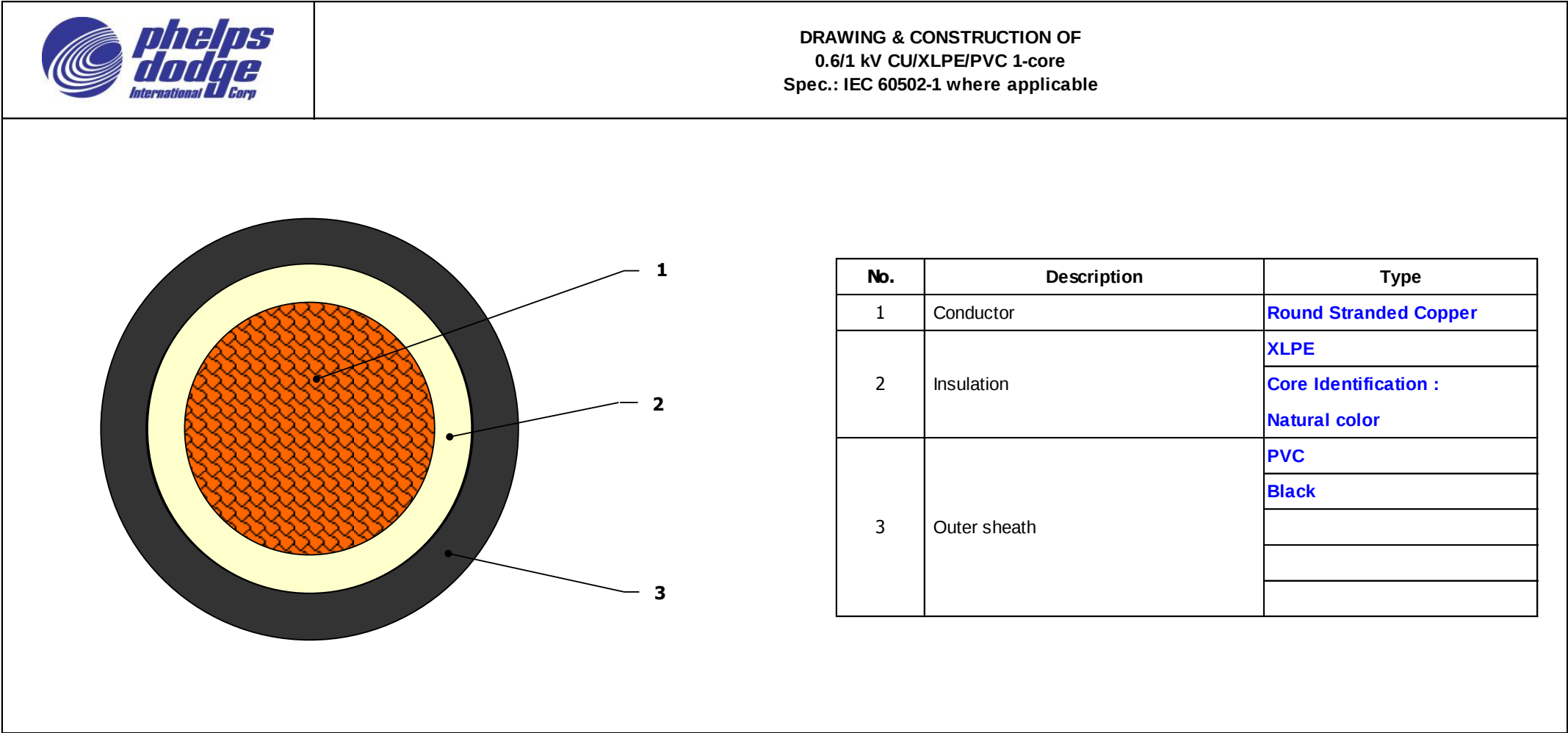


Figure 1 – Cable drawing of 0.6/1 KV CU/XLPE/PVC 1-Core

Table 1 – Technical data of 0.6/1 KV CU/XLPE/PVC 1-Core

| Description                             | unit    | 1 x 1.5    | 1 x 2.5    | 1 x 4      | 1 x 6      | 1 x 10     | 1 x 16     | 1 x 25     | 1 x 35     | 1 x 50     | 1 x 70     | 1 x 95     | 1 x 120    | 1 x 150    | 1 x 185    | 1 x 240    | 1 x 300    | 1 x 400    | 1 x 500    | 1 x 630    |
|-----------------------------------------|---------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| <b>Conductor material</b>               |         | Copper     | Copper     | Copper     | Copper     | Copper     | Copper     | Copper     | Copper     | Copper     | Copper     | Copper     | Copper     | Copper     | Copper     | Copper     | Copper     | Copper     | Copper     | Copper     |
| Class / Standard                        |         | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 |
| Diameter of Conductor (Approx.)         | mm      | 1.6        | 2.0        | 2.6        | 3.1        | 3.7        | 4.6        | 5.8        | 7.0        | 8.0        | 9.7        | 11.3       | 12.8       | 14.2       | 15.8       | 18.2       | 20.3       | 23.0       | 25.9       | 29.9       |
| <b>Insulation material</b>              |         | XLPE       | XLPE       | XLPE       | XLPE       | XLPE       | XLPE       | XLPE       | XLPE       | XLPE       | XLPE       | XLPE       | XLPE       | XLPE       | XLPE       | XLPE       | XLPE       | XLPE       | XLPE       | XLPE       |
| Insulation thickness (Nominal)          | mm      | 0.7        | 0.7        | 0.7        | 0.7        | 0.7        | 0.7        | 0.9        | 0.9        | 1.0        | 1.1        | 1.1        | 1.2        | 1.4        | 1.6        | 1.7        | 1.8        | 2.0        | 2.2        | 2.4        |
| Diameter over Insulation (Approx.)      | mm      | 3.1        | 3.5        | 4.0        | 4.6        | 5.2        | 6.1        | 7.7        | 8.9        | 10.1       | 12.0       | 13.6       | 15.3       | 17.1       | 19.1       | 21.8       | 24.1       | 27.2       | 30.5       | 34.9       |
| <b>Outer sheath material</b>            |         | PVC        | PVC        | PVC        | PVC        | PVC        | PVC        | PVC        | PVC        | PVC        | PVC        | PVC        | PVC        | PVC        | PVC        | PVC        | PVC        | PVC        | PVC        | PVC        |
| Outer sheath thickness (Nominal)        | mm      | 1.4        | 1.4        | 1.4        | 1.4        | 1.4        | 1.4        | 1.4        | 1.4        | 1.4        | 1.4        | 1.5        | 1.5        | 1.6        | 1.6        | 1.7        | 1.8        | 1.9        | 2.0        | 2.2        |
| Overall diameter (Approx.)              | mm      | 6          | 7          | 7          | 8          | 8          | 9          | 11         | 12         | 13         | 15         | 17         | 19         | 21         | 23         | 26         | 28         | 32         | 35         | 40         |
| Total cable weight (Approx.)            | kg/km   | 50         | 65         | 85         | 105        | 145        | 205        | 305        | 400        | 525        | 740        | 995        | 1245       | 1530       | 1890       | 2465       | 3060       | 3900       | 4960       | 6410       |
| Maximum conductor DC resistance at 20°C | Ohm/km  | 12.1       | 7.41       | 4.61       | 3.08       | 1.83       | 1.15       | 0.727      | 0.524      | 0.387      | 0.268      | 0.193      | 0.153      | 0.124      | 0.0991     | 0.0754     | 0.0601     | 0.0470     | 0.0366     | 0.0283     |
| Minimum Insulation Resistance at 20°C   | Mohm-km | 1021       | 842        | 698        | 591        | 514        | 421        | 430        | 367        | 357        | 326        | 284        | 274        | 287        | 294        | 273        | 260        | 256        | 250        | 238        |

# SPECIFICATION

## LOW VOLTAGE POWER CABLE 0.6/1(1.2) KV CU/XLPE/PVC (CV CABLE)

Copper Conductor, Cross-Linked Polyethylene Insulation  
and Polyvinyl Chloride Sheathed Cables

| REVISION | ISSUED DATE     |
|----------|-----------------|
| 03       | 9 November 2016 |

## CONTENTS

|                                                                           |          |
|---------------------------------------------------------------------------|----------|
| <b>1. SCOPE .....</b>                                                     | <b>3</b> |
| <b>2. REFERENCE STANDARDS .....</b>                                       | <b>3</b> |
| <b>3. DEFINITIONS .....</b>                                               | <b>3</b> |
| <b>4. APPLICATION / SERVICE CONDITIONS .....</b>                          | <b>3</b> |
| <b>5. CABLE CONSTRUCTION .....</b>                                        | <b>4</b> |
| 5.1 CONDUCTOR .....                                                       | 4        |
| 5.2 INSULATION .....                                                      | 4        |
| 5.3 CORE IDENTIFICATION .....                                             | 4        |
| 5.4 CORE LAY UP .....                                                     | 5        |
| 5.5 OVERSHEATH .....                                                      | 5        |
| <b>6. CABLE MARKING AND IDENTIFICATION .....</b>                          | <b>5</b> |
| <b>7. TESTS AND INSPECTIONS .....</b>                                     | <b>6</b> |
| 7.1 ROUTINE TESTS .....                                                   | 6        |
| 7.2 SAMPLE TESTS .....                                                    | 6        |
| <b>8. PACKING AND LABELING .....</b>                                      | <b>6</b> |
| <b>ANNEX A - CABLE DRAWING AND TECHNICAL DATA .....</b>                   | <b>7</b> |
| Figure 1 – Cable drawing of 0.6/1 KV CU/XLPE/PVC 1-Core .....             | 7        |
| Figure 2 – Cable drawing of 0.6/1 KV CU/XLPE/PVC 2-Core .....             | 9        |
| Figure 3 – Cable drawing of 0.6/1 KV CU/XLPE/PVC 3-Core .....             | 11       |
| Figure 4 – Cable drawing of 0.6/1 KV CU/XLPE/PVC 4-Core .....             | 13       |
| Figure 5 – Cable drawing of 0.6/1 KV CU/XLPE/PVC 2-Core with ground ..... | 15       |
| Figure 6 – Cable drawing of 0.6/1 KV CU/XLPE/PVC 3-Core with ground ..... | 17       |
| Figure 7 – Cable drawing of 0.6/1 KV CU/XLPE/PVC 4-Core with ground ..... | 19       |
| Table 1 – Technical data of 0.6/1 KV CU/XLPE/PVC 1-Core .....             | 8        |
| Table 2 – Technical data of 0.6/1 KV CU/XLPE/PVC 2-Core .....             | 10       |
| Table 3 – Technical data of 0.6/1 KV CU/XLPE/PVC 3-Core .....             | 12       |
| Table 4 – Technical data of 0.6/1 KV CU/XLPE/PVC 4-Core .....             | 14       |
| Table 5 – Technical data of 0.6/1 KV CU/XLPE/PVC 2-Core with ground ..... | 16       |
| Table 6 – Technical data of 0.6/1 KV CU/XLPE/PVC 3-Core with ground ..... | 18       |
| Table 7 – Technical data of 0.6/1 KV CU/XLPE/PVC 4-Core with ground ..... | 20       |

## 1. SCOPE

This specification specifies the construction, dimensions and test requirements of electric cables which the manufacturer shall comply in order to supply copper conductor, XLPE insulation and PVC outer sheathed cables for 0.6/1 (1.2) kV rated voltage conforming to IEC60502-1.

## 2. REFERENCE STANDARDS

Except otherwise specified elsewhere in this specification, the cable shall be manufactured and tested in conformity with the latest edition of the standards listed below:-

IEC 60228, *Conductors of Insulated Cables*

IEC 60502-1, *Power cables with extruded insulation and their accessories for rated voltages from 1 kV ( $U_m = 1.2$  kV) up to 30 kV ( $U_m = 36$  kV) - Part 1: Cables for rated voltages of 1 kV ( $U_m = 1.2$  kV) and 3 kV ( $U_m = 3.6$  kV)*

## 3. DEFINITIONS

### 3.1 nominal cross-sectional area

value that identifies a particular size of conductor but is not subject to direct measurement

### 3.2 nominal value

value by which a quantity is designated; it is checked by measurements taking into account specified tolerances

### 3.3 approximate value

value which is only indicative; it is neither guaranteed nor checked

### 3.4 routine tests

tests made by the manufacturer on all production lengths of cable to demonstrate their integrity

### 3.5 sample tests

tests made on samples of completed cable or components taken from a completed cable, adequate to verify that the product meets the designed specifications

## 4. APPLICATION / SERVICE CONDITIONS

These cables are designed to be suitable for fixed installations in duct, conduit, ladder, tray and direct burial in ground.

The insulation and other components are capable of operation continuously at a maximum conductor temperature of 90°C for normal operation and 250°C for short circuit conditions.

## 5. CABLE CONSTRUCTION

The general construction of the cables is shown as cable drawing in Figure 1 to Figure 7 and consists of the followings

### 5.1 CONDUCTOR

The conductor shall be plain annealed copper. Conductor size up to 6 sq.mm. shall be concentric stranded circular construction and conductor size above 6 sq.mm. shall be compact stranded circular construction. All various conductor constructions shall be conformable to IEC 60228 Class 2. Minimum number of wires and diameter of conductor shall be complying with IEC 60228.

### 5.2 INSULATION

The insulation shall be cross-linked polyethylene (XLPE) whose properties meet electrical requirements, mechanical requirements and particular requirements specify in IEC 60502-1.

The average thickness of insulation shall be not less than the nominal value specified in Table 1 to Table 7. The minimum thickness shall not fall below 90% of the nominal value by more than 0.1 mm.

$$t_m \geq 0.9t_n - 0.1$$

where

$t_m$  is the minimum thickness (mm)

$t_n$  is the nominal thickness (mm)

### 5.3 CORE IDENTIFICATION

If there is not any other requirement specified in tender documents, each insulated core shall be identified by color as below

|                   |                             |
|-------------------|-----------------------------|
| 1-core:           | Natural XLPE color          |
| 2-core:           | Brown and Blue              |
| 3-core:           | Brown, Black, and Grey      |
| 4-core:           | Brown, Black, Grey and Blue |
| Ground core (PE): | Green with Yellow strip     |

## 5.4 CORE LAY UP

The insulated cores of multi-core cables shall be laid up together with left-hand lay. Fillers may be used to fill interstices of the multi-core cables where necessary to give the completed cable a substantially circular cross section.

Fillers shall be polypropylene filament or yarn or other non-hygroscopic materials that is suitable for the operating temperature of the cable and compatible with the insulating material. The suitable binding tape shall be applied over the laid up cores.

## 5.5 OVERSHEATH

The oversheath shall be an extruded layer of polyvinyl chloride (PVC) whose properties meet mechanical requirements and particular requirements of PVC sheath type ST2 specified in IEC 60502-1.

The nominal thicknesses of oversheath are specified in Table 1 to Table 7. The minimum thickness of oversheath shall not fall below 80% of the nominal value by more than 0.2 mm.

$$t_m \geq 0.80t_n - 0.2$$

where

$t_m$  is the minimum thickness (mm)

$t_n$  is the nominal thickness (mm)

The color of the oversheath shall be Black.

## 6. CABLE MARKING AND IDENTIFICATION

The oversheath of the cables shall be legibly marked with the following information throughout the length of the cables by printing method.

" 0.6/1 KV CV A X B + C SQ.MM., PHELPS DODGE "

Note A : specify the number of conductor

B : specify the nominal cross-sectional area of phase conductor

C : specify the nominal cross-sectional area of ground conductor (If require)

Sequential length number shall be marked on the oversheath of cable at 1 meter intervals.

## **7. TESTS AND INSPECTIONS**

### **7.1 ROUTINE TESTS**

The following routine tests shall be carried out in accordance with IEC 60502-1 on each manufactured length of cable.

- a) Measurement of the electrical resistance of conductors
- b) High voltage test

### **7.2 SAMPLE TESTS**

The following sample tests shall be carried out in accordance with IEC 60502-1. The number of test sample shall be in accordance with IEC 60502-1.

- a) Conductor examination
- b) Check of dimensions
  - i) measurement of thickness of insulation and non-metallic sheath
  - ii) measurement of external diameter
- c) Hot set test for XLPE insulation

## **8. PACKING AND LABELING**

The cable shall be packed on non-returnable wooden reel or returnable steel reel which covered with suitable covering to provide the cable with physical protection during storage and transportation.

Following description shall be marked on a flange of the reel.

- a) Direction of rotation of the reel
- b) Type of cable, Voltage grade
- c) Number of conductors and size
- d) Length
- e) Net weight
- f) Gross weight
- g) Manufacturer's name
- h) Year of manufacturing
- i) Reel No.

Each end of cable shall be hermetically sealed with cap.

ANNEX A - CABLE DRAWING AND TECHNICAL DATA

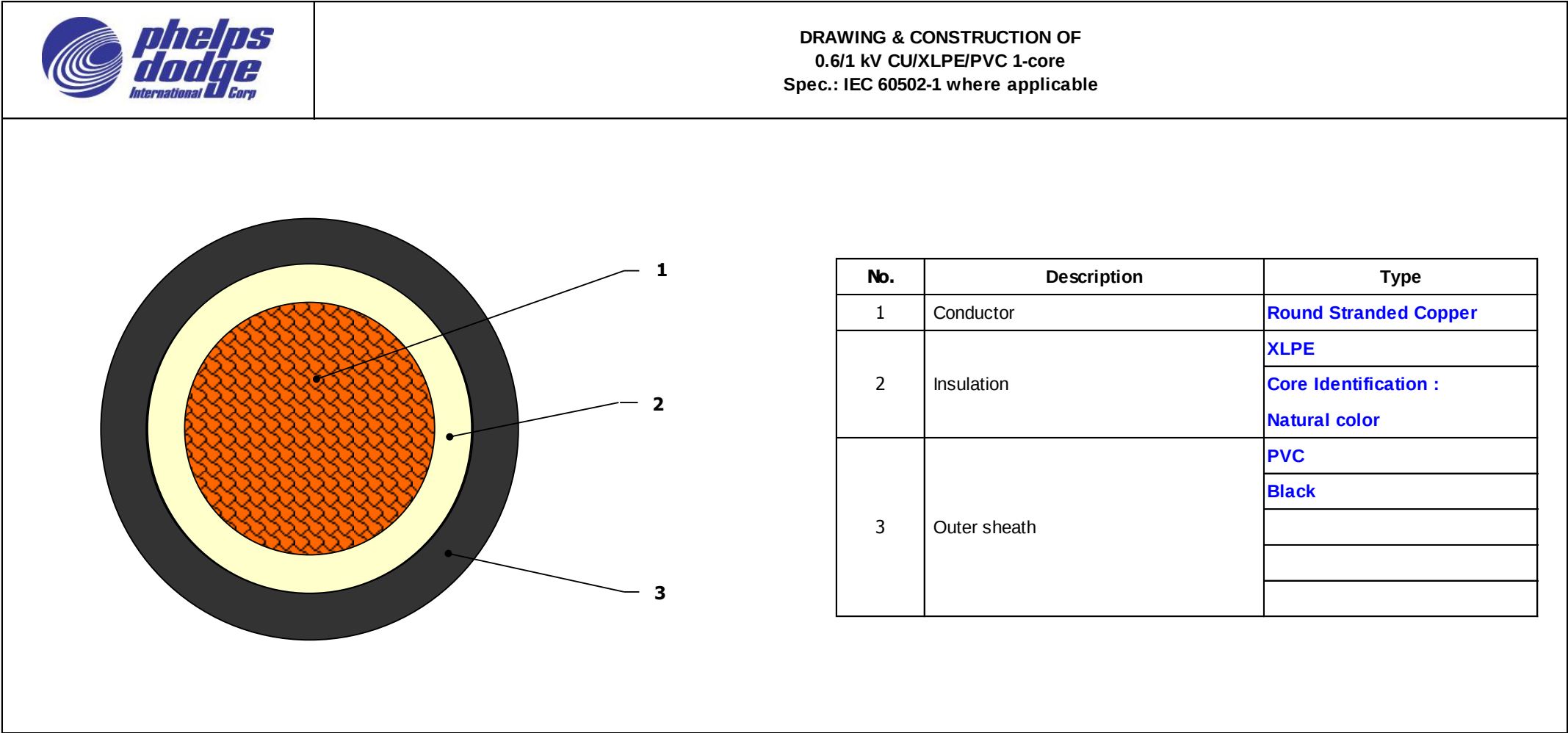


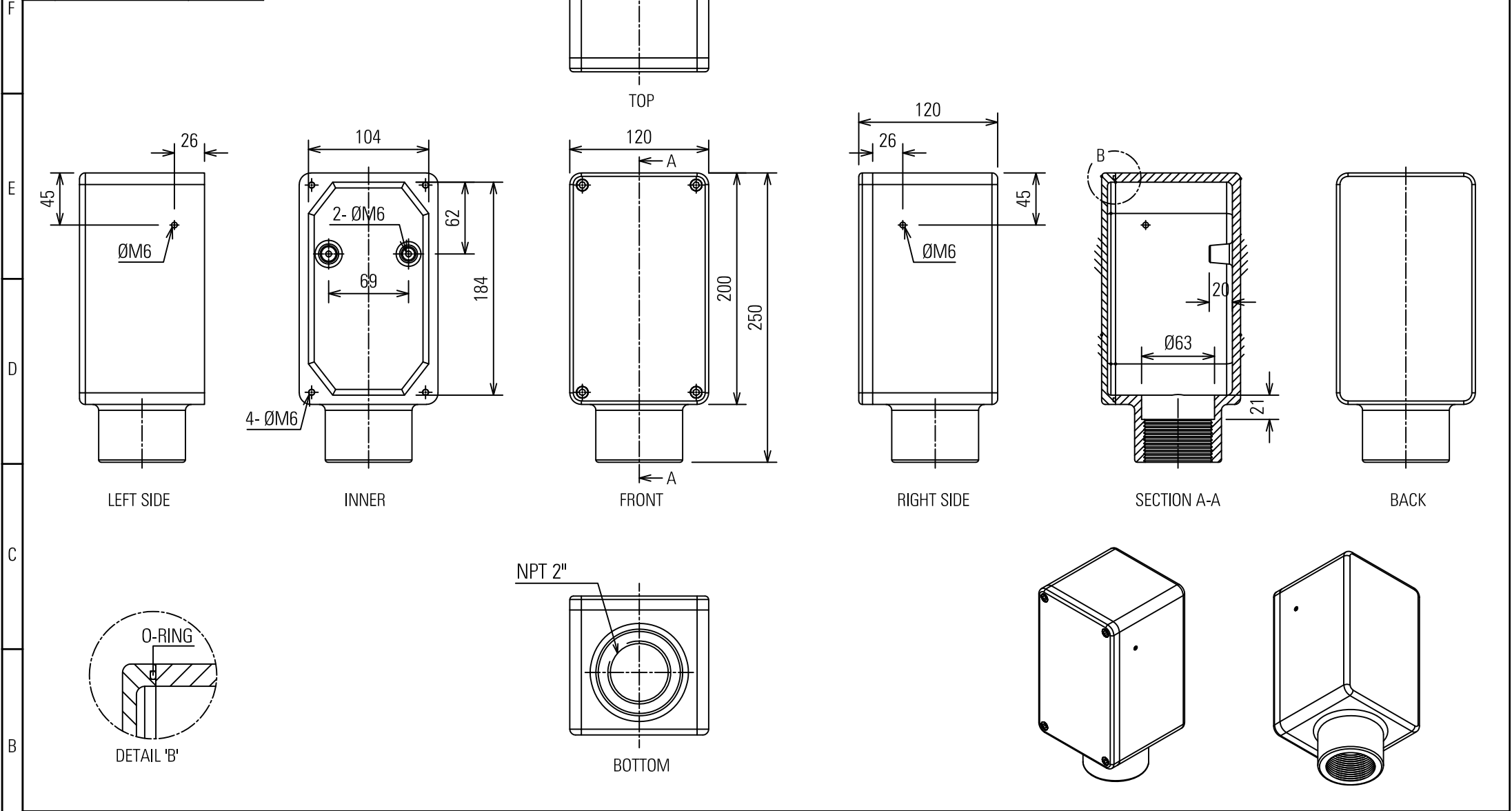
Figure 1 – Cable drawing of 0.6/1 KV CU/XLPE/PVC 1-Core

Table 1 – Technical data of 0.6/1 KV CU/XLPE/PVC 1-Core

| Description                             | unit    | 1 x 1.5    | 1 x 2.5    | 1 x 4      | 1 x 6      | 1 x 10     | 1 x 16     | 1 x 25     | 1 x 35     | 1 x 50     | 1 x 70     | 1 x 95     | 1 x 120    | 1 x 150    | 1 x 185    | 1 x 240    | 1 x 300    | 1 x 400    | 1 x 500    | 1 x 630    |
|-----------------------------------------|---------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| <b>Conductor material</b>               |         | Copper     | Copper     | Copper     | Copper     | Copper     | Copper     | Copper     | Copper     | Copper     | Copper     | Copper     | Copper     | Copper     | Copper     | Copper     | Copper     | Copper     | Copper     | Copper     |
| Class / Standard                        |         | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 | 2/IEC60228 |
| Diameter of Conductor (Approx.)         | mm      | 1.6        | 2.0        | 2.6        | 3.1        | 3.7        | 4.6        | 5.8        | 7.0        | 8.0        | 9.7        | 11.3       | 12.8       | 14.2       | 15.8       | 18.2       | 20.3       | 23.0       | 25.9       | 29.9       |
| <b>Insulation material</b>              |         | XLPE       | XLPE       | XLPE       | XLPE       | XLPE       | XLPE       | XLPE       | XLPE       | XLPE       | XLPE       | XLPE       | XLPE       | XLPE       | XLPE       | XLPE       | XLPE       | XLPE       | XLPE       | XLPE       |
| Insulation thickness (Nominal)          | mm      | 0.7        | 0.7        | 0.7        | 0.7        | 0.7        | 0.7        | 0.9        | 0.9        | 1.0        | 1.1        | 1.1        | 1.2        | 1.4        | 1.6        | 1.7        | 1.8        | 2.0        | 2.2        | 2.4        |
| Diameter over Insulation (Approx.)      | mm      | 3.1        | 3.5        | 4.0        | 4.6        | 5.2        | 6.1        | 7.7        | 8.9        | 10.1       | 12.0       | 13.6       | 15.3       | 17.1       | 19.1       | 21.8       | 24.1       | 27.2       | 30.5       | 34.9       |
| <b>Outer sheath material</b>            |         | PVC        | PVC        | PVC        | PVC        | PVC        | PVC        | PVC        | PVC        | PVC        | PVC        | PVC        | PVC        | PVC        | PVC        | PVC        | PVC        | PVC        | PVC        | PVC        |
| Outer sheath thickness (Nominal)        | mm      | 1.4        | 1.4        | 1.4        | 1.4        | 1.4        | 1.4        | 1.4        | 1.4        | 1.4        | 1.4        | 1.5        | 1.5        | 1.6        | 1.6        | 1.7        | 1.8        | 1.9        | 2.0        | 2.2        |
| Overall diameter (Approx.)              | mm      | 6          | 7          | 7          | 8          | 8          | 9          | 11         | 12         | 13         | 15         | 17         | 19         | 21         | 23         | 26         | 28         | 32         | 35         | 40         |
| Total cable weight (Approx.)            | kg/km   | 50         | 65         | 85         | 105        | 145        | 205        | 305        | 400        | 525        | 740        | 995        | 1245       | 1530       | 1890       | 2465       | 3060       | 3900       | 4960       | 6410       |
| Maximum conductor DC resistance at 20°C | Ohm/km  | 12.1       | 7.41       | 4.61       | 3.08       | 1.83       | 1.15       | 0.727      | 0.524      | 0.387      | 0.268      | 0.193      | 0.153      | 0.124      | 0.0991     | 0.0754     | 0.0601     | 0.0470     | 0.0366     | 0.0283     |
| Minimum Insulation Resistance at 20°C   | Mohm-km | 1021       | 842        | 698        | 591        | 514        | 421        | 430        | 367        | 357        | 326        | 284        | 274        | 287        | 294        | 273        | 260        | 256        | 250        | 238        |

| REV. | DESCRIPTION | DATE      |
|------|-------------|-----------|
| 0    | PRELIMINARY | 06-APR-21 |
|      |             |           |
|      |             |           |

| No. | PARTS          | MATERIAL                       | FINISHED                | REMARKS |
|-----|----------------|--------------------------------|-------------------------|---------|
| 1   | BODY AND COVER | FIBRE REINFORCED PLASTIC (FRP) | POLYESTER POWDER COATED | TBA     |
|     |                |                                |                         |         |
|     |                |                                |                         |         |



|   |                                                                                                                                                                                                                                               |                                                            |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|
| A | <div> <div> </div> <div> <div>TEXAS MANUFACTURING CO.,LTD.</div> <div>214/104 Arden Phatthakan, Soi Patthanakan 20, Patthanakan Rd., Suan Luang Sub District/District, Bangkok 10250 THAILAND</div> <div>www.TexasExp.com</div> </div> </div> | <div>PROJECT:</div> <div>OWNER:</div> <div>CUSTOMER:</div> |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|

## STOPAQ® CZH PASTE

### Product Information

**Generic type:** Non cross-linked, non-crystalline, special reinforced viscous polymer compound with cold flow-, self healing-, adhesive- and viscous-elastic properties. STOPAQ® CZH Paste is a non toxic, corrosion protective mastic sheet adhering extremely well to steel and line pipe coatings like PE, PP, FBE. It is fully resistant to water and has an extremely low gas- and water vapor permeability.

**Product description:** STOPAQ® CZH Paste is always viscous at the temperatures of use: -45°C up to +70°C (cold flow) and therefore flows into all irregularities on the substrate surface. The compound does not cure and is unable to build-up internal stresses. The mechanical resistance of the STOPAQ® CZH Paste can be improved by covering it with a protective layer of non-woven PP (Geotextile), prior to mechanical protection with STOPAQ® Outerwrap, Outerglass Shield, High Impact Shield or Polyester.

#### Features:

- Cold flow providing permanent inflow into the finest pores of the substrate
- Temperature resistance up to +70°C.
- Conforms to any shape
- Adherence created by Van der Waal's forces
- Low surface tension; adheres on all dry substrates at a molecular level
- Surface tolerant: no grit-blasting, only wire brushing or hand tool cleaning required
- Constant film thickness
- Chemically stable
- Inert and fully amorphous

#### Benefits:

- Harmless to environment and workers
- Easy to mould
- Can be modelled onto all irregular shaped objects
- No osmosis or under creep possible
- No cathodic disbondment
- CP function is not affected
- Guaranteed performance

### Application examples

**Flange protection:** For external corrosion protection and moulding of buried, immersed and above ground situated flange connections, Insulation flanges and flange seals.

**Valves:** For external corrosion protection and moulding around valves, integrated in pipeline systems. Shaped parts: For external corrosion protection of manhole covers, bolts & nuts.

**Cat-welds:** For protection of welded CP-wire connections on pipelines and other cathodic protected steel constructions.

**Coating repairs:** For filling of corrosion pits and voids, prior to application of general STOPAQ® surface coating.

### Product Properties\_STOPAQ® CZH Paste

|                                       |                                                                                                                                                                                           |
|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Colour</b>                         | Green                                                                                                                                                                                     |
| <b>Density</b>                        | 1,4 - 1,6g/cm <sup>3</sup> (NEN 1833)                                                                                                                                                     |
| <b>Elongation</b>                     | >100% (ASTM D 1000)                                                                                                                                                                       |
| <b>Moisture absorption</b>            | <0,03% (ASTM D 570)                                                                                                                                                                       |
| <b>Permeability</b>                   | >0,2g/m <sup>2</sup> /day (ASTM E 96)                                                                                                                                                     |
| <b>Temperature Ranges</b>             | Operation temp.:<br>• -45°C - +70°C<br>Short term Max:<br>• +85°C<br>Application temp. substrate:<br>• between -30°C and +70°C<br>Application temp. STOPAQ® CZH Paste:<br>• +5°C to +70°C |
| <b>Specific Electrical Resistance</b> | Rs > 10E+8 Ωxm <sup>2</sup> (EN 12068)                                                                                                                                                    |
| <b>Adhesion</b>                       | Tested at 23°C and 70°C (EN 12068)                                                                                                                                                        |
| <b>Salt spray resistance</b>          | Tested for 720h 5% NaCl at +85°C (ASTM B 117) No corrosion detected                                                                                                                       |

### Product Properties\_STOPAQ® CZH Paste / Geotextile + STOPAQ® Outerwrap

|                               |                                                                                                                                          |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Total Thickness</b>        | 23mm thickness                                                                                                                           |
| <b>Impact resistance</b>      | Tested at 15 J (EN 12068)<br>at -45°C : no holidays (< 5 min.)<br>at +23°C: no holidays (< 5 min.)<br>at +70°C: no holidays (< 120 min.) |
| <b>Indentation resistance</b> | 10N/mm <sup>2</sup> (EN 12068) at 23°C, no holidays (EN 12068) at 70°C, no holidays (<120 min.)                                          |

### General order information

|                  |                                                                         |
|------------------|-------------------------------------------------------------------------|
| <b>Product</b>   | STOPAQ® CZH Paste is available in sheets protected by siliconized foil. |
| <b>Packaging</b> | In boxes. 6 sheets per box – 288 per pallet.                            |
| <b>Handling</b>  | Handle with care. Keep the boxes upright.                               |
| <b>Storage</b>   | Indoor, clean and dry. No shelf-life.                                   |

| <b>Application instruction _Preparation</b>               |                                                                                                                                                                                                                                                                                                                                                                   | <b>Application instruction _Final steps</b>                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                               |
|-----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Application equipment</b>                              | 1. Temperature probe, Dew point meter and 20 kV holiday tester.)<br>2. Scissors, Putty knife.<br>3. Abrading pads and Wire brushes.<br>4. Safety goggles, Hard hat & Gloves.                                                                                                                                                                                      | <b>Visual inspection</b>                                                                                                                                                                                                                                                             | The applied Mouldable CZH Paste must look smooth and tight and should cover all details with a thickness not less than 20mm.                                                                                                                  |
| <b>High humidity</b>                                      | STOPAQ® CZH Paste can be applied in a humid atmosphere that does not reach the dew point.                                                                                                                                                                                                                                                                         | <b>Holiday detection</b>                                                                                                                                                                                                                                                             | Immediately after application of the Paste, a holiday testing should be carried out with a High Voltage test unit (15 - 25 kV). Test with minimum 15 kV. A brush probe is recommended. No further testing is required.                        |
| <b>Work area and substrate</b>                            | The work area and substrate should be protected against negative weather influences.                                                                                                                                                                                                                                                                              | <b>Application instruction _Mechanical protection</b>                                                                                                                                                                                                                                |                                                                                                                                                                                                                                               |
| <b>STOPAQ® conditions</b>                                 | The Mouldable CZH Paste should be dry and have a temperature, (min. +35°C) for the ease of shaping.                                                                                                                                                                                                                                                               | <b>Mechanical Protection</b>                                                                                                                                                                                                                                                         | The ready shaped paste layer should be protected against impact, soil pressure or other influences by means of a layer of woven geotextile and a wrap of STOPAQ® Outerwrap, or Polyester, starting and ending on the Border-zone wraps.       |
| <b>Application instruction _Surface Preparation</b>       |                                                                                                                                                                                                                                                                                                                                                                   | <b>Bringing into service</b>                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                               |
| <b>General</b>                                            | The areas to be coated have to be clean, dry, and free from grease and dust. All contamination including millscale has to be removed.                                                                                                                                                                                                                             | <b>Handling</b>                                                                                                                                                                                                                                                                      | Areas coated with STOPAQ® should not be exposed to loads from supports or lifting equipment.                                                                                                                                                  |
| <b>Degreasing Salts and Bacteria Condensation - water</b> | Degrease surfaces with isopropanol. No need for additional cleaning.                                                                                                                                                                                                                                                                                              | <b>Immersion / backfilling</b>                                                                                                                                                                                                                                                       | Immersion or burial is possible immediately after completion of the coating application. Backfill and compact with clean sand and fill material without sharp stones or hard lumps.                                                           |
| <b>Steel</b>                                              | Prior to - and during the application, the substrate(s) must be at least 3°C above the dew point.                                                                                                                                                                                                                                                                 | <b>STOPAQ® Information and Warranty</b>                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                               |
| <b>Bitumen</b>                                            | Surface preparation minimal St 2/3 according to ISO 8501-3. Roughness profile is not essential for adhesion. Remove loose bitumen. For immediate adhesion, make sure that the surface is clean and dry. Heating up the surface to 60°C might be recommended. Avoid the recoating of moisturous bitumen parts. See the Technical Standard for repair instructions. | <b>Documentation</b>                                                                                                                                                                                                                                                                 | Extensive information is available on our web-site. Detailed application instructions, "STOPAQ® Technical Standard" can be acquired from our head office or local distributor; <a href="mailto:info@stopaq.com">info@stopaq.com</a>           |
| <b>Other substrates</b>                                   | De-gloss and de-grease the surface by using an abrasive pad and isopropanol.                                                                                                                                                                                                                                                                                      | <b>Certified staff</b>                                                                                                                                                                                                                                                               | The application of STOPAQ® coating Systems should always be carried out by certified personnel.                                                                                                                                               |
| <b>Final control</b>                                      | Substrates prepared for coating, should be clean, dry and free of loose rust/coating and dust according to dust ISO 8502-3 – grade 3.                                                                                                                                                                                                                             | <b>Long term guarantee</b>                                                                                                                                                                                                                                                           | STOPAQ® offers a 30 year guarantee on the properties of the STOPAQ® CZH materials as described in this document. The lifetime of the STOPAQ® CZH materials is more than twice that period.                                                    |
| <b>Application instruction _ Application</b>              |                                                                                                                                                                                                                                                                                                                                                                   | <b>STOPAQ® Performance</b>                                                                                                                                                                                                                                                           | Extensive laboratory tests and more than 10 years of service in extreme wet and chemical aggressive environments have proven that Corrosion, Bacterial Growth or Stress Corrosion Cracking cannot develop on substrates, coated with STOPAQ®. |
| <b>Border zones</b>                                       | Apply wraps of 100mm wide STOPAQ® Wrappingband CZH in the border areas outside the planned Mouldable Paste CZH area.                                                                                                                                                                                                                                              |  <p><b>STOPAQ® Europe B.V.</b></p> <p>Gasselterstraat 20<br/>9503 JB Stadskanaal<br/>[T] +31 (0)599 696170<br/>[F] +31 (0)599 696177<br/><a href="http://www.stopaq.com">www.stopaq.com</a></p> |                                                                                                                                                                                                                                               |
| <b>Area covering and shaping</b>                          | Apply lumps of mouldable paste around the shaped objects. Press the paste. Avoid air enclosures. After modelling, the surface should be smooth with a shape suited for wrapping with the final outer wrap.                                                                                                                                                        |                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                               |
| <b>Reinforcing</b>                                        | In case the Mouldable CZH Paste layer thickness exceeds 20mm, it is recommended to apply a reinforcement interlayer web for stabilization.                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                               |

*DISCLAIMER: To the best of our knowledge, the technical data contained herein is true and accurate on the date of publication and is subject to change without prior notice. User must contact STOPAQ® Europe B.V. to verify correctness before specifying and ordering. No guarantee of accuracy is given or implied. We assume no responsibility for coverage, performance or injuries resulting from use. Liability, if any, is replacement of products. No other warranty or guarantee of any kind is made by STOPAQ Europe, express or implied, statutory, by operation of law, or otherwise, including merchantability and fitness for a particular purpose.*

*STOPAQ® is a registered trademark of STOPAQ® Europe B.V.*

## STOPAQ® OUTERWRAP PVC

### Product Information

**Generic type:** UV-resistant, flexible polyvinyl chloride tape, coated with a modified, pressure sensitive rubber resin adhesive.

**Product Description:** STOPAQ® Outer Wrap PVC is used for mechanical protection of corrosion protective systems, such as the STOPAQ® Wrappingband CZH and CZ. The Outer Wrap has high puncture and aging resistance. Is well suited for above-ground, under ground and submerged applications. The heavy-duty adhesive layer provides high adhesion strength to the outer surface of the STOPAQ® Wrappingband as well as to its own backing. The Outer Wrap has a good resistance to impacts and abrasion as well as resistance against the influences from alkalis and acids.

#### Features:

- Easy to apply
- Cold applied
- Good conformability
- Good adhesion to STOPAQ® Wrappingband as well as to its own backing
- Excellent impact resistance
- Wide temperature range for service

#### Benefits:

- Extremely well suited for hand application
- Easy to stretch and to apply for protection of STOPAQ® corrosion protected irregular shapes, such as valves, flanges, bends and tee's
- Resists impacts and indentations which may occur during installation and backfilling
- Very high resistance to ageing - even when exposed to max or min temperature for longer periods of time

### Mechanical Protection examples:

**Piping & Vessels:** STOPAQ® corrosion protected carbon steel pipelines (underground, above ground, immersed), structures and reservoirs.

**Field Joints:** STOPAQ® corrosion protected field-weld joints of pipelines, on-shore.

### Product Properties\_STOPAQ® Outer Wrap PVC

|                          |                                                                                                     |
|--------------------------|-----------------------------------------------------------------------------------------------------|
| <b>Colour</b>            | Black (matt finish)                                                                                 |
| <b>Thickness</b>         | Total: 0,5mm ± 0,055mm (ISO 9001)<br>(Backing: 0,45mm ± 0,045mm)                                    |
| <b>Temperature Range</b> | Application +10°C - +65°C<br>Service -45°C - +60°C<br>Application temp. Outerwrap:<br>+10°C - +60°C |
| <b>Adhesive strength</b> | 0,5 N/mm (at 23°C)<br>On STOPAQ® Wrappingband and on itself:                                        |
| <b>Operation temp.</b>   | - 45°C - +60°C                                                                                      |
| <b>Short term max.</b>   | Up to 85°C                                                                                          |
| <b>Tensile strength</b>  | > 10 kg/25mm                                                                                        |
| <b>Elongation</b>        | > 200%                                                                                              |

### Product Properties\_STOPAQ® Outer Wrap PVC on STOPAQ® Wrappingband CZH/CZ

|                               |                                                                                                                                         |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| <b>Total Thickness</b>        | 2,8mm - 3,2mm (ISO 9001)                                                                                                                |
| <b>Impact resistance</b>      | Tested at 15 J (EN 12068)<br>at -45°C: no holidays (< 5 min.)<br>at +23°C: no holidays (< 5 min.)<br>at +70°C: no holidays (< 120 min.) |
| <b>Indentation resistance</b> | 10N/mm <sup>2</sup> (EN 12068)<br>at 23°C, no holidays (< 5 min.)<br>at 70°C, no holidays (< 120 min.)                                  |

### General Order Information

|                        |                                                                                                                                                                                                                                                                                                                     |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Product</b>         | STOPAQ® Outer Wrap PVC is available in rolls Wide: 50mm (core ID 1 1/2"), 75, 100, and 150mm (core ID 3"), in 10m* or 30m lengths (* 50mm wide only).                                                                                                                                                               |
| <b>Packaging</b>       | Coiled on cardboard cores. Packed in cardboard boxes.                                                                                                                                                                                                                                                               |
| <b>Handling</b>        | Handle with care, keep the box always upright.                                                                                                                                                                                                                                                                      |
| <b>Storage</b>         | Indoor, dry and clean. Storage temperature not above 40°C for a long shelf-life.                                                                                                                                                                                                                                    |
| <b>Fire Resistance</b> | In case of special requirements for fire self-extinguishing properties, STOPAQ EUROPE B.V. can offer a special Outerwrap PVC on request containing this feature. This Outerwrap can be described as Self-Extinguishing when tested to the test method of BS EN 60454-2 Clause 19 - Resistance to Flame Propagation. |

**Application instruction Preparation**

|                                |                                                                                                                   |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------|
| <b>Application equipment</b>   | Scissors, knife, and measuring tape.                                                                              |
| <b>High humidity</b>           | STOPAQ® Outer Wrap PVC can be applied in a humid atmosphere that does not reach the dew point.                    |
| <b>Work area and substrate</b> | The work area and application surface should be dry and clean and protected against negative weather influences.  |
| <b>Tape conditions</b>         | STOPAQ® Outer Wrap PVC should be dry and have a temperature of 10°C to 30°C for the ease of handling and shaping. |

**Application instruction Short cut**

|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Wrapping</b> | <p>The STOPAQ® Outer Wrap PVC must be applied with little TENSION.</p> <p>Start the wrapping 3mm with one full circumferential wrap. Leave 3mm of STOPAQ® CZH visible. Then follow with spiral wrapping with minimum 50% overlap. Avoid air-enclosures.</p> <p>End full-circle overlap, Outer Wrap on Outer Wrap: minimum 300mm.</p> <p>Finish the wrapping 3mm inside the STOPAQ® Wrappingband with two straight, TENSIONLESS circumferential wrappings. Cut the tape end in a 45° angle at the downwards side with the longest tip pointing in the direction of the wrapped part.</p> |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**Application instruction Quality Control**

|                          |                                                                                                             |
|--------------------------|-------------------------------------------------------------------------------------------------------------|
| <b>Visual inspection</b> | The applied Outer Wrap must look smooth and tight and should be shaped around all details and into corners. |
|--------------------------|-------------------------------------------------------------------------------------------------------------|

**Bringing into service**

|                              |                                                                                                                                                                                                    |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Bringing into service</b> | Backfilling is possible immediately after completion of the coating application. The STOPAQ® coated, Outer Wrap protected areas should not be exposed to loads from supports and lifting equipment |
| <b>Backfilling</b>           | Backfill with clean sand without sharp stones or hard lumps of soil.                                                                                                                               |

**STOPAQ® Information**

|                        |                                                                                                                                                                                                                                         |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Documentation</b>   | Extensive information is available on our web-site. Detailed application instructions, "STOPAQ® Technical Standard" can be acquired from our head office and/or local distributor; <a href="mailto:info@stopaq.com">info@stopaq.com</a> |
| <b>Certified staff</b> | The application of STOPAQ® coating systems should always be carried out by certified personnel                                                                                                                                          |


**STOPAQ® Europe B.V.**

Gasselterstraat 20  
 9503 JB Stadskanaal  
 [T] +31 (0)599 696170  
 [F] +31 (0)599 696177  
[www.stopaq.com](http://www.stopaq.com)

*DISCLAIMER: To the best of our knowledge, the technical data contained herein is true and accurate on the date of publication and is subject to change without prior notice. User must contact Stopaq Europe B.V. to verify correctness before specifying and ordering. No guarantee of accuracy is given or implied. We assume no responsibility for coverage, performance or injuries resulting from use. Liability, if any, is replacement of products. No other warranty or guarantee of any kind is made by Stopaq Europe, express or implied, statutory, by operation of law, or otherwise, including merchantability and fitness' for a particular purpose.  
 Stopaq® is a registered trademark of Stopaq Europe B.V.*

## STOPAQ® WRAPPINGBAND CZH

### Product Information

**Generic type:** Universal, inert, amorphous, non-cross linked monolithic polymer wrap coating with cold flow, self-healing, viscous-elastic properties. STOPAQ® Wrappingband CZH is a non-toxic wrap material adhering extremely well to steel and line pipe coatings like PE, PP, FBE. It is fully resistant to water and has a very low gas- and watervapor permeability.

**Product Description:** STOPAQ® Wrappingband CZH is always viscous at the temperatures of use, -45°C up to +70°C (cold flow) and therefore flows, into all irregularities on the steel surface and is able to self-heal small damages like dents and cuts.

The STOPAQ® Wrappingband CZH impact resistance can be improved by covering it with a mechanical protective layer e.g. Outerwrap PVC, Outerwrap PE, High Impact Shield or Polyester.

#### Features:

- Cold flow providing permanent inflow into the finest pores of the substrate
- High temperature resistance up to +85°C max.
- Conforms to any shape
- Low surface tension; adheres on all dry substrates at a molecular level
- Very surface tolerant: no grit-blasting, only wire brushing or hand tool cleaning required
- Constant film thickness
- Non-crystalline
- Chemically stable
- Inert and amorphous

#### Benefits:

- Harmless to environment and workers
- Fast and easy to apply
- Easy to control during application
- Can be modeled on all irregular shape objects
- No osmosis or under creep problems possible
- No cathodic disbondment
- CP function is not affected by STOPAQ®
- Guaranteed performance

### Application examples

**Piping & Vessels:** Carbon steel large diameter pipelines (underground, above ground, immersed), structures and reservoirs.

**Field Joints:** Field-weld joints of pipelines, on-shore as well as offshore.

**Shaped parts:** Bends, Tee's, Flanges, Insulation flanges, Valves, Manhole Covers and Cat-welds.

**Repair coating:** Rehabilitation and repair of existing coating systems.

### Product Properties\_STOPAQ® Wrappingband CZH

|                                       |                                                                                                                                                                                  |
|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Colour</b>                         | Green                                                                                                                                                                            |
| <b>Thickness</b>                      | 1,8mm – 2,2mm (ISO 9001)                                                                                                                                                         |
| <b>Density</b>                        | 1,4 – 1,6g/cm3 (NEN 1833)                                                                                                                                                        |
| <b>Elongation</b>                     | > 100% (ASTM D 1000)                                                                                                                                                             |
| <b>Moisture absorption</b>            | < 0,03% (ASTM D 570)                                                                                                                                                             |
| <b>Permeability</b>                   | 0,2g/m2/day (ASTM E 96)                                                                                                                                                          |
| <b>Temperature Ranges</b>             | Operation temp.:<br>• -45°C up to +70°C<br>Short term max.:<br>• up to +85°C<br>Application temp. substrate:<br>• -30°C to +70°C<br>Application temp. STOPAQ®:<br>• +5°C to 70°C |
| <b>Specific Electrical Resistance</b> | Rs > 10 10 <sup>8</sup> Ohm x m2 (EN 12068)                                                                                                                                      |
| <b>Adhesion</b>                       | Tested at 23°C and 70°C (EN 12068)<br>No adhesive failure. (C-Steel, PE, PP and FBE: residual protective layer: > 0,5mm).                                                        |

|                              |                                                                 |
|------------------------------|-----------------------------------------------------------------|
| <b>Salt spray resistance</b> | Tested for 720h 5% NaCl 85°C (ASTM B 117) No corrosion detected |
|------------------------------|-----------------------------------------------------------------|

|                  |                   |
|------------------|-------------------|
| <b>Peel test</b> | Cohesive Fracture |
|------------------|-------------------|

### Product Properties\_STOPAQ® Wrappingband + STOPAQ® Outerwrap (50% Overlap)

|                                        |                                                                                                                                                |
|----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Total Thickness</b>                 | 2,8mm – 3,2mm (ISO 9001)                                                                                                                       |
| <b>Cathodic disbondment resistance</b> | Tested at 23°C and 70°C (EN 12068)<br>No disbondment observed.<br>Defect (Ø 6mm) self-healed within 1 day.                                     |
| <b>Impact resistance</b>               | Tested at 15 J (EN 12068 annex H)<br>At -45°C: no holidays (< 5 min.)<br>At +23°C: no holidays (< 5 min.)<br>At +70°C: no holidays (< 60 min.) |
| <b>Indentation resistance</b>          | 10 N/mm2 (EN 12068/ annex G)<br>At -45°C: no holidays (< 5 min.)<br>At +23°C: no holidays (< 5 min.)<br>At +70°C: no holidays (< 60 min.)      |
| <b>Self healing ability</b>            | Defect Ø 6mm<br>At +70°C: < 1day<br>At +23°C: < 1day<br>At -45°C: < 90days                                                                     |

### General Product Information

|                  |                                                                                                                                                                                                                                    |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Product</b>   | STOPAQ® Wrappingband CZH is available in boxes.                                                                                                                                                                                    |
| <b>Packaging</b> | 50mmx5m: 24 rolls – 576 per pallet<br>50mmx10m: 12 rolls – 360 per pallet<br>100mmx10m: 6 rolls – 180 per pallet<br>200mmx10m: 2 rolls – 96 per pallet<br>200mmx20m: 2 rolls – 96 per pallet<br>300mmx10m: 2 rolls – 64 per pallet |
| <b>Handling</b>  | Handle with care. Keep the rolls upright.                                                                                                                                                                                          |
| <b>Storage</b>   | Indoor, clean and dry. No shelf-life.                                                                                                                                                                                              |

**PRODUCT DATA SHEET | STOPAQ® WRAPPINGBAND CZH**
**Application instruction\_Preparation**

|                                |                                                                                                                                                                                     |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Application equipment</b>   | 1 Temperature probe, Dew point meter and 20 kV holiday tester.<br>2 Scissors, Knife, and Measuring tape.<br>3 Abrading pads and Wire brushes<br>4 Safety goggles, Hard hat & Gloves |
| <b>High humidity</b>           | STOPAQ® Wrappingband can be applied in a humid atmosphere that does not reach the dew point.                                                                                        |
| <b>Work area and substrate</b> | The work area and substrate should be protected against negative weather influences.                                                                                                |
| <b>STOPAQ® conditions</b>      | The Wrappingband CZH should be dry and have a temperature, (min. +5°C) for the ease of handling and shaping.                                                                        |

**Application instruction\_Surface Preparation**

|                             |                                                                                                                                                                                                                                                      |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>General</b>              | The areas to be coated have to be clean, dry, and free from grease and dust. All contamination has to be removed.                                                                                                                                    |
| <b>Degreasing</b>           | Degrease surfaces with Isopropanol.                                                                                                                                                                                                                  |
| <b>Salts and Bacteria</b>   | No need for additional cleaning.                                                                                                                                                                                                                     |
| <b>Condensation - water</b> | Prior to – and during the application, the temperature of the substrate(s) must be at least 3°C above the dew point.                                                                                                                                 |
| <b>Steel</b>                | Surface preparation minimal St2 – St3 according ISO 8501-3                                                                                                                                                                                           |
| <b>Bitumen repair</b>       | Remove loose bitumen. For immediate adhesion, make sure that the surface is clean and dry. Heating up the surface to 60°C might be recommended. Avoid the recoating of moisturous bitumen parts. See the Technical Standard for repair instructions. |
| <b>Other substrates</b>     | De-gloss and de-grease the surfaces by using an abrasive pad and isopropanol for faster adhesion.                                                                                                                                                    |
| <b>Final control</b>        | The substrates prepared for coating, should be clean, dry and free of dust according to dust grade ISO 8502-3, grade 3.                                                                                                                              |

**Application instruction\_Brief version**

|                                                              |                                                                                                                                                                                                                   |
|--------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Wrapping</b>                                              | Apply the sticky side of the Wrappingband on the substrate. Do not apply with TENSION, but LAY the Wrappingband on the substrate. Avoid air-enclosures. Massage the Wrappingband tight on the substrate surfaces. |
| <b>Release foil</b>                                          | Do not remove the release foil before application of the CZH. Remove only at the moment of adhesion of the CZH when applied to the surface.                                                                       |
| <b>Overlap of wrap</b>                                       | STOPAQ® on STOPAQ®: 10mm,<br>STOPAQ® on factory coated pipeline: 50mm.                                                                                                                                            |
| <b>Connection to- &amp; overlap on Bitumen</b>               | Apply STOPAQ® on the steel: Tight, shoulder to shoulder to the bitumen coating. Finally apply a 100mm wide sheet over the STOPAQ®/bitumen joint with 50mm overlap on each material.                               |
| <b>Overlap of ends of STOPAQ® wraps Spiral wrap on pipes</b> | STOPAQ® on STOPAQ®: < 50mm. Start with one, full straight wrapping, follow with one wrap from "straight to spiral" and then continue spiral wrapping. End with one straight, circumferential wrapping.            |

|                     |                                                                                                                                                             |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Field joints</b> | Two wide STOPAQ® Wrappingband CZH sheets are used. Each (straight) wrap should overlap the factory coating with min. 50mm and the weld seam with min. 30mm. |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|

**Application instruction\_Final steps**

|                           |                                                                                                                                                                                                                            |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Visual inspection</b>  | The applied Wrappingband CZH must look smooth and tight and should be shaped around all details and into corners.                                                                                                          |
| <b>Quality inspection</b> | Immediately after application, holiday testing can be carried out with a High Voltage test unit (15 – 25kV). Test with minimum 5kV per mm coating thickness. A brush probe is recommended. No further testing is required. |

**Application instruction\_Mechanical protection**

|                              |                                                                                                                                                                                          |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Mechanical protection</b> | Follow systems are available: Outerwrap PVC or PE, - Polyester, or – High Impact Shield (shrinkable). (see <a href="http://www.stopaq.com">www.stopaq.com</a> for separate PDS and MSDS) |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**Bringing into service**

|                              |                                                                                                                                                                                    |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Bringing into service</b> | Backfilling is possible immediately after completion of the coating application. The areas coated with STOPAQ® should not be exposed to loads from supports and lifting equipment. |
| <b>Backfilling</b>           | Backfill and compact with clean sand and fill material without sharp stones or hard lumps of soil.                                                                                 |

**STOPAQ® Information and Warranty**

|                            |                                                                                                                                                                                                                                               |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Documentation</b>       | Extensive information is available on our web-site. Application instructions, "STOPAQ® Technical Standard" can be required from our head office or local distributor;<br><b>info@stopaq.com</b>                                               |
| <b>Certified staff</b>     | The application of STOPAQ® CZH coating system should always be carried out by certified personnel.                                                                                                                                            |
| <b>STOPAQ® performance</b> | Extensive laboratory tests and more than 10 years of service in extreme wet and chemical aggressive environments have proven that Corrosion, Bacterial Growth or Stress Corrosion Cracking cannot develop on substrates, coated with STOPAQ®. |
| <b>Long term guarantee</b> | STOPAQ® offers a 30 year guarantee on the material properties of the STOPAQ® CZH materials as described in this document. The lifetime of the STOPAQ® CZH materials is more than twice this period. The product is NSF Certified.             |


**STOPAQ® Europe B.V.**

Gasselterstraat 20  
9503 JB Stadskanaal  
[T] +31 (0)599 696170  
[F] +31 (0)599 696177  
[www.stopaq.com](http://www.stopaq.com)

*DISCLAIMER: To the best of our knowledge, the technical data contained herein is true and accurate on the date of publication and is subject to change without prior notice. User must contact Stopaq Europe B.V. to verify correctness before specifying and ordering. No guarantee of accuracy is given or implied. We assume no responsibility for coverage, performance or injuries resulting from use. Liability, if any, is replacement of products. No other warranty or guarantee of any kind is made by Stopaq Europe, express or implied, statutory, by operation of law, or otherwise, including merchantability and fitness for a particular purpose.*

*Stopaq® is a registered trademark of Stopaq Europe B.V.*

## KB

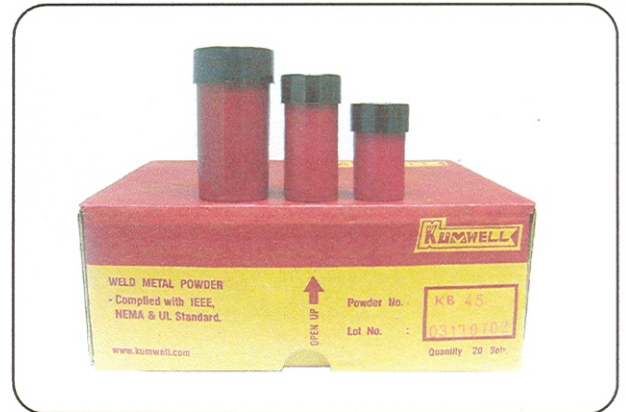
### WELD METAL POWDER

**“KUMWELL”** Exothermic welding powder **KB** type is special powder designed for cathodic protection and complied with many standard, such as

- NEMA PUB No. CC1 (Electric power connectors for substations)
- IEEE-STD. 837-1989 (Standard for qualifying permanent connections used in substation grounding)
- ANSI/UL 476-1984 (Grounding and bonding equipment)
- ANSI/ASME B 31.4-1988 (Pipe line Transportation systems for liquid hydrocarbons and other liquids)
- ANSI/ASME B 31.8-1999 (Gas transmission and distribution piping systems)

The KUMWELL exothermic welding process for cable to surface steel piping provides perfect connections which a fusion of high conductivity high copper content alloy it will withstand repeated fault currents, will not loosen in the way that mechanical connectors, can corrosion resistance too. and creat nil effect of weld process on the piping.

Cathodic protection mounds are capable to use up to 100 times.



| Code | kb 15 | kb 25 | kb 32 | kb 45 | kb 65 |
|------|-------|-------|-------|-------|-------|
| Size | 15 g. | 25 g. | 32 g. | 45 g. | 65 g. |



# TOOL & ACCESSORIES



KTA001



KTA002



KTA006



KTA007



KTA008



KTA014



KTA017



KTA018

## FOR CATHODIC MOULD

| CODE NO. | DESCRIPTION                  |
|----------|------------------------------|
| KTA001   | Tool Box 220 x 430 x 240 mm. |
| KTA002   | 8" File                      |
| KTA006   | Cable clean brush            |
| KTA007   | Mould brush                  |
| KTA008   | Scraper for #15              |
| KTA014   | Flint gun                    |
| KTA017   | Butane Torch                 |
| KTA018   | Hole brush                   |
|          |                              |
|          |                              |



# DAIRYLAND ELECTRICAL INDUSTRIES

ISOLATE. GROUND. PROTECT.

## PCRH DATA SHEET

The PCRH is a solid-state device designed to simultaneously provide DC decoupling and AC continuity/grounding when used with cathodically protected structures, such as pipelines, tanks, grounding systems, and cable casings. By decoupling the cathodic protection system from grounding systems and other structures, the CP requirements can be minimized, while maintaining an effective ground or bond rated for AC faults and lightning current. All Dairyland devices are maintenance-free, with no requirements for periodic service or testing. Differentiating it from the PCR, the PCRH line of products features explosion-proof construction certified for Zone 1, Group IIB, and Class I, Division 1 & 2, Groups B, C, D hazardous locations. The PCRH has been fully tested and listed by Underwriter's Laboratory (UL) to the US and Canadian standards, as well as to International standards ATEX and IECEx.

### Features:

- Fail-safe design assures bonding/grounding
- Certified for hazardous locations, electrical grounding
- Higher blocking voltage than polarization cells
- Inherent over-voltage protection provided to structure
- No maintenance or testing required

### Typical Applications:

- Insulated Joint Protection
- AC Voltage Mitigation
- Decoupling Electric Equipment Grounding Systems
- Decoupling From Utility Grounding Systems

### Why Fault Current Is Important:

Fault current exposure for the product relates to the ampacity, proximity and mode of current transfer from a faulting source (power transmission line, motor circuit, induction from overhead lines, etc.). Select a product rating that has reasonable margin above the site conditions. Contact DEI for any assistance with selection of appropriate ratings.

#### AC Fault Current Ratings (Amps AC-RMS Symmetrical)

| PCRH Model     | Rating at 30 Cycles |        |
|----------------|---------------------|--------|
|                | 60Hz                | 50Hz   |
| PCRH-3.7KA-XXX | 3,700               | 3,700  |
| PCRH-5KA-XXX   | 5,000               | 5,000  |
| PCRH-10KA-XXX  | 10,000              | 9,000  |
| PCRH-15KA-XXX  | 15,000              | 14,000 |

Note: For other models and options available, please visit

[www.dairyland.com](http://www.dairyland.com)

XXX = BCD for Div 1 versions

XXX = IECEx for Zone 1 versions

### Other Ratings and Certifications:

*Threshold Voltage*

-3/+1V (standard)

-2/+2V (optional)

*AC Steady-State Current (amperes - rms) 50/60Hz*  
45A

*Lightning Surge Current*

100kA crest (8 x 20 µs waveform)

*Environmental rating:*

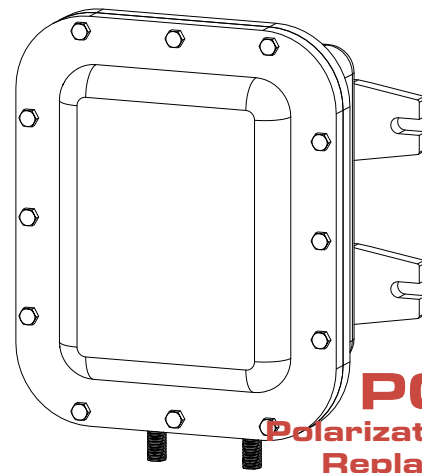
NEMA 4X (for Div 1 versions)

IP66 (for Zone 1 versions)

### Hazardous Location Certifications:

| Rating                                                  | Certification Agency |
|---------------------------------------------------------|----------------------|
| Class I, Division 1 & 2 Groups B, C, D,<br>Temp Code T5 | UL, C-UL             |
| Zone 1, Group IIB                                       | UL/DEMKO             |

For model numbers, options and accessories, see full technical literature at [www.dairyland.com](http://www.dairyland.com)



**PCRH**  
Polarization Cell  
Replacement