

LIST OF MATERIALS

Transmission (EHV Substation)

**Acceptable for Use on Systems of
SARAWAK ENERGY BERHAD**

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The items shown in this Transmission Approved Products List (TAPL) covers material and major equipment used for transmission substation. The list stipulated in this document supersedes all preceding issues including revisions. The updated documents shall be made available on SEB website.

Manufacturer who desire to have their items listed in the Transmission Approved Products List (TAPL) for transmission substation or wish to address any omission in the list, such as an obsolete item, etc, should address to: -

**Chief Executive Officer
Syarikat SESCO Berhad
A Subsidiary of Sarawak Energy Berhad
Menara Sarawak Energy
No. 1, The Isthmus, 93050 Kuching
Sarawak, MALAYSIA.
Tel : +6 082-388388
Fax : +6 082-341063**

Attention: Transmission APL [Vice-President, Transmission for Chief Executive Officer]

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1.0 SUBSTATION PRIMARY EQUIPMENTS

Where NOT specified as GIS, the equipment listed is defined for AIS substations.

1.1 500/275/33kV, 275/132/33kV, 275/33kV and 132/33kV Auto/Power Transformer

1.1.1 500/275/33kV Auto Transformer

| Manufacturer | Type / Catalogue / Model. No | Country of Manufacture |
|---|------------------------------|------------------------|
| ABB | - | Ludvika, Sweden |
| SIEMENS | - | Nuremberg, Germany |
| GE Grid Solutions | - | Kocaeli, Turkey |
| Fuji Electric Co., Ltd | - | Tokyo, Japan |
| Hyosung | - | Seoul, Korea |
| Hyundai Electric & Energy Systems Co., Ltd. | - | Ulsan, Korea |

1.1.2 275/132/33kV Auto Transformer

| Manufacturer | Type / Catalogue / Model. No | Country of Manufacture |
|---|------------------------------|----------------------------------|
| ABB | Up to 240 MVA | Thailand; Chongqing China |
| TBEA Shenyang Transformer Group Co | Up to 240 MVA | Shenyang, Lioing Province, China |
| SPECO | Up to 240MVA | Shangdong, China |
| PT Elsewedy Electric Indonesia* | Up to 240MVA | Bogor, Indonesia |
| Hyundai Electric & Energy Systems Co., Ltd. | Up to 240MVA | Ulsan, Korea |
| Siemens | Up to 240MVA | Jinan, China |
| Nantong Hyosung | Up to 240MVA | Nantong, China |
| BALIKESİR ELEKTROMEKANİK SANAYİ TESİSLERİ A.Ş. (BEST A.S.) | Up to 240MVA | Balikesir, Turkey |
| *Defect liability period further extended to another 3 years by OEM after completion of the main contract. | | |

1.1.3 275/33kV Power Transformer

| Manufacturer | Type / Catalogue / Model. No | Country of Manufacture |
|---|------------------------------|----------------------------------|
| Meidensha | Up to 120 MVA | Japan |
| ABB | Up to 120 MVA | Thailand; Chongqing China |
| TBEA Shenyang Transformer Group Co | Up to 120 MVA | Shenyang, Lioing Province, China |
| SPECO | Up to 120MVA | Shangdong, China |
| PT Elsewedy Electric Indonesia* | Up to 120 MVA | Bogor, Indonesia |
| Nantong Hyosung | Up to 120MVA | Nantong, China |
| Hyundai Electric & Energy Systems Co., Ltd. | Up to 120 MVA | Ulsan, Korea |
| Siemens | Up to 120MVA | Jinan, China |
| BALIKESİR ELEKTROMEKANİK SANAYİ TESİSLERİ A.Ş. (BEST A.S.) | Up to 120MVA | Balikesir, Turkey |
| *Defect liability period further extended to another 3 years by OEM after completion of the main contract. | | |

1.1.4 132/33kV Power Transformer

| Manufacturer | Type / Catalogue / Model. No | Country of Manufacture |
|---|------------------------------|----------------------------------|
| ABB | Up to 120 MVA | Samutprakarn, Thailand |
| TBEA Shenyang Transformer Group Co | Up to 120 MVA | Shenyang, Lioing Province, China |
| Tirathai | Up to 120 MVA | Samutprakarn, Thailand |
| Meidensha | Up to 80 MVA | Japan |
| ABB | Up to 80 MVA | Chongqing China |
| Daihen | Up to 80 MVA | Thailand |
| SPECO | Up to 120MVA | Shangdong, China |
| PT Elsewedy Electric Indonesia* | Up to 80 MVA | Bogor, Indonesia |
| Hyundai Electric & Energy Systems Co., Ltd. | Up to 80 MVA | Ulsan, Korea |
| Siemens | Up to 120MVA | Jinan, China |
| Nantong Hyosung | Up to 120MVA | Nantong, China |
| Shihlin Electric and Engineering Corporation | Up to 120MVA | HsinChu, Taiwan |
| Tatung Co. | Up to 120 MVA | Taoyuan, Taiwan |
| BALIKESİR ELEKTROMEKANİK SANAYİ TESİSLERİ A.Ş. (BEST A.S.) | Up to 120 MVA | Balikesir, Turkey |
| *Defect liability period further extended to another 3 years by OEM after completion of the main contract. | | |

1.2 500kV and 275kV Shunt Reactor

1.2.1 500kV Shunt Reactor

| Manufacturer | Type / Catalogue / Model. No | Country of Manufacture |
|---|------------------------------|------------------------|
| ABB | - | Ludvika, Sweden |
| SIEMENS | - | Nuremberg, Germany |
| GE Grid Solutions | - | Kocaeli, Turkey |
| Fuji Electric Co., Ltd | - | Tokyo, Japan |
| Hyosung | - | Seoul, Korea |
| Hyundai Electric & Energy Systems Co., Ltd. | - | Ulsan, Korea |

1.2.2 275kV Shunt Reactor

| Manufacturer | Type / Catalogue / Model. No | Country of Manufacture |
|--|-------------------------------------|----------------------------------|
| ABB | - | Chongqing China |
| Crompton Greave | - | India |
| TBEA Shenyang Transformer Group Co | - | Shenyang, Lioing Province, China |
| Hyundai Electric & Energy Systems Co., Ltd. | - | Ulsan, Korea |
| BALIKESİR ELEKTROMEKANİK SANAYİ TESİSLERİ A.Ş. (BEST A.S.) | - | Balikesir, Turkey |

1.2.3 33kV Shunt Reactor

| Manufacturer | Type / Catalogue / Model. No | Country of Manufacture |
|--|-------------------------------------|----------------------------------|
| ABB | - | Chongqing China |
| Crompton Greave | - | India |
| TBEA Shenyang Transformer Group Co | - | Shenyang, Lioing Province, China |
| Hyundai Electric & Energy Systems Co., Ltd. | - | Ulsan, Korea |
| BALIKESİR ELEKTROMEKANİK SANAYİ TESİSLERİ A.Ş. (BEST A.S.) | - | Balikesir, Turkey |

1.3 Circuit Breaker

1.3.1 500kV Circuit Breaker

| Manufacturer | Type / Catalogue / Model. No | Country of Manufacture |
|--|------------------------------|------------------------------|
| Siemens* | 3AP series | Berlin, Germany |
| ABB* | HPL series | Ludvika, Sweden |
| GE Grid Solutions* | GL317 series | Boulogne Billancourt, France |
| *Circuit breaker shall be spring operated mechanisms. | | |

1.3.2 275kV Circuit Breaker

| Manufacturer | Type / Catalogue / Model. No | Country of Manufacture |
|--|------------------------------|------------------------|
| Siemens* | 3AP series | Germany / India |
| ABB* | HPL series | Sweden / Beijing China |
| GE Grid Solutions* | GL314 series | France / Suzhou China |
| *Circuit breaker shall be spring operated mechanisms. | | |

1.3.3 132kV Circuit Breaker

| Manufacturer | Type / Catalogue / Model. No | Country of Manufacture |
|--|------------------------------|------------------------|
| Siemens* | 3AP series | Germany / India |
| ABB* | LTB series | Sweden / Beijing China |
| GE Grid Solutions* | GL312 series | Germany / Suzhou China |
| *Circuit breaker shall be spring operated mechanisms. | | |

1.4 500kV, 275kV and 132kV Isolator

1.4.1 500kV Isolator

| Manufacturer | Type / Catalogue / Model. No | Country of Manufacture |
|-------------------|------------------------------|------------------------|
| Coelme | STC series | Venezia, Italy |
| GE Grid Solutions | S3CD series | VE, Italy |
| Hapam | SSBIII series | The Netherland |

1.4.2 275kV and 132kV Isolator

| Manufacturer | Type / Catalogue / Model. No | Country of Manufacture |
|-------------------|------------------------------|------------------------|
| Coelme | CBD series | Venezia, Italy |
| GE Grid Solutions | S2DA series | VE, Italy |
| Hapam | SBII series | The Netherland |

1.5 500kV, 275kV and 132kV Current Transformer

1.5.1 500kV Current Transformer

| Manufacturer | Type / Catalogue / Model. No | Country of Manufacture |
|-------------------|------------------------------|------------------------|
| ABB | IMB series | Ludvika, Sweden |
| GE Grid Solutions | OSKF series | Kassel, Germany |
| Trench | IOSK series | SV, Italy |
| Arteche | CA series | Viscaya, Spain |

1.5.2 275kV and 132kV Current Transformer

| Manufacturer | Type / Catalogue / Model. No | Country of Manufacture |
|---|------------------------------|-----------------------------------|
| ABB | IMB series | Ludvika, Sweden |
| GE Grid Solutions | OSKF series | Brazil |
| Trench | IOSK series | SV, Italy |
| Trench High Voltage Products Ltd., Shenyang | IOSK series | Shenyang, China |
| TBEA Shenyang Transformer Group Co | AGU series (132kV only) | Shenyang, Lioning Province, China |
| GE Grid Solutions | OSKF series | Tamil Nadu, India |
| Emek Elektrik Endrustri A.S | AT series | Ankara, Turkey |
| Arteche High Voltage Instrument Transformer | CA series (132kV only) | Dalian Liaoning Province, China |

1.6 500kV, 275kV and 132kV Capacitor Voltage Transformer

1.6.1 500kV Capacitor Voltage Transformer

| Manufacturer | Type / Catalogue / Model. No | Country of Manufacture |
|-------------------|------------------------------|------------------------|
| ABB | CPB series | Ludvika, Sweden |
| GE Grid Solutions | OTCF series | Charleroi Pa, USA |
| Trench | TCVT series | SV, Italy |
| Arteche | DFK series | Viscaya, Spain |

1.6.2 275kV and 132kV Capacitor Voltage Transformer

| Manufacturer | Type / Catalogue / Model. No | Country of Manufacture |
|--------------------------------|------------------------------|------------------------|
| ABB | CPB series | Ludvika, Sweden |
| GE Grid Solutions | OTCF series | Charleroi Pa, USA |
| Trench | TCVT series | SV, Italy |
| GE Grid Solutions | CCV series | Tamil Nadu, India |
| Emek Elektrik Endrustri A.S | KGT series | Ankara, Turkey |

1.7 500kV, 275kV, 132kV and 33kV Surge Arrester

1.7.1 500kV Surge Arrester

| Manufacturer | Type / Catalogue / Model. No | Country of Manufacture |
|--------------|------------------------------|------------------------|
| Siemens | 3EP / 3EQ series | Berlin, Germany |
| ABB | EXLIM / TEXLIM series | Ludvika, Sweden |
| Tridelta | SB / SBKT series | Hermsdorf, Germany |

1.7.2 275kV, 132kV and 33kV Surge Arrester

| Manufacturer | Type / Catalogue / Model. No | Country of Manufacture |
|--------------|--|-------------------------|
| Siemens | 3EP series | Berlin, Germany |
| ABB | EXLIM series | Ludvika, Sweden |
| Hubbell | MH series | USA |
| Tridelta | SB series | Hermsdorf, Germany |
| Xi'AN XD | Y20W Series Y10W Series Y5W Series | Shaanxi Province, China |

1.8 500kV, 275kV, 132kV and 33kV Connector

1.8.1 500kV Connector

| Manufacturer | Type / Catalogue / Model. No | Country of Manufacture |
|--------------|------------------------------|------------------------|
| PLP Subcon | - | Dornbirn, Austria |
| Lorünser | - | Schlins, Austria |
| Arruti | - | Bizkaia, Spain |

1.8.2 275kV, 132kV and 33kV Connector

| Manufacturer | Type / Catalogue / Model. No | Country of Manufacture |
|-------------------|------------------------------|------------------------|
| Tyco Simel | - | France |
| PLP Subcon | - | Dornbirn, Austria |
| GE Grid Solutions | - | VE, Italy |
| Lorünser | - | Schlins, Austria |
| Arruti | - | Bizkaia, Spain |

1.9 33kV Neutral Earthing Resistor

| Manufacturer | Type / Catalogue / Model. No | Country of Manufacture |
|--------------|------------------------------|------------------------|
| Powercap | - | Malaysia |
| AnyOhm | - | Malaysia |
| Pestech | - | Malaysia |

1.10 275kV and 132kV Cable Accessories

| Manufacturer | Type / Catalogue / Model. No | Country of Manufacture |
|------------------------------|--|------------------------|
| Pfisterer | All types (132kV & 275kV) | Switzerland |
| Taihan Electric Wire Co. Ltd | 132kV Outdoor Termination 132kV GIS Termination 132kV Plug-In Type GIS Termination 132kV Insulation Joint 132kV Straight Through Joint | Gyeonggi-do, Korea |
| G&W (Shanghai) Electric Ltd | 132kV Porcelain Outdoor Termination (PAT 140) 132kV Premolded Rubber Joint (PMJ 140) | Shanghai, China |

1.11 275kV and 132kV Capacitor Units and Capacitor Banks

| Manufacturer | Type / Catalogue / Model. No | Country of Manufacture |
|-------------------|------------------------------|------------------------|
| Siemens | - | Brazil |
| GE Grid Solutions | - | Finland |
| ABB | - | Xi'an China |

1.12 145kV Gas Insulated Switchgears

| Manufacturer | Type / Catalogue / Model. No | Country of Manufacture |
|---|------------------------------|------------------------|
| GE Grid Solutions | F35 | Suzhou, China |
| ABB | ELK-04 | Xiamen, China |
| Hyundai Electric & Energy Systems Co., Ltd. | 145SP | Ulsan, Korea |
| Hyosung | HSG-144 | Changwon, Korea |
| Siemens | 8DN8 | Shanghai, China |

1.13 275kV Gas Insulated Switchgears

| Manufacturer | Type / Catalogue / Model. No | Country of Manufacture |
|---|------------------------------|------------------------|
| Siemens | 8DQ1 | Berlin, Germany |
| GE Grid Solutions | B105 | Aix-les-Bains, France |
| ABB | ELK-14 | Zürich, Switzerland |
| Hyundai Electric & Energy Systems Co., Ltd. | 550SR | Ulsan, Korea |

1.14 500kV Gas Insulated Switchgears

| Manufacturer | Type / Catalogue / Model. No | Country of Manufacture |
|---|------------------------------|--------------------------------------|
| Siemens | 8DQ1 | Berlin, Germany/ Shanghai China |
| GE Grid Solutions | T155 | Aix-les-Bains, France/ Suzhuo, China |
| ABB | ELK-3 | Zürich, Switzerland/ Xiamen China |
| Hyundai Electric & Energy Systems Co., Ltd. | 550SR | Ulsan, Korea |
| Hyosung | 550HSG | Changwon, Korea |

1.15 DC System

| Manufacturer | Type / Catalogue / Model. No | Country of Manufacture |
|--|------------------------------|---------------------------|
| AEG Power Solutions | - | Singapore |
| Sunpower Technologies Sdn. Bhd | - | Negeri Sembilan, Malaysia |
| PMI Elektrik ve Elektronik Sistemleri Dis. Tic. Ltd. Sti | - | Ankara, Turkey |
| Nimac Power System (M) Sdn Bhd | NPT Series | Selangor, Malaysia |

| | | |
|---------|-------------|-------------------------|
| STATRON | BDTe Series | Petaling Jaya, Malaysia |
|---------|-------------|-------------------------|

1.16 500kV, 275kV, 132kV and 33kV Post Insulator

1.16.1 500kV Post Insulator

| Manufacturer | Type / Catalogue / Model. No | Country of Manufacture |
|---|------------------------------|------------------------|
| NGK | C16-1800 | Tokyo, Japan |
| LAPP | C16-1800 II | Wunsiedel, Germany |
| PPC Insulators | C16-1800 | Nove Sady, Slovakia |
| Suzhou Porcelain Insulator Works Co., Ltd | C16-1800 | Weiting Town, China |

1.16.2 275kV, 132kV and 33kV Post Insulator

| Manufacturer | Type / Catalogue / Model. No | Country of Manufacture |
|---|-------------------------------|------------------------|
| NGK | C10-325 C8-650 C16-1175 | Tokyo, Japan |
| LAPP | C10-325 C8-650 C16-1175 | Wunsiedel, Germany |
| PPC Insulators | C10-325 C8-650 C16-1175 | Nove Sady, Slovakia |
| Modern Insulator Limited | C8-650 (132kV only) | Rajasthan, India |
| Suzhou Porcelain Insulator Works Co., Ltd | C10-170 C8-650 C16-1050 | Weiting Town, China |

APPENDIX A – STL MEMBERS LABORATORIES

| STL Member | Member Laboratories | Country |
|------------------------|---|----------------------------|
| Intertek (ASTA) | Testing & Certification Australia Lane Cove Testing Station | Sydney, Australia |
| KEMA | KEMA Testing, Inspections & Certification High Power Laboratory | AR Arnhem, The Netherlands |
| | KEMA Testing, Inspections & Certification KEMA High-Voltage Laboratory | AR Arnhem, The Netherlands |
| | KEMA Testing, Inspections & Certification KEMA – Powertest Inc | Chalfont, USA |
| CESI | CESI Centro Elettrotecnico Sperimentale Italiano S.p.A. | Milano MI, Italy |
| | Institut “Prieffeld fur elektrische Hochleitungstechnik” GmbH (IPH) | Berlin, Germany |
| | | |

| | | |
|--------------|--|----------------------------|
| | FGH Engineering & Test GmbH | Mannheim, Germany |
| KERI | High Power High Voltage Testing & Evaluation Division in Main Office | Gyeongsangnam, South Korea |
| | Power Apparatus Testing & Evaluation Division in Ansan office Korea Electrotechnology Research Institute | Gyeonggi-do, South Korea |
| CPRI | Central Power Research Institute Central Research & Testing Laboratory (CRTL) | Bangalore, India |
| | Central Power Research Institute Switchgear Testing & Development Station (STDS) | Bhopal, India |
| | Central Power Research Institute UHV Research Laboratory (UHVRL) | Hyderabad, India |
| PEHLA | ABB Switzerland Ltd. High Voltage Products and Components, Dept. PTHX | Baden, Switzerland |
| | High-Voltage Institute Kassel | Kassel, Germany |

| | | |
|-------------|--|-------------------------------|
| | GE Grid Solutions GmbH | |
| | ABB AG Calor Emag Medium Voltage Products | Ratingen, Germany |
| | FGH Engineering & Test GmbH | Mannheim, Germany |
| | Institut „Prueffeld fur elektrische Hochleistungstechnik“ GmbH (IPH) | Berlin, Germany |
| | Siemens AG | Berlin, Germany |
| | Siemens AG | Frankfurt am Main, Germany |
| SATS | ABB AB | Ludvika, Sweden |
| | STRI AB | Ludvika, Sweden |
| | NEXANS Norway AS | Halden, Norway |
| | NEFI | Skien, Norway |
| ESEF | Laboratoires des Matériels Electriques (LME), Site des Renardieres, EDF-R&D-LME | Moret-sur-Loing Cedex, France |
| | Centre d'Essais Rhodanien De l'Appareillage, CERDA, GE Grid Solutions | Villeurbanne Cedex, France |

| | | |
|--------------|---|--------------------------|
| | L2E VOLTA, Schneider Electric Industries SAS | Grenoble Cedex 9, France |
| JSTC | Central Research Institute of Electric Power Industry CRIEPI | Kanagawa, Japan |
| | Japan AE Power Systems Corp. Kokubu High Power Laboratory 1-1, Kokubu-cho | Ibaragi, Japan |
| | Japan AE Power Systems Corp. Numazu High Power Laboratory | Shizuoka, Japan |
| | Mitubishi Electric Corp. High Voltage & High Power Testing Laboratories | Hyogo, Japan |
| | High Voltage and High Power Testing Laboratory Nissin Electric Co., Ltd | Kyoto, Japan |
| | Toshiba Corp. Hamakawasaki High Voltage and High Power Testing Laboratory | Kanagawa, Japan |
| STLNA | Powertech Laboratories Inc. | British Columbia, Canada |
| | | Franksville, USA |

| | | |
|------------------|---|----------------------|
| | Cooper Power Systems – High Power Lab | |
| | KEMA PowerTest Inc. | Chalfont, USA |
| | Eaton Corp. | Pittsburgh, USA |
| | LAPEM-CFE | Irapuato, GTO Mexico |
| | S&C Electric Company | Chicago, USA |
| | AREVA T&D BRASIL | Minas Gerais, Brasil |
| VEIKI-VNL | VEIKI-VNL Electric Large laboratories Ltd | Budapest, Hungary |
| ZKU | ZKU, Zkušebnictví, a.s. Czech Republic | Czech Republic |
| | ZKU Member Laboratories Zkušebnictví, a.s. (ZKU) Czech Republic | |