KETRACO
KENYA ELECTRICITY TRANSMISSION CO.

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Web: www.ketraco.co.ke
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Our Ref: KETRACO-PT-010-2025 14th April 2025

Notice to all Bidders

RE: TENDER ADDENDUM AND CLARIFICATION 2 FOR PROCUREMENT OF TRANSMISSION LINES HARDWARE & FITTINGS FOR VARIOUS CONDUCTOR TYPES INCLUDING CANARY, CONDOR, LARK, LYNX, PHEASANT, STARLING ACSR CONDUCTORS AND OPGW.

The following amendments are made to the specified provisions of Procurement Of Transmission Lines Hardware & Fittings For Various Conductor Types Including Canary, Condor, Lark, Lynx, Pheasant, Starling ACSR Conductors And OPGW. **(KETRACO-PT-010-2025)**. Save where expressly amended by the terms of this clarification, the Principal Tender Document shall continue to be in full force and effect.

Find herein an ADDENDUM AND CLARIFICATION No. 2. This document should be returned along with the duly filled Form of Tender.

No	Clarification	KETRACO Response
1	Whether the supply includes both hardware fittings and insulators	The supply is only for the hardware fittings only.
2	There is mismatch between provided specification and price schedule	Amended specifications and price schedule attached in this addendum
3	We request for detailed drawings, for the manufacturers to have precise dimensions to allow comprehensive and accurate offer.	Drawings to be offloaded on the system by 21/04/2025
4	We wish to formally request for an extension of the closing date for the above referenced tender by at least 14 days. The manufacturers are asking for adequate time to work on the design of the items before they come up with a quotation for the same.	"Closing date extended to April 29th ,2025 @10.30am Local time"

The tender closing date has been extended to 29th April 2025 at 10.30 AM. All other terms and conditions of the tender document remain the same.

USER REPRESENTATIVE: Francis Mutinda

SIGNATURE: ----------

APPROVED BY:

Ag. SENIOR MANAGER, SUPPLY CHAIN

Tender Addendum and Clarification No. 1 of Tender No. KETRACO-PT-010-2025 has been received and incorporated in the Tender Documents.

Name of Tenderer *(in block letters)*: _____

Signature: _____

Date: _____

Signed for the Tenderer by *(Name in block letters)*: _____

In the office bearer capacity of: _____

LOT 1 TECHNICAL SPECIFICATIONS

This document contains the technical specifications for Lot 1, comprising Lynx Conductor Hardware & Fittings and OPGW Hardware & Fittings for Kenya Electricity Transmission Company Ltd (KETRACO). These specifications outline the requirements for design, manufacture, testing, supply, and delivery of hardware components to be used in KETRACO's transmission infrastructure.

EMPLOYER'S REQUIREMENTS & TECHNICAL SPECIFICATIONS FOR

LYNX CONDUCTOR HARDWARE & FITTINGS

TABLE OF CONTENTS

FOREWORD

This specification has been prepared by Power System Operation and Maintenance Department (System Operation and Power Management Directorate) of the Kenya Electricity Transmission Company LTD (KETRACO) and it lays down requirements for Lynx Conductor Hardware & Fittings.

This specification is based on international standards and is subject to revision as and when required.

Type test reports from accredited facilities shall be submitted with bid.

It shall be the manufacturer's responsibility to be knowledgeable of the requirements contained herein and in the referenced standards.

1. SCOPE

This specification covers the minimum technical requirements for design, manufacture, testing, supply and delivery of hardware and fittings for use with ACSR Lynx conductors.

The specification also covers inspection and test of the hardware and fittings as well as schedule of Guaranteed Technical Particulars, Price schedules to be filled in, signed by the manufacturer and submitted for tender evaluation. Complete installation instructions, Technical support documentation and Maintenance procedures shall be submitted with this bid for evaluation.

The specifications stipulate the minimum requirements for Hardware and Fittings for ACSR Lynx conductor acceptable for use by KETRACO and it shall be the responsibility of the manufacturer to ensure adequacy of the design, good workmanship and good engineering practice in the manufacture of the hardware and fittings. The hardware and fittings supplied shall strictly adhere to the issued drawings. Where inconsistencies exist between the drawings and specifications, the drawings shall govern unless otherwise approved in writing by KETRACO.

2. REFERENCE STANDARDS

The hardware and fittings shall comply with the latest editions of the following standards:

- IEC 61284: Overhead lines - Requirements and tests for fittings
- IEC 60120: Dimensions of ball and socket couplings of string insulator units
- IEC 60372: Locking devices for ball and socket couplings of string insulator units - Dimensions and tests
- IEC 60471: Dimensions of clevis and tongue couplings of string insulator units
- BS EN 61284: Overhead lines - Requirements and tests for fittings
- BS EN 60672-3: Ceramic and glass-insulating materials
- BS EN ISO 1461: Hot dip galvanized coatings on fabricated iron and steel articles
- BS EN ISO 2178: Non-magnetic coatings on magnetic substrates - Measurement of coating thickness - Magnetic method
- ASTM A153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- ASTM B230: Standard Specification for Aluminum 1350-H19 Wire for Electrical Purposes
- ASTM B232: Standard Specification for Concentric-Lay-Stranded Aluminum Conductors

3. SERVICE CONDITIONS

1. The hardware and fittings shall be suitable for continuous operation outdoor in tropical areas at altitudes of up to 2200m above sea level, humidity of up to 90%, ambient temperature of +30 degrees centigrade with a minimum of -1 degree centigrade and a maximum of +40-degree centigrade, heavy saline conditions along the coast and tropical sunshine conditions.
2. The weather isokeraunic levels reach up to 180 thunderstorms days per year.
3. The level of galvanizing for all parts and materials used shall be suitable for these conditions.

4. MATERIALS AND CONSTRUCTION

4.1 GENERAL REQUIREMENTS

1. All hardware and fittings shall be designed, manufactured and tested in accordance with IEC 61284 and other applicable/latest standards and requirements of this specification.
2. All ferrous parts shall be hot-dip galvanized after fabrication in accordance with ISO 1461 and ASTM A153. The zinc coating shall be smooth, continuous, and uniform. It shall be free from areas that are bare, have blisters, flux and ash inclusions, lumps, or coarse crystals.
3. The galvanized coating on all hardware shall withstand four one-minute dips in copper sulphate solution as per IEC 61284 without showing signs of copper deposits.
4. Design and construction drawings shall be submitted by the winning bidder.
5. Spring washers shall be of spring steel and electro-galvanized.
6. Security clips and split pins shall be of stainless steel.
7. The surfaces of all hardware shall be smooth, without cuts, abrasions, projections, ridges or exfoliation that might damage the conductor or cause radio interference.
8. All bolts and nuts shall have hexagonal heads and shall be locked in an approved manner.
9. All hardware shall be suitable for use with ACSR Lynx conductor (diameter 19.53 mm, weight 922 kg/km, UTS 110.5 kN) and shall have adequate strength, conductivity, and corona performance.
10. The design shall minimize the number of parts and the number of bolts per assembly.

4.2 SPECIFIC MATERIAL REQUIREMENTS

1. Aluminum and Aluminum Alloys:
    - Suspension clamp bodies, tension clamp bodies, armor rods, and other aluminum components shall be made from high-strength aluminum alloy.
    - Aluminum alloy castings shall be free from flaws, surface blemishes, and shrinkage defects.
2. Steel and Steel Alloys:
    - All steel used shall be thoroughly hot-dip galvanized after fabrication.
    - Malleable cast iron shall not be used.
    - Drop-forged steel shall be used for tension and suspension hardware components requiring high mechanical strength.
3. Fasteners:
    - All bolts, nuts, and washers shall be hot-dip galvanized steel.

- All bolts shall be provided with one flat washer and one spring washer.
- Split pins and security clips shall be of stainless steel.

4. Corona and Radio Interference:
    - All fittings shall be designed to minimize corona discharge and radio interference.
    - Corona rings/shields shall be provided where necessary to ensure corona extinction levels are maintained.
    - Minimum corona extinction voltage shall be 105 kV (rms).
    - Radio Interference Voltage at 110 kV shall not exceed 500 μV.

5. HARDWARE AND FITTINGS SETS

1. LYNX CONDUCTOR HARDWARE & FITTINGS SE

General Specifications

- System voltage: 132 kV
- Short circuit capacity: 31.5 kA for 1 second
- Conductor diameter (ACSR Lynx): 19.53 mm
- Conductor weight (ACSR Lynx): 922 kg/km
- Ultimate Tensile Strength (UTS) of Lynx conductor: 110.5 kN
- All ferrous parts (except spring washers) shall be hot-dip galvanized
- Spring washers: Spring steel, electro-galvanized
- Security clips and split pins: Stainless steel

1. SINGLE SUSPENSION STRING HARDWARE & FITTINGS SET

Set Components

1. D-Shackle
2. HH bal link
3. Ring arcing horn
4. Socket Eye
5. Ball arcing Horn
6. Suspension Clamp with complete set of P.A. Rods

Technical Specifications

1. System Voltage, Um = 145kV
2. Power frequency withstand voltage, 50 Hz, wet = 275kV
3. Lightning impulse withstand voltage, 1.2/50, pos. = 650kV
4. Creepage distance = 3,625mm (minimum)
5. Minimum breaking strength: 120 kN
6. Short circuit capacity: 31.5 kA for 1 second
7. Minimum slip strength of suspension clamp: 15% of conductor UTS
8. Ball / Socket coupling size: 16mm as per IEC 60120
9. Minimum corona extinction voltage: 105 kV (rms)
10. Radio Interference Voltage at 110 kV: 500 μV (maximum)

Material Specifications

- All ferrous parts (except spring washers) shall be hot-dip galvanized
- Spring washers: Spring steel, electro-galvanized
- Security clips and split pins: Stainless steel
- Suspension clamp body: Aluminum alloy
- Armor rods: Aluminum alloy.

Suspension Clamp Assembly

- Suitable for ACSR Lynx conductor
- Minimum breaking strength of clamp: 70 kN
- Slip strength: 15-20% of conductor UTS
- Minimum failing load: 45 kN

2. DOUBLE SUSPENSION STRING HARDWARE & FITTINGS SET

Set Components

1. D-Shackle
2. Triangular yoke plate
3. Ring arcing horn
4. Ball clevis
5. Socket clevis

6. Ball arcing Horn
7. Suspension Clamp with complete set of P.A. Rods

Technical Specifications

1. System Voltage, Um = 145kV
2. Power frequency withstand voltage, 50 Hz, wet = 275kV
3. Lightning impulse withstand voltage, 1.2/50, pos. = 650kV
4. Creepage distance = 3,625mm (minimum)
5. Minimum breaking strength: 160 kN
6. Short circuit capacity: 31.5 kA for 1 second
7. Minimum slip strength of suspension clamp: 15% of conductor UTS
8. Ball / Socket coupling size: 16mm as per IEC 60120
9. Minimum corona extinction voltage: 105 kV (rms)
10. Radio Interference Voltage at 110 kV: 500 μV (maximum)

Material Specifications

- All ferrous parts (except spring washers) shall be hot-dip galvanized
- Spring washers: Spring steel, electro-galvanized
- Security clips and split pins: Stainless steel
- Suspension clamp body: Aluminum alloy
- Armor rods: Aluminum alloy
- Yoke plates: Mild Steel, hot-dip galvanized

3. SINGLE TENSION STRING HARDWARE & FITTINGS SET

Set Components

1. D-Shackle
2. HH Ball Link
3. Ring arcing horn
4. Socket eye
5. Ball arcing Horn
6. Dead end assembly for ACSR lynx

Technical Specifications

1. System Voltage, Um = 145kV

2. Power frequency withstand voltage, 50 Hz, wet = 275kV
3. Lightning impulse withstand voltage, 1.2/50, pos. = 650kV
4. Creepage distance = 3,625mm (minimum)
5. Minimum breaking strength: 2 x 120 kN
6. Short circuit capacity: 31.5 kA for 1 second
7. Slip strength/mechanical load of tension clamp: 95% UTS of conductor
8. Ball / Socket coupling size: 16mm as per IEC 60120
9. Minimum corona extinction voltage: 105 kV (rms)
10. Radio Interference Voltage at 110 kV: 500 μV (maximum)

Material Specifications

- All ferrous parts (except spring washers) shall be hot-dip galvanized
- Spring washers: Spring steel, electro-galvanized
- Security clips and split pins: Stainless steel
- Compression Dead End Clamp: Al/steel
- Yoke plates: Mild Steel, hot-dip galvanized

Tension Clamp Assembly

- Suitable for ACSR Lynx conductor
- Slip strength: 95% of conductor UTS
- Minimum failing load: 105 kN

4. DOUBLE TENSION STRING HARDWARE & FITTINGS SET

Set Components

1. D-Shackle
2. Chain link
3. Triangular yoke plate
4. Ring arcing horn
5. Ball clevis
6. Socket clevis
7. Ball arcing Horn
8. Dead end assembly for ACSR lynx

9. Clevis eye

Technical Specifications

11. System Voltage, Um = 145kV
12. Power frequency withstand voltage, 50 Hz, wet = 275kV
13. Lightning impulse withstand voltage, 1.2/50, pos. = 650kV
14. Creepage distance = 3,625mm (minimum)
15. Minimum breaking strength: 2 x 120 kN
16. Short circuit capacity: 31.5 kA for 1 second
17. Slip strength/mechanical load of tension clamp: 95% UTS of conductor
18. Ball / Socket coupling size: 16mm as per IEC 60120
19. Minimum corona extinction voltage: 105 kV (rms)
20. Radio Interference Voltage at 110 kV: 500 μV (maximum)

Material Specifications

- All ferrous parts (except spring washers) shall be hot-dip galvanized
- Spring washers: Spring steel, electro-galvanized
- Security clips and split pins: Stainless steel
- Compression Dead End Clamp: Al/steel
- Yoke plates: Mild Steel, hot-dip galvanized

Tension Clamp Assembly

- Suitable for ACSR Lynx conductor
- Slip strength: 95% of conductor UTS
- Minimum failing load: 105 kN

5. MID SPAN COMPRESSION JOINT SET

Set Components

1. Aluminium sleeve
2. Steel sleeve

Technical Specifications

1. System Voltage, Um = 145kV

2. Power frequency withstand voltage, 50 Hz, wet = 275kV
3. Lightning impulse withstand voltage, 1.2/50, pos. = 650kV
4. Creepage distance = 3,625mm (minimum)
5. Minimum breaking strength: 120 kN
6. Short circuit capacity: 31.5 kA for 1 second
7. Slip strength/mechanical load of tension clamp: 95% UTS of conductor
8. Ball / Socket coupling size: 16mm as per IEC 60120
9. Minimum corona extinction voltage: 105 kV (rms)
10. Radio Interference Voltage at 110 kV: 500 μV (maximum)

Material Specifications

- All ferrous parts (except spring washers) shall be hot-dip galvanized
- Spring washers: Spring steel, electro-galvanized
- Security clips and split pins: Stainless steel
- Compression Dead End Clamp: Al/steel
- Yoke plates: Mild Steel, hot-dip galvanized

6. REPAIR SLEEVE

Set components

1. Aluminium sleeve

Technical Specifications

1. System Voltage, Um = 145kV
2. Power frequency withstand voltage, 50 Hz, wet = 275kV
3. Lightning impulse withstand voltage, 1.2/50, pos. = 650kV
4. Creepage distance = 3,625mm (minimum)
5. Minimum breaking strength: 120 kN
6. Short circuit capacity: 31.5 kA for 1 second
7. Slip strength/mechanical load of tension clamp: 95% UTS of conductor
8. Ball / Socket coupling size: 16mm as per IEC 60120
9. Minimum corona extinction voltage: 105 kV (rms)
10. Radio Interference Voltage at 110 kV: 500 μV (maximum)

Material Specifications

- All ferrous parts (except spring washers) shall be hot-dip galvanized
- Spring washers: Spring steel, electro-galvanized
- Security clips and split pins: Stainless steel
- Compression Dead End Clamp: Al/steel
- Yoke plates: Mild Steel, hot-dip galvanized

7. VIBRATION DAMPER HARDWARE & FITTINGS SET

Set components

1. Clamp body
2. Keeper piece
3. Messenger cable
4. Damper weight

Technical Specifications

1. System Voltage, Um = 145kV
2. Power frequency withstand voltage, 50 Hz, wet = 275kV
3. Lightning impulse withstand voltage, 1.2/50, pos. = 650kV
4. Creepage distance = 3,625mm (minimum)
5. Minimum breaking strength: 120 kN
6. Short circuit capacity: 31.5 kA for 1 second
7. Slip strength/mechanical load of tension clamp: 95% UTS of conductor
8. Ball / Socket coupling size: 16mm as per IEC 60120
9. Minimum corona extinction voltage: 105 kV (rms)
10. Radio Interference Voltage at 110 kV: 500 μV (maximum)

Material Specifications

- All ferrous parts (except spring washers) shall be hot-dip galvanized
- Spring washers: Spring steel, electro-galvanized
- Security clips and split pins: Stainless steel
- Compression Dead End Clamp: Al/steel
- Yoke plates: Mild Steel, hot-dip galvanized

5.1 MANUFACTURING, MARKING, PACKING & LABELLING

Each hardware and fiting shall be legibly and indelibly marked with the name and trademark of the manufacturer, the year of manufacture and the SML (specified mechanical load) in accordance with IEC 61109.
The following information shall be marked indelibly in a permanent manner by embossing on each insulator hardware and fittings during manufacture:

a) Manufacturer's name or Trademark.
b) Voltage rating
c) Specified mechanical load
d) The letters "property of KETRACO"

All markings shall be permanent and shall be by embossing on the hardware and fitting part before galvanizing. The marking shall not affect the performance. Tags and stickers shall not be accepted. A Reference list of same type as quoted installed in similar climatic conditions and list of 10 previous customers with detailed contacts shall be submitted with this bid from the manufacturer.
The hardware and fittings shall be packed in wooden crates which are reinforced and held closed by external steel wire binding. Each crate shall be internally braced to permit stacking and the steel wire bindings shall be designed to keep firmly closed and permit easy and rapid opening at time of installation. The production capacity, the Manufacturing process schedule, the disposal procedures and Corona and Radio Interference documentation shall be provided with the bid.

The crates shall be designed to keep on sturdy wood pallet. The assembly shall be held tightly in place with steel bands and protected against moisture by a complete covering of heat shrinkable polyethylene film.

6. QUALITY MANAGEMENT SYSTEM

The supplier shall submit a quality assurance plan (QAP) that will be used to ensure that the hardware and fittings design, material, manufacture workmanship, tests, service capability, maintenance and documentation will fulfil the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfill the requirements of ISO 9001:2008.

The manufacturer's Declaration of conformity to reference standards and copies of quality management certification including copy of valid ISO 9001, 14001 & 45001 certificates shall be submitted with the tender for evaluation.

7. TESTS AND INSPECTION

7.1 DESIGN TESTS

Design tests shall be performed on each type of hardware and fitting to verify that the design meets the requirements of this specification and the relevant standards. Design tests shall include:

1. Verification of dimensions
2. Verification of mechanical characteristics
3. Verification of galvanizing
4. Corona and radio interference tests
5. Electrical conductivity test (for current-carrying fittings)

7.2 TYPE TESTS

Type tests shall be performed on each type of hardware and fitting to verify that the production equipment and processes consistently produce hardware and fittings that meet the requirements of this specification and the relevant standards. Type tests shall include:

1. Mechanical strength test
2. Electrical resistance test (for current-carrying fittings)
3. Heating cycle test (for compression fittings)
4. Slip strength test (for suspension and tension clamps)
5. Fatigue test (for vibration dampers)
6. Corona and radio interference tests
7. Galvanizing test

7.3 SAMPLE TESTS

Sample tests shall be performed on samples taken at random from each batch to verify that the batch meets the requirements of this specification and the relevant standards. Sample tests shall include:

1. Visual inspection
2. Verification of dimensions
3. Verification of mechanical characteristics
4. Verification of galvanizing
5. Slip strength test (for suspension and tension clamps)

7.4 ROUTINE TESTS

Routine tests shall be performed on each hardware and fitting to verify that it meets the requirements of this specification and the relevant standards. Routine tests shall include:

1. Visual inspection
2. Verification of dimensions
3. Verification of mechanical characteristics

Copies of the previous design and type test reports by relevant Independent International or National Testing/Standards Authority of the country of manufacture (or ISO/IEC 17025 accredited independent laboratory) shall be submitted with the offer for evaluation (all in English language). A copy of the accreditation certificate for the laboratory shall also be submitted.

Routine and sample test reports for the hardware and fittings to be supplied shall be submitted to KETRACO for approval before shipment/delivery of the goods. KETRACO Engineers (2) shall witness acceptance tests at the factory before shipment. The cost of travelling, Accommodation, Visa fees, Local and off-shore airport transfers shall be borne by the manufacturer/Supplier. A description of test equipment, and Complete test protocols shall be submitted with this bid. In addition, the manufacturer/supplier shall provide a daily subsistence allowance equivalent to USD 350 for each KETRACO engineer that will witness the factory acceptance test.

Factory Acceptance tests (FAT) shall include Routine and Sample tests as per IEC 61284 and applicable latest IEC standards and the following:

1. Verification of Dimensions
2. Verification of locking systems
3. Verification of mechanical strength
4. Verification of slip strength (for suspension and tension clamps)
5. Galvanization test

8. GUARANTEED TECHNICAL PARTICULARS (GTP)

LYNX CONDUCTOR HARDWARE & FITTINGS SET

General Specifications

S/N	Description	Unit	Guaranteed Value	Offered Value
1	System Voltage	kV	132	
2	Conductor type	-	ACSR Lynx	
3	Conductor diameter	mm	19.53	

S/N	Description	Unit	Guaranteed Value	Offered Value
4	Conductor weight	kg/km	922	
5	Ultimate Tensile Strength (UTS) of conductor	kN	110.5	
6	Short circuit capacity	kA/sec	31.5/1	

Suspension Clamp Assembly

S/N	Description	Unit	Guaranteed Value	Offered Value
7	Minimum breaking strength of clamp	kN	70	
8	Slip strength	% of conductor UTS	15-20	
9	Minimum failing load	kN	45	

Tension Clamp Assembly

S/N	Description	Unit	Guaranteed Value	Offered Value
10	Slip strength	% of conductor UTS	95	
11	Minimum failing load	kN	105	

Material Specifications

S/N	Description	Unit	Guaranteed Value	Offered Value
20	Suspension/tension clamp body material	-	Aluminum alloy	
21	Armor rod material	-	Aluminum alloy	
22	Galvanization standard for ferrous parts	-	[To be provided]	

1. SINGLE SUSPENSION STRING HARDWARE & FITTINGS SET

S/N	Description	Unit	Guaranteed Value	Offered Value
1	System Voltage, Um	kV	145	
2	Power frequency withstand voltage (wet)	kV	275	
3	Lightning impulse withstand voltage	kV	650	
4	Creepage distance	mm	3,625 (minimum)	
5	Minimum breaking strength	kN	120	
6	Short circuit capacity	kA/sec	31.5/1	
7	Minimum slip strength of suspension clamp	% of conductor UTS	15	
8	Ball / Socket coupling size	mm	16	

S/N	Description	Unit	Guaranteed Value	Offered Value
9	Minimum corona extinction voltage	kV (rms)	105	
10	Radio Interference Voltage at 110 kV	μV	500 (maximum)	
11	Total weight of assembly	kg	[To be provided]	
12	Dimension of arcing horns	mm	[To be provided]	
13	Material of suspension clamp body	-	Aluminum alloy	
14	Material of armor rods	-	Aluminum alloy	
15	Galvanization standard for ferrous parts	-	[To be provided]	

2. DOUBLE SUSPENSION STRING HARDWARE & FITTINGS SET

S/N	Description	Unit	Guaranteed Value	Offered Value
1	System Voltage, Um	kV	145	
2	Power frequency withstand voltage (wet)	kV	275	
3	Lightning impulse withstand voltage	kV	650	
4	Creepage distance	mm	3,625 (minimum)	
5	Minimum breaking strength	kN	160	
6	Short circuit capacity	kA/sec	31.5/1	
7	Minimum slip strength of suspension clamp	% of conductor UTS	15	
8	Ball / Socket coupling size	mm	16	

S/N	Description	Unit	Guaranteed Value	Offered Value
9	Minimum corona extinction voltage	kV (rms)	105	
10	Radio Interference Voltage at 110 kV	μV	500 (maximum)	
11	Total weight of assembly	kg	[To be provided]	
12	Dimension of arcing horns	mm	[To be provided]	
13	Material of suspension clamp body	-	Aluminum alloy	
14	Material of armor rods	-	Aluminum alloy	
15	Material of yoke plates	-	Mild Steel, hot-dip galvanized	
16	Galvanization standard for ferrous parts	-	[To be provided]	

3. SINGLE TENSION STRING HARDWARE & FITTINGS SET

S/N	Description	Unit	Guaranteed Value	Offered Value
1	System Voltage, Um	kV	145	
2	Power frequency withstand voltage (wet)	kV	275	
3	Lightning impulse withstand voltage	kV	650	
4	Creepage distance	mm	3,625 (minimum)	
5	Minimum breaking strength	kN	2 x 120	
6	Short circuit capacity	kA/sec	31.5/1	
7	Slip strength of tension clamp	% of conductor UTS	95	
8	Ball / Socket coupling size	mm	16	

S/N	Description	Unit	Guaranteed Value	Offered Value
9	Minimum corona extinction voltage	kV (rms)	105	
10	Radio Interference Voltage at 110 kV	μV	500 (maximum)	
11	Total weight of assembly	Kg	[To be provided]	
12	Dimension of arcing horns	mm	[To be provided]	
13	Material of tension clamp body	-	Aluminum alloy	
14	Material of yoke plates	-	Mild Steel, hot-dip galvanized	
15	Galvanization standard for ferrous parts	-	[To be provided]	

S/N	Description	Unit	Guaranteed Value	Offered Value
16	Compression die size for dead end	-	[To be provided]	

4. DOUBLE TENSION STRING HARDWARE & FITTINGS SET

S/N	Description	Unit	Guaranteed Value	Offered Value
1	System Voltage, Um	kV	145	
2	Power frequency withstand voltage (wet)	kV	275	
3	Lightning impulse withstand voltage	kV	650	
4	Creepage distance	mm	3,625 (minimum)	
5	Minimum breaking strength	kN	2 x 120	

S/N	Description	Unit	Guaranteed Value	Offered Value
6	Short circuit capacity	kA/sec	31.5/1	
7	Slip strength of tension clamp	% of conductor UTS	95	
8	Ball / Socket coupling size	mm	16	
9	Minimum corona extinction voltage	kV (rms)	105	
10	Radio Interference Voltage at 110 kV	μV	500 (maximum)	
11	Total weight of assembly	Kg	[To be provided]	
12	Dimension of arcing horns	mm	[To be provided]	
13	Material of tension clamp body	-	Aluminum alloy	

S/N	Description	Unit	Guaranteed Value	Offered Value
14	Material of yoke plates	-	Mild Steel, hot-dip galvanized	
15	Galvanization standard for ferrous parts	-	[To be provided]	
16	Compression die size for dead end	-	[To be provided]	

5. MID-SPAN COMPRESSION JOINT HARDWARE & FITTINGS SET

S/N	Description	Unit	Guaranteed Value	Offered Value
1	Tensile strength	% of conductor UTS	95 (minimum)	
2	Electrical resistance	% of equivalent conductor length	75 (maximum)	

6. REPAIR SLEEVE HARDWARE & FITTINGS SET

S/N	Description	Unit	Guaranteed Value	Offered Value
1	Tensile strength	% of conductor UTS	95 (minimum)	

7. VIBRATION DAMPER HARDWARE & FITTINGS SET

S/N	Description	Unit	Guaranteed Value	Offered Value
1	Clamp slip strength	kN	2.5 - 5	
2	Messenger cable construction	-	19 wire strand	

I/We declare that the information provided in this GTP is true and correct, and all supporting documents are authentic and valid.

Signature: _____ Name: _____

Position: _____ Company: _____

Date: _____ Company Seal: _____

9. PRICE SCHEDULE

Instructions to Bidders:

1. All prices should be quoted in Kenya Shillings (KES) and are VAT inclusive.

LYNX CONDUCTOR HARDWARE & FITTINGS SET

Item No.	Description	Unit	Quantity	Unit Price	Total Price
1	Single Suspension String Hardware & Fittings Set	Set	100		
2	Double Suspension String Hardware & Fittings Set	Set	100		
3	Single Tension String Hardware & Fittings Set	Set	100		
4	Double Tension String Hardware & Fittings Set	Set	100		
5	Mid Span Compression Joint	Set	200		
6	Repair Sleeve Hardware & Fittings Set	Piece	200		
7	Vibration Damper Hardware & Fittings Set	set	200		
TOTAL PRICE FOR LYNX HARDWARE AND FITTINGS					

Declaration

We confirm that our bid complies with all requirements as specified in the tender document.

Company Name: _____

Authorized Signatory: _____

Position: _____

Date: _____

Company Stamp: _____

EMPLOYER'S REQUIREMENTS & TECHNICAL SPECIFICATIONS FOR OPGW HARDWARE & FITTINGS

TABLE OF CONTENTS

FOREWORD

This specification has been prepared by Power System Operation and Maintenance Department (System Operation and Power Management Directorate) of the Kenya Electricity Transmission Company LTD (KETRACO) and it lays down requirements for OPGW Hardware & Fittings.

This specification is based on international standards and is subject to revision as and when required.

Type test reports from accredited facilities shall be submitted with bid.

It shall be the manufacturer's responsibility to be knowledgeable of the requirements contained herein and in the referenced standards.

10. SCOPE

This specification covers the minimum technical requirements for design, manufacture, testing, supply and delivery of hardware and fittings for use with OPGW .

The specification also covers inspection and test of the hardware and fittings as well as schedule of Guaranteed Technical Particulars, Price schedules to be filled in, signed by the manufacturer and submitted for tender evaluation. Complete installation instructions, Technical support documentation and Maintenance procedures shall be submitted with this bid for evaluation.

The specifications stipulate the minimum requirements for Hardware and Fittings for OPGW acceptable for use by KETRACO and it shall be the responsibility of the manufacturer to ensure adequacy of the design, good workmanship and good engineering practice in the manufacture of the hardware and fittings. The hardware and fittings supplied shall strictly adhere to the

issued drawings. Where inconsistencies exist between the drawings and specifications, the drawings shall govern unless otherwise approved in writing by KETRACO

11. REFERENCE STANDARDS

The hardware and fittings shall comply with the latest editions of the following standards:

- IEC 61284: Overhead lines - Requirements and tests for fittings
- IEC 60120: Dimensions of ball and socket couplings of string insulator units
- IEC 60372: Locking devices for ball and socket couplings of string insulator units - Dimensions and tests
- IEC 60471: Dimensions of clevis and tongue couplings of string insulator units
- BS EN 61284: Overhead lines - Requirements and tests for fittings
- BS EN 60672-3: Ceramic and glass-insulating materials
- BS EN ISO 1461: Hot dip galvanized coatings on fabricated iron and steel articles
- BS EN ISO 2178: Non-magnetic coatings on magnetic substrates - Measurement of coating thickness - Magnetic method
- ASTM A153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- ASTM B230: Standard Specification for Aluminum 1350-H19 Wire for Electrical Purposes
- ASTM B232: Standard Specification for Concentric-Lay-Stranded Aluminum Conductors

12. SERVICE CONDITIONS

1. The hardware and fittings shall be suitable for continuous operation outdoor in tropical areas at altitudes of up to 2200m above sea level, humidity of up to 90%, ambient temperature of +30 degrees centigrade with a minimum of -1 degree centigrade and a maximum of +40-degree centigrade, heavy saline conditions along the coast and tropical sunshine conditions.
2. The weather isokeraunic levels reach up to 180 thunderstorms days per year.
3. The level of galvanizing for all parts and materials used shall be suitable for these conditions.

13. MATERIALS AND CONSTRUCTION

13.1 GENERAL REQUIREMENTS

1. All hardware and fittings shall be designed, manufactured and tested in accordance with IEC 61284 and other applicable/latest standards and requirements of this specification.
2. All ferrous parts shall be hot-dip galvanized after fabrication in accordance with ISO 1461 and ASTM A153. The zinc coating shall be smooth, continuous, and uniform. It shall be free from areas that are bare, have blisters, flux and ash inclusions, lumps, or coarse crystals.

3. The galvanized coating on all hardware shall withstand four one-minute dips in copper sulphate solution as per IEC 61284 without showing signs of copper deposits.
4. Spring washers shall be of spring steel and electro-galvanized.
5. Security clips and split pins shall be of stainless steel.
6. Design and construction drawings shall be submitted by the winning bidder.
7. The surfaces of all hardware shall be smooth, without cuts, abrasions, projections, ridges or exfoliation that might damage the conductor or cause radio interference.
8. All bolts and nuts shall have hexagonal heads and shall be locked in an approved manner.
9. All hardware shall be suitable for use with OPGW (diameter 19.53 mm, weight 922 kg/km, UTS 110.5 kN) and shall have adequate strength, conductivity, and corona performance.
10. The design shall minimize the number of parts and the number of bolts per assembly.

13.2 SPECIFIC MATERIAL REQUIREMENTS

5. Aluminum and Aluminum Alloys:
    - Suspension clamp bodies, tension clamp bodies, armor rods, and other aluminum components shall be made from high-strength aluminum alloy.
    - Aluminum alloy castings shall be free from flaws, surface blemishes, and shrinkage defects.
6. Steel and Steel Alloys:
    - All steel used shall be thoroughly hot-dip galvanized after fabrication.
    - Malleable cast iron shall not be used.
    - Drop-forged steel shall be used for tension and suspension hardware components requiring high mechanical strength.
7. Fasteners:
    - All bolts, nuts, and washers shall be hot-dip galvanized steel.
    - All bolts shall be provided with one flat washer and one spring washer.
    - Split pins and security clips shall be of stainless steel.
8. Corona and Radio Interference:
    - All fittings shall be designed to minimize corona discharge and radio interference.
    - Corona rings/shields shall be provided where necessary to ensure corona extinction levels are maintained.

- Minimum corona extinction voltage shall be 105 kV (rms).
- Radio Interference Voltage at 110 kV shall not exceed 500 μV.

14. HARDWARE AND FITTINGS SETS

1. OPGW HARDWARE AND FITTINGS SET

Set Components

1. Dead End Set
2. Suspension Set

General Technical Specifications

1. Applicable standards: IEEE 1138/1994
2. Suitable for OPGW cable diameter: 19.6-20.6 mm (to be confirmed for specific components)
3. Short circuit capacity: 31.5 kA for 1 second
4. General tolerance: ±3% unless otherwise specified
5. All ferrous parts (except spring washers) shall be hot-dip galvanized conforming to B.S. 729
6. Spring washers: Spring steel, electro-galvanized
7. Security clips and split pins: Stainless steel

Specific Component Requirements

1. Dead End Set

Components:

- Dead end assembly
- Structural reinforcing rods
- Dead end rods
- Thimble clevis
- Extension link
- Parallel clamp
- Grounding wire
- U-shackle

Key Specifications:

- U.T.S. of hardware fittings: 120 kN
- U.T.S. of tension clamp: 95% of U.T.S of OPGW cable
- Ball and socket designation: 16 mm (as per IEC:120)

2. Suspension Set

Components:

- Suspension assembly
- Grounding wire
- Currrent transfer plate
- Eyelink
- U shackle

Key Specifications:

- U.T.S. of hardware fittings: 70 kN
- Slip strength of suspension clamp: 15% of U.T.S. of OPGW cable

3. Vibration Damper

- Clamp
- Keeper
- Washer
- Lock washer
- Hex bolt
- Collet
- Weight
- Messenger
- Armor rods
- Repair rods

General Specifications

- Stockbridge type
- OPGW diameter 11.7mm,UTS 63.5/50kN
- Clamp range 20.1-25mm

Additional Requirements

1. Components should be compatible with each other and form complete sets as specified
2. Manufacturer must provide test certificates for all items
3. Packaging should be suitable to prevent damage during transportation and storage
4. Clear marking and identification on all components
5. Compliance with KETRACO's quality assurance requirements

14.1 MANUFACTURING, MARKING, PACKING & LABELLING

Each hardware and fiting shall be legibly and indelibly marked with the name and trademark of the manufacturer, the year of manufacture and the SML (specified mechanical load) in accordance with IEC 61109.
The following information shall be marked indelibly in a permanent manner by embossing on each insulator hardware and fittings during manufacture:

e) Manufacturer's name or Trademark.
f) Voltage rating
g) Specified mechanical load
h) The letters "**property of KETRACO**"

All markings shall be permanent and shall be by embossing on the hardware and fitting part before galvanizing. The marking shall not affect the performance. Tags and stickers shall not be accepted. A Reference list of same type as quoted installed in similar climatic conditions and list of 10 previous customers with detailed contacts shall be submitted with this bid from the manufacturer.
The hardware and fittings shall be packed in wooden crates which are reinforced and held closed by external steel wire binding. Each crate shall be internally braced to permit stacking and the steel wire bindings shall be designed to keep firmly closed and permit easy and rapid opening at time of installation. The production capacity, the Manufacturing process schedule, the disposal procedures and Corona and Radio Interference documentation shall be provided with the bid.

The crates shall be designed to keep on sturdy wood pallet. The assembly shall be held tightly in place with steel bands and protected against moisture by a complete covering of heat shrinkable polyethylene film.

15. QUALITY MANAGEMENT SYSTEM

The supplier shall submit a quality assurance plan (QAP) that will be used to ensure that the hardware and fittings design, material, manufacture workmanship, tests, service capability, maintenance and documentation will fulfil the requirements stated in the contract documents,

standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfill the requirements of ISO 9001:2008.

The manufacturer's Declaration of conformity to reference standards and copies of quality management certification including copy of valid ISO 9001, 14001 & 45001 certificates shall be submitted with the tender for evaluation.

16. TESTS AND INSPECTION

16.1 DESIGN TESTS

Design tests shall be performed on each type of hardware and fitting to verify that the design meets the requirements of this specification and the relevant standards. Design tests shall include:

1. Verification of dimensions
2. Verification of mechanical characteristics
3. Verification of galvanizing
4. Corona and radio interference tests
5. Electrical conductivity test (for current-carrying fittings)

16.2 TYPE TESTS

Type tests shall be performed on each type of hardware and fitting to verify that the production equipment and processes consistently produce hardware and fittings that meet the requirements of this specification and the relevant standards. Type tests shall include:

1. Mechanical strength test
2. Electrical resistance test (for current-carrying fittings
3. Heating cycle test (for compression fittings)
4. Slip strength test (for suspension and tension clamps)
5. Fatigue test (for vibration dampers
6. Corona and radio interference tests
7. Galvanizing test

16.3 SAMPLE TESTS

Sample tests shall be performed on samples taken at random from each batch to verify that the batch meets the requirements of this specification and the relevant standards. Sample tests shall include:

1. Visual inspection
2. Verification of dimensions
3. Verification of mechanical characteristics.
4. Verification of galvanizing

5. Slip strength test (for suspension and tension clamps)

16.4 ROUTINE TESTS

Routine tests shall be performed on each hardware and fitting to verify that it meets the requirements of this specification and the relevant standards. Routine tests shall include:

1. Visual inspection
2. Verification of dimensions
3. Verification of mechanical characteristics

Copies of the previous design and type test reports by relevant Independent International or National Testing/Standards Authority of the country of manufacture (or ISO/IEC 17025 accredited independent laboratory) shall be submitted with the offer for evaluation (all in English language). A copy of the accreditation certificate for the laboratory shall also be submitted.

Routine and sample test reports for the hardware and fittings to be supplied shall be submitted to KETRACO for approval before shipment/delivery of the goods. KETRACO Engineers (2) shall witness acceptance tests at the factory before shipment. The cost of travelling, Accommodation, Visa fees, Local and off-shore airport transfers shall be borne by the manufacturer/Supplier. A description of test equipment, and Complete test protocols shall be submitted with this bid. In addition, the manufacturer/supplier shall provide a daily subsistence allowance equivalent to USD 350 for each KETRACO engineer that will witness the factory acceptance test.

Factory Acceptance tests (FAT) shall include Routine and Sample tests as per IEC 61284 and applicable latest IEC standards and the following:

1. Verification of Dimensions
2. Verification of locking systems
3. Verification of mechanical strength
4. Verification of slip strength (for suspension and tension clamps)
5. Galvanization test

17. GUARANTEED TECHNICAL PARTICULARS (GTP)

1. General Particulars

S/N	Description	Unit	Guaranteed Value	Offered Value
1.1	Applicable Standard	-	IEEE 1138/1994	
1.2	Suitable OPGW cable diameter	mm	19.6-20.6	
1.3	Short circuit capacity	kA/sec	31.5/1	
1.4	General tolerance	%	±3	
1.5	Galvanization standard for ferrous parts	-	B.S. 729	
1.6	Spring washer material	-	Spring steel, electro-galvanized	
1.7	Security clips and split pins material	-	Stainless steel	

S/N	Description	Unit	Guaranteed Value	Offered Value
1.8	Suitable for transmission line voltage	kV	400 and 220	
1.9	Total weight of the complete set	Kg	[To be provided]	

2. Dead End Set

S/N	Description	Unit	Guaranteed Value	Offered Value
2.1	U.T.S. of hardware fittings	kN	120	
2.2	U.T.S. of tension clamp	% of OPGW UTS	95	
2.3	Ball and socket designation	Mm	16 (as per IEC:120)	
2.4	Tower Hinge material	-	[To be provided]	
2.5	Extension Strap material	-	[To be provided]	

S/N	Description	Unit	Guaranteed Value	Offered Value
2.6	Sag Adjustment Plate material	-	[To be provided]	
2.7	Heavy Hexagonal Ball Eye material	-	[To be provided]	
2.8	Arcing Ring (T.S. and L.S.) material	-	[To be provided]	
2.9	Heavy Hexagonal Socket Eye material	-	[To be provided]	
2.1	Dead End Clamp material	-	[To be provided]	
2.11	Thimble material	-	[To be provided]	
2.12	Protection Splice material	-	[To be provided]	

S/N	Description	Unit	Guaranteed Value	Offered Value
2.13	Single Tower Clamp material	-	[To be provided]	
2.14	Total weight of the set	Kg	[To be provided]	

3. Suspension Set

S/N	Description	Unit	Guaranteed Value	Offered Value
3.1	U.T.S. of hardware fittings	kN	70	
3.2	Slip strength of suspension clamp	% of OPGW UTS	15	
3.4	Components list	-	[To be provided]	
3.5	Total weight of the set	Kg	[To be provided]	

3. Vibration damper for OPGW

S/N	Description	Unit	Guaranteed Value	Offered Value
3.1	U.T.S. of hardware fittings	kN	63.5	

S/N	Description	Unit	Guaranteed Value	Offered Value
3.2	Clamp range	mm	15.5-20	
3.4	Components list	-	[To be provided]	
3.5	Total weight of the set	Kg	1.8	

I/We declare that the information provided in this GTP is true and correct, and all supporting documents are authentic and valid.

Signature: _____ Name: _____

Position: _____ Company: _____

Date: _____ Company Seal: _____

18. PRICE SCHEDULE FOR OPGW HARDWARE ANG FITTINGS

Instructions to Bidders:

1. All prices should be quoted in Kenya Shillings (KES) and are VAT inclusive.

Item No.	Description	Unit	Quantity	Unit Price	Total Price
1	Dead End Set for OPGW	Set	100		
2	Suspension Set for OPGW	Set	100		
3	Vibration damper set for OPGW	Set	200		
TOTAL FOR OPGW HARDWARE AND FITTINGS					

Declaration

We confirm that our bid complies with all requirements as specified in the tender document.

Company Name: _____

Authorized Signatory: _____

Position: _____

Date: _____

Company Stamp: _____

19. PRICE SCHEDULE FOR LOT 1

Instructions to Bidders:

1. All prices should be quoted in Kenya Shillings (KES) and are VAT inclusive.

Item No.	Description	Unit	Quantity	Unit Price	Total Price
1	LYNX CONDUCTOR HARDWARE AND FITTINGS	LOT	LOT	LOT	
2	OPGW HARDWARE AND FITTINGS	LOT	LOT	LOT	
TOTAL FOR LOT 1					

Declaration

We confirm that our bid complies with all requirements as specified in the tender document.

Company Name: _____

Authorized Signatory: _____

Position: _____

Date: _____

Company Stamp: _____

LOT 2 TECHNICAL SPECIFICATIONS

This document contains the technical specifications for Lot 2, comprising Canary Conductor Hardware & Fittings , Starling Conductor Hardware & Fittings and ACSR 300/50 Conductor Hardware and Fittings for Kenya Electricity Transmission Company Ltd (KETRACO). These specifications outline the requirements for design, manufacture, testing, supply, and delivery of hardware components to be used in KETRACO's transmission infrastructure.

EMPLOYERS REQUIREMENTS & TECHNICAL SPECIFICATIONS FOR

CANARY CONDUCTOR HARDWARE & FITTINGS

TABLE OF CONTENTS

FOREWORD

This specification has been prepared by Power System Operation and Maintenance Department (System Operation and Power Management Directorate) of the Kenya Electricity Transmission Company LTD (KETRACO) and it lays down requirements for Canary Conductor Hardware & Fittings.

This specification is based on international standards and is subject to revision as and when required.

Type test reports from accredited facilities shall be submitted with bid.

It shall be the manufacturer's responsibility to be knowledgeable of the requirements contained herein and in the referenced standards.

1. SCOPE

This specification covers the minimum technical requirements for design, manufacture, testing, supply and delivery of hardware and fittings for use with ACSR canary conductors.

The specification also covers inspection and test of the hardware and fittings as well as schedule of Guaranteed Technical Particulars, Price schedules to be filled in, signed by the manufacturer and submitted for tender evaluation. Complete installation instructions, Technical support documentation and Maintenance procedures shall be submitted with this bid for evaluation.

The specifications stipulate the minimum requirements for Hardware and Fittings for ACSR Canary conductor acceptable for use by KETRACO and it shall be the responsibility of the manufacturer to ensure adequacy of the design, good workmanship and good engineering practice in the manufacture of the hardware and fittings. The hardware and fittings supplied shall strictly adhere to the issued drawings. Where inconsistencies exist between the drawings and specifications, the drawings shall govern unless otherwise approved in writing by KETRACO.

2. REFERENCE STANDARDS

The hardware and fittings shall comply with the latest editions of the following standards:

- IEC 61284: Overhead lines - Requirements and tests for fittings
- IEC 60120: Dimensions of ball and socket couplings of string insulator units
- IEC 60372: Locking devices for ball and socket couplings of string insulator units - Dimensions and tests
- IEC 60471: Dimensions of clevis and tongue couplings of string insulator units
- BS EN 61284: Overhead lines - Requirements and tests for fittings
- BS EN 60672-3: Ceramic and glass-insulating materials
- BS EN ISO 1461: Hot dip galvanized coatings on fabricated iron and steel articles
- BS EN ISO 2178: Non-magnetic coatings on magnetic substrates - Measurement of coating thickness - Magnetic method
- ASTM A153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- ASTM B230: Standard Specification for Aluminum 1350-H19 Wire for Electrical Purposes
- ASTM B232: Standard Specification for Concentric-Lay-Stranded Aluminum Conductors

3. SERVICE CONDITIONS

1. The hardware and fittings shall be suitable for continuous operation outdoor in tropical areas at altitudes of up to 2200m above sea level, humidity of up to 90%, ambient temperature of +30 degrees centigrade with a minimum of -1 degree centigrade and a maximum of +40-degree centigrade, heavy saline conditions along the coast and tropical sunshine conditions.
2. The weather isokeraunic levels reach up to 180 thunderstorms days per year.
3. The level of galvanizing for all parts and materials used shall be suitable for these conditions.

4. MATERIALS AND CONSTRUCTION

4.1 GENERAL REQUIREMENTS

1. All hardware and fittings shall be designed, manufactured and tested in accordance with IEC 61284 and other applicable/latest standards and requirements of this specification.
2. All ferrous parts shall be hot-dip galvanized after fabrication in accordance with ISO 1461 and ASTM A153. The zinc coating shall be smooth, continuous, and uniform. It shall be free from areas that are bare, have blisters, flux and ash inclusions, lumps, or coarse crystals.
3. The galvanized coating on all hardware shall withstand four one-minute dips in copper sulphate solution as per IEC 61284 without showing signs of copper deposits.
4. Design and construction drawings shall be submitted by the winning bidder.
5. Spring washers shall be of spring steel and electro-galvanized.
6. Security clips and split pins shall be of stainless steel.
7. The surfaces of all hardware shall be smooth, without cuts, abrasions, projections, ridges or exfoliation that might damage the conductor or cause radio interference.
8. All bolts and nuts shall have hexagonal heads and shall be locked in an approved manner.
9. All hardware shall be suitable for use with ACSR Canary conductor (diameter 19.53 mm, weight 922 kg/km, UTS 110.5 kN) and shall have adequate strength, conductivity, and corona performance.
10. The design shall minimize the number of parts and the number of bolts per assembly.

4.2 SPECIFIC MATERIAL REQUIREMENTS

1. Aluminum and Aluminum Alloys:
    - Suspension clamp bodies, tension clamp bodies, armor rods, and other aluminum components shall be made from high-strength aluminum alloy.
    - Aluminum alloy castings shall be free from flaws, surface blemishes, and shrinkage defects.
2. Steel and Steel Alloys:
    - All steel used shall be thoroughly hot-dip galvanized after fabrication.
    - Malleable cast iron shall not be used.
    - Drop-forged steel shall be used for tension and suspension hardware components requiring high mechanical strength.
3. Fasteners:

- All bolts, nuts, and washers shall be hot-dip galvanized steel.
- All bolts shall be provided with one flat washer and one spring washer.
- Split pins and security clips shall be of stainless steel.

4. Corona and Radio Interference:
   - All fittings shall be designed to minimize corona discharge and radio interference.
   - Corona rings/shields shall be provided where necessary to ensure corona extinction levels are maintained.
   - Minimum corona extinction voltage shall be 105 kV (rms).
   - Radio Interference Voltage at 110 kV shall not exceed 500 μV.

5. HARDWARE AND FITTINGS SETS

1. CANARY CONDUCTOR HARDWARE AND FITTINGS SET

1. DOUBLE SUSPENSION INSULATOR STRING HARDWARE AND FITTINGS SET

Set Components

1. Tower Hinge
2. Extension Strap
3. Yoke Plate (T.S.)
4. Ball Clevis
5. Arcing Ring (T.S.)
6. Arcing Ring (L.S.)
7. Socket Clevis
8. Yoke Plate (L.S.)
9. Complete Suspension Clamp Assembly with P.A. Rod

Technical Specifications

General Requirements

1. Applicable standard: B.S. 3288, Part-I
2. Ultimate Tensile Strength (U.T.S.) of hardware fittings: 2 x 70 kN
3. Ball and socket designation: 16 mm (as per IEC:120)
4. Slip strength of suspension clamp: 15% of U.T.S. of relevant conductor
5. Short circuit capacity: 31.5 kA per 1 second
6. General tolerance: ±3% unless otherwise specified

7. All ferrous parts (except spring washer) shall be hot-dip galvanized conforming to B.S. 729
8. Spring washer: Spring steel, electro-galvanized
9. Security clip & split pin: Stainless steel
10. Suitable for single ACSR Canary conductor

Specific Component Requirements

1. Tower Hinge
    - Material: Mild Steel, Hot Dip Galvanized (HDG)
    - U.T.S.: 140 kN
2. Extension Strap
    - Material: Mild Steel, HDG
    - U.T.S.: 140 kN
3. Yoke Plate (T.S.)
    - Material: Mild Steel, HDG
    - U.T.S.: 140 kN
4. Ball Clevis
    - Material: Forged Steel, HDG
    - U.T.S.: 70 kN
5. Arcing Ring (T.S.)
    - Material: Mild Steel, HDG
6. Arcing Ring (L.S.)
    - Material: Mild Steel, HDG
    - Dimensions:
        - Outer diameter: 340 mm
        - Inner diameter: 166 mm
        - Thickness: 16 mm
    - Mounting: M12x40 bolt & nut (2 sets), with spring washers
7. Socket Clevis
    - Material: Forged Steel, HDG
    - U.T.S.: 70 kN
8. Yoke Plate (L.S.)
    - Material: Mild Steel, HDG

- U.T.S.: 140 kN

9. Complete Suspension Clamp Assembly with P.A. Rod
    - Technical Specifications:
        - Suitable for ACSR Canary conductor
        - Minimum breaking strength: 70 kN
        - Slip strength of suspension clamp: 15% of UTS of conductor
        - Short circuit capacity: 31.5 kA for 1 second
        - P.A. Rod material: Aluminum Alloy 6061
        - Clamp body material: Aluminum Alloy
        - Twisted shackle material: Forged Steel, Hot Dip Galvanized
    - Components:
        - Clamp & keeper
        - Saddle
        - Side strap
        - U-bolt (M-12)
        - M-12 nut
        - Spring washer
        - M10 bolt
        - Plain washer
        - Twisted shackle
        - M-16x90 bolt, nut & flat washer
        - Split pin
        - P.A. Rod (135°)
    - Materials:
        - Clamp body: Aluminum Alloy
        - Other components: Forged Steel, HDG
    - U.T.S.: 70 kN

Additional Requirements

1. All components must be designed for use in 220 kV transmission lines

2. Components should be compatible with each other and form a complete double suspension insulator string set
3. Manufacturer must provide test certificates for all items
4. Packaging should be suitable to prevent damage during transportation and storage
5. Clear marking and identification on all components
6. Compliance with KETRACO's quality assurance requirements

2. DOUBLE TENSION INSULATOR STRING HARDWARE AND FITTINGS SET

Set Components

1. Tower Hinge
2. Fixed Extension Strap
3. Adjustable Extension Strap
4. Clevis Eye
5. Heavy Hexagonal Ball Eye
6. Arcing Ring (T.S.)
7. Arcing Ring (L.S.)
8. Heavy Hexagonal Socket Clevis
9. Yoke Plate
10. Clevis Eye (160 kN)
11. Dead End Clamp
12. Additional Link (AEL-351)
13. Additional Link (AEL-352)

Technical Specifications

General Requirements

1. Applicable standard: B.S. 3288, Part-I
2. Ultimate Tensile Strength (U.T.S.) of hardware fittings: 2 x 120 kN (without tension clamp)
3. U.T.S. of tension clamp: 95% UTS of ACSR Canary conductor
4. Ball and socket designation: 16 mm (as per IEC:120)
5. Short circuit capacity: 31.5 kA per 1 second
6. General tolerance: ±3% unless otherwise specified
7. All ferrous parts (except spring washer) shall be hot-dip galvanized conforming to B.S. 729
8. Spring washer: Spring steel, electro-galvanized

9. Split pin & security clip: Stainless steel
10. Suitable for single ACSR Canary conductor
11. Insulator string length: 2539 mm

Specific Component Requirements

1. Tower Hinge
    - Material: Mild Steel FE-410, Hot Dip Galvanized (HDG)
    - U.T.S.: 120 kN
2. Fixed Extension Strap
    - Material: Mild Steel FE-410, HDG
    - U.T.S.: 120 kN
3. Adjustable Extension Strap
    - Material: Mild Steel FE-410, HDG
    - U.T.S.: 120 kN
4. Clevis Eye
    - Material: Forged Steel (Class-IV), HDG
    - U.T.S.: 120 kN
5. Heavy Hexagonal Ball Eye
    - Material: Forged Steel (Class-IV), HDG
    - U.T.S.: 120 kN
6. Arcing Ring (T.S.)
    - Material: Mild Steel FE-410, HDG
7. Arcing Ring (L.S.)
    - Material: Mild Steel FE-410, HDG
    - Dimensions:
        - Outer diameter: 332 mm
        - Inner diameter: 216 mm
        - Thickness: 16 mm
    - Mounting: M12x40 bolt & nut (2 sets), with spring washers
8. Heavy Hexagonal Socket Clevis
    - Material: Forged Steel (Class-IV), HDG
    - U.T.S.: 120 kN

9. Yoke Plate
    - Material: Mild Steel FE-410, HDG
    - U.T.S.: 240 kN
10. Clevis Eye
    - Material: Forged Steel (Class-IV), HDG
    - U.T.S.: 160 kN
    - U.T.S.: 95% of UTS of ACSR Canary conductor
11. Additional Link (AEL-351 and AEL-352)
    - Material: Mild Steel, HDG
    - U.T.S.: 120 kN
12. Complete Tension Clamp Assembly (Dead End Clamp)
    - Materials:
        - Body: Extruded Aluminum (99.5% purity)
        - Other components: Forged Steel, HDG
    - U.T.S.: 95% of UTS of ACSR Canary conductor
    - Technical Specifications:
        - Suitable for ACSR Canary conductor
        - Slip/mechanical strength (minimum): 95% UTS of conductor
        - Compression die numbers: DA-11 (AL) & DS-10 (STEEL)
        - Compression pressure: 100 ton
        - Short circuit capacity: 31.5 kA for 1 second
    - Components:
        - Dead end body (Extruded Aluminum Alloy)
        - Steel dead end (Forged Steel)
        - M12x60 bolt & nut
        - Plain washer for M12 bolt
        - Spring washer for M12 bolt
        - Filler plug
        - M16x80 bolt & nut
        - Plain washer for M16 bolt
        - Split pin

- 5mm thick washer

Additional Requirements

1. All components must be designed for use in 220 kV transmission lines
2. Components should be compatible with each other and form a complete double tension insulator string set of hardware and fittings
3. Manufacturer must provide test certificates for all items
4. Packaging should be suitable to prevent damage during transportation and storage
5. Clear marking and identification on all components
6. Compliance with KETRACO's quality assurance requirements

3. SINGLE SUSPENSION INSULATOR STRING HARDWARE AND FITTINGS SET

Set Components

1. Tower Hinge
2. Heavy Hexagonal Ball Link
3. Arcing Ring (T.S.)
4. Arcing Ring (L.S.)
5. Heavy Hexagonal Socket Eye
6. Complete Suspension Clamp Assembly with P.A. Rod

Technical Specifications

General Requirements

1. Applicable standard: B.S. 3288, Part-I
2. Ultimate Tensile Strength (U.T.S.) of hardware fittings: 70 kN
3. Ball and socket designation: 16 mm (as per IEC:120)
4. Slip strength of suspension clamp: 15% of U.T.S. of relevant conductor
5. Short circuit capacity: 31.5 kA per 1 second
6. General tolerance: ±3% unless otherwise specified
7. All ferrous parts (except spring washer) shall be hot-dip galvanized conforming to B.S. 729
8. Spring washer: Spring steel, electro-galvanized
9. Security clip & split pin: Stainless steel
10. Suitable for single ACSR Canary conductor
11. Total length of insulator string: 2971 mm (approximate)

Specific Component Requirements

1. Tower Hinge
    - Material: Mild Steel, Hot Dip Galvanized (HDG)
    - U.T.S.: 70 kN
2. Heavy Hexagonal Ball Link
    - Material: Forged Steel, HDG
    - U.T.S.: 70 kN
3. Arcing Ring (T.S.)
    - Material: Mild Steel, HDG
4. Arcing Ring (L.S.)
    - Material: Mild Steel, HDG
    - Dimensions:
        - Outer diameter: 332 mm
        - Inner diameter: 166 mm
        - Thickness: 16 mm
    - Mounting: M12x40 bolt & nut (2 sets), with spring washers
5. Heavy Hexagonal Socket Eye
    - Material: Forged Steel, HDG
    - U.T.S.: 70 kN
6. Complete Suspension Clamp Assembly with P.A. Rod
    - Technical Specifications:
        - Suitable for ACSR Canary conductor
        - Minimum breaking strength: 70 kN
        - Slip strength of suspension clamp: 15% of UTS of conductor
        - Short circuit capacity: 31.5 kA for 1 second
        - P.A. Rod material: Aluminum Alloy 6061
        - Clamp body material: Aluminum Alloy
        - Twisted shackle material: Forged Steel, Hot Dip Galvanized
    - Components:
        - Clamp & keeper

        - Saddle
        - Side strap
        - U-bolt (M-12)
        - M-12 nut
        - Spring washer
        - M10 bolt
        - Plain washer
        - Twisted shackle
        - M-16x90 bolt, nut & flat washer
        - Split pin
        - P.A. Rod (135°)
    - Materials:
        - Clamp body: Aluminum Alloy
        - Other components: Forged Steel, HDG
    - U.T.S.: 70 kN
    - Suitable for ACSR Canary conductor

Additional Requirements

1. All components must be designed for use in 220 kV transmission lines
2. Components should be compatible with each other and form a complete single suspension insulator string set of harware and fittings
3. Manufacturer must provide test certificates for all items
4. Packaging should be suitable to prevent damage during transportation and storage
5. Clear marking and identification on all components
6. Compliance with KETRACO's quality assurance requirements

4. SINGLE TENSION INSULATOR STRING HARDWARE AND FITTINGS SET

Set Components

1. Tower Hinge
2. Extension Strap
3. Sag Adjustment Plate
4. Heavy Hexagonal Ball Eye
5. Arcing Ring (T.S.)

6. Arcing Ring (L.S.)
7. Heavy Hexagonal Socket Eye
8. Complete Dead End Clamp Assembly
9. Additional Link (AEL-351)
10. Additional Link (AEL-352)

Technical Specifications

General Requirements

1. Applicable standard: B.S. 3288, Part-I
2. Ultimate Tensile Strength (U.T.S.) of hardware fittings: 120 kN
3. U.T.S. of tension clamp: 95% of U.T.S of ACSR Canary conductor
4. Ball and socket designation: 16 mm (as per IEC:120)
5. Short circuit capacity: 31.5 kA per 1 second
6. General tolerance: ±3% unless otherwise specified
7. All ferrous parts (except spring washer) shall be hot-dip galvanized conforming to B.S. 729
8. Spring washer: Spring steel, electro-galvanized
9. Split pin & security clip: Stainless steel
10. Suitable for single ACSR Canary conductor
11. Insulator string length: 2539 mm
12. Arcing gap: 2100 mm

Specific Component Requirements

1. Tower Hinge
    - Material: Mild Steel, Hot Dip Galvanized (HDG)
    - U.T.S.: 120 kN
2. Extension Strap
    - Material: Mild Steel, HDG
    - U.T.S.: 120 kN
3. Sag Adjustment Plate
    - Material: Mild Steel, HDG
    - U.T.S.: 120 kN
    - Adjustment range: 280-430 mm
4. Heavy Hexagonal Ball Eye

- Material: Forged Steel, HDG
- U.T.S.: 120 kN

5. Arcing Ring (T.S.)
    - Material: Mild Steel, HDG
6. Arcing Ring (L.S.)
    - Material: Mild Steel, HDG
    - Dimensions:
        - Outer diameter: 332 mm
        - Inner diameter: 166 mm
        - Thickness: 16 mm
    - Mounting: M12x40 bolt & nut (2 sets), with spring washers
7. Heavy Hexagonal Socket Eye
    - Material: Forged Steel, HDG
    - U.T.S.: 120 kN
8. Complete Dead End Clamp Assembly
    - Materials:
        - Body: Extruded Aluminum (99.5% purity)
        - Other components: Forged Steel, HDG
    - U.T.S.: 95% of U.T.S. of ACSR Canary conductor
9. Additional Link (AEL-351 and AEL-352)
    - Material: Mild Steel, HDG
    - U.T.S.: 120 kN

5.MID-SPAN COMPRESSION JOINT

Technical Specifications:

- Conforms to B.S.: 3288, (Part-1)
- Slip strength: 95% of UTS of conductor
- Compression die numbers: DA-11 (AL) & DS-10 (STEEL)
- Compression pressure: 100 ton

Components:

- Aluminum sleeve (99.5% purity, EC grade)
- Filler plug

- Steel sleeve (Mild Steel, Hot Dip Galvanized, FE-410, IS: 2062)

6. REPAIR SLEEVE

Technical Specifications:

- Conforms to B.S.: 3288, (Part-1)
- Material: Extruded Aluminum, EC grade
- Slip strength: 95% of UTS of ACSR Canary conductor
- For ACSR Canary conductor (29.52 mm diameter)
- Dimensions:
    - Outside diameter: 48 mm
    - Inside diameter: 31 mm
    - Length: 279 mm
- Compression die number: DA-11

7. VIBRATION DAMPER

Technical Specifications:

- Conforms to B.S.: 3288, (Part-1)
- Mass pull-off value: 500 kg
- Slip strength of clamp:
    - Before fatigue test: 2.5 kN (minimum)
    - After fatigue test: 2.0 kN (minimum)
- UTS of messenger cable: 135 kg/sq.mm (minimum)
- Messenger cable: 19 strand
- Lay ratio of messenger cable: 9-11
- Tightening torque: 6.5 kg-m

Components:

- Hook half clamp (Aluminum Alloy)
- Damper mass (big) (Cast Iron, Hot Dip Galvanized)
- Cover half clamp (Aluminum Alloy)
- Messenger cable (High Tensile Steel, Hot Dip Galvanized)
- Damper mass (small) (Cast Iron, Hot Dip Galvanized)
- M16 flat washer
- M16 spring washer

- Bolt (M16)
- Tar sealing plug
- Taper sleeves

General Requirements:

- All components must be suitable for use with ACSR Canary conductor on 220 kV transmission lines
- All metallic parts should be hot-dip galvanized unless otherwise specified
- All items should conform to relevant international standards (e.g., B.S. 3288)
- General tolerance: ±3% unless otherwise specified
- Manufacturer must provide test certificates for all items
- Items should be packaged to withstand transportation and storage without damage
- Clear marking and identification on all components
- Compatibility with existing KETRACO infrastructure

Additional Requirements

1. All components must be designed for use in 220 kV transmission lines
2. Components should be compatible with each other and form a complete single tension insulator string set of hardware and fittings
3. Manufacturer must provide test certificates for all items
4. Packaging should be suitable to prevent damage during transportation and storage
5. Clear marking and identification on all components
6. Compliance with KETRACO's quality assurance requirements

5.1 MANUFACTURING, MARKING, PACKING & LABELLING

Each hardware and fiting shall be legibly and indelibly marked with the name and trademark of the manufacturer, the year of manufacture and the SML (specified mechanical load) in accordance with IEC 61109.
The following information shall be marked indelibly in a permanent manner by embossing on each insulator hardware and fitting during manufacture:

a) Manufacturer's name or Trademark.
b) Voltage rating
c) Specified mechanical load
d) The letters "**property of KETRACO**"

All markings shall be permanent and shall be by embossing on the hardware and fitting part before galvanizing. The marking shall not affect the performance. Tags and stickers shall not

be accepted. A Reference list of same type as quoted installed in similar climatic conditions and list of 10 previous customers with detailed contacts shall be submitted with this bid from the manufacturer.
The hardware and fittings shall be packed in wooden crates which are reinforced and held closed by external steel wire binding. Each crate shall be internally braced to permit stacking and the steel wire bindings shall be designed to keep firmly closed and permit easy and rapid opening at time of installation. The production capacity, the Manufacturing process schedule, the disposal procedures and Corona and Radio Interference documentation shall be provided with the bid.

The crates shall be designed to keep on sturdy wood pallet. The assembly shall be held tightly in place with steel bands and protected against moisture by a complete covering of heat shrinkable polyethylene film.

6. QUALITY MANAGEMENT SYSTEM

The supplier shall submit a quality assurance plan (QAP) that will be used to ensure that the hardware and fittings design, material, manufacture workmanship, tests, service capability, maintenance and documentation will fulfil the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfill the requirements of ISO 9001:2008.

The manufacturer's Declaration of conformity to reference standards and copies of quality management certification including copy of valid ISO 9001, 14001 & 45001 certificates shall be submitted with the tender for evaluation.

7. TESTS AND INSPECTION

7.1 DESIGN TESTS

Design tests shall be performed on each type of hardware and fitting to verify that the design meets the requirements of this specification and the relevant standards. Design tests shall include:

1. Verification of dimensions
2. Verification of mechanical characteristics
3. Verification of galvanizing
4. Corona and radio interference tests
5. Electrical conductivity test (for current-carrying fittings)

7.2 TYPE TESTS

Type tests shall be performed on each type of hardware and fitting to verify that the production equipment and processes consistently produce hardware and fittings that meet the requirements of this specification and the relevant standards. Type tests shall include:

1. Mechanical strength test

2. Electrical resistance test (for current-carrying fittings)
3. Heating cycle test (for compression fittings)
4. Slip strength test (for suspension and tension clamps)
5. Fatigue test (for vibration dampers)
6. Corona and radio interference tests
7. Galvanizing test

7.3 SAMPLE TESTS

Sample tests shall be performed on samples taken at random from each batch to verify that the batch meets the requirements of this specification and the relevant standards. Sample tests shall include:

1. Visual inspection
2. Verification of dimensions
3. Verification of mechanical characteristics
4. Verification of galvanizing
5. Slip strength test (for suspension and tension clamps)

7.4 ROUTINE TESTS

Routine tests shall be performed on each hardware and fitting to verify that it meets the requirements of this specification and the relevant standards. Routine tests shall include:

1. Visual inspection
2. Verification of dimensions
3. Verification of mechanical characteristics

Copies of the previous design and type test reports by relevant Independent International or National Testing/Standards Authority of the country of manufacture (or ISO/IEC 17025 accredited independent laboratory) shall be submitted with the offer for evaluation (all in English language). A copy of the accreditation certificate for the laboratory shall also be submitted.

Routine and sample test reports for the hardware and fittings to be supplied shall be submitted to KETRACO for approval before shipment/delivery of the goods. KETRACO Engineers (2) shall witness acceptance tests at the factory before shipment. The cost of travelling, Accommodation, Visa fees, Local and off-shore airport transfers shall be borne by the manufacturer/Supplier. A description of test equipment, and Complete test protocols shall be submitted with this bid. In addition, the manufacturer/supplier shall provide a daily subsistence allowance equivalent to USD 350 for each KETRACO engineer that will witness the factory acceptance test.

Factory Acceptance tests (FAT) shall include Routine and Sample tests as per IEC 61284 and applicable latest IEC standards and the following:

1. Verification of Dimensions
2. Verification of locking systems
3. Verification of mechanical strength
4. Verification of slip strength (for suspension and tension clamps)
5. Galvanization test

8. GUARANTEED TECHNICAL PARTICULARS (GTP)

1. CANARY CONDUCTOR HARDWARE AND FITTINGS SET

1. Complete Suspension Clamp Assembly with P.A. Rod

S/N	Description	Unit	Required Value	Offered Value
1.1	Suitable Conductor	-	ACSR Canary	
1.2	Conductor Diameter	Mm	29.52	
1.3	Minimum Breaking Strength	kN	70	
1.4	Slip Strength	% of UTS	15	
1.5	Short Circuit Capacity	kA/sec	31.5/1	
1.6	Clamp Body Material	-	Aluminum Alloy	

S/N	Description	Unit	Required Value	Offered Value
1.7	P.A. Rod Material	-	Aluminum Alloy 6061	
1.8	P.A. Rod Angle	degrees	135	
8	Heavy Hexagonal Socket Clevis (ASC-9H/1)	Piece	200	
9	Yoke Plate (AYP-10C7)	Piece	100	

2. Complete Tension Clamp Assembly (Dead End Clamp)

S/N	Description	Unit	Required Value	Offered Value
2.1	Suitable Conductor	-	ACSR Canary	
2.2	Conductor Diameter	mm	29.52	
2.3	Slip/Mechanical Strength	% of UTS	95 (min)	

S/N	Description	Unit	Required Value	Offered Value
2.4	Compression Die Numbers	-	DA-11 (AL) & DS-10 (STEEL)	
2.5	Compression Pressure	ton	100	
2.6	Short Circuit Capacity	kA/sec	31.5/1	
2.7	Dead End Body Material	-	Extruded Aluminum Alloy	
2.8	Steel Dead End Material	-	Forged Steel	
2.9	Total Weight	kg	[To be provided]	

3. Mid-span Compression Joint

S/N	Description	Unit	Required Value	Offered Value
3.1	Suitable Conductor	-	ACSR Canary	
3.2	Conductor Diameter	mm	29.52	

S/N	Description	Unit	Required Value	Offered Value
3.3	Applicable Standard	-	B.S.: 3288, (Part-1)	
3.4	Slip Strength	% of UTS	95 (min)	
3.5	Compression Die Numbers	-	DA-11 (AL) & DS-10 (STEEL)	
3.6	Compression Pressure	ton	100	
3.7	Aluminum Sleeve Material	-	EC Grade, 99.5% purity	
3.8	Steel Sleeve Material	-	Mild Steel, HDG, FE-410	
3.9	Total Weight	kg	[To be provided]	

4. Repair Sleeve

S/N	Description	Unit	Required Value	Offered Value
4.1	Suitable Conductor	-	ACSR Canary	

S/N	Description	Unit	Required Value	Offered Value
4.2	Conductor Diameter	mm	29.52	
4.3	Applicable Standard	-	B.S.: 3288, (Part-1)	
4.4	Sleeve Material	-	Extruded Aluminum, EC grade	
4.5	Outside Diameter	mm	48	
4.6	Inside Diameter	mm	31	
4.7	Length	mm	279	
4.8	Compression Die Number	-	DA-11	
4.9	Weight	kg	[To be provided]	

5. Vibration Damper

S/N	Description	Unit	Required Value	Offered Value
5.1	Suitable Conductor	-	ACSR Canary	
5.2	Conductor Diameter	Mm	29.52	
5.3	Applicable Standard	-	B.S.: 3288, (Part-1)	
5.4	Mass Pull-off Value	Kg	500	
5.5	Slip Strength (Before Fatigue Test)	kN	2.5 (min)	
5.6	Slip Strength (After Fatigue Test)	kN	2.0 (min)	
5.7	Messenger Cable UTS	kg/sq.mm	135 (min)	
5.8	Messenger Cable Strands	-	19	
5.9	Messenger Cable Lay Ratio	-	11-Sep	

Note: HDG stands for Hot Dip Galvanized

2. DOUBLE SUSPENSION INSULATOR STRING

1. General Particulars

S/N	Description	Unit	Required Value	Offered Value
1.1	Applicable Standard	-	B.S. 3288, Part-I	
1.2	Total U.T.S. of hardware fittings	Kn	2 x 70	
1.3	Ball and socket designation	Mm	16 (as per IEC:120)	
1.4	Slip strength of suspension clamp	% of conductor UTS	15	
1.5	Short circuit capacity	kA/sec	31.5/1	
1.6	General tolerance	%	±3	
1.7	Galvanization standard for ferrous parts	-	B.S. 729	
1.8	Suitable conductor	-	ACSR Canary	

S/N	Description	Unit	Required Value	Offered Value
1.9	Total weight of the complete set	Kg	[To be provided]	

2. Component-specific Particulars

2.1 Tower Hinge

S/N	Description	Unit	Required Value	Offered Value
2.1.1	Material	-	Mild Steel, HDG	
2.1.2	U.T.S.	kN	140	
2.1.3	Weight	kg	[To be provided]	

2.2 Extension Strap

S/N	Description	Unit	Required Value	Offered Value
2.2.1	Material	-	Mild Steel, HDG	
2.2.2	U.T.S.	kN	140	
2.2.3	Weight	kg	[To be provided]	

2.3 Yoke Plate (T.S.)

S/N	Description	Unit	Required Value	Offered Value
2.3.1	Material	-	Mild Steel, HDG	
2.3.2	U.T.S.	kN	140	
2.3.3	Weight	kg	[To be provided]	

2.4 Ball Clevis

S/N	Description	Unit	Required Value	Offered Value
2.4.1	Material	-	Forged Steel, HDG	
2.4.2	U.T.S.	kN	70	
2.4.3	Weight	kg	[To be provided]	

2.5 Arcing Ring (T.S.)

S/N	Description	Unit	Required Value	Offered Value
2.5.1	Material	-	Mild Steel, HDG	
2.5.2	Dimensions (OD x ID x Thickness)	Mm	[Drawing To be provided]	
2.5.3	Weight	Kg	[To be provided]	

2.6 Arcing Ring (L.S.)

S/N	Description	Unit	Required Value	Offered Value
2.6.1	Material	-	Mild Steel, HDG	
2.6.2	Outer Diameter	mm	340	
2.6.3	Inner Diameter	mm	166	
2.6.4	Thickness	mm	16	
2.6.5	Mounting Bolt Size	-	M12x40	
2.6.6	Weight	kg	[To be provided]	

2.7 Socket Clevis

S/N	Description	Unit	Required Value	Offered Value
2.7.1	Material	-	Forged Steel, HDG	
2.7.2	U.T.S.	kN	70	
2.7.3	Weight	kg	[To be provided]	

2.8 Yoke Plate (L.S.)

S/N	Description	Unit	Required Value	Offered Value
2.8.1	Material	-	Mild Steel, HDG	
2.8.2	U.T.S.	kN	140	
2.8.3	Weight	kg	[To be provided]	

2.9 Complete Suspension Clamp Assembly with P.A. Rod

S/N	Description	Unit	Required Value	Offered Value
2.9.1	Clamp Body Material	-	Aluminum Alloy	
2.9.2	Other Components Material	-	Forged Steel, HDG	
2.9.3	U.T.S.	kN	70	
2.9.4	Suitable Conductor	-	ACSR Canary	
2.9.5	Weight	kg	[To be provided]	

2. Component-specific Particulars

2.1 Tower Hinge

S/N	Description	Unit	Required Value	Offered Value
2.1.1	Material	-	Mild Steel FE-410, HDG	
2.1.2	U.T.S.	kN	120	
2.1.3	Weight	kg	[To be provided]	

2.2 Fixed Extension Strap

S/N	Description	Unit	Required Value	Offered Value
2.2.1	Material	-	Mild Steel FE-410, HDG	
2.2.2	U.T.S.	kN	120	
2.2.3	Weight	kg	[To be provided]	

2.3 Adjustable Extension Strap

S/N	Description	Unit	Required Value	Offered Value
2.3.1	Material	-	Mild Steel FE-410, HDG	
2.3.2	U.T.S.	kN	120	
2.3.3	Weight	kg	[To be provided]	

2.4 Clevis Eye

S/N	Description	Unit	Required Value	Offered Value
2.4.1	Material	-	Forged Steel (Class-IV), HDG	
2.4.2	U.T.S.	kN	120	
2.4.3	Weight	kg	[To be provided]	

2.5 Heavy Hexagonal Ball Eye

S/N	Description	Unit	Required Value	Offered Value
2.5.1	Material	-	Forged Steel (Class-IV), HDG	
2.5.2	U.T.S.	kN	120	
2.5.3	Weight	kg	[To be provided]	

2.6 Arcing Ring (T.S.)

S/N	Description	Unit	Required Value	Offered Value
2.6.1	Material	-	Mild Steel FE-410, HDG	
2.6.2	Dimensions (OD x ID x Thickness)	Mm	[To be provided]	
2.6.3	Weight	Kg	[To be provided]	

2.7 Arcing Ring (L.S.)

S/N	Description	Unit	Required Value	Offered Value
2.7.1	Material	-	Mild Steel FE-410, HDG	

S/N	Description	Unit	Required Value	Offered Value
2.7.2	Outer Diameter	mm	332	
2.7.3	Inner Diameter	mm	216	
2.7.4	Thickness	mm	16	
2.7.5	Mounting Bolt Size	-	M12x40	
2.7.6	Weight	kg	[To be provided]	

2.8 Heavy Hexagonal Socket Clevis

S/N	Description	Unit	Required Value	Offered Value
2.8.1	Material	-	Forged Steel (Class-IV), HDG	
2.8.2	U.T.S.	kN	120	
2.8.3	Weight	kg	[To be provided]	

2.9 Yoke Plate (AYP-10C7)

S/N	Description	Unit	Required Value	Offered Value
2.9.1	Material	-	Mild Steel FE-410, HDG	
2.9.2	U.T.S.	kN	240	
2.9.3	Weight	kg	[To be provided]	

2.10 Clevis Eye

S/N	Description	Unit	Required Value	Offered Value
2.10.1	Material	-	Forged Steel (Class-IV), HDG	
2.10.2	U.T.S.	kN	160	
2.10.3	Weight	kg	[To be provided]	

2.11 Dead End Clamp

S/N	Description	Unit	Required Value	Offered Value
2.11.1	Body Material	-	Extruded Aluminum (99.5% purity)	
2.11.2	Other Components Material	-	Forged Steel, HDG	

S/N	Description	Unit	Required Value	Offered Value
2.11.3	U.T.S.	% of conductor UTS	95	
2.11.4	Suitable Conductor	-	ACSR Canary	
2.11.5	Weight	Kg	[To be provided]	

2.12 Additional Link

S/N	Description	Unit	Required Value	Offered Value
2.12.1	Material	-	Mild Steel, HDG	
2.12.2	U.T.S.	kN	120	
2.12.3	Weight	kg	[To be provided]	

4. SINGLE SUSPENSION INSULATOR STRING HARDWARE AND FITTINGS

Component-specific Particulars

2.1 Tower Hinge

S/N	Description	Unit	Guaranteed Value	Offered Value
2.1.1	Material	-	Mild Steel, HDG	
2.1.2	U.T.S.	kN	70	
2.1.3	Weight	kg	[To be provided]	

2.2 Heavy Hexagonal Ball Link

S/N	Description	Unit	Guaranteed Value	Offered Value
2.2.1	Material	-	Forged Steel, HDG	
2.2.2	U.T.S.	kN	70	
2.2.3	Weight	kg	[To be provided]	

2.3 Arcing Ring (T.S.)

S/N	Description	Unit	Guaranteed Value	Offered Value
2.3.1	Material	-	Mild Steel, HDG	
2.3.2	Dimensions (OD x ID x Thickness)	Mm	[To be provided]	
2.3.3	Weight	Kg	[To be provided]	

2.4 Arcing Ring (L.S.)

S/N	Description	Unit	Guaranteed Value	Offered Value
2.4.1	Material	-	Mild Steel, HDG	
2.4.2	Outer Diameter	mm	332	
2.4.3	Inner Diameter	mm	166	
2.4.4	Thickness	mm	16	
2.4.5	Mounting Bolt Size	-	M12x40	
2.4.6	Weight	kg	[To be provided]	

2.5 Heavy Hexagonal Socket Eye

S/N	Description	Unit	Guaranteed Value	Offered Value
2.5.1	Material	-	Forged Steel, HDG	
2.5.2	U.T.S.	kN	70	
2.5.3	Weight	kg	[To be provided]	

2.6 Complete Suspension Clamp Assembly with P.A. Rod

S/N	Description	Unit	Guaranteed Value	Offered Value
2.6.1	Clamp Body Material	-	Aluminum Alloy	
2.6.2	Other Components Material	-	Forged Steel, HDG	
2.6.3	U.T.S.	kN	70	
2.6.4	Suitable Conductor	-	ACSR Canary	
2.6.5	Slip Strength	% of conductor UTS	15	
2.6.6	Total Weight	Kg	[To be provided]	
2.6.7	P.A. Rod Material	-	[To be provided]	
2.6.8	P.A. Rod Length	Mm	[To be provided]	

5. SINGLE TENSION INSULATOR STRING HARDWARE AND FITTINGS

2. Component-specific Particulars

2.1 Tower Hinge

S/N	Description	Unit	Guaranteed Value	Offered Value
2.1.1	Material	-	Mild Steel, HDG	
2.1.2	U.T.S.	kN	120	
2.1.3	Weight	kg	[To be provided]	

2.2 Extension Strap

S/N	Description	Unit	Guaranteed Value	Offered Value
2.2.1	Material	-	Mild Steel, HDG	
2.2.2	U.T.S.	kN	120	
2.2.3	Weight	kg	[To be provided]	

2.3 Sag Adjustment Plate

S/N	Description	Unit	Guaranteed Value	Offered Value
2.3.1	Material	-	Mild Steel, HDG	
2.3.2	U.T.S.	kN	120	
2.3.3	Adjustment range	mm	280-430	
2.3.4	Weight	kg	[To be provided]	

2.4 Heavy Hexagonal Ball Eye

S/N	Description	Unit	Guaranteed Value	Offered Value
2.4.1	Material	-	Forged Steel, HDG	
2.4.2	U.T.S.	kN	120	
2.4.3	Weight	kg	[To be provided]	

2.5 Arcing Ring (T.S.)

S/N	Description	Unit	Guaranteed Value	Offered Value
2.5.1	Material	-	Mild Steel, HDG	
2.5.2	Dimensions (OD x ID x Thickness)	Mm	[To be provided]	

S/N	Description	Unit	Guaranteed Value	Offered Value
2.5.3	Weight	Kg	[To be provided]	

2.6 Arcing Ring (L.S.)

S/N	Description	Unit	Guaranteed Value	Offered Value
2.6.1	Material	-	Mild Steel, HDG	
2.6.2	Outer Diameter	mm	332	
2.6.3	Inner Diameter	mm	166	
2.6.4	Thickness	mm	16	
2.6.5	Mounting Bolt Size	-	M12x40	
2.6.6	Weight	kg	[To be provided]	

2.7 Heavy Hexagonal Socket Eye

S/N	Description	Unit	Guaranteed Value	Offered Value
2.7.1	Material	-	Forged Steel, HDG	
2.7.2	U.T.S.	kN	120	
2.7.3	Weight	kg	[To be provided]	

2.8 Dead End Clamp

S/N	Description	Unit	Guaranteed Value	Offered Value
2.8.1	Body Material	-	Extruded Aluminum (99.5% purity)	
2.8.2	Other Components Material	-	Forged Steel, HDG	
2.8.3	U.T.S.	% of conductor UTS	95	
2.8.4	Suitable Conductor	-	ACSR Canary	
2.8.5	Weight	Kg	[To be provided]	

2.9 Additional Link (AEL-351 and AEL-352)

S/N	Description	Unit	Guaranteed Value	Offered Value
2.9.1	Material	-	Mild Steel, HDG	

S/N	Description	Unit	Guaranteed Value	Offered Value
2.9.2	U.T.S.	kN	120	
2.9.3	Weight	kg	[To be provided]	

I/We declare that the information provided in this GTP is true and correct, and all supporting documents are authentic and valid.

Signature: _____ Name: _____

Position: _____ Company: _____

Date: _____ Company Seal: _____

9. PRICE SCHEDULE FOR CANARY CONDUCTOR HARDWARE AND FITTINGS

Instructions to Bidders:

All prices should be quoted in Kenya Shillings (KES) and are VAT inclusive.

Item No.	Description	Unit	Quantity	Unit Price	Total Price
1.	Double Suspension Insulator String Hardware And Fittings Set complete with suspension clamp assembly	Set	100		
2	Double Tension Insulator String Hardware And Fittings Set complete with tension clamp assembly	Set	100		
3	Single Tension Insulator String Hardware And Fittings Set complete with tension clamp assembly	Set	100		

Item No.	Description	Unit	Quantity	Unit Price	Total Price
4	Single Suspension Insulator String Hardware And Fittings Set complete with suspension clamp assembly	Set	100		
5	Mid-span Compression Joint	Set	200		
6	Repair Sleeve	Piece	200		
7	Vibration Damper	Set	200		
TOTAL FOR CANARY CONDUCTOR HARDWARE AND FITTINGS					

Declaration

We confirm that our bid complies with all requirements as specified in the tender document.

Company Name: _____

Authorized Signatory: _____

Position: _____

Date: _____

Company Stamp: _____

EMPLOYERS REQUIREMENTS & TECHNICAL SPECIFICATIONS FOR ACSR 300/50 CONDUCTOR HARDWARE & FITTINGS

TABLE OF CONTENTS

FOREWORD

This specification has been prepared by Power System Operation and Maintenance Department (System Operation and Power Management Directorate) of the Kenya Electricity Transmission Company LTD (KETRACO) and it lays down requirements for ACSR 300/50 CONDUCTOR Hardware & Fittings.

This specification is based on international standards and is subject to revision as and when required.

Type test reports from accredited facilities shall be submitted with bid.

It shall be the manufacturer's responsibility to be knowledgeable of the requirements contained herein and in the referenced standards.

10. SCOPE

This specification covers the minimum technical requirements for design, manufacture, testing, supply and delivery of hardware and fittings for use with ACSR 300/50 CONDUCTOR .

The specification also covers inspection and test of the hardware and fittings as well as schedule of Guaranteed Technical Particulars, Price schedules to be filled in, signed by the manufacturer and submitted for tender evaluation. Complete installation instructions, Technical support documentation and Maintenance procedures shall be submitted with this bid for evaluation.

The specifications stipulate the minimum requirements for Hardware and Fittings for ACSR 300/50 CONDUCTOR acceptable for use by KETRACO and it shall be the responsibility of the manufacturer to ensure adequacy of the design, good workmanship and good engineering practice in the manufacture of the hardware and fittings. The hardware and fittings supplied

shall strictly adhere to the issued drawings. Where inconsistencies exist between the drawings and specifications, the drawings shall govern unless otherwise approved in writing by KETRACO.

11. REFERENCE STANDARDS

The hardware and fittings shall comply with the latest editions of the following standards:

- IEC 61284: Overhead lines - Requirements and tests for fittings
- IEC 60120: Dimensions of ball and socket couplings of string insulator units
- IEC 60372: Locking devices for ball and socket couplings of string insulator units - Dimensions and tests
- IEC 60471: Dimensions of clevis and tongue couplings of string insulator units
- BS EN 61284: Overhead lines - Requirements and tests for fittings
- BS EN 60672-3: Ceramic and glass-insulating materials
- BS EN ISO 1461: Hot dip galvanized coatings on fabricated iron and steel articles
- BS EN ISO 2178: Non-magnetic coatings on magnetic substrates - Measurement of coating thickness - Magnetic method
- ASTM A153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- ASTM B230: Standard Specification for Aluminum 1350-H19 Wire for Electrical Purposes
- ASTM B232: Standard Specification for Concentric-Lay-Stranded Aluminum Conductors

12. SERVICE CONDITIONS

1. The hardware and fittings shall be suitable for continuous operation outdoor in tropical areas at altitudes of up to 2200m above sea level, humidity of up to 90%, ambient temperature of +30 degrees centigrade with a minimum of -1 degree centigrade and a maximum of +40-degree centigrade, heavy saline conditions along the coast and tropical sunshine conditions.
2. The weather isokeraunic levels reach up to 180 thunderstorms days per year.
3. The level of galvanizing for all parts and materials used shall be suitable for these conditions.

13. MATERIALS AND CONSTRUCTION

13.1 GENERAL REQUIREMENTS

1. All hardware and fittings shall be designed, manufactured and tested in accordance with IEC 61284 and other applicable/latest standards and requirements of this specification.
2. All ferrous parts shall be hot-dip galvanized after fabrication in accordance with ISO 1461 and ASTM A153. The zinc coating shall be smooth, continuous, and uniform. It shall be

free from areas that are bare, have blisters, flux and ash inclusions, lumps, or coarse crystals.

3. The galvanized coating on all hardware shall withstand four one-minute dips in copper sulphate solution as per IEC 61284 without showing signs of copper deposits.
4. Spring washers shall be of spring steel and electro-galvanized.
5. Security clips and split pins shall be of stainless steel.
6. Design and construction drawings shall be submitted by the winning bidder.
7. The surfaces of all hardware shall be smooth, without cuts, abrasions, projections, ridges or exfoliation that might damage the conductor or cause radio interference.
8. All bolts and nuts shall have hexagonal heads and shall be locked in an approved manner.
9. All hardware shall be suitable for use with ACSR 300/50 CONDUCTOR (diameter 24.5 mm, weight 1264 kg/km, UTS 110.5 kN) and shall have adequate strength, conductivity, and corona performance.
10. The design shall minimize the number of parts and the number of bolts per assembly.

13.2 SPECIFIC MATERIAL REQUIREMENTS

5. Aluminum and Aluminum Alloys:
    - Suspension clamp bodies, tension clamp bodies, armor rods, and other aluminum components shall be made from high-strength aluminum alloy.
    - Aluminum alloy castings shall be free from flaws, surface blemishes, and shrinkage defects.
6. Steel and Steel Alloys:
    - All steel used shall be thoroughly hot-dip galvanized after fabrication.
    - Malleable cast iron shall not be used.
    - Drop-forged steel shall be used for tension and suspension hardware components requiring high mechanical strength.
7. Fasteners:
    - All bolts, nuts, and washers shall be hot-dip galvanized steel.
    - All bolts shall be provided with one flat washer and one spring washer.
    - Split pins and security clips shall be of stainless steel.
8. Corona and Radio Interference:
    - All fittings shall be designed to minimize corona discharge and radio interference.

- Corona rings/shields shall be provided where necessary to ensure corona extinction levels are maintained.
- Minimum corona extinction voltage shall be 105 kV (rms).
- Radio Interference Voltage at 110 kV shall not exceed 500 μV.

14. HARDWARE AND FITTINGS SETS

1. DOUBLE SUSPENSION INSULATOR STRING HARDWARE AND FITTINGS SET

Set Components

1. Clevis Hinge
2. Ball Clevis
3. Yoke plate
4. Ball eye (type U (T.S.)
5. Upper Arcing horn
6. Bottom Arcing horn
7. Socket Clevis
8. Yoke Plate (L.S.)
9. Suspension Clamp Assembly with P.A. Rod

Technical Specifications

General Requirements

1. Applicable standard: B.S. 3288, Part-I
2. Ultimate Tensile Strength (U.T.S.) of hardware fittings: 2 x 90 kN
3. Ball and socket designation: 16 mm (as per IEC:120)
4. Slip strength of suspension clamp: 15% of U.T.S. of relevant conductor
5. Short circuit capacity: 31.5 kA per 1 second
6. General tolerance: ±3% unless otherwise specified
7. All ferrous parts (except spring washer) shall be hot-dip galvanized conforming to B.S. 729
8. Spring washer: Spring steel, electro-galvanized
9. Security clip & split pin: Stainless steel
10. Suitable for single ACSR ACSR 300/50 conductor

Specific Component Requirements

1. Clevis Hinge
    - Material: Mild Steel, Hot Dip Galvanized (HDG)
    - U.T.S.: 100 kN
2. Ball Clevis
    - Material: Mild Steel, HDG
    - U.T.S.: 100 kN
3. Yoke plate
    - Material: Forged Steel, HDG
    - U.T.S.: 100 kN
4. Upper Arcing Horn
    - Material: Mild Steel, HDG
5. Botttom Arcing Horn
    - Material: Mild Steel, HDG
    - Mounting: M12x40 bolt & nut (2 sets), with spring washers
6. Socket Clevis
    - Material: Forged Steel, HDG
    - U.T.S.: 70 kN
7. Yoke Plate (L.S.)
    - Material: Mild Steel, HDG
    - U.T.S.: 100 kN
8. Suspension Clamp Assembly with P.A. Rod
    - Materials:
        - Clamp body: Aluminum Alloy
        - Other components: Forged Steel, HDG
    - Technical Specifications:
        - Suitable for ACSR ACSR 300/50 conductor
        - Minimum breaking strength: 90 kN
        - Slip strength of suspension clamp: 15% of UTS of conductor
        - Short circuit capacity: 31.5 kA for 1 second
        - P.A. Rod material: Aluminum Alloy 6061

- Clamp body material: Aluminum Alloy
- Twisted shackle material: Forged Steel, Hot Dip Galvanized
- Ball and socket size according to IEC 120/16

- Components:
  - Clamp body & keeper
  - U-bolts
  - Flat washers M16
  - Spring washers M16
  - M-16 nut
  - Clevis
  - Bolt M18x90
  - Cotter pin type A
  - Nut M18
  - P.A. Rod

Additional Requirements

1. All components must be designed for use in 220 kV transmission lines
2. Components should be compatible with each other and form a complete double suspension insulator string set hardware and fittings
3. Manufacturer must provide test certificates for all items
4. Packaging should be suitable to prevent damage during transportation and storage
5. Clear marking and identification on all components
6. Compliance with quality assurance requirements

2. DOUBLE TENSION INSULATOR STRING HARDWARE AND FITTINGS SET

Set Components

1. Tower Hinge
2. Fixed Extension Strap
3. Adjustable Extension Strap
4. Clevis Eye (
5. Heavy Hexagonal Ball Eye
6. Arcing Ring (T.S.)
7. Arcing Ring (L.S.)

8. Heavy Hexagonal Socket Clevis
9. Yoke Plate
10. Clevis Eye (160 kN)
11. Dead End Clamp
12. Additional Link
13. Additional Link

Technical Specifications

General Requirements

1. Applicable standard: B.S. 3288, Part-I
2. Ultimate Tensile Strength (U.T.S.) of hardware fittings: 2 x 160 kN (without tension clamp)
3. U.T.S. of tension clamp: 95% UTS of ACSR ACSR 300/50 conductor
4. Ball and socket designation: 16 mm (as per IEC:120)
5. Short circuit capacity: 31.5 kA per 1 second
6. General tolerance: ±3% unless otherwise specified
7. All ferrous parts (except spring washer) shall be hot-dip galvanized conforming to B.S. 729
8. Spring washer: Spring steel, electro-galvanized
9. Split pin & security clip: Stainless steel
10. Suitable for single ACSR ACSR 300/50 conductor
11. Insulator string length: 2539 mm

Specific Component Requirements

1. Tower Hinge
    - Material: Mild Steel FE-410, Hot Dip Galvanized (HDG)
    - U.T.S.: 160 kN
2. Fixed Extension Strap
    - Material: Mild Steel FE-410, HDG
    - U.T.S.: 160 kN
3. Adjustable Extension Strap
    - Material: Mild Steel FE-410, HDG
    - U.T.S.: 160 kN
4. Clevis Eye
    - Material: Forged Steel (Class-IV), HDG

- U.T.S.: 160 kN

5. Heavy Hexagonal Ball Eye
    - Material: Forged Steel (Class-IV), HDG
    - U.T.S.: 160 kN
6. Arcing Ring (T.S.)
    - Material: Mild Steel FE-410, HDG
7. Arcing Ring (L.S.)
    - Material: Mild Steel FE-410, HDG
    - Dimensions:
        - Outer diameter: 332 mm
        - Inner diameter: 216 mm
        - Thickness: 16 mm
    - Mounting: M12x40 bolt & nut (2 sets), with spring washers
8. Heavy Hexagonal Socket Clevis
    - Material: Forged Steel (Class-IV), HDG
    - U.T.S.: 160 kN
9. Yoke Plate
    - Material: Mild Steel FE-410, HDG
    - U.T.S.: 320 kN
10. Clevis Eye (160 kN)
    - Material: Forged Steel (Class-IV), HDG
    - U.T.S.: 160 kN
11. Dead End Clamp
    - Materials:
        - Body: Extruded Aluminum (99.5% purity)
        - Other components: Forged Steel, HDG
    - Technical Specifications:
        - Suitable for ACSR ACSR 300/50 conductor
        - Slip/mechanical strength (minimum): 95% UTS of conductor
        - Compression die numbers: DA-12 (AL) & DS-11 (STEEL)
        - Compression pressure: 100 ton

        - Short circuit capacity: 31.5 kA for 1 second
    - Components:
        - Dead end body (Extruded Aluminum Alloy)
        - Steel dead end (Forged Steel)
        - M12x60 bolt & nut
        - Plain washer for M12 bolt
        - Spring washer for M12 bolt
        - Filler plug
        - M16x80 bolt & nut
        - Plain washer for M16 bolt
        - Split pin
        - 5mm thick washer

12. Additional Links
    - Material: Mild Steel, HDG
    - U.T.S.: 160 kN

Additional Requirements

1. All components must be designed for use in 220 kV transmission lines
2. Components should be compatible with each other and form a complete double tension insulator string set hardware and fittings
3. Manufacturer must provide test certificates for all items
4. Packaging should be suitable to prevent damage during transportation and storage
5. Clear marking and identification on all components
6. Compliance with quality assurance requirements

3. SINGLE SUSPENSION INSULATOR STRING HARDWARE AND FITTINGS SET

Set Components

1. Tower Hinge (1 pc)
2. Heavy Hexagonal Ball Link (1 pc)
3. Arcing Ring (T.S.) (1 pc)
4. Arcing Ring (L.S.) (1 pc)
5. Heavy Hexagonal Socket Eye (1 pc)

6. Suspension Clamp Assembly with P.A. Rod (1 set)

Technical Specifications

General Requirements

1. Applicable standard: B.S. 3288, Part-I
2. Ultimate Tensile Strength (U.T.S.) of hardware fittings: 90 kN
3. Ball and socket designation: 16 mm (as per IEC:120)
4. Slip strength of suspension clamp: 15% of U.T.S. of relevant conductor
5. Short circuit capacity: 31.5 kA per 1 second
6. General tolerance: ±3% unless otherwise specified
7. All ferrous parts (except spring washer) shall be hot-dip galvanized conforming to B.S. 729
8. Spring washer: Spring steel, electro-galvanized
9. Security clip & split pin: Stainless steel
10. Suitable for single ACSR ACSR 300/50 conductor
11. Total length of insulator string: 2971 mm (approximate)

4. SINGLE TENSION INSULATOR STRING HARDWARE AND FITTINGS SET

Set Components

1. Tower Hinge (1 pc)
2. Extension Strap (1 pc)
3. Sag Adjustment Plate (1 pc)
4. Heavy Hexagonal Ball Eye (1 pc)
5. Arcing Ring (T.S.) (1 pc)
6. Arcing Ring (L.S.) (1 pc)
7. Heavy Hexagonal Socket Eye (1 pc)
8. Dead End Clamp (1 pc)
9. Additional Link (1 pc)
10. Additional Link (1 pc)

Technical Specifications

General Requirements

1. Applicable standard: B.S. 3288, Part-I
2. Ultimate Tensile Strength (U.T.S.) of hardware fittings: 160 kN
3. U.T.S. of tension clamp: 95% of U.T.S of ACSR ACSR 300/50 conductor

4. Ball and socket designation: 16 mm (as per IEC:120)
5. Short circuit capacity: 31.5 kA per 1 second
6. General tolerance: ±3% unless otherwise specified
7. All ferrous parts (except spring washer) shall be hot-dip galvanized conforming to B.S. 729
8. Spring washer: Spring steel, electro-galvanized
9. Split pin & security clip: Stainless steel
10. Suitable for single ACSR ACSR 300/50 conductor
11. Insulator string length: 2539 mm
12. Arcing gap: 2100 mm

5. MID-SPAN COMPRESSION JOINT

Technical Specifications:

1. Conforms to B.S.: 3288, (Part-1)
2. Slip strength: 95% of UTS of conductor
3. Compression die numbers: DA-12 (AL) & DS-11 (STEEL)
4. Compression pressure: 100 ton

Components:

1. Aluminum sleeve (99.5% purity, EC grade)
2. Filler plug
3. Steel sleeve (Mild Steel, Hot Dip Galvanized, FE-410, IS: 2062)

6. REPAIR SLEEVE

Technical Specifications:

1. Conforms to B.S.: 3288, (Part-1)
2. Material: Extruded Aluminum, EC grade
3. Slip strength: 95% of UTS of ACSR ACSR 300/50 conductor
4. Dimensions:
    - Outside diameter: 52 mm
    - Inside diameter: 33 mm
    - Length: 300 mm
5. Compression die number: DA-12

7. VIBRATION DAMPER

Technical Specifications:

1. Conforms to B.S.: 3288, (Part-1)
2. Mass pull-off value: 500 kg
3. Slip strength of clamp:
    - Before fatigue test: 2.5 kN (minimum)
    - After fatigue test: 2.0 kN (minimum)
4. UTS of messenger cable: 135 kg/sq.mm (minimum)
5. Messenger cable: 19 strand
6. Lay ratio of messenger cable: 9-11
7. Tightening torque: 6.5 kg-m

General Requirements:

1. All components must be suitable for use with ACSR ACSR 300/50 conductor on 220 kV transmission lines
2. All metallic parts should be hot-dip galvanized unless otherwise specified
3. All items should conform to relevant international standards (e.g., B.S. 3288)
4. General tolerance: ±3% unless otherwise specified
5. Manufacturer must provide test certificates for all items

14.1 MANUFACTURING, MARKING, PACKING & LABELLING

Each hardware and fiting shall be legibly and indelibly marked with the name and trademark of the manufacturer, the year of manufacture and the SML (specified mechanical load) in accordance with IEC 61109.
The following information shall be marked indelibly in a permanent manner by embossing on each insulator hardware and fitting during manufacture:

e) Manufacturer's name or Trademark.
f) Voltage rating
g) Specified mechanical load
h) The letters "**property of KETRACO**"

All markings shall be permanent and shall be by embossing on the hardware and fitting part before galvanizing. The marking shall not affect the performance. Tags and stickers shall not be accepted. A Reference list of same type as quoted installed in similar climatic conditions and list of 10 previous customers with detailed contacts shall be submitted with this bid from the manufacturer.
The hardware and fittings shall be packed in wooden crates which are reinforced and held closed by external steel wire binding. Each crate shall be internally braced to permit stacking and the steel wire bindings shall be designed to keep firmly closed and permit easy and rapid

opening at time of installation. The production capacity, the Manufacturing process schedule, the disposal procedures and Corona and Radio Interference documentation shall be provided with the bid.

The crates shall be designed to keep on sturdy wood pallet. The assembly shall be held tightly in place with steel bands and protected against moisture by a complete covering of heat shrinkable polyethylene film.

15. QUALITY MANAGEMENT SYSTEM

The supplier shall submit a quality assurance plan (QAP) that will be used to ensure that the hardware and fittings design, material, manufacture workmanship, tests, service capability, maintenance and documentation will fulfil the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfill the requirements of ISO 9001:2008.

The manufacturer's Declaration of conformity to reference standards and copies of quality management certification including copy of valid ISO 9001, 14001 & 45001 certificates shall be submitted with the tender for evaluation.

16. TESTS AND INSPECTION

16.1 DESIGN TESTS

Design tests shall be performed on each type of hardware and fitting to verify that the design meets the requirements of this specification and the relevant standards. Design tests shall include:

1. Verification of dimensions
2. Verification of mechanical characteristics
3. Verification of galvanizing
4. Corona and radio interference tests
5. Electrical conductivity test (for current-carrying fittings)

16.2 TYPE TESTS

Type tests shall be performed on each type of hardware and fitting to verify that the production equipment and processes consistently produce hardware and fittings that meet the requirements of this specification and the relevant standards. Type tests shall include:

17. Mechanical strength test

18. Electrical resistance test (for current-carrying fittings)

19. Heating cycle test (for compression fittings)

20. Slip strength test (for suspension and tension clamps)

21. Fatigue test (for vibration dampers)
22. Corona and radio interference tests
23. Galvanizing test

16.3 SAMPLE TESTS

Sample tests shall be performed on samples taken at random from each batch to verify that the batch meets the requirements of this specification and the relevant standards. Sample tests shall include:

6. Visual inspection
7. Verification of dimensions
8. Verification of mechanical characteristics
9. Verification of galvanizing
10. Slip strength test (for suspension and tension clamps)

16.4 ROUTINE TESTS

Routine tests shall be performed on each hardware and fitting to verify that it meets the requirements of this specification and the relevant standards. Routine tests shall include:

4. Visual inspection
5. Verification of dimensions
6. Verification of mechanical characteristics

Copies of the previous design and type test reports by relevant Independent International or National Testing/Standards Authority of the country of manufacture (or ISO/IEC 17025 accredited independent laboratory) shall be submitted with the offer for evaluation (all in English language). A copy of the accreditation certificate for the laboratory shall also be submitted.

Routine and sample test reports for the hardware and fittings to be supplied shall be submitted to KETRACO for approval before shipment/delivery of the goods. KETRACO Engineers (2) shall witness acceptance tests at the factory before shipment. The cost of travelling, Accommodation, Visa fees, Local and off-shore airport transfers shall be borne by the manufacturer/Supplier. A description of test equipment, and Complete test protocols shall be submitted with this bid. In addition, the manufacturer/supplier shall provide a daily subsistence allowance equivalent to USD 350 for each KETRACO engineer that will witness the factory acceptance test.

Factory Acceptance tests (FAT) shall include Routine and Sample tests as per IEC 61284 and applicable latest IEC standards and the following:

1. Verification of Dimensions

2. Verification of locking systems
3. Verification of mechanical strength
4. Verification of slip strength (for suspension and tension clamps)
5. Galvanization test

17. GUARANTEED TECHNICAL PARTICULARS (GTP)

CONDUCTOR HARDWARE AND FITTINGS SET

1. Suspension Clamp Assembly with P.A. Rod

S/N	Description	Unit	Guaranteed Value	Offered Value
1.1	Suitable Conductor	-	ACSR 300/50	
1.2	Conductor Diameter	mm	31.77	
1.3	Minimum Breaking Strength	kN	90	
1.4	Slip Strength	% of UTS	15	
1.5	Short Circuit Capacity	kA/sec	31.5/1	
1.6	Clamp Body Material	-	Aluminum Alloy	
1.7	P.A. Rod Material	-	Aluminum Alloy 6061	
1.8	P.A. Rod Angle	degrees	135	
1.9	Twisted Shackle Material	-	Forged Steel, HDG	
1.10	Total Weight	kg	[To be provided]	

2. Tension Clamp (Dead End Clamp)

S/N	Description	Unit	Guaranteed Value	Offered Value
2.1	Suitable Conductor	-	ACSR ACSR 300/50	
2.2	Conductor Diameter	mm	31.77	
2.3	Slip/Mechanical Strength	% of UTS	95 (min)	
2.4	Compression Die Numbers	-	DA-12 (AL) & DS-11 (STEEL)	

S/N	Description	Unit	Guaranteed Value	Offered Value
2.5	Compression Pressure	ton	100	
2.6	Short Circuit Capacity	kA/sec	31.5/1	
2.7	Dead End Body Material	-	Extruded Aluminum Alloy	
2.8	Steel Dead End Material	-	Forged Steel	
2.9	Total Weight	kg	[To be provided]	

3. Mid-span Compression Joint

S/N	Description	Unit	Guaranteed Value	Offered Value
3.1	Suitable Conductor	-	ACSR ACSR 300/50	
3.2	Conductor Diameter	mm	31.77	
3.3	Applicable Standard	-	B.S.: 3288, (Part-1)	
3.4	Slip Strength	% of UTS	95 (min)	
3.5	Compression Die Numbers	-	DA-12 (AL) & DS-11 (STEEL)	
3.6	Compression Pressure	ton	100	
3.7	Aluminum Sleeve Material	-	EC Grade, 99.5% purity	
3.8	Steel Sleeve Material	-	Mild Steel, HDG, FE-410	
3.9	Total Weight	kg	[To be provided]	

4. Repair Sleeve

S/N	Description	Unit	Guaranteed Value	Offered Value
4.1	Suitable Conductor	-	ACSR ACSR 300/50	
4.2	Conductor Diameter	mm	31.77	
4.3	Applicable Standard	-	B.S.: 3288, (Part-1)	
4.4	Sleeve Material	-	Extruded Aluminum, EC grade	
4.5	Outside Diameter	mm	52	
4.6	Inside Diameter	mm	33	
4.7	Length	mm	300	
4.8	Compression Die Number	-	DA-12	

S/N	Description	Unit	Guaranteed Value	Offered Value
4.9	Weight	kg	[To be provided]	

5. Vibration Damper

S/N	Description	Unit	Guaranteed Value	Offered Value
5.1	Suitable Conductor	-	ACSR 300/50	
5.2	Conductor Diameter	mm	31.77	
5.3	Applicable Standard	-	B.S.: 3288, (Part-1)	
5.4	Mass Pull-off Value	kg	500	
5.5	Slip Strength (Before Fatigue Test)	kN	2.5 (min)	
5.6	Slip Strength (After Fatigue Test)	kN	2.0 (min)	
5.7	Messenger Cable UTS	kg/sq.mm	135 (min)	
5.8	Messenger Cable Strands	-	19	
5.9	Messenger Cable Lay Ratio	-	9-11	
5.10	Tightening Torque	kg-m	6.5	
5.11	Clamp Material	-	Aluminum Alloy	
5.12	Damper Mass Material	-	Cast Iron, HDG	
5.13	Total Weight	kg	[To be provided]	

DOUBLE SUSPENSION INSULATOR HARDWARE AND FITTINGS

2. Component-specific Particulars

2.1 Tower Hinge

S/N	Description	Unit	Guaranteed Value	Offered Value
2.1.1	Material	-	Mild Steel, HDG	
2.1.2	U.T.S.	kN	160	
2.1.3	Weight	Kg	[To be provided]	

2.2 Yoke Plate (T.S.)

S/N	Description	Unit	Guaranteed Value	Offered Value
2.2.1	Material	-	Mild Steel, HDG	

S/N	Description	Unit	Guaranteed Value	Offered Value
2.2.2	U.T.S.	kN	160	
2.2.3	Weight	Kg	[To be provided]	

2.3 Ball Clevis

S/N	Description	Unit	Guaranteed Value	Offered Value
2.3.1	Material	-	Forged Steel, HDG	
2.3.2	U.T.S.	kN	90	
2.3.3	Weight	Kg	[To be provided]	

2.4 Arcing Ring (T.S.)

S/N	Description	Unit	Guaranteed Value	Offered Value
2.4.1	Material	-	Mild Steel, HDG	
2.4.2	Dimensions (OD x ID x Thickness)	mm	[To be provided]	
2.4.3	Weight	kg	[To be provided]	

2.5 Arcing Ring (L.S.)

S/N	Description	Unit	Guaranteed Value	Offered Value
2.5.1	Material	-	Mild Steel, HDG	
2.5.2	Outer Diameter	mm	340	
2.5.3	Inner Diameter	mm	166	
2.5.4	Thickness	mm	16	
2.5.5	Mounting Bolt Size	-	M12x40	
2.5.6	Weight	kg	[To be provided]	

2.6 Socket Clevis

S/N	Description	Unit	Guaranteed Value	Offered Value
2.6.1	Material	-	Forged Steel, HDG	
2.6.2	U.T.S.	kN	90	
2.6.3	Weight	Kg	[To be provided]	

2.7 Yoke Plate (L.S.)

S/N	Description	Unit	Guaranteed Value	Offered Value
2.7.1	Material	-	Mild Steel, HDG	
2.7.2	U.T.S.	kN	160	
2.7.3	Weight	Kg	[To be provided]	

2.8 Suspension Clamp Assembly with P.A. Rod

S/N	Description	Unit	Guaranteed Value	Offered Value
2.8.1	Clamp Body Material	-	Aluminum Alloy	
2.8.2	Other Components Material	-	Forged Steel, HDG	
2.8.3	U.T.S.	kN	90	
2.8.4	Suitable Conductor	-	ACSR ACSR 300/50	
2.8.5	Slip Strength	% of conductor UTS	15	
2.8.6	Total Weight	kg	[To be provided]	
2.8.7	P.A. Rod Material	-	[To be provided]	
2.8.8	P.A. Rod Length	mm	[To be provided]	

DOUBLE TENSION INSULATOR STRING HARDWARE AND FITTINGS SET

2. Component-specific Particulars

2.1 Tower Hinge

S/N	Description	Unit	Guaranteed Value	Offered Value
2.1.1	Material grade	-	Mild Steel FE-410	
2.1.2	Surface treatment	-	Hot Dip Galvanized	
2.1.3	Ultimate tensile strength	kN	160	
2.1.4	Minimum galvanizing thickness	microns	86	
2.1.5	Bolt hole diameter	mm	[To be provided]	
2.1.6	Individual weight	kg	[To be provided]	

2.2 Extension Straps

S/N	Description	Unit	Guaranteed Value	Offered Value
2.2.1	Material grade	-	Mild Steel FE-410	
2.2.2	Surface treatment	-	Hot Dip Galvanized	
2.2.3	Ultimate tensile strength	kN	160	
2.2.4	Fixed strap length	mm	[To be provided]	
2.2.5	Adjustable strap range	mm	[To be provided]	
2.2.6	Individual weights	kg	[To be provided]	

2.3 Clevis Eye

S/N	Description	Unit	Guaranteed Value	Offered Value
2.3.1	Material specification	-	Forged Steel Class-IV	
2.3.2	Surface treatment	-	Hot Dip Galvanized	
2.3.3	Standard clevis UTS	kN	160	
2.3.4	Heavy duty clevis UTS	kN	160	
2.3.5	Minimum galvanizing thickness	microns	86	
2.3.6	Individual weight	kg	[To be provided]	

2.4 Heavy Hexagonal Ball Eye

S/N	Description	Unit	Guaranteed Value	Offered Value
2.4.1	Material specification	-	Forged Steel Class-IV	
2.4.2	Surface treatment	-	Hot Dip Galvanized	
2.4.3	Ultimate tensile strength	kN	160	
2.4.4	Ball diameter	mm	16	
2.4.5	Minimum galvanizing thickness	microns	86	
2.4.6	Individual weight	kg	[To be provided]	

2.5 Arcing Rings

S/N	Description	Unit	Guaranteed Value	Offered Value
2.5.1	Material grade	-	Mild Steel FE-410	
2.5.2	Surface treatment	-	Hot Dip Galvanized	

S/N	Description	Unit	Guaranteed Value	Offered Value
2.5.3	T.S. ring outer diameter	mm	[To be provided]	
2.5.4	L.S. ring outer diameter	mm	332	
2.5.5	L.S. ring inner diameter	mm	216	
2.5.6	Ring thickness	mm	16	
2.5.7	Individual weights	kg	[To be provided]	

2.6 Heavy Hexagonal Socket Clevis

S/N	Description	Unit	Guaranteed Value	Offered Value
2.6.1	Material specification	-	Forged Steel Class-IV	
2.6.2	Surface treatment	-	Hot Dip Galvanized	
2.6.3	Ultimate tensile strength	kN	160	
2.6.4	Socket dimension	mm	16	
2.6.5	Minimum galvanizing thickness	microns	86	
2.6.6	Individual weight	kg	[To be provided]	

2.7 Yoke Plate

S/N	Description	Unit	Guaranteed Value	Offered Value
2.7.1	Material grade	-	Mild Steel FE-410	
2.7.2	Surface treatment	-	Hot Dip Galvanized	
2.7.3	Ultimate tensile strength	kN	320	
2.7.4	Plate thickness	mm	[To be provided]	
2.7.5	Bolt hole diameter	mm	[To be provided]	
2.7.6	Individual weight	kg	[To be provided]	

2.8 Dead End Clamp

S/N	Description	Unit	Guaranteed Value	Offered Value
2.8.1	Body material	-	Extruded Aluminum 99.5%	
2.8.2	Steel components material	-	Forged Steel, HDG	
2.8.3	Slip strength	% of conductor UTS	95	

S/N	Description	Unit	Guaranteed Value	Offered Value
2.8.4	Compression pressure	Ton	100	
2.8.5	Compression die numbers	-	[To be provided]	
2.8.6	Aluminum sleeve length	Mm	[To be provided]	
2.8.7	Steel sleeve length	Mm	[To be provided]	
2.8.8	Complete assembly weight	Kg	[To be provided]	

2.9 Additional Links

S/N	Description	Unit	Guaranteed Value	Offered Value
2.9.1	Material grade	-	Mild Steel	
2.9.2	Surface treatment	-	Hot Dip Galvanized	
2.9.3	Ultimate tensile strength	kN	160	
2.9.4	Link length	mm	[To be provided]	
2.9.5	Minimum galvanizing thickness	microns	86	
2.9.6	Individual weight	kg	[To be provided]	

SINGLE SUSPENSION INSULATOR STRING HARDWARE AND FITTINGS SET

2. Component-specific Particulars

2.1 Tower Hinge

S/N	Description	Unit	Guaranteed Value	Offered Value
2.1.1	Material	-	Mild Steel, HDG	
2.1.2	U.T.S.	kN	90	
2.1.3	Minimum galvanizing thickness	microns	86	
2.1.4	Bolt hole diameter	mm	[To be provided]	
2.1.5	Weight	kg	[To be provided]	

2.2 Heavy Hexagonal Ball Link

S/N	Description	Unit	Guaranteed Value	Offered Value
2.2.1	Material	-	Forged Steel, HDG	

S/N	Description	Unit	Guaranteed Value	Offered Value
2.2.2	U.T.S.	kN	90	
2.2.3	Ball diameter	mm	16	
2.2.4	Minimum galvanizing thickness	microns	86	
2.2.5	Weight	kg	[To be provided]	

2.3 Arcing Ring (T.S.)

S/N	Description	Unit	Guaranteed Value	Offered Value
2.3.1	Material	-	Mild Steel, HDG	
2.3.2	Outer diameter	mm	[To be provided]	
2.3.3	Inner diameter	mm	[To be provided]	
2.3.4	Thickness	mm	[To be provided]	
2.3.5	Weight	kg	[To be provided]	

2.4 Arcing Ring (L.S.)

S/N	Description	Unit	Guaranteed Value	Offered Value
2.4.1	Material	-	Mild Steel, HDG	
2.4.2	Outer diameter	mm	332	
2.4.3	Inner diameter	mm	166	
2.4.4	Thickness	mm	16	
2.4.5	Mounting bolt size	-	M12x40	
2.4.6	Weight	kg	[To be provided]	

2.5 Heavy Hexagonal Socket Eye

S/N	Description	Unit	Guaranteed Value	Offered Value
2.5.1	Material	-	Forged Steel, HDG	
2.5.2	U.T.S.	kN	90	
2.5.3	Socket dimension	mm	16	
2.5.4	Minimum galvanizing thickness	microns	86	
2.5.5	Weight	kg	[To be provided]	

2.6 Suspension Clamp Assembly with P.A. Rod

S/N	Description	Unit	Guaranteed Value	Offered Value
2.6.1	Clamp body material	-	Aluminum Alloy	
2.6.2	Other components material	-	Forged Steel, HDG	
2.6.3	U.T.S.	kN	90	
2.6.4	Suitable conductor	-	ACSR ACSR 300/50	
2.6.5	Slip strength	% of conductor UTS	15	
2.6.6	Keeper groove diameter	Mm	31.77	
2.6.7	P.A. Rod material	-	Aluminum Alloy 6061	
2.6.8	P.A. Rod length	Mm	[To be provided]	
2.6.9	Complete assembly weight	Kg	[To be provided]	

3. Material Properties & Finishes

S/N	Description	Unit	Guaranteed Value	Offered Value
3.1	Hot dip galvanizing thickness	microns	≥ 86	
3.2	Aluminum alloy grade (clamp body)	-	[To be provided]	
3.3	Stainless steel grade (security clips)	-	[To be provided]	
3.4	Spring steel grade (washers)	-	[To be provided]	
3.5	Surface finish quality	-	Smooth and defect-free	
3.6	Marking durability	-	Permanent and legible	

SINGLE TENSION INSULATOR STRING HARDWARE AND FITTINGS SET

2. Component-specific Particulars

2.1 Tower Hinge

S/N	Description	Unit	Guaranteed Value	Offered Value
2.1.1	Material grade	-	Mild Steel FE-410	
2.1.2	Surface treatment	-	Hot Dip Galvanized	
2.1.3	Ultimate tensile strength	kN	160	
2.1.4	Minimum galvanizing thickness	microns	86	

S/N	Description	Unit	Guaranteed Value	Offered Value
2.1.5	Bolt hole diameter	mm	[To be provided]	
2.1.6	Weight	kg	[To be provided]	

2.2 Extension Strap

S/N	Description	Unit	Guaranteed Value	Offered Value
2.2.1	Material grade	-	Mild Steel FE-410	
2.2.2	Surface treatment	-	Hot Dip Galvanized	
2.2.3	Ultimate tensile strength	kN	160	
2.2.4	Strap length	mm	[To be provided]	
2.2.5	Minimum galvanizing thickness	microns	86	
2.2.6	Weight	kg	[To be provided]	

2.3 Sag Adjustment Plate

S/N	Description	Unit	Guaranteed Value	Offered Value
2.3.1	Material grade	-	Mild Steel FE-410	
2.3.2	Surface treatment	-	Hot Dip Galvanized	
2.3.3	Ultimate tensile strength	kN	160	
2.3.4	Adjustment range	mm	280-430	
2.3.5	Plate thickness	mm	[To be provided]	
2.3.6	Weight	kg	[To be provided]	

2.4 Heavy Hexagonal Ball Eye

S/N	Description	Unit	Guaranteed Value	Offered Value
2.4.1	Material specification	-	Forged Steel Class-IV	
2.4.2	Surface treatment	-	Hot Dip Galvanized	
2.4.3	Ultimate tensile strength	kN	160	
2.4.4	Ball diameter	mm	16	
2.4.5	Minimum galvanizing thickness	microns	86	
2.4.6	Weight	kg	[To be provided]	

2.5 Arcing Rings

S/N	Description	Unit	Guaranteed Value	Offered Value
2.5.1	Material grade	-	Mild Steel FE-410	
2.5.2	Surface treatment	-	Hot Dip Galvanized	
2.5.3	T.S. ring dimensions	mm	[To be provided]	
2.5.4	L.S. ring outer diameter	mm	332	
2.5.5	L.S. ring inner diameter	mm	166	
2.5.6	Ring thickness	mm	16	
2.5.7	Weight per ring	kg	[To be provided]	

2.6 Heavy Hexagonal Socket Eye

S/N	Description	Unit	Guaranteed Value	Offered Value
2.6.1	Material specification	-	Forged Steel Class-IV	
2.6.2	Surface treatment	-	Hot Dip Galvanized	
2.6.3	Ultimate tensile strength	kN	160	
2.6.4	Socket dimension	mm	16	
2.6.5	Minimum galvanizing thickness	microns	86	
2.6.6	Weight	kg	[To be provided]	

2.7 Dead End Clamp

S/N	Description	Unit	Guaranteed Value	Offered Value
2.7.1	Body material	-	Extruded Aluminum 99.5%	
2.7.2	Steel components material	-	Forged Steel, HDG	
2.7.3	Slip strength	% of conductor UTS	95	
2.7.4	Compression pressure	ton	100	
2.7.5	Compression dies reference	-	[To be provided]	
2.7.6	Aluminum sleeve length	mm	[To be provided]	
2.7.7	Steel sleeve length	mm	[To be provided]	
2.7.8	Assembly weight	kg	[To be provided]	

2.8 Additional Links

S/N	Description	Unit	Guaranteed Value	Offered Value
2.8.1	Material grade	-	Mild Steel	
2.8.2	Surface treatment	-	Hot Dip Galvanized	
2.8.3	Ultimate tensile strength	kN	160	
2.8.4	Link lengths	mm	[To be provided]	
2.8.5	Minimum galvanizing thickness	microns	86	
2.8.6	Individual weights	kg	[To be provided]	

3. Material Properties & Finishes

S/N	Description	Unit	Guaranteed Value	Offered Value
3.1	Hot dip galvanizing thickness	microns	≥ 86	
3.2	Aluminum alloy purity (clamp body)	%	99.5	
3.3	Forged steel class	-	Class-IV	
3.4	Stainless steel grade (security clips)	-	[To be provided]	
3.5	Surface finish quality	-	Smooth and defect-free	
3.6	Marking durability	-	Permanent and legible	

I/We declare that the information provided in this GTP is true and correct, and all supporting documents are authentic and valid.

Signature: _____ Name: _____

Position: _____ Company: _____

Date: _____ Company Seal: _____

18. PRICE SCHEDULE FOR ACSR 300/50 HARDWARE AND FITTINGS

Instructions to Bidders:

1. All prices should be quoted in Kenya Shillings (KES) and are VAT inclusive.

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL PRICE
1.	Double Suspension Insulator Hardware and Fittings Set	Set	100		
2.	Double Tension Insulator Hardware and Fittings Set	Set	100		
3.	Single Suspension Insulator Hardware and Fittings Set	Set	100		
4.	Single Tension Insulator Hardware and Fittings Set	Set	100		
5.	Mid span compression joint	Set	200		
6.	Repair sleeve	Piece	200		
7.	Vibration Damper	Set	200		
	TOTAL FOR ACSR 300/50 HARDWARE AND FITTINGS				

Declaration

We confirm that our bid complies with all requirements as specified in the tender document.

Company Name: _____

Authorized Signatory: _____

Position: _____

Date: _____

Company Stamp: _____

EMPLOYERS REQUIREMENTS & TECHNICAL SPECIFICATIONS FOR STARLING CONDUCTOR HARDWARE & FITTINGS

TABLE OF CONTENTS

FOREWORD

This specification has been prepared by Power System Operation and Maintenance Department (System Operation and Power Management Directorate) of the Kenya Electricity Transmission Company LTD (KETRACO) and it lays down requirements for STARLING CONDUCTOR Hardware & Fittings.

This specification is based on international standards and is subject to revision as and when required.

Type test reports from accredited facilities shall be submitted with bid.

It shall be the manufacturer's responsibility to be knowledgeable of the requirements contained herein and in the referenced standards.

19. SCOPE

This specification covers the minimum technical requirements for design, manufacture, testing, supply and delivery of hardware and fittings for use with STARLING CONDUCTOR .

The specification also covers inspection and test of the hardware and fittings as well as schedule of Guaranteed Technical Particulars, Price schedules to be filled in, signed by the manufacturer and submitted for tender evaluation. Complete installation instructions, Technical support documentation and Maintenance procedures shall be submitted with this bid for evaluation.

The specifications stipulate the minimum requirements for Hardware and Fittings for STARLING CONDUCTOR acceptable for use by KETRACO and it shall be the responsibility of the

manufacturer to ensure adequacy of the design, good workmanship and good engineering practice in the manufacture of the hardware and fittings. The hardware and fittings supplied shall strictly adhere to the issued drawings. Where inconsistencies exist between the drawings and specifications, the drawings shall govern unless otherwise approved in writing by KETRACO.

- REFERENCE STANDARDS

The hardware and fittings shall comply with the latest editions of the following standards:

- IEC 61284: Overhead lines - Requirements and tests for fittings
- IEC 60120: Dimensions of ball and socket couplings of string insulator units
- IEC 60372: Locking devices for ball and socket couplings of string insulator units - Dimensions and tests
- IEC 60471: Dimensions of clevis and tongue couplings of string insulator units
- BS EN 61284: Overhead lines - Requirements and tests for fittings
- BS EN 60672-3: Ceramic and glass-insulating materials
- BS EN ISO 1461: Hot dip galvanized coatings on fabricated iron and steel articles
- BS EN ISO 2178: Non-magnetic coatings on magnetic substrates - Measurement of coating thickness - Magnetic method
- ASTM A153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- ASTM B230: Standard Specification for Aluminum 1350-H19 Wire for Electrical Purposes
- ASTM B232: Standard Specification for Concentric-Lay-Stranded Aluminum Conductors

- SERVICE CONDITIONS

4. The hardware and fittings shall be suitable for continuous operation outdoor in tropical areas at altitudes of up to 2200m above sea level, humidity of up to 90%, ambient temperature of +30 degrees centigrade with a minimum of -1 degree centigrade and a maximum of +40-degree centigrade, heavy saline conditions along the coast and tropical sunshine conditions.
5. The weather isokeraunic levels reach up to 180 thunderstorms days per year.
6. The level of galvanizing for all parts and materials used shall be suitable for these conditions.

- MATERIALS AND CONSTRUCTION

13.1 GENERAL REQUIREMENTS

11. All hardware and fittings shall be designed, manufactured and tested in accordance with IEC 61284 and other applicable/latest standards and requirements of this specification.

12. All ferrous parts shall be hot-dip galvanized after fabrication in accordance with ISO 1461 and ASTM A153. The zinc coating shall be smooth, continuous, and uniform. It shall be free from areas that are bare, have blisters, flux and ash inclusions, lumps, or coarse crystals.
13. The galvanized coating on all hardware shall withstand four one-minute dips in copper sulphate solution as per IEC 61284 without showing signs of copper deposits.
14. Spring washers shall be of spring steel and electro-galvanized.
15. Security clips and split pins shall be of stainless steel.
16. Design and construction drawings shall be submitted by the winning bidder.
17. The surfaces of all hardware shall be smooth, without cuts, abrasions, projections, ridges or exfoliation that might damage the conductor or cause radio interference.
18. All bolts and nuts shall have hexagonal heads and shall be locked in an approved manner.
19. All hardware shall be suitable for use with STARLING CONDUCTOR (diameter 19.53 mm, weight 922 kg/km, UTS 110.5 kN) and shall have adequate strength, conductivity, and corona performance.
20. The design shall minimize the number of parts and the number of bolts per assembly.

13.2 SPECIFIC MATERIAL REQUIREMENTS

9. Aluminum and Aluminum Alloys:
    - Suspension clamp bodies, tension clamp bodies, armor rods, and other aluminum components shall be made from high-strength aluminum alloy.
    - Aluminum alloy castings shall be free from flaws, surface blemishes, and shrinkage defects.
10. Steel and Steel Alloys:
    - All steel used shall be thoroughly hot-dip galvanized after fabrication.
    - Malleable cast iron shall not be used.
    - Drop-forged steel shall be used for tension and suspension hardware components requiring high mechanical strength.
11. Fasteners:
    - All bolts, nuts, and washers shall be hot-dip galvanized steel.
    - All bolts shall be provided with one flat washer and one spring washer.
    - Split pins and security clips shall be of stainless steel.
12. Corona and Radio Interference:

- All fittings shall be designed to minimize corona discharge and radio interference.
- Corona rings/shields shall be provided where necessary to ensure corona extinction levels are maintained.
- Minimum corona extinction voltage shall be 105 kV (rms).
- Radio Interference Voltage at 110 kV shall not exceed 500 μV.

HARDWARE AND FITTINGS SETS

1. DOUBLE SUSPENSION INSULATOR STRING HARDWARE AND FITTINGS SET

Technical Specifications:

- Assembly UTS: 120 kN
- Ball & socket designation: 16 mm (IEC-120)
- Weight: 31.0 kg (approx.)

Major Components:

1. P.A. Rods (Al. Alloy 6061)
2. Suspension Clamp
3. Ring Type Arcing Horn
4. Triangular Yoke Plate
5. Socket Clevis
6. Ball Arcing Horn
7. H.H. Ball Clevis
8. Extension Plate
9. Clevis Clevis
10. Tower Hinge(swivel)

Specifications of Suspension Clamp Assembly with P.A. Rod

Technical Specifications:

- Suitable for ACSR Starling conductor
- Minimum breaking strength: 120 kN
- Slip strength of suspension clamp: 15% of UTS of conductor

- Ball and socket designation: 16 mm as per IEC-120
- P.A. Rod material: Aluminum Alloy (6061, ASTM:B 308)
- Clamp body material: Aluminum Alloy (A-6, BS:1490)
- Ball & socket locking by R-clip as per IEC-372
- Weight: 18.0 kg (approx.)

Components:

- Clamp & keeper (Aluminum Alloy A-6)
- P.A. Rod (Aluminum Alloy)
- Suspension clamp body
- U-bolt (Stainless Steel)
- Keeper piece
- Hardware sets (bolts, nuts, washers)

2. DOUBLE TENSION INSULATOR STRING HARDWARE AND FITTINGS SET

Technical Specifications:

- Assembly UTS: 210 kN
- Ball & socket designation: 20 mm (IEC-120)

Major Components:

1. Dead End Assembly
2. Adjustment Extension Plate (Line Side)
3. Clevis Eye
4. Ring Type Arcing Horn
5. Triangular Yoke Plate
6. Socket Clevis
7. Ball Arcing Horn
8. H.H. Ball Clevis
9. Adjustment Extension Plate (Tower Side)
10. Tower Hinge

Specifications of Dead End Assembly

Technical Specifications:

- Suitable for ACSR Starling conductor

- Slip strength: 95% of conductor UTS
- Compression pressure: 100 ton
- Ball and socket designation: 20 mm as per IEC-120
- Ultimate tensile strength: 210 kN
- Weight: 21.0 kg (approx.)

Components:

- Dead end body (Aluminum Alloy LM-0, BS1490)
- Steel clevis (Forged Steel)
- Terminal pad
- Jumper terminal
- Hardware sets

3. SINGLE SUSPENSION INSULATOR STRING HARDWARE AND FITTINGS SET

Technical Specifications:

- Assembly UTS: 120 kN
- Ball & socket designation: 16 mm (IEC-120)
- Total length: 3030 mm
- Weight: 14.0 kg (approx.)

Major Components:

1. Suspension Clamp complete with P.A rod
2. Ball Arcing Horn
3. Socket Eye
4. Ring Type Arcing Horn
5. H.H. Ball Clevis
6. Extension Plate
7. Clevis Clevis
8. Tower Hinge swivel

Specification of Suspension Clamp Assembly with P.A. Rod

Technical Specifications:

- Suitable for ACSR Starling conductor
- Minimum breaking strength: 120 kN

- Slip strength of suspension clamp: 15% of UTS of conductor
- Ball and socket designation: 16 mm as per IEC-120
- P.A. Rod material: Aluminum Alloy (6061, ASTM:B 308)
- Clamp body material: Aluminum Alloy (A-6, BS:1490)
- Ball & socket locking by R-clip as per IEC-372
- Weight: 18.0 kg (approx.)

Components:

- Clamp & keeper (Aluminum Alloy A-6)
- P.A. Rod (Aluminum Alloy)
- Suspension clamp body
- U-bolt (Stainless Steel)
- Keeper piece
- Hardware sets (bolts, nuts, washers)

4. SINGLE TENSION INSULATOR STRING HARDWARE AND FITTINGS SET

Technical Specifications:

- Assembly UTS: 210 kN
- Ball & socket designation: 20 mm (IEC-120)
- Minimum height: 3215 mm

Major Components:

1. Dead End Assembly
2. Adjustment Extension Plate (Line Side)
3. Clevis Eye
4. Ring Type Arcing Horn
5. Triangular Yoke Plate
6. Socket Clevis
7. Ball Arcing Horn
8. H.H. Ball Clevis
9. Adjustment Extension Plate (Tower Side)
10. Tower Hinge

Specifications of Dead End Assembly

Technical Specifications:

- Suitable for ACSR Starling conductor
- Slip strength: 95% of conductor UTS
- Compression pressure: 100 ton
- Ball and socket designation: 20 mm as per IEC-120
- Ultimate tensile strength: 210 kN
- Weight: 21.0 kg (approx.)

Components:

- Dead end body (Aluminum Alloy LM-0, BS1490)
- Steel clevis (Forged Steel)
- Terminal pad
- Jumper terminal
- Hardware sets

5. MID-SPAN COMPRESSION JOINT

Technical Specifications:

- Suitable for ACSR Starling conductor
- Slip strength: 95% of UTS
- Compression pressure: 100 ton
- Total weight: 1.6 kg (approx.)

Dimensions:

- Before compression: 710 ± 5 mm
- After compression: 760 ± 15 mm
- Aluminum sleeve diameter: 29 ± 0.5 mm
- Steel sleeve diameter: 10.5 ± 0.2 mm

6. REPAIR SLEEVE

Technical Specifications:

- Material: Aluminum
- Suitable for ACSR Starling conductor
- Total weight: 0.83 kg (approx.)
- Before compression length: 275 ± 5 mm

7. VIBRATION DAMPER (4R-STOCK BRIDGE TYPE)

Technical Specifications:

- Suitable for ACSR Starling conductor
- Mass pull-off: 500 kg (min)
- UTS of messenger cable: 135 kg/sq.mm (min)
- Bolt tightening torque: 6 kgm
- Total weight: 4.3 kg (approx.)

Components:

- Damper weight (Cast Iron, HDG)
- Messenger cable (High Strength Steel)
- Clamp body (Aluminum Alloy)
- Keeper piece (Aluminum Alloy)

GENERAL REQUIREMENTS

1. All ferrous parts shall be hot-dip galvanized as per ISO 1461
2. All components must be suitable for use on 220 kV transmission lines
3. General tolerance: ±3% unless otherwise specified
4. R-clips and security clips: Stainless Steel (AISI-304)
5. Spring washers: Spring steel, electro-galvanized
6. Clear marking and identification required on all components
7. Test certificates required for all items
8. Packaging suitable for transportation and storage

TESTING REQUIREMENTS

1. Type tests as per relevant standards
2. Routine tests for all components
3. Galvanizing tests as per ISO 1461
4. Visual and dimensional checks
5. Mechanical strength tests
6. Slip strength tests for suspension clamps and tension clamps
7. Compression tests for compression fittings

19.1 MANUFACTURING, MARKING, PACKING & LABELLING

Each hardware and fiting shall be legibly and indelibly marked with the name and trademark of the manufacturer, the year of manufacture and the SML (specified mechanical load) in accordance with IEC 61109.
The following information shall be marked indelibly in a permanent manner by embossing on each insulator hardware and fitting during manufacture:

i) Manufacturer's name or Trademark.
j) Voltage rating
k) Specified mechanical load
l) The letters "property of KETRACO"

All markings shall be permanent and shall be by embossing on the hardware and fitting part before galvanizing. The marking shall not affect the performance. Tags and stickers shall not be accepted. A Reference list of same type as quoted installed in similar climatic conditions and list of 10 previous customers with detailed contacts shall be submitted with this bid from the manufacturer.
The hardware and fittings shall be packed in wooden crates which are reinforced and held closed by external steel wire binding. Each crate shall be internally braced to permit stacking and the steel wire bindings shall be designed to keep firmly closed and permit easy and rapid opening at time of installation. The production capacity, the Manufacturing process schedule, the disposal procedures and Corona and Radio Interference documentation shall be provided with the bid.

The crates shall be designed to keep on sturdy wood pallet. The assembly shall be held tightly in place with steel bands and protected against moisture by a complete covering of heat shrinkable polyethylene film.

- QUALITY MANAGEMENT SYSTEM

The supplier shall submit a quality assurance plan (QAP) that will be used to ensure that the hardware and fittings design, material, manufacture workmanship, tests, service capability, maintenance and documentation will fulfil the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfill the requirements of ISO 9001:2008.

The manufacturer's Declaration of conformity to reference standards and copies of quality management certification including copy of valid ISO 9001, 14001 & 45001 certificates shall be submitted with the tender for evaluation.

- TESTS AND INSPECTION

16.1 DESIGN TESTS

Design tests shall be performed on each type of hardware and fitting to verify that the design meets the requirements of this specification and the relevant standards. Design tests shall include:

6. Verification of dimensions
7. Verification of mechanical characteristics
8. Verification of galvanizing
9. Corona and radio interference tests
10. Electrical conductivity test (for current-carrying fittings)

16.2 TYPE TESTS

Type tests shall be performed on each type of hardware and fitting to verify that the production equipment and processes consistently produce hardware and fittings that meet the requirements of this specification and the relevant standards. Type tests shall include:

- Mechanical strength test
- Electrical resistance test (for current-carrying fittings)
- Heating cycle test (for compression fittings)
- Slip strength test (for suspension and tension clamps)
- Fatigue test (for vibration dampers)
- Corona and radio interference tests
- Galvanizing test

16.3 SAMPLE TESTS

Sample tests shall be performed on samples taken at random from each batch to verify that the batch meets the requirements of this specification and the relevant standards. Sample tests shall include:

11. Visual inspection
12. Verification of dimensions
13. Verification of mechanical characteristics
14. Verification of galvanizing
15. Slip strength test (for suspension and tension clamps)

16.4 ROUTINE TESTS

Routine tests shall be performed on each hardware and fitting to verify that it meets the requirements of this specification and the relevant standards. Routine tests shall include:

7. Visual inspection
8. Verification of dimensions
9. Verification of mechanical characteristics

Copies of the previous design and type test reports by relevant Independent International or National Testing/Standards Authority of the country of manufacture (or ISO/IEC 17025 accredited independent laboratory) shall be submitted with the offer for evaluation (all in English language). A copy of the accreditation certificate for the laboratory shall also be submitted.

Routine and sample test reports for the hardware and fittings to be supplied shall be submitted to KETRACO for approval before shipment/delivery of the goods. KETRACO Engineers (2) shall witness acceptance tests at the factory before shipment. The cost of travelling, Accommodation, Visa fees, Local and off-shore airport transfers shall be borne by the manufacturer/Supplier. A description of test equipment, and Complete test protocols shall be submitted with this bid. In addition, the manufacturer/supplier shall provide a daily subsistence allowance equivalent to USD 350 for each KETRACO engineer that will witness the factory acceptance test.

Factory Acceptance tests (FAT) shall include Routine and Sample tests as per IEC 61284 and applicable latest IEC standards and the following:

- Verification of Dimensions
- Verification of locking systems
- Verification of mechanical strength
- Verification of slip strength (for suspension and tension clamps)
- Galvanization test

17. GUARANTEED TECHNICAL PARTICULARS (GTP)

CONDUCTOR HARDWARE AND FITTINGS SET

Suspension Clamp Assembly with P.A. Rod

S/N	Description	Unit	Guaranteed Value	Offered Value
1.1	Suitable Conductor	-	ACSR Starling	
1.2	Minimum Breaking Strength	kN	120	
1.3	Slip Strength	% of UTS	15	
1.4	Ball & Socket Size	Mm	16 (IEC-120)	
1.5	Clamp Body Material	-	Aluminum Alloy (A-6)	
1.6	P.A. Rod Material	-	Al. Alloy 6061	
1.7	P.A. Rod Angle	Degrees	135	
1.8	Total Weight	Kg	18.0	

Dead End Assembly

S/N	Description	Unit	Guaranteed Value	Offered Value
2.1	Suitable Conductor	-	ACSR Starling	
2.2	Slip Strength	% of UTS	95	
2.3	Compression Pressure	ton	100	
2.4	Ball & Socket Size	mm	20 (IEC-120)	
2.5	Body Material	-	Al. Alloy LM-0	
2.6	Steel Component Material	-	Forged Steel, HDG	
2.7	Total Weight	kg	21.0	

Mid-span Compression Joint

S/N	Description	Unit	Guaranteed Value	Offered Value
3.1	Suitable Conductor	-	ACSR Starling	
3.2	Slip Strength	% of UTS	95	
3.3	Compression Pressure	Ton	100	
3.4	Before Compression Length	Mm	710 ± 5	
3.5	After Compression Length	Mm	760 ± 15	
3.6	Aluminum Sleeve Diameter	Mm	29 ± 0.5	
3.7	Steel Sleeve Diameter	Mm	10.5 ± 0.2	
3.8	Total Weight	Kg	2.6	

Repair Sleeve

S/N	Description	Unit	Guaranteed Value	Offered Value
4.1	Suitable Conductor	-	ACSR Starling	
4.2	Material	-	Aluminum	
4.3	Before Compression Length	mm	275 ± 5	
4.4	After Compression Length	mm	290 ± 5	
4.5	Weight	kg	0.83	

Vibration Damper

S/N	Description	Unit	Guaranteed Value	Offered Value
5.1	Suitable Conductor	-	ACSR Starling	
5.2	Mass Pull-off Value	Kg	500 (min)	
5.3	Messenger Cable UTS	kg/sq.mm	135 (min)	
5.4	Messenger Cable Strands	-	High Strength Steel	
5.5	Tightening Torque	kg-m	6	
5.6	Clamp Material	-	Aluminum Alloy	
5.7	Damper Mass Material	-	Cast Iron, HDG	
5.8	Total Weight	Kg	4.3	

1. Material Properties & Finishes (Common for all sets)

S/N	Description	Unit	Guaranteed Value	Offered Value
1.1	Hot dip galvanizing thickness	microns	≥ 86	
1.2	Aluminum alloy grade (clamp body)	-	A-6, BS:1490	
1.3	Stainless steel grade (security clips)	-	AISI-304	
1.4	Surface finish quality	-	Smooth and defect-free	
1.5	Marking durability	-	Permanent and legible	

I/We declare that the information provided in this GTP is true and correct, and all supporting documents are authentic and valid.

Signature: _____ Name: _____

Position: _____ Company: _____

Date: _____ Company Seal: _____

18. PRICE SCHEDULE FOR STARLING CONDUCTOR HARDWARE AND FITTINGS SET

Instructions to Bidders:

All prices should be quoted in Kenya Shillings (KES) and are VAT inclusive.

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL PRICE
1.	DOUBLE SUSPENSION INSULATOR STRING HARDWARE AND FITTINGS SET	Set	100		
2.	DOUBLE TENSION INSULATOR STRING HARDWARE AND FITTINGS SET	Set	100		
3.	SINGLE SUSPENSION INSULATOR STRING HARDWARE AND FITTINGS SET	Set	100		
4.	SINGLE TENSION INSULATOR STRING HARDWARE AND FITTINGS SET	Set	100		
5.	MID-SPAN COMPRESSION JOINT	Set	200		
6.	REPAIR SLEEVE	piece	200		
7.	VIBRATION DAMPER (4R-STOCK BRIDGE TYPE	Piece	200		
TOTAL FOR STARLING CONDUCTOR HARDWARE AND FITTINGS					

Declaration

We confirm that our bid complies with all requirements as specified in the tender document.

Company Name: _____

Authorized Signatory: _____

Position: _____

Date: _____

Company Stamp: _____

19. PRICE SCHEDULE FOR LOT 2

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL PRICE
1.	Canary Conductor Hardware and Fittings	LOT	LOT	LOT	
2.	ACSR 300/50 Conductor Hardware and Fittings	LOT	LOT	LOT	
3.	Starling Conductor Hardware and Fittings	LOT	LOT	LOT	
TOTAL FOR LOT 1					

Declaration

We confirm that our bid complies with all requirements as specified in the tender document.

Company Name: _____

Authorized Signatory: _____

Position: _____

Date: _____

Company Stamp: _____

LOT 3 TECHNICAL SPECIFICATIONS

This document contains the technical specifications for Lot 1, comprising Condor Conductor Hardware & Fittings and LARK CONDUCTOR Hardware & Fittings for Kenya Electricity Transmission Company Ltd (KETRACO). These specifications outline the requirements for design, manufacture, testing, supply, and delivery of hardware components to be used in KETRACO's transmission infrastructure.

EMPLOYERS REQUIREMENTS & TECHNICAL SPECIFICATIONS FOR

CONDOR CONDUCTOR HARDWARE & FITTINGS

TABLE OF CONTENTS

FOREWORD

This specification has been prepared by Power System Operation and Maintenance Department (System Operation and Power Management Directorate) of the Kenya Electricity Transmission Company LTD (KETRACO) and it lays down requirements for Condor Conductor Hardware & Fittings.

This specification is based on international standards and is subject to revision as and when required.

Type test reports from accredited facilities shall be submitted with bid.

It shall be the manufacturer's responsibility to be knowledgeable of the requirements contained herein and in the referenced standards.

1. SCOPE

This specification covers the minimum technical requirements for design, manufacture, testing, supply and delivery of hardware and fittings for use with ACSR Condor conductors.

The specification also covers inspection and test of the hardware and fittings as well as schedule of Guaranteed Technical Particulars, Price schedules to be filled in, signed by the manufacturer and submitted for tender evaluation. Complete installation instructions, Technical support documentation and Maintenance procedures shall be submitted with this bid for evaluation.

The specifications stipulate the minimum requirements for Hardware and Fittings for ACSR Condor conductor acceptable for use by KETRACO and it shall be the responsibility of the manufacturer to ensure adequacy of the design, good workmanship and good engineering practice in the manufacture of the hardware and fittings.The hardware and fittings supplied shall strictly adhere to the issued drawings. Where inconsistencies exist between the drawings and specifications, the drawings shall govern unless otherwise approved in writing by KETRACO.

2. REFERENCE STANDARDS

The hardware and fittings shall comply with the latest editions of the following standards:

- IEC 61284: Overhead lines - Requirements and tests for fittings
- IEC 60120: Dimensions of ball and socket couplings of string insulator units
- IEC 60372: Locking devices for ball and socket couplings of string insulator units - Dimensions and tests
- IEC 60471: Dimensions of clevis and tongue couplings of string insulator units
- BS EN 61284: Overhead lines - Requirements and tests for fittings
- BS EN 60672-3: Ceramic and glass-insulating materials
- BS EN ISO 1461: Hot dip galvanized coatings on fabricated iron and steel articles
- BS EN ISO 2178: Non-magnetic coatings on magnetic substrates - Measurement of coating thickness - Magnetic method
- ASTM A153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- ASTM B230: Standard Specification for Aluminum 1350-H19 Wire for Electrical Purposes
- ASTM B232: Standard Specification for Concentric-Lay-Stranded Aluminum Conductors

3. SERVICE CONDITIONS

1. The hardware and fittings shall be suitable for continuous operation outdoor in tropical areas at altitudes of up to 2200m above sea level, humidity of up to 90%, ambient temperature of +30 degrees centigrade with a minimum of -1 degree centigrade and a maximum of +40-degree centigrade, heavy saline conditions along the coast and tropical sunshine conditions.
2. The weather isokeraunic levels reach up to 180 thunderstorms days per year.
3. The level of galvanizing for all parts and materials used shall be suitable for these conditions.

4. MATERIALS AND CONSTRUCTION

4.1 GENERAL REQUIREMENTS

1. All hardware and fittings shall be designed, manufactured and tested in accordance with IEC 61284 and other applicable/latest standards and requirements of this specification.
2. All ferrous parts shall be hot-dip galvanized after fabrication in accordance with ISO 1461 and ASTM A153. The zinc coating shall be smooth, continuous, and uniform. It shall be free from areas that are bare, have blisters, flux and ash inclusions, lumps, or coarse crystals.
3. The galvanized coating on all hardware shall withstand four one-minute dips in copper sulphate solution as per IEC 61284 without showing signs of copper deposits.
4. Design and construction drawings shall be submitted by the winning bidder.
5. Spring washers shall be of spring steel and electro-galvanized.
6. Security clips and split pins shall be of stainless steel.
7. The surfaces of all hardware shall be smooth, without cuts, abrasions, projections, ridges or exfoliation that might damage the conductor or cause radio interference.
8. All bolts and nuts shall have hexagonal heads and shall be locked in an approved manner.
9. All hardware shall be suitable for use with ACSR Condor conductor (diameter 27.72 mm, weight 922 kg/km, UTS 110.5 kN) and shall have adequate strength, conductivity, and corona performance.
10. The design shall minimize the number of parts and the number of bolts per assembly.

4.2 SPECIFIC MATERIAL REQUIREMENTS

1. Aluminum and Aluminum Alloys:
    - Suspension clamp bodies, tension clamp bodies, armor rods, and other aluminum components shall be made from high-strength aluminum alloy.
    - Aluminum alloy castings shall be free from flaws, surface blemishes, and shrinkage defects.
2. Steel and Steel Alloys:
    - All steel used shall be thoroughly hot-dip galvanized after fabrication.
    - Malleable cast iron shall not be used.

- Drop-forged steel shall be used for tension and suspension hardware components requiring high mechanical strength.

3. Fasteners:
   - All bolts, nuts, and washers shall be hot-dip galvanized steel.
   - All bolts shall be provided with one flat washer and one spring washer.
   - Split pins and security clips shall be of stainless steel.
4. Corona and Radio Interference:
   - All fittings shall be designed to minimize corona discharge and radio interference.
   - Corona rings/shields shall be provided where necessary to ensure corona extinction levels are maintained.
   - Minimum corona extinction voltage shall be 105 kV (rms).
   - Radio Interference Voltage at 110 kV shall not exceed 500 μV.

5. HARDWARE AND FITTINGS SETS FOR CONDOR CONDUCTOR

Set Components

1. SINGLE SUSPENSION STRING HARDWARE & FITTINGS SET

Set Components

1. Cross Hinge
2. Ball eye-Straight
3. Adjustable arc ring
4. Arc/Corona ring
5. Socket tongue-Straight
6. Yoke
7. Double tongue-twisted
8. Suspension Clamp Assembly with P.A. Rod

Technical Specifications

1. System Voltage, Um = 420kV
2. One minute power frequency withstand voltage, 50 Hz, wet = 715 / 760kV
3. Switching impulse withstand voltage, 250/2500, pos. = 1050 / 1085kV
4. Lightning impulse withstand voltage, 1.2/50, pos. = 1725 / 1835kV

5. Creepage distance = 15,400mm
6. Minimum breaking strength: 120 kN
7. Short circuit capacity: 40 kA/1sec
8. Calculated arcing distance: 3,200 mm (SSS-S/S, SSS-L), 3,800 mm (SSS-H)
9. Slipping force for suspension clamp = 31 kN
10. Torque for screw of suspension clamp = 38 Nm
11. Minimum corona extinction voltage = 303 kV
12. Ball / Socket coupling size acc. to IEC 60120/16A

Material Specifications

- All ferrous parts (except spring washers) shall be hot-dip galvanized
- Spring washers: Spring steel, electro-galvanized
- Security clips and split pins: Stainless steel

Suspension Clamp Assembly

- Suitable for ACSR Condor conductor (27.72 mm diameter)
- Minimum breaking strength of clamp: 120 kN
- Slip strength: 31 kN
- Tightening torque: 38 Nm

2. DOUBLE SUSPENSION STRING HARDWARE & FITTINGS SET

Set Components

1. Cross Hinge
2. Double tongue-straight
3. Yoke
4. Arc horn
5. Ball eye
6. Corona ring
7. Socket tongue
8. Yoke assembly
9. Double tongue twisted
10. Suspension Clamp Assembly with P.A. Rod

Technical Specifications

1. System Voltage, Um = 420kV
2. One minute power frequency withstand voltage, 50 Hz, wet = 850kV
3. Switching impulse withstand voltage, 250/2500, pos. = 1215kV
4. Lightning impulse withstand voltage, 1.2/50, pos. = 2050kV
5. Creepage distance = 15,400mm
6. Minimum breaking strength: 240 kN
7. Short circuit capacity: 40 kA/1sec
8. Calculated arcing distance: 3,200 mm (DSS-S/S, DSS-L), 3,800 mm (DSS-H)
9. Slipping force for suspension clamp = 31 kN
10. Torque for screw of suspension clamp = 38 Nm
11. Minimum corona extinction voltage = 303 kV
12. Ball / Socket coupling size acc. to IEC 60120/16A

Material Specifications

- All ferrous parts (except spring washers) shall be hot-dip galvanized
- Spring washers: Spring steel, electro-galvanized
- Security clips and split pins: Stainless steel

Suspension Clamp Assembly

- Suitable for ACSR Condor conductor (27.72 mm diameter)
- Minimum breaking strength of clamp: 120 kN
- Slip strength: 31 kN
- Tightening torque: 38 Nm

3. DOUBLE TENSION STRING HARDWARE & FITTINGS SET

Set Components

1. Cross Hinge
2. Clevis Tongue - Straight
3. Ball Eye - Straight
4. Adjustable Arc Ring
5. Arc / Corona Ring
6. Socket Tongue - Twisted
7. Yoke

8. Double Tongue – Twisted
9. Double Tongue - Straight
10. Adjustable Extension Link
11. Compression Dead End Clamp

Technical Specifications

1. System Voltage, Um = 420kV
2. One minute power frequency withstand voltage, 50 Hz, wet = 715 / 760 / 850kV
3. Switching impulse withstand voltage, 250/2500, pos. = 1050 / 1085 / 1215kV
4. Lightning impulse withstand voltage, 1.2/50, pos. = 1725 / 1835 / 2050kV
5. Creepage distance = 16,025mm
6. Minimum breaking strength: 2 x 210 kN
7. Short circuit capacity: 40 kA/1sec
8. Calculated arcing distance: 3,200 mm, 3,400 mm, 3,800 mm
9. Minimum corona extinction voltage = 303 kV
10. Ball / Socket couplig size acc. to IEC 60120/20

Compression Dead End Clamp

- Suitable for ACSR Condor conductor (27.72 mm diameter)
- Slip strength: 95% of the UTS of the conductor
- Compression die numbers: DA-12 (AL) & DS-12 (STEEL)
- Compression pressure: 120 ton

Material Specifications

- All ferrous parts (except spring washers) shall be hot-dip galvanized
- Spring washers: Spring steel, electro-galvanized
- Security clips and split pins: Stainless steel
- Compression Dead End Clamp: Al/steel

4. MIDSPAN COMPRESSION JOINT

- Aluminum sleeve length before compression: 700 mm
- Aluminum sleeve length after compression: 749 mm
- Steel tube length before compression: 180 mm
- Steel tube length after compression: 188 mm

- Compression die numbers: KZ46 (Aluminum), KZ17 (Steel)
- Minimum breaking strength: 95% of UTS of conductor

5. TRIPLE SPACER DAMPER

- Suitable for conductor diameter range: 26.8 - 28.1 mm
- Clamp slip strength: 2.5 kN minimum
- Tightening torque: 45 Nm

6. VIBRATION DAMPER

- Suitable for conductor diameter range: 26.8 - 28.1 mm
- Messenger cable diameter: 10.0 mm
- Messenger cable length: 483 mm
- Counterweights: 0.8 kg and 1.4 kg
- Installation tightening torque: 40 Nm

5.1 MANUFACTURING, MARKING, PACKING & LABELLING

Each hardware and fiting shall be legibly and indelibly marked with the name and trademark of the manufacturer, the year of manufacture and the SML (specified mechanical load) in accordance with IEC 61109.
The following information shall be marked indelibly in a permanent manner by embossing on each insulator hardware and fitting during manufacture:

a) Manufacturer's name or Trademark.
b) Voltage rating
c) Specified mechanical load
d) The letters "**property of KETRACO**"

All markings shall be permanent and shall be by embossing on the hardware and fitting part before galvanizing. The marking shall not affect the performance. Tags and stickers shall not be accepted. A Reference list of same type as quoted installed in similar climatic conditions and list of 10 previous customers with detailed contacts shall be submitted with this bid from the manufacturer.
The hardware and fittings shall be packed in wooden crates which are reinforced and held closed by external steel wire binding. Each crate shall be internally braced to permit stacking and the steel wire bindings shall be designed to keep firmly closed and permit easy and rapid opening at time of installation. The production capacity, the Manufacturing process schedule, the disposal procedures and Corona and Radio Interference documentation shall be provided with the bid.

The crates shall be designed to keep on sturdy wood pallet. The assembly shall be held tightly in place with steel bands and protected against moisture by a complete covering of heat shrinkable polyethylene film.

6. QUALITY MANAGEMENT SYSTEM

The supplier shall submit a quality assurance plan (QAP) that will be used to ensure that the hardware and fittings design, material, manufacture workmanship, tests, service capability, maintenance and documentation will fulfil the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfill the requirements of ISO 9001:2008.

The manufacturer's Declaration of conformity to reference standards and copies of quality management certification including copy of valid ISO 9001, 14001 & 45001 certificates shall be submitted with the tender for evaluation.

7. TESTS AND INSPECTION

7.1 DESIGN TESTS

Design tests shall be performed on each type of hardware and fitting to verify that the design meets the requirements of this specification and the relevant standards. Design tests shall include:

1. Verification of dimensions
2. Verification of mechanical characteristics
3. Verification of galvanizing
4. Corona and radio interference tests
5. Electrical conductivity test (for current-carrying fittings)

7.2 TYPE TESTS

Type tests shall be performed on each type of hardware and fitting to verify that the production equipment and processes consistently produce hardware and fittings that meet the requirements of this specification and the relevant standards. Type tests shall include:

1. Mechanical strength test
2. Electrical resistance test (for current-carrying fittings)
3. Heating cycle test (for compression fittings)
4. Slip strength test (for suspension and tension clamps)
5. Fatigue test (for vibration dampers)
6. Corona and radio interference tests
7. Galvanizing test

7.3 SAMPLE TESTS

Sample tests shall be performed on samples taken at random from each batch to verify that the batch meets the requirements of this specification and the relevant standards. Sample tests shall include:

1. Visual inspection
2. Verification of dimensions
3. Verification of mechanical characteristics
4. Verification of galvanizing
5. Slip strength test (for suspension and tension clamps)

7.4 ROUTINE TESTS

Routine tests shall be performed on each hardware and fitting to verify that it meets the requirements of this specification and the relevant standards. Routine tests shall include:

1. Visual inspection
2. Verification of dimensions
3. Verification of mechanical characteristics

Copies of the previous design and type test reports by relevant Independent International or National Testing/Standards Authority of the country of manufacture (or ISO/IEC 17025 accredited independent laboratory) shall be submitted with the offer for evaluation (all in English language). A copy of the accreditation certificate for the laboratory shall also be submitted.

Routine and sample test reports for the hardware and fittings to be supplied shall be submitted to KETRACO for approval before shipment/delivery of the goods. KETRACO Engineers (2) shall witness acceptance tests at the factory before shipment. The cost of travelling, Accommodation, Visa fees, Local and off-shore airport transfers shall be borne by the manufacturer/Supplier. A description of test equipment, and Complete test protocols shall be submitted with this bid. In addition, the manufacturer/supplier shall provide a daily subsistence allowance equivalent to USD 350 for each KETRACO engineer that will witness the factory acceptance test.

Factory Acceptance tests (FAT) shall include Routine and Sample tests as per IEC 61284 and applicable latest IEC standards and the following:

1. Verification of Dimensions
2. Verification of locking systems
3. Verification of mechanical strength
4. Verification of slip strength (for suspension and tension clamps)

5. Galvanization test

8. GUARANTEED TECHNICAL PARTICULARS (GTP)

1.CONDOR CONDUCTOR HARDWARE & FITTINGS SET

General Specifications

S/N	Description	Unit	Guaranteed Value	Offered Value
1	System Voltage, Um	kV	420	
2	Conductor type	-	ACSR Condor	
3	Conductor diameter	mm	27.72	
4	Short circuit capacity	kA/sec	40/1	
5	Minimum corona extinction voltage	kV	303	

Compression Dead End Clamp

S/N	Description	Unit	Guaranteed Value	Offered Value
6	Slip strength	% of conductor UTS	95	
7	Compression die numbers	-	DA-12 (AL) & DS-12 (STEEL)	
8	Compression pressure	ton	120	

Midspan Compression Joint

S/N	Description	Unit	Guaranteed Value	Offered Value
9	Aluminum sleeve length before/after compression	mm	711 / 749	
10	Steel tube length before/after compression	mm	250 / 229	
11	Compression die numbers	-	KZ46 (Al), KZ17 (Steel)	
12	Minimum breaking strength	% of conductor UTS	95	

Suspension Clamp Assembly

S/N	Description	Unit	Guaranteed Value	Offered Value
13	Minimum breaking strength of clamp	kN	120	
14	Slip strength	kN	31	
15	Tightening torque	Nm	38	

Vibration Damper

S/N	Description	Unit	Guaranteed Value	Offered Value
16	Suitable conductor diameter range	mm	26.8 - 28.1	
17	Messenger cable diameter	mm	10.0	
18	Messenger cable length	mm	483	
19	Counterweights	kg	0.8 and 1.4	
20	Installation tightening torque	Nm	40	

Spacer Damper

S/N	Description	Unit	Guaranteed Value	Offered Value
21	Suitable conductor diameter range	mm	26.8 - 28.1	
22	Clamp slip strength	kN	2.5 (minimum)	
23	Tightening torque	Nm	45	

2.SINGLE SUSPENSION STRING

S/N	Description	Unit	Guaranteed Value	Offered Value
1	System Voltage, Um	kV	420	
2	Power frequency withstand voltage (wet)	kV	715 / 760	
3	Switching impulse withstand voltage	kV	1050 / 1085	

S/N	Description	Unit	Guaranteed Value	Offered Value
4	Lightning impulse withstand voltage	kV	1725 / 1835	
5	Creepage distance	mm	15,400	
6	Minimum breaking strength	kN	120	
7	Short circuit capacity	kA/sec	40/1	
8	Calculated arcing distance (SSS-S/S, SSS-L)	mm	3,200	
9	Calculated arcing distance (SSS-H)	mm	3,800	
10	Slipping force for suspension clamp	kN	31	
11	Torque for screw of suspension clamp	Nm	38	
12	Minimum corona extinction voltage	kV	303	
13	Ball / Socket coupling size	-	IEC 60120/16A	
14	Total weight of assembly	kg	[To be provided]	

3.DOUBLE SUSPENSION STRING

S/N	Description	Unit	Guaranteed Value	Offered Value
1	System Voltage, Um	kV	420	
2	Power frequency withstand voltage (wet)	kV	850	
3	Switching impulse withstand voltage	kV	1215	
4	Lightning impulse withstand voltage	kV	2050	
5	Creepage distance	mm	15,400	
6	Minimum breaking strength	kN	240	
7	Short circuit capacity	kA/sec	40/1	
8	Calculated arcing distance (DSS-S/S, DSS-L)	mm	3,200	
9	Calculated arcing distance (DSS-H)	mm	3,800	
10	Slipping force for suspension clamp	kN	31	
11	Torque for screw of suspension clamp	Nm	38	
12	Minimum corona extinction voltage	kV	303	

S/N	Description	Unit	Guaranteed Value	Offered Value
13	Ball / Socket coupling size	-	IEC 60120/16A	
14	Total weight of assembly	kg	[To be provided]	

4.DOUBLE TENSION STRING

S/N	Description	Unit	Guaranteed Value	Offered Value
1	System Voltage, Um	kV	420	
2	Power frequency withstand voltage (wet)	kV	715 / 760 / 850	
3	Switching impulse withstand voltage	kV	1050 / 1085 / 1215	
4	Lightning impulse withstand voltage	kV	1725 / 1835 / 2050	
5	Creepage distance	mm	16,025	
6	Minimum breaking strength	kN	2 x 210	
7	Short circuit capacity	kA/sec	40/1	
8	Calculated arcing distance	mm	3,200 / 3,400 / 3,800	
9	Minimum corona extinction voltage	kV	303	
10	Ball / Socket coupling size	-	IEC 60120/20	
11	Slip strength of dead end clamp	% of conductor UTS	95	
12	Total weight of assembly	kg	[To be provided]	

I/We declare that the information provided in this GTP is true and correct, and all supporting documents are authentic and valid.

Signature: _____ Name: _____

Position: _____ Company: _____

Date: _____ Company Seal: _____

9. PRICE SCHEDULE FOR CONDOR CONDUCTOR HARDWARE AND FITTINGS

Instructions to Bidders:

1. All prices should be quoted in Kenya Shillings (KES) and are VAT inclusive.

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
1.	SINGLE SUSPENSION STRING HARDWARE & FITTINGS SET	Set	100		
2.	DOUBLE SUSPENSION STRING HARDWARE & FITTINGS SET	Set	100		
3.	DOUBLE TENSION STRING HARDWARE & FITTINGS SET	Set	100		
4.	MIDSPAN COMPRESSION JOINT	Set	200		
5.	SPACER DAMPER	Set	200		
6.	VIBRATION DAMPER	Set	200		
TOTAL					

Declaration

We confirm that our bid complies with all requirements as specified in the tender document.

Company Name: _____

Authorized Signatory: _____

Position: _____

Date: _____

Company Stamp: _____

EMPLOYERS REQUIREMENTS & TECHNICAL SPECIFICATIONS FOR LARK CONDUCTOR HARDWARE & FITTINGS

TABLE OF CONTENTS

FOREWORD

This specification has been prepared by Power System Operation and Maintenance Department (System Operation and Power Management Directorate) of the Kenya Electricity Transmission Company LTD (KETRACO) and it lays down requirements for LARK CONDUCTOR Hardware & Fittings.

This specification is based on international standards and is subject to revision as and when required.

Type test reports from accredited facilities shall be submitted with bid.

It shall be the manufacturer's responsibility to be knowledgeable of the requirements contained herein and in the referenced standards.

10. SCOPE

This specification covers the minimum technical requirements for design, manufacture, testing, supply and delivery of hardware and fittings for use with LARK CONDUCTOR .

The specification also covers inspection and test of the hardware and fittings as well as schedule of Guaranteed Technical Particulars, Price schedules to be filled in, signed by the manufacturer and submitted for tender evaluation. Complete installation instructions, Technical support documentation and Maintenance procedures shall be submitted with this bid for evaluation.

The specifications stipulate the minimum requirements for Hardware and Fittings for LARK CONDUCTOR acceptable for use by KETRACO and it shall be the responsibility of the manufacturer to ensure adequacy of the design, good workmanship and good engineering practice in the manufacture of the hardware and fittings. The hardware and fittings supplied

shall strictly adhere to the issued drawings. Where inconsistencies exist between the drawings and specifications, the drawings shall govern unless otherwise approved in writing by KETRACO.

11. REFERENCE STANDARDS

The hardware and fittings shall comply with the latest editions of the following standards:

- IEC 61284: Overhead lines - Requirements and tests for fittings
- IEC 60120: Dimensions of ball and socket couplings of string insulator units
- IEC 60372: Locking devices for ball and socket couplings of string insulator units - Dimensions and tests
- IEC 60471: Dimensions of clevis and tongue couplings of string insulator units
- BS EN 61284: Overhead lines - Requirements and tests for fittings
- BS EN 60672-3: Ceramic and glass-insulating materials
- BS EN ISO 1461: Hot dip galvanized coatings on fabricated iron and steel articles
- BS EN ISO 2178: Non-magnetic coatings on magnetic substrates - Measurement of coating thickness - Magnetic method
- ASTM A153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- ASTM B230: Standard Specification for Aluminum 1350-H19 Wire for Electrical Purposes
- ASTM B232: Standard Specification for Concentric-Lay-Stranded Aluminum Conductors

12. SERVICE CONDITIONS

1. The hardware and fittings shall be suitable for continuous operation outdoor in tropical areas at altitudes of up to 2200m above sea level, humidity of up to 90%, ambient temperature of +30 degrees centigrade with a minimum of -1 degree centigrade and a maximum of +40-degree centigrade, heavy saline conditions along the coast and tropical sunshine conditions.
2. The weather isokeraunic levels reach up to 180 thunderstorms days per year.
3. The level of galvanizing for all parts and materials used shall be suitable for these conditions.

13. MATERIALS AND CONSTRUCTION

13.1 GENERAL REQUIREMENTS

1. All hardware and fittings shall be designed, manufactured and tested in accordance with IEC 61284 and other applicable/latest standards and requirements of this specification.
2. All ferrous parts shall be hot-dip galvanized after fabrication in accordance with ISO 1461 and ASTM A153. The zinc coating shall be smooth, continuous, and uniform. It shall be

free from areas that are bare, have blisters, flux and ash inclusions, lumps, or coarse crystals.

3. The galvanized coating on all hardware shall withstand four one-minute dips in copper sulphate solution as per IEC 61284 without showing signs of copper deposits.
4. Spring washers shall be of spring steel and electro-galvanized.
5. Security clips and split pins shall be of stainless steel.
6. Design and construction drawings shall be submitted by the winning bidder.
7. The surfaces of all hardware shall be smooth, without cuts, abrasions, projections, ridges or exfoliation that might damage the conductor or cause radio interference.
8. All bolts and nuts shall have hexagonal heads and shall be locked in an approved manner.
9. All hardware shall be suitable for use with LARK CONDUCTOR (diameter 19.53 mm, weight 922 kg/km, UTS 110.5 kN) and shall have adequate strength, conductivity, and corona performance.
10. The design shall minimize the number of parts and the number of bolts per assembly.

13.2 SPECIFIC MATERIAL REQUIREMENTS

5. Aluminum and Aluminum Alloys:
    - Suspension clamp bodies, tension clamp bodies, armor rods, and other aluminum components shall be made from high-strength aluminum alloy.
    - Aluminum alloy castings shall be free from flaws, surface blemishes, and shrinkage defects.
6. Steel and Steel Alloys:
    - All steel used shall be thoroughly hot-dip galvanized after fabrication.
    - Malleable cast iron shall not be used.
    - Drop-forged steel shall be used for tension and suspension hardware components requiring high mechanical strength.
7. Fasteners:
    - All bolts, nuts, and washers shall be hot-dip galvanized steel.
    - All bolts shall be provided with one flat washer and one spring washer.
    - Split pins and security clips shall be of stainless steel.
8. Corona and Radio Interference:
    - All fittings shall be designed to minimize corona discharge and radio interference.

- Corona rings/shields shall be provided where necessary to ensure corona extinction levels are maintained.
- Minimum corona extinction voltage shall be 105 kV (rms).
- Radio Interference Voltage at 110 kV shall not exceed 500 μV.

14. HARDWARE AND FITTINGS SETS FOR LARK CONDUCTOR

1. SINGLE SUSPENSION INSULATOR STRING HARDWARE AND FITTINGS SET

Set Components

1. Tower Hinge
2. Heavy Hexagonal Ball Eye
3. Arcing Ring (T.S.)
4. Arcing Ring (L.S.)
5. Heavy Hexagonal Socket Clevis
6. Yoke Plate
7. Suspension Clamp Assembly with P.A. Rod

General Technical Specifications

1. Applicable standards: B.S. 3288, Part-I
2. Ultimate Tensile Strength (U.T.S.) of hardware fittings: 160 kN
3. Slip strength of suspension clamp: 15% UTS of ACSR Lark conductor
4. Short circuit capacity: 31.5 kA for 1 second
5. Minimum corona extinction voltage: 290 kV
6. Radio Interference Voltage (RIV) at 275 kV: 45 dB
7. General tolerance: ±3% unless otherwise specified
8. All ferrous parts (except spring washers) shall be hot-dip galvanized conforming to B.S. 729
9. Spring washers: Spring steel, electro-galvanized
10. Security clips and split pins: Stainless steel
11. Suitable for ACSR Quad Lark conductor

Specific Component Requirements

1. Tower Hinge

- Material: Mild Steel FE-410, Hot Dip Galvanized (HDG)
- Breaking strength: 160 kN
- Components: Tower hinge, bolts, nuts, washers, split pins

2. Heavy Hexagonal Ball Eye

- Material: Forged Steel (Class-IV), HDG
- Minimum breaking load: 160 kN
- Ball designation: 20 mm as per IEC 120/BS-3288

3. Arcing Ring (T.S.)

- Material: Mild Steel FE-410, HDG
- Components: Arcing ring, ball, bolts, nuts, spring washers

4. Arcing Ring (L.S.)

- Material: Mild Steel FE-410, HDG
- Components: Arcing ring, ball, bolts, nuts, spring washers

5. Heavy Hexagonal Socket Clevis

- Material: Forged Steel (Class-IV), HDG
- Minimum breaking load: 160 kN
- Socket designation: 20 mm as per IEC 120/BS-3288

6. Yoke Plate

- Material: Mild Steel FE-410, HDG
- Breaking strength: 160 kN

7. Suspension Clamp Assembly with P.A. Rod

- Minimum breaking strength of clamp: 70 kN
- Components: Suspension clamp (Al alloy), keeper, U-bolts, washers, saddle, side strap, armor rod (11 nos/set, Al alloy), twisted shackle
- Armor rod material: Aluminum alloy

Additional Requirements

1. All components must be designed for use in 400 kV transmission lines
2. Components should be compatible with each other and form a complete single suspension insulator string set
3. Manufacturer must provide test certificates for all items
4. Packaging should be suitable to prevent damage during transportation and storage
5. Clear marking and identification on all components
6. Compliance with KETRACO's quality assurance requirements
7. Detailed installation instructions to be provided

2. DOUBLE SUSPENSION INSULATOR STRING HARDWARE AND FITTINGS SET

Set Components

1. Tower Hinge
2. Yoke Plate
3. Ball Clevis
4. Arcing Ring (T.S.)
5. Arcing Ring (L.S.)
6. Heavy Hexagonal Socket Clevis
7. Yoke Plate
8. Suspension Clamp Assembly with P.A. Rod

General Technical Specifications

1. Applicable standards: B.S. 3288, Part-I
2. Ultimate Tensile Strength (U.T.S.) of hardware fittings: 2 x 160 kN
3. Slip strength of suspension clamp: 15% UTS of ACSR Lark conductor
4. Short circuit capacity: 31.5 kA for 1 second
5. Minimum corona extinction voltage: 290 kV
6. Radio Interference Voltage (RIV) at 275 kV: 45 dB
7. General tolerance: ±3% unless otherwise specified
8. All ferrous parts (except spring washers) shall be hot-dip galvanized conforming to B.S. 729
9. Spring washers: Spring steel, electro-galvanized
10. Security clips and split pins: Stainless steel
11. Suitable for ACSR Quad Lark conductor

Specific Component Requirements

1. Tower Hinge

- Material: Mild Steel FE-410, Hot Dip Galvanized (HDG)
- Breaking strength: 320 kN
- Components: Tower hinge, bolts, nuts, washers, split pins

2. Yoke Plate

- Material: Mild Steel FE-410, HDG
- Breaking strength: 320 kN

3. Ball Clevis

- Material: Forged Steel (Class-IV), HDG
- Minimum breaking load: 160 kN
- Ball designation: 20 mm as per IEC 120/BS-3288

4. Arcing Ring (T.S.)

- Material: Mild Steel FE-410, HDG
- Components: Arcing ring, ball, bolts, nuts, spring washers

5. Arcing Ring (L.S.)

- Material: Mild Steel FE-410, HDG
- Components: Arcing ring, ball, bolts, nuts, spring washers

6. Heavy Hexagonal Socket Clevis

- Material: Forged Steel (Class-IV), HDG
- Minimum breaking load: 160 kN
- Socket designation: 20 mm as per IEC 120/BS-3288

7. Yoke Plate

- Material: Mild Steel FE-410, HDG
- Breaking strength: 320 kN

8. Suspension Clamp Assembly with P.A. Rod

- Minimum breaking strength of clamp: 70 kN
- Components: Suspension clamp (Al alloy), keeper, U-bolts, washers, saddle, side strap, armor rod (11 nos/set, Al alloy), twisted shackle

Additional Requirements

1. All components must be designed for use in 400 kV transmission lines
2. Components should be compatible with each other and form a complete double suspension insulator string set
3. Manufacturer must provide test certificates for all items
4. Packaging should be suitable to prevent damage during transportation and storage
5. Clear marking and identification on all components
6. Compliance with KETRACO's quality assurance requirements
7. Detailed installation instructions to be provided

3. ACS FITTINGS AND ACCESSORIES SET

Set Components

1. Midspan Compression Joint with Aluminum Encasing

2. Suspension Clamp Assembly
3. Tension Clamp with Aluminum Encasing
4. Vibration Damper
5. Flexible Copper Earth Bond

General Technical Specifications

1. Applicable standards: B.S. 3288, Part-I
2. Short circuit capacity: 31.5 kA for 1 second
3. General tolerance: ±3% unless otherwise specified (±5% for flexible copper earth bond)
4. All ferrous parts (except spring washers) shall be hot-dip galvanized conforming to B.S. 729
5. Spring washers: Spring steel, electro-galvanized
6. Suitable for ACS earthwire (7/3.26 mm)

Specific Component Requirements

1. Midspan Compression Joint with Aluminum Encasing

- Slip/mechanical strength: 95% of UTS of earthwire
- Compression pressure: 100 ton
- Components: Steel tube, aluminum encasing
- Material: Steel tube - Mild Steel, Aluminum encasing - EC grade aluminum

2. Suspension Clamp Assembly

- UTS for fittings: 25 kN (minimum)
- Slip strength: Not less than 5 kN and not more than 14 kN
- Tightening torque: 5 kg-m
- Components: Clamp body, keeper piece, U-bolt, J-bolt, saddle, side strap, twisted shackle

3. Tension Clamp with Aluminum Encasing

- Mechanical/slip strength: Not less than 95% of UTS of relevant earthwire
- Components: Anchor shackle, dead end clamp, aluminum sleeve, jumper plate, jumper cover

4. Vibration Damper

- Mass pull-off value: 500 kg
- Slip strength of clamp:
    - Before fatigue test: 2.5 kN (minimum)
    - After fatigue test: 2.0 kN
- UTS of messenger cable: 135 kg/sq.mm
- Messenger cable: 19 strand

- Lay ratio of messenger cable: 10-11
- Tightening torque: 6 kg-m
- Components: Hook half clamp, damper masses, cover half clamp, messenger cable

5. Flexible Copper Earth Bond

- Pull-off load: 300 kg
- Resistance: Less than 1 ohm
- Components: Flexible copper wire (37/0.417 mm, 35 sq.mm), connecting lugs

Additional Requirements

1. All components must be designed for use in 400 kV and 220 kV transmission lines
2. Components should be compatible with each other and with ACS earthwire (7/3.26 mm)
3. Manufacturer must provide test certificates for all items
4. Packaging should be suitable to prevent damage during transportation and storage
5. Clear marking and identification on all components
6. Compliance with KETRACO's quality assurance requirements
7. Detailed installation instructions to be provided

4. DOUBLE TENSION INSULATOR STRING HARDWARE AND FITTINGS SET

Set Components

1. Tower Hinge
2. Fixed Extension Strap
3. Adjustable Extension Strap
4. Heavy Hexagonal Ball Eye
5. Arcing Ring (T.S.)
6. Arcing Ring (L.S.)
7. Heavy Hexagonal Socket Clevis
8. Extension Straps
9. Yoke Plate
10. Clevis Eye
11. Yoke Plate
12. Extension Straps
13. Sag Adjustment Plate

14. Dead End Assembly
15. Rigid Spacer
16. Additional Links

General Technical Specifications

1. Applicable standards: B.S. 3288, Part-I
2. Ultimate Tensile Strength (U.T.S.) of hardware fittings: 2 x 160 kN (without tension clamp)
3. Slip strength/mechanical load of tension clamp: 95% UTS of ACSR Lark conductor
4. Ball and socket designation: 20 mm as per IEC:120
5. Short circuit capacity: 31.5 kA for 1 second
6. Minimum corona extinction voltage: 290 kV
7. Radio Interference Voltage (RIV) at 275 kV: 45 dB
8. General tolerance: ±3% unless otherwise specified
9. All ferrous parts (except spring washers) shall be hot-dip galvanized conforming to B.S. 729
10. Spring washers: Spring steel, electro-galvanized
11. Security clips and split pins: Stainless steel
12. Suitable for ACSR Quad Lark conductor

Specific Component Requirements

1. Tower Hinge (ATEL-3B/2)

- Material: Mild Steel FE-410, Hot Dip Galvanized (HDG)
- Breaking strength: 160 kN

2. Fixed Extension Strap (AEL-273)

- Material: Mild Steel, HDG
- Breaking strength: 160 kN

3. Adjustable Extension Strap (ASA-79)

- Material: Mild Steel FE-410, HDG
- Breaking strength: 160 kN
- Adjustable in multiple positions

4. Heavy Hexagonal Ball Eye (ABE-20)

- Material: Forged Steel (Class-IV), HDG
- Minimum breaking load: 160 kN

5. Arcing Ring (T.S.) (AAH/FRB-13H) and (L.S.) (AAH/FRB-14H)

- Material: Mild Steel FE-410, HDG

6. Heavy Hexagonal Socket Clevis (ASC-6H/1)

- Material: Forged Steel (Class-IV), HDG
- Minimum breaking load: 160 kN

7. Extension Straps (AEL-274, AEL-275, AEL-276)

- Material: Mild Steel, HDG
- Breaking strength: 160 kN

8. Yoke Plate (AYP-64K)

- Material: Mild Steel FE-410, HDG
- Breaking strength: 320 kN

9. Clevis Eye (ACE-76T)

- Material: Forged Steel (Class-IV), HDG
- Breaking strength: 160 kN

10. Yoke Plate (AYP-10N3)

- Material: Mild Steel FE-410, HDG
- Breaking strength: 160 kN

11. Extension Straps (AEL-130, AEL-255)

- Material: Mild Steel, HDG
- Breaking strength: 80 kN

12. Sag Adjustment Plate (ASA-59A)

- Material: Mild Steel FE-410, HDG
- Breaking strength: 80 kN

13. Dead End Assembly (ADE/C-023, ADE/C-023L, ADE/C-023R)

- Slip/mechanical strength: 95% UTS of conductor
- Components: Dead end body (Extruded Al Tube, 99.5% purity), Steel dead end (Forged Steel), Dead end body, bolts, nuts, washers, filler plug
- Compression die numbers: DA-9 (AL) & DS-9 (STEEL)
- Compression pressure: 100 ton

14. Rigid Spacer (ARGS-001/LR)

- Material: Aluminum Alloy
- Clamp slip strength: 2.5 kN
- Compression load: 14 kN
- Tension load: 7 kN

15. Additional Links (AEL-353, AEL-360, AEL-361, AEL-362, AEL-363)

- Material: Mild Steel, HDG
- Breaking strength: 160 kN
- Various lengths for different deviation angles

Additional Requirements

1. All components must be designed for use in 400 kV transmission lines
2. Components should be compatible with each other and form a complete double tension insulator string set
3. Manufacturer must provide test certificates for all items
4. Packaging should be suitable to prevent damage during transportation and storage
5. Clear marking and identification on all components
6. Compliance with KETRACO's quality assurance requirements
7. Detailed installation instructions to be provided

5. MID-SPAN COMPRESSION JOINT

- Slip strength: 95% of UTS of conductor
- Compression die numbers: DA-9 (AL) & DS-9 (STEEL)
- Compression pressure: 100 ton
- Components: Aluminum sleeve, steel sleeve, filler plug

6. REPAIR SLEEVE

- Material: Aluminum alloy
- Slip strength: 95% of UTS of conductor

7. QUAD SPACER DAMPER

- Compressive strength: 14 kN
- Tensile strength: 7 kN
- Slip strength: 6.5 kN
- Damping element hardness: 65-80 Shore A
- Components: Frame, cover, arm, keeper, damping element, rubber bushing, bolts, washers

8. T-CONNECTOR

- Clamp slip strength: 2.5 kN
- Compression load: 14 kN
- Tension load: 7 kN

9. VIBRATION DAMPER

- Mass pull-off value: 500 kg
- Slip strength of clamp:
    - Before fatigue test: 2.5 kN (minimum)
    - After fatigue test: 2.0 kN (minimum)
- UTS of messenger cable: 135 kg/sq.mm (minimum)
- Messenger cable: 19 strand
- Lay ratio of messenger cable: 9-11
- Tightening torque: 6.5 kg-m

Additional Requirements

1. All components must be designed for use in 400 kV transmission lines
2. Components should be compatible with each other and with ACSR Lark conductor
3. Manufacturer must provide test certificates for all items
4. Packaging should be suitable to prevent damage during transportation and storage
5. Clear marking and identification on all components
6. Compliance with KETRACO's quality assurance requirements
7. Detailed installation instructions to be provided

14.1 MANUFACTURING, MARKING, PACKING & LABELLING

Each hardware and fiting shall be legibly and indelibly marked with the name and trademark of the manufacturer, the year of manufacture and the SML (specified mechanical load) in accordance with IEC 61109.
The following information shall be marked indelibly in a permanent manner by embossing on each insulator hardware and fitting during manufacture:

e) Manufacturer's name or Trademark.
f) Voltage rating
g) Specified mechanical load
h) The letters "**property of KETRACO**"

All markings shall be permanent and shall be by embossing on the hardware and fitting part before galvanizing. The marking shall not affect the performance. Tags and stickers shall not be accepted. A Reference list of same type as quoted installed in similar climatic conditions and list of 10 previous customers with detailed contacts shall be submitted with this bid from the manufacturer.
The hardware and fittings shall be packed in wooden crates which are reinforced and held closed by external steel wire binding. Each crate shall be internally braced to permit stacking and the steel wire bindings shall be designed to keep firmly closed and permit easy and rapid opening at time of installation. The production capacity, the Manufacturing process schedule,

the disposal procedures and Corona and Radio Interference documentation shall be provided with the bid.

The crates shall be designed to keep on sturdy wood pallet. The assembly shall be held tightly in place with steel bands and protected against moisture by a complete covering of heat shrinkable polyethylene film.

15. QUALITY MANAGEMENT SYSTEM

The supplier shall submit a quality assurance plan (QAP) that will be used to ensure that the hardware and fittings design, material, manufacture workmanship, tests, service capability, maintenance and documentation will fulfil the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfill the requirements of ISO 9001:2008.

The manufacturer's Declaration of conformity to reference standards and copies of quality management certification including copy of valid ISO 9001, 14001 & 45001 certificates shall be submitted with the tender for evaluation.

16. TESTS AND INSPECTION

16.1 DESIGN TESTS

Design tests shall be performed on each type of hardware and fitting to verify that the design meets the requirements of this specification and the relevant standards. Design tests shall include:

1. Verification of dimensions
2. Verification of mechanical characteristics
3. Verification of galvanizing
4. Corona and radio interference tests
5. Electrical conductivity test (for current-carrying fittings)

16.2 TYPE TESTS

Type tests shall be performed on each type of hardware and fitting to verify that the production equipment and processes consistently produce hardware and fittings that meet the requirements of this specification and the relevant standards. Type tests shall include:

17. Mechanical strength test
18. Electrical resistance test (for current-carrying fittings)
19. Heating cycle test (for compression fittings)
20. Slip strength test (for suspension and tension clamps)
21. Fatigue test (for vibration dampers)

22. Corona and radio interference tests

23. Galvanizing test

16.3 SAMPLE TESTS

Sample tests shall be performed on samples taken at random from each batch to verify that the batch meets the requirements of this specification and the relevant standards. Sample tests shall include:

6. Visual inspection
7. Verification of dimensions
8. Verification of mechanical characteristics
9. Verification of galvanizing
10. Slip strength test (for suspension and tension clamps)

16.4 ROUTINE TESTS

Routine tests shall be performed on each hardware and fitting to verify that it meets the requirements of this specification and the relevant standards. Routine tests shall include:

4. Visual inspection
5. Verification of dimensions
6. Verification of mechanical characteristics

Copies of the previous design and type test reports by relevant Independent International or National Testing/Standards Authority of the country of manufacture (or ISO/IEC 17025 accredited independent laboratory) shall be submitted with the offer for evaluation (all in English language). A copy of the accreditation certificate for the laboratory shall also be submitted.

Routine and sample test reports for the hardware and fittings to be supplied shall be submitted to KETRACO for approval before shipment/delivery of the goods. KETRACO Engineers (2) shall witness acceptance tests at the factory before shipment. The cost of travelling, Accommodation, Visa fees, Local and off-shore airport transfers shall be borne by the manufacturer/Supplier. A description of test equipment, and Complete test protocols shall be submitted with this bid. In addition, the manufacturer/supplier shall provide a daily subsistence allowance equivalent to USD 350 for each KETRACO engineer that will witness the factory acceptance test.

Factory Acceptance tests (FAT) shall include Routine and Sample tests as per IEC 61284 and applicable latest IEC standards and the following:

1. Verification of Dimensions
2. Verification of locking systems

3. Verification of mechanical strength
4. Verification of slip strength (for suspension and tension clamps)
5. Galvanization test

17. GUARANTEED TECHNICAL PARTICULARS (GTP)

1.LARK CONDUCTOR HARDWARE & FITTINGS

1. General Particulars

S/N	Description	Unit	Guaranteed Value	Offered value
1.1	Applicable Standard	-	B.S. 3288, Part-I	
1.2	Conductor type	-	ACSR Lark	
1.3	Short circuit capacity	kA/sec	31.5/1	
1.4	General tolerance	%	±3	
1.5	Galvanization standard for ferrous parts	-	[To be provided]	
1.6	Spring washer material	-	Spring steel, electro-galvanized	
1.7	Security clips and split pins material	-	Stainless steel	

2. Suspension Clamp Assembly

S/N	Description	Unit	Guaranteed Value	Offered value
2.1	Manufacturer and Model	-	[To be provided]	
2.2	Minimum breaking strength of clamp	Kn	70	
2.3	Minimum slip strength	% of conductor UTS	15	
2.4	Material of clamp body	-	Aluminum alloy	
2.5	Material of armor rod	-	Aluminum alloy	
2.6	Number of armor rods per set	-	11	
2.7	Bolt and nut material	-	Mild steel, HDG	
2.8	Twisted shackle material	-	Forged steel, HDG	
2.9	Total weight of assembly	kg	[To be provided]	

3. Dead End Assembly

S/N	Description	Unit	Guaranteed Value	Offered value
3.1	Manufacturer and Model	-	[To be provided]	
3.2	Slip/mechanical strength	% of conductor UTS	95 (minimum)	
3.3	Compression die number for aluminum	-	DA-9	
3.4	Compression die number for steel	-	DS-9	
3.5	Compression pressure	ton	100	
3.6	Material of dead end body	-	Extruded aluminum (99.5% purity)	
3.7	Bolt grade	-	5.6/5.0	
3.8	Total weight of assembly	kg	[To be provided]	

4. Mid-span Compression Joint

S/N	Description	Unit	Guaranteed Value	Offered value
4.1	Manufacturer and Model	-	[To be provided]	
4.2	Slip strength	% of conductor UTS	95	
4.3	Compression die number for aluminum	-	DA-9	
4.4	Compression die number for steel	-	DS-9	
4.5	Compression pressure	ton	100	
4.6	Material of aluminum sleeve	-	EC grade aluminum	
4.7	Material of steel sleeve	-	Mild steel, HDG	
4.8	Dimensions of aluminum sleeve (L x OD)	mm	610 x 38	
4.9	Dimensions of steel sleeve (L x OD)	mm	203 x 18	
4.10	Total weight of joint	kg	[To be provided]	

5. Repair Sleeve

S/N	Description	Unit	Guaranteed Value	Offered value
5.1	Manufacturer and Model	-	[To be provided]	
5.2	Material	-	Aluminum alloy	
5.3	Slip strength	% of conductor UTS	95	
5.4	Length	mm	[To be provided]	
5.5	Outside diameter	mm	[To be provided]	
5.6	Inside diameter	mm	[To be provided]	
5.7	Weight	kg	[To be provided]	

6. Quad Spacer

S/N	Description	Unit	Guaranteed Value	Offered value
6.1	Manufacturer and Model	-	[To be provided]	
6.2	Compressive strength	kN	14	
6.3	Tensile strength	kN	7	
6.4	Slip strength	kN	6.5	
6.5	Damping element hardness	Shore A	65-80	
6.6	Material of frame and arms	-	Aluminum alloy	
6.7	Material of damping element	-	EPDM	
6.8	Bolt size and grade	-	[To be provided]	
6.9	Weight of spacer	kg	[To be provided]	

7. Vibration Damper

S/N	Description	Unit	Guaranteed Value	Offered value
7.1	Manufacturer and Model	-	[To be provided]	
7.2	Mass pull-off value	kg	500	
7.3	Slip strength before fatigue test	kN	2.5 (minimum)	
7.4	Slip strength after fatigue test	kN	2.0 (minimum)	
7.5	UTS of messenger cable	kg/sq.mm	135 (minimum)	
7.6	Number of strands in messenger cable	-	19	

S/N	Description	Unit	Guaranteed Value	Offered value
7.7	Lay ratio of messenger cable	-	9-11	
7.8	Tightening torque	kg-m	6.5	
7.9	Clamp material	-	Aluminum alloy	
7.10	Damper mass material	-	Cast iron, HDG	
7.11	Weight of damper	kg	[To be provided]	
7.12	Resonance frequencies (1st, 2nd, 3rd, 4th)	Hz	1621, 1941, 3542, 4222	

2.SINGLE SUSPENSION INSULATOR

1. General Particulars

S/N	Description	Unit	Guaranteed Value	Offered value
1.1	Applicable Standard	-	B.S. 3288, Part-I	
1.2	Conductor type	-	ACSR Quad Lark	
1.3	Total U.T.S. of hardware fittings	kN	160	
1.4	Slip strength of suspension clamp	% of conductor UTS	15	
1.5	Short circuit capacity	kA/sec	31.5/1	
1.6	Minimum corona extinction voltage	kV	290	
1.7	Radio Interference Voltage at 275 kV	dB	45	
1.8	General tolerance	%	±3	
1.9	Galvanization standard for ferrous parts	-	B.S. 729	
1.10	Total weight of the complete set	kg	[To be provided]	

2. Component-specific Particulars

2.1 Tower Hinge (ATEL-3B/2)

S/N	Description	Unit	Guaranteed Value	Offered value
2.1.1	Material	-	Mild Steel FE-410, HDG	
2.1.2	Breaking strength	kN	160	
2.1.3	Dimensions (L x W x T)	mm	[To be provided]	

S/N	Description	Unit	Guaranteed Value	Offered value
2.1.4	Weight	kg	[To be provided]	

2.2 Heavy Hexagonal Ball Eye (ABL-8)

S/N	Description	Unit	Guaranteed Value	Offered value
2.2.1	Material	-	Forged Steel (Class-IV), HDG	
2.2.2	Minimum breaking load	kN	160	
2.2.3	Ball designation	mm	20	
2.2.4	Weight	kg	[To be provided]	

2.3 Arcing Ring (T.S.) (AAH/FRB-13H)

S/N	Description	Unit	Guaranteed Value	Offered value
2.3.1	Material	-	Mild Steel FE-410, HDG	
2.3.2	Dimensions (OD x ID x T)	mm	[To be provided]	
2.3.3	Weight	kg	[To be provided]	

2.4 Arcing Ring (L.S.) (AAH/FRB-14G)

S/N	Description	Unit	Guaranteed Value	Offered value
2.4.1	Material	-	Mild Steel FE-410, HDG	
2.4.2	Dimensions (OD x ID x T)	mm	[To be provided]	
2.4.3	Weight	kg	[To be provided]	

2.5 Heavy Hexagonal Socket Clevis (ASC-6H/1)

S/N	Description	Unit	Guaranteed Value	Offered value
2.5.1	Material	-	Forged Steel (Class-IV), HDG	
2.5.2	Minimum breaking load	kN	160	
2.5.3	Socket designation	mm	20	
2.5.4	Weight	kg	[To be provided]	

2.6 Yoke Plate (AYP-176)

S/N	Description	Unit	Guaranteed Value	Offered value
2.6.1	Material	-	Mild Steel FE-410, HDG	
2.6.2	Breaking strength	kN	160	

S/N	Description	Unit	Guaranteed Value	Offered value
2.6.3	Dimensions (L x W x T)	mm	[To be provided]	
2.6.4	Weight	kg	[To be provided]	

2.7 Suspension Clamp Assembly with P.A. Rod (A-30-ASSY)

S/N	Description	Unit	Guaranteed Value	Offered value
2.7.1	Minimum breaking strength of clamp	kN	70	
2.7.2	Slip strength	% of conductor UTS	15	
2.7.3	Clamp material	-	Aluminum alloy	
2.7.4	Number of armor rods per set	-	11	
2.7.5	Armor rod material	-	Aluminum alloy	
2.7.6	Suitable conductor diameter range	mm	[To be provided]	
2.7.7	Total weight of assembly	kg	[To be provided]	

3.DOUBLE SUSPENSION INSULATOR

1. General Particulars

S/N	Description	Unit	Guaranteed Value	Offered value
1.1	Applicable Standard	-	B.S. 3288, Part-I	
1.2	Conductor type	-	ACSR Quad Lark	
1.3	Total U.T.S. of hardware fittings	kN	2 x 160	
1.4	Slip strength of suspension clamp	% of conductor UTS	15	
1.5	Short circuit capacity	kA/sec	31.5/1	
1.6	Minimum corona extinction voltage	kV	290	
1.7	Radio Interference Voltage at 275 kV	dB	45	
1.8	General tolerance	%	±3	
1.9	Galvanization standard for ferrous parts	-	B.S. 729	
1.10	Total weight of the complete set	kg	[To be provided]	

2. Component-specific Particulars

2.1 Tower Hinge (ATEL-3B/3)

S/N	Description	Unit	Guaranteed Value	Offered value
2.1.1	Material	-	Mild Steel FE-410, HDG	
2.1.2	Breaking strength	kN	320	
2.1.3	Dimensions (L x W x T)	mm	[To be provided]	
2.1.4	Weight	kg	[To be provided]	

2.2 Yoke Plate (AYP-211)

S/N	Description	Unit	Guaranteed Value	Offered value
2.2.1	Material	-	Mild Steel FE-410, HDG	
2.2.2	Breaking strength	kN	320	
2.2.3	Dimensions (L x W x T)	mm	[To be provided]	
2.2.4	Weight	kg	[To be provided]	

2.3 Ball Clevis (ABC-2)

S/N	Description	Unit	Guaranteed Value	Offered value
2.3.1	Material	-	Forged Steel (Class-IV), HDG	
2.3.2	Minimum breaking load	kN	160	
2.3.3	Ball designation	mm	20	
2.3.4	Weight	kg	[To be provided]	

2.4 Arcing Ring (T.S.) (AAH/FRB-18B)

S/N	Description	Unit	Guaranteed Value	Offered value
2.4.1	Material	-	Mild Steel FE-410, HDG	
2.4.2	Dimensions (OD x ID x T)	mm	[To be provided]	
2.4.3	Weight	kg	[To be provided]	

2.5 Arcing Ring (L.S.) (AAH/FRB-14G)

S/N	Description	Unit	Guaranteed Value	Offered value
2.5.1	Material	-	Mild Steel FE-410, HDG	
2.5.2	Dimensions (OD x ID x T)	mm	[To be provided]	
2.5.3	Weight	kg	[To be provided]	

2.6 Heavy Hexagonal Socket Clevis (ASC-6H/1)

S/N	Description	Unit	Guaranteed Value	Offered value
2.6.1	Material	-	Forged Steel (Class-IV), HDG	
2.6.2	Minimum breaking load	kN	160	
2.6.3	Socket designation	mm	20	
2.6.4	Weight	kg	[To be provided]	

2.7 Yoke Plate (AYP-10C1)

S/N	Description	Unit	Guaranteed Value	Offered value
2.7.1	Material	-	Mild Steel FE-410, HDG	
2.7.2	Breaking strength	kN	320	
2.7.3	Dimensions (L x W x T)	mm	[To be provided]	
2.7.4	Weight	kg	[To be provided]	

2.8 Suspension Clamp Assembly with P.A. Rod (A-30-ASSY)

S/N	Description	Unit	Guaranteed Value	Offered value
2.8.1	Minimum breaking strength of clamp	kN	70	
2.8.2	Slip strength	% of conductor UTS	15	
2.8.3	Clamp material	-	Aluminum alloy	
2.8.4	Number of armor rods per set	-	11	
2.8.5	Armor rod material	-	Aluminum alloy	
2.8.6	Suitable conductor diameter range	mm	[To be provided]	
2.8.7	Total weight of assembly	kg	[To be provided]	

4.ACS FITTINGS AND ACCESSORIES

1. General Particulars

S/N	Description	Unit	Guaranteed Value	Offered value
1.1	Applicable Standard	-	B.S. 3288, Part-I	
1.2	Earthwire type	-	ACS 7/3.26 mm	
1.3	Short circuit capacity	kA/sec	31.5/1	

S/N	Description	Unit	Guaranteed Value	Offered value
1.4	General tolerance	%	±3 (±5 for flexible copper earth bond)	
1.5	Galvanization standard for ferrous parts	-	B.S. 729	
1.6	Spring washer material	-	Spring steel, electro-galvanized	
1.7	Total weight of the complete set	kg	[To be provided]	

2. Midspan Compression Joint with Aluminum Encasing

S/N	Description	Unit	Guaranteed Value	Offered value
2.1	Manufacturer and Model	-	[To be provided]	
2.2	Slip/mechanical strength	% of earthwire UTS	95	
2.3	Compression pressure	ton	100	
2.4	Steel tube material	-	Mild Steel	
2.5	Aluminum encasing material	-	EC grade aluminum	
2.6	Dimensions before compression (L x OD)	mm	[To be provided]	
2.7	Dimensions after compression (L x OD)	mm	[To be provided]	
2.8	Weight	kg	[To be provided]	

3. Suspension Clamp Assembly

S/N	Description	Unit	Guaranteed Value	Offered value
3.1	Manufacturer and Model	-	[To be provided]	
3.2	UTS for fittings	kN	25 (minimum)	
3.3	Slip strength range	kN	5-14	
3.4	Tightening torque	kg-m	5	
3.5	Clamp body material	-	Malleable cast iron, HDG	
3.6	U-bolt and J-bolt material	-	Mild steel, HDG	
3.7	Twisted shackle material	-	Forged steel, HDG	

S/N	Description	Unit	Guaranteed Value	Offered value
3.8	Weight	kg	[To be provided]	

4. Tension Clamp with Aluminum Encasing

S/N	Description	Unit	Guaranteed Value	Offered value
4.1	Manufacturer and Model	-	[To be provided]	
4.2	Mechanical/slip strength	% of earthwire UTS	95 (minimum)	
4.3	Anchor shackle material	-	Forged steel, HDG	
4.4	Dead end clamp material	-	Mild steel, HDG	
4.5	Aluminum sleeve material	-	Extruded aluminum	
4.6	Compression die number	-	[To be provided]	
4.7	Dimensions of aluminum sleeve (L x OD)	mm	[To be provided]	
4.8	Weight	kg	[To be provided]	

5. Vibration Damper

S/N	Description	Unit	Guaranteed Value	Offered value
5.1	Manufacturer and Model	-	[To be provided]	
5.2	Mass pull-off value	kg	500	
5.3	Slip strength before fatigue test	kN	2.5 (minimum)	
5.4	Slip strength after fatigue test	kN	2.0	
5.5	UTS of messenger cable	kg/sq.mm	135	
5.6	Number of strands in messenger cable	-	19	
5.7	Lay ratio of messenger cable	-	10-11	
5.8	Tightening torque	kg-m	6	
5.9	Clamp material	-	Aluminum alloy	
5.10	Damper mass material	-	Cast iron, HDG	
5.11	Total weight	kg	2.35 ±0.1	

S/N	Description	Unit	Guaranteed Value	Offered value
5.12	Weight of big mass	gm	1,145 ±50	
5.13	Weight of small mass	gm	850 ±50	

6. Flexible Copper Earth Bond

S/N	Description	Unit	Guaranteed Value	Offered value
6.1	Manufacturer and Model	-	[To be provided]	
6.2	Pull-off load	kg	300	
6.3	Resistance	ohm	< 1	
6.4	Flexible copper wire size	-	37/0.417 mm (35 sq.mm)	
6.5	Total length	mm	500 ±5	
6.6	Connecting lug material	-	Copper, tinned	
6.7	Weight	kg	[To be provided]	

Note: HDG stands for Hot Dip Galvanized

5.DOUBLE TENSION INSULATOR

Guaranteed Technical Particulars (GTP)

1. General Particulars

S/N	Description	Unit	Guaranteed Value	Offered value
1.1	Applicable Standard	-	B.S. 3288, Part-I	
1.2	Conductor type	-	ACSR Quad Lark	
1.3	Total U.T.S. of hardware fittings (without tension clamp)	kN	2 x 160	
1.4	Slip strength/mechanical load of tension clamp	% of conductor UTS	95	
1.5	Ball and socket designation	mm	20 (as per IEC:120)	
1.6	Short circuit capacity	kA/sec	31.5/1	
1.7	Minimum corona extinction voltage	kV	290	
1.8	Radio Interference Voltage at 275 kV	dB	45	

S/N	Description	Unit	Guaranteed Value	Offered value
1.9	General tolerance	%	±3	
1.10	Galvanization standard for ferrous parts	-	B.S. 729	
1.11	Total weight of the complete set	kg	[To be provided]	

2. Component-specific Particulars

2.1 Tower Hinge (ATEL-3B/2)

S/N	Description	Unit	Guaranteed Value	Offered value
2.1.1	Material	-	Mild Steel FE-410, HDG	
2.1.2	Breaking strength	kN	160	
2.1.3	Dimensions (L x W x T)	mm	[To be provided]	
2.1.4	Weight	kg	[To be provided]	

2.2 Fixed Extension Strap (AEL-273)

S/N	Description	Unit	Guaranteed Value	Offered value
2.2.1	Material	-	Mild Steel, HDG	
2.2.2	Breaking strength	kN	160	
2.2.3	Dimensions (L x W x T)	mm	[To be provided]	
2.2.4	Weight	kg	[To be provided]	

2.3 Adjustable Extension Strap (ASA-79)

S/N	Description	Unit	Guaranteed Value	Offered value
2.3.1	Material	-	Mild Steel FE-410, HDG	
2.3.2	Breaking strength	kN	160	
2.3.3	Adjustment range	mm	[To be provided]	
2.3.4	Weight	kg	[To be provided]	

2.4 Heavy Hexagonal Ball Eye (ABE-20)

S/N	Description	Unit	Guaranteed Value	Offered value
2.4.1	Material	-	Forged Steel (Class-IV), HDG	
2.4.2	Minimum breaking load	kN	160	

S/N	Description	Unit	Guaranteed Value	Offered value
2.4.3	Dimensions	mm	[To be provided]	
2.4.4	Weight	kg	[To be provided]	

2.5 Arcing Ring (T.S.) (AAH/FRB-13H) and (L.S.) (AAH/FRB-14H)

S/N	Description	Unit	Guaranteed Value	Offered value
2.5.1	Material	-	Mild Steel FE-410, HDG	
2.5.2	Dimensions (OD x ID x T)	mm	[To be provided]	
2.5.3	Weight	kg	[To be provided]	

2.6 Heavy Hexagonal Socket Clevis (ASC-6H/1)

S/N	Description	Unit	Guaranteed Value	Offered value
2.6.1	Material	-	Forged Steel (Class-IV), HDG	
2.6.2	Minimum breaking load	kN	160	
2.6.3	Dimensions	mm	[To be provided]	
2.6.4	Weight	kg	[To be provided]	

2.7 Yoke Plate (AYP-64K)

S/N	Description	Unit	Guaranteed Value	Offered value
2.7.1	Material	-	Mild Steel FE-410, HDG	
2.7.2	Breaking strength	kN	320	
2.7.3	Dimensions (L x W x T)	mm	[To be provided]	
2.7.4	Weight	kg	[To be provided]	

2.8 Dead End Assembly (ADE/C-023, ADE/C-023L, ADE/C-023R)

S/N	Description	Unit	Guaranteed Value	Offered value
2.8.1	Slip/mechanical strength	% of conductor UTS	95	
2.8.2	Dead end body material	-	Extruded Al Tube (99.5% purity)	
2.8.3	Steel dead end material	-	Forged Steel	

S/N	Description	Unit	Guaranteed Value	Offered value
2.8.4	Compression die numbers	-	DA-9 (AL) & DS-9 (STEEL)	
2.8.5	Compression pressure	ton	100	
2.8.6	Dimensions	mm	[To be provided]	
2.8.7	Weight	kg	[To be provided]	

2.9 Rigid Spacer (ARGS-001/LR)

S/N	Description	Unit	Guaranteed Value	Offered value
2.9.1	Material	-	Aluminum Alloy	
2.9.2	Clamp slip strength	kN	2.5	
2.9.3	Compression load	kN	14	
2.9.4	Tension load	kN	7	
2.9.5	Dimensions	mm	[To be provided]	
2.9.6	Weight	Kg	[To be provided]	

2.10 Additional Links (AEL-353, AEL-360, AEL-361, AEL-362, AEL-363)

S/N	Description	Unit	Guaranteed Value	Offered value
2.10.1	Material	-	Mild Steel, HDG	
2.10.2	Breaking strength	kN	160	
2.10.3	Lengths	Mm	300, 500, 1000, 1500, 2000	
2.10.4	Weight (each)	Kg	[To be provided]	

Note: HDG stands for Hot Dip Galvanized

I/We declare that the information provided in this GTP is true and correct, and all supporting documents are authentic and valid.

Signature: _____ Name: _____

Position: _____ Company: _____

Date: _____ Company Seal: _____

18. PRICE SCHEDULE FOR LARK HARDWARE AND FITTINGS

Instructions to Bidders:

1. All prices should be quoted in Kenya Shillings (KES) and are VAT inclusive.

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
1.	SINGLE SUSPENSION INSULATOR STRING HARDWARE AND FITTINGS	Set	100		
2.	DOUBLE SUSPENSION INSULATOR STRING HARDWARE AND FITTINGS	Set	100		
3.	ACS HARDWARE AND FITTINGS	Set	100		
4.	DOUBLE TENSION INSULATOR STRING HARDWARE AND FITTINGS	Set	100		
5.	MID SPAN COMPRESSION JOINT	Set	200		
6.	REPAIR SLEEVE	Pieces	200		
7.	QUAD SPACER DAMPER	Set	200		
8.	RIGID SPACER	Set	200		
9.	VIBRATION DAMPERS	Set	200		
TOTAL FOR LARK HARDWARE AND FITTINGS					

Declaration

We confirm that our bid complies with all requirements as specified in the tender document.

Company Name: _____

Authorized Signatory: _____

Position: _____

Date: _____

Company Stamp: _____

19. PRICE SCHEDULE FOR LOT 3 HARDWARE AND FITTINGS

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
1.	CONDOR HARDWARE AND FITTINGS	LOT	LOT	LOT	
2.	LARK HARWARE AND FITTINGS	LOT	LOT	LOT	
TOTAL FOR LOT 3					

Declaration

We confirm that our bid complies with all requirements as specified in the tender document.

Company Name: _____

Authorized Signatory: _____

Position: _____

Date: _____

Company Stamp: _____

LOT 3 TECHNICAL SPECIFICATIONS

This document contains the technical specifications for Lot 1, comprising Condor Conductor Hardware & Fittings and LARK CONDUCTOR Hardware & Fittings for Kenya Electricity Transmission Company Ltd (KETRACO). These specifications outline the requirements for design, manufacture, testing, supply, and delivery of hardware components to be used in KETRACO's transmission infrastructure.

EMPLOYERS REQUIREMENTS & TECHNICAL SPECIFICATIONS FOR

CONDOR CONDUCTOR HARDWARE & FITTINGS

TABLE OF CONTENTS

FOREWORD

This specification has been prepared by Power System Operation and Maintenance Department (System Operation and Power Management Directorate) of the Kenya Electricity Transmission Company LTD (KETRACO) and it lays down requirements for Condor Conductor Hardware & Fittings.

This specification is based on international standards and is subject to revision as and when required.

Type test reports from accredited facilities shall be submitted with bid.

It shall be the manufacturer's responsibility to be knowledgeable of the requirements contained herein and in the referenced standards.

1. SCOPE

This specification covers the minimum technical requirements for design, manufacture, testing, supply and delivery of hardware and fittings for use with ACSR Condor conductors.

The specification also covers inspection and test of the hardware and fittings as well as schedule of Guaranteed Technical Particulars, Price schedules to be filled in, signed by the manufacturer and submitted for tender evaluation. Complete installation instructions, Technical support documentation and Maintenance procedures shall be submitted with this bid for evaluation.

The specifications stipulate the minimum requirements for Hardware and Fittings for ACSR Condor conductor acceptable for use by KETRACO and it shall be the responsibility of the manufacturer to ensure adequacy of the design, good workmanship and good engineering practice in the manufacture of the hardware and fittings.The hardware and fittings supplied shall strictly adhere to the issued drawings. Where inconsistencies exist between the drawings and specifications, the drawings shall govern unless otherwise approved in writing by KETRACO.

2. REFERENCE STANDARDS

The hardware and fittings shall comply with the latest editions of the following standards:

- IEC 61284: Overhead lines - Requirements and tests for fittings
- IEC 60120: Dimensions of ball and socket couplings of string insulator units
- IEC 60372: Locking devices for ball and socket couplings of string insulator units - Dimensions and tests
- IEC 60471: Dimensions of clevis and tongue couplings of string insulator units
- BS EN 61284: Overhead lines - Requirements and tests for fittings
- BS EN 60672-3: Ceramic and glass-insulating materials
- BS EN ISO 1461: Hot dip galvanized coatings on fabricated iron and steel articles
- BS EN ISO 2178: Non-magnetic coatings on magnetic substrates - Measurement of coating thickness - Magnetic method
- ASTM A153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- ASTM B230: Standard Specification for Aluminum 1350-H19 Wire for Electrical Purposes
- ASTM B232: Standard Specification for Concentric-Lay-Stranded Aluminum Conductors

3. SERVICE CONDITIONS

1. The hardware and fittings shall be suitable for continuous operation outdoor in tropical areas at altitudes of up to 2200m above sea level, humidity of up to 90%, ambient temperature of +30 degrees centigrade with a minimum of -1 degree centigrade and a maximum of +40-degree centigrade, heavy saline conditions along the coast and tropical sunshine conditions.
2. The weather isokeraunic levels reach up to 180 thunderstorms days per year.
3. The level of galvanizing for all parts and materials used shall be suitable for these conditions.

4. MATERIALS AND CONSTRUCTION

4.1 GENERAL REQUIREMENTS

1. All hardware and fittings shall be designed, manufactured and tested in accordance with IEC 61284 and other applicable/latest standards and requirements of this specification.
2. All ferrous parts shall be hot-dip galvanized after fabrication in accordance with ISO 1461 and ASTM A153. The zinc coating shall be smooth, continuous, and uniform. It shall be free from areas that are bare, have blisters, flux and ash inclusions, lumps, or coarse crystals.
3. The galvanized coating on all hardware shall withstand four one-minute dips in copper sulphate solution as per IEC 61284 without showing signs of copper deposits.
4. Design and construction drawings shall be submitted by the winning bidder.
5. Spring washers shall be of spring steel and electro-galvanized.
6. Security clips and split pins shall be of stainless steel.
7. The surfaces of all hardware shall be smooth, without cuts, abrasions, projections, ridges or exfoliation that might damage the conductor or cause radio interference.
8. All bolts and nuts shall have hexagonal heads and shall be locked in an approved manner.
9. All hardware shall be suitable for use with ACSR Condor conductor (diameter 27.72 mm, weight 922 kg/km, UTS 110.5 kN) and shall have adequate strength, conductivity, and corona performance.
10. The design shall minimize the number of parts and the number of bolts per assembly.

4.2 SPECIFIC MATERIAL REQUIREMENTS

1. Aluminum and Aluminum Alloys:
    - Suspension clamp bodies, tension clamp bodies, armor rods, and other aluminum components shall be made from high-strength aluminum alloy.
    - Aluminum alloy castings shall be free from flaws, surface blemishes, and shrinkage defects.
2. Steel and Steel Alloys:
    - All steel used shall be thoroughly hot-dip galvanized after fabrication.
    - Malleable cast iron shall not be used.

- Drop-forged steel shall be used for tension and suspension hardware components requiring high mechanical strength.

3. Fasteners:
   - All bolts, nuts, and washers shall be hot-dip galvanized steel.
   - All bolts shall be provided with one flat washer and one spring washer.
   - Split pins and security clips shall be of stainless steel.
4. Corona and Radio Interference:
   - All fittings shall be designed to minimize corona discharge and radio interference.
   - Corona rings/shields shall be provided where necessary to ensure corona extinction levels are maintained.
   - Minimum corona extinction voltage shall be 105 kV (rms).
   - Radio Interference Voltage at 110 kV shall not exceed 500 μV.

5. HARDWARE AND FITTINGS SETS FOR CONDOR CONDUCTOR

Set Components

1. SINGLE SUSPENSION STRING HARDWARE & FITTINGS SET

Set Components

1. Cross Hinge
2. Ball eye-Straight
3. Adjustable arc ring
4. Arc/Corona ring
5. Socket tongue-Straight
6. Yoke
7. Double tongue-twisted
8. Suspension Clamp Assembly with P.A. Rod

Technical Specifications

1. System Voltage, Um = 420kV
2. One minute power frequency withstand voltage, 50 Hz, wet = 715 / 760kV
3. Switching impulse withstand voltage, 250/2500, pos. = 1050 / 1085kV
4. Lightning impulse withstand voltage, 1.2/50, pos. = 1725 / 1835kV

5. Creepage distance = 15,400mm
6. Minimum breaking strength: 120 kN
7. Short circuit capacity: 40 kA/1sec
8. Calculated arcing distance: 3,200 mm (SSS-S/S, SSS-L), 3,800 mm (SSS-H)
9. Slipping force for suspension clamp = 31 kN
10. Torque for screw of suspension clamp = 38 Nm
11. Minimum corona extinction voltage = 303 kV
12. Ball / Socket coupling size acc. to IEC 60120/16A

Material Specifications

- All ferrous parts (except spring washers) shall be hot-dip galvanized
- Spring washers: Spring steel, electro-galvanized
- Security clips and split pins: Stainless steel

Suspension Clamp Assembly

- Suitable for ACSR Condor conductor (27.72 mm diameter)
- Minimum breaking strength of clamp: 120 kN
- Slip strength: 31 kN
- Tightening torque: 38 Nm

2. DOUBLE SUSPENSION STRING HARDWARE & FITTINGS SET

Set Components

1. Cross Hinge
2. Double tongue-straight
3. Yoke
4. Arc horn
5. Ball eye
6. Corona ring
7. Socket tongue
8. Yoke assembly
9. Double tongue twisted
10. Suspension Clamp Assembly with P.A. Rod

Technical Specifications

1. System Voltage, Um = 420kV
2. One minute power frequency withstand voltage, 50 Hz, wet = 850kV
3. Switching impulse withstand voltage, 250/2500, pos. = 1215kV
4. Lightning impulse withstand voltage, 1.2/50, pos. = 2050kV
5. Creepage distance = 15,400mm
6. Minimum breaking strength: 240 kN
7. Short circuit capacity: 40 kA/1sec
8. Calculated arcing distance: 3,200 mm (DSS-S/S, DSS-L), 3,800 mm (DSS-H)
9. Slipping force for suspension clamp = 31 kN
10. Torque for screw of suspension clamp = 38 Nm
11. Minimum corona extinction voltage = 303 kV
12. Ball / Socket coupling size acc. to IEC 60120/16A

Material Specifications

- All ferrous parts (except spring washers) shall be hot-dip galvanized
- Spring washers: Spring steel, electro-galvanized
- Security clips and split pins: Stainless steel

Suspension Clamp Assembly

- Suitable for ACSR Condor conductor (27.72 mm diameter)
- Minimum breaking strength of clamp: 120 kN
- Slip strength: 31 kN
- Tightening torque: 38 Nm

3. DOUBLE TENSION STRING HARDWARE & FITTINGS SET

Set Components

1. Cross Hinge
2. Clevis Tongue - Straight
3. Ball Eye - Straight
4. Adjustable Arc Ring
5. Arc / Corona Ring
6. Socket Tongue - Twisted
7. Yoke

8. Double Tongue – Twisted
9. Double Tongue - Straight
10. Adjustable Extension Link
11. Compression Dead End Clamp

Technical Specifications

1. System Voltage, Um = 420kV
2. One minute power frequency withstand voltage, 50 Hz, wet = 715 / 760 / 850kV
3. Switching impulse withstand voltage, 250/2500, pos. = 1050 / 1085 / 1215kV
4. Lightning impulse withstand voltage, 1.2/50, pos. = 1725 / 1835 / 2050kV
5. Creepage distance = 16,025mm
6. Minimum breaking strength: 2 x 210 kN
7. Short circuit capacity: 40 kA/1sec
8. Calculated arcing distance: 3,200 mm, 3,400 mm, 3,800 mm
9. Minimum corona extinction voltage = 303 kV
10. Ball / Socket couplig size acc. to IEC 60120/20

Compression Dead End Clamp

- Suitable for ACSR Condor conductor (27.72 mm diameter)
- Slip strength: 95% of the UTS of the conductor
- Compression die numbers: DA-12 (AL) & DS-12 (STEEL)
- Compression pressure: 120 ton

Material Specifications

- All ferrous parts (except spring washers) shall be hot-dip galvanized
- Spring washers: Spring steel, electro-galvanized
- Security clips and split pins: Stainless steel
- Compression Dead End Clamp: Al/steel

4. MIDSPAN COMPRESSION JOINT

- Aluminum sleeve length before compression: 700 mm
- Aluminum sleeve length after compression: 749 mm
- Steel tube length before compression: 180 mm
- Steel tube length after compression: 188 mm

- Compression die numbers: KZ46 (Aluminum), KZ17 (Steel)
- Minimum breaking strength: 95% of UTS of conductor

5. TRIPLE SPACER DAMPER

- Suitable for conductor diameter range: 26.8 - 28.1 mm
- Clamp slip strength: 2.5 kN minimum
- Tightening torque: 45 Nm

6. VIBRATION DAMPER

- Suitable for conductor diameter range: 26.8 - 28.1 mm
- Messenger cable diameter: 10.0 mm
- Messenger cable length: 483 mm
- Counterweights: 0.8 kg and 1.4 kg
- Installation tightening torque: 40 Nm

5.1 MANUFACTURING, MARKING, PACKING & LABELLING

Each hardware and fiting shall be legibly and indelibly marked with the name and trademark of the manufacturer, the year of manufacture and the SML (specified mechanical load) in accordance with IEC 61109.
The following information shall be marked indelibly in a permanent manner by embossing on each insulator hardware and fitting during manufacture:

a) Manufacturer's name or Trademark.
b) Voltage rating
c) Specified mechanical load
d) The letters "**property of KETRACO**"

All markings shall be permanent and shall be by embossing on the hardware and fitting part before galvanizing. The marking shall not affect the performance. Tags and stickers shall not be accepted. A Reference list of same type as quoted installed in similar climatic conditions and list of 10 previous customers with detailed contacts shall be submitted with this bid from the manufacturer.
The hardware and fittings shall be packed in wooden crates which are reinforced and held closed by external steel wire binding. Each crate shall be internally braced to permit stacking and the steel wire bindings shall be designed to keep firmly closed and permit easy and rapid opening at time of installation. The production capacity, the Manufacturing process schedule, the disposal procedures and Corona and Radio Interference documentation shall be provided with the bid.

The crates shall be designed to keep on sturdy wood pallet. The assembly shall be held tightly in place with steel bands and protected against moisture by a complete covering of heat shrinkable polyethylene film.

6. QUALITY MANAGEMENT SYSTEM

The supplier shall submit a quality assurance plan (QAP) that will be used to ensure that the hardware and fittings design, material, manufacture workmanship, tests, service capability, maintenance and documentation will fulfil the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfill the requirements of ISO 9001:2008.

The manufacturer's Declaration of conformity to reference standards and copies of quality management certification including copy of valid ISO 9001, 14001 & 45001 certificates shall be submitted with the tender for evaluation.

7. TESTS AND INSPECTION

7.1 DESIGN TESTS

Design tests shall be performed on each type of hardware and fitting to verify that the design meets the requirements of this specification and the relevant standards. Design tests shall include:

1. Verification of dimensions
2. Verification of mechanical characteristics
3. Verification of galvanizing
4. Corona and radio interference tests
5. Electrical conductivity test (for current-carrying fittings)

7.2 TYPE TESTS

Type tests shall be performed on each type of hardware and fitting to verify that the production equipment and processes consistently produce hardware and fittings that meet the requirements of this specification and the relevant standards. Type tests shall include:

1. Mechanical strength test
2. Electrical resistance test (for current-carrying fittings)
3. Heating cycle test (for compression fittings)
4. Slip strength test (for suspension and tension clamps)
5. Fatigue test (for vibration dampers)
6. Corona and radio interference tests
7. Galvanizing test

7.3 SAMPLE TESTS

Sample tests shall be performed on samples taken at random from each batch to verify that the batch meets the requirements of this specification and the relevant standards. Sample tests shall include:

1. Visual inspection
2. Verification of dimensions
3. Verification of mechanical characteristics
4. Verification of galvanizing
5. Slip strength test (for suspension and tension clamps)

7.4 ROUTINE TESTS

Routine tests shall be performed on each hardware and fitting to verify that it meets the requirements of this specification and the relevant standards. Routine tests shall include:

1. Visual inspection
2. Verification of dimensions
3. Verification of mechanical characteristics

Copies of the previous design and type test reports by relevant Independent International or National Testing/Standards Authority of the country of manufacture (or ISO/IEC 17025 accredited independent laboratory) shall be submitted with the offer for evaluation (all in English language). A copy of the accreditation certificate for the laboratory shall also be submitted.

Routine and sample test reports for the hardware and fittings to be supplied shall be submitted to KETRACO for approval before shipment/delivery of the goods. KETRACO Engineers (2) shall witness acceptance tests at the factory before shipment. The cost of travelling, Accommodation, Visa fees, Local and off-shore airport transfers shall be borne by the manufacturer/Supplier. A description of test equipment, and Complete test protocols shall be submitted with this bid. In addition, the manufacturer/supplier shall provide a daily subsistence allowance equivalent to USD 350 for each KETRACO engineer that will witness the factory acceptance test.

Factory Acceptance tests (FAT) shall include Routine and Sample tests as per IEC 61284 and applicable latest IEC standards and the following:

1. Verification of Dimensions
2. Verification of locking systems
3. Verification of mechanical strength
4. Verification of slip strength (for suspension and tension clamps)

5. Galvanization test

8. GUARANTEED TECHNICAL PARTICULARS (GTP)

1.CONDOR CONDUCTOR HARDWARE & FITTINGS SET

General Specifications

S/N	Description	Unit	Guaranteed Value	Offered Value
1	System Voltage, Um	kV	420	
2	Conductor type	-	ACSR Condor	
3	Conductor diameter	mm	27.72	
4	Short circuit capacity	kA/sec	40/1	
5	Minimum corona extinction voltage	kV	303	

Compression Dead End Clamp

S/N	Description	Unit	Guaranteed Value	Offered Value
6	Slip strength	% of conductor UTS	95	
7	Compression die numbers	-	DA-12 (AL) & DS-12 (STEEL)	
8	Compression pressure	ton	120	

Midspan Compression Joint

S/N	Description	Unit	Guaranteed Value	Offered Value
9	Aluminum sleeve length before/after compression	mm	711 / 749	
10	Steel tube length before/after compression	mm	250 / 229	
11	Compression die numbers	-	KZ46 (Al), KZ17 (Steel)	
12	Minimum breaking strength	% of conductor UTS	95	

Suspension Clamp Assembly

S/N	Description	Unit	Guaranteed Value	Offered Value
13	Minimum breaking strength of clamp	kN	120	
14	Slip strength	kN	31	
15	Tightening torque	Nm	38	

Vibration Damper

S/N	Description	Unit	Guaranteed Value	Offered Value
16	Suitable conductor diameter range	mm	26.8 - 28.1	
17	Messenger cable diameter	mm	10.0	
18	Messenger cable length	mm	483	
19	Counterweights	kg	0.8 and 1.4	
20	Installation tightening torque	Nm	40	

Spacer Damper

S/N	Description	Unit	Guaranteed Value	Offered Value
21	Suitable conductor diameter range	mm	26.8 - 28.1	
22	Clamp slip strength	kN	2.5 (minimum)	
23	Tightening torque	Nm	45	

2.SINGLE SUSPENSION STRING

S/N	Description	Unit	Guaranteed Value	Offered Value
1	System Voltage, Um	kV	420	
2	Power frequency withstand voltage (wet)	kV	715 / 760	
3	Switching impulse withstand voltage	kV	1050 / 1085	

S/N	Description	Unit	Guaranteed Value	Offered Value
4	Lightning impulse withstand voltage	kV	1725 / 1835	
5	Creepage distance	mm	15,400	
6	Minimum breaking strength	kN	120	
7	Short circuit capacity	kA/sec	40/1	
8	Calculated arcing distance (SSS-S/S, SSS-L)	mm	3,200	
9	Calculated arcing distance (SSS-H)	mm	3,800	
10	Slipping force for suspension clamp	kN	31	
11	Torque for screw of suspension clamp	Nm	38	
12	Minimum corona extinction voltage	kV	303	
13	Ball / Socket coupling size	-	IEC 60120/16A	
14	Total weight of assembly	kg	[To be provided]	

3.DOUBLE SUSPENSION STRING

S/N	Description	Unit	Guaranteed Value	Offered Value
1	System Voltage, Um	kV	420	
2	Power frequency withstand voltage (wet)	kV	850	
3	Switching impulse withstand voltage	kV	1215	
4	Lightning impulse withstand voltage	kV	2050	
5	Creepage distance	mm	15,400	
6	Minimum breaking strength	kN	240	
7	Short circuit capacity	kA/sec	40/1	
8	Calculated arcing distance (DSS-S/S, DSS-L)	mm	3,200	
9	Calculated arcing distance (DSS-H)	mm	3,800	
10	Slipping force for suspension clamp	kN	31	
11	Torque for screw of suspension clamp	Nm	38	
12	Minimum corona extinction voltage	kV	303	

S/N	Description	Unit	Guaranteed Value	Offered Value
13	Ball / Socket coupling size	-	IEC 60120/16A	
14	Total weight of assembly	kg	[To be provided]	

4.DOUBLE TENSION STRING

S/N	Description	Unit	Guaranteed Value	Offered Value
1	System Voltage, Um	kV	420	
2	Power frequency withstand voltage (wet)	kV	715 / 760 / 850	
3	Switching impulse withstand voltage	kV	1050 / 1085 / 1215	
4	Lightning impulse withstand voltage	kV	1725 / 1835 / 2050	
5	Creepage distance	mm	16,025	
6	Minimum breaking strength	kN	2 x 210	
7	Short circuit capacity	kA/sec	40/1	
8	Calculated arcing distance	mm	3,200 / 3,400 / 3,800	
9	Minimum corona extinction voltage	kV	303	
10	Ball / Socket coupling size	-	IEC 60120/20	
11	Slip strength of dead end clamp	% of conductor UTS	95	
12	Total weight of assembly	kg	[To be provided]	

I/We declare that the information provided in this GTP is true and correct, and all supporting documents are authentic and valid.

Signature: _____ Name: _____

Position: _____ Company: _____

Date: _____ Company Seal: _____

9. PRICE SCHEDULE FOR CONDOR CONDUCTOR HARDWARE AND FITTINGS

Instructions to Bidders:

1. All prices should be quoted in Kenya Shillings (KES) and are VAT inclusive.

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
1.	SINGLE SUSPENSION STRING HARDWARE & FITTINGS SET	Set	100		
2.	DOUBLE SUSPENSION STRING HARDWARE & FITTINGS SET	Set	100		
3.	DOUBLE TENSION STRING HARDWARE & FITTINGS SET	Set	100		
4.	MIDSPAN COMPRESSION JOINT	Set	200		
5.	SPACER DAMPER	Set	200		
6.	VIBRATION DAMPER	Set	200		
TOTAL					

Declaration

We confirm that our bid complies with all requirements as specified in the tender document.

Company Name: _____

Authorized Signatory: _____

Position: _____

Date: _____

Company Stamp: _____

EMPLOYERS REQUIREMENTS & TECHNICAL SPECIFICATIONS FOR LARK CONDUCTOR HARDWARE & FITTINGS

TABLE OF CONTENTS

FOREWORD

This specification has been prepared by Power System Operation and Maintenance Department (System Operation and Power Management Directorate) of the Kenya Electricity Transmission Company LTD (KETRACO) and it lays down requirements for LARK CONDUCTOR Hardware & Fittings.

This specification is based on international standards and is subject to revision as and when required.

Type test reports from accredited facilities shall be submitted with bid.

It shall be the manufacturer's responsibility to be knowledgeable of the requirements contained herein and in the referenced standards.

10. SCOPE

This specification covers the minimum technical requirements for design, manufacture, testing, supply and delivery of hardware and fittings for use with LARK CONDUCTOR .

The specification also covers inspection and test of the hardware and fittings as well as schedule of Guaranteed Technical Particulars, Price schedules to be filled in, signed by the manufacturer and submitted for tender evaluation. Complete installation instructions, Technical support documentation and Maintenance procedures shall be submitted with this bid for evaluation.

The specifications stipulate the minimum requirements for Hardware and Fittings for LARK CONDUCTOR acceptable for use by KETRACO and it shall be the responsibility of the manufacturer to ensure adequacy of the design, good workmanship and good engineering practice in the manufacture of the hardware and fittings. The hardware and fittings supplied

shall strictly adhere to the issued drawings. Where inconsistencies exist between the drawings and specifications, the drawings shall govern unless otherwise approved in writing by KETRACO.

11. REFERENCE STANDARDS

The hardware and fittings shall comply with the latest editions of the following standards:

- IEC 61284: Overhead lines - Requirements and tests for fittings
- IEC 60120: Dimensions of ball and socket couplings of string insulator units
- IEC 60372: Locking devices for ball and socket couplings of string insulator units - Dimensions and tests
- IEC 60471: Dimensions of clevis and tongue couplings of string insulator units
- BS EN 61284: Overhead lines - Requirements and tests for fittings
- BS EN 60672-3: Ceramic and glass-insulating materials
- BS EN ISO 1461: Hot dip galvanized coatings on fabricated iron and steel articles
- BS EN ISO 2178: Non-magnetic coatings on magnetic substrates - Measurement of coating thickness - Magnetic method
- ASTM A153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- ASTM B230: Standard Specification for Aluminum 1350-H19 Wire for Electrical Purposes
- ASTM B232: Standard Specification for Concentric-Lay-Stranded Aluminum Conductors

12. SERVICE CONDITIONS

1. The hardware and fittings shall be suitable for continuous operation outdoor in tropical areas at altitudes of up to 2200m above sea level, humidity of up to 90%, ambient temperature of +30 degrees centigrade with a minimum of -1 degree centigrade and a maximum of +40-degree centigrade, heavy saline conditions along the coast and tropical sunshine conditions.
2. The weather isokeraunic levels reach up to 180 thunderstorms days per year.
3. The level of galvanizing for all parts and materials used shall be suitable for these conditions.

13. MATERIALS AND CONSTRUCTION

13.1 GENERAL REQUIREMENTS

1. All hardware and fittings shall be designed, manufactured and tested in accordance with IEC 61284 and other applicable/latest standards and requirements of this specification.
2. All ferrous parts shall be hot-dip galvanized after fabrication in accordance with ISO 1461 and ASTM A153. The zinc coating shall be smooth, continuous, and uniform. It shall be

free from areas that are bare, have blisters, flux and ash inclusions, lumps, or coarse crystals.

3. The galvanized coating on all hardware shall withstand four one-minute dips in copper sulphate solution as per IEC 61284 without showing signs of copper deposits.
4. Spring washers shall be of spring steel and electro-galvanized.
5. Security clips and split pins shall be of stainless steel.
6. Design and construction drawings shall be submitted by the winning bidder.
7. The surfaces of all hardware shall be smooth, without cuts, abrasions, projections, ridges or exfoliation that might damage the conductor or cause radio interference.
8. All bolts and nuts shall have hexagonal heads and shall be locked in an approved manner.
9. All hardware shall be suitable for use with LARK CONDUCTOR (diameter 19.53 mm, weight 922 kg/km, UTS 110.5 kN) and shall have adequate strength, conductivity, and corona performance.
10. The design shall minimize the number of parts and the number of bolts per assembly.

13.2 SPECIFIC MATERIAL REQUIREMENTS

5. Aluminum and Aluminum Alloys:
    - Suspension clamp bodies, tension clamp bodies, armor rods, and other aluminum components shall be made from high-strength aluminum alloy.
    - Aluminum alloy castings shall be free from flaws, surface blemishes, and shrinkage defects.
6. Steel and Steel Alloys:
    - All steel used shall be thoroughly hot-dip galvanized after fabrication.
    - Malleable cast iron shall not be used.
    - Drop-forged steel shall be used for tension and suspension hardware components requiring high mechanical strength.
7. Fasteners:
    - All bolts, nuts, and washers shall be hot-dip galvanized steel.
    - All bolts shall be provided with one flat washer and one spring washer.
    - Split pins and security clips shall be of stainless steel.
8. Corona and Radio Interference:
    - All fittings shall be designed to minimize corona discharge and radio interference.

- Corona rings/shields shall be provided where necessary to ensure corona extinction levels are maintained.
- Minimum corona extinction voltage shall be 105 kV (rms).
- Radio Interference Voltage at 110 kV shall not exceed 500 μV.

14. HARDWARE AND FITTINGS SETS FOR LARK CONDUCTOR

1. SINGLE SUSPENSION INSULATOR STRING HARDWARE AND FITTINGS SET

Set Components

1. Tower Hinge
2. Heavy Hexagonal Ball Eye
3. Arcing Ring (T.S.)
4. Arcing Ring (L.S.)
5. Heavy Hexagonal Socket Clevis
6. Yoke Plate
7. Suspension Clamp Assembly with P.A. Rod

General Technical Specifications

1. Applicable standards: B.S. 3288, Part-I
2. Ultimate Tensile Strength (U.T.S.) of hardware fittings: 160 kN
3. Slip strength of suspension clamp: 15% UTS of ACSR Lark conductor
4. Short circuit capacity: 31.5 kA for 1 second
5. Minimum corona extinction voltage: 290 kV
6. Radio Interference Voltage (RIV) at 275 kV: 45 dB
7. General tolerance: ±3% unless otherwise specified
8. All ferrous parts (except spring washers) shall be hot-dip galvanized conforming to B.S. 729
9. Spring washers: Spring steel, electro-galvanized
10. Security clips and split pins: Stainless steel
11. Suitable for ACSR Quad Lark conductor

Specific Component Requirements

1. Tower Hinge

- Material: Mild Steel FE-410, Hot Dip Galvanized (HDG)
- Breaking strength: 160 kN
- Components: Tower hinge, bolts, nuts, washers, split pins

2. Heavy Hexagonal Ball Eye

- Material: Forged Steel (Class-IV), HDG
- Minimum breaking load: 160 kN
- Ball designation: 20 mm as per IEC 120/BS-3288

3. Arcing Ring (T.S.)

- Material: Mild Steel FE-410, HDG
- Components: Arcing ring, ball, bolts, nuts, spring washers

4. Arcing Ring (L.S.)

- Material: Mild Steel FE-410, HDG
- Components: Arcing ring, ball, bolts, nuts, spring washers

5. Heavy Hexagonal Socket Clevis

- Material: Forged Steel (Class-IV), HDG
- Minimum breaking load: 160 kN
- Socket designation: 20 mm as per IEC 120/BS-3288

6. Yoke Plate

- Material: Mild Steel FE-410, HDG
- Breaking strength: 160 kN

7. Suspension Clamp Assembly with P.A. Rod

- Minimum breaking strength of clamp: 70 kN
- Components: Suspension clamp (Al alloy), keeper, U-bolts, washers, saddle, side strap, armor rod (11 nos/set, Al alloy), twisted shackle
- Armor rod material: Aluminum alloy

Additional Requirements

1. All components must be designed for use in 400 kV transmission lines
2. Components should be compatible with each other and form a complete single suspension insulator string set
3. Manufacturer must provide test certificates for all items
4. Packaging should be suitable to prevent damage during transportation and storage
5. Clear marking and identification on all components
6. Compliance with KETRACO's quality assurance requirements
7. Detailed installation instructions to be provided

2. DOUBLE SUSPENSION INSULATOR STRING HARDWARE AND FITTINGS SET

Set Components

1. Tower Hinge
2. Yoke Plate
3. Ball Clevis
4. Arcing Ring (T.S.)
5. Arcing Ring (L.S.)
6. Heavy Hexagonal Socket Clevis
7. Yoke Plate
8. Suspension Clamp Assembly with P.A. Rod

General Technical Specifications

1. Applicable standards: B.S. 3288, Part-I
2. Ultimate Tensile Strength (U.T.S.) of hardware fittings: 2 x 160 kN
3. Slip strength of suspension clamp: 15% UTS of ACSR Lark conductor
4. Short circuit capacity: 31.5 kA for 1 second
5. Minimum corona extinction voltage: 290 kV
6. Radio Interference Voltage (RIV) at 275 kV: 45 dB
7. General tolerance: ±3% unless otherwise specified
8. All ferrous parts (except spring washers) shall be hot-dip galvanized conforming to B.S. 729
9. Spring washers: Spring steel, electro-galvanized
10. Security clips and split pins: Stainless steel
11. Suitable for ACSR Quad Lark conductor

Specific Component Requirements

1. Tower Hinge

- Material: Mild Steel FE-410, Hot Dip Galvanized (HDG)
- Breaking strength: 320 kN
- Components: Tower hinge, bolts, nuts, washers, split pins

2. Yoke Plate

- Material: Mild Steel FE-410, HDG
- Breaking strength: 320 kN

3. Ball Clevis

- Material: Forged Steel (Class-IV), HDG
- Minimum breaking load: 160 kN
- Ball designation: 20 mm as per IEC 120/BS-3288

4. Arcing Ring (T.S.)

- Material: Mild Steel FE-410, HDG
- Components: Arcing ring, ball, bolts, nuts, spring washers

5. Arcing Ring (L.S.)

- Material: Mild Steel FE-410, HDG
- Components: Arcing ring, ball, bolts, nuts, spring washers

6. Heavy Hexagonal Socket Clevis

- Material: Forged Steel (Class-IV), HDG
- Minimum breaking load: 160 kN
- Socket designation: 20 mm as per IEC 120/BS-3288

7. Yoke Plate

- Material: Mild Steel FE-410, HDG
- Breaking strength: 320 kN

8. Suspension Clamp Assembly with P.A. Rod

- Minimum breaking strength of clamp: 70 kN
- Components: Suspension clamp (Al alloy), keeper, U-bolts, washers, saddle, side strap, armor rod (11 nos/set, Al alloy), twisted shackle

Additional Requirements

1. All components must be designed for use in 400 kV transmission lines
2. Components should be compatible with each other and form a complete double suspension insulator string set
3. Manufacturer must provide test certificates for all items
4. Packaging should be suitable to prevent damage during transportation and storage
5. Clear marking and identification on all components
6. Compliance with KETRACO's quality assurance requirements
7. Detailed installation instructions to be provided

3. ACS FITTINGS AND ACCESSORIES SET

Set Components

1. Midspan Compression Joint with Aluminum Encasing

2. Suspension Clamp Assembly
3. Tension Clamp with Aluminum Encasing
4. Vibration Damper
5. Flexible Copper Earth Bond

General Technical Specifications

1. Applicable standards: B.S. 3288, Part-I
2. Short circuit capacity: 31.5 kA for 1 second
3. General tolerance: ±3% unless otherwise specified (±5% for flexible copper earth bond)
4. All ferrous parts (except spring washers) shall be hot-dip galvanized conforming to B.S. 729
5. Spring washers: Spring steel, electro-galvanized
6. Suitable for ACS earthwire (7/3.26 mm)

Specific Component Requirements

1. Midspan Compression Joint with Aluminum Encasing

- Slip/mechanical strength: 95% of UTS of earthwire
- Compression pressure: 100 ton
- Components: Steel tube, aluminum encasing
- Material: Steel tube - Mild Steel, Aluminum encasing - EC grade aluminum

2. Suspension Clamp Assembly

- UTS for fittings: 25 kN (minimum)
- Slip strength: Not less than 5 kN and not more than 14 kN
- Tightening torque: 5 kg-m
- Components: Clamp body, keeper piece, U-bolt, J-bolt, saddle, side strap, twisted shackle

3. Tension Clamp with Aluminum Encasing

- Mechanical/slip strength: Not less than 95% of UTS of relevant earthwire
- Components: Anchor shackle, dead end clamp, aluminum sleeve, jumper plate, jumper cover

4. Vibration Damper

- Mass pull-off value: 500 kg
- Slip strength of clamp:
    - Before fatigue test: 2.5 kN (minimum)
    - After fatigue test: 2.0 kN
- UTS of messenger cable: 135 kg/sq.mm
- Messenger cable: 19 strand

- Lay ratio of messenger cable: 10-11
- Tightening torque: 6 kg-m
- Components: Hook half clamp, damper masses, cover half clamp, messenger cable

5. Flexible Copper Earth Bond

- Pull-off load: 300 kg
- Resistance: Less than 1 ohm
- Components: Flexible copper wire (37/0.417 mm, 35 sq.mm), connecting lugs

Additional Requirements

1. All components must be designed for use in 400 kV and 220 kV transmission lines
2. Components should be compatible with each other and with ACS earthwire (7/3.26 mm)
3. Manufacturer must provide test certificates for all items
4. Packaging should be suitable to prevent damage during transportation and storage
5. Clear marking and identification on all components
6. Compliance with KETRACO's quality assurance requirements
7. Detailed installation instructions to be provided

4. DOUBLE TENSION INSULATOR STRING HARDWARE AND FITTINGS SET

Set Components

1. Tower Hinge
2. Fixed Extension Strap
3. Adjustable Extension Strap
4. Heavy Hexagonal Ball Eye
5. Arcing Ring (T.S.)
6. Arcing Ring (L.S.)
7. Heavy Hexagonal Socket Clevis
8. Extension Straps
9. Yoke Plate
10. Clevis Eye
11. Yoke Plate
12. Extension Straps
13. Sag Adjustment Plate

14. Dead End Assembly
15. Rigid Spacer
16. Additional Links

General Technical Specifications

1. Applicable standards: B.S. 3288, Part-I
2. Ultimate Tensile Strength (U.T.S.) of hardware fittings: 2 x 160 kN (without tension clamp)
3. Slip strength/mechanical load of tension clamp: 95% UTS of ACSR Lark conductor
4. Ball and socket designation: 20 mm as per IEC:120
5. Short circuit capacity: 31.5 kA for 1 second
6. Minimum corona extinction voltage: 290 kV
7. Radio Interference Voltage (RIV) at 275 kV: 45 dB
8. General tolerance: ±3% unless otherwise specified
9. All ferrous parts (except spring washers) shall be hot-dip galvanized conforming to B.S. 729
10. Spring washers: Spring steel, electro-galvanized
11. Security clips and split pins: Stainless steel
12. Suitable for ACSR Quad Lark conductor

Specific Component Requirements

1. Tower Hinge (ATEL-3B/2)

- Material: Mild Steel FE-410, Hot Dip Galvanized (HDG)
- Breaking strength: 160 kN

2. Fixed Extension Strap (AEL-273)

- Material: Mild Steel, HDG
- Breaking strength: 160 kN

3. Adjustable Extension Strap (ASA-79)

- Material: Mild Steel FE-410, HDG
- Breaking strength: 160 kN
- Adjustable in multiple positions

4. Heavy Hexagonal Ball Eye (ABE-20)

- Material: Forged Steel (Class-IV), HDG
- Minimum breaking load: 160 kN

5. Arcing Ring (T.S.) (AAH/FRB-13H) and (L.S.) (AAH/FRB-14H)

- Material: Mild Steel FE-410, HDG

6. Heavy Hexagonal Socket Clevis (ASC-6H/1)

- Material: Forged Steel (Class-IV), HDG
- Minimum breaking load: 160 kN

7. Extension Straps (AEL-274, AEL-275, AEL-276)

- Material: Mild Steel, HDG
- Breaking strength: 160 kN

8. Yoke Plate (AYP-64K)

- Material: Mild Steel FE-410, HDG
- Breaking strength: 320 kN

9. Clevis Eye (ACE-76T)

- Material: Forged Steel (Class-IV), HDG
- Breaking strength: 160 kN

10. Yoke Plate (AYP-10N3)

- Material: Mild Steel FE-410, HDG
- Breaking strength: 160 kN

11. Extension Straps (AEL-130, AEL-255)

- Material: Mild Steel, HDG
- Breaking strength: 80 kN

12. Sag Adjustment Plate (ASA-59A)

- Material: Mild Steel FE-410, HDG
- Breaking strength: 80 kN

13. Dead End Assembly (ADE/C-023, ADE/C-023L, ADE/C-023R)

- Slip/mechanical strength: 95% UTS of conductor
- Components: Dead end body (Extruded Al Tube, 99.5% purity), Steel dead end (Forged Steel), Dead end body, bolts, nuts, washers, filler plug
- Compression die numbers: DA-9 (AL) & DS-9 (STEEL)
- Compression pressure: 100 ton

14. Rigid Spacer (ARGS-001/LR)

- Material: Aluminum Alloy
- Clamp slip strength: 2.5 kN
- Compression load: 14 kN
- Tension load: 7 kN

15. Additional Links (AEL-353, AEL-360, AEL-361, AEL-362, AEL-363)

- Material: Mild Steel, HDG
- Breaking strength: 160 kN
- Various lengths for different deviation angles

Additional Requirements

1. All components must be designed for use in 400 kV transmission lines
2. Components should be compatible with each other and form a complete double tension insulator string set
3. Manufacturer must provide test certificates for all items
4. Packaging should be suitable to prevent damage during transportation and storage
5. Clear marking and identification on all components
6. Compliance with KETRACO's quality assurance requirements
7. Detailed installation instructions to be provided

5. MID-SPAN COMPRESSION JOINT

- Slip strength: 95% of UTS of conductor
- Compression die numbers: DA-9 (AL) & DS-9 (STEEL)
- Compression pressure: 100 ton
- Components: Aluminum sleeve, steel sleeve, filler plug

6. REPAIR SLEEVE

- Material: Aluminum alloy
- Slip strength: 95% of UTS of conductor

7. QUAD SPACER DAMPER

- Compressive strength: 14 kN
- Tensile strength: 7 kN
- Slip strength: 6.5 kN
- Damping element hardness: 65-80 Shore A
- Components: Frame, cover, arm, keeper, damping element, rubber bushing, bolts, washers

8. T-CONNECTOR

- Clamp slip strength: 2.5 kN
- Compression load: 14 kN
- Tension load: 7 kN

9. VIBRATION DAMPER

- Mass pull-off value: 500 kg
- Slip strength of clamp:
    - Before fatigue test: 2.5 kN (minimum)
    - After fatigue test: 2.0 kN (minimum)
- UTS of messenger cable: 135 kg/sq.mm (minimum)
- Messenger cable: 19 strand
- Lay ratio of messenger cable: 9-11
- Tightening torque: 6.5 kg-m

Additional Requirements

1. All components must be designed for use in 400 kV transmission lines
2. Components should be compatible with each other and with ACSR Lark conductor
3. Manufacturer must provide test certificates for all items
4. Packaging should be suitable to prevent damage during transportation and storage
5. Clear marking and identification on all components
6. Compliance with KETRACO's quality assurance requirements
7. Detailed installation instructions to be provided

14.1 MANUFACTURING, MARKING, PACKING & LABELLING

Each hardware and fiting shall be legibly and indelibly marked with the name and trademark of the manufacturer, the year of manufacture and the SML (specified mechanical load) in accordance with IEC 61109.
The following information shall be marked indelibly in a permanent manner by embossing on each insulator hardware and fitting during manufacture:

e) Manufacturer's name or Trademark.
f) Voltage rating
g) Specified mechanical load
h) The letters "**property of KETRACO**"

All markings shall be permanent and shall be by embossing on the hardware and fitting part before galvanizing. The marking shall not affect the performance. Tags and stickers shall not be accepted. A Reference list of same type as quoted installed in similar climatic conditions and list of 10 previous customers with detailed contacts shall be submitted with this bid from the manufacturer.
The hardware and fittings shall be packed in wooden crates which are reinforced and held closed by external steel wire binding. Each crate shall be internally braced to permit stacking and the steel wire bindings shall be designed to keep firmly closed and permit easy and rapid opening at time of installation. The production capacity, the Manufacturing process schedule,

the disposal procedures and Corona and Radio Interference documentation shall be provided with the bid.

The crates shall be designed to keep on sturdy wood pallet. The assembly shall be held tightly in place with steel bands and protected against moisture by a complete covering of heat shrinkable polyethylene film.

15. QUALITY MANAGEMENT SYSTEM

The supplier shall submit a quality assurance plan (QAP) that will be used to ensure that the hardware and fittings design, material, manufacture workmanship, tests, service capability, maintenance and documentation will fulfil the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfill the requirements of ISO 9001:2008.

The manufacturer's Declaration of conformity to reference standards and copies of quality management certification including copy of valid ISO 9001, 14001 & 45001 certificates shall be submitted with the tender for evaluation.

16. TESTS AND INSPECTION

16.1 DESIGN TESTS

Design tests shall be performed on each type of hardware and fitting to verify that the design meets the requirements of this specification and the relevant standards. Design tests shall include:

1. Verification of dimensions
2. Verification of mechanical characteristics
3. Verification of galvanizing
4. Corona and radio interference tests
5. Electrical conductivity test (for current-carrying fittings)

16.2 TYPE TESTS

Type tests shall be performed on each type of hardware and fitting to verify that the production equipment and processes consistently produce hardware and fittings that meet the requirements of this specification and the relevant standards. Type tests shall include:

17. Mechanical strength test
18. Electrical resistance test (for current-carrying fittings)
19. Heating cycle test (for compression fittings)
20. Slip strength test (for suspension and tension clamps)
21. Fatigue test (for vibration dampers)

22. Corona and radio interference tests

23. Galvanizing test

16.3 SAMPLE TESTS

Sample tests shall be performed on samples taken at random from each batch to verify that the batch meets the requirements of this specification and the relevant standards. Sample tests shall include:

6. Visual inspection
7. Verification of dimensions
8. Verification of mechanical characteristics
9. Verification of galvanizing
10. Slip strength test (for suspension and tension clamps)

16.4 ROUTINE TESTS

Routine tests shall be performed on each hardware and fitting to verify that it meets the requirements of this specification and the relevant standards. Routine tests shall include:

4. Visual inspection
5. Verification of dimensions
6. Verification of mechanical characteristics

Copies of the previous design and type test reports by relevant Independent International or National Testing/Standards Authority of the country of manufacture (or ISO/IEC 17025 accredited independent laboratory) shall be submitted with the offer for evaluation (all in English language). A copy of the accreditation certificate for the laboratory shall also be submitted.

Routine and sample test reports for the hardware and fittings to be supplied shall be submitted to KETRACO for approval before shipment/delivery of the goods. KETRACO Engineers (2) shall witness acceptance tests at the factory before shipment. The cost of travelling, Accommodation, Visa fees, Local and off-shore airport transfers shall be borne by the manufacturer/Supplier. A description of test equipment, and Complete test protocols shall be submitted with this bid. In addition, the manufacturer/supplier shall provide a daily subsistence allowance equivalent to USD 350 for each KETRACO engineer that will witness the factory acceptance test.

Factory Acceptance tests (FAT) shall include Routine and Sample tests as per IEC 61284 and applicable latest IEC standards and the following:

1. Verification of Dimensions
2. Verification of locking systems

3. Verification of mechanical strength
4. Verification of slip strength (for suspension and tension clamps)
5. Galvanization test

17. GUARANTEED TECHNICAL PARTICULARS (GTP)

1.LARK CONDUCTOR HARDWARE & FITTINGS

1. General Particulars

S/N	Description	Unit	Guaranteed Value	Offered value
1.1	Applicable Standard	-	B.S. 3288, Part-I	
1.2	Conductor type	-	ACSR Lark	
1.3	Short circuit capacity	kA/sec	31.5/1	
1.4	General tolerance	%	±3	
1.5	Galvanization standard for ferrous parts	-	[To be provided]	
1.6	Spring washer material	-	Spring steel, electro-galvanized	
1.7	Security clips and split pins material	-	Stainless steel	

2. Suspension Clamp Assembly

S/N	Description	Unit	Guaranteed Value	Offered value
2.1	Manufacturer and Model	-	[To be provided]	
2.2	Minimum breaking strength of clamp	Kn	70	
2.3	Minimum slip strength	% of conductor UTS	15	
2.4	Material of clamp body	-	Aluminum alloy	
2.5	Material of armor rod	-	Aluminum alloy	
2.6	Number of armor rods per set	-	11	
2.7	Bolt and nut material	-	Mild steel, HDG	
2.8	Twisted shackle material	-	Forged steel, HDG	
2.9	Total weight of assembly	kg	[To be provided]	

3. Dead End Assembly

S/N	Description	Unit	Guaranteed Value	Offered value
3.1	Manufacturer and Model	-	[To be provided]	
3.2	Slip/mechanical strength	% of conductor UTS	95 (minimum)	
3.3	Compression die number for aluminum	-	DA-9	
3.4	Compression die number for steel	-	DS-9	
3.5	Compression pressure	ton	100	
3.6	Material of dead end body	-	Extruded aluminum (99.5% purity)	
3.7	Bolt grade	-	5.6/5.0	
3.8	Total weight of assembly	kg	[To be provided]	

4. Mid-span Compression Joint

S/N	Description	Unit	Guaranteed Value	Offered value
4.1	Manufacturer and Model	-	[To be provided]	
4.2	Slip strength	% of conductor UTS	95	
4.3	Compression die number for aluminum	-	DA-9	
4.4	Compression die number for steel	-	DS-9	
4.5	Compression pressure	ton	100	
4.6	Material of aluminum sleeve	-	EC grade aluminum	
4.7	Material of steel sleeve	-	Mild steel, HDG	
4.8	Dimensions of aluminum sleeve (L x OD)	mm	610 x 38	
4.9	Dimensions of steel sleeve (L x OD)	mm	203 x 18	
4.10	Total weight of joint	kg	[To be provided]	

5. Repair Sleeve

S/N	Description	Unit	Guaranteed Value	Offered value
5.1	Manufacturer and Model	-	[To be provided]	
5.2	Material	-	Aluminum alloy	
5.3	Slip strength	% of conductor UTS	95	
5.4	Length	mm	[To be provided]	
5.5	Outside diameter	mm	[To be provided]	
5.6	Inside diameter	mm	[To be provided]	
5.7	Weight	kg	[To be provided]	

6. Quad Spacer

S/N	Description	Unit	Guaranteed Value	Offered value
6.1	Manufacturer and Model	-	[To be provided]	
6.2	Compressive strength	kN	14	
6.3	Tensile strength	kN	7	
6.4	Slip strength	kN	6.5	
6.5	Damping element hardness	Shore A	65-80	
6.6	Material of frame and arms	-	Aluminum alloy	
6.7	Material of damping element	-	EPDM	
6.8	Bolt size and grade	-	[To be provided]	
6.9	Weight of spacer	kg	[To be provided]	

7. Vibration Damper

S/N	Description	Unit	Guaranteed Value	Offered value
7.1	Manufacturer and Model	-	[To be provided]	
7.2	Mass pull-off value	kg	500	
7.3	Slip strength before fatigue test	kN	2.5 (minimum)	
7.4	Slip strength after fatigue test	kN	2.0 (minimum)	
7.5	UTS of messenger cable	kg/sq.mm	135 (minimum)	
7.6	Number of strands in messenger cable	-	19	

S/N	Description	Unit	Guaranteed Value	Offered value
7.7	Lay ratio of messenger cable	-	9-11	
7.8	Tightening torque	kg-m	6.5	
7.9	Clamp material	-	Aluminum alloy	
7.10	Damper mass material	-	Cast iron, HDG	
7.11	Weight of damper	kg	[To be provided]	
7.12	Resonance frequencies (1st, 2nd, 3rd, 4th)	Hz	1621, 1941, 3542, 4222	

2.SINGLE SUSPENSION INSULATOR

1. General Particulars

S/N	Description	Unit	Guaranteed Value	Offered value
1.1	Applicable Standard	-	B.S. 3288, Part-I	
1.2	Conductor type	-	ACSR Quad Lark	
1.3	Total U.T.S. of hardware fittings	kN	160	
1.4	Slip strength of suspension clamp	% of conductor UTS	15	
1.5	Short circuit capacity	kA/sec	31.5/1	
1.6	Minimum corona extinction voltage	kV	290	
1.7	Radio Interference Voltage at 275 kV	dB	45	
1.8	General tolerance	%	±3	
1.9	Galvanization standard for ferrous parts	-	B.S. 729	
1.10	Total weight of the complete set	kg	[To be provided]	

2. Component-specific Particulars

2.1 Tower Hinge (ATEL-3B/2)

S/N	Description	Unit	Guaranteed Value	Offered value
2.1.1	Material	-	Mild Steel FE-410, HDG	
2.1.2	Breaking strength	kN	160	
2.1.3	Dimensions (L x W x T)	mm	[To be provided]	

S/N	Description	Unit	Guaranteed Value	Offered value
2.1.4	Weight	kg	[To be provided]	

2.2 Heavy Hexagonal Ball Eye (ABL-8)

S/N	Description	Unit	Guaranteed Value	Offered value
2.2.1	Material	-	Forged Steel (Class-IV), HDG	
2.2.2	Minimum breaking load	kN	160	
2.2.3	Ball designation	mm	20	
2.2.4	Weight	kg	[To be provided]	

2.3 Arcing Ring (T.S.) (AAH/FRB-13H)

S/N	Description	Unit	Guaranteed Value	Offered value
2.3.1	Material	-	Mild Steel FE-410, HDG	
2.3.2	Dimensions (OD x ID x T)	mm	[To be provided]	
2.3.3	Weight	kg	[To be provided]	

2.4 Arcing Ring (L.S.) (AAH/FRB-14G)

S/N	Description	Unit	Guaranteed Value	Offered value
2.4.1	Material	-	Mild Steel FE-410, HDG	
2.4.2	Dimensions (OD x ID x T)	mm	[To be provided]	
2.4.3	Weight	kg	[To be provided]	

2.5 Heavy Hexagonal Socket Clevis (ASC-6H/1)

S/N	Description	Unit	Guaranteed Value	Offered value
2.5.1	Material	-	Forged Steel (Class-IV), HDG	
2.5.2	Minimum breaking load	kN	160	
2.5.3	Socket designation	mm	20	
2.5.4	Weight	kg	[To be provided]	

2.6 Yoke Plate (AYP-176)

S/N	Description	Unit	Guaranteed Value	Offered value
2.6.1	Material	-	Mild Steel FE-410, HDG	
2.6.2	Breaking strength	kN	160	

S/N	Description	Unit	Guaranteed Value	Offered value
2.6.3	Dimensions (L x W x T)	mm	[To be provided]	
2.6.4	Weight	kg	[To be provided]	

2.7 Suspension Clamp Assembly with P.A. Rod (A-30-ASSY)

S/N	Description	Unit	Guaranteed Value	Offered value
2.7.1	Minimum breaking strength of clamp	kN	70	
2.7.2	Slip strength	% of conductor UTS	15	
2.7.3	Clamp material	-	Aluminum alloy	
2.7.4	Number of armor rods per set	-	11	
2.7.5	Armor rod material	-	Aluminum alloy	
2.7.6	Suitable conductor diameter range	mm	[To be provided]	
2.7.7	Total weight of assembly	kg	[To be provided]	

3.DOUBLE SUSPENSION INSULATOR

1. General Particulars

S/N	Description	Unit	Guaranteed Value	Offered value
1.1	Applicable Standard	-	B.S. 3288, Part-I	
1.2	Conductor type	-	ACSR Quad Lark	
1.3	Total U.T.S. of hardware fittings	kN	2 x 160	
1.4	Slip strength of suspension clamp	% of conductor UTS	15	
1.5	Short circuit capacity	kA/sec	31.5/1	
1.6	Minimum corona extinction voltage	kV	290	
1.7	Radio Interference Voltage at 275 kV	dB	45	
1.8	General tolerance	%	±3	
1.9	Galvanization standard for ferrous parts	-	B.S. 729	
1.10	Total weight of the complete set	kg	[To be provided]	

2. Component-specific Particulars

2.1 Tower Hinge (ATEL-3B/3)

S/N	Description	Unit	Guaranteed Value	Offered value
2.1.1	Material	-	Mild Steel FE-410, HDG	
2.1.2	Breaking strength	kN	320	
2.1.3	Dimensions (L x W x T)	mm	[To be provided]	
2.1.4	Weight	kg	[To be provided]	

2.2 Yoke Plate (AYP-211)

S/N	Description	Unit	Guaranteed Value	Offered value
2.2.1	Material	-	Mild Steel FE-410, HDG	
2.2.2	Breaking strength	kN	320	
2.2.3	Dimensions (L x W x T)	mm	[To be provided]	
2.2.4	Weight	kg	[To be provided]	

2.3 Ball Clevis (ABC-2)

S/N	Description	Unit	Guaranteed Value	Offered value
2.3.1	Material	-	Forged Steel (Class-IV), HDG	
2.3.2	Minimum breaking load	kN	160	
2.3.3	Ball designation	mm	20	
2.3.4	Weight	kg	[To be provided]	

2.4 Arcing Ring (T.S.) (AAH/FRB-18B)

S/N	Description	Unit	Guaranteed Value	Offered value
2.4.1	Material	-	Mild Steel FE-410, HDG	
2.4.2	Dimensions (OD x ID x T)	mm	[To be provided]	
2.4.3	Weight	kg	[To be provided]	

2.5 Arcing Ring (L.S.) (AAH/FRB-14G)

S/N	Description	Unit	Guaranteed Value	Offered value
2.5.1	Material	-	Mild Steel FE-410, HDG	
2.5.2	Dimensions (OD x ID x T)	mm	[To be provided]	
2.5.3	Weight	kg	[To be provided]	

2.6 Heavy Hexagonal Socket Clevis (ASC-6H/1)

S/N	Description	Unit	Guaranteed Value	Offered value
2.6.1	Material	-	Forged Steel (Class-IV), HDG	
2.6.2	Minimum breaking load	kN	160	
2.6.3	Socket designation	mm	20	
2.6.4	Weight	kg	[To be provided]	

2.7 Yoke Plate (AYP-10C1)

S/N	Description	Unit	Guaranteed Value	Offered value
2.7.1	Material	-	Mild Steel FE-410, HDG	
2.7.2	Breaking strength	kN	320	
2.7.3	Dimensions (L x W x T)	mm	[To be provided]	
2.7.4	Weight	kg	[To be provided]	

2.8 Suspension Clamp Assembly with P.A. Rod (A-30-ASSY)

S/N	Description	Unit	Guaranteed Value	Offered value
2.8.1	Minimum breaking strength of clamp	kN	70	
2.8.2	Slip strength	% of conductor UTS	15	
2.8.3	Clamp material	-	Aluminum alloy	
2.8.4	Number of armor rods per set	-	11	
2.8.5	Armor rod material	-	Aluminum alloy	
2.8.6	Suitable conductor diameter range	mm	[To be provided]	
2.8.7	Total weight of assembly	kg	[To be provided]	

4.ACS FITTINGS AND ACCESSORIES

1. General Particulars

S/N	Description	Unit	Guaranteed Value	Offered value
1.1	Applicable Standard	-	B.S. 3288, Part-I	
1.2	Earthwire type	-	ACS 7/3.26 mm	
1.3	Short circuit capacity	kA/sec	31.5/1	

S/N	Description	Unit	Guaranteed Value	Offered value
1.4	General tolerance	%	±3 (±5 for flexible copper earth bond)	
1.5	Galvanization standard for ferrous parts	-	B.S. 729	
1.6	Spring washer material	-	Spring steel, electro-galvanized	
1.7	Total weight of the complete set	kg	[To be provided]	

2. Midspan Compression Joint with Aluminum Encasing

S/N	Description	Unit	Guaranteed Value	Offered value
2.1	Manufacturer and Model	-	[To be provided]	
2.2	Slip/mechanical strength	% of earthwire UTS	95	
2.3	Compression pressure	ton	100	
2.4	Steel tube material	-	Mild Steel	
2.5	Aluminum encasing material	-	EC grade aluminum	
2.6	Dimensions before compression (L x OD)	mm	[To be provided]	
2.7	Dimensions after compression (L x OD)	mm	[To be provided]	
2.8	Weight	kg	[To be provided]	

3. Suspension Clamp Assembly

S/N	Description	Unit	Guaranteed Value	Offered value
3.1	Manufacturer and Model	-	[To be provided]	
3.2	UTS for fittings	kN	25 (minimum)	
3.3	Slip strength range	kN	5-14	
3.4	Tightening torque	kg-m	5	
3.5	Clamp body material	-	Malleable cast iron, HDG	
3.6	U-bolt and J-bolt material	-	Mild steel, HDG	
3.7	Twisted shackle material	-	Forged steel, HDG	

S/N	Description	Unit	Guaranteed Value	Offered value
3.8	Weight	kg	[To be provided]	

4. Tension Clamp with Aluminum Encasing

S/N	Description	Unit	Guaranteed Value	Offered value
4.1	Manufacturer and Model	-	[To be provided]	
4.2	Mechanical/slip strength	% of earthwire UTS	95 (minimum)	
4.3	Anchor shackle material	-	Forged steel, HDG	
4.4	Dead end clamp material	-	Mild steel, HDG	
4.5	Aluminum sleeve material	-	Extruded aluminum	
4.6	Compression die number	-	[To be provided]	
4.7	Dimensions of aluminum sleeve (L x OD)	mm	[To be provided]	
4.8	Weight	kg	[To be provided]	

5. Vibration Damper

S/N	Description	Unit	Guaranteed Value	Offered value
5.1	Manufacturer and Model	-	[To be provided]	
5.2	Mass pull-off value	kg	500	
5.3	Slip strength before fatigue test	kN	2.5 (minimum)	
5.4	Slip strength after fatigue test	kN	2.0	
5.5	UTS of messenger cable	kg/sq.mm	135	
5.6	Number of strands in messenger cable	-	19	
5.7	Lay ratio of messenger cable	-	10-11	
5.8	Tightening torque	kg-m	6	
5.9	Clamp material	-	Aluminum alloy	
5.10	Damper mass material	-	Cast iron, HDG	
5.11	Total weight	kg	2.35 ±0.1	

S/N	Description	Unit	Guaranteed Value	Offered value
5.12	Weight of big mass	gm	1,145 ±50	
5.13	Weight of small mass	gm	850 ±50	

6. Flexible Copper Earth Bond

S/N	Description	Unit	Guaranteed Value	Offered value
6.1	Manufacturer and Model	-	[To be provided]	
6.2	Pull-off load	kg	300	
6.3	Resistance	ohm	< 1	
6.4	Flexible copper wire size	-	37/0.417 mm (35 sq.mm)	
6.5	Total length	mm	500 ±5	
6.6	Connecting lug material	-	Copper, tinned	
6.7	Weight	kg	[To be provided]	

Note: HDG stands for Hot Dip Galvanized

5.DOUBLE TENSION INSULATOR

Guaranteed Technical Particulars (GTP)

1. General Particulars

S/N	Description	Unit	Guaranteed Value	Offered value
1.1	Applicable Standard	-	B.S. 3288, Part-I	
1.2	Conductor type	-	ACSR Quad Lark	
1.3	Total U.T.S. of hardware fittings (without tension clamp)	kN	2 x 160	
1.4	Slip strength/mechanical load of tension clamp	% of conductor UTS	95	
1.5	Ball and socket designation	mm	20 (as per IEC:120)	
1.6	Short circuit capacity	kA/sec	31.5/1	
1.7	Minimum corona extinction voltage	kV	290	
1.8	Radio Interference Voltage at 275 kV	dB	45	

S/N	Description	Unit	Guaranteed Value	Offered value
1.9	General tolerance	%	±3	
1.10	Galvanization standard for ferrous parts	-	B.S. 729	
1.11	Total weight of the complete set	kg	[To be provided]	

2. Component-specific Particulars

2.1 Tower Hinge (ATEL-3B/2)

S/N	Description	Unit	Guaranteed Value	Offered value
2.1.1	Material	-	Mild Steel FE-410, HDG	
2.1.2	Breaking strength	kN	160	
2.1.3	Dimensions (L x W x T)	mm	[To be provided]	
2.1.4	Weight	kg	[To be provided]	

2.2 Fixed Extension Strap (AEL-273)

S/N	Description	Unit	Guaranteed Value	Offered value
2.2.1	Material	-	Mild Steel, HDG	
2.2.2	Breaking strength	kN	160	
2.2.3	Dimensions (L x W x T)	mm	[To be provided]	
2.2.4	Weight	kg	[To be provided]	

2.3 Adjustable Extension Strap (ASA-79)

S/N	Description	Unit	Guaranteed Value	Offered value
2.3.1	Material	-	Mild Steel FE-410, HDG	
2.3.2	Breaking strength	kN	160	
2.3.3	Adjustment range	mm	[To be provided]	
2.3.4	Weight	kg	[To be provided]	

2.4 Heavy Hexagonal Ball Eye (ABE-20)

S/N	Description	Unit	Guaranteed Value	Offered value
2.4.1	Material	-	Forged Steel (Class-IV), HDG	
2.4.2	Minimum breaking load	kN	160	

S/N	Description	Unit	Guaranteed Value	Offered value
2.4.3	Dimensions	mm	[To be provided]	
2.4.4	Weight	kg	[To be provided]	

2.5 Arcing Ring (T.S.) (AAH/FRB-13H) and (L.S.) (AAH/FRB-14H)

S/N	Description	Unit	Guaranteed Value	Offered value
2.5.1	Material	-	Mild Steel FE-410, HDG	
2.5.2	Dimensions (OD x ID x T)	mm	[To be provided]	
2.5.3	Weight	kg	[To be provided]	

2.6 Heavy Hexagonal Socket Clevis (ASC-6H/1)

S/N	Description	Unit	Guaranteed Value	Offered value
2.6.1	Material	-	Forged Steel (Class-IV), HDG	
2.6.2	Minimum breaking load	kN	160	
2.6.3	Dimensions	mm	[To be provided]	
2.6.4	Weight	kg	[To be provided]	

2.7 Yoke Plate (AYP-64K)

S/N	Description	Unit	Guaranteed Value	Offered value
2.7.1	Material	-	Mild Steel FE-410, HDG	
2.7.2	Breaking strength	kN	320	
2.7.3	Dimensions (L x W x T)	mm	[To be provided]	
2.7.4	Weight	kg	[To be provided]	

2.8 Dead End Assembly (ADE/C-023, ADE/C-023L, ADE/C-023R)

S/N	Description	Unit	Guaranteed Value	Offered value
2.8.1	Slip/mechanical strength	% of conductor UTS	95	
2.8.2	Dead end body material	-	Extruded Al Tube (99.5% purity)	
2.8.3	Steel dead end material	-	Forged Steel	

S/N	Description	Unit	Guaranteed Value	Offered value
2.8.4	Compression die numbers	-	DA-9 (AL) & DS-9 (STEEL)	
2.8.5	Compression pressure	ton	100	
2.8.6	Dimensions	mm	[To be provided]	
2.8.7	Weight	kg	[To be provided]	

2.9 Rigid Spacer (ARGS-001/LR)

S/N	Description	Unit	Guaranteed Value	Offered value
2.9.1	Material	-	Aluminum Alloy	
2.9.2	Clamp slip strength	kN	2.5	
2.9.3	Compression load	kN	14	
2.9.4	Tension load	kN	7	
2.9.5	Dimensions	mm	[To be provided]	
2.9.6	Weight	Kg	[To be provided]	

2.10 Additional Links (AEL-353, AEL-360, AEL-361, AEL-362, AEL-363)

S/N	Description	Unit	Guaranteed Value	Offered value
2.10.1	Material	-	Mild Steel, HDG	
2.10.2	Breaking strength	kN	160	
2.10.3	Lengths	Mm	300, 500, 1000, 1500, 2000	
2.10.4	Weight (each)	Kg	[To be provided]	

Note: HDG stands for Hot Dip Galvanized

I/We declare that the information provided in this GTP is true and correct, and all supporting documents are authentic and valid.

Signature: _____ Name: _____

Position: _____ Company: _____

Date: _____ Company Seal: _____

18. PRICE SCHEDULE FOR LARK HARDWARE AND FITTINGS

Instructions to Bidders:

1. All prices should be quoted in Kenya Shillings (KES) and are VAT inclusive.

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
1.	SINGLE SUSPENSION INSULATOR STRING HARDWARE AND FITTINGS	Set	100		
2.	DOUBLE SUSPENSION INSULATOR STRING HARDWARE AND FITTINGS	Set	100		
3.	ACS HARDWARE AND FITTINGS	Set	100		
4.	DOUBLE TENSION INSULATOR STRING HARDWARE AND FITTINGS	Set	100		
5.	MID SPAN COMPRESSION JOINT	Set	200		
6.	REPAIR SLEEVE	Pieces	200		
7.	QUAD SPACER DAMPER	Set	200		
8.	RIGID SPACER	Set	200		
9.	VIBRATION DAMPERS	Set	200		
TOTAL FOR LARK HARDWARE AND FITTINGS					

Declaration

We confirm that our bid complies with all requirements as specified in the tender document.

Company Name: _____

Authorized Signatory: _____

Position: _____

Date: _____

Company Stamp: _____

19. PRICE SCHEDULE FOR LOT 3 HARDWARE AND FITTINGS

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
1.	CONDOR HARDWARE AND FITTINGS	LOT	LOT	LOT	
2.	LARK HARWARE AND FITTINGS	LOT	LOT	LOT	
TOTAL FOR LOT 3					

Declaration

We confirm that our bid complies with all requirements as specified in the tender document.

Company Name: _____

Authorized Signatory: _____

Position: _____

Date: _____

Company Stamp: _____