



Kenya Power

TITLE:

**SPECIFICATION FOR
HAND PROTECTION
EQUIPMENT**

Part 2: Insulating gloves

Doc. No.	KP1/6C.1/13/TSP/09/90-2
Issue No.	1
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0.1 Circulation List

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1	Manager, Standards
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0.2 Amendment Record

Rev No.	Date (YYYY-MM-DD)	Description of Change	Prepared by (Name & Signature)	Approved by (Name & Signature)
0	2015-10-12	New Issue	Michael Apudo	Dr. Eng. Peter Kimemia

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FOREWORD

This specification has been prepared by the Standards Department in collaboration with Human Resource & Administration Department; Safety, Health & Environment (SHE) Department of The Kenya Power and Lighting Company Limited (KPLC/Kenya Power) and The Kenya Electrical Trade & Allied Workers(KETAWU) . The specification lays down requirements for insulating gloves for use when performing switching of power lines. It is intended for use by KPLC in purchasing the gloves.

The supplier shall submit information which confirms manufacturer's satisfactory service experience with products which fall within the scope of this specification.

1. SCOPE

- 1.1. This document specifies the general requirements for insulating gloves which are intended to protect the wearer against electric hazards for field and substation operation staff of KPLC.
- 1.2. It also specifies the minimum requirements for protection, ergonomic characteristics, innocuousness, mechanical properties, marking and information for users and the appropriate test methods. The insulating gloves covered in this specification shall include:
 - a) **Class 2 insulating gloves** (Highest operating voltage of 17.5kV)
 - b) **Class 4 insulating gloves** (Highest operating voltage of 36kV)
- 1.3. The specification stipulates the minimum requirements for insulating gloves in the company and it shall be the responsibility of the supplier to ensure adequacy of the design, good engineering practice, adherence to the specification and applicable standards and regulations as well as ensuring good workmanship in the manufacture of the items.

The specification does not purport to include all the necessary provisions of a contract.

2. REFERENCES

The following standards contain provisions which, through reference in this text constitute provisions of this specification. Unless otherwise stated, the latest editions (including amendments) apply:

IEC 60903: Live working – Gloves of insulating material.

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IEC 61318: Live working. Conformity assessment applicable to tools, devices and equipment

3. TERMS AND DEFINITIONS

For the purpose of this specification, the definitions given in the reference standards shall apply.

4. REQUIREMENTS

4.1. SERVICE CONDITIONS

- The insulating gloves shall be tropicalized, designed and constructed for continuous outdoor operation in tropical areas and harsh climatic conditions including areas exposed to:
- a) Sea spray (along the coast), Pollution level III (Heavy) as per IEC/TS 60815.
 - b) Humidity of up to 95% and
 - c) Average ambient temperature of +30°C with a minimum of -1°C and a maximum of +40°C.
 - d) Altitudes of not more than 2200m above sea level

4.2. DESIGN AND CONSTRUCTION

- 4.2.1. Insulating gloves for electrical protection shall be made of elastomer such as Natural Rubber Latex (Polyisoprene), Neoprene (Polychloroprene Rubber) etc.
- 4.2.2. The gloves shall be lined, have an exterior covering, for protection against chemical attack in accordance with IEC 60903 and IEC 61318.
- 4.2.2. The insulating gloves shall be provided with a cuff. The shape will be as shown in Fig. 1 and dimensions as shown in Table 1.
- 4.2.3. The minimum thickness shall be determined only by the ability to pass the dielectric tests. The maximum thickness on the flat surface of a glove (no ribbed area if present) shall be 2.30mm for class 2 and 3.60mm for class 4 in order to obtain the appropriate flexibility.
- 4.2.4. The length of the glove shall be measured from the tip of the second finger to the outer edge of the cuff. The measurement is made with the glove in a relaxed position and the edge of the cuff perpendicular to the line of measurement. The various lengths are as shown in Table 1.

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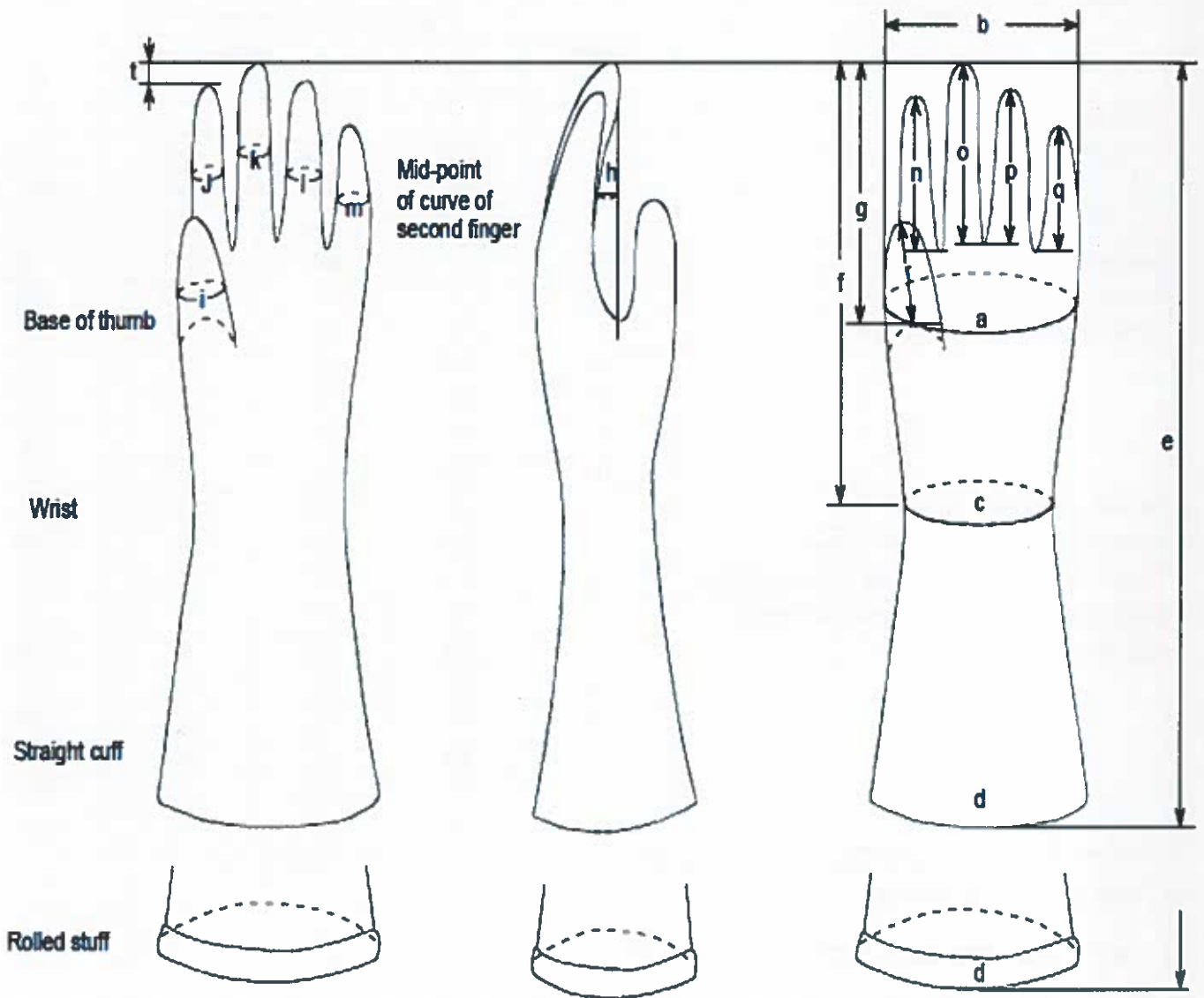


Fig.1. Shape of a glove.

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Table 1: Details of insulating glove dimension as per IEC 60903

Detail	Letter	Dimensions in mm			
		size			
		8	9	10	11
Circumference -of palm -of wrist -of cuff	a	210	235	255	280
	c	220	230	240	255
	d	330	340	350	360
Length of glove for class 2	e	-	360	410	460
Length of glove for class 4	e	-	-	410	460
Circumference of fingers	i	70	80	90	95
	j	60	70	80	85
	k	60	70	80	85
	l	60	70	80	85
	m	55	60	70	75
Width of palm	b	95	100	110	125
Wrist to end of second finger	f	170	175	185	195
Base of thumb to end of second finger	g	110	110	115	120
Midpoint of curve of second finger	h	6	6	6	8
Length of fingers	n	60	65	70	70
	o	75	80	85	85
	p	70	75	80	80
	q	55	60	65	65
	r	55	60	65	65
	t	15	17	17	17

NOTE: Dimension "e" varies according to voltage class and desire of customer (see Table F. 1 of IEC 60903).

4.3. ELECTRICAL LIMITS

Table 2: Electrical limits of the insulating gloves

Insulating glove class	Highest operational voltage of the system		Withstand test voltage kV rms	RILL U _{90r} kV peak
	kV _{rms}	kV _{d.c.}		
2	17.0	25.5	30	50
4	36.0	39.75	50	83

Note: RILL- Required insulation level for live working

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4.4. WORKMANSHIP AND FINISH

4.4.2. Insulating gloves shall be free on both inner and outer surfaces from harmful physical irregularities that can be detected by thorough test and inspection.

NOTE: Harmful physical irregularities shall be defined as any feature that disrupts the uniform, smooth surface contour, such as pinholes, cracks, blisters, cuts, conductive embedded foreign matter, creases, pinch marks, voids (entrapped air), prominent ripples and prominent mould marks.

4.4.3. The working area is defined as all finger and thumb forks, the palm and the palm side of the fingers and thumb as per figure 2.

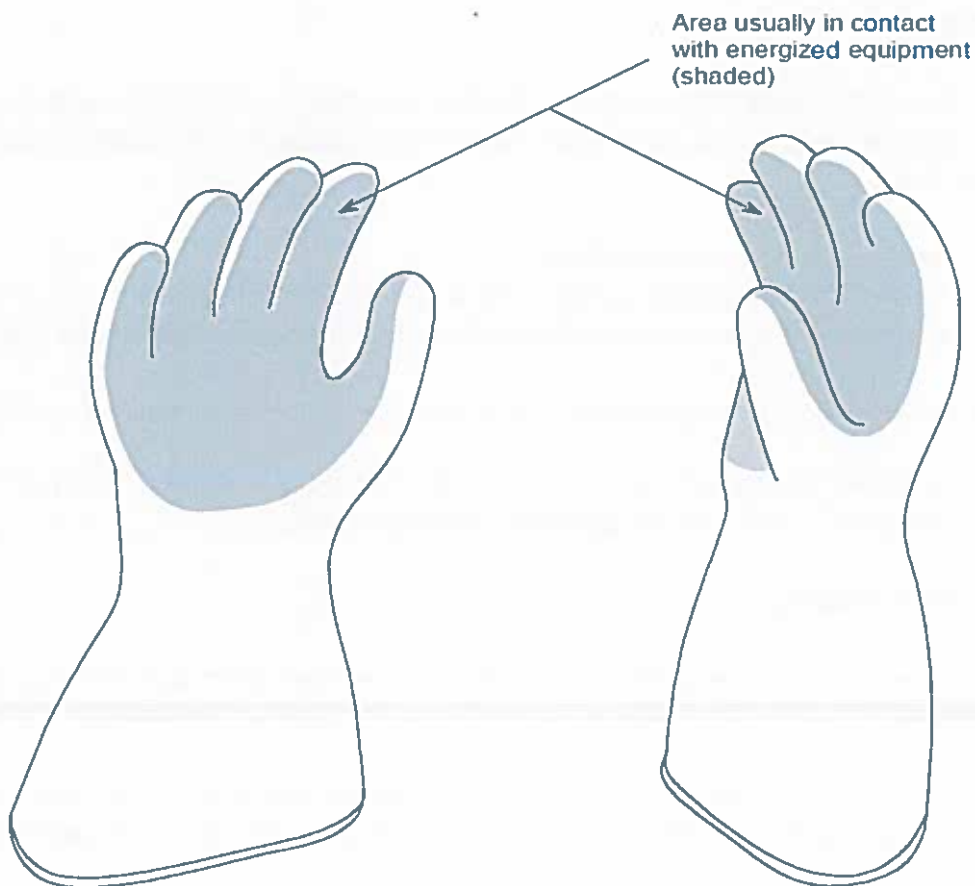


Fig. 2: Areas usually in contact with energized equipment

4.4.4. Palm and finger surfaces designed to improve the grip shall not be considered as irregularities.

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4.5. PERFORMANCE REQUIREMENTS

4.5.2. Mechanical requirements

- 4.5.2.1. These requirements are applicable to the basic glove or sample material taken from the finished glove.
 - 4.5.2.1.1. Tensile strength and elongation at break- the average tensile strength shall not be less than 16 MPa and the average elongation at break shall not be less than 600 %.
 - 4.5.2.1.2. Tension set - the tension set shall not exceed 15 %.

4.5.3. Electrical requirements

- 4.5.3.1. All gloves shall pass the proof and withstand voltage tests along with the a.c. proof test current requirements, as specified in Table 4 and Clause 8 of IEC 60903, according to their class.
- 4.5.3.2. The proof test is deemed successful if
 - (i) The proof test voltage is reached and maintained during the test period,
 - (ii) The proof test current does not exceed the specified values during the test period.
- 4.5.3.3. Current measurement may be done continuously or at the end of the test period.
- 4.5.3.4. The withstand test is deemed successful if the voltage at which electrical puncture occurs equals or exceeds the specified withstand values.

4.5.4. Ageing requirements

- 4.5.4.1. Test pieces shall be submitted to high temperature tests to simulate the effects of ageing.
- 4.5.4.2. For dumb-bell test pieces, the lowest value of tensile strength at break shall be a value of not less than 80 % of the unaged value. The tension set shall not exceed 15 %.
- 4.5.4.3. Each glove shall also pass the dielectric proof test, but without being subjected to the moisture conditioning.

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4.5.5. Thermal requirements

4.5.5.1. Low temperature resistance

- 4.5.5.1.1. No tear, break or crack shall be visible on the gloves, after being subjected to a low temperature test.
- 4.5.5.1.2. Each glove shall also pass the dielectric proof test, but without being subjected to moisture conditioning.

4.5.5.2. Flame retardancy

- 4.5.5.2.1. Sample pieces taken from the gloves shall be flame retardant (see 8.6.2 of IEC 60903). The flame shall not have reached the reference line located on the test piece 55 mm from its edge (e.g. from the tip of the finger), within 55 s after withdrawal of the flame.

4.6. SAMPLING PROCEDURE

Sampling for tests shall be based on the classification of defects either as major or minor in accordance with IEC 61318 and as per Table 3 a & b.

Table 3a – Sampling plan for minor defects (AQL 10)

Lot	Sample size	Number of defects for acceptance	Number of defects for rejection
2 to 90	5	1	2
91 to 150	8	2	3
151 to 3,200	13	3	4
3,201 to 35,000	20	5	6

NOTE: When lot size is less than sampling size, the lot manufactured shall be great enough to provide the required sample, e.g. a lot of 2 will require a minimum lot size of 5.

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Table 3b – Sampling plan for major defects (AQL 4.0)

Lot	Sample size	Number of defects for acceptance	Number of defects for rejection
2 to 90	3	0	1
91 to 3,200	13	1	2
3,201 to 35,000	20	2	3

NOTE: When lot size is less than sampling size, the lot manufactured should be great enough to provide the required sample, e.g. a lot of 2 will require a minimum lot size of 3.

4.7. QUALITY MANAGEMENT SYSTEM

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

4.7.3. The Manufacturer’s Declaration of Conformity to applicable standards and copies of quality management certifications including copy of valid and relevant ISO 9001: 2008 certificate shall be submitted with the tender for evaluation.

5.0. TESTS AND INSPECTION

5.1. The insulating gloves shall be inspected and tested in accordance with the requirements of the IEC 60903, IEC 61318 and all the provisions of this specification. It shall be the responsibility of the supplier to perform or to have performed the tests specified and whatever other tests he normally performs at works.

5.2. Copies of previous Type Tests Reports issued by a third party testing laboratory that is accredited to ISO/IEC 17025 shall be submitted with the tender for the purpose of technical evaluation. The accreditation certificate to ISO/IEC 17025 for the same third party testing laboratory used shall also be submitted with the tender document (all in English Language). The type tests shall include:

- a) Mechanical tests
 - Tension set
 - Tensile strength and elongation at break
 - Resistance to mechanical puncture

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- b) Leakage current test
- c) Dielectric tests
 - AC tests (withstand and proof tests)
 - DC tests (withstand and proof tests)
- d) Proof test current requirement
- e) Thermal tests
 - Flame retardancy
 - Low temperature resistance
- f) Proof test current requirement.
- g) Ageing tests

5.3. The insulating gloves shall be subject to acceptance tests at the manufacturer's works before dispatch. Acceptance tests shall be witnessed by two Engineers appointed by The Kenya Power and Lighting Company Limited (KPLC). Routine and Sample Test Reports for the insulating gloves to be supplied shall be submitted to KPLC for approval before delivery of the goods. The tests to be witnessed shall include;

- a) Visual inspection and measurements (shape, dimensions, thickness, workmanship & finish and packaging).
- b) Mechanical tests
 - Tension set
 - Tensile strength and elongation at break
 - Resistance to mechanical puncture
- c) Leakage current test
- d) Dielectric tests
 - AC tests (withstand and proof tests)
 - DC tests (withstand and proof tests)
- e) Proof test current requirement
- f) Thermal tests
 - Flame retardancy
 - Low temperature resistance.

5.4. On receipt of the product, KPLC will perform any of the tests specified in order to verify compliance with this specification. The supplier shall replace without charge to KPLC the insulating gloves which upon examination, test or use; fail to meet any of the requirements in the specification.

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6.0. MARKING AND PACKING

6.1. MARKINGS

6.1.1. Each glove shall bear an indelibly marked label and/or marking giving the following information:

- a) Symbol IEC 60417-5216 – Suitable for live working; double triangle;
- b) Number of the relevant IEC standard immediately adjacent to the symbol with year of publication (four digits) (IEC 60903:200X);
- c) Name, trademark or identification of the manufacturer;
- d) Category of the glove;
- e) Size;
- f) Class;
- g) Month and year of manufacture.
- h) The words, "**PROPERTY OF KPLC**"

6.1.2. Markings and/or labels shall be adjacent to the cuff but not closer than 2.5 mm.

6.1.3. Markings shall be clearly visible and legible to a person with normal or corrected vision without additional magnification.

- 6.1.4. In addition, each glove shall provide the user or the testing laboratory either
- a) An area permitting the marking of the date of the current inspection or date of next required inspection and test, or
 - b) Any other suitable means to identify the date the glove is put into service and the dates of periodic inspection and test.
 - c) The marking or label shall not impair the quality of the glove; it shall be durable and shall remain visible after being subjected to a durability test.

- 6.1.5. The following additional markings of colour code symbols corresponding to each glove category shall also be marked on the body of the glove:
- a) Class 2 – yellow;
 - b) Class 4 – orange.

Note: *The durability of marking shall be checked by rubbing the marking for 15 s with a piece of lint-free cloth soaked in soapy water and then rubbing it for a further 15 s with a piece of lint-free cloth soaked in isopropanol. At the end of the test the marking shall remain legible.*

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6.2. PACKAGING

- 6.2.1. Each pair of gloves shall be packaged in an individual container or package of sufficient strength to properly protect the gloves from damage. The outside of the container or package shall be marked with the name of the manufacturer or supplier, the classification, category, size, length and cuff design. The container shall be sturdy enough to be used throughout the life of the insulating glove.
- 6.2.2. The type of packaging suitable for transport shall be defined by the manufacturer. At the request of the customer, or according to government specifications, information contained in Annex E of IEC 60903 and any additional or amended instructions shall be included in the package.
- 6.2.3. The insulating gloves shall be packed in a manner so as to protect it from damage during transportation and storage. Instructions for storage and handling shall be included in each package, all in English Language.

7. DOCUMENTATION

7.1 The bidder shall submit its tender complete with technical documents required by Annex A (Guaranteed Technical Particulars) for tender evaluation. The technical documents to be submitted (all in English language) for tender evaluation shall include the following:

- a) Guaranteed Technical Particulars signed by the manufacturer;
- b) Copies of the Manufacturer's catalogues, brochures, drawings and technical data;
- c) Sales records for the last five years and at least four customer reference letters;
- d) Details of manufacturing capacity and the manufacturer's experience;
- e) Copies of required type test reports by a third party testing laboratory accredited to ISO/IEC 17025;
- f) Copy of accreditation certificate to ISO/IEC 17025 for the third party testing laboratory;
- g) Manufacturers letter of authorization, ISO 9001:2008 certificate and other technical documents required in the tender.

7.2 The successful bidder (supplier) shall submit the following documents/details to The Kenya Power & Lighting Company for approval before manufacture:

- a) Guaranteed Technical Particulars signed by the manufacturer;
- b) Design Drawings with details of insulating gloves to be manufactured for KPLC.
- c) Quality assurance plan (QAP) that will be used to ensure that the design, material; workmanship, tests, service capability, maintenance and documentation will fulfill 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
- d) Detailed test program to be used during factory testing;

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- e) Marking details and method to be used in marking the insulating gloves;
- f) Manufacturer's undertaking to ensure adequacy of the design, good engineering practice, adherence to the specification and applicable standards and regulations as well as ensuring good workmanship in the manufacture of the insulating gloves for The Kenya Power & Lighting Company;
- g) Packaging details (including packaging materials).
- h) Additional information in accordance with IEC 60903, Annex E for in-service recommendations of :
 - (i) Storage
 - (ii) Examination before use
 - (iii) Temperature
 - (iv) Precautions in use
 - (v) Periodic inspection and electrical re-testing

7.3 The supplier shall submit recommendations for use, care, storage and routine inspection/testing procedures, all in the English Language, during delivery of the insulating gloves to KPLC stores.

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ANNEX A: Guaranteed Technical Particulars (to be filled and signed by the Manufacturer and submitted together with relevant copies of the Manufacturer's catalogues, brochures, drawings, technical data, sales records for previous five years, four customer reference letters, details of manufacturing capacity, the manufacturer's experience and copies of complete type test certificates and type test reports for tender evaluation, all in English Language)

Tender No.

Clause	Description	Guaranteed Technical Particulars offered
	Name of Manufacturer & Country of manufacture of the insulating gloves being offered	specify
	Type/Model Reference Number	specify
1	Scope: Supplier to ensure adequacy of the design, good workmanship, good engineering practice and adherence to standards, specifications and applicable regulations in the manufacture of the insulators for KPLC	specify
2	Standard (s) of manufacture - IEC 60903	Specify
3	Terms and Definitions (if applicable)	Specify
4	Requirements	
4.1	Service condition	Specify
4.2	Design and construction	
	Insulating material Elastomer – Type of elastomer	State the type of elastomer / lining and their properties
	Lining and lining material	
	Shape and dimensions	Attach drawing showing all dimensions
	Maximum thickness on flat surface	
	Details of insulating glove dimension of gloves as per Fig. 1	
	Circumference	mm
	-of palm	a
	-of wrist	c
	-of cuff	d
	Length of glove for class 2	e
	Length of glove for class 4	e
	Circumference of fingers	i
		j
		k
		l
		m
		State the offered dimensions for each glove size (8, 9, 10 or 11)

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	Width of palm		b	
	Wrist to end of second finger		f	
	Base of thumb to end of second finger		g	
	Midpoint of curve of second finger		h	
	Length of fingers		n	
			o	
			p	
			q	
			r	
			t	
4.3	Electrical Limits	Insulation glove class	2	4
		Highest operational voltage, kV	AC	17.0
			DC	25.5
		Withstand test voltage, kVrms	30	50
		RILL U_{90r} , kV pk	50	83
				36.0
				39.75
				Prove compliance – Attach test report
4.4	Workmanship and finish			Specify
	Free on both inner and outer surfaces from harmful physical irregularities such as pinholes, cracks, blisters, cuts, conductive embedded foreign matter, creases, pinch marks, voids (entrapped air), prominent ripples and prominent mould marks.			Specify
	Palm and finger surfaces designed to improve the grip shall not be considered as irregularities.			Specify
4.5	Performance requirements			
	Mechanical requirements	Tensile strength and elongation at break		Prove compliance – Attach test report
		Tension set		
	Electrical requirements	Proof current test and voltage withstand tests		Prove compliance – Attach test report
	Ageing requirements			Prove compliance – Attach test report
	Thermal requirements	Low temperature resistance		Prove compliance – Attach test report
		Flame retardancy		Prove compliance – Attach test report
4.6	Sampling procedure of test – for minor or major defects			
4.7	Quality Management System			
	Quality Assurance Plan			provide
	Copy of ISO 9001:2008 Certificate			provide
	Manufacturer's experience			provide
	Manufacturing Capacity (units per month)			provide
	List of previous customers			provide
	Customer reference letters			provide
5.1	Test standards and responsibility of carrying out tests			provide

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5.2	Copies of Type Test Reports submitted with tender	provide
5.3	Test reports to be submitted by supplier to KPLC for approval	provide
5.4	Replacement of rejected insulating gloves.	specify
6.1	Marking	specify
6.2	Packing	specify
7.1	Documents submitted with tender	provide
7.2	Documents to be submitted by supplier to KPLC for approval before manufacture	provide
8.0	Manufacturer's Guarantee and Warranty	provide
9.0	List catalogues, brochures, technical data and drawings submitted to support the offer	provide
10.0	List customer sales records and reference letters submitted to support the offer.	provide
11.0	List Test Certificates submitted with tender	provide
12.0	List test reports of the wrenches to be submitted to KPLC for approval before shipment	provide
13.0	Statement of compliance to specification (indicate deviations if any & supporting documents)	provide

NOTE:

- 1) Bidders shall give full details and the offered values of the insulating gloves as per Annex A. The details provided shall conform to the test reports and their certificates as required by clause 5.2., well labeled drawings complete with dimensions, catalogues and/or brochures for the purposes of tender evaluation.
- 2) Bidder who shall have not complied by this requirement in bullet 1 shall automatically be disqualified from bidding for this item.

.....
Manufacturer's Name, Signature, Stamp and Date

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