

Islamic Republic of Iran
Vice Presidency for Strategic Planning and Supervision

**General Technical Specification and
Execution Procedures for Transmission
and Subtransmission Networks
Transmission Line Fitting, Hardware
and Accessories**

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**Office of Deputy for Strategic Supervision
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Technical Specification for Transmission Line Fitting, Hardware and Accessories



1- General requirements

This technical specification covers minimum requirements for the nominal rating, kind of compound materials, design, construction and test of commonly used fittings in overhead transmission and subtransmission lines. Fittings of overhead lines shall be designed, manufactured and tested in accordance with the requirements of the latest revision of the following standards and to this specification:

- IEC 61284: Overhead lines- requirements and test for fittings.
- IEC 60060-1: High voltage test techniques, part 1: General definitions and test requirement.
- IEC 60120: Dimensions of ball and socket coupling of string insulator units.
- IEC 60471: Dimensions of clevis and tongue coupling of string insulators units.
- IEC 60372: Locking device for ball and socket coupling of string insulator units: Dimensions and tests.
- IEC 60826: Loading and strength of overhead transmission lines.
- IEC 61089: Round wire concentric lay overhead electrical stranded conductors.
- IEC 61897: Overhead lines- requirements and tests for stockbridge type aeolian vibration dampers.
- IEC 61854: Overhead lines- requirements and tests for spacers.
- CISPR 16-1: Specification for radio disturbance and immunity measuring apparatus and methods- part 1: Radio disturbance and immunity measuring apparatus.
- CISPR 18-2: Radio interference characteristics of overhead power lines and high voltage equipment- part 2: Method of measurement and procedure for determining limits
- ISO 1461: Hot dip galvanized coating on fabricated ferrous products- specifications
- ISO 2859: Sampling procedures for inspection by attributes.
- ISO 3951: Sampling procedures and charts for inspection by variables for percent non- conforming.

Also other reputable national or international standards subject to purchaser confirmation and if their details are compatible with mentioned standards, can be used. The contractor shall include in his bid sufficient information to permit a correct evaluation of the bid in relation to the specification. If the contractor's proposal includes hardware offered on the basis of standards other than mentioned, he shall submit as part of his proposal two copies of the subject standards and explanation and justification in writing of any difference from aforesaid standards.

On the basis of this information, the acceptability of the proposed hardware will be determined by the owner.

2- Detailed requirements

2-1- Design

The fittings shall be designed so as to:

- Avoid damaging the conductor under service conditions.
- Withstand the mechanical loads relevant to installation, maintenance and service, the designed service current including short circuit current, the service temperatures and environmental circumstances.
- Ensure that individual components are secured against becoming loose in service.
- Have limited corona effects.

Fittings for live line maintenance shall be suitably designed for safe and easy handling.

Surfaces of compression fittings in contact with the conductor or earth wire shall be protected from becoming contaminated before installation.

Brittleness of finished parts shall be avoided by adopting suitable materials and manufacturing process.

All hardware designed with a pin and cotter key so that the cotter key would be subject to wear shall include a bolt, nut and cotter key. Cotter keys for use with pins shall be brass or stainless steel. All cotter keys shall be hump type. Ends beyond the hump shall be pointed or cut diagonally and shall not project beyond the pins by more than 15mm.

Hardware assembly drawings shall show, when required, an extension link (or other piece of hardware) to be specifically designed for attaching a hot-line strain yoke, or equivalent device.

Provision to use hot-line tools shall be provided between the insulator string and the supporting structure and between the insulator string and the line conductor.

If dissimilar materials are used for the accessories suitable precaution shall be taken to minimize electrolytic action.

2-2- Fabrication

All hardware components shall be so fabricated and treated that there shall be no electrolytic action occurring between the accessories and the cables and between the various parts of the individual accessories.

Surface shall be smooth, free from burs, lumps, dross and all edges and corners rounded.

All plate, shapes and straps shall be neatly and accurately formed. Shearing or cutting shall be clean without ragged or drawn edges.

Holes shall be clean and at right angle to the surface of the plates, shapes, or straps and free from any ridges or shoulders, so that the shackles shall hand true and the shackle pin shall have maximum bearing area.

Distortion due to heat stresses shall be corrected before galvanizing by methods that will not damage the material.

2-3- Materials

Fittings shall be made of any material suitable for the purpose.

2-3-1- Metallic materials

The materials shall meet service life requirements and shall not be liable to intergranular or stress corrosion. They shall not cause corrosion of any other parts of the conductor or earth wire.

The materials of compression fittings shall be capable of withstanding the cold working due to compression. Furthermore, the steel compression components shall also have a sufficient impact strength after the compression.

Examples of suitable materials are the following:

- Aluminum or aluminum alloy
- Galvanized steel
- Galvanized malleable or ductile iron
- Stainless steel
- Copper and copper alloys

In accordance with the IEC 61284 recommendation, ISO standards for materials be used where they exist.

2-3-2- Non- metallic materials

Non- metallic materials employed shall have good resistance to ageing and be capable of withstanding service temperatures without detrimental change of properties. Materials shall have adequate resistance to the effects of ozone, ultra- violet radiation and air pollution over the whole range of the service temperature.

Non- metallic materials shall not induce corrosion in materials which are in contact with them.

2-4- Welding

Aluminum alloys shall be welded by an inert gas shielded tungsten or inert gas shield arc process.

Steel shall be welded by an arc process.

During welding operating, parts shall be held by clamps or other suitable means to keep them in correct position.

All weld shall be completely sealed.

Welding surface shall be smooth and without overlaps of excessive under cutting. Rough surface slag, and splatter from welding shall be removed before galvanizing by grinding or sand blasting.

2-5- Dimensions and tolerances

The dimensions shall be shown on contract drawings.

Particular regard shall be paid to those dimensions which involve interchangeability, correct assembly, and those for which gauge are specified. Reference shall be made to relevant standards, for example IEC 60120, 60372, and 60471.

Tolerances applied to dimensions shall ensure that the fitting meet their specified mechanical and electrical requirements.

2-6- Protection against corrosion

All parts of insulator, conductor and earth wire fittings shall be either inherently resistant to atmospheric corrosion or be suitably protected against corrosion, such as can occur in transport, storage and in service.

All ferrous parts which will be exposed to the atmosphere in service, except those made of appropriate stainless steel, shall be protected by hot dip galvanizing in accordance with ISO 1461 or other means giving equivalent protection.

2-7- Marking

Marking shall ensure the system of traceability for each of the component parts of the fittings.

When practicable, and unless otherwise agreed between purchaser and manufacturer, fittings shall be clearly and indelibly marked as follows:

- **Fittings used as individual components with castings method**

- 1) Identification of fittings (reference number/ specified minimum failure load)
- 2) Manufacturer's identification

- 3) Date of manufacture (month and year)
- 4) Cast code
- **Fittings used as individual components with forgings method**
 - 1) Identification of fittings (reference number/ specified minimum failure load)
 - 2) Manufacturer's identification
 - 3) Date of manufacture (month and year)
- **Links and plates**
 - 1) Identification of fittings (reference number/ specified minimum failure load)
 - 2) Manufacturer's identification
 - 3) Date of manufacture (month and year)
- **Assemblies of fittings**
 - 1) Identification (reference number/ specified minimum failure load)
 - 2) Manufacturer's identification
 - 3) Date of manufacture of individual items (month and year)
 - 4) Conductor diameter range or conductor code (s), as agreed between purchaser and supplier
 - 5) Fittings bolt installation torque (unless bolts breakaway torque are used)
- **Conductor compression fittings**
 - 1) Identification (reference number/ specified minimum failure load)
 - 2) Manufacturer's identification
 - 3) Date of manufacture (month and year)
 - 4) Conductor size or code name
 - 5) Compression die sizes
 - 6) Length to be compressed

2-8- Catalogue numbers and drawings

The contractor shall notify the owner of changes to catalogue items, catalogue numbers, or drawings of transmission line hardware and components to ensure that the owner has the up-to-date information.

All change shall be described in writing, stating the purpose of changes, how they affect the product, and whether any of the physical or electrical properties have been altered in any way.

The contractor shall submit two prints of preliminary drawings with his proposal. For any item not shown fully dimensioned in the contractor's catalogue, the contractor shall submit fully dimensioned detail drawings with his proposal. Final drawings shall be submitted and approved before testing and delivery can commence.

The contractor shall submit a schedule indicating when final drawings will be submitted for approval, and a schedule for submitting a test program, conducting the test program, and shipping the approved accepted material.

Dimensions shown in catalogues and drawings will be in the metric system, but its equivalent in other systems shall mention.

All required drawings shall be drawn to scale (preferably 25mm=10cm) and fully dimensioned.

All items thereon shall be identified with appropriate nomenclatures as to size, type, rated strength, nominal phase to phase voltage specification as well as features and requirement as specified by the owner.

Drawings shall show on one sheet all items to be furnished for an assembly, and shall include a complete bill of materials.

2-9- Packaging and shipment

Hardware and accessory items shall be packaged in accordance with one of the following at the contractor's option:

- Package all like components together
- Package all like assemblies together

In all cases all material to be shipped shall be properly packaged to protect it from damage in transit. Any articles that might otherwise be lost shall be boxed or wired in bundles and identified.

All package shall clearly indicate the contents, and all markings shall be legible and weather proof.

When packaging like assemblies, if two package are required per assembly, then all items and components required for the tower side of the insulator string shall be in one package and all items and components required for the line side, including the suspension clamp, shall be in another package.

Manufacturer shall present instruction and manual of installation of hardware and accessories which is needed.

3- Requirement for specified fittings

3-1- Insulator set fittings and earth wire fittings

For parts made of forged steel, holes which are under mechanical stress can be made by hot punching provided that the holes conform to tolerances on at least 70% of punched thickness. For parts made of forged steel, holes which are not under mechanical stress can be made by cold or hot punching without the aforementioned limits.

3-2- Suspension clamps

The conductor or the earth wire installed in the suspension clamps can be used bare or equipped with armour rods.

The suspension clamps shall be so designed that the effect of vibration, both on the conductor or on the earth wire and on the clamps themselves, are minimized. The clamps shall be designed to avoid localized pressure or damage to the conductor or the earth wire.

The suspension clamps shall have sufficient contact surface to avoid damage by fault currents.

The wear resistance of the articulation assembly shall be sufficient to prevent deterioration in service.

Magnetic losses shall not exceed the laid down value, if specified.

The body of suspension clamps shall permit oscillation around a horizontal axis perpendicular to the conductor.

The manufacturer shall provide the purchaser with the usage limits of the suspension clamps.

For each type of clamp, the purchaser can choose between standard clamps or controlled slippage suspension clamps. In standard clamps, the slip load of the conductor or earth wire is not lower than a specified minimum slip load. In controlled slippage clamps, the slip load of the conductor remains between two values defined by mutual agreement between the purchaser and the supplier.

3-3- Fittings for jointing, terminating and repairing conductor and earth wire

Fittings for the purpose of jointing, terminating and repairing conductor and earth wire include, but are not limited to, the following:

- Compression type connectors
- Cone or wedge type clamps
- Bolted type clamps
- Factory- formed helical fittings
- Fitting installed using an explosive charge

The above fitting types may be used for tension and non-tension joints, and T connectors. When the fittings are designed so as not to provide electrical continuity of the conductor (e.g. a tension clamp) the fittings shall not reduce the electrical capability of the conductor or earth wire.

Fittings used for electrical continuity connections shall meet the requirement of heat cycle tests.

Those fittings with auxiliary eyes intended for use during construction or maintenance shall be marked with a specified minimum failure load stated by the manufacturer.

All fittings shall be designed to minimize internal voids and to prevent the ingress or entrapment of moisture during service.

Fittings may be provided with an oxide-inhibiting compound intended to reduce metal oxidation at metal-to-metal electrical contact points. These compounds are commonly used in compression fittings to fill internal voids not to prevent ingress of water during service.

Fittings and connectors shall be so designed in such away that after installation, the initial contact area between the fitting and the conductor does not raise stresses which can lead to failure under aeolian vibration or other conductor oscillation conditions.

Fittings and connectors intended to connect conductors of two dissimilar materials shall be designed to avoid bimetallic corrosion.

Fittings and connectors shall be designed to avoid localized pressures which may cause excessive cold flow of the conductor or earth wire material.

Fittings and connectors intended for repairing of a conductor shall have appropriate installation manufacturer's instructions.

3-4- Insulator protective fittings

Should steel tubes be used for insulator protective fittings, both the internal and external surfaces of the tubes shall be hot dip galvanized.

When the tube is sealed after galvanizing, the quality of the internal surface shall be agreed between purchaser and supplier.

For insulator protective fittings designed to protect insulator sets against damage caused by power arcs (arcing horns, arcing rings, rings), the short circuit current conditions shall be stated by the customer in the order.

The protective fittings shall be designed in such a way as not to be subject to breakage through fatigue due to vibration caused by the wind. The insulator protective fittings shall withstand a static mechanical load agreed upon between supplier and purchaser.

The insulator protective fitting shall be so designed and installed in such a way that is not obstruct working with repairing and maintenance equipment of live line.

3-5- Dampers

The damper shall be designed so as to:

- Damp aeolian vibration
- Withstand mechanical loads imposed during installation, maintenance and specified service conditions
- Avoid damage to the conductor under specified service conditions
- Be capable of being removed and re-installed without damage to the conductor
- Be free from unacceptable levels of corona and radio interference under all service conditions
- Be suitable for safe and easy installation. The clamp design shall retain all parts when opened for attachment to conductor. Furthermore, the clamp design shall be such that the damper, during installation, can be suspended on the conductor before tightening the clamp
- Ensure that individual components will not become loose in service
- Maintain its function over the entire service temperature range
- Avoid audible noise
- Prevent water collection

Other desirable characteristics which are not essential to the basic functions of the damper but which may be advantageous include:

- Verification of proper installation from the ground
- Ease of installation and removal from energized lines

In the case of vibration dampers for conductors or earth wires containing integral fiber optic elements account should be made of the possible effects of the damper on these fiber optic elements.

Damper mass and significant dimensions, including appropriate tolerances, shall be shown on contract drawings.

The dampers shall be free of defects and irregularities. They shall have all outside surface smooth and all edges and corners well-rounded.

The supplier shall provide a clear and complete description of the installation procedure and their position relative to clamp and each other.

3-6- Spacers

The spacer shall be designed as to:

- Maintain subconductor spacing (at spacer locations), within any prescribed limits, under all conditions of service excluding short-circuit currents.
- Prevent, in subspans between spacers, physical contact between subconductors, except during the passage of short circuit currents when the possibility of contact is accepted provided that the specified spacing is restored immediately following fault clearance.
- Withstand mechanical loads imposed on the spacer during installation, maintenance and service (including short circuit condition) without any component failure or unacceptable permanent deformation.
- Avoid damage to the subconductor under specified service conditions.
- Be free from unacceptable levels of corona and radio interference under specified service conditions.
- Be suitable for safe and easy installation. For the bolted and latching clamp the design shall retain all parts when opened for attachment to the conductor.
- Ensure that individual components will not become loose in service.
- Be capable of being removed and re-installed on the subconductors without damage to the spacer or subconductors.
- Maintain its function over the entire service temperature range.
- Avoid audible noise.

Other desirable characteristics, which are not essential to the basic function of the spacer but which may be advantageous to the purchaser, include:

- Verification of proper installation from the ground
- Ease of installation and removal from energized lines

The conductivity of the various non-metallic components shall be such that when properly installed:

- Potential differences between metallic components do not cause damage due to discharge
- Any current flow between subconductors does not degrade spacer materials

Spacer mass and significant dimensions, including appropriate tolerances, shall be shown on contract drawings.

Tolerances applied to the mass and to the dimensions should ensure that the spacers meet their specified mechanical and electrical requirements.

The spacers shall be free of defects and irregularities. All outside surfaces shall be smooth and all edges and corners well-rounded.

In fitting marking, correct position of the top of the spacer (for example arrows pointing upward), if necessary, shall also be provided.

The supplier shall provide clear and complete description of the installation procedure and, if required, the in-span location of the spacers.

The supplier shall make available any special installation tool that is required.

4- Tests

Prior to the owner acceptance and approval of the hardware and accessories, the contractor shall furnish sufficient and satisfactory proof of the performance of the hardware undergoing the electrical and mechanical tests.

Tests shall be conducted in laboratories having ample facilities to prove the fulfillment of the basic requirements as defined herein.

Prior to performing such tests, the contractor, shall accurately indicate and describe, in the form of photographs, drawings, or writing, the proposed test facilities, test schedule, and procedure for preparing, measuring, recording, and applying voltage or mechanical load.

During the course of testing, material samples shall be fully equal to and representative of those which the contractor intends to supply. If any modification is made after testing, the contractor shall explain, justify and retest, the owner's discretion, the modified item to the owner's satisfaction.

Any change in material, design, and detail drawings after approval by the owner will only be permitted after written approval of the changes is given by the owner.

All type, sample and routine tests on hardware and accessories of transmission lines shall be done in accordance with the latest revision of IEC 61284, IEC 61897 and IEC 61854 and mentioned references on those. List of relevant tests on different type of fittings and accessories are given in table 1 and 2.

Table 1- Tests on fittings used in overhead transmission lines according to IEC 61284

Test	Insulator set fittings and earth wire fittings			Suspension clamps			Tension joints and tension clamps			Partial tension fittings			Repair sleeve			Insulator protective fittings (1)		
	Type tests	Sample tests	Routine tests	Type tests	Sample tests	Routine tests	Type tests	Sample tests	Routine tests	Type tests	Sample tests	Routine tests	Type tests	Sample tests	Routine tests	Type tests	Sample tests	Routine tests
Visual examination		2	3		2	3		2	3		2	3		2	3		2	3
Dimensional and material verification			3			3			3			3			3			3
Hot dip galvanizing	3		-	3		-	3		-	3		-	3	-	-	3		-
Non- destructive testing	3	3	3	3	3	3	3	3	3	3	3	-	-	-	-	3	3	3
Damage and failure load test			3,4			3,4		3	-	-	-	-	-	-	-	3	3	3
Slip test	-	-	-			-	-	-	-	-	-	-	-	-	-	-	-	-
Clamp bolt tightening test	-	-	-		2	-		2	-	-	-	-	-	-	-	-	-	-
Tensile test	-	-	-	-	-	-			-		-	-			-	-	-	-
Damage and failure load test of the attachment point used during erection		3	-	-	-	-		3	3,4	-	-	-	-	-	-	-	-	-
Magnetic losses test	-	-	-	3	-	-	3	-	-	-	-	-	-	-	-	-	-	-
Heat cycle tests	-	-	-	-	-	-	5	-	-	5	-	-	-	-	-	-	-	-
Corona and RIV test	3,6	-	-	3,6	-	-	3	-	-	3	-	-	3	-	-	3,6	-	-

1- Includes electrical gradient devices

2- Inspection by attributes only

3- By agreement between purchaser and supplier

4- Only as regards damage load test

5- Only for current- carrying joints

6- Only in connection with the complete insulator set

Table 2- Tests on fittings used in overhead transmission lines according to IEC 61854,61897

[illegible]

Table 2- Tests on fittings used in overhead transmission lines according to IEC 61854,61897

Test	Dampers			Spacer damper			Flexible spacer			Rigid spacer		
	Routine tests	Type tests	Sample tests	Routine tests	Routine tests	Type tests	Sample tests	Routine tests	Routine tests	Type tests	Sample tests	Routine tests
Damper characteristic test		1	-	-	-	-	-	-	-	-	-	-
Damper effectiveness evaluation	-		-	-	-	-	-	-	-	-	-	-

1- Additional tests which shall perform subject to purchaser request.
2- If applicable.
3- When use in conjunction with vibration dampers.
4- Not applicable for earth wire dampers.

5- Inspection

The manufacturer shall afford the purchaser all necessary and sufficient testing facilities to satisfy him. Whether the test results are positive or not, the purchaser can reject factory production if during of erection time, the fitting specification have not adoption with necessary requirement or working not well in service (during guarantee time resulting manufacturer shortcoming).

6- Drawing and documents**6-1- Documents to be given by tenderer**

- Filled fitting schedule II
- Catalog and technical pamphlets
- Detailed summary of exceptions to tender specification
- Reference list
- List of spare parts
- List of special tools
- Summary of test reports
- Packing, shipping, warehousing, installation and maintenance instruction manuals

6-2- Documents to be given by contractor/ supplier

The design, manufacturing, factory testing, packing, marking, shipping, warehousing, erection, site testing and operation document, electrical drawing and manual of fitting shall be submitted but not limited to the following:

- Calculation sheets to establish adequacy of fittings in any respect
- Details of packing, shipment and warehousing
- Report of tests and certificate
- Erection, operation and maintenance manual instruction
- Drawings which depict dimension, shape, shipment type, weight, type and other specification
- Details of installation and erection of fitting
- Monthly progress report
- Time schedule
- List of drawings
- List of equipment

SCHEDULE FITTING (I)
RATING AND CHARACTERISTICS OF FITTING

ITEM	DESCRIPTION	TECHNICAL SPECIFICATION FOR SYSTEMS WITH FOLLOWING NOMINAL VOLTAGES			
		63/66 kV	132 kV	230 kV	400 kV
1	Particulars of systems				
1-1	Nominal system voltage kV	63/66	132	230	400
1-2	Highest system voltage kV	72.5	145	245	425
1-3	Nominal system frequency Hz	50	50	50	50
1-4	Specification of phase conductors of transmission line	*	*	*	*
1-5	Specification of guard wires of transmission line	*	*	*	*
1-6	Radio interference voltage level in 1MHz frequency and 10% over transmission line highest voltage μV	*	*	*	*
1-7	Specification of transmission line string insulators set include: type and number of each set, number of strings in insulators set, approximate dimension of sets and specification and number of insulator unit in each string insulator	*	*	*	*
2	Service condition				
2-1	Max. ambient temperature $^{\circ}\text{C}$	40/45/50/55	40/45/50/55	40/45/50/55	40/45/50/55
2-2	Min. ambient temperature $^{\circ}\text{C}$	-40/-35/-30/-25	-40/-35/-30/-25	-40/-35/-30/-25	-40/-35/-30/-25
2-3	Seismic acceleration m/s^2	0.2/0.25/0.3/0.35	0.2/0.25/0.3/0.35	0.2/0.25/0.3/0.35	0.2/0.25/0.3/0.35
2-4	Max. wind velocity m/s	30/40/45	30/40/45	30/40/45	30/40/45
2-5	Wind velocity at ice condition m/s	20	20	20	20
2-6	Ice coating thickness	5/10/20/25	5/10/20/25	5/10/20/25	5/10/20/25
2-7	Pollution level	Low/medium/high/ very high/special	Low/medium/high/ very high/special	Low/medium/high/ very high/special	Low/medium/high/ very high/special
2-8	Altitude above sea level mm	1000/1500/2000/2500	1000/1500/2000/2500	1000/1500/2000/2500	1000/1500/2000/2500
2-9	Relative humidity	90/95/more than 95	90/95/more than 95	90/95/more than 95	90/95/more than 95

SCHEDULE FITTING (I)
RATING AND CHARACTERISTICS OF FITTING

ITEM	DESCRIPTION	TECHNICAL SPECIFICATION FOR SYSTEMS WITH FOLLOWING NOMINAL VOLTAGES			
		63/66 kV	132 kV	230 kV	400 kV
3	Suspension clamp for phase conductors and guard wire				
3-1	Rated tensile strength kN	*	*	*	*
3-2	Min. and max. slip strength kN	*	*	*	*
4	Tension clamp for phase conductors and guard wire				
4-1	Rated tensile strength kN	*	*	*	*
5	Mid span joint for phase conductors and guard wire				
5-1	Min. slip strength kN	*	*	*	*
6	Repair sleeve for phase conductors				
6-1	Min. slip strength kN	*	*	*	*
7	Dampers for phase conductors and guard wires				
7-1	Range of operating frequency Hz	*	*	*	*
8	Spacers for bundle conductors				
8-1	Type (rigid / flexible / equipped with damper)	*	*	*	*
8-2	Rated tensile strength kN	*	*	*	*
9	Aarmor rod for phase conductors and guard wires				
9-1	Overall diameter with wire conductor mm	*	*	*	*
10	Counter weight				
10-1	Weight kg	*	*	*	*
10-2	Material	*	*	*	*

SCHEDULE FITTING (I)
RATING AND CHARACTERISTICS OF FITTING

ITEM	DESCRIPTION	TECHNICAL SPECIFICATION FOR SYSTEMS WITH FOLLOWING NOMINAL VOLTAGES			
		63/66 kV	132 kV	230 kV	400 kV
11	Extension link				
11-1	Type	*	*	*	*
11-2	Material	*	*	*	*
12	T clamp for phase conductor and guard wire				
12-1	Type	*	*	*	*
12-2	Material	*	*	*	*
13	Corona and arcing rings				
13-1	Material	*	*	*	*
14	Warning sphere marker				
14-1	Color	*	*	*	*
14-2	Approximate dimension specifications	*	*	*	*
15	Insulator set fittings				
15-1	Type	*	*	*	*
15-2	Material	*	*	*	*
15-3	Rated tensile strength	*	*	*	*
16	Earth wire fittings				
16-1	Type	*	*	*	*
16-2	Material	*	*	*	*
16-3	Rated tensile strength	*	*	*	*

* These will be specified by engineer.

SCHEDULE FITTING (II)
RATED VALUES AND TECHNICAL SPECIFICATION OF FITTING

ITEM	DESCRIPTION	TECHNICAL SPECIFICATION FOR SYSTEMS WITH FOLLOWING NOMINAL VOLTAGES			
		63/66 kV	132 kV	230 kV	400 kV
1	General				
1-1	Max. design ambient temperature °C				
1-2	Min. design ambient temperature °C				
1-3	Pollution level m				
1-4	Design altitude above sea level m/s				
1-5	Max. design wind velocity m/s				
1-6	Max. design wind in ice condition mm				
1-7	Max. design ice thickness				
1-8	Permissible relative humidity m/s ²				
1-9	Design seismic acceleration				
1-10	Max. design R.I.V level in 1 MHz and 15% over transmission highest voltage μV				
1-11	Documents (test reports / outline drawings / catalogues / maintenance installation manuals / reference list / list of spare parts) (yes/No)				
2	Suspension clamp for phase conductors and guard wire				
2-1	Manufacturer's name and country				
2-2	Manufacturer's type & designation				
2-3	Rated tensile strength kN				
2-4	Min. and max. slip strength kN				

SCHEDULE FITTING (II)
RATED VALUES AND TECHNICAL SPECIFICATION OF FITTING

ITEM	DESCRIPTION		TECHNICAL SPECIFICATION FOR SYSTEMS WITH FOLLOWING NOMINAL VOLTAGES			
			63/66 kV	132 kV	230 kV	400 kV
2-5	Bolt torque	kN.m				
2-6	Weight	kg				
2-7	Material of different items of clamps					
2-8	Dimension specification	mm				
3	Tension clamp for phase conductors and guard wire					
3-1	Manufacturer's name and country					
3-2	Manufacture's type and designation					
3-3	Rated tensile strength	kN				
3-4	Weight	kg				
3-5	Material of different items of clamps					
3-6	Dimension specification	mm				
3-7	Mould and required press apparatus specification					
4	Mid span joint for phase conductors and guard wire					
4-1	Manufacturer's name and country					
4-2	Manufacturer's type and designation					
4-3	Min. rated slip strength	kN				
4-4	Weight	kg				
4-5	Material of different items of mid span joint					
4-6	Dimension specification	mm				
4-7	Mould and required press apparatus specification					

SCHEDULE FITTING (II)
RATED VALUES AND TECHNICAL SPECIFICATION OF FITTING

ITEM	DESCRIPTION	TECHNICAL SPECIFICATION FOR SYSTEMS WITH FOLLOWING NOMINAL VOLTAGES			
		63/66 kV	132 kV	230 kV	400 kV
5	Repair sleeve for phase conductors and guard wires				
5-1	Manufacturer's name and country				
5-2	Manufacturer's type and designation				
5-3	Min. rated slip strength				
5-4	Weight				
5-5	Material of different items of sleeve				
5-6	Dimensional specification				
5-7	Mould and press apparatus specification				
6	Dampers for phase conductors and guard wires				
6-1	Manufacturer's name and country				
6-2	Manufacturer's type and designation				
6-3	Weight				
6-4	Bolt torque				
6-5	Material of different items of dampers				
6-6	Operation frequency range				
6-7	Dimensional specifications				
7	Spacers for bundle conductors				
7-1	Manufacturer's name and country				
7-2	Manufacturer's type and designation				
7-3	Rated tensile strength				

SCHEDULE FITTING (II)
RATED VALUES AND TECHNICAL SPECIFICATION OF FITTING

ITEM	DESCRIPTION	TECHNICAL SPECIFICATION FOR SYSTEMS WITH FOLLOWING NOMINAL VOLTAGES			
		63/66 kV	132 kV	230 kV	400 kV
7-4	Weight kg				
7-5	Material of different items of spacers				
7-6	Dimensional specification mm				
8	Armor rod for phase conductors and guard wires				
8-1	Manufacturer's name and country				
8-2	Manufacturer's type and designation				
8-3	Weight kg				
8-4	Material of rods				
8-5	Diameter of each strand mm				
8-6	Number of strand				
8-7	Overall diameter with wire conductor mm				
8-8	Dimensional specification mm				
8-9	Turning direction				
9	Counter weight				
9-1	Manufacturer's name and country				
9-2	Manufacturer's type and designation				
9-3	Weight of each set kg				
9-4	Material				
9-5	Dimensional specification mm				

SCHEDULE FITTING (II)
RATED VALUES AND TECHNICAL SPECIFICATION OF FITTING

ITEM	DESCRIPTION	TECHNICAL SPECIFICATION FOR SYSTEMS WITH FOLLOWING NOMINAL VOLTAGES			
		63/66 kV	132 kV	230 kV	400 kV
10	Extension link of guard wire				
10-1	Manufacture's name and country				
10-2	Manufacture's type and designation				
10-3	Bolt torque	kN.m			
10-4	Weight	kg			
10-5	Material of different items of clamps				
10-6	Dimensional specifications	mm			
11	T clamp of phase conductor and guard wire				
11-1	Manufacturer's name and country				
11-2	Manufacturer's type and designation				
11-3	Bolt torque	kN.m			
11-4	Weight	kg			
11-5	Material				
11-6	Dimensional specification	mm			
12	Corona and arcing rings				
12-1	Manufacturer's name and country				
12-2	Manufacturer's type and designation				
12-3	Weight	kg			
12-4	Material				
12-5	Dimension	mm			
12-6	Installation locations				

SCHEDULE FITTING (II)
RATED VALUES AND TECHNICAL SPECIFICATION OF FITTING

ITEM	DESCRIPTION	TECHNICAL SPECIFICATION FOR SYSTEMS WITH FOLLOWING NOMINAL VOLTAGES			
		63/66 kV	132 kV	230 kV	400 kV
13	Warning sphere marker				
13-1	Manufacture's name and country				
13-2	Manufacture's type and designation				
13-3	Color				
13-4	Weight kg				
13-5	Material of different items of warning sphere marker				
13-6	Dimension mm				
14	Insulator set fittings				
14-1	Manufacturer's name and country				
14-2	Manufacture's type and designation				
14-3	Strength kN				
14-4	Weight kg				
14-5	Material of different items of insulator string				
14-6	Dimension mm				
15	Earth wire fittings				
15-1	Manufacturer's name and country				
15-2	Manufacturer's type and designation				
15-3	Rated tensile strength kN				
15-4	Weight kg				
15-5	Material of different item of earth wire fittings				
15-6	Dimension mm				