MAHARASHTRA STATE ELECTRICITY TRANSMISSION COMPANY LTD
(CIN NO- U40109MH2005SGC153646)

Office of the,
Executive Engineer
MSETCL EHV O&M, Division,
Near Market Yard, Bapat Camp, Kolhapur
Tal: - Karvir, Dist-Kolhapur-416 005
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MSETCL/EE/EHV O&M/Dn./Kop/T/LP/ 1143 Date : 23.09.2022.

E- Enquiry (Budgetary offer)

Sub : - Enquiry for submission of budgetary offer for **Providing & Fixing of Bird flight Diverter** for various 220/132/110kV EHV lines under EHV O&M DN, Kolhapur.

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Dear Sir

Budgetary offer are invited by the undersigned for Providing & Fixing of Bird flight Diverter for various 220/132/110kV EHV lines under EHV O&M DN, Kolhapur **on or before:03/10/2022 up to 18:00 Hrs**. The other terms and conditions are as mentioned below.

1) Quotation should be duly filled in and submitted to this office **via post or e-mail – ee3210@mahatransco.in**
2) **This enquiry is solely for collection of offer for estimate purpose & not for work allocation.**
3) The offer should be submitted as per details mentioned below.
4) **Quote rate in prescribed format & Attached Specifications::**

A) **Details are below:**

Particular	Unit	Rate per unit (Incl. of All Taxes)
1) Supply of Bird Flight Diverter	No.	
2) Fixing of Bird Flight Diverter	No.	

Executive Engineer
EHV O&M Dn. Kolhapur.

Hon'ble Supreme Court constituted committee for assessing the feasibility of laying transmission lines underground in Great Indian Bustard Priority and Potential Areas

Date: 31.05.2022

To,
Chairman
Central Electricity Authority

Subject: Preparation of technical standards for Bird Flight Diverters - reg

Sir,

1. Kindly refer to Honourable Supreme Court's order dated 21.04.2022 in WP(C) No. 838/2019, wherein it was directed that, "*the Committee which has been appointed by the Court shall within a month in consultation with the CEA formulate the standards of quality required for the bird divertors so that uniformity can be maintained in the standards to be observed. Necessary steps shall be taken immediately thereafter for ensuring that the time schedule of completing the installation of bird divertors in the priority areas associated with the Great Indian Bustard and Lesser Florican is observed by all power producers in Gujarat and Rajasthan.*" The committee vide letter dated 20.05.2022, had requested Hon'ble Supreme Court to grant time extension till 31.05.2022 to formulate and submit the Technical Specifications for Bird Flight Diverters (BFD).

2. In compliance with the above order, videoconference (VC) meetings of the Committee were held with CEA on 18.05.2022 and 30.05.2022 to discuss various technical and compliance issues related to technical specifications of BFD. Accordingly, the Technical Specifications for BFD has been developed in consultation with CEA and is enclosed herewith.

3. It is requested that the same may please be circulated to concerned utility agencies for further necessary actions.

Thanking you,

Yours sincerely,

Dr. Rahul Rawat
Scientist 'C'
MNRE

31.05.2022

Dr. Sutirtha Dutta
Scientist D
Wildlife Institute of India

31.05.2022

Dr. Devesh Gadhavi
Deputy Director
The Corbett Foundation

Technical Specifications for Bird Flight Diverter

1 Background

The collision and electrocution of Great Indian Bustard (GIB) and other birds with the overhead power transmission lines is one of the major causes of death of these birds. The Great Indian Bustard is a flagship species of India, the State bird of Rajasthan, and is a Critically Endangered/near-extinct species. Bird Flight Diverter is identified as one of the measures to avoid the chances of collision of birds with transmission lines.

Bird Flight Diverter (BFD) designs available with different manufacturers in the market are not similar, and it becomes difficult for the utilities to procure suitable diverters for their requirements meeting environmental conditions. Moreover, the size, colour, operating temperature, grip strength, & other construction features of Bird Flight Diverter, installation, and testing are important features/parameters that need to be standardised. Keeping in mind the difficulties faced by the utilities, there is a need for standardisation of Bird Flight Diverter's specifications so that similar types of bird diverters are installed on the power transmission & distribution lines across the country. This guideline on Technical Specifications of Bird Flight Diverters has been developed as directed by Hon'ble Supreme Court in WP No. 838/2019 by the SC Committee in consultation with CEA, based on the existing document prepared by CEA on this subject.

The specification broadly covers general technical requirements, major design parameters, the requirement of certification, type tests and test procedures. Installation guideline is not part of this document and will be suggested separately by the Committee.

2 General Technical Requirement

a) Bird Flight Diverter must be dynamic type and shall consist of warning disc (2-D or 3-D in design) and associated clamps & connectors.

b) The dynamic solar-powered LED type Bird Flight Diverter shall be preferred in areas where foggy/dusty weather persists, or the intensity of light is low, or the sections of the lines lying in the route of migratory birds. Since the Great Indian Bustard habitats in Rajasthan and Gujarat satisfy the above criteria, LED type BFD should be installed there, especially in the 'Priority' and 'Potential' areas identified by Hon'ble Supreme Court of India vide its order dated 19.04.2021. The utility may install a mixture of LED and Non-LED BFD on their powerlines, where at least one in five (20% of total) BFD on a line should be LED type.

c) Bird Flight Diverter shall be suitable for efficient working and shall retain good physical characteristics under all weather conditions.

d) Bird Flight Diverter (BFD) shall be designed for an expected service life of at least 15 years.

e) BFD shall be suitable for installation on the live line.

f) The iron, steel or other metal parts used in the diverter must be corrosion proof and should withstand all weather conditions.

3 Design Parameters

3.1 Warning Disc

For visibility of Bird Flight Diverter, a warning disc shall be provided. The warning disc shall:

a) Have glow in the dark feature. Glow in the dark shall remain activated for at least 12 hours after exposure to sunlight. If glow in the dark sticker is used, the same shall be of high

quality with strong adhesive property, laminated, and suitable for all weather conditions.

b) The warning disk in the BFD should have strong luminescence properties that emit immense light to provide enhanced visibility to the birds at night.

c) Have contrasting coloured (combination of any two colours from White, Black, Red, Yellow, Orange,) retro-reflective surface with Sun and Moonlight reflectors on both faces. Since the warning disc is to be designed to rotate, the colour change, while revolving, shall provide significant forewarning.

d) Swing, sway and rotate easily.

e) Must not flip on the powerline in high wind velocity.

f) Be resistant to all weather conditions

g) Be aerodynamically stable so that diverter faces a minimum amount of drag force which provides a swing and rotation effect under medium/strong wind speed.

h) Be made of UV stabilised plastic. The bearing shall be made of stainless steel and should allow free spinning at a minimum wind speed of 1 km/hour.

i) Be made of a sealed bearing to avoid deposition of sand and/or soil particles and helps in smooth rotation.

j) Have a diameter of not less than 150 mm for a circular disc. If the warning disc is quadrilateral or trapezoid or of any other shape, then the shortest arm length shall not be less than 90 mm. The total surface area of the warning disc should not be less than 15,000 mm2 (including air vents).

k) The thickness of not less than 3 mm.

l) The reflective area on each face of the warning disc should not be less than 3500 mm2. And the glow in the dark area should not be less than 3500 mm2 for the LED type BFD, and not less than 7500 mm2 for the non-LED type BFD.

3.2 Weight of BFD

The total weight of the Bird Flight Diverter shall not be more than 800 gm. LED type bird flight diverter should not weigh more than 1000 gm.

3.3 Length of BFD

From connection point to end, the length of the bird diverter should not be more than 430 mm.

3.4 Clamp & Hardware:

The warning disc shall be suitable for hanging on conductor/earth wire (or OPGW), by means of clamp & hardware. Design details are as follows:

The clamp for holding conductor/OPGW/earth wire shall be spring type and shall be made of UV stabilised engineered composite plastic (polymer) or metal or carbon fibre and shall be suitable for live line installation by hot stick or drone.

a) All metal hardware used in Bird Flight Diverter, including bearing, must be corrosion-free material.

b) All plastic (polymer) parts must be UV stabilised.

c) The holding clamp must be suitable for gripping the conductor/OPGW/ earth wire strongly; otherwise, due to aeolian vibrations/high wind speed, diverters may shift and move from their original position and get collected at mid-span (lowest sagging point). Rubber/polyurethane lining shall be used in the gripping area of the clamp as per the requirement of the conductor type.

d) More than 50% of the clamp gripping area shall be in contact with earth wire/OPGW/Conductor.

e) Clamp shall be free from sharp ends or edges, abrasions, projections, grit or materials; and shall not cause chafing or damage to the conductor/earth wire/OPGW during fitting or during continued operation.

f) Parts of the clamp touching conductor must be able to withstand temperature ranges' from -15 °C to +85 °C for conventional conductors. In case of installation on HTLS conductor, the utility shall specify maximum operating temperature under emergency loading conditions.

g) The clamp must be able to bear a pulling load of at least 50 kg, and it is to be tested on Universal Testing Machine by a NABL accredited laboratory.

h) **Grip retaining strength:** The clamp shall have a smooth and permanent grip to keep the Bird Flight Diverter in its original position

on the conductor/earth wire/OPGW without damaging the strands or causing premature fatigue failure of the conductor/earth wire/OPGW due to clamping pressure. The clamp should not slip beyond the permissible limit as specified in the test procedure in **Annexure** when pulled by a force of 25 Kg in the direction parallel to conductor/earth wire/OPGW.

i) In the case of metallic bird diverters, the parts of the clamp touching conductor/earth wire/OPGW must be made of a material which is a bad conductor of electricity.

3.5 Additional requirements for LED type BFD

For solar-powered LED type diverter, the following additional requirement shall be fulfilled:

(a) LED shall be of Orange or White colour or a combination of both (one white followed by one orange arrangement system) with adequate light intensity so that it is clearly visible from a distance (>300 m) even during foggy/dusty weather/under the low intensity of light.

(b) The battery shall guarantee a service life of 5 years and be suitable for at least 100 hrs of flashing operation by a single charge.

(c) An automatic power cut-off electronics circuit shall be provided to improve battery life so that during daytime (due to the high intensity of light from the sun), the circuit gets cut off & stops flashing, and the circuit switches on automatically under low-intensity light conditions.

(d) The position of the solar cells shall be such that it gets sunlight irrespective of the direction of the diverter face, and the dust & snow does not decrease its efficiency.

4 Tests & certifications:

4.1 Type Tests

The buyer/purchaser/utility/power agency must get reports/certificates for the following type tests conducted by the testing laboratory accredited by NABL or any accreditation body as per relevant ISO/ IEC/ IS standards. All of the following tests shall be conducted on the same sample. However, No. of Samples for type tests shall be as per the relevant standard or procedure specified in **Annexure**. Type test report/ certificate shall be valid for 10 years from the date of successful completion of tests for manufacturing.

a) Mechanical Strength test **(As per Annexure)**:
   - Direct Pull Test (50 kg by Universal Testing Machine)
   - Clamp Slip Test/Grip Retaining Strength Test (25 kg force)

b) Vibration test **(As per Annexure)**

c) Temperature cycle test **(As per Annexure)**

d) Heating cycle test **(As per Annexure)**

e) Radio Interference Voltage and Visual Corona Test **(As per Annexure)** (applicable for bird diverters for use on transmission lines at 220 kV and above)

f) Corrosion Resistance Test: Salt fog (at 5% salt solution) and Humidity test (at 90% Rh) as per procedure in accordance with MIL-STD 810F (method 509.4 and Method 507.4)

g) Ageing tests - solar radiation test & sand and dust test as per procedure in accordance with MIL-STD 810F (Method 505.4 proc II and 510.4 proc I)

Note: The Mechanical Strength Tests shall be carried out before and after Ageing Test.

4.1.1 Acceptance tests:

Following acceptance tests shall be carried out on at least 20 samples in the presence of the representative of the purchaser:

a) Visual Examination Test (As per Annexure)

b) Verification of Dimensions (As per Annexure)

c) Mechanical Strength test* (As per Annexure):

- **Direct Pull Test (50 kg by Universal Testing Machine)**
- **Clamp Slip Test/Grip Retaining Strength Test (25 kg force)**

***Only one of the 20 samples shall be subjected to the ultimate failure load.**

4.2 Warranty Period:

All bird diverters should come with a warranty period of at least 5 years. The warranty shall cover all components of the diverter. If defect/damage/failure of any component is noticed during the warranty period, the diverter shall be liable for replacement.

4.3 Quality control & monitoring:

Manufacturers of BFD must ensure that their products are as per the above standards and qualify for the tests mentioned in this guideline. The utility agency must ensure that the purchased BFDs are certified by by the testing laboratory accredited by NABL or any accreditation body as per relevant ISO/ IEC/ IS standards. The utility agency must also monitor BFDs installed on their powerlines on a quarterly (every three-month) basis and replace all defective pieces.

4.3.1 Monitoring for future refinements of Technical Specifications of BFD:

Since the development and deployment of Bird Flight Diverters are an emerging field in India, there is ample scope of improving the quality of these devices from learnings based on assessment of their field durability and effectiveness. Hence, a mechanism may be explored to carry out routine field inspection / monitoring of installed BFD and develop a shareable information repository for further required refinements of these Technical Standards by a suitable committee or agency as per further directions by Hon'ble SC, if any.

Annexure

Test Procedures

1. Visual Examination Test

Bird diverter assemblies shall be visually examined for general finish and good workmanship.

2. Verification of Dimensions

The dimensions of the bird diverter assembly, including area of warning disc, reflective area and glow-in-dark area, shall be checked against approved drawings and requirements given in the technical specification.

3. Vibration Test

The tests shall be conducted in a laboratory set up with a minimum effective span length of 30 m for conductor, earthwire and OPGW separately. The conductor/earthwire/OPGW shall be tensioned at 25% of their Ultimate Tensile Strength (UTS). Constant tension shall be maintained within the span by means of lever arm arrangement. The span shall be equipped with vibration inducing equipment suitable for producing steady standing vibration. The inducing equipment shall have facilities for stepless speed control as well as stepless amplitude arrangement. Equipment shall be able to measure the frequency, cumulative number of cycles and amplitude of vibration at any point along the span.

Four number of Bird Diverters shall be clamped to the conductor /earthwire/OPGW in and around the middle of the test span. These bird diverters shall be free to vibrate and shall not be re-torqued or adjusted between the tests. The frequency of vibration is so chosen as to get an odd number of loops. The shaker shall be positioned at least two loops away from the test specimens to allow free movement of the conductor /earthwire/OPGW close to the test specimens. The conductor /earthwire/OPGW shall be connected to the shaker and vibrated to an amplitude such that

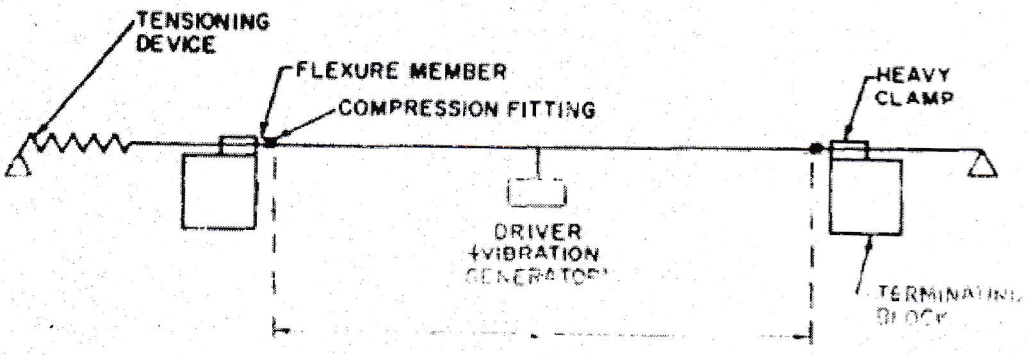
$f^{1.8} Y_{max} > 1000$ mm/sec.

Where Y_{max} being the antinode displacement (mm) and f is the test frequency (Hz).

The test frequency shall be greater than 24 Hz and the total number of cycles shall be more than 10 million. The bird diverter shall withstand the vibration test without slipping on the conductor/earthwire/OPGW, loosening, damage or failure of component parts.

After the completion of test, the same bird diverter shall be subjected to mechanical strength test (direct pull test & clamp slip test) as per the procedure given and the sample shall be able to withstand the tests without damage/deformation.

A representative , diagram of test assembly is given below.



4. Temperature Cycle Test

The complete bird diverter assembly shall be quickly and completely immersed, without being placed in an intermediate container, in a water bath maintained at a temperature of 85°C and left submerged at this temperature for 15 minutes. The sample then shall be withdrawn and quickly & completely immersed, without being placed in an intermediate container, in the cold water bath maintained at a temperature of -15°C where it shall remain for 15 minutes. The sample shall be subjected to 10 such cycles.

The time taken to transfer from either bath to the other shall be as short as possible and never exceed 30 seconds. The quantity of water in the test tanks shall be sufficiently large for the immersion of the samples so as not to cause a temperature variation of more than ±5°C in the water.

After completion of 10 cycles, the sample shall be examined to verify that the sample has not deformed/damaged.

5. Heating Cycle Test

The heating-cycle test shall be carried out on an assembly of conductor & bird diverters and heated by passing a current through the assembly. The conductor shall be tensioned at 20 percent of its Ultimate Tensile strength (UTS) and shall be erected indoors so that the conductor is roughly horizontal. Air shall be able to circulate freely around the assembly which shall not however be exposed to draughts.

The sample shall be connected on the conductor in accordance with the manufacturer's recommendations. The minimum length of conductor used for determining this current shall be 2 m. The test current shall be that power frequency current which raises the surface temperature of the conductor to the specified maximum operating temperature of the conductor and maintains the temperature at a steady value. The test current shall be passed continuously through the assembly for a period of 30 min or such longer period as may be necessary to bring the reference conductor to the specified maximum operating temperature of conductor ±2.5 °C. The current shall then be interrupted and the conductor shall be allowed to cool to within 5 °C above the ambient temperature. The conductor temperature shall be measured near the centre of the test length.

This sequence of operation shall be repeated so that 250 cycles of heating and cooling are applied. The sample shall not be tightened or adjusted during the test. The sample shall afterwards be opened and there shall be no sign of local heating, burning or fusing of any part of the sample or of the conductor, as a result of the test.

6. Mechanical Strength Test

Following Mechanical Strength Tests shall be carried out on the bird diverter after completion of Vibration Test, Temperature Cycle Test, Heating Cycle Test, Corrosion Resistance Test and Ageing Test.

a) Direct Pull test:

The clamp of the completely assembled Bird diverters shall be subjected to a load equal to 50% of the specified load of 50 kg (using Universal Testing machine) which shall then be increased at a steady rate to 67% of the specified load. The load shall be held for five minutes and then removed. After removal of the load, the assembly and its components shall not show any visual

deformation and it shall be possible to disassemble them. The clamp shall then be reassembled and loaded to 50% of specified load. The load shall be further increased at a steady rate to the maximum load of 50 kg and shall be held for one minute. No damage /deformation should occur during this period. The applied load shall then be gradually increased until the failing load is reached and the value shall be recorded.

b) Clamp Slip Test/Grip retaining strength test:

The test shall be carried out as per IEC 61854 (Fig. 1a). The tests shall be performed separately using conductor, earthwire, and OPGW. The conductor/earthwire/OPGW, free of any defects or damage, shall be tensioned to 20% of its rated tensile strength. By means of a suitable device (see fig. 1a of IEC 61854), load shall be applied to the clamp along the axis of the conductor/ earthwire/OPGW and shall be gradually increased (not faster than 100 N/s or 10 Kgf/s) until it reaches the specified minimum slip load of 250 N or 25 Kgf. The load shall be kept constant for one minute. The movement of the clamp relative to its original position on the conductor/ earthwire/OPGW shall be observed. The clamp should not slip more than 10 mm and there should not be any damage / deformation of the bird diverter and the conductor/earth wire/OPGW. Thereafter, the load shall be increased gradually in steps of 25 N or 2.5 kgf and shall be kept constant for one minute at each step. The slippage at each step shall be recorded. The process shall be continued till the slippage is observed to be more than 10 mm from its previous position and the corresponding load shall be recorded.

7. Corona Extinction Voltage Test (Dry)

The sample, when subjected to power frequency voltage, shall have a corona extinction voltage of not less than that stipulated in the Table below. The test shall be carried out as per IEC: 61284. The atmospheric condition during testing shall be recorded and the test results shall be accordingly corrected with suitable correction factor as stipulated in IEC 60060-1.

8. Radio Interference Voltage Test (Dry)

Under the conditions as specified above, Radio Interference Voltage (RIV) level of the sample shall be less than the values stipulated in the Table given below. The test procedure shall be in accordance with IEC 61284.

Sl. No.	Voltage level	Minimum Corona Extinction Voltage (kV)	Maximum radio interference voltage (at 1 MHz under dry condition (micro volts)
1	**765kV**	508	1000 (at 508 kV rms)
2	**400kV**	320	1000 (at 320 kV rms)
3	**220kV/230kV**	156	1000 (at 156 kV rms)