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Specification – Western Grid**

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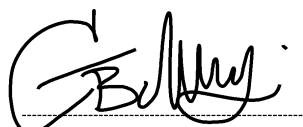
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## REVISION CONTROL

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## 1. PROJECT DESCRIPTION

The purpose of this specification is to set out the remedial measures needed to increase the life expectancy of the Cross-rope or Guyed Vee towers and to minimise the risk of a possible tower and line failure. This will be done through the restoration and treatment of the guy anchor links for various states of corrosion.

All activities that are performed by the contractor should be recorded and assist the engineer in evaluating the method statements and Safe Work Procedure prescribed by the contractor. The use of cameras to record the activities should be promoted during the Guy anchor restoration and contractors should price for such activities.

(Note: This Specification is valid for lines in the Western Grid. Eskom LES must be consulted per project to check if the information in this specification is applicable to that particular project scope.)

### 1.1. Technical tender evaluation criteria

For the technical tender evaluation, the score sheet provided in the document package will be used with the given weighting criterion and weighting per discipline in multidisciplinary packages to evaluate each tenderer. Points will be provided and evaluated according to the matrices in technical tender evaluation form.

## 2. APPLICABILITY

This guideline shall be applicable to Eskom's Transmission Division and has been specifically adapted for use on Cross – rope and Guyed – Vee structures in the Eskom Transmission Western Grid.

## 3. NORMATIVE REFERENCES

- Eskom Transmission Line Towers and Line Construction Specification TRMSCAAC.6
- Access to Farms Procedure TPC41-340
- Fencing Act No. 31 of 1963

## 4. DEFINITIONS AND ABBREVIATIONS

### Landowner

A landowner is defined for the purposes of this document as the owner of the land, registered as such in the Deeds Office, his/her assignee, representative or the legal occupier, manager, or lessee of the land.

### Contractor

Any company or person that performs work for or on behalf of ESKOM Transmission on the servitude or line.

### Employer

Eskom Transmission Western Grid.

### Corrosion category

A predefined state of corrosion as defined in this specification.

### Scabbling

Exposing of underlying concrete by chipping away surface layer.

### Link

A steel plate or round bar attached to the end of the tower anchor stay wire assembly and anchored into the concrete stay wire foundation.

## 5. DESIGN OF FOUNDATIONS

The Contractor shall be responsible for the detailed designs of foundations, anchor links, temporary anchors and HD bolt arrangements that might be required by this specification.

## 6. RESTORATION OF ANCHORS

### 6.1. Exposure of Anchor Foundation

#### 6.1.1 Inclined Pile Anchor Foundations

There are guyed anchor towers that have inclined pile anchors, where concrete of anchor foundation extends above the natural ground level (NGL). There are some of these anchors where the foundation concrete surface lies below, but not lower than 500mm below the NGL. The contractor must assess every tower and repair accordingly.

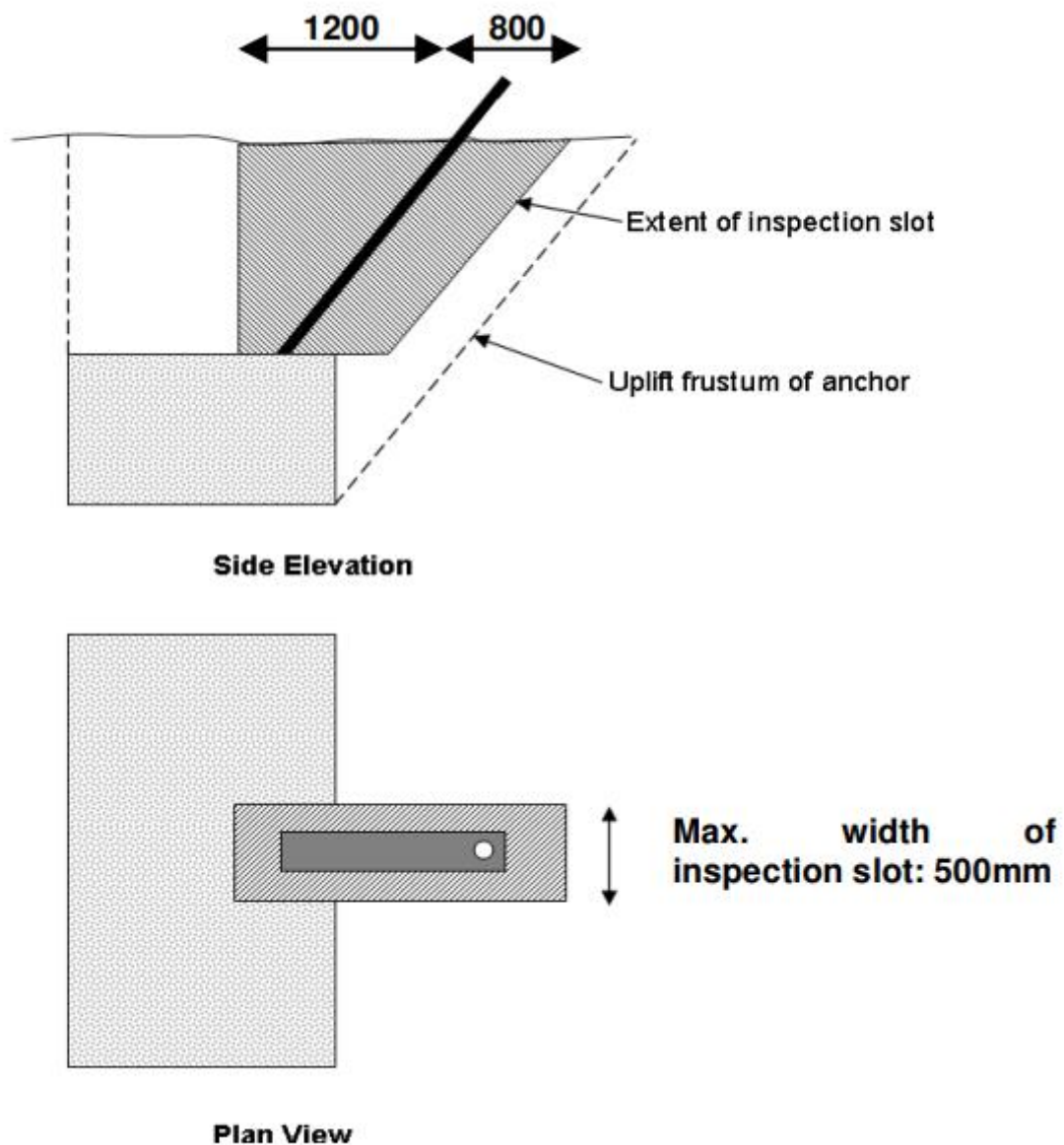
It might be required to clear and expose the anchor foundation concrete during construction, which can be done with a hand brush. The anchor link must be exposed to the level of concrete on the top of the pile.

#### 6.1.2 Deadman Anchor Foundations

Deadman anchor links are to be exposed to the top of the foundation concrete (this can be a depth of up to 2 meters). **The extent of exposure must be carefully controlled to avoid weakening of the foundation.**

This may be accomplished using a metal template or frame which is laid on the ground, beyond which excavation is not permitted.

The extent of excavation must be limited to a 500mm wide trench, as shown in Figure 1 below:



**Figure 1: Excavation limits on Deadman Anchors**

## 6.2. Cleaning of Corroded elements

Prior to assessment of the corrosion condition – corroded elements (the anchor link) must be thoroughly cleaned, by means of wire brushing, washing with water, and drying. No sandblasting is to be done on this stage of the assessment process.




### 6.3. Assessment of Corrosion

For the appropriate restoration measures to be applied consistently, corrosion must be categorised. The level of corrosion, defined as corrosion categories of the anchor links, will predict the restoration and or treatment process.

Corrosion assessment categories have been identified with a scale from 1 to 7 in Table 4 below. These categories in turn trigger one of three restoration options.



**Table 1: Corrosion Assessment Table**

Assessment Category	Corrosion Condition	Pictures	Restoration Category
1	No visible signs of galvanic depletion. Galvanising thickness 60 microns or more.		No Corrosion
2	No visible signs of galvanic depletion. Galvanising thickness 30 – 59 microns.		
3	Galvanising visibly depleted. Onset of steel discolouring.		Light Corrosion
4	Galvanising almost depleted. Thin film of rust developing on surface.		
5	Deeper rust hardened crust / Pitting in smaller areas of 2 cm.		
6	Component rusted through more than 30% of cross-sectional area.		Severe Corrosion
7	Component rusted through more than 60% of cross-sectional area and/or completely disintegrated.		

Each corrosion assessment is to be accompanied by a digital photograph in which the following information is indicated on a board held in front of the corroded element:

- Tower number
- Foundation leg (A to D)
- Corrosion category (1 to 7).

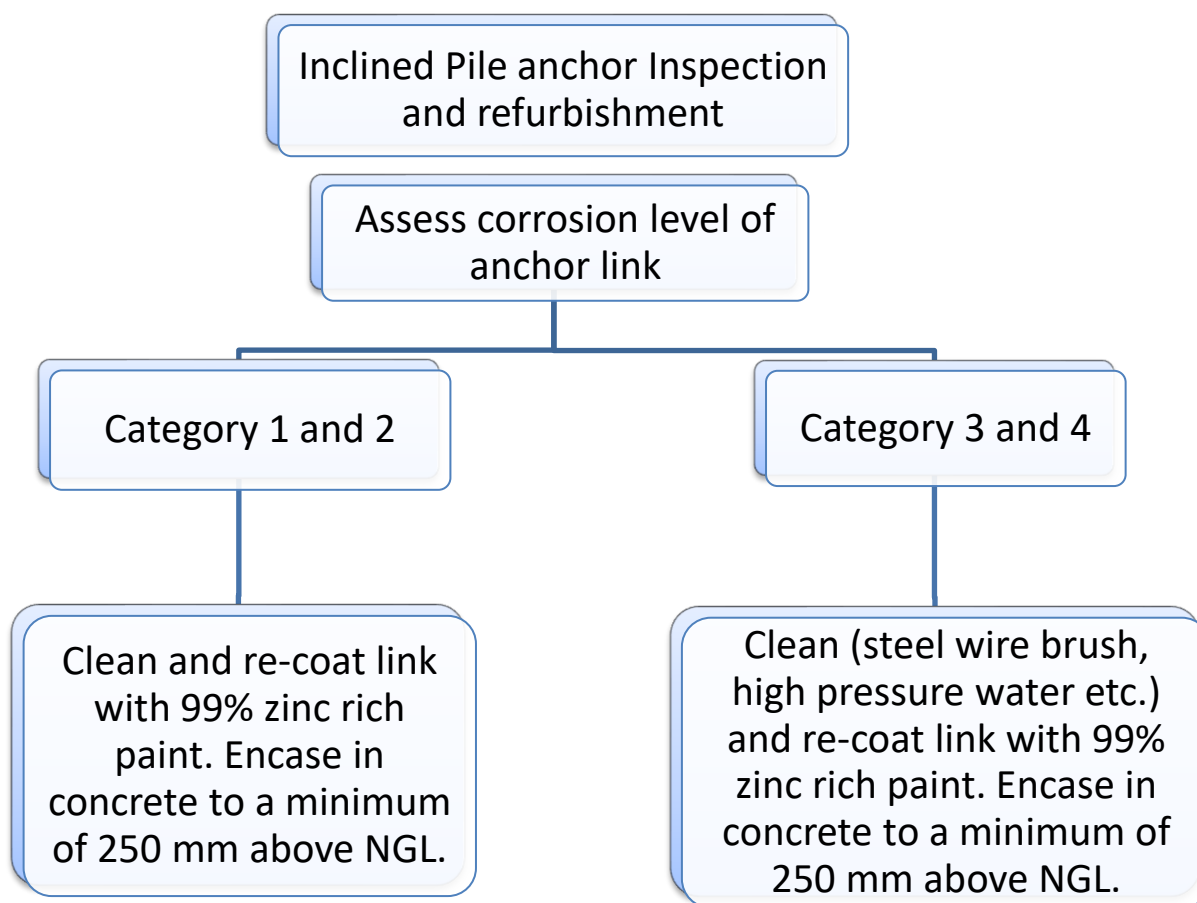
The pictures must show at least 4 different side of the corroded element at close range.

All photographs will become part of the as built records.

## 6.4. Restoration and Treatment of Guy Anchors

### 6.4.1 Inclined Pile Anchor Foundation

Most of the inclined pile anchor foundation concrete extends approximately 150mm above the NGL. There are, however, several inclined pile anchors where the concrete is not more than 500mm below the NGL. The refurbishment of the inclined pile anchors must involve the following procedure in Figure 2 below:

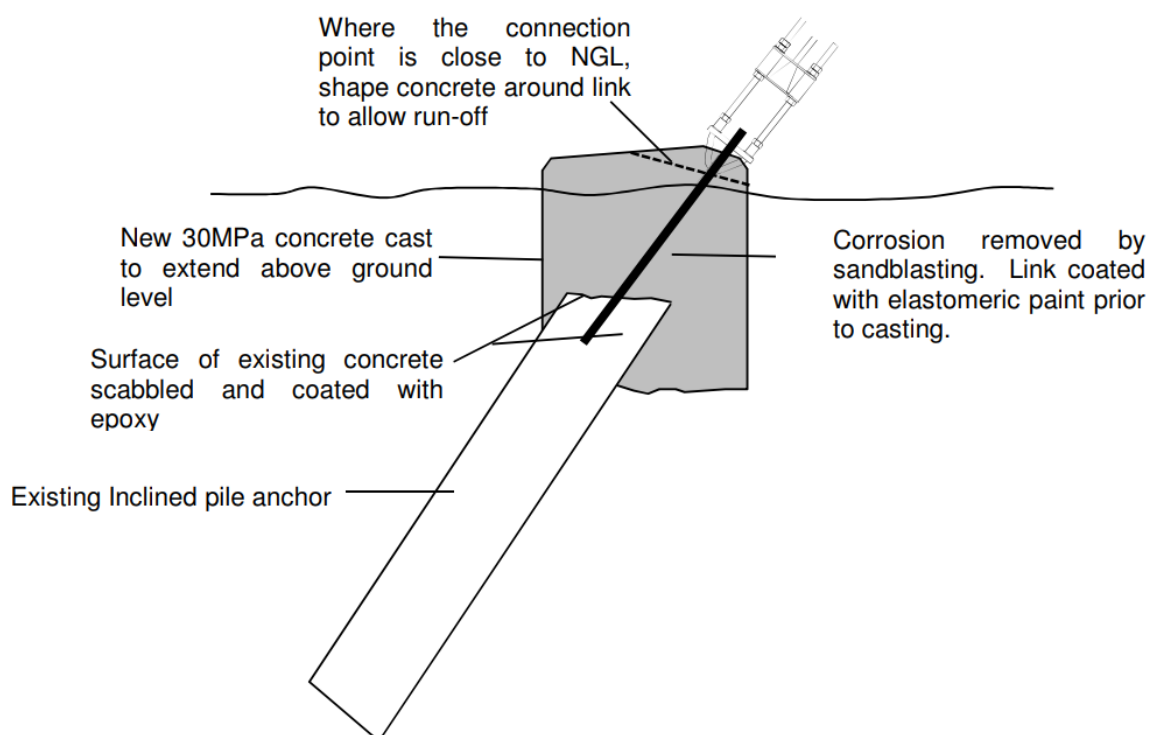


**Figure 2: Flow chart - assessment and refurbishment of incline pile anchors**

Prior to the construction of the encasement (see Figure 3), any signs of corrosion on the anchor link (normally just above the concrete) must be removed through sandblasting. Two coats of 99% zinc rich paint shall be applied prior to the final concrete encasement. This coating must be applied to the total length of the anchor plate.

All inclined pile anchors' concrete encasements must be extended to a level of at least 250mm above the NGL, without encasing the anchor link couplings. The link is to be encased in 30MPa concrete to 250mm above natural ground level. Scabbling of the old concrete and the use of wet to dry epoxy will be required prior to the casting of the concrete. Where the U-bolt is less than 250mm above NGL, the encasement shall extend up to the U-bolt (Without cover the U-bolt).

NB: The concrete must be up to the dashed line as shown in Figure 1 below, i.e., the concrete should end before/under the service hole of the pile anchor. This will prevent the breakage of the concrete due to vibration.



**Figure 3: Encasement of un-corroded / lightly corroded inclined pile anchor**

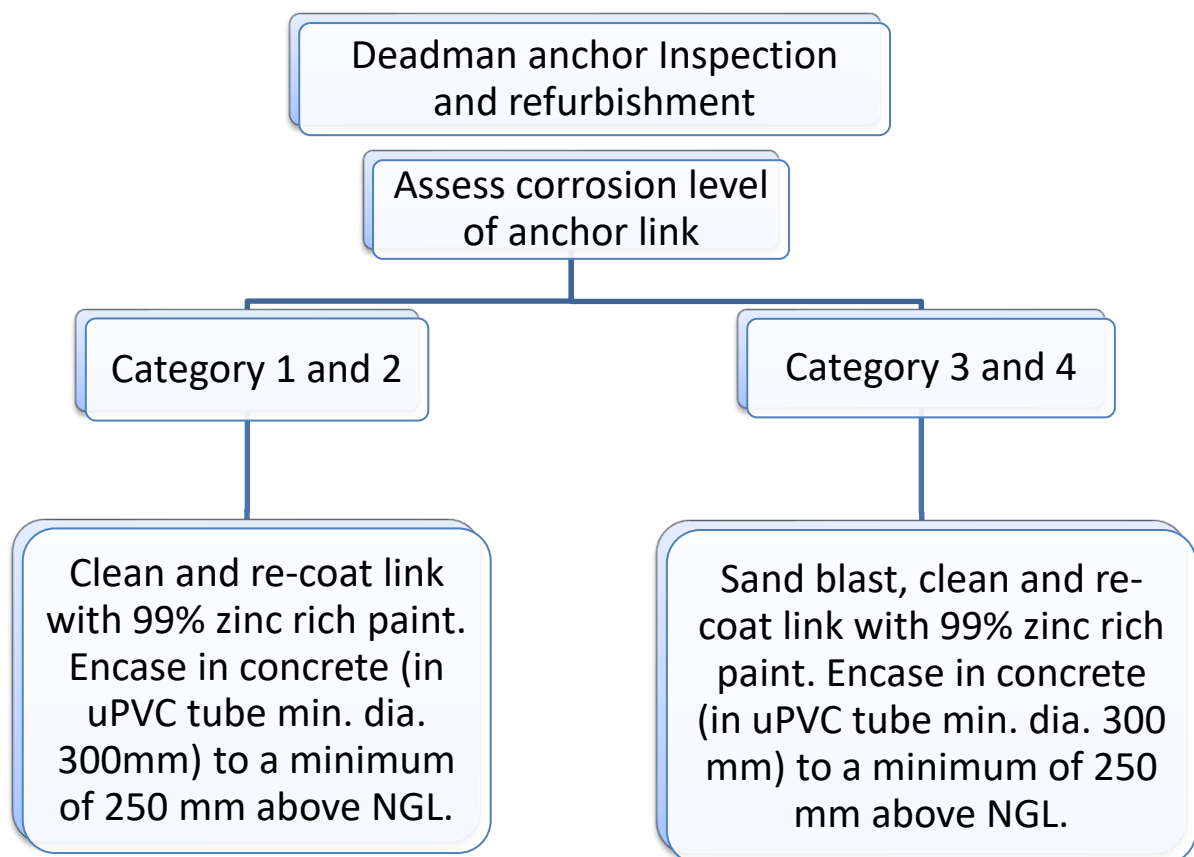
The contractor to submit a proposal on measures to be implemented to bond the existing concrete and the new concrete to LES for acceptance.

#### 6.4.2 Deadman Anchors

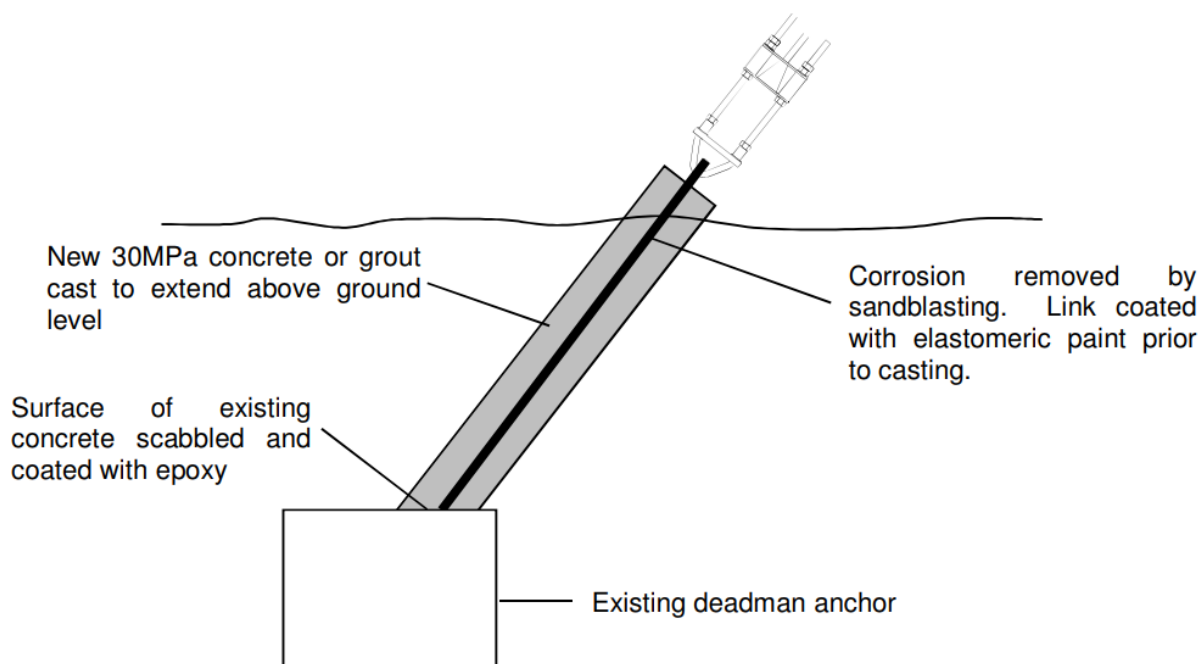
The restoration process of dead man anchors will entail the following procedure:

- The total length of the link must be exposed to the level on the top of the concrete, while taking care to stay within the maximum dimensions as per Figure 1 above.
- An assessment will need to be done of the corrosion condition. Only category 1, 2, 3 and 4 will be applicable.
- All rust needs to be removed by soft wire brushing (category 1 & 2) and sand blasting for category 3 & 4.
- Metal surfaces are to be cleaned and coated with 2 coats of 99% zinc rich paint, or similar approved.
- The exposed link is to be encased in 30MPa concrete to 250mm above natural ground level using a 300mm diameter uPVC pipe. Larger diameter tubes may be used where applicable. This encasement method will be applicable to all dead man anchors.

The refurbishment of the dead man anchors should involve the following procedure:



**Figure 4: Flow chart - assessment and refurbishment of Deadman anchors**



**Figure 5: Refurbishment of Deadman anchors**

Where the U-bolt is less than 250mm from the ground level, the encasement shall extend up to the U-bolt (Without covering the U-bolt). A minimum cover of 50mm is to be maintained to encased steel. The contractor to submit a proposal on measures to be implemented to bond the existing concrete and the new concrete to LES for acceptance.

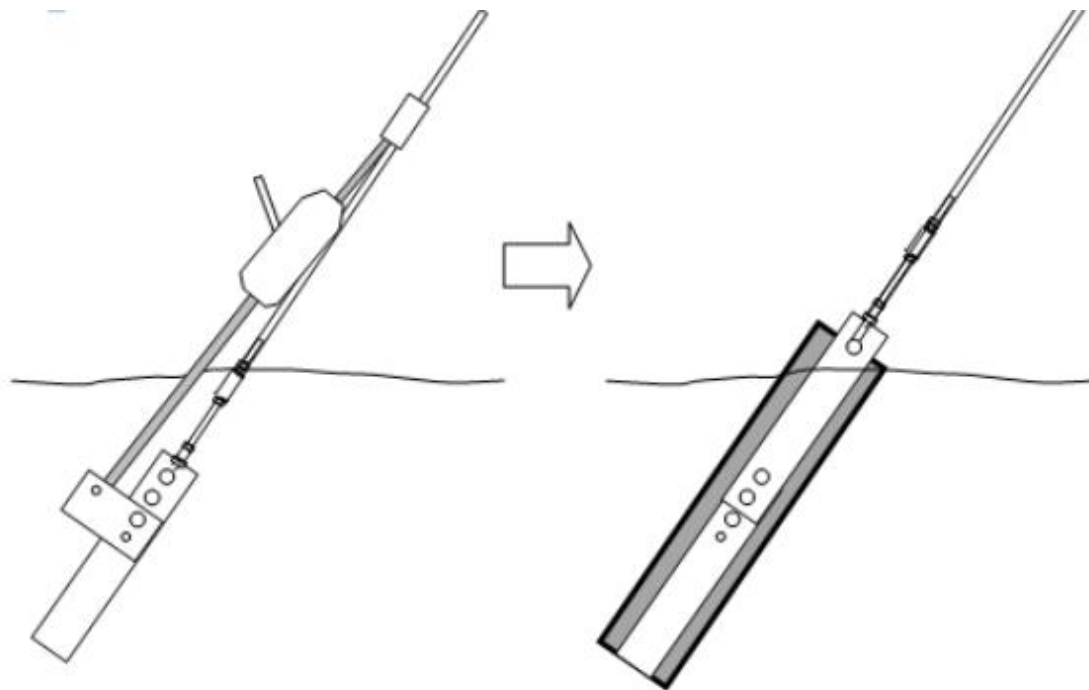
The tube is to be split to fit over the anchor link and sealed with fibre reinforced tape after fitment to ensure a mortar tight seal on the split seam. The concrete should end before/under the service hole of the link plate. This will prevent the breakage of the concrete due to vibration.

#### **6.4.3 Deadman anchors couplings below natural ground level**

Any tower that has anchors that are on or below natural ground level (NGL), the contractor must assess the line and verify the number of the affected foundations. The anchor plates should be extended above NGL by extending the existing anchor plate to a height of 1 – 1.5 meters above the NGL and encased in a 300mm PVC pipe filled with concrete.

A temporary anchor or attachment arrangement onto the existing stay plate will be required to decouple the u-bolt from the existing anchor to be able to attach the extended the stay plate. See Figure 6 below.

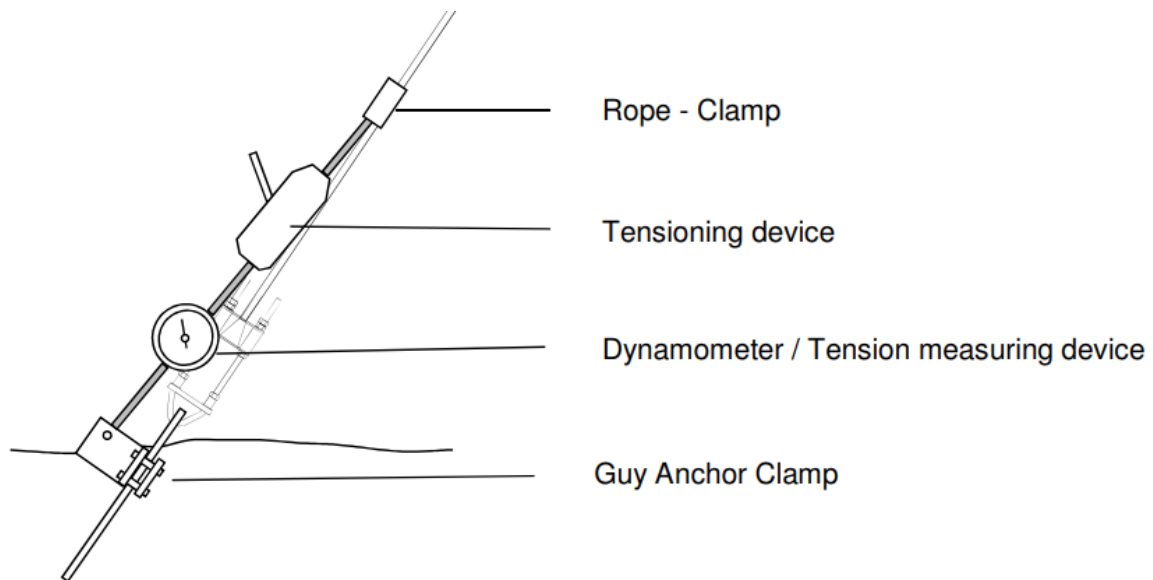
This activity must be confirmed and supervised by an Eskom representative.



**Figure 6: Refurbishment of anchors with low corrosion and coupling below the natural ground level.**

## 7. RETENSIONING

Guy tensioning will need to be checked and corrected where applicable. The correction of the guy tension can be achieved by adjusting the U-bolt, which must be included in the scope of work on restoration contracts. Figure 7 below shows a typical re - tensioning system arrangement that can be used on lines. All towers and hardware to be inspected before any tensioning can be done.



**Figure 7: Typical Re - tensioning system arrangement**

## **8. CONCRETE MIX DESIGN**

Concrete shall be batched and placed in accordance with the Line Construction Specification TRMSCAAC 6. Concrete mix designs shall be proportioned to obtain a minimum required strength of 30MPa and a target strength of 35MPa.

CEM II cement containing fly ash shall be used to prevent the development of an Alkali- Silica reaction. The maximum stone size for all concrete is 6mm, to aid in the compaction of concrete in constricted spaces.

## **9. ACCESS AND ENVIRONMENTAL ASPECTS**

For access onto the ESKOM servitude to carry out the work, the contractor will adhere to ESKOM'S Guideline on Farm Access (TPC41-340). The contractor will also need to be appointed in terms of Eskom's High Voltage Regulations to work on ground level. Access to site will also need to be obtained before any construction will be allowed to commence.

Region specific policies and procedures with respect to the accessing of servitudes must be strictly adhered to, to maintain sound landowner relationships.

No heavy construction vehicles will only be allowed during construction work. All vehicles will always remain within the servitude and within the tower anchor boundaries.

## 10. SAFETY

For the restoration of the anchor links accurate safety measures will be applicable.

The Contractor must prepare Safe Work Procedure (SWP) for all activities to be done on this project.

SWP must highlight the risks in every operation and the methods employed to minimize and accommodate such risks. It is not considered necessary to use temporary stays for the initial inspection and assessment of the link condition and on-site cleaning and treatment of lightly corroded steel provided that:

- a) The Contractor does not expose more than the recommended extent of soil over anchors and makes use of hand excavation and an excavator.
- b) No work is executed during winds in excess of 35km/h – specifically referring to the restoration on the dead man anchors.
- c) Adequate SWP and supervision is provided to ensure the above.

A Health and Safety Plan will be compiled by the Contractor and submitted to Eskom for approval. The Contractor must make provision for this plan in his quotation.

It is also not considered necessary to use temporary shoring of excavations, provided that the excavation sides are inspected by a suitably qualified person and certified as having no risk of total collapse.

No uncoupling of any guy or anchor is permitted,

No climbing of towers is permitted and all work to be done at ground level.

No outages will be required.

Safety regulations applicable to groundwork under power lines will need to be followed.

Line 'ARC OFF' settings shall be considered for restoration of category 6 and 7 anchor links and requested by the Contractor if required.