

Doc. No.: TPDF02-DIS01-OCP-020

OCP - ERECTION OF HT OVERHEAD (OH) LINE

Rev. No. /Dt: 00 /01.12.2021

DOCUMENT CONTROL

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1	1	0	01.12.2021	First Issue	Shilajit Ray Satish Shah	Snehal Shah Abdulrashid Shaikh
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1. PURPOSE

1.1. Erection of 22 kV & 11 kV Overhead (OH) Line

2. SCOPE OF DOCUMENT

- 2.1. The scope of this document is to define a structured activity-level flow for Erection of 22 kV & 11 kV Overhead (OH) Line.
- 2.2. The process document aims to define the guidelines to ensure the process effectiveness as required by the Integrated Management System.

3. FIELD OF APPLICATION

3.1. This procedure is used for Erection of 22 kV & 11 kV Overhead (OH) Line in TPL-D's Franchise areas of Bhiwandi and SMK.

4. FREQUENCY

4.1. As and when required

5. AUTHORITIES AND RESPONSIBILITY

- 5.1. The Head of Department is responsible for Execution & implementation of this procedure for effectiveness
- 5.2. The Head of HT O&M/Projects at respective locations are responsible for execution of this procedure for effectiveness.

6. REFERENCES

- 6.1 Guideline # TPDF02-DIS01-GDL-001_Guideline for HV Network Design
- 6.2 Guideline #TPDF02-DIS01-GDL-003_Guideline for Applicable Legal Requirement
- 6.3 OCP # TPDF02-SAQ02-OCP-006 (Operational Control Procedure for Handling, Collection, Storage and Management of Hazardous Waste)

7. SPECIFIC COMPETENCY REQUIREMENTS

- 7.1. Technician/GET/Jr. Exe/Exe/AM/M should have Knowledge of
 - (1) O&M of Overhead Line equipment
 - (2) Safe working practices and use of PPE
- 7.2. Technician/GET/Jr. Exe/Exe/AM/M having valid authorization from General Manager Distribution shall have authority for electrical isolation and issue of PTW

8. INTERFACE WITH OTHER DEPARTMENTS/SECTIONS, IF ANY

8.1. Store for material issue and return.

9. TOOLS AND TACKLES

9.1. Sling/nylon ropes and D-shackle for lifting as per equipment/ material to be transported used to be with 2.5 times higher capacity than lifting objects



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- 9.2. Cotton ropes/belt
- 9.3. Tools for excavation
- 9.4. Tool Bag
- 9.5. Chain pulley block as per site requirement
- 9.6. Ladder as per site requirement
- 9.7. Crane/Hydra as Per Requirement
- 9.8. Pipe Wrench
- 9.9. Crimping Tools
- 9.10. Torch if required
- 9.11. Operating Rod
- 9.12. DO Rod
- 9.13. Live Line Detector
- 9.14. HT/LT earthing and shorting devices in required qt
- 9.15. Fuse Puller
- 9.16. Operating handle of switchgear

10. PERSONAL PROTECTIVE EQUIPMENTS / SAFETY TOOLS

Following PPEs shall be used to carry out work at site:

- 10.1. Safety Helmets
- 10.2. Safety Shoes /Gum boots
- 10.3. Full Body Harness/Lanyard with double hook instead of Full Body Harness/Lanyard
- 10.4. Reflective jacket
- 10.5. 22 kV Hand gloves
- 10.6. LT Hand gloves
- 10.7. Barricading tape (if required)
- 10.8. Caution board / "Men at work" sign board (if required)
- 10.9. Barricading cone (if required)

11. SIGNIFICANT RISK PARAMETERS

- 11.1. Quality Management System: Low
- 11.2. Impact on Environment: High
- 11.3. Health and Safety Risk: High



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11.4. Energy Management: Low

11.5. Asset Management Risk: High

12. PROCEDURE

12.1. JOB PREPARATION

- (1) Visit the site location for prelims for necessary tools, manpower and material requirement.
- (2) Seek the Approval wherever required from concern authorities in verbal /written / any other electronic mode
- (3) For taking verbal/written permission for Road opening from concerned authorities for intermediate cables if required:
 - (a) HV Cell shall verify the sketch, other details like type of road etc. prepared by site in charge. After verifying all details, HV Cell shall inward RO application to Municipal Corporation (MC) wherever required.
 - (b) Inward details will be entered in SAP and Inward copy will be uploaded.
 - (c) HV Cell shall co-ordinate with MC for taking verbal/ written RO Permission
 - (d) After receiving RO permission (verbal or written), RO permission received details will be entered in SAP & the same will be conveyed to concerned department through email
 - (e) In case of any issue regarding RO permission, HV cell shall communicate with PR team for co-ordinate with MC to resolve the same.
- (4) During excavation ensure no existence of other utilities at identified location
- (5) Ensure that the contractor /technician gang has necessary manpower to carry out the job and all the persons to work at site should have valid gate pass issued by HR department, TPL.
- (6) Necessary arrangement of crane/hydra etc. as per the site requirement.
 - (a) Issue the material & Transfer material and tools to site.

12.2. PRECAUTIONS

- (1) Barricading the working area by barricading tape with appropriate sign board shall be displayed near the barricade.
- (2) Aware all persons for nearby any live network and maintain safe clearance and safety while working.
- (3) Use all required PPEs during execution of the job.
- (4) Following steps to be followed for working at height.
 - (a) Person who has to climb on the pole must use full body harness with lanyard which is be hooked & locked properly on pole at convenient height where the person has to perform the job.



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(b) Ladder is to be erected in safe working condition and its top end is to be tied with pole by means of rope.

(c) All the materials should be lifted or lowered by means of hand line only and nothing should be thrown up by the ground helper or thrown down by the lineman. As there is tendency, many times on the part of the work man to throw smaller items such as spanner, bolts, nuts etc. from the ground to the top or from the top to the ground to save the labour and time which may lead to an accident hence it is should be strictly avoided.

12.3. ISOLATION

- (1) For isolation equipment from the system follows the procedure as per OCP No: TPDF02-DIS01-OCP-005 for Distribution Network Isolation and Normalisation as per the switching requirement.
- (2) Authorized person issue "Permit to Work" as applicable to competent person after required isolation and local earthing

12.4. WORK PROCEDURE

- (1) Erection of Overhead Line
 - (a) Pole to be erected may be of any type i.e. RSJ/PSC/ Rail Pole.
 - (b) The purpose of pole may be for main line / supporting pole (strut) / flying stay pole/ double pole structure/ four pole structure.
 - (c) Erection process includes following sub process.
 - (d) Mark all the points where the poles are to be erected (Preferably within 40-50 meters for HT and 25-35 meters for LT range).
 - (e) Range all the points so that we get a straight line along the alignment.
 - (f) After ranging the points, check physically that no construction is on/near the route.
 - (g) If there is construction, then rearrange the pole locations in such a manner that safe distance remains between construction & line.
- (2) Erection of poles.
 - (a) Pit work
 - I. Pit size is normally 4ft X 2ft X 6ft (Length X Width X Depth). Normally the depth of pit should be 1/6th height of the pole to be erected in that pit. & Pit dimensions may very as per site situation as well as length of pole.
 - II. After marking of the pole location with pegs excavation can be started. The pit should be excavated up-to depth of 5 to 6 feet in sloping manner in the direction of the line as this will give greater lateral stability.



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III. The pit should be completely cleaned of debris. The bottom of the pit should be properly levelled. A RCC slab (Stay Block) may be provided where soil is very soft. This would evenly distribute the pressure due to weight of pole on the soil.

(b) Prelims for pole to be erected

- I. When the pit is ready the pole should be brought near the pit by manual labour/Hydra/crane. The pole should be laid along the line that is along the length of pit with a broader end of pole near the edge of the pit. Then the pole should be got ready for erection.
- II. Required cross arm/pole fitting/Stay clamp etc should be fitted to the pole at required distance as per the requirement and should be tightened. This will facilitate the erection of the pole as well as remove the difficulty of fixing these items after erection of pole.
- III. Next, four Manila/cotton ropes of size ¾" and about 40/50 feet long are tied to the top end of the pole.
- IV. A steel girder/rail pole piece of about 7 to 8 feet long is placed vertically inside the pit.
- V. If pole to be erected is Rail/ steel pole the portion which will remain in ground should be painted with paint to protect it from corrosion.

(c) Erection of Pole

- I. Tide the required size of sling at mid length of pole and anchor the same in hook of the hoist of the crane and lock it.
- II. Lift the pole, while lifting tide the cotton rope on its pole top fitting and other end of the same is to be handled by the person who will control the swing movement of the pole while being lifted by crane.
- III. Ensure that pole is being lifted in balanced condition.
- IV. When the bottom ends the pole comes near to pole pit, the crane boom is to be raised in such a manner that position of pole from its horizontal i.e., parallel to ground position to vertical position.
- V. The pole is then checking for perfect verticality by means of spirit level both transverse as well as longitudinal direction. In absence of spirit level, a mason's plumb can be used.
- VI. Place the pole in the centre of the pit and in line with other pole after verifying the alignment of the line.
- VII. Simultaneously prepare mixture of cement, sand & kapachi.



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- VIII. The concreting is done in ratio 1:2:4 (that is 1 part of cement, 2 part of sand and 4 parts of coarse aggregates/metals) where concreting is done muffing of the pole should be carried out normally one foot in diameter and up to one foot above the ground level and finished smooth by cement slurry. This will prevent the pole from rusting due to water. Proper care should be taken while earth filling is carried out. The excavated earth is first making with rubble or coarse aggregates in dry form outside the pit then adequate quantity of water is sprinkled on it and the mass of excavated earth then shovelled up back and forth to form homogeneous lump. This mass is then filled up inside the pit and during this process ramming by means of wooden piece or crowbar to be done to ensure no air voids in filled earth.
- IX. After allowing the concreting material to be cured, dismantle ropes tide on poles.
- X. The other erection related jobs on the pole to be performed after the concreting is got solid
- (3) Stay Work in Overhead Line Pole
 - (a) Function of Stay & its application:

Stays are required to avoid any unbalance forces acting on poles which may results in tilting, uprooting, breaking of the supports. Generally, stays are provided where the line configuration is as under.

- (b) There is an angular deviation.
 - I. Dead ends.
 - II. Tapping/T-Off poles.
 - III. Poles at steep gradients to avoid its up lifting.

The stays should normally make an angle of 30°/45° with vertical pole. However, when the distance behind the pole for fixing the stays is insufficient (less than 3 meters) or stays likely to foul in the road, it is to provide in different manner.

(c) Types of Stays

Following are the different types of stays which are to be provided in OH line:

- I. Normal Stay
 - i. Normal stays are provided to the pole in opposite direction to the forces being applied by line on the pole. This type of stay provided on most locations. The top end of the stay wire is fixed to the pole with the stay clamp on the pole and the lower end of the stay wire is fixed to the stay bow through stay insulator. The stay bow is fixed firmly in the stay pit through stay assembly.



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II. Flying Stay

i. When the line is to be erected along a rod and rod turns towards the line side, the stay will have to be provided towards the rod side which may cause obstruction to the road traffic in such cases a pole of about 15 to 20 feet long is being erected on other side of the road and the stay wire from main pole is being fixed to this pole and then this flying stay pole is being fixed by normal stay.

III. Strut

i. Where it is not possible to provide normal stay or flying stay support pole at an angle to the main pole is being erected on the deviation side of the line.

(d) Components Stay Assembly

- I. Stay bow.
- II. Stay channel.
- III. Stay rod with two Nos. of nut.
- IV. Stay plate.
- V. Stay Block
- (e) Erection or installation of stay.
 - I. Excavation of stay pit.
 - i. The stay pit should be mark in the direction opposite to that of the conductor and the suitable distance to the pole depends on the angle of deviation one or additional stay have to be provided in the direction bisecting the angle of deviation so that the stays will balance the resultant stresses due to the conductor in the two directions. Size of the stay pit should be 2 feet x 2 feet x 5 feet deep.
 - II. Fixing of Stay Rod Assembly.
 - i. The stay rod should be placed in the stay pit in such a position so that it will make angle inclination with vertical face of the stay pit is 30°/45°. The bottom end of rod is being fixed through stay block and stay plate and top end is being fixed to stay channel and stay anchor assembly.
 - III. Back filling of the stay Pit.
 - i. The remaining portion of the stay pit earth to be back filled by the excavated earth and ramming it.
 - ii. In case stay is pit is in waterlogged location the same is to be concreted. In such cases proper time is to be allowed for setting the concrete material.



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IV. Stay wire fixing

- i. Then the stay wire is passed through the eye of the anchor rod, bent back parallel to the main length of the stay wire and bound after inserting the GI thimble. The binding should be done by closely binding the strands (each strand one by one) on the loose end over the main length of the stay wire for a length about 30mm for each strand. The loop is to be made on upper end of stay wire and ends of stay wire is to bound by closely binding the strands (each strand one by one) on the loose end over the main length of stay wire for a length about 30 mm for each strand. Then the loop eye is to be passed through pair of stay clamp which will be clamped on the pole.
- ii. Stay insulator are used in the middle of the main stay wire to prevent the lower part of the stay from becoming electrically energise by a contact of the upper part of the stay when main line conductor snaps and falls on them due to leakage. The stay insulator shall be located 8 feet height from the ground. Also note that the insulator should not be too closed to stay clamp where the stay wire is anchored.
 - a. For 11 / 22 KV OH Line: Stay insulator suitable for 11/22 KV line is to be used.
- iii. Recommended size of stay wire is 7/8 SWG Hot dip GI wire.
- iv. When the line is being strung, the tension coming on the pole is to be balanced by tightening of stay wire by means of adjusting nut provided on stay rod. By tightening this bolt, the stay wire will get tight & will come in tension.
- (4) Fixing Of Cross Arm & Line Insulator On 11/22 KV Overhead Line
 - (a) In case of single circuit line:
 - I. For Pin Pole:
 - i. V type cross arms for two lower conductors, while the third conductor carried out in the top fitting fixed vertically on the top of the pole. When the line is having deviation of angle @ 5 to 10 degree & if it is a pin pole, it is preferable to provide double V cross arm each on both side of the pole along the line & to provide Pin insulator on both the V cross arm for each phase. Also on Pole top for middle conductor double pole tops are to be provided with pin insulator on each pole top. This will give more mechanical strength.
 - II. For Tension (Shackle) Pole:



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i. At cut point location i.e. on tension (Shackle) pole however horizontal formation may be used where in terminal channel is to be used. It is preferable to provide double terminal channel each on both side of the pole along the cut point on the line to have better mechanical strength in case of conductor breakdown during line is in service condition.

(b) Type of Insulators:

I. For Pin pole:

i. Pin insulators are being mounted on GI Thimble which is to be fixed in the holes provided on V Cross arm. In case of terminal channel pin insulator / suspension type disc insulator is to be provided in holes of terminal channel.

II. For Shackle Pole:

- Disc Insulators are being fixed with GI straps in the holes provided in the terminal channels using proper size of nut & bolts. Normally in HT Overhead line one disc insulator per phase is required, however it is preferable to use double disc for each phase to have
 - a. more mechanical strength &
 - b. In case of failure of one disc, line will not be tripped.
 - c. Have more & safe clearance from jumpers which will in turn increase reliability.

(c) Methodology of Fixing Cross arm and Line Insulators

- I. Normally required pole fittings are fitted before the pole is being erected however if same is not fitted then it is required to be erected after the erection of the poles and stay is completed. In such cases lineman has to climb the pole with hand line (thin but strong cotton rope) with him using required size of ladder.
- II. The cross arm/pole fittings with required clamps is then tight to one end of hand line and slowly pulled up to top of the pole by helper on the ground, through a pulley fixed at the pole top. The above cross arm should be held in position till the lineman fixed the clamp and cross arm as required, by bolts and nuts. Similarly other top fitting and clamps are being fitted in position on the pole by lineman. All fittings are checked for its tightness to ensure not any slip down even after taking the tension to the conductor or the stays on line.
- III. The required line insulators are to be mounted on the above cross arm fittings as per the line configuration
- (5) Replacement of Pole In OH Line



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(a) Transfer of old conductors to new pole.

- I. If insulated or bare conductor is to be transferred on intermediate pin pole of a section, then
 - i. Remove binding of conductor with old pole insulator.
 - ii. Transfer conductor to insulator of new pole.
 - iii. Loosely bind conductor to insulator.
 - iv. Transfer conductors of other phases as above.
- II. If conductor is to be transferred on a shackle pole, then
 - Remove jumpers on the all the phase conductor on both shackle insulators on the shackle pole which is to be replaced.
 - a. If bound, then remove binding wire.
 - b. If connected by binding wire then remove barrel lug junction
 - c. If connected by lug, then open by removing nut bolt.
 - ii. Choose the side where conductor falls short due to shifting of pole.
- III. Ensure binding of conductor is secure on the shackle pole and intermediate poles on both sides.
- IV. On new pole, anchor the two Nos. of double sheave pulley assembly on the pole top fitting near to tension hardware fitting for outer most conductors.
- V. Release the rope in both above pulley assembly such that lower pulley can be anchored in the eye of the come along clamp.
- VI. Each outer most conductor is to be gripped in the groove of sliding contacts of come along clamp & eye of which is to be anchored in the hook of lower pulley.
- VII. Pull the loop of rope through this double sheave pulley assembly.
- VIII. When come along clamp come in tension, release the ball shank of disc insulator from the socket eye of tension hard ware by removing "W" or "R" pin from the pole which is to be replaced.
- IX. Keeping come along clamp in tension, earmark on conductor keeping margin equal to length of insulator string where the tension hardware is to be fixed.
- X. Insert the tension hardware from the tail length of the conductor keeping bolted portion of tension hardware on tail side and position the tension hardware.



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ightening nuts in two/three II-tyne

- XI. Fix the tension hardware by tightening nuts in two/three U-type bolted connections.
- XII. Adjust the tension hardware in such way that set of disc insulator will remain in required tension and jumpers to be provided will remain in required position.
- XIII. Slowly release the rope through the double sheave pulley assembly and release the conductor & cut the conductor keeping required tail length of conductor.
- XIV. Repeat the same for middle conductor.
- XV. Lower the conductors from old poles which falls short in reference with intermediate pole erected against replacement.
 - On old pole, anchor the two Nos. of double sheave pulley assembly on the pole top fitting near to tension hardware fitting for outer most conductors.
 - ii. Release the rope in both above pulley assembly such that lower pulley can be anchored in the eye of the come along clamp.
 - iii. Each outer most conductor is to be gripped in the groove of sliding contacts of come along clamp & eye of which is to be anchored in the hook of lower pulley.
 - iv. Pull the loop of rope through this double sheave pulley assembly.
 - v. When come along clamp come in tension, release the ball shank of disc insulator from the socket eye of tension hardware by removing "W" or "R" pin from the pole which is to be replaced.
 - vi. Slowly release the rope through the double sheave pulley assembly and lower the conductors.
 - vii. Repeat the same for middle conductor.
- XVI. Remove the damage pole.
 - i. Tide a wire sling of required length with pole top fitting.
 - ii. Anchor the hook of hoist of crane in the loop of wire sling.
 - iii. Lift the boom so that wire sling will come in tension.
 - iv. Lift the pole.
 - v. Chip off pedestal/muffing if provided.
 - vi. Chip off grouting to about 2 feet below ground level.
 - vii. Pull the pole if base of pole is not coming out from its foundation, then Cut the pole from 2 ft. below the ground



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level.

- viii. Gradually lower pole by loosening hoist of crane
- ix. Backfill pit with excavated material
 - a. Lay excavated material in pit.
 - b. Ram it thoroughly
- XVII. Take the measurement for each phase conductor which is to be connected on new intermediate pole.
- XVIII. Make the joint of conductor on all three conductors.
- XIX. Tensioning, stringing, and sagging of above conductors on new pole. Follow the process as mentioned above.
- XX. Bind the conductor on the insulators and make jumpers if required:
- (b) If outdoor termination is required to be lowered from old pole & to be connected on new pole, follow the procedure as per the OCP No. TPDF02-DIS01-OCP-023 for Raising /lowering outdoor termination on Overhead line.
- (c) If Guarding is required on new pole, follow the procedure as per OCP No: TPDF02-DIS01-OCP-021 for Stringing of Guard wire on Overhead line.
- (d) If cradle guarding is to be done, follow the procedure as per OCP No: TPDF02-DIS01-OCP-021 for Cradle guarding on Overhead line.
- (e) Pole earthing:
 - Connect body earthing of all connected fitting on the pole up to common earth terminal which is to be connected with guard wire.
 - II. If the earth pit of the pole is exist, then run the GI earth strip along the length of the pole and connect it with main earth strip of earth pit and other end of above strip with common earth terminal on pole.
- (6) Site housekeeping
 - (a) After completion of work remove all packing, waste material and dump, collect and submit at stores.
 - (b) Remove barricades, temporary stakes etc.
 - (c) Clean the whole area.
 - (d) Remove barricades, temporary stakes etc.
 - (e) Ensure the backfield areas are level with ground surface



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12.5. **RESTORATION**

- (1) If isolation of the system is taken then, after completion of pole erection.
- (2) Remove the local shorting & earthing.
- (3) Take clearance from concerned person and Cancel "Permit to Work"
- (4) Open the mechanical /electrical locks of the isolation devices.
- (5) For normalisation of above switching follow the procedure as per OCP No: TPDF02-DIS01-OCP-005 for Distribution Network Isolation and Normalisation.

12.6. WORK CHECKLIST

(1) Update entries in Standard Format (Field Force Application or Hard copy)

12.7. JOB COMPLETION

- (1) Material reconciliation is to be done.
- (2) Update in GIS / SAP, if applicable.

13. IMPACT ANALYSIS OF SIGNIFICANT RISKS

13.1. QUALITY MANAGEMENT SYSTEM

- (1) Details of Quality Issues involved
 - (a) Incompetent manpower (Improper Execution of work)
- (2) Details of Quality Assurance plan
 - (a) Work Quality/OCP Training
 - (b) Effective supervision
 - (c) Penalty mechanism

13.2. ENVIRONMENTAL MANAGEMENT SYSTEM

- (1) Details of Environmental impact
 - (a) Resource Depletion
 - (b) Land Contamination
- (2) Precautions to minimize Environmental impact
 - (a) Ensure that all persons working at site are aware about the significant environmental impacts
 - (b) Ensure that all type of generated waste including hazardous waste should be collected and submitted to stores as per OCP no: TPDF02-STO01-OCP-006.

13.3. HEALTH AND SAFETY

(1) Details of Health and Safety Hazard involved



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- (a) Person working at site without TPL supervision
- (b) working/travelling in extreme weather condition
- (c) Animal/insect bite
- (d) Contact with Live terminal/cable/wire/busbar
- (e) Working in congested area
- (f) Use of faulty Tools
- (g) Negligence of use of safety PPEs / Non usage of PPEs/ Use of faulty PPEs
- (h) Accident to public due to Working without Area barricading
- (i) Fall of external object
- (j) Fall of overhead line
- (k) Working in unhygienic area
- (I) Contact with sharp edges
- (m) Fall of person from Height
- (n) Slips, trips and Falls of Persons
- (o) Fall of material /equipment during loading / unloading / shifting/handling
- (p) Travelling in heavy traffic
- (q) Electric shock due to improper earthing of welding / Other electrical tools
- (r) Failure of loading / unloading equipment
- (2) Health and Safety Precautions required
 - (a) Ensure use of PPEs
 - (b) Ensure use of Barricading Tape and caution board
 - (c) Ensure physical condition of Loading and unloading equipment/accessories.

13.4. ENERGY MANAGEMENT

- Details of energy use involved
 - (a) Fuel consumption in transportation/ material movement
- (2) Precautions to minimise energy use
 - (a) Ensure Optimum Usage & Turn off the engine when not in use

13.5. ASSET MANAGEMENT

(1) Details of Asset related risks



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- (a) Loss of Equipments
- (b) Frequent Small Duration Forced Outages
- (c) Sustained Forced Outage requiring Major Repair
- (d) Frequent Planned Outages
- (e) Overloading of equipment
- (f) Mishandling by handling equipment
- (2) Mitigation plan for asset related risks
 - (a) Ensure Work as per OCP
 - (b) Ensure Training to workforce

14. LIST OF ATTACHMENTS

Sr	Document /Record Description	Reference No.	
1	Permit to Work (PTW)	TPDF02-SAQ02-OCP-005-F02	
2	HV Cell Activity Checklist	TPDF02-DIS01-CHK-001-F05	
3	Height work permit	TPDF02-SAQ02-OCP-007-F01	
4	Deviation Format	TPDF02-DIS00-FOR-001	

***** End of Procedure *****