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MEC 1: MAINLINE PUMP AND BOOSTER PUMP

Aim: To provide guidelines for Maintenance of Booster and Mainline Pump.

Responsibility: Officer In- Charge- Mechanical

Frequency: Fortnightly

Common Instructions:

- Take applicable work permit:
  - Cold Work Permit
  - Electrical Isolation

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Ear Plug or muff
  - Eye Goggles

- In case any lifting equipment is to be used, visually check the condition of the same, also ensure that the date of examination of the lifting equipment, carried out by the competent person, is within the due date.

Checks for Running Pumps:

- Check for satisfactory working of pressure gauges and transmitter (suction and discharge side)

- Check for bearing temperature at both DE and NDE.

- Check the vibration readings and check if it is under the limits.

- Check decibel reading and note for any abnormal noise from Motor/Pump.

- Check mechanical seal system, lubrication system complete (force feed or Constant level oiler type) system and all its associated instrumentation / piping.

- Check mechanical seal inlet and outlet piping for any undue heating / temp rise of flushing oil.

- For Main Line Pumps, check all the piping connections of forced feed lubrication system and instrumentation piping.

Maintenance Instructions for Pumps:

- Take cold work and Isolation permit.
- Ensure the respective breaker is drawn out.
- LCS to be in stop lock position.
- Clean the casing cover, bearing housing, motor body and bearing housing Mechanical seal and associated accessories complete.
- In case of Force feed lubrication system complete skid shall be cleaned along with see through glasses of lubrication system and associated parts of pump.
- Top up constant level oiler of Booster Pump and Mainline Pump wherever applicable, if required.
- Wherever applicable and available check for buffer oil level and Top up seal pot level of BP & MP if required.
- Check for the working and calibration date of associated Pressure Gauge, Pressure Transmitter, RTD etc.
- Check tightness of foundation bolts and supports. If required tighten the same.
- Re-fit the coupling Guard and ensure that it is fully tight and no bolt is missing.
- Close the Permits and Handover the same to Shift In charge for Operation.

MEC 2: MECHANICAL SEAL

Aim: To provide guidelines for maintenance of mechanical seal of Mainline and Booster Pumps.

Responsibility: Officer In- Charge- Mechanical

Frequency: As and when required

Common Instructions:

- Take applicable work permit:
  - Cold Work Permit
  - Electrical Isolation

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Eye Goggles
  - Hand gloves

Maintenance Instructions both for Mainline & Booster Pumps:

- **Visual inspection of Reservoir, Pressure Gauge, Cooler, Pressure Switch, Flow Indicator to be carried out. Visual inspection for any leakage from seal/ seal systems**.

- **For any failure of mechanical seal, mechanical seal to be retrieved as per the below mentioned steps**

  - Ensure the respective breaker is drawn out and DC supply is switched off.

  - LCS to be in stop lock position.

  - Fully close the suction and discharge valves, isolate the power supply and keep the knob in "stop" position.

  - Drain the respective Pump depressurize the same completely including the suction and discharge piping.

  - Pump under repair need to be positively blinded in case of valves are passing before taking up job.

- Wherever we have External buffer fluid for Mechanical seal the same to be isolated by closing down the valves of the pot and entire flushing line to be drained and depressurized.
- Drain lube oil from bearing housing of the respective Pump.
- After completing jobs lube oil to be filled up/topped up. If required Mechanical seal pot to be topped up.
- All connections for instrument gadgets, lube oil circulation, mechanical seal oil, circulations line to be put back in original place.
- Boxing up of pumps by removing blind flanges from suction/delivery pipelines
- Thereafter the Pumps to be charged and leak testing is to be completed before the Pump is handed Over to Control Room for operation.
- Alignment of pump and motor to be checked.
- Maintenance Instruction for Booster Pumps:
- Remover the coupling guard.
- Lock seal in position.
- Remove flexible coupling.
- Remove lock-nut on shaft.
- Remove flange hub.
- Remove gun metal gland plate.
- Remove half cover of the bearing housing.
- Drain lubricant.
- Slide the ball bearing (2Nos) out.
- Disconnect oiler piping.
- Draw the entire bearing housing out.

- Disconnect cyclone separator / seal flush line connections.
- Unscrew seal bolts and use same as jacks.
- Check compression unit for its suitability.

❖ **Opening of cyclone separator / Seal flush line**

- Disconnect the unions (3Nos) / flanged connections after depressurization.
- Remove bolts of cyclone separator / seal flush line.
- Clean the inner surface / flush the line and inspect for dirt.

Mechanical Seal maintenance of mainline pump

NDE (Non - drive end):

- Remove the bearing housing after dislodging the dowel pins.
- Lock the seal in position.
- Depressurize the seal and pump.
- Disconnect the flushing line connections.
- Unscrew allen key screws on the lantern ring.
- Unscrew the bolts and use them as jacks. 2Nos to slide the seal assembly out.

DE (Drive End):

- Remove coupling guard.
- Remove flexible coupling.
- Remove key on shaft.
- Remove the flange gland hub.

- Remove gunmetal gland plate.
- Remove half cover of the bearing housing.
- Drain lubricant.
- Slide the two split halves of the bearing out.
- Disconnect the oiler piping.
- Draw entire bearing housing out.
- Discount the cyclone separator piping connections.
- Unscrew the seal bolts and use as jack for drawing the seal assembly out from the shaft.

NOTE:
Mechanical seal of both NDE and DE has to be dismantled and then the shaft has to be centered during box up. Only NDE side or DE side checking not to be done.

MEC 3: BEARINGS

Aim: To provide guidelines for maintenance of Booster Pump and motor, Mainline Pump & Motor Bearing.

Responsibility: Officer In- Charge- Mechanical

Frequency: As and when required

Common Instructions:

- Take applicable work permit:
  - Cold Work Permit
  - Electrical Isolation

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Eye Goggles
  - Hand gloves

Maintenance Instructions for Mechanical Bearing applicable for both Mainline & Booster Pumps and motors:

❖ **Common instructions for isolating pumps for bearing maintenance**

- Draw out the breaker of the respective pump motor.
- Keep LCS in stop lock position.
- Fully close the suction and discharge valves, isolate the power supply and keep the knob in "stop" position.
- Drain out entire lubricating oil from the respective bearing housings.
- Post Reinstallation and before Handing Over the Pumps to Control Room the system shall be checked for Noise and temperature.

❖ **Maintenance Instruction for bearing of Booster Pump**

- Check for oil level in the constant oil leveler.
- Check for darkening of lubricating oil. In case blackened, change oil.
- Remove the coupling guard.
- Lock mechanical seal in position.
- Remove flexible coupling.
- Remove lock-nut on shaft.
- Remove flange hub.
- Remove gun metal gland plate.
- Remove half cover of the bearing housing.
- Drain lubricant.
- Slide the ball bearing (2Nos) out.
- Check for wear marks on the shaft and bearings.
- If found worn out bearing to be changed.

❖ **Maintenance Instructions for bearing of Mainline Pumps**

- Check for oil level in the oil leveler.
- Check for any rattling noise.
- Check for temperature on bearing housing.

DE (Drive – end) of Mainline Pump

- Remove coupling guard.
- Remove coupling.

- Remove key and flange hub.
- Unscrew gland plate using Allen key and slide out gasket sheet.
- Unscrew bolts on the opposite faces.
- Unscrew bolts on top half and using dowel pins, raise top half.
- Remove top half of the journal bearing
- Drain oil.
- Lift shaft slightly manually and slide the other half of split bearing.
- Examine the inner surface of the split bearings and corresponding bearing area on shaft for wear marks.
- Thoroughly clean the housing with SKO and remove all deposits.
- Reinstall and reassemble the bearings.
- Use filter while filling the oil.
- Check for noise and temperature after installation.

NDE (Non-drive end) of Mainline Pump

- Check for oil level in the oil leveler.
- Check for any rattling noise.
- Check for temperature on bearing housing.
- Drain oil.
- Thrust bearing cover to be opened.
- Open top half cover of the housing.
- Open lock-washer and lock-nut.

- Slide out ball/roller bearings 2Nos with cover.
- Open the gland plate and slide out gasket sheet.
- Slide out the journal bearings.
- Examine the inner surface of the split bearings and corresponding bearing area on shaft for wear marks. In case of slight wear, polish the surfaces.
- Thoroughly clean the housing with SKO and remove all deposits.
- Reinstall and reassemble the bearings.
- Use filter while filling the oil.
- Check for noise and temperature after Installation.

❖ **Maintenance Instruction for bearings of Mainline motor**

DE (Drive End) bearing of Mainline motor

- Check for oil level in the oil leveler.
- Check for any rattling noise.
- Check for temperature on bearing housing.
- Remove coupling guard.
- Remove coupling and disconnect temperature sensors.
- Remove weather hood.
- Top portion bolts of the housing to be unscrewed and lifted out.
- Drain oil in case of Force Feed Lubrication system.
- Slide out one half of the split journal bearing.

- Apply jack and raise the shaft by 2mm.
- Slide out the oil ring.
- Slide out the second half of the bearing.
- Inspect for wear marks on the inner surface of the bearings and shaft. Polish with polish paper in case of minor wear marks.
- Clean the bearing housing thoroughly with SKO and remove all deposits.
- While remounting, apply a thin film of oil between shaft and bearing.
- Top up oil in the oil leveler with a filter.
- Check for noise and temperature after re-installation.

DE (Drive End) bearing of Mainline motor

- Check for oil level in the oil leveler.
- Check for any rattling noise.
- Check for temperature on bearing housing.
- Remove NDE fan cove using HOT/EOT crane.
- Disconnect filler pipe.
- Remove the fan.
- Top portion bolts of the housing to be unscrewed and lifted out.
- Drain oil in case of Force Feed Lubrication System.
- Slide out one half of the split journal bearing.
- Apply jack and raise the shaft by 2mm.
- Slide out the oil ring.
- Slide out the second half of the bearing.

- Inspect for wear marks on the inner surface of the bearings and shaft. Polish with polish paper in case of minor wear marks.
- Clean the bearing housing thoroughly with SKO and remove all deposits.
- While remounting, apply a thin film of oil between shaft and bearing.
- Top up oil in the oil leveler with a filter.
- Check for temperature and noise after re-installation.

MEC 4: ALIGNMENT OF BOOSTER & MAINLINE PUMP

Aim: To provide guidelines for the maintenance of Booster pump and motor, mainline pump and motor (Alignment).

Responsibility: Officer In- Charge- Mechanical

Frequency: Half yearly

Common Instructions:

- Take applicable work permit:
  - Cold Work Permit
  - Electrical Isolation

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Eye Goggles
  - Hand gloves

Maintenance Instructions for Mechanical Bearing applicable for both Mainline & Booster Pumps and motors:

- Ensure that the pumps that are to be checked for alignment are at ambient temperature and proper cooling time has to be provided for the pumps after stopping.

- Make a marking over the coupling and the shaft shall be made with the help of a permanent marker on both sides. The marking shall be made in a manner so that half of the marking is at the coupling face and half over the motor / Pump shaft face. This will ensure the coupling is installed back in the same position while installation.

- Remove the coupling.

- Take run out readings by mounting frame on motor shaft and record as:

- Take readings under Radial and Axial with motor and pump shafts rotating simultaneously with same point as reference in all four quadrants.
- Difference in readings obtained from above two steps gives net mis-alignment. Record the net reading.
- Check that A and R are within 0.05mm (or OEM recommendation).
- First correct for Axial, by adding shims and using side adjustment bolts and bring to within 0.05mm (or OEM recommendation)
- Subsequently, correct for radial by adding shims and using bolts and bring to within 0.05mm (or OEM recommendation).
- Re-commission and re-check.

NOTE:

1. Axial values to be taken with two number of dial gauges and the average of both the readings to be mentioned. ((A1+A2)/2)
2. If any corrosion is observed in the pump / motor metal base, same to be cleaned and anti-corrosion material to be applied.

MEC 5: VIBRATION/NOISE CHECK OF BOOSTER AND MAINLINE PUMP

Aim: To provide guidelines for the maintenance of Booster Pump and Motor, Mainline pump and motor Vibration/ Noise Level check.

Responsibility: Officer In- Charge- Mechanical

Frequency: Fortnightly

Common Instructions:

- Take applicable work permit:
  - Cold Work Permit

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Hand gloves

Maintenance Instructions for Checking the vibrations of running pumps is as follows:

❖ **For Booster Pump**

Driving END:	H (Horizontal)	:	On bearing housing
	V (Vertical)	:	On bearing housing
	A (Axial)	:	On bearing housing
Non driving END		:	NA

❖ **For Booster Motor**

DE	:	Record for H, V and A.
NDE	:	Record for V and H only

- Compare readings with limits and correct alignment if required (as per the SOP MEC 4).

❖ **Mainline pump and motor:**

- For pump record H, V and A on DE and NDE sides.

- For motor record H, V and A on DE side.

- On NDE side, record, H and V on cover frame.

- Vibration Signature Analysis shall be carried out on yearly basis through a external agency and the analysis report shall be maintained along with record of action taken on the recommendations

- For measuring noise level, the readings have to be taken 1 meter from the equipment. The minimum permissible limit shall be as per OEM/PCB/Factory regulations.

MEC 6: CORROSION INHIBITOR SKID

Aim: To provide guidelines for the maintenance of Corrosion Inhibitor Pump.

Responsibility: Officer In- Charge- Mechanical

Frequency: Half yearly

Common Instructions:

- Take applicable work permit:
  - Cold Work Permit
  - Electrical Isolation

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Eye Goggles
  - Hand gloves

Maintenance Instruction for CI Pump

- Ensure venting & draining of material from the pump and its piping.
- Clean all the visible surfaces.
- Check and arrest gland leakages, if any.
- Check for bearing oil and replace if blackened.
- Check for satisfactory working of pressure relief valve by cross checking with set pressure and by closing the gate valve leading to suction heads.
- Open the strainer and clean thoroughly.
- Check for leakage in the associated piping skid.
- Check the level Indicator of Storage Tank and clean if required.
- Ensure proper venting/charging of associated pipe after maintenance.

- Ensure that the dosage does not exceed the recommended dosage.
- Check for any abnormal noise.

MEC 7: SUMP/INTERMIX/DISPLACEMENT PUMP

Aim: To provide guidelines for the maintenance of Sump Pump, Interface Pump and Displacement Pump.

Responsibility: Officer In- Charge- Mechanical

Frequency: Half yearly

Common Instructions:

- Take applicable work permit:
  - Cold Work Permit
  - Electrical Isolation

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Eye Goggles
  - Hand gloves

- In case any lifting equipment is to be used, visually check the condition of the same, also ensure that the date of examination of the lifting equipment, carried out by the competent person, is within the due date.

Maintenance Instruction for Sump/Interface & Displacement Pump:

- Check for vibration levels on pump and motor whenever pump is operated.
- Check and arrest gland leakages, if any.
- Check for abnormal noise.
- Apply fresh grease to motor bearings.
- Clean the pump discharge end T-strainer.

MEC 8: DENSITY PUMP

Aim: To provide guidelines for the maintenance of Density Pump.

Responsibility: Officer In- Charge- Mechanical

Frequency: Half yearly

Common Instructions:

- Take applicable work permit:
  - Cold Work Permit
  - Electrical Isolation

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Eye Goggles
  - Hand gloves

- In case any lifting equipment is to be used, visually check the condition of the same, also ensure that the date of examination of the lifting equipment, carried out by the competent person, is within the due date.

Maintenance Instruction for Density Pump:

- Check for any leaks in piping, flanges, strainer etc. In case of any leaks take corrective action.
- Check for vibration levels on pump and motor.
- Check and arrest gland leakages, if any.
- Check for abnormal noise.
- Apply fresh grease to motor bearings.
- Clean the suction T strainer or Duplex Magnetic Filter Skid whichever is there installed at respective location.
- Check for working of rotameter. Check for satisfactory working of Pressure Gauge and Pressure Transmitter.

MEC 9: DRA PUMP SKID

Aim: To provide guidelines for the maintenance of DRA Pump.

Responsibility: Officer Incharge(Mechanical).

Frequency: Half yearly

Common Instructions:

- Take applicable work permit:
  - Cold Work Permit
  - Electrical Isolation

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Eye Goggles
  - Hand gloves

Maintenance Instruction of DRA Pump:

- Clean all the visible surfaces, Suction and discharge NRV of Pump.
- Check the condition of Diaphragm if pump is Diaphragm types.
- Inspect the liquid end for indication of leakage. Glands to be tightened as gently as possible, if any.
- Check for noise and Vibration.
- Check for Oil Level in the gear box. The oil should be changed every 500 hours of operation or every 3 months-whichever is earlier.
- Check for satisfactory working of pressure relief valve. Adjust the pressure setting of the spring using the nut/screw arrangement provided in the TSV to achieve the desired set pressure, or replace the TSV if adjustment cannot be done in-house.
- Adjust the dosage not to exceed the recommended dosage
- Stirrer Motor and recirculating pump to be operated to avoid choking of DRA. If the DRA skid is not operated for more than 24 hrs, stirrer motor and recirculating pump has to be operated for an hour in recirculating mode, wherever applicable.

MEC 10: FORCE FEED LUBRICATION SYSTEM

Aim: To provide guidelines for the maintenance of Force Feed Lubrication System.

Responsibility: Officer Incharge(Mechanical).

Frequency: Half yearly

Common Instructions:

- Take applicable work permit:
  - Cold Work Permit
  - Electrical Isolation

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Eye Goggles
  - Hand gloves

Maintenance Instruction for Force Feed Lubrication System:

- Check for the cleanliness of the tank including tank sump. Visual inspection shall be carried out for any settled sludge or particles at the tank bottom.

- Clean the suction strainers. In case the filter element is clogged severely, damaged/deformed or there is excessive drop in pressure, the filter element shall be replaced.

- Check the pump of the Lube oil system. Pump shall be checked for any abnormal vibration/noise and temperature in the bearing area. If scrapping or rattling sound observed from the pump instead of the normal humming sound, bearing to be thoroughly checked. Check for loosening of foundation nut/bolts, support system of rotating components, check for any misalignment, and wear and tear of moving parts.

- Check for pump running hours from last servicing and oil change. Check for any leakage of lube oil from bearing block, threaded /flanged connection. Check for any contamination or moisture in the Lube Oil.

- Check for proper functioning of the PCV for Lube Oil System.

- Check for the proper functioning of the pressure gauge, pressure transmitters and temperature gauges for the lube oil system.

- Check for the proper functioning of the lube oil heating system / heat exchanger.

NOTE:

The Oil may be tested in the laboratory for moisture and contamination if required. However, it is recommended to Change the oil after every 1 year.

MEC 11: AIR/LPG COMPRESSOR

Aim: To provide guidelines for the maintenance of Air?LPG Compressor.

Responsibility: Officer Incharge(Mechanical).

Frequency: Half yearly

Common Instructions:

- Take applicable work permit:
  - Cold Work Permit
  - Electrical Isolation

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Eye Goggles
  - Hand gloves

Maintenance Instruction of Compressor:

- Check all the system piping for possible air leaks.
- Check for loosened fasteners.
- Check instrument piping with soap solutions for any leakages.
- Remove all the dust/dirt accumulation on the equipment and enclosures.
- Verify that all the equipment housing covers are in place to ensure safety.
- Check for lube oil level of compressor.
- Carry out bearing lubrication.
- Check for working of pressure switch and for auto start up and auto cut out.
- Check for tightness/slackness of belts and carry out corrective action if required.

Testing by Competent Authority:

- UT testing of compressor to be carried out once in 4 years.
- Hydrostatic testing of compressor once in four years to be carried out.

MEC 12: PUMP OVERHAULING

Aim: To provide guidelines for the overhauling of pumps.

Responsibility: Officer Incharge(Mechanical).

Frequency: Horizontal pumps: 16000 hours or 4 years whichever is earlier or OEM recommendation

Vertical pumps: 24000 hours or 4 years whichever is early or OEM recommendation

Common Instructions:

- Take applicable work permit:
  - Cold Work Permit
  - Electrical Isolation

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Eye Goggles
  - Hand gloves

❖ In case any lifting equipment is to be used, visually check the condition of the same, also ensure that the date of examination of the lifting equipment, carried out by the competent person, is within the due date.

Maintenance Instruction of Pump Overhauling:

- Take cold work and Isolation permit.
- Ensure the respective breaker is drawn out.
- LCS to be in stop lock position.
- Close the suction and discharge valve of the pump to be overhauled.

- Remove the suction and discharge pressure gauge connection to check whether the valve is holding or not.
- Remove the electrical connection of the motor and mark the connections appropriately.
- Mark the motor to the body and coupling and top cover with permanent marker.
- Remove the coupling bolts between pump and motor shaft.
- Remove all nuts from the top cover of the pump.
- With the help of chain block of required capacity, remove the upper casing of pump and later remove the shaft from lower casing of pump.
- Cover the lower casing of pump with cloth.
- Remove the mechanical seal with marking over shaft for positioning and check for any damage.
- Check the condition of sleeve and check for grooves and markings where mechanical seal is fixed.
- If sleeve is having a lot of grooves, then sleeve to be replaced.
- Clean the impeller, key, shaft and top cover.
- Check the impeller for corrosion, pitting, cavitation and wear.
- Check condition of impeller blades for narrowing.
- Check the key for crack and key way too.
- Check the following clearances: -
  - sleeve to shaft – as per OEM recommendation
  - impeller to shaft – as per OEM recommendation
  - wear ring clearances – as per OEM recommendation
  - stuffing box throat bushing and shaft- as per OEM recommendation
- Shaft to be taken out and placed on V-block. Run out at all stages, Centre bush and Throttle bush to be measured and recorded.

- Shaft sagging / run out more than 0.05 mm to be checked w.r.t. to IOM.
- If clearances are ok then start boxing back the pump in reverse direction.
- Place impeller shaft on the lower casing.
- Make shaft clean and dry. Put gland cover. Place new mechanical seal in the exact position and lock it keeping it mind that in all screw position the seal is at same distance.
- Put washer in place and then the key. Place the upper casing.
- Tighten the upper casing nut and installed new bearings.
- Check for the freely movement of impeller shaft.
- Alignment to be done as per MEC 4 SOP procedure.
- No-Load run of motor to be carried out to check the direction of motor.
- Connect the couplings.
- Crack open suction valve and charge the pump.
- Make pressure gauge connections.
- Check for leakage in mechanical seal
- Make motor connection
- Open suction valve completely.
- Start the pump at a lower flow rate.
- Check for abnormal noise. Check for pressure build up.
- Slowly the speed of the pump to be increased and check the noise and vibration level at various flow rates.
- Once there is no abnormality, the pump to be put to operation.

MEC 13: T- STRAINER

Aim: To provide guidelines for the cleaning of T- Strainer in LPG/POL Pipelines.

Responsibility: Officer Incharge(Mechanical).

Frequency:

1. As and when required (When the Differential pressure crosses the set limit for each location)

or

2. When the pressure remains constant at a low or near zero value and the element rupture is suspected.

or

3. Yearly (if no maintenance has been done for the past year).

Common Instructions:

- Take applicable work permit-
  - Cold Work Permit for POL pipelines
  - Hot work permit for LPG pipelines
  - Electrical isolation permit

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Eye Goggles
  - Hand gloves

❖ In case any lifting equipment is to be used, visually check the condition of the same, also ensure that the date of examination of the lifting equipment, carried out by the competent person, is within the due date.

Maintenance Instruction for T- Strainers:

- Isolate the T- strainer of the corresponding pump by closing the inlet and outlet valves. Switch off power supply to the pump motor, valve actuators.

- In case of passing valve, segment need to be positively isolated by blind.

- Vent out the product from the section between inlet valve and the outlet valve and de-pressurize the section by opening Vent / Drain valves. In case of LPG, release the LPG through cold flare line in a controlled manner.

- After ensuring complete depressurization and emptying of the section, open the end cover of the strainer by opening the bolts. If any drain plug provided at T Strainer Flange, same has to be removed after depressurization before opening the end bolts.

- Remove the spiral wound metallic/ ring type gasket from of the end cover. If found damaged keep replacement ready for use while boxing up the strainer.

- Draw out the element from the strainer body carefully. Collect the strainer residue for further analysis. Strainer residue need to be collected in a metal bucket and kept submerged in water and to be preserved in a container at safe distance for final disposal.
- Rinse the strainer element with water and dry completely. Check for damages of the element, the reinforcement and the mesh. In case of any damage, the damaged element shall be replaced.

- After cleaning, the element shall be re-inserted and the top cover to be fixed and tightened.

- Close the strainer drain valve, other drain valves and fill the section with line product by crack opening the inlet MOV.

- After boxing up, section to be purged by venting of LPG mixed air for 2-3 times. Close the pump venting valves and pressurize the section to the line pressure. Open the inlet fully. (Applicable for LPG Pipeline Only).

- Check for any leakage from the strainer end flanges using soap solution and LEL Meter.

- Record the differential pressure across the strainer before and after cleaning the strainer.

MEC 14: BASKET FILTER

Aim: To provide guidelines for the cleaning of Basket Filter.

Responsibility: Officer Incharge(Mechanical).

Frequency:

1. As and when required (When the Differential pressure crosses the set limit for each location)

or

2. When the pressure remains constant at a low or near zero value and the element rupture is suspected.

or

3. Yearly (if no maintenance has been done for the past year).

Common Instructions:

- Take applicable work permit
  - Cold Work Permit for POL pipelines
  - Hot work permit for LPG pipelines
  - Electrical isolation permit

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Eye Goggles
  - Hand gloves

❖ In case any lifting equipment is to be used, visually check the condition of the same, also ensure that the date of examination of the lifting equipment, carried out by the competent person, is within the due date.

Cleaning Instruction of Basket Filter:

- Upon reaching a differential pressure of minimum of design /operation manual across filters, isolate the basket filter by closing the inlet and outlet valves. Switch off supply to the valve actuators in case the valves are MOVs. Isolate impulse piping of the instrumentation like DPT/PT connected to the filter.

- Inject sealant into the U/S and D/S valves so as to ensure that the valves are completely holding.

- Open Vent & drain valves, de-pressurize and empty out product inside the filter.
- Open the top cover of the filter by opening the bolts of the top flange (in case of vertical basket filter) or by opening the Quick Opening Enclosure(QOC) arrangement for horizontal basket filter.
- For Vertical Basket Filter Rotate the davit assembly and lift the top cover away from the shell. Keep it sufficiently away to give required work space.
- Similarly, for Horizontal Basket Filter rotate the Quick Opening Closure(QOC) away from the shell for removal of the filter element.
- Remove the gasket / 'O' ring of the top cover. If found damaged keep replacement ready for use while boxing up the filter.
- Draw out the element from the filter body carefully.
- Clean the filter element with a jet of water in the direction opposite to the flow of fluid.
- Check the mesh size of the filter element and ensure that the same is as per the design.
- Check for any damage to the element body, the reinforcement and the mesh. In case of any damage, filter element shall be replaced.
- After cleaning the filter element shall be re-inserted and the top cover (QOC or flanged) is closed and tightened.
- If the filter element is found damaged the same to be replaced.
- Close the filter drain and fill the filter appropriately with line product (by opening the inlet partially or by using back flushing line).
- Close the filter vent and pressurize the filter to the line pressure. Open the inlet fully.
- Check for any leakage from the filter flanges by applying soap solution.
- Make the instrumentation connected to the filter online by opening the valves in the impulse piping which were closed earlier during isolation of equipment.
- Record the differential pressure across the filter before and after cleaning the filter.

MEC 15: DUPLEX MAGNETIC FILTER SKID

Aim: To provide guidelines for the maintenance of Duplex Magnetic Filter.

Responsibility: Officer Incharge(Mechanical).

Frequency:

1. As and when required (When the Differential pressure crosses the set limit for each location)

or

2. When the pressure remains constant at a low or near zero value and the element rupture is suspected.

or

3. Yearly (if no maintenance has been done for the past year.

Common Instructions:

- Take applicable work permit
  - Cold Work Permit.

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Eye Goggles
  - Hand gloves

Maintenance Instruction of Duplex Magnetic Filter:

- Upon reaching a differential pressure of minimum of design /operation manual the filter has to be taken for maintenance.

- Make offline the choked filter by operating the 3-way valve using the single lever handle by turning through 90 degrees.

- Release the pressure in the filter by using the vent valve at the top and then drain the filter using the drain valve at the bottom.

- Open the top flange and take out the spring loaded filter element.

- Open the magnet rod and clean by wiping with a cotton cloth. The filter element (80 mesh) is to be cleaned using water and compressed air to remove trapped particles. Clean the filter shell internals by water flushing if required.

- Collect the scales and other solid residues.

- Load the magnet in the filter element and insert in the shell with the spring. Also, check the condition of the gasket in the filter element before inserting.

- Tighten the top flange and close the vent and drain valves.

- Charge with fresh product. Check for any leakages from flanges by applying soap solution.

MEC 16: HAND/ELECTRICALLY OPERATED OVERHEAD TRAVELLING CRANE

Aim: To provide guidelines for the maintenance of Hand/ Electrically operated overhead traveling crane.

Responsibility: Officer Incharge(Mechanical).

Frequency: Half yearly

Common Instructions:

- Take applicable work permit
  - Cold Work Permit
  - Working at Height permit
  - Electrical isolation permit

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Eye Goggles
  - Hand gloves

❖ In case any lifting equipment is to be used, visually check the condition of the same, also ensure that the date of examination of the lifting equipment, carried out by the competent person, is within the due date.

Maintenance Instruction for Electrically operated Over travelling Crane:

- Isolate the power to EOT by switching off the SFU from the MCC panel.
- Use safety belts/ proper harness while working on the EOT crane.
- Brake lining shall be checked for any wear. Linkages and adjustments shall be checked to ensure brake is not dragging grease linkage pins.
- Hoist wire rope: check for any wear & broken strands
- Alignment & elevation of the Rails shall be checked as per the O&M Manual

- Check the rope sheaves for any wear & tear.
- Check for leaks for oil seals and spillage of grease.
- Check for the tightness of the Structural bolts & machinery hold down bolts
- Inspect the drive wheel for any wear and tear
- Remove the dry dust from the EOT with blower.
- Clean the guide rails on top of gantry girders on either side for the elevation gradient.
- Post above steps switch on the SFU from the MCC Panel.
- Check for free movement of wheels. Carryout greasing.
- Check gear wheels for free operation. Carry out greasing.
- Check for longitudinal movement (length wise) and lateral movement (breadth wise) simultaneously.
- Apply grease to the rope drum and carry out lubrication as per lubrication chart.
- Check for the functioning of controls / Push buttons on the pendant type control unit.
- Check for smooth up/down movement.

Maintenance Instruction for Hand operated Over travelling Crane:

- Clean the guide rails on top of gantry girders on either side.
- Check for free movement of wheels. Carry out greasing.
- Check gear wheels for free operation. Carry out greasing.
- Check for longitudinal movement (length wise) and lateral movement (breadth wise) simultaneously.
- Lubricate chain pulley and check for operation.

NOTE:

The HOT / EOT Crane shall be examined by a competent person as per the Factory Act 1948, at least once in every12 months. Chain Pulley Block (full assembly) is to be load tested at 1.25 times (applicable only Upto 20 tonnes) the rated capacity or as per the relevant state factory acts at the location. The Competent Person shall issue the examination certificate in the prescribed format.

MEC 17: TRUNION MOUNTED BALL VALVES

Aim: To provide guidelines for the maintenance of TMBV Valves.

Responsibility: Officer Incharge(Mechanical).

Frequency: Half yearly

Common Instructions:

- Take applicable work permit
  - Cold Work Permit
  - Electrical isolation permit

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Eye Goggles
  - Hand gloves

Maintenance Instruction for Trunion Mounted Ball Valves:

- Ensure that the operation of the particular valve shall not affect the pipeline operation.
- Maintenance Instruction of Trunion Mounted Ball Valves-
- Operate electrically and observe for noise while opening / closing and note as smooth, rough.
- Open drain plug, and check for product cleanliness.
- Check for leakage through stem. If it leaks, use stem sealant.
- Check for ease of operation manually and record as good, fair or poor.
- Check for proper seat sealing by opening drain and vent plugs with valve in fully closed condition/fully open condition.
- Check for operation of Valve by application of partial stroking (closing of valve a minimum of 15%) to ensure smooth functioning.

- Apply sealant if valve is found passing. Sealant to be injected in fully open condition and then open-close the valve for two to three times. Again, close the valve and inject sealant. After injection of sealant, open the valve. (Note: Sealant to be as per OEM recommendation)

- Check for oil leakage from actuators. In case of leakages inform Electrical Incharge.
- Check for remote opening/closing of valve through SCADA/PLC from respective controlling locations.

- Gear Box Grease to be changed as per OEM recommendation.

- If the TMBV is underground valve, same shall be inspected every five years for its corrosiveness checking in the external face by excavating the sand and if any corrosion is occurring, same has to be painted with epoxy coatings. (Especially in SV stations)

MEC 18: PLUG VALVES

Aim: To provide guidelines for the maintenance of Plug Valves.

Responsibility: Officer Incharge(Mechanical).

Frequency: Half yearly

Common Instructions:

- Take applicable work permit
  - Cold Work Permit
  - Electrical isolation permit

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Eye Goggles
  - Hand gloves

- Ensure that the operation of the particular valve shall not affect the pipeline operation.

Maintenance Instruction of Plug Valves:

- Check for case of hand operation and record as good, fair or poor.

- Check for leakage though stem / gland. If leaks use stem sealant.

- Apply fresh plug sealant grease through the sealant injection point till sufficient back-pressure is developed and the pressure is holding in the sealant injection gun.

- Sealant to be injected in fully open condition and then open-close the valve for two to three times. Again, close the valve and inject sealant. After injection of sealant, open the valve. (Note: Sealant to be as per OEM recommendation)

- Gear Box grease to be changed as per OEM recommendation.

MEC 19: DBBDIV VALVES (Double Block Bleed Double Isolation Valves)

Aim: To provide guidelines for the maintenance of DBBDIV Valves.

Responsibility: Officer Incharge(Mechanical).

Frequency: Half yearly

Common Instructions:

- Take applicable work permit
  - Cold Work Permit
  - Electrical isolation permit

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Eye Goggles
  - Hand gloves

- Ensure that the operation of the particular valve shall not affect the pipeline operation.

Maintenance Instruction of DBBDIV Valves:

- Check for case of hand operation.

- Check for leakage though stem / gland. If leaks use sealant.

- Check for passing thru the bleed facility provided. In case the valve is passing dismantled the bottom plate and residue to be flushed and drained.

- If stem packing fails, it can be changed as follows:
  a) Remove operator.
  b) Remove packing gland and replace inner and outer O-rings and backup ring.
  c) Remove and replace packing rings carefully.
  d) Replace packing gland.
  e) Reinstall operator.

- DBBV Valve seats can be renewed without removing the valve from the pipeline. In open position, after the bottom cover is removed, the segments can be retracted from the seat and replaced. Care should be taken to ensure that the line is drained.

MEC 20: GLOBE VALVES

Aim: To provide guidelines for the maintenance of Globe Valves.

Responsibility: Officer Incharge(Mechanical).

Frequency: Half yearly

Common Instructions:

- Take applicable work permit
  - Cold Work Permit
  - Electrical isolation permit

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Eye Goggles
  - Hand gloves

- Ensure that the operation of the particular valve shall not affect the pipeline operation.

Maintenance Instruction of Globe Valves:

- Check for case of hand operation and record as good, fair or poor.

- Check for leakage though bonnet.

- In case of leakage, replace bonnet gasket.

- Check for any leakage through gland packing, If any leak is observed tight the bolts of the gland packing. If leak continues replace the gland packing, after depressurizing of the valve.

- Check for oil leakage from actuators. In case of leakages inform Electrical Incharge.

- Gear Box grease to be changed as per OEM recommendation.

MEC 21: GATE VALVES

Aim: To provide guidelines for the maintenance of Gate Valves.

Responsibility: Officer Incharge(Mechanical).

Frequency: Half yearly

Common Instructions:

- Take applicable work permit
  - Cold Work Permit
  - Electrical isolation permit

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Eye Goggles
  - Hand gloves

- Ensure that the operation of the particular valve shall not affect the pipeline operation.

Maintenance Instruction of Gate Valves:

- Check for case of hand operation and record as good, fair or poor.

- Check for leakage though stem. If leaks use stem sealant.

- Check for leakage though bonnet.

- In case of leakage, replace bonnet gasket.

- Check for any leakage through gland packing, If any leak is observed tight the bolts of the gland packing. If leak continues replace the gland packing, after depressurizing of the valve.

- Carry out bottom draining of valve wherever valve is having draining facility.

- Apply grease in the threaded portion of the stem of the gate valve and check for smooth operation

- Apply grease in the gearing box area of the valve.
- Check for leakage from actuators. In case of leakages inform Electrical Incharge.
- Gear Box grease to be changed as per OEM recommendations.

MEC 22: NON RETURN VALVES

Aim: To provide guidelines for the maintenance of Non Return Valves.

Responsibility: Officer Incharge(Mechanical).

Frequency: Half yearly

Common Instructions:

- Take applicable work permit
  - Cold Work Permit

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Eye Goggles
  - Hand gloves

- Ensure that the operation of the particular valve shall not affect the pipeline operation.

Maintenance Instruction of Non return Valves:

- Take necessary isolation of the pipeline section where valve maintenance to be carried out.
- Release counterweight and check for condition of key. (In case of Swing Check Valve)
- Reset counter weight at required angle using slots provided. (In case of Swing Check Valve)
- Check for leakage though bonnet.
- In case of leakage, replace bonnet gasket.
- Check for leakage through gland.
- In case of leaks, replace gland packing.
- Carry out bottom draining of valve wherever valve is having draining facility.
- Lubricate moving parts of spindle (hydraulic dampening system) wherever provided.

MEC 23: THERMAL SAFETY VALVE SYSTEM

Aim: To provide guidelines for the maintenance of Thermal Safety Valve.

Responsibility: Officer Incharge(Mechanical).

Frequency: Yearly

Common Instructions:

- Take applicable work permit
  - Cold Work Permit
  - Hot work permit in case of LPG

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Eye Goggles
  - Hand gloves

Maintenance Instruction of Thermal Safety Valves:

- Isolate the valve and dismantle 'TSV'.

- Clean the internal parts and remove dirt. Check the condition of internal parts.

- Verify the actuation mechanism by using Testing bed. Check for proper set and reset pressure. Carry out the adjustment if required.

- Adjust the pressure setting of the spring using the nut/screw arrangement provided in the TSV to achieve the desired set pressure, or replace the TSV if adjustment cannot be done in-house.

- Check for proper installation and make it online.

- Acceptability criteria for TSV is + 3% for TSV of set pressure 5 Kg/CM2 or more and 2% for less than 5 Kg/CM2 set pressure. (As per OISD).

- Safety Valve to ensure - that the normal operating pressure of the system does not exceeded by more than 10%. If the normal operating pressure is the maximum allowable operating pressure of the pipeline, then the set pressure for pressure safety valve should be at a pressure 2 kg / Cm2 above the MAOP or at a pressure equal MAOP plus 10%, whichever is less.

MEC 24: SURGE RELIEF VALVE

Aim: To provide guidelines for the maintenance of Surge Relief valve.

Responsibility: Officer Incharge(Mechanical).

Frequency: Yearly

Common Instructions:

- Take applicable work permit
  - Cold Work Permit

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Eye Goggles
  - Hand gloves

Maintenance Instruction of Surge Relief Valves:

- Check all the system piping for possible defects and /or leaks.
- Check for loosened fasteners.
- Check instrument piping with soap solutions for any leakages.
- Check for damaged electrical wiring/cabling & electrical grounding connectors.
- Remove all the dust/dirt accumulation on the equipment, electrical junction boxes and panel enclosures.
- Verify that all the equipment housing covers are in place to ensure mechanical and electrical safety.
- Check all the system pressures. Ensure that the Nitrogen pressure is maintained as per the OEM recommendation.
- Check the regulator to regulate the nitrogen pressure.

- Check functioning of relief valves, check valves, isolation valves & ball valves.

- Check pressure switch activation for two positions
  a) High
  b) Low
- Check visually plenum bottle for any damage or deterioration and check the fitting with soap solution for any leak.

- Check nitrogen cylinder with soap solution for any leak.

- Check the functionality.

- Note down the readings of the flowmeter before and after checking the functionality of SRV in case of LPG.

MEC 25: EMERGENCY RESPONSE VEHICLE

Aim: To provide guidelines for the maintenance of Emergency Response Vehicle.

Responsibility: Officer Incharge(Mechanical).

Frequency: Yearly

Common Instructions:

- Take applicable work permit
  - Cold Work Permit
- Following minimum PPEs to be used
  - Safety Shoes and Helmets
  - Hand gloves
- Check for Fitness certificate, Insurance copy, Pollution certificate.
- Ensure adequate quantity of fuel all the time.
- Check for the materials, Tools & tackles available in the vehicle for its functionality

Maintenance Instruction of Emergency Response Vehicle:

- Check for Condition of Chassis against corrosion/cracks/tightness of body mounting.
- Check for Condition of Shutters for free opening and closing. Apply slight grease.
- Check for tyre conditions and Pressure & check for spare tyre also
- Check for cleanliness of Under Carriage and Cabin
- Apply grease on rotating equipment and connecting levers
- Check for proper functioning of all lights, wipers, indicator lights.
- Check Engine Oil level and condition, battery condition, brake fluid level, coolant level, oil level in power steering reservoir and engine exhaust system.
- Check for proper functioning of Power Take Off Unit.

- Check for proper functioning of pumps and compressors in the vehicle.
- Check for condition of DG and its functionality, if available.

NOTE:
ERV should be serviced from an authorized service center as recommended by OEM.

MEC 26: EMERGENCY MAINTENANCE VEHICLE

Aim: To provide guidelines for the maintenance of Emergency Maintenance Vehicle.

Responsibility: Officer Incharge(Mechanical).

Frequency: Monthly

Common Instructions:

- Take applicable work permit
  - Cold Work Permit
- Following minimum PPEs to be used
  - Safety Shoes and Helmets
  - Hand gloves
- Check for Fitness certificate, Insurance copy, Pollution certificate.
- Ensure adequate quantity of fuel all the time.
- Check for the materials, Tools & tackles available in the vehicle for its functionality

Maintenance Instruction of Emergency Maintenance Vehicle:

- Check for Condition of Chassis against corrosion/cracks/tightness of body mounting.
- Check for Condition of Shutters for free opening and closing. Apply slight grease.
- Check for tyre conditions and Pressure & check for spare tyre also
- Check for cleanliness of Under Carriage and Cabin
- Apply grease on rotating equipment and connecting levers
- Check for body damage
- Check for proper functioning of all lights, wipers, indicator lights.
- Check Engine Oil level and condition, battery condition, brake fluid level, coolant level, oil level in power steering reservoir and engine exhaust system.

- Check for condition of DG and its functionality, if available.
- Check for condition of Compressor and associated assesories.

NOTE:
EMV should be serviced from an authorized service center as recommended by OEM.

MEC 27: MOBILE HOT FLARE UNIT VEHICLE

Aim: To provide guidelines for the maintenance of Mobile Hot Flare Unit Vehicle.

Responsibility: Officer Incharge(Mechanical).

Frequency: Monthly

Common Instructions:

- Take applicable work permit
  - Cold Work Permit
- Following minimum PPEs to be used
  - Safety Shoes and Helmets
  - Hand gloves
- Check for Fitness certificate, Insurance copy, Pollution certificate.
- Ensure adequate quantity of fuel all the time.
- Check for the materials, Tools & tackles available in the vehicle for its functionality

Maintenance Instruction of Hot flare unit:

- Check for Condition of Chassis against corrosion/cracks/tightness of body mounting.
- Check for Tyre conditions and Pressure & check for spare tyre also
- Check for cleanliness of Under Carriage and Cabin
- Check for any body damage
- Apply grease on rotating equipments and connecting levers
- Check for proper functioning of all lights, wipers, indicator lights.
- Check Engine Oil level and condition, battery condition, brake fluid level, coolant level, oil level in power steering reservoir and engine exhaust system.
- Check for the condition of the hoist rope.

- Check the condition of the brake drum and shoes. Ensure that the brakes are intact.
- Check for smooth operation of Self-locking arrangement.
- Check for smooth operation of electric winch while lifting up the stack as well as lowering the stack.
- Check the condition of LPG hoses.
- Replace the grease in the self-locking arrangement as per OEM recommendations.
- Check for condition of DG and its functionality, if available.

NOTE:
HFU should be serviced from an authorized service center as recommended by OEM.

MEC 28: SCRAPPER LAUNCER/RECEIVER/ UNIVERSAL BARREL

Aim: To provide guidelines for the maintenance of Scrapper Launcher & Receiver System/ Universal barrel.

Responsibility: Officer Incharge(Mechanical).

Frequency: Half yearly

Common Instructions:

- Take applicable work permit
  - Cold Work Permit
  - Electrical isolation permit

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Eye Goggles
  - Hand gloves

Maintenance Instruction of Scrapper Launcher & Receiver System:

- Ensure proper closure and isolation of all the valves connected to the barrel.
- Keep the HOV in lock position or Chain lock the HOV.
- Depressurize both minor as well as major barrel.
- Open the pressure warning flow pipe slowly to check that the barrel is completely drained
- Open the barrel.
- Clean the top bolts and grease generously. Check for proper tightening of bolts.
- Check for leakage from ‘O’ ring / ‘V’ Seals, Pig Signalers. In case of any leaks please rectify the same.
- Grease the handling system.

- Check for working of Pig Signaler by lifting the flag available on the signaler. Check for its Indication in PLC & Scada.

- Check for operation of winch

- Grease the rack and check for rotation of jib crane.

MEC 29: ABOVE GROUND STATION PIPING

Aim: To provide guidelines for the maintenance of Above Ground Station Piping.

Responsibility: Officer Incharge(Mechanical).

Frequency: Visual Inspection: Yearly

UT Testing: Once in 4 years

Common Instructions:

- Take applicable work permit
  - Hot Work Permit (For only UT)

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Eye Goggles
  - Hand gloves
  - Ear Muff/Plug

Maintenance Instruction of Above Ground Piping:

❖ **For Visual Inspection**

- Check for Product leakage if any.
- Check for Dent/ bulges / support condition/connected equipment condition.
- Check for condition of paint / protective coating or concrete coating if any.
- Check for external corrosion spots.
- Check for pipe vibration & its effect on weld joints.
- Check for pipe earthing /continuity strip existence, condition of studs/ nuts & their protruded lengths.

❖ **For UT Testing**

- Check for Min. 3 readings on bends at the outer curvature. One shall be at center and other two on either side of this reading

- Check for Min. 1 UT scan (3-6-9 & 12 O'clock positions) on the straight pipes on upstream and downstream of the bend adjacent to welds of the bend to pipe.

- One ultrasonic scan on the entire circumference (four readings) upstream and downstream of the weld joint.

- Minimum one ultrasonic scan (four readings) each on reducer/ expander and just downstream on the pipe.

- One ultrasonic scan on the pipe downstream of valves orifices, etc.

- One ultrasonic scan minimum on horizontal pipe for every three meters' length at lower elevations where possibilities of collection and stagnation of carryover water, or acid condensation or SO2 flow exist.

- One UT scan at every ten-meter interval of the exposed piping and also at 5-meter interval of the underground piping after insulating coupling

NOTE:

1. Ultrasonic thickness measurements shall be taken on exposed sections of the pipe once in 4 years for POL lines and once in 2 years for LPG lines as per OISD 130. The details of thickness survey shall be maintained on an isometric sketch. Previous reading shall be compared with the present reading and Rate of corrosion shall be established.

2. UT scan/reading shall be done by competent person only

MEC 30: PIPELINE CLAMPING

Aim: To provide guidelines for Pipeline Clamping.

Responsibility: Officer Incharge(Mechanical), Location In Charge,
Pipeline Maintenance In Charge (For pipe book updation).

Frequency: As and when required

Common Instructions:

- Take applicable work permit
  - Cold Work Permit
  - Hot work permit

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Eye Goggles
  - Hand gloves

Instruction for Pipeline Clamping:

- Identify the exact location of the pipe where clamping needs to be done by using GPS Co-ordinates, PDM/PCM.

- For being absolute sure of the pipeline expose the weld joints of the pipe at both ends and measure the seam position- (“” O- Clock””) of both upstream and downstream pipe and compare it with survey reports.

- Low thickness portion of the pipe line has to be ascertained as per the relevant survey reports

- Ensure to maintain minimum pressure at the point of clamping.

- Remove the coating.

- Clean that portion thoroughly.

- Verify the thickness of the pipe line in all the positions by using ultrasonic thickness detector and co-relate with the survey reports.

- Check for the proper gasket condition of the clamp.

- Position the clamp and tighten the stud bolts and nuts. Check uniformity of tightening using filler gauge or adequacy as per the OEM.
- Flood coating or painting using epoxy primer to be carried out in the clamping to ensure that no CP current drainage is there at the clamping point.

- Backfill the soil.

- Update the History Card and the pipe book.

MEC 31: PIPELINE LEAK REPAIR

Aim: To provide guidelines for Pipeline Leak Repair.

Responsibility: Officer Incharge(Mechanical), Location In Charge,
Pipeline Maintenance In Charge (For pipe book updation).

Frequency: As and when required

Common Instructions:

- Take applicable work permit
  - Cold Work Permit
  - Hot work permit

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Eye Goggles
  - Hand gloves

Instruction for Pipeline Leak Repair:

- Deploy ERV (Emergency Response Vehicle), EMV (Emergency Maintenance vehicle), Fire Tender and Fire Fighting Team at site.

- Expose the Pipeline where leak repair has to be done. Precaution to be taken that OFC Cable and Pipeline is not damaged.

- Remove the coating.

- Depressurize the line to maximum possible extent possible.

- Completely Isolate the U/S side of pipe where leak repair shall be done.

- Ensure at Downstream side valves are opened and tanks lined up to keep the line in depressurize steps and to avoid pressure rise in P/L.

- Remove the stub piece, clamps etc. whatever is the cause of leaks by using hacksaw (cold cutting) or by using Grinders.

- Insert Wooden/metal plug into the Pipeline at the site of leak. - At the time of Insertion of Wooden/Metal Plug measure the puncture size and take photographs of the same for future reference and subsequent actions like sleeving.

- The drawing of the NPT metal plugging is attached as Appendix A.

- Cut the extra protrusion of the wooden plug. In case of metal plug use follow Annexure- 4(Drawing).

- Thereafter use buffing tool to prepare pipeline for application of primer and for subsequent clamping of the pipeline.

- Post Clamping backfilling to be done and pipeline shall be restored as was before.

- Update the History Card and the pipe book

NOTE:
Clamping to be done as per Maintenance Instruction depicted above in section MEC 31.

MEC 32: PIPELINE SLEEVING

Aim: To provide guidelines for Pipeline Sleeving.

Responsibility: Officer Incharge(Mechanical), Location In Charge,

Pipeline Maintenance In Charge (For pipe book updation).

Frequency: As and when required

Common Instructions:

- Take applicable work permit
  - Hot work permit

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Eye Goggles
  - Hand gloves

Instruction for Pipeline Sleeving:

- Positive identification of the locations where repair is planned by using GPS Co-ordinates, PDM/PCM.

- Excavate the area and remove the coating.

- For being absolute sure of the pipeline expose the weld joints of the pipe at both ends and measure the seam position- (“” O- Clock””) of both upstream and downstream pipe and compare it with survey reports.

- Ascertain the pipe thickness using UT thickness measuring gauge and co-relate with survey report.

- Pressure-test the pipe for sleeving purpose to a test pressure equivalent to that of the pipeline system.

- Half-cut the pipe longitudinally and prepare the pipe to match the OD of pipeline to be sleeved. Also prepare the edges for fillet welding of circumference and butt welding of longitudinal side.

- Length and the orientation of the sleeve to be decided as per ASME B 31.4.
- Install the half cut sleeve on the carrier pipe. Gap between sleeve and carrier pipe, if any, shall be filled up with putty.
- Establish communication to Main pumping station from the site location. Reduce the pressure and flow to the minimum permitted range and be in continuous contact with pumping location to monitor the same.
- Switch off T/R units protecting that particular section of the pipeline.
- Ensure to maintain minimum possible pressure at the point of sleeving during fitment and welding.
- Sleeve the pipe with hydro-tested pipe sleeve using approved welding accessories and welders qualified as per API 1104 Section 5 and API 1104 Appendix B.
- Welding shall be carried out as per API 1104 Appendix B and Pipeline repair manual prepared by pipeline research council international Catalogue number L 52047.
- In case of stoppage in pumping operation, welding will be stopped immediately.
- All weldment shall be tested for DP test and upon satisfactory results only welding to be accepted.
- Progressively increase the pressure and flow in the pipeline and observe the welds for leakage/sweating.
- Apply primer and tape coat (eg. Denso tape) the pipe sleeve and check for holiday using holiday detector.
- Restore the ROU and backfill to its original condition.
- Update the History Card and the pipe book.
- The drawing of the NPT metal plugging is attached as Appendix A.

NOTE:

1. Pipe used for preparing sleeves shall have thickness of the pipe and should be of same grade or higher as that of main line pipe of the sleeving section.
2. Flow rate during the welding activity to be appropriately chosen (basis the thermal characteristics of product heat energy generated by welding) so as to avoid localised heating / sudden cooling of weld joint.
3. In case readymade sleeves are not available, sleeve halves may be prepared prior to the activity as per main line diameter and the length of the sleeves may be appropriately chosen basis the dimensions of the defect.

MEC 33: MUD PLUGGING

Aim: To provide guidelines for Mud Plugging.

(NOTE: Mud plugging should be avoided to the extent possible).

Responsibility: Officer Incharge(Mechanical).

Frequency: As and when required

Common Instructions:

- Take applicable work permit
  - Cold work permit
  - Hot work permit

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Eye Goggles
  - Hand gloves

Common Instruction for Mud Plugging in Station piping and Cross country pipeline

- The quantity calculated above will be sufficient to form a barrier of 1.5 times that of the pipe diameter.

- Major length of the plug should consist of MDPE foam pig (cut or uncut). Mud should be used minimally at the front end only to prevent gas/vapour escaping from the other end towards the work area (ideally not more than 2 inches thick or depending on the site conditions).

- Grease may be used at the rear end of the pig (away from the work location) to additionally plug the vapors and also ease of pig insertion. Dry ice (if available) can also be used at the rear end before inserting the foam pig.

- Mud Plug is formed by mixing of Bentonite, clay (preferably potters/ brick clay) & Water. Mixing if done by weight- (Ratio of 50% Bentonite & 50% Water, however 60:40 is also acceptable).

- For best process and mixing add bentonite/clay to water and mix to prepare well processed mud.

- Make mud ball and store it in a place which slows down evaporation. (Preferably in sealed box and store at room temperature). For ease of handling the ball shall be of 3-inch size.

- Ensure the mud ball are free from any voids.

❖ **Installation of Mud Plug- Process 1 (For both cross country & station piping)**

- Clean the debris, deposits etc. from the interior surface of the pipeline on which welding is to be done.

- Measure and Mark point on the pipe line at a distance of 1.5 times the diameter of the pipe from where Mud Plugging has to start relative to the open end.

- Ensure the gaps are completely sealed and no voids are present to avoid any passage of Vapour.

- Measure LEL level at the place where welding has to take place.

- Once the process of welding is completed then the mud plug is to be removed by flushing with water as per the procedure for the Recommissioning of facility.

- In the cross country pipeline the mud plug along with the foam pig should be allowed to travel to the next station along with the water plug.

❖ **Installation of Mud Plug- Process 2 (In station piping where we need to install any stub piece for inclusion of any equipment in station)**

- After water flushing of the section to be cut, positive isolation of the section to be ensured.

- Carry out the cold cutting of the line.

- Clean the debris, deposits etc. from the interior surface of the pipeline on which welding is to be done.

- Measure and Mark point on the pipe line at a distance of 1.5 times the diameter of the pipe from where Mud Plugging has to start relative to the open end.

- If the space is available for retrieving the blind plate fabricate a blind plate of diameter slightly smaller than the pipe diameter so that it fits into the effected pipe where job needs to

be done. Base disc shall be made on the blind which is placed on the pipeline marked at a distance of 1.5 metre from the point of action. Then pack entire length of mud balls in the form of Series of Rings or Disc. The first disc which is at the farthest point is called a base disc. Subsequent disc or rings shall be moulded together to form a solid plug.

- If no sufficient space is available for retrieving the blind plate pack entire length of mud balls in the form of Series of Rings or Disc. The first disc which is at the farthest point is called a base disc. Subsequent disc or rings shall be moulded together to form a solid plug

- Ensure the gaps are completely sealed and no voids are present to avoid any passage of Vapour.

- Ensure that the vents on both sides of the welding point are open so that proper gas release is available.

- Continue the same steps till desired length of plugs has been achieved and suitable space is left for working on the affected pipe.

- Once the process of welding is complete then the blind plate prepared can be pulled out. If the blind plate is not installed, the mud plug has to be flushed out of the pipeline using pressurized water.

MEC 34: PIPELINE REPLACEMENT

Aim: To provide guidelines for Pipeline Replacement.

Responsibility: Officer Incharge(Mechanical), Location In Charge,
Pipeline Maintenance In Charge (For pipe book updation).

Frequency: As and when required

Common Instructions:

- Take applicable work permit
  - Hot work permit

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Eye Goggles
  - Hand gloves

Instruction for Pipeline Replacement:

- Identify the exact pipe where replacement has to be done by using Dig sheets and GPS Co-ordinates, PDM/PCM.

- Trenching to be carried out as per OSHAS

- Expose the pipe line after deploying the firefighting team at the site.

- For being absolute sure of the pipeline expose the weld joints of the pipe at both ends and measure the seam position- (“” O- Clock””) of both upstream and downstream pipe and compare it with survey reports.

- Remove the coating.

- Measure the wall thickness Observe for external pitting and damage if any and co-relate with the survey reports.

- Start the water pumping with maximum dosage of C.I and stop the pumps after sufficient batch quantity is pumped. Batching/ Cup pig shall be launched to avoid inter mixing of product with water.
- Switch of CP- T/R Unit.
- Depressurize the pipeline.
- Cut the pipeline with hack saw (Cold cutting).
- Drain the water and apply mud plugs. In case air pigging has been done we need to apply only mud plug.
- Hydrostatic pressure tested pipe of sufficient length shall be kept ready.
- Check the concentration of vapors with explosive meter.
- Edges of mainline have to be prepared.
- Tie-in joints fitment and welding has to be completed after conducting root DP tests as required. Welding shall be carried out as per ASME B 31.4, API 1104 and by welders qualified as per ASME Sec IX.
- Conduct 100 % post welding radiography of the joints and certify the quality of weld joints with level II and level III certified welding inspector/surveyors
- In case air pigging is done, fill the block segment with water using batch PIG or localised arrangement.
- Post completion Pumping to be Resumed.
- Coating has to be restored and holiday testing to be done.
- Soil has to be back filled.
- Switch on TR unit.
- Mud plugs have to be taken in the designated receipt tanks.

- Monitor differential pressure across filters at downstream locations for abnormal pressure drop / chocking due to passing of mud plugs.

- Pipe book to be updated post Pipeline Replacement.

NOTE:
If possible air pigging can be planned post water pumping so that pipe is entirely free from oil traces and debris.

MEC 35: PIPELINE COATING

Aim: To provide guidelines for Pipeline Replacement.

Responsibility: Officer Incharge(Mechanical), Location In Charge,
Pipeline Maintenance In Charge (For pipe book updation).

Frequency: As and when required

Common Instructions:

- Take applicable work permit
  - Cold work permit
  - Hot work permit

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Eye Goggles
  - Hand gloves

Instruction for Pipeline Coating:

- The area of coating to be repaired shall be removed by cutting the defective or damaged coating and pipe shall be placed in an environment free of moisture.

- Surrounding edges of the removed coating area shall be beveled and all dirt, foreign matter and other contaminant shall be cleaned with wire brush and sand paper, till the metal surface becomes white free of foreign particles.

- If the area to be repaired is less than 2 X 2 cm, cold applied tape shall be used for filling and repairing. The application procedure as given in procedure 1-

- Cold applied tape system shall comprise of primer, an inner wrap and an outer wrap. The inner and outer wraps shall be asymmetric 3-ply tape with co-extruded polyethylene carrier film and butyl rubber adhesive layers on both sides. The inner layer of butyl rubber adhesive of inner wrap shall have a thickness of min. 1.0 mm. The inner and outer wraps are to be spirally wrapped with 55% overlap, equivalent to two layers each providing a total minimum thickness of 3.0 mm on the pipe body and 2.5 mm on the weld.

- Cold applied joint protection tapes shall be of the type which can be applied by spirally wrapping on the pipe. Immediately after the completion of surface preparation the approved primer of wet film thickness 150 microns or as per manufacturer's recommendation whichever is higher to cover the exposed bare metal of the welded field joint and 10mm min. onto the adjacent pipe coating if recommended by the manufacturer. Any dirt on the primed surface shall be removed. If the primer is damaged, the damaged area shall be cleaned and re-primed.

- Approximately 100mm of tape interleaving paper shall be peeled back and tape shall be applied with the adhesive side to the pipe. Whilst continuously removing the interleaving paper, the tape shall be spirally applied to provide a minimum of 55% overlap. Sufficient tension shall be applied to ensure good conformity, avoiding air pockets and also continuously smooth out as the wrapping proceeds. The wrapping shall start and finish to give a minimum of 50mm overlap on to the adjoining yard applied coating. Outer wrap shall also be applied in similar method.

- If the defect is only on the final layer i.e. between enamel and outer wrap, which is called dis-bonding, the dis-bonded outer wrap should be removed. Hot enamel shall then be applied followed by outer wrap.

- If required, the thickness of the repaired pipes shall be checked and Holiday test may also be conducted.

- For all these defects, DENSO coating tape wrap may also be used after applying a suitable primer.

- The tape may also be applied with the tape wrap machine or by hand.

- Post Repair Pipe book to be updated.

MEC 36: INSERVICE LOWERING

Aim: To provide guidelines for Inservice Lowering.

Responsibility: Officer Incharge(Mechanical), Maintenance In Charge, Location In Charge.

Frequency: As and when required

Common Instructions:

- Take applicable work permit
  - Cold work permit
  - Hot work permit

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Eye Goggles
  - Hand gloves

Instruction for Inservice Lowering:

- Identify the section of the Pipe on which lowering has to be done by using PCM/PDM and GPS Co-ordinates.

- Track down the depth of the pipeline. Knowing the depth and the location of the pipeline are of at most important in proper excavation and exposing of the pipeline.

- Track down the OFC cable lying along the pipe.

- Use API 1117 to calculate:
  - Longitudinal Stress
  - Longitudinal Stress
  - Total Stress
  - Pipeline Trench Profile
  - Trench Length
  - Free Span between the two support.

- Excavate to expose the pipeline to desired trench length. Manual excavation to be done within 30 cm of the pipeline.

- Use any one of the Pipeline Movement Method for carrying out the In-service lowering-
  - Pig Pen Method of P/L Support
  - Air/sand Bag Method of P/L Support
  - Earth Pillar Method of P/L Support.
  - Sling Method of P/L Support.
- Generally, from cost point of view Earth Pillars support is used but for P/L safety Pig Pen supports should also be used along with earth pillars.

- Pig Pen to be provided between the earth pillars to provide additional support and also safety in case the earth pillar collapses.

- After all the required pig pen supports are in place, earth pillars to be removed. Use P/L Movement with two boom technique or P/L Movement with one boom and one backhoe to carry out the lowering.

- Match the trench bed to the new pipeline profile calculated as per API 1117.

- Arrangement for lifting of the exposed pipeline to be done using backhoes/hydra/cranes.

- The exposed pipeline is to be checked for holiday defects and repaired if any.

- Gradually remove the pig pen supports step by step while the pipeline is also being lifted by the backhoes/hydra/cranes. Utmost care needs to be taken while use of Hydra/JCB etc. that the pipeline is lifted only to an extent that layer by layer blocks used in pig pen are removed.

- Backfilling of the trench to be carried out and ROU restored to its original condition.

- The calculation sheet for the Inservice lowering is attached as Appendix – B.

MEC 37: PIPELINE HYDROTESTING

Aim: To provide guidelines for Pipeline hydrotesting.

Responsibility: Officer Incharge(Mechanical), Maintenance In Charge, Location In Charge.

Frequency: Once in 10 years

Common Instructions:

- Take applicable work permit
  - Cold work permit
  - Hot work permit

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Hand gloves

Instruction for Pipeline Hydrotesting:

- Measure and Calculate Line Fill and arrange for Pumping the water and for filling the line completely.

- Before filling operation of pipeline is started pigging shall be done to separate product & filling material and also for removing hydrocarbon traces.

- Material required for filling the pipeline are-
  - Large Volume fill pump.
  - Filter Screens.
  - Flowmeters
  - Portable Tanks.

- Use Large volume fill pump for filling the entire section of the pipeline. For measuring the quantity of filling material a flowmeter shall be used.

- Once filling operation is complete pressurization to start. Equipment used for pressurization are-
  - High Pressure Positive Displacement Pumps.

- Flow Meter & Vacuum Accumulator
- Dead Weight Pressure Tester
- Temperature Recorder
- Pressure Recorder
- Portable Tank

- Pressurization of the section should be done at controlled rate to avoid surging of the line.
- The flow rate shall be monitored and logged for plotting P-V plot.

- Once 80 to 90 % of test pressure is achieved rate of Pressurization should be reduced.

- After reaching the desired pressure equipment shall be stopped and isolated.

- Note- Pressure charts, sensors and display shows approximation of actual pressure. Charts provide continuity of the test. Dead Weight Tester provide actual pressure recorded.

- Test Pressure: 1.25 times the design pressure.

- Test Duration:
  - 24 hours for Line Pipe
  - 4 hours for Station Piping

- Test Medium:
  Water or any other component as decided. In case water is used the same shall be doped with Corrosion inhibitor.

- History card to be updated.

MEC 38: CLEANING OF UNDER GROUND TANKS (SUMP TANK), AND ABOVE GROUND TANKS (INTERFACE, SLOP AND FIRE WATER TANK)

Aim: To provide guidelines for cleaning of Underground tanks (sump tank), and Above ground tanks (interface, slop and fire water tank).

Responsibility: Officer Incharge(Mechanical), Location In Charge.

Frequency: Above Ground Tanks: Once in 5 years
Under Ground Tanks: Once in 10 years

Common Instructions:

- Take applicable work permit
  - Cold work permit
  - Hot work permit
  - Entry into confined space

- Following minimum PPEs to be used
  - Gum Boot
  - Apron
  - Safety Helmet
  - Oil Resistant Gloves
  - Mask
  - Safety Goggles

Instruction for cleaning of Above Ground Tanks (Interface, Slop & Fire Water Tanks):

- Completely empty out the tank.

- Thereafter open both the manholes nozzles etc. existing on the tanks for Vapour to escape.

- Place an exhaust fan (Flame Proof) on one side of the manhole and keep the other side of the manhole for degasification to take place.

- Arrange for a slurry pump and empty barrels or Tank Trucks for removing and collecting the sludge from the tanks.

- Take LEL value and ensure for proper ventilation and lighting for subsequent step of Coarse Washing to take place.

- At desired LEL value Coarse Washing of the Tanks is to be done for removing the debris, traces etc. which may be lying or may be stuck on shell plates, joints rivets etc. The person carrying out the Coarse Washing shall wear complete PPE like Mask, Gloves, Goggles, Helmets, Gum Boot

- Again by using the slurry pumps collect the sludge generated during the Coarse Washing of the tanks.

- Again Take LEL value and at desired value start fine washing of the Tanks to make the tank completely free from traces of sludge.

- During Entire process of cleaning the degasification unit (the Exhaust Fan) needs to be continuously in operation.

- Take LEL reading. Once the desired LEL is achieved handover the Tank for Internal Inspection.

Note: The cleaning frequency of Tanks is decided by the frequency of Internal Inspection.

Instruction for cleaning of Underground tank:

- Completely empty out the tank.

- Open the manholes nozzles etc. existing on the tanks for Vapour to escape.

- Remove Motor, Pumps etc. available on the Sump Tanks. WATER FILLING

- Place an exhaust fan (Flame Proof) on one side of the manhole and keep the other side of the manhole for degasification to take place.

- Arrange for a slurry pump and empty barrels or Tank Trucks for removing and collecting the sludge from the tanks.

- Take LEL value and ensure for proper ventilation and lighting for subsequent step of Coarse Washing to take place.

- At desired LEL value Coarse Washing of the Tanks is to be done for removing the debris, traces etc. which may be lying or may be stuck on shell plates, joints rivets etc. The person carrying out the Coarse Washing shall wear complete PPE like Mask, Gloves, Goggles, Helmets, Gum Boot

- Again by using the slurry pumps collect the sludge generated during the Coarse Washing of the tanks.

- Again Take LEL value and at desired value start fine washing of the Tanks to make the tank completely free from traces of sludge.

- During Entire process of cleaning the degasification unit (the Exhaust Fan) needs to be continuously in operation.

- Take LEL reading. Once the desired LEL is achieved handover the Tank for Internal Inspection.

Note: The cleaning frequency of Tanks is decided by the frequency of Internal Inspection

MEC 39: INSPECTION OF UNDER GROUND TANKS (SUMP TANK), AND ABOVE GROUND TANKS (INTERFACE, SLOP AND FIRE WATER TANK).

Aim: To provide guidelines for Inspection of underground tanks (sump tank), and above ground tanks (interface, slop and fire water tank).

Responsibility: Officer Incharge(Mechanical), Maintenance In Charge, Location In Charge.

Frequency: **Above ground:**

Routine inspection:	Daily
External/internal inspection:	5 years
Underground tank inspection:	10 years

Common Instructions:

- Take applicable work permit
  - Cold work permit
  - Hot work permit
  - Entry into confined space

- Following minimum PPEs to be used
  - Gum Boot
  - Apron
  - Safety Helmet
  - Oil Resistant Gloves
  - Mask
  - Safety Goggles

- Clean the subject Tanks till the tank is free from Hydrocarbon Gases. All the Instruction in MNT 33 shall be adhered while cleaning the Tanks.

Instruction for Inspection of Above ground tanks:

❖ **Routine In- Service Inspection:**

It includes normal checking of valves, pipes paint, vegetation growth, evidence of leaks, etc. on daily basis.

❖ **External Inspection:** It include following two checks-

a) Visual Inspection:

i) It includes checking the condition of Protective coating, paints etc.

ii) **Roof plates** shall be checked for water accumulation, pin holes, corrosion, product accumulation or leakages mark. It also includes the position of roof if it is tilted or not.

iii) **Ladder** shall be checked for corrosion and broken parts, condition of paints, movements of crossover ladder wheels. Handrails to be checked for firmness.

iv) Tank Pads: Tanks pads shall be visually checked for settlement, sinking, tilting, spalling, cracking, grass/ weed growth and general deterioration.
Slope of tank pads
Sealing condition between tank shell and bottom plate.

v) Fire Fighting System

vi) Vents & Pressure Relieving Devices: All open vents, flame arrestors and breather valves shall be examined to ensure that the wire mesh and screens are neither torn nor clogged by foreign matter or insects.

vii) Insulation: The insulation, weatherproof sealing and straps around the insulation cladding shall be inspected for damage. The waterproof sealing of the insulation shall be examined.

viii) Grounding Condition:

ix) Leaks

x) Tanks Mountings: Tank mountings such as Breather Valves/ P&V Valves, Relief Valves, Flame Arrestors etc. shall be ensured clean and operable after monsoon. Check for condition of roof drain and emergency drain condition.

b) UT Thickness survey: The frequency of UT Survey shall be determined by Dt/4N where Dt is the difference between measured shell thickness and the minimum thickness required, N is the Tank Shell Corrosion rate.

i) Tank Fittings, Nozzles etc.: UT survey to be done at 0, 3, 6 and 9 O clock position.

ii) The following minimum requirement for thickness survey is recommended on all the tanks:
All the plates of bottom two-shell course should be checked for thickness.

On the first course, the readings shall be taken in such a way that the bottom, middle and top positions of each plate are checked for thickness. An average of a minimum of 4 readings shall be taken on each plate diagonally to arrive at the remaining thickness.

On the second course, thickness measurement shall be carried out at two elevations to cover all plates. One location shall be very close to the bottom weld joint and the other at the approachable height. An average of a minimum of 4 readings shall be taken at each location to arrive at the remaining thickness

For the balance shell courses, thickness measurement shall be taken at three elevations covering bottom, middle and top of the shell plate approachable from the spiral staircase. An average of a minimum of 4 readings shall be taken at each plate to arrive at the remaining thickness.

iii) For Tanks Handling MS middle shell shall be rigorously monitored as this shell is more effected due to frequent wetting and drying.

iv) For the tanks which are likely to have water at the bottom, the bottom shell courses near the annular ring weld joint should be thoroughly checked ultrasonically for 150mm of the bottom plates.

Normally for tanks handling HSD/SKO/MS/LPG and having CP and with corrosion based assessment the frequency of UT is generally- 5 years and tanks without corrosion based assessment shall have frequency of 3 years.

However Actually the frequency must be decided by Dt/4N value only.

- **Internal Inspection:** It includes measuring the bottom plate thickness of the shell depending upon the Dt/4N ratio.
  - **i) Roofs: Fixed & Floating:** Carry out UT testing. If 25% of the metal is lost as compared to initial thickness than the same to be rejected**.**
  - **ii) Tank shell:** Carry out visual inspection of joints, rivets etc.
  - **iii) Tank bottom:**
    - DP Test for find cracks etc.
    - UT test for measuring the thickness of tank Bottom. Minimum 3 readings per plate to be taken while carrying out the Survey.

- To measure the soil side corrosion of the Tanks- corrosion coupon must be retracted and the hole to be sealed by welding the patch plate.

iv) **Water Draw Off:** It shall be checked for thickness

v) **Roof Drain:** The swivel joints to be checked for thickness.

vi) **Valves etc. shall be checked by DPT.**

Normally for Corrosion Based Assessment the frequency is 15 years and without corrosion based assessment the frequency is 10 years. However, in actual the measuring frequency must be decided by Dt/4N ratio.

Hydro testing: The hydrotesting shall be done if any repair etc. is done at pressure 1.5* operating pressure.

Instruction for inspection of underground tanks (sump tanks)-

- The Tanks shall be cleaned as per Instruction given in MEC 38 and thereafter UT shall be carried out on shell and plates after every 10 years.

MEC 40: PRESSURE VESSEL TESTING

Aim: To provide guidelines for Pressure Vessel Testing.

Responsibility: Officer Incharge(Mechanical), Maintenance In Charge, Location In Charge.

Frequency: External inspection: Once in 2 years

Internal Inspection: Once in 4 years

Common Instructions:

- Take applicable work permit
  - Cold work permit
  - Hot work permit

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Hand gloves

Maintenance Instruction for Pressure Vessel Testing:

❖ **For Visual Inspection**

- Check for Product leakage if any from the pressure vessel.
- Check for Dent/ bulges and connected equipment condition.
- Check for condition of paint / protective coating.
- Check for external corrosion spots.
- Check for vibration.
- Check for condition of support structures or mounting skid whichever is applicable.

❖ **For Internal Inspection**

- Carry out Ultra Sonic Thickness Survey of Pressure Vessel at points and guidelines as mentioned in OISD 141.

- For Hydrotesting of the Pressure Vessel Measure and Calculate Line Fill and arrange for Pumping the water and for filling the vessel completely.

- Before filling operation is initiated all traces of hydrocarbon shall be removed i.e. pressure vessel shall be free from any hydrocarbon traces.

- Once filling operation is complete pressurization to start. Equipment used for pressurization are-
  - High Pressure Positive Displacement Pumps.
  - Portable Tank

- Pressurization of the section should be done at controlled rate to avoid surging of the vessel.

- Once 80 to 90 % of test pressure is achieved rate of Pressurization should be reduced.

- After reaching the desired pressure equipment shall be stopped and isolated.

- Test Pressure: 1.25 times the design pressure.

- Test Duration:
  - 4 hours

- Test Medium:
  Water or any other component as decided.

- History card to be updated.

- Maintenance Format shall be filled at the time when Pressure Vessel Testing is done.

- Inference shall be drawn based on the previous and present reading (both UT and Hydrotest Report).

MEC 41: LIFTING TOOLS AND EQUIPMENTS

Aim: To provide guidelines for maintenance of Lifting tools and equipment.

Responsibility: Officer Incharge(Mechanical).

Frequency: Annually

Common Instructions:

- Take applicable work permit
  - Cold work permit

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Hand gloves
  - Safety Belts

Maintenance Instruction for Chain Pulley Block.

- Visually check the condition of the chain pulley block
- Check for any wear & tear.
- Check for the tightness of the chain.
- Remove the dry dust with blower.
- Check for free movement of chain.
- Lubricate the chain pulley.
- Carry out the load test with 1.25 times the rated capacity (or as per the relevant Factory act).

Maintenance Instruction for winches of High Mast Lights.

- Isolate the supply of the winch motor.

- Check the condition of the winch rope.
- Check for any wear and tear.
- Carryout the lubrication as per recommended Lubrication chart
- Check for free movement.
- Ensure that no one underneath the radius of the high mast light during up/down movement.
- Carry out the load test with 1.25 times the rated capacity (or as per the relevant Factory act).

NOTE:

All lifting tools and equipment shall be examined by a competent person as per the Factory Act 1948, at least once in every12 months. The Competent Person shall issue the examination certificate in the prescribed format.

MEC 42: CASING EXTENSION

Aim: To provide guidelines for carrying out casing extension job at pipelines.

Responsibility: Officer Incharge(Mechanical), Location In Charge,
Pipeline Maintenance In Charge (For pipe book updation).

Frequency: As and when required

Common Instructions:

- Take applicable work permit
  - Cold work permit
  - Hot work permit

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Hand gloves
  - Safety goggles

Instruction for Casing extension.

- Prepare the pipe in two pieces required for the casing extension.
- Trenching to be carried out as per OSHAS
- Expose the pipe line.
- Switch off the TR unit feeding the section of the pipeline.
- Disconnect the existing TLP connections from the casing and from the pipe.
- Remove the end cap of the existing casing.
- Check for the condition of the existing spacers in between the pipe and casing and if required replace the same.

- Cut the existing vent pipe in the casing and repair of the gap in the casing to be carried out using pipe piece as required.
- Check for the holiday of the carrier pipe where the extension has to be carried out. If any coating damages are observed, the same has to be rectified.
- The insulators and spacers to be provided over the carrier pipe and then fit up of the casing pipe to be carried out.
- Welding to be carried out as per the welding procedure provided. Ensure to carry out the Die Penetration test in the welding.
- Once the installation of the casing has been completed, vent pipe to be installed at the casing end.
- Casing end caps to be installed in the pipeline.
- Cleat welding to be carried out for the pipe and the casing connections to the TLP.
- Switch on the TR Unit.
- Ensure that no electrical continuity is there between the casing and the carrier pipe by checking the PSP and CSP at the location.
- Back fill of the site to be carried out.
- Update the pipe book and history card.

MEC 43: RECOMMISSIONING OF FACILITY

Aim: To provide guidelines for recommissioning of facilities at pipeline stations after any maintenance activity.

Responsibility: Officer Incharge(Mechanical).

Frequency: As and when required

Common Instructions:

- Take applicable work permit
  - Cold work permit
  - Hot work permit

- Following minimum PPEs to be used
  - Safety Shoes
  - Helmets
  - Hand gloves

Instruction for Recommissioning of facilities.

❖ **For jobs carried out inside the station premises**

- Ensure that the job is completed in all respects.
- Remove all the tools and tackles from the job site.
- Ensure that all the test certificates including radiography have been received and no defects are to be attended.
- Incase mud plug is provided along with the removable stub, the same should be removed.
- Use pressurized water to clean facility and any debris has to be flushed out of the line.
- Ensure proper tightening of the equipment and flanges have been done.
- Slowly pressurize the section using water or any other medium advised and venting should be done simultaneously. Ensure that the line is fully pressurized.

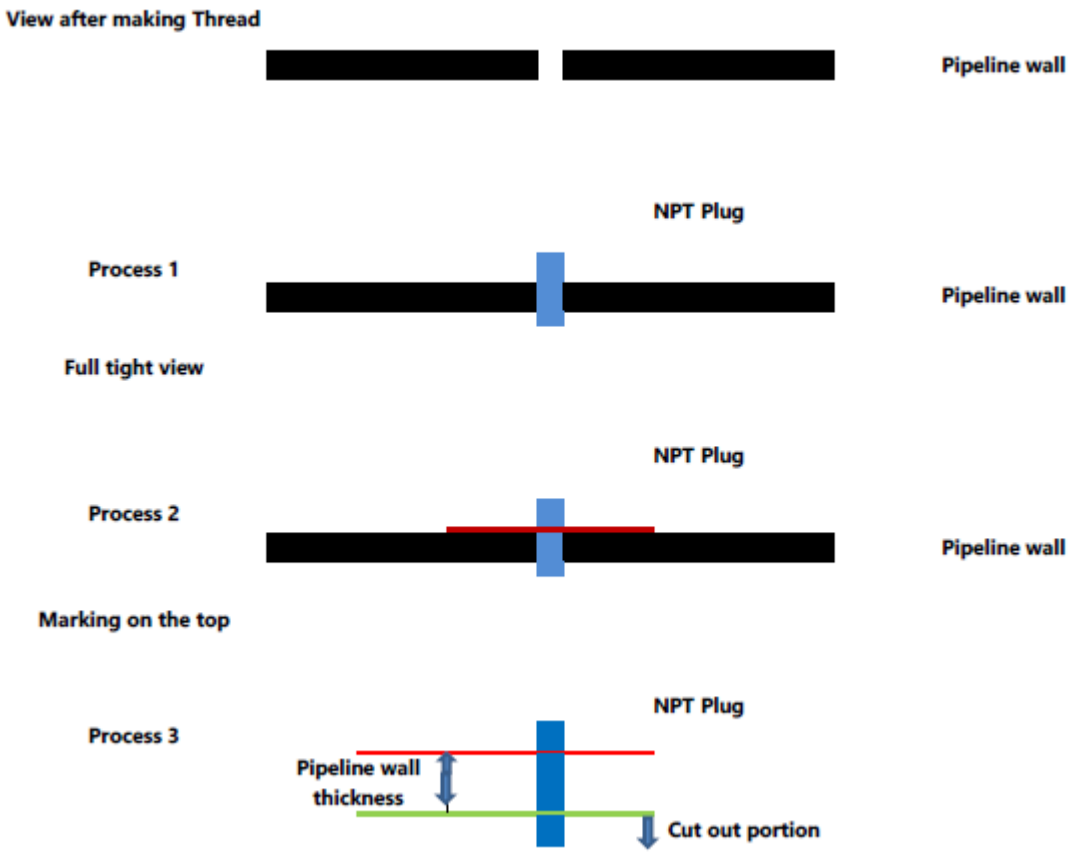
- Open all the upstream and downstream valves and line up the station / facility for operation.
- Check for any leakages at the job location. If there is any, rectification has to be carried out.
- Once the station/facility is fully lined up, inform the same to the operations department.
- Monitor for some time after the normal operation is resumed.
- Update the history card accordingly and necessary modification in the P&ID to be carried out.

❖ **For jobs carried out outside the station premises**

- Ensure that the job is completed in all respects.
- Remove all the tools and tackles from the job site.
- Ensure that all the test certificates including radiography have been received and no defects are to be attended.
- Incase mud plug is provided along with the removable stub, the same should be removed.
- If possible, use pressurized water to clean facility and any debris has to be flushed out.
- Open all the upstream and downstream valves and line up the station / facility for operation.
- Once the station/facility is fully lined up, inform the same to the operations department.
- Monitor for some time after the normal operation is resumed.
- Check for any leakages at the job location. If there is any, rectification has to be carried out.
- In case the mud plugging is done in the pipeline, the mud plug along with the foam pig should be allowed to travel to the next station along with the water plug.

APPENDIX – A

DRAWING FOR METAL PLUG (NPT THREAD)



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APPENDIX – B

CALCULATION SHEET FOR IN SERVICE LOWERING

API 1117 MOVEMENT OF IN SERVICE PIPELINE

1. INPUT DATA	Symbol	Formula	Value	unit	Value (converted)	unit2
Nominal Pipe Size	NPS		18	In		
Pipe Outside Dia	D	NPS*25.4	457.2	mm	18.0	in
Wall Thickness with Corr allowance	t		1.4	mm		
Wall Thickness original	t-min		6.4	mm		
Corrosion Allowance	Corr		5	mm		
Material Grade			API 5L X60			
SMYS	SMYS		4.14E+08	Pa	60000	PSI
Design Factor	DF		0.72			
Design Pressure	PI	2*DF*SMYS*t/D*10^-5	18.2	barg	264.57	PSI
Installation Temp	T1		50	deg C		
Design Temp (Min)	T2		15	deg C		
Coeff of thermal expansion	α		0.0000117	per deg C		
Poisson's Ratio	μ		0.3			
Young's Modulus of Elasticity	E		2.04085E+11	Pa	2.96E+07	PSI
Lowering Height	Δ		1	m	3.28	ft
Filled Pipeline weight per unit length	ωt	(π / 4) [ρm (do2 - di2) + ρl di2]	178.02	Kg/m	9.97	lb/in
2. PIPE SECTION PROPERTIES	**Symbol**		**value**	**unit**	**value2**	**unit2**
Internal Diameter	ID	D-2t	454.4	mm	17.9	in
Pipe Cross Section	Ax	(π / 4) (do2 - di2)	2005.5	mm2		

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Area						
Pipe internal Area	Ai	(π / 4) (di2)	162233.8	mm2		
Moment of Inertia	I	(π / 64) (do4 - di4)	5.21E+07	mm4	125.1	in4
Flexural Rigidity	EI	E*I	1.06E+07	Nm2		
Section Modulus of Elasticity	S	I/Y	2.28E+05	mm3	13.9	in3
3. CALCULATION OF COMBINED STRESS FOR LOWERING (API RP 1117)			**value**	**unit**	**value2**	**unit2**
Maximum Allowable Stress		90% of SMYS	372.32	N/mm2	54000.00	PSI
Tensile Hoop Stress		DF*SMYS	297.85	N/mm2	43200.00	PSI
Longitudinal Stress due to Internal pressure	Sp	P*D*μ/2t	89.36	N/mm2	12960.00	PSI
Longitudinal Stress due to Thermal Expansion	Sr	E*α*(T1-T2)	83.57	N/mm2	12121.20	PSI
Longitudinal Flexural Stress due to Elastic Curvature	Sc		0.00	N/mm2	0.00	PSI
Net Existing Longitudinal Stress	Se	Sp+Sc+Sr	172.93	N/mm2	25081.20	PSI
Minimum Trench length	Li	$\sqrt{\frac{(3.87\times10^7)D\Delta+(7.74\times10^7)\Delta^2}{F_D SMYS - S_E}}$	414.87	ft	126.45	m
Minimum UDL for Deflection	ωr	384*E*I*Δ/(Li^4)	1.63	Kg/m	0.09	lb/in
Longitudinal Stress due to bending	Sb	(ωr*Li^2)/12S	93.36	N/mm2	13541.39	PSI
Longitudinal Stress due to	Ss	2.67E*(Δ/Li)^2	34.08	N/mm2	4942.52	PSI

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Elongation						
Total longitudinal Stress	SL	Se+Sb+Ss	300.37	N/mm2	43565.11	PSI
Available Longitudinal Bending Stress	Sa	DF*SMYS-Se-Ss	90.85	N/mm2	13176.28	PSI
Maximum Allowable support spacing	Ls	$\sqrt{\frac{0.0286 S_A (D^4 - d^4)}{D^3 - 0.8724 d^2 D}}$	34.56	ft	10.53	m
Trench profile						
Δx=(16*x^2*Δ(L-x)^2)/L^4	**x ft**	**Δ mm**	**x in m**			
	0.00	0.00	0.00			
	20.74	-36.10	6.32			
	41.49	-129.60	12.65			
	62.23	-260.10	18.97			
	82.97	-409.60	25.29			
	103.72	-562.50	31.61			
	124.46	-705.60	37.94			
	145.20	-828.10	44.26			
	165.95	-921.60	50.58			
	186.69	-980.10	56.90			
	207.44	-1000.00	63.23			
	228.18	-980.10	69.55			
	248.92	-921.60	75.87			
	269.67	-828.10	82.19			
	290.41	-705.60	88.52			
	311.15	-562.50	94.84			
	331.90	-409.60	101.16			
	352.64	-260.10	107.48			
	373.38	-129.60	113.81			
	394.13	-36.10	120.13			
	414.87	0.00	126.45			

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