Session: LT Distribution Network

Learning Objective	Evaluation Criteria
Explain the LT distribution network breakdown maintenance – possible faults, their identification and rectification	Interactive Questioning

	**Duration**	60 Minutes
	**Resources**	PowerPoint Presentation, Whiteboard, Markers, Screen and Projector
	**Facilitator's Notes**	In this session, you will take the participants through an interactive presentation with video snippets on LT distribution network breakdown maintenance, possible faults, their identification and rectification.

End of Notes

		**1.**	**Tell:** Welcome to the video presentation on LT distribution network breakdown maintenance – possible faults, their identification and rectification. In this session, we will know about LT faults, possible breakdowns in LT distribution network and their rectification.
			**Facilitator's Notes:** • Display the slide • Read out the objectives and ask learners to note them down • Inform them that they will be asked questions during the session **End of Notes**
		**2.**	**Tell:** By the end of this session, you will be able to explain the LT distribution network breakdown maintenance – possible faults, their identification and rectification. Let us start with knowing what Mr. Devraj Koundal, Assistant Manager, BSES Rajdhani Power Limited, is saying about LT faults, possible breakdowns in LT distribution network and their rectification.

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	3.	**Tell:** The team will go to the house of the complainant and check if there is really no supply. They first check the display in BSES meter. If they notice that there is no light in the display of energy meter, the team will check on the pole or underground cable or check the service line. Let us now discuss fault identification and rectification at the consumer's premises. **Facilitator's Notes:** Click to play the video.
	4.	**Tell:** First, we see if there is a fault at the consumer's premises. This is because the consumer has reported that there is no electricity in the premises. So, the lineman visits the consumer's premises. The lineman first checks the incoming service line by opening the meter box, where the MCB is installed and connected. He then checks the availability of supply at MCB terminals. **Facilitator's Notes:** Continue to play the video.
	5.	**Tell:** On opening the meter box, he observes that there is lot of rat dung on the base plate of the meter box. Rats have damaged the incoming control cable at the entry point. On further checking, he observes that the neutral is missing. He finds that rats have cut the neutral wires at the cable entry point of the meter box. **Facilitator's Notes:** Continue to play the video.
	6.	**Tell:** Lineman checks the availability of supply at the meter board in the presence of the consumer. The lineman is showing the consumer that supply is available up to his MCB from the meter terminal. In many cases, there will be no supply at the consumer's MCB from meter. In that case, the lineman checks the service line from the feeding point. **Facilitator's Notes:** Continue to play the video.
	7.	**Tell:** He checks the bus bar box, where the service line is connected from the meter. On opening the bus bar box, the lineman finds loose connections and temporary joints. **Facilitator's Notes:** Continue to play the video.

		8.	**Tell:** Bus bar strips are missing and incoming and outgoing lines are jointed and taped. Two outgoing service lines are cut from the joint. Outgoing leads are overheated and damaged. **Facilitator's Notes:** Continue to play the video.
		9.	**Tell:** Supply is missing from the bus bar boxes. Leads are temporarily jointed. The incoming service line is damaged at bus bars and overheated at the joint. The joint of incoming service line is loose and the circuit is open from the feeding point. **Facilitator's Notes:** Continue to play the video.
		10.	**Tell:** A similar condition prevails at the pole where, due to jumbling of service lines and excessive stress on cables, there is a 'no current' complaint. **Facilitator's Notes:** Continue to play the video.
		11.	**Tell:** It is very challenging for a lineman to attend a 'Fuse Call' or 'No Current Complaint' in such a bad condition of wiring. He is unable to identify the consumer's outgoing line from the meter. There are also safety issues. **Facilitator's Notes:** Continue to play the video.
		12.	**Tell:** Now, let's look at the defective meter cases and how the consumer's supply is affected. **Facilitator's Notes:** Click to play the video.
		13.	**Tell:** A flash has occurred at the meter terminal. Smoke and black soot is clearly visible. **Facilitator's Notes:** Continue to play the video.
		14.	**Tell:** These are cases of meter being burnt. The consumer's electricity supply gets interrupted due to short circuit at the meter terminal. 'R' phase terminal of the meter and both incoming and outgoing leads are overheated and burnt here. **Facilitator's Notes:** Continue to play the video.

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		15-16.	**Tell:** The worst thing that can happen when a heavy flash occurs with fire in the meter box is complete damage of the metering equipment. **Facilitator's Notes:** Continue to play the video.
		17.	**Tell:** Instead of making temporary joints to restore the consumer's supply from the bus bar, ensure that there are firm and tight connections with sockets. There should be no jumbling of wires, as loose and temporary connections are the major cause for any breakdown. The following are the corrective measures: **Facilitator's Note:** Click to play the video.
		18-19.	**Tell:** Energy meters must be installed in a row with clear and distinct gaps. Both incoming and outgoing cables should be properly saddled with clear visibility from their feeding points. Meter terminals need to be tightly connected and covered with seal. There must be no joints within the incoming cable. **Facilitator's Notes:** Continue to play the video.
		20.	**Tell:** Pole mount distribution boxes are commonly used to avoid too many service lines from a single pole. This helps avoid jumbling of service lines. . Here, you can see that two distribution boxes have been fitted on the pole. Usage of a service cable anchor not only reduces stress on the cable but also reduces extra length and jumbling of the cable at the top of the pole. **Facilitator's Notes:** Click to play the video.
		21.	**Tell:** Clamp the service cable up to the meter box emanating from the pole. Avoid the hanging of service lines. The lineman is replacing the control wire of the meter, which was damaged by rats. **Facilitator's Notes:** Continue to play the video.
		22.	**Tell:** 'M-Seal' is applied at cable glands to avoid entry of reptiles from the cable entry point of the meter box. **Facilitator's Notes:** Continue to play the video.

		23.	**Tell:** The consumer's supply has been restored. Testing of meter and readings is being carried out in the presence of the consumer. **Facilitator's Notes:** Continue to play the video. **Tell:** This way of clean and tidy wiring makes it look neat. It not only reduces no current complaints or fuse calls, but also saves leakage of electricity due to loose joints and overheating of connection leads.
		24.	**Tell:** You can see that a lineman is repairing the LT service cable emanating from the transformer and going to the consumer's premises. A flash has occurred at the transformer's LT cable end box, thereby damaging the service line cable insulation. Before a new service line can be laid to the consumer premises, a TCR (Temporary Current Restored) is being prepared by breakdown staff. This is done by tapping at the insulation tape on the damaged portion of the service line cable lead. **Facilitator's Notes:** Click to play the video.
		25.	**Tell:** If the service line is in a good condition, we will check the MCB of the consumer. MCB is checked thoroughly to know whether there is a fault in the input or outgoing terminal. If the fault is in input terminal, we will thoroughly check it, repair it and provide supply to the consumer. If the fault is in the outgoing terminal of the MCB, the fault will be at the consumer end. The consumer will be informed accordingly. The consumer will have to get the fault rectified. **Facilitator's Notes:** Continue to play the video. **Tell:** Another type of complaint that we receive is about power failure in the whole area or block. If we receive such complaints, we can be sure that the fault is from our end and it could be a major one.
		26.	**Tell:** **Power failure in whole area:** Such a fault can be classified as force majeure. That is, it could be due to natural calamities like storm, floods, earthquakes and so on. Other reasons could be short circuit by birds, called birdage, electric pole hit by a vehicle or someone has damage the underground cable during digging. Civic agencies keep carrying out unscheduled digging along the cable route to lay their gas, water or optic fibre lines. In the process, they often damage the electric cables. Let's now see some breakdowns due to natural disasters.

			Facilitator's Notes: Click to play the video.
		**27.**	**Tell:** This is a case of storm, where LT lines have got damaged due to an uprooted tree falling on the cable. Apart from supply failure, there can be a severe traffic jam. LT lines are lying on the road here. In such a case, breakdown personnel make a temporary barricade by placing their van in the centre of the road. This is to prevent heavy vehicles from passing over the fallen lines. On the other side, they have placed tree branches as a barricade. **Facilitator's Notes:** Continue to play the video.
		**28.**	**Tell:** Here, due to a severe storm, a communication tower has got uprooted and has fallen on the wall of an electric substation. Due to the pressure, wires have snapped, including the LT lines. A tree has fallen on the LT lines near a pole-mounted substation. LT lines have snapped and are badly damaged. **Facilitator's Notes:** Continue to play the video.
		**29.**	**Tell:** Here, due to the uprooting of a tree and its impact, the LT PCC pole has got uprooted and the LT overhead line is touching the ground. This is the case of a Boeing aircraft force landing in a field of an urban area. It has hit a tree, which has fallen on the electric lines. **Facilitator's Notes:** Continue to play the video.
		**30.**	**Tell:** Here, a tree has fallen on the LT lines and has blocked the road. The other image is that of an LT PCC pole hit by a vehicle in a small lane. The pole has broken. You can see that the accessories of the street light fixture and wires have been damaged. These are all emergency situations. The breakdown people have to quickly restore the supply to make the system normal. Let us see how the system is being made normal. The defective portion of system has been cordoned into a separate section. **Facilitator's Notes:** Continue to play the video.
		**31.**	**Tell:** • New poles are being erected in the flood-affected area and the lines are being shifted to the new poles with the help of a crane • New LT lines are being laid to restore the supply

			• With the help of cranes, the uprooted trees are being removed. Roadblocks are being cleared • A broken tree is being lifted with the help of a crane to remove it from the lines • The branches of trees are being lifted and taken away by crane **Facilitator's Notes:** Click to play the video.
		32.	**Tell:** This is the case of an LT PCC pole getting broken and uprooted. It has been hit by a tractor trolley. You can see that the lowest conductor line has snapped and has fallen on the ground. This LT feeder has tripped from the substation due to earth fault. Thus, the entire area has no electricity. The breakdown personnel have to arrange a new 9-metre PCC pole as replacement. They will also have to take permission for erection of the new LT pole and emergency shutdown of HT feeder, as LT lines are leaning over the HT pole. The electric supply of the area has to be restored within six hours as per regulation. **Facilitator's Notes:** Click to play the video.
		33.	**Tell:** If we receive no current complaint for a whole area, we still check the ACB and then do area patrolling. During area patrolling, we first check the overhead lines to see if there is any fault. If any fault is found in the line, we rectify it and close the complaint. The complaint will be closed after the ACB is on and supply for the whole area is restored to normal. **Facilitator's Notes:** Continue to play the video. **Tell:** If there is repeated tripping due to overload or short circuit, functioning of the ACB becomes weak. This results in damage, flashing and so on. In such cases, the breakdown personnel bypass the burst ACB. They then try to restore the supply and take up the task of replacing the old ACB with a new one.
		34.	**Tell:** Here, you can see an LT switch-board panel. It has been manufactured in 1989 and also has fuse units for housing the HRC cut outs. It is thus obsolete and no longer in use as on date. You can see waste scrap lying in front of the panel. Porcelain insulator bobbins are cracked and rubber hosing is dried up and eroding. The operational reliability of LT switch gear has become suspect here. **Facilitator's Notes:** Click to play the video.

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		35.	**Tell:** The lineman is confused as to how to take up the job. This is because all the components in the panel are on the verge of collapsing. Repair is thus not feasible. Look closely how the lineman is operating the LT switch gear because of the safety hazard. The ultimate solution is to replace all old and out of date panels with new ones. Here, you can see that the complete LT panel has been replaced with a new ACB. Each LT feeder is having an individual ACB. Their tripping mechanism has been set according to their load profile. The system has thus been made reliable and efficient. **Facilitator's Notes:** Continue to play the video.
		36.	**Tell:** Let's make a comparison between old and new panels. Here, you can see the old bulky panels. There is only one LT main switch gear, with one incoming line from the transformer LT side and three outgoing feeders. One of them is faulty. Repairing the LT bus is a tough task because of non-availability of obsolete accessories. Moreover, repairing it takes a lot of time and there is very low reliability even after the repair. **Facilitator's Notes:** Click to play the video.
		37.	**Tell:** In this case, you can see that all the feeders mentioned have been replaced with a new ACB. These are easy to operate and efficient. **Facilitator's Notes:** Continue to play the video.
		38.	**Tell:** This is an LT ACB of 400 amperes made by Larsen & Toubro. It has been set at 75% in its tripping relays. We are going to energise the ACB after cleaning the dust and washing the arc chamber with CRC. **Facilitator's Notes:** Click to play the video.
		39.	**Tell:** If the frequency of complaints increases in an area, it means that the fault is not inside the individual ACB but in the LT main. In this case, we check the LT main for the second time and patrol the area. There are three types of LT mains in general depending on the distribution transformer capacity. They are 400 KVA, 630 KVA and 990 KVA respectively. In a 400 KVA transformer, an 800-ampere LT main is installed. In 630 KVA, 1250-ampere LT main is installed and in 990 KVA transformer, 2000-ampere LT main is installed. The LT main setting is done at 80% to avoid overloading. If a fault arises in this

			condition, we patrol the area to check for unbalanced load, birdage, snapping of jumpers, breaking of neutral and so on. Most of these complaints are due to neutral breakdown. In that case, we check the neutral, connect it properly and also connect it properly to the jumper. Then, we go to the sub-station and switch on the LT main. This is how we resolve an LT breakdown complaint. **Facilitator's Notes:** Click to play the video.
		**40.**	**Tell:** Let's have a close look at an LT overhead network. You can identify the fault in case of a breakdown as you can see the complete network. We start from the dead end of LT pole. You can see that there are five ACSR conductor lines wound over the shackle insulators on 'D' clamps. The upper three heavy conductors are three-phase lines. **Facilitator's Notes:** Click to play the video.
		**41.**	**Tell:** The next one is a low-size conductor for street lights. The fifth one is neutral and the lowest is GI wire, which guards all the wires above it. This is called earth or ground wire. **Facilitator's Notes:** Continue to play the video.
		**42.**	**Tell:** Each ACSR conductor is connected with an extension loop. In local language, it is called Ghori. All the inter-linked connections to the lines are made from these extension loops. When we proceed to the next span, which meets at a 'T' point, the connection with jumpers is through the extension loop or Ghori. These jumpers act as isolation points for each pole line. The faulty portion of a distribution line can thus be isolated. All the service connections to the consumers are connected on extension loop. This is for easy isolation and to ensure that it has the least effect on the main line conductor in case of a fault. **Facilitator's Notes:** Continue to play the video.
		**43.**	**Tell:** This is an LT control panel inside a substation. You can see that there is an LT main connected from the transformer outgoing. **Facilitator's Notes:** Click to play the video.

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	44.	**Tell:** Here, there is distribution to a number of individual feeders, like outgoing feeder to a streetlight, zonal office, school and others. In case any fault occurs either in earth or because of current overload, the individual feeder will get tripped. You can see that this is the outgoing feeder for the capacitor bank. It regulates the voltage of the transformer. **Facilitator's Notes:** Continue to play the video. **Tell:** There are also different types of complaints, such as low voltage, high voltage or fluctuations. Here, you can see how the field people check the status of LT lines. They are equipped with a Multi-meter and Clamp ON meter.
	45.	**Tell:** Here, there is checking of the line condition by multi-meter and clamp ON meter. Now, individual line status of voltage and current is being checked. **Facilitator's Notes:** Click to play the video.
	46.	**Tell:** The online status is displayed on the multi-meter. In such conditions, we do area patrolling to find out the cause of the complaint. It may be due to unbalanced load, jumper snap, neutral breakdown, phase-to-phase short circuit or blowing out of DD fuse on the HT side of the distribution transformer. **Facilitator's Notes:** Continue to play the video.
	47.	**Tell:** The engineer checks the phase current with the help of the clamp ON meter. In case of an unbalanced load, the load in R-Y-B phase should be properly balanced. The current in neutral should ideally be zero. However, 20% of total phase current is allowed. Suppose there is unbalanced current. In one phase, there is 100 amperes flowing and in the other, it is 20 amperes. In such cases, current flow increases in the neutral, leading to problems. **Facilitator's Notes:** Continue to play the video.
	48.	**Tell:** When a jumper snap occurs, we get a complaint that one phase is missing and there is excess voltage in another phase. In such cases, we must immediately switch off the LT main, repair the jumper and rectify the problem before switching on the LT main. Then, we check whether the supply has been restored as desired. This is how such

			complaints are resolved. When we get a complaint that a DD fuse is blown, the voltage in the LT main of that particular phase will become very dim. In that case, we immediately switch off the transformer, call the HT breakdown, repair the blown DD fuse and resolve the complaint.
			Tell: In this video presentation, we have learnt about LT distribution network, importance of the balance load, neutral current, maintenance, possible faults, causes for faults, their identification and rectification of faults in the LT distribution network.
		49-50.	**Tell:** Let us quickly recollect the key points of this session. • In case of a no current complaint, first check the display in BSES meter • Check if there is any fault at the premises of the consumer who has made the no current complaint • Instead of making temporary joints to restore the consumer's supply from bus bar, ensure that there are firm and tight connections with sockets • Energy meters must be installed in a row with clear and distinct gaps • Meter terminals should be tightly connected and covered with a seal. There must be no joint in the incoming cable • Pole mount distribution boxes are commonly used to avoid too many service lines from a single pole and to prevent jumbling of service lines • Power failure in an entire area can be due to natural calamities, short circuit by birds, electric pole being hit by a vehicle or someone damaging the underground cable during digging • If there is repeated tripping due to overload or short circuit, functioning of the ACB will become weak • The three types of LT mains as per the distribution transformer capacity are 400 KVA, 630 KVA and 990 KVA • In case of unbalanced load, the load in R-Y-B phase should be properly balanced and the current in neutral should ideally be zero • In case of a jumper snap, switch off the LT main immediately, repair the jumper, rectify the problem and switch on the LT main • In case a DD fuse gets blown, switch off the transformer immediately, call the HT breakdown, repair the blown DD fuse and resolve the complaint