












Session: Sub-station Maintenance and Transformer Augmentation

Learning Objective	Evaluation Criteria
Explain the preventive maintenance of a distribution transformer	Interactive Questioning









	Duration	30 Minutes
	Resources	PowerPoint Presentation, Whiteboard, Markers, Screen and Projector
	Facilitator's Notes	In this session, take the participants through an interactive presentation with video snippets on preventive maintenance of a distribution transformer.

End of Notes













		1.	<p>Tell:</p> <p>Welcome to the video presentation on 'Substation Maintenance and Transformer Augmentation'.</p>
			<p>Facilitator's Notes:</p> <ul style="list-style-type: none"> • Display the slide • Play videos whenever required • Tell the participants to observe the videos carefully • Inform them that they will be asked questions during the session • You can pause the video when you want to explain a concept or ask questions
		2.	<p>Tell:</p> <p>By the end of this session, you will be able to explain the preventive maintenance of a distribution transformer.</p>
		3.	<p>Tell:</p> <p>In this presentation, you will see the preventive maintenance of a pole-mounted substation. Preventive maintenance covers:</p> <ul style="list-style-type: none"> • Checking transformer oil level • Checking oil leakage from the transformer tank or from its radiator • Checking for any damage or hairline cracks on transformer bushings • Checking the condition of HT joints and LT terminations • Checking the condition of silica gel in breather and • Taking a sample of the transformer oil to check its Break Down Voltage or BDV



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 	<p>4.</p>	<p>Tell:</p> <p>Let us watch few videos to understand the concept.</p> <p>We will first see the double pole (DP) structure surrounded by tree branches.</p> <p>It is difficult to climb the DP structure to do maintenance. We will first need to trim the trees. Then, check for loose points of connection, where the jumpers are burnt and replace them.</p> <p>Facilitator’s Note:</p> <p>Click to play the video.</p>
 	<p>5.</p>	<p>Tell:</p> <p>Let us now look at the breather unit of a transformer.</p> <p>Ask:</p> <p>Have you ever heard the word breather?</p> <p>Responses:</p> <ul style="list-style-type: none"> • No • Yes <p>Ask:</p> <p>What do you think is a breather?</p> <p>Possible Responses:</p> <ul style="list-style-type: none"> • Controls moisture level • Absorbs moisture in the air <p>Tell:</p> <p>A breather unit absorbs the moisture from the air sucked in by the transformer.</p> <p>Facilitator’s Note:</p> <p>Click to play the video.</p>
 	<p>6.</p>	<p>Tell:</p> <p>The pink silica gel needs to be replaced. This is because it cannot absorb any more moisture from the transformer.</p> <p>Facilitator’s Note:</p> <p>Continue to play the video.</p> <p>Tell:</p> <p>Let us now watch a video on how to change the oil cup of a breather.</p>
 	<p>7.</p>	<p>Tell:</p> <p>Let us watch a video to know how we can replace the gel with fresh blue-coloured silica gel.</p> <p>By filling of the oil in cup, all the dust particles get deposited into the oil and cannot reach the silica gel.</p> <p>Facilitator’s Note:</p> <p>Click to play the video.</p>

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 	<p>8.</p>	<p>Tell: Let us now observe how to collect transformer oil from the outlet valve for testing the Breakdown Voltage (BDV) of the oil.</p> <p>Ask: What do you mean by BDV?</p> <p>Possible Responses:</p> <ul style="list-style-type: none"> • Break Down Voltage • Minimum voltage to become electrically conductive <p>Tell: That's correct. BDV means Break Down Voltage.</p> <p>Facilitator's Notes: Click to play the video.</p>
 	<p>9.</p>	<p>Tell: Once the oil is collected from the transformer, the oil sample is taken to the laboratory to test its BDV.</p> <p>Facilitator's Note: Continue to play the video.</p>
 	<p>10.</p>	<p>Tell: After the oil is collected, all the parts and units have to be cleaned. Then, cleaning of HT bushing of transformer is carried out.</p> <p>Facilitator's Note: Click to play the video.</p>
 	<p>11.</p>	<p>Tell: Now, let us know about augmentation of power system. This is not part of maintenance. However, it is done in view of the regular increase of power demand.</p> <p>Augmentation of power systems is carried out to enhance the current carrying capacity of power lines as well as the rating of transformers. This is to meet the increased demand by consumers.</p> <p>Facilitator's Note: Click to play the video.</p> <p>Tell: Let us look at the LT Air Circuit Breaker (LT ACB) augmentation.</p>
 	<p>12.</p>	<p>Tell:</p> <p>Facilitator's Note: Click to play the video.</p> <p>Tell: You can see that there are two transformers.</p>
 	<p>13.</p>	<p>Tell: We have installed a new 400 kVA transformer in the place of 315 kVA transformer.</p> <p>Facilitator's Note: Continue to play the video.</p>



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 	14.	<p>Tell:</p> <p>You can also see a safety zone prepared around the DP structure, where the transformer is placed. The lines are grounded with shorting chains.</p> <p>Facilitator's Note:</p> <p>Continue to play the video.</p>
 	15.	<p>Tell:</p> <p>Single core 95 square millimetre cable leads have been connected on the HT side up to the new transformer.</p> <p>Facilitator's Note:</p> <p>Continue to play the video.</p>
 	16.	<p>Tell:</p> <p>Two LT ACBs of 400 amperes have been placed on channels below the transformer.</p> <p>Facilitator's Note:</p> <p>Continue to play the video.</p>
 	17.	<p>Tell:</p> <p>You can see that the 4 X 300 sq mm cable is coming out from the LT bushing of the transformer. This is laid for onward connection to ACB. You can see the lineman crimping the 300 sq mm cable thimble or the socket at the LT bushing of the transformer. There are four service line connections.</p> <p>Facilitator's Note:</p> <p>Continue to play the video.</p>
 	18.	<p>Tell:</p> <p>There are four service line connections.</p> <p>Facilitator's Note:</p> <p>Continue to play the video.</p>
 	19.	<p>Tell:</p> <p>These service connections will be further connected to service cables from the ACB to the consumer end. This will complete the connection work.</p> <p>Facilitator's Note:</p> <p>Continue to play the video.</p>
 	20.	<p>Tell:</p> <p>One end of the LT cable is fixed to transformer LT bushing using a crimping tool.</p> <p>Facilitator's Note:</p> <p>Continue to play the video.</p>
 	21.	<p>Tell:</p> <p>The other end of the LT wire is connected to terminals at the back of the LT ACB.</p> <p>Facilitator's Note:</p>

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			Continue to play the video.
		22.	<p>Tell:</p> <p>This is the wooden cleat used for supporting the LT cable, so that any extra stress of its weight is not exerted on the transformer LT bushing. It is fixed to the Mild Steel or MS frame, so that the LT cable coming out from transformer LT side remains firm and tight.</p> <p>Facilitator's Note:</p> <p>Continue to play the video.</p>
		23.	<p>Tell:</p> <p>The painter is painting the name for identifying the substation to which the transformer belongs, along with particulars like its serial number and the zone name. Details about its capacity and make of the transformer are also written for proper indexing and record.</p> <p>Facilitator's Note:</p> <p>Click to play the video.</p> <p>Tell:</p> <p>In this way, augmentation enhances the capacity of substation from 315 kVA to 400 kVA. Thus, additional load of up to 85 kVA can be provided to consumers.</p>
			<p>Tell:</p> <p>In this video presentation, you have seen "Substation maintenance and transformer augmentation".</p>
		24-25.	<p>Tell:</p> <p>Let us quickly recollect the key points of this session.</p> <ul style="list-style-type: none"> • Breather is a unit of the transformer. It is filled with silica gel to absorb the moisture in the air, which is sucked in by the transformer during the breathing process • The steps to be followed in maintenance of a pole-mounted sub-station include: <ul style="list-style-type: none"> – Trimming the branches of trees around the work area – Checking for loose connection points and insulating them – Checking and replacing any burnt jumpers – Replacing silica gel in breather with new gel – Filling the breather cup with fresh oil – Collecting transformer oil from the outlet valve for testing the BDV of the oil – Cleaning the HT bushing of the transformer • The steps involved in augmentation of a power system include: <ul style="list-style-type: none"> – Preparing a safety zone around the DP structure – Connecting single core 95 square millimetre cable leads to HT side up to the new transformer



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			<ul style="list-style-type: none">- Connecting service connections to service cables from the ACB to the consumer end- Attaching a wooden cleat for supporting the LT cable, so that any extra stress of its weight is not exerted on the transformer LT bushing- Painting the name for identifying to which substation the transformer belongs
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