

<b>Developed by:</b>	John Tan Hong Cheng
<b>Course Title:</b>	Higher Nitec in Facility Management
<b>Module Title:</b>	Building Management System
<b>Title of Instructional Plan:</b>	Install and Commission a Variable Speed Drive (VSD) (Through Learning through filming)
<b>Competences covered in Skills Standard:</b>	Specify the competence(s) covered in this instructional plan (if different from whole task)
<b>Duration:</b>	26 hrs
<b>Situating Learning:</b>	<p><i>You are a Technician from RH Synergy, and your company has recently received a Work Order for installing a Variable Speed Drive (VSD) for controlling the operations of the 3 circulation pumps for a Swimming Pool in a Prestigious Condominium. You have been assigned this task and you are required to complete the task within the day.</i></p> <p><i>The management was told by the sales engineer that this installation will reduce the energy consumption at the estate and that the pumps will be running at a smoother and more enduring manner, which will mean longer life-span.</i></p> <p><i>In order to install and commission a working VSD, you will have to carry out the following tasks.</i></p> <ul style="list-style-type: none"> <li>- <i>Perform a System Appreciation for the VSD control circuit and other Control, Protection and Switching (CPS) peripherals required for the Job, according to the Manufacturer's Manual.</i></li> <li>- <i>Prepare the necessary work tools and equipment.</i></li> <li>- <i>Install the physical VSD with its relevant CPS peripherals, in a neatly organized Control Panel with proper wirings to the Pumps</i></li> <li>- <i>Test Run the VSD after making all the necessary settings, in terms of timing controls and proper electrical and pump specification settings.</i></li> </ul> <p><i>The assessment for a proper VSD installation with its relevant CPS, will include the requirement for it to be completed within the period of about 10 man hours and should ensure that the pumps run smoothly without any undue vibrations or noises, with relevant Rev ups and Rev downs, before and after the off peak periods, as set in the timing controls of the VSD.</i></p> <p><i>As the VSD is a rather complicated electrical contraption, its proper installation according to relevant specifications will indicate the technician's proficiency and competency to work alone as a senior technician or as a team leader for subsequent electrical installation jobs.</i></p>

Learning Chunks	M, S, P Competences	Performance Criteria	Learning Objectives (of the knowledge & skills)	Methods of Delivery	Learning Activities (Brief description of strategies, sequence of lesson, evaluation)	Duration	Tools / Equipment / Resources	Stages
<b>Whole Task:</b> Install and Commission a Variable Speed Drive (VSD)	S: Listen to superior attentively when receiving instruction in the workshop  M: Interpret Manufacturer's Manual  P: Treat oneself, others and equipment with respect at all time  P: Conduct oneself professionally, responsibly and with integrity in executing given workplace task.	Variable Speed Drive (VSD) is installed and commissioned according to manufacturer's manual.	Students should be able to install and commission a VSD according to the manufacturer's manual.	Blended	<b>Trigger interest</b> <ol style="list-style-type: none"> <li>Organise class into groups of 4 for the Learning through filming (LTF) project</li> <li>Show a video of previous Learning through Filming (LTF) project for the given task. To inform students that they will film the process of the whole task and construct an instructional video about it. To also include diagrams and pictures about the task, to value add to its delivery</li> <li>Show students the actual components required for the task, i.e. The VSD and all its relevant CPS components.</li> <li>Using questioning technique, guide students to talk about               <ul style="list-style-type: none"> <li>What is the effect of the VSD on the AC motor e.g. controls the speed, the direction, the duration of each run etc.</li> <li>To note the connecting circuits, from the 3 pole isolator to the RCCB, MCB, controlling relays and contactors, to the VSD, to the AC motor.</li> </ul> </li> </ol> <b>Plan learning (LTF)</b> <ol style="list-style-type: none"> <li>Using LTF method, student to start planning in their groups, the resources required to create a LTF project based on the given task.</li> <li>Students to draft out a project timeline using a Gantt Chart using the PDCA Cycle ie Plan, Do, Check and Action.</li> <li>Students are to do up a Story board detailing the sequence of filming for the task.</li> </ol>	3 hrs	Powerpoint slides, worksheets, Working Variable Speed Drive, working AC induction motor, working CPS components, e.g. Magnetic Contactors, RCCBs, MCBs and glass block relays.  <b>LTF –Planning schedule - Gantt charts (from PC or paper)</b>	Plan Enquire Reflect

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					<p><b>Enquire and Reflect (LTF)</b></p> <ol style="list-style-type: none"> <li>Students are to share with the class their timeline for the LTF project, the resources required and the storyboard. This will allow the lecturer and their classmates to comment on the possible improvements to the project.</li> <li>Using 321 strategy, get students to write down what are the 3 main components in the VSD installation, 2 important settings in the VSD and 1 important feature of the AC 3 phase motor they have learnt in the lesson.</li> </ol>			
<p><b>Learning chunk 2:</b></p> <p><b>Sub-task:</b></p> <p><i>Perform System Appreciation</i></p>	<p><i>M: Interpret Manufacturer's Manual</i></p>		<p><b>Theory LO</b></p> <p>Students should be able to:</p> <ol style="list-style-type: none"> <li>Identify the symbols of each of these CPS components and how to use them in drafting a working control circuit for the VSD.</li> <li>Explain the roles of each of these components and their relationship with other component in the circuit.</li> <li>Identify different types of AC motors, their physical connections and their characteristics.</li> <li>Identify the relevant connecting terminals for the VSD, Squirrel Cage 3 phase AC motor, and other CPS electrical peripherals.</li> </ol>	Blended	<p><b>Recap:</b></p> <ol style="list-style-type: none"> <li>Using Questioning technique, recap the whole task.</li> <li>Conceptualize the sequence of the whole task, PPE, Wiring Diagrams and Actual installation, and pen out the <b>story board</b> for the LTF video project.</li> </ol> <p><b>Teach knowledge and Check understanding (LTF)</b></p> <ol style="list-style-type: none"> <li>Students are given resources i.e. iDelite and youtube video links for the 4 Technical Knowledge (TK) via MyConnexion,</li> <li>Students to write down and summarizes all the salient points about the 4 TKs after watching the video links in their LTF groups.</li> <li>Present their summary of the salient points of the 4 TKs on the flip chart and explain how the system works.</li> <li>Use gallery walk strategy, get students to point out what are the mistakes made by the other groups.</li> <li>Teacher summarizes the activity and write the key points on the board</li> </ol>	6 hrs	<p><i>White board, Video links of AC motors and their characteristics, flip charts and PC with MS powerpoint software</i></p> <p><b>LTF – story boarding worksheets,</b></p> <p><b>1X PC per group with MS Office, video editing software, internet access</b></p>	<p><i>Explore Practice Enquire Reflect</i></p>

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		System Appreciation is completed for drafting of working drawing of VSD control circuit.	<p><b>Practical LO</b> Students should be able to:</p> <ol style="list-style-type: none"> <li>1. Draft out a working drawing (i.e. Single-Line Diagram SLD) for the VSD control circuit</li> </ol>		<p><b>Teach skills:</b></p> <ol style="list-style-type: none"> <li>1. Teacher to explain a Working Drawing (i.e. a Single-Line Diagram (SLD)) and to show points to note when drafting a SLD.</li> <li>2. Teacher to show on white board, how to translate a wiring diagram to a SLD for a simpler control circuit and then a VSD control circuit.</li> </ol> <p><b>Practice skills:</b></p> <ol style="list-style-type: none"> <li>1. Students will draw out all electrical symbols of the components required for the installation using MS powerpoint.</li> <li>2. Students will capture pictures of the diagram in different stages of the wiring.</li> <li>3. These pictures of the stages of wiring will be inserted into the LTF video.</li> </ol> <p><b>Summarise learning:</b> Students are to compile captured Photos of the stages of wiring the circuit in the SLD, by using Video editing software, e.g. Windows Movie Maker, and to save the file.</p> <p><b>Enquire and Reflect (LTF)</b> Students to present to the class their wiring diagram in LTF video crafted so far and the 3 important points to note when drafting a SLD, 2 main components in the wiring diagram and 1 benefit of having a SLD prepared for an electrical installation they have learnt in the lesson.</p>			
<p><b>Learning chunk 3:</b></p> <p><b>Sub-task:</b></p> <p>Prepare work tools and equipment</p>	<p><i>M: Interpret Manufacturer's Manual</i></p> <p><i>P: Adhere to safety regulation</i></p>		<p><b>Theory LO</b> Students should be able to:</p> <ol style="list-style-type: none"> <li>1. Identify the wiring tools required for performing electrical wiring.</li> <li>2. Identify the testing equipment required for testing the electrical wiring and component</li> <li>3. State the safety precautions required when carrying out wiring and testing of electrical works.</li> </ol>	Blended	<p><b>Recap:</b> Student to present to Class the LTF video produced until this stage. It should contain the stages of wiring for the VSD circuit in SLD diagram.</p> <p><b>Teach knowledge and Check understanding (LTF)</b></p> <ol style="list-style-type: none"> <li>1. Inform students the learning objective of this sub-task.</li> <li>2. Students are to use their text books or via google searches, to identify the tools, equipment and components used for the installation of the VSD.</li> <li>3. Students to take pictures of the tools, equipment and components that are to be used for the LTF video.</li> <li>4. Students are to insert labels to describe the names and functions of the items photographed.</li> </ol>	6 hrs	<p>White board, * Wiring tools, i.e. flat and phillip head screw driver, wire stripper, long nose plier, normal plier, * Testing equipment, Multi-meter, test pen, clamp meter, * PPE samples, safety shoe, wiring gloves, * 2.0cm diameter wires (Brown, Blue and Earth color) for wiring purpose, Wiring control board testing terminals. 3 phase isolators</p>	<p>Explore Practice Enquire Reflect</p>
		Wiring Tools and Testing Equipment are properly	<b>Practical LO</b>		<p><b>Teach skills:</b></p> <ol style="list-style-type: none"> <li>1. Teacher show all the necessary work tools and testing equipment to the students and help to identify them.</li> </ol>		<p>LTF – 1 X mobile phone with video filming capability,</p>	

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		<p>selected for basic electrical wiring.</p> <p>Wiring Tools and Testing Equipment are used in a safe and effective manner</p>	<p>Students should be able to:</p> <ol style="list-style-type: none"> <li>1. Select the correct tools for different wiring tasks</li> <li>2. Perform wiring processes by using the tools safely and effectively</li> <li>3. Perform testing processes by using the testing equipment on the wiring circuit and components in a safe and effective manner.</li> </ol>		<p>2. Teacher to demonstrate how each tool is used in safe and effective manner.</p> <p><b>Practice skills (LTF)</b>  <i>Students, in their LTF groups are to form several stations for different practical activities (i.e. to become experts for that activity) and</i></p> <ol style="list-style-type: none"> <li>1. 2 members from each LTF group are to go to each particular station, e.g. stripping of wires, fastening the wire to the electrical terminals, using the Multi-meter, test pen, clamp meter. 1 to do the practical work another 1 to film the act of the practical activity.</li> <li>2. The students will present their practical activities, in the form of recorded video, to the whole class to give suggestions and comments to improve on the work</li> <li>3. When they finish, get the students to exchange roles with the other members in the LTF groups.</li> </ol> <p><b>Summarise learning:</b>            Students are to compile captured videos of the practical sessions, of stripping wires and checking continuity, to stitch them together with the LTF video project completed so far, by using Video editing software, e.g. Windows Movie Maker, and to save the file.</p> <p><b>Reflect:</b>            To watch through video to analyze practical activities. To see if any portion of the activity can be improved, e.g. wire stripping etc.</p>		<p><b>to be supplied by student (To standby 2 to 3 spare phones)</b></p> <p><b>1X PC per group with MS Office, video editing software, internet access</b></p>	
<p><b>Learning chunk 4:</b></p> <p><b>Sub-task 1:</b> <i>Install VSD and peripherals</i></p> <p><b>Sub-task 2:</b> <i>Perform VSD Test Run</i></p>	<p><i>M: Interpret Manufacturer's Manual</i></p> <p><i>M: Sequence Steps to assemble components</i></p> <p><i>S: Interpret results from test using technical manual</i></p> <p><i>P: Self-motivate and manage work in a pressurized environment</i></p>		<p><b>Theory LO</b>            Students should be able to:</p> <ol style="list-style-type: none"> <li>1. List all the operation perimeters of a 3 phase AC motor</li> <li>2. List all the perimeters to be inputted to the VSD setting option</li> <li>3. State the performance criteria for the VSD.</li> <li>4. State the steps to complete a Service report</li> <li>5. List the steps to seek for client's acknowledgement of a Completed installation, i.e. Job done</li> </ol>	Blended	<p><b>Recap:</b>            Using watching the LTF video project compiled so far, recap the whole task and what was taught specifically in the previous sub tasks.</p> <p><b>Teach knowledge and Check understanding (LTF, TK1, 2,3)</b>            Teacher to demonstrate how to key in the settings of the VSD, the students to film down all the steps. The teacher will go through all the different perimeters to be inputted and what are the performance criteria. All are to be recorded by the students and to be played back and analyzed later.</p> <p><b>Teach knowledge and Check understanding (LTF, TK4)</b>            Students to use either MS word or powerpoint, to use screencast software, to record down the different columns to fill out in the service report. To be used in the LTF video.</p> <p><b>Teach knowledge and Check understanding (LTF, TK5)</b>            Students in the LTF groups, to appoint 2 actors, with a written script (baseline provided by the teacher, modified slightly by the student), to act out the event and steps to seeking the client's acknowledgement of a completed installation.</p>	6 hrs	<p><i>White board, * Wiring tools, i.e. flat and phillip head screw driver, wire stripper, long nose plier, normal plier, * Testing equipment, Multi-meter, test pen, clamp meter, * PPE samples, safety shoe, wiring gloves, * 2.0cm diameter wires (Brown, Blue and Earth color) for wiring purpose, Wiring control board testing terminals. 3 phase isolators. * Working VSD * Working 3 phase AC motors *</i></p>	<p><i>Explore Practice Enquire Reflect</i></p>

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							Working CPS electrical peripherals, i.e. RCCBs, MCBs, Magnetic Contactors, Relays	
		VSD with AC 3 phase motor are correctly installed and operated with all the correct perimeter settings and operation criteria.  Service Report is correctly completed with all auxiliary checklists completed.  Explanation and complete handing over of all necessary documentation is adhered to when seeking client's acknowledgement of Job Done	<b>Practical LO</b> Students should be able to:  1. Install the VSD and connect it to an AC 3 phase motor with all correct settings and operation criteria.  2. Fill up a Service Report according to current Industrial practice and regulation  3. Correctly hand over a completed VSD installation project to client with all necessary documents and explanation on operation and preventive maintenance of project		<b>Teach skills: (All will be filmed down for LTF purpose)</b> 1. Teacher show all the necessary considerations for AC motor operation criteria i.e. voltage and current ratings and VSD ratings and operation criteria. 2. Teacher to demonstrate how to connect all the peripherals i.e.CPS to VSD to AC motor. 3. Teacher to complete lesson with the completion of a Service report and the handing over of a project i.e. seeking acknowledgement of Job done from client.  <b>Practice skills (LTF)</b> 1. Using LTF technique, Get each student to work on installing the VSD and to be filmed down by another student in the group. 2. When they finish, the partners will switch over the roles. 3. The partner to give suggestions and comments to improve on the work  <b>Summarise learning:</b> Students are to compile captured videos of the practical sessions, of filling up the service report, and installing the VSD, to stitch them together with the LTF video project completed so far, by using Video editing software, e.g. Windows Movie Maker, and to save the file.  <b>Reflect (LTF)</b> To watch the video filmed on the activity, to criticize it amongst group members and to note down areas of improvements.		LTF – 1 X mobile phone with video filming capability, to be supplied by student (To standby 2 to 3 spare phones)  1X PC per group with MS Office, video editing software, internet access	
<b>Whole Task:</b>  <i>Install and Commission a Variable Speed Drive</i>	<i>M:Interpret Manufacturer's Manual</i>	Variable Speed Drive (VSD) is installed and commissioned according to manufacturer's manual.	Students should be able to install and commission a VSD according to the manufacturer's manual.	Classroom Based	<b>Integrated performance</b> (To show entire class, the LTF videos by the groups, group members to be present at the end of video for QnA sessions)  Using questioning technique, get students to recall what are the knowledge and skills they have learnt in the whole task 1. What are the tools to be selected for wiring and testing for the task? 2. What are the safety precautions before commencement of the task? 3. What are the settings and rating criteria to note before installing the VSD? 4. What are the items to hand over and explained to the Client after completion of task.	30mins for each group (assuming 10 groups) .total - 5 hours	White board,  1X PC per group with MS Office, video editing software, internet access	Perform Enquire Reflect

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					5. Each group to reflect and apply what they had learnt earlier to perform the whole task following the work sequence 6. Get students to reflect and discuss on what they can do to improve the performance of the whole task.			
					<u>Integrated Assessment</u> 1. View the Performance of the whole task, from LTF video 2. Assess the performance using a set of assessment criteria 3. Summarise and reflect on the learning	<i>Ditto</i>	<i>Ditto, plus Excel Marking Scheme</i>	