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| #1 Process  (if applicable) | Knit fabrics from various yarn colors and types using a computer-controlled knitting machine. |
| #2 Equipment | Knitting machine. Shima Seiki SWG091N2. |
| #3 Personal Protective Equipment (PPE) | Minimum shop PPE. |
| #4 Environmental /  Ventilation controls. | Make sure that the machine is stable, no yarns are tangled, and no needles are protruding from their default position on the needle beds. |
| #5 Required training or approval | * Knitting machine-specific training required. Contact lab manager for more information. * Review and observe general shop safety practices for this shop. * Refer to the manufacturer’s operating manuals for all operating procedures. |
| #6 Inspection requirements before use | * Ensure that there are no cracks on or damage to the machine or cord. If found, cease using the machine and contact the lab manager immediately. * Ensure that all vents on the machine are free of obstruction. * Ensure that all covers are in place before running. * Check the needle bed for any anomalies (i.e. needles out of default position, bent needles, obstructions on either bed). |
| #7 Safe operating procedures or precautions | * Do NOT try to fix the device, remove device covers, or otherwise service the device. ALWAYS connect with the lab manager for repairs as the device must undergo lock out tag out procedures. If interested in servicing the device, the lab manager can point you toward mandatory lock out tag out classes, as well as train you specifically on procedures for this machine. * NEVER stick your fingers near the rollers of the machine without placing the machine into a locked-out and tagged-out state. * Be sure to keep fingers, clothing, and other objects not intended for knitting away from the needle beds and cam system while the machine is in operation. * Whenever possible, avoid transferring more than one stitch at a time. * While the machine is in operation, always keep your eyes on the working area and do not touch or adjust any moving parts. * DO NOT leave the machine alone while it is in operation. * If you are the first to use the machine for the day, it is a good idea to run a debugging cycle and needle training cycle before starting your project. See below sections on debugging and needle training. * Before running your job, ALWAYS check the stitch settings for your pattern and adjust as needed. * Avoid adjusting the speed settings for the knitting machine. If needed, contact the lab manager ahead of time. * If your knit went well, be sure to download a .999 file to your USB stick via the USB icon page. This will save your adjusted settings to use in the future. * Avoid conducting knit operations requiring racking of 4 or more wales. Connect with manager beforehand. * **To start the machine,** follow these instructions:   + Turn the mains power knob just under the lip of the bed to the “on” position.   + When the screen reads “Press the drive power button,” press the power button at the base of the bed. Let the machine boot.   + When the main control window shows up with the message “Drive with operation switch,” press the green operation switch to start the zeroing of the feeder motors.   + Once done, press “Prepa” and select the reset option.   + If this is the first time that the machine has been used for the day, you must now run a “debug” routine and a “needle training” routine:     - Debugging:       * Press the maintenance icon on the right side of the home screen.       * Press “debug mode.”       * Press “test pattern,” then F5 to start debugging.       * Let the system debug around 10 to 30 seconds, then press F2 or the “x” button on the screen to stop debugging.     - Needle training:       * Press the maintenance icon on the right side of the home screen.       * Press “needle training.”       * Press “start” next to “manual.”       * Press the green operation start button and let the system complete the needle training.   + You are now ready to load in your file. * **To run the machine (prepare a file, load your file onto the machine, and start a knit),** follow the below instructions:   + Frequently, users utilize a 3rd party software to generate a knit pattern, but you may also utilize the Apex computer to craft your own knit pattern. Regardless of how, you will use the Apex computer to post your file in the format the machine requires.   + On the Apex Computer, open your file.   + Select the “Auto” button on the top tool bar. It should auto-select your pattern; If not, click inside of your pattern area. You should see a moving, dotted line around the pattern if selected correctly. Hit OK in the dialog box.   + On the next screen, select the carriers you wish to use for the given carrier addresses:     - For each carrier address, there will be a 1-digit address and a 3-digit address. Ensure that the addresses with the same final number (that being X and 10X; ex. 2 and 102) have the same carriers selected.   + Step through the tabs at the top of this window to ensure that these carriers are consistent with the addresses throughout the menus.   + Once at the final tab, select the folder and USB you would like to load your file onto and select “OK” to generate the knit-out file (.000). It is always a good idea to press the “Knit Assist” button to see if the program catches any potential issues with your file. This also generates a simulated knit that you may view if desired. Eject your drive before pulling it out of the Apex computer (it does not do this automatically for you and it may corrupt your drive if you just pull it out).   + To load your file into the knitting machine via USB, flip out the USB port by depressing the left side of the panel on the far right, front part of the machine:     - Plug in your USB, select the USB icon on the right side of the screen, and select the upload icon.     - Find the file you want to upload and double click it twice to load it into memory.   + Move back to the home screen by pressing the Shima Seiki logo on the lower-left screen corner. You may double check your file is loaded by clicking the F5/Shima-tronic button.   + Press the physical “prepa” key and select the far-right icon to zero the machine and prepare it for knitting your file.   + Once complete, you may start your file with the green “operation” switch.   + Use the red “stop” switch to pause your file; You may also use the white “manual” switch to drive your file a bit at a time if troubleshooting. * To **change which carriers your knit file will use on the Apex computer,** follow the steps below:   + When outputting your knit file with Auto, select your pattern and proceed to the next screen.   + Once the page with different tabs shows up (“Yarn,” “Y. Hold Hook,” “Edge yarn,” “YF,” “Other”), look under the “Yarn” tab and you will notice the yarn addresses stated in your knit file.   + Change the first number after “N” to whichever carrier you want to use. Do this for each yarn carrier address you want to change.   + Next, switch to “Y. Hold Hook” tab and locate the stitch address on the left side of each line. Ensure that the “Carrier no.” corresponds with the carrier number you set for each address in the “Yarn” tab.   + Once you confirm that both tabs correspond to the same carriers, you may execute as usual. You have changed the yarn carriers on the knit file. * To **change which carriers your knit file will use on the machine,** follow the steps below:   + From the main screen, press the “Knitting Settings” menu icon, second from the top on the right-hand menu.   + From the Knitting Settings page, click on the “yarn carrier” icon.   + Press the physical SEL (select) button to cycle the function (f) buttons.   + Press F3 to open the EDIT menu.   + At this point, you may either change a carrier to use or swap two carriers that are currently being used (if applicable).     - To change a carrier:       * Select the first option icon, detailing an arrow leading from one box to another.       * In the new window, select the first box and type in the number of the carrier you want to change.       * In the second box, type in the number for the new carrier you wish to use.       * Finally, press the SET button. You have now changed the carrier and all related settings.     - To swap two carriers:       * Select the second option icon, detailing a double-headed arrow pointing to both boxes.       * In the new window, select the first box and type the number of the first carrier you want to swap.       * Select the second box and type the number of the corresponding carrier you want to swap.       * Finally, press the SET button. You have now swapped the two carriers for the operations they will conduct. * **If the threads seem to be getting caught on the needles or missing needles**, press the red stop button to pause the job. Place the machine into Ultra-slow speed mode and hold the white manual run button, letting off occasionally to check that the machine is correcting itself. You may want to adjust the stitch settings and run it with the white button for short bursts at a time. If it is still not catching properly, you may need to abort the piece and initiate a press-off. * **To initiate a press-off**:   + Press the maintenance icon on the right side of the home screen.   + Press “press off kn.”   + Press the button in the upper-right corner of the screen. Back out of the new menu to the previous menu without touching anything.   + Press the “prepa” physical button, then select F5 or the far right icon of the prepa bar. The system should now read “Press off knit executing. Reset key on to interrupt.”   + Press the red stop key, then the green operation button and the system will start to press off the failed knit.   + If the system tries to go immediately into starting a new knit, immediately press the red stop button.   + If the piece still does not let go, contact the lab manager.   + \*\*\*NEVER activate the rollers during a press-off\*\*\* * **If a press-off does not effectively remove all threads:**   + Open the front cover of the knitting machine and ensure cam carriage and yarn carriers are in their default positions.   + Locate the needles with the caught threads and slide their selector pins up to activate them and reveal their operation pins.   + Utilize their operation pins to extend the needles fully.   + Use tweezers and/or the yarn snips to remove the stuck threads from the needles. The knit should be able to be removed relatively easily from the output of the room.   + Once removed, remember to completely retract the needle heads and transfer heads by moving the operation pins to their lowest positions.   + Once operation pins are fully pulled down**, remember to deselect the needles by fully pulling selector pins to their lowest position.** They should be even with the other deselected pins and the operation pins should no longer be above the needle bed. * **If your jobs are failing,** you may want to try debugging the system and training the needles again. Please see the section on both under “**To start the machine**.” * **To turn off the machine,** follow these instructions:   + Hold down the drive power button until the screen reads “power off completed.”   + Turn the mains power knob to the “off” position. * **Recommended materials** for the knitting machine are as listed:   + 2/14 Acrylic machine yarn – contact the lab manager for sourcing information.   + If using other materials, confirm with the lab manager. * **When utilizing conductive threads and other non-standard materials:**   + Abide by the “**SOP for the Use of Non-Standard Materials in the Shima Seiki SWG091N2 Knitting Machine”** document on the Fablab SOPs page directly under this SOP: <https://fablab.cs.washington.edu/sops/> * If you have any further questions or notice a broken needle or other oddity, contact the lab manager. |
| #8 Chemicals/ spill procedures/waste disposal | Ensure that your area is clean and free of obstructions that might block ventilation on the machine and that there are no tools sitting on the top of the machine. |
| Author Signature: Date: | |