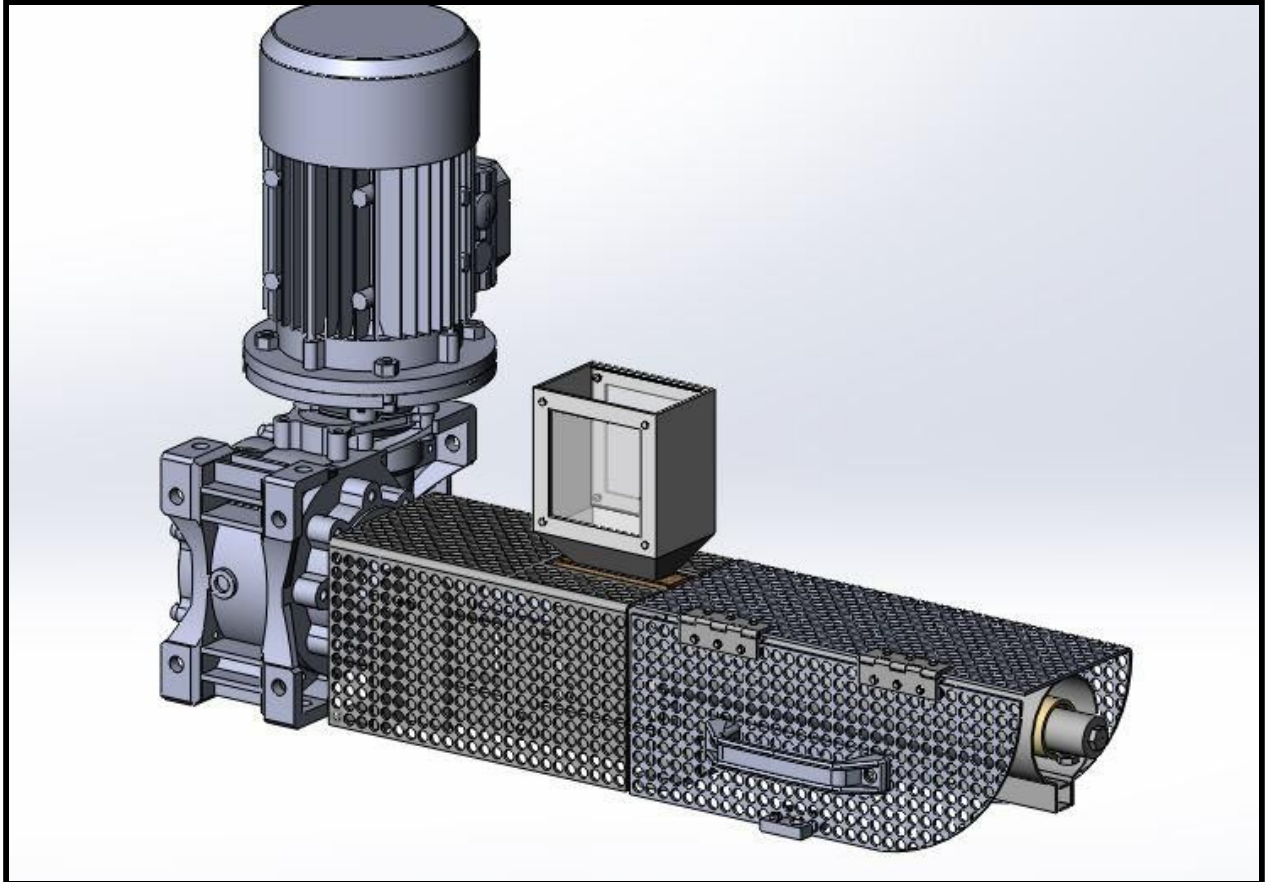


SAFE WORK INSTRUCTION

EXTRUDER MACHINE - PRECIOUS PLASTIC MONASH



Authorisation

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1. Purpose

This document is a guide to assist operators managing the risks associated with use of the extruder machine developed by Precious Plastic Monash University, which has a function to process plastic flakes into extruded filaments by heating the plastics at their melting temperatures.

The machine instructions on procedures of assembly, set-up, manufacturing, maintenance and cleaning are explained in detail to identify machinery hazards and sequentially eliminate or reduce the risk of those hazards causing harm to personnel, property and the environment.

2. Scope

This document illustrates the standard operation of the extruder machine, identifies general machinery and equipment issues during the whole processes from set-up to cleaning, and provides suggestions for risk control of mechanical hazards, non-mechanical hazards and access hazards.

Pre-experiment checks before starting procedure and personal protective equipment are required before formal installation to outline the preferred method of handling the extruder machine, whilst emphasising ways to reduce any risk of harm.

Possible emergency conditions arising from the operation and their corresponding shutdown procedures are outlined to safely shutdown the machine.

3. Definitions

PPE - Personal Protective Equipment

OHS- Occupational Health and Safety

PPMU - Precious Plastic Monash University

SWI - Safe Work Instructions

4. Emergency Shutdown Procedure

1. Unexpected injuries owing to impact injuries, heat issues (contact with heating elements at high temperatures), toxic gases or fumes, etc.

Machine is supposed to be turned off immediately manually for subsequent wound treatment and subsequent processing.

2. Pellets stuck inside barrels, connections and nozzles.

Turn off the power switch manually and remove residual plastics from the barrel and nozzle caps after cooling down.

3. Electricity

A kill switch is designed and configured to shut off machinery and abort the extruder operation as quickly as possible when there is a short-circuit condition due to high operational temperature, high voltage, exposed wires, etc.

5. The DOs and DON'Ts

DO's:

- Follow the operating checklist each time the machine is being operated
- Always wear PPE
- Check the motor is turned/ plugged off
- Set up appropriate melting temperatures based on specific plastics
- Preheat the barrel and other elements before operation
- Close the protective cover during operation
- Always Remove residual plastics from the barrel and nozzle caps
- Tighten up the nozzle caps
- Ensure a bowl is underneath the nozzle for the initial run.

DONT's

- Touch the motor shaft, barrel, nozzle and other heating elements when it is in operation
- Remove the protective cover before the machine is turned off
- Remove the protective cover until the barrel is totally cooled down
- Run the motor after sufficient heating of barrel at the end of operation to remove any excess plastic

6. Authorisation

- Prior Authorisation required to use the extruder.
- Safe operating procedures have to be read carefully before using the machine.
- A representative of the extruder or the management team needs to be present at all times during the operation.

7. Hazards and Risk Summary associated with equipment/ machinery/ technique / process

1. Harmful Fumes

All plastics tend to emit some harmful chemicals and prolonged exposure to the fumes should be avoided. Common risks include irritation to eyes, skin and respiratory tracts. A prolonged exposure may lead to nausea and headache and in such a case the person should be taken to well ventilated area immediately. Melting process should be undertaken in a well-ventilated area to avoid much exposure to fumes.

2. Electrocution

High voltage used to reach the desired melting temperature and to operate the motor.

3. Skin Burns

High temperature operation may lead to risks of burns if not handled with appropriate care. All protection measures should be in place before switching on the machine.

4. Cloth getting stuck in Motor shaft

Shaft should be clear of any material which may disrupt the operation. Loose clothes has a chance of getting stuck in motor shaft. Restriction of movement of the shaft may lead to unwanted consequences and possess a high-risk hazard.

5. The motor after continuous usage may be hot. Direct contact with the motor should be avoided at all times.
6. Since extruder is protruding out of the Pallet table, care must be taken not get injured by hitting on the nozzle.

8. Pre-Experiment Checks before Starting Procedure

1. Before work commences, ensure familiarity with general emergency procedures for the extruder machine, including the location of kill switch, local First Aider and the location of Emergency Procedures. For any emergency call security on campus please call 333. During operation outside the university limits for any emergencies dial 000.
2. Ensure the work area, are clean, clear, and Equipment required are operational.
3. A proper check of the feed used for the extruder must be carried. Each plastic requires a different melting temperature and hence a proper check must be carried out. Failure to do so will lead to clogging of the extruder barrel as some plastic feed may not melt.
4. After inspecting the feed, the operator must always double check with the melting temperature chart present to set the appropriate temperature to the heating coils. In case of wrong temperature set, this would lead to excessive heating or partial heating of the plastic and may cause maintenance issues.
5. Inspect PPE to ensure that it is appropriate and in good condition. Safety glasses should be scratch free and good fitting, personal clothing should not be loose fitting and full-length trousers and enclosed footwear must be worn at all times.
6. Ensure familiarity with the required Waste procedures, and location of appropriate waste containers within the workshop or place of operation. If not present, or insufficient for the process generated waste, make arrangements to dispose of the waste in an appropriate manner.

9. Personal Protective Equipment

1. Gloves - Heat resistant gloves should be made use at all times during the operation.
2. Face masks - Face masks to be used to avoid exposure to fumes during the melting procedure especially by the operator when operating the machine for long hours.
3. Closed Toe Shoes covering the entire foot should be worn at all times during the operation.

10. General Setup

10.1 Motor Assembly

1. Place the motor in the right position over the table.
2. Insert the Bearing into the shaft.
3. Insert the motor shaft into the gearbox. If the screw is attached to the shaft, use the barrel over screw to protect it and place it on top of table holder.
4. Push the shaft until it reaches the circlip.
5. Bolt the shaft at the other end.

6. Bolt the Gearbox to the table.

10.2 Table holder Assembly

1. Place the table holder in its position over the table and secure it with bolts. (Position should have been predetermined before operation).
2. Bolt the Bearing to the table holder.
3. With the screw attached to the shaft, insert the barrel and place it on top of the table holder.
4. Bolt the flanges that secure the barrel in place to the table holder.
5. Bolt the barrel wing to the table holder with the wooden panels between the wing and table holder.
6. Carefully place the wooden attachment between the barrel wings and secure it with bolts.
7. Attach the two-acrylic panel to the hopper with bolts and slide the hopper into the wooden attachment.

10.3 Electrical Assembly

1. Always ensure the electricals are not live. Here, most of the circuits should have been initially wired.
2. The Band heaters should be slid into the barrel in the specified order and secured at the positions marked on the barrel.
3. Now attach the nozzle.

11. Working Procedure

1. Ensure all the electrical are connected and components are in place.
2. Appropriate PPE should be worn. At least one should have a heat resistant glove.
3. Make sure the right nozzle tip is placed.
4. Attach any moulds or prepare the setup if it is going to be collected in a reel.
5. Turn the Band heaters ON and set the temperature according to the plastic being used.
6. Leave the Band heaters ON for 15-20 mins for the barrel to heat up.
7. After heating up, Turn the motor ON and fill the hopper with the selected plastic pellets.
8. Ensure not to fill up with too much plastic inside hopper based on whether a mould is attached or collected in a reel.
9. After the satisfactory operation always ensure the pellets are completely out of the hopper.
10. Turn OFF the Motor and the band heaters.
11. Carefully remove the mould or cut off the excess plastic at the end. There may be pressurized hot plastic at the end which should be carefully handled.

12. Clean-up procedure

1. Before any Clean-up or removal of components make sure the motor and heating element is OFF and mains power is switched OFF.
2. Everyone doing the clean-up must wear a heat resistant glove.
3. Attach the closed nozzle cap and remove the nozzle from barrel.
4. Residual Plastic chunks will be accumulated at the end of barrel which should be removed with necessary tools.

5. If there are more residuals inside the screw and barrel, turn the heaters ON and run the motor until satisfactory plastic residues are pushed to the end of barrel.
6. Turn OFF the motor and band heaters and ensure the main of OFF.
7. It is recommended, with precaution, the molten plastic should be removed while it is hot.
8. Always ensure the nozzle is placed after the clean-up.

Version No.	Issue date	Description of amendment
Version 1	21/09/2018	Original version
Version 2		Reason for updating Addition of the procedure