

# A bomb, a gun, or a useful tool

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If you pack plastic into a steel pipe with no included air, plug both ends of the pipe, and heat it, you have made a bomb. The damage it can cause depends on the amount of heat applied before the pipe or plugs let go. If a small amount of heat has been added (little more than required to form a melt) before the contents are released, the molten plastic will burst out but little expansion will take place. The pressure generated, which may be large, is caused by the difference between the thermal expansion of the plastic and the steel container. Although the energy released is not great, the container parts are capable of flying some distance and causing injury. An example of this would be a rupture disc failing during extruder operations.

If the plugs or pipe let go after more heat is applied, the results could be catastrophic. Assume that the heat has caused some or all the plastic to degrade. Now the pipe is filled with high pressure gas as well as the compressed plastic. A tremendous amount of energy could be stored in the pipe. If the pipe fails it could explode like a bomb. If the plugs let go they could be fired like a cannon. The compressed gas expands when released and pushes plastic and any metal particles ahead of it. In addition, the escaping gas would be flammable and probably above its flash point.

Every time you heat up extrusion equipment you have the opportunity to turn the useful plastic processing tool into a bomb or gun as described above. This is particularly true of multiple extrusion lines such as coextrusion where one extruder can pack plastic into the melt channel from a non operating extruder. The pipe in the above example could be the die, adapter, melt transfer tube, or the barrel. The plugs could be the cold plastic frozen into the openings of the ends of these "pipes."

There is one other danger when starting an extruder screw. If all of the plastic between the screw and the die opening is not melted, a plastic plug could form. Most feed screws can generate a pressure in excess of 10,000 PSI. This could not be detected unless a pressure gage is located at that point. This high pressure could cause sudden failure of mechanical joints or cause the plug to suddenly let go spewing hot degraded plastic out of the die.

Some precautions:

1. Do not heat any of the metal parts hot enough and/or long enough to degrade the plastic.
2. Be sure that the plastic at the ends and joints of melt channels melts as quickly as the plastic in the mid-point of the channel.
3. Be sure all the plastic in the system is melted before starting the screw.
4. Never be in front of the die opening, transfer tube opening, barrel, etc. during heat-up or start-up.
5. Remember that pressures can be building in the equipment and you will not know it.

- William McCormick

See also:

- [Extrusion and safety](#)
- [Extrusion with plugged vented barrel extruders](#)

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