Process Extrusion Guide THERMODAN® HF (LSZH/HFFR)

This guide applies to our thermoplastic halogen free flame retardant (HFFR) products including the following grades:

TP519C, TP521, TP536, TP543, TP568, TP-0810, TP-0831, TP-0832, TP-0840, TP-0870, TP-0851, TP-0812

Equipment

Extruder	Ideally 20 to 24 L/D ratio.
Extruder head	Ideally with deep flow channels. A head assembly with a diverter valve is beneficial.
Screw	Low compression less than 1.5:1 and ideally 1.2:1.
Extension piece	If there is an extension piece connecting the end of the extruder and head then this needs to be heated to 160°C by heater bands or similar.
Tooling Pressure	Ring die should be the same size or slightly smaller than the final cable diameter. Short land length; no longer than 3mm. The flow path should be as gentle as possible with the adequate separation of the core and ring die.
Tubing	Double taper designs are preferred. Draw down ratios of no greater than 1.5:1 is recommended.

Processing conditions

Drying	Generally not necessary unless the material is exposed to the atmosphere for a long period of time. In this case, it can be dried in a dehumidifying drier.
Temperature profile	Ranging from 125°C to 160°C from the feed to the end of the extruder with 165°C on the head and 165°C on the die. A higher temperature can be used for TP-0812.

Melt temperature	Aim for between 160°C and 170°C. For TP-0812 a melt temperature of 190°C can be acceptable
Colour Masterbatches	Those from PW Hall are recommended.

Troubleshooting Guides

Problem	Cause	Solution
Poor surface finish	Temperature low	Increase barrel and head temperatures
		Use higher shear screw
	Melt fracture	Increase barrel and head temperatures
		Use lower draw-down ratio
		Reduce extrusion rate
	Extrusion O/D too low	Reduce haul off speed
		Change to smaller die (run with slight die swell)
	Improper filling of the die	Use smaller size die

Porosity	Compound wet	Vacuum dry, replace material
	Colour master batches wet	Vacuum dry, replace material
	Melt temperatire too high (decomposition of fillers)	Reduce barrel temperatures
		Use lower shear screw
		Check heating and cooling equipment

Troubleshooting Guides

Surging extrudate	Insufficient back pressure in extruder	Increase gauze packing
	Screw speed too high	Reduce screw speed
	Porosity in extrudate	See above

Problem	**Cause**	**Solution**
Die drool	Low molecular weight material exuding during extrusion	Use highly polished die/point
		Add 1-2% process aid
High motor amps	Is motor rating sufficient?	Upgrade motor
	Incorrect screw design	Use lower shear/compression design
	Gauze pack too harsh	Remove some/all gauzes
	Head design restrictive	Change head design
	Material too stiff	Increase temperature profile
		Check heater bands/thermocouples
		Use higher MFI material
High shrinkage	Draw-down too high	Reduce draw-down
	Vacuum too high	Reduce vacuum