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BEST PRACTICIES FOR ACHIEVING GOOD FLOW AND CV WITH DRTS DRIPPERS

DRIPPER PERFORMANCE GUIDE

Introduction

When producing drip irrigation pipe two of the most important parameters to control are the dripper flow and the consistency of flow from dripper to dripper measured by the coefficient of variation (CV).

The flow can be adjusted by:

- Altering the pipe material composition (Raw Material type and mixture)
- Controlling the melt temperature of the pipe material through the flow process and temperatures of the extruders and the cross head
- Adjusting and controlling the dimensions of the crosshead tooling and to calibrator tooling dimensions (or drawdown) distance, and making sure wall thickness is balanced all around the pipe.
- Water temperature at the calibrator and water temperature at the vacuum tank,
- Vacuum tank pressure.

However, many of these parameters also have an effect on pipe dimensions which must meet a rigid standard so often there is a balancing between adjusting flow while achieving pipe parameters.

CV can be controlled by ensuring that the process is as controlled as possible and as stable as possible. More specifically it can be harmed by: high crosshead temperatures, overly high insertion speeds, misalignment of insertion to crosshead, large distance between crosshead and calibrator, non-concentric pipe, turbulence in the calibrator, inconsistent line speed, inconsistent pipe wall thickness, high clamping force from the puller, and mishandling or poor storage of the drippers.

This guide is intended to highlight some of the techniques to adjust flow, while maintaining a good CV with DRTS drippers.

IMPORTANT:

To begin it is important to produce dimensionally stable pipe according to the market/manufacturing standards.

Insert drippers and confirm you have a good bonding between pipe and dripper. Good bonding should be confirmed both physically (see in below guide) as we as by flow test. Conduct a 1 Bar flow test. The flow test result should be such that at 1 Bar pressure you get the drippers nominal flow.

The subsequent information will help you make adjustments to improve process and adjust the flow without straying from the required pipe dimensions.

A note on pipe material

Pipe material can often play a large role in the process and each manufacturer develops a blend that meets their needs. Here is a starting point for pipe raw material many manufacturers start from.

55.5% LDPE – MFI 0.2g/ 10MIN (190:2.16 Kg) Density: 0.92 g/cm3

25% MDPE or HDPE – MFI 0.3g/ 10MIN (190:2.16 Kg) Density: 0.94 g/cm3
- Elongation at break: > 600%
- ESCR > 1000 HR
- Tensile strength at break around 340 Kg/cm2
- Tensile strength at yield around 210 Kg/cm2
- Additives: No slip, no anti-block

15% LLDPE – MFI 1.0g/ 10MIN (190:2.16 Kg) Density 0.92 g/cm^3
- Elongation break: > 600%
- Tensile strength at yield 115 Kg/cm2
- Tensile strength at break 380 Kg/cm2

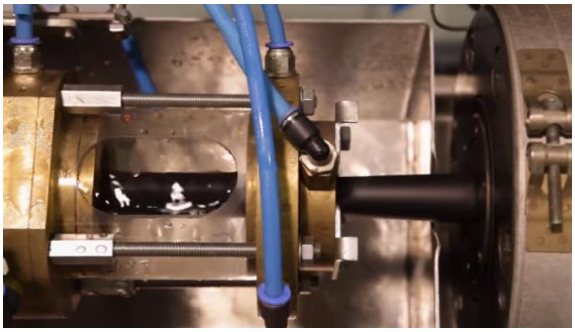
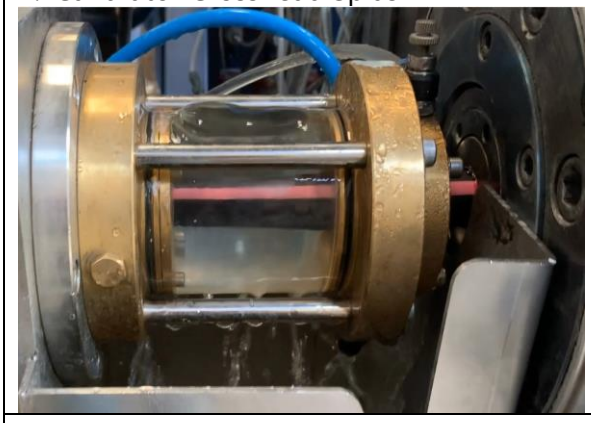
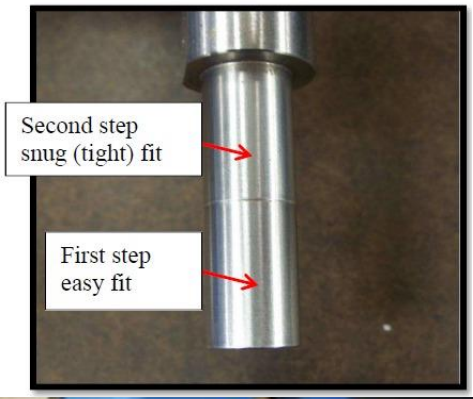
4.5% CARBON BLACK – Pigment content: 48% - 51%
MFI: 70 -120 g/10MIN (190:2.16 Kg)
Bulk density: 650 – 850 g/m
Particle size: nominal 60 NM
Additives:
- 0.25 Processing aid
- 0.20 Phenolic antioxidant
- 0.80 Phosphate antioxidant

Raw Material Suppliers

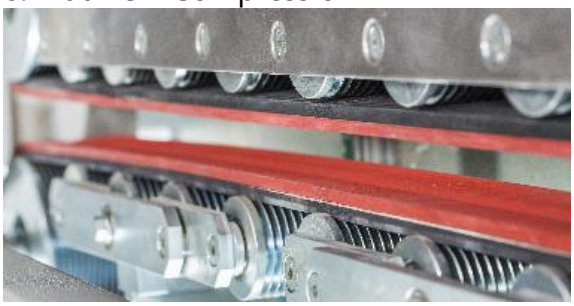
HELLER PERFORMANCE POLYMERS, INC.
7227 Doe Avenue
Visalia, CA 93291
Tel: (559) 651-2091
Fax: (559) 651-2231

EQUISTAR CHEMICALS, LP
EQUISTAR TECHNOLOGY CENTER
11530 Northlake Drive
P.O. Box 429566
Cincinnati, OH 45249
Tel: (513) 530-4161 & (513) 530-4000
Fax: (513) 530-4284

UNION CARBIDE CORPORATION
950 South Coast Drive, Suite #145
P.O. Box 5068
Costa Mesa, CA 92628
Tel: (562) 986-7925
Fax: (562) 986-7928
Customer Service: (800) 631-2555

Subject	Guidance	Importance
1. Crosshead to Calibrator Distance 	Set to minimum. Ideally the length of a dripper or less (20-40mm)	Larger distances generally means lower and less consistent flow and dripper spacing out of tolerance.
	Distance should be repeatable	In order to have a repeatable process.
2. Calibrator Crosshead Splash 	Make sure water is not splashing the crosshead	Splash cools the pipe melt and affects consistency and bonding.
	Aquarium shouldn't spray the crosshead	
	Splashguard should be sufficient.	
3. Pipe Inner Diameter (ID)  	For 16mm drippers Pipe ID: 13.8-14.0 mm	A smaller pipe ID reduces flow. A larger pipe ID increases flow. Pipe ID should be set according to market standards. Use a stepped tool [pictured] to quickly check ID before starting dripline production.
	For 18mm drippers Pipe ID: 16.7-17.0 mm	
	For 20mm drippers Pipe ID: 17.6 mm	

4. Vacuum Stability 	Vacuum must be absolutely stable Recommended gauge range: -15 to -40mbar	Vacuum is used to adjust dripper flow. Stronger vacuum means higher flow. Stable vacuum means stable flow.
5. Water Temperatures	Water temp in the Calibrator 15-25°C (lower temp for higher line speed) Water temp in the vacuum tank can be a few degrees colder than the Calibrator.	It can be helpful to have the Calibrator warmer than the Vacuum Tank. If the vacuum is too cold it will shock freeze the pipe. Too warm and the pipe won't cure properly.
6. Pipe Centricity and Wall Thickness 	Wall thickness should be measured consistent at 4-6 points around the circumference of the pipe. Mark the pipe at the top to assist in adjustments.	Uneven pipe can cause flow variations.

7. Material Melt Temperature  	Melt temperature can be controlled at the Crosshead zone. Too high and the labyrinth is melted. Too low and the bonding is incomplete.	Labyrinth should be bonded to the pipe but not overly melted which causes a mushroom effect on the labyrinth teeth [top picture]. When the pipe is too cold bonding is incomplete [bottom picture]
8. Haul-Off Compression 	Make sure the haul-off/puller of the pipe does not smash the drippers. It should be adjusted to a minimum that consistently pulls the pipe. V grooved belt on the haul-off is recommended.	Too much compression on the drippers from the Haul-Off can cause low flow and inconsistency. DRTS uses a unique hauloff design that regulated the pressure with air as well as use a floating belt mechanism to reduce the pressure on the dripline.

9. Perforator Depth 	Make sure that the Perforator drilling of the pipe is not scratching the dripper pool.	Even minor scratch marks indicate the occasional possibility for small punctures in the dripper which greatly increas flow.