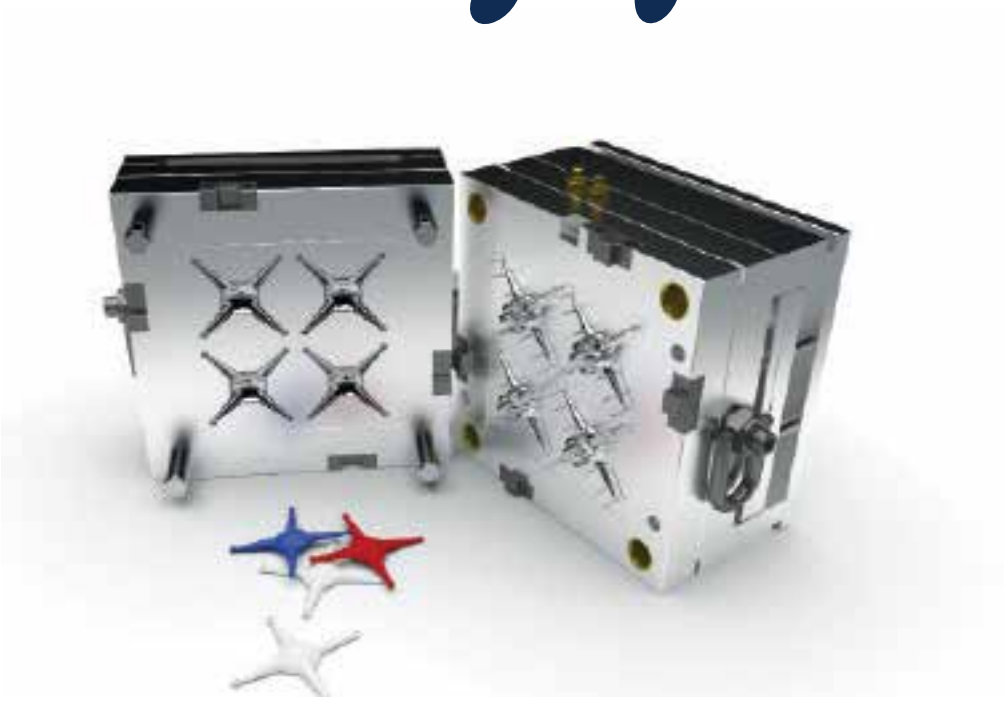
DME®

FRESH START PURGING SOLUTIONS™ CASE STUDIES

fresh start Polymer Solutions Inc.



Made in the USA

DEVELOPED BY POLYMER ENGINEERS FOR POLYMER ENGINEERING APPLICATIONS

FRESH START PURGING SOLUTIONS™

PURGING COMPOUND EVALUATION 1

16 CAVITY CAP MOLD WITH HOT RUNNER SYSTEM

Purging Scenarios Evaluated:

- Resin / pigment to resin / pigment push
- Purging compound Fresh Start® MC2
- Purging compound Competitor A
- Purging compound Competitor B

Criteria for Determination of Effective Color Change:

Color change was deemed to have occurred when all 16 cavities of the shot had achieved balanced and uniform color presentation with no signs of streaking, flow lines, or contamination.

Molding Conditions & Procedure:

Machine Engel Speed 180T

- Clamping Force 1800 kN
- Screw 40 mm
- L/D 24:1
- Screw design general purpose
- Shot weight 175 grams (max)
- Barrel capacity 175 grams

Mold Master Hot Runner Manifold:

Machine Engel Speed 180T

- Mold 16 cavities
- Gate size 1.20 mm (47 thousandth of inch)
- Part cap – 1.8 gram each
- Mold fill 28.8 grams
- Manifold Temperature 230°C
  (Hot Runner – nozzles, manifold & inlet)
- Cooling temperature 20°C

Mold Master Hot Runner Manifold Conditions:

Machine Engel Speed 180T

- Barrel temperature 230°C (front, middle and rear)
- Cycle time 8.49 seconds
- Injection time 0.11-0.13 seconds
- Injection peak pressure 58 bars
- Hold pressure 38 bars
- Hold time 2.0 seconds

Materials

Test Resin: Lyondellbasel Profax 702, natural, MFI 35 g/10min

Premixes Created:

- 2 kilo blend of 2% colour concentrate (Clariant 07RHD-40) Black HPB (Lot 1221) in Profax 702 (lot 0608853000) 35 MFI Polypropylene Copolymer
- 2 kilo blend of 2% colour concentrate (Clariant PE33754493) Red PE PP 00.100 (Lot NA6893) in Profax 702 (lot 0608853000) 35 MFI Polypropylene Copolymer

Procedure For Evaluating Purging Compounds:

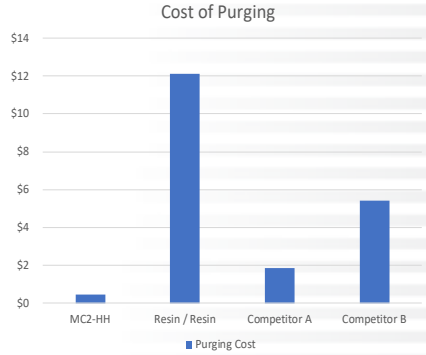
- Hopper was emptied, black colorant & PP blend was introduced into the hopper
- Several shots were made until uniform black cap was produced
- Line was stopped, and resin removed from the hopper
- The balance of the resin was left in the barrel and hot runner for 15 minutes under full temperature of 230°C.
- The screw and barrel were backed away from the mold
- The resin left soaking under heat was emptied from the barrel
- 350 grams of purging compound was introduced into the hopper
- With back pressure of 10 bars, the purging compound was manually extruded.
- Barrel was advanced to the manifold and an additional 350 grams of purging compound was introduced into the hopper
- This material was shot through the manifold and molded into caps until the barrel was emptied.
- Red / PP blend was introduced into the barrel and parts were molded
- Parts were evaluated for colour change

Results:

- The result from the evaluations indicate that the application of a pigment to pigment push practice is not an effective. It was noted that higher amounts of polypropylene were consumed in the process with a significant loss of production time.
- Of the three purging compounds, Fresh Starts™ MC2 presented the most effective cost saving with reduced consumption of resin and lowest production time lost during the switch over.

Savings:

- Fresh Start® MC2-HH offers the most efficient and cost savings of all four scenarios
- Net cost of the purge



PURGE COMPOUND	PUSH	MC2-HH	COMPETITOR A	COMPETITOR B
Barrel (grams)	None	350	350	350
Manifold (grams)	None	350	350	350
Number of purge shots through manifold	None	12	12	12
Cost of the pruging compound per lb.	N/A	$3.50	$3.50	$3.50
Number of shots to acheive good parts	201+	7	31	90+
Grams of compound used	5789	201	893	2593
Times to acheive good parts (minutes)	28.5	<1.0	4.4	12.75
Cost of PP	$2.09/kilo	$2.09/kilo	$2.09/kilo	$2.09/kilo
Cost off PP consumed before on color	$12.12	$0.42	$1.87	$5.42

FRESH START PURGING SOLUTIONS™
PURGING COMPOUND EVALUATION 2

Focus of the Trial - Switching from Dark Colors to White

Problem: Switching from dark colors to white customer pulls screw and barrel, losing 10 hours of production. Prolong ruuns of virgin material to switch to white color.

Objective: Introduce customer to Fresh Start Purging Compound as a solution to eliminate wasted production time and a more efficient method of cleaning the barrel and screw.

Process Parameters:

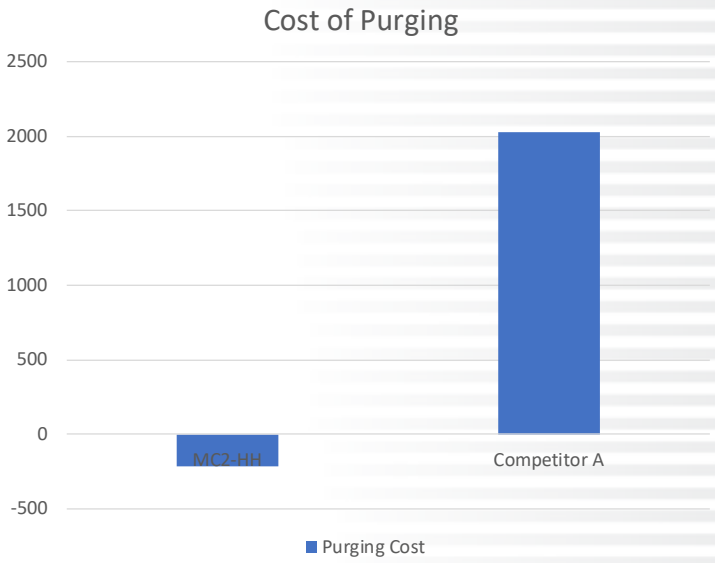
- 96 cavity Mold Master melt disc hot runner manifold
- Husky Hylectric 400 Ton
- IMSI Mold Master Controller
- Gates – 96
- Material – LDPE 25 melt
- Color – Blue to white
- Cycle time – 7.3
- shot weight – 157 grams

Procedure for Evaluating Purging Compounds:

- Line was stopped, and resin removed from the hopper
- The screw and barrel were backed away from the mold
- The resin was emptied from the barrel
- The purging compound was introduced into the hopper
- With back pressure of 10 -20 bars, the purging compound was manually extruded.
- Once the barrel was clean, it was advanced to the manifold and purging compound was introduced into the hopper
- This material was shot through the manifold and molded into parts until the barrel was emptied.
- The next polymer was introduced into the barrel and parts were molded
- Parts were evaluated for colour change

Savings:

- Customer recognized a $2,398 savings per color change with Fresh Start® MC2-HH .Net cost of the purge
- Increase in production time pays for the purging compound, increased ROI



How Savings is Calculated:

- Material based on 2 hr run @ .80 lb
- Purge calculated at list price
- Time of purge calculated with 2 hr run plus 8 hr screw pull.
- Labor cost is operator plus 2 maintenance personnel.

CUSTOMER	UNITS		INCUMBENT	FRESH START®
Lbs. of resin scrapped	lbs.	LDPE	347	
Cost of resin scrapped	$/lb		$0.80	$0.00
Total cost of resin scrapped	$		$277.60	$0.00
Lbs. of incumbent pruging compound	lbs.		0	
Selling price incumbent pruging compound	$/lb		$0.00	
Total incumbent pruging material cost	$		$0.00	
Total pruging material cost	$			$17
Selling price Fresh Start Start Pruging Solutions®	$/lb			$3.50
Total pruging material cost	$			$59.50
Time required for purging	minutes		600	120
Down-time/lost production hourly cost	$	$100.00	$1,00.00	$200.00
Down-time cost for operators	$	$75.00	$750.00	$150,00
Total machine cost			$1.750.00	$350.00
Cost of purging	$		$2,027.60	$409.50
Contribution of margin	%	15%		
Average selling price	$	$0.01		
Parts/cycle		96		
Time data	minutes	480		
Contribution on margin $ from additional up time in production				$568.11
Total cost of purging			$2,027.60	$212.01
Savings acheived using Fresh Start®				**$2,398.21**

FRESH START PURGING SOLUTIONS™
PURGING COMPOUND EVALUATION 3

Focus of the Trial - Switching from Black to Beige

Problem: Dark colors are harder to purge and when switching from black to beige on an automotive panel

Objective: Introduce customer to Fresh Start Purging Compound as a solution to eliminate wasted production time and a more efficient method of cleaning the barrel and screw.

Example: Truck Quarter Panel

Process Parameters:

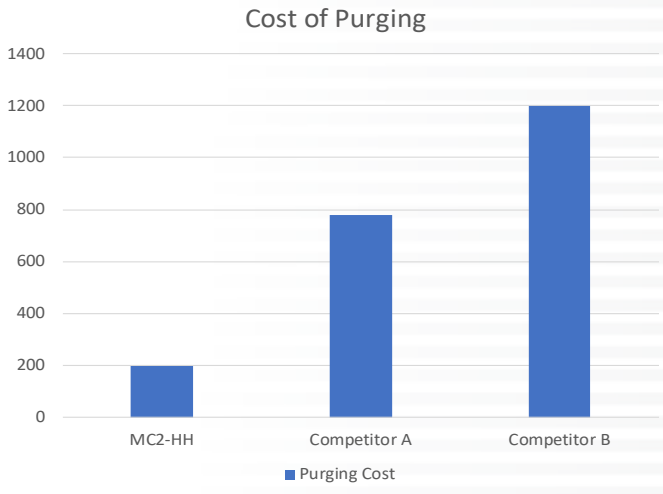
- Single cavity sequential multi gate hot runner manifold
- Milacron 3,500 ton
- IMSI Mold Master Controller
- Gates – 6
- Hot runner manifold
- Material – PPRC 35 MFI
- Color – Black to Beige
- Cycle time – 63 seconds
- Shot weight – 8 pounds

Procedure for Evaluating Purging Compounds:

- Line was stopped, and resin removed from the hopper
- The screw and barrel were backed away from the mold
- The resin was emptied from the barrel
- The purging compound was introduced into the hopper
- With back pressure of 10 -20 bars, the purging compound was manually extruded.
- Once the barrel was clean, it was advanced to the manifold and purging compound was introduced into the hopper
- All the gates were opened, and purge was shot through the manifold (1-2 shots)
- All the gates were closed, in an open mold, shots were taken while sequentially opening and closing each gate.
- Purge shots through the manifold continued until the tool was clean and the barrel empty .
- The next polymer and pigment was introduced into the barrel and parts were molded
- Parts were evaluated for colour change and accepted

Savings:

- Customer recognized a $581 savings per color change with Fresh Start® MC2-HH . Net cost of the purge



How Savings is Calculated:

- Historical values shared by the customer
  - » Parts Scrapped
  - » Time lost
- Purge calculated at list price
- Labor cost is operator plus 2 maintenance personnel.

		FRESH START® MC2-HH	COMPETITOR A	COMPETITOR B
Volume used				
Barrel/screw	lbs.	25	50	50
Mold	lbs.	20	25	50
	lbs	45	75	100
Purging compound unit cost	$/lb.	$3.35	$2.10	$3.15
Total	$	$150.75	$157.50	$315.00
Time savings w MC2-HH			67%	122%
Parts/resin scrapped				
Total number of parts		4	53	75
Weight per part		8	8	8
Total weight of resin		32	424	600
Resin price per lb.	$	$0.70	$0.70	$0.70
Cost of resin	$	$22.40	$296.80	$420.00
Operation costs				
Cycle time	sec	63	63	63
Cycles/time		57	57	57
Machine time lost	hours	0.07	0.9275	1.3125
Operational costs / hour	$	$350.00	$350.00	$350.00
Cost of purging	$	$24.50	$324.63	$459.38
Total cost of purging	**$**	**$197.65**	**$778.93**	**$1,194.38**
Savings acheived using MC2-HH	**%**		**294%**	**504%**

		FRESH START® MC2-HH	COMPETITOR A	COMPETITOR B
Operational Cost				
Cycle time	sec	63	63	63
Cycles/time		57	57	57
Machine down-time	hours	0.07	0.9275	1.3125
Comparison of operational costs			MC2-HH vs A	MC2-HH vs B
Additional up-time	hours		0.8575	1.2425
Additional production	units		49	71
Increased machine up-time			1225%	1775%

FRESH START PURGING SOLUTIONS™
APPLICATION & SPECIFICATIONS

APPLICATIONS:	**Injection**- cold and hot runners, blow molding **Extrusion**- profile, sheet, cast film, compounding, blow film
Temperature Range:	350º F - 625º F (177º C - 329º C)
Types of Resins:	All types
Minimum Clearance:	.010 inch or 254µm (microns)
Amount of Purge	Generally requiring 1 to 3 times the barrel capacity depending on the machine condition
Shelf-life	For best results use within 12 months. The purging compounds have been adjusted to address the challenge of exposure to moisture. (Keep bag sealed for maximum shelf life.)

MACHINE CLAMPING FORCE	Suggested Purge Quantity Guideline	
	Initial Purge	Regular Use
100 ton machine	5 pounds	1.5 pounds
200 ton machine	7.5 pounds	2.5 pounds
300 ton machine	10 pounds	4 pounds
400 ton machine	15 pounds	5.5 pounds
500 ton machine	18 pounds	6.5 pounds
600 ton machine	20 pounds	8 pounds
700 ton machine	25 pounds	9.5 pounds
800 ton machine	28 pounds	10.5 pounds
900 ton machine	32 pounds	12 pounds
1000 ton machine	35 pounds	13.5 pounds
1500 ton machine	40 pounds	20 pounds
2000 ton machine	45 pounds	26 pounds
2500 ton machine	50 pounds	33 pounds
3000 ton machine	65 pounds	40 pounds

PROCESS		Grades	
		GP-HH Hybrid	MC2-HH™
Injection Molding	Hot Runner Systems	•	•
	Cold Runner/Conventional	•	•
Other Processes	Blow Molding	•	•
	Compounding	•	•
Extrusion	Blown Film	•	•
	Cast Film	•	•
	Sheet	•	•
	Profile	•	•
Processing Temperature	Low (°F)	350	350
	High (°F)	625	625
	Low (°C)	177	177
	High (°C)	329	329

Suggested Purge Quantity is a guideline for purging the barrel and screw only. Purging through the manifold/mold may require an additional 30 – 50% of the suggested amounts

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