

Effect of Co-Extrusion Die Design on Overall Equipment Effectiveness (OEE)

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BRAMPTON ENGINEERING

An innovator in multi-layer blown film extrusion since 1973, with over 250 lines with 5 to 11 layers installed worldwide.









ef·fec·tive·ness i'fektivnəs/

noun

the degree to which **something*** is successful in producing a desired result

* Process or equipment





OVERALL EQUIPMENT EFFECTIVENESS (OEE)



OEE is a score that measures how effectively a manufacturing operation or equipment is utilized. It identifies the percentage of manufacturing time that is truly productive.

An **OEE** score of 100% means you are making no scrap, at the ideal output rate, with no Downtime.

CALCULATING OEE



Quality Score – Yield (%)

Determines the amount of good product as a ratio of total production

Availability Score – Productive time (%)

Measures the total productive time divided by the duration of the manufacturing cycle

Performance Ratio - Capacity (%)

Indicates the actual process or equipment output as a ratio of the ideal output





What period of time should I use for my OEE calculation?

- Choose the time period that is most meaningful for your process or plant: shift, job (part run), hour, day, year.
- Use **ideal cycle time**, which represents the maximum theoretical speed that the process can run.
- Ideal cycle does not include allocations for typical losses such as planned or unplanned downtime, process slowdown, slow cycles, and defects.







EFFECT OF DIE DESIGN ON OVERALL BLOWN FILM EXTRUSION EFFECTIVENESS

STREAMLINED CO-EXTRUSION DIE SCD® CONVENTIONAL CYLINDRICAL DIE



STREAMLINED CO-EXTRUSION DIES – SCD®





FEATURES

- Modular design
- Stackable
- Streamlined channels
- No hang-up points
- Easy access for cleaning
- Lower wetted surface
- Multiple options for temperature control





SCD[®] - Flow Channel Geometry





ADVANTAGES

- Lowest flow resistance
- Fast purging
- Minimizes carbon buildup and gel generation
- Quick cleaning





Cylindrical Dies - Flow Channel Geometry





Distribution Channels

Spirals





OEE – PROCESS INPUTS

EQUIPMENT & PROCESS SPECS	SCD®	OTHER
DIE SIZE (mm)	350	350
AVERAGE OUTPUT (Kg/h)	445	467
DAILY MAINTENANCE (h)	0.5	0.5
WEEKLY MAINTENANCE (h)	0.75	0.75
DIE CLEAN DURATION	4 Days	10 Days
DIE CLEAN INTERVAL	18 Months	12 Months





OEE INPUTS PRODUCTION PLAN



EQUIPMENT & PROCESS SPECS	SCD ®	OTHER
MINIMUM RUN SIZE (Kg)	10,000	10,000
FILM STRUCTURES	4	4
CHANGEOVERS	4	4
TRIM PER SIDE (mm)	10	10
AVERAGE OFF-SPEC (%)	2	2
WORKING DAYS (days/year)	350	350





OEE - PURGING CONDITIONS

EQUIPMENT & PROCESS SPECS	SCD®	OTHER
PURGE TIME – SIMILAR RESINS (min)	20	30
PURGE TIME – PURGE RESINS (min)	45	120
CHANGEOVER on GAUGE (min)	20	20

* Purge time refers to changing the resin in one of more layers of the die, i.e., PE to Nylon.







OEE – PRODUCT PORTFOLIO

FILM TYPE	၂ န RATIO	LAYFLAT (mm)	BLOW-UP RATIO	PURGE RESIN	FILM COST	RUN SIZE
BARRIER/7LAYERS/50μ	10 %	1600	2.26	Similar	1.60 \$/lb	10,000 Kg
BARRIER/7LAYERS/80μ	30 %	1600	2.26	Purge	1.75 \$/lb	30,000 Kg
POD/4LAYERS/80µ	20 %	1580	2.24	Similar	1.10 \$/lb	20,000 Kg
POD/3LAYERS/50µ	40 %	1600	2.29	Purge	1.13 \$/lb	40,000 Kg





KEY PERFORMANCE INDICATORS













PROCESSING TEMPERATURE SENSITIVE RESINS?



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DIE SIZE (mm)	350	350
AVERAGE OUTPUT (Kg/h)	445	467
DAILY MAINTENANCE (h)	0.5	0.5
WEEKLY MAINTENANCE (h)	0.75	0.75
DIE CLEAN DURATION	4 Days	10 Days
DIE CLEAN INTERVAL	18 Months	6 Months







KEY PERFORMANCE INDICATORS



SCD® DIES DO NOT REQUIRE ADDITIONAL CLEANING TIME WHEN PROCESSING HEAT SENSITIVE MATERIALS DUE TEMPERATURE ISOLATION.







LOWER AVAILABILITY RESULTED IN OEE REDUCTION OF 3%



FINANCIAL IMPLICATIONS





* Other costs include inventory cost and holding costs.





* Equipment costs represent yearly amortization cost.





ANNUAL COSTS & OPPORTUNITY LOSS (WHY OEE IS IMPORTANT)





OEE & YIELD vs. Minimum Run Size









FINAL REMARKS

OEE enable operations managers to **identify and address** losses in the process that limit effectiveness

Improving OEE results in cost reductions and increased yield – **more revenue potential and profitability**

The SCD[®] advantage is to reduce set-up and changeover time, and to maximize line availability (reduce cleaning time and frequency) – reliability is key

Further reducing minimum run size will negatively impact OEE (lower yield) – need to make decision based on inventory and holding costs





What's your OEE?

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