Why Precise Feeding Saves a lot of Money.

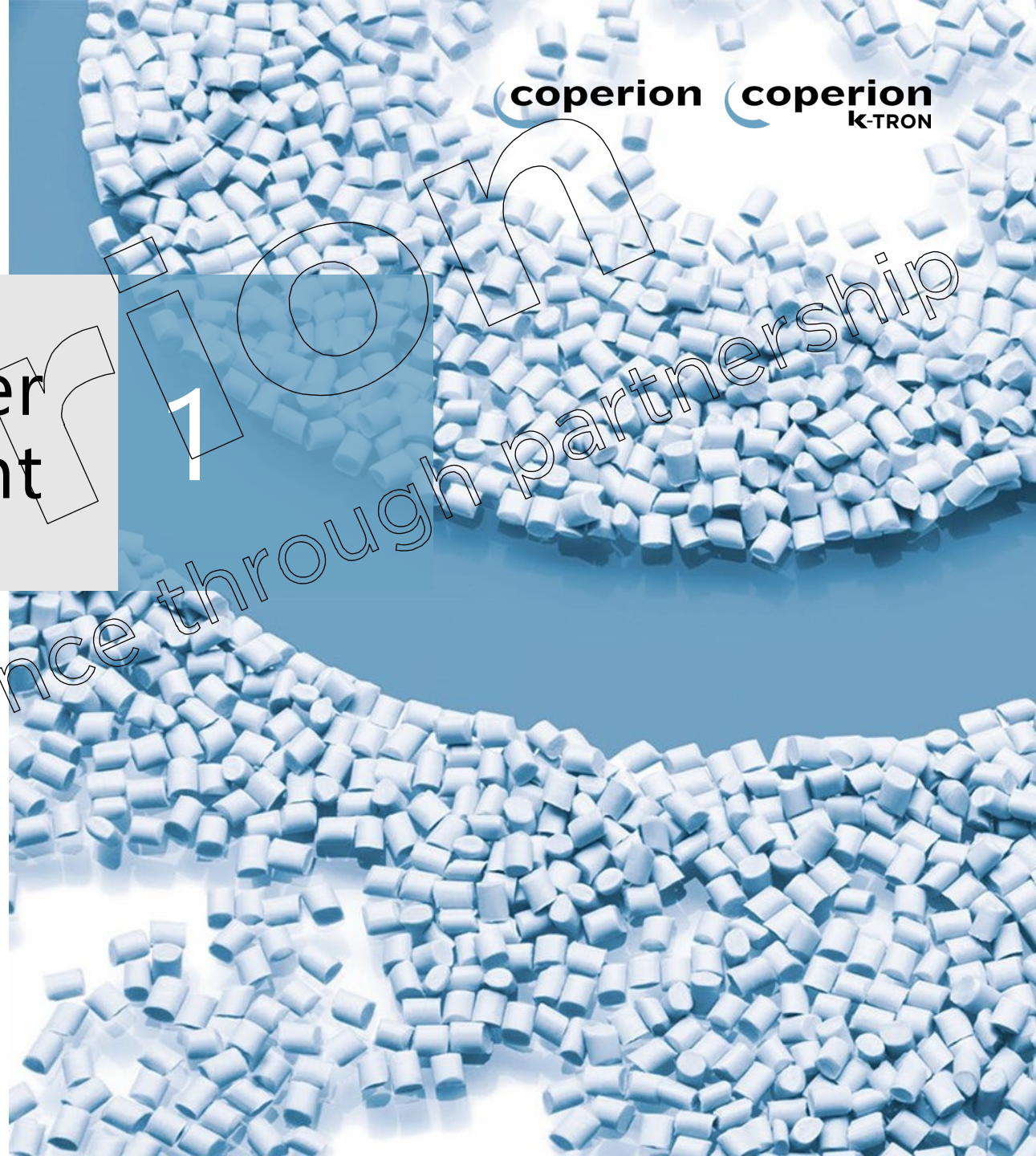
The Importance of Accurate Feeding for an Efficient Production Process.

Roadshow Vietnam Nov 2024

SC Yong I Regional Sales Manager I Coperion

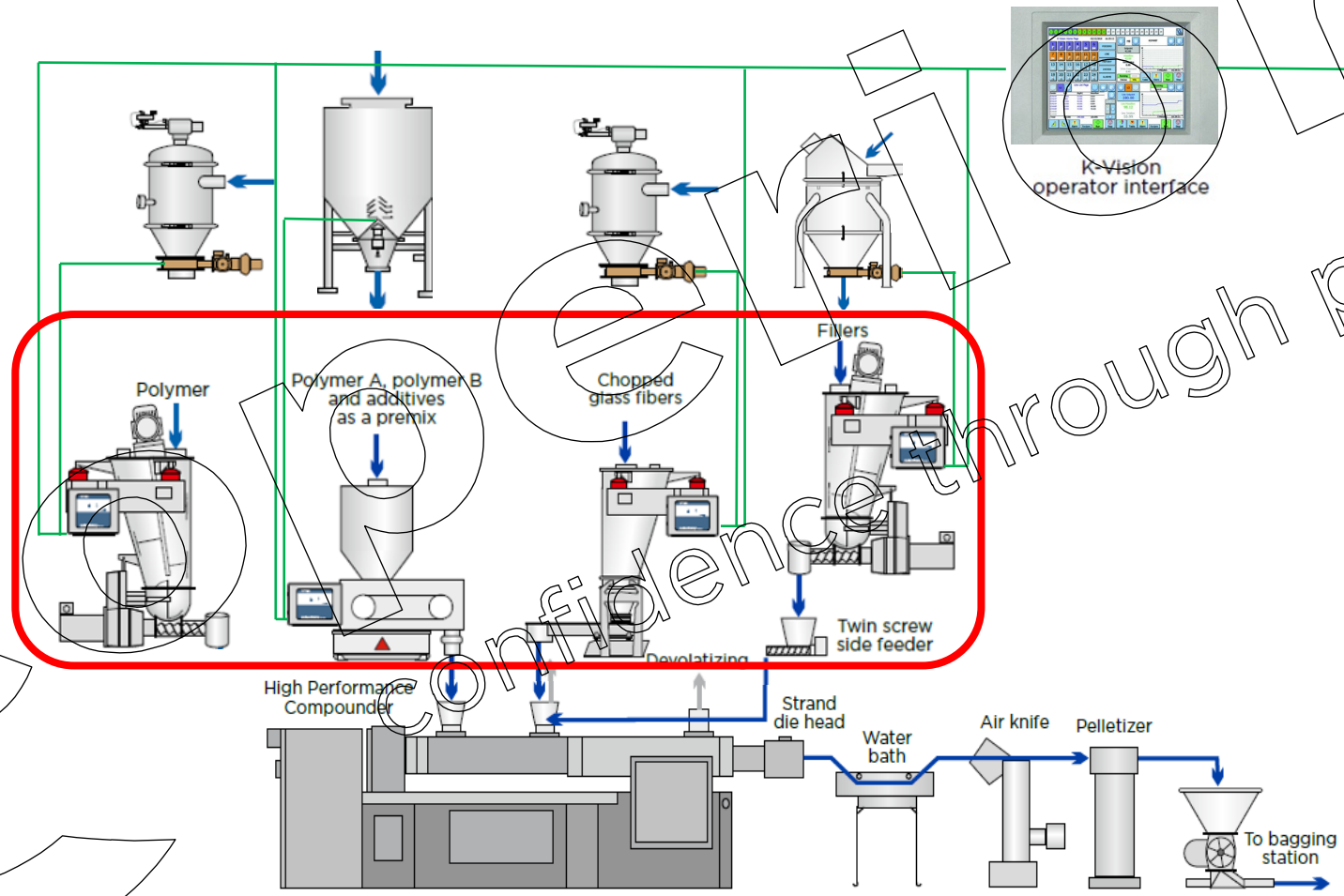
CHAPTERS

Typical Feeder Arrangement



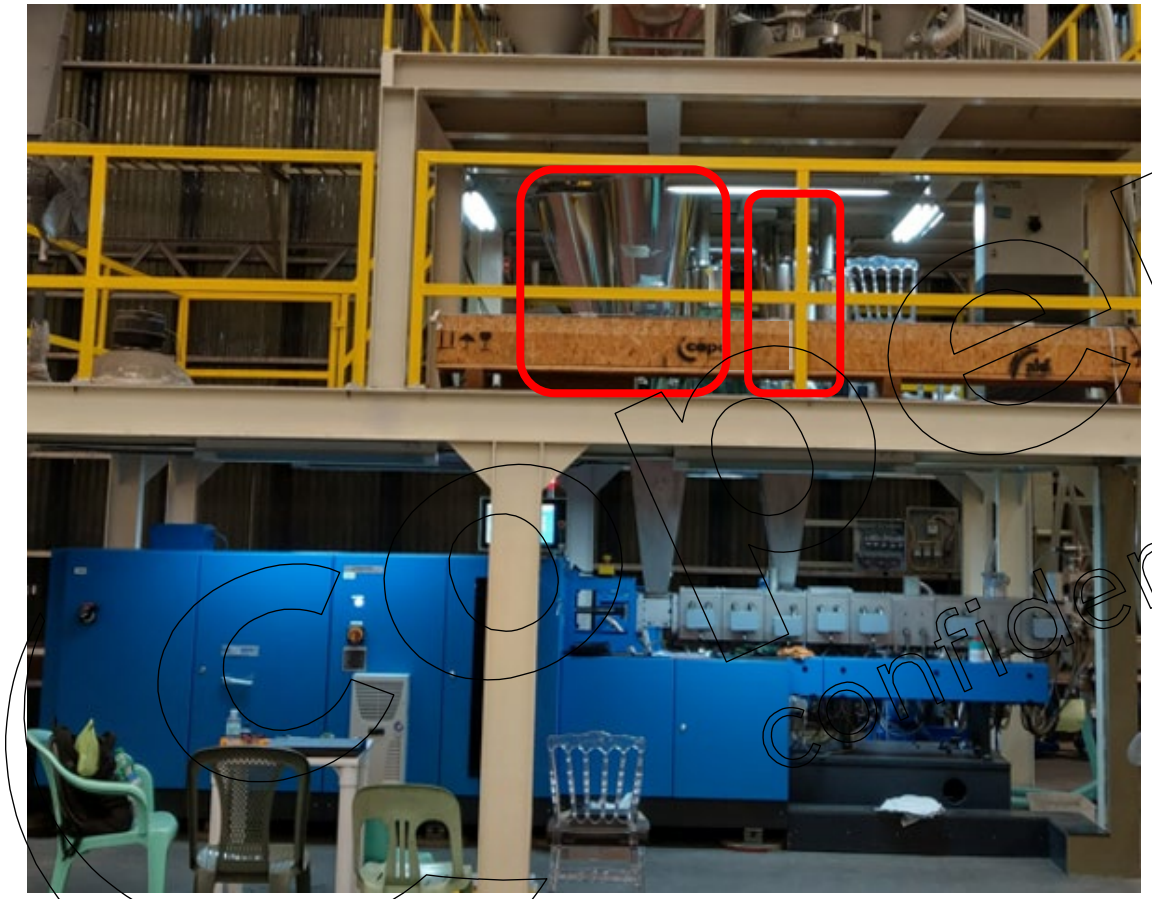
Typical Feeder Arrangement

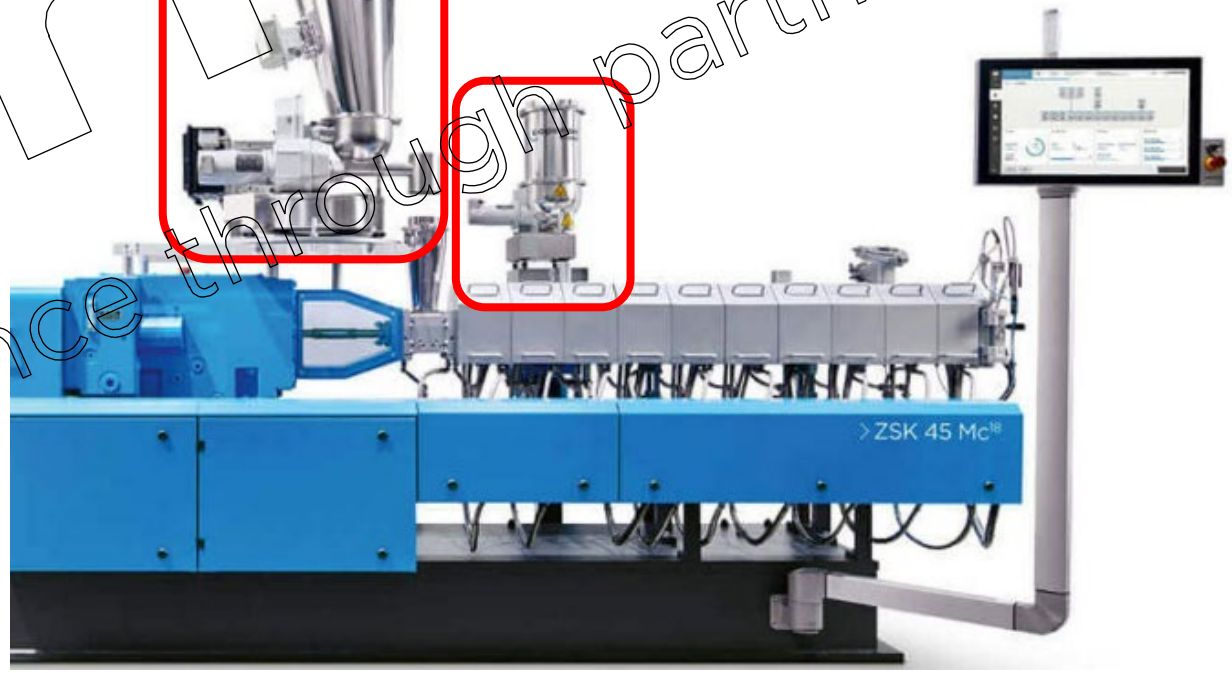
Sample Flow Diagram



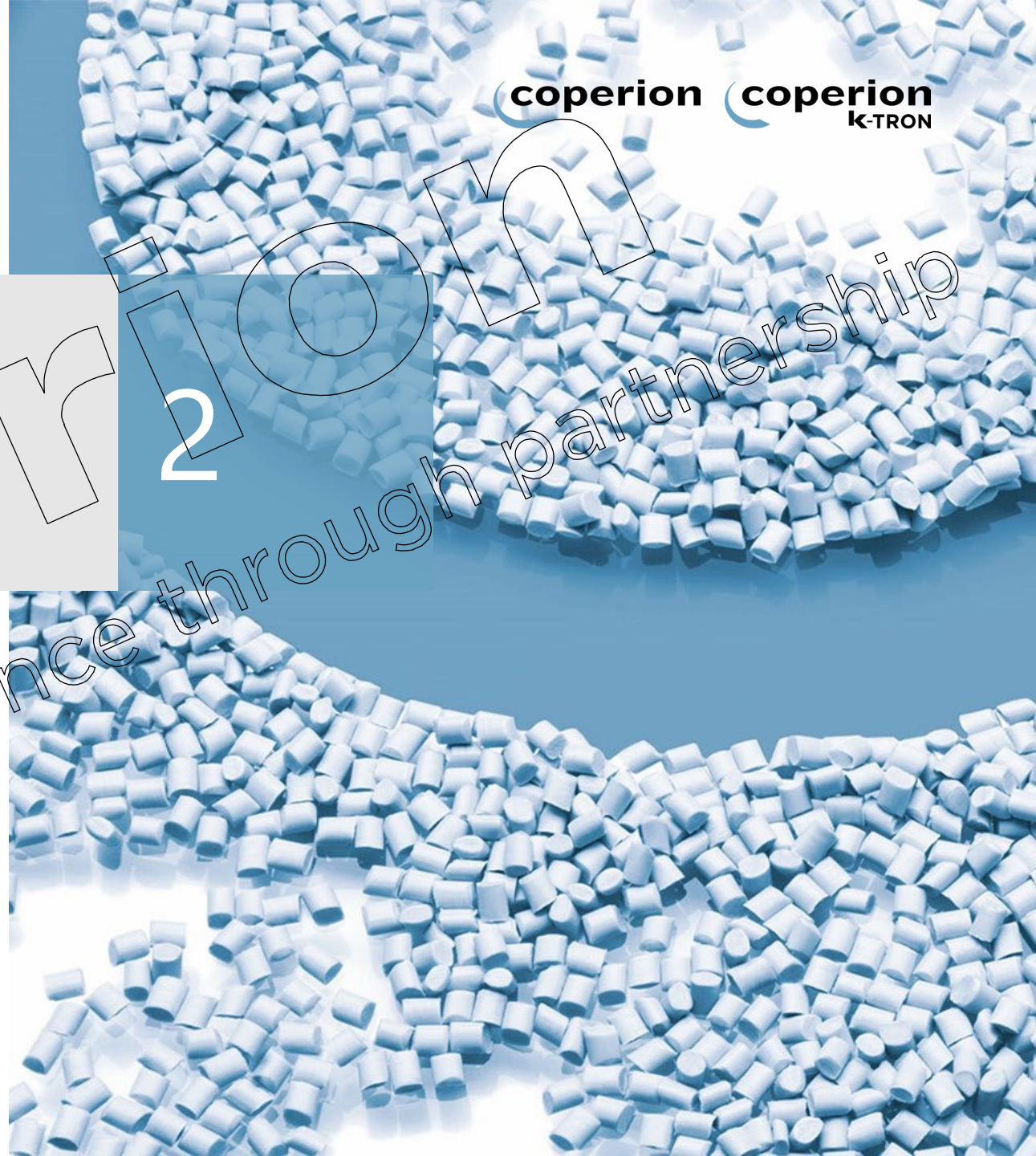
Typical Feeder Arrangement

Sample Site Photos





Recipe Management



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Recipe Management

Sample Recipe On Compounding

Fdr#	Material Name	Geometry	min %	max %	min BD, kg/l	max BD, kg/l	Min. rate, kg/h	Max. rate, kg/h	Min. rate, l/h	Max. rate, l/h	Feeder Model	Hopper size, L	Refill Per Hour
1	Plastic Resin	pellet	15	80	0.4	1	75	400	75	1000	K2-ML-D5-S60	110	8
2	Glass Fiber	fiber	10	50	0.27	0.35	50	250	142.9	925.93	K3-ML-D5-V200	110	8
3	Flame retardant	powder	10	50	0.6	1.6	50	250	31.25	416.67	K2-ML-D5-T35	110	4
4	Filler (CaCo3, BaSo4, talc, silica, mica)	Powder/flakes	10	50	0.16	1	50	250	50	1562.5	K2-ML-T60	160	9
5	Processing additive mix (AO, dispersant) + pigment	powder	0.5	15	0.4	2.1	2.5	75	1.19	187.5	K2-ML-D5-T35	50	4
6	Modifying additive mix (UV powder, slip powder, PPA powder, coupling agent pellets)	Powder+pellet	0.5	30	0.3	1	2.5	150	2.5	500	K2-ML-D5-S60	110	4
7	Recyled plastic	flake/pellet	5	80	0.3	1.2	25	400	20.83	1333.3	K2-ML-S60	180	7
8	Liquid	liquid	1	3	1	1	2.5	250	2.5	250	LLW	60	4

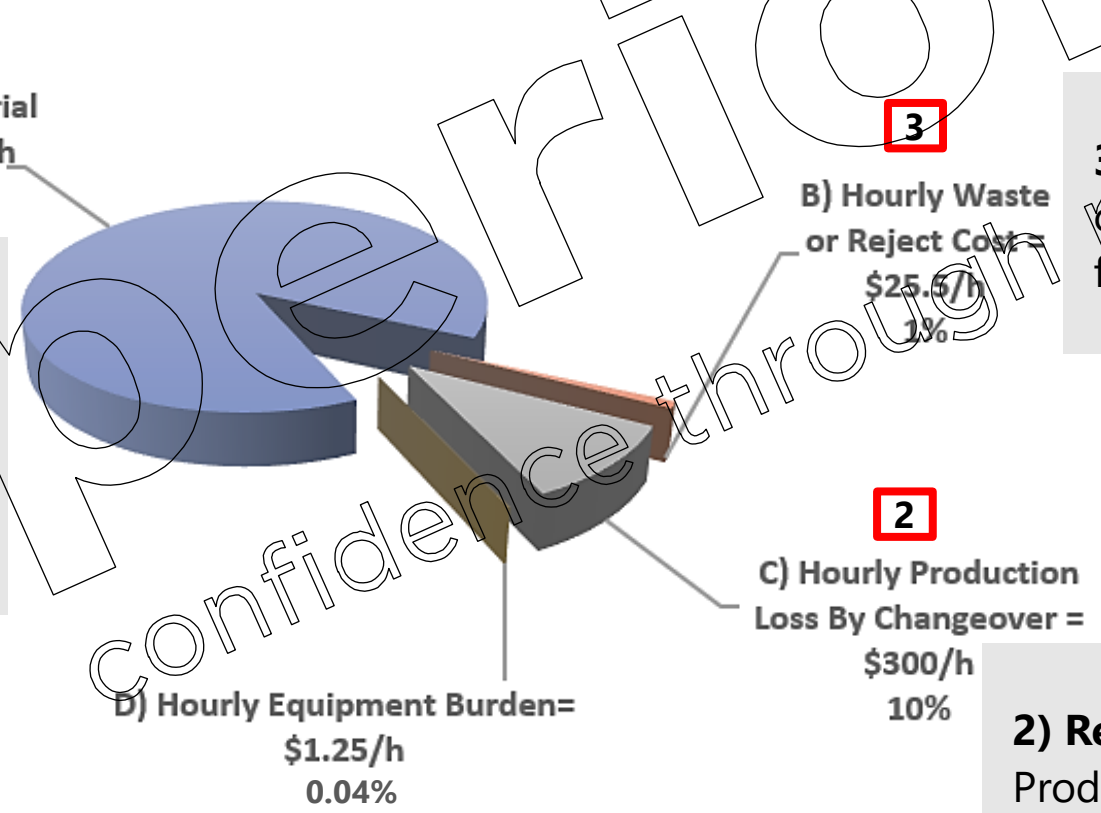
Recipe Management

Hourly Cost Elements

Extrusion Rate, kg/h = 1000	1,000	kg/h
Unit Material Cost, $/kg = 3	3	$/kg
On-line Production Time/Uptime, % = 85	85	%
A) Hourly Material Cost, $/h = Extrusion Rate, kg/h x Unit Material Cost, $/kg x Uptime	**2,550**	**$/h**
Reject or Waste Rate, % = 1		
B) Hourly Waste or Reject Cost, $/h = 2550*0.01	**25.50**	**$/h**
Recipe Changeover Downtime (Ignore Labor), % = 15	15	%
Unit Material Sell Price, $/kg = 5	5	$/kg
C) Hourly Production Loss By Changeover, $/h = Extrusion Rate kg/h x Recipe changeover downtime % x (Sell Price - Cost)	**300**	**$/h**
Equipment acquisition cost, $ = 100,000	100,000	$
Equipment life expectancy, year = 10	10	year
Operating hours per year = 8000	8,000	h/y
D) Hourly Equipment Burden, $/h = Equipment Acquisition Cost, $ / 10 years /8000 hours	**1.25**	**$/h**

Recipe Management

Hourly Cost Elements Summary



Priority:

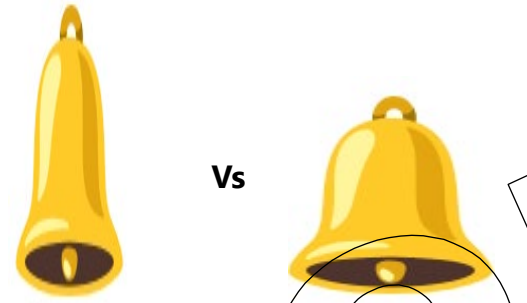
1) Save Materials to the core with high performance feeders that can improve both momentary and long-term accuracy

3) Cut Reject Rate with consistent and controllable feeding equipment

2) Reduce Changeover Production Loss with flexible, cleanable, reliable feeding equipment

Recipe Management

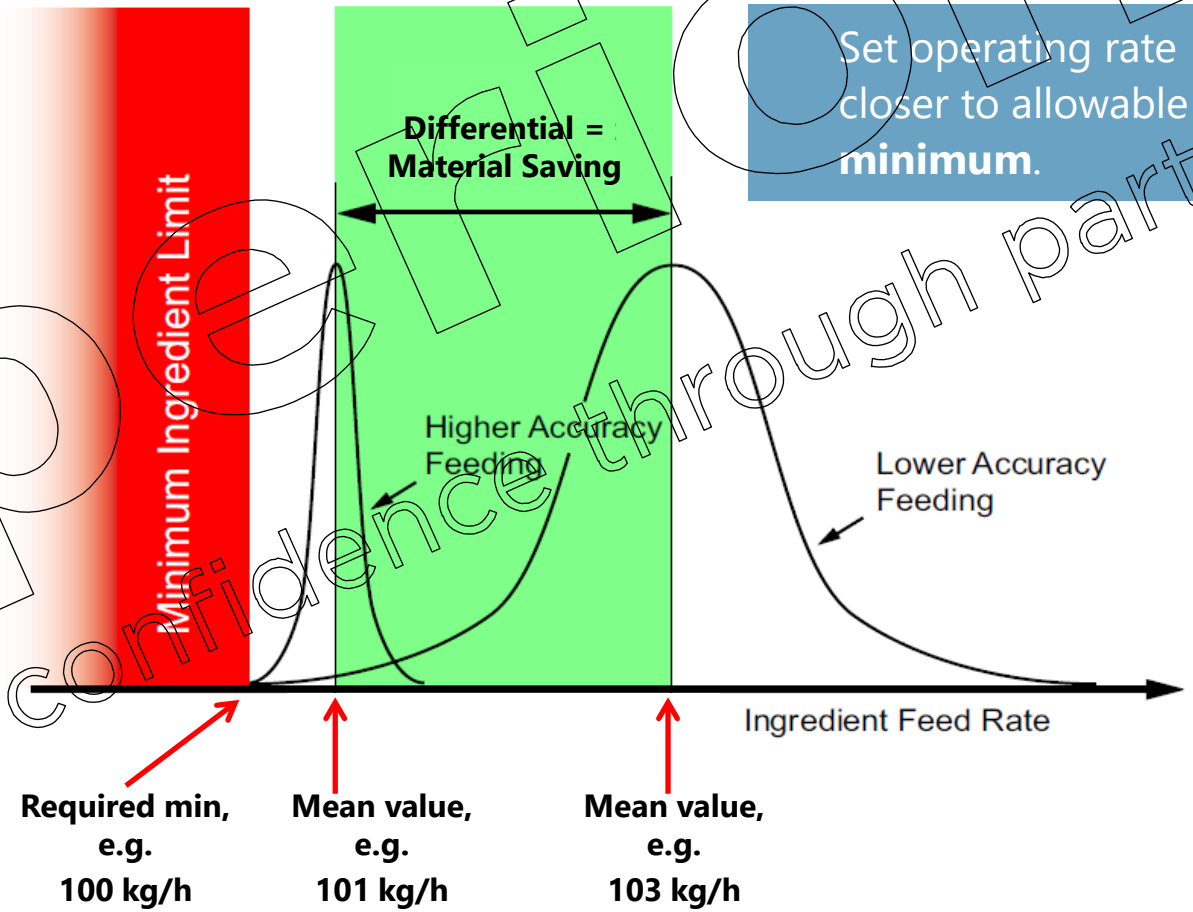
Minimize **EXPENSIVE** Or Critical Materials



Vs

Accurate

Less Accurate

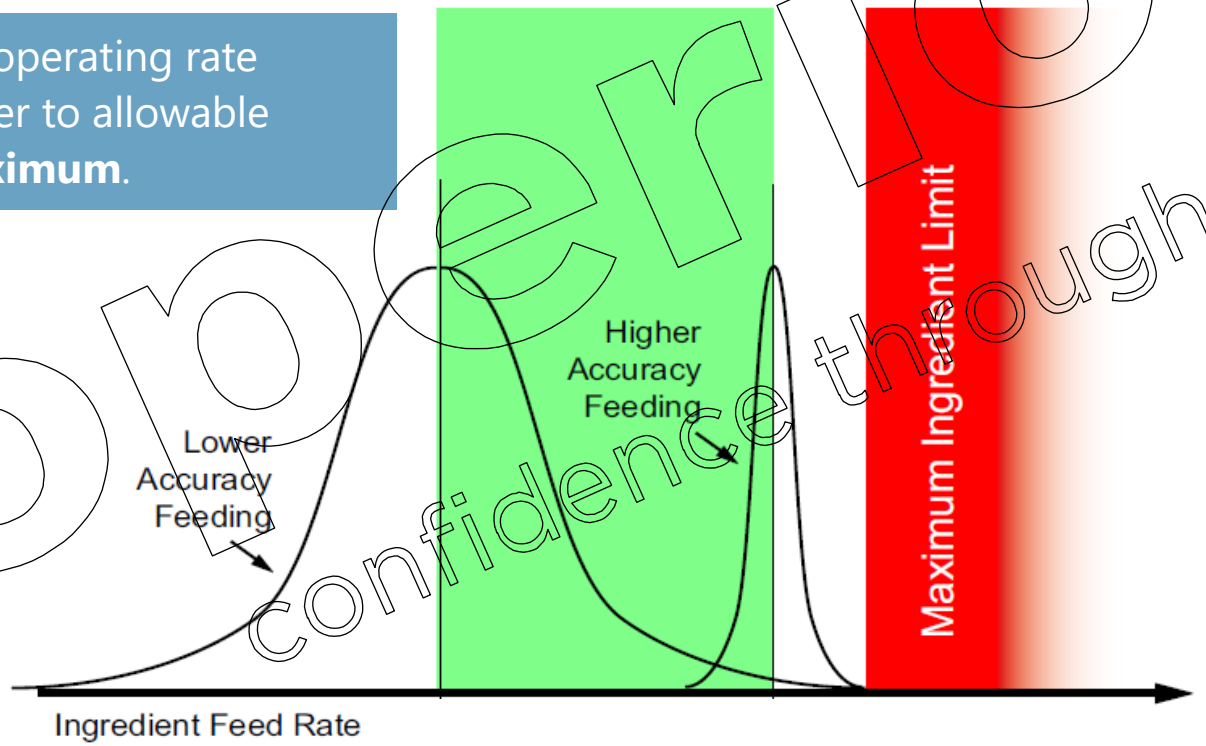


Set operating rate closer to allowable **minimum**.

Recipe Management

Maximize **INEXPENSIVE** Or Non-critical Materials

Set operating rate closer to allowable **maximum**.



Recipe Management

Recipe Optimization Program As A Whole

Original Recipe Data Entry

No	Ingredient Name	Cost Rank	Ingredient Unit Cost ($/kg)	Recipe Prop (%)	Rate (kg/hr)	Cost ($/hr)	Allowable Proportions (%) Minimum (%)	Allowable Proportions (%) Maximum (%)	Fdr Accuracy +/-% Ing Rate
1	Resin	6	0.2200	45.00	450.00	99.00	41.00	48.00	1.00
2	Filler A	4	0.5000	30.00	300.00	150.00	27.00	33.00	1.00
3	C. Agent	5	0.3400	10.00	100.00	34.00	9.00	11.00	1.00
4	AO powder	2	1.2000	8.00	80.00	96.00	7.20	8.80	1.00
5	MB	3	0.6000	3.00	30.00	18.00	2.70	3.30	1.00
6	Pigment	1	3.5500	4.00	40.00	142.00	3.60	4.40	1.00
			Total	100.00	1,000.00	539.00			

CASE A = Cost-Minimized Recipe at Current Feeder Performance

No	Ingredient Name	Cost Rank	Ingredient Status	Recipe Prop (%)	Rate (kg/hr)	Cost ($/hr)
1	Resin	6	Maximized	47.50	475.00	104.50
2	Filler A	4	In Range	27.95	279.50	139.75
3	C. Agent	5	Maximized	10.80	108.00	36.72
4	AO powder	2	Minimized	7.33	73.30	87.96
5	MB	3	Minimized	2.75	27.50	16.50
6	Pigment	1	Minimized	3.67	36.70	130.29
			Total	100.00	1,000.00	515.72

Case A vs Original Recipe Differences

Recipe Prop (%)	Rate (kg/hr)	Cost ($/hr)
2.50	25.00	5.50
-2.05	-20.50	-10.25
0.80	8.00	2.72
-0.67	-6.70	-8.04
-0.25	-2.50	-1.50
-0.33	-3.30	-11.71
0.00	0.00	-23.28

Saving

515.72 - 539.00 = -$23.28/h

Saving of **-$186,240** per Year

(By Recipe Optimization Program)

Recipe Management

With Better Accuracy Feeders

Original Recipe Data Entry

No	Ingredient Name	Cost Rank	Ingredient Unit Cost ($/kg)	Recipe Prop (%)	Rate (kg/hr)	Cost ($/hr)	Allowable Proportions (%) Minimum (%)	Allowable Proportions (%) Maximum (%)	Fdr Accuracy +/-% Ing Rate
1	Resin	6	0.2200	45.00	450.00	99.00	41.00	48.00	0.50
2	Filler A	4	0.5000	30.00	300.00	150.00	27.00	33.00	0.50
3	C. Agent	5	0.3400	10.00	100.00	34.00	9.00	11.00	0.50
4	AO powder	2	1.2000	8.00	80.00	96.00	7.20	8.80	0.50
5	MB	3	0.6000	3.00	30.00	18.00	2.70	3.30	0.50
6	Pigment	1	3.5500	4.00	40.00	142.00	3.60	4.40	0.50
			Total	100.00	1,000.00	539.00			

CASE A = Cost-Minimized Recipe at Current Feeder Performance

No	Ingredient Name	Cost Rank	Ingredient Status	Recipe Prop (%)	Rate (kg/hr)	Cost ($/hr)
1	Resin	6	Maximized	47.75	477.50	105.05
2	Filler A	4	In Range	27.72	277.20	138.60
3	C. Agent	5	Maximized	10.90	109.00	37.06
4	AO powder	2	Minimized	7.27	72.70	87.24
5	MB	3	Minimized	2.73	27.30	16.38
6	Pigment	1	Minimized	3.63	36.30	128.87
			Total	100.00	1,000.00	513.20

Case A vs Original Recipe Differences

Recipe Prop (%)	Rate (kg/hr)	Cost ($/hr)
2.75	27.50	6.05
-2.28	-22.80	-11.40
0.90	9.00	3.06
-0.73	-7.30	-8.76
-0.27	-2.70	-1.62
-0.37	-3.70	-13.13
0.00	0.00	-25.80

Saving

513.20 - 539.00 = -$25.80/h

Saving of **-$206,400** per Year

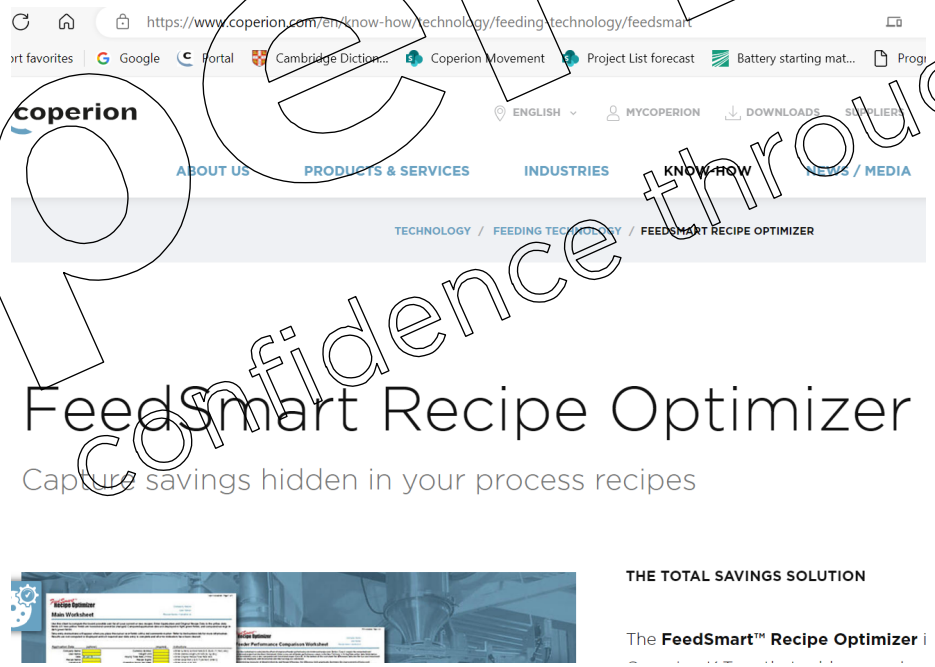
(Further using better accuracy feeder, +/- 0.5**%** versus +/- 1% feeder)

Recipe Management

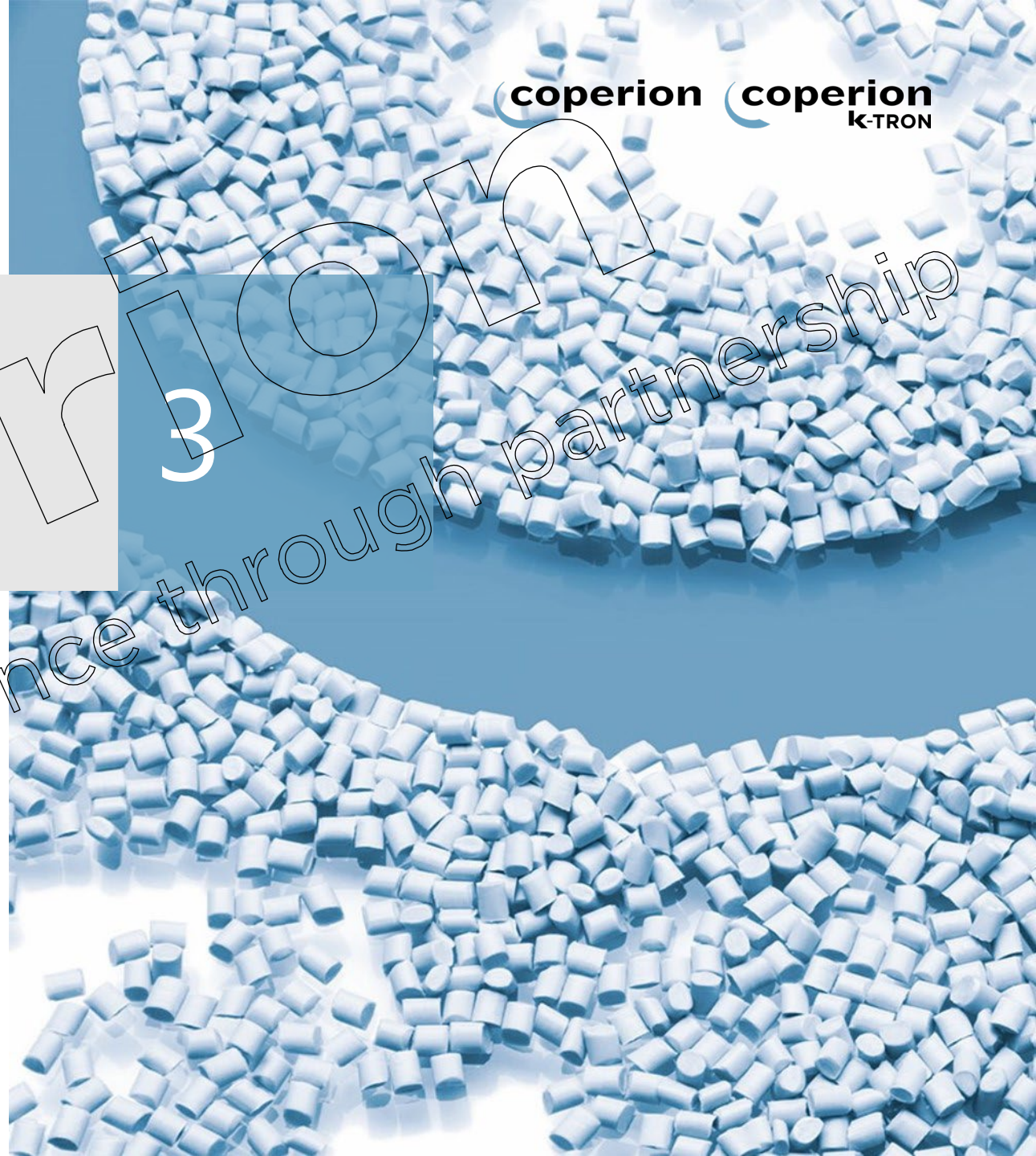
Feedsmart Recipe Optimizer

Downloadable at the following link

https://www.coperion.com/en/know-how/technology/feeding-technology/feedsmart



The Technology



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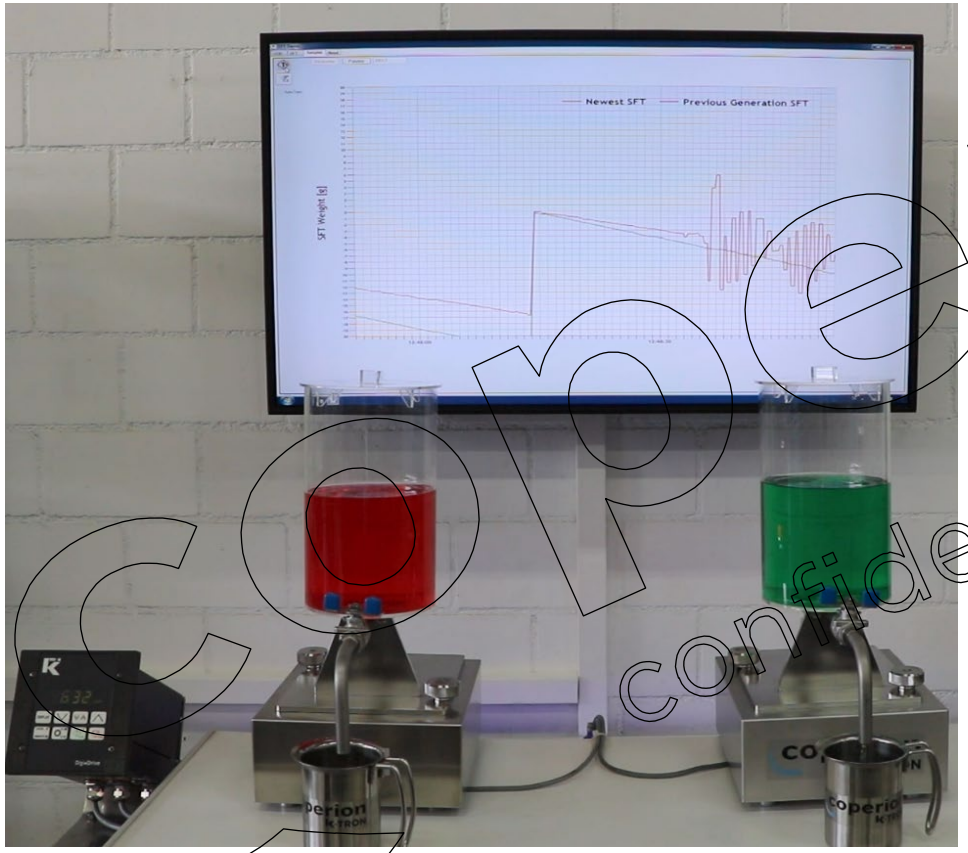
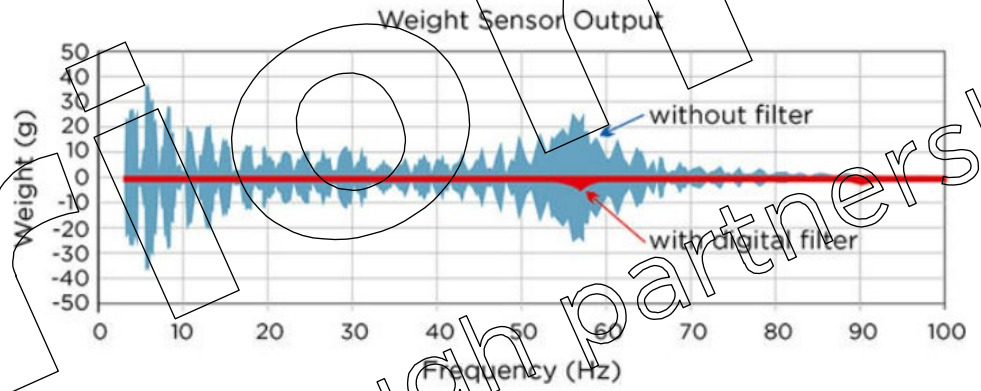
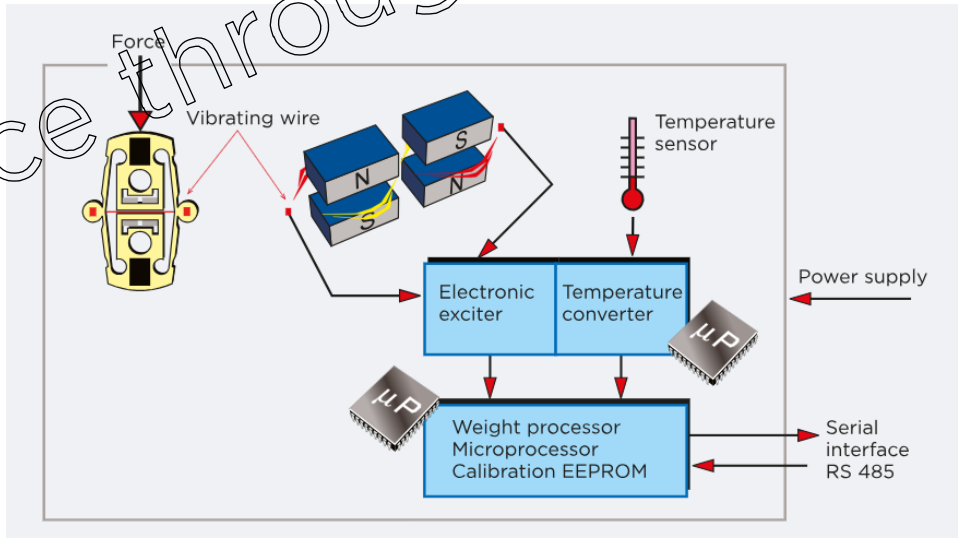
Technology

Digital Load Cell With Digital Filter – Saving No. 1 Hourly Material







Technology

Proven Showcase of Accuracy, with Microfeeder MT12 – Saving No. 1 Hourly Material

Pitch		Twin concave screws	Twin auger screws	Screw speed range
coarse	dm^3/h	0.078 - 10.36	0.076 - 10.71	RPM
	ft^3/h	0.0028 - 0.3656	0.0027 - 0.3781	1 - 150
fine	dm^3/h	0.045 - 5.89	0.031 - 4.52	RPM
	ft^3/h	0.0016 - 0.2079	0.0011 - 0.1595	1 - 150

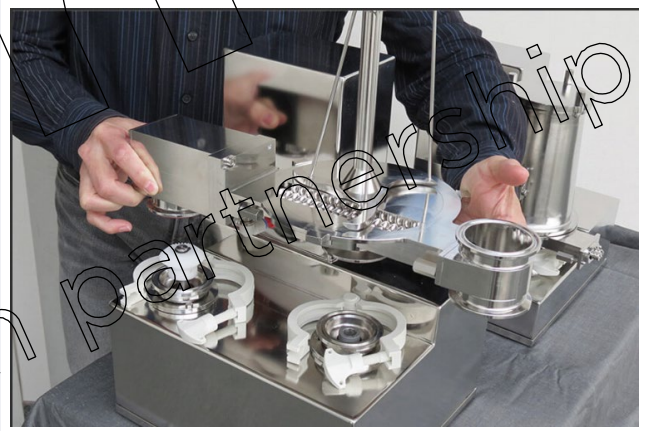
Minimum rate at 0.031 dm3/h,

Assumed bulk density 0.5 kg/dm3

15 grams per hour.

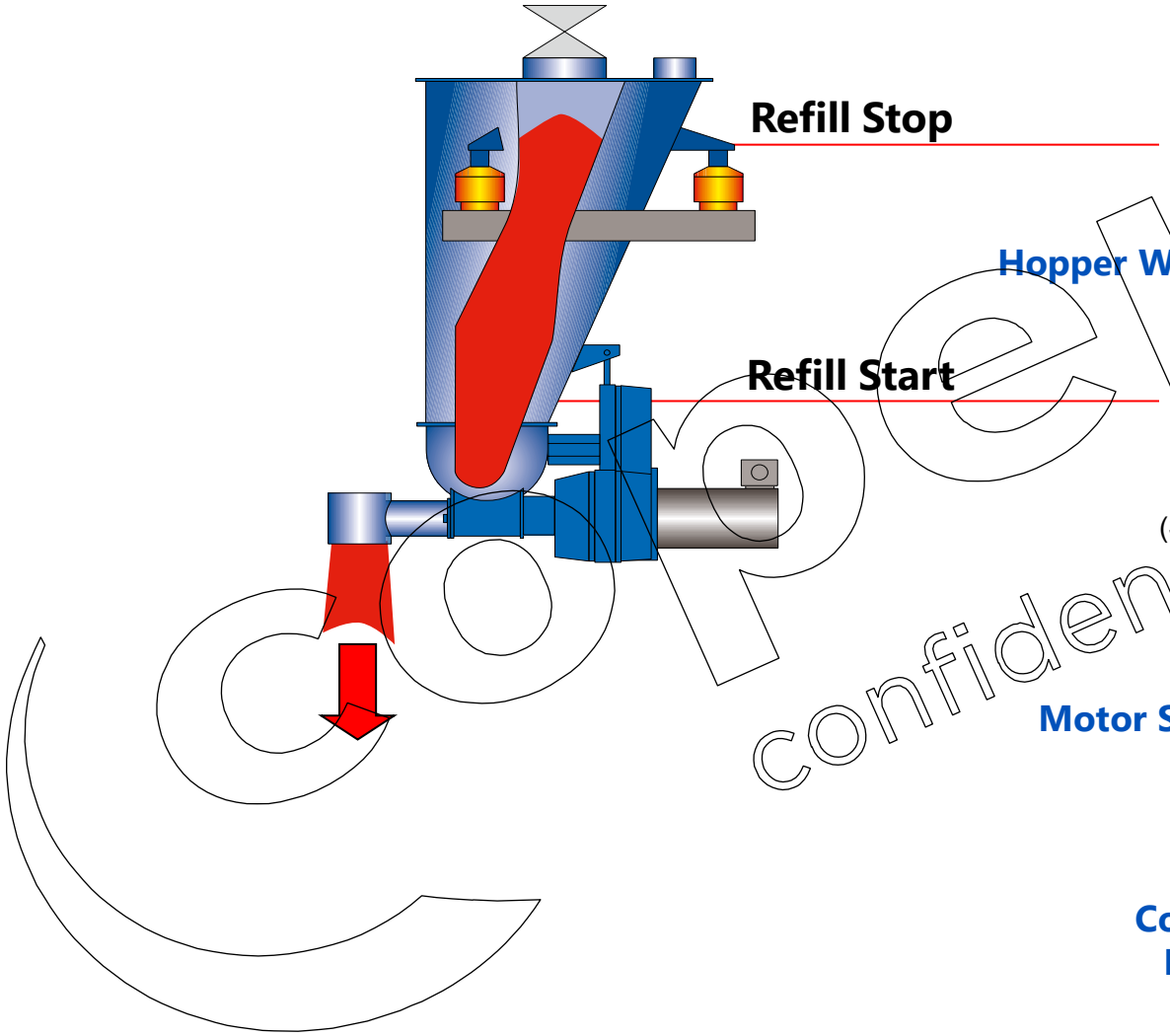
250mg per minute

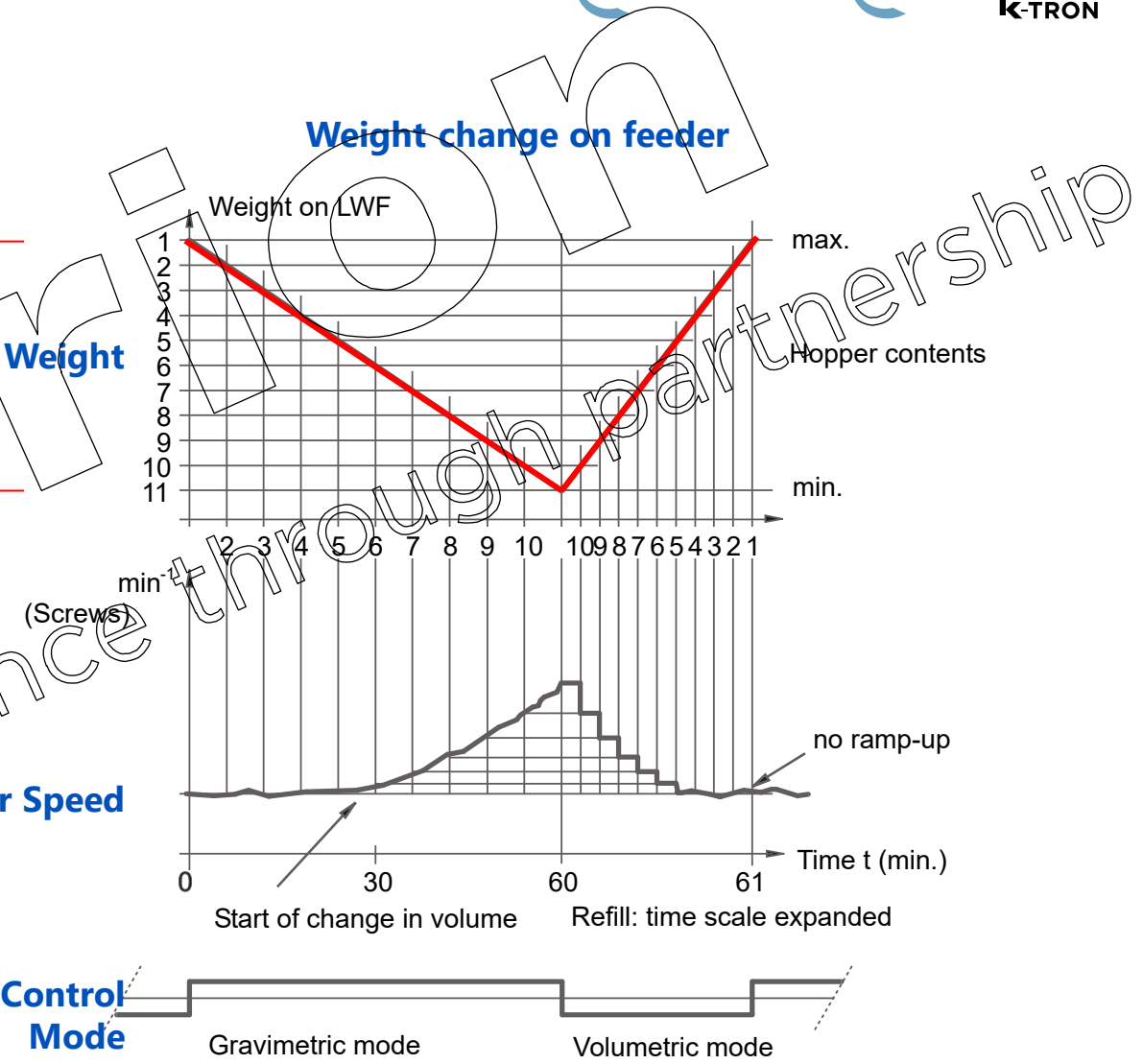
Weight of half a Paracetamol pill in a minute



Technology

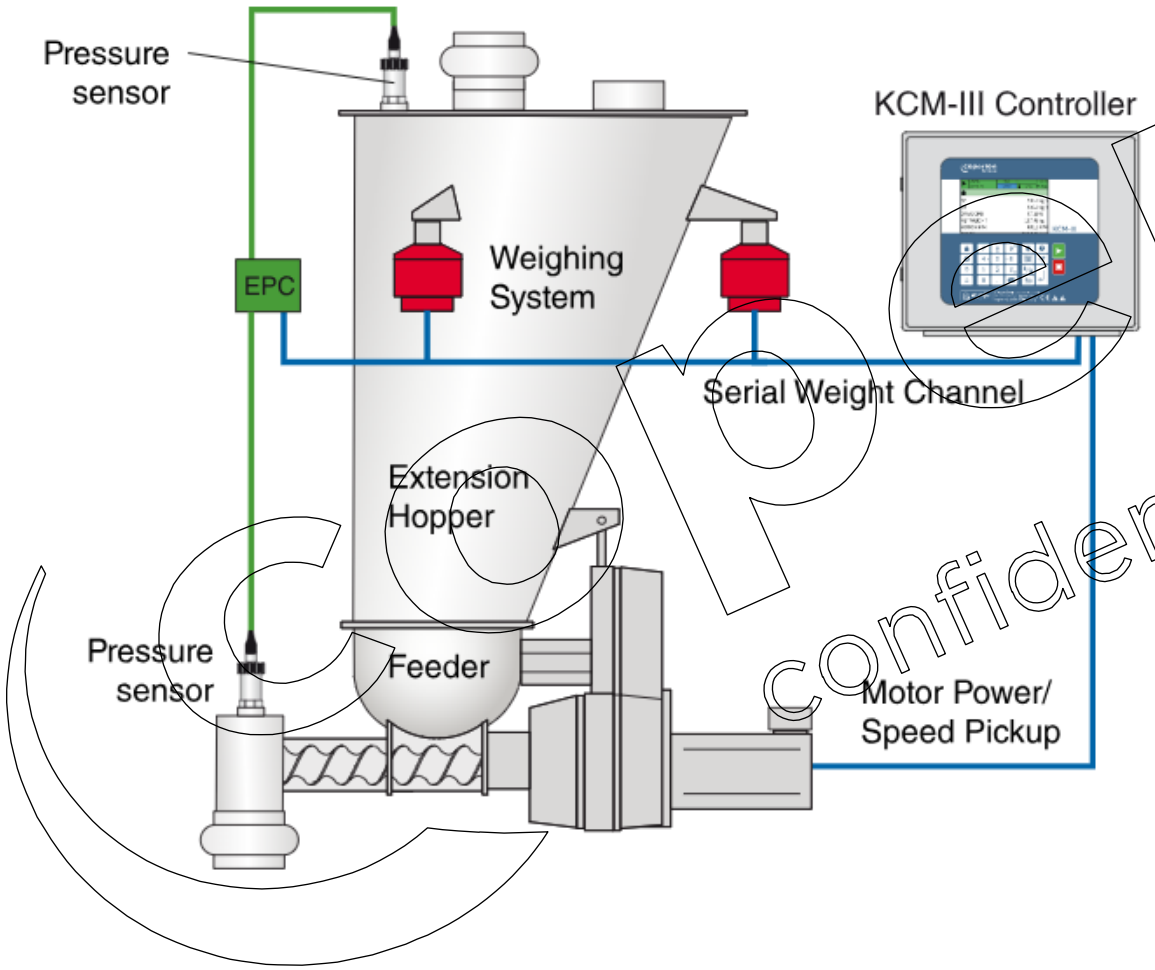
Smart Refill Algorithm – Saving No. 1 Hourly Material





Technology

Electronic Pressure Compensation – Saving No. 1 Hourly Material



Technology

The Package Of Versatility – Reducing No. 2 Hourly Changeover Loss

Unprecedentedly High Turndown Ratio

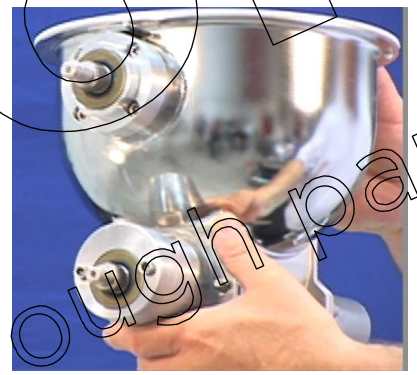
Example:
2267/5.2 = 436!
(Maximum is 436 times of minimum)
The possibility of using the same feeder to feed different material when Line recipe changed

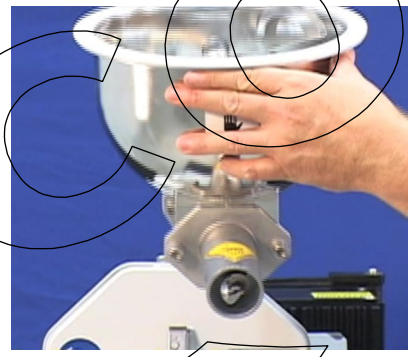
Pitch		Twin concave screws	Twin auger screws	Twin spiral screws	Double auger screws
coarse pitch	dm^3/h	2.9 - 1417	5.2 - 2267	3.4 - 1398	4.3 - 1712
	ft^3/h	0.1 - 50.02	0.18 - 80.03	0.12 - 49.35	0.15 - 60.43
fine pitch	dm^3/h	2.1 - 920	2.4 - 1370	1.82 - 1023	2.4 - 1254
	ft^3/h	0.07 - 32.48	0.08 - 48.36	0.06 - 36.11	0.08 - 44.27

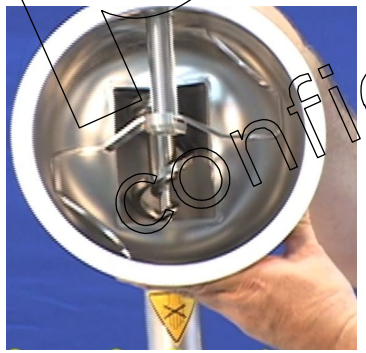
Technology

The Package Of Versatility – Reducing No. 2 Hourly Changeover Loss

Quick Change Module



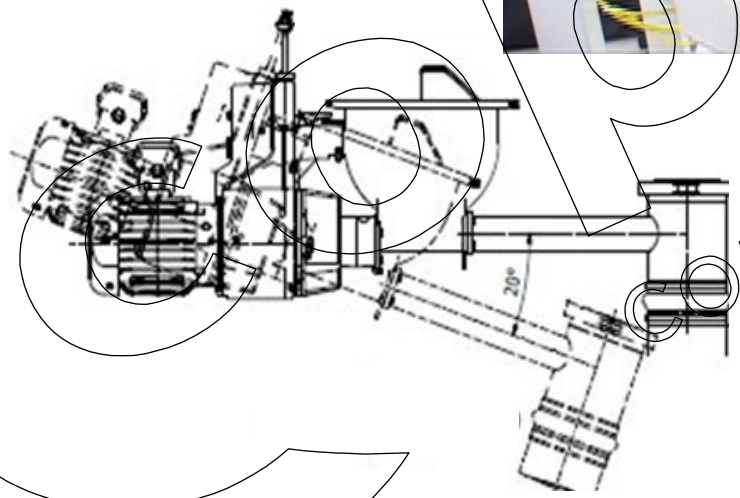




Technology

The Package Of Versatility – Reducing No. 2 Hourly Changeover Loss

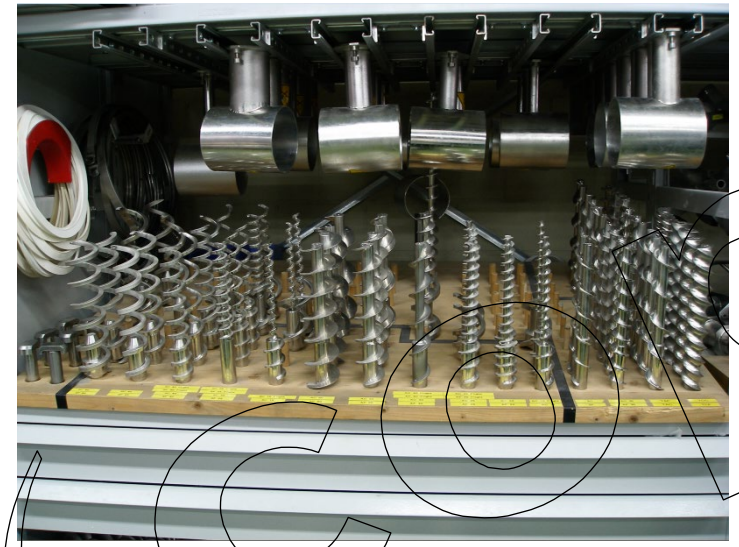
Detachable Bowl
(along with agitator)

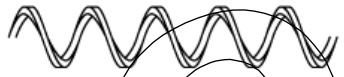


Technology

The Package Of Versatility – Reducing No. 2 Hourly Changeover Loss

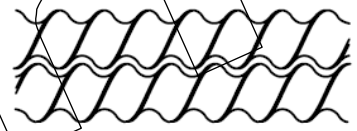
Detachable screws



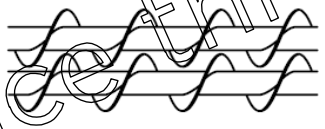


Single Spiral

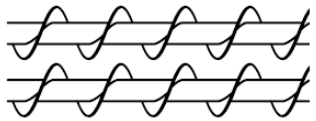
Single Auger



Twin Concave



Twin Auger

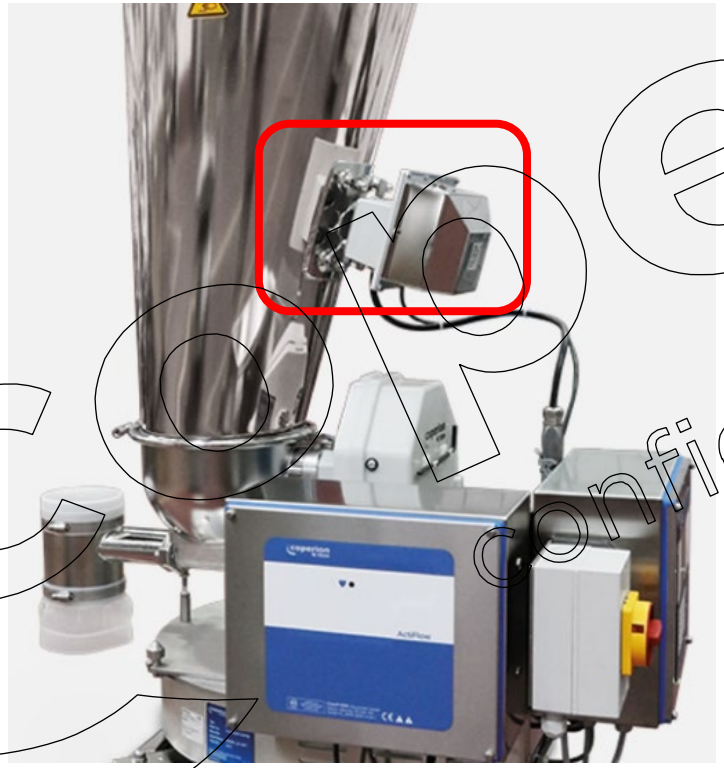


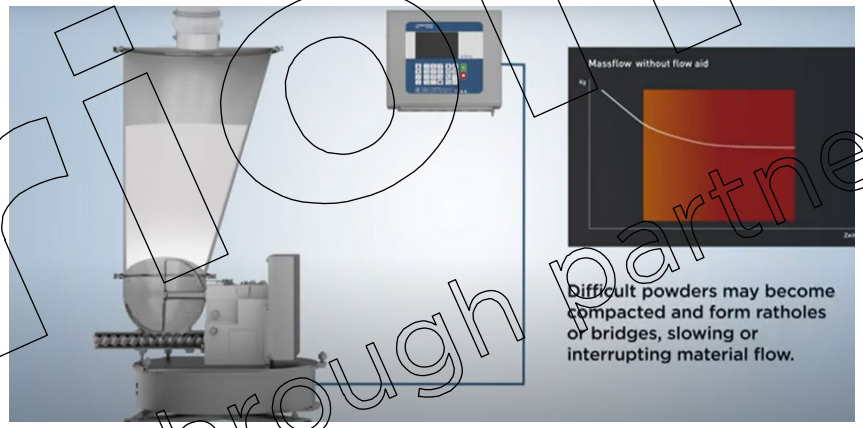
Double Auger

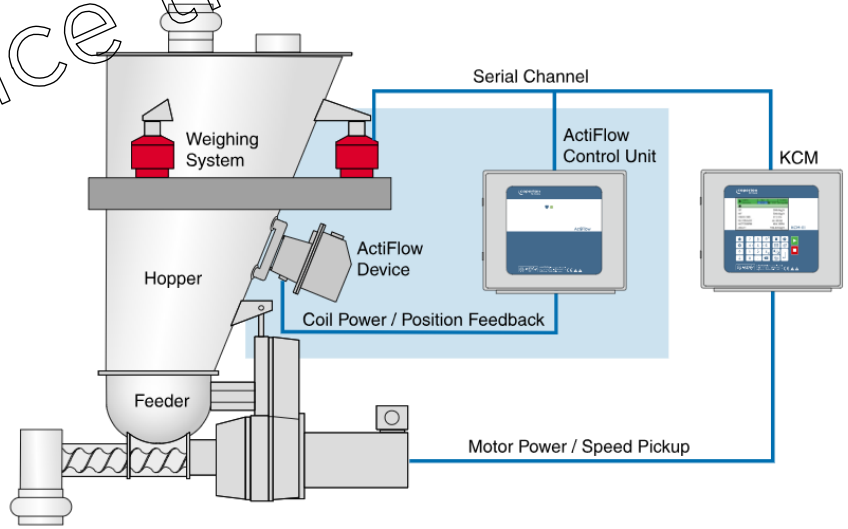
Technology

The Package Of Versatility – Reducing No. 2 Hourly Changeover Loss

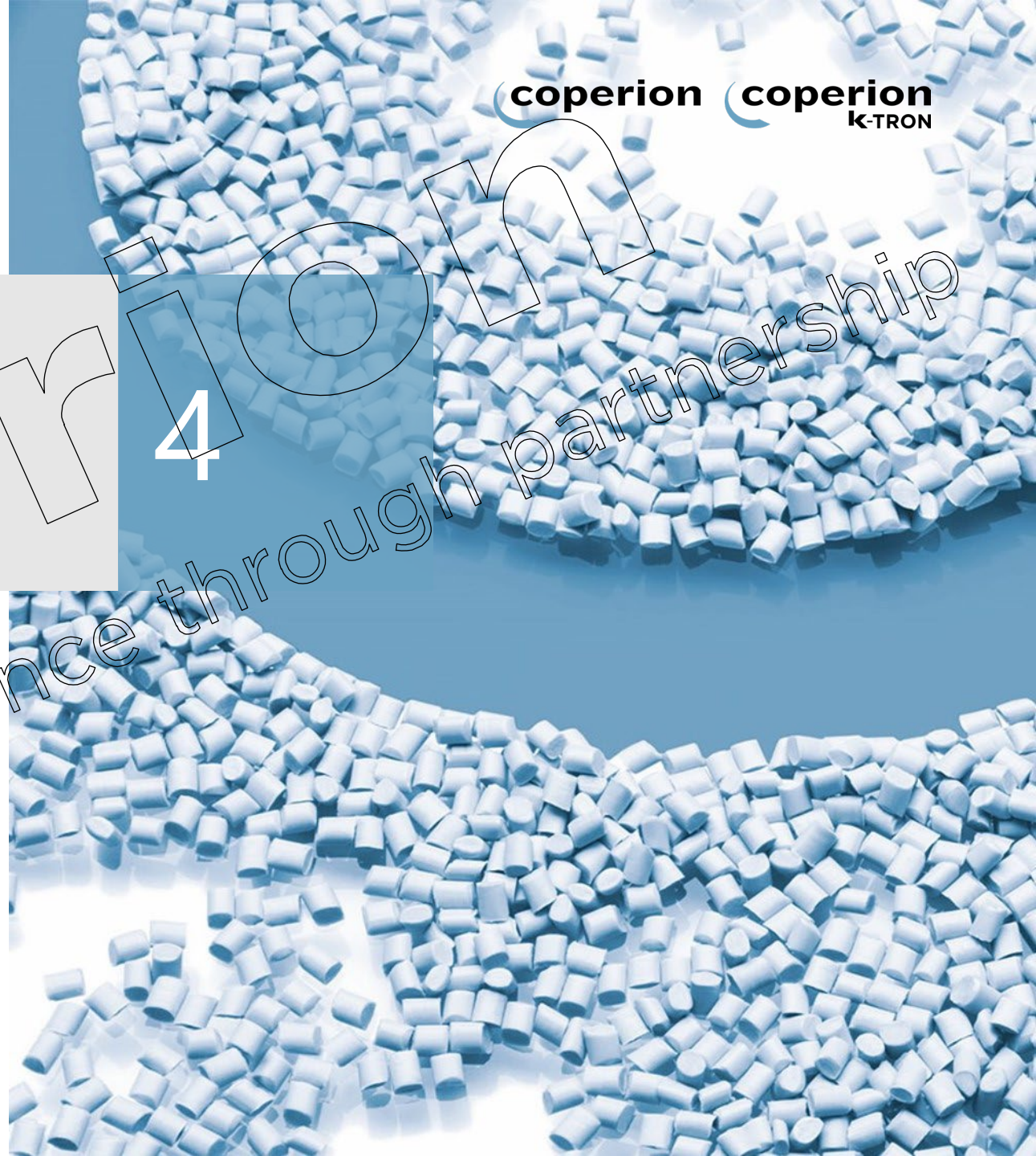
Actiflow







Feeder Variety Showcase



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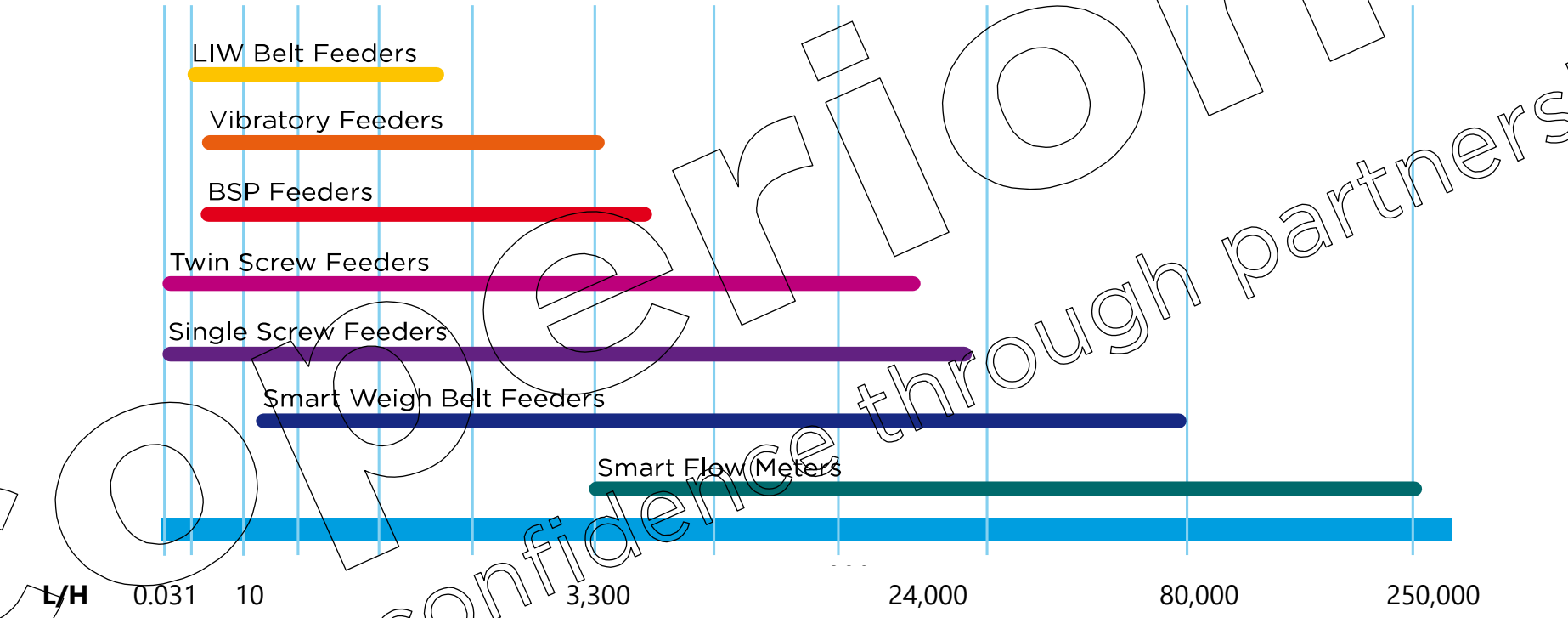
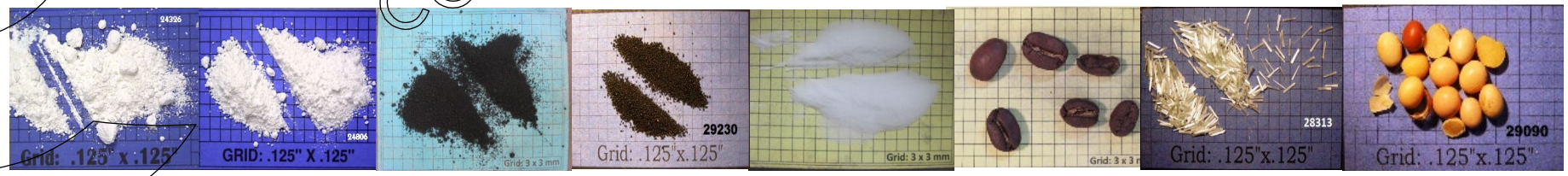
Feeder Variety Showcase

Range of Products





Feeder Variety Showcase

Vibratory Feeder

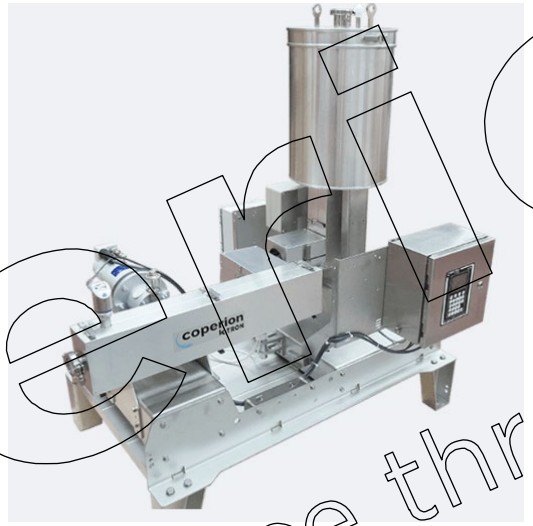
To handle fragile, non-uniform, abrasive materials

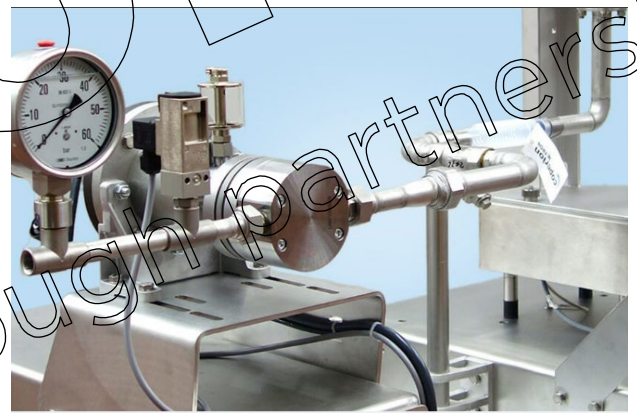
Easy to clean

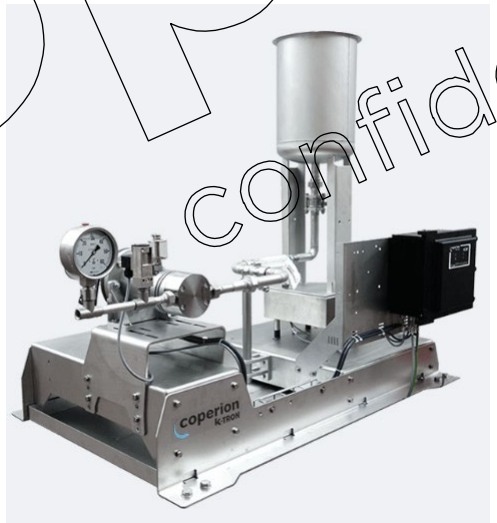
Low energy consumption

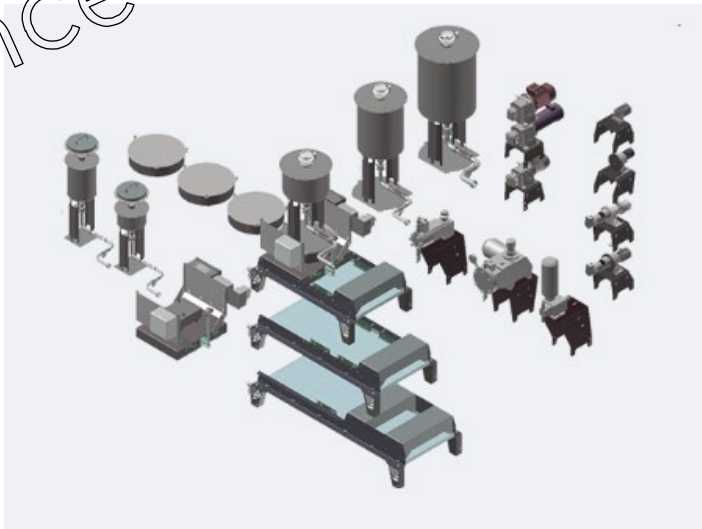
Feeder Variety Showcase

Liquid Loss-In-Weight Feeder

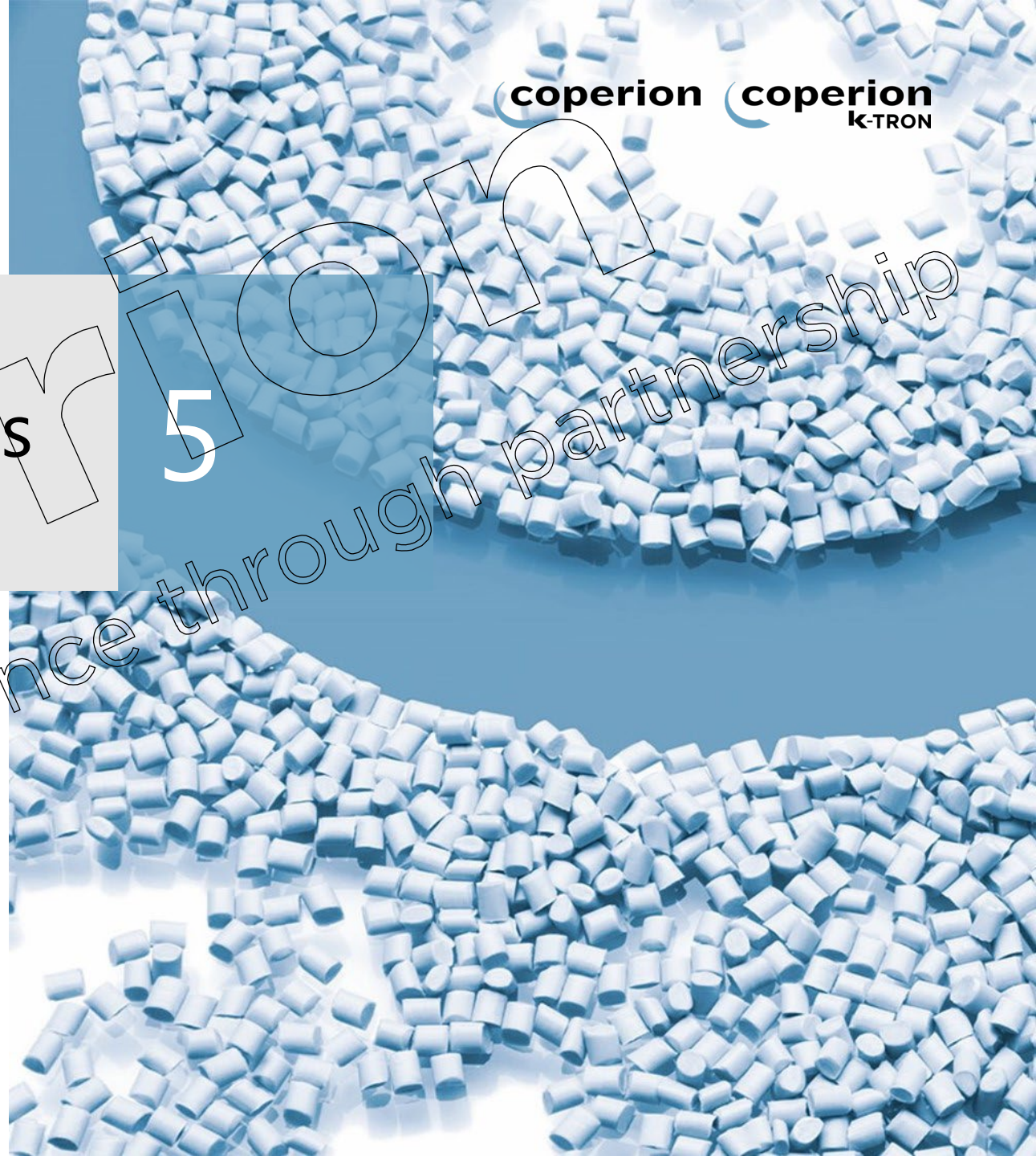








Smart Controllers 5



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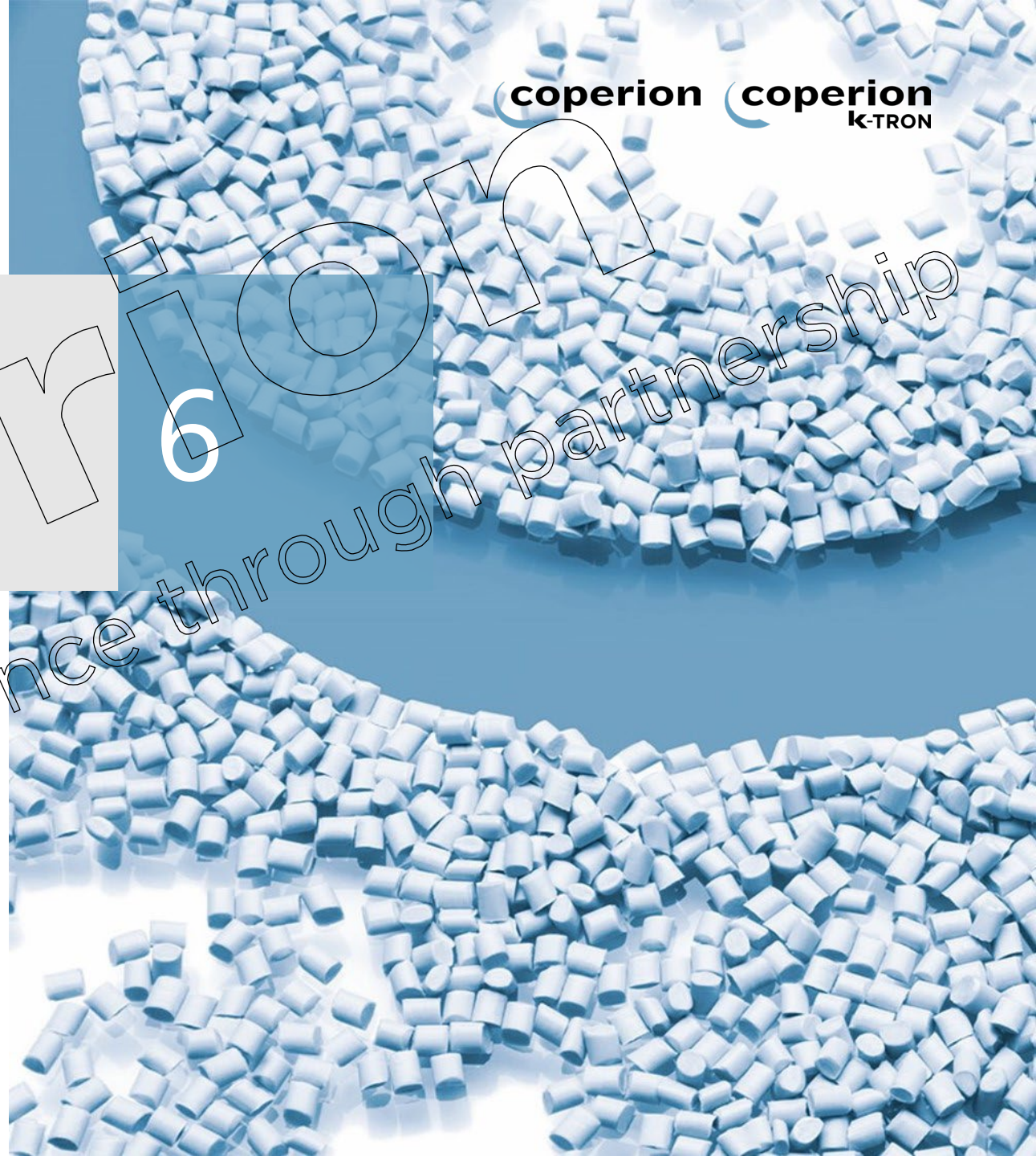
Engineering Plastic Seminar 2024

Smart Controllers

KCM / K-Vision

Refill Systems

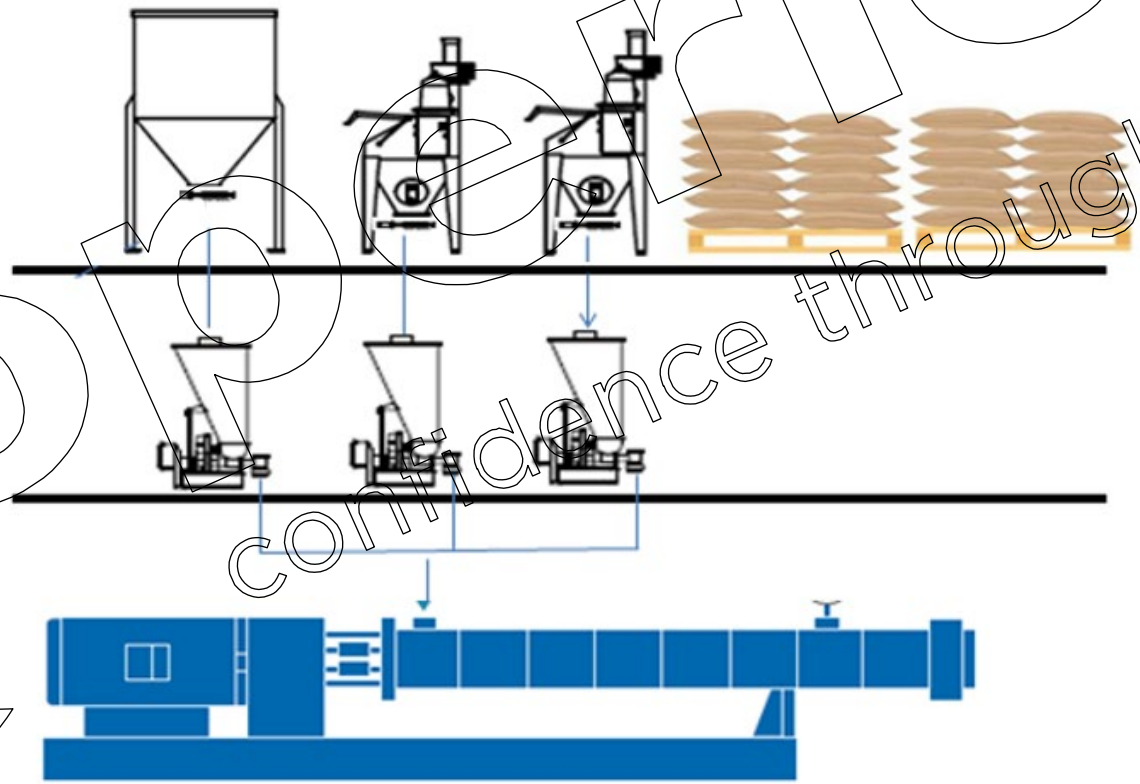


Engineering Plastic Seminar 2024

Refill Systems

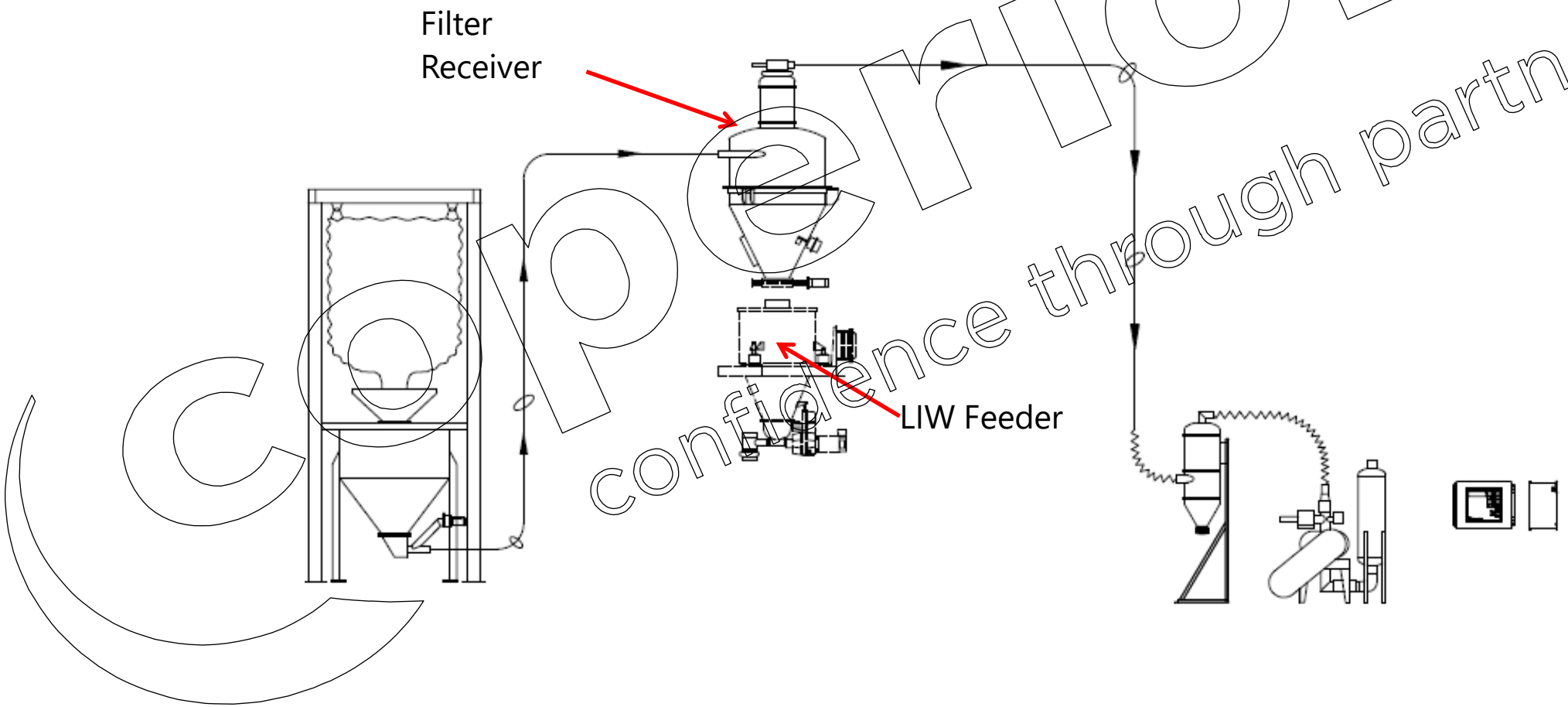
Introduction

Height, Space, Load Bearing, Safety?



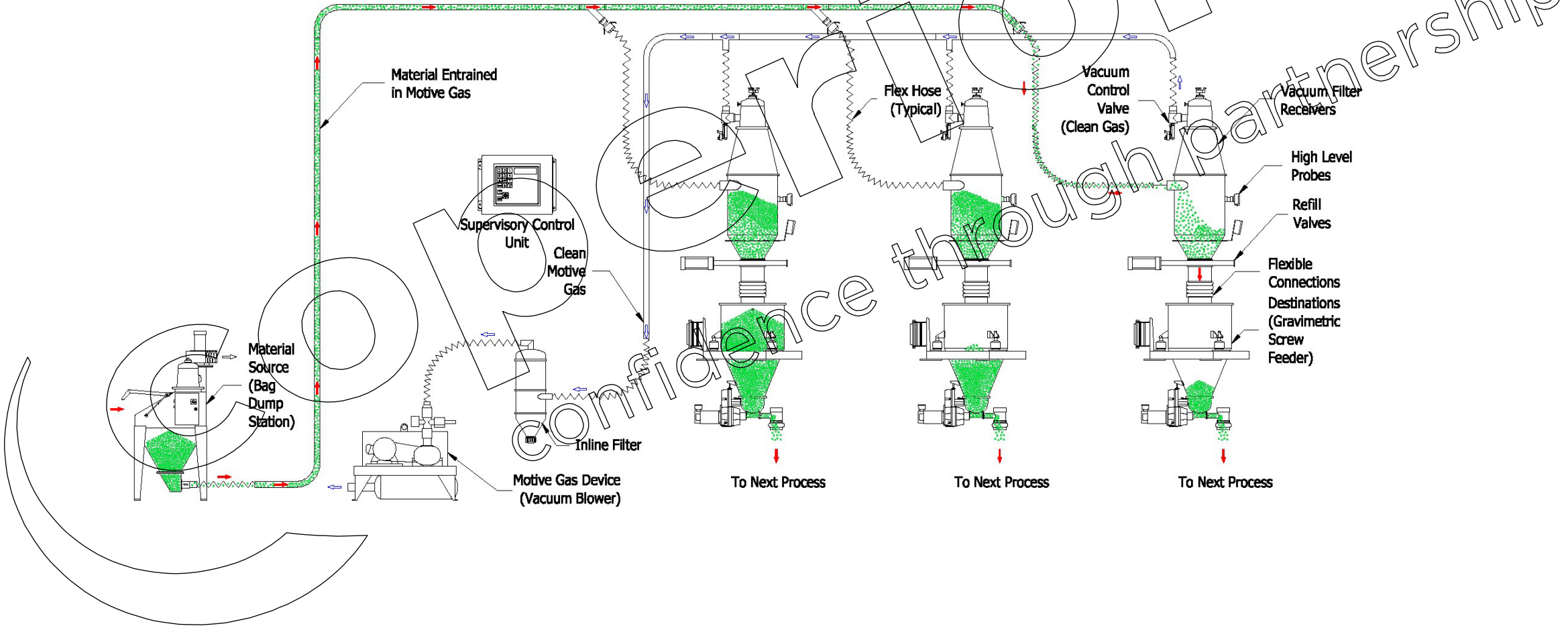
Refill Systems

Direct Refill



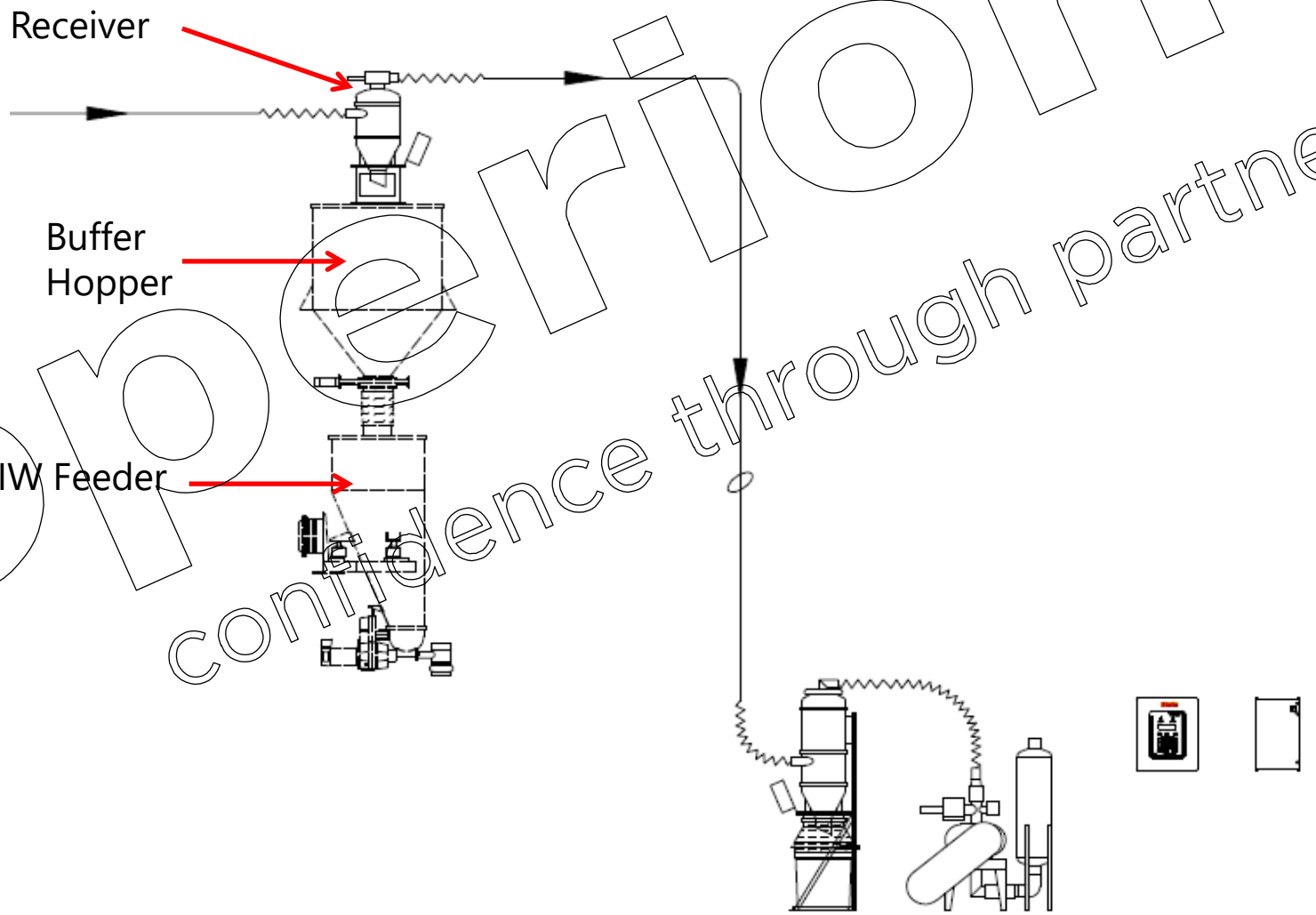
Refill Systems

Sequencing Refills



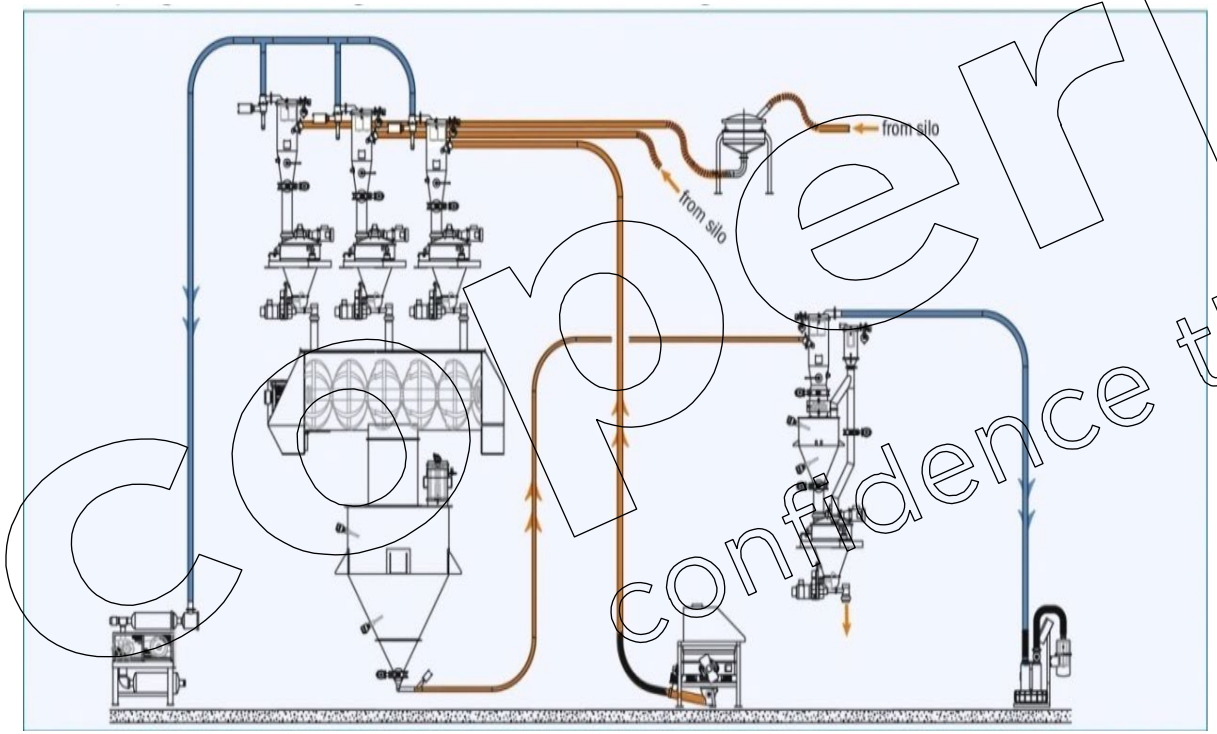
Refill Systems

Refill With Buffer Hopper



Refill Systems

Sample Diagram And Photo



Refill Systems

Sample Photos

Receiver SS

Receiver hopper and secondary filter

Receiver painted

Cartridge filter

Refill Systems

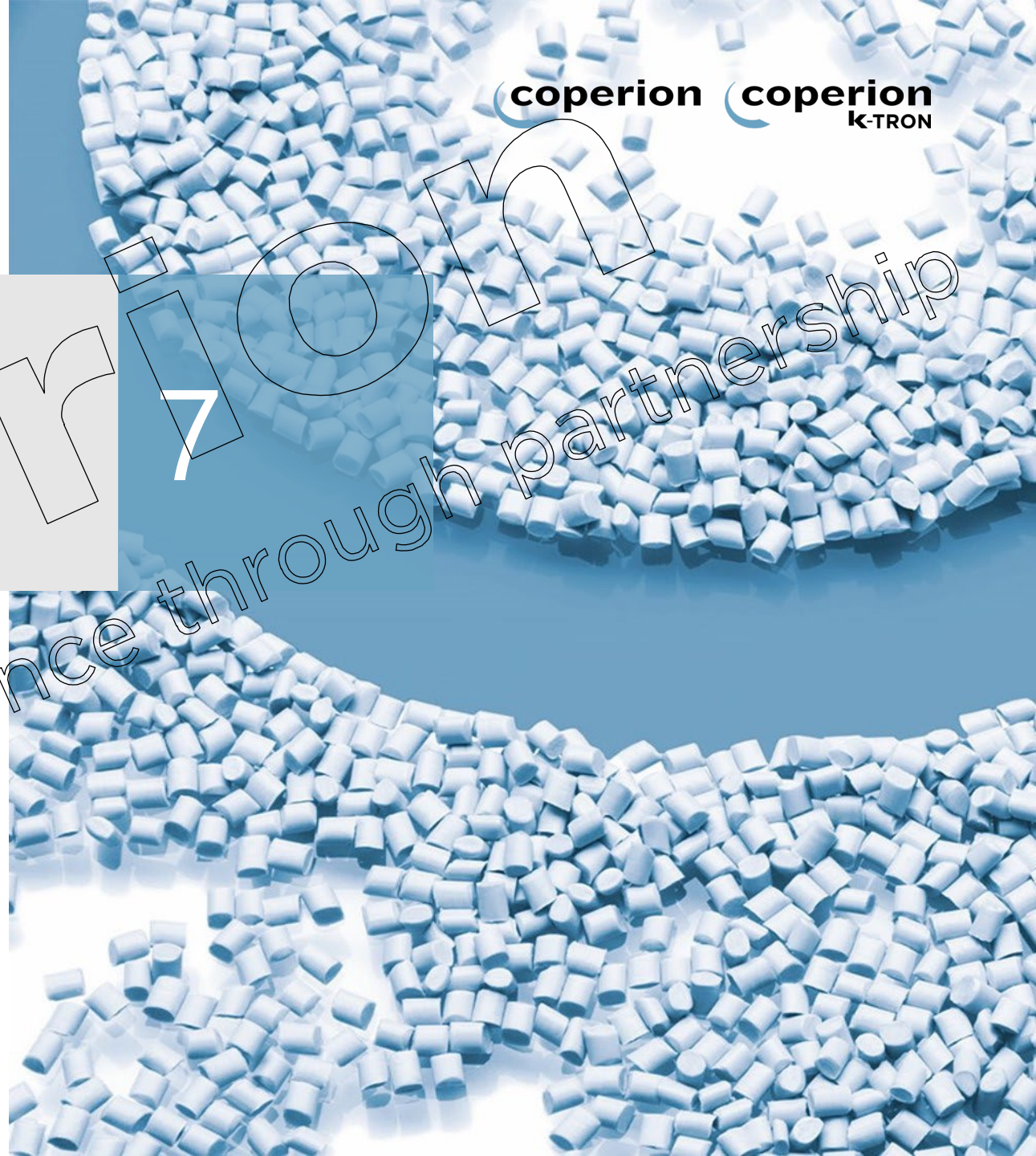
Sample Photos

Blow through rotary valve with hopper

Rotary valve

Diverter valve

Takeaway



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7

confidence through partnership

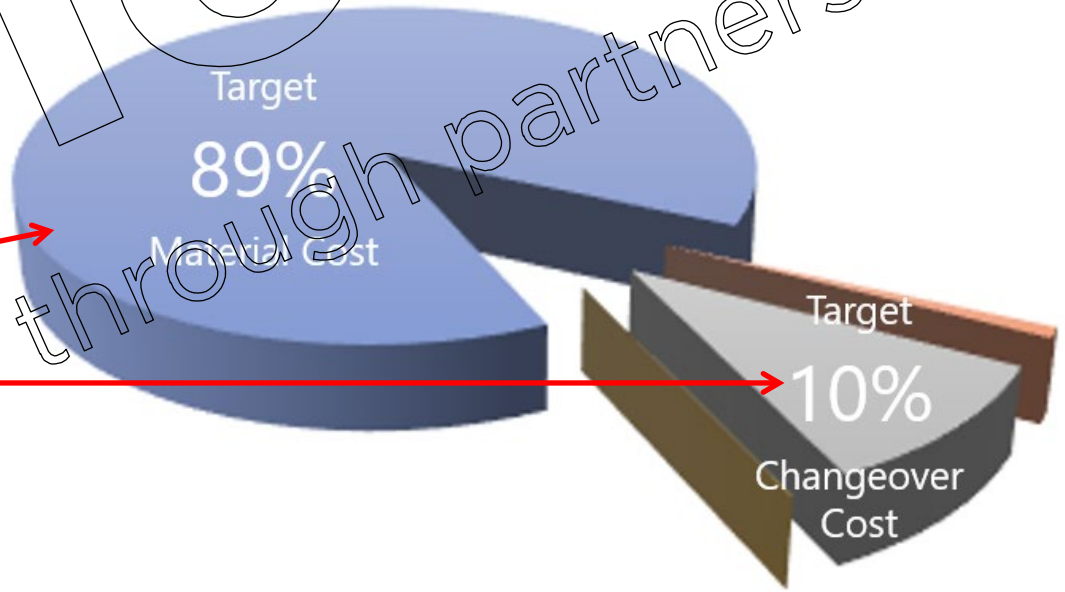
Takeaway

Use Feedsmart Recipe Optimizer to **save a lot** of money

Use high accuracy feeders to **save a lot MORE** money

Supported by top-notch **technology** and **versatility**

Backed with **smart controllers**: ease of use, great functionalities and connectivity.



This is why:

Precise Feeding Saves a lot of Money

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