## **EFFICIENT INJECTION MOLDING PRODUCTION SOLUTIONS FOR MEDICAL AND CLEANROOM APPLICATIONS**

NPE 2024, Orlando

## Krauss Maffei

**Pioneering Plastics** 







**Thomas Hoerl** Head of Expert Sales & Key Account Mgt. Medical



**Jochen Mitzler** Head of Product Management

#### Krauss Maffei

**Pioneering Plastics** 

## PIONEERING PLASTICS

plastics and rubber. For more than 180 years.

LOCATIONS WORLDWIDE SINCE **1838** ~4,700

16

PRODUCTION PLANTS

60

NUMBER OF EMPLOYEES SUBSIDIARIES

1,200

PATENTS

30

INJECTION MOLDING MACHINERY Automotive Construction Chemicals **REACTION PROCESS MACHINERY** Electronics Electrical Engineering EXTRUSION TECHNOLOGY Consumer Goods Medicine White Goods **DIGITAL & SERVICE SOLUTIONS** Packaging

авоит **570** COMMERCIAL AND SERVICE PARTNERS

#### **PIONEERING PLASTICS**

At the cutting edge of digitalisation.

Working with – and for – our customers.

One brand. Limitless possibilities.

## Full-Liner in plastics processing Overview Application Portfolio (1/3)

#### **APPLICATIONS**

#### PRODUCTS



### New Site Laatzen I Hannover Germany / Overview Extrusion plant



### New Site Munich Germany with a solar capacity of 9,1 MWp Most modern plant for IMM in Europe



## **Medical Applications**



## Pharma / Medical industry is trusting into KM and KM products

Longterm, reliable and trusthful partnership



a Novartis company



### Medical products and the different risk classes





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### Medical products and the different risk classes Medical devices in Europe - Distribution by risk class 2012



🔵 Anteil an Medizinprodukten im europäischen Markt gesamt

Anteil an im Jahr 2012 in Verkehr gebrachten Medizinprodukten

Source: Verteilung der Medizinprodukte in Europa nach Risikoklassen 2012 | Statista [Zugriff am 07. Dezember 2020]

### Class III: Heart catheter, Stents, Pacemaker, Hip prosthesis, Heart valves Class IIb: Respiratory devices, Dialyse devices, Blood bags, Irradiation devices, Condoms (HIV) Class IIa: Tooth filling, Hearing aid, Syringes (single use), Contact lenses, Disinfectant Class I: Thermometer, Reading classes, Wheelchair, Bandage, Hospital

bed.

## Segmentation in MEDICAL – Wide range of requirements





## Factors that affect the Quality of an Injection Molded Part (Partial List)

## **CLEAN ROOM**





### Clean room standards: Normal range for plastics processing

The count and size of particles is considered

A	pplied standar	'd		Maximum parti	cle load per m <sup>a</sup>	3
DIN EN <b>ISO</b> 14644-1	~ EG- <b>GMP</b>	~ <b>US</b> Fed. Std.209	> 0.3 um	> 0.5 um	> 1.0 um	> 5 0 um
European standard	Global	NAFTA (still the most common std.)	2 0,3 μm	≥ 0,5 µm	2 1,0 μm	2 3,0 μm
1						
2			10	4		
3		1	102	35	8	
4		10	1,020	352	83	
5	A/B	100	10,200	3,520	832	29
6		1,000	102,000	35,200	8,320	293
7	С	10,000		352,000	83,200	2,930
8	D	100,000		3,520,000	832,000	29,300
9				35,200,000	8,320,000	293,000

Orange section: Relevant range for IMM



Example:

Clean room class **DIN EN ISO 8** allows no more than 3,520,000 particles  $\ge 0.5\mu$ m in a **cubic meter** (m<sup>3</sup>) of air Clean room class **US Fed. Std. 209** class 100,00 allows no more than 100,000 particles in a **cubic foot** (cft) of air

A cubic foot (= 28,3 I) fits 35 times into a cubic meter

## IMM and clean room technology

#### Combinations of IMM and clean room

Room in room*	Outside	Inside
Highest clean room classes possible	often the "starter" technology	still most common solution
Only the clamping unit is inside the clean room (working position) For mold changes, cleaning and maintenance, the IMM can be moved outside the clean room	The Filter Flow Unit (FFU) is mounted directly over the mold area of the clamping unit For mounting or mold changes, the FFU can be moved over the ejector	The IMM is completely located inside the clean room The IMM must be prepared and equipped for clean room application
GMP class A	GMP class C	GMP class C
DIN EN ISO 14644-1 class 5	DIN EN 14644-1 class 7	DIN EN 14644-1 class 7
US Fed. Std. 209 class 100	US Fed. Std. 209 class 10,000	US Fed. Std. 209 class 10,000

\* = currently only available for CX machines ≤ 200t

## IMM and clean room technology

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GMP class A	GMP class C	GMP class C
DIN EN ISO 14644-1 class 5	DIN EN 14644-1 class 7	DIN EN 14644-1 class 7
US Fed. Std. 209 class 100	US Fed. Std. 209 class 10,000	US Fed. Std. 209 class 10,000

\* = currently only available for CX machines ≤ 200t

## Compact clamp unit increases the air change rate

- Working elements of clampingsystem outside the clamp itself
- Clamp unit with minimum volume



For high cleanroom requirements (GMP A), leave only the most essential equipment in the cleanroom .....all other equipment out if possible

Krauss Maffei





#### Application:

- Vaccine container (clinical use)
- COC for container
- TPE for stopper

#### Innovation:

- Production in GMP A
- Fully-automated production

#### Benefits:

- No sterilization required
- Lowest reject rates thanks to fully-automated production
- Safer product plastic instead of glass container

Nemera- Vaccine container (clinical use)

DEN

Krauss Maffei Pioneering Plastics

ALL TOLERS.

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## Injection molding machine

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**Krauss Maffei** 

PX 120-180 CleanForm

## The all electric PX-series – outstanding flexibility

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Wide range of clamping and injection unit combinations



Injection unit	SP 55	SP 100	SP 180	SP 250	SP 380	SP 540	SP 750	SP 1000	SP 1400	SP 2000	SP 3000	Unit	Standard / Option
Injection speed 1	125	125	125	125	125	125	125	125	125	125	95	mm/s	Standard
Injection speed 2	270	270	270	270	270	270	270	270	270	270	n. a.	mm/s	ZE 70.312
Injection speed 3	450	450	450	450	450	450	450	n. a.	n. a.	n. a.	n. a.	mm/s	ZE 70.313

Tvn	Clamp			Injection Unit																																		
Typ	Force	Tie bar spacing			Screw Diameter in mm																																	
		hxv		SF	° 55			SP	100			SP	180		S	P 2	50	S	P 3	80	S	6P 54	10	S	P 7	50	S	P 10	00	S	P 14	00	S	P 20	00	SI	P 30	00
	kN	mm	15	18	20	22	20	22	25	28	25	28	30	35	30	35	40	35	40	45	40	45	50	45	50	55	50	55	60	55	60	70	60	70	75	70	80	90
PX25	250	270 x 270	٠	•	٠	•	٠	•	•	٠																												
PX50	500	370 x 320	٠	•	٠	•	٠	•	•	٠	٠	٠	•	٠	٠	٠	٠	٠	٠	٠																		
PX51	500	435 x 385	٠	٠	٠	٠	•	٠	٠	٠	٠	٠	٠	•	•	٠	٠	٠	٠	٠																		
PX80	800	420 x 370					•	٠	•	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠															
PX81	800	485 x 435					•	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠															
PX120	1.200	470 x 420									٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	•	٠	٠	٠	٠	٠												
PX121	1.200	530 x 480									٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠												
PX160	1.600	520 x 470					1								٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠									
PX161	1.600	585 x 535													٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠									
PX200	2.000	570 x 520																٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠						
PX201	2.000	635 x 585																٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	•	٠	٠	٠	٠						
PX250	2.500	620 x 570					1														٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠			
PX251	2.500	735 x 685					1														٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠			
PX320	3.200	720 x 670																						٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠
PX321	3.200	820x 770																						٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠
PX400	4.000	820x 770																															٠	٠	٠	٠	٠	٠

## PX SERIES – POWER MEETS FLEXIBILITY



## PX SERIES – POWER MEETS FLEXIBILITY – our Medical options



## **ORCA MOLD COOLING - MONITORED**

Chapter

### Pipette 32 - cavities Customer: Thermofisher





Internal Reference: PX 81 – 180 (KM Order number 621258)

### Pipette 32 - cavities Customer: Thermofisher

**KraussMaffei** has been presented with an achievement award from Thermo Fisher Scientific



Internal Reference: PX 81 – 180 (KM Order number 621258)

## APC+

EP 3 359 365 B1

(67) International Verötfentledungenummet: WO 2017/060220 (13.04.2017 Gazatte 2017)119)

(11)

EUROPAISCHE PATENTSCHRIFT (51) Int Cl.: ASIT6 (2006.0 B29C ASIT6 (2006.0

Hinweises auf d. 14.08.2019 Pate

T: 16779045.0 05.10.2016

Update & news





#### Humidity variations Seasons · Batch changes Day & night Humidity • .... Filler content • Regrind Wear effects • **Functionality** of non-return valve Different operators **Temperature** ▲ ⊗ A (3) fluctuations

# APCplus keeps your production process constant in all conditions!



## APCplus is the cruise control for your production process

No matter the circumstances – the outcome stays the same



## Shot weight varies depending on the time of day

Conventional: Constant changover point (holding pressure)



#### Shot weight varies depending on the time of day

## APC plus stabilizes the shot weight

Adaptive process control with APC plus

Shot weight with APC
 Shot weight without APC



#### APC stabilizes the shot weight

## Selection of the plastic material – Material Database APC plus / Referencing





Adaptive process control Potential benefits with APC plus



#### Your benefit:

- Significantly lower reject rates
- Constant high part quality



#### Your benefit:

- Enormous cost reduction potential
- Increase of recyclate proportion







#### Your benefit:

- Reduced downtime costs
- Easier to use and faster ramp-up



#### Your benefit:

- Significantly lower energy costs
- Increased production output

## APC plus stabilizes the processes and maximize profits



## **RESIDENCE TIME & TORQUE MONITORING**

A forgotten parameter in the injection moulding process

## **Residence Time Monitoring** ensures optimal thermal stress on the thermoplastic melt smartControl MC6

#### **Illustration in the MC6 control**

11.03.24 09:58:07	Produktionsleiter	• °0		? [	5		<b>*</b>	s 🔳 🗖			1C6 Kra	uss Maffei
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Zyklus-	enti 🦰			1	<b></b>		1					
Zeit 20,45 s	Datum Zeit	Zyklus	Verweil. Zeit	Moment Palstif. Nm	Zyklus- Zeit Z	Spritz- Zeit Z	Plast- Zeit Z	Plast- hub Z	Masse- Polster	Umsch MasDrZ bar	Max MasDr bar	
Werkzeug- Pos	11.03.24 09:53:38 11.03.24 09:54:10	53838 53839	118,6 118,6	844,40 844 30	31,39 30,89	1,47	14,78 14,60	141,9 141 9	27,4	513 513	569	
-0,0 mm	11.03.24 09:54:41	53840	118,7	844,40	30,83	1,47	14,10	141,9	27,8	514	568	
0.45-0	11.03.24 09:55:12	53841	118,0	844,40	31,37	1,47	14,05	141,9	27,3	514	568	
Kraft	11.03.24 09:55:43	53842	117,6	843,90	31,39	1,47	14,60	141,9	27,3	515	569	
1458 kN	Sollwert	53842	120,0	0,000	0,00	0,00	0,00	0,0	0,0	0	0	
	11.03.24 09:56:15	53843	117,6	844,50	30,75	1,47	14,60	141,9	27,8	515	569	
Position	11.03.24 09:56:45	53844	117,7	844,20	30,76	1,47	13,96	141,8	27,5	515	569	
107,8 mm	11.03.24 09:57:16	53845	117,7	844,10 844,30	30,78	1,47	13,99	141,9	27,5	514	569	
Agg Pos 0,0 mm	Sollwert		120,0	0,000	0,00	0,00	0,00	0,0	0,0	0		
Spritz-	Mittelwert	~	133,3	838,27	33,43	1,42	16,78	139,9	27,9	513	568	t.6.1
Zeit	TolÜberwachung	sin 🔽										
Moment Mit.	+Toleranz		1,0	0,000	0,01	0,20	0,00	0,0	0,3	0	0	D. dl
Palstif.	-Toleranz		1,0	0,000	0,01	0,20	0,00	0,0	0,3	0	0	₩ 40
844,30 Nm	01.01.01 00:00:00	Start Dat	tum/Zeit		1 22				<b>T</b>			
	01.01.01 00:00:00	Ende Da	tum/Zeit	14-	44-	-99	->1		Т	<b>↑</b>	*	
				<u>_</u>		×						
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#### **Residence time:**

Duration the plastic melt remains on the screw until it's finally in the mold cavity

#### KraussMaffei Residence Time Monitoring:

- **continuously calculate the age of the plastic melt** in the plasticizing unit of the current cycle
- ensures optimal thermal stress on the thermoplastic melt
- shows the residence time in the actual value log and compares with the target value of the respective cycle
- Standard in the MC6 control system
- Available for thermoplastic applications

## **Plasticizing Torque Monitoring** ensures optimal mechanical stress on the thermoplastic melt smartControl MC6

#### **Illustration in the MC6 control**

11.03.24 09:57:48	Foreman 🚓	°0 [ ′	? [	5		2	s 🔳 🏧			MC6 Kra	uss Maffei
1 2 3	Actual-value	cycles		_	_						1 2 3
Curdo				-							
time	Date Time C	Dwell Sycle time	Torque plast. Nm	Cycle time C s	inj. time C s	Plast. time C s	Plast. str C mm	Melt cushion mm	Switch MeltPrC bar	Max MeltPr bar	
Mold pos	11.03.24 09:53:38      53        11.03.24 09:54:10      53	3838 118,6 3839 118,6	844,40 844,30	31,39 30,89	1,47 1,47	14,78 14,60	141,9 141,9	27,4 27,1	513 513	569 569	
1,9 mm	11.03.24 09:54:41      53        11.03.24 09:55:12      53	3840118,73841118,0	844,40 844,40	30,83 31,37	1,47 1,47	14,10 14,05	141,9 141,9	27,8 27,3	514 514	568 568	
force 10 kN	11.03.24 09:55:43 53 Set-value 53	3842      117,6        3842      120,0	843,90 0,000	31,39 0,00	1,47 0,00	14,60 0,00	141,9 0,0	27,3 0,0	515 0	569 0	
Screw position	11.03.24 09:56:15 53 11.03.24 09:56:45 53 11.03.24 09:57:16 53	3843      117,6        3844      117,7        3845      117,7	844,50 844,20 844,10	30,75 30,76 30,78	1,47 1,47	14,60 13,96 13,99	141,9 141,8 141,9	27,8 27,5 27,3	515 515 514	569 569 568	
141,9 mm IniUn	11.03.24 09:57:47 53	3846	044,10	50,10	1,47	13,33	141,5	21,5	514	300	
pos 0,0 mm	Set-value	120,0	0,000	0,00	0,00	0,00	0,0	0,0	0	0	
Inj. time	Mean value		838,21	33,43	1,42	16,81	139,8	27,9	513	568	<b>M</b>
1,47 s Torque avg.	+Tolerance	1,0	0,000	0,01	0,20	0,00	0,0	0,3			Ба
plast.	-Tolerance	1,0	0,000	0,01	0,20	0,00	0,0	0,3	0	0	UP 48
044,50 100	01.01.01 00:00:00 S 01.01.01 00:00:00 F	tart date/time inish date/time	<b> </b> <	-+>	**	<b>→</b>	<b>_</b>	Ŧ	*	Ł	
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면법			<u> </u>								
<b>КМ</b>					utti I	9		808			

#### **Plasticizing Torque:**

Force acting on the melt during the plasticizing process

#### KraussMaffei Plasticizing Torque Monitoring:

- continuously calculate the plasticizing torque the material is processed of the current cycle
- ensures optimal <u>mechanical</u> stress on the thermoplastic melt
- shows the plasticizing torque in the actual value log and compares with the target value of the respective cycle
- Displayed in the curve configurator
- Standard in the MC6 control system
- Available for thermoplastic applications

## **QUALIFICATION – VALIDATION GMP DOCUMENTATION**

Chapter

## Customer requirements – UserRequirementSpecifications URS for IMM

#### Each customer has different requirements





### Operative excellence based on zero-error tolerance

Qualification steps – V-Model – a closed loop quality system



## Molding parameter recording for process validation

## Ideal situation: Setting and monitoring of all parameters of all components of the production cell by injection molding machine control

Automation, conveyor, separation of parts for quality control and reject



Hotrunner controller zones integrated in IMM or external controller via interface



Mold chiller connected via interface (for example 20mA, Euromap 82.1 or other)

02.09.20 12.36.55	MC6 Kr	auss Maffe
1 2 3 ZAlen Zel		1 2 3
1.39 x Worksnug Pos 6.6 mm		
Schiefe Coat	101 102 103 104 105 106 107 108 109 110 111 112	
Schweik Rickien	501 18 × 16 M 16 × 18	
493- 700	D-Pass	
El non Sports Set	20ml 20ml	H
1.11 +	Pac.Nz	H
	Hegen Köller	
pla .	M A 🚍 🖬 🕅 📾 🔮 🏯 🛳 🛸	

Mold cooling water flow monitoring



Tolerance monitoring of all components included in production cell













Krauss Maffei P

## **Ancillary equipment control / monitoring**

Setting & monitoring of hotrunner and chiller parameters and tolerances

4 Button for "Acknowledge alarms of hotrunner leak monitoring"

5 Temperature actual and set values of heating zones

6 Display of "Hotrunner leak monitoring active" status

📥 🛃 🔜 🧱 🕱 💋 MC6 Krauss Maffei = °o ? 1 2 3 Mold temperatures control parameters 2 Da j Da j 198 1 8 9 10 11 12-150 ·c 150 150 150 150 ·c 150 150 0 0 150 150 0,0 mm 0 0 0 0 0 0 0 6 12 26 % 25 27 24 0 0 -9 kN 6 0 ·c 0 'C 11 Mold heating optimization 0,00 s Hotrunner leak monitoring Acknowledge alarms of hotrunner leak monitoring 6 Dall 口半 DIN NO STOP P00000

Fig. 12.104 Mold temperatures control parameters 2

1 Heating zones for mold heating

- 2 Display of "Alarm hotrunner leak monitoring" status
- 3 "Hotrunner leak monitoring" selection

Integrated hotrunner controller



#### Fig. 8.141 External heat-balancing units

1 Graphic Actual/set value display "Temperature"

- 2 Selection of heat balancing
- 3 Input of "Temperature" set value
- 4 Actual value display "Temperature"
  - ay temperature

· °0

5 Display of "Flow" 6 Selection field "Mode" 7 Display of "DMH-TK" 8 Selection field "Interface" 9 Input "Parameter number (Par. no.)" 10 Checkbox "Evacuat." 11 Display "Heating/cooling" 12 "Status" display

#### External mold chiller

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## Adherence of validated processes in long-term operation

Example of continuous monitoring of shot weight by IMM control



	-			Sent.	Plant-	Varia				S75-80
Datum Zot	Zyklus	Wange	Zelt Z	Zet Z		Poister	hub 2	MasDr2	Massedt.	Abfall
10 10 10 00 07 49	Alcar	0 333.60	20.71	0.05	15.46	mm a a	610	Dur.	100	12
10.10.12.09.07.43	1607	273,00	20.74	0,93	45.55	27	65.0	474	766	10
18 10 12 00 00 03	1569	274.50	29.67	0.05	10.00	37	64.0	427	764	11
18 10 12 09 09 42	1560	274.13	20.60	0.95	15.60	37	64.9	425	756	-11
18 10 12 09:10:22	1600	274,70	39.65	0.95	15.93	3.7	64.9	434	758	11
18.10.12 09:12:25	1601		38.27	0.95	15.87	3.7	65.0	439	764	11
15.10.12 09:13:03	1002	274,01	39,66	0.95	16,46	3.7	65.0	437	763	11
18.10.12.09:13:43	1603	274,80	39,62	0,95	16,16	3.7	64,9	431	758	12
18.10.12 09:14.23	1604	274,44	39,58	0,95	10,13	3,6	65,0	427	748	12
18.10.12 09:15:03	1605	274,25	39,58	0,95	16,04	3,6	65,0	424	742	12
18.10.12 09:15:42	1606	274,08	39,57	0,95	15,88	3,6	65,0	423	738	12
18.10.12 09:16.22	1607	273,84	39,58	0,95	15,98	3,6	64,9	422	738	12
18.10.12 09:17:01	1008	273,84	39,51	0,95	16,01	3,5	65,0	421	738	12
18.10.12.09:17:40	1609	273,95	39,57	0.95	16,05	3,6	64,9	421	740	12
18.10.12 09:18:20	1610	273,86	39,51	0,95	16,05	3,6	65,0	420	736	12
18.10.12 09:19:00	1611	274,48	39,53	0,95	16,12	3,5	64,9	416	730	13
18.10.12 09:19:39	1612	273,09	39,48	0,95	16,02	3,6	64,9	415	734	12
18.10.12 09:20:19	1613	274,03	39,49	0,95	16,27	3,5	65,0	417	733	13
18.10.12 09:20:58	1614	274,41	39,54	0,95	16,19	3,5	64,9	416	731	13
18.10.12.09:21:38	1615	273,97	39,50	0,95	16,18	3,5	65,0	414	727	12
18.10.12 09:22:17	1616	273,60	39,46	0,95	16,34	3,5	63,0	414	727	12
Schwankungsbreit	te 👻	322,21	358,85	1,00	39,41	5,7	67,7	709	1156	27
Sollwert		273.00	39,50	0.95	16.50	3,3	65.0	394	695	0
TolÜberwachung	a aus				-	-	-			
+Toleranz	10100	1.50	15.00	0.02	2.00	0.5	1.0	40	60	5
				-	2,00	10				-
•Toleranz		1,50	5,00	0,02	2,00	0,5	1,0	40	60	,
17.10.12 22:51:12	Start Dati	im/Zeit						* 1		- 1
17.10.12 22:51:12	Ende Dat	um/Zeit				4 12		T	n. 11	-
	1	31.		1				N	1	1
edil	(F		-							
								-		
	1	10000				-			1	

After take-out from mold the robot places the parts on a balance and then on the conveyor (if weight is within tolerance)

In addition or alternatively to weight monitoring also visual checks by camera can be integrated.

## SMART OPERATION

**RUN A MACHINE WITH 2 BUTTONS** 

Simple, Fast and Safe



## With *smartOperation* for injection molding ... as simple as making coffee





## Dramatic influence on the production KPI's - OEE, waste of material, shift costs ...



# CHALLENGES

- Worldwide large gap in molding experts
- Experts are not 24/7 available
- **Complex processes** can only be operated by a few employees
- No fixed procedure for each mold
- Frequent change of personnel
- Many low-cost unskilled workers in production
- Missing documentation of specific work instructions for the operation
- Risk of unskilled operators setting the process wrong

Krauss Maffei Pioneering Plastics

## 24

## SITUATIONS for Experts

- Start-up a new mounted mold
- Restart a mold after interruption
- Production end stop for mold change



## **PRODUCTION KPI's**

- Shorter ramp up time specially when experts are not available Value metric: Improved OEE
- Less plastic during start-up
  Value metric: Material costs
- Easiest operation with smart Buttons enables "everybody" to run the mold
   Value metric: Labor & Training costs for employees

Integrated documentation and expert knowledge for the operation Value metric: Documentation effort, Consistent quality

Standardized operation process Value metric: Availability

## #Strengthening global set up and collaboration

Take Away Message

- Define the requirements and fit the equipment to ....but still be flexibel
- Smart functions like APCplus & smartOperation boosting the performance of your production
- Our Know-how in e.g. screws, plastizicing and engineering design drives your OEE
- Our DWELL Time monitoring will give you even more security for a high quality production
- KraussMaffei is investing into new plants for your future requirements

**KraussMaffei** has been presented with an achievement award from Thermo Fisher Scientific

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## Visit us at booth W600





### 32-fold blood vial tube (75 mm) PX 251 – 1400 (KM order number 621701)

- Application: Medical
- Shot weight:
  - Cavities:
  - Cycle time:
  - Clamp force:
  - Injection unit:
  - Material:
- Automation:
- Mold:
- Hotrunner: \_

- 68 g
- 32
  - ~7 s
- 2.500 kN
- SP1400 D60
  - PP 9074 MED
    - Hekma side entry
  - Vasantha
- Mold Master

#### Videos on YouTube:

- KrausMaffei Medical PX with 96 cavities in 5.7 s: (39) Maximum efficiency in the cleanroom Insulin pen caps on a PX 200 YouTube
- KraussMaffei Medical PX with Pipettes: (39) Pipettes for medical technology PX 81-180 Medical YouTube
- Video and Demonstration LSR: (24) Micro Injection Molding with Liquid Silicone Rubber: Live-Demo KraussMaffei Technical Centre YouTube
- <u>SmartOperations: smartOperation simple, fast and reliable machine operation in production YouTube</u>
- SmartAssist: <u>SMARTASSIST YOUR INSTANT-SUPPORT YouTube</u>
- APCplus: KraussMaffei APC plus YouTube
- <u>SocialProductions: socialProduction | Production. Communication. Mobile. Intuitive. YouTube</u>

#### Further links:

- KraussMaffei Homepage Medical: <u>Medical technology KraussMaffei</u>
- Industrie 4.0 topics: <u>https://www.kraussmaffei.com/en/our-products/digital-products</u>

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gunuton or the outstanding service, team performance releastess commitment to supporting our company's ability to increase production of critical products used in the fight against COVID-19.