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Injection moulding
under cleanroom conditions

Where do we need clean conditions ?

Parts for **medical use**

Food and pharmaceutical packaging

Production of **optical lenses, displays** and parts for fiber optics engineering.

Parts for sensitive miniaturized technologies like parts for fuel injection in the **automotive area**.

Other industries....

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What is a clean part ?

A part is clean if there are not any other particles,
that do not belong to the part.

After processing a plastic part is clean, but even while ejection particles may be cut from the part and waste it.

A sterile part is free of any living cultures like bacteria or viren.
After production (melting and freezing the plastic)
the part typically is sterile.

A part may be sterile but even it needs not to be clean
if existing foreign particles are sterile too.

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What does cleanroom condition mean ?

Clean area, no particles inside

How to reach it ?

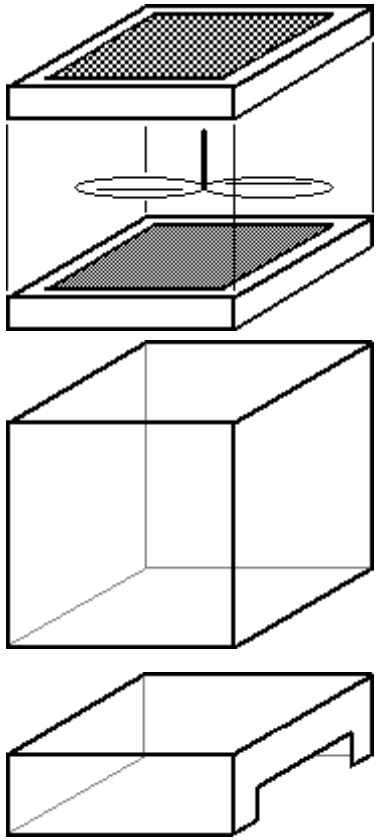
Easy to clean area (walls and internal accessories)
Waste particles may not enter (tight for particles)

Constant cleaning via filtrated air stream
keeping a little overpressure

➡ Laminar Flow

How to create a cleanroom ?
- Laminar Flow System

- Define your clean room dimensions
- Add a filter system with fan
  1. Coarse filter
  2. Fan
  3. Fine filter
- Make sure, that the air can leave in a defined way



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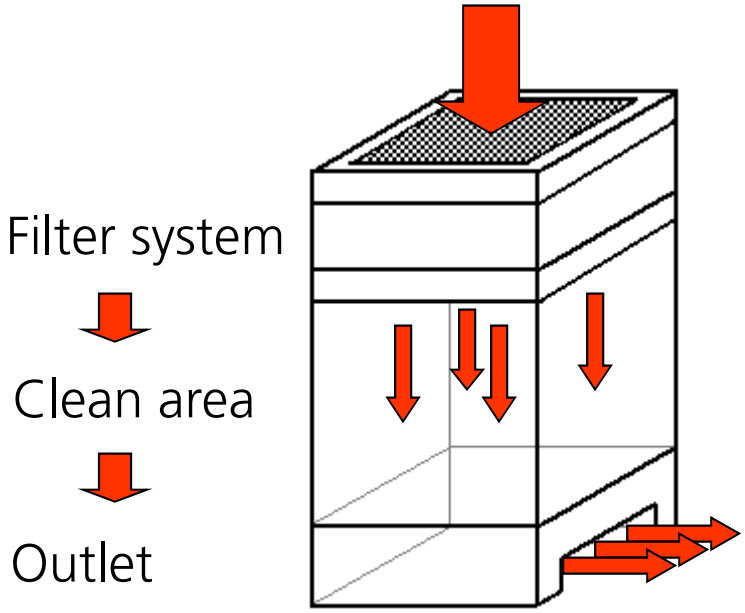
Laminar Flow System

The filter system with fan presses a clean air stream through the cleanroom



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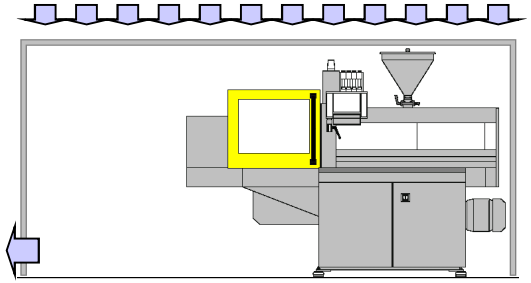
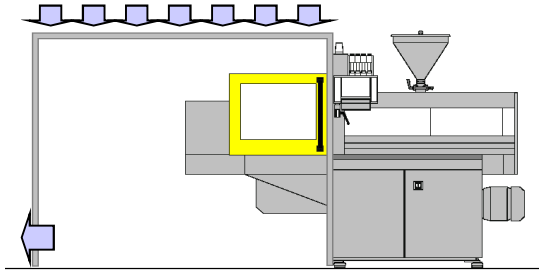
Production in a Clean Area

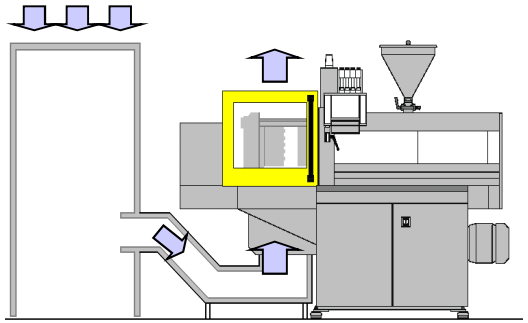
Solutions for injection moulding



Complete machine in the cleanroom
- big clean volume
- high clean air throughput requested
- complete machine must be clean



Clamping system in the cleanroom
- less clean volume
- less contamination due to machine, plastics and equipment



Machine outside of the cleanroom
- minimum clean volume per machine
- only the parts are in the clean air stream
- the throughput of air must be adjusted to the machine run

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Cleanroom concept with partial integrated machine

(Presentation of a clean room)

- The two platen clamp system with the overhanging clamp unit showes the best base for this economic system.
- Separation of the clean mould area and the processing area
- There is only a minimum of the machine hydraulics in the clean mould area.

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Cleanroom concept with partial integrated machine

Just the
clamping unit
is in the clean room.

Cleanroom class.
Iso 14644-1 class. 5

(old US Fed Std. 209
class 100)

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Production Sample

Machine with injection system outside of the clean area

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Production Sample

Couplings for media pipes
self closing
stainless steel

Additional operation control inside the cleanroom.
The machine can be driven from inside and outside the cleanroom.

Cleanroom classifications

Old standard: **US Federal Standard 209 E**

This standard counts the number of particles with a size between 0,5 µm and 1µm in one cubic foot.
(limitations for other particle dimensions are given too).

Example:
US Federal Standard 209 E class 1000 allowes 1000 particles with a size of 0,5 µm up to 1 µm in one cubic foot.

This standard is no more in use.

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Cleanroom classifications

Actual standard: DIN EN ISO 14644 -1

This standard counts the number of particles with a size between 0,1 µm and 0,2 µm in one cubic meter
(limitations for other particle dimensions are given too).

ISO classification 1:	10	particles* / cubic meter
ISO classification 2:	100	particles* / cubic meter
ISO classification 3:	1000	particles* / cubic meter
ISO classification 4:	10000	particles* / cubic meter
ISO classification 5:	100000	particles* / cubic meter

*Size between 0,1 µm and 0,2 µm

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Comparison: ISO 14644-1 to US-Fed.STD.209 E

ISO 14644 - 1 Klassifizierungszahl (N)	Höchstwert der Partikelkonzentrationen (Partikel je Kubikmeter Luft) gleich oder größer als die betrachteten Größen, welche nachfolgend abgebildet sind.						Alte US-FEDERAL Standard
	0,1µm	0,2 µm	0,3 µm	0,5 µm	1 µm	5 µm	209 E
ISO Klasse 1	10	2	-	-	-	-	-
ISO Klasse 2	100	24	10	4	-	-	-
ISO Klasse 3	1.000	237	102	35	8	-	1
	28	**7**	**3**	**1**	**0**		
ISO Klasse 4	10.000	2.370	1.020	352	83	-	10
	284	**67**	**29**	**10**	**2**		
ISO Klasse 5	100.000	23.700	10.200	3.520	832	29	
	2.841	**673**	**290**	**100**	**24**	**1**	**100**
ISO Klasse 6	1.000.000	237.000	102.000	35.200	8.320	293	
	28.409	**6.733**	**2.898**	**1.000**	**236**	**8**	**1.000**
ISO Klasse 7	-	-	-	352.000	83.200	2.930	
				10.000	**2.364**	**83**	**10.000**
ISO Klasse 8			-	3.520.000	832.000	29.300	
				100.000	**23.636**	**832**	**100.000**
ISO Klasse 9	-			35.200.000	8.320.000	293.000	

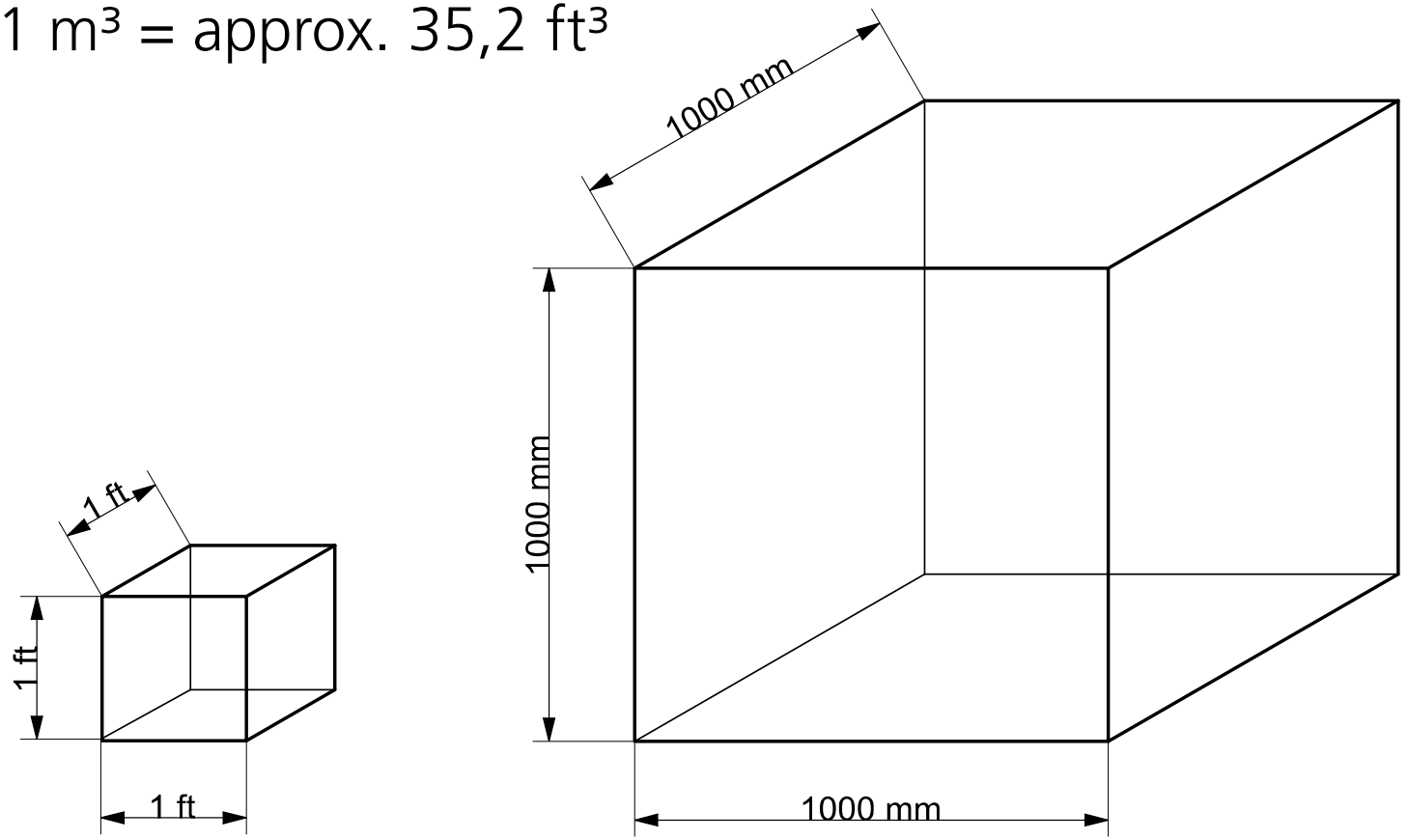
Red letters:
particles / cubic foot

Black letters:
particles / cubic meter

Source: M. Petek, Reinraumtechnik

Relation: American System – Metric System

1 m³ = approx. 35,2 ft³



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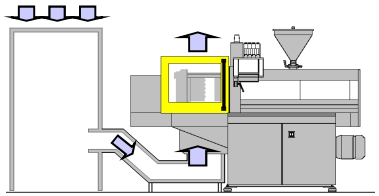
Small version of a clean concept



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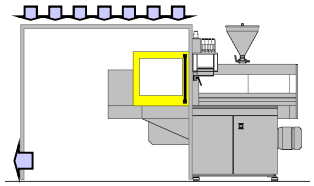
Compact Cleanroom

...with integrated packaging unit



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Very simple solution of a cleanroom

Portable clean tent

A portable clean tent concept, described as "a low-cost option and an economical solution to first-tier entry", was one of the highlights at the recent open day event held by Boy Ltd, at its new showroom in Milton Keynes.

Shown in association with Moorfield Associates, the tent was erected in less than 45 minutes and was displayed with a Boy 22M inside producing a two-impression medical part in polystyrene under clean room conditions. The unit reflected managing director Bob Wilson's theme of niche areas at the event, which saw Boy show most of models in its range including the new Boy 55MVV insert machine. Addressing the micro-moulding field, a Boy 12A demonstrated a nylon six-gear wheel with component weight of just 0.009grams in an economical alternative to expensive one-shot machinery or popular but limited benchtop machines.

Also on the agenda was liquid silicone rubber moulding, demonstrated in a 12-impression mould tool from Polymer Systems Technology with an Alfa beam robot used to remove the parts for cooling on a conveyor. Wilson described the event as "a great success" with three machines sold as a direct result.

Boy Ltd 01908 306600