

A close-up photograph of a silver aerosol can with a white spray nozzle. A fine, white mist is being emitted from the nozzle, spreading outwards. The background is black, making the white spray stand out. The image is positioned on the left side of the slide, partially overlapping a white background and a dark blue horizontal band.

**THE AEROSOL: a little known
technology**

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FIVE REASONS TO USE AEROSOLS

Aerosols offer five distinct advantages as a packaging format:

- 1.- No mess:** Aerosols dispense product accurately and efficiently.
- 2.- Minimal product waste:** You can use every drop of product, avoiding waste, leakage and spills.
- 3.- Easy of use:** People tend to prefer the convenience and ability to dispense products accurately.
- 4.- Reliable:** Aerosols perform consistently from the first spray to the very last. They are airtight, clean and hygienic.
- 5.- Recyclable:** Aerosols are generally made of metal and are readily recyclable.

PRODUCTION WORLDWIDE IS ESTIMATED AT MORE THAN:

- a) 1,5 billion units
- b) 5 billion units
- c) 10 billion units
- d) 15 billion units

Aerosol

Suspension of fine solid or liquid particles in air or gas
EXAMPLE:



Smoke



Fog

Aerosol types

Propellant in contact
with product



Valves

Propellant not in contact
with product



BOVs

Without propellant



Spray Pumps



00

Aerosol propellants

Liquefied propellants and Compressed gasses



Liquefied Propellants

- Liquefied Petroleum Gas (LPG)
- Dimethylether (DME)
- Halogenated Fluoro Carbons (HFC)



Compressed Gasses

- Non soluble (compressed air and nitrogen)
- Soluble (carbon dioxide and nitrous oxide)



Aerosol propellants

Types of Propellants

	DME	HFC152a	HFC134a	Propane	I-butane	N-butane	N2	Air	CO2	N2O
Boiling point (°C)	-25,1	-25,1	-26,1	-42,1	-12,2	-0,5	-195,8	-194,1	-78,4	-88,5
Vapour pressure (21°C)	4,3	4,3	4,9	7,5	2,1	1,2	n/a	n/a	58,2	52,4
Liquid density (21°C)	0,66	0,91	1,21	0,51	0,56	0,58	0,00114	0,00129	0,713	0,913
Flammability in air (LEL)	3,3	3,9	n/a	2,2	1,8	1,9	NO	NO	NO	NO
Flash point (°C)	-41	-50	NO	-104	-83	-74	NO	NO	NO	NO
Solubility in water (%wt)	35,1	1,7	1,1	0,007	0,008	0,008	0,015	0,018	0,759	0,588
Flammability	YES	YES	NO	YES	YES	YES	NO	NO	NO	NO
Toxicity	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW
Environmental	VOC	No VOC	GWP	VOC	VOC	VOC	LOW	LOW	LOW	LOW



01

Aerosol forms

One clear phase · Emulsion · Suspension



ONE CLEAR PHASE

HOMOGENEOUS AEROSOL SYSTEM

The propellant is completely soluble into the product



EMULSION

TWO STABLE PHASES

Propellant and product (usually rich of water) are not soluble



SUSPENSION

POWDER

Powder suspended into one clear phase/homogeneous product



02

How an aerosol works

How an aerosol works

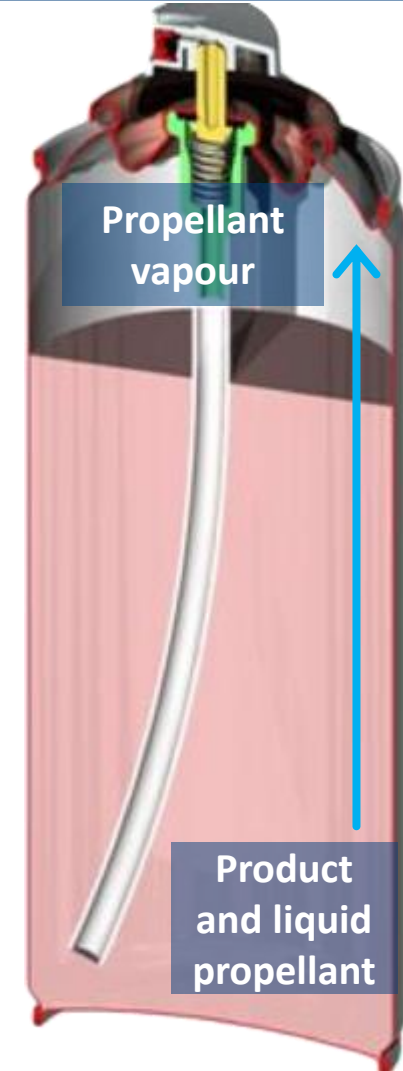
Liquefied propellants

Liquefied propellants are gases that exist as liquids under pressure.

Because the aerosol is under pressure the propellant exists mainly as a liquid, but it will also be in the head space as a vapour.

As the product is used up as the valve is opened, some of the liquid propellant turns to vapour and keeps the head space full of vapour.

In this way the pressure in the can remains essentially constant and the spray performance is maintained throughout the life of the aerosol.



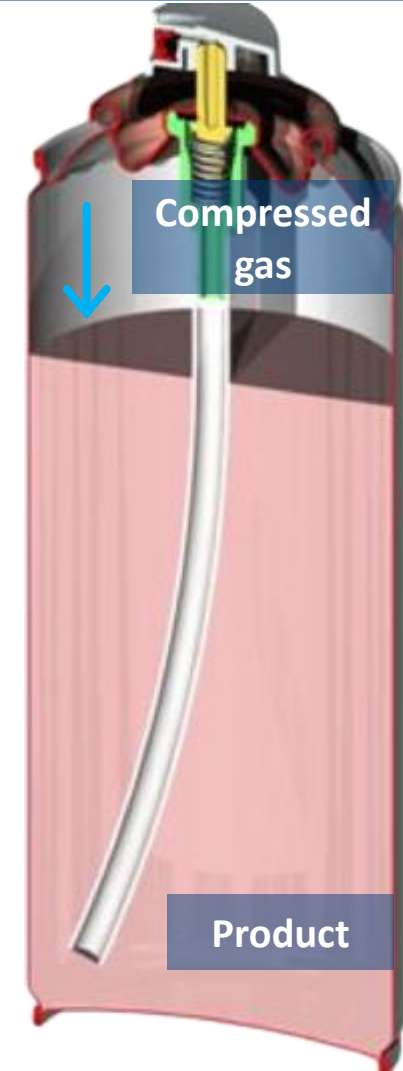
How an aerosol works

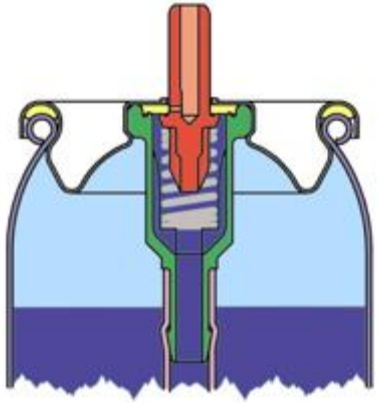
Compressed gasses

Compressed gas propellants really only occupy the head space above the liquid in the can.

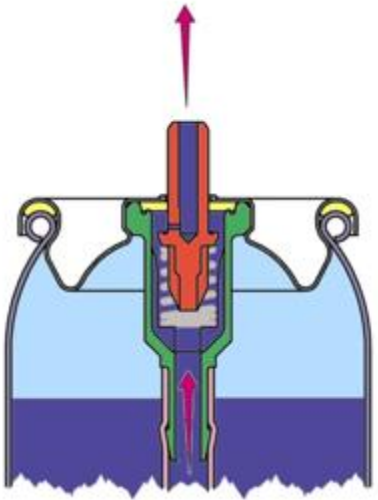
When the aerosol valve is opened the gas “pushes” the liquid out of the can.

The amount of gas in the headspace remains the same but it has more space, and as a result the pressure will drop during the life of the can.





The valve opens when the stem is depressed into the body and shuts off when it is released and spring back into place. When in closed position the stem is pressed upward by a metal spring but when a sufficient downward pressure is applied the spring tension is overcome and the stem is forced downward.



This serves to slide one or more horizontal stem orifice(s) past the stem gasket and into the top of the valve housing, which is under pressure from the aerosol product. The pressure forces the product through the stem orifice(s) into the vertical centre hole of the stem and out through the valve button or spout.



How an aerosol works

Liquefied and Compressed propellants



Aerosol with LIQUEFIED PROPELLANT



Aerosol with COMPRESSED PROPELLANT



03

Valves and Actuators

Components



VALVE CUP: Link between can and valve.
Typically constructed from tin plated steel, chrome plated or aluminium



OUTER GASKET: This is the seal between the valve cup and the aerosol can



INNER GASKET: The ON-OFF switch. Covers the hole in the valve stem



VALVE STEM: Controls the flow. In effect, the tap through which the product flows



VALVE SPRING: Closes the valve. Usually stainless steel



VALVE HOUSING: Contains the valve stem, spring and inner gasket



DIP TUBE: Allows the liquid to enter the valve

ACTUATOR (not shown): Fits onto the valve stem



Materials



VALVE CUP: Plain, Clear lacquered, Gold out/Clear in lacquered tin plate
PET coated chrome plate
Micoflex and Clear lacquered aluminium



OUTER GASKET: Buna (std) and Chlorobutyl (on request)



INNER GASKET: Buna, Neoprene, Butyl and Chlorobutyl



VALVE STEM: POM and PE
1 opening 0.27, 0.30, 0.40, 0.50 and 0.60 mm
1 opening 0.50 and 0.60 for powder products
2 openings 0.50 mm std and for powder products
4 opening 0.50 mm



VALVE SPRING: Stainless steel AISI 302



VALVE HOUSING: PE and POM



DIP TUBE: PE



The actuator may be a simple spray button or it may be an integral part of various spouts or spray domes.

As a rule, it not only allows the user to operate the valve, but it may also fulfil a major role in determining spray rate, spray pattern, particle size distribution and so forth.

A very large array of actuator is available for dispensing sprays, foams and other product varieties.

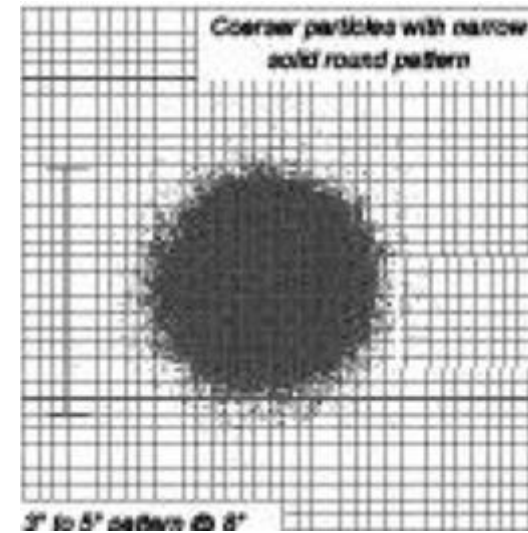
The actuators are almost always injection moulded from PE or PP with components that virtually eliminate any change of cracking from stem tension.



ONE PIECE · directional without insert



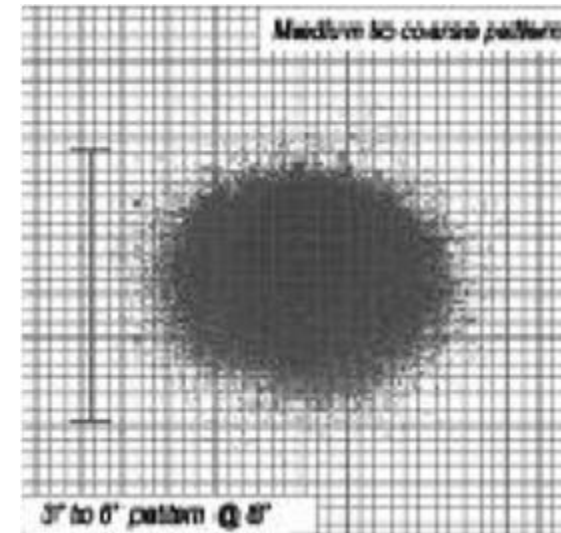
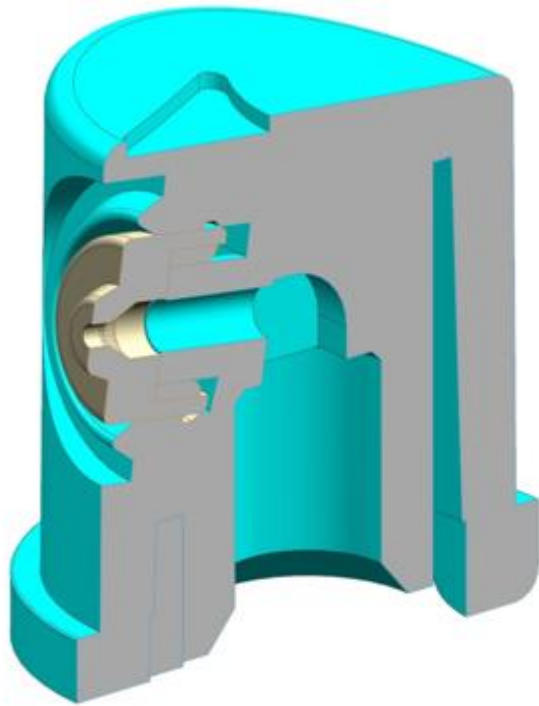
Narrow cone | Long distance spray



Insecticide | Dry airfreshener | Technical

Aerosol actuators

DIRECTIONAL TWO PIECE · with NMBU insert



Medium-Narrow cone | Medium-Long distance spray

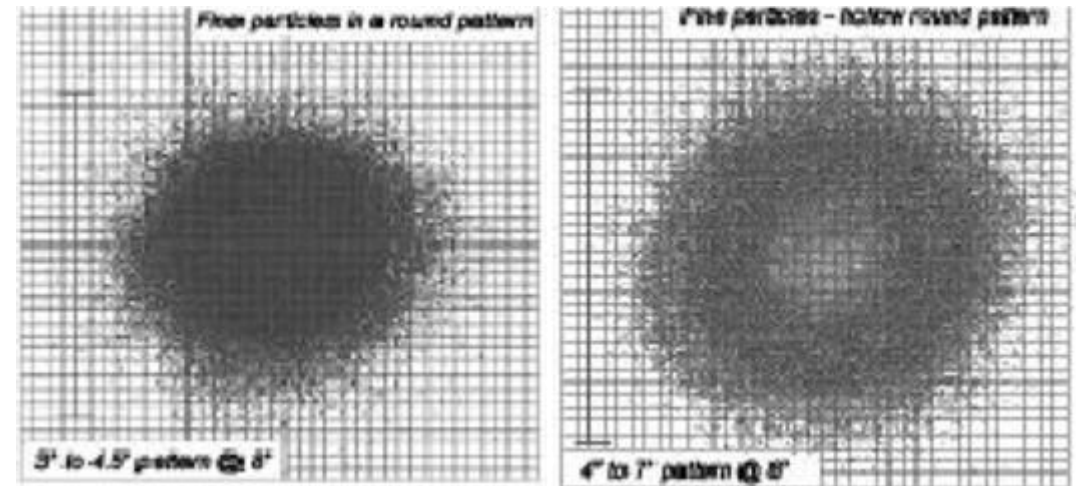
Glitters | Spot remover | Product with powder

Aerosol actuators

FINE MIST TWO PIECE · with MBU insert



Good nebulisation | Large cone | Short distance spray



Body deodorant | Hairspray | Water based product

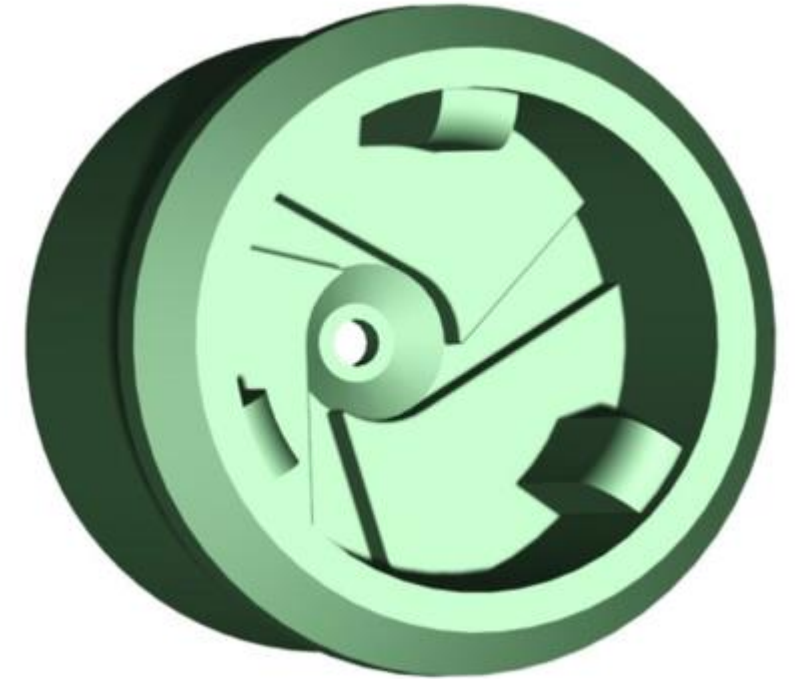
Actuators may be specially formed and equipped with plastic insert to aid in the development of particularly desirable spray pattern.

In general they are called MBU or mechanical break-up system.

The insert is forced into the enlarged orifice area of actuator.

The product enters a peripheral channel and then goes into at least 2 and nearly always 4 offset radial channels placed in the insert.

The configuration acts to give the product a strong swirling action as it leaves the actuator.





04 How are aerosol filled

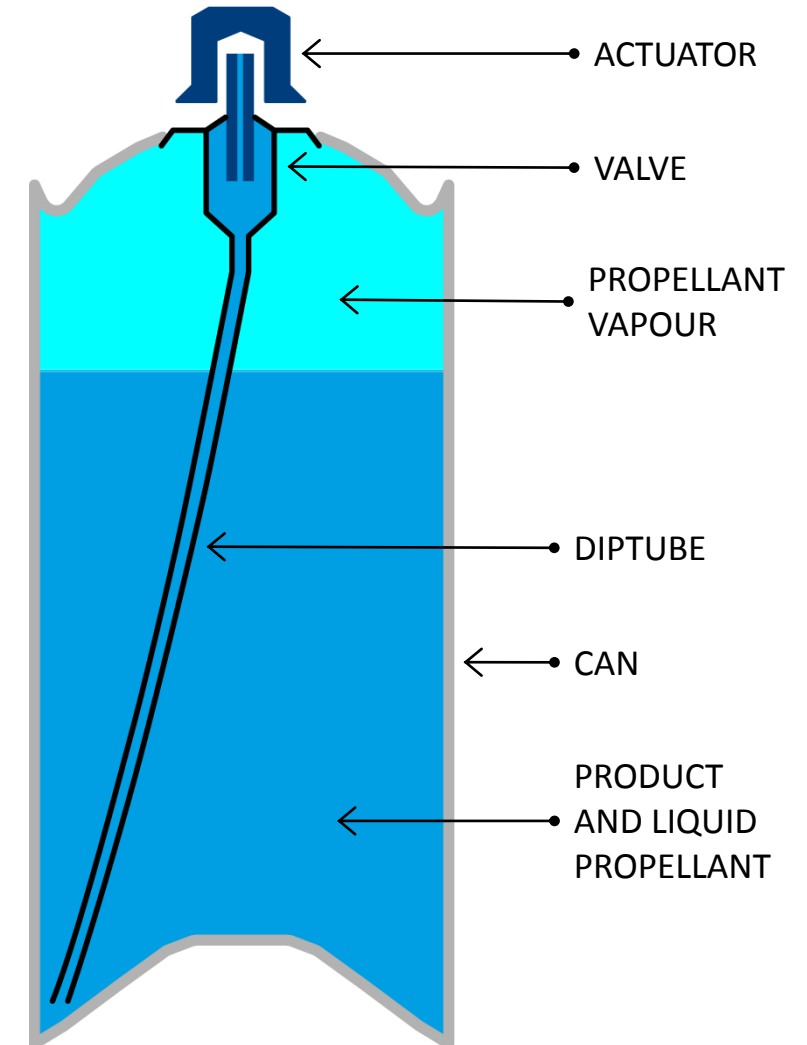
How are aerosol filled

Basic components

An aerosol is made up of several basic components:

- An aerosol can
- The product
- The propellant
- A valve with or without dip tube
- An actuator
- A dust cap (not shown)

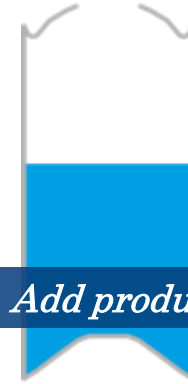
These all have to be assembled, and this is achieved using automatic filling machinery.



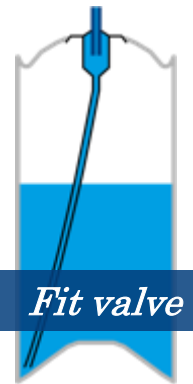
Filling phases



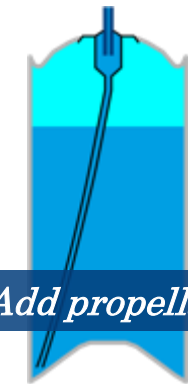
Start with an empty aerosol container.
This will be made of tinplate or aluminium.



The product, usually in the form of a liquid, is added. This contains all the active ingredients, except for the propellant.



The Aerosol valve is fitted and crimped to the can.
This is a very critical operation and the crimping machinery has to be carefully set up to ensure that the can / valve seal does not leak.



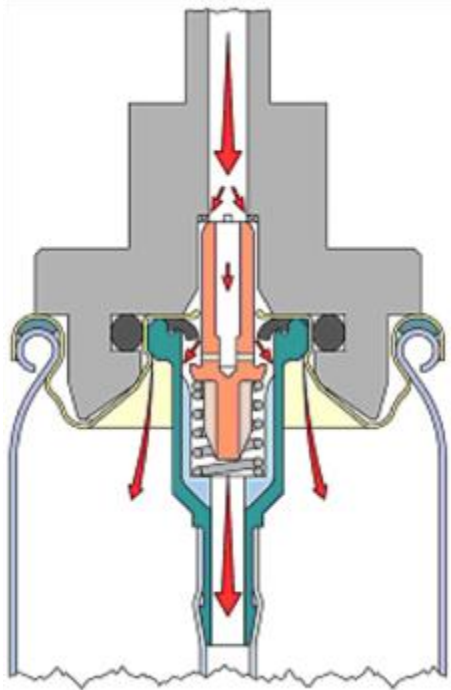
The propellant is injected under pressure, through the valve. The propellant may be in the form of a liquefied or a compressed gas.
If a liquefied gas is used it will exist as both a liquid, and vapour in the aerosol can head space. The volume of liquid in the can will increase. If a compressed gas is used, it will usually only be in the head space, above the liquid in the can, and there will be little or no increase in liquid volume.

How are aerosol filled

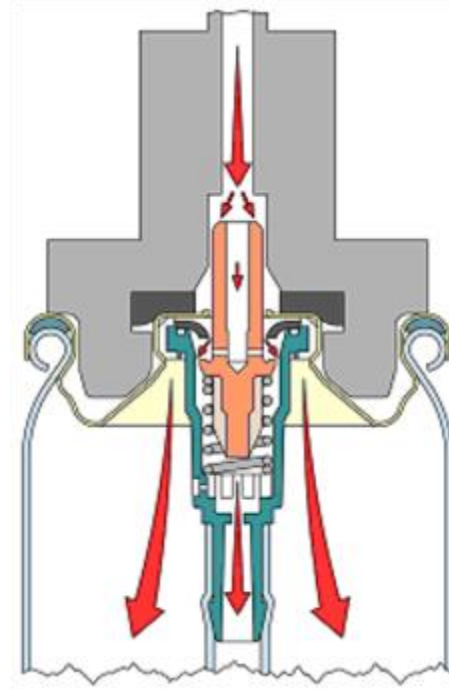
1 · The propellant is forced (about 50 BAR) through the valve into the aerosol can.

2 · The propellant enters through the stem / housing / dip tube and between the stem / dome mounting cup / inner gasket / housing.

1.



2.



Crimping quotes

The quotes below are usually suggested for Coster valves and tin plate or aluminium cans with neck dimension according to Fea standard. The quotes below are only indicative. They must be confirmed or slightly modified only after sealing tests with significant number of samples.

MOUNTING CUP MATERIAL	CAN MATERIAL			
	TINPLATE		ALUMINIUM	
	HEIGHT	DIAMETER	HEIGHT	DIAMETER
TIN PLATE	4.90 ± 0.05	27.10 ± 0.10	4.95 ± 0.05	27.10 ± 0.10
ALUMINIUM	NO	NO	5.15 ± 0.05	26.90 ± 0.05
LAMINATED TIPLATE	4.35 ± 0.10	27.10 ± 0.10	NO	NO



05

Coster Pharma

- **2019 Turnover:** 210 Million Euro
- **Headcount:** 900 Employees
- **1963 - 2020:** 57th Anniversary
- **Manufacturing sites:** 15 Globally
 - **Italy:** 8 (Trento / Milan)
 - **Europe:** 3 (NL / Spain / UK)
 - **Asia:** 2 (India / Malaysia)
 - **USA:** 1 (Chicago)
 - **South America:** 1 (Argentina)
- **Customers:** + 600





COSTER 1
CALCERANICA – TRENTO
Technical and R&D
Headquarters

COSTER 2
CALCERANICA – TRENTO
Clean Room Manufacturing

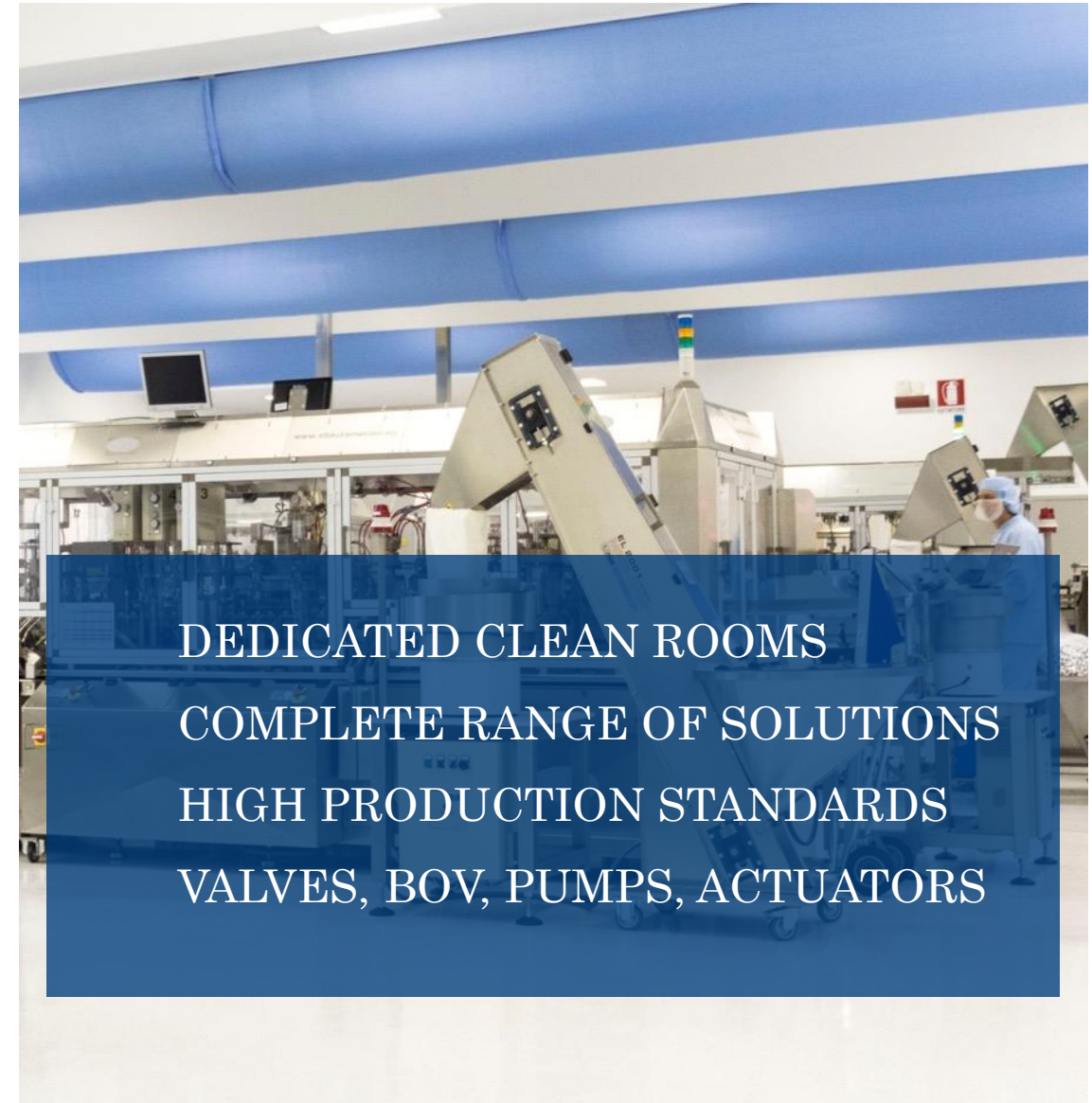


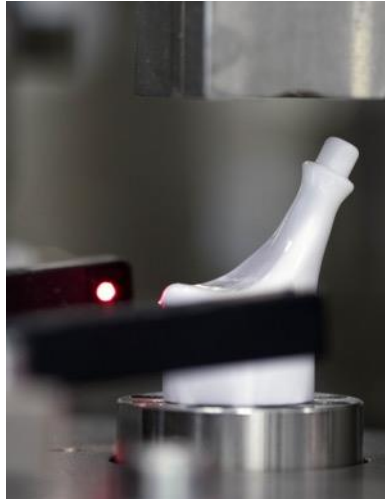
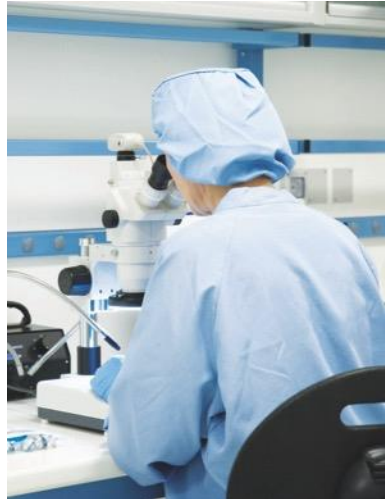
Key features and assets

- Sole company supplying packaging components and filling machines for MDI, nasal, oral and topical products
- Dedicated Clean Rooms class ISO 7 and ISO 8
- ISO 15378 certified
- DMF Type III for MDI valves
- State-of-the-art manufacturing and assembly equipment
- Formulation and reformulation services on selected products

Product suite

- MDI valves and actuators
- Spray pumps and dispensers
- BOVs (one inch and 20 mm)
- Filling machines for MDIs, nasal and oral sprays, topical products





Clean Room manufacturing
GMP Certifications in place

Aerosol Technology courses & training on the spot or at customer site

In-house analytical & compatibility tests
Dedicated Labs

Manufacturing excellence
Technological know-how & expertise

Formulation Services
Reformulation Services

Documentation Experts
Regulatory Support

At the forefront of technology

Dedicated Team

Europe & the Americas

Aerosol experts since 1963

Dedicated Lab Managers

Dedicated Technical Resources

Coster provides packaging solutions for pharmaceutical applications:



NASAL applications



INHALATION applications



TOPICAL applications



ORAL applications

New products and strategic partners



Pharma AirNext



Neptune



Mini inhaler



Upgrading of KPM & 32D valves



Metering BOVs



RPC
Dose Indicator



Presspart
Ear & oral actuators



Plastiap/RPC
Oral actuator



Urdatec/Aeropump
Preservative-free pumps

Products for nasal applications





Products for topical applications



Products for oral applications





- Semi-automatic machines
- Fully-automatic machines
- For filling MDIs, nasal and oral spray, topical products
- Local technical support

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PRODUCTION WORLDWIDE IS ESTIMATED AT MORE THAN:

a) 1,5 billion units

b) 5 billion units

c) 10 billion units

d) 15 billion units, of which 7% (1,05 billion) is equivalent to the production of pharmaceutical aerosols.



www.coster.com

THANK YOU FOR YOUR ATTENTION