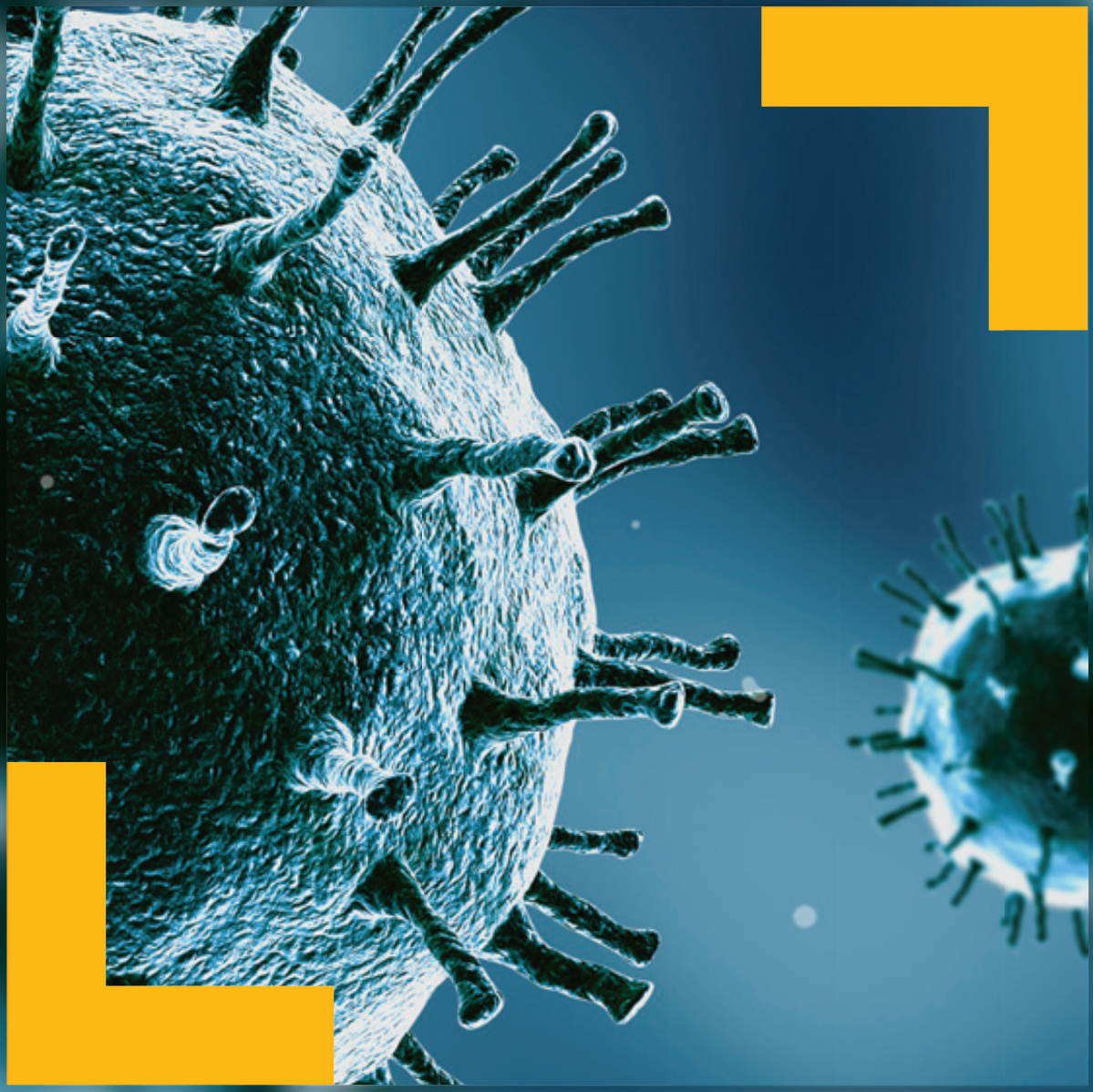


FOCUSED ON PRODUCTIVITY, QUALITY AND COST-EFFICIENCY

Meeting the challenge of compressed air contamination.

Parker

ENGINEERING YOUR SUCCESS.

FOCUSED ON COMPRESSED AIR CONTAMINATION

Compressed air is often a vital element in modern production processes. Irrespective of whether it comes into direct contact with the product or is used to automate a process, provide motive power, packaging, or even to generate other gases on-site, a clean, dry, reliable compressed air supply is essential.

In order to achieve a safe and efficient system, it is important to understand the sources of compressed air contamination and the types of contaminants which must be reduced or eliminated. Once these issues have been identified, we can implement measures to protect the consumer and ensure a smooth-running and cost-effective production facility.

"A clean and reliable compressed air supply is a crucial part of the production process"

Operations Manager, Pharmaceutical Company

With up to 100 million micro-organisms in every cubic metre of ambient air, just a few of these entering a clean environment can have a costly impact

FOCUSED ON IDENTIFYING THE RISKS

In a typical compressed air system, there are ten major contaminants:

Water Vapour, Water Aerosols and Condensed Water

Oil is often perceived to be the cause of liquid contamination, but in the majority of instances, it is actually oily condensate that is being observed. In fact, in a typical compressed air system, up to 99.9% of the total liquid contamination is water.

The ability of air to hold water vapour is dependent upon its pressure and temperature. The higher the temperature, the more water vapour that can be held by the air. The higher the pressure, a greater amount of water vapour is squeezed out. As large volumes of air are drawn into the compressor and compressed, the temperature of the air increases significantly. This allows the heated air

to easily retain the water vapour in the atmospheric air. Prior to exiting the compressor, compressed air is normally cooled to a usable temperature. This reduces the air's ability to retain water vapour, resulting in a proportion of the water vapour condensing into liquid water.

This condensed water, together with water aerosols, leads to corrosion in the storage and distribution system, damage to production equipment, and can also spoil the end product.

Oil Vapour

Atmospheric air also contains oil in the form of unburned hydrocarbons which are drawn into the compressor intake. Typical concentrations can vary between 0.05 and 0.5mg per cubic metre of ambient air. Once inside the compressed air system, oil vapour will cool and condense, causing the same contamination issues as liquid oil. Vaporised oil from the compression stage of a lubricated compressor will also condense within the system and add to the overall level of oil contamination.

Liquid Oil and Oil Aerosols

Most air compressors use oil in the compression stage for sealing, lubrication and cooling. During operation, lubricating oil is carried over into the compressed air system as liquid oil and aerosols.

This oil mixes with water in the air and is often very acidic, causing damage to the compressed air storage and distribution system, production equipment and final product.

Atmospheric Dirt

In an industrial environment, every cubic metre of atmospheric air typically contains 140 million dirt particles. 80% of these particles are less than 2 microns in size and are too small to be captured by an intake filter, and therefore they pass directly into the compressor itself.

Micro-organisms

Bacteria and viruses will also be drawn into the compressed air system through the compressor intake and warm, moist air provides an ideal environment for the growth of micro-organisms. Every cubic metre of ambient air can contain up to 100 million micro-organisms. And even if only a few of these enter a clean, sterile environment or production process, it can have a costly impact on product quality, and may even render a product entirely unfit for use and subject to recall.

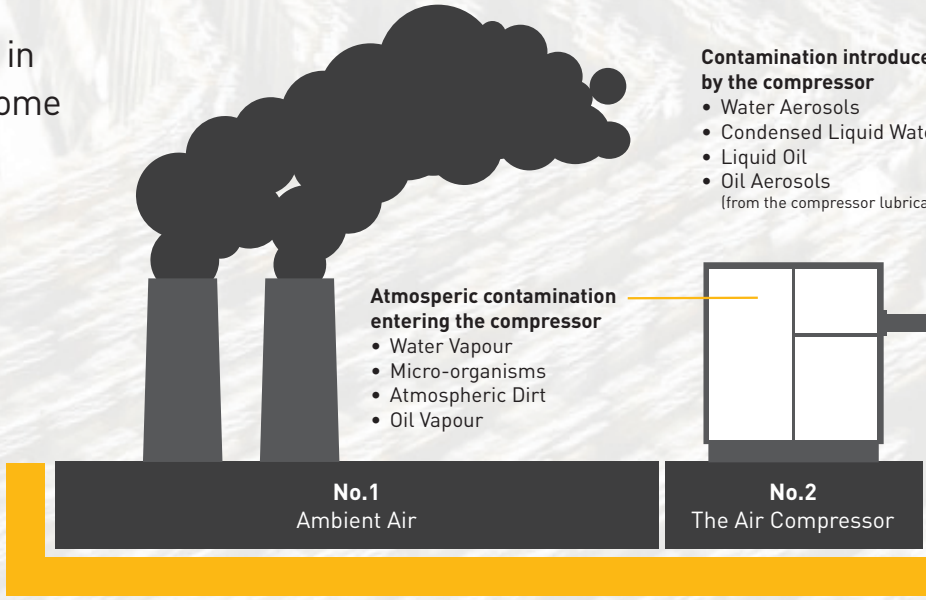
Rust and Pipescale

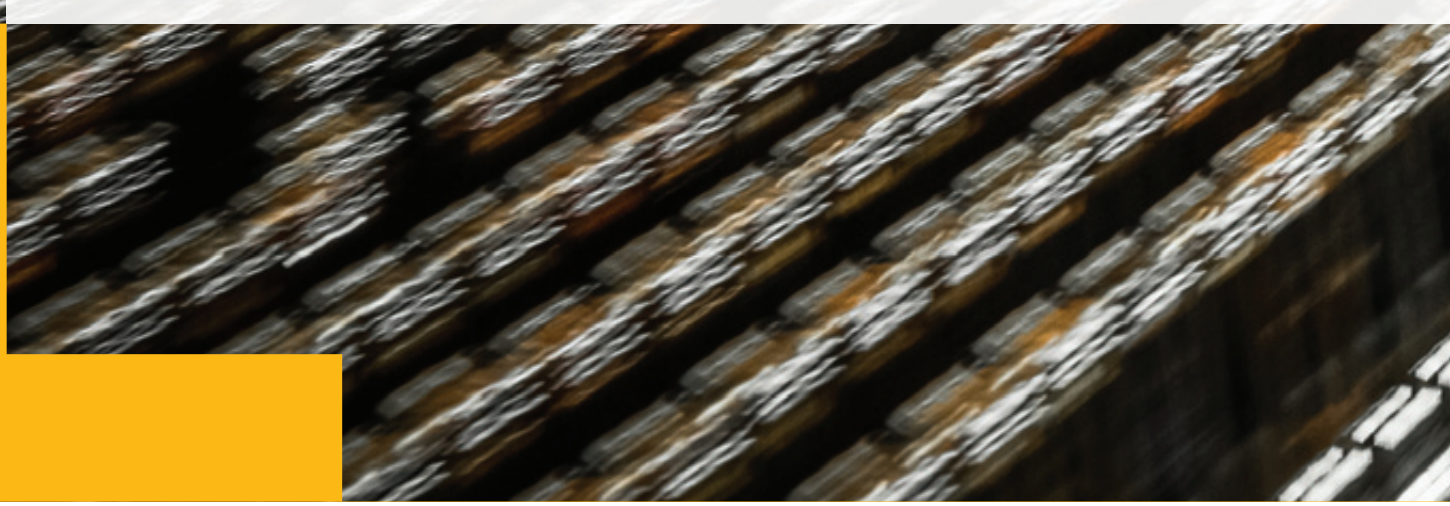
Rust and pipescale can be found in air receivers and the piping of "wet systems" (systems without adequate purification equipment) or systems which were operated "wet" prior to purification equipment being installed. Over time, this contamination breaks away to cause damage or blockage in production equipment, which in turn can lead to problems in the final product and processes.

FOCUSED ON CONTAMINATION: THE RISK POINTS IN THE SYSTEM

The ten main contaminants in a compressed air system come from four main sources:

Source 1 – Ambient Air
Source 2 – The Air Compressor
Source 3 – The Air Receiver
Source 4 – The Distribution Piping





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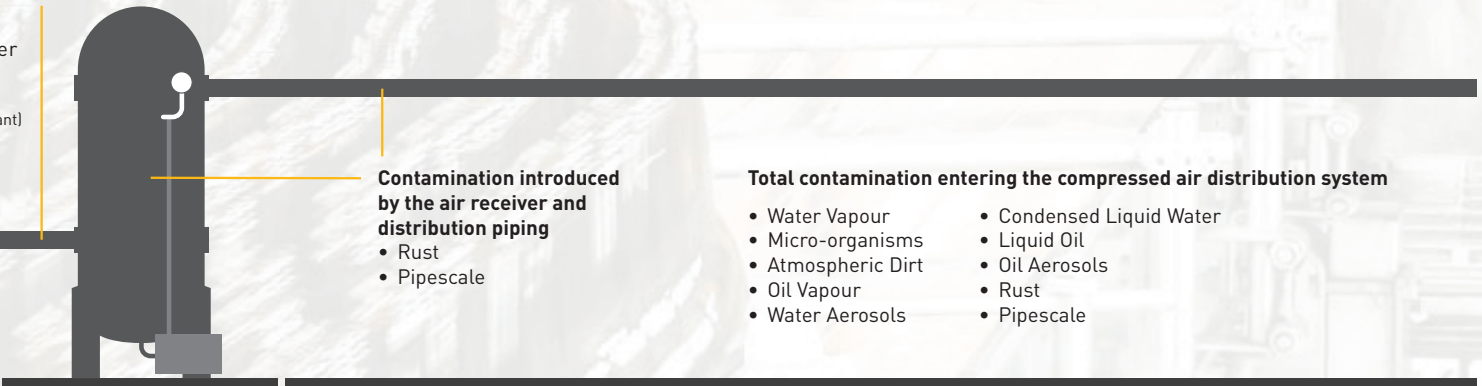


Contamination introduced by the air receiver and distribution piping
- Rust
- Pipescale

Total contamination entering the compressed air distribution system
- Water Vapour
- Micro-organisms
- Atmospheric Dirt
- Oil Vapour
- Water Aerosols
- Condensed Liquid Water
- Liquid Oil
- Oil Aerosols
- Rust
- Pipescale

No.3
The Air Receiver

No.4
The Distribution Piping

Contaminant Source

FOCUSED ON PREVENTION AND REDUCTION

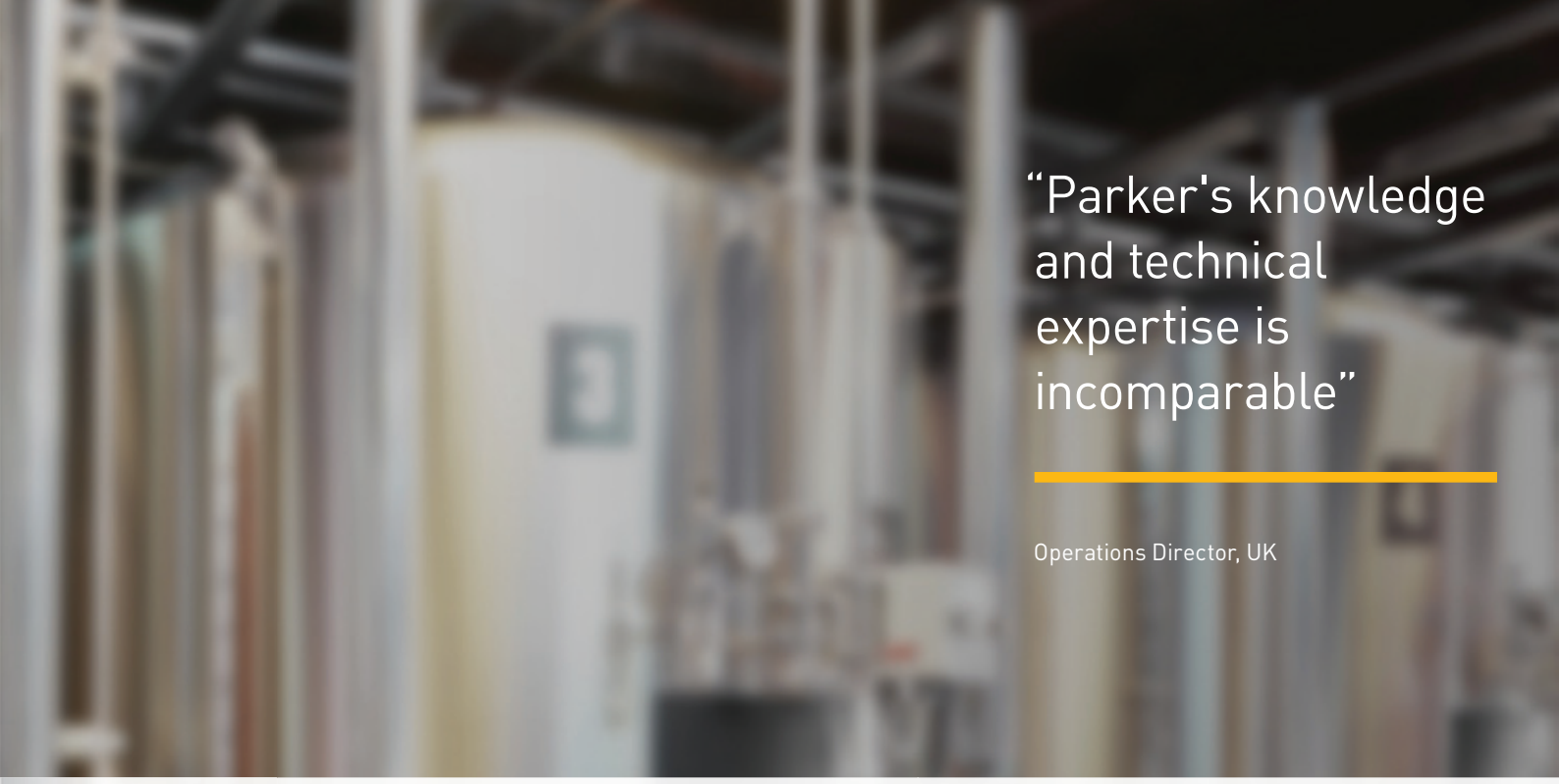
Failure to prevent or reduce contamination can cause numerous problems in the compressed air system, such as:

- Microbiological contamination
- Corrosion within storage vessels and the distribution system
- Damaged production equipment
- Blocked or frozen valves, cylinders, air motors and tools
- Premature unplanned desiccant changes for adsorption dryers

In addition to problems associated with the compressed air system itself, allowing contamination such as water, solid particulate, oil and micro-organisms to exhaust from valves, cylinders, air motors and tools, can lead to an unhealthy working environment. This will increase the potential for personal injury, staff absences and financial compensation claims.

Compressed air contamination will ultimately lead to:

- Inefficient production processes
- Spoiled, damaged or reworked products
- Reduced production efficiency
- Increased manufacturing costs



"Parker's knowledge and technical expertise is incomparable"

Operations Director, UK

FOCUSED ON COMPLYING WITH INTERNATIONAL STANDARDS

ISO8573-1 lists the main contaminants as solid particulate, water and oil. The purity levels for each contaminant are shown separately in tabular form, however for ease of use, this document combines all three contaminants into one easy to use table.

ISO8573-1:2010 CLASS	Solid Particulate				Water		Oil
	Maximum number of particulates per m³			Mass Concentration mg/m³	Vapour Pressure Dewpoint	Liquid g/m³	Total Oil (aerosol liquid and vapour)
	0.1 - 0.5 micron	0.5 - 1 micron	1 - 5 micron				mg/m³
0	As specified by the equipment user or supplier and more stringent than Class 1						
1	≤ 20,000	≤ 400	≤ 10		≤ -70°C		0.01
2	≤ 400,000	≤ 6,000	≤ 100		≤ -40°C		0.1
3		≤ 90,000	≤ 1,000		≤ -20°C		1
4			≤ 10,000		≤ +3°C		5
5			≤ 100,000		≤ +7°C		
6				≤ 5	≤ +10°C		
7				5 - 10		≤ 0.5	
8						0.5 - 5	
9						5 - 10	
X				> 10		> 10	> 10

FOCUSED ON
WORKING TOGETHER

At Parker, we have a complete range of products that can protect your compressed air system at every dewpoint, every flow and every pressure, across every industry. And because all of our solutions are part of the Parker family, everything is designed to integrate perfectly, and work smoothly and efficiently for you.

- World leaders in compressed air and gas treatment
- Three specialist brands, concentrated on technological expertise and innovation
- Focused on meeting customer needs – energy efficient, lowest cost of ownership, productivity and profitability, service and support

To find out more about Parker compressed air and gas treatments, visit **solutions.parker.com/focusedonCAGT**

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AE – Vereinigte Arabische Emirate, Dubai
Tel: +971 4 8127100
parker.me@parker.com

AT – Österreich, Wiener Neustadt
Tel: +43 (0)2622 23501-0
parker.austria@parker.com

AT – Osteuropa, Wiener Neustadt
Tel: +43 (0)2622 23501 900
parker.easteurope@parker.com

AZ – Aserbaidschan, Baku
Tel: +994 50 2233 458
parker.azerbaijan@parker.com

BE/LU – Belgien, Nivelles
Tel: +32 (0)67 280 900
parker.belgium@parker.com

BG – Bulgarien, Sofia
Tel: +359 2 980 1344
parker.bulgaria@parker.com

BY – Weißrussland, Minsk
Tel: +48 (0)22 573 24 00
parker.poland@parker.com

CH – Schweiz, Etoy,
Tel: +41 (0)21 821 87 00
parker.switzerland@parker.com

CZ – Tschechische Republik, Klecany
Tel: +420 284 083 111
parker.czechrepublic@parker.com

DE – Deutschland, Kaarst
Tel: +49 (0)2131 4016 0
parker.germany@parker.com

DK – Dänemark, Ballerup
Tel: +45 43 56 04 00
parker.denmark@parker.com

ES – Spanien, Madrid
Tel: +34 902 330 001
parker.spain@parker.com

FI – Finnland, Vantaa
Tel: +358 (0)20 753 2500
parker.finland@parker.com

FR – Frankreich, Contamine s/Arve
Tel: +33 (0)4 50 25 80 25
parker.france@parker.com

GR – Griechenland, Athen
Tel: +30 210 933 6450
parker.greece@parker.com

HU – Ungarn, Budaörs
Tel: +36 23 885 470
parker.hungary@parker.com

IE – Irland, Dublin
Tel: +353 (0)1 466 6370
parker.ireland@parker.com

IL – Israël
Tel: +39 02 45 19 21
parker.israel@parker.com

IT – Italien, Corsico (MI)
Tel: +39 02 45 19 21
parker.italy@parker.com

KZ – Kasachstan, Almaty
Tel: +7 7273 561 000
parker.easteurope@parker.com

NL – Niederlande, Oldenzaal
Tel: +31 (0)541 585 000
parker.nl@parker.com

NO – Norwegen, Asker
Tel: +47 66 75 34 00
parker.norway@parker.com

PL – Polen, Warschau
Tel: +48 (0)22 573 24 00
parker.poland@parker.com

PT – Portugal
Tel: +351 22 999 7360
parker.portugal@parker.com

RO – Rumänien, Bukarest
Tel: +40 21 252 1382
parker.romania@parker.com

RU – Russland, Moskau
Tel: +7 495 645-2156
parker.russia@parker.com

SE – Schweden, Spånga
Tel: +46 (0)8 59 79 50 00
parker.sweden@parker.com

SK – Slowakei, Banská Bystrica
Tel: +421 484 162 252
parker.slovakia@parker.com

SL – Slowenien, Novo Mesto
Tel: +386 7 337 6650
parker.slovenia@parker.com

TR – Türkei, Istanbul
Tel: +90 216 4997081
parker.turkey@parker.com

UA – Ukraine, Kiew
Tel: +48 (0)22 573 24 00
parker.poland@parker.com

UK – Großbritannien, Warwick
Tel: +44 (0)1926 317 878
parker.uk@parker.com

ZA – Republik Südafrika, Kempton Park
Tel: +27 (0)11 961 0700
parker.southafrica@parker.com

Nordamerika

CA – Kanada, Milton, Ontario
Tel: +1 905 693 3000

US – USA, Cleveland
Tel: +1 216 896 3000

Asien-Pazifik

AU – Australien, Castle Hill
Tel: +61 (0)2-9634 7777

CN – China, Schanghai
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