



**Our Quality Workmanship Ensures  
Your Pharma Process Integrity**

Top-class pharmaceutical vessels and aseptic equipment made of stainless steel and special alloys

## Hidden gem

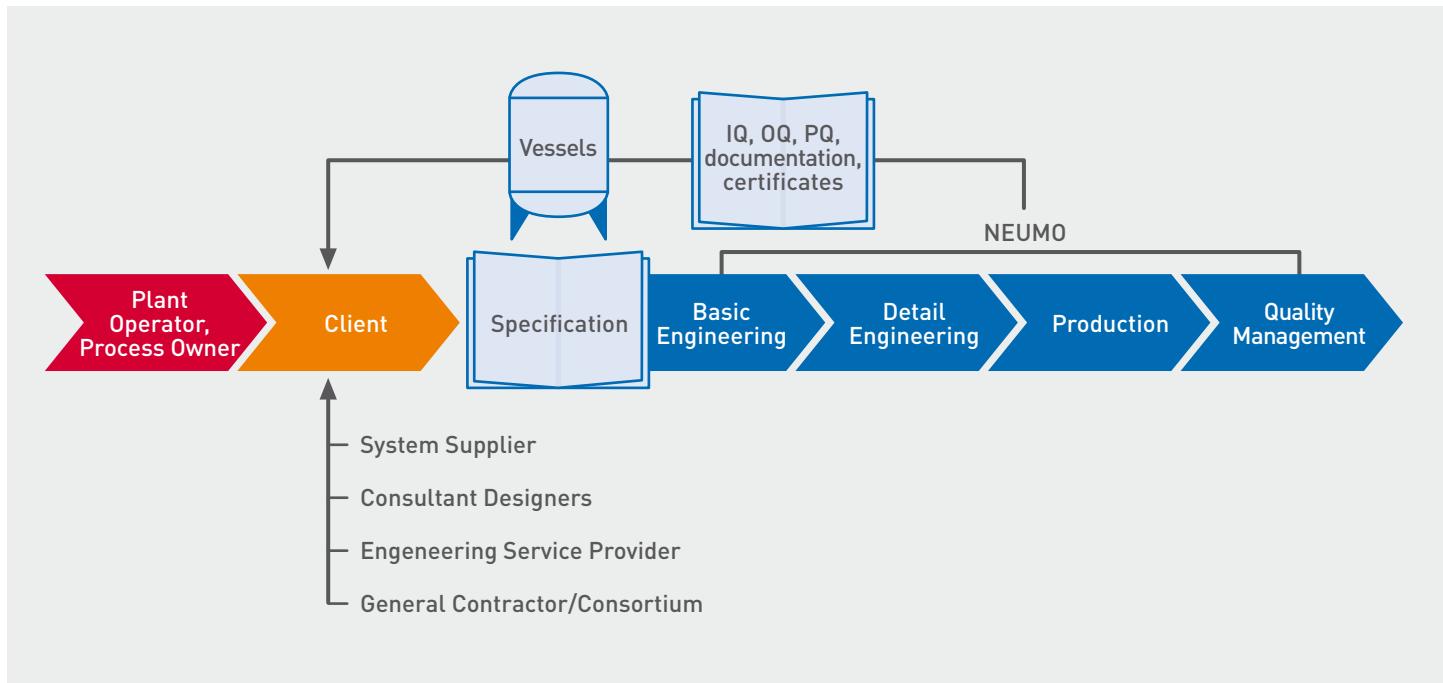
NEUMO tends to shun the limelight. Firmly rooted in the local tradition of Southwest Germany, NEUMO prefers understatement and believes that actions speak louder than words. Customers around the world value the quality workmanship of NEUMO products and solutions.

Based on its own unique approach, the company has become one of the leading suppliers of pharmaceutical vessels and equipment which are used at many of the world's pharmaceutical and biotechnology plants. Our products and solutions do not attract a great deal of attention, but every one of them is rugged, cGMP compliant and solidly designed and built. They deliver the latest functionality and are the result of excellent workmanship.

### It is what is on the inside that counts

Whoever makes them, polished stainless steel vessels and equipment always look great from the outside. However, it is what is on the inside which sets NEUMO apart. These "hidden" features are highly valued by NEUMO customers around the world. The knowledgeable NEUMO customer base includes the people who design, build and operate pharmaceutical and biotechnology plants as well as the teams that have responsibility for the





NEUMO – an integral part of the pharmaceutical value-add chain

pharmaceutical production process and product quality or work with the vessels and equipment on a day-to-day basis. Our mission is to satisfy their needs. The onus is on us to understand exactly what they do. Our solutions, which are based on that understanding, make a vital contribution to the integrity of the pharmaceutical process.

## ASSISTANCE

### Business model and service delivery

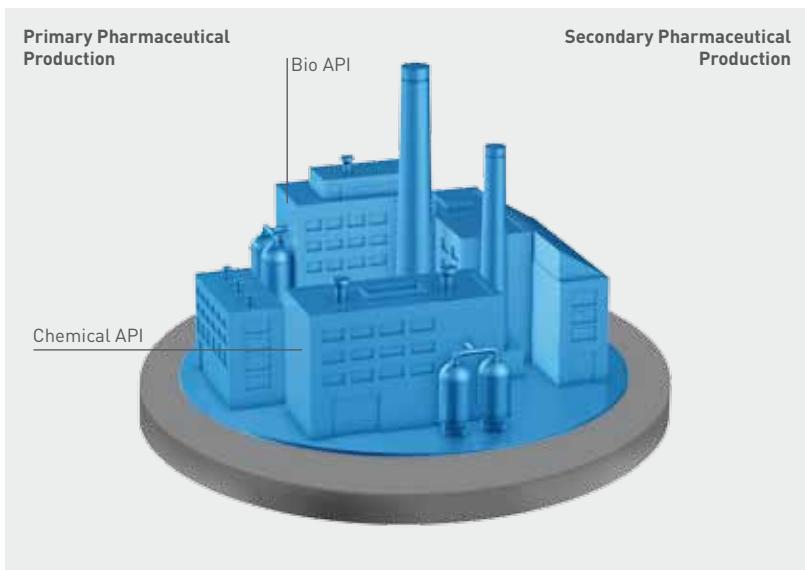
NEUMO rarely supplies products and solutions directly to end customers, i.e. plant operators such as multinational pharmaceutical and biotechnology companies. We normally act as an OEM and project partner for plant design and construction companies as well as for large engineering firms with worldwide operations which have responsibility for realizing projects of any size right up to large-scale turnkey plants.

At the start of the project, NEUMO is given a specification which defines the basic product design and requirements profile. Leveraging its wealth of experience, NEUMO implements the specification as a conceptual design. A liaison team which brings together the expertise of the three main players then reviews the results (see illustration). This advisory service combined with NEUMO's in-depth implementation and manufacturing expertise is the key to success for NEUMO customers. NEUMO supplies exceptional solutions and products which deliver the "inner values" which these customers have been looking for.

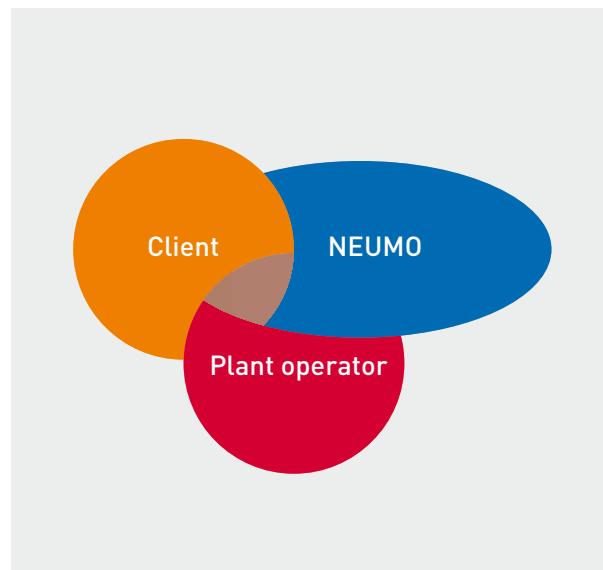
## INTEGRITY

## Pharmaceutical vessels

A lot of companies make tanks and vessels. Some even know how to handle stainless steel. NEUMO is different because it would be hard to find another company which understands how to translate a basic set of data and specifications for a particular vessel into a unique, functional solution which meets 110% of the user's needs and expectations. Nothing is supplied off the shelf. Each vessel is individually manufactured based on a specific design and a specific set of engineering drawings. Everything conforms to applicable standards such as DGRL 97/23/EG, ASME and TSG R0004. NEUMO uses cutting-edge 3D CAD/CAM technology to ensure that every vessel is perfectly suited to the particular production environment. People often talk about tailored solutions, but NEUMO actually delivers them.



NEUMO vessels in pharmaceutical production



NEUMO consultancy in the team environment

NEUMO vessels have capacities ranging from 0.5 to 8,000 liters. They are designed to withstand pressures up to 8 bar (in some cases as much as 40 bar). NEUMO vessels are used primarily in two broad sets of applications, namely API production and processing ("small" molecules) and biotechnology where "larger" molecules such as long-chain peptides, proteins or monoclonal antibodies are genetically engineered. NEUMO only uses approved, pharmaceutical-grade stainless steel which is procured from reliable suppliers. When even higher corrosion resistance is needed for the process, NEUMO uses high-grade duplex steel or nickel-based alloys such as Hastelloy® und Alloy® for its products. NEUMO belongs to the elite and exclusive group of companies worldwide which are able (and certified) to produce vessels made of these special materials.

Perfection down to the last detail

# ANTI-FOULING

All NEUMO vessels are process optimized to ensure that the stirring geometry and temperature control meet the specific needs of the process. The same applies to the peripherals such as media supply, gas injection and condensate separation in bioreactors. NEUMO vessels are designed to be 100% self-emptying, and the outstanding anti-fouling properties are the result of uncompromising attention to detail. The finish on the media contact parts is hand polished (and electro-polished if necessary) to perfection, virtually eliminating the risk of incrustation. The biotechnology vessels are designed to meet the most demanding sterile requirements. NEUMO pays particular attention to the cleanability of its biotech vessels which can be sterilized using short Cleaning-in-Place (CIP) and Steaming-in-Place(SIP) cycles. The cell cultures are able to express and synthesize the target biopharmaceuticals undisturbed.

NEUMO pharmaceutical and biotechnology vessels deliver unparalleled cleanliness, cleanability and cGMP compliance. Users particularly appreciate the design details in day-to-day application. At NEUMO, "zero defects" is not a quality buzzword. It is the reality. NEUMO simply does not receive complaints about its vessels.



NEUMO pharmaceutical vessels for handling APIs – tailored design, impeccable workmanship



NEUMO pharmaceutical vessels for biotechnology – a class on their own

### Sterile heat exchangers

Heat exchangers are one of the most critical unit operations in sterile process applications. They are often used as a source of aseptic ultra-pure water or WFI (Water for Injection) which is needed in large volumes at many stages in biotechnology production including preparation of the media, fermentation and downstream processing. The design of each NEUMO heat exchanger used to produce sterile water is based on the underlying process characteristics of the specific application. Every heat exchanger supplied by NEUMO is designed for optimal compatibility with the material and heat parameters, material streams, flow volumes and the actual installation configuration on site. Functionality which is second to none, ease of maintenance, the safe and reliable supply of ultra-pure, biotechnology-grade water in sufficient volumes and maximum energy efficiency are the key features of our sterile heat exchangers. Considering all of these factors, it should come as no surprise that NEUMO has a global footprint and market share in excess of 50% in this product segment. Once again, cGMP par excellence and zero defects are top priorities.

## INDIVIDUAL



NEUMO sterile heat exchangers are the standard setters

# EXPERTISE



NEUMO – the partner for machinery manufacturers  
who need parts and subassemblies for sterile applications

## Components and subassemblies

Component and module production is another impressive growth segment at NEUMO. Leveraging its wealth of specialized expertise, NEUMO supplies components and subassemblies which large machinery manufacturers design into their equipment and special machines. The company has built up an enviable reputation particularly in the sterile applications sector which includes beverage fillers for beer and dairy products and packaging lines for liquids in the pharmaceutical industry. NEUMO components and subassemblies are often the solution of choice for exceptionally delicate tasks or they are installed at critical points on the equipment. It would appear that NEUMO's expertise in eliminating destructive microbes and its ability to deliver safe, dependable components and subassemblies is the decisive factor for these customers. This is another example of NEUMO's uncompromising commitment to quality, zero defects and total compliance with tolerance specifications.

## Innovative interface technology

Vessels and other pieces of equipment which are part of the process always need an external „conduit“ and they have to be integrated into the overall network of unit operations. Pipe fittings are needed to provide liquid and gas inlets during fermentation. Fittings which hold probes are mounted on fermenters, enabling operators to monitor the operating state in the bioreactor, manage major process parameters and control fermentation. A sight glass can be an invaluable feature for keeping an eye on what is going on in a fermenter or ensuring that things are as they should be in a pharmaceutical vessel.

The connection and interfacing technology for these items which are mounted on or fitted into vessels and other equipment are absolutely essential for proper operation. However in many cases, conventional connections, flanges and nozzles generate significant amounts of dead volume or low-flow zones. They are often weak points in the pharmaceutical production process, causing fouling and creating problems during cleaning and sterilization.

In order to eliminate these deficiencies at the connections and interfacing points on vessels and other equipment, NEUMO has taken a different approach. NEUMO's patented innovative LowVoid® and CleanLip® technology sets new standards in vessel and equipment connection technology and it is attracting an increasing number of adherents worldwide.

# CLEANLIP®

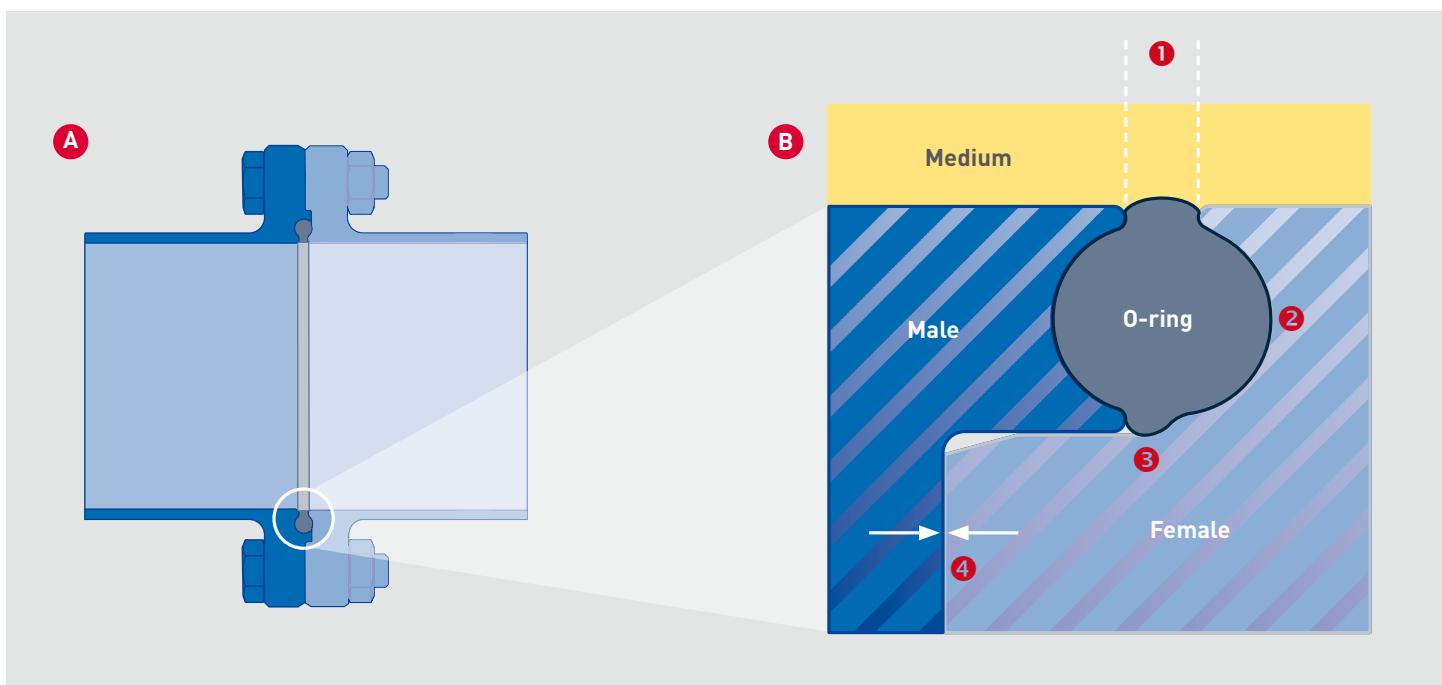


Vessel cover with BioControl® CS probes

### LowVoid® Technology

There is of course good reason why that is the case. The innovative LowVoid® sealing mechanism has an O-ring made of EPDM, Viton, Kalrez, etc. which is almost completely encapsulated and tightened with uniform torque. With this design, the medium cannot penetrate behind the sealing element and dead volume is minimized. The risk of incrustation and infestation by foreign microbes is virtually eliminated. As one of the outstanding features of the patent-protected BioControl® products, LowVoid® technology is available for all types of connections and probes on vessels and other equipment. You can view the list of licensees who use BioControl® connection technology on their instrumentation at [www.neumo.de](http://www.neumo.de).

# LOWVOID®



Unique NEUMO LowVoid® sealing mechanism

**A** Flange joint

**B** Sealing mechanism

- ① Small gap > minimal dead volum
- ② Full surround O-ring clamping
- ③ O-ring expansion space
- ④ Defined stop

### CleanLip® Technology

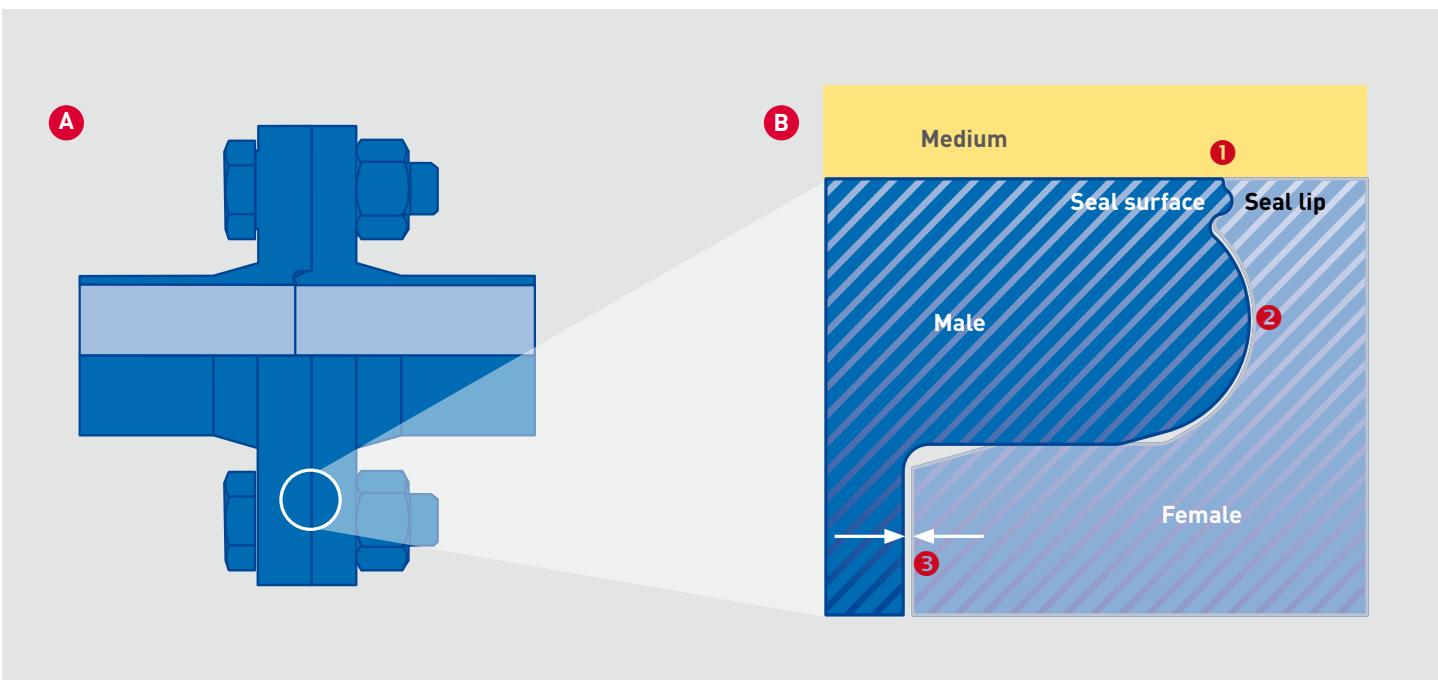
NEUMO goes one step further with its CleanLip® Technology. This type of connection uses no soft elastomer seal to isolate two mating flanges from the outside environment. Instead, a spring-loaded sealing lip on the female end is formed, for example on a stainless steel block flange. Under controlled tightening, the lip mates perfectly with the sealing surface on the male end. This operation is reversible. When the CleanLip® joint is disconnected, the sealing lip "snaps" back to its original position. It can be tightened again hundreds of times to create a sealed joint with no problems. As already mentioned, there is no soft seal made of rubber-like material. The sealing action is metal to metal. CleanLip® is the first sealing technology on the market that can be described as void-free. CleanLip® connections are suitable for any medium (organic and aqueous) without restriction. They are marked under the BioControl® CS brand and are the connection of choice for any type of vessel in pharmaceutical production. You can view the list of licensees who use BioControl® CS housing on their instrumentation at [www.neumo.de](http://www.neumo.de).

# NO SOFT SEAL

A Flange joint

B Sealing mechanism

- 1 Metal/metal seal (no soft rubber), virtually no dead space
- 2 Contoured design
- 3 Defined stop



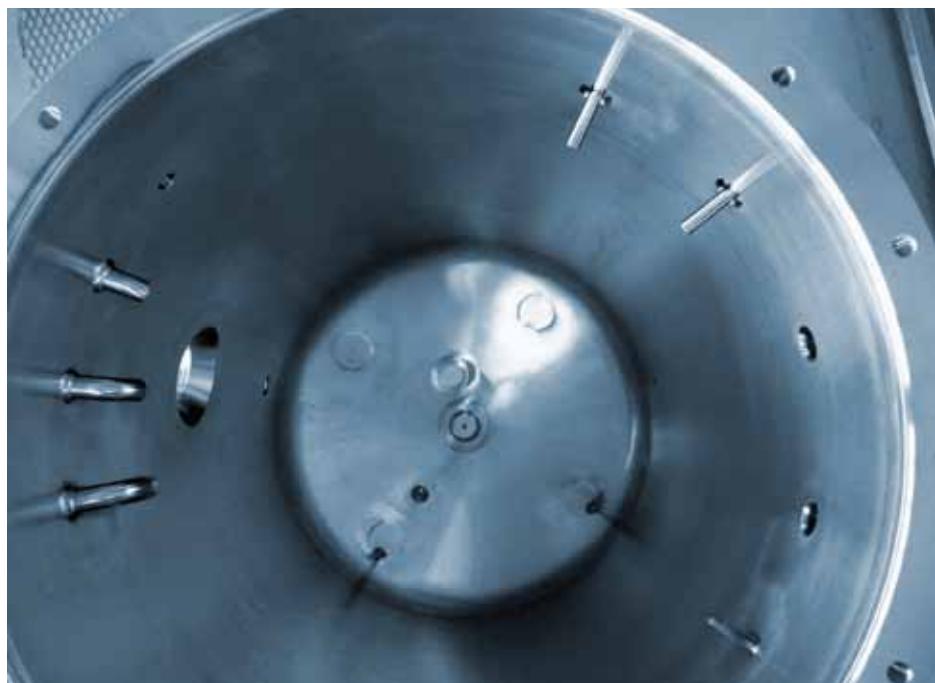
## The new standard

NEUMO vessels and equipment featuring LowVoid® and CleanLip® technology set new standards for minimization or elimination of dead space as well as anti-fouling, cleanability and sterilization-friendly design. These standards are likely to be incorporated into applicable norms and could act as a model for cGMP compliant vessel design. Vessels and equipment with this type of connections make the pharmaceutical production process simpler and safer. They make a vital contribution to process integrity in the pharmaceutical industry, and they will continue to do so in the future.

# STANDARD



Demonstrator with traditional connections and NEUMO's innovative built-in connections



Connections with minimal dead space in a NEUMO vessel

## NEUMO worldwide

Ehrenberg is a privately owned and managed global corporate group with more than 1,600 employees. It has subsidiaries and offices in more than 50 countries around the world. NEUMO develops and produces components and equipment made of stainless steel and special materials for machinery manufacturing and process engineering applications. NEUMO products and solutions are major components on systems that are used to make food products, APIs and biopharmaceuticals. They make a vital contribution to the safety and integrity of the production process.



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