

werner



Pure and Ultrapure Water Technology for

Microelectronics/

Micromechanics

Industrial Processes

Pharmaceuticals

and Cosmetics

Biotechnology



Company headquarter at
Leverkusen with a production
area of 1200 m²

ABOUT OURSELVES.

Wilhelm Werner GmbH.

For more than 25 years our name has been a synonym for the highest quality in pure and ultrapure water treatment. As an efficient and flexible medium-sized company we are active both at home and abroad. With our own marketing organization and branches in many European countries we are always in great demand for setting up plants for pure and ultrapure water production and have been able to establish ourselves as one of the leading suppliers in this sector. We are members of many special committees and have made a vast contribution to standardization and legislation in our field of activities.

Analyses which are continually becoming more exact and more demanding – and production techniques in industry and research – require innovative solutions in water purification. We offer the complete range: we manufacture individual, made-to-measure and extremely precise units based on the latest technology and using the best quality components available to suit all requirements from very small laboratory units with 0.5 l/min up to process plants with 25 000 l/h. We apply our vast stock of know-how and experience from the planning phase of our units onwards.

Quality is of the uttermost importance. Since 1996 we have officially fulfilled the highest requirements for quality. With the achievement of ISO certification according to DIN EN ISO 9001 we have become prominent as being one of the first manufacturers in the water purification sector to be certified; this provides our customers and business partners with a



Water analyses for
critical problems at
the start of a project



TOTAL CUSTOMER CARE.

Our competence is characterized by the provision of complete solutions in setting up plants. With WERNER you have a partner who takes care of everything from the planning phase through construction, manufacture, assembly and start-up – all from a single hand.

Providing sound and individual customer advice by our particular product specialist stands at the start of each project. Our own laboratory also carries out just as important preliminary work in drawing up the plant design as does the whole of the WERNER team. In individual cases pilot tests are carried out in order to link different methods together in an optimal way. This is a basic concept which has proved itself to be successful in practice, particularly where critical requirements have to be met.

During the realization of the project experienced engineers are in constant contact with the customer to ensure that the project runs smoothly. The installation and start-up of the plant is accompanied by comprehensive training of the operators. After-sales service with servicing, maintenance and the provision of spare parts concludes the project within the context of the WERNER principle: **Total**

Competence



100% quality
and security:
certification to
DIN EN ISO 9001



REVERSE OSMOSIS, THE FIRST TREATMENT STAGE.

WERNER reverse osmosis units are primarily used for the purification of drinking water to produce deionized water which can, if necessary, then be further processed to produce ultrapure water. The low operating costs and operation with virtually no chemicals (no regeneration chemicals, no neutralization) of the reverse osmosis units all speak in favor of this future-oriented method which in many sectors has already completely replaced conventional anion/cation exchanger units.

Our range of supply extends from simple laboratory units with a capacity of 3 l/h up to complex industrial plant with a capacity of 25 000 l/h.

The first step at the start of a project is, of course, a fundamental analysis of the requirements and an investigation of the raw water which is available. The most suitable purification method can be selected with the aid of a computer-supported design program and the achievable product quality can also be predicted. This means that the possible risks will have been recognized and countermeasures agreed upon with the operator of the plant even before an order



WERNER reverse osmosis plant for the micro-electronic industry



Reverse Osmosis

SAFE CONDITIONING.

The selection of the correct conditioning method is decisive for reliable and low-cost operation. Removal of iron, removal of manganese, flocculation, chemical hardness stabilization (softening if necessary), particle filtration and settling out colloids are only a selection of the methods which WERNER can include in their plant design.

HIGH PRODUCT QUALITY.

The conductivity of water deionized by reverse osmosis (permeate) is approx. 10-20 $\mu\text{S}/\text{cm}$ in Central Europe; this quality is already adequate for many applications. If a 2-stage reverse osmosis plant is used then the permeate conductivity can be reduced to < 1

MEASURING AND CONTROL INSTRUMENT TECHNOLOGY.

All WERNER reverse osmosis plants are individually tailored to the requirements of the customer. This also applies to the measuring and control instrument technology; the fulfilling of company specifications and other special requirements is just as much a matter of course as is the construction of manually operated plants for countries in which it is difficult to obtain spare parts or the construction of completely automatic plants with SPS and an operator panel for process



State-of-the-art microprocessor-control for completely automatic operation

FROM PURE WATER TO ULTRAPURE WATER.

Although the use of 1-stage or 2-stage reverse osmosis units already provides outstanding results, in many cases it is necessary to use extensive additional purification techniques to fulfil the customer's requirements.

With our own regeneration service with two AQUADEM® regeneration units we can offer our customers mixed-bed resin in different purity stages as a further purification stage.

As licensee of the E-Cell Corporation, Canada, we offer one of the most favorably-priced continuous electrochemical deionizing methods. The E-Cell™ stack supplies an ultrapure water quality of $> 16 \text{ M}\Omega \times \text{cm}$ as a further highly efficient purification stage following reverse osmosis unit.

The modular design allows virtually any performance to be realized with the two different Standard-Stacks and the FDA-approved Pharm-Stack. Depending on the size of the unit and availability we can always achieve the most favorably-priced solution for your ultrapure water system.



E-Cell™ stacks for continuous electrochemical deionization





SUPER-AQUADEM® POLISHERSYSTEMS.

To meet the highest demands we have been supplying our Super-AQUADEM® polishing systems with capacities up to 20.000 l/h, tailored for the specific application and the customer's requirements, for more than 20 years. Each cartridge in this system with its volume of up to 600 l is filled only with high-quality semi-conductor grade pure resins: as well as the obligatory disinfection process, each handling stage takes place under the highest conditions of purity. An additional scavenger with special TOC adsorbers ensures extremely low organic constituents in the ultrapure water; these can be reduced to < 1 ppb TOC



UV oxidation, polishing stage and 0.1 µm membrane filtration (15.000 l/h)

Ultrapure Water

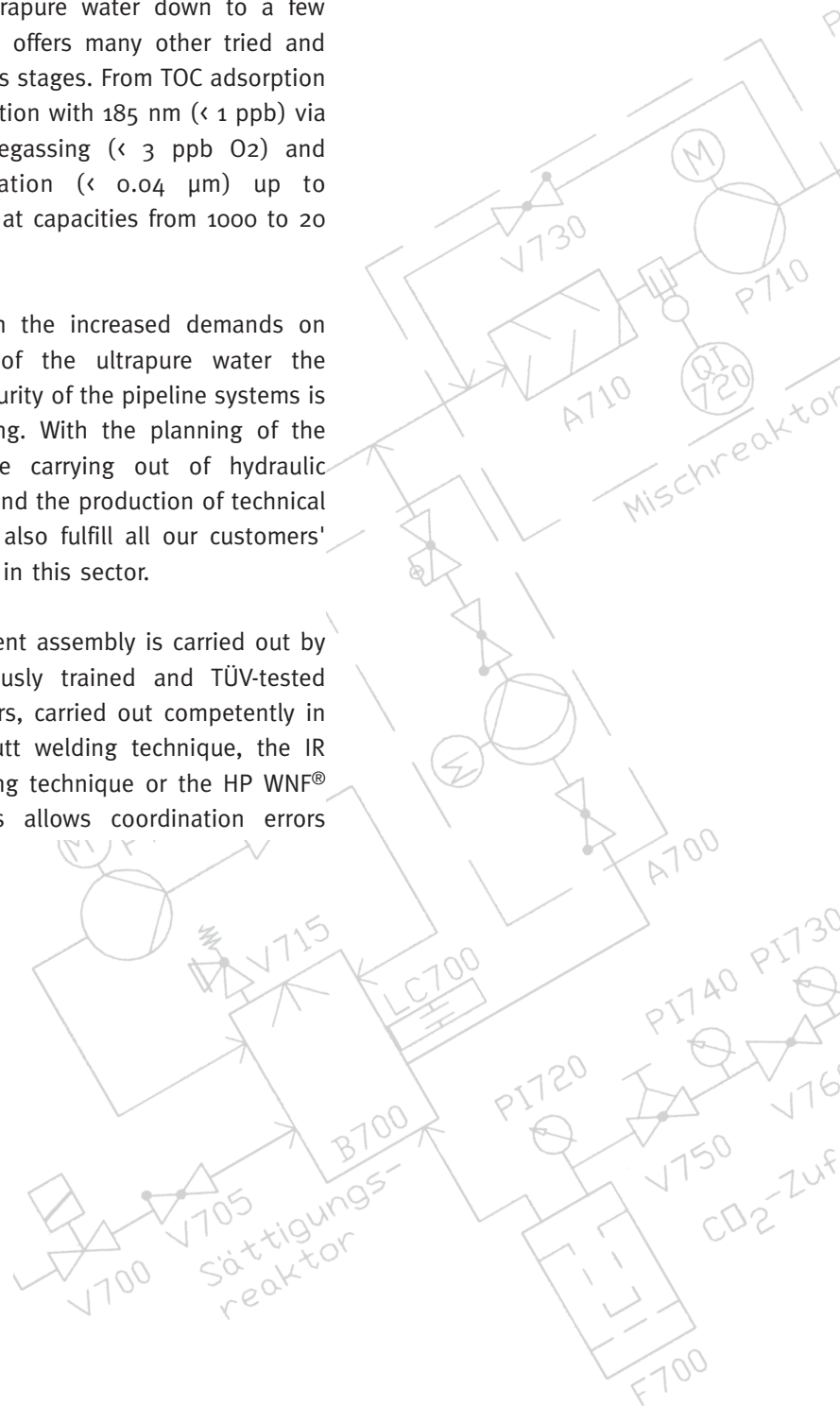
ULTRAPURE WATER FOR THE MICROELECTRONICS AND MICROMECHANICS INDUSTRIES.

Ever-smaller structural sizes in the microelectronics and micromechanics sectors require innovative solutions in ultrapure water technology. Apart from the established Super-AQUADEM® polishing systems for the reduction of anions and metals in ultrapure water down to a few ppt, WERNER offers many other tried and tested process stages. From TOC adsorption and UV oxidation with 185 nm (< 1 ppb) via membrane degassing (< 3 ppb O₂) and particle filtration (< 0.04 µm) up to ultrafiltration at capacities from 1000 to 20 000 l/h.

Together with the increased demands on the quality of the ultrapure water the quality and purity of the pipeline systems is also increasing. With the planning of the pipelines, the carrying out of hydraulic calculations and the production of technical drawings we also fulfill all our customers' requirements in this sector.

The subsequent assembly is carried out by our continuously trained and TÜV-tested plastic welders, carried out competently in either the butt welding technique, the IR Plus™ welding technique or the HP WNF® method. This allows coordination errors

Complete system from a single hand –
PVDF pipelines welded by the IR method

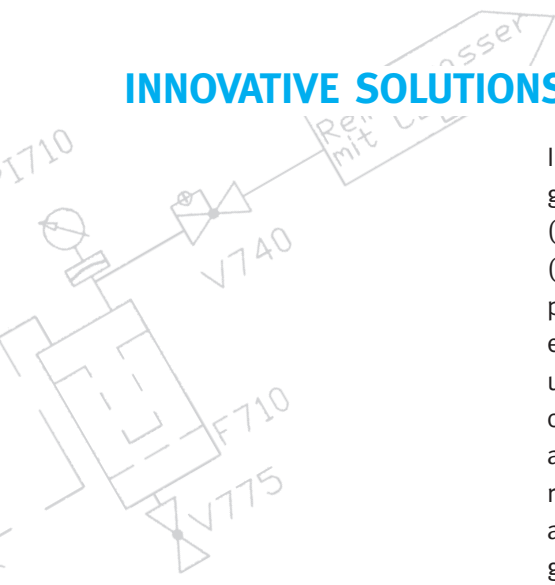




INNOVATIVE SOLUTIONS FOR WAFER PROCESSING

In wafer processing, e.g. dicing and grinding, water with differing conductivities ($0.055 - 20 \mu\text{S}/\text{cm}$) is required. The **APWS** (antistatic pure water system), for which a patent has been applied, avoids the electrostatic charges which often occur with ultrapure water with a conductivity of $0.055 \mu\text{S}/\text{cm}$. The ultrapure water can be adjusted exactly to any conductivity required. Load-dependent variations, which are normal in conventional membrane gassing systems, are completely avoided by this patented new development.

Our principle of **Total Customer Care** in this highly critical region contains both solutions for ultrapure water production as well as for the heating and cooling of wafer saw and spindle cooling water. Additional process stages allow the inexpensive recycling of slightly polluted wastewater from the various wafer processing stages as well as batch-wise or flow-through neutralization of the rinsing water.



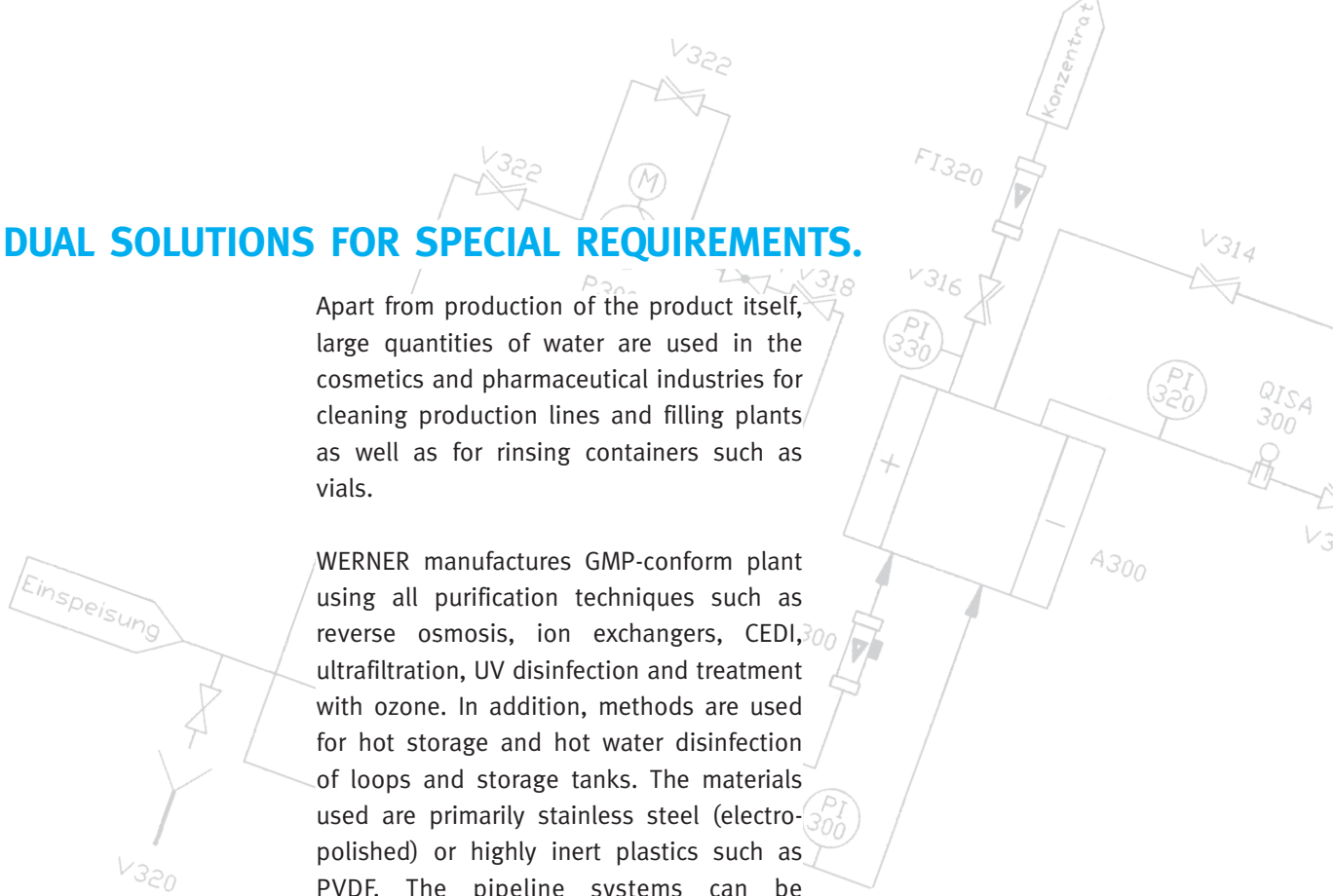
APWS – antistatic pure water system,
patent no. 197 46 533.1

Microelectronics

INDIVIDUAL SOLUTIONS FOR SPECIAL REQUIREMENTS.

Apart from production of the product itself, large quantities of water are used in the cosmetics and pharmaceutical industries for cleaning production lines and filling plants as well as for rinsing containers such as vials.

WERNER manufactures GMP-conform plant using all purification techniques such as reverse osmosis, ion exchangers, CEDI, ultrafiltration, UV disinfection and treatment with ozone. In addition, methods are used for hot storage and hot water disinfection of loops and storage tanks. The materials used are primarily stainless steel (electropolished) or highly inert plastics such as PVDF. The pipeline systems can be completely emptied and are fitted with dead-leg-free valves in order to meet the particular requirements up to WFI quality via the various CIP and SIP methods. All our units are designed to meet the specifications of the particular pharmacopoeia which is applicable.



RNAse-free ultrapure water from WERNER – specially for biotechnology



Production units with an ultrapure water quality according to USP 23



Biotechnology is increasing its demands for ultrapure water which is free from enzymes and nucleic acids. The special problems encountered in dealing with RNA has led to the creation of the term "RNase-free ultrapure water", which can be produced by specially configured WERNER ultrapure water systems and therefore is a real alternative to previous manufacturing processes, e.g. those using the carcinogenic DEPC.



As well as the ultrapure resin ion exchangers which guarantee a high product water resistance and a low hydrocarbon content, the UV-irradiation chamber and the ultrafilter are major components of this system. In the UV-irradiation chamber multiwave irradiators (maximum emissions at 185 and 254 nm) deactivate microorganisms which would otherwise be able to spread throughout the whole system and thus represent a latent RNase source. Short-wave UV-irradiation also breaks up larger molecules such as enzymes and converts them to CO₂ by photo-oxidation. The subsequent ultrafilter separates off molecules and molecular components which are neither adsorbed nor oxidized and which have a molecular weight of more than 5000 (10000) daltons; in this way it prevents the carryover of inadequately deactivated RNases.

As a result of the synergetic effects of polisher systems, UV irradiation and ultrafiltration our systems meet all the above-mentioned biotechnological demands. Apart from very small amounts for laboratory use, WERNER plans and realizes production-scale ultrapure water units for the manufacture of molecular biology preparations and buffer solutions.



Individual Solutions



REFERENCES PROVIDE THE BEST EVIDENCE.

Our customers – references from many
countries throughout the world

ABB AG
Adam Opel AG
AEG AG
AGFA Gevaert AG
Alcatel SEL AG
Atlas Material Testing Technology B.V.
AUDI AG
B. Braun Melsungen AG
BASF AG
BASF Lynx GmbH
Bayer AG
Bayer Diagnostics GmbH
Beiersdorf AG
Biofrontera GmbH
Bitop GmbH
BMW AG
Boehringer Ingelheim GmbH
Boehringer Mannheim GmbH
Carl Zeiss
CIBA Vision GmbH
Ciba Geigy AG
Coca Cola Rhein-Ruhr GmbH
CSEM SA, CH
Daimler Chrysler AG
DEA Mineralöl AG
Degussa AG
Desy Deutsches Elektronen Synchrotron
Deutsche Aerospace Airbus
Deutsche Bahn AG
Deutsche Telekom AG
Deutsche Thomson-Brandt GmbH
DuPont GmbH & Co. KG
Dynamit Nobel AG
Endress + Hauser GmbH & Co.
Ford-Werke AG
Gerling Consulting Gruppe GmbH
Gervais Danone AG
Gillette Continental
Global Light Industries GmbH
H. C. Starck GmbH & Co. KG
Henkel KGaA
Heraeus Industrietechnik GmbH
Heraeus Quarzglas GmbH
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References

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HMR Hoechst Marion Roussel GmbH
Hoechst AG
Hüls AG
IBM Deutschland GmbH
ICI Lacke und Farben GmbH
Kali-Chemie AG
Kleber Reifen AG
Kodak AG
KRANTZ-TKT Cleanroom Technology
Krupp Hoesch Stahl AG
Lagnese-Iglo GmbH
Leuna-Werke GmbH
Leybold Vakuum GmbH
Linde AG
Lufthansa Cargo AG
MAN Nutzfahrzeuge AG
Mannesmann AG
Mazda Motors Deutschland GmbH
Messer Griesheim GmbH
Mira Diagnostika GmbH
Mitsubishi Semiconductor GmbH
MTU GmbH
NUKEM GmbH
OLYMPUS Optical Co.
Pall Deutschland GmbH
Philips GmbH
Preussag Stahl AG
Qiagen GmbH
Rheinbraun AG
Rhône-Poulenc Rorer GmbH
Riedel-de Haen AG
Robert Bosch GmbH
Roche Diagnostics GmbH
Ruhr Oel GmbH
Ruhrgas AG
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RWE Energie AG
Sanacorp eG
Sangui biotec GmbH
Schering AG
SCHWARZ PHARMA AG
Siemens AG
SKW Trostberg AG
Solvay Pharmaceuticals GmbH
STEAG MicroTech GmbH
Temic Telefunken AG
Thyssen Stahl AG
Toyota Deutschland GmbH
Varian GmbH
VAW Aluminium AG
Volkswagen AG
Wacker Siltronic AG
Warsteiner Brauerei
Zander Klimatechnik GmbH
ZENECA GmbH

References

We are active members in the following technical associations:

- APV, Arbeitsgemeinschaft für pharmazeutische Verfahrenstechnik e.V.
(Study Group for Pharmaceutical Chemical and Process Engineering e.V.)
- BioGenTec NRW (North-Rhine Westphalia)
- DGQ,
Deutsche Gesellschaft für Qualität e.V.
(German Association for Quality e.V.)
- FIGAWA, Bundesvereinigung der Firmen im Gas- und Wasserfach e.V.
(Federal Confederation of Companies in the Gas and Water Sector e.V.)
- FIGAWA, Arbeitskreis Membrantechnik
(Membrane Technology Work Group)
- FIGAWA, Arbeitskreis UV-Entkeimung
(UV Disinfection Work Group)
- Gesellschaft Deutscher Chemiker, Fachgruppe Wasserchemie
(Association of German Chemists: Water Chemistry Technical Group)
- LabTops, Labor Produkte Hersteller e.V.
(Association of German, Swiss and Austrian Manufacturers of Laboratory Products)

Registered Trademarks:

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| AQUADEM® | WeteA Wasser-Technische Anlagen Wilhelm Werner GmbH |
| E-Cell™ | E-Cell Corporation, Guelph, Ontario Canada |
| IR PLUS™ | Georg Fischer Rohrleitungssystem AG |
| WNF® | Georg Fischer Rohrleitungssystem AG |

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