Tinita
ENGINEERING PRIVATE LIMITED

904L Scrubbers for Fertilizer Plants

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HIGH-PERFORMANCE 904L SCRUBBERS FOR FERTILIZER PLANTS

The fertilizer manufacturing industry operates in highly corrosive environments, particularly in NPK, ammonia, nitric acid, and phosphoric acid production. These processes release aggressive off-gases, acidic fumes, and condensates containing NO, SO_2, HCl, H_2SO_4, and high chlorides. Conventional materials such as Stainless Steel 316L and rubber-lined carbon steel exhibit accelerated deterioration under these conditions. SS 316L suffers from localised pitting and chloride-induced stress corrosion cracking, while rubber-lined CS frequently fails due to thermal cycling, chemical degradation, and coating delamination, exposing the substrate to rapid corrosion. These degradation mechanisms lead to recurring replacements, elevated maintenance frequency, and unplanned shutdowns that impact plant reliability and throughput.

To address these corrosion-based challenges, 904L Austenitic Stainless Steel (UNS N08904) has become a consistent metallurgical selection for fertilizer scrubber systems. Its Ni-Cr-Mo-Cu alloying chemistry provides improved resistance to mixed acid media and chloride-intensive condensates, resulting in enhanced asset longevity and more predictable lifecycle planning. Tinita Engineering Pvt. Ltd., with over 18 years of experience in fabrication using exotic metallurgies, manufactures custom-engineered 904L scrubber systems and associated process equipment suited for these demanding service conditions.

MISSION STATEMENT

Tinita Engineering is committed to delivering corrosion-resistant, long-life process equipment to the global chemical, fertilizer, and petrochemical industries. We achieve this by combining engineering excellence with proven expertise in the precision fabrication of exotic metallurgical materials, ensuring maximized operational uptime and superior total cost of ownership for our clients.

WHY 904L FOR FERTILIZER SCRUBBER SYSTEMS

904L is a super-austenitic stainless steel developed for use in medium to high concentrations of H_2SO_4 and other aggressive acids. Its applicability in fertilizer plants is driven by its alloy composition: approximately 23% Ni, 20% Cr, 4.5% Mo, and 1.5% Cu.

METALLURGICAL ADVANTAGES:

- **Strong Acid Resistance:**
  High Nickel and Copper provide excellent resistance to non-oxidising acids like H_2SO_4, HCl, and acidic off-gas condensates.
- **High Pitting Protection:**
  Elevated molybdenum levels increase pitting resistance (PREN ≈ 35), improving performance in chloride-bearing environments relative to SS 316L.
- **Stress Corrosion Crack Resistance:**
  High nickel stabilises the austenitic structure and increases resistance to chloride stress corrosion cracking, a critical failure mechanism in hot, pressurised acid recirculation circuits.
- **Long Service Life**
  Improved resistance to localised corrosion and SCC supports equipment longevity in cyclic acidic scrubber environments, reducing replacement intervals and unplanned interventions.

TINITA'S EXPERTISE IN 904L FABRICATION

The fabrication of super-austenitic alloys such as 904L requires welding discipline, controlled heat input, alloy verification, and post-fabrication testing to avoid phase imbalance, microstructural sensitisation, and loss of corrosion resistance. Tinita Engineering maintains infrastructure and fabrication protocols designed for these requirements.

KEY 904L PROCESS EQUIPMENT MANUFACTURED:

Tinita produces equipment used in scrubbing and gas-treatment systems in fertilizer production units:

TAIL GAS SCRUBBERS:	For final emissions control.
PRE-SCRUBBER TANKS:	Handling initial, high-concentration contaminants.
FUME SCRUBBER TOWERS:	Used for process gas cleaning.
PIPE REACTOR TANKS:	Critical components in certain process trains (e.g., NPK).
ABSORBER/QUENCH COLUMNS:	For cooling and primary contaminant removal.
904L DUCTING & PIPING:	For corrosive gas and liquid transfer.
CIRCULATION FILTERS & PRESSURE VESSELS:	Essential components in the acidic recirculation and storage systems.

CORE FABRICATION STRENGTHS:

ADVANCED 904L WELDING:

Welding procedures include GTAW and SMAW with controlled heat input and compatible filler metals to minimise carbide precipitation, sigma phase formation and corrosion sensitivity in the weld and Heat-Affected Zone.

100% NON DESTRUCTIVE TESTING:

Critical weld locations undergo inspection, including:

- Radiographic Testing for subsurface discontinuities
- Ultrasonic Testing for thickness and defect mapping
- Dye Penetrant Testing for surface flaw detection

QUALITY ASSURANCE & CONTROL:

Fabrication is governed by a formal Quality Assurance Plan incorporating Positive Material Identification, dimensional checks, hydrostatic testing, and material traceability throughout manufacturing.

COMPLIANCE:

All equipment is produced under ASME-compliant practices and internal WPS/PQR control.

LOGISTICS:

Export packing and handling procedures are implemented to minimise risk of mechanical distortion, surface contamination, and transit damage.

CERTIFICATIONS:

Tinita Engineering operates under ISO-certified management systems. Welding procedures and qualifications are documented through approved WPS and PQR records aligned with applicable standards.

KEY FERTILIZER PROJECTS EXECUTED

Tinita Engineering has supplied 904L equipment for fertilizer production systems operating under corrosive conditions. Representative project experience includes:

CLIENT NAME: ZUARI AGRO CHEMICALS LTD. (INDIA)

PROJECT SCOPE: UPGRADE OF NPK SCRUBBER SYSTEM

EQUIPMENT SUPPLIED :

904L TAIL GAS SCRUBBER

904L TAIL GAS SCRUBBER

904L PRE-SCRUBBER TANK

PIPE REACTOR TANK

PIPE REACTOR TANK

FUME SCRUBBER & COATING OIL TANK

CLIENT NAME: PVFCCO VIETNAM (CONSULTANT: TKIS INDIA)

PROJECT SCOPE: NEW FERTILIZER COMPLEX COMPONENTS

EQUIPMENT SUPPLIED :

904L SCRUBBER TANK

904L PRE-SCRUBBER TANK

CLIENT NAME: JORDAN INDIA (ONSHORE EPC)

PROJECT SCOPE: SCRUBBER & AUXILIARY SYSTEM

EQUIPMENT SUPPLIED :

904L CIRCULATION FILTERS

PRESSURE VESSELS

PRESSURE VESSELS

904L DUCTING & PIPING

904L DUCTING & PIPING

LIFECYCLE ADVANTAGE: TOTAL COST OF OWNERSHIP

Although the initial capital cost for 904L equipment exceeds SS 316L or rubber-lined CS, corrosion-resistant performance contributes to extended service intervals and reduced unscheduled maintenance. This impacts both direct mechanical costs and downtime exposure.

MATERIAL	ESTIMATED SERVICE LIFE	MAINTENANCE REQUIREMENT	COMPARATIVE LIFE CYCLE COST
Rubber-Lined (CS)	1–3 years	Very High (frequent liner repair/replacement)	Very High
SS 316L	3–6 years	Medium (pitting/ SCC-related repairs)	High
904L Austenitic SS	10+ years	Low (limited intervention frequency)	Lowest long-term cost

Extended operating life reduces replacement frequency and mitigates the operational impact associated with corrosion-driven failure events.

CONCLUSION:
THE PREFERRED PARTNER FOR RELIABILITY

The corrosive nature of NPK, Ammonia, Nitric Acid, and Phosphoric Acid production environments requires materials capable of maintaining metallurgical stability and corrosion resistance under high acid loading and chloride exposure. 904L Austenitic Stainless Steel offers performance advantages for scrubber and gas-treatment equipment subjected to these conditions.

Tinita Engineering Pvt. Ltd. applies controlled fabrication practices, documented welding procedures, and project-based experience to manufacture 904L systems for fertilizer applications. Completed installations for clients, including Zuari Agro Chemicals, PVFCCo Vietnam, and Jordan India, demonstrate applied capability in corrosive service environments.

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At Tinita Engineering Pvt. Ltd. we are committed to excellence in design, manufacturing, and innovation. If you would like to know more about our Titanium Gr.2 Cladded Reactors or discuss your specific process requirements, our experts would be glad to assist.

Reach out to us—we'll help you find the right solution for your industrial needs.

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