ALTFORT
PROJECTS PRIVATE LIMITED

ENGINEERING EXCELLENCE PROCESS
EQUIPMENT & HYGIENIC SYSTEMS

TECHNICAL BROCHURE

Manufacturing Excellence:

Advanced fabrication of large-scale pressure vessels and storage solutions in our heavy-duty manufacturing bay, adhering to ASME Section VIII Division 1 standards.

Executive Summary

Altfort Projects Private Limited specializes in the engineering, design, and manufacturing of advanced Clean-in-Place (CIP) systems and process vessels for industries demanding stringent hygiene and operational efficiency standards. Our technical solutions integrate proven sanitary design principles with contemporary automation technologies to deliver optimized cleaning performance, reduced total cost of ownership, and regulatory compliance across pharmaceutical, food & beverage, biotechnology, and chemical processing sectors.

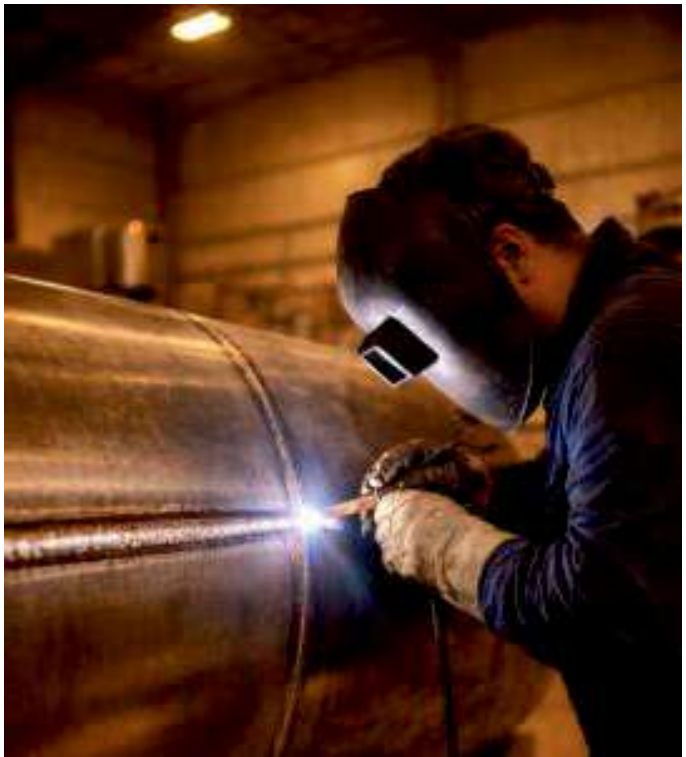
CLEAN-IN-PLACE (CIP) SYSTEMS:

TECHNICAL OVERVIEW

Fundamental Principles Of CIP Technology

Clean-in-Place systems enable automated cleaning of process equipment interior surfaces-including piping, vessels, heat exchangers, and ancillary fittings—without disassembly. CIP technology relies on controlled circulation of cleaning solutions at specified temperatures, flow rates, and chemical concentrations to achieve reproducible cleaning efficacy.
The TACT Principle governs CIP effectiveness:

- **Time:** Duration of exposure to cleaning agents (typically 60-90 minutes per cycle).
- **Action:** Mechanical energy from turbulent flow (minimum 1.5 m/s fluid velocity) and spray impingement.
- **Chemical:** Detergent selection and concentration (caustic, acid, sanitizers).
- **Temperature:** Thermal energy (up to 100°C for effective soil removal).



ABOUT

ALTFORT PROJECTS PRIVATE LIMITED

Engineering Capabilities & Core Competencies

Altfort Projects has established itself as a specialized engineering organization focusing on turnkey process equipment solutions with particular expertise in:

- **Automated Clean-in-Place (CIP) Systems**: Single-tank through multi-tank recovery configurations.
- **ASME standard Storage Tanks:** Atmospheric and low-pressure vessels from 500L to 50,000L capacity
- **Process Vessels & Reactors:** Agitated vessels, mixing systems, jacketed reactors.
- **Complete Process Integration:** Piping, instrumentation, automation, and validation support.

Our engineering team comprises qualified mechanical, process, and instrumentation engineers with extensive experience in sanitary system design, ASME code compliance, and GMP/cGMP documentation protocols. Our design methodology emphasizes:

- Application-Specific Engineering
- TACT Optimization (Time, Action, Chemical, Temperature)
- Resource Efficiency
- Validation-Ready Design
- Life cycle Support

Selection logic

CIP AUTOMATION & CONTROL SYSTEMS

Control Architecture

Modern CIP systems utilize PLC-based control with HMI for operator interaction and recipe management. Critical control elements include:

- **Flow Control:** VFD-driven centrifugal pumps maintaining 1.5-3.0 m/s velocity.
- **Temperature Control:** PID loops managing HE operation (±2°C accuracy).
- **Chemical Concentration:** Conductivity-based feedback control.
- **Safety Interlocks:** Level switches, pressure transmitters, and temperature limits.

Data Acquisition & Trending

Comprehensive data logging captures critical process parameters: Flow rates (L/min), Supply and return temperatures (°C), Chemical concentrations, Phase durations, and Alarm/deviation events.

CIP PROCESS SEQUENCE & PHASE DEFINITIONS

Standard 5-Phase CIP Cycle:

- **Pre-Rinse (5-10 min):** Ambient water flush removing gross product residue.
- **Caustic Wash (20-30 min):** Hot alkaline detergent (1-2% NaOH at 70-85°C).
- **Intermediate Rinse (5-8 min):** Ambient water flush removing residual caustic.
- **Acid Wash (15-20 min):** Optional; removes mineral scale.
- **Final Rinse (10-15 min):** High-quality water flush (conductivity <20 µS/cm).
- **Sanitization (10-15 min):** Optional; chemical sanitizer or hot water (≥85°C).

CIP SYSTEM ARCHITECTURE & DESIGN CONFIGURATIONS

Configuration 1: Single-tank CIP System

- **Technical Specifications:** Single tank serves as source for all cleaning solutions and rinses; Once- through or partial recirculation capability; Portable skid-mounted or fixed installation options.
- **Typical applications:** Small-scale operations, single-circuit cleaning, budget-constrained projects.
- **Advantages:** Minimal capital investment; Compact footprint (<2m²); Simple operation.
- **Limitations:** Higher operating costs; No recovery capability.

Configuration 2: Two-tank Recovery System

- **Technical Specifications:** Tank 1: Fresh water; Tank 2: Caustic detergent with recovery capability. Recirculation pumps with VFD control; Temperature control via PHE or direct steam injection.
- **Operating Principle:** Caustic solution recovered post-cleaning and reused until conductivity indicates replacement.
- **Benefits:** 40-60% reduction in chemical consumption; Decreased wash cycle time (20-30% improvement).

Configuration 3: Multi-tank Recovery/reuse System

- **Technical Specifications:** Tank 1: Fresh water; Tank 2: Caustic with recovery; Tank 3: Rinse water recovery; Tank 4 (optional): Acid solution with recovery.
- **Features:** PLC/SCADA-based automation; Recipe management; Automatic concentration adjustment.
- **Benefits:** Water consumption: 60-80% reduction; Chemical usage: 50-70% reduction; Pre-heating recovered solutions reduces thermal demand.

Performance Parameter	1-Tank System	2-Tank System	3+ Tank System
Operating Cost/Cycle	High	Medium	Low
Water Consumption (L/cycle)	1000-1500	500-800	200-400
Chemical Reuse Capability	None	Caustic only	Caustic + Acid + Rinse
Automation Complexity	Manual/Semi-auto	Semi-auto/Auto	Fully Automated
Footprint (m²)	2-4	6-10	12-20
Cycle Time (minutes)	90-120	60-80	45-60
ROI Period (months)	18-36	18-24	12-18

PUMP & HEAT EXCHANGER SELECTION

CIP Supply Pumps:

Sanitary centrifugal pumps (typically Alfa Laval LKH series or equivalent) selected based on Required flow rate (Q), System pressure drop (ΔP), and Temperature rating. Material: 316L SS wetted components with double mechanical seal.

Heating Systems:

- **PHE:** High thermal efficiency, pharmaceutical grade.
- **Direct Steam Injection:** Rapid response, clean steam required.
- **Electric Immersion:** No steam requirement, higher cost.

Industry Applications & Regulatory Compliance

Industry Sector	Typical Equipment Cleaned	Critical Requirements
Pharmaceutical	Reactors, blenders, API vessels	cGMP, FDA 21 CFR Part 11, validation
Food & Beverage	Processing tanks, pasteurizers, filling lines	FSMA, HACCP, allergen prevention
Dairy	Homogenizers, separators, storage silos	PMO compliance, bacterial limits
Brewery/Distillery	Fermenters, bright tanks, transfer lines	Yeast prevention, flavor control
Biotechnology	Bioreactors, chromatography skids	Sterility, endotoxin removal
Chemical	Reactors, mixing vessels, crystallizers	Cross-contamination prevention

PUMP & HEAT EXCHANGER SELECTION

- **Design Qualification (DQ):** User requirement specifications (URS), Risk assessments (FMEA), Vendor qualification.
- **Installation Qualification (IQ):** Equipment verification, instrument calibration, as-built P&IDs.
- **Operational Qualification (OQ):** Parameter verification, Alarm/interlock testing, recipe validation.
- **Performance Qualification (PQ):** Cleaning efficacy studies, Residue testing (HPLC/TOC), microbial challenge.

STORAGE TANK DESIGN & FABRICATION

Engineering Standards

Altfort designs in strict accordance with ASME Section VIII Division 1, API 650, ASME BPE (Bioprocessing Equipment), and 3A Sanitary Standards.

Tank Design Portfolio: Vertical Storage Tanks

- **Parameters:** Capacity: 500L to 50,000L; Pressure: Atmospheric to 3 bar(g); Temperature: -20°C to +150°C.
- **Materials:** Carbon steel, SS304/L, SS316/L. Bottom configurations: Flat, dished, cone (15°-60°).

Horizontal Storage Tanks
Applications: Space-constrained installations, transport requirements. Capacity: 1,000L to 30,000L.

Jacketed Vessels
Thermal Control: Heating (steam, thermal fluid) and Cooling (glycol, refrigerant). Jacket types: Conventional, Half-Pipe Coil, Dimple Jacket.

Cone Bottom Tanks
Geometry ensures 100% product recovery and gravity-assisted drainage. Angles: 30°, 45°, 60°.

Material Selection & Metallurgy

Material	UNS Designation	Key Properties	Typical Applications
Carbon Steel	ASTM A516 Gr.70	High strength, cost-effective	Non-corrosive, coated vessels
SS 304/304L	UNS S30400/03	General corrosion resistance	Food, Beverage, Dairy
SS 316/316L	UNS S31600/03	Enhanced chloride tolerance	Pharma, Marine, Chemicals
Duplex 2205	UNS S31803	High strength + corrosion res	Aggressive environments
Hastelloy C-276	UNS N10276	Exceptional acid resistance	Hcl, oxidizing acids
Nickel 200	UNS N02200	Caustic service	NaOH solutions

Surface Finish Specifications

- **Standard:** 2B mill finish.
- **Sanitary:** 180 grit (Ra 0.4-0.6 µm).
- **High-Polish:** 240-320 grit (Ra 0.2-0.4 µm).
- **Mirror:** >400 grit electropolish.

Agitation & Mixing Systems

Selected for Viscosity (1-100,000 cP) and mixing intensity.

- **Propeller/Marine:** Low viscosity blending.
- **Pitched Blade Turbines:** Medium viscosity.
- **Anchor/Paddle:** High viscosity heat transfer.
- **Helical Ribbon:** Laminar flow (>50,000 cP).

TURNKEY PROJECT EXECUTION METHODOLOGY

Phase 1: Conceptual & Basic Engineering (2-4 weeks)

Deliverables: Process flow diagrams (PFD), Heat & material balance, Equipment sizing, Preliminary P&IDs, Budget estimates (±20% accuracy).

Phase 2: Detailed Engineering (6-10 weeks)

Mechanical: GA drawings, Foundation load calculations, Bill of materials (BOM). Piping: Isometric drawings, Pipe support, stress analysis. I&C: Instrument data sheets, Loop drawings, Control narrative, PLC/SCADA programming.

Phase 3: Manufacturing & FAT (8 -16 weeks)

Process: CNC cutting, Rolling, Welding per ASME Sec IX, PWHT, NDT (RT/UT/PT/MT). Factory Acceptance Test (FAT): Dimensional verification, Pressure testing, Functional simulation.

Phase 4: Site Installation & Commissioning (4 - 8 weeks)

Activities: Equipment Rigging, Field welding, Electrical/Instrument installation, Pre-Commissioning leak testing, Performance verification studies.

Phase 5: Validation & Documentation (2 - 4 weeks)

Protocols: IQ (50-100 test points), OQ (100-200 test points), PQ (3 successful cycles). Documentation: Material certificates (EN 10204 3.1), Welding documents, Surface finish reports, O&M manuals.

QUALITY ASSURANCE & TESTING

Manufacturing QC Hold Points:

- Material Receipt (MTC & PMI verification)
- Post-Cutting Dimensional check
- Fit-Up Inspection (Joint gap alignment)
- Welding Inspection (Visual & NDT)
- Pressure Test acceptance

Certifications & Standards:

ISO 9001:2015, ISO 14001:2015, OHSAS 45001:2018. ASME U- Stamp compliance, 3A Sanitary, cGMP Compliance, CE Marking (PED 2014/68/EU).

Non-destructive Testing (NDT) Methods

Method	Application	Acceptance Criteria
Radiographic (RT)	Full penetration welds	ASME Sec VIII Div. 1, App. 4
Ultrasonic (UT)	Thick-walled vessels	ASME Sec V, Article 4
Magnetic Particle (MT)	Subsurface defects	ASME Sec V, Article 7
Liquid Penetrant (PT)	Surface defects	ASME Sec V, Article 6
Helium Leak Testing	Ultra-tight detection	$<10^{-6}$ mbar·L/s

TECHNICAL CASE STUDY – ALCO-BREW INDUSTRY

Requirements:

Reliable-repeatable cleaning of blending tanks, filler-machines and pipelines to eliminate carry over of particles in final product bottles

Present practice & challenges :

- Inconsistent manual cleaning
- Particle carry-over to bottles even after manual cleaning
- Long cleaning cycles – up to 24 hours
- Huge water drain-out – up to 4000 L every cleaning cycle

Our solution :

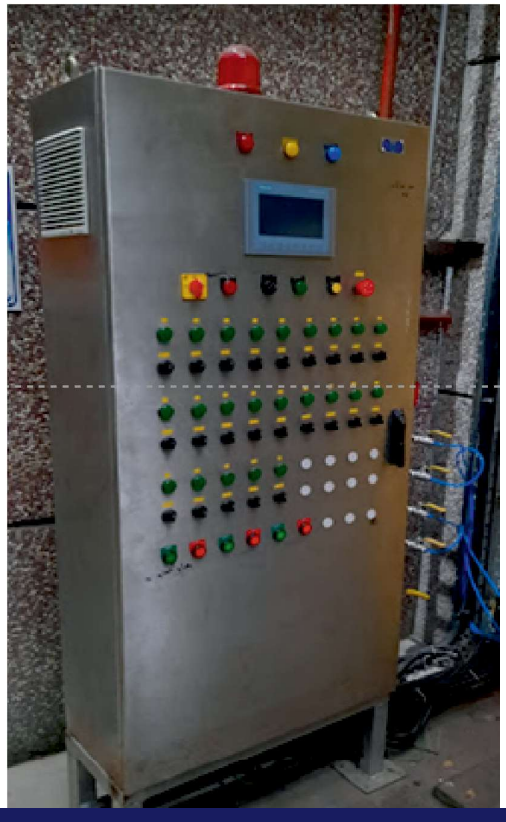
PLC controlled closed-loop CIP system with sequential cleaning of objects

Performance & Results :

- Repeatable Uniform cleaning
- Water drain reduced to 800 – 1000 L every cycle
- Cleaning time – 1 hour

Savings with ALTFORT CIP system :

- Up to 60% water savings by volume
- Up to 80% savings in CIP time



Our Solution

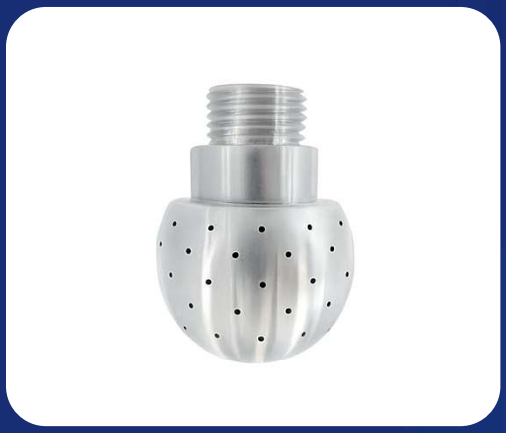
Targeted cleaning systems for every level of soiling

Cleaning requirements vary — from simple rinsing to removal of hardened residues.
At Altfort, we use a structured soiling classification model to guide the selection of cleaning systems, ensuring precision and efficiency for every cleaning task.

Recommended Solutions by Soiling Type:

- **Soil Class I** – Static Cleaners
- **Soil Class II** – Free Rotating Cleaners
- **Soil Class III** – Controlled Rotating Cleaners
- **Soil Class IV** – Index and Orbital Cleaners

Each solution is designed to match the cleaning intensity required — delivering performance, reliability, and resource savings across all applications



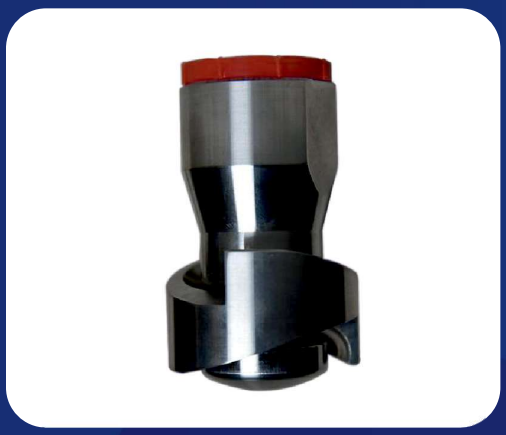
Soiling Class I – Rinsing

Static Cleaners

Cleaning vessels categorized under Soiling Classification I requires a cleaning method that ensures uniform liquid distribution, delivering high volumes of fluid across the entire interior surface. Static spray balls, commonly used for this purpose, generate minimal mechanical force and depend primarily on the flow of liquid down the vessel walls to create surface friction or dissolve residues.

Main benefits include:

- Low capital investment
- Maintenance-free operation
- Wide range of spray patterns, materials, and surface finishes available



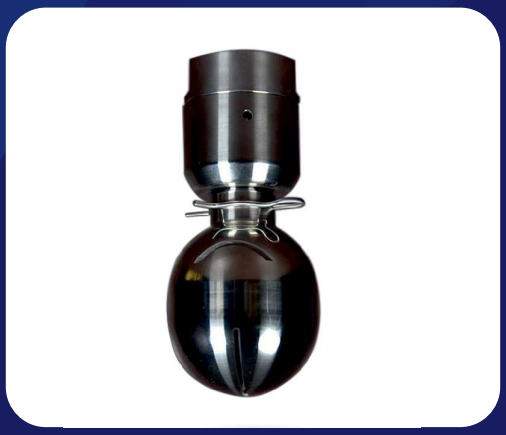
Soiling Class II – Low impact

Free Rotating Cleaners

Free-rotating cleaners spin quickly around one axis, powered by the flow of cleaning liquid. This spinning creates fast-moving droplets that help remove dirt by hitting the walls of the vessel with gentle force.

Main benefits include:

- Long-lasting performance with no need for maintenance
- Different spray options: full 360°, 180° towards the inlet, or 180° away from the inlet
- Small, efficient design that fits easily into various systems



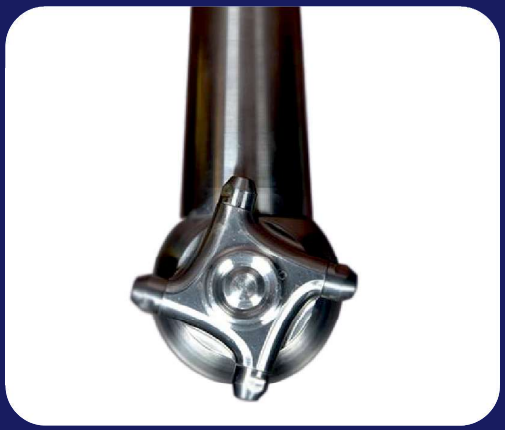
Soiling Class III – Medium impact

Controlled Rotating Cleaners

Altfort's controlled rotating cleaners utilize precisely directed flat or round jets to deliver the cleaning solution onto vessel surfaces with high impact. Operating at higher liquid pressures than traditional free-rotating units, these cleaners maintain a consistent, controlled rotation speed. This controlled motion increases the dwell time of the spray jets on the vessel walls, significantly enhancing cleaning effectiveness—particularly for stubborn or hard-to-remove residues.

Main benefits include:

- Enhanced cleaning performance through reduced rotational speed and increased jet dwell time
- Optimized jet design for efficient and thorough cleaning
- Extended service life supported by robust hydrodynamic bearing technology



Soiling Class IV – High impact

Altfort's comprehensive range of orbital and indexing cleaners provides high-impact cleaning solutions for the most demanding applications. Both product lines feature Altfort's advanced solid stream nozzle technology, which enhances spray jet projection and maximizes cleaning efficiency by delivering powerful, targeted impact to vessel surfaces.

Cleaner	Type	Coverage [deg] *	Pressure [bar]	Flow range [l/min]	ATEX	Beverage, Wine Brewery, Distillery	Food & Dairy	Transport	(Bio-) Chemical	Pharma/ Personal Care	Pulp & Paper	Utilities
Alto static	 Static	Various	1.0–2.5 Optimum 2	6–450	Ex	•	•	•	•	•	•	
Altospray	 Free rotating	360	2–4 Optimum 2	40–245	Ex	•	•		•	•		
Alto-Chem	 Free rotating	360	2–4 Optimum 3	40–134	Ex	•	•	•	•	•	•	
Rota Alt	 Free rotating	360	1–4 Optimum 3	38–408	Ex	•	•	•		•		
Altoz	 Controlled rotating	360	1–4 Optimum 4	15–118	Ex	•	•	•	•	•		
Rota Disc	 Controlled rotating	360	2–4 Optimum 3	140–1100	Ex	•	•	•	•	•	•	
AltoJet	 Controlled rotating	360	3–12 Optimum 3	50–270		•						
Orbi Clean	 Orbital	360	4–10 Optimum 6–8	80–380	Ex	•	•		•	•		
Sani Alt	 Orbital	360	3–20 Optimum 6–8	25–92	Ex	•	•	•	•	•		
Alto Flush	 Orbital	270	1.5–7 Optimum 6–8	17–75	Ex	•	•	•	•	•	•	

The above selection guide is only provided as an assistance to the cleaner selection process. Altfort's policy of continued improvement means that specifications may vary without prior notice

AFTER-SALES SERVICE & TECHNICAL SUPPORT

Manufacturing Excellence:

Preventive Maintenance: Quarterly Service: Pump seal inspection, spray device cleaning, calibration verification. Annual Service: Complete system performance verification, tank internal inspection, software updates.

Support Services:

24/7 emergency helpline. Remote diagnostics via VPN. On-site engineer response within 24-48 hours. Spare parts inventory for pump seals and instruments.

WHY CHOOSE ALTFORT PROJECTS

- **Technical Expertise:** Qualified engineers with Pharma/F&B experience. In-house design using AutoCAD, SolidWorks, PV Elite.
- **Manufacturing Excellence:** ASME certified facility. Advanced welding (GTAW/GMAW /SAW). In-house NDT lab.
- **Project Management:** Structured execution. Transparent reporting. On-time delivery.
- **Lifecycle Support:** Commissioning, Validation, and Operator training programs.

CONTACT & RFQ INQUIRIES

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Rfq Information Required :

Product characteristics, soil type, volume scope, utility availability (Steam/Power/Water), site constraints, regulatory standards (GMP/FDA), project timeline, and budget range.

Quality Policy Statement

"Altfort Projects is committed to delivering engineered process equipment solutions that exceed customer expectations through technical excellence, manufacturing precision, and adherence to international quality standards. We continuously Improve our design methodologies, fabrication processes, and service delivery to maintain our position as a trusted partner for CIP systems and sanitary process equipment."

PROUD SUPPORTER OF MAKE IN INDIA