

The Zero-Guesswork Specification Framework

The 7-gate specification discipline LibertyCES runs before any chemical or high-purity fluid-handling equipment gets selected — not a marketing phrase, an actual document trail.

INTRODUCTION

"We Need to Pump This Chemical" Is Not a Specification

A facility with thousands of chemical-handling applications cannot afford to answer any of them with "it's approximately this." The real question is always more specific: what chemical, at what concentration, at what temperature, what purity, what solids, what vapor behavior, what wetted material, what elastomer, what pump type, what happens during deadhead, what happens during dry run, what happens if the pipe leaks, how is the leak detected, and what shuts the system down.

The cost asymmetry is real. A \$400 valve can sit inside a system supporting millions of dollars of production. A \$20 O-ring can be the only incompatible material in an otherwise perfectly engineered assembly. A missing \$1,000 protection device can let a \$7,000 mag-drive pump destroy itself repeatedly. Guesswork on a small line item becomes a six- or seven-figure operational problem.

The Zero-Guesswork Specification Framework is the 7-gate process that closes that gap before equipment is ever ordered — not after it fails.

THE SEVEN GATES

Every application closes all seven before equipment selection

Fluid, Hydraulic, Material, Purity

GATE 01 – FLUID SPECIFICATION

What is actually in the liquid?

Exact chemical name, concentration, contaminants, temperature range (normal / min / max), specific gravity, viscosity, solids (concentration, particle size, abrasiveness), vapor behavior (off-gassing, entrained gas), required purity tier, required wetted-material compatibility, and process hazard classification. "No solids expected" and "solids unknown" are never treated as the same answer.

GATE 02 – HYDRAULIC SPECIFICATION

What is the real operating envelope?

Minimum, normal, and maximum flow; required discharge pressure; static head; pipe diameter and length; fittings and valves; elevation change; available and required NPSH; suction condition (flooded vs. lift); operating turndown; maximum shutoff pressure; minimum-flow requirement. Equipment gets selected for the system operating envelope, not because a catalog maximum happens to clear the target flow.

GATE 03 – MATERIAL SPECIFICATION

Every wetted component, named explicitly

Pump casing, impeller, shaft, bushings, O-rings, valve seats, diaphragms, tubing, pipe, fittings, tank, instrument wetted parts, sensor bodies, flowmeter liner/electrodes, injection fittings. One unexamined elastomer can be the weak link in a million-dollar system.

GATE 04 – PURITY SPECIFICATION

For high-purity and semiconductor-grade service

Required material grade, extractables requirements, metallic and particle contamination limits, surface quality, packaging standard, cleanroom requirement, fusion/joining qualification, operator certification, traceability, flush procedure, acceptance testing, and water-quality release criteria.

Containment, Instrumentation, Controls

GATE 05 – CONTAINMENT SPECIFICATION

If it fails, where does it go?

Single vs. dual containment, carrier and containment pipe material, annular-space design, leak detection method (discrete-point vs. continuous cable), slope, drain location, valve-box containment, penetrations, expansion allowance, supports, inspection access, and the required response when leakage is detected.

GATE 06 – INSTRUMENTATION SPECIFICATION

Every instrument closes a specific failure mode

Flow, pressure, differential pressure, level, low-low level, temperature, conductivity, resistivity, pH, ORP, leak detection, motor/pump power monitoring, vibration, tank overflow, chemical concentration. Instrumentation is selected because it closes an identified failure mode — not because a template said to add it.

GATE 07 – CONTROLS SPECIFICATION

The control narrative, not just the instrument list

Automatic vs. manual operation, PLC requirement, plant network, analog/digital I/O, communication protocol, permissives, interlocks, alarm levels, fail positions, duty/standby sequencing, emergency shutdown, restart logic, historian requirement, remote monitoring. A P&ID with instruments but no defined control narrative is incomplete.

Gates 01-07 apply in sequence but inform each other — a Purity Gate answer can change the Material Gate answer, and a Containment Gate answer can add a new line to the Instrumentation Gate. The framework is a discipline, not a form filled out once and filed away.

Unknowns Get Elevated, Not Hidden

Every proposal built from this framework carries an Assumption Register — a running list of what's confirmed and what isn't. Unknown information isn't a gap the proposal quietly works around. It's a line item somebody has to close before the equipment gets ordered.

ITEM	STATUS
Chemical concentration	Confirmed
Maximum temperature	Confirmed
Solids concentration	Unknown — customer confirmation required
NPSHa	To be calculated
Elastomer	Pending chemical compatibility review
Hazardous classification	Owner to provide
Discharge pressure	Confirmed

A cheaper pump that repeatedly runs dry, cavitates, loses prime, spills chemical, or trips a process is not cheaper. The Assumption Register is what keeps a proposal honest about what's actually been checked before that pump gets ordered.

The Zero-Guesswork Equipment Tag

Every major chemical equipment tag gets one of these attached — a single-page record that makes every protection decision explicit and traceable back to a real approval, not a default.

TAG	P-4201A/B
SERVICE	Fluoride Waste Transfer
FLUID	Owner-confirmed composition
NORMAL FLOW	---
MAXIMUM FLOW	---
TDH	---
TEMPERATURE	---
SPECIFIC GRAVITY	---
VISCOSITY	---
SOLIDS	---
NPSHa	---
PUMP TECHNOLOGY	---
WETTED MATERIAL	---
ELASTOMER	---
CONTAINMENT	---
POWER MONITOR	Required / Not Required
LOW-LEVEL INTERLOCK	Required / Not Required
FLOW CONFIRMATION	Required / Not Required
PRESSURE MONITORING	Required / Not Required
LEAK DETECTION	Required / Not Required

CONTROL RESPONSE	---
ASSUMPTIONS	---
CUSTOMER APPROVAL	---

Run This on Your Next Application

LibertyCES runs this framework on every chemical and fluid-handling application before equipment gets recommended — a documented answer, not a catalog guess. For a spec review on a real application, call, text, or email James directly.

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