



INFANT FORMULA

**Powder & liquid
processing systems.**

Precision from the first ingredient
to the finished pack.



Engineer the process. Protect the specification.

Ingredient handling • Precision dosing • Mixing & homogenization
Thermal processing • Drying & instantization • Filling & inspection

Powder hygiene and liquid commercial sterility require different process strategies.

One group.
Connected process expertise.
Build the line around the formula.
Powder and liquid routes. Defined equipment roles.



INGREDIENT HANDLING & DOSING

Receiving, storage, enclosed transfer and controlled major- and minor-ingredient additions.



POWDER CONDITIONING

Application-specific milling or deagglomeration where required, with particle properties and hygiene protected.



MIXING & PREPARATION

Dry blending, premixing and liquid preparation. Select mixer action, working volume and cleaning access for the recipe.



DISPERSION & HOMOGENIZATION

Powder incorporation, high-shear dispersion, emulsification and homogenization for suitable liquid formulations.



DRYING SYSTEMS

Spray-drying integration and application-specific drying duties. Define instantization interfaces and powder properties.



SPECIALIST EXTRUSION

Relevant to selected upstream ingredient projects; not a standard step in finished infant formula production.



FILLING & PACKAGING

Powder filling and packaging configurations. Define liquid packaging and aseptic interfaces within the project scope.



INSPECTION

Metal detection and checkweighing selected for the product, package and agreed inspection requirements.



PROC-X ENGINEERING

Connect the process, utilities, controls, hygienic design and acceptance criteria.
 Confirm specialist thermal, aseptic and fluid-bed modules within the agreed scope.

An integrated line begins with a defined process.

Equipment selection supports the manufacturing system; it does not replace product validation or regulatory responsibilities.

Choose the production route.

Different routes. One defined product specification.

Wet-process powder • Dry blend • Hybrid • Liquid

01

WET-PROCESS POWDER

Prepare the liquid formulation, apply validated heat treatment, concentrate as required, spray dry and cool. Add instantization where specified, then pack under controlled hygienic conditions.



02

DRY-BLENDED POWDER

Receive qualified, released powdered ingredients; weigh, premix, blend and pack. Blending provides no microbial kill step: supplier controls and contamination prevention are essential.



03

HYBRID POWDER PROCESS

Produce a wet-processed, dried base, then add selected ingredients by controlled dry blending. Verify addition accuracy, uniformity and hygienic protection after the heat-treatment stage.



04

LIQUID FORMULA

Prepare and homogenize the formulation as required. Achieve commercial sterility through a validated UHT-and-aseptic route or an appropriate in-container sterilization process.



THE PROC-X ANSWER

Select the route around ingredient characteristics, nutrient stability, output, utilities, packaging and validation requirements. Define specialist thermal and aseptic systems within the project scope.



Powdered infant formula is not sterile.

Drying and instantization do not establish sterility. Liquid commercial sterility requires a validated product-and-package process.

Quality starts at receiving.

**Qualify the ingredient.
Protect every transfer.**

Powders • Oils • Liquid ingredients • Micronutrients

01

QUALIFY & RELEASE

Define approved suppliers, ingredient specifications, verification and release procedures. Confirm identity, lot traceability and microbiological suitability for the intended process route.



02

MATCH THE RECEIVING SYSTEM

Select bag tipping, bulk-bag unloading, silo or liquid receiving systems for the ingredient. Control foreign-material entry, dust and exposure during connections and unloading.



03

STORE WITH CONTROL

Maintain specified temperature, humidity and storage time. Segregate quarantined and released materials, manage allergens, and use stock rotation with clear lot identification.



04

TRANSFER WITHOUT COMPROMISE

Choose enclosed pneumatic, screw or liquid transfer for product behavior and hygiene. Limit segregation, moisture pickup and unnecessary handling; verify line clearance and cleanability.



THE PROC-X ANSWER

AIS connects receiving, storage, conveying and dosing. Proc-X defines interfaces, zoning, cleaning access and traceability requirements around the formula.



Ingredient control is part of the safety strategy.

Dry blending has no microbial kill step. Incoming-material controls and contamination prevention remain essential.

Every addition matters.

**Precision dosing.
Controlled micronutrient premixing.**

Major ingredients • Minor additions • Vitamins & minerals

01

DEFINE THE ADDITION

Verify ingredient identity, released lot and approved recipe. Account for potency and moisture basis where applicable; establish target weights and tolerances for each addition.



02

DOSE AT THE REQUIRED SCALE

Match feeders and weighing systems to actual addition quantities. Verify accuracy, repeatability, refill behavior and complete discharge under production conditions.



03

BUILD A CONTROLLED PREMIX

Use a suitable carrier and validated addition sequence to distribute low-dose ingredients. Select mixer action, working volume and mixing time around the formulation.



04

VERIFY THROUGH TRANSFER

Confirm additions and batch reconciliation. Evaluate premix uniformity, recovery, segregation and carryover through discharge and transfer into the main batch.



THE PROC-X ANSWER

AIS integrates controlled dosing and ingredient tracking. QuantumX supports premixing and final blending, with process verification defined around the formula.



A precise weight does not prove a uniform blend.

Verify dosing performance and ingredient distribution separately, using appropriate sampling and analytical methods.

Condition the powder. Choose the mixing action.

**Protect particle structure.
Build a uniform blend.**

01

CONDITION ONLY WHERE REQUIRED

Use screening, deagglomeration or milling only when justified by the ingredient and process. Define particle-size targets, temperature limits and hygienic handling.



02

RIBBON & PADDLE MIXING

Evaluate ribbon and paddle designs for the formulation, fill range and required mixing intensity. Assess minor-ingredient distribution, discharge recovery and cleanability.



03

PLOW & SPECIALIST MIXING

Consider plow mixers where more intensive mixing or controlled liquid addition is justified. Evaluate conical-screw or tumble designs for suitable gentle-blending duties.



04

VERIFY THE COMPLETE BATCH

Use representative trials to confirm uniformity, particle integrity and discharge behavior. Evaluate segregation during transfer and packing, not only inside the mixer.



THE PROC-X ANSWER

DP supports application-specific powder conditioning. QuantumX selects mixing action and equipment configuration around the formula, hygiene needs and verified process performance.

DP

QuantumX

Preserve the structure created by instantization.

Unnecessary milling or excessive shear can damage agglomerates and alter flow, wetting and reconstitution behavior.

Build a consistent liquid feed.

**Controlled wet mixing.
Complete hydration. Prepared oil phase.**

01

CONTROL WATER & CHARGING

Use water meeting the defined process specification. Verify ingredient release, addition sequence and batch quantities. Control charging to limit lumps, dust and entrained air.



02

HYDRATE & DISSOLVE

Match temperature, mixing intensity and hold time to each ingredient. Confirm hydration or dissolution before the next addition, while controlling total processing time.



03

PREPARE THE OIL PHASE

Condition oils and incorporate permitted oil-soluble components according to the approved formulation. Control temperature, exposure and transfer to protect ingredient quality.



04

COMBINE & VERIFY THE FEED

Introduce the prepared phases under controlled mixing. Check solids, pH, viscosity and consistency before downstream homogenization, heat treatment or concentration.



THE PROC-X ANSWER

QuantumX preparation vessels and mixers integrate with AIS dosing and EmulXion dispersion systems. Proc-X defines charging, transfer, temperature control and cleaning interfaces around the formulation.



Mixing prepares the formulation. It does not sterilize it.

Define holding conditions and validated downstream microbial controls for the selected production route.

Engineer the dispersion. Control the air.

**Emulsification, homogenization
& air management.**

01

BUILD THE EMULSION

Bring prepared oil and aqueous phases together under controlled conditions. Select high-shear dispersion for the formulation, addition sequence and required initial droplet distribution.



02

DEFINE HOMOGENIZATION DUTY

Evaluate pressure, stages, temperature and throughput through product trials. Confirm droplet-size distribution and emulsion stability within the complete process route.



03

MANAGE ENTRAINED AIR

Limit air pickup during charging and transfer. Evaluate vacuum mixing or deaeration where justified to control foam, filling behavior and oxygen exposure.



04

VERIFY DOWNSTREAM STABILITY

Assess creaming, sedimentation, viscosity and oxidation indicators after the selected heat treatment. For powder routes, also evaluate drying and reconstitution performance.



THE PROC-X ANSWER

EmulXion supports high-shear dispersion and high-pressure homogenization. QuantumX preparation systems and Proc-X engineering connect mixing, air management and downstream process interfaces.



EmulXion | Dispersion & homogenization

Homogenization does not replace hydration or sterilization.

Set each operation around its specific duty and validate performance through the full product-and-package process.

Validate the heat step. Protect what follows.

Thermal treatment & microbial control for powdered formula.

01

DEFINE THE MICROBIAL CONTROL

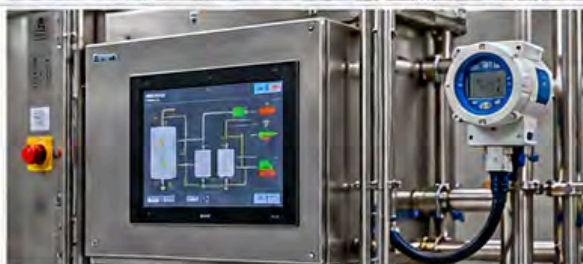
Assess ingredient and process hazards. Establish a validated heat treatment for the actual liquid formulation, target organisms and operating conditions before drying.



02

MONITOR CRITICAL CONDITIONS

Define time, temperature, flow and other critical factors through validation. Use calibrated instruments, recorded controls and defined handling of process deviations.



03

PROTECT NUTRIENT & PRODUCT QUALITY

Evaluate cumulative heat exposure, nutrient retention, protein functionality and emulsion stability. Confirm performance through concentration, drying and reconstitution.



04

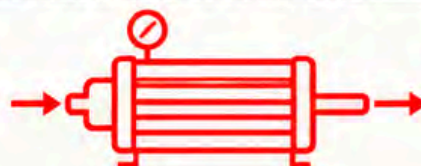
PREVENT RECONTAMINATION

Protect downstream equipment, drying air, powder transfer and packing. Control post-heat additions through qualified ingredients, hygienic handling and verification.



THE PROC-X ANSWER

Proc-X coordinates preparation, thermal-process interfaces, drying and hygienic transfer. Define specialist heat-treatment equipment and validation responsibilities within the agreed scope.



Powdered infant formula is not sterile.

A validated upstream heat step does not make the finished powder sterile. Spray drying and instantization are not substitutes for microbial control.

From liquid feed to engineered powder.

Concentration, spray drying & controlled cooling.

01

DEFINE THE FEED CONDITION

Set feed solids, viscosity, temperature and emulsion consistency. Evaluate concentration where appropriate, accounting for thermal exposure, fouling and nutrient stability.

02

CONTROL ATOMIZATION & DRYING

Match atomization, feed rate and drying-air conditions to the formulation. Verify powder moisture, particle structure and product quality across the operating range.

03

FINISH DRYING & COOL

Integrate secondary drying and cooling where required. Define drying-air quality, fines handling and downstream interfaces to protect hygiene and powder properties.

04

VERIFY THE POWDER SPECIFICATION

Evaluate moisture, water activity, bulk density, particle-size distribution, surface fat and reconstitution. Confirm results after subsequent instantization, blending and packaging.



THE PROC-X ANSWER

ThermoFlow supports spray-drying integration. Proc-X connects feed preparation, concentration, drying, cooling and protected transfer, with specialist modules and acceptance criteria defined in the project scope.



Drying develops powder properties. It does not establish sterility.

Validate upstream microbial controls and prevent contamination throughout drying, cooling and downstream handling.

Engineer reconstitution.

Instantization, agglomeration & controlled wetting.

01

DEFINE RECONSTITUTION TARGETS

Set measurable targets for wetting, sinking, dispersion, lump formation and sediment. Assess performance under the intended preparation conditions and through shelf life.



02

BUILD POROUS AGGLOMERATES

Evaluate integrated spray-dryer agglomeration or a suitable fluid-bed route. Control fines return, liquid addition where used, drying and cooling to obtain the required structure.



03

EVALUATE SURFACE TREATMENT

Where formulation and regulatory requirements permit, evaluate lecithination or other suitable treatments. Confirm the effect on wetting, stability and ingredient specifications.



04

PRESERVE THE FINISHED STRUCTURE

Limit attrition during conveying, blending and filling. Verify particle size, bulk density, moisture and reconstitution after handling and in the finished pack.



THE PROC-X ANSWER

Proc-X connects drying, agglomeration, cooling and protected transfer. Define ThermoFlow drying interfaces, specialist fluid-bed modules and downstream handling around verified powder performance.



Instantization improves powder behavior. It does not sterilize it.

Improved wetting and dispersion do not make every component soluble. Maintain validated microbial controls and hygienic protection.

Protect the final formulation.

Sensitive additions, final blending & protected transfer.

01

QUALIFY POST-DRYING ADDITIONS

Add selected heat-sensitive ingredients only where permitted by the approved formulation. Confirm identity, potency, microbiological specifications and suitability for addition after the heat step.



02

CONTROL DOSE & DISTRIBUTION

Use accurate weighing and a validated premix strategy where needed. Define addition sequence, working volume and mixing time to distribute minor ingredients throughout the batch.



03

BLEND WITHOUT DAMAGING STRUCTURE

Select mixing action for uniformity while limiting attrition of instantized powder. Evaluate particle integrity, bulk density and reconstitution after the final blend.



04

PROTECT TRANSFER TO PACKING

Use enclosed, cleanable transfer with controlled exposure. Verify discharge recovery, segregation and carryover, and maintain lot traceability through filling.



THE PROC-X ANSWER

AIS supports controlled additions and ingredient tracking. QuantumX supports final blending. Proc-X connects dosing, mixing, transfer and packaging around verified product requirements.



Every post-heat addition needs its own control strategy.

These ingredients may receive no subsequent microbial reduction step. Protect their quality and prevent contamination through packing.

Protect the powder through the final pack.

Hygienic filling, sealing & inspection.

01

CONTROL THE FILLING ENVIRONMENT

Define hygienic zoning, air quality and exposure controls around filling. Use cleanable product-contact parts and controlled transfer to limit contamination and powder damage.



02

MATCH FILLER & PACKAGE

Select filling equipment for powder flow, bulk density, fill target and pack format. Evaluate can, tub or pouch compatibility, changeover and product recovery.



03

VERIFY SEALS & PRODUCT PROTECTION

Confirm seams or seals, closure integrity and barrier performance. Where specified, validate gas flushing and residual oxygen targets against shelf-life requirements.



04

INSPECT, IDENTIFY & RECONCILE

Verify fill weight, label, lot code and reject handling. Select foreign-material inspection for the product and package; reconcile packed output to the batch record.



THE PROC-X ANSWER

PreciXion configures powder filling and packaging. InspeX supports metal detection and checkweighing. Proc-X defines inspection locations and specialist checks around the package and process.



Pack weight is one check. Product release requires more.

Checkweighing does not demonstrate nutrient uniformity or microbiological quality. Use defined sampling, testing and release procedures.

Build stability into liquid formula.

Preparation, heat compatibility & finished-product performance.

01

DEFINE THE LIQUID FORMAT

Establish the approved formulation and intended format: ready-to-feed or liquid concentrate. Specify solids, viscosity, pack size and the intended storage conditions.



02

CONTROL INGREDIENT INTERACTIONS

Manage hydration, oil incorporation, mineral addition, pH and mixing sequence. Evaluate protein stability, emulsion behavior and air pickup before thermal processing.



03

TRIAL THE COMPLETE HEAT CYCLE

Assess the formulation using the selected sterilization route. Evaluate fouling, coagulation, viscosity change, color and nutrient retention under representative processing conditions.



04

CONFIRM PACKED-PRODUCT STABILITY

Check creaming, sedimentation, gelation, flavor and nutrient specifications through the intended shelf life. Verify compatibility with the final package and storage conditions.



THE PROC-X ANSWER

QuantumX and EmulXion support preparation, mixing and homogenization. Proc-X coordinates formulation trials and interfaces with specialist sterilization and packaging systems.



Evaluate the product after processing—not only in the mixing tank.

Physical stability and commercial sterility require separate verification within the complete product-and-package system.

Liquid sterilization. Aseptic protection.

**Validate the product, sterile path
& package together.**

01

DEFINE THE VALIDATED UHT PROCESS

Select direct or indirect heating for the formulation and duty. Have a qualified process authority establish the scheduled process and critical factors for the actual product and equipment.



02

ESTABLISH & MAINTAIN THE STERILE PATH

Validate equipment sterilization before production. Protect downstream cooling, any aseptic holding and transfer through controlled barriers, utilities and monitored operating conditions.



03

INTEGRATE ASEPTIC FILLING

Validate package and closure treatment, the filling environment and sealing. Maintain the aseptic boundary from treated product to the hermetically sealed pack.



04

CONTROL DEVIATIONS & RELEASE

Record critical conditions and define responses to loss of control. Apply validated restart procedures, product segregation, package-integrity checks and documented release criteria.



THE PROC-X ANSWER

Proc-X connects preparation and homogenization with specialist UHT and aseptic packaging systems. Define equipment responsibilities, sterile interfaces, utilities, controls and validation deliverables at project outset.



A UHT unit alone does not establish commercial sterility.

The validated thermal process, sterile downstream system and hermetic package must function together.

Sterilize in the final container.

Validated retort processing & package integrity.

01

MATCH FORMULA, PACKAGE & RETORT

Select a compatible container, closure and retort system. Assess product viscosity, fill quantity, headspace and thermal stability as part of the complete process design.



02

VALIDATE HEAT DISTRIBUTION & PENETRATION

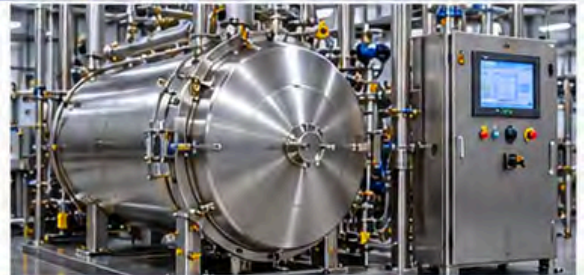
Have a qualified process authority establish the scheduled process. Evaluate retort heat distribution and product heat penetration for the actual formulation, package and load pattern.



03

CONTROL THE FULL CYCLE

Monitor the defined critical factors through heating, holding and cooling. Control cooling-water quality and pressure where required to protect the container and closure.



04

VERIFY INTEGRITY & RELEASE

Check closure performance, leaks and container condition after processing. Review cycle records, deviations and defined product-release checks; confirm quality through shelf life.



THE PROC-X ANSWER

Proc-X connects formulation preparation and filling with specialist retort systems. Define package compatibility, thermal validation, utilities, handling and acceptance criteria within the project scope.



Commercial sterility depends on the validated product-and-package process.

Retort settings cannot be transferred between formulas, containers or load patterns without technical assessment and appropriate validation.

Design hygiene into every boundary.

Zoning, cleaning, SIP & environmental monitoring.

01

SEPARATE HYGIENIC ZONES

Define personnel, material and waste flows. Protect post-heat powder areas and aseptic boundaries with appropriate access, airflow, moisture and maintenance controls.



02

MATCH CLEANING TO THE PROCESS

Use validated dry or wet cleaning methods for the equipment and soil. Control water introduction in dry areas; verify drying before powder production resumes.



03

DISTINGUISH CIP FROM SIP

Cleaning-in-place removes residues. Sterilization-in-place establishes required microbial control in suitable closed systems. Validate each cycle and maintain the protected state before operation.



04

MONITOR, INVESTIGATE & VERIFY

Use a risk-based environmental monitoring program with defined sampling sites, trends and corrective actions. Investigate adverse findings and verify corrective measures before restart or release as applicable.



THE PROC-X ANSWER

Proc-X defines hygienic interfaces, cleaning access, drainability where required, utilities and control requirements. Coordinate cleaning and sterilization validation with the facility quality team and specialist suppliers.



A clean appearance does not verify microbial control.

Use documented procedures, validated methods and appropriate verification. Environmental monitoring complements preventive controls and product testing.

Connect the complete production line.

**Four example routes.
Product-specific engineering.**

01

WET-PROCESS INSTANT POWDER

Ingredient dosing; wet preparation and homogenization as required; validated heat treatment; concentration where appropriate; spray drying and agglomeration; cooling; protected transfer; filling and inspection.



02

HYBRID POWDER WITH FINAL ADDITIONS

Wet-processed dried base; qualified post-drying ingredients; precision dosing and premixing; final blending; enclosed transfer; powder filling, sealing and inspection.



03

UHT & ASEPTIC LIQUID FORMULA

Ingredient dosing; hydration and blending; homogenization in the validated process arrangement; UHT treatment; sterile cooling and transfer; aseptic filling and hermetic sealing.



04

RETORTED LIQUID FORMULA

Formulation preparation and homogenization as required; controlled filling and hermetic sealing; validated in-container sterilization; controlled cooling; package inspection and documented release.



THE PROC-X ANSWER

Connect AIS dosing, QuantumX mixing, EmulXion dispersion, ThermoFlow drying, PreciXion packaging and InspeX inspection with the specialist modules required for the selected route.

Confirm scope, hygiene boundaries, utilities, controls and acceptance criteria before equipment selection.



One route does not fit every formulation.

Confirm AIS processing sequence and critical factors through application review, trials and appropriate validation.



MANUFACTURING GROUP

Define acceptance. Demonstrate performance. Trials, validation & documented handover.



01

TRIAL THE ACTUAL FORMULA

Use representative ingredients and the intended processing route. Evaluate dosing, mixing, thermal exposure, drying or liquid stability, transfer and packaging against agreed specifications.



02

VERIFY NUTRIENTS & PRODUCT QUALITY

Use appropriate analytical methods and sampling plans to assess nutrient composition, uniformity and retention. Confirm reconstitution or liquid stability through the intended shelf life.



03

SEPARATE VALIDATION FROM ACCEPTANCE TESTING

Agree FAT and SAT criteria for equipment operation, output, utilities and controls. Define separate validation protocols for microbial controls, cleaning and the product-and-package process.



04

DELIVER THE ENGINEERING PACKAGE

Document the design basis, general arrangement, P&ID, equipment specifications, utilities, control philosophy, test records, cleaning procedures, training and maintenance requirements.



THE PROC-X ANSWER

Set measurable acceptance criteria and clear validation responsibilities at project outset. Connect equipment suppliers, process specialists and the manufacturer's quality team through a documented execution plan.



Equipment acceptance is one part of manufacturing readiness.

Product release also depends on validated controls, appropriate testing, complete records and applicable infant formula requirements.



MANUFACTURING GROUP

Your formula. Our process expertise.

**From the first ingredient
to the finished pack.**

Bring us your formulation, production target and packaging requirements. Together, we define the process, connect the equipment and establish measurable acceptance criteria.



QuantumX

EmulXion

DP

AIS

FuXion

ThermoFlow

InspeX

PreciXion



OFFICES & REGIONAL PRESENCE

United States — Kansas City • Phoenix
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