



NanoDose™ Flocculant Dosing Kit

Automated alum make-up, storage and proportional dosing skid for coagulation, flocculation and iron-removal duty — model NDK-100.

100 L

Make-up & dosing tank capacity

0.37 kW

Peripheral recirculation pump duty

≤10 L/h

Etatron PKX dosing range @ up to 6 bar

AUTO

Continuous recirculation & in-line dosing

01 Overview

The NanoDose™ Flocculant Dosing Kit is a self-contained chemical make-up and dosing skid built to prepare, hold and continuously proportion an aluminium sulphate (alum) coagulant solution into a raw water stream ahead of storage, clarification or filtration.

- Combines a 100 L chemical make-up/day tank, an Etatron PKX solenoid-diaphragm metering pump, and a 0.37 kW peripheral pump feeding a NanoJet EcoShear™ Tank, Pool & Pond mixing nozzle mounted inside the tank.
- The recirculation loop keeps the alum solution fully mixed and in suspension, while the Etatron PKX pump draws a precise, adjustable dose and injects it in-line into the raw water, ahead of the main process or storage tank.
- Where the duty is iron (and/or manganese) removal from borehole water, this sheet also covers the recommended pH range, oxidation requirement, and the NanoJet™ FUSION™ Borehole Pressure-Boost Kit used as the preferred oxidation mechanism ahead of dosing (Section 6).

02 System Configuration

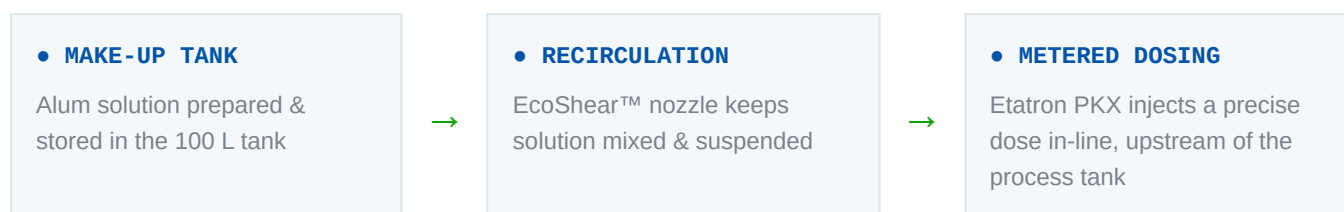
100 L Make-Up / Day Tank	Chemical-resistant polyethylene tank that holds and stores the mixed alum solution, sized for a full duty/standby dosing cycle between refills.
Etatron PKX Dosing Pump	Solenoid-diaphragm metering pump that draws alum solution from the tank and injects it in-line into the raw water stream at a precisely controlled, adjustable rate.
0.37 kW Peripheral Pump	Continuously recirculates the tank contents through the NanoJet EcoShear™ nozzle to keep the alum in solution and uniformly mixed.

NanoJet EcoShear™ Nozzle

Venturi-type mixing/eductor nozzle mounted inside the tank; converts the recirculation pump's discharge into a combined high-shear jet at the nozzle throat and a gentle bulk rolling flow through the tank body (see Section 7).

03 How the System Works

Raw alum is made up in the day tank and kept continuously in solution while a precise dose is drawn off and injected in-line into the incoming raw water.



- The 0.37 kW peripheral pump draws from the base of the tank and returns flow through the NanoJet EcoShear™ nozzle, continuously agitating the full tank volume — preventing sedimentation or crystallisation and keeping the concentration uniform.
- The Etatron PKX pump draws directly from the recirculating tank and doses into the raw water pipeline, upstream of the main process/storage tank, allowing in-line mixing and reaction time before the next process stage.
- Coagulation and flocculation of the raw water's suspended solids, colour and (where applicable) oxidised iron floc then proceed in the pipeline and downstream tankage — see Sections 4–7.

Commissioning note

Dosing rate is raw-water specific. Cape WaterTech recommends jar testing (or on-site trial dosing) to establish the optimum alum dose (mg/L) and confirm pH response for each site before final commissioning.

04 The Chemistry of Alum — Coagulation & Flocculation

Chemical identity

The coagulant referred to commercially as “alum” is **aluminium sulphate**, $\text{Al}_2(\text{SO}_4)_3 \cdot 14\text{--}18\text{H}_2\text{O}$ — not aluminium *sulphide*. Aluminium sulphide (Al_2S_3) is an unrelated, water-reactive compound that decomposes on contact with water to release hydrogen sulphide (H_2S) gas, and has no role in coagulation. Please specify “aluminium sulphate, technical/water-treatment grade” on purchase orders and SDS requests.

Dissolution & hydrolysis. When alum dissolves, it dissociates into aluminium (Al^{3+}) and sulphate (SO_4^{2-}) ions. The small, highly charged Al^{3+} ion is unstable in water and hydrolyses rapidly, stepping through a series of soluble hydroxo-aluminium species before condensing into an insoluble, amorphous aluminium hydroxide ($\text{Al}(\text{OH})_3$) floc. This reaction consumes natural alkalinity and releases hydrogen ions — the

reason alum dosing depresses pH, and one more reason accurate pH control (Section 5) matters on iron-removal duty.

Charge neutralisation (coagulation). Raw-water turbidity, colour and clay/silt colloids are almost always negatively charged and stay in suspension because mutual electrostatic repulsion keeps particles apart. The positively charged aluminium hydrolysis species adsorb onto these particle surfaces and neutralise that charge, collapsing the repulsive barrier so short-range attractive forces can pull particles together — this destabilisation step is coagulation proper.

Sweep flocculation. At the dose rates typically used in water treatment, the bulk of the aluminium hydroxide precipitates as a voluminous, gelatinous floc that physically enmeshes and “sweeps” destabilised colloids, organics and fine solids out of suspension as it settles. This sweep-floc mechanism, more than charge neutralisation alone, is usually the dominant removal pathway at normal dosing rates.

Optimum pH window. Because both the hydrolysis chemistry and the solubility of $\text{Al}(\text{OH})_3$ are strongly pH-dependent, alum only forms a strong, settleable floc within a defined band — typically around pH 5.8–7.2. Below this range aluminium tends to stay dissolved rather than precipitate; above roughly pH 8 the hydroxide can redissolve as soluble aluminate. Site-specific jar testing is recommended to confirm the optimum dose and pH for each raw water source.

05 Application Note: Iron (Fe) Removal from Borehole Water

Borehole and groundwater iron is almost always present as soluble ferrous iron (Fe^{2+}), often complexed with bicarbonate. It is essentially colourless at the point of abstraction and only becomes visible as rust-coloured stain once exposed to atmospheric oxygen. Removing it requires two sequential steps: oxidising the soluble Fe^{2+} to insoluble ferric iron (Fe^{3+}), then precipitating, flocculating and filtering the resulting ferric hydroxide floc.



Recommended pH range: 7.0–8.5. This oxidation reaction is strongly pH-dependent — the rate accelerates sharply as pH rises, and becomes impractically slow under mildly acidic or near-neutral raw water, particularly where iron is organically complexed. Cape WaterTech recommends correcting raw water into the 7.0–8.5 pH band ahead of, or during, oxidation. This gives fast, reliable Fe^{2+} oxidation while avoiding the scaling and aluminate-solubility issues that appear above roughly pH 8.5, and keeps the water within the effective coagulation band once alum is dosed downstream (Section 4). pH correction is typically achieved with a small dose of alkali (e.g. soda ash or caustic soda), available as an optional add-on dosing skid alongside the NanoDose unit.

Manganese, where present, commonly co-occurs with borehole iron and generally requires a somewhat higher pH and/or a stronger oxidant to remove reliably — see Section 6.

06 Oxidation Systems & the NanoJet™ FUSION™ Borehole Pressure-Boost Kit

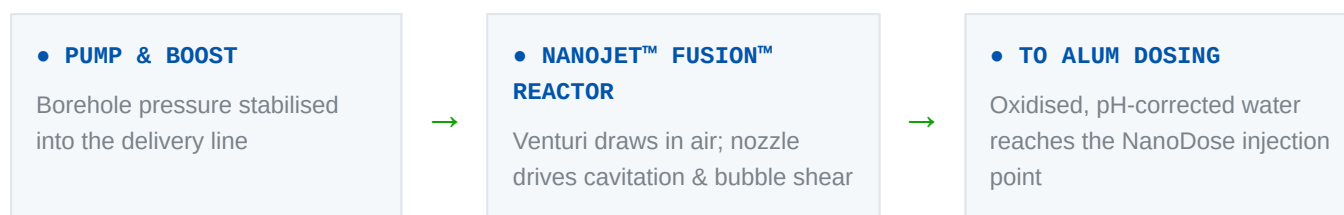
Once pH is corrected, ferrous iron must be oxidised before alum is dosed and the water enters the contact/settling tank. Two oxidation routes are available ahead of the NanoDose unit:

STANDARD – ATMOSPHERIC AIR

- For straightforward ferrous loads — as a guideline, below roughly 5–7 mg/L, without significant organic complexation or manganese — oxidation using entrained atmospheric air through a turbulent contact reactor is normally sufficient.
- Lowest cost, lowest maintenance option: no compressed air, blower or chemical oxidant required.

ENHANCED – NANOJET™ FUSION™ (PREFERRED)

- For higher iron loads, co-occurring manganese, or organically-complexed iron that resists simple aeration, Cape WaterTech recommends the NanoJet™ FUSION™ Borehole Pressure-Boost Kit ahead of the NanoDose unit.
- Purpose-built turbulent reactor — the preferred mechanism whenever more oxidising power is needed than plain aeration can deliver.



- Boosts and maintains adequate, stable pressure into the delivery line, forcing water through a high-pressure NanoJet™ reactor nozzle.
- Dramatically increases flow velocity at the nozzle aperture, entraining atmospheric oxygen directly into the pipe and generating nano- and micro-bubbles for maximum gas–liquid contact.
- Creates cavitation and turbulence that begins oxidation and floc-forming mixing before the water even reaches the NanoDose alum injection point — giving the alum a head start once dosed.

REACTOR NOZZLE	APPLICATION FOCUS
● VORTEX™	General-purpose cavitation and mixing
● FUSION™ — recommended for iron removal	Enhanced oxidation and bubble generation
● CYCLONE™	High-shear turbulent flocculation

See the separate NanoJet™ Borehole Pressure-Boost Kits data sheet for full specification of the reactor unit.

High iron / manganese loads

Where raw water testing shows iron above roughly 10 mg/L, significant manganese, or strong organic complexation, a supplementary chemical oxidant dosing point (e.g. sodium hypochlorite or potassium permanganate) can be added ahead of the FUSION™ reactor. Contact Cape WaterTech for a site-specific recommendation.

07 How the NanoJet EcoShear™ Nozzle Enhances Flocculation

Classic flocculation practice uses two distinct mixing stages: a brief, high-energy *rapid mix* to flash-disperse coagulant and drive charge neutralisation, followed by a longer, gentle *slow mix* that lets destabilised particles collide and grow into larger, settleable flocs without tearing them apart. The velocity gradient (“G value”) needed for rapid mix is roughly an order of magnitude higher than for slow mix — and conventional plants use two separate pieces of equipment to deliver each stage.

The NanoJet EcoShear™ nozzle delivers both regimes from a single recirculating loop:

- **At the nozzle throat:** the constriction accelerates flow and drops local pressure, creating cavitation and fine shear — rapidly dispersing and dissolving fresh alum, and, on aeration duty, entraining and shearing air into micro-bubbles.
- **Through the tank body:** the jet's momentum drives a broad, rolling recirculation pattern across the full 100 L volume — a much lower, more uniform velocity gradient that mimics the gentle paddle-mixing classically used in flocculation basins, giving destabilised particles time to collide and grow into larger flocs without excessive shear breaking them apart.
- Because both regimes run continuously from one pump and one nozzle, the tank needs no separate rapid-mix and slow-mix stage — reducing footprint, moving parts and maintenance compared with a conventional flash-mixer/flocculator arrangement.

Performance note

Floc formation is a function of dose, pH, raw water chemistry and residence time as much as mixing energy. Cape WaterTech recommends jar testing to fine-tune dose and confirm floc formation on site.

08 Technical Specifications

100 L MAKE-UP / DAY TANK

Capacity	100 L nominal working volume
Construction	Chemical-resistant polyethylene (PE), UV-stabilised, with lockable lid and inspection port
Chemical held	Aluminium sulphate (alum) solution/slurry, technical or water-treatment grade
Level indication	Sight tube standard; float-switch low-level alarm/interlock optional
Mounting	Free-standing on skid/bund; wall-mounted bracket kit optional

ETATRON PKX DOSING PUMP

Type	Solenoid-driven diaphragm metering pump
Flow rate range	Model-dependent, up to approx. 10 L/h at rated pressure; sized to the site's calculated alum dose

Max. discharge pressure	Up to approx. 6 bar (model-dependent)
Control	Manual (0–100%) or proportional dosing — pulse/volumetric timer, 4–20 mA or pH/ORP-linked control available
Wetted parts	Pump head: PP or PVDF; diaphragm: PTFE; valves: FPM (Viton) standard, EPDM/PTFE optional
Power supply	230 V / 50 Hz standard (12 Vdc, 24 Vdc/Vac variants available)
Enclosure	Anti-acid plastic casing, IP65
Connections	4×6 mm dosing tube, standard suction/injection valve kit

0.37 kW PERIPHERAL RECIRCULATION PUMP

Motor rating	0.37 kW (0.5 HP), single-phase
Power supply	230 V ±10% / 50 Hz, ≈2.6 A
Pump type	Peripheral (regenerative turbine) — self-priming, suited to low-flow / high-head recirculation duty
Typical performance envelope	Up to ≈40 L/min (≈2.4 m³/h); max. head ≈33 m; max. pressure ≈10 bar (indicative for this pump class — confirm curve for the model fitted)
Enclosure	IP44
Duty	Continuous recirculation of tank contents through the NanoJet EcoShear™ nozzle

NANOJET ECOSHEAR™ NOZZLE

Type	Venturi/eductor-type Tank, Pool & Pond mixing nozzle
Function	Self-aspirating air entrainment at the throat; combined cavitation/shear zone and bulk tank recirculation (see Section 7)
Construction	Corrosion-resistant PVC/PP; no moving parts
Connection	Threaded/barbed, sized to match the 0.37 kW pump discharge

UTILITIES & SITE REQUIREMENTS

Electrical	Single-phase 230 V / 50 Hz supply for dosing and recirculation pumps
Chemical supply	Aluminium sulphate (alum), technical/water-treatment grade
Containment	Bunded area or drip tray recommended beneath the tank and pumps
Raw water tie-in	In-line dosing/injection point on the raw water pipeline, upstream of the process/storage tank

09 Standard Kit Contents & Options

STANDARD KIT INCLUDES

100 L polyethylene make-up/day tank with lid

Etatron PKX dosing pump with suction & injection valve kit

0.37 kW peripheral recirculation pump

NanoJet EcoShear™ mixing nozzle (in-tank)

Interconnecting tubing, fittings & mounting hardware

OPTIONAL EXTRAS

NanoJet™ FUSION™ Borehole Pressure-Boost Kit (recommended for iron removal)

pH correction dosing skid (soda ash / caustic soda)

Low-level float switch, alarm & pump interlock

Bunded tank base / drip tray

4–20 mA or pulse flow-proportional dosing control

Supplementary chemical oxidant dosing point (NaOCl / KMnO₄)

Dosing rates, pump sizing and oxidation duty are raw-water specific. Contact Cape WaterTech (Pty) Ltd with a raw water analysis for a site-specific recommendation and quotation.