



LOW-SHRINKAGE CORROSION-RESISTANT UHPC PREMIX

High strength & toughness (from UC120) | Low shrinkage (controlled natural curing) | High durability (chloride/marine) | Fiber Class II PF-UHPC-II | Standard T/CBMF 96-2020 / T/CCPA 20-2020

PRODUCT OVERVIEW AND BOUNDARIES

The Low-shrinkage Corrosion-resistant UHPC Premix ("the product") is a dry-mix engineering material based on high-belite calcium sulphoaluminate cement and/or high-free-lime belite sulphoaluminate clinker, slag and gypsum, with ultra-fine mineral powder, continuously graded fine aggregate and functional components, used together with metallic or non-metallic fibers. With the specified water, forced mixing, forming and curing, it produces UHPC with high strength, high toughness, low permeability and controlled shrinkage.

Positioning: select and manage as fiber-containing Class II UHPC premix (PF-UHPC-II), with fibers packed separately. The final designation, strength grade, tensile grade, permeability grade and workability grade follow the contract and the certificate of conformity.

Value area	Technical note
High strength	Default grade ≥UC120; optimized mixes reach 124–140 MPa at 28 d.
Toughness	Fiber bridging limits cracking; tensile/flexural performance set by fiber system and member loading.
Low shrinkage	Low w/b, optimized hydration and grading control volume change; natural-curing drying shrinkage targeted ≤300×10 ⁻⁶ .
Durability	Dense matrix slows chloride ingress; suited to marine, port, bridge and protection/strengthening use.
Placement fit	High-flow, low-viscosity design for thin walls, complex moulds and steel-UHPC composites; control flow path and fiber orientation.

Not directly suitable / requires special review: replacing designed concrete in load-bearing members without structural review; use in strong acid/alkali, high-temperature or special corrosive media before media testing; changing water, fiber dosage, admixtures or adding other powders on site; using free-fall mixers or plant that cannot safely disperse fibers; winter, hot or windy conditions without a temperature/moisture/curing plan.

MATERIAL SYSTEM AND MECHANISM

- Multi-scale densification: DSP-based continuous grading and low w/p reduce capillary porosity and connected pores.
- Low shrinkage & stability: the high-belite sulphoaluminate system and functional components control early hydration and drying shrinkage; "low" is not "zero" — reinforcement, bays and curing are still needed.
- Fiber toughening: fibers bridge micro-cracks and carry tension post-cracking; type, aspect ratio, dosage, orientation and dispersion strongly affect tensile/flexural/fracture behaviour — compression alone does not measure toughness.
- Corrosion resistance in context: from low permeability, low connected porosity and crack control that slow chloride/sulphate/moisture ingress; verify by project media and exposure — it is not maintenance-free against all media forever.

CLASSIFICATION, DELIVERY AND MARKING

Series	Colour / hydration	Main use	Selection focus
UHPC- II ·W	White/light; appearance-first	Panels, landscape, thin walls	Colour, whiteness, bubbles, mould fit
UHPC- II ·G	Grey; balanced	Bridges, joints, precast, strengthening	Workability, dispersion, strength, shrinkage
UHPC- II ·LH	Low-heat; controlled rise	Steel-UHPC decks, mass/continuous pours	Adiabatic rise, window, thermal curing
UHPC- II ·CR	Corrosion-enhanced	Ports, wharves, salt spray, deicing	Chloride diffusion, crack control, exposure

Note: these are recommended names for selection and do not replace the standard designation; the official grade, colour code and performance grades must be consistent across the label, contract, certificate and test report.

Component	Typical delivery	Site control
Dry premix	25 kg bags or 1000 kg jumbo; bulk by contract	Segregate grades/batches; reject damp/caked
Fibers	Sealed separately; by type, size, mass	Check material, size, mass; no rust/oil on steel fiber
Admixtures (if any)	Packed separately, batch and dosage stated	No swapping/overdosing; match premix batch
Documents	COA, instructions, batch test report	Check standard, date, net content, shelf life

The label and certificate shall include at least: product name, grade, official designation and colour; producer name/address, production date, batch, net content; standard number, shelf life, storage and precautions; fiber type, size, net mass and separate-pack identification; inspection status, certificate number and traceable quality records.

TECHNICAL REQUIREMENTS AND PERFORMANCE DATA

Basis: the "recommended delivery control values" below are the compliant expression used here. Where the contract sets a higher grade, the strictest of the contract, current standard and agreed method governs. Typical values are not an unconditional batch guarantee. Distinguish three kinds of information: standard requirement, company control value, typical measured value.



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Property	Unit	Recommended value	Typical range	Note
Appearance	—	Dry, even, no lumps; intact packs	Conforms	No visible steel-fiber rust
Spread	mm	≥600	760~890	Workability grade per standard/contract
Spread loss	mm	≤100	50~80	State the test time
Spread time	s	≤10	5~8	Plant, temperature, fiber sensitive
Uniformity	—	No dry clumps, bleeding or fiber balls	Conforms	Confirm by trial and observation

Property	Unit	Recommended value	Typical range	Note
28 d compression	MPa	≥120 (UC120)	124~140	100 mm cube; higher by contract
28 d flexure	MPa	≥18.0	19.5~26.5	Consistent specimen, span, curing
Axial tension	MPa	≥5.0 or by tensile grade	5.4~6.6; optimized ≈9.0	Dog-bone specimen and set loading
Elastic modulus	GPa	By contract; ≥40 suggested	48~70	Not a default works-test item
Drying shrinkage	×10 ⁻⁶	≤300	230~280	State start time and test age
Chloride diffusion	×10 ⁻¹² m ² /s	By grade; ≤0.06 suggested	0.02~0.04	Do not mix methods directly

Premises for stated performance: use the confirmed mix and matched fibers (no equal-mass substitution); water metering, mixing time and ambient temperature within the method statement; specimen forming, demoulding, curing and testing as contracted; typical ranges come from different binder systems and do not extend automatically to all colours and grades.

APPLICATIONS AND SELECTION

Field	Key indicators	Design / site note
Bridges / steel-UHPC	Comp., tension, flexure, shrinkage, chloride	Verify interface, stud/PBL, heat, continuity, fatigue
Precast joints / wet joints	Flow, early strength, bond/anchorage, shrinkage	Verify bar gaps, flow path, venting, curing window
Ports / salt spray	Chloride, crack width, abrasion, freeze-thaw	Cover, drainage, maintenance by exposure
Strengthening / protection	Bond, shrinkage, crack, thickness	Roughen, clean, SSD; pull-off if needed
Thin panels / décor	Flexure, tension, colour, surface	Matched release/mould; colour panel first
Blast / impact	Tensile strain, fracture energy, dynamics	Special design and full-scale/equivalent test

Selection advice: where both low shrinkage and durability matter, first fix the shrinkage test regime, chloride-diffusion grade, allowable crack width and curing method, then set the compressive grade; do not use a higher compressive grade as a substitute for durability design.

MIX AND APPLICATION

Reference starting mix: water/premix mass ratio 0.085; fiber ≈5%–11% of premix mass. These are trial starting points only, to be fixed by fiber type, target grade, temperature, plant and member verification. Never add water by experience on site.

Pre-conditions: a forced mixer with sufficient power and shear, with calibrated weighing; mixer, hoppers and transport clean and pre-wetted but without free water; confirm grade, batch, temperature, dosage and charging order of premix, fibers and admixtures; complete a plant trial, mould sealing, flow-path, venting and curing rehearsal; re-check workability if ambient/material temperature deviates from the trial.

Charging and mixing: (1) meter all water per the supplier, counting any reserved trim water within the approved total; (2) start the mixer, add the specified water and matched admixtures (if any), then add the premix evenly; (3) mix until fully wetted, continuously flowing, no dry clumps; (4) add fibers gradually and evenly to avoid "fiber balls", keeping the mixer running; (5) mix until fibers are dispersed and uniform — at least ≈5 min, governed by the trial-proven procedure; (6) check spread, temperature and appearance, then transport and place promptly.

Prohibited: no retempering after workability is lost; no unapproved water reducer, retarder, cement, sand or other powders; do not use caked or moisture-damaged material.

Control	Requirement	Risk
Continuous pour	Plan batch size and tempo to avoid cold joints	Stops create weak interfaces
Discharge	Multi-point, short flow, thin continuous placing	Long flow biases fiber orientation
Compaction	Light assisted vibration or per trial	Over-vibration segregates fiber/aggregate
Congested rebar	Prove passing with a clear mould/panel	Narrow gaps bridge and trap air
Curing	Cover/moist-cure at once; thermal regime by trial, no ad-hoc rate change	Early drying / thermal gradient cracking



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Transport & demoulding: ideally ≤60 min from mixing to placing, covered against sun/wind/rain; demould only when strength, stiffness, handling and surface protection are all met — not by fixed hours. Cold-weather work needs preheating, insulation and extended curing.

QUALITY CONTROL, INSPECTION AND ACCEPTANCE

Item	Content	Disposition
Documents	Contract, COA, batch, test report, mix sheet	Do not use if missing/inconsistent
Packaging	Intact, dry, clear labels, traceable	Isolate damaged/damp
Appearance	Dry premix; clean, rust-free, non-clumped fiber	Retest or return abnormal lots
Shelf life	Within 90 d; admixtures/fiber per own label	Beyond 90 d: recheck appearance and works tests

Process control and retained samples: each shift records batch, actual usage, water, fiber, mixing time, ambient/discharge temperature and operator; test spread, spread time, loss and appearance per the method, stopping and investigating anomalies; make companion compression, tension/flexure, shrinkage and durability specimens representing the real mix, fiber, mixing and curing; use the specified specimens/methods for tension and chloride diffusion (methods are not interchangeable); keep one-to-one traceability among premix, fiber, specimens, member locations and reports.

Acceptance: the premix is tested to T/CBMF 96-2020 / T/CCPA 20-2020 and the contract; site UHPC and members must also meet the design, acceptance standard and project conditions. A conforming premix does not automatically mean a conforming member. On non-conformity, isolate the lot, review records, retest per standard/contract, and resolve jointly with designer, supervisor, contractor and supplier.

PACKAGING, TRANSPORT, STORAGE AND SHELF LIFE

Item	Requirement
Bags	Moisture-resistant bags, commonly 25 kg; packs ≤50 kg meet applicable rules
Jumbo bags	Commonly 1000 kg; bag and lifting meet rated load and standards
Net content	≥99% of marked mass per bag; 20-bag total ≥ marked total
Transport	Protect from rain/damp/sun/damage; do not mix grades/batches
Storage	Indoor, ventilated, cool, dry, off-ground; away from fire/water
Shelf life	Premix 90 d from production; beyond 90 d retest before use
Separate items	Admixtures/fiber per own label; keep steel fiber dry and rust-free

Site stacking: pallets ≥100 mm off the ground with wall ventilation gaps; FIFO with batch tags outward and daily damp checks; isolate any rain/condensation/hardening/damage/rust for QC judgement. Handling symbols per current GB/T 191-2025 (effective 2026-03-01, replacing GB/T 191-2008).

SAFETY, HEALTH AND ENVIRONMENT

Basic hazards: charging dry powder raises dust; wetted cementitious components are alkaline and can irritate skin/eyes; short steel fibers can cut/prick. Operators must be trained and read the accompanying SDS.

Task	Protection	First aid
Charging/mixing	Local extraction; mask, sealed goggles, alkali gloves, long sleeves	Move to fresh air; seek care if symptoms persist
Wet contact	Waterproof boots; keep wet mix out of gloves/boots	Remove clothing; rinse skin thoroughly
Eye contact	Goggles/face shield; eyewash on site	Rinse ≥15 min and seek care
Steel fiber	Puncture gloves; use tools; clear stray fiber	Clean, stop bleeding, seek care if needed
Equipment	Lockout/tagout; no reaching into running plant	Clear blockages only after power-off, by authorized staff

Environment: keep powder, slurry and wash water out of drains, soil and water; harden and sort surplus per the project plan; settle and reuse wash water; recycle packaging/fiber packs; collect spilled powder by vacuum or gentle sweeping. This manual is not a hazardous-goods classification; follow the latest SDS and local regulations for classification, exposure control, transport class and waste codes.

ORDERING AND TECHNICAL SERVICE

Item	To confirm
Project	Member type, size, rebar/studs, season, plant, haul, tempo
Performance	Comp., tension, permeability, workability, shrinkage, media, colour, early demould
Fibers	Type, size, dosage, packing, whether in premix mass
Curing	Natural or thermal; demould/lift/stress/delivery ages



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Inspection	Works/type/third-party, specimen size, method, rules
Documents	COA, batch report, instructions, SDS, mix sheet, traceability

Recommended service flow: needs clarification → lab trial mix → plant trial → panel verification → first-article review → bulk supply (batch traceability and ongoing QC). Writing the official designation, grades, test methods, curing, the typical-vs-guaranteed boundary, retest rules, service scope and non-conformity handling into a technical agreement greatly reduces acceptance disputes.

PRE-START CHECKLIST (ANNEX A)

To be confirmed jointly by supplier, contractor and supervisor/owner before the first-article (print and tick):

- Standard, grade, batch and contract match; premix, fiber and admixtures in date and intact.
- Mixer capacity/power/blades and weighing confirmed; approved w/p, fiber dosage, charging order and mix time posted.
- Spread/temperature/strength and shrinkage/durability specimen plan set; mould sealing, release, discharge points, flow path and venting verified.
- Ambient/material temperature, haul limits and stoppage contingency per plan; covers, insulation, monitoring and curing owner in place.
- SDS, PPE, eyewash, dust control and lockout in place; first-article review, deviation handling and stop-work authority defined.

First-article rule: any change of key material, fiber, plant, temperature or curing triggers re-assessment for a new trial or first-article.

REFERENCES AND COMPLIANCE (ANNEX B)

Main references: T/CBMF 96-2020 / T/CCPA 20-2020 (UHPC premix — production, classification, inspection, marking, packaging, storage); T/CECS 10107-2020 (UHPC technical requirements — classification, performance, inspection, delivery); GB/T 191-2025 (packaging handling symbols); GB/T 50081-2019 (concrete mechanical test methods); GB/T 50082-2009 (concrete long-term/durability test methods); GB 6566 (radioactivity limits for building materials); GB/T 9774 (cement bags); GB/T 10454 (jumbo bags).

- Dated references use the stated edition; undated/"current" ones must be verified for the latest valid status before ordering, printing and use.
- "Low shrinkage / corrosion resistant / high strength" claims need supporting reports and do not extend to untested media, fire, VOC, service life or structural safety.
- Typical values and cases show possibilities, not batch guarantees; changes of mix, fiber or special use require a separate technical agreement.
- Where the standard, contract, label, report and this manual differ, the applicable mandatory rules and the valid contract govern.

COMPANY INFORMATION

Item	Information
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