

FIELD-CAST UHPC CLOSURE POUR SOLUTIONS FOR PREFABRICATED BRIDGE ELEMENT CONNECTIONS



DESCRIPTION:

Ductal® JS1000 is an ultra-high performance concrete (UHPC) that offers superior strength, durability, ductility, and bond capacity compared to conventional and high performance concretes and grouts. Composed of an optimized gradation of fine granular particles and a water-to-cementitious ratio less than 0.25, Ductal® is denser than conventional concrete giving it a discontinuous pore structure that attributes to remarkable imperviousness and durability against liquid ingress, chloride penetration, freeze-thaw, abrasion, scaling, chemical attack, alkali reactivity, and carbonation.

Internally reinforced with millions of discrete steel fibers (2% by volume, typ.), Ductal® JS1000 is extremely strong in compression and flexible in bending. Cracking is controlled and maintained at microscopic levels, ensuring impermeability and long-term durability against adverse conditions, aggressive agents and environments.

APPLICATIONS:

Ductal® JS1000 is primarily used as a closure pour material to connect prefabricated structural elements on-site. Its fluidity, strength, and enhanced bond properties make it ideal for this application; enabling engineers and contractors to create optimized, durable designs using precast systems. Typical applications include: beam haunch connections and connections between Precast Deck Panels, Deck Bulb-Tees, Next D Beams, and Adjacent Box Beams for bridge structures. Other applications include: link slabs, expansion joint headers, and pier jackets.

TYPICAL MATERIAL PROPERTIES		
In accordance with ASTM C1856 / C1856M.		
Material and curing conditions at 73°F (23°C) and 50% R.H. ⁽¹⁾		
Density	150 - 160 lb/ft ³ (2,400 - 2,565 kg/m ³)	
Flow	7 to 10 in. (175 to 250 mm) diameter without visible sign of fiber segregation	
Working Time / Set Time	approx. 120 min. / 15 to 18 hrs	
Compressive Strength ⁽²⁾	> 14 ksi (100 MPa) ⁽³⁾	at 4 days ^(4,5)
Compressive Strength ⁽²⁾	> 21 ksi (150 MPa)	at 28 days
Tensile Strength ⁽⁶⁾	> 725 psi (5 MPa)	at 28 days
Modulus of Elasticity	> 6,500 ksi (45 GPa)	at 28 days
Long-term Shrinkage	< 800 microstrain	at 28 days
Chloride Ion Penetrability	< 250 coulombs (very low)	at 56 days
Freeze -Thaw Resistance	> 96% RDM	at 300 cycles

- (1) Field results may differ depending on mixing/test methods, equipment used, temperature, and site/curing conditions.
- (2) Compression tests are performed on 3 in. x 6 in. (75 mm x 150 mm) cylinders with ends ground flush prior to testing.
- (3) 14 ksi (100 MPa) is the typical minimum compressive strength required before application of design live load for most closure pour applications; consult the Engineer or Project Specifications to verify.
- (4) 4 days or less is typical when the ambient curing temperature is greater than 60°F (16°C). For colder temperatures, an accelerating admixture may be required to obtain 14 ksi (100 MPa) in 4 days.
- (5) For 14 ksi (100 MPa) compressive strength in 12-36 hours, consider using rapid-set Ductal® JS1212.
- (6) This test measures the sustainable, post-cracking, direct tension strength of a mix with 2% (by volume) steel fibers.



COMPONENTS, PACKAGING & YIELD:

- Premix** (dark-grey): pre-blended cement, sand, ground quartz, silica fume
 - 600 lb (272 kg) mini-bulk bags; 4 bags per pallet.
1 pallet yields approx. 0.65 yd³ (0.50 m³)
 - 2,460 lb (1,115 kg) bulk bags; 1 bag per pallet.
1 pallet yields approx. 0.65 yd³ (0.50 m³)
- Liquid Admixture:** high range water reducer, accelerator*
 - 5 gal (19 L) pails or 264 gal (1,000 L) totes
 - *An accelerator is required for curing temperatures below 50°F (10°C)
- Steel Fibers:** 0.008 in (0.20 mm) dia. x 0.5 in (13 mm) long; Tensile Strength >290 ksi (2,000 MPa).
 - 44 lb (20 kg) bags
- Water and/or Ice*:** to be provided by the Contractor
 - *Ice may be required when batching in warm/hot weather

STORAGE:

All materials should be stored in a dry environment and/or be thoroughly covered to prevent moisture ingress, seepage, corrosion, and UV exposure. Materials should be stored between 40-95°F (4-35°C) and conditioned to 65-75°F (18-24°C) prior to use for optimum performance. Premix may be stored for up to one year in the original, unopened packaging.

PREPARATION:

Concrete surfaces to be in contact with Ductal® should be sound, have a roughened or exposed aggregate finish with 0.25 in. (6 mm) average amplitude, and be prewetted to a saturated surface-dry (SSD) condition prior to placing Ductal® to ensure a watertight bond. All dirt, oil, grease, and other bond-inhibiting materials should be removed prior to placement. Forms should be installed watertight to prevent leaking. Forms should be lined or coated to prevent absorption of water from the fresh material.

BATCHING:

Ductal® JS1000 should be batched on-site in accordance with Holcim's Ductal® UHPC General SOP & QC Plan. A Holcim field representative shall be on-site during all Ductal® operations (service fee applies), unless directed otherwise. The components should be proportioned, weighed, and sequenced in accordance with the representative's recommendations based on field conditions. Ice and/or chilled water is required when the mix temperature is expected to exceed 85°F (29°C). An accelerating admixture is required when the curing temperature is below 50°F (10°C). Record the mix temperature and perform a flow test on each batch of Ductal® prior to placing.

High-shear mixers are recommended to properly and efficiently mix Ductal®. At least two mixers are recommended for most projects. Note that advertised batch capacities of most mixers are not appropriate for Ductal®. Consult a Holcim representative to evaluate the proposed mixing equipment. High-shear mixers may be rented from Holcim (subject to availability) with Ductal® mixing capacities of 0.20, 0.65, or 1.30 yd³ (0.15, 0.50, or 1.00 m³) per batch. Typical output is 2 to 3 batches per hour, per mixer.

Disclaimer: The values indicated above depend on the product characteristics, experimentation method, raw materials, formulae, manufacturing procedures and equipment used; all of which may vary. This data sheet provides no guarantee or commitment that the values set forth above will be achieved in any particular application of Ductal®. Ductal® is a registered trademark and may not be used without permission. The ultra-high performance material that is Ductal® and its various components are protected by various patents and may not be used except pursuant to the terms of a license agreement with the patent holder.

PLACING:

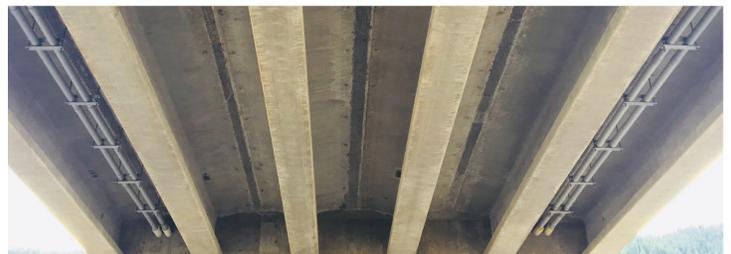
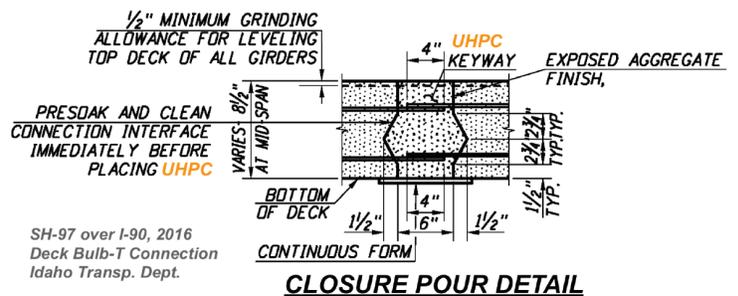
Ductal® JS1000 should be poured in-place using a bucket, wheelbarrow, or buggy and placed within 120 minutes of batching. Ductal® is self-leveling and selfconsolidating and should not be vibrated as fiber segregation may occur. Exposed surfaces should be covered with poly or vapor barriers immediately after placement to prevent surface dehydration. Top forms are required when casting JS1000 on a sloping grade; properly secure top forms to restrain the hydrostatic pressure of the material. Cold weather placement procedures should be implemented when ambient temperatures drop below 50°F (10°C). Refer to Holcim's Ductal® UHPC Jointfill SOP for additional guidance on placements in closure pour applications.

FINISHING:

The top surface of Ductal® JS1000 should be poured 0.375 in. (10 mm) higher than the finish grade and ground flush to remove all surface air voids. Top forms may be removed and grinding may commence using lightweight equipment <2,500 lb (1,135 kg) once the material has obtained 10 ksi (70 MPa) compressive strength, or as directed by a Holcim representative.

CLOSURE POUR DESIGN & DETAILING:

UHPC's high strength and fiber confinement allow for substantially reduced closure pour widths for structural connections. Detailing of the connection is drastically simplified through the use of short, straight reinforcing bars with development lengths as short as 6 in. (150 mm) for #6 (#19) epoxy-coated rebars. Fabrication and installation of prefabricated elements is also simplified due to the use of non-obstructive, non-contact lap splice detailing. One example of a closure pour connection with a UHPC keyway is provided below. Refer to FHWA Publication No: FHWA-HRT-14-084 for guidance on the design and construction of fieldcast UHPC connections. For design assistance with Ductal®, please contact a Holcim engineering representative.



Contact one of our representatives to discover more ways to use Ductal®.

Holcim US
6401 Golden Triangle Dr. Suite 400
Greenbelt, MD 20770
www.holcim.us/ductal