

Approval & Reception Procedure

DEE – Departamento de Estruturas e Edifícios	
Ultra-High Performance Concrete (UHPC) Precast Elements	Document no. : ARP/DEE/032
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1 Scope of application

This Approval & Reception Procedure applies to precast elements made of ultra-high performance concrete (UHPC).

Remark : ARP/DEE/005 should be followed for the quality control of back-attached steel frames.

2 Approval procedures

2.1 Submission

The following documents should be submitted for approval :

- Project information
- Manufacturer information
- Details of UHPC and method statement of production
- Quality control plan
- 3rd party laboratories
- Delivery plan
- Others (if necessary)

2.1.1. Project information

Project information includes :

- Shop drawing ;
- Technical requirement (e.g. technical specification) ;
- Structural calculations, etc °

2.1.2. Manufacturer information

Manufacturer information includes :

- Catalogue and job references ;

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- Certificate of quality management system ;
- Organization chart ;
- Information and calibration certificates for equipment, instruments, etc ;
- Fabrication plan, including all process steps and quality control measures (e.g. measures to ensure uniform distribution of fibers, measures to prevent cracking of precast elements, etc.) ;
- Curing and storage plans, etc.

Depending on the actual situation, inspections on the factory of manufacturer and the 3rd party laboratories will be required to verify the technical and quality competence for the project.

2.1.3. Details of UHPC and method statement of production

Details of UHPC and method statement of production include :

- Mix design and technical requirement (Compressive strength, tensile strength, workability, etc) of UHPC, and the related reference standards ;
- Details and origin of raw materials, test reports and quality certificates within the recent 6 months (refer to ARP/DMC/14) ;
- Formwork information ;
- Details, relevant test reports and quality certificates of embedded components ;
- Trial mix (witnessed by LECM) ;
- Details of back-attached steel frames ;
- Information of façade (if applicable) .

2.1.4. Quality control plan

Quality control plan includes :

- Information of quality control department of the factory, including personnel qualifications, calibration certificates of testing equipment and instruments, etc. ;
- Auto-control plan, including : inspection items, contracting regulations, sampling frequency, testing methods, acceptance criteria, etc. ;

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- Reception control plan (tests must be performed by laboratories approved by LECM) , including : test items, contracting regulations, sampling frequency, testing methods, acceptance criteria, etc. ;
- Quality control records of recent similar projects.

2.1.5. 3rd party laboratories

3rd party laboratories include :

- Details, catalogue and job references ;
- Accredited certificates (e.g. CNAS 、 HOKLAS) ;
- Accredited test list ;
- Inspection on the laboratory (if necessary) 。

2.1.6. Delivery plan

Delivery plan includes :

- Inspection before delivery ;
- Protection measures during transportation ;
- Mode of transportation, including vehicles and routes, etc. ;
- Loading and unloading process ;
- Defect repairing plan.

2.2 Trial production

Before the factory is officially put into production, trial production should be performed to evaluate whether the technology and quality can meet the design requirements. Sample requirements for trial production (type, size, quantity, etc.) should be determined through negotiation. During the trial production, quality control testing (including raw materials and finished products) must be carried out according to the formal production quality control plan, and witnessed by LECM when necessary, especially for key processes.

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In addition to the tests performed as in formal production (2.3 Inspection and tests) , trial production samples should undergo additional tests if necessary. For example :

- Cut the precast element and observe the uniformity of fiber distribution on the cross section ;
- If the precast element contains components that need to withstand external forces, mechanical tests should be performed on the relevant components (e.g. pull-out test (BS 5080), anchorage test (ASTM C1354), etc.) ;
- Wind load modelling test, etc .

2.3 Inspection and tests

Auto-control and reception control should be performed according to the quality control plan during production. Items for reception control should at least include :

- Visual inspection (e.g. appearance, cracks, etc.) ;
- Dimension check (can take reference to section 4 of T/ZS 0203-2021 if there is no special requirement) ;
- Physical and mechanical properties, including: compressive strength, ultimate bending strength, bulk density, water absorption, etc. (if there is no special requirement, the tests can be performed with reference to GB/T 15231) .

3 Reception procedure

3.1 Delivery Notes

When precast elements arrived on site, delivery notes should be submitted for verification. At least, the following information should be included in the delivery notes :

- Manufacturer
- Project
- Details of the precast element, including production records, size, grade, etc.
- Quality control records, including auto-control and reception control test reports

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3.2 Reception

When the precast elements arrive at the construction site, reception inspection should be performed to ensure that the elements meet the requirements. Reception inspection should include at least :

- Visual inspection ;
- Dimension check ;
- If the precast element contains components that need to withstand external forces, mechanical tests should be performed on the relevant components (e.g. pull-out test) .

4 Reference standards

Regulations No. 42/97/M	Norma de Betões de Macau
Regulations No. 63/96/M	Norma de Cimentos de Macau
BS 5080 : Part 1 : 1993	Structural fixings in concrete and masonry - Part 1. Method of test for tensile loading
GB/T 15231-2008	Test methods for the properties of glassfibre reinforced cement
GB/T 40715-2021	Specification of precast concrete curtain wall panel
TCECS 10107-2020	超高性能混凝土 (UHPC) 技術要求
T/CCPA 30—2022 (T/CBMF 171)	Ultra-high performance concrete (UHPC) panel for exterior wall
T/CSTM 00289-2022	超高性能混凝土外牆掛板
TZS 0203-2021	超高性能混凝土外牆 (UHPC) 圍護和裝飾板應用技術標準