Building chemistry Industrty, Dammam, Kingdom of Saudi Arabia

Method statement for raft foundation water proofing with BCI , Hybrid polyurea system BC 690 H and BC 6354 ISocyanate

Introduction

Waterproofing of immersed underground structures requires permanent dewatering during the execution phase and continues until the pressure caused by the weight of the concrete structure exceeds the hydrostatic pressure exerted by the water table.

The types of foundations designed for such structures is most of the time raft foundation with or without piles, or a combination of the raft and pile caps, depending on the bearing capacity of the soil. In such cases, the waterproofing is called tanking as it envelops completely the structure from the bottom to the water table level and preferably to the ground floor level. The waterproofing of the vertical part will start only when the full foundation raft/pile caps are cast.

Pile head waterproofing
The head of the pile should protrude by 20 cm higher than the blinding level. First, repair the pile head to provide a leveled and high strength capping. Then finish pile capping with an epoxy mortar.

Horizontal part of tanking under foundation
The surface of the blinding should be dry, smooth, plane and free from any obstacle that might puncture the waterproofing membrane.

System Guide

BC Backing rods
BC Tec 30 S Polyurethane sealant
BC Fix tapes
BC Poxy Putty 2000 **, Concrete repair mortar / Surfacer**
BC Epoxy primer 349 , High performance epoxy primer
BC 690 H Polyurea , Pure elastomeric polyurea membrane

Waterproofing of deep underground structures exposed to high hydrostatic pressure is quite challenging as it has to address various complex issues, the most important of all is to provide a complete barrier to the high water pressure encountered in such depths

BC 690 H Polyurea membrane waterproofing system is a seamless system totally devoid of any joints or laps which in major cases are the sources of water penetration

The system comprises of a 2mm thick spray applied fast setting coating

comprises of a 2mm thick spray applied fast setting coating based on Polyurea technology, which on curing forms a very tough yet flexible waterproofing layer

A 3.5mm thick self-adhering bituminous membrane surfaced with a tough 400gsm polypropylene fleece is applied on top of the waterproofing coating

This membrane functions as the secondary layer of waterproofing, as well as protecting the

underlying coating from external damages.

The polypropylene fleece bonds completely with the concrete when the RCC raft is casted to become a part of the concrete structure thus preventing the lateral movement of water, should there be any leakage post construction.

Being a liquid based coating, it is ensured that even the minutest of critical details are properly sealed and

protected from water penetration, ensuring a complete water tight seal all around the structure.

BC 690 H With protection sheet

Properties	Values
Thickness,	mm 5.5
Tensile strength,	N/5 cm >1200
Tear strength,	N >900
Puncture Resistance,	N >2200
Hydrostatic head pressure,	bar 7
Crack bridging ability,	mm 3

Area of Application

Foundations & basements of high rise towers and large developments

Structures under high hydrostatic presuure

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Scope of works: Supply and application of BC690 polyurea system

. Treat all expansion joints with high performance sealants line BC Tec 30S Open wide groves at the joints and clean them thoroughly to have excellent bonding of Sealants and other accessories , fix backing rods where ever required
.Primer application The surface is given a complete coat of BCI , high performance epoxy primer @ 200-250 µ
.Polyurea membrane application
. BC 690 H polyurea system is applied as per guidelines from product data sheet@2000 µ .Work area is back with appropriate filling materials and tiles are re installed

Antiskid Application.

A non-slip surface can be achieved by broadcasting approx. 1Kg/ M2 of Nonslip aggregate (Medium) to the primer Whilst still wet.

Primer application should be dry for at least 04 hours prior to commencing of Polyurea application.

Antiskid Application.

Polyurea Application.

Upon completion of Primer and Antiskid application, Polyurea system application shall commence where a combination of Component-A & Component-B) is sprayed onto the prepared up to a thickness of 2mm, using evolution combination equipment.

Apply Polyurea at a consistent rate using a standard crosshatch spray pattern, with a minimum of 2 alternate directional passes for complete coverage, at the required application coverage total wet film thickness of 2mm to the horizontal & Vertical surface of areas.

Allow the applied Polyurea coating to dry for minimum curing period of 04Hours Prior to proceeding with the Water test.

Water Test.

Carry out a visual check of the Polyurea application works for any possible damages due to movement of men before filling water.

Pour clean water (Should be free of any toxic / salt contents) up to a height of minimum 50mm at the highest point.

Retain the water for 24hours.

Check for leak / dampness.

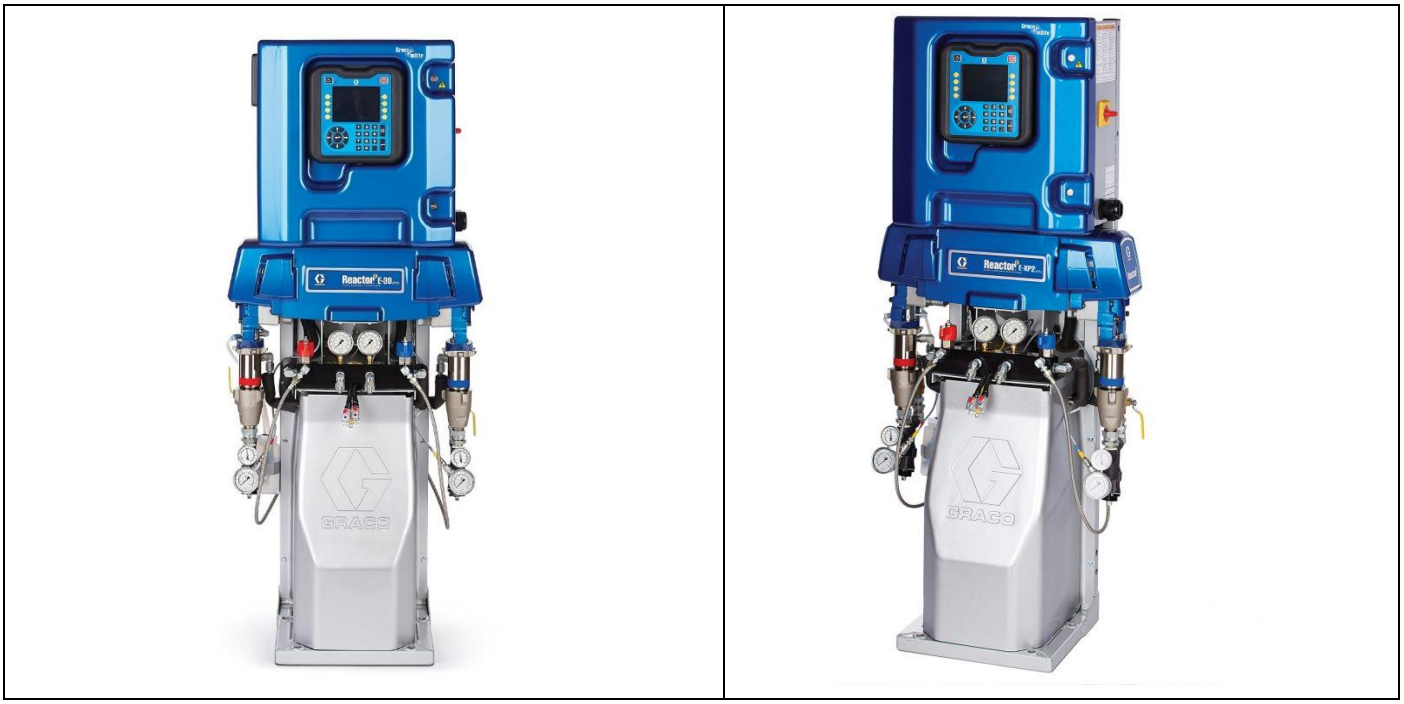
If there is leakage found, remove the water, and allow the area surface to dry.
Search for the spots from where water enters the areas and carry out additional coating to rectify the week areas and again carry out works as mentioned above.

This is repeated till a completely leak-proof installation is obtained.

Laying of Separation Layer.

Laying of Separation Layer (Non-Woven Polyester Geotextile) over the Horizontal & Vertical Polyurea Coating.

It should be prevented from wind uplift by putting some weight.



Equipment Introduction

Reactor 2 E-XP2 proportioner is an advanced technology in applying fast-curing polyurea coatings. The Reactor 2 E-XP2 is engineered to process and spray polyurea and other coatings that require high pressures. The hybrid heater and heated hose condition the materials to the right viscosity prior to mixing. Quick knockdown lower pump for easy maintenance, easy-to-use controls, and rugged design make the Reactor the preferred choice for coatings applications.

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Scope of Work

This method of statement is for Plural component spray application of BC 237 polyurea describes the procedures intended to adopt for all associated works with this contract package.

Access/Egress

The Access/Egress to the site for the easy movement of workmen, material andequipment will be carried out in a safe manner. Any obstacle shall be properly cleared either manually or employing suitable mechanical equipment. The access to the trenches should be as per project safety procedures.

Lighting

Safety Lighting

Customer will provide Safety lighting at the entry point/s of the project as such adequate to the basic security of the site premises or in accordance with the projectrequirements.

Task Lighting

Tower light or portable light is use in the dark or in reduced visibility, lights will befitted and used to enable the work area to be adequately illuminated. In addition, amber flashing beacons that give warning of the presence of the vehicle will be fittedand used if necessary.

General

Generally, if otherwise required custom will provide adequate lighting facilitywherever there is a necessity for the lighting for the safety of its employees, material,equipment or any other asset of Client.

Plant & Equipment

Plant & Equipment Schedule

Plant and Equipment

Sn	Description	Qty	Model	Utilization
2.	Graco Reactor, Polyurea Machine	12	2 E-XP2	**1 year**
3.	Heater Hose (240 bar), 15cm with Scuff Guard	22	E-XP2, 240	**3 years**
4.	Whip Hose (240 bar), 3m with Scuff Guard	8	E-XP2, 240	**9 months**
5.	Fusion Gun AP	16	Fusion	**7 months**
6.	Transfer Pump	24	T2 Pump	**2 years**
7.	**Air Supply and Fusion Gun**	**24**	**Kit for Pumps**	**4 years**

1.1 Personnel Protective Equipment(PPE)

- Safety Helmet
- Clear Goggles
- Black Goggles
- Coverall
- Safety vest
- Safety Shoe
- Hand Gloves
- Face Shield (Where required)

1.2 Manpower

- Foreman/Supervisor
- Site Engineer
- QC
- Plumbers
- Labors (As Required)
- Flagman's (As Required)
- Operators (As Required)
- Masons (As Required)

2. Materials

Surface preparation tools like grinding wheels, cleaning tools
BC Epoxy primer 349
BC 237 Polyurea
BC MC Urethane

3. Sequence/Method of work:

Delivery of Material using Dyna Truck

- Before any delivery of materials to site, the supervisor with his crew will prepare the area of storage to receive the material at the lay down area. Number of containers, packing size and total quantity, drum condition, labelling and documents etc. shall be verified.
- The supplier shall inform the site at least two (2) days before the delivery date to have sufficient time on securing relevant work permit and gate passes required.
- If the delivery vehicle is from the supplier, it must be checked to ensure that it is conforming to the requirement of the project using the approved vehicle/equipment checklist. Driver of the delivery vehicle must be of complete PPE while he is in the jobsite.
- The delivery vehicle shall be escorted by SUBCONTRACTOR representative from gate to laydown area and vice versa.

- Upon arrival of the material, the driver will hand over the delivery receipt to the warehouse supervisor who will check the document that includes the following:
- .After completion of unloading and material inspection, the materials shall be covered with tarpaulin or blue sheets to protect from exposure to weather.
- The materials delivered have been checked and they are correct as per the approved material submittal

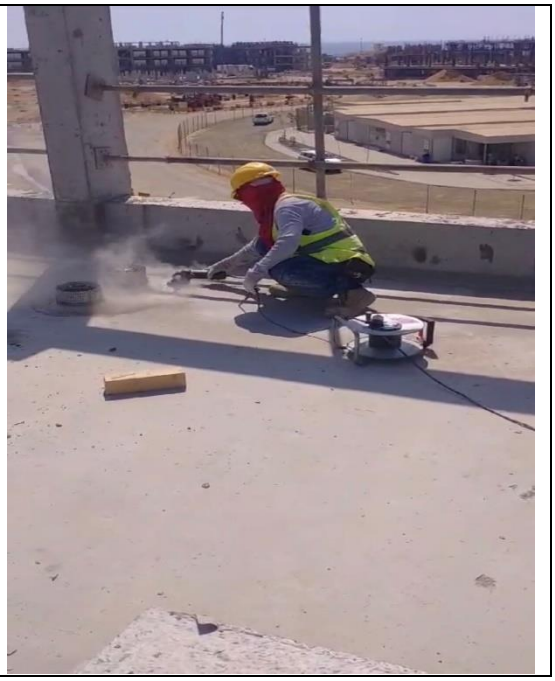
Material Receiving by Manual Handling

- The delivery materials will receive by workforce manually as all of materials are not too heavy.
- Each shipment should be inventoried and inspected upon arrival.
- It is the carrier's responsibility to deliver the shipment in good condition, and it is the receiver's responsibility to ensure that there has been no loss or damage.

4. Program

- Approved schedule will be followed for the duration of project
- Permits from concerned Client authority.
- Wear all necessary protective equipment like safety helmet , hand gloves , cover all and masks etc. before starting any activity including surface preparation Start surface preparation as approved by site in charge
- Degree of surface preparation shall be verified and approved by customer ‘s representative for the project
- Start the compressor and heat the reactor 70 Dec temperature while developing required application pressure

Surface preparation



Surface Preparation.
Conduct visual inspection for any defects prior to the coating.

Prior to starting preparation, close the area to be prepared to all traffic and other trades.

Protrusion and other sharp elements from the substrate to be removed.

Surface to be prepared with high strength repair mortar and to be grinded to have a proper surface to apply the floor coat.

Angle fillet shall be provided at all the corners.

Required clearances to be obtained from the other trades prior to start coating.
Remove all surface laitance, oil, grease, or any defective concrete that will reduce the bond of the coating.

If any part of the floor is contaminated by oil, grease or fat, the contamination should be removed before other forms of preparation are undertaken.

Surface irregularities must be ground down or filled out with repair materials.

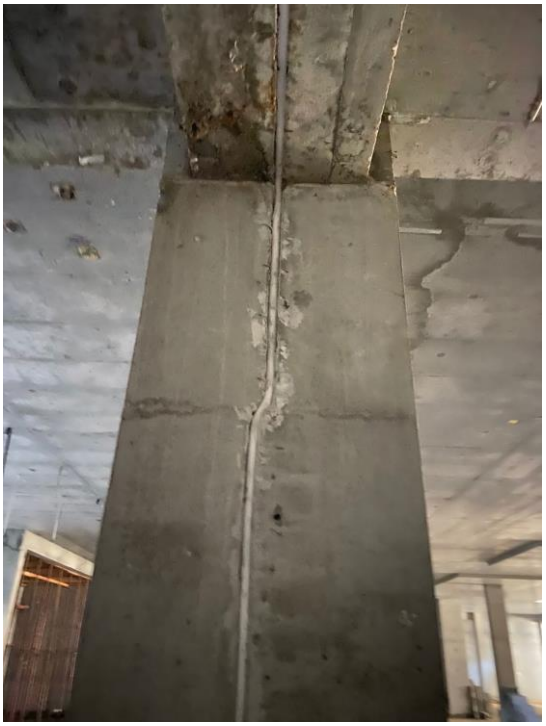
Prepare the concrete substrate using the chosen method, removing all weak or friable laitance and concrete. The finished surface should have the texture of fine to medium grade sandpaper.

Surface defects such as shrinkage cracks, blow holes, minor honeycombing, minor damage to joint arises etc. shall be filled.

Expansion joints treatment

BC Epoxy primer 349

BC Epoxy primer 349



Priming.

Mixing: -
Stir the base and hardener separately.

Mix hardener gradually into the base under continuous stirring as per stated mixing ratio.
Apply after induction time and before expiration of pot life
Application.
Mix the A and B components of together until it is free of streaks. Apply the mixed to the substrate, using a medium pile roller depending on the absorption of the substrate.

The coverage would vary significantly based on the nature of the concrete surface.

On porous surface where the primer is absorbed quickly leaving dry patches, a second coat is recommended.

5. Risks and Controls

5.1 Hazards/risks

Risk Assessment (See appendix)

5.2 Control measures/permits

Permit to work shall in place prior to any work issued by Permit authorizer and must be communicated to workers, operators & staff.

5.3 Third party protection

Obtain third party inspection for equipment and operator if necessary as perGuidelines in Table 1. Plant and Equipment - Training, Licensing, and Certification Requirements.

5.4 Environmental considerations and sustainability

A. Waste Management

- Waste shall be controlled and managed at all times
- Waste shall be transferred by appropriately registered carriers and only removed to licensed sites
- Wastes shall be kept in a secure manner, suitably contained and labeled
- Hazardous wastes shall be kept separately and securely labeled containers for the task and disposed of in accordance with the Hazardous Waste Regulations

BC 690 H Application

Waste minimization

APC shall endeavor to minimize waste streams in line with the principles of the waste hierarchy

- Avoidance of waste at source
- Reduction of waste volumes
- Re-use of uncontaminated spoil within the works
- Arrange for recycling of the waste
- Disposal as a last option

C. Operations of vehicles and plant

To ensure minimal impact from the operation of vehicles and plant, operators shall give due regard and implement the following

- Minimize route and journey mileage to and from and around site
- Prevent nuisance to the community caused by parking, spoil from vehicle movements, noise and access restrictions
- Ensure prevention of spillage of spoil, fuels, coolants, hydraulic oils and other vehicle fuels
- Maintain vehicles
- Ensure all vehicles and machinery are turned off when not in use
- Ensure suitable control for the means of access and egress to public highway

D. Noise and nuisance

Care shall be taken to ensure good image and relations with the local community by the following

- The use of offensive language, behavior and or discourtesy to the public prohibited
- Excessive noise from plant, equipment, vehicles and employees being monitored
- Strict compliance with noise and working hour restrictions
- Excessive emissions of dust, fumes and odors
- APC will ensure a high standard of housekeeping and litter control on all sites at all times

F. Air Quality

- Any black smoke / unsightly emissions from vehicles and other equipment must be reported.
- Customer shall ensure that smoking is only permitted in designated areas.
- All material stockpiles to be adequately covered to prevent loss of material through wind erosion as well as dust lift.
- Where possible, avoid simultaneous instances of side-by-side material handling to prevent excessive generation of nuisance dust.

5.5 General

Personal Protective Equipment and selection refer to Employer Requirement (AML-DEV-H&S-GLE-0014 Personal Protective Equipment) for minimum requirements for selection, use and maintenance of PPE.

5.6 Communication and Fire Precautions

- Ensure fire extinguishers, type ABC dry chemical, are provided

in allactive work areas. Units shall be sized and spaced according to work activity occurring, quantities of combustible and flammable materialsin the work area, and level of potential for fires.

- Ensure temporary enclosures are equipped with a minimum of onefire extinguisher suitable for all classes of fires that are expected inside the enclosure

- Ensure all permit requirements for hot work activities are followed.Refer to Employer Requirement (AML-DEV-H&S-GLE-0035 Welding, Cutting & Brazing).

- Maintain that combustible debris, rubbish and waste material are removed from buildings at the end of each shift of work. Refer to theEmployer Requirement (AML-DEV-H&S-GLE-0013 Housekeeping).

- Ensure that combustible debris, rubbish and waste material aredisposed of properly.

- Ensure that adequate and unimpeded means of egress from all parts ofthe works, is available at all times in case fire.

- Customer shall ensure that smoking is only permitted in designatedareas.

6. Training

- All on site must complete site safety induction.

Antiskid Application.

A non-slip surface can be achieved by broadcasting approx. 1Kg/ M2 of Nonslip aggregate (Medium) to the primer Whilst still wet.

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Upon completion of Primer and Antiskid application, Polyurea system application shall commence where a combination of Component-A (MDI Prepolymer) & Component-B (Mixture of Poluether amine & Polyol) is sprayed onto the prepared up to a thickness of 2mm, using evolution combination equipment.

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Other finishes by Main Contractor

- Toolbox meeting must be conducted prior to commence the activity.
- Provide awareness training for the new employee for (tools, equipment and etc.) and discuss a wide variety of hazards that new workers can encounter while performing different types of tasks, and explains what they need to do to avoid those hazards.
- Working at height training.

7. Supervision

- Works to be supervised by APC site management.
- The Site Supervisor manages and assesses any potential safety hazards on site and looks at eliminating them. Conduct a regular site inspection and provide a safety program.
- Ensure that a project is seen through and completed safely.

8. Supervisor

- To ensure that the approved reparation methodology is well executed by all of the team.
- Safety of the Manpower should always be promoted in all the duration of work daily to avoid any kind of accidents.

A. Foreman

- To ensure the high level of workmanship. To ensure that the preparation methodology adopted by the Supervisor involved is well executed.
- To ensure the availability and the quality of the tools and product use by the team.
- The provision to his responsible Supervisor in charge the adequate information for works performance.
- The provision to his responsible Supervisor the daily report illustrating work progress / reparation methodology applied / resources / manpower / completed work.
- Manage the equipment's in the working zone in a safe way.

B. QC Inspector

- Inspect and conform the quality and test report of the required backfilling materials.
- Witness placement, compaction and compaction test.
- Responsible for random inspection required during the execution
- Responsible for the witness testing approval and records.
- Responsible for arranging third parties required for testing at site whenever needed.

C. Safety Officer

- Ensure that work is performed according to the safety instruction and precautions specified in the work permit.
- Ensure that barricades and warning tapes are erected where required and safety equipment is readily available at the site.

D. Work Permit Receiver

- Submit the activity permit request.
- Must abide by the instructions provided in the activity permit.
- Responsible for obtaining work permits required for the daily job and maintain the record as per project requirements.

9. Working Hours

APC generally have an 8 hour working schedule. However, working hours maybe extended by the Project In charge which is paid in accordance with the Saudi labor laws. Usually breaks are considered as per project requirements and Saudi labor laws.

10. Housekeeping

- All rubbish and debris must be cleared from the work site on a daily basis in progress with the work.
- No excess rubbish or debris will be permitted to be left onsite at the end of the working shift.
- Sufficient bins must be available for the Contractor at each work face to cope with debris generated.
- Bins must be emptied/changed immediately when full.

11. Other Information

- Safety induction to be conducted to all new workers that involved to this activity.
- Safety tool box meeting shall be conducted to remind the workers about concerning the safety.
- Make sure that material will be stored at temp storage area and should be barricaded properly.