

METHOD STATEMENT

HM CARBON FIBER WRAP Manual Dry Application



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1 SCOPE

This Method Statement is written as a guideline for the use of the HM CFRP WRAP strengthening composite system. This document must be used and referred to, in combination with all other relevant Technical data sheet(TDS), Material Safety Data Sheets (MSDS) and the specific Project Specifications. Structural strengthening must only be carried out by experienced specialists

2 SYSTEM DESCRIPTION

HM CFRP WRAP strengthening composite system is a high performance strengthening system containing FRP fabrics and impregnation resins. They are applied on the strengthening site and formed into a fibre composite.

The main range of applications is as follows:

- Increasing the load bearing capacity of structural elements
- Shear strengthening
- Flexural strengthening
- Masonry strengthening
- Column strengthening (for Confinement and / or Ductility)
- Changes of building use
- Structural upgrading to comply with current standards
- Improved functionality
- General seismic upgrading and / or retrofitting
- Prevention of damage by seismic action
- Improved seismic performance for masonry walls
- Blast mitigation (accident or terrorism)
- Impact protection
- Structural design construction defects
- To replace and substitute missing rebars

2.1 REFERENCES

Pull-off tests shall be performed according to GB 50550-2010 or the corresponding local standard, and considering the values mentioned in the text below.

2.2 LIMITATIONS

- The products must only be used in accordance for their intended applications. The system configuration as described in the Product Data Sheets must be fully complied with and may not be changed.

- The HM CFRP wrap strengthening systems may only be used by experienced professionals. All strengthening works must be carried out as directed by a suitably qualified Structural Engineer as the Supervising Officer.
- For any other specific construction / build information please refer to the relevant Engineer's specifications, details, drawings, and risk assessments.
- Local differences in product may result in performance variations. The most recent and relevant local Technical Data Sheets (TDS) and Material Safety Data Sheets (MSDS) apply.
- Always record the batch numbers for the HM CFRP fabrics and HM-180C3P resins that are used each day. Additionally at the end of each working say also check to make sure that the fabric application is uniform and smooth.
- Large mixing quantities of the HM 180C3P resins and /or high temperatures result in shortening of the pot life. In order to prolong the pot life, reduce the quantity of the mixing components and/or the material's temperature (i.e. store the sealed units in cool conditions until immediately prior to mixing and application).
- For application in cold or hot conditions, pre-condition the resin materials for at least 24 hours in temperature controlled storage facilities to improve the on-site mixing, application and pot life limitations.
- Special attention should be paid to the ambient environment and conditions. Observe the minimum /maximum temperatures for substrate, atmosphere and the materials, as well as taking care to avoid application in dew point conditions (Application temperature must be at least +3 °C above the dew point)
- The substrate moisture content must be less than 4 %. All of the concrete surfaces to be treated must be dry and free of surface water or ice.

This Method Statement is produced and intended as a guide and must be adapted to suit the local Products, Standards, Legislation or any other specific local requirements.

3 PRODUCTS

3.1 SYSTEM COMPONENTS

Fabric: Dependent on the application, fabrics with different weights (from 200 g/m² to 600g/m²) and fabrics with different widths (100 mm, 300 mm, 500 mm) are used. The table below gives an overview of these different fabric , weights and widths available.

Model	Specification	Available width (mm)
HM-20	200g/m ²	100\150\200\300\500
HM-23	230g/m ²	Can be customized
HM-30	300g/m ²	100\150\200\300\500
HM-43	430g/m ²	Can be customized
HM-45	450g/m ²	Can be customized
HM-53	530g/m ²	Can be customized

HN-60	600g/m ²	500
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The fabric rolls are packed in cartons boxes. The standard roll length is 100 meters.(600gsm is 50 meters)

Impregnation resin:

Model	Description
HM-180C3P	Impregnating Adhesive HM-180C3P, used for impregnating carbon fibers and bonding the carbon fiber fabric to concrete surface.
HM-180	Primer HM-180, used for improving the properties of the concrete surface, which is in direct contact with the carbon fiber system
HM-180CE	Leveling Adhesive HM-180CE, used for leveling and repairing physical defecton the concrete surface of the existing structure.

3.2 MATERIALS STORAGE

Materials must be stored properly in undamaged, original sealed packaging, in dry and cool conditions at temperatures between +5°C and +25°C (Resins), or between +5°C and +35°C (Fabrics). Protect all of the products from direct sunlight. Please refer to the specific information contained in the respective Product Data Sheets regarding the minimum and maximum storage temperatures and times. All of the HM-180C3P epoxy resin based products can be stored for up to 12 months from the date of production

4 EQUIPMENT

4.1 TOOLS



Concrete grinder



Vacuum cleaner



Application trowels



Putty Knife



Plastic roller



Mixing Container



Mixing Paddle



Electric scissors

4.2 CLEANING

Clean all tools and application equipment with Isopropanol based cleaner immediately after use. Any uncured epoxy should be wiped up with a rag wetted with solvent. Hardened material can only be removed mechanically.

5 HEALTH AND SAFETY

5.1 RISK ASSESSMENT

The risks to health and safety from everything including any defects in the structure, working procedures and all of the chemicals used during the materials installation must be properly assessed and safely accommodated. Any working areas on platforms and temporary structures must also provide a stable and safe area to work. All work and working procedures must be carried out fully in accordance with the relevant local health and safety legislation.

5.2 PERSONAL PROTECTION

Work Safely!

Safety shoes, gloves and other appropriate skin protection should be worn at all times. The use of disposable or new / clean protective clothing during the materials preparation and application is strongly recommended. Always wear nitrile based protective gloves when handling epoxy adhesives / impregnating resins, as they can otherwise cause skin irritation. Additionally apply barrier cream to hands and any unprotected areas of skin before starting work. Appropriate eye protection should be worn at all times whilst handling, mixing and installing the products. Carrying an eye wash with you at all times is recommended. Always wash hands with suitable soap and clean water after handling the products and before food consumption, smoking, visiting the toilet and after finishing work. The work area needs to be well ventilated and operatives should take frequent breaks in fresh air to avoid any other health issues.

Silica dust produced by the grinding or blast cleaning of concrete can be hazardous. Protect yourself and others by using a vacuum grinder or vacuum blast cleaning equipment with dust extraction and abrasive recycling attachments respectively. Always wear a dust mask/respirator when grinding concrete. Do not inhale the concrete dust.

5.3 FIRST AID

If the epoxy resin based adhesive products come into contact with eyes or mucous membranes, remove any glasses or contact lenses and rinse with clean warm water for 10 to 15 minutes then seek medical attention. Any chemical spillages on skin must be cleaned immediately and rinsed thoroughly with clean warm water.

5.4 WASTE DISPOSAL

Do not empty any surplus material into drainage or water systems; dispose of all waste materials and packaging responsibly through licensed waste disposal facilities or contractors, fully in accordance with local legislation and the relevant authorities' requirements. Also avoid any chemical materials run-off into soil or into waterways, drains or sewers. Any uncured adhesive waste, spillages and / or leftover Isopropanol based cleaner must be disposed of as hazardous waste and according to local regulations. Cured adhesive waste can be disposed of safely as normal building materials waste according to local regulations.

6 PREPARATION

6.1 PRE-PROJECT

Review the project specifications in detail. Inspect the site conditions and the concrete surfaces to receive the treatment and report immediately in writing to the responsible Engineer if anything is unsuitable for proper execution of the works.

6.2 SUBSTRATE

The HM CFRP strengthening system can be used on concrete, masonry and wooden structures. Where none of these are specifically mentioned below, the statements refer to concrete. Before preparing the substrate for the application, it must be thoroughly inspected and any unsound material (such as any areas of damaged concrete, pieces of formwork or tie-wires etc.) must be removed. Where concrete repairs are necessary on a structure prior to the application of a HM CFRP strengthening system, it is important that the repair materials are designed and installed to be fully compatible with the HM 180C3P adhesive and suitable for use in a structural situation (i.e. they must have low shrinkage, compatible modulus of elasticity, good interface bond, adequate strength and an appropriate finished surface). Layer for both of these surface repair options, to ensure a good bond with the substrate and no voids in the repairs. Any non-moving structural cracks can be filled by injection with HM-120L or other suitable injection resin with the Structural Engineer's agreement.

The actual strength of the concrete substrate must be verified on all projects.

The concrete, stone and masonry substrates must be prepared mechanically using abrasive blast cleaning, or grinding equipment. During this preparation work, an integrated vacuum system (see should be used, in order to reduce the risk of contamination, plus a dust mask should be worn to prevent the inhalation of concrete dust.

The mechanical preparation is carried out to remove cement laitance, any loose and friable materials and achieve a profiled, open textured surface. Any surface defects such as honeycombing, blowholes and voids must be fully exposed.

Timber substrates must be planed or sanded to remove all dust and any loose or friable materials completely from all surfaces.

All prepared surfaces must be brushed, air blasted and vacuumed to achieve a dust free condition . No loose particles should be left on any of the substrate surfaces.

External corners and arrises must generally be rounded to a minimum radius of 20 mm, or as required by the Engineer's specification. This can be achieved either by grinding

The surfaces to be strengthened must be levelled to ensure that the specified tolerances are achieved and maintained as detailed in the table below. The plane and level of the substrate is to be checked with a suitable straight edge. The tolerance required depends on the specified standards to be achieved. Their method of measurement and testing can be varied on different projects and structures according to any local guidelines and requirements. Obviously any testing must only be carried out in relation to one standard or another.

The final surface must be smooth, dry and free of damaged concrete and any other contaminants as dust, foreign particles, cement laitance, oil, grease, surface coatings, curing compounds, waxes and impregnations etc., which could adversely affect or inhibit the bond of the strengthening system to the concrete. The substrate moisture content must be less than 4% pbw.

6.3 RESINS

For the dry application of the HM CFRP system, HM-180C3P is normally used for the resin priming coat and as the impregnating resin, whilst HM-180 can be used as the resin primer on smoother concrete surfaces (see below). The resins should be mixed and used as described below. Avoid aeration during all mixing actions. The pot life begins when the resin and hardener are mixed. It is shorter at high temperatures and longer at low temperatures. The greater the quantity that is mixed, the shorter the pot life becomes. To obtain longer workability at high temperatures, the mixed adhesive may be divided into portions. Another method is to chill components A and B before mixing them.

The sequence of operations must be planned to ensure that the adhesive can be applied and the work with it completed within one hour of mixing, or within 80% of the pot life, whichever comes first.

7 APPLICATION

7.1 GENERAL

Prior to starting the application, measure and record the substrate moisture content (to be less than 4%), the relative humidity and determine the dew point. The temperature must be min. 3°C above the dew point. Cut the HM CFRP fabric to the desired dimensions for the installation.

Always work in the same direction as the fibres. Avoid excessive force and moving the roller back and forth when laminating, to prevent any folding or creasing of the HM CFRP fabric.

Overlapping pieces of fabric must be installed in the same direction as the fibres and the overlap must be at least 200 mm, or according to the project specifications.

When placing several unidirectional HM CFRP fabric side by side, no overlapping in the weft direction (perpendicular to the fibres) is generally required, unless specified otherwise in the strengthening design. Formulti-directional fabrics, overlapping in the weft direction must be by at least 200 mm or again according to the project specifications.

After application, protect the finished installation of HM CFRP fabric Reinforcement from rain, sand, dust and any other contaminants using protective plastic sheets or other barriers. Do not allow the protective sheets to come into contact with the finished HM CFRP fabric installation.

7.2 THE DRY APPLICATION PROCESS



Surface Treatment



Apply Primer



Leveling



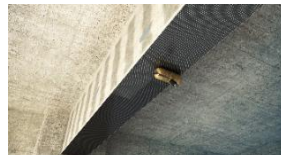
Applying epoxy resin



Cutting carbon fiber cloth



Pasting carbon fiber cloth



Applying adhesive again



Curing and protecting

1. Surface Preparing:

Remove the coating of concrete surface with grinder. Polishing the Surface. If there is angular, grinder it into round.

2. Setting out:

Get the concrete surface clean and keep it dry, then setting out.

3. Apply Primer:

Apply primer adhesive onto the surface of the concrete.

4. Apply Putty/Leveling:

Apply putty for repairing and leveling if needed.

5. Fabric Cutting:

Cut carbon fiber fabric into sizes as designed.

6. Preparing the impregnation adhesive:

Weight and mixing adhesive according to ratio. Stirring the adhesive until the color is even. Avoid air bubble in this process.

7. Applying Impregnation Adhesive:

Apply impregnation adhesive when primer adhesive is touch dry. (If primer is not required, impregnated adhesive can be applied directly.)

8. Apply carbon fiber fabric:

Apply carbon fiber fabric onto the concrete surface as designed. Leveling subsurface from one end to another

9. Check Gap or Bubble:

Apply impregnation carbon fiber adhesive again. Make sure the adhesive impregnate fully into the fabric. The surface flat and no air bubble. Repeat above process from cutting carbon fiber if applying two or more layers..

8 INSPECTION AND TESTING

8.1 BEFORE APPLICATION

The substrate strength (concrete, masonry, natural stone) must always be checked and verified in all situations.

8.2 SITE INSPECTION

On site, all aspects of preparation, mixing, and application of materials should be continuously observed and recorded, including the following:

- Surface preparation and testing
- Materials labels and batch numbers
- Mixing of the resin materials
- Application of the resin to the substrate and the fabric
- Curing of the materials
- System testing
- All other details relating to the strengthening requirement and system specification

Upon completion of the curing process the installed system should be checked again for any areas where the impregnation resin has not fully penetrated, or where any resin has not completely cured. Any such areas covering more than 25 x 25 mm on the surface must be repaired. Any repairs must be made subject to the same application, curing and quality control specifications as the original work.

Small delaminations and / or bubbles can be injected with a compatible resin system to re-establish bond between the substrate and the strengthening system.

If large defects are found, removal of the applied system and re-application, or the application of additional layers of FRP Reinforcement may be necessary. The repair type, the preparatory works, the number of layers to be added and the overlapping lengths must all be approved by the responsible Structural Engineer.

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