

PART 1 - GENERAL

1.1 GENERAL CONDITIONS

- .1 All materials, methods and workmanship shall conform to requirements of the 2005 National Building Code with Manitoba amendments, Section 4.3 Wood and Section 9.23 Wood Frame Construction in addition to these specifications; in all case the most conservative requirements shall govern.

1.2 WORK INCLUDED

The Work under this section of the specification includes all labour, materials, equipment and services necessary for or incidental to the repair, reinforcement, injection grouting, and other repairs to all glulam members constituting the building structure described herein, identified elsewhere in these documents, and otherwise required by Site conditions to complete this Contract. This shall include, but not be limited to the following:

- .1 Provision of all temporary supports while remedial Work is in progress.
- .2 Provision of all scaffolding, Work platforms, etc.
- .3 Determination of repair methodology by reason of each area of deterioration.
- .4 Removal of rotted or otherwise deteriorated material in split or damaged glulam beams, struts, etc. and preparation for repairs and reinforcing.
- .5 Execution of repairs, remediation, etc.
- .6 Injection grouting and other repairs, and reinforcing of all affected timber.
- .7 Sandblasting, cleaning and preparation of all wood and steel for painting and/or repair.
- .8 Repainting steel, connections and exposed glulam, struts, base enclosures, etc.
- .9 Making good all trades on completion.

PART 2 – PRODUCTS

2.1 MATERIALS

- .1 Lumber
 1. Lumber shall meet CSA and NLGA Standard Grading Rules for Canadian Lumber and must be of same species as framing.
 2. Moisture content: all lumber shall be kiln dried and moisture content at time of application **MUST** not exceed 15%.

.2 Nails and Fasteners

1. The size and number of nails must in every case be not less than the requirements of Section 9.23 of the National Building Code with Manitoba amendments.
 2. Nails for rough carpentry shall be hot dipped galvanized. Generally nails to be of sufficient length to give not less than 1½" penetration after passing through board being nailed.
- .3 Resin for reinforcement and associated Injection Grouting: shall be "Rotafix CB10T SS" or approved equal in accordance with B6.
- .4 Injection Tubing: Code No. 3655 as supplied by "Rotafix" or approved equal in accordance with B6.
- .5 Molding Mortar: "Rotafix TM3" Code No. 3420 or approved equal in accordance with B6.
- .6 Reinforcing Rods: shall be "Rotaflex" rods, 19 mm or equivalent bundles of 5.1 mm diameter as supplied by "Rotafix", or approved equal in accordance with B6 FRP rods.
- .7 Pourable Epoxy Grout: shall be "Rotafix TG6".

2.2 ALTERNATIVE MATERIALS

- .1 The materials specified for the injection and FRP reinforcement are an integral part of an homogenous tested system for wood repairs of this type. Testing of these materials as a composite system have been carried out by various universities and others in Europe and North America including by an ISIS Program at the University of Manitoba.
- .2 For more information on "Rotafix" products and systems Contractor is referred to their web site (www.rotafix.co.uk). The specified resins have been formulated with special characteristics with respect to "wetting" action of the wood materials and consequent penetration of the wood matrix. These materials are unique for use with wood and are not multi-purpose for use with concrete as with common epoxy injection grouting of concrete cracks or separations.
- .3 Contractor and/or suppliers wishing to submit requests for alternative materials shall in accordance with B6 produce testing information specific to use with wood and especially glulam; multi-purpose resins (epoxies) will not be considered as "Equals" or "Alternatives".

PART 3 – EXECUTION

3.1 GENERAL WORKMANSHIP

- .1 The accompanying drawings are diagrammatic only to provide member sizes, dimensions, etc. and to demonstrate the different repair methods which are required. The eventual methodology for any individual location will depend on as

found conditions determined on Site after the Contractor has completed his exploratory Work and assessment of each member.

- .2 As an “assist” to the successful Contractor it is anticipated that a representative from “Rotafix” may be on Site during the early stages of the Work to advise on the installation process for the routing out and insertion of wedges/fillets of replacement timber and other methods.
- .3 Contractor shall note that as with all resins, strict adherence to the manufacturer’s instructions is essential, especially in the preparation of the mix designs. Weights of product must be exact and mixing instructions followed exactly.
- .4 As indicated elsewhere in these documents, the moisture content of the repair wood “fillets” must be similar to the current moisture content of the wood structure. If necessary lumber for the repairs shall be obtained from a company who can dry out required materials to these lower contents – lumber from normal sources may not be acceptable.

3.2 RESIN INJECTION WORKMANSHIP – TYPE 1 REPAIR

In capsulated form, the process shall be as follows:

- .1 For cracks and separations up to 6 mm (0.25”), the face of the member shall be sealed with CB 10T SS, glue gun, or approved material in accordance with B6.
- .2 Holes shall then be drilled at approximately 100 mm (4”) through the seal for insertion of a “syringe” needle.
- .3 CB 10T SS shall then be injected at the lowest hole or end hole until resin product appears at the next hole. Injection shall stop and the first hole be “plugged” with a wood filler (round toothpicks have been found to serve well for this purpose). The process shall continue until the entire crack/split has been filled.
- .4 After resin has set (approximately 3 days) any “glass fibre-epoxy resin (FRP) rods shall be installed to “pin” the various members as indicated elsewhere in the documents. Installation of rods will be done by drilling 19 mm ($\frac{3}{4}$ ” diameter) holes in the member and then inserting CB 10T SS and bundles of 7 - 5.1 mm ($\frac{1}{4}$ ” \emptyset) rods installed one at a time. Each rod shall be installed separately with a twisting motion to ensure rod is coated with the resin. After the last rod is in position, the bundle shall be pushed into the hole to leave a filler space approximately $\frac{3}{4}$ ” deep ready for the “Molding Mortar”. When set the fill material shall be hand tooled and stained to match surrounding timber texture and colour – staining is required regardless of final painting.

3.3 RESIN INJECTION COMBINED WITH TIMBER FILLET REPAIR (TYPE 2)

- .1 For splits, cracks/fissures or rotted areas in excess of 6 mm (0.25”) wide, a router and guide with a single flute cutter shall be used to produce a “chase/slot” of necessary depth and width to match the damage centred on the line and direction of the damage.

- .2 Using the routed “chase” as a template, produce moisture and species matched timber fillets, either parallel sided or frustrum shaped to almost fill the depth of the “chase”. Where damage extends through the member, do half the depth at a time allowing first half to set before completing infill. Fillets shall be installed with CB 10T SS ensuring that fillets fit easily into “chase” without exerting pressure on the split/chase which could induce stresses into the base member.
- .3 After fillets have “cured/set” for a minimum of three days, profile fillet, etc. to match adjacent material surface. If necessary recess fillet to allow for finishing “chase” with molding mortar which can be sanded, profiled and stained as for injection repairs.
- .4 If required after repair is completed, do additional injection grouting as identified in 3.2.
- .5 After resin has set (approximately 3 days) the “glass fibre-epoxy resin” rods shall be installed to “pin” the various members as indicated elsewhere in the documents. Installation of rods will be done by drilling 19 mm ($\frac{3}{4}$ ” diameter) holes in the member and then inserting CB 10T SS and fibreglass rods. Each 5.1 mm rod shall be installed separately with a twisting motion to ensure rod is coated with the resin. After the last rod is in position, the “bundle” shall be pushed into the hole to leave a filler space approximately $\frac{3}{4}$ ” deep ready for the “Molding Mortar”. Fill recess with Molding Mortar and when set the fill material shall be tooled, sanded level and stained to match surrounding timber texture and colour – staining is required regardless of final painting.
- .6 Surface of repair and colour shall match existing – already sanded wood surface ready for painting.

3.4 RESIN INJECTION COMBINED WITH 38 MM END LAMINATION REPLACEMENT – TYPE 3

- .1 For rotted out beam ends and/or where adjacent beam laminations are rotted through the full beam width, preparation for repair shall produce a “toothed” or overlapping configuration as indicated on the accompanying drawings. Blocks of new material of the same length shall not be installed at the end of the beam in the same “stacked” manner as with previous repairs.
- .2 Full width infill material shall be of differing lengths to create an overlapping splice by using the “toothed” out shape. A combination of Type 1 and Type 2 repair may be required and shall be checked with the Contract Administrator before proceeding. In addition, specific conditions where several layers/laminations one above the other are in contact, dowelling into the adjacent end of a lamination may be required as per detail.
- .3 After remedial Work has set for a minimum of 3 days, vertical and/or diagonal FRP rods shall be installed as described in 3.3.5 above, depending on specific details.

- .4 If required by final installed condition, do additional resin injection grouting.

3.5 REPAIR OF "TIE DOWN" GLULAM SIDE MEMBERS & BLOCKING

- .1 Certain of the glulam members which are in contact with the steel side plates used as part of the tie down structural system are rotted or otherwise damaged and require repair. Repairs of this damage shall be done in general conformity with one or other of the three repair types.
- .2 Several of the pieces of solid wood blocking between the tie down diagonal members are to be replaced. After removing the through bolts, check the faces of the members which have been in contact with the blocking and advise Contract Administrator of suspected need for repair. In all cases where damage to blocking exists, entire piece of lumber shall be removed and replaced with new material. New material shall be of "clear" number 1 Douglas Fir cut to exact size from oversize lumber; layered material to match width will not be accepted. Custom factory manufactured glulam fillers of appropriate size will be acceptable if manufactured by a company specializing in glulam beam manufacture to all applicable building and manufacturing codes.
- .3 Any confirmed damage to interfaces of side tie down glulam members shall be repaired using one of the approved methods.
- .4 After all wood repairs are complete and blocking re-installed, install new galvanized bolts to match original configuration.

3.6 RE-CONNECTION OF STEEL FRAMING SYSTEMS

- .1 After all glulam and wood repairs have been completed and cured for minimum seven (7) days the inverted saddle over the beam end can be re-installed. Note under Section 05120 steel preparation is required, including special "painting" of what will be concealed steel plate faces.
- .2 Prior to proceeding with saddle installation, the position of the roof beam must be checked to determine whether any deflection has occurred during the remedial Work and which requires adjustment of the beam position. Careful records of existing beam positions and centre deflection shall be obtained at the outset of Work on each beam and compared with conditions immediately prior to attaching and welding the side plates back in position. If necessary the position of the beam shall be adjusted to ensure conformity with pre-existing conditions.
- .3 After the side plates are welded and the new cover plate installed, refinishing of the wood and steel materials may proceed. On completion of all painting and any other remediation the support at the centre of the arena may gradually be released and load transferred back to the tie down system. This release process must be carefully monitored by the Contractor and any unusual conditions or problems with the repaired glulam must be noted and immediately relayed to the Contract Administrator.

3.7 WORK SEQUENCE

The first phase of the Work shall be to the exposed beam ends along the east side of the arena. The beams shall be done one at a time to alternate beams, e.g. No.'s 1, 5, 9, 3, 7 followed by 2, 6, 10, 4 and 8. Changes to this sequence may be approved after the first beam is completed, but the Contractor shall **NOT** assume this will be the case.

3.9 CLEAN UP

- .1 All areas affected by the Work shall be cleaned up as the Work is complete and the area left clean and free of debris.

END OF SECTION