

# *Technical Notes*

From the PTI Technical Advisory Board (TAB)

Issue 18 • May 2014

## Major Changes in Quality Assurance Requirements for Unbonded PT Construction

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### 1—INTRODUCTION

This Technical Note addresses the use of encapsulated unbonded tendons and expanded inspection requirements that encompass all aspects of tendon finishing. It is directed to the licensed design professional (LDP), the field installation crews, and the field inspector. Initiated by the PTI Technical Advisory Board (TAB), the Post-Tensioning Institute (PTI) has adopted the following directive:

**“All unbonded single strand post-tensioning tendons used for structures designed in accordance with the Building Code Requirements for Structural Concrete (ACI 318) must be encapsulated, regardless of the exposure conditions.”**

The encapsulation of the tendons shall be in accordance with the material requirements for aggressive environments in the PTI Specification for Unbonded Single Strand Tendons (PTI M10.2-00) and the ACI Specification for Unbonded Single-Strand Tendon Materials and Commentary (ACI 423.7-07).

### 2—BACKGROUND

At their spring 2009 meeting, PTI’s Technical Advisory Board (TAB) established a Task Group to investigate reported cases of strand corrosion in encapsulated tendons. The Task Group found that the key issue was improper installation of encapsulation caps, frequently caused by excessive strand projection (strand tail) that prevented proper seating of the encapsulation caps. Cases were also found where improper material, such as stucco, was used to fill the stressing pockets.

The Task Group members initiated changes in ACI 301 that now requires installation of the encapsulation caps within 8 hours of cutting of the tendon tails, essentially meaning the same day. An effort by the Task Group members and PTI staff will continue to include the requirement for inspection of the finishing operations, including the installation of encapsulation caps in ACI 301, Section 9.3.2. PTI intends to revise their specifications to include the requirements stated previously because it believes the longevity of encapsulated tendons is dependent, to a large degree, on proper execution of the finishing process.

### 3—QUALITY ASSURANCE FACTORS

The quality of construction involves both materials and execution. Either the materials or the execution alone cannot guarantee the desired durability.

The materials aspect is addressed by the requirement for encapsulated systems for all ACI 318 designed structures. This is important, as it removes the need for subjective judgment regarding aggressive or non-aggressive environment as it relates to tendon encapsulation. Direct or indirect exposure, coastal proximity, deicing salt application, and so on are often difficult to assess in respect to the effect on the durability of the post-tensioning (PT) system. Also, even in enclosed structures protected from the weather, conditions during construction can lead to long-term problems in non-encapsulated systems.

The focus of this Technical Note is to emphasize the need for encapsulated PT systems including finishing and inspection. Often in the past, the PT work was considered done once the elongations were approved and tendon tails cut off. The finishing operations were considered secondary in nature. Inspection of the PT work must include the finishing operations.

#### 3.1—Installation

Installation of tendons shall be in accordance with the PTI Field Procedures Manual, latest edition.

1. The tendons shall be installed in accordance with PT installation drawings that have been reviewed and approved by the LDP.
2. Insert the pocket former into the anchor cavity, and secure the assembly to the edge form (usually by nails).
  - a. Stressing anchorages shall be firmly secured so that the pocket former is perpendicular to and in uniform contact with the edge form.
  - b. Reject any pocket former that will allow concrete slurry to enter the anchor cavity.
  - c. Do not allow PT coating or any other lubricants on any part of the pocket former that comes in contact with the concrete, as this would prevent the bond between the concrete and the stressing pocket patching material.
3. Thread the strand end through the transition tube, anchor, pocket former, and the edge form.
  - a. Cut the sheathing immediately behind the anchor but leave it temporarily in place.
  - b. Install the transition tube (unless it is already a part of the anchor encapsulation) to seal the gap between the back side of the anchor and the sheathing.

4. Remove the pocket former after the concrete has reached the designated strength, pull out the pre-cut sheathing from the tendon tail, remove any concrete slurry or dirt from the anchor cavity, insert the wedges, and stress the tendon.
  - a. Do not proceed with stressing operations if the wedges are restrained from entering the anchor cavity. This condition is usually caused by an obstruction in the anchor cavity, such as dirt or concrete slurry, which shall be removed and the wedges reinstalled.

### 3.2—Finishing and Inspection

Tendon finishing shall be in accordance with the PTI Field Procedures Manual, latest edition.

Note: “Finishing” refers to three steps in PTI’s Specification for Unbonded Single Strand Tendons. They are: 1) cutting the tendon tail; 2) installing the encapsulation cap; and 3) filling the stressing pocket with nonmetallic, nonshrink grout.

1. Cut the tendon tails within 1 working day after acceptance of stressing records by the LDP.
  - a. The stressing records with elongations are to be approved or disapproved preferably within the next working day after stressing.
  - b. The strand tails are to project beyond the wedges no less than 0.50 in., no more than 0.75 in., or as specified by the PT supplier to accommodate proper seating of the encapsulation caps.
  - c. Cutting of the tendon tail shall be done by an approved method that results in strand tail length, which does not impair seating of the encapsulation cap.
  - d. A qualified inspector shall verify that tendon tail cutting was completed within the specified time frame and that tendon tail lengths are within specified tolerances.
2. Install the encapsulation cap as soon as practical but not to exceed 8 hours after cutting off tendon tails.
  - a. The encapsulation cap shall be filled with an approved PT coating material.
  - b. Installation of the encapsulation cap within the prescribed period of time shall be inspected by a qualified inspector.

3. Fill the stressing pocket with nonmetallic, nonshrink grout within 1 day after tendon tail cutting.
  - a. The patch material shall be a high-quality premixed cementitious chloride-free nonmetallic, nonshrink grout, mixed with limited amount of water per manufacturers’ recommendation for use as repair material. The material shall be submitted to the LDP for review and approval prior to use.
  - b. The patch material shall not be installed until the stressing pocket has been cleaned with a wire brush or similar to ensure the proper bond of the patch material; a bonding agent may be applied.
  - c. The patch material shall be suitably packed into the stressing pocket and struck-off flush with the outer face of the member.
  - d. Installation of the nonmetallic, nonshrink grout within the prescribed period of time shall be inspected by a qualified inspector.
4. The inspector shall submit a report to the LDP containing data on the three steps of the finishing operation: 1) cutting the tendon tail; 2) installing the encapsulation cap; and 3) filling the stressing pocket.
5. At intermediate anchorages, encapsulation elements shall be installed within 1 working day after acceptance of stressing records by the LDP, and shall be inspected and reported as described previously.
6. Tendons with elongations not approved by the LDP shall be protected from the weather until the deficiency has been evaluated and corrective actions performed.
  - a. Finishing operations shall continue on approved tendons during evaluation and remediation of the rejected tendons.
  - b. If cutting or capping is delayed for any reason, adequate protection shall be provided to prevent moisture from reaching the anchorages.



Technical Note, May 2014

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