



AA ALWARDI POST TENSION WLL

GENERAL METHOD STATEMENT

CR 109564-01

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1. General

This method statement has been developed to provide guidance for all personnel involved in the project on stages of implementation of Post Tensioning - Installation, Stressing and Grouting operation.

2. Materials

<u>Strands</u>	0.5"	0.6"
Nominal Diameter	12.7mm	15.24mm
Nominal Area	98.7mm ²	140mm ²
Nominal weight	0.774kg/m	1.102kg/m
Tensile strength	1860N/mm ²	1860N/mm ²
Modulus of elasticity	195kN/mm ²	195kN/mm ²
Min breaking load of strand	186kN	260.7kN
International standard used	BS	ASTM

2.1 Ducts

The sheathing consists of plain or smooth ducts made from galvanized steel strips of 0.4mm thick cut in lengths of 5.0M

2.2 Anchorage

The type of anchorages commonly used are Flat Anchorage (For Slab), Multiplane Anchorages (For Beams), and Bond Head (Dead End) Anchorages. The various types of anchorages are shown in the shop drawings (Standard Details). The purpose of the anchorages are when the strands are stressed, the tendon force would be transferred to the concrete. Bursting reinforcement is provided behind the anchorage to distribute the stressing force.



Design data for friction / elongation calculation

Friction of coefficient μ	:	0.2 } or as per the consultants recommendation
Wobble factor k	:	0.0017/m } design parameters
Draw in of wedge	:	6mm (approximately)
Stressing anchorage	:	Type FA, MA & Coupler
Loss in jack	:	Varies from 0 to 2.0% for various type of jacks

3.0 Handling and storage of materials

- The pre-stressing strands shall be free of grease and corrosion enhancing properties.
- No flame cutting of strands is allowed
- Care should be taken during handling of construction work in order to avoid mechanical damage to the strands.
- Strands should be raised above ground level to prevent ingress of soil.
- Suitable ropes or slings shall be used for loading and unloading in order to avoid mechanical damage to the strand coil.
- The component must be handled and stored such that any contamination, mechanically damage or corrosion can be avoided.

4.0 General Working Procedure

a) Pre requisite for commencement of Tendon Installation:

1. Shuttering work for the intended P.T slab to be casted has to be made ready in all respect.
2. Bottom layer of the slab reinforcement & perimeter RCC beam reinforcement has to be in place / fabricated in accordance with the approved drawing.
3. Required numbers of pre fabricated bar chairs & bursting links should be made available



b) Preparation

1. H.T Strand will be uncoiled using coil dispenser.
2. Ensure the straightness of the strand and cut the strand as per the required length using disc Cutter / cutting Wheel

c) Laying of tendons

1. Mark the anchorage position onto the reinforcement links / bottom shuttering as per the approved tendon profile drawing.
2. Secure the anchorage head (pre assembled with recess former) either by placing of horizontal support bars across the links (if required) or by tying directly to the top reinforcement bars of perimeter RCC beam.
3. Lay the empty GI sheathing in one direction by jointing / inserting into another length & connect the same with the anchorage head to form a tendon.
4. Care should be taken to avoid other trade laborers stepping on to the empty sheathing laid / formed tendons.
5. Inserting in / threading of strands into the empty sheathing.
6. Ensure enough stressing length (200 - 350mm) of strand has been allowed to protrude outside the perimeter RCC beam / slab edge.
7. Make bulb on to the other end of the strand to form as the dead end of the tendon.
8. Mark the profile of the other direction tendons at the crossover points either on the shuttering / upon the tendon already laid.
9. Lay the empty GI sheathing in other direction by jointing / inserting into another length & connect the same with the anchorage head to form a tendon.
10. Ensure the layer of tendons as per the profile drawing is achieved on site.
11. Seal off all the joints of sheathing laid, with the help of duct tape to ensure the cement slurry shall not ingresses through these joints.
12. As per the approved tendon profile drawing, elevate the assembled tendons to the required height with the help of the bar chairs & secure them with the binding wires.
13. Spread the bulb formed strands at the dead end to have 450mm in width & tie them on to a horizontal bar resting on the required profile bar chair.
14. Erect the side shuttering with holes for protruding strands & complete the same to receive concrete.



d) Points to be taken care while Concreting:

1. Care should be taken to ensure that the sheathing does not get damaged during concreting.
2. Ensure the minimum grade of concrete for Post – Tensioning work should be M – 45.

e) Preparation for Stressing:

1. Immediately after the removal of side shuttering, the recess former shall be removed.
2. The strands projecting outside the anchorages will be cleaned and the anchor block along with the wedges shall be slotted on to them.
3. Wedges shall be mildly rammed with a steel pipe to ensure for their even seating.

f) Pre requisite for Stressing

1. Jacks used for stressing should be supplied with necessary calibration certificate.
2. All stressing equipment will be cleaned and checked before put into operation.
3. Theoretical elongation calculation shall be prepared and kept ready.
4. Compressive strength of the concrete should be confirmed to have achieved 33N/mm^2 before the commencement of stressing activity.

g) Stressing of tendons & its sequence

1. Initial stressing shall be commenced by applying 25% of the total designed force. The purpose of initial stressing is to remove the slack of the strands in the tendon.
2. Paint mark shall be made on the strand as a datum for measuring elongation.
3. Proceed with full 100% stressing of the total designed force.
4. Measure the difference in length from the paint mark to the wedge plate. This will reflect the elongation per strand from 25% to 100%. (Assume this to be X mm in length.)
5. Add the wedge draw in which is approximately 6mm to the elongation
6. The values will be recorded & documented duly signed by P.T Engineer / client / consultant.
7. By extrapolation the full measurement can be calculated and compared against theoretical elongation.



h) Extrapolation of measured elongation

Therefore the full elongation for one-end stressing will be

$$= (X + 6\text{mm}) \times \frac{100}{75} \%$$

$$= (X + 6\text{mm}) \times 1.3333$$

Similarly for tendons with two end stressing, the tendons may be stressed from one end followed by another. Sum of elongations from both ends is then compared with total theoretical extension.

Assuming the far end elongation is Y.

The total elongation will be:

$$\{(X + 6\text{mm}) + (Y + 6\text{mm})\} \times \frac{100}{75} \%$$

After approval by consultant's / client's engineer the protruding strands are to be cut off to a minimum of 10mm from the wedge plate.

- All stressing results shall be tabulated on a stressing record and submitted for approval by the engineer.
- If the average stressing result of the whole pour is within $\pm 8\%$ it shall be deemed as satisfactory.
- In accordance to the Federation Institute of Prestressing (FIP) code, the average shall be within $\pm 8\%$. If any individual tendon of a pour falls outside this, then the average extension over the whole respective pour should be checked and this falls within the tolerance of $\pm 8\%$, then the stressing operation is considered satisfactory.
- Stripping of formwork can be carried out after full stressing of beam / slab is completed.

However the Resident Engineer on-site shall be consulted by the contractor before any stripping of formwork can commence



I) Grouting of tendons

j) Pre requisite for Grouting

1. Sealing / Patching of tendon's recesses will be done using cement mortar as per specifications.
2. Water will be potable, free from impurities and cement (OPC – 53 grade) will be used and the same should be free from any lumps.
3. Compressed air shall be flushed through the tendons prior to the grouting operation.

k) Proposed grout mix

- Cement in standard 50kg package
(Ordinary Portland Cement)
- Water = $0.45 \times 50\text{kg} = 22.5 \text{ kg}$
= 22.5 liters
- Admixture = 0.4% by weight of cement
(sika intraplast-CFG)

Mixing sequence = water - additive – cement
Min mixing time = 3-4 min

4. The mixing time of grout will be 2 – 3 minutes and approved non-aluminum based expanding agent may be added.
5. Grout in the collection drum will be kept in continuous slow agitation by means of agitator until pumped into the duct.
6. Grout will be pumped into the duct by inlet.
7. Start filling the duct with the specified grout mix, consistency of the grout has to be checked from the other end grout vent, and if it reaches the same, close both the vent and seal them by folding and tying the tubes with binding wire.
8. Same procedure will be adopted for remaining tendons.
9. During grouting workers will wear protective goggles, helmets, and hand gloves.
10. All the data will be recorded in the format.



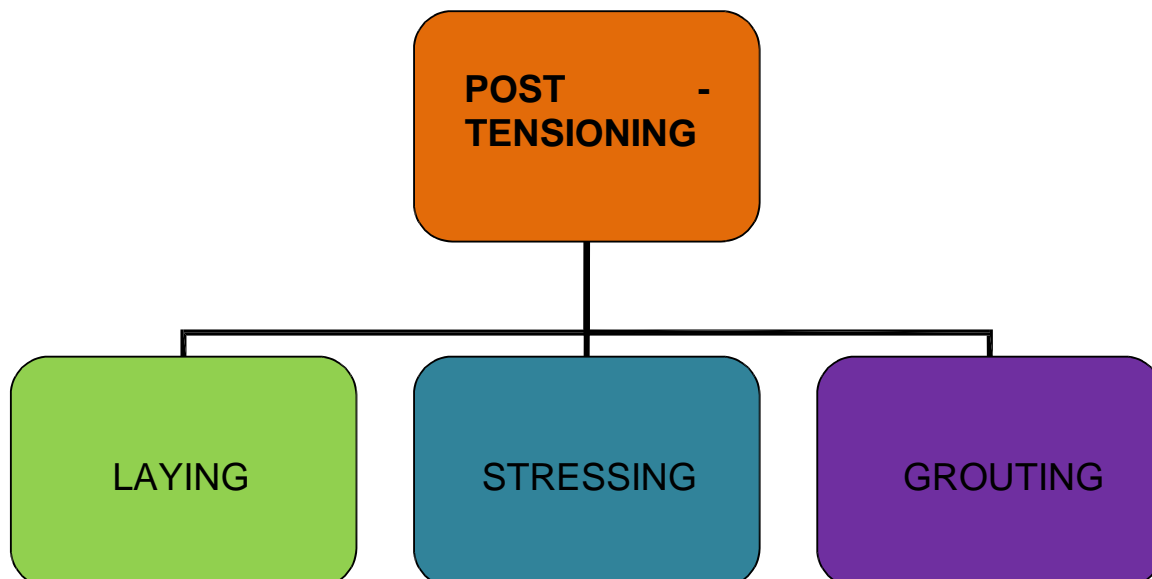
I) Measurement for compressive strength of grout cubes

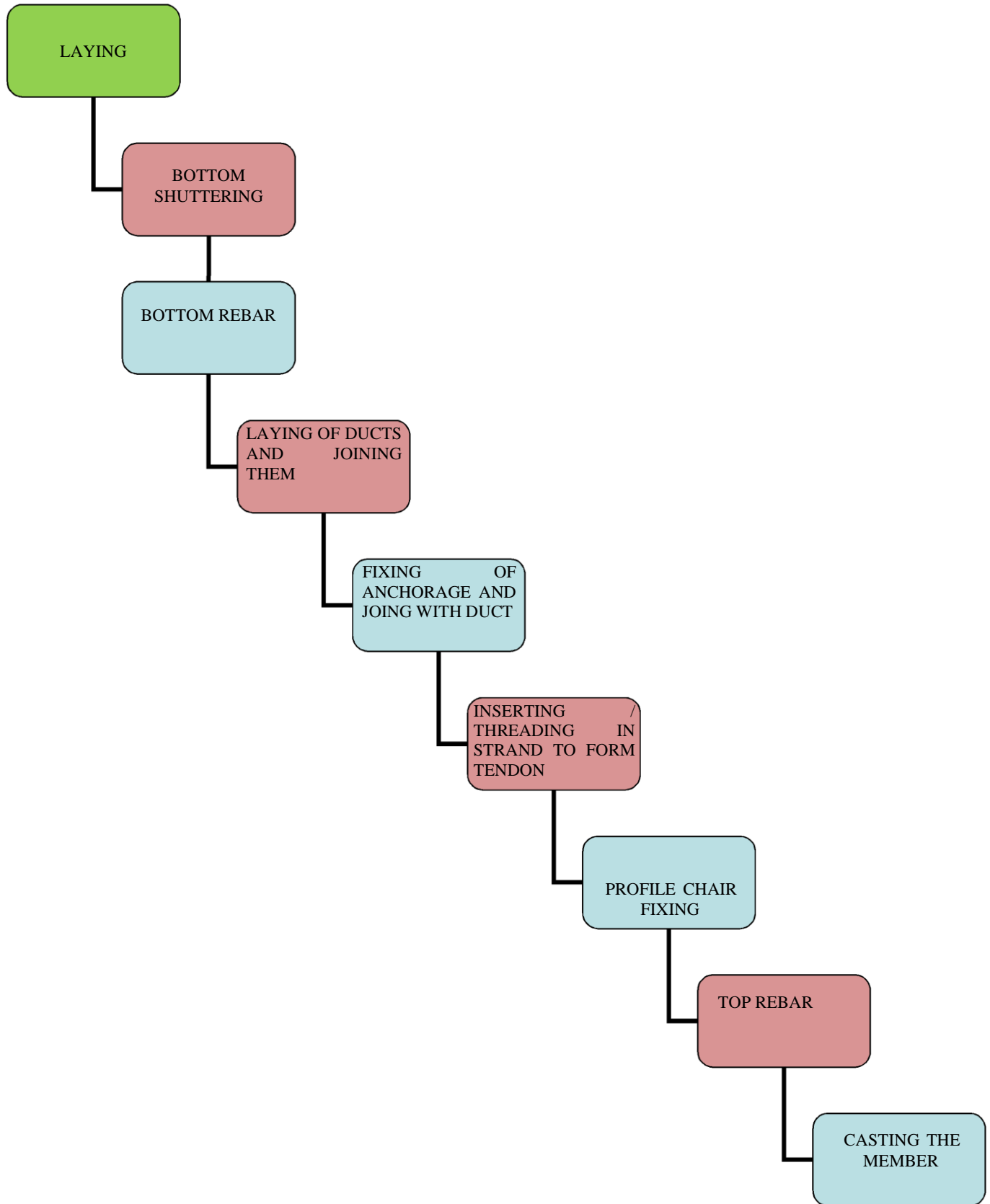
- 6 samples of 100 X 100mm cubes per grouting session will be made.
- After 18 to 24 hours, remove cubes from mold and store in water storage tank.
- Compressive strength shall be measured for 7 & 28 days.
- According to specification, compressive strength of cube shall be:

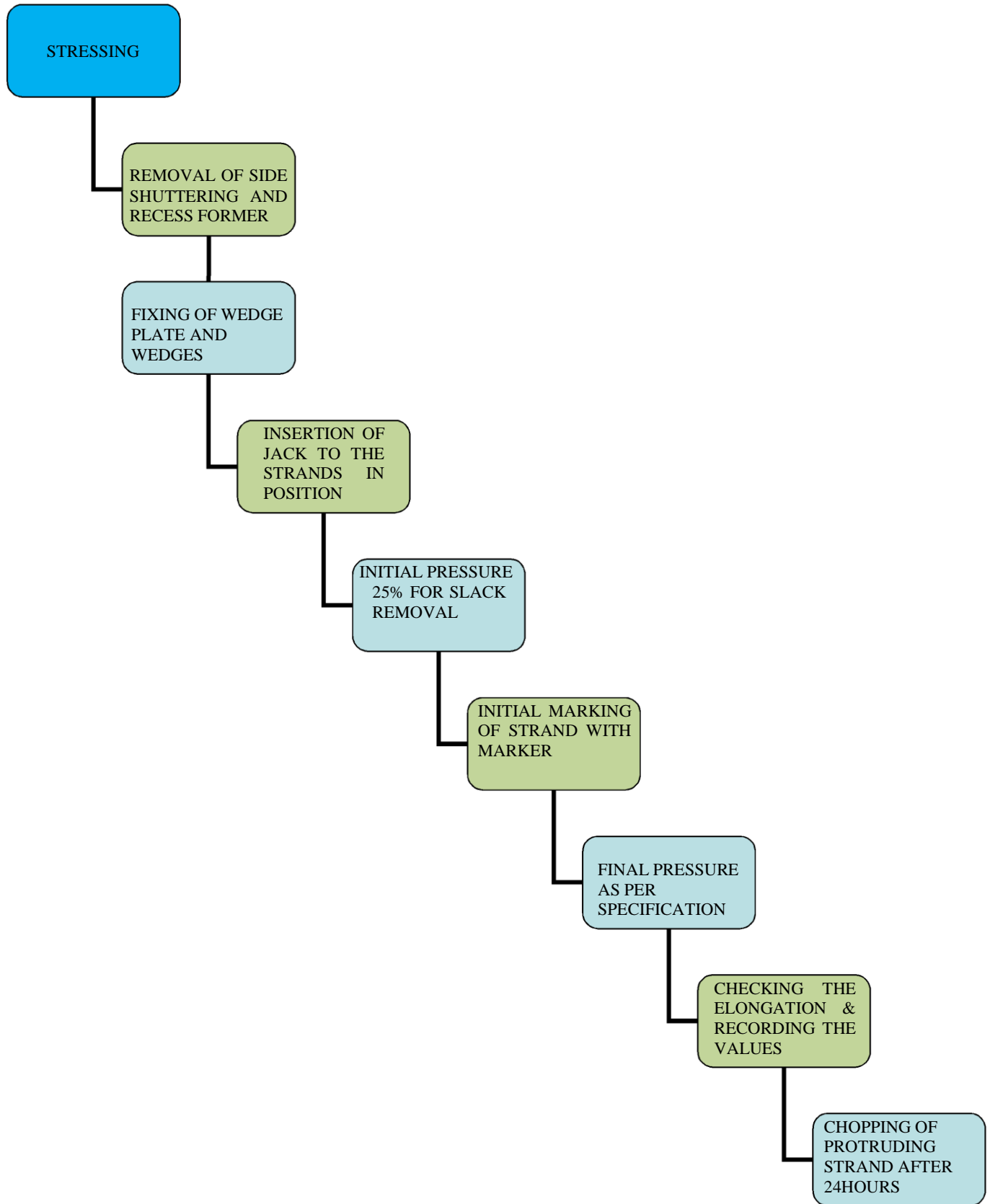
7 days : minimum of 17 N/mm²

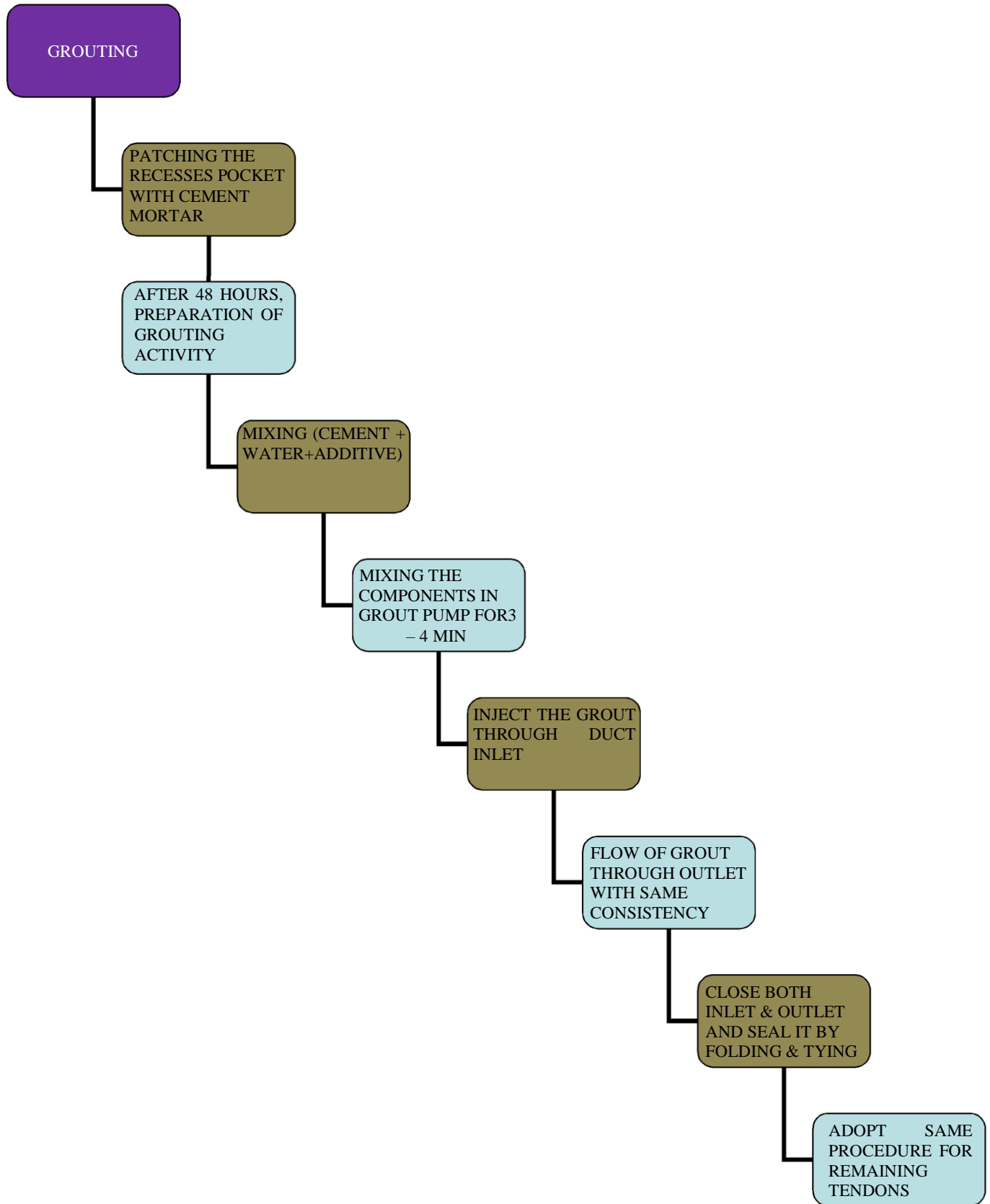
28 days : minimum of 30 N/mm²

SEQUENCE OF WORK











m) Records:

1) Prestressing material quality Reports.

a. Manufacturer Test Certificates for Strand and Anchorages.

2) Calibration certificates for Pressure gauges.

3) Stressing Check list.

4) Grouting Check list.
