HIGH PERFORMANCE INJECTION GROUTING: VSL-HPI®

OPTIMISED QUALITY OF GROUTING
TO ENHANCE DURABILITY
OF POST TENSIONED STRUCTURES:

INTERNAL TENDONS
EXTERNAL TENDONS
SLAB TENDONS
STRESSBARS
GROUND ANCHORS

VSL-HPI®: A package for improving to enhance the durability of post-te

COMMITMENT

QUALITY END PRODUCT

TRAINED AND EXPERIENCED STAFF

VSL-

With VSL-HPI® grouting, VSL provi
post-tensioning works including g
materials and execution on site will
and quality requirements. VSL ca
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VSL IS COMMITTED TO PERFORM QUALITY GROUTING

Experience with grouted post-tensioning tendons over about half a century has proven that a cementitious grout can provide excellent protection for the prestressing steel.
Experience has also shown that the quality of the grouting is of prime importance for the durability of post-tensioning tendons for any kind of application: Bonded internal tendons, external tendons, slab tendons, stressbars.
For these concerns, VSL has developed a full process dedicated to improving the quality of grouting activities on site and grouting materials, under the trademark VSL-HPI® (high performance injection).

VSL PROVIDES OPTIMISED GROUT MIXES DESIGNED FOR THE INTENDED USE AND ENVIRONMENT

Constituent materials (cement, water, admixtures) are carefully selected. They are checked for compatibility with each other. Quantities of admixtures and water are optimised to provide stable, low-bleed grouts which assure complete filling of the tendon ducts and an alkaline environment for long-term protection of the tendon. Grout mixes consisting of selected local cements and specific admixtures have been analysed and optimised for exclusive use in the VSL network.

VSL USES SPECIFICALLY ADJUSTED EQUIPMENT

VSL grouting equipment has confirmed compatibility with our optimised grout mixes, and the confirmed ability to produce a homogeneous grout mix.
The VSL grouting equipment has also the confirmed ability to grout tendons as specified in our proven method statements and procedures.

the quality of grouting
nsioned structures

OPTMISED
GROUT MIX

STATE-OF-THE-ART
TESTING OF GROUT

-HPI®

des a full sub-contract package for
routing. Thus, VSL assures that all
meet state-of-the-art specifications
n also assure the client that all the
f quality grouting are taken care of.

SPECIFICALLY
ADJUSTED
EQUIPMENT

PROVEN
ON-SITE
PROCEDURES

VSL APPLIES WELL PROVEN PROCEDURES

Grouting works on site are carried out in accordance with well-proven procedures, adapted to the equipment and grout mix used, by qualified and experienced VSL staff. These procedures include checking of the most critical tendon locations for complete filling after grouting. Completely filled and well-protected tendons can therefore be guaranteed.

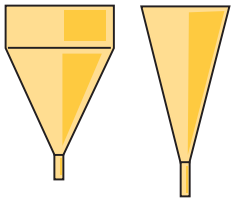
TRAINED AND EXPERIENCED STAFF

Grouting works are supervised by well-qualified and trained specialists with several years of experience. These specialists are familiar with the latest developments in grout mix design and grouting technology.
They assure that the training of our personnel on site is adapted to the intended activities.

VSL SERVICES

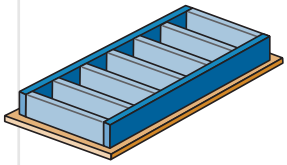
- When the complete VSL-HPI® grouting package is provided, including the supply of a grout mix optimised for the intended use, VSL will take full responsibility for the quality of grouting works, and guarantee the complete filling of tendons.
- Whether standard or special cases such as long vertical cables, loop tendons, grouting of long horizontal tendons etc., VSL will use post-tensioning system detailing, grouting equipment, and grouting procedures that are best adapted to the particular case.
- VSL can offer assistance to the engineer in selecting structural details best adapted to assure long-term durability of the tendons and the structure.
- Vacuum-assisted grouting providing improved quality may be offered for long horizontal tendons to avoid or reduce the need for vents, and for external tendons without access/vents at the high points of the tendon profile.
- VSL can provide HPI® grouting in combination with the CS 2000 post-tensioning system and the PT-PLUS plastic duct system to provide the highest level of tendon protection available today, and to permit electrical monitoring of the tendon during construction and its entire life (EIT technology).

THE VSL-HPI® GROUTING TESTS



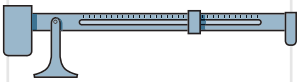
Standard test for the viscosity

- Aim: Assure proper viscosity (flow time) of grout for injection into tendon duct. Several forms of cones are used to measure flow time. CRD and EN cones are most common.
- Minimum 2 tests for any grout mix, carried out before and during grouting.
- Requirements: Flow time limits: 13 to 18 seconds. Stability of flow time over extended periods of time up to 2 hours and more.



Standard test for compessive strength

- Aim: Record compressive strength, usually after 7 and 28 days. Specimens are: Cubes of 50, 70 or 100 mm side length, or prisms of 40x40x160 mm.
- Requirements: VSL-HPI Grouts achieve strengths of 75 MPa and 90 MPa at 7 days and 28 days, respectively, which are well above the usual specifications.

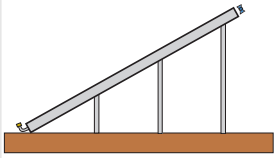


Mud balance test

- Aim: Verification of fluid grout density (weight / volume). Used for approval testing and on-site testing to confirm the water content of the grout mix in-situ.
- Requirements: VSL-HPI Grouts have a high density of about 2,050 kg/m^3 because of their low water content and low porosity.

Wick-induced bleed test

- Aim: Verification of bleed and volume change.
- Grout column with 1 strand at centre. Used for on-site testing.
- Requirements: VSL-HPI Grouts have less than 0.3% bleed, and less than 1% volume change.



Inclined tube test

- Aim: Verification of bleed and stability; after preliminary testing, used as approval test.
- Only test available today to represent realistically the environment of grout inside the cable.
- 2 transparent PVC tubes, each with 12 strands 0.6''.
- Requirements: VSL-HPI Grouts have less than 0.3% bleed and show no segregation.

VSL-HPI® Grouting is the result of intensive research work on the combination of Special Grout and on-site procedures. Today's state-of-the-art grouting, it significantly enhances the durability of post-tensioned structures.

State-of-the-art testing of grout:

Many projects today have demanding requirements in terms of pressure differential for deep and inclined tendon profiles, workability over extended periods, setting, and particularly grout stability for bleed, sedimentation, and segregation. Such applications require the use of Special Grouts with improved properties and specifically selected cements and admixtures. These grouts must go through an approval process including tests not normally specified by today's national standards, but suggested in new recommendations by fib, PTI, EOTA, etc.

VSL-HPI® grouts satisfy all the standard test procedures for bleed, flow time, strength, and volume change. In addition, VSL-HPI® grouts satisfy the more stringent requirements now proposed in the above-mentioned recommendations for the following tests:

- Inclined Tube test
- Wick Induced Bleed test
- Mud Balance test
- Stability of Flow Time

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