

Cementitious Grouting under base plates and fixing of rails in an Automatic Storage Yards - A case study

[Excerpts from Pidilite case studies]

1.0 Background

M/s KONE Elevators has got a factory unit at Ayanambakkam, near Chennai. They are among the top three leading manufacturers of elevators worldwide. They planned to install Automatic Storage yards with steel columns foundation and rail base plates in consultation with "CRN", a leading consultant based at Chennai. Grouting was to be carried out in two rails of the sizes 21.55 m long, 300 mm wide and 40 mm depth and 5.5 m long, 350 mm wide and 60 mm depth, for the 1st and 2nd rail respectively. Grouting was also to be carried out for the base plates of 28 steel columns as shown in Fig. 1.



Fig. 1: View of rail 1 and base plates of steel columns

2.0 Grout Material

The cementitious grout selected was PAGEL V1/50 which consisted of basalt sand and gravel up to 8 mm. The particle grain size of the grout material was up to 5 mm. The water to powder ratio was 0.12. The compressive strength of the grout was 38 MPa & 75 MPa respectively, after 24 hours and 28 days. The work was carried out by M/s Sri Jaivarshini Chemtec, Chennai. Properties of this grout were as follows:

- Heat-resistant up to 400°C
- Capable of high flowability, it can be used as grouting mortar or, depending on the quantity of water, as tamping mortar
- Ready to use, needed water only to be mixed with
- Free of chlorides
- Does not shrink, develops a controlled increase in volume with force locking bond between concrete foundation and machine plate
- Resistant to freeze thaw-cycles, impervious to water and resistant to oil and chemicals

The general properties of the grout which require specification and control are given in Table 1.

Table 1. Test methods & requirement for grout properties

Property	Test Method	EN 447(2004)	EN 447(2007)
Flowability	Cone Method	≤ 25 s	≤ 25 s
	Immersion test	≥ 30 s	-
Bleeding	Grout slump	-	≥ 140 mm
	Wick-induced inclined tube	-	≤ 0,3% initial vol.
Sedimentation	Glass cylinder	≤ 2% volume	-
	Grout density	-	< 5%
Setting time	EN 196-3	-	> 3 h final: < 24 h
Volume change	Wick-induced test	-	> - 0,5% < + 5
	Cylinder/Can method	> - 1% vol. < + 5% vol.	-
Compressive strength	EN 445:1996	28 days ≥ 30 MPa	-
	EN 12190	-	7days ≥ 27 MPa

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3.0 Application

3.1 Form work

The form work must be of rigid construction, made of wood or steel, with sand or dry mortar placed around the concrete base carefully to prevent leakage. In this case, wooden form work was prepared and fixed in position as shown in Fig. 2.



Fig. 2: View of form work and the rail being placed firmly before grouting

3.2 Surface Preparation

The surface was cleaned thoroughly; all loose and unsound materials were removed by an air compressor (Fig. 3). Prior to grouting, the surface was wetted (Fig. 4) continuously with water for approximately 6 hours till saturation.



Fig. 3: Removing dust by air compressor



Fig. 4: Prewetting the surface

3.3 Mixing

The grout selected was a ready-to-use grout, which required only water to be added. For better flow and workability, the temperature of mixing water should be above 0°C and below 25°C, which was maintained in this case. The required quantity of water as per water to powder ratio of 0.12 was measured and two thirds of this was filled into a container and added with the dry mortar and mixed for about 3 minutes. Then the remaining water was filled in and mixed for another 2 minutes. Since the quantity was small, the mechanical mixing was done in a small container (Fig. 5). In case of a large quantity of grout material, a concrete mixer would have been taken for mixing. Then the grouting took place immediately after the mixing.



Fig. 5: Mechanical mixing of grout material in a container

3.4 Grouting

The mixed grout was placed from one side corner only and was poured continuously. When grouting is taken in large areas, the pouring should be done from the middle using a pipe or a funnel. For installation of machine, first the grout was filled into anchor bolt pockets up to the top of the anchor bolt pockets and then the underside of the base plate of the machine. Fig. 6 shows pouring of grout to fix the rail.

4.0 Pidilite Grout Materials

Pidilite has wide range of grout products from Pagel for different specific applications and environment conditions which are given as follows:



Fig. 6: Pouring of grouts for fixing rail 1

4.1 Pagel Free flow Grouts

- Pagel V1/10 - Premium grout for critical applications (5- 20 mm grouting height)
- Pagel V1/50 - Premium grout for critical applications (20 - 120 mm grouting height)
- Pagel V12HT - Premium high early strength (16 hours - 30 MPa) grout for critical applications
- Pagel V1/160 - Premium grout for critical applications (> 100 mm grouting height)
- Pagel V1 - Universal grout for precision machines of any kind
- Pagel V12 - High early, high strength grout for all foundations

4.2 Pagel Speciality Cementitious Grouts

- Pagel V1A/40 - Steel fibre reinforced grout for heavy load foundations
- Pagel V15/50 - Heat resistant grout
- Pagel V1A15/50 - Steel fibre with basalt grout
- Pagel V2/40 - Quick setting grout
- Pagel V14/40 UW - Under water grout

4.3 Dr. Fixit Grouts

- Dr. Fixit Pidigrout 5M - Medium strength, non - shrink, cementitious free flow grout for machine foundations
- Dr. Fixit Pidigrout 10M - High strength, non-shrink, free flow cementitious grout for foundations up to 70 mm
- Dr. Fixit Pidigrout EG-3 - High early strength and chemical resistance high flow epoxy grout for heavy dynamic and mobile loads

5.0 Conclusion

As it can be seen that there is a wide range of grout products available in the market, but the selection of grout materials should be such that it satisfies all the required properties, meets the requirement of standard specifications, and is followed by a step-by-step procedure of application. The grouting work of foundation for steel columns and rail base plates of Automatic Storage yards was completed successfully.

(Refer our ReBuild publications Vol.3, No.1, 2009 and Vol.4, No.4, 2010, pp.7-10 on grouting for further studies)