

Japanese 2 liquid type Grouting with European TBM grouting pipes.

Comparison of European TBM grouting pipes and Japanese

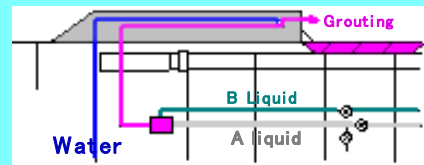
Japanese Backfill Grouting Pipes is different from European. It is due to the difference of grouting materials between Europe and Japan. Japanese 2 liquid type has the character quick thixotropy, quick hardening. European 1 liquid type, slowly hardening.

European style



- (1). Thick Skin Plate (inside pipe)
- (2). Simple Structure
- (3). No lid structure
- (4). No washing function
- (5). Pipe washing needs high-pressure jet.

Japanese style

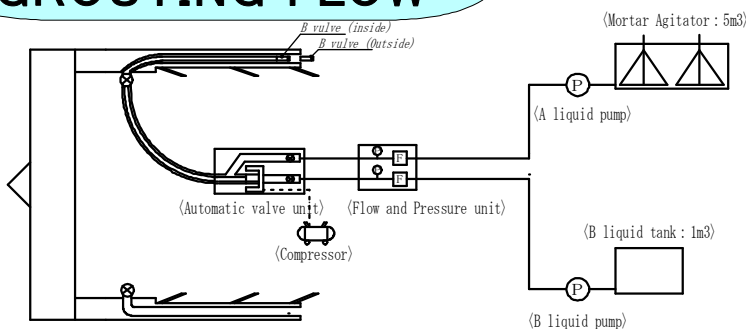


- (1). Thin Skin Plate (outside pipe)
- (2). Complicated Structure (Jack system)
- (3). Safety Lid
- (4). Washing function
- (5). Mortar pipe can be removed.

In case using quick hardening material with European grouting Pipe

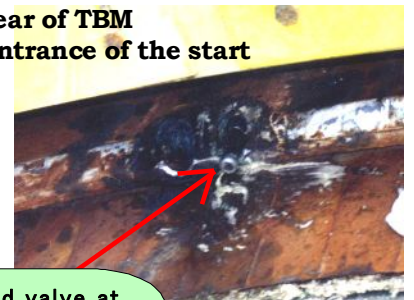
With the grouting pipe of simple structure, it had been said conventionally that thixotropical-gel-grout material could not be used. However, in case Netherlands Botrek tunnel construction (diameter 9.8m L=1.8km EPB). All route completions by using 2 liquid thixotropical-gel-grout (gel-time 5 second, strength $1H=0.5\text{kg/cm}^2$) with Europe grouting pipe were realized successfully. Thereby, in Europe, evaluation of 2 liquid type grouting method of construction is increasing. How did it construct?

GROUTING FLOW

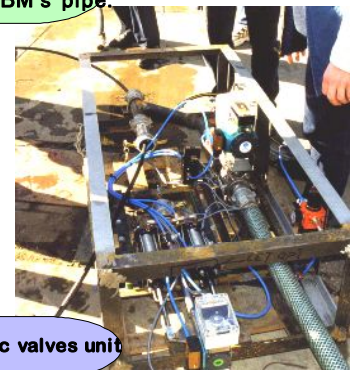


- ① B liquid valve is equipped in a pipe. It is mounted at a tip.
- ② Inject material through a check valve in all the directions. The mixed effect is raised by this.
- ③ At the time of grouting, B liquid is pushed out to Tail void. 2 liquid mixture is not performed within a pipe.
- ④ Exchange of the B liquid valve is should be carried out before a holiday.
- ⑤ When taking out a B liquid valve, don't solidify the inside of a pipe. It is filled up with material. (Bentonites, grease etc.).

The rear of TBM
The entrance of the start



B liquid valve at the out of TBM's pipe.



The automatic valves unit