



Lubrication Fluids for Micro-Tunnelling/ Pipe-Jacking

General information

Keys to success

- Anticipate the specific characteristics of your project based on soil conditions
- Adapt the formulation of both the drilling mud and the lubricating slurry
- Control and adjust previous formulations during the operation
- Choose the Süd-Chemie Group's tried and tested products – bentonites and polymers



Micro-tunnelling and pipe-jacking techniques are used to install pipelines without digging open trenches. The process begins at a launching shaft and ends at a reception shaft which can be positioned several hundred meters away.

The challenge of this trenchless technology lies in its need to overcome the frictional resistance induced when jacking the pipes into the ground (skin friction).

Injecting a high-quality lubricating slurry around the outside of the pipes is strongly recommended to reduce skin friction and increase jacking distances, especially if the oversize cut is not adequate, as in the case of unstable soil.

It is common practice to use a bentonite slurry as a lubricant, but

this may be mixed with and, in certain situations, even completely replaced by polymers and other specific additives.

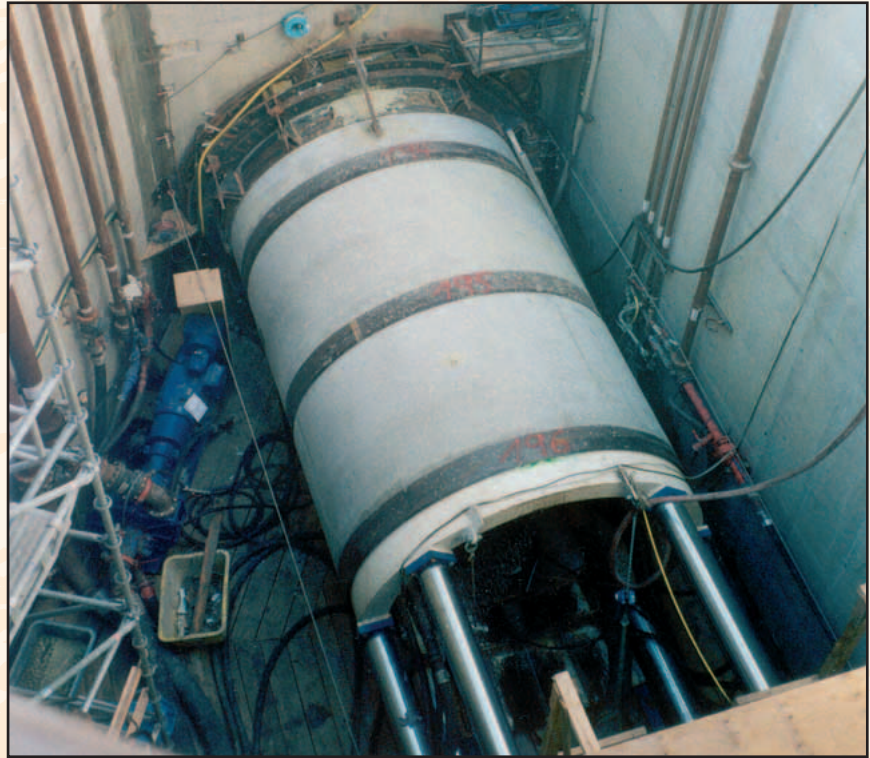
When the tunnelling machine bores through unstable formations, the drilling mud must be formulated to achieve an efficient face support during excavation and simplify removal of the cuttings (see also tunnelling brochure).

Definition of the „fluid solution“ is therefore of major importance for the success of such projects.

The Süd-Chemie Group provides support for specialised companies by sharing its field experience and drilling-mud know-how, based on a comprehensive range of proven products and services which can be adapted according to the specific characteristics of each project.



Function and characteristics of lubrication slurry



Function of lubricating slurry

Function 1

The lubricant helps reduce the jacking force by modifying the nature of the contact between the soil and the pipe.

Function 2

The lubricant also contributes to stabilisation of the oversize cut in the case of unstable soil.

Characteristics of lubricating slurry

Function 1

A lubricant is usually classified only on the basis of its viscosity, based on the assumption that this alone determines its lubricating ability. To gain a fuller picture, measurement of its viscosity (which is the time taken for a defined volume of lubricant to fill a cup when flowing through a standardised funnel known as a Marsh Viscometer) must be supplemented by other rheological parameters, such as gel strength, yield point and plastic viscosity. The Marsh Funnel Viscosity value is an indicator of the optimum dosage required for lubrication. The rheology of a lubricant provides information on its pumping qualities and on its behaviour in the

oversize cut, as well as in the impregnation zone of permeable soil (internal cake).

These rheological parameters determine the capacity of the lubricant to reduce the permeability of the soil (cake build-up process) and limit the hydration of water-sensitive formations (sticking, swelling effects etc.)

Function 2

The cake and filtrate loss factors are also important since they contribute to modification of the contact between the ground and pipes (by depositing clay particles at the point of interface and releasing free water in the surrounding ground).

Measuring the density of the lubricant guarantees the correct dosage of bentonite.

Choice of lubrication fluid

The choice of a high-quality lubricant is determined by evaluating the interaction between the soil, the machine and the drilling fluids, as well as the specific features of each project. Both the equipment

(mixing device, injection pump etc.) and economic and environmental aspects are of major importance, since these will directly influence the selection of products and the dosages required.

Nature of the ground	Foreseen difficulties	Rheological characteristics					Our Fluid Solutions
		Viscosity Marsh (sec/qt.)	FannViscosimeter			Filtrate API	
			VA (cp)	VP (cp)	YP (Pa)		
Plastic clay, marl	increasing Jacking force	30 – 50	5 – 10	4 – 6	1 – 5	N.A. or < 25ml	“Non-wetting” lubricant: SC MUD
Hard clay, limestone	increasing Jacking force Loss of lubricant	35 – 50	5 – 10	4 – 6	1 – 5	N.A. or < 25ml	SC MUD or BENTONIL® CF (TIXOTON®)
Sandy formation: clayey sand, fine sand	increasing Jacking force Loss of lubricant	40 – 50	10 – 20	5 – 10	2 – 10	< 25ml	BENTONIL® CF (TIXOTON®) low-rheology mud with SC MUD or SC VIS and, if necessary, SC PLUG
Very coarse ground: gravel, pebbles, coarse sand	increasing Jacking force Loss of lubricant	60 – 120	15 – 40	10 – 25	10 – 25	< 25ml	BENTONIL® CF (TIXOTON®) high-rheology mud with SC PLUG



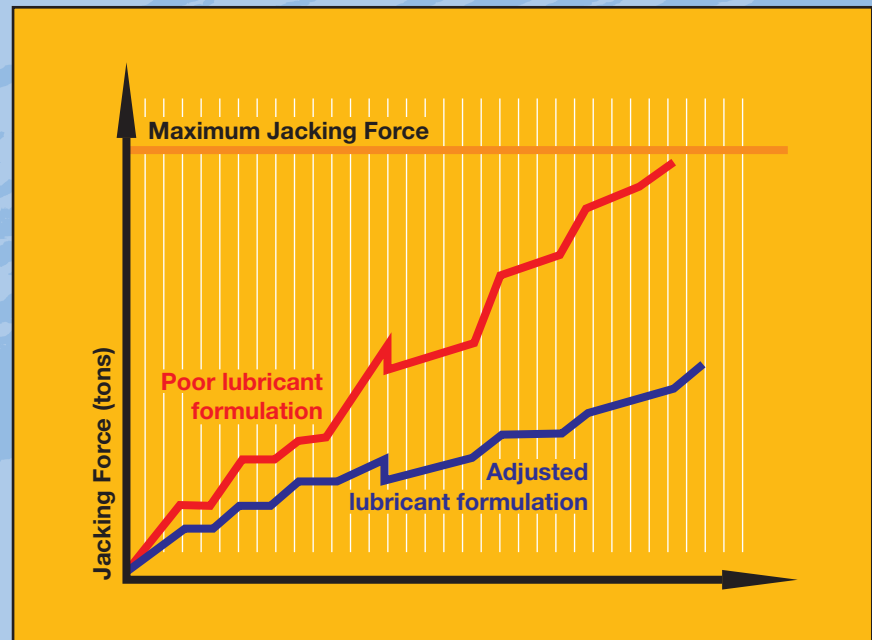
Project follow-up

How to prepare Süd-Chemie fluid solution

The preparation of lubricating slurry using Süd-Chemie products requires a minimum of on-site mixing equipment. However, certain procedures must be adhered to in order to obtain maximum product performance.

Monitoring the jacking force

Monitoring the development of the jacking force during the operation is an extremely important tool for controlling the frictional resistance to be overcome. It acts as an indicator for adjusting or changing the formulation of the lubricant, as well as the method of injection.



Süd-Chemie services

Our experienced staff are ready to help you to define the best “fluid solution”, providing on-site assistance to optimise formulation of the lubricant by overseeing its preparation and the injection method used.

Our laboratory can provide personalised studies to ensu-

re effective results based on the specific characteristics of your project (complementary soil description, interaction between lubricant and soil etc.).

Süd-Chemie offers highly-flexible and responsive production facilities to supply you with customised fluid solutions.



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