ANCHORING TECHNOLOGY - GROUT VS INJECTION

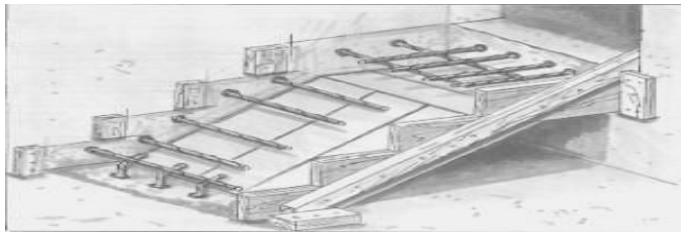
AGENDA

- **Rebar as an anchor applications overview**
- **Grout application methods, issues and restrictions**
- **Grout performance in various application conditions**
- **Performance stability vs temperature variation**
- **Summary and take away**
- **Questions**

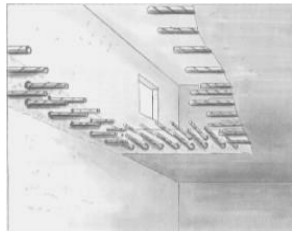
APPLICATION OVERVIEW - STRUCTURAL

Connections of new slabs

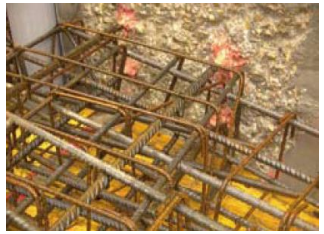

Staircase connection



Close openings / slab enlargement

Connection of beams

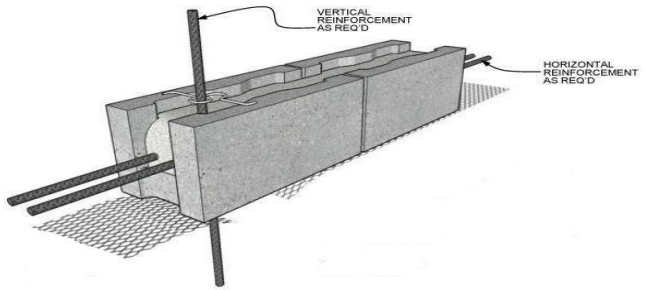



Additional / missing / misplaced rebars

Connections of new columns


APPLICATION OVERVIEW – NON-STRUCTURAL

Block wall Up stands



Block wall Up stands

Loads are typically smaller and less complex which requires no design.

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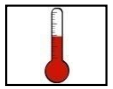
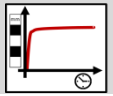
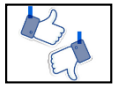
ASSESSMENT CRITERIA OF GROUTS

Criteria	Test type	
Maximum bond strength	**ETAG $F1_{Ref}$ floor position**	
Influence installation position	**ETAG $F1_{Ref}$ wall position**	
Temperature Stability	**ETAG A21**	
Creep stability (not executed)	**ETAG F6**	
Productivity, Ease of Use	**Handling**	
Safety, Labelling	**GHS evaluation**	
Additional observations	**Check**	

GROUT PRODUCTS WERE TESTED IN OUR CHEMICAL ANCHORS DEVELOPMENT CENTER IN KAUFRENG

2 component grout – both liquid	Name	2 Component Grout – liquid and powder
- 2 component epoxy mortar - 2:1 mixing ratio, 1.93kg/l density - Available in 1.2kg / 6kg units	Description	- 2 component polyester mortar - Unknown mixing ratio - Available in 1l and 2.5l packs
- No technical data for anchoring/rebar	Technical Data	- Technical data available - Needs for large annular gaps (M12=>20mm hole,
- Application temperature 25°C-45°C - Full curing after 7 days - Pot life 120min/25°C and 45min/45°C - 3min mixing before application	Features	- Application temperature 10-30°C - No curing time indicated - Gel time 15min @ 30°C - creep at elevated temperatures mentioned - Contains styrene

LIQUID COMPONENTS GROUT

Viscosity:	“like honey”
Thixotropic:	low → dripping from wall

Mixing by hand:	easy to mix proper mixing quality reached
Mixing by machine:	easy to mix but generates air bubbles during process

Borehole filling: ✓ dip & stick ✓ pouring

Curing time: full curing @23°C: 7 days

HSE:

Information not available in English
Product still with the old HSE labels

Classification: A-comp.

B-comp.

POWDER / LIQUID COMPONENTS GROUT

Viscosity:	“like honey”
Thixotropic:	low → dripping from wall

Mixing by hand:	easy to mix proper mixing quality reached ✓
Mixing by machine:	not possible. it’s very dusty process (one of the components is powder in a plastic bag)

Borehole filling: ✓ dip & stick pouring —

Curing time: full curing @23°C: 7 days

HSE:

Information not available in English
Product still with the old HSE labels

Classification: A-comp.

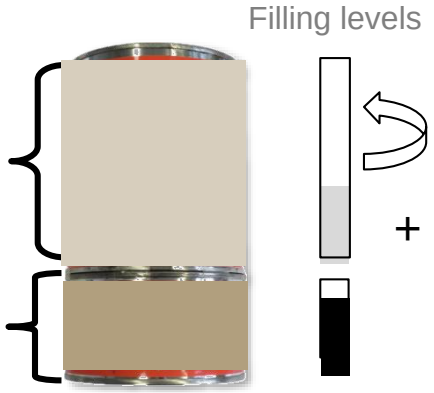
B-comp.

APPLICATION OF GROUTS

1 2 component grout packaging

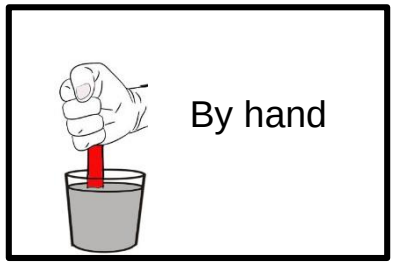
Component- „A“
(Epoxide resin)

Component- „B“
(hardener)



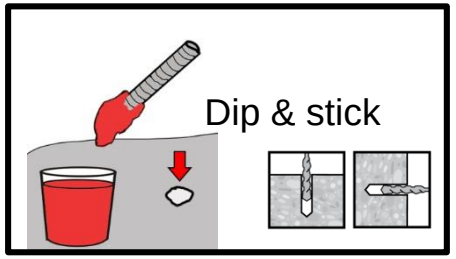
B-component „mixed“
into A-component
(2 : 1 ratio)

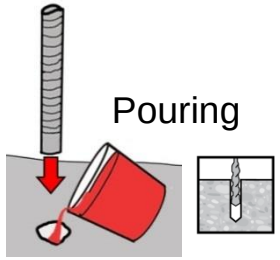
2 Mixing of components



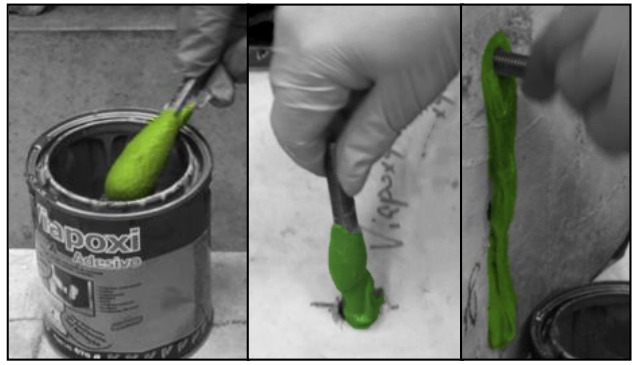
or using
a machine
with a mixer

3 Filling of hole (and inserting fastener)





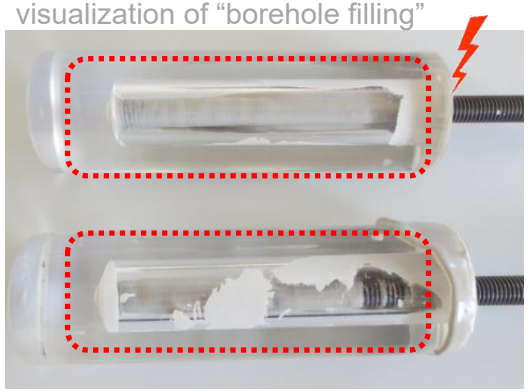
FILLING OF BOREHOLES



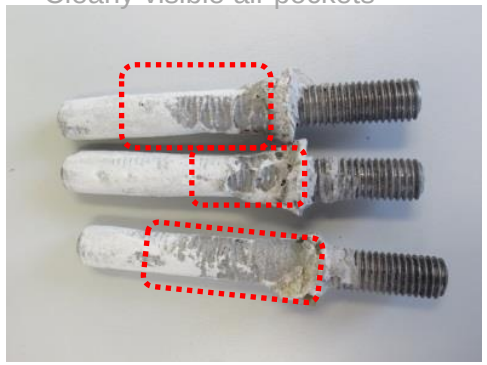
Proper filling is…
- time consuming
- feasible only for experienced users
- even impossible for some applications

air bubbles within holes = reduced performance

Acrylic glass used for visualization of “borehole filling”



Anchors after pull-out tests:
- Clearly visible air pockets



Proper filling of boreholes is a major concern for all grouting applications, regarding application safety !

Dip & stick application is especially crucial

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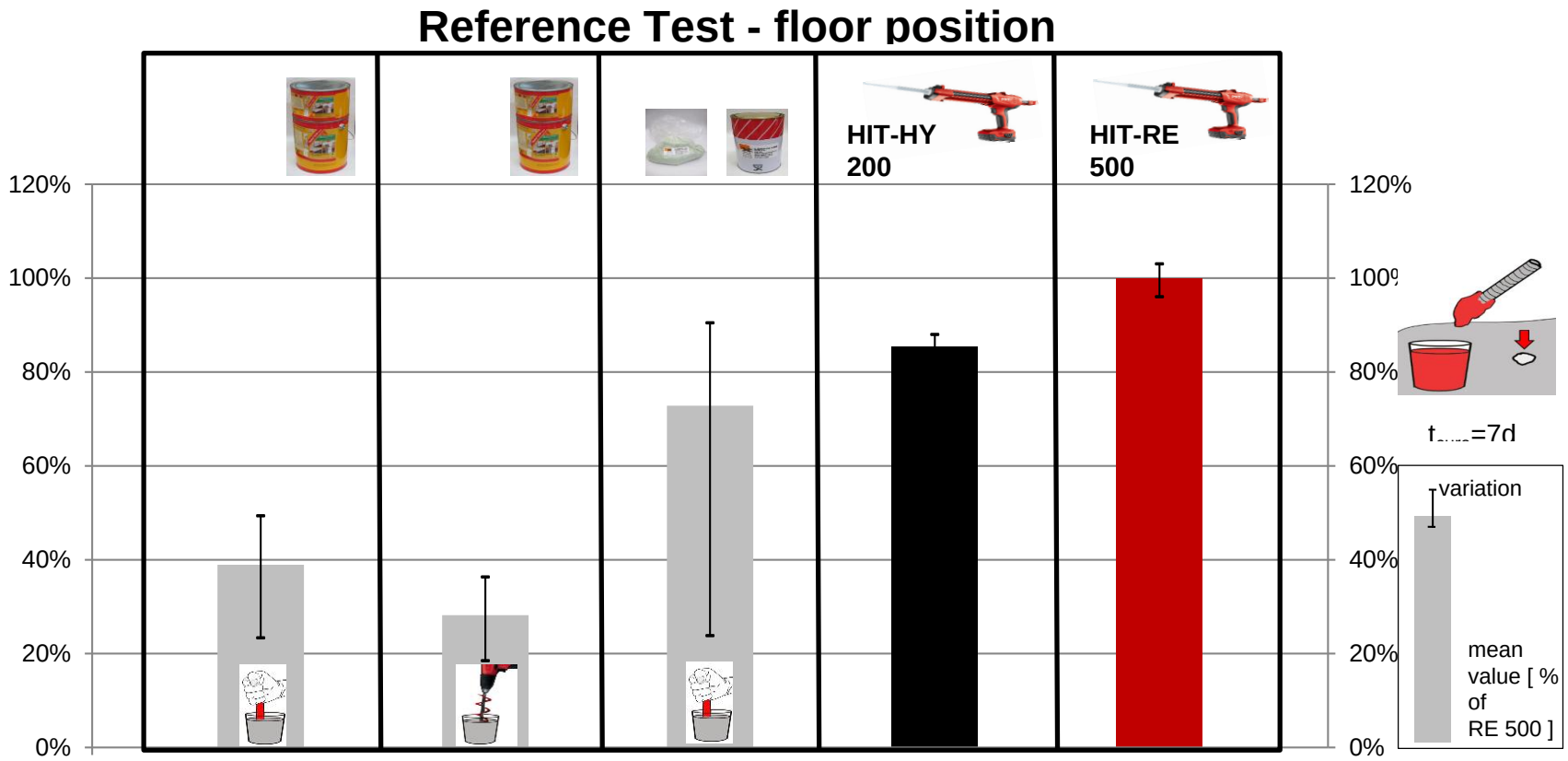
RATING OF APPLICATION SAFETY BASED ON (IN)PROPER BOREHOLE FILLING

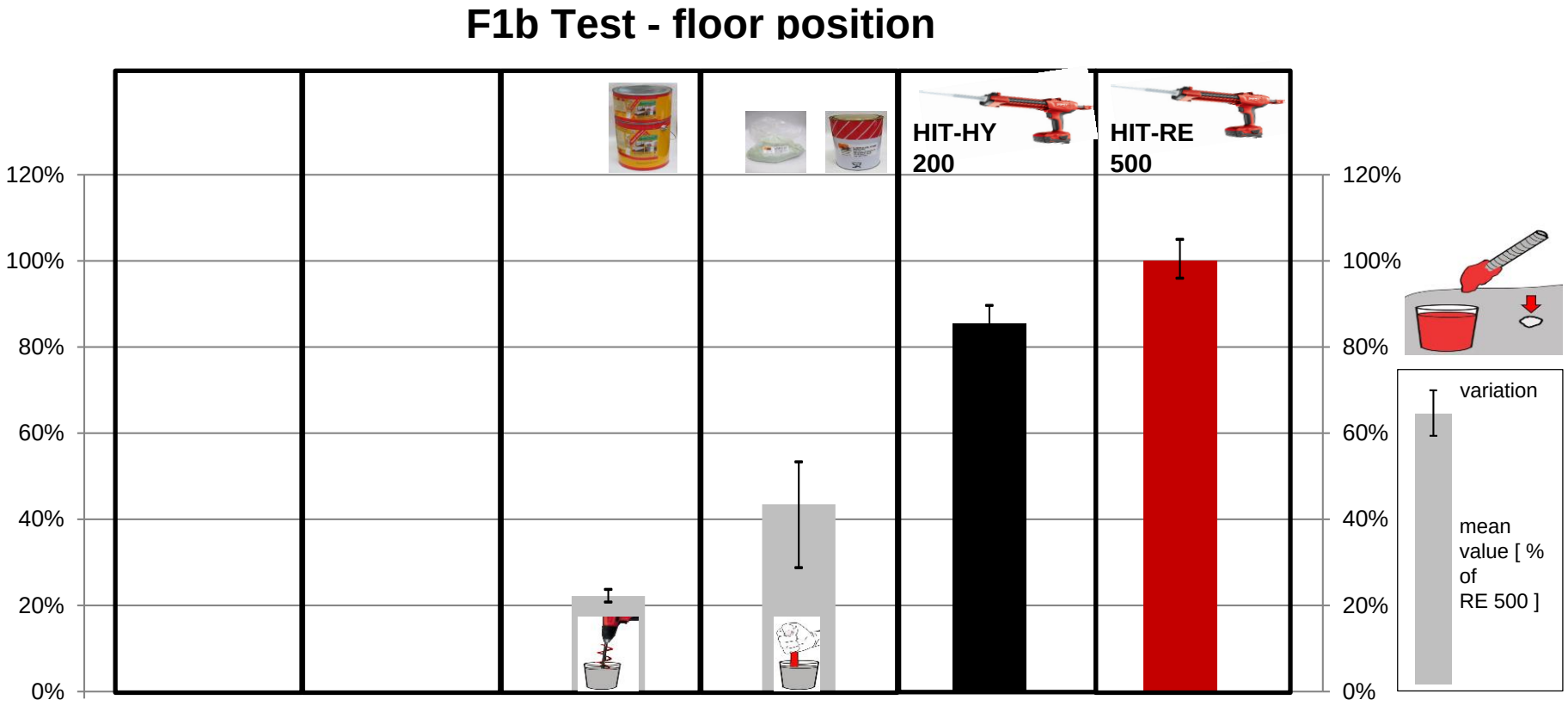
Direction of application	Liquid Grouts	Powder/liquid Grout	HIT RE/HY 
	+/-	+/-	✓
	⚡	⚡	✓
	STOP	STOP	✓

THE PERFORMANCE OF GROUTS IS ALREADY UNDER REFERENCE CONDITIONS AND WAY BELOW HILTI



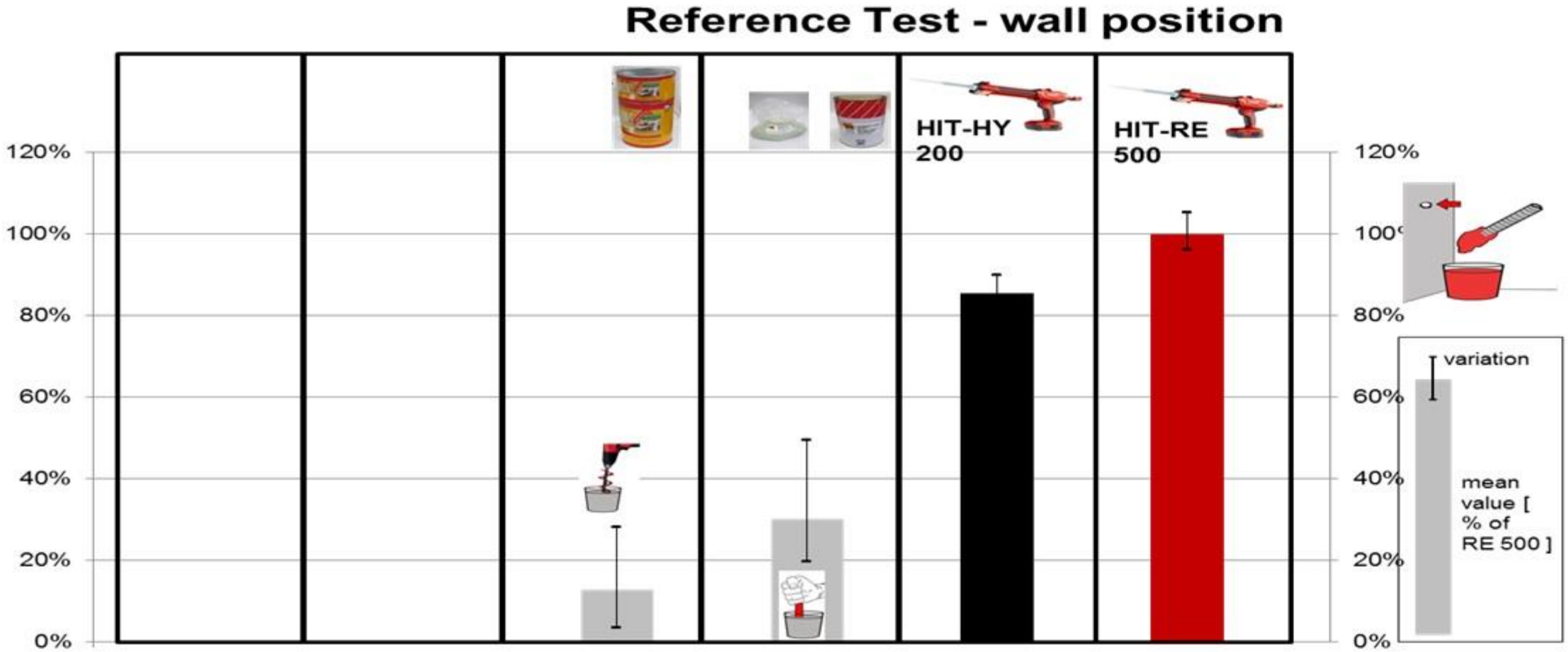
It´s very hard to fill the borehole with grouts. With Machine Mixing air bubbles are generated which makes it even more difficult. Only dip and stick, high scatter comes for the air bubbles filling the hole

IN UNCLEANED BORE HOLES, THE PERFORMANCE OF GROUTS DROPS FURTHER



Under tougher conditions the performance drop is significant in bot cases.
SIKA load level is around 20% reduces dramatically the scope of potential applications

IN WALL APPLICATION GROUTS HAVE A SIGNIFICANT LOAD DROP THAT



Dip & Stick installation process is the main responsible for the load drop

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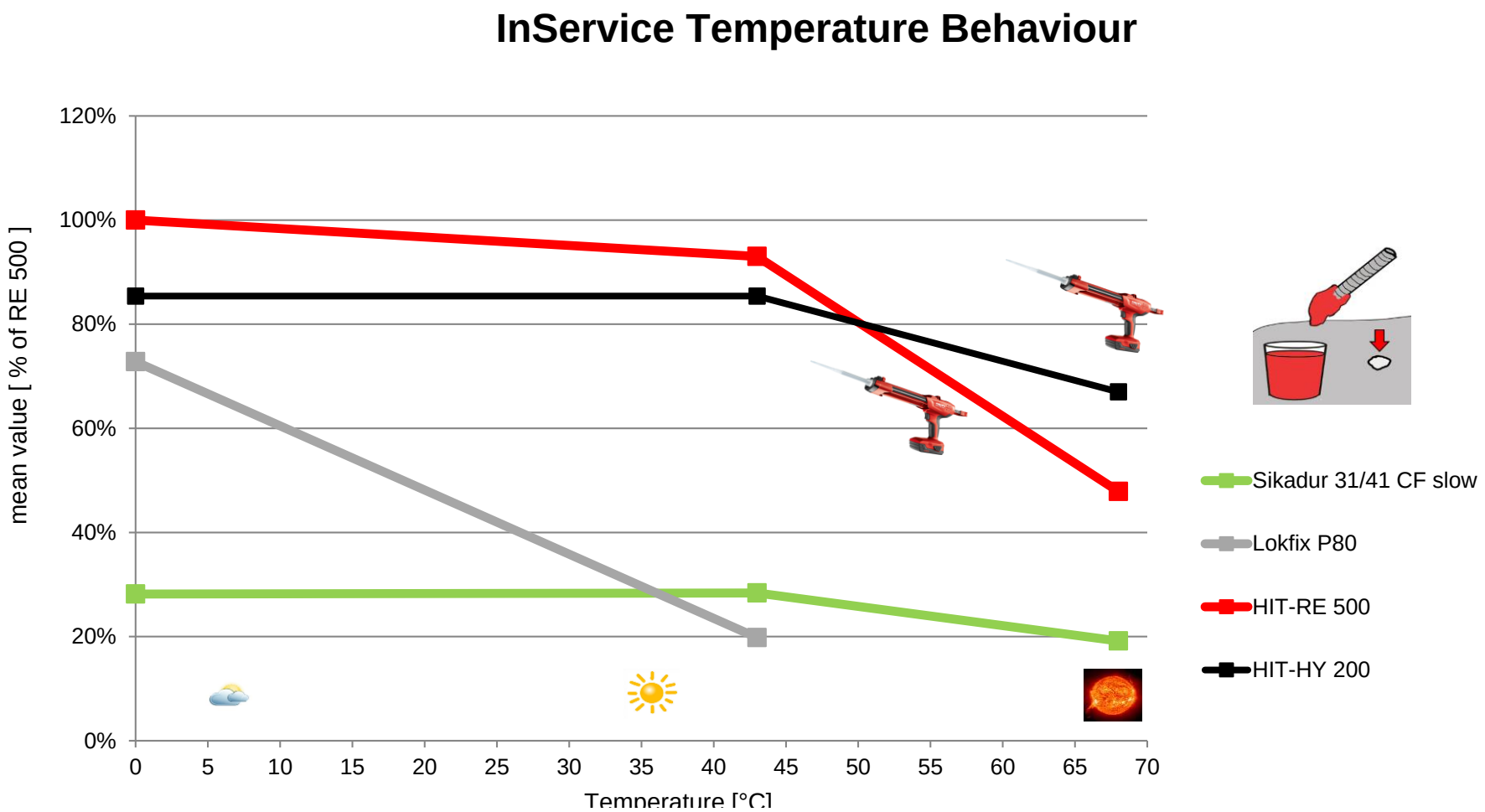
UNDER HIGH TEMPERATURES GROUTS ARE NOT SAFE ANYMORE WITH LOW LOADS AND HIGH SCATTER



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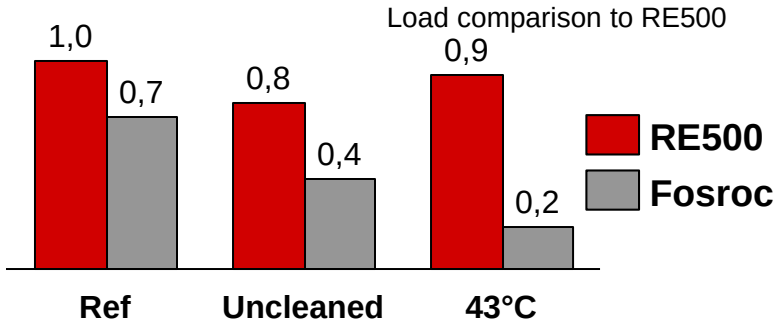
INJECTION TECHNOLOGY IS SUPERIOR IN ALL ASPECTS

4x higher load performance

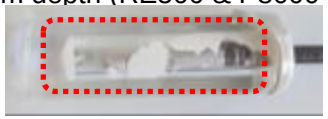


Reliable long term

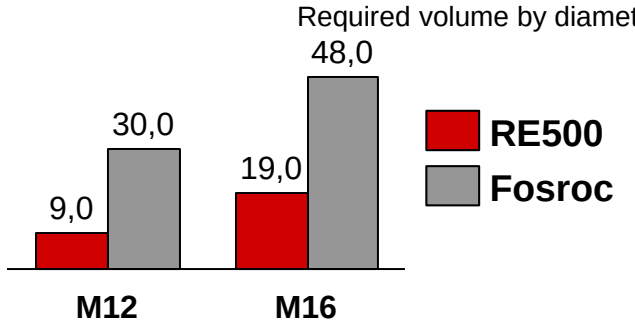
- Passing creep test at 40°C
- High resistance to aggressive substances
- Tested for 50 years lifetime

Better versatility

- HIT can be used at any temperature without changing the formulation from 5-40°C
- In all directions (⇧⇩⇦)
- Filling the holes completely up to 3m depth (RE500 & P8000-D)



Saving material



Faster to install

Less waste, less toxic

- Little direct contact with chemical substances
- Easy to re-use cartridge
- Efficient waste management with foil packs
- Best-in-class formulations with lowest amount of dangerous substances
- Approved for potable water, LEED and low VOC content