

Accelerated Cable Aging at 500Hz,
“Time is Money”

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Accelerated Aging:

- **To intensify certain parameters to accelerate aging, in order to reach the same degree of aging in a short time, as usually will be obtained under service conditions during cable life**
- **Any parameter and any acceleration degree is permitted, as long as the aging mechanism, remains unchanged.**
- **No difference should be made between “natural” and “unnatural” parameters and conditions.**

Accelerated aging method should be decisive in a reasonable period of time:

- **Good cables are good**
- **Bad cables are bad**

Parameters:

- | | |
|--------------------------------------|-----------------------------|
| ➤ Electrical stress | no clear relation |
| ➤ Mechanical Stress | no clear relation |
| ➤ Temperature | opposite relation |
| ➤ Temperature gradient | different aging mech |
| ➤ Chemical condition of water | no clear relation |
| ➤ Frequency | clear relation |

- **CENELEC, 2 year**
- **500 Hz, 3000 hours, 4 months**
- **cable length: 60 m, without outer coverings**
- **conditioning: under water 80 degree C, 1 month**
- **water: tap water + additives, Ph 6.5-7.5**
- **temperature: 30 degree C**
- **voltage: 2.5 U_o**
- **frequency: 50Hz or 500 Hz**
- **duration: 3000 hours or 2 years**
- **requirements: step test (U_o/5min) on 5m samples**

all withstand 14kV/min / > 73% withstand 18kV/min / > 40% withstand 22kV/min

➤ **Test results om the same cable that has been aged in the field:**

➤ **50 Hz 3000h**

➤ **500 Hz 3000h**

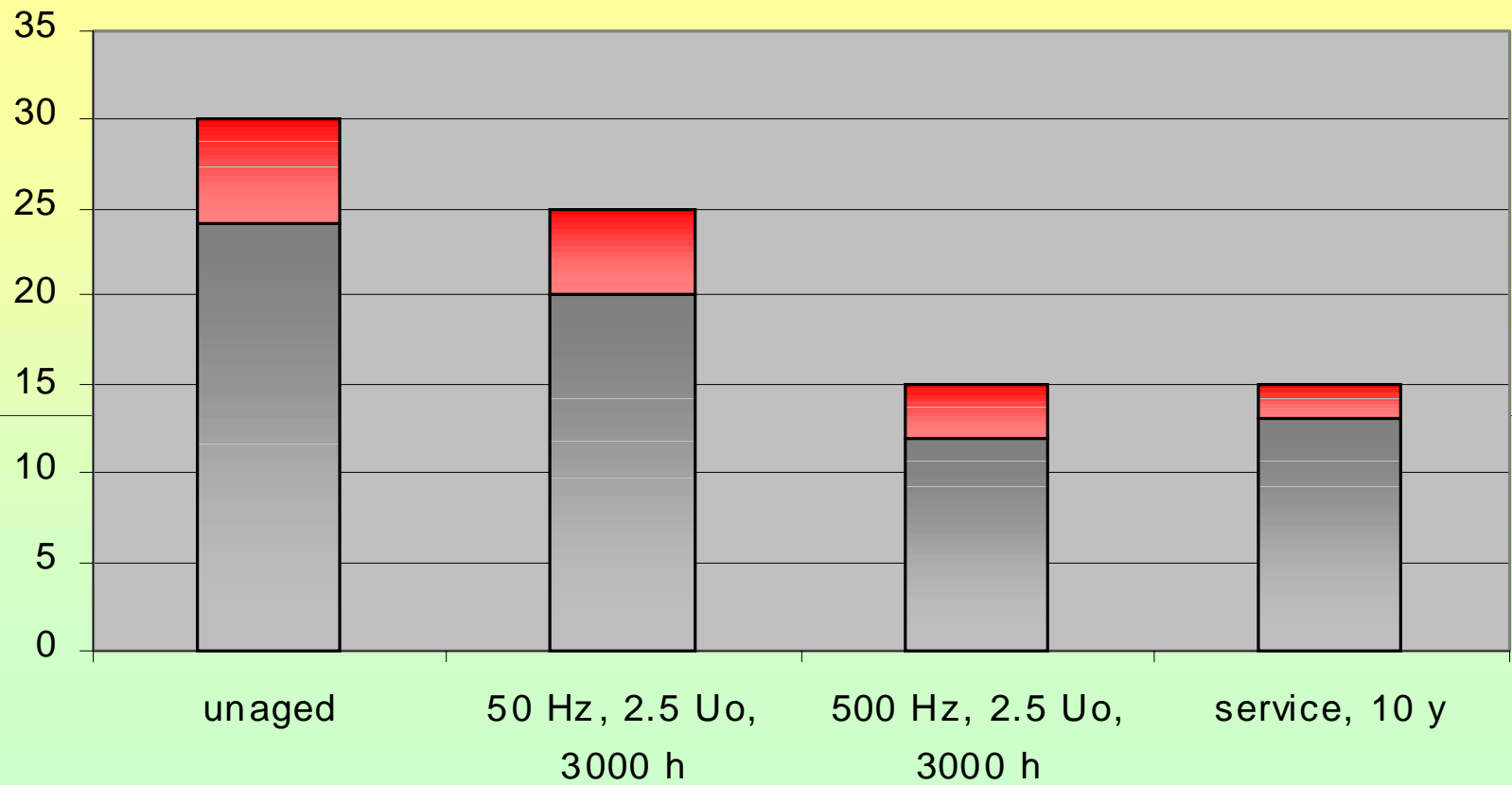
➤ **field aged 12y**

➤ **unaged**

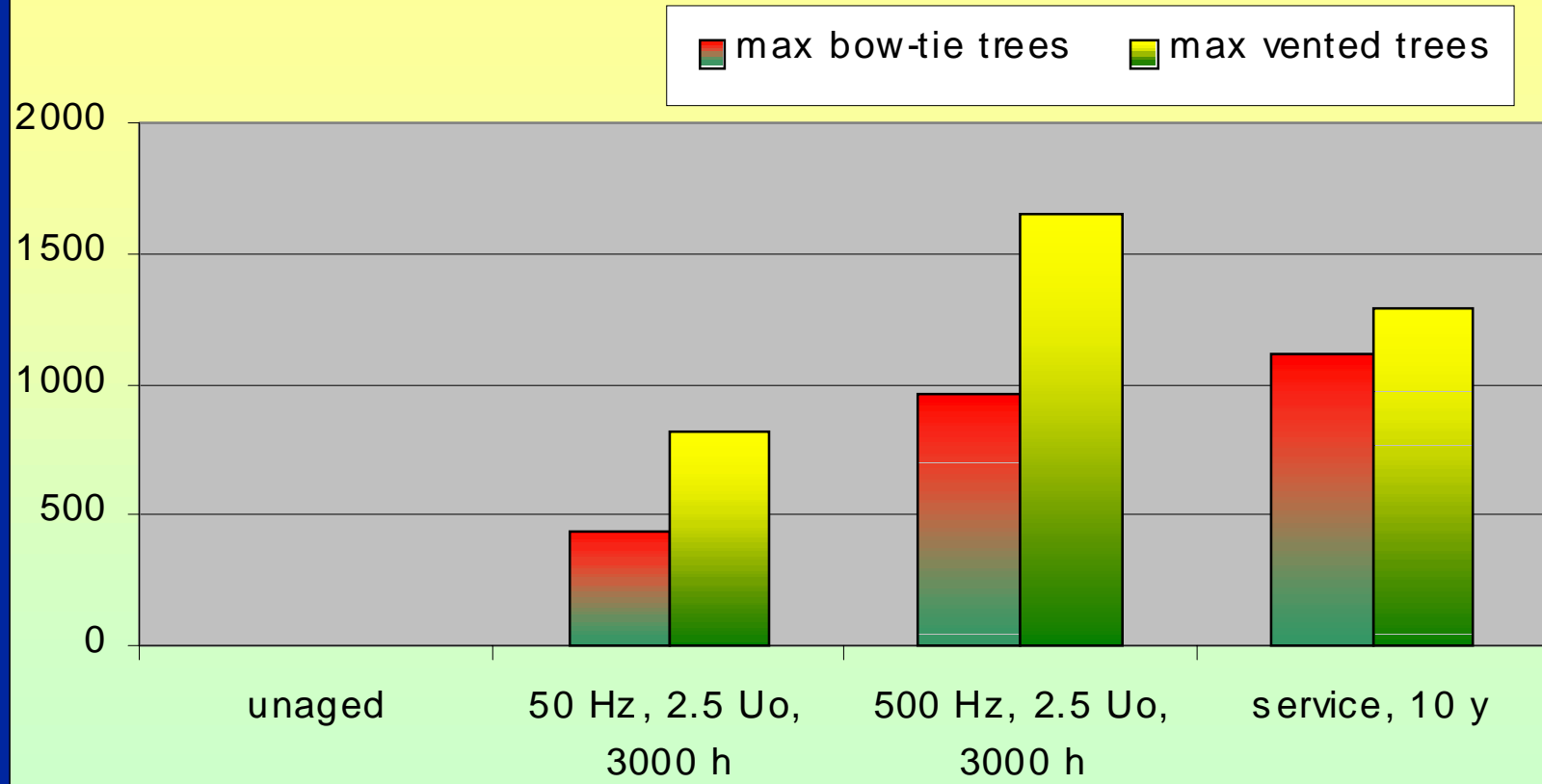


➤ **Tets results of bad(standard compound) and good (WTR) cable for both 50Hz and 500 Hz**

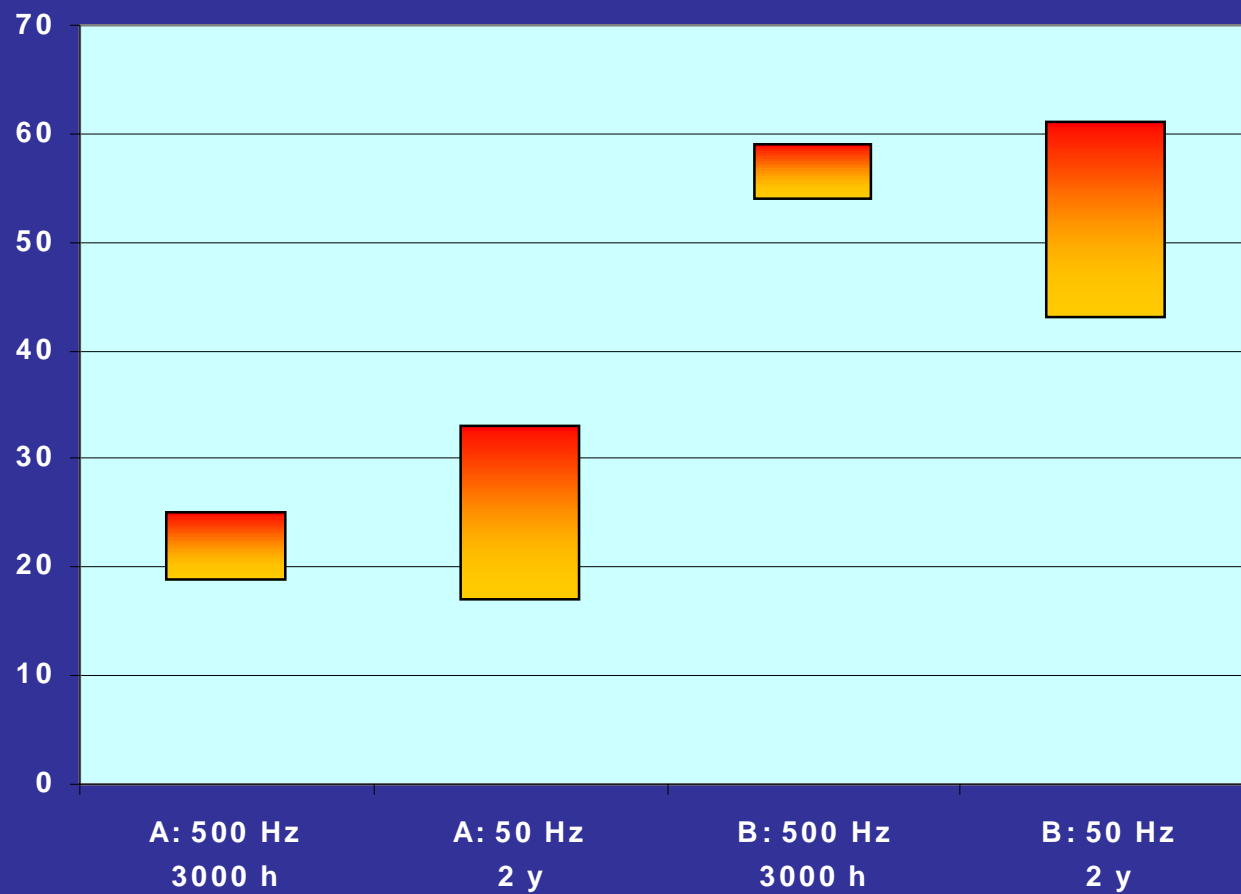
63 % breakdown values in kV/mm for a bad cable



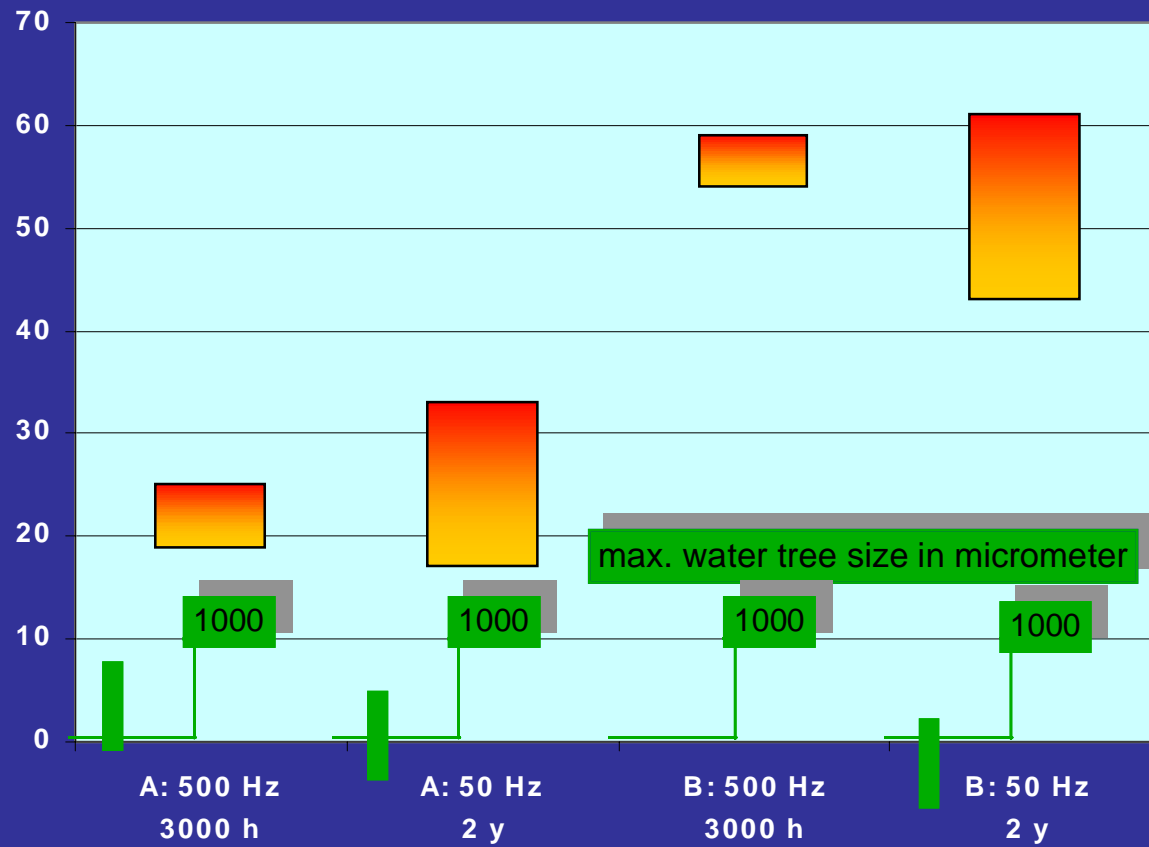
water tree lengths in micrometer for a bad cable



breakdown stress level [kV/mm]



breakdown stress level [kV/mm]



Test experience in the NL

- **Since 1997, 500 Hz aging is an alternative in the Dutch specification of MV cables (NEN 3620)**
- **500 Hz aging is also part of CENELEC HD 605**
- **Positive experience**
- **Growing interest for 500Hz testing within CENELEC**

Conclusions

- **Same aging mechanism for 60Hz and 500 Hz**
- **6 times shorter duration of test**
- **Reliable 500 Hz generator available**
- **5 years positive experience in the NL**
- **Growing interest for 500Hz testing**