

# Optical Connector Design Concept for GI-POF

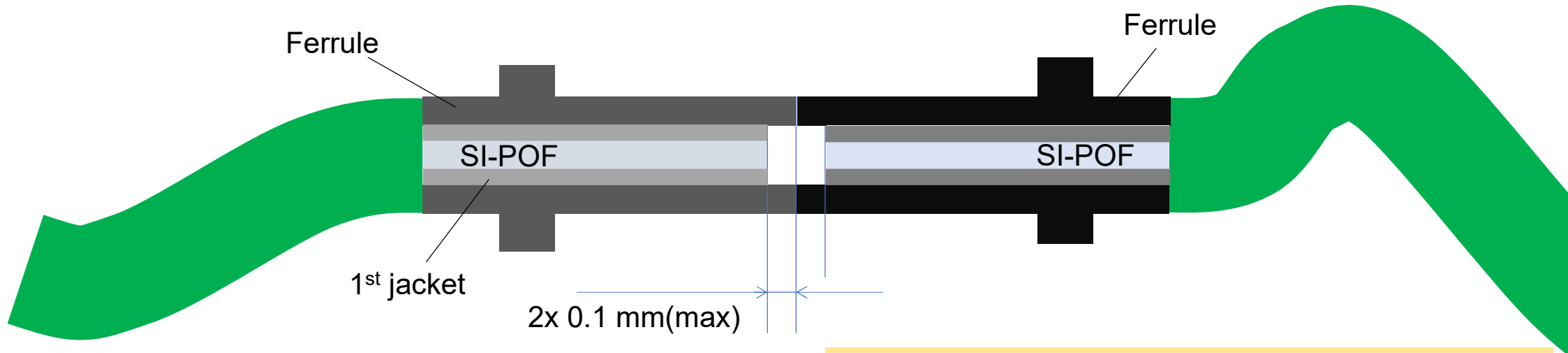
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IEEE802.3dh Multi-Gigabit Automotive Ethernet over Plastic Optical Fiber Task Force  
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## Introduction

- Some concern was proposed on reliability of butt joint using GI-POF(A4i) in previous meeting
- Report vibration test results at the fiber to fiber connection system by using GI-POF (A4j)

# Butt coupling for MOST Optical Components



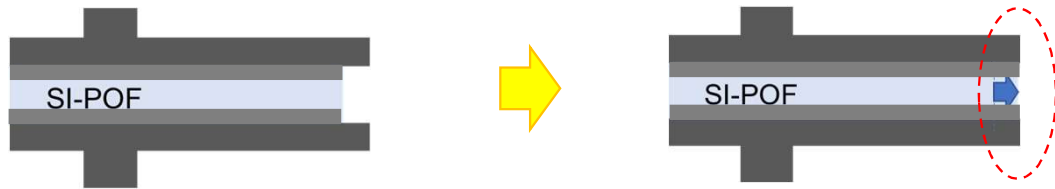
## <General requirement>

- Coupling loss: 2.5dB/ connection
- Temperature range: -40 ~ 85 degC
- Automotive environments (Vibration, etc.)

## <Countermeasure>

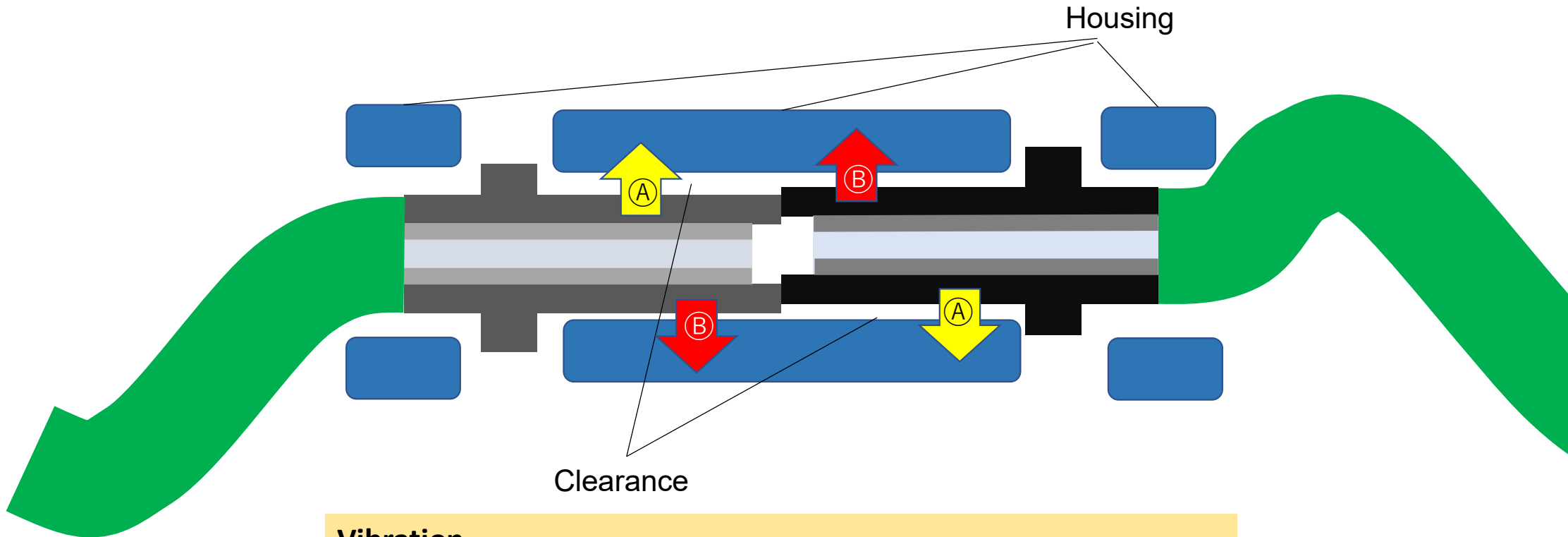
- Both ferrules to be contacted when connectors are mated
  - > Reduce coupling loss)
- Recessed SI-POF surface:  $\sim 0.1 \text{ mm (max)}$ 
  - > Avoid scratching while driving (vibration)
  - > Consideration for pistoning\*

## \* What is Pistoning



Once temperature is changed, an end face of SI-POF is moved to back and forth.  
(Thermal expansion/ shrinkage)

# Butt coupling for MOST Optical Components : Vibration protection

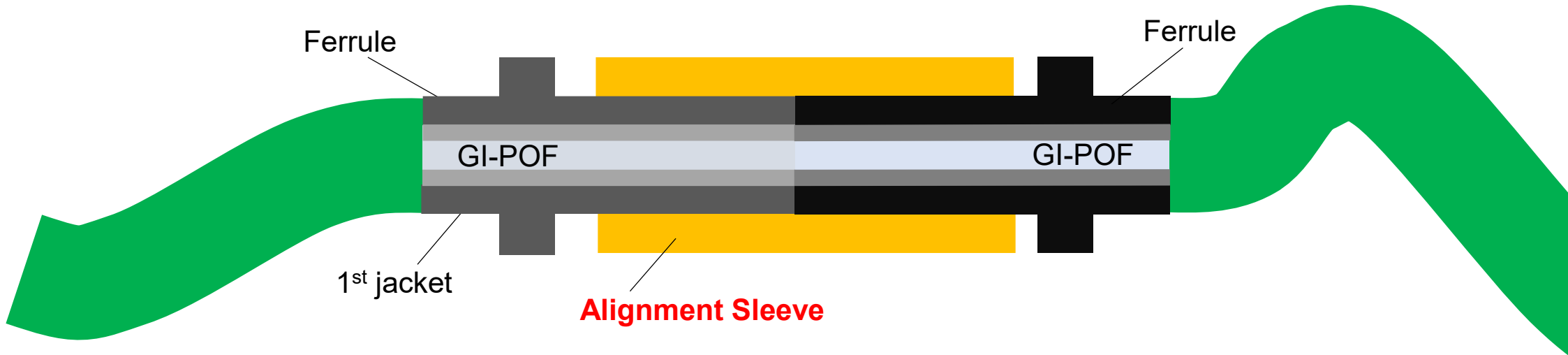


## **Vibration**

- Ferrules inside housing are floating structure
- Both ferrules move randomly when vibrations are applied

The fiber end face is recessed relative to the ferrule surface to avoid possible friction of fiber connecting surface.

# Butt coupling for GI-POF Optical Components - Concept

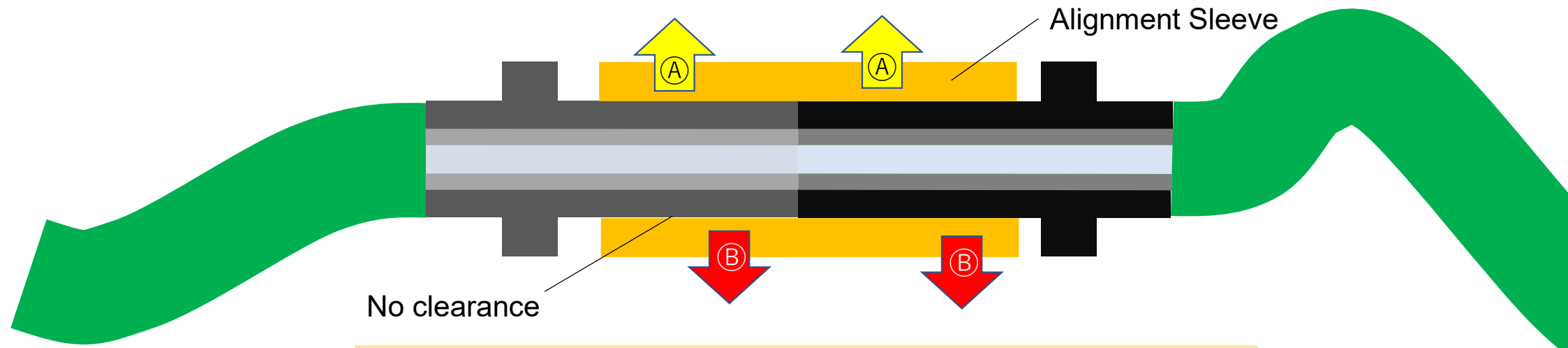


## Concept

- Alignment Sleeve is used to reduce shaft misalignment and gaps
- Contact end face to reduce coupling loss

What's happen during vibration?

# Butt coupling for GI-POF Optical Components - Mechanism



## **Vibration**

- Ferrules inside alignment sleeve is fixed and no clearance between ferrule and sleeve
- Both ferrules move synchronically when vibrations are applied

Butt coupling can be used because there is no possibility of friction on the fiber end faces

Note: Connector design is an implementation matter and is out of the scope on this standard

# Vibration Test Result

Remind: Already reported in September Interim meeting

## Vibration test result

### Test condition

- Reference standard: ISO16750-3, Test1 Passenger car, engine – see Fig 1
- DUT: GI-POF(A4i) ,1.0m + 3.0m,  
Connection: Split sleeve(made by Zirconia)  
※Since the connector can not be disclosed, this test was carried out by using a split sleeve
- Vibration direction: Y-axis, which has the greatest impact
- Test duration: 24 hours
- Collect optical power as  $P_i$  continuously
- Attenuation calculation by  $P_{\text{initial}}$  and  $P_{\text{after}}$   
A formula of the optical attenuation change ( $A_{\text{opt}}$ ):  
$$A_{\text{opt}} = -10 \log (P_{\text{after}} / P_{\text{initial}})$$

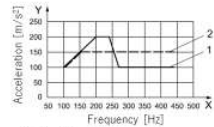


Fig 1. Vibration severity curves

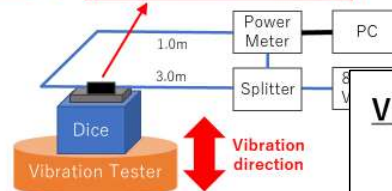


Fig 2, Schematic diagram of vibration test

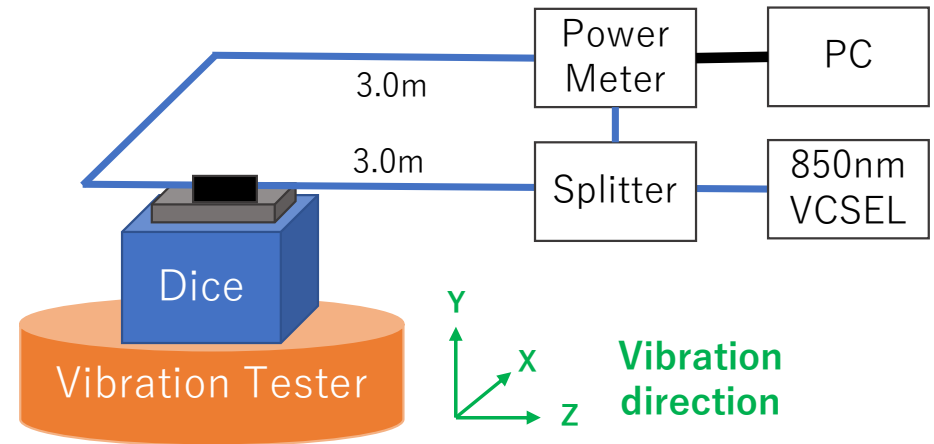
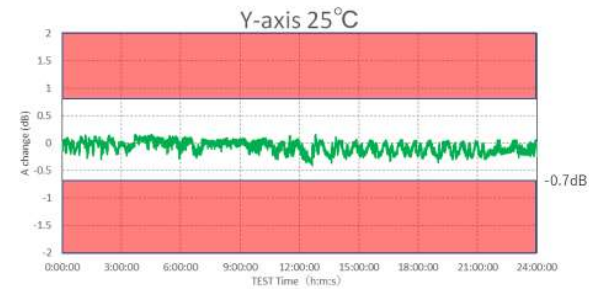


Fig 2, Schematic diagram of vibration test

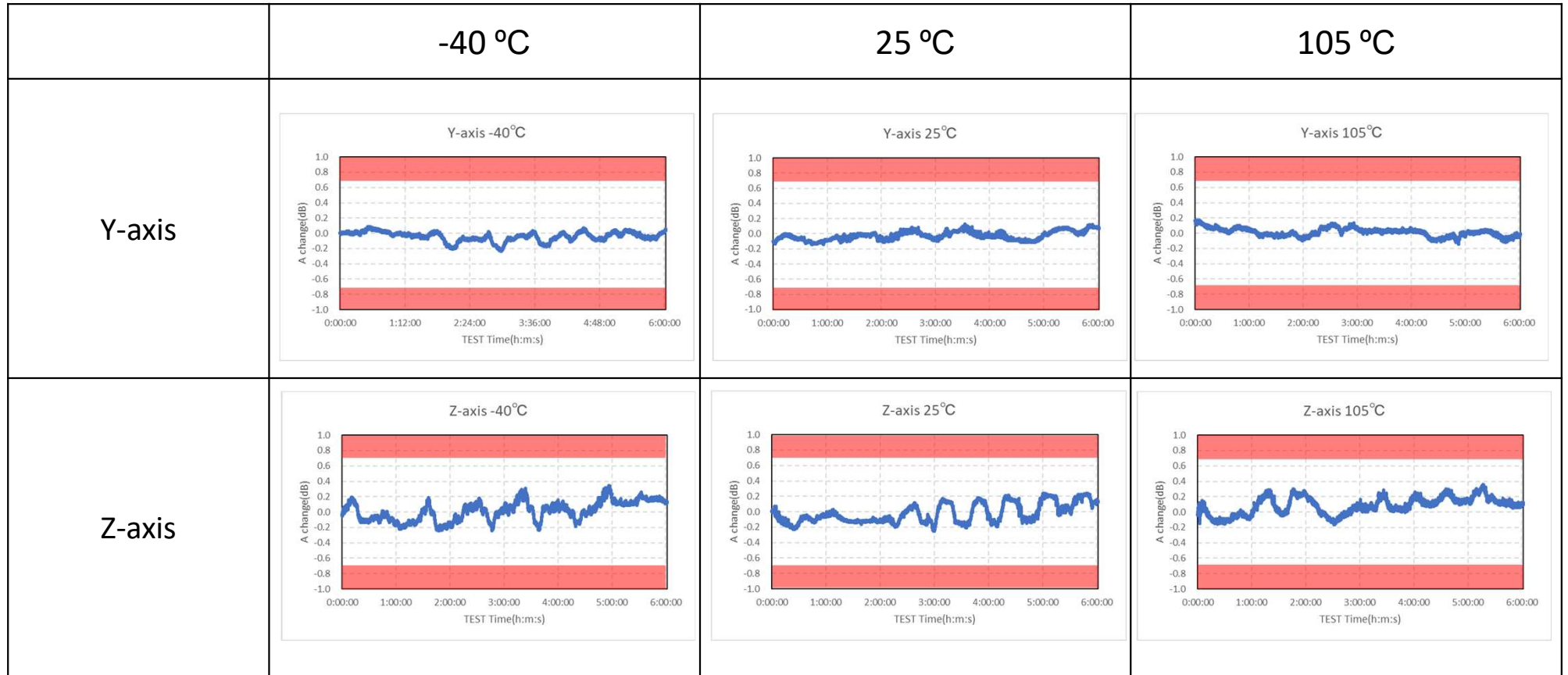
## Vibration test result



- The test results in the Y-axis were less than 0.5dB through the whole test.  
Target criteria: less than +/- 0.7dB change (cf. ISO Std.)

# Vibration Test Result - Update

Vibration test – attenuation change at each temperature (-40, 25 and 105 °C) by A4j(55/490)





## Summary

- Connectors for SI-POF and GI-POF have different fiber to fiber connecting structures
- No significant attenuation changes are observed through the vibration test for A4j
- Therefore, this vibration test results prove that the butt coupling concept can be applicable for GI-POF

Thank you for your attention