Development and Several Additional Performances of Dual-Spindle Rotating Bending Fatigue Testing Machine

GIGA QUAD

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GIGA QUAD

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Background

**Background 1**
Recently, particular attention has been paying to the fatigue property of metallic materials in the very high cycle regime to realize the low-carbon sustainable society.
But, one of difficulties in fatigue tests in the very high cycle regime is to take a long time to perform the fatigue test. If the fatigue test is performed at the loading frequency of 50Hz, it takes 200 days to $10^9$ cycles.

**Background 2**
The fatigue property data in various environments still remain unsolved.
Development of New Testing Machine

In order to overcome this difficulty, we have developed special type of fatigue testing machines in rotating bending, in which four specimens can be tested simultaneously. Thus a series of fatigue tests even in gigacycle regime can be carried out within a reasonable period.

Based on this advantageous performance, the name of “GIGA QUAD” was accepted for this new machine. Accordingly, this machine is very useful to file up a number of fatigue test data.
Dual-Spindle Rotating Bending Fatigue Testing Machine

<GIGA QUAD Outline>

**GIGA QUAD : YRB200**
SIZE OF MACHINE (mm): 470X400X1050
WEIGHT (Kg): 140

- Collet nut
- Specimen
- Adapter
- Spring
- Weight: 20Kg (MAX)
- 3,150rpm (52.5Hz)

**GIGA QUAD : YRB200L**
SIZE OF MACHINE (mm): 800X660X1100
WEIGHT (Kg): 170

- Collet nut
- Specimen
- Adapter
- Counter
- Weight: 80Kg (MAX)
Dual-Spindle Rotating Bending Fatigue Testing Machine

< GIGA QUAD Outline >

Collet nut
Specimen
Spring
Counter
GIGA QUAD

<Main environmental options>

① High temperature environmental testing unit
② Low temperature environmental testing unit
③ Corrosive environmental unit
④ 2-step variable loading unit
High temperature environmental testing unit

- **Temperature controlling range**: room temperature to 600°C
- **Size of control panel box**: 170mm x 220mm x 280mm
GIGA QUAD

/Main environmental options/>

High temperature environmental testing unit

Safety mechanism
Low temperature environmental testing unit

Compressed liquid nitrogen cylinder

Insulation manifold

No.1 No.2 No.3 No.4

Proportional valve

Insulation chamber with specimen

Protection Cover

Exhaust

Temperature indicating controller

O₂ densitometer

Control box

【Temperature controlling range】
-100deg.C. to room temperature

【Size of control panel box】
170mm x 220mm x 280mm
GIGA QUAD

<Main environmental options>

Corrosive environmental unit

- Stand
- Flowing pass-tube
- Outer block
- Corrosive chamber
GIGA QUAD

<Main environmental options>

Corrosive environmental unit

Schematics of corrosion fatigue testing machine
GIGA QUAD

<Main environmental options>

2-step variable loading unit

<table>
<thead>
<tr>
<th>Maximum load</th>
<th>Diameter of the critical section</th>
<th>Upper side load (MPa)</th>
<th>Lower side load (MPa)</th>
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<tr>
<td>80kg x 4 points</td>
<td>φ 6 mm</td>
<td>173〜2491</td>
<td>111〜2274</td>
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<tr>
<td></td>
<td>φ 8 mm</td>
<td>73〜1050</td>
<td>47〜959</td>
</tr>
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</table>
Concluding Remarks

The high performance fatigue testing machine in rotating bending “GIGA QUAD” has been developed in this work.

Based on a lot of experimental results, the fundamental performance of this testing machine was confirmed.

Actually, GIGA QUAD are already being used at many laboratories in universities and industries in JAPAN and several countries.

Thus, every customer has informed that GIGA QUAD is successfully used to obtain a number of fatigue data under many environments within a reasonable short period.

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Thank you for your attention.