Q-dummies Modification History

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Contents

Memorandum prepared for GRSP: Q- dummies Modification History

This presentation follows that document

• Purpose and Objective
• Overview of dummy deliveries
• Upgrade program quantity and content
• Communication to the market
• Modification to the Q-dummies since 2004
• Conclusions and Recommendations
Purpose and Objective

• **Purpose**
  - To describe the configuration status of the Q-dummies with the eye on regulatory application of the dummies.
  - The preparation requested by GRSP Informal Group CRS testing in its meeting in Vienna on September 02, 2008.

• **Objective**
  - Describes Q-dummies final configuration that was frozen in winter 2004
  - Addresses all Q-dummy modifications since 2004.
  - Obtain transparency on Q-dummies configuration
  - Support confidence in Q-dummies as consistent measurement tool for crash testing
Overview of Dummy Deliveries

<table>
<thead>
<tr>
<th>Dummy</th>
<th>Calendar year</th>
<th>Remark</th>
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<tbody>
<tr>
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<td>98</td>
<td>99</td>
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<tr>
<td>Q0</td>
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<td>Q1</td>
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<td>Q1.5</td>
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<td>Q3</td>
<td>6</td>
<td>4</td>
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<td>Q6</td>
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<td>Q3 upgrade kits</td>
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- Q3 dummy deliveries started in November 1998
- Development Q3, Q1, Q6 Q1.5 and Q0 ended 2003
- Before 2004 - 23 Q3 and 3 Q6 dummies delivered
- All early Q6 dummies delivered in final configuration
Upgrade Program Quantity and Content

- Early Q3 dummies (23 off) requires an upgrade
- 18 Q3-Upgrade kits delivered
  - 6 kits “Q3-UPGRADE”
    for chest string potentiometer version
  - 12 kits “Q3-UPGRADE-2”
    for chest IR-TRACC version
  - 5 Q3-dummies still in “OLD” configuration (all in JAPAN)

- Upgrade kits bring Q3-dummy 020-0000 to 020-0001 level
  - For content of upgrade kits see next slides
Upgrade Program Quantity and Content

- **Q3-UPGRADE and Q3-UPGRADE-2 Bill of material (cont’d)**
  - Head Frontal Assembly PN: 020-1020
    - New skin material
    - Higher mass
    - Revised interface with neck
    - Four holes in top to make neck interface bolts better accessible
  - Rear Skull Cap Assembly PN: 020-1020
    - New skin material
  - Head Acc Mounting Bracket Assembly PN: 020-1013
    - Suitable for application of linear accelerometers
      (Optional: Bracket allowing angular rate sensors application)
Upgrade Program Quantity and Content

Q3-UPGRADE and Q3-UPGRADE-2

- Bill of material (cont’d)
  - Neck Assembly PN: 020-2100
    - Atlas and OC joint deleted
    - Neck rubber segmented
    - Fiber cord neck cable
    - Lower mass
  - Neck Torso Interface Plate PN: 020-2015
    - Interface adapted to the new neck
  - Clavicle Q3, modified PN: 020-3201
    - To suite with new shoulder-spine interface parts
  - Rubber Shoulder-Spine Interface PN: 020-3310 and 020-3320
    - Rubber shoulder to spine interface part
    - Higher mass
Upgrade Program Quantity and Content

Q3-UPGRADE and Q3-UPGRADE-2

- Bill of material (cont’d)
  - Thoracic Spine (Spring Pot) PN: 020-4006 for string potentiometer
    Optional Q3 UPGRADE-2:
    Thoracic spine for IR-TRACC application - Part number 020-4401
      - Lower mass
    - Pelvis Flesh, Molded PN: 020-7010
      - Changed skin material
  - Optional Q3-UPGRADE-2:
    IR-TRACC provisions kit PN’s: 020-4402, -4403, -4404, -4405, -4406, -4407 and -4411
    (together with dedicated thoracic spine 020-4401)
      - Accurate measurement under high velocity loading conditions
Communication to the Market

Since January 2004 the market was informed through:

• Mailings to customers
  – Q3-UPGRADE (for string pot) was offered to all customers
  – Q3-UPGRADE-2 (for IR-TRACC) was offered on request

• Conference presentations
  – Wiebe Onvlee: Dec ‘04 Munich
  – Kate de Jager: June ‘05 ESV and Dec ‘05 Munich
  – Kees Waagmeester: May ‘06 CHILD dissemination workshop

• FTSS NewsLine articles
  – Nov 2004 and April 2005

• Technical Sheets also used in FTSS exhibition booths

• Publication of the EEVC Q-dummies report in April 2008
Communication to the Market

• Updated manuals, Jan 2007 (Q1 and Q1.5) and July 2007 (Q3 and Q6)
Available through https://select.ftss.com

Manual presentation
(Example Q3 manual)
• Parts list specifying per part:
  • Description
  • Part number
  • Quantity
• Exploded views
  • Parts pictures
  • Part numbers
Q-dummy Modification Since 2004

Product improvements implemented
• Overcome manufacturing problems,
• Address user feedback
• Solve customer complaints.
• Modification described in terms of: What, Why, When and Implications.

All changes are presented in the following sheets:
– Neck (Q1, Q1.5 and Q3)
– Rib Cage (Q3 only)
– Glossier appearance (all dummies)
– Lower arm (Q3 only)
Q-dummy Modification Since 2004

Neck durability improvement (Q1, Q1.5 and Q3)

Part: Q3 Neck Assembly (also for Q1 and Q1.5) PN: 020-2100

What: New material vendor that guarantees consistency rubber.
Mould shape slight changed to reduce stress concentration.

Why: Necks showed small surface cracks in rubber and some users reported neck failures.
Process control at vendor not appropriate.
Other material vendor selected.

When: Start in June 2006 and was solved in November 2006.
Customers got replacement parts free of charge.

Implications:
No affect on bending performance characteristic.
Old parts can be used as they are.
Q-dummy Modification Since 2004

Neck durability improvement (Q1, Q1.5 and Q3)

Implications: No affect on bending performance characteristic

Neck certification test results

Certification corridor:
Head flexion angle 66 to 76 degrees

Before: Test number: 116059, 125020, 125069 and 126903

After: Test number: 65948, 66617 and 67306

Tested according to old certification procedures
Q-dummy Modification Since 2004

Rib cage durability (Q3 only)

**Part**: Rib Cage Assembly PN: 020-4100

**What**: Radius cut out at mid sagittal plane in upstanding flange of rib cage at clavicle mount location.

**Why**: Customers suffered early crack initiation. High stresses in top of flange due to bending promotes fatigue crack initiation.

**When**: May 2007 Parts identification controlled by serial number

**Implications**:

- No affect on stiffness of ribcage section.
- Improved fatigue life for frontal impacts.
- No affect on impact performance of the rib cage.
- Old parts can be used as they are.
Q-dummy Modification Since 2004

Rib cage durability (Q3 only)

Implications: No affect on impact performance of the rib cage

Certification test results before and after tohrax modification

- **A probe (before)**
- **D chest (before)**
- **A probe (after)**
- **D chest (after)**

Certification corridor: Chest deflection 22.5 to 25.5 mm

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Q-dummy Modification Since 2004

Glossier finish of molded parts

Part : Moulded parts (several part numbers)

What : Previously the surface finish of the moulded parts was satin, this changed to a glossier finish.

Why : The production of the Q-dummies is shifted form the United Kingdom to America.
      The molding process is harmonized with processes applied in production of parts like for Hybrid III and ES-2

When : Nov 2007, Parts identification controlled by serial number

Implications:
This appearance change of dummies, do not have any implication for performance of the dummies.
Old parts can be used as they are.
Q-dummy Modification Since 2004

Durability of extremities (Q3 only)

Part : Q3 Lower Arm Assembly, PN 020-9302 (LH), 020-9402 (RH)

What : S. Steel reinforcement molded into bone at elbow end

Why : Q6 arm failed in 2004 in a frontal tests
       (Q6 was reinforced in 2004, Q3 was reinforced later as proactive measure to try to avoid this failure.)

When : October 2005. Parts identification controlled by serial number

Implications:

   Lower arm mass still within specification.
   Old parts can be used as they are.
Conclusions and Recommendations

Conclusions

• Q dummies configuration is consistent since 2004
  No changes that affects performance are applied
• Five Q3 dummies (in Japan) are still in the old configuration
• Six Q3 dummies (in Europe) are still equipped with string potentiometer for the chest deflection

Recommendations

• Replace all chest string potentiometers with IR-TRACC’s
• In case of doubts on parts, check with manual information and contact FTSS for help if necessary.
Q-dummy family well equipped …

… to contribute to child safety

Q6  23.0 kg
Q3  14.5 kg
Q0  3.4 kg
Q1  9.6 kg
Q1.5 11.0 kg