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|             |                 |
|-------------|-----------------|
| Manual No.  | 28              |
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| Product No. | 128             |
| Lot No.     | DQB13-4 DQA10-3 |

**CTS** Collaborative Transplant Study

**WORKING INSTRUCTION**  
**HLA-DQB1\*/-DQA1\* low resolution**  
**CTS-PCR-SSP TRAY KIT**  
**LOCUS- AND LOT-SPECIFIC MANUAL**

To be applied to the following product:

| Product No. | Description  |
|-------------|--|
| 128         | HLA-DQB1*/-DQA1* low resolution CTS-PCR-SSP Tray Kit   |

**1. Main differences**

**HLA-DQB1**

- **Between lot DQB13-4 (the current lot) and lot DQB13-3:**  
 The kit was updated to cover new alleles included in the IMGT/HLA Database of January 2023. Deleted and renamed alleles were taken into consideration.

**HLA-DQA1**

- **Between lot DQA10-3 (the current lot) and lot DQA10-2:**  
 The kit was updated to cover new alleles included in the IMGT/HLA Database of January 2023. Deleted and renamed alleles were taken into consideration.

**2. Introduction**

- Intended use: This kit reveals a low/intermediate resolution typing of HLA-DQB1\* and a low resolution typing of HLA-DQA1\* by the PCR-SSP method.
- Allele coverage: IMGT/HLA Sequence Database Release 3.51.0, January 2023 for HLA-DQB1 and HLA-DQA1, except:
  - **HLA-DQB1\*02:25/02:35/02:40/02:72/02:147, DQB1\*03:05:02/03:05:05/03:17:02/03:61/03:72/03:100/03:181/03:226/03:262/03:346, DQB1\*04:02:02/04:02:08/04:02:22-04:02:23/04:31/04:48, DQB1\*05:01:14/05:03:10/05:21/05:60/05:72-05:73/05:82/05:98/05:105/05:116/05:175/05:207/05:218/05:258/05:300, DQB1\*06:09:04/06:22:01/06:22:03/06:69:02/06:153:01-06:153:02/06:167/06:231/06:247/06:260/06:301/06:318/06:332/06:342/06:415/06:417/06:441**
  - **HLA-DQA1\*01:20/03:29**
  - These alleles are considered to be rare.
- This manual is only valid for **Lot No. DQB13-4 DQA10-3.**
- This manual should be used together with the Main Manual (General Information) which is the 'Working instruction for the CTS-PCR-SSP TRAY and MINITRAY KITS' (Manual No. 100A).

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#### 4. Kit Composition

- Number of PCR primer mixes per test: 24:
  - 13 HLA-specific mixes for HLA-DQB1 typing
  - 10 HLA-specific mixes for HLA-DQA1 typing
  - 1 negative control mix
- Number of tests per tray: 4
- Number of trays per kit: 10
- The primer mixes are aliquoted and dried in PCR-Trays.
- PCR buffer: 3.0 ml of Mastermix SSP (without Taq polymerase).

For storage condition, please refer to Section 1 of the 'Working instruction for the CTS-PCR-SSP TRAY and MINITRAY KITS' (Manual No. 100A) supplied along with this product.

#### 5. Materials, Reagents and Equipment not supplied

Please refer to Section 2 of the 'Working instruction for the CTS-PCR-SSP TRAY and MINITRAY KITS' (Manual No. 100A) supplied along with this product.

#### 6. Sample Requirements, PCR and Gel Electrophoresis

Please refer to Section 3 to 6 of the 'Working instruction for the CTS-PCR-SSP TRAY and MINITRAY KITS' (Manual No. 100A) supplied along with this product.

#### 7. Result Evaluation

- Check the approximate size of the PCR product against the Primer Mix Specificity Tables (Appendix / Table 1 and 2) to confirm the correct product size.
- Use the Amplification Pattern Tables (Appendix / Table 3 and 4) to make the allele assignments or use the SCORE Software for detailed result interpretation.

#### 8. Interpretation Hints

- Weak or false positive reactions can occur if you use a different Taq polymerase. Also the quality and quantity of DNA is a crucial factor that can affect the mix reactivities. Under suboptimal test conditions, some mixes could give rise to false positive reactions (if there are any potentially false positive reactions when using this specific lot, they are indicated in Section 9).
- Alleles that are known to amplify weakly are listed with "w" (= weak) in the tables (Appendix).
- Please refer to Section 7 and 8 of the 'Working instruction for the CTS-PCR-SSP TRAY and MINITRAY KITS' (Manual No. 100A) supplied along with this product.

#### 9. Special notes

- **HLA-DQB1\* locus:**
  - Differentiation of HLA-DQB1\*03 serological equivalents: Mix 6 and 7 mainly detect HLA-DQB1\*03 alleles which belong to the serological group of HLA-DQ7(3). Mix 8 and 9 react positively with HLA-DQB1\*03 alleles of the HLA-DQ8(3) serological group, whereas mix 10 and 11 amplify HLA-DQB1\*03 alleles which can serologically be defined as HLA-DQ9(3). Some other less common alleles are amplified by these mixes in addition.
  - HLA-DQB1\*03:02 (DQ8) reacts positively with mix 8 and mix 9. In case of a positive reaction in mix 8, mix 9 must be checked carefully, since the reaction may be weak.
  - HLA-DQB1\*03:03 (DQ9) reacts positively with mix 10 and mix 11. In case of a positive reaction in mix 11, mix 10 must be checked carefully, since the reaction may be weak.
  - Some mixes contain specific primers which may give rise to PCR fragments of **two** different sizes simultaneously (see Table 1).
- **HLA-DQA1\* locus:**
  - HLA-DQA1\*05:04 generates two PCR fragments with Mix 9.
  - Potentially false positive reactions: Mix 5

## **10. Troubleshooting**

Please refer to Section 8 of the 'Working instruction for the CTS-PCR-SSP TRAY and MINITRAY KITS' (Manual No. 100A) supplied along with this product.

## **11. Precaution**

Please refer to Material Safety Data Sheet for the CTS-PCR-SSP TRAY and MINITRAY KITS (Manual No. 100B) supplied along with this product.

## **12. Contact**

If you have any particular questions concerning this kit, which are not answered in this or the Main Manual, please do not hesitate to contact us at:

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E-mail: [dna.labor@med.uni-heidelberg.de](mailto:dna.labor@med.uni-heidelberg.de)

### 13. Appendix

**Table 1:** Allele specificities and sizes of the PCR products of each **HLA-DQB1\*** CTS-PCR-SSP primer mix (**Lot-No DQB13-4**) based on IMGT/HLA Sequence Database Release 3.51.0, January 2023

| Position |    |    |     | Mix   | Allele  | Serology        | Size      |
|----------|----|----|-----|-------|---|-----------------|-----------|
| H1       | H4 | H7 | H10 | Mix 1 | DQB1*04:10w, DQB1*05:01:01:01-05:01:13/05:01:15/05:01:16w/05:01:17-05:01:18/05:01:19w/05:01:20-05:03:09/05:03:11-05:03:24/05:03:25w/05:03:26-05:20:02/05:22-05:25/05:26w/05:27-05:33/05:34w/05:35-05:43:02/05:44w/05:45-05:59/05:61-05:71/05:74-05:81/05:83-05:97/05:99-05:104/05:106-05:112/05:113w/05:114-05:115/05:117-05:127/05:128Nw/05:129/05:130w/05:131-05:170/05:171w/05:172-05:174/05:176-05:206N/05:208N-05:217/05:219-05:227/05:228w/05:229-05:257/05:259-05:299/05:301/05:302w/05:303-05:318, DQB1*06:23/06:156/06:162/06:169/06:325 | -, DQ5(1), Null | see below |
|          |    |    |     |       | DQB1*04:10w, DQB1*05:03:02/05:43:02/05:301, DQB1*06:23/06:156/06:162/06:169   | -, DQ5(1)       | 135 bp    |
|          |    |    |     |       | DQB1*05:01:01:01-05:01:13/05:01:15/05:01:16w/05:01:17-05:01:18/05:01:19w/05:01:20-05:03:09/05:03:11-05:03:24/05:03:25w/05:03:26-05:20:02/05:22-05:25/05:26w/05:27-05:33/05:34w/05:35-05:43:02/05:44w/05:45-05:59/05:61-05:71/05:74-05:81/05:83-05:97/05:99-05:104/05:106-05:112/05:113w/05:114-05:115/05:117-05:127/05:128Nw/05:129/05:130w/05:131-05:170/05:171w/05:172-05:174/05:176-05:206N/05:208N-05:217/05:219-05:227/05:228w/05:229-05:257/05:259-05:299/05:301/05:302w/05:303-05:318, DQB1*06:325   | DQ5(1), -, Null | 225 bp    |

| Position |    |    |     | Mix   | Allele  | Serology             | Size      |
|----------|----|----|-----|-------|---|----------------------|-----------|
| G1       | G4 | G7 | G10 | Mix 2 | DQB1*03:194/03:408, DQB1*06:01:01:01-06:01:29/06:01:30?/06:01:31-06:01:34/06:02:07/06:03:01:01-06:03:06/06:03:08-06:03:18/06:03:20-06:03:46/06:08:01-06:08:03/06:11:02-06:12/06:14:01/06:14:03/06:17/06:21/06:26N/06:28/06:30-06:31/06:35/06:40-06:45/06:53:01-06:57:02/06:59-06:65/06:67/06:82/06:87/06:90-06:92:02/06:98-06:105/06:108/06:110/06:120/06:128/06:132-06:134/06:140-06:145:02/06:148/06:149w/06:154/06:157/06:165/06:168/06:170/06:177/06:181/06:184-06:185/06:187/06:190:01-06:191/06:194-06:196/06:199/06:203/06:205/06:209-06:210/06:214/06:218/06:221-06:223/06:229-06:230/06:233-06:234/06:238-06:239/06:243-06:246/06:248/06:250-06:251/06:253/06:257w/06:258-06:259/06:263/06:268-06:269/06:272/06:274-06:275/06:276w/06:277-06:279/06:285/06:302/06:305/06:307/06:309-06:310/06:312/06:316/06:319:01/06:321/06:323/06:327-06:331/06:334/06:336/06:340/06:345N-06:346/06:350/06:352/06:359-06:360/06:362/06:365/06:367/06:371/06:373/06:378/06:382/06:385/06:391-06:392/06:394N/06:396/06:399?/06:400/06:403/06:410/06:418-06:419/06:421/06:423N-06:425/06:427-06:428/06:433/06:435/06:440/06:443/06:450/06:453-06:455/06:459-06:460/06:462-06:463/06:464?/06:466 | -, DQ6(1), DQ1, Null | see below |
|          |    |    |     |       | DQB1*03:408, DQB1*06:01:01:01-06:01:29/06:01:30?/06:01:31-06:01:34/06:35/06:43/06:45/06:53:01-06:57:02/06:98-06:105/06:108/06:120/06:132/06:140/06:142/06:157/06:168/06:177/06:181/06:194/06:205/06:209/06:214/06:229/06:239/06:243/06:245-06:246/06:251/06:257w/06:258/06:263/06:268/06:274/06:277/06:285/06:305/06:307/06:309-06:310/06:312/06:321/06:323/06:330N/06:359/06:382/06:418-06:419/06:421/06:427/06:435/06:462-06:463/06:464?/06:466   | -, DQ6(1), Null      | 160 bp    |
|          |    |    |     |       | DQB1*03:194/06:02:07/06:03:01:01-06:03:06/06:03:08-06:03:18/06:03:20-06:03:46/06:08:01-06:08:03/06:11:02-06:12/06:14:01/06:14:03/06:17/06:21/06:26N/06:28/06:30-06:31/06:40-06:42/06:44/06:59-06:65/06:67/06:82/06:87/06:90-06:92:02/06:110/06:128/06:133-06:134/06:141/06:143-06:145:02/06:148/06:149w/06:154/06:165/06:170/06:184-06:185/06:187/06:190:01-06:191/06:195-06:196/06:199/06:203/06:210/06:218/06:221-06:223/06:230/06:233/06:234/06:238/06:244/06:248/06:250/06:253/06:259/06:269/06:272/06:275/06:276w/06:278-06:279/06:302/06:316/06:319:01/06:327-06:329/06:331/06:334/06:336/06:340/06:345N-06:346/06:350/06:352/06:360/06:362/06:365/06:367/06:371/06:373/06:378/06:385/06:391-06:392/06:394N/06:396/06:399?/06:400/06:403/06:410/06:423N-06:425/06:428/06:433/06:440/06:443/06:450/06:453-06:455/06:459-06:460   | -, DQ6(1), DQ1, Null | 170 bp    |

| Position |    |    |     | Mix   | Allele  | Serology                | Size      |
|----------|----|----|-----|-------|---|-------------------------|-----------|
| F1       | F4 | F7 | F10 | Mix 3 | DQB1*03:08/03:23:01-03:23:02/03:137/03:217/03:228, DQB1*05:43:02, DQB1*06:02:01:01-06:03:03/<br>06:03:05w/06:03:06-06:03:07/06:03:11-06:03:13/06:03:15/06:03:17-06:03:25/06:03:27-06:03:29/06:03:31-<br>06:03:33/06:03:35-06:03:46/06:07:01/06:08:01/06:10-06:11:03/06:13:01-06:14:02/06:15:01-06:16/06:19:01-<br>06:20/06:23-06:24/06:26N/06:28-06:32:01/06:33/06:37/06:40-06:41:01:03/06:44/06:46-06:50/06:51:02/<br>06:60-06:63/06:65w/06:67-06:68/06:70-06:84:01:02/06:87/06:90/06:92:02/06:95-06:97/06:106-06:107/<br>06:109-06:118:01/06:118:03/06:119/06:122-06:128/06:130-06:131/06:133-06:134/06:136-06:138/06:141/<br>06:143-06:144N/06:146:01-06:148/06:150-06:152/06:154/06:156/06:159/06:161-06:163/06:165-06:166/<br>06:169-06:170/06:173-06:176/06:178-06:179N/06:182-06:185/06:187-06:188/06:191-06:192/06:195/06:197-<br>06:201/06:203/06:206:01-06:206:02/06:208:01-06:208:02/06:210-06:211/06:213/06:215-06:216N/06:218-<br>06:219/06:221-06:228/06:230/06:232-06:238/06:240/06:242/06:244/06:248-06:250/06:253/06:255-06:256/<br>06:262/06:264/06:269-06:273/06:276/06:278-06:279/06:284/06:286/06:289-06:290/06:293-06:298/06:300/<br>06:304N/06:306N/06:308N/06:311/06:314-06:317N/06:319:02/06:322:01-06:322:03/06:324/06:326-06:329/<br>06:333-06:338/06:340-06:341N/06:344-06:347/06:350/06:352/06:354-06:357/06:360/06:362-06:367/<br>06:370/06:372-06:374/06:376/06:378-06:380/06:383N-06:386/06:388-06:397N/06:399-06:406/06:408-<br>06:413/06:416Q/06:422N-06:425/06:428/06:430-06:431/06:433/06:436-06:438/06:440/06:442-06:443/<br>06:445-06:448/06:450-06:451/06:453-06:457/06:459-06:461 | -, DQ6(1),<br>DQ1, Null | see below |
|          |    |    |     |       | DQB1*03:23:01-03:23:02/03:217, DQB1*06:02:01:01-06:02:06/06:02:08-06:02:10/06:02:12-06:02:42/<br>06:02:44-06:02:59/06:03:07/06:11:01:01-06:11:01:02/06:14:02/06:15:01-06:16/06:19:01-06:20/06:24/06:33/<br>06:37/06:46-06:50/06:51:02/06:68/06:70-06:74/06:76-06:81/06:83-06:84:01:02/06:95/06:96:02-06:97/<br>06:107/06:109/06:111-06:117/06:118:03/06:122/06:124/06:127/06:131/06:137-06:138/06:146:01-06:147/<br>06:150/06:152/06:159/06:161/06:163/06:173/06:175-06:176/06:178-06:179N/06:183/06:188/06:192/06:197-<br>06:198/06:200-06:201/06:208:01-06:208:02/06:211/06:213/06:215-06:216N/06:219/06:224-06:228/06:232/<br>06:235-06:237/06:240/06:242/06:249/06:255-06:256/06:262/06:270:01-06:271/06:273/06:284/06:286/<br>06:289-06:290/06:293-06:298/06:300/06:304N/06:306N/06:308N/06:311/06:314-06:315/06:317N/06:322:03/<br>06:324/06:326/06:333/06:335/06:338/06:341N/06:344/06:347/06:354-06:357/06:363-06:364/06:366/06:370/<br>06:372/06:376/06:379N-06:380/06:384/06:386/06:388/06:390/06:395/06:397N/06:401-06:402/06:404-<br>06:406/06:409/06:411-06:413/06:416Q/06:422N/06:430-06:431/06:436-06:438/06:442/06:445-06:448/<br>06:451/06:457/06:461  | -, DQ6(1),<br>DQ1, Null | 130 bp    |

| Position |  |  | Mix | Allele   | Serology                | Size   |
|----------|--|--|-----|--|-------------------------|--------|
|          |  |  |     | DQB1*03:08/03:137/03:228, DQB1*06:02:01:01-06:02:06/06:02:09-06:02:59/06:03:07/06:10-06:11:01:02/<br>06:13:01-06:13:03/06:14:02/06:16/06:19:01-06:20/06:24/06:29/06:33/06:46-06:47/06:49-06:50/06:68/06:70-<br>06:81/06:83-06:84:01:02/06:95-06:97/06:106-06:107/06:109/06:111-06:117/06:119/06:122-06:125/06:127/<br>06:130-06:131/06:136-06:138/06:146:01-06:147/06:150/06:152/06:159/06:161/06:163/06:166/06:173/<br>06:175-06:176/06:178-06:179N/06:182-06:183/06:188/06:192/06:197-06:198/06:200-06:201/06:206:01-<br>06:206:02/06:208:01-06:208:02/06:211/06:213/06:215-06:216N/06:219/06:224-06:228/06:232/06:235-<br>06:237/06:240/06:242/06:249/06:255-06:256/06:262/06:264/06:270:01-06:271/06:273/06:284/06:286/<br>06:289-06:290/06:293-06:298/06:300/06:304N/06:306N/06:308N/06:311/06:314-06:315/06:317N/06:319:02/<br>06:322:01-06:322:03/06:324/06:326/06:333/06:335/06:337-06:338/06:341N/06:344/06:347/06:354-06:357/<br>06:363-06:364/06:366/06:370/06:372/06:374/06:376/06:379N-06:380/06:384/06:386/06:388/06:390/06:395/<br>06:397N/06:401/06:404-06:406/06:408-06:409/06:411-06:413/06:416Q/06:422N/06:430-06:431/06:436-<br>06:438/06:442/06:445-06:448/06:451/06:461  | -, DQ6(1),<br>DQ1, Null | 165 bp |
|          |  |  |     | DQB1*03:23:01, DQB1*05:43:02, DQB1*06:02:01:01-06:02:02/06:02:04/06:02:06-06:02:09/06:02:12-<br>06:02:13/06:02:15/06:02:17-06:02:18/06:02:20-06:02:42/06:02:44-06:02:57/06:02:59-06:03:03/06:03:05w/<br>06:03:06-06:03:07/06:03:11-06:03:12/06:03:15/06:03:17-06:03:25/06:03:27-06:03:29/06:03:31-06:03:32/<br>06:03:35-06:03:38/06:03:40-06:03:46/06:07:01/06:11:01:01-06:11:03/06:14:01-06:14:02/06:15:01-06:16/<br>06:19:02-06:20/06:23-06:24/06:26N/06:28/06:30-06:32:01/06:33/06:37/06:40-06:41:01:03/06:44/06:46-<br>06:50/06:51:02/06:60-06:62/06:65w/06:67-06:68/06:70-06:74/06:76-06:79:01/06:80-06:84:01:02/06:87/<br>06:90/06:92:02/06:95/06:96:02/06:107/06:109-06:113/06:115-06:118:01/06:118:03/06:122/06:124/06:126-<br>06:128/06:131/06:133-06:134/06:137/06:141/06:143-06:144N/06:146:01-06:148/06:151/06:154/06:156/<br>06:159/06:161-06:163/06:165/06:169/06:173-06:176/06:178-06:179N/06:183-06:185/06:187-06:188/06:191-<br>06:192/06:195/06:197-06:201/06:203/06:210-06:211/06:213/06:216N/06:218-06:219/06:221/06:223-06:228/<br>06:230/06:232-06:238/06:240/06:244/06:248-06:250/06:253/06:255-06:256/06:262/06:269-06:273/06:276/<br>06:278-06:279/06:284/06:286/06:289-06:290/06:293-06:298/06:300/06:304N/06:306N/06:308N/06:311/<br>06:314-06:317N/06:322:03/06:324/06:326-06:329/06:333-06:336/06:338/06:340-06:341N/06:344-06:347/<br>06:350/06:352/06:354-06:357/06:360/06:362-06:367/06:370/06:372-06:373/06:376/06:378-06:380/06:383N-<br>06:386/06:388/06:390-06:397N/06:399-06:406/06:409-06:413/06:416Q/06:422N-06:425/06:428/06:430-<br>06:431/06:433/06:436-06:438/06:440/06:442-06:443/06:445-06:446/06:448/06:450-06:451/06:453-06:454N/<br>06:456N-06:457/06:459-06:461 | -, DQ6(1),<br>DQ1, Null | 65 bp  |



| Position |    |    |     | Mix   | Allele   | Serology             | Size   |
|----------|----|----|-----|-------|--|----------------------|--------|
|          |    |    |     |       | DQB1*06:02:01:01-06:02:02/06:02:04/06:02:06-06:02:07/06:02:09/06:02:11-06:02:13/06:02:15/06:02:17-06:02:18/06:02:20-06:02:57/06:02:59-06:03:03/06:03:05w/06:03:06-06:03:07/06:03:11-06:03:13/06:03:15/06:03:17-06:03:25/06:03:27-06:03:29/06:03:31-06:03:33/06:03:35-06:03:46/06:08:01/06:10-06:11:03/06:13:01/06:14:01-06:14:02/06:16/06:19:02-06:20/06:23-06:24/06:26N/06:28-06:31/06:33/06:40-06:41:01:03/06:44/06:46-06:47/06:49-06:50/06:60-06:63/06:65w/06:67-06:68/06:70-06:79:01/06:80-06:84:01:02/06:87/06:90/06:92:02/06:95-06:96:02/06:106-06:107/06:109-06:113/06:115-06:117/06:122/06:124-06:128/06:130-06:131/06:133-06:134/06:136-06:137/06:141/06:143-06:144N/06:146:01-06:148/06:151/06:154/06:156/06:159/06:161-06:163/06:165-06:166/06:169-06:170/06:173-06:176/06:178-06:179N/06:182-06:185/06:187-06:188/06:191-06:192/06:195/06:197-06:201/06:203/06:206:01/06:210-06:211/06:213/06:216N/06:218-06:219/06:221-06:228/06:230/06:232-06:238/06:240/06:244/06:248-06:250/06:253/06:255-06:256/06:262/06:264/06:269-06:273/06:276/06:278-06:279/06:284/06:286/06:289-06:290/06:293-06:298/06:300/06:304N/06:306N/06:308N/06:311/06:314-06:317N/06:322:01/06:322:03/06:324/06:326-06:329/06:333-06:336/06:338/06:340-06:341N/06:344-06:347/06:350/06:352/06:354-06:357/06:360/06:362-06:367/06:370/06:372-06:374/06:376/06:378-06:380/06:383N-06:386/06:388-06:397N/06:399-06:401/06:403-06:406/06:408-06:413/06:416Q/06:422N-06:425/06:428/06:430-06:431/06:433/06:436-06:438/06:440/06:442-06:443/06:445-06:446/06:448/06:450-06:451/06:453-06:456N/06:459-06:461 | DQ6(1), -, DQ1, Null | 105 bp |
| E1       | E4 | E7 | E10 | Mix 4 | DQB1*06:04:01:01-06:07:02/06:09:01:01-06:09:03/06:09:05/06:09:06w/06:09:07-06:09:12/06:18:01-06:18:02/06:22:02/06:25/06:27:01-06:27:02/06:32:01-06:32:02/06:34/06:36/06:38-06:39/06:52/06:58/06:66/06:69:01/06:85-06:86/06:88:01:01-06:89/06:93-06:94/06:118:01-06:118:02/06:118:04/06:121w/06:129/06:135/06:142/06:155/06:158N/06:160/06:164/06:168/06:171-06:172/06:180/06:186/06:189/06:193N/06:202/06:204/06:207/06:212w/06:217/06:241/06:252N/06:254/06:261/06:265-06:267/06:280-06:283/06:287-06:288/06:291-06:292/06:299/06:303N/06:313/06:320/06:339/06:343/06:348-06:349/06:351/06:353/06:358/06:361/06:368-06:369/06:375/06:381/06:387/06:398/06:407/06:414N/06:420/06:426/06:429/06:432/06:434/06:439Q/06:444/06:449/06:452N/06:458N/06:465   | DQ6(1), -, Null      | 170 bp |
| D1       | D4 | D7 | D10 | Mix 5 | DQB1*02:01:01:01-02:01:09/02:01:11-02:01:13/02:01:15-02:01:23/02:01:24w/02:01:25-02:24/02:26-02:34/02:36/02:37w/02:38-02:39/02:41-02:45/02:46w-02:47w/02:48-02:71/02:73-02:89:02/02:90w/02:91-02:146/02:148-02:211   | DQ2, -, Null         | 200 bp |

| Position |    |    |     | Mix   | Allele  | Serology                        | Size      |
|----------|----|----|-----|-------|---|---------------------------------|-----------|
| C1       | C4 | C7 | C10 | Mix 6 | DQB1*03:01:01:01-03:01:01:12/03:01:01:14-03:01:58/03:04:01:01-03:04:04/03:09-03:10:03/03:13-03:14:02/<br>03:16/03:19:01:01-03:19:06/03:21-03:23:02/03:24/03:27-03:29/03:35/03:36w/03:42/03:44/03:46-03:60/<br>03:69/03:71/03:73/03:75-03:77/03:80/03:82-03:84N/03:92-03:94/03:101-03:103/03:108-03:109/03:114-<br>03:116/03:118N-03:121/03:122w/03:127-03:131/03:133-03:135/03:138-03:140/03:142-03:144/03:147/<br>03:150/03:151w/03:152/03:154/03:157-03:160/03:162-03:167/03:169-03:170/03:171w/03:172-03:173/<br>03:180/03:182-03:183/03:186-03:188/03:191-03:198:02/03:201-03:202/03:206-03:208/03:216-03:219/<br>03:231-03:232/03:235-03:236/03:241-03:243/03:246/03:252-03:257/03:260/03:264/03:266-03:268/03:271/<br>03:275-03:276N/03:281/03:284-03:286/03:288/03:290-03:294/03:297/03:302-03:303N/03:305-03:307/<br>03:309:01-03:309:02/03:311-03:312/03:317:01-03:318/03:326-03:331/03:335/03:338N/03:340N-03:342/<br>03:347/03:350/03:353-03:355/03:358N/03:360-03:361/03:366/03:370/03:372-03:373/03:376N-03:378/<br>03:380-03:381/03:385N/03:387/03:389-03:391/03:394/03:396/03:399N-03:401/03:404/03:407N-03:408/<br>03:417-03:421/03:423-03:428/03:430-03:432/03:434-03:436/03:438-03:439/03:443/03:448-03:449/03:451/<br>03:454-03:455/03:458/03:460/03:465/03:467-03:470/03:472-03:476/03:480Q/03:482-03:483/03:485-<br>03:486/03:488N/03:491-03:492/03:496-03:497/03:499N/03:503/03:506/03:508, DQB1*04:10,<br>DQB1*05:03:02?, DQB1*06:35/06:53:01-06:53:02           | DQ7(3), -, Null,<br>DQ3, DQ5(1) | see below |
|          |    |    |     |       | DQB1*03:01:01:01-03:01:01:12/03:01:01:14-03:01:37/03:01:39-03:01:58/03:04:01:01-03:04:01:02/03:04:03-<br>03:04:04/03:09/03:13/03:16/03:19:01:01-03:19:06/03:21-03:22:02/03:24/03:27-03:29/03:35/03:36w/03:42/<br>03:44/03:46-03:60/03:69/03:71/03:73/03:75/03:77/03:82-03:84N/03:92-03:94/03:101-03:103/03:108-03:109/<br>03:114-03:116/03:118N-03:120/03:122w/03:127/03:129-03:130/03:133-03:135/03:140/03:142-03:144/<br>03:147/03:150/03:151w/03:152/03:154/03:157-03:160/03:162-03:165/03:167/03:169-03:170/03:171w/<br>03:172-03:173/03:182/03:186-03:188/03:191-03:194/03:196-03:198:02/03:201-03:202/03:206-03:208/<br>03:216/03:218-03:219/03:231-03:232/03:235-03:236/03:241-03:243/03:246/03:252-03:254/03:256/03:260/<br>03:264/03:266-03:268/03:271/03:275-03:276N/03:281/03:284-03:286/03:288/03:290-03:294/03:297/03:302-<br>03:303N/03:305-03:307/03:309:01-03:309:02/03:311-03:312/03:317:01-03:318/03:326/03:328-03:331/<br>03:335/03:338N/03:340N-03:342/03:347/03:350/03:354N-03:355/03:358N/03:360-03:361/03:370/03:372-<br>03:373/03:376N-03:378/03:380-03:381/03:385N/03:387/03:389-03:391/03:394/03:396/03:399N-03:401/<br>03:404/03:407N-03:408/03:417-03:421/03:423-03:428/03:430-03:432/03:434-03:436/03:439/03:443/03:448-<br>03:449/03:451/03:454-03:455/03:458/03:460/03:465/03:467-03:470/03:472-03:473N/03:476/03:480Q/<br>03:482-03:483/03:485-03:486/03:488N/03:491-03:492/03:496-03:497/03:499N/03:503/03:506/03:508,<br>DQB1*06:35/06:53:01-06:53:02 | DQ7(3), -, Null                 | 100 bp    |

| Position |    |    |     | Mix     | Allele   | Serology             | Size   |
|----------|----|----|-----|---------|--|----------------------|--------|
|          |    |    |     |         | DQB1*03:01:01:01-03:01:01:12/03:01:01:14-03:01:58/03:04:01:01-03:04:04/03:09-03:10:03/03:13-03:14:02/03:16/03:19:01:01-03:19:06/03:21-03:22:02/03:24/03:27-03:29/03:35/03:36w/03:42/03:44/03:46-03:60/03:69/03:71/03:73/03:75-03:77/03:80/03:82-03:84N/03:92-03:94/03:101-03:103/03:108-03:109/03:114-03:116/03:118N-03:121/03:122w/03:127-03:131/03:133-03:135/03:138-03:140/03:142-03:144/03:147/03:150/03:151w/03:152/03:154/03:157-03:160/03:162-03:167/03:169-03:170/03:171w/03:172-03:173/03:180/03:182-03:183/03:186-03:188/03:191-03:198:02/03:201-03:202/03:206-03:207/03:216/03:218-03:219/03:231-03:232/03:235-03:236/03:241-03:243/03:246/03:252-03:257/03:260/03:264/03:266-03:268/03:271/03:275-03:276N/03:281/03:284-03:286/03:288/03:290-03:294/03:297/03:302-03:303N/03:305-03:307/03:309:01-03:309:02/03:311-03:312/03:317:01-03:318/03:326-03:331/03:335/03:338N/03:340N-03:342/03:347/03:350/03:353-03:355/03:358N/03:360-03:361/03:366/03:370/03:372-03:373/03:376N-03:378/03:380-03:381/03:385N/03:387/03:389-03:391/03:394/03:396/03:400N-03:401/03:404/03:407N-03:408/03:417-03:421/03:423-03:428/03:430-03:432/03:434/03:436/03:438-03:439/03:448-03:449/03:451/03:454-03:455/03:458/03:460/03:465/03:467-03:470/03:472-03:476/03:480Q/03:482-03:483/03:485-03:486/03:488N/03:491-03:492/03:496-03:497/03:499N/03:503/03:506/03:508 | DQ7(3), -, Null, DQ3 | 215 bp |
|          |    |    |     |         | DQB1*03:23:01-03:23:02/03:217/03:355, DQB1*04:10, DQB1*05:03:02?   | -, DQ5(1)            | 120 bp |
| B1       | B4 | B7 | B10 | Mix 7   | DQB1*03:04:01:01-03:04:04/03:14:01-03:14:02/03:70/03:80/03:179w/03:318/03:327/03:443/03:474w, DQB1*06:246w   | DQ7(3), -            | 175 bp |
| A1       | A4 | A7 | A10 | Mix 8   | DQB1*03:02:01:01-03:02:09/03:02:11-03:02:15/03:02:16w/03:02:17-03:02:37/03:07-03:08/03:11/03:32/03:37/03:45:01-03:45:02/03:62-03:64/03:66N-03:68/03:70/03:81/03:85/03:106-03:107/03:125/03:146/03:153/03:161/03:174-03:175/03:178-03:179/03:184-03:185/03:189-03:190/03:199/03:203-03:205/03:210-03:211/03:213N-03:215/03:220-03:221/03:223-03:224/03:225w/03:228-03:229/03:233/03:237N/03:240/03:245/03:247/03:251/03:261/03:263:01:01-03:263:01:02/03:265/03:269N/03:273-03:274/03:277-03:279/03:287/03:289/03:295-03:296/03:298-03:301/03:308/03:310N/03:315/03:320-03:324/03:333-03:334N/03:339N/03:343-03:345/03:348-03:349/03:352/03:362/03:364/03:367-03:369/03:371/03:379/03:383/03:386/03:388/03:392/03:403N/03:409-03:410/03:412-03:413/03:415-03:416/03:422N/03:429/03:433/03:437w/03:440N-03:442/03:444/03:446-03:447/03:450/03:452/03:456-03:457/03:459/03:462-03:464/03:466/03:471/03:479/03:481/03:484/03:490/03:493/03:495/03:498/03:500-03:502/03:504, DQB1*06:29/06:123/06:139/06:246/06:337   | DQ8(3), -, Null      | 130 bp |
| H2       | H5 | H8 | H11 | Mix 9 † | DQB1*03:02:01:01-03:02:01:10/03:02:01:12-03:02:03/03:02:09/03:02:12/03:02:21-03:02:24/03:02:32-03:02:33/03:02:36-03:02:37/03:05:01/03:05:03-03:05:04/03:08/03:11/03:37/03:68/03:211/03:245/03:247/03:250-03:251/03:263:01:01-03:263:01:02/03:289/03:415-03:416/03:422N/03:442/03:464/03:481/03:484/03:493/03:498/03:500-03:502/03:504  | DQ8(3), -, Null      | 190 bp |

| Position |    |    |     | Mix      | Allele   | Serology                                | Size   |
|----------|----|----|-----|----------|--|---|--------|
| G2       | G5 | G8 | G11 | Mix 10   | DQB1*02:03:01/02:77/02:180, DQB1*03:03:02:01-03:03:05/03:03:06w/03:03:07-03:03:16/03:03:17w/03:03:18-03:03:25/03:03:27-03:03:29/03:06w/03:12/03:15/03:20/03:23:03/03:25:01w-03:25:02w/03:26/03:30-03:31/03:33-03:34/03:38:01-03:41/03:43/03:65/03:74/03:79/03:86-03:91Q/03:95N-03:99Q/03:104-03:105/03:111-03:113/03:117/03:123-03:124/03:126w/03:136-03:137/03:141/03:145w/03:155-03:156/03:168/03:176-03:177/03:200/03:209/03:212/03:222/03:227/03:230/03:234/03:238-03:239/03:248-03:249/03:258/03:270/03:280/03:282N-03:283/03:304/03:313/03:316/03:319/03:332/03:336-03:337/03:351/03:356N-03:357N/03:359/03:363/03:365/03:374-03:375N/03:382/03:384/03:393/03:395/03:397-03:398/03:402/03:405-03:406/03:411N/03:414/03:445/03:453/03:461/03:477-03:478/03:487/03:489/03:494/03:505/03:507/03:509N, DQB1*04:03:01w-04:03:03w, DQB1*06:02:43/06:03:10/06:03:33/06:51:01/06:66/06:96:01/06:118:04/06:168/06:172/06:322:01-06:322:02/06:377              | DQ2, -, DQ9(3), DQ3, Null               | 135 bp |
| F2       | F5 | F8 | F11 | Mix 11 † | DQB1*03:02:01:11/03:03:02:01-03:03:04/03:03:11/03:25:01/03:31/03:40/03:126/03:195/03:239/03:248-03:249/03:414/03:445/03:453/03:505/03:507  | -, DQ9(3)                               | 175 bp |
| E2       | E5 | E8 | E11 | Mix 12   | DQB1*03:01:01:01-03:01:01:12/03:01:01:14-03:01:01:55/03:01:03-03:01:05/03:01:06w/03:01:07-03:01:52/03:01:54-03:02:02:02/03:02:04w/03:02:05-03:02:12/03:02:13w/03:02:14-03:02:22/03:02:24-03:03:02:11/03:03:04-03:04:04/03:05:03-03:05:04/03:07-03:17:01/03:18-03:19:06/03:21-03:22:02/03:23:02-03:24/03:25:02-03:36/03:38:01/03:39-03:53/03:54w/03:55-03:60/03:62-03:71/03:74/03:76-03:99Q/03:101-03:111/03:113-03:117/03:119-03:128/03:130-03:131/03:133-03:135/03:137-03:155/03:157-03:161/03:163-03:174/03:176-03:180/03:182/03:184-03:203/03:204w/03:205-03:222/03:224-03:225/03:227-03:236/03:239-03:249/03:251/03:253-03:261/03:263:01:01-03:268/03:269Nw/03:270-03:290/03:292-03:324/03:326-03:335/03:336w/03:337-03:345/03:347-03:350/03:352w/03:353/03:355-03:370/03:372-03:390/03:391w/03:392-03:440N/03:441w/03:442-03:487/03:488N?/03:489-03:509N, DQB1*05:11:01/05:240, DQB1*06:02:02/06:03:02/06:03:34/06:04:08/06:09:07/06:145:02/06:208:02 | DQ7(3), -, Null, DQ8(3), DQ9(3), DQ6(1) | 160 bp |
| D2       | D5 | D8 | D11 | Mix 13   | DQB1*03:132, DQB1*04:01:01:01-04:01:05/04:01:06?/04:02:01:01/04:02:01:04-04:02:01:20/04:02:03-04:02:07/04:02:09-04:02:21/04:02:23?/04:02:24-04:03:01/04:04-04:30/04:32-04:47/04:49-04:66/04:67w/04:68N-04:90/04:91?/04:92-04:95  | -, DQ4, Null                            | 210 bp |

**Amplification control (internal positive control):** 440 base pairs (bp)

w = weak

? = nucleotide sequence information not available for the primer matching sequence or alleles with unknown reactivities

**Bold:** mixes which result in PCR fragments of different sizes (the specificities are first indicated all in one row, then split into several groups in the subsequent rows depending on the fragment size)

**Mix 6, HLA-DQB1\*03:10:** a rare allele according to Mack SJ et al., Tissue Antigens 2013, serological equivalent is controversially discussed (DQ3, DQ7 or DQ8).

† **ATTENTION!** Alleles which are not sequenced in the primer binding sites of mixes 9 and 11 (according to the IMGT/HLA Database of January 2023) have been excluded from the list of allele specificities of these mixes.

**Table 2:** Allele specificities and sizes of the PCR products of each **HLA-DQA1\*** CTS-PCR-SSP primer mix (**Lot-No DQA10-3**) based on IMGT/HLA Sequence Database Release 3.51.0, January 2023

| Position |    |    |     | Mix    | Allele   | Serology | Size             |
|----------|----|----|-----|--------|--|----------|------------------|
| C2       | C5 | C8 | C11 | Mix 1  | DQA1*01:01:01:01-01:01:01:03/01:01:01:05-01:01:11/01:04:01:01-01:05:04/01:07Q/01:12/01:18/01:22/01:26-01:27/01:29w/01:34-01:35/01:37/01:43/01:49/01:53/01:55-01:56/01:59-01:61/01:64/01:66-01:67/01:74/01:77/01:80/01:83/01:86/01:88N-01:90/01:95-01:96/01:98-01:99/01:107/01:110  | -, Null  | 145 bp           |
| B2       | B5 | B8 | B11 | Mix 2  | DQA1*01:02:01:01-01:03:08/01:06/01:08-01:11/01:13-01:17/01:19/01:21/01:23-01:25/01:28/01:30-01:33/01:36/01:38:01:01-01:42/01:44-01:48/01:50-01:52/01:54/01:57-01:58/01:62-01:63:01:02/01:65/01:68-01:73/01:75-01:76/01:78-01:79/01:81-01:82/01:84-01:85/01:87:01:01-01:87:01:02/01:91/01:92?/01:93-01:94/01:97/01:100-01:106/01:108-01:109/01:111  | -, Null  | 145 bp           |
| A2       | A5 | A8 | A11 | Mix 3  | DQA1*01:01:01:01-01:01:01:03/01:01:01:05-01:02:18/01:04:01:01-01:04:05/01:04:06?-01:04:07?/01:04:08-01:09/01:11-01:13/01:16N/01:18-01:19/01:21-01:23/01:25-01:28/01:31-01:32/01:34-01:43/01:46/01:48-01:49/01:51:01:01-01:56/01:58-01:59/01:60?/01:61-01:64/01:66-01:67/01:69/01:71-01:74/01:75?/01:77/01:80-01:81/01:83/01:85-01:86/01:88N-01:91/01:92?/01:93-01:96/01:98-01:100/01:103-01:107/01:109-01:111  | -, Null  | 170 bp           |
| H3       | H6 | H9 | H12 | Mix 4  | DQA1*01:03:01:01-01:03:08/01:10/01:14-01:15N/01:17/01:24/01:30/01:33/01:44-01:45/01:47/01:50/01:57/01:65/01:68/01:70/01:76/01:78-01:79/01:82/01:84?/01:87:01:01-01:87:01:02/01:97/01:102/01:108  | -, Null  | 170 bp           |
| G3       | G6 | G9 | G12 | Mix 5  | DQA1*01:03:02?-01:03:03?/01:03:05?/01:04:01:01-01:04:02:02/01:04:03?-01:04:04?/01:04:05-01:05:04/01:06?/01:07Q/01:08?-01:09?/01:12?-01:13?/01:15N?/01:17?-01:18?/01:20?/01:22?/01:26?/01:28?-01:29?/01:31?-01:37?/01:40Q?/01:42?/01:46?-01:47?/01:50?/01:52?-01:53?/01:55?-01:56?/01:59?-01:62?/01:64/01:67?-01:75?/01:77?-01:79?/01:80/01:81?/01:83?/01:85?/01:86/01:90?-01:98?/01:100/01:101?/01:103?/01:108?-01:111?, DQA1*02:01:02?/02:18?-02:24?, DQA1*03:01:03?/03:19?/03:22?-03:27N?/03:29?-03:30?, DQA1*04:01:04?-04:01:05?/04:03N?-04:04?/04:09?-04:12N?, DQA1*05:02?/05:04?/05:10?/05:32?/05:34?-05:35:01?/05:37?/05:39?-05:46?/05:50?/05:52?, DQA1*06:01:02?-06:04? | -, Null  | 200 bp           |
| F3       | F6 | F9 | F12 | Mix 6  | DQA1*02:01:01:01-02:05/02:06/02:07-02:31   | -, Null  | 105 bp           |
| E3       | E6 | E9 | E12 | Mix 7  | DQA1*03:01:01:01/03:01:01:03/03:01:03-03:28/03:29?/03:30-03:44   | -, Null  | 130 bp           |
| D3       | D6 | D9 | D12 | Mix 8  | DQA1*01:02:12, DQA1*04:01:01:01-04:17  | -, Null  | 215 bp           |
| C3       | C6 | C9 | C12 | Mix 9  | <b>DQA1*05:01:01:01-05:01:02/05:01:04-05:09:01:02/05:10w/05:11:01:01-05:33/05:34?/05:35:01-05:48/05:49?/05:50-05:74</b>  | -, Null  | <b>see below</b> |
|          |    |    |     |        | DQA1*05:04   | -        | 205 bp           |
|          |    |    |     |        | DQA1*05:01:01:01-05:01:02/05:01:04-05:09:01:02/05:10w/05:11:01:01-05:33/05:34?/05:35:01-05:48/05:49?/05:50-05:74   | -, Null  | 190 bp           |
| B3       | B6 | B9 | B12 | Mix 10 | DQA1*06:01:01:01-06:04   | -        | 105 bp           |
| A3       | A6 | A9 | A12 | Mix 11 | -  | -        | None (440bp)     |

**Amplification control (internal positive control):** 440 base pairs (bp)

w = weak

? = nucleotide sequence information not available for the primer matching sequence

**Bold:** mixes which result in PCR fragments of different sizes (the specificities are first indicated all in one row, then split into several groups in the subsequent rows depending on the fragment size)

**Table 3:** Amplification patterns of **HLA-DQB1\*** alleles detected by the HLA-DQB1\* CTS-PCR-SSP primer mixes (**Lot No. DQB13-4**) based on IMGT/HLA Sequence Database Release 3.51.0, January 2023

| Allele  | Serology             | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|----------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|
| DQB1*02:01:01:01-02:01:09/02:01:11-02:01:13/02:01:15-02:01:23/02:01:25-02:01:24/02:26-02:34/02:36/02:38-02:39/02:41-02:45/02:48-02:71/02:73-02:76/02:78-02:89/02:91-02:146/02:148-02:179/02:181-02:211  | DQ2, -, Null         |   |   |   |   | 5 |   |   |   |   |    |    |    |    |
| DQB1*02:01:24/02:37/02:46-02:47/02:90   | -                    |   |   |   |   | w |   |   |   |   |    |    |    |    |
| DQB1*02:77/02:180   | -                    |   |   |   |   | 5 |   |   |   |   | 10 |    |    |    |
| DQB1*03:01:01:01-03:01:01:12/03:01:01:14-03:01:01:55/03:01:03-03:01:05/03:01:07-03:01:52/03:01:54-03:01:58/03:09-03:10:03/03:13/03:16/03:19:01:01-03:19:06/03:21-03:22:02/03:24/03:27-03:29/03:35/03:42/03:44/03:46-03:53/03:55-03:60/03:69/03:71/03:76-03:77/03:82-03:84N/03:92-03:94/03:101-03:103/03:108-03:109/03:114-03:116/03:119-03:121/03:127-03:128/03:130-03:131/03:133-03:135/03:138-03:140/03:142-03:144/03:147/03:150/03:152/03:154/03:157-03:160/03:163-03:167/03:169-03:170/03:172-03:173/03:180/03:182/03:186-03:188/03:191-03:193/03:196-03:198:02/03:201-03:202/03:206-03:208/03:216/03:218-03:219/03:231-03:232/03:235-03:236/03:241-03:243/03:246/03:253-03:257/03:260/03:264/03:266-03:268/03:271/03:275-03:276N/03:281/03:284-03:286/03:288/03:290/03:292-03:294/03:297/03:302-03:303N/03:305-03:307/03:309:01-03:309:02/03:311-03:312/03:317:01-03:317:02/03:326/03:328-03:331/03:335/03:338N/03:340N-03:342/03:347/03:350/03:353/03:355/03:358N/03:360-03:361/03:366/03:370/03:372-03:373/03:376N-03:378/03:380-03:381/03:385N/03:387/03:389-03:390/03:394/03:396/03:399N-03:401/03:404/03:407N/03:417-03:421/03:423-03:428/03:430-03:432/03:434-03:436/03:438-03:439/03:448-03:449/03:451/03:454-03:455/03:458/03:460/03:465/03:467-03:470/03:472-03:473N/03:475-03:476/03:480Q/03:482-03:483/03:485-03:486/03:491-03:492/03:496-03:497/03:499N/03:503/03:506/03:508 | DQ7(3), -, Null, DQ3 |   |   |   |   |   | 6 |   |   |   |    |    | 12 |    |
| DQB1*03:01:02/03:01:53/03:73/03:75/03:118N/03:129/03:162/03:183/03:252/03:291/03:354N   | DQ7(3), -, Null      |   |   |   |   |   | 6 |   |   |   |    |    |    |    |
| DQB1*03:01:06/03:54/03:391  | -                    |   |   |   |   |   | 6 |   |   |   |    |    | w  |    |
| DQB1*03:02:01:01-03:02:01:10/03:02:01:12-03:02:02:02/03:02:09/03:02:12/03:02:21-03:02:22/03:02:24/03:02:32-03:02:33/03:02:36-03:02:37/03:11/03:68/03:211/03:245/03:247/03:251/03:263:01:01-03:263:01:02/03:289/03:415-03:416/03:422N/03:442/03:464/03:481/03:484/03:493/03:498/03:500-03:502/03:504   | DQ8(3), -, Null      |   |   |   |   |   |   |   | 8 | 9 |    |    | 12 |    |
| DQB1*03:02:01:11  | -                    |   |   |   |   |   |   |   | 8 |   |    | 11 | 12 |    |
| DQB1*03:02:03/03:02:23/03:37  | DQ8(3), -            |   |   |   |   |   |   |   | 8 | 9 |    |    |    |    |
| DQB1*03:02:04/03:02:13/03:204/03:269N/03:352/03:441   | DQ8(3), -, Null      |   |   |   |   |   |   |   | 8 |   |    |    | w  |    |

| Allele  | Serology  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|-----------|---|---|---|---|---|---|---|---|---|----|----|----|----|
| DQB1*03:02:05-03:02:08/03:02:11/03:02:14-03:02:15/03:02:17-03:02:20/03:02:25-03:02:31/03:02:34-03:02:35/03:07/03:32/03:45:01-03:45:02/03:62-03:64/03:66N-03:67/03:81/03:85/03:106-03:107/03:125/03:146/03:153/03:161/03:174/03:178/03:184-03:185/03:189-03:190/03:199/03:203/03:205/03:210/03:213N-03:215/03:220-03:221/03:224/03:229/03:233/03:240/03:261/03:265/03:273-03:274/03:277-03:279/03:287/03:295-03:296/03:298-03:301/03:308/03:310N/03:315/03:320-03:324/03:333-03:334N/03:339N/03:343-03:345/03:348-03:349/03:362/03:364/03:367-03:369/03:379/03:383/03:386/03:388/03:392/03:403N/03:409-03:410/03:412-03:413/03:429/03:433/03:440N/03:444/03:446-03:447/03:450/03:452/03:456-03:457/03:459/03:462-03:463/03:466/03:471/03:479/03:490/03:495 | -, Null   |   |   |   |   |   |   |   | 8 |   |    |    | 12 |    |
| DQB1*03:02:10/03:03:26/03:17:01/03:18/03:78/03:110/03:148-03:149/03:244/03:259/03:272/03:314  | -         |   |   |   |   |   |   |   |   |   |    |    | 12 |    |
| DQB1*03:02:16/03:225/03:437   | -         |   |   |   |   |   |   |   | w |   |    |    | 12 |    |
| DQB1*03:03:02:01-03:03:02:11/03:03:04/03:03:11/03:31/03:40/03:239/03:248-03:249/03:414/03:445/03:453/03:505/03:507  | DQ9(3), - |   |   |   |   |   |   |   |   |   | 10 | 11 | 12 |    |
| DQB1*03:03:03:01-03:03:03:02  | DQ9(3), - |   |   |   |   |   |   |   |   |   | 10 | 11 |    |    |
| DQB1*03:03:05/03:03:07-03:03:10/03:03:12-03:03:16/03:03:18-03:03:25/03:03:27-03:03:29/03:12/03:15/03:23:03/03:26/03:30/03:33-03:34/03:38:01/03:39/03:41/03:43/03:65/03:74/03:79/03:86-03:91Q/03:95N-03:99Q/03:104-03:105/03:111/03:113/03:117/03:123-03:124/03:141/03:155/03:168/03:176-03:177/03:200/03:209/03:212/03:222/03:227/03:230/03:234/03:258/03:270/03:280/03:282N-03:283/03:304/03:313/03:316/03:319/03:332/03:337/03:356N-03:357N/03:359/03:363/03:365/03:374-03:375N/03:382/03:384/03:393/03:395/03:397-03:398/03:402/03:405-03:406/03:411N/03:461/03:477-03:478/03:487/03:489/03:494/03:509N  | -, Null   |   |   |   |   |   |   |   |   |   | 10 |    | 12 |    |
| DQB1*03:03:06/03:03:17/03:25:02/03:145  | -         |   |   |   |   |   |   |   |   |   | w  |    | 12 |    |
| DQB1*03:04:01:01-03:04:04/03:14:01-03:14:02/03:80/03:318/03:327/03:443  | DQ7(3), - |   |   |   |   |   | 6 | 7 |   |   |    |    | 12 |    |
| DQB1*03:05:01/03:250  | DQ8(3), - |   |   |   |   |   |   |   |   | 9 |    |    |    |    |
| DQB1*03:05:03-03:05:04  | DQ8(3)    |   |   |   |   |   |   |   |   | 9 |    |    | 12 |    |
| DQB1*03:06, DQB1*04:03:02-04:03:03  | DQ3, -    |   |   |   |   |   |   |   |   |   | w  |    |    |    |
| DQB1*03:08  | -         |   |   | 3 |   |   |   |   | 8 | 9 |    |    | 12 |    |
| DQB1*03:20/03:38:02/03:112/03:136/03:156/03:238/03:351, DQB1*06:51:01/06:377  | -         |   |   |   |   |   |   |   |   |   | 10 |    |    |    |
| DQB1*03:23:01   | -         |   |   | 3 |   |   | 6 |   |   |   |    |    |    |    |
| DQB1*03:23:02/03:217  | -         |   |   | 3 |   |   | 6 |   |   |   |    |    | 12 |    |
| DQB1*03:25:01   | -         |   |   |   |   |   |   |   |   |   | w  | 11 |    |    |
| DQB1*03:36/03:122/03:151/03:171   | -         |   |   |   |   |   | w |   |   |   |    |    | 12 |    |
| DQB1*03:70  | -         |   |   |   |   |   |   | 7 | 8 |   |    |    | 12 |    |
| DQB1*03:126   | -         |   |   |   |   |   |   |   |   |   | w  | 11 | 12 |    |



| Allele   | Serology             | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|--|----------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|
| DQB1*03:132, DQB1*04:01:01:01-04:01:05/04:02:01:01/04:02:01:04-04:02:01:20/04:02:03-04:02:07/04:02:09-04:02:21/04:02:24/04:04-04:09/04:11-04:30/04:32-04:47/04:49-04:66/04:68N-04:90/04:92-04:95   | -, DQ4, Null         |   |   |   |   |   |   |   |   |   |    |    |    | 13 |
| DQB1*03:137  | -                    |   |   | 3 |   |   |   |   |   |   | 10 |    | 12 |    |
| DQB1*03:175/03:223/03:237N/03:371, DQB1*06:139   | -, Null              |   |   |   |   |   |   |   | 8 |   |    |    |    |    |
| DQB1*03:179  | -                    |   |   |   |   |   |   | w | 8 |   |    |    | 12 |    |
| DQB1*03:194/03:408   | -                    |   | 2 |   |   |   | 6 |   |   |   |    |    | 12 |    |
| DQB1*03:195  | -                    |   |   |   |   |   | 6 |   |   |   |    | 11 | 12 |    |
| DQB1*03:228  | -                    |   |   | 3 |   |   |   |   | 8 |   |    |    | 12 |    |
| DQB1*03:336  | -                    |   |   |   |   |   |   |   |   |   | 10 |    | w  |    |
| DQB1*03:474  | -                    |   |   |   |   |   | 6 | w |   |   |    |    | 12 |    |
| DQB1*03:488N   | Null                 |   |   |   |   |   | 6 |   |   |   |    |    | ?  |    |
| DQB1*04:01:06/04:02:23/04:91   | -                    |   |   |   |   |   |   |   |   |   |    |    |    | ?  |
| DQB1*04:03:01  | -                    |   |   |   |   |   |   |   |   |   | w  |    |    | 13 |
| DQB1*04:10   | -                    | w |   |   |   |   | 6 |   |   |   |    |    |    | 13 |
| DQB1*04:67   | -                    |   |   |   |   |   |   |   |   |   |    |    |    | w  |
| DQB1*05:01:01:01-05:01:13/05:01:15/05:01:17-05:01:18/05:01:20-05:03:01:09/05:03:03-05:03:09/05:03:11-05:03:24/05:03:26-05:10/05:11:02-05:20:02/05:22-05:25/05:27-05:33/05:35-05:43:01/05:45-05:59/05:61-05:71/05:74-05:81/05:83-05:97/05:99-05:104/05:106-05:112/05:114-05:115/05:117-05:127/05:129/05:131-05:170/05:172-05:174/05:176-05:206N/05:208N-05:217/05:219-05:227/05:229-05:239/05:241-05:257/05:259-05:299/05:301/05:303-05:318, DQB1*06:325  | DQ5(1), -, Null      | 1 |   |   |   |   |   |   |   |   |    |    |    |    |
| DQB1*05:01:16/05:01:19/05:03:25/05:26/05:34/05:44/05:113/05:128N/05:130/05:171/05:228/05:302   | -, Null              | w |   |   |   |   |   |   |   |   |    |    |    |    |
| DQB1*05:03:02  | DQ5(1)               | 1 |   |   |   |   | ? |   |   |   |    |    |    |    |
| DQB1*05:11:01/05:240   | -                    | 1 |   |   |   |   |   |   |   |   |    |    | 12 |    |
| DQB1*05:43:02, DQB1*06:23/06:156/06:162/06:169   | -                    | 1 |   | 3 |   |   |   |   |   |   |    |    |    |    |
| DQB1*06:01:01:01-06:01:29/06:01:31-06:01:34/06:03:04/06:03:08-06:03:09/06:03:14/06:03:16/06:03:26/06:03:30/06:08:02-06:08:03/06:11:04-06:12/06:14:03/06:17/06:21/06:42-06:43/06:45/06:54N-06:57:02/06:59/06:64/06:91/06:98-06:105/06:108/06:120/06:132/06:140/06:145:01/06:157/06:177/06:181/06:190:01-06:190:02/06:194/06:196/06:205/06:209/06:214/06:229/06:239/06:243/06:245/06:251/06:258-06:259/06:263/06:268/06:274-06:275/06:277/06:285/06:302/06:305/06:307/06:309-06:310/06:312/06:319:01/06:321/06:323/06:330N-06:331/06:359/06:371/06:382/06:418-06:419/06:421/06:427/06:435/06:462-06:463/06:466 | DQ6(1), -, DQ1, Null |   | 2 |   |   |   |   |   |   |   |    |    |    |    |
| DQB1*06:01:30/06:464   | -                    |   | ? |   |   |   |   |   |   |   |    |    |    |    |

| Allele  | Serology                | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|-------------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|
| DQB1*06:02:01:01-06:02:01:31/06:02:03-06:02:06/06:02:08-06:02:42/06:02:44-06:02:59/06:03:07/<br>06:03:19/06:10-06:11:01:02/06:13:01-06:13:03/06:14:02/06:15:01-06:16/06:19:01-06:20/06:24/06:33/<br>06:37/06:46-06:50/06:51:02/06:68/06:70-06:81/06:83-06:84:01:02/06:95/06:96:02-06:97/06:106-<br>06:107/06:109/06:111-06:117/06:118:03/06:119/06:122/06:124-06:127/06:130-06:131/06:136-06:138/<br>06:146:01-06:147/06:150-06:152/06:159/06:161/06:163/06:166/06:173-06:176/06:178-06:179N/<br>06:182-06:183/06:188/06:192/06:197-06:198/06:200-06:201/06:206:01-06:206:02/06:208:01/06:211/<br>06:213/06:215-06:216N/06:219/06:224-06:228/06:232/06:235-06:237/06:240/06:242/06:249/06:255-<br>06:256/06:262/06:264/06:270:01-06:271/06:273/06:284/06:286/06:289-06:290/06:293-06:298/06:300/<br>06:304N/06:306N/06:308N/06:311/06:314-06:315/06:317N/06:319:02/06:322:03/06:324/06:326/<br>06:333/06:335/06:338/06:341N/06:344/06:347/06:354-06:357/06:363-06:364/06:366/06:370/06:372/<br>06:374/06:376/06:379N-06:380/06:383N-06:384/06:386/06:388-06:390/06:393/06:395/06:397N/<br>06:401-06:402/06:404-06:406/06:408-06:409/06:411-06:413/06:416Q/06:422N/06:430-06:431/06:436-<br>06:438/06:442/06:445-06:448/06:451/06:456N-06:457/06:461 | DQ6(1), -, DQ1,<br>Null |   |   | 3 |   |   |   |   |   |   |    |    |    |    |
| DQB1*06:02:02/06:208:02   | DQ6(1), -               |   |   | 3 |   |   |   |   |   |   |    |    | 12 |    |
| DQB1*06:02:07/06:03:01:01-06:03:01:21/06:03:03/06:03:06/06:03:11-06:03:13/06:03:15/06:03:17-<br>06:03:18/06:03:20-06:03:25/06:03:27-06:03:29/06:03:31-06:03:32/06:03:35-06:03:46/06:08:01/<br>06:11:02-06:11:03/06:14:01/06:26N/06:28/06:30-06:31/06:40-06:41:01:03/06:44/06:60-06:63/06:67/<br>06:82/06:87/06:90/06:92:02/06:110/06:128/06:133-06:134/06:141/06:143-06:144N/06:148/06:154/<br>06:165/06:170/06:184-06:185/06:187/06:191/06:195/06:199/06:203/06:210/06:218/06:221-06:223/<br>06:230/06:233-06:234/06:238/06:244/06:248/06:250/06:253/06:269/06:272/06:278-06:279/06:316/<br>06:327-06:329/06:334/06:336/06:340/06:345N-06:346/06:350/06:352/06:360/06:362/06:365/06:367/<br>06:373/06:378/06:385/06:391-06:392/06:394N/06:396/06:400/06:403/06:410/06:423N-06:425/<br>06:428/06:433/06:440/06:443/06:450/06:453-06:455/06:459-06:460   | -, DQ6(1), DQ1,<br>Null |   | 2 | 3 |   |   |   |   |   |   |    |    |    |    |
| DQB1*06:02:43/06:96:01/06:322:01-06:322:02  | -                       |   |   | 3 |   |   |   |   |   |   | 10 |    |    |    |
| DQB1*06:03:02   | DQ6(1)                  |   | 2 | 3 |   |   |   |   |   |   |    |    | 12 |    |
| DQB1*06:03:05/06:65   | -                       |   | 2 | w |   |   |   |   |   |   |    |    |    |    |
| DQB1*06:03:10   | -                       |   | 2 |   |   |   |   |   |   |   | 10 |    |    |    |
| DQB1*06:03:33   | -                       |   | 2 | 3 |   |   |   |   |   |   | 10 |    |    |    |
| DQB1*06:03:34/06:145:02   | -                       |   | 2 |   |   |   |   |   |   |   |    |    | 12 |    |
| DQB1*06:04:01:01-06:04:07/06:04:09-06:06/06:07:02/06:09:01:01-06:09:03/06:09:05/06:09:08-<br>06:09:12/06:18:01-06:18:02/06:22:02/06:25/06:27:01-06:27:02/06:32:02/06:34/06:36/06:38-06:39/<br>06:52/06:58/06:69:01/06:85-06:86/06:88:01:01-06:89/06:93-06:94/06:118:02/06:129/06:135/06:155/<br>06:158N/06:160/06:164/06:171/06:180/06:186/06:189/06:193N/06:202/06:204/06:207/06:217/<br>06:241/06:252N/06:254/06:261/06:265-06:267/06:280-06:283/06:287-06:288/06:291-06:292/06:299/<br>06:303N/06:313/06:320/06:339/06:343/06:348-06:349/06:351/06:353/06:358/06:361/06:368-06:369/<br>06:375/06:381/06:387/06:398/06:407/06:414N/06:420/06:426/06:429/06:432/06:434/06:439Q/<br>06:444/06:449/06:452N/06:458N/06:465  | DQ6(1), -, Null         |   |   |   | 4 |   |   |   |   |   |    |    |    |    |

| Allele                           | Serology | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|----------------------------------|----------|---|---|---|---|---|---|---|---|---|----|----|----|----|
| DQB1*06:04:08/06:09:07           | -        |   |   |   | 4 |   |   |   |   |   |    |    | 12 |    |
| DQB1*06:07:01/06:32:01/06:118:01 | -        |   |   | 3 | 4 |   |   |   |   |   |    |    |    |    |
| DQB1*06:09:06/06:121/06:212      | -        |   |   |   | w |   |   |   |   |   |    |    |    |    |
| DQB1*06:29/06:123/06:337         | -        |   |   | 3 |   |   |   |   | 8 |   |    |    |    |    |
| DQB1*06:35/06:53:01-06:53:02     | -        |   | 2 |   |   |   | 6 |   |   |   |    |    |    |    |
| DQB1*06:66/06:118:04/06:172      | -        |   |   |   | 4 |   |   |   |   |   | 10 |    |    |    |
| DQB1*06:142                      | -        |   | 2 |   | 4 |   |   |   |   |   |    |    |    |    |
| DQB1*06:149/06:257               | -        |   | w |   |   |   |   |   |   |   |    |    |    |    |
| DQB1*06:168                      | -        |   | 2 |   | 4 |   |   |   |   |   | 10 |    |    |    |
| DQB1*06:246                      | -        |   | 2 |   |   |   |   | w | 8 |   |    |    |    |    |
| DQB1*06:276                      | -        |   | w | 3 |   |   |   |   |   |   |    |    |    |    |
| DQB1*06:399                      | -        |   | ? | 3 |   |   |   |   |   |   |    |    |    |    |

w = weak

? = nucleotide sequence information not available for the primer matching sequence or alleles with unknown reactivities

**ATTENTION!** Alleles which are not sequenced in the primer binding sites of mixes 9 and 11 (according to the IMGT/HLA Database of January 2023) have been excluded from the list of allele specificities of these mixes.

**Table 4:** Amplification patterns for **HLA-DQA1\*** alleles detected by the HLA-DQA1\* CTS-PCR-SSP primer mixes (**Lot-No DQA10-3**) based on IMGT/HLA Sequence Database Release 3.51.0, January 2023

| Allele  | Serology | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|----------|---|---|---|---|---|---|---|---|---|----|
| DQA1*01:01:01:01-01:01:01:03/01:01:01:05-01:01:11/01:27/01:43/01:49/01:66/01:88N-01:89/01:99/01:107   | -, Null  | 1 |   | 3 |   |   |   |   |   |   |    |
| DQA1*01:02:01:01-01:02:11/01:02:13-01:01:02:18/01:11/01:16N/01:19/01:21/01:23/01:25/01:38:01:01-01:39/01:41/01:48/01:51:01:01-01:51:01:02/01:54/01:58/01:63:01:01-01:63:01:02/01:104-01:106 | -, Null  |   | 2 | 3 |   |   |   |   |   |   |    |
| DQA1*01:02:12   | -        |   | 2 | 3 |   |   |   |   | 8 |   |    |
| DQA1*01:03:01:01-01:03:01:13/01:03:04/01:03:06-01:03:08/01:10/01:14/01:24/01:30/01:44-01:45/01:57/01:65/01:76/01:82/01:87:01:01-01:87:01:02/01:102  | -        |   | 2 |   | 4 |   |   |   |   |   |    |
| DQA1*01:03:02-01:03:03/01:03:05/01:15N/01:17/01:33/01:47/01:50/01:68/01:70/01:78-01:79/01:97/01:108   | -, Null  |   | 2 |   | 4 | ? |   |   |   |   |    |
| DQA1*01:04:01:01-01:04:02:02/01:04:05/01:04:08-01:05:04/01:07Q/01:64/01:80/01:86  | -        | 1 |   | 3 |   | 5 |   |   |   |   |    |
| DQA1*01:04:03-01:04:04/01:12/01:18/01:22/01:26/01:34-01:35/01:37/01:53/01:55-01:56/01:59/01:61/01:67/01:74/01:77/01:83/01:90/01:95-01:96/01:98/01:110                                       | -        | 1 |   | 3 |   | ? |   |   |   |   |    |
| DQA1*01:04:06-01:04:07  | -        | 1 |   | ? |   | 5 |   |   |   |   |    |
| DQA1*01:06/01:08-01:09/01:13/01:28/01:31-01:32/01:36/01:40Q/01:42/01:46/01:52/01:62/01:69/01:71-01:73/01:81/01:85/01:91/01:93-01:94/01:103/01:109/01:111                                    | -        |   | 2 | 3 |   | ? |   |   |   |   |    |
| DQA1*01:20  | -        |   |   |   |   | ? |   |   |   |   |    |
| DQA1*01:29  | -        | w |   |   |   | ? |   |   |   |   |    |
| DQA1*01:60  | -        | 1 |   | ? |   | ? |   |   |   |   |    |
| DQA1*01:75  | -        |   | 2 | ? |   | ? |   |   |   |   |    |
| DQA1*01:84  | -        |   | 2 |   | ? |   |   |   |   |   |    |
| DQA1*01:92  | -        |   | ? | ? |   | ? |   |   |   |   |    |
| DQA1*01:100   | -        |   | 2 | 3 |   | 5 |   |   |   |   |    |
| DQA1*01:101   | -        |   | 2 |   |   | ? |   |   |   |   |    |
| DQA1*02:01:01:01-02:01:01:05/02:01:03-02:05/02:07-02:17/02:25-02:31   | -, Null  |   |   |   |   |   | 6 |   |   |   |    |
| DQA1*02:01:02/02:18-02:24   | -        |   |   |   |   | ? | 6 |   |   |   |    |
| DQA1*03:01:01:01/03:01:01:03/03:01:04-03:18/03:20-03:21/03:28/03:31-03:44   | -, Null  |   |   |   |   |   |   | 7 |   |   |    |
| DQA1*03:01:03/03:19/03:22-03:27N/03:30  | -, Null  |   |   |   |   | ? |   | 7 |   |   |    |
| DQA1*03:29  | -        |   |   |   |   | ? |   | ? |   |   |    |

| Allele   | Serology | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|--|----------|---|---|---|---|---|---|---|---|---|----|
| DQA1*04:01:01:01-04:01:03/04:01:06-04:02/04:05-04:08/04:13-04:17   | -, Null  |   |   |   |   |   |   |   | 8 |   |    |
| DQA1*04:01:04-04:01:05/04:03N-04:04/04:09-04:12N   | -, Null  |   |   |   |   | ? |   |   | 8 |   |    |
| DQA1*05:01:01:01-05:01:02/05:01:04-05:01:11/05:03:01:01-05:03:02/<br>05:05:01:01-05:09:01:02/05:11:01:01-05:31/05:33/05:35:02-05:36N/05:38/05:47-<br>05:48/05:51/05:53-05:74 | -, Null  |   |   |   |   |   |   |   |   | 9 |    |
| DQA1*05:02/05:04/05:32/05:35:01/05:37/05:39-05:46/05:50/05:52  | -        |   |   |   |   | ? |   |   |   | 9 |    |
| DQA1*05:10   | -        |   |   |   |   | ? |   |   |   | w |    |
| DQA1*05:34   | -        |   |   |   |   | ? |   |   |   | ? |    |
| DQA1*05:49   | -        |   |   |   |   |   |   |   |   | ? |    |
| DQA1*06:01:01:01-06:01:01:04   | -        |   |   |   |   |   |   |   |   |   | 10 |
| DQA1*06:01:02-06:04  | -        |   |   |   |   | ? |   |   |   |   | 10 |

w = weak

? = nucleotide sequence information not available for the primer matching sequence



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**CTS** Collaborative Transplant Study

## Certificate of Analysis

### HLA-DQB1\* CTS-PCR-SSP Tray Kit

|  |         |
|--|---------|
| Product number                               | 119     |
| Lot number                                   | DQB13-4 |
| Number of HLA-specific primer mixes per test | 13      |

#### Mix specifications

The specificity of each primer pair has been tested against a panel of well characterized DNAs.

#### Result

No false positive or false negative amplifications were obtained under our test conditions of the bulk reagents.

|                  |  |
|------------------|--|
| Date of approval | 12.04.2023                                   |
| Approved by      | H. Tran, M.D.<br>Quality Control, Supervisor |



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**CTS** Collaborative Transplant Study

## Certificate of Analysis

### HLA-DQA1\* CTS-PCR-SSP Tray Kit

|  |         |
|--|---------|
| Product number                               | 127     |
| Lot number                                   | DQA10-3 |
| Number of HLA-specific primer mixes per test | 10      |

#### Mix specifications

The specificity of each primer pair has been tested against a panel of well characterized DNAs.

#### Result

No false positive or false negative amplifications were obtained under our test conditions of the bulk reagents.

|                  |  |
|------------------|--|
| Date of approval | 09.03.2023                                   |
| Approved by      | H. Tran, M.D.<br>Quality Control, Supervisor |