

## Contents

<b>1</b>	<b>Safety briefing/employee qualification</b> .....	<b>1</b>
1.1	Qualification .....	1
<b>2</b>	<b>Safety information</b> .....	<b>2</b>
2.1	Safety information .....	2
2.2	Safety precautions when working on the cooling system .....	4
2.3	Safety precautions when using testers and measuring instruments during a road test .....	5
2.4	High-voltage components / electric vehicles .....	5
<b>3</b>	<b>Repair instructions</b> .....	<b>6</b>
3.1	Information on handling fine dust, aluminium dust and steel dust .....	6
3.2	Bonding surfaces for self-adhesive components .....	7
3.3	Secure threaded connections .....	7
3.4	Identification plates .....	7
3.5	Impact wrenches .....	7
3.6	Multi-material mix .....	8
3.7	Extraction systems for steel/aluminium body repair station ("multi-material-mix" workplace) .....	8
3.8	Battery, power supply .....	9
3.9	Air conditioning system / refrigerant .....	9
3.10	Electronic control units .....	10
<b>4</b>	<b>General notes on body repairs</b> .....	<b>11</b>
4.1	Original joint .....	11
4.2	Galvanised body parts .....	11
4.3	Removing remaining material .....	11
4.4	New parts .....	11
4.5	Moulded foam inserts .....	11
<b>5</b>	<b>Explanation of symbols</b> .....	<b>13</b>
5.1	Symbols relating to procedures for separating components .....	13
5.2	Symbols relating to welding, brazing and soldering .....	13
5.3	Symbols relating to rivets .....	14
5.4	Symbols relating to preparation .....	15
5.5	Symbols relating to corrosion protection .....	16
<b>6</b>	<b>Vehicle body construction features</b> .....	<b>18</b>
6.1	Body structures .....	18
<b>7</b>	<b>Assessing damage</b> .....	<b>19</b>
7.1	General notes .....	19
7.2	Checking weld seams and aluminium node castings .....	19
7.3	Load paths .....	19
7.4	Measuring procedures / damage diagnosis .....	22
7.5	Overview of materials used .....	23
7.6	Passive safety .....	28
<b>8</b>	<b>Thermal joining techniques</b> .....	<b>32</b>
8.1	Resistance spot welding (RP) .....	32
8.2	Shielded arc plug welding (SG plug welding) .....	33
8.3	SG continuous seams and stitch weld seams .....	34
8.4	MIG soldering/brazing .....	35
8.5	Aluminium welding .....	35
8.6	Laser welding .....	36
8.7	Laser soldering/brazing .....	37
8.8	Replacement joining techniques in repair work (steel) .....	37
8.9	Replacement joining techniques in repair work (aluminium) .....	37
<b>9</b>	<b>Processing body structure adhesive D 180 004 M2</b> .....	<b>39</b>
9.1	Preparing bonding surfaces .....	40



<b>10</b>	<b>Cold joining techniques</b> .....	<b>53</b>
10.1	Rivets .....	53
10.2	Flow-drill screws (FDS) .....	59
10.3	Clinching .....	61
<b>11</b>	<b>Separating techniques in body welding; areas of application</b> .....	<b>63</b>
11.1	Drilling .....	63
11.2	Saw-cutting .....	63
11.3	Grinding .....	63
11.4	Milling .....	63
<b>12</b>	<b>Surface repairs</b> .....	<b>65</b>
12.1	Dent removal techniques for sheet steel .....	65
12.2	Dent removal procedures for aluminium panels .....	66
12.3	Processing metal and aluminium filler .....	67
12.4	Processing unleaded tin .....	68
12.5	Definition of “accurately aligned surface” / handover to paint shop .....	68
<b>13</b>	<b>Performing straightening work on body structure</b> .....	<b>69</b>
13.1	Straightening .....	69
13.2	Separating cuts .....	69
13.3	Body sub-parts and part sections .....	69
<b>14</b>	<b>Corrosion protection</b> .....	<b>70</b>
14.1	Corrosion protection for attachments and welded parts .....	70
14.2	Cavity sealing agent .....	70
<b>15</b>	<b>Plastic repairs</b> .....	<b>72</b>
15.1	Repairing dents .....	72
15.2	Repairing scratches .....	73
15.3	Repairing cracks and tears (up to a length of 100 mm) .....	74
15.4	Repairing holes (up to 30 mm diameter) .....	75
15.5	Plastic repairs (glass fibre materials) .....	77
<b>16</b>	<b>Glass repairs</b> .....	<b>81</b>
16.1	Repairing windscreens .....	81
16.2	Special tools, workshop equipment, testers, measuring instruments and other items required .....	85
16.3	Description of repair work .....	87
<b>17</b>	<b>Thread repairs</b> .....	<b>92</b>
17.1	Thread repairs for safety-related components .....	92
17.2	Repairing threads for attachment of subframe .....	92
17.3	Helicoil plus Twinert .....	99