Contents

87 - Air conditioning system 1

1 Safety information 1
1.1 Safety precautions when working on air conditioners 1
1.2 Safety precautions when handling refrigerants 1
1.3 Safety precautions when working on vehicles with start/stop system 2
1.4 Safety precautions when working on vehicles with high-voltage system 2
1.5 Safety precautions when working in the vicinity of high-voltage components 3
1.6 Safety precautions when using testers and measuring instruments during a road test 3

2 General information on air conditioning systems 5
2.1 Introduction 5
2.2 Other reference material 5
2.3 Principles of air conditioning systems 6
2.4 Refrigerant R134a 9
2.5 Properties of refrigerant R134a 10
2.6 Refrigerant oil 12
2.7 How air conditioning works 13
2.8 General work safety 15
2.9 Product properties 15
2.10 Handling refrigerant 15
2.11 Handling pressure vessels 17
2.12 Basic rules for working on refrigerant circuit 17
2.13 (before using air conditioner after it has been re-charged). 20

3 General information on refrigerant circuit 21
3.1 Components of refrigerant circuit 21
3.2 Layout of components of refrigerant circuit and their influence on high-pressure and low-pressure sides 21
3.3 Design of refrigerant circuit 44
3.4 Refrigerant circuit with electrically driven air conditioner compressor 46
3.5 Connections for quick-release coupling in refrigerant circuit 48
3.6 Switches and senders in refrigerant circuit and related connections 54
3.7 Electrical components not installed in refrigerant circuit 63
3.8 Pressures and temperatures in refrigerant circuit 64
3.9 Tests and measurements performed with pressure gauge 69
3.10 Air conditioner service and recycling units 70
3.11 Repair instructions for refrigerant circuit 71

4 Laws and regulations 73
4.1 Laws and regulations 73

5 Refrigerant circuit 78
5.1 Important repair instructions for air conditioning systems 78
5.2 Converting refrigerant circuits from refrigerant R12 to refrigerant R134a 78
5.3 Working with the air conditioner service station 79
5.4 Blowing out refrigerant circuit with compressed air and nitrogen 95
5.5 Cleaning (flushing) refrigerant circuit with refrigerant R134a 99
5.6 Tracing leaks in refrigerant circuit 174

6 Problems with refrigerant circuit 189
6.1 Possible complaints about refrigerant circuit 189

7 Connecting air conditioner service station 191
7.1 Connecting air conditioner service station - vehicles with a connection on the low-pressure and high-pressure side of the refrigerant circuit 191
7.2 Connecting air conditioner service station - vehicles with no connection on the low-pressure side of the refrigerant circuit 192

8 Checking pressures 196

8.1 Checking pressures in refrigerant circuit with air conditioner service station (with ignition switched off) . . . 196
8.2 Checking pressures - vehicles with restrictor and reservoir (with internally regulated air conditioner compressor) . . . 203
8.3 Checking pressures - vehicles with expansion valve and receiver (with internally regulated air conditioner compressor) . . . 208
8.4 Checking pressures - vehicles with restrictor, reservoir and air conditioner compressor regulating valve N280 (with externally regulated air conditioner compressor) . . . 213
8.5 Checking pressures - vehicles with expansion valve, receiver and air conditioner compressor regulating valve N280 (with externally regulated air conditioner compressor) . . . 220
8.6 Checking pressures - vehicles with electrically driven air conditioner compressor (vehicles with high-voltage system) . . . 232
9 Renewing components of refrigerant circuit . . . 274
9.1 Renewing components . . . 274
10 Capacities for refrigerant R134a/refrigerant oil and approved refrigerant oils . . . 293
10.1 Capacities for refrigerant R134a . . . 293
10.2 Approved refrigerant oils and refrigerant oil capacities . . . 334
11 Test equipment and tools . . . 380
11.1 List of testers, tools and materials . . . 380
11.2 Tools and materials available from regional sales centre or importer . . . 382
11.3 Commercially available tools and materials . . . 386
11.4 Improvised tools . . . 389