

PAS 301:2017

Civilian armoured vehicles – Automotive test methods



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Foreword

This PAS was sponsored by the Centre for the Protection of National Infrastructure (CPNI). Its development was facilitated by BSI Standards Limited and it was published under licence from The British Standards Institution. It came into effect on 30 April 2017.

Acknowledgement is given to the technical author from the Metropolitan Police Service, Special Projects and to the following organizations that were involved in the development of this PAS as members of the steering group:

- Centre for the Protection of National Infrastructure (CPNI)
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This PAS is not to be regarded as a British Standard. It will be withdrawn upon publication of its content in, or as, a British Standard.

The PAS process enables a test method to be rapidly developed in order to fulfil an immediate need in industry. A PAS can be considered for further development as a British Standard, or constitute part of the UK input into the development of a European or International Standard.

Relationship with other publications

The test methods described in this PAS were developed from the *VSAG 12 Part 3 (Draft): Civilian armoured vehicles – Automotive testing handbook* [1] with kind permission from the Vehicle Security Advisory Group (VSAG).

Product testing. Users of this PAS are advised to consider the desirability of third-party testing of product conformity with this PAS. Users seeking assistance in identifying appropriate conformity assessment bodies or schemes may ask BSI to forward their enquiries to the relevant association.

Use of this document

The PAS refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

It has been assumed in the preparation of this PAS that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions of this PAS are presented in roman (i.e. upright) type. Its methods are expressed as a set of instructions, a description, or in sentences in which the principal auxiliary verb is “shall”.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Where words have alternative spellings, the preferred spelling of the Shorter Oxford English Dictionary is used (e.g. “organization” rather than “organisation”).

Requirements in this PAS are drafted in accordance with *Rules for the structure and drafting of UK standards*, subclause J.1.1, which states, “Requirements should be expressed using wording such as: ‘When tested as described in Annex A, the product shall ...’”. This means that only those products that are capable of passing the specified test will be deemed to conform to this PAS.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a PAS cannot confer immunity from legal obligations.

Introduction

PAS 301 describes test methods that may be completed on a civilian armoured vehicle (CAV) to assess its automotive characteristics for payload, acceleration, maximum speed, through gear acceleration, handling, braking and run flat. The test methods are set out in a manner to allow each test to be completed independently. If more than one test is required on a CAV then the test order followed is usually payload, acceleration, maximum speed, through gear acceleration, handling, braking and run flat. One or multiple test vehicles may be used to complete testing in accordance with the test methods. Where it is agreed a change in test vehicle specification does not affect the properties being tested then read across of the test results is permitted.

For each test, careful consideration is given to any damage sustained on the test vehicle. If there is a risk of compromising or invalidating any further testing then actions are taken to minimize this risk. For example, new wheels and tyres may be used for the run flat test.

During any phase of testing it might become evident that the CAV design does not achieve acceptable results in accordance with the defined criteria set out in this PAS. In this situation the party requesting testing may be given the option to submit a redesign for retest. If this option is not taken, the test vehicle receives the assessed categorization. The party requesting testing may withdraw at any time from further testing.

The tests may be completed with the minimum requirements set out in this document. However, the party conducting the tests seeks to establish the maximum performance of the CAV.

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1 Scope

PAS 301 describes automotive test methods and performance categories for the payload, acceleration, maximum speed, through gear acceleration, handling, braking and run flat capabilities of a civilian armoured vehicle (CAV).

This PAS does not replace any statutory requirements for the inspection and testing of a vehicle.

NOTE For example the European Community Whole Vehicle Type Approval (EC-WVTA) [2] and Individual Vehicle Approval (IVA) [3].

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS ISO 3888-1:1999, *Passenger cars – Test track for a severe lane-change manoeuvre – Part 1: Double-lane change*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this PAS, the following terms and definitions apply.

3.1.1 circle of error probability (CEP)

used in a global positioning system (GPS) to define a circle of stated radius where 95% position probability exists

3.1.2 company

manufacturer or converter of the civilian armoured vehicle who has requested testing

3.1.3 gross vehicle mass (GVM)

maximum operating mass of a civilian armoured vehicle as specified by the company, including, the chassis, body, armour, engine, engine fluids, fuel, accessories, operational equipment, driver, occupants and luggage

3.1.4 maximum axle mass

maximum allowable mass specified for each axle

3.1.5 maximum speed

either tyre maximum speed rating of all fitted tyres, maximum attainable speed

3.1.6 operational kerb mass

mass of the complete civilian armoured vehicle, with all operational equipment installed, full tank of fuel, all service fluids and no driver, occupants or luggage

NOTE *Operational equipment might include permanently installed equipment, such as radio equipment and run flat systems.*

3.1.7 operational mass

mass measured at each wheel station when the civilian armoured vehicle is loaded with operational payload

3.1.8 operational payload

gross vehicle mass minus the operational kerb mass

NOTE *For example, operational payload available for driver, occupants, luggage, weapons, and extra fuel cans.*

3.1.9 test site

location where a test is conducted

3.1.10 test vehicle

civilian armoured vehicle that is identical to the final design specification

NOTE *A record may be made of items included in the test vehicle.*

3.1.11 through gear acceleration

civilian armoured vehicle's ability to accelerate through different moving speed ranges with or without gear changes

3.1.12 track surface condition

3.1.12.1 dry

surface is not affected by water, slush, snow or ice

3.1.12.2 damp

surface shows a change in colour due to moisture

3.1.12.3 wet

surface is soaked but no significant patches of standing water are visible

3.1.12.4 flooded

standing water patches covering >25% of surface are visible

3.2 Abbreviations

For the purposes of this PAS, the following abbreviations apply.

AST	acceleration, maximum speed and through gear acceleration test level
BK	brake test level
CAV	civilian armoured vehicle
CEP	circle of error probability
DAS	data acquisition system
ESC	electronic stability control
GVM	gross vehicle mass
H	handling test level
P	payload test level
RF	run flat test level
TC	traction control

4 Apparatus

NOTE The following apparatus is used in the test methods described in Clauses 5 to 9.

4.1 Brake pedal force transducer, capable of recording brake pedal force in accordance with Table 1.

4.2 Camera mounts, easily attached to the test vehicle and capable of securely holding the video cameras (4.11).

NOTE For example, clamp type mounts with articulated arms. Applying strong suction mounts to the inner surface of armoured glass should be avoided as it could delaminate the inner laminate surface.

4.3 Dummy pads, with a vertical height equal to that of the mass measuring scales (4.5) used and of an equivalent stiffness.

NOTE They may also be referred to as levelling mats.

4.4 Handheld infrared temperature sensor or similar, capable of measuring the test track surface temperature in accordance with Table 1.

4.5 Mass measuring scales, calibrated and capable of measuring the test vehicle mass at each wheel station in accordance with Table 1.

NOTE At least four mass measuring scales should be used for each test.

4.6 Test ballast, used to simulate payload in the test vehicle.

NOTE For example, occupants, luggage, and equipment may be represented by sand bags or water dummies.

4.7 Time based multi-channel recording system [Data Acquisition System (DAS)], capable of measuring the time history data of the test vehicle's longitudinal velocity (v_x) and GPS position and height in accordance with Table 1, with the facility to allow the test site to trigger flags on the time base. It is also capable of displaying acceleration [in terms of longitudinal acceleration (m/s^2)] determined from the test vehicle longitudinal velocity.

NOTE 1 The system records all necessary test data so that it can be analysed post-test and provide a formal log of results.

NOTE 2 Trigger flags are used to clearly mark critical events on the time base, for example the start of acceleration phase, or passing the 400 m marker.

NOTE 3 Video and audio data may also be recorded by the system (see Table 1).

4.8 Timer, capable of measuring time in accordance with Table 1.

4.9 Track markers, the specification determined by the test site to clearly mark the track for the test engineers.

NOTE For example, ground paint or cones may be used as track markers.

4.10 Tyre pressure gauge, capable of measuring tyre pressure in accordance with Table 1.

4.11 Video cameras, ruggedized (water resistant), fixed to camera mounts (4.2) capable of capturing video in accordance with Table 1.

NOTE For internal or external mounting and powered by the test vehicle, recording system or batteries.

4.12 Weather station or similar, capable of measuring ambient temperature, relative humidity and wind speed in accordance with Table 1.

Table 1 – Test variables to be determined

Variable	Operating range	Recommended maximum overall error
Brake pedal force	(0 – 750) N	± 0.1 N
Test track surface temperature (T_{Track})	(0 – 100)°C	$\pm 1^\circ\text{C}$
Mass measuring scales	(0 – 6 000) kg	± 5.0 kg
Test vehicle longitudinal velocity (v_x)	(0 – 300) km/h	± 1 km/h for $v_x < 100$ km/h ± 2 km/h for $v_x \geq 100$ km/h
Longitudinal acceleration	(-20 – +20) m/s ²	± 0.1 m/s ²
Timer	—	± 1 s
Tyre pressure gauge	(0 – 5) bar	± 0.1 bar
Ambient temperature (T_{Amb})	(0 – 60)°C	$\pm 1^\circ\text{C}$
Wind speed (W_{Amb})	(0 – 30) m/s	± 1 m/s
Optional		
GPS position (latitude, longitude)	± 5.0 m	95% CEP
GPS height	± 10 m	95% CEP
Video	at least 25 fps PAL or NTSC 580 lines colour	—
Audio	single internal microphone	—
Relative humidity (RH_{Amb})	(0 – 100)%	$\pm 1\%$
NOTE The recommended maximum overall error accuracies should be achieved whether the variables are measured or are calculated.		

5 Payload test method

5.1 Principle

A test vehicle (3.1.10) is weighed to ensure the manufacturer's stated maximum axle mass, GVM and tyre and wheel load ratings are not exceeded. The payload test is carried out with all seating positions filled. The payload test assessment is completed prior to any other automotive tests to ensure the test vehicle complies with the stated limits and assessed against the score criteria.

NOTE The test method describes the procedure for test vehicles with two axles. For test vehicles with more than two axles a similar procedure should be followed.

5.2 Payload (P) test levels

The payload test level shall be defined in terms of:

- number of occupants;
- occupant mass in kg [for example selected as (75 ±0.5) kg or (100 ±0.5) kg]; and
- total additional payload mass in kg.

NOTE 1 For example, 4 occupants each weighing 100 kg and 20 kg of total additional payload is test level P-4/100/20; or 6 occupants each weighing 75 kg and 100 kg of total additional payload is test level P-6/75/100.

NOTE 2 It should be assumed that occupants occupy the seated positions provided and the total additional payload is stored in the space normally allocated for luggage.

5.3 Test setup

NOTE See also Consolidated code of practice: enforcement weighing of vehicles [4] for further information.

5.3.1 The payload test shall be conducted on clean, flat and horizontal hard standing.

NOTE The ground should be free from stones and provide a stable base for the mass measuring scales (4.5).

5.3.2 The longitudinal slope along the centreline of the test vehicle shall be <1%, measured between any two points 5 m apart.

5.3.3 The lateral slope, measured perpendicular to the centreline shall be <4%.

5.3.4 The surface irregularity of the payload test area, when measured along the centreline and at right angles to the centreline at 2 m intervals, shall be ≤10 mm at any point along the 2 m length.

NOTE This is assessed by placing a 2 m straight edge along the surface and measuring the height above the surface of the edge at its highest point.

5.4 Test procedure

5.4.1 Prepare a test log to record data in accordance with Annex A.

5.4.2 Record the required loading configuration in the test log (see Annex A).

5.4.3 Record the tyre load rating from the tyre wall in the test log (see Annex A).

5.4.4 Record the wheel load rating from the wheel test certificate in the test log (see Annex A).

5.4.5 Using the tyre pressure gauge (4.10) check and record the tyre pressures cold and adjust to the manufacturer's specified pressure in the test log (see Annex A).

5.4.6 Switch on all the mass measuring scales (4.5) and check they are operating correctly.

5.4.7 Position the mass measuring scales and test vehicle such that every wheel being weighed is positioned, so as to ensure that the weight bearing area of the tyre is correctly located, on the active weighing surface of the scale.

5.4.8 Drive the test vehicle onto the mass measuring scales.

5.4.9 For manual vehicles apply the park brake, switch off the engine, engage a low gear and then release all brakes.

NOTE For automatic or semi-automatic a similar process should be followed.

5.4.10 Check the positioning to ensure all wheels remain within the active area of the mass measuring scales.

5.4.11 Using the mass measuring scales record the operational kerb mass at each wheel position: A (front near side), B (front off side), C (rear near side), D (rear off side) in the test log (see Annex A).

NOTE A test ballast (4.6) may be used to obtain the correct operational kerb mass.

5.4.12 In cases where a test vehicle is equipped with more than 2 axles, it might not be possible to weigh all axles of the test vehicle simultaneously. In such cases, the axles are weighed sequentially, starting with axle 1 and 2. In each weighing position, place the dummy pads (4.3) under each of the non-weighed wheels so that the test vehicle remains parallel to the ground.

5.4.13 Using the test ballast, load the test vehicle with the specified masses at the passenger and luggage, or equipment positions, to represent the required payload condition (P) defined by the test level (see 5.2).

5.4.14 Using the mass measuring scales record the operational mass at each wheel position in the test log (see Annex A): E (front near side), F (front off side), G (rear near side), and H (rear off side).

5.4.15 Record the manufacturer's maximum front and rear axle mass as P1 and P2 in the test log (see Annex A).

NOTE The maximum front and rear axle mass are stated in the operator's manual or displayed on the vehicle axle load plate attached to the test vehicle.

5.4.16 Record the manufacturer's maximum gross vehicle mass as GVM in the test log (see Annex A).

NOTE The maximum GVM is stated in the operator's manual or displayed on the vehicle axle load plate attached to the test vehicle.

5.4.17 Assess the results in accordance with 5.5.

5.5 Expression of results

5.5.1 When all the data is recorded in accordance with 5.4, complete the following calculations and enter results in the test log (see Annex A).

- Calculate the combined operational kerb mass for front (K1) and rear axles (K2) in kg:

$$K1 = A + B \text{ and } K2 = C + D$$

- Calculate the combined operational mass for front and rear axles in kg:

$$O1 = E + F \text{ and } O2 = G + H$$

- Calculate the total operational kerb mass (K) in kg:

$$K = K1 + K2$$

- Calculate the total operational mass (OM) in kg:

$$OM = O1 + O2$$

- Calculate the operational payload available (PA) in kg:

$$PA = GVM - K$$

5.5.2 When all calculations have been completed, score the test vehicle in accordance with the criteria given in Table 2 and record the results in the test log (see Annex A).

Table 2 – Payload (P) score criteria

Parameter	Score criteria	
	Pass	Fail
Tyre load rating	operational mass at each wheel position $\leq$ recorded rating	operational mass at each wheel position $>$ recorded rating
Wheel load rating	operational mass at each wheel position $\leq$ recorded rating	operational mass at each wheel position $>$ recorded rating
GVM (kg)	$GVM \geq OM$	$GVM < OM$
Axle 1 mass (front) (kg)	$P1 \geq O1$	$P1 < O1$
Axle 2 mass (rear) (kg)	$P2 \geq O2$	$P2 < O2$
Payload (kg)	$PA \geq P$	$PA < P$
NOTE The results only apply to the design submitted as the test vehicle. If at any stage changes are made to the design, then the results become void until the design changes are submitted for testing.		

5.6 Report

As a minimum requirement the party completing the testing shall submit a test log and score results in accordance with Annex A.

A certificate shall be issued stating as a minimum:

- certificate number;
- test vehicle number/identifier (e.g. build configuration);
- test dates and report issue date;
- test party details (organization);
- test apparatus details and calibration declaration;
- test level and score;
- test report number; and
- statement that the test only applies to the test vehicle configuration tested.

NOTE In addition, supporting evidence may be included, for example photographs or printouts from the recording systems.

6 Acceleration, maximum speed, through gear acceleration test methods

6.1 Principle

The test vehicle acceleration is timed from a standing start to assess acceleration.

The test vehicle maximum speed is based on the ability of the test vehicle to achieve a minimum lower speed limit and not exceed the upper speed limit.

The test vehicle acceleration is timed between set speeds to assess through gear acceleration, with the time recorded of the acceleration measurement defined from the positive change in accelerator pedal position to the instant the specified test level speed is achieved.

The performance of the test vehicle is then categorized into one of six performance bands in accordance with Table 3.

NOTE Where constant speeds are required to start a test then the speed is held for at least 5 s before starting the test.

6.2 Acceleration, maximum speed, through gear acceleration (AST) test levels

The AST test levels shall be selected in accordance with Table 3.

NOTE 1 For example, an AST test specified with acceleration (0 – 95) km/h time (≥ 14 and < 20) s, acceleration 400 m time (≥ 23 and ≤ 30) s, maximum speed (≥ 180 and < 200) km/h, and through gear acceleration (50 – 110) km/h time (≥ 14 and < 20) s, (80 – 110) km/h time (≥ 8 and < 10) s, (110 – 160) km/h time (≥ 16 and < 19) s is test level AST-1C/2B/3D/4B/5D/6C.

NOTE 2 The acceleration is based on two assessments, the test vehicle's ability to accelerate from (0-95) km/h and cover a distance of 400 m from standing start.

NOTE 3 The through gear acceleration is based on the test vehicle's ability to accelerate between different speeds, for example, (50 – 110) km/h, (80 – 110) km/h and (110 – 160) km/h.

Table 3 – AST test levels

Index	Test level	A	B	C	D	E	F
1	Acceleration standing start (0 – 95) km/h Time (s)	≥ 30	≥ 20 and < 30	≥ 14 and < 20	≥ 12 and < 14	≥ 9 and < 12	< 9
2	Acceleration standing start 400 m Time (s)	≥ 30	≥ 23 and < 30	≥ 21 and < 23	≥ 19 and < 21	≥ 17 and < 19	< 17
3	Maximum speed (lower and upper value) (km/h)	≥ 50 and < 100	≥ 100 and < 150	≥ 150 and < 180	≥ 180 and < 200	≥ 200 and < 220	≥ 220 and < 300
4	Through gear acceleration (50 – 110) km/h Time (s)	≥ 20	≥ 14 and < 20	≥ 12 and < 14	≥ 10 and < 12	≥ 8 and < 10	< 8
5	Through gear acceleration (80 – 110) km/h Time (s)	≥ 20	≥ 12 and < 20	≥ 10 and < 12	≥ 8 and < 10	≥ 6 and < 8	< 6
6	Through gear acceleration (110 – 160) km/h Time (s)	≥ 30	≥ 19 and < 30	≥ 16 and < 19	≥ 13 and < 16	≥ 10 and < 13	< 10

6.3 Test setup

6.3.1 The acceleration, maximum speed, and through gear acceleration tests shall be conducted at an ambient temperature of $(20 \pm 15)^{\circ}\text{C}$. The wind conditions shall be $\leq 18 \text{ km/h}$ ($\leq 5 \text{ m/s}$), Beaufort scale 3, gentle breeze.

***NOTE** There are no humidity constraints but this information should be recorded in the test log (see Annex B).*

6.3.2 The test track surface shall be smooth, clean and constructed from solid paved concrete or asphalt. The test track surface condition (3.1.12) shall be dry or damp. The test shall be postponed when the track is assessed as wet or flooded.

***NOTE** Track irregularities and undulations, such as dips and large cracks, are unsuitable.*

6.3.3 The test track surface temperature shall be $(20 \pm 15)^{\circ}\text{C}$.

6.3.4 The track gradient in the direction of travel shall be $\leq 2\%$.

***NOTE** The test track may be level or banked laterally.*

6.3.5 Track markers (4.9) shall be set out to identify the start and end of the 400 m track.

6.4 Test vehicle preparation

6.4.1 The test vehicle operational kerb mass (3.1.6) shall be correctly configured.

6.4.2 The test vehicle shall be ballasted to GVM.

***NOTE** The test vehicle loading should take into account the mass of the test engineers and test equipment installed on the test vehicle.*

6.4.3 The test apparatus in accordance with Clause 4 shall be installed on the test vehicle to facilitate data collection in accordance with 6.5.

***NOTE** The installation method may be determined by the test site provided the data collection can be completed successfully.*

6.4.4 Using the tyre pressure gauge (4.10), the tyre pressures shall be checked cold and adjusted to the manufacturer's specified pressure.

6.4.5 Record the tyre maximum speed rating in the test log (see Annex B).

6.4.6 Record the maximum electronic speed limit, if pre-configured in test vehicle setup, in the test log (see Annex B).

6.4.7 The test vehicle configurable settings shall be set to achieve the optimum performance and recorded in the test log (see Annex B).

6.5 Test procedure

***NOTE 1** Testing should conform with the test site local safety procedures at all times.*

***NOTE 2** The test procedure described in 6.5 requires test vehicles to complete manoeuvres and to be driven at speeds that could be hazardous.*

***NOTE 3** For some tests, observers track side or in a chase vehicle may be used to provide additional feedback information to the test engineer(s) conducting the tests.*

***NOTE 4** During the test a second test engineer may also occupy the test vehicle to facilitate the recording of observations.*

6.5.1 General

6.5.1.1 Prepare a test log to record data in accordance with Annex B.

6.5.1.2 Record the test levels in the test log (see Annex B).

6.5.1.3 Using the weather station (4.12) measure and record the ambient temperature, wind speed, and the prevailing wind direction in accordance with 6.3.1 in the test log (see Annex B).

***NOTE** There are no humidity constraints but this information should be recorded in the test log.*

6.5.1.4 Using the infrared temperature sensor (4.4) measure and record the test track surface temperature and track surface condition (3.1.12) in accordance with 6.3.2 and 6.3.3 in the test log (see Annex B).

6.5.1.5 Drive the test vehicle until at normal engine operating temperature and record the status of any ancillary equipment that might impose any additional loading on the engine, for example air conditioning, headlights, etc., in the test log (see Annex B).

***NOTE** Ancillary equipment can change the performance of the test vehicle.*

6.5.1.6 For automatic transmission vehicles, the test vehicle is held in drive for all tests in 6.5.

6.5.1.7 For manual transmission vehicles, the gear is that deemed as most suitable for steady state driving for that vehicle type and class. Record the gear at steady state in the test log (see Annex B).

6.5.1.8 Record if the test vehicle is 2wd, 4wd or the drive has been automatically selected by the test vehicle in the test log (see Annex B).

6.5.1.9 During the warm up (see 6.5.1.5), check the test apparatus is operating correctly.

6.5.1.10 Bring the test vehicle up to a speed of (50 ± 1) km/h, as indicated by the test vehicle speedometer, check the test vehicle speed against the recording system (4.7) speed readout and record the speed offset in the test log (see Annex B).

***NOTE** The test vehicle speedometer is not used for data collection but the offset compared to the recording system speed may be recorded as optional information.*

6.5.1.11 Bring the test vehicle up to a speed of (80 ± 1) km/h, as indicated by the test vehicle speedometer, check the test vehicle speed against the recording system speed readout and record the speed offset in the test log (see Annex B).

6.5.1.12 Bring the test vehicle up to a speed of (110 ± 1) km/h, as indicated by the test vehicle speedometer, check the test vehicle speed against the recording system speed readout and record the speed offset in the test log (see Annex B).

6.5.2 Acceleration and maximum speed test procedure

6.5.2.1 Position the front of the test vehicle at the start track marker (4.9).

***NOTE** The test engineer should decide how to identify the datum for the front of the test vehicle, provided it is easily achieved and repeatable.*

6.5.2.2 Start the recording system (4.7) and check it is recording.

6.5.2.3 Trigger a time base flag and simultaneously accelerate the test vehicle from a standing start.

6.5.2.4 As the test vehicle reaches 95 km/h trigger a time base flag.

6.5.2.5 As the front of the test vehicle passes the 400 m distance track marker trigger a time base flag.

6.5.2.6 As the test vehicle achieves the maximum speed trigger a time base flag.

6.5.2.7 Bring the test vehicle to a halt.

6.5.2.8 Stop the recording system and save the test data.

6.5.2.9 Repeat steps 6.5.2.1 to 6.5.2.8 for subsequent tests, with at least three tests being completed.

6.5.2.10 Average and assess the results in accordance with 6.6.

6.5.3 Through gear acceleration test procedure

6.5.3.1 Start the recording system (4.7) and check it is recording.

6.5.3.2 Position the front of the test vehicle at the start track marker (4.9).

6.5.3.3 Bring the test vehicle up to a constant (50 ± 1) km/h and hold for at least 5 s.

6.5.3.4 Trigger a time base flag and simultaneously accelerate the test vehicle to (110 ± 1) km/h.

***NOTE** For manual transmission test vehicles no gear changes are allowed during the acceleration phase.*

6.5.3.5 As the test vehicle reaches (110 ± 1) km/h trigger a time base flag.

6.5.3.6 Bring the test vehicle to a halt.

6.5.3.7 Stop the recording system and save the data.

6.5.3.8 Repeat steps 6.5.3.1 to 6.5.3.7 for subsequent tests, with at least three tests being completed.

6.5.3.9 Assess the results in accordance with 6.6.

6.5.3.10 Position the front of the test vehicle at the start track marker (4.9).

6.5.3.11 Start the recording system (4.7) and check it is recording.

6.5.3.12 Bring the test vehicle up to a constant (80 ± 1) km/h and hold for at least 5 s.

6.5.3.13 Trigger a time base flag and simultaneously accelerate the test vehicle to (110 ± 1) km/h.

***NOTE** For manual transmission test vehicles no gear changes are allowed during the acceleration phase.*