

Repair Manual

911 Carrera **(993)**

**Volume I:
General
Engine**

Preface

Structure

The "Technical Literature" for the "911 Carrera (993)" model is basically structured as before, i.e. the structure follows the familiar repair groups.

A new feature is that the structure includes the main groups **0 to 9** and the main group **D**.

Main groups:	0	Complete vehicle – General
	1	Engine
	2	Fuel, exhaust, engine electrical system
	3	Transmission
	4	Chassis
	5	Body
	6	Body equipment, outside
	7	Body equipment, interior
	8	Air conditioning
	9	Electrical system
	D	Diagnosis

Layout

The layout in the below items remains unchanged throughout the repair manual

1. Table of tightening torques
2. Special tools required
3. Exploded views
4. Legends for the exploded views
5. Assembly notes / use of special tools

As a new feature, however, the former item 6 (Repair group diagnosis) is no longer filed in the volume corresponding to the respective repair group. The **Diagnosis test plans / diagnosis procedures** have been combined in a **separate Diagnosis volume** broken down according to the main groups 0 to 9.

Another new feature is that the contents of the "Service Information Technik" are indicated in the Repair Manual. This brochure concentrates on a description of the design and function of components and of the new features introduced for a particular model year.

Service Number

All major repair procedures and repair descriptions are identified by a two- or four-digit **Service Number** completed by two additional digits to identify the work that corresponds to the first six digits of the working position number in the Working Times and Damage Catalog.

Example: 30 37 37 Dismantling and assembling clutch control shaft

Explanation: 30 37 37 50 (full working position number)

Repair group

here: Clutch, control

Component designation

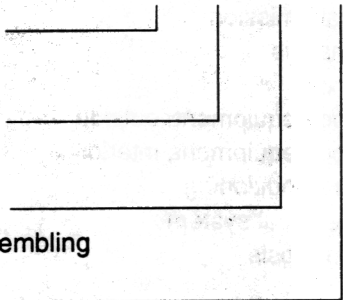
here: Clutch control shaft

Activity

here: Dismantling and assembling

Index

here: Removed



Presentation in the various documents

30 37 37 50 Working position no. from **Working Times and Damage Catalog**, consisting of repair group, component designation, activity and index

30 37 37 Six-digit number in **Repair Manual**, consisting of repair group, component designation and activity

30 37 Service number in **Service Information**, consisting of repair group and component designation

Goal

The introduction of a service number in the "technical literature" is intended to facilitate standardization and positive identification to allow direct cross-referencing among the various documents. This is of particular importance with regard to the use of electronic media.

Structure of the Repair Manual

This Repair Manual describes all the important operations that require special instructions to ensure proper completion. This manual is an essential source of information for the shop foreman and the shop mechanics as the information in this manual must be observed at all times to keep the vehicle in safe and roadworthy condition. The basic safety rules of course also apply without exception to all repairs on motor vehicles.

Breakdown of the Repair Manual

1. Overview of repair groups
2. Registration sheet for supplements
3. List of contents
4. Technical data
5. Repair groups

Breakdown of the repair groups

1. Table of tightening torques
2. Special tools required
3. Exploded views
4. Legends for the exploded views
5. Assembly notes / use of special tools
6. Diagnosis for repair groups

The Repair Manual will be updated regularly with supplements which must be filed immediately to maintain the usefulness of the manual. Appropriate entries must be made in the registration sheet to prove that the manual is complete.

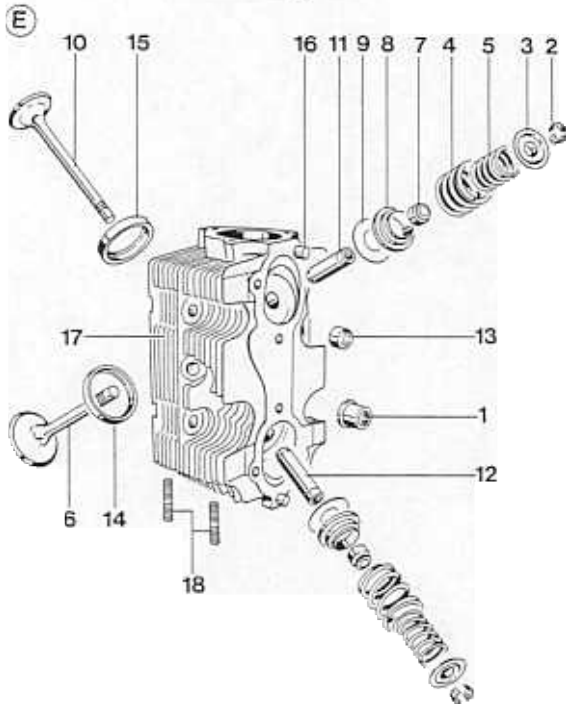
The contents of the Repair Manual will be supplemented by Technical Information Bulletins which will be integrated into the manual from time to time.

Descriptions of design and function can be found in the service training course reference material.

Layout of the exploded view

(A) 15 (B) Engine, Cylinder Head, Valve Drive (C) 911 Carrera (939)

15 70 37 Dismantling and assembling cylinder head



15 - 4 15 70 37 Dismantling and assembling cylinder head
Printed in Germany - 1, 1993

(D) (E) (F)

(C) (B) 911 Carrera (939) Engine, Cylinder Head, Valve Drive (A) 15

No.	Designation	Qty.	Removal	Note:	
				Installation	
1	Cylinder head nut	4	Use screwdriver insert for 9295 polygon-head nut	Apply a thin coat of Optimoly HT to cylinder head nut bearing surface	
2	Valve collet	4			
3	Valve spring retainer	2			
4	Valve spring, outer	2			
5	Valve spring, inner	2			
6	Inlet valve	1			
7	Valve stem seal	2	Pull off	Replace, use assembly sleeve	
8	Valve spring ring	2			
9	Washer	X			
10	Exhaust valve	1			
11	Valve guide, inlet	1			
12	Valve guide, outlet	1			
13	Thread insert	2			
14	Valve seat insert, inlet	1			
15	Valve seat insert, exhaust	1			
16	Roll pin	2		Pressed in to stop	
17	Cylinder head	1			
18	Studs M 8 x 22	2		Fitted with Loctite 270, protruding length 23 - 0.5 mm. Screw studs with unmarked end into cylinder head (exhaust side)	

15 70 37 Dismantling and assembling cylinder head
Printed in Germany - 1, 1993 15 - 5

(F) (E) (D)

- A - Repair group, numbers
- B - Repair group, text
- C - Type of repair vehicle
- D - Page number
- E - Operation, including "Service No." and "Title"
- F - Impressum, supplement number, year of printing
- G - Diagram item number in dismantling sequence
- H - Special notes for removal or installation

The assembly notes/Special Tool lists following the exploded view are always arranged in the order of text → diagram.

Volume I:	Overall vehicle – General	0
General	Maintenance, diagnosis	03
Engine	Engine	1
	Engine – Crankcase, mounting	10
	Engine – Crankshaft, pistons	13
	Engine – Cylinder head, valve drive	15
	Engine – Lubrication	17
	Engine – Cooling	19
	Fuel, exhaust system, engine electrical system	2
	Fuel supply, control	20
	Exhaust system – Turbocharging	21
	Fuel system, electronic injection	24
	Fuel system, K-Jetronic	25
	Exhaust system	26
	Starter, power supply, GRA	27
	Ignition system	28
Volume II:	Transmission	3
Transmission	Clutch, control	30
Manual transmission	Manual transmission – Controls, case	34
	Manual transmission – Gears, shafts, inner operation	35
	Final drive, differential, differential lock	39
Volume III:	Transmission	3
Transmission	Automatic transmission – Torque converter	32
Automatic	Automatic transmission – Controls, case	37
transmission	Automatic transmission – Gears, control	38
	Final drive, differential, differential lock	39
Volume IV:	Chassis	4
Chassis	Front wheel suspension, drive shaft	40
	Rear wheel suspension, drive shaft	42
	Wheels, tires, alignment	44
	Anti-Lock System (ABS)	45
	Brakes – Mechanical	46
	Brakes – Hydraulics, regulator, booster	47
	Steering	48

Volume V:	Body	5
Body	Body front section	50
	Body center section, roof, frame	51
	Body rear section	53
	Hoods, lids	55
	Front doors, Central Locking System	57
	Exterior body equipment	6
	Sunroof	60
	Soft top, hardtop	61
	Bumpers	63
	Glasses, window control	64
	Exterior equipment	66
	Interior equipment, passenger protection	68
	Interior body equipment	7
	Trim, insulation	70
	Seat frames	72
	Seat upholstery, covers	74

Volume VI:	Air conditioning	8
Air conditioning	Heater	80
Vehicle electrics	Ventilation	85
	Air conditioning	87
	Auxiliary air conditioning system	88
	Electrical system	9
	Instruments, alarm	90
	Radio, telephone, on-board computer	91
	Windshield wipers and washer	92
	Exterior lights, lamps, switches	94
	Interior lights, lamps, switches	96

Volume VII:	Electrical system	9
Wiring diagrams	Wiring	97

Volume VIII:	Diagnosis	D
Diagnosis	Self-diagnosis	03
	DME Diagnosis	24
	Tiptronic Diagnosis	37
	PDAS Diagnosis	39
	ABS Diagnosis	45
	Airbag Diagnosis	68
	Heater Diagnosis	80
	Alarm Diagnosis	90

I General / Engine

The Repair Manual of the 911 Carrera (993) also includes the 911 Carrera 4 manual (993 four-wheel drive). The 911 Carrera (993) is the basic model covered by the repair operations described in this Manual. "911 Carrera (993)" is also indicated in the header of each page.

Descriptions of repair operations that deviate for the 911 Carrera 4 will be included after the respective 911 Carrera section. The repair descriptions of both models are separated by a cover page. All pages included after the cover page (separation sheet) have the "911 Carrera 4" heading. To facilitate distinction, the page numbering will start with 100.

0	Overall Vehicle –General	
0	Technical data	0 - 1
03	Maintenance, diagnosis	
03 20 00	Maintenance . . . . .	. 03 - 1
03 80 00	Additional service . . . . .	. 03 - 23
1	Engine	
1	Tightening torques for the engine	1 -
10	Engine– Crankcase, Mounting	
10 01 19	Removing and installing the engine . . . . .	. . . . . 10 - 1
10	Tightening torques: Removing and installing the engine . . . . .	. . . . . 10 - 11
10	Special Tool 9111/3 . . . . .	. . . . . 10 - 13
10 01 37	Disassembling and assembling engine . . . . .	. . . . . 10 - 17
10 10	Measuring and repairing the crankcase . . . . .	. . . . . 10 - 31
10 10 03	Measuring the crankcase . . . . .	. . . . . 10 - 33
10 10 49	Reworking and remaining . . . . .	. . . . . 10 - 35
13	Engine – Crankshaft, Pistons	
13 01	Engine holder . . . . .	. . . . . 13 - 1
13 10	Identification of crankcase engine number and engine type . . . . .	. . . . . 13 - 3
13 48	Crankshaft - Standard and Repair Dimensions . . . . .	. . . . . 13 - 5
13 40 02	Connecting rod weight groups . . . . .	. . . . . 13 - 7
13 13 37	Dismantling and assembling crankshaft . . . . .	. . . . . 13 - 9

13 40 38	Dismantling and assembling connecting rods	13 - 10a
13 59 19	Removing and installing crankshaft oil seal	13 - 11
13 10 03	Measuring pistons and cylinders	13 - 15
13 10 37	Dismantling and assembling pistons and cylinders	13 - 17
13 10	Pistons	13 - 23
13 78 05	Checking and adjusting drive belts	13 - 29

15 Engine – Cylinder Head, Valve Drive

15 70 37	Dismantling and assembling cylinder head	15 - 1
15 59 04	Measuring valve lifters	15 - 7b
15 75 02	Checking valve guides	15 - 8a
15 75 56	Replacing valve guides	15 - 8b
15 62 04	Measuring the valves	15 - 8d
15 65 06	Checking and adjusting installed length of valve springs	15 - 8e
15 63 19	Removing and installing valve seal	15 - 8g
15 03 37	Dismantling and assembling camshaft housings	15 - 9
15 31 37	Dismantling and assembling chain housing with camshaft drive	15 - 15
15 05	Camshafts, timing	15 - 21
15 31 37	Determining parallelity of chain sprockets	15 - 23
15 05 06	Checking and adjusting camshafts	15 - 25
15 30 37	Dismantling and assembling intermediate shaft	15 - 31
15 20 01	Checking intermediate shaft	15 - 33
15 38 19	Removing and installing camshaft housing seal	15 - 35

17 Engine – Lubrication

17 26 38	Remove and reinstall pressure-regulating valve (Relief valve / Safety / valve)	17 - 1
17 10 30	Cleaning crankcase (oil pressure)	17 - 3
17 03 01	Checking oil pressure	17 - 5
17 00	Lubrication (Engine)	
17 00	Lubrication (Engine oil circuit diagram)	17 - 7
17 37 37	Dismantling and assembling oil temperature regulator housing	17 - 9

2 Fuel, exhaust system, engine electrical system

20 Fuel Supply, Operation

20 02 01	Checking fuel pressure	20 - 1
20 66 01	Checking fuel pump delivery	20 - 3

24	Fuel System, Electronic Injection	
24 04	Test specifications	24 - 1
24 04	Checking idle speed and CO level (vehicle with cat. converter)	24 - 3
24 04	Checking idle speed and CO level (vehicle without cat. converter)	24 - 5
24 46 19	Removing and installing intake distributor (injection system components)	24 - 7
24 46 37	Dismantling and assembling intake distributor	24 - 11
	911 Carrera RS Varioram - injection system engine M 64/20	
24 00 01	Fuel system - checking vacuum system for leakage	24 - 19
	911 Carrera RS Varioram - injection system M 64/20	
24	Hose connection schematic -	
	911 Carrera RS Varioram - engine M 64/20	24 - 21
24	911 Carrera Varioram - injection system -engine M 64/21-24	24 - 21a
24 70 19	Removing and installing DME control unit	24 - 23
24 46 19	Removing and installing intake distributor	24 - 25
24	Checking components of injections system for leaks	24 - 31
26	Exhaust System	
26 01 55	Replacing exhaust system	26 - 1
27	Starter, Power Supply, GRA	
27 22 19	Removing and installing alternator	27 - 1
27 30 49	Adjusting belt tension for new V-belts	27 - 7
27 60 19	Removing and installing starter (manual transmission)	27 - 9
27 60 19	Removing and installing starter (Tiptronic)	27 - 11
27 82 01	Troubleshooting the cruise control's control unit	27 - 13
27 84 01	Troubleshooting the cruise control actuator	27 - 15
27 88 05	Checking and adjusting tie rod for cruise control	27 - 17

Survey of contents of Service Information Technik '95

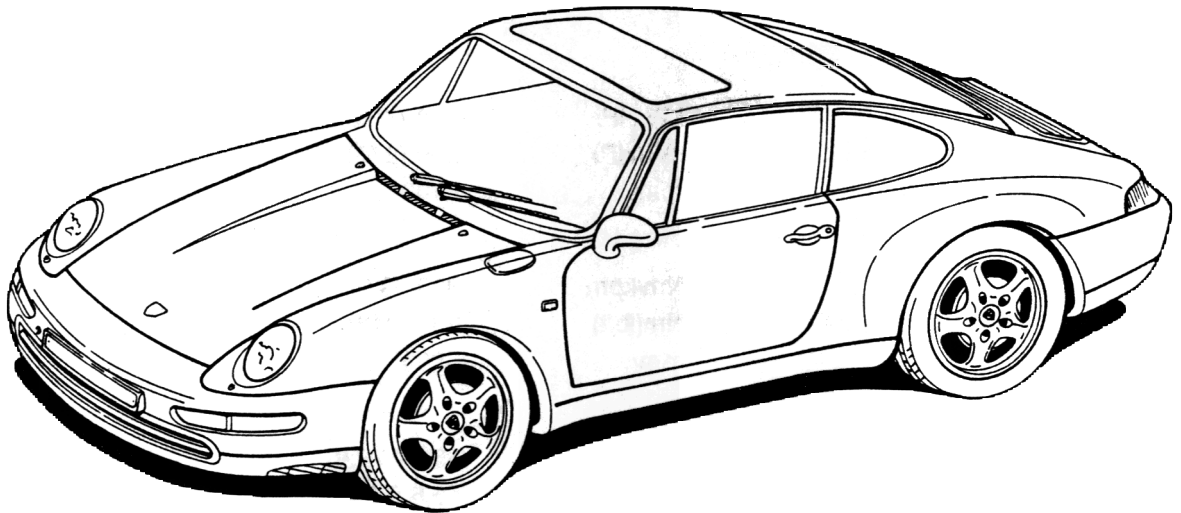
The Service Information gives a detailed description of the technical features of the new 911 Carrera.

	Rep. Gr.	Page
Engine		
General		1 - 1
Engine cross-sections	10	1 - 4
Full-load curve		1 - 6
Belt pulley	13	1 - 8
Pistons	13	1 - 10
Hydraulic valve lash adjuster	15	1 - 16
Setting the timing	15	1 - 18
USA - auxiliary air pump		1 - 19
Fuel and ignition systems		
General		2 - 1
DME - Schematic	24	2 - 2
Fuel - air flow	24	2 - 3
Exhaust gas flow	26	2 - 5
DME control unit 2.10.1	24	2 - 9
Mass air flow sensor	24	2 - 12
Throttle potentiometer	24	2 - 18
Ignition system	28	2 - 24
Plausibility test		2 - 28
Diagnosis		2 - 29
Auxiliary air pump	26	2 - 33
Power transmission		
Transmission	30	3 - 1
Clutch	30	3 - 2
Manual transmission	34	3 - 3
Transmission ratios		3 - 6
Gear set	35	3 - 8
Synchromesh	35	3 - 9
Final drive	39	3 - 13
Oil supply		3 - 15
Porsche Tiptronic	37	3 - 16
Modifications for the '95 model year		3 - 17

	Rep. Gr.	Page
Running gear		
General		4 - 1
Front axle	40	4 - 2
Steering	48	4 - 7
Rear axle	42	4 - 8
Elasto-kinematic toe correction	42	4 - 12
Coil springs (layout)	42	4 - 13
Wheels, tires	44	4 - 15
Suspension alignment	44	4 - 17
Brakes	47	4 - 20
Bleeding the brakes	47	4 - 23
ABS 5	45	4 - 24
Operation of the ABD	45	4 - 30
Diagnosis ABS/ABD	45	4 - 34
Body		
General		5 - 1
Constructional dimensions	50	5 - 4
Aerodynamics and air ducting	50	5 - 8
Body equipment		
Body equipment		6 - 1
Color scheme as of 1995 model year	60	6 - 1
Windows	64	6 - 8
Airbag system	68	6 - 14
Body - interior trim		
Body - interior trim	70	7 - 1
Seats	72	7 - 5
Heating, air conditioning, ventilation		
Particle filter	85	8 - 1
Air ducting	80	8 - 3
Heating - air conditioning unit	85	8 - 5
Heating - air conditioning unit	87	8 - 6
Series resistor of rear blower	80	8 - 9

	Rep. Gr.	Page
Electrical system		
Instruments	90	9 - 1
Alarm system/central locking system	90	9 - 3
Heated rear window	64	9 - 6
Central Information System (Z I)	91	9 - 7
Radio "Alpine 7807"	91	9 - 10
Sound package, DSP-System	91	
Windshield wiper and washer system	92	
Headlights	94	
Front end light cluster	94	
Tail lights	94	
Engine compartment baseplate	97	
Wiring diagram		
Summary		
Maintenance		0 - 1
Number ranges		0 - 4
Technical data		0 - 5

911 Carrera **(993)**



Technical data

(Adjusting values and wear limits are included in the respective repair groups)

Note: U.S. values are given in brackets

Drive unit

Internal engine designation	Manual transm.	Row M 64 / 05	USA 07
	Tiptronic	Row M 64 / 06	USA 08
No. of cylinders		6	
Bore	mm/in.	100 (3.94)	
Stroke	mm/in.	76.4 (3.01)	
Displacement (actual)	c.c./cu.in.	3600 (219.7)	
Compression ratio		11.3 : 1	
Max. engine power to 80/1269 EEC	kW/HP	200 / 272	
Net Power, SAE J 1349 at engine speed	kW(HP) rpm	200 (270) 6100	
Max. torque to 80/1269 EEC	Nm/kpm	330/33.6	
Net Torque, SAE J 1349 at engine speed	Nm(lbft) rpm	330 (243) 5000	
Max. specific power output DIN 70020	kW/l/HP/l	55.6 / 75.6	
SAE J 1349	kW/l (HP/l)	55,6 (75,0)	
Rpm limiter, fuel cutoff at	rpm	6700	
Idle speed	rpm	800 ± 40	
Fuel octane rating	RON/MON	98/88	
Engine weight (dry, ready for fitting)			
Manual transmission	kg (lbs)	232 (511)	
Tiptronic	kg (lbs)	224 (494)	

Engine design

Type	6-cylinder four-stroke internal combustion engine with 2 horizontally opposed cylinder banks (flat engine)	
Crankcase	Light-alloy, two-piece	
Crankshaft	Forged, 8-bearing design	
Main bearings	Friction bearings	
Connecting rods	Forged	
Big end bearings	Friction bearings	
Pistons	Light alloy, pressed	
Cylinders	Light alloy, individual cylinders	
Cylinder head	Light alloy, individual cylinder heads with ceramic exhaust port liners	
Valve guides	Press-fitted	
Valve arrangement	1 inlet, 1 exhaust, suspended in V-design	
Valve timing	One overhead camshaft each on right and left	
Camshaft	Cast	
Camshaft drive	Double chain	
Valve clearance	Hydraulic lash adjustment	
Timing for 1 mm valve lift and zero clearance	Inlet opens	1 degree BTDC
	Inlet closes	60 degrees ABDC
	Exhaust opens	45 degrees BBDC
	Exhaust closes	6 degrees ATDC
Induction system	With controlled tuning flap	

Engine cooling

	Air-cooled system
Fan drive	Via V-belts from the crankshaft
Transmission ratio: Crankshaft to fan	approx. 1:1.60
Air delivery rate	1010 l / sec at 6,000 rpm of crankshaft

Engine lubrication

	Dry sump lubrication with separate oil tank
Oil cooling	Thermostatically controlled, front oil cooler in right-hand front fender, 2-stage electric fan
Oil filter	in return line
Oil pressure at $n = 5,000$ rpm	approx. 6.5 bar at 90° C oil temperature
Oil pressure indicator	0...5 bar, electric, and oil pressure warning lamp
Oil consumption	up to 1.5 l / 1000 km

Exhaust system

Twin-branch system, heat exchanger with joining of exhaust pipes outside of heat exchanger, twin-branch 3-way catalytic converter with Lambda control and central induction across mixing chamber, one muffler per exhaust line

Emission control

Lambda control with 3-way catalytic converter (metal carrier) or internal engine control

Heating

Engine-dependent hot air heating with additional electric fans and automatic temperature control

Fuel system

Type	DME (Digital Engine Electronics)
Fuel supply	1 electric roller cell pump

Clutch

Manual transmission	Single-plate dry clutch hydraulically operated double-mass flywheel
Thrust plate	G MFZ 240
Drive plate	rigid, dia. 240

Electrical system

Interference suppression	ECE-R 10 and 72/245/EEC	
Battery voltage	V	12
Battery capacity	Ah	75
Alternator output	A/W	115/1610 A/C
Ignition	DME, dual ignition, knock control	
Firing order	1 - 6 - 2 - 4 - 3 - 5	
Ignition timing control	Via DME	
Spark plugs	Bosch FR 6 LDC Bosch FR 5 DTC Beru 14 FR - 5 DTU	
Spark plug gap	mm (in)	0.7 + 0.1 (0.026 + 0.004)

Body construction

Integral steel body, electrically extending rear spoiler, Coupé, optionally with sunroof, Cabriolet

Dimensions (at DIN curb weight)

		Row	USA
Length	mm (in.)	4245 (167.1)	4260 (167,7)
Width	mm (in.)	1735 (68.3)	
Height	mm (in.)	1300 (51.2)	1315 (51,8)
	Sport chassis	1285 (50.6)	
Wheelbase (design)	mm (in.)	2272 (89.4)	
Front track	mm (in.)	1405 (55.3)	
Rear track	mm (in.)	1444 (56.9)	
Ground clearance (at gross vehicle weight)	mm (in.)	110 (4.3)	120 (4,7)
	Sport chassis	90 (3.5)	
Ramp angle (at gross vehicle weight)	degrees	13.0	
	Sport chassis	12.0	
Front overhang angle (at gross vehicle weight)	degrees	11.0	
	Sport chassis	10.5	
Rear overhang angle (at gross vehicle weight)	degrees	12.5	13,1
	Sport chassis	11.5	

Weights to DIN 70020 (manual transmission)

Total curb weight	kg	1370	
Curb weight to 70/156/EEC	kg	1445	
Gross vehicle weight	kg	1710	1690
Max. front axle load	kg	720	
Max. rear axle load	kg	1065	
Max. roof load including roof rack	kg/lbs	75 (165) with original Porsche roof transport system	

Capacities

Engine	Use only approved engine oils. Refer to Technical Information Handbook
Engine oil capacity	Approx. 11.5 l (approx. 9 l for oil change) Determined by measurements with oil dipstick as per Owner's Manual
Manual transmission with differential	3.6 l
Tiptronic with torque converter	approx. 9 l
Differential	0.9 l
Fuel tank	approx. 71 l (approx. 10 l reserve)
Brake fluid reservoir	approx. 0.34 l
Washer fluid for windshield and headlights	approx. 7.3
Power-assisted steering	approx. 1.0 l ATF (Dexron)

Performance (manual transmission)

Top speed	km/h / mph	270 (168)
Acceleration from 0 to 100 km/h	s	5.6
Kilometer from standing start	s	25.1

Hill climbing

	Manual transmission	
In %	1st gear	75%
	2nd gear	51%
	3rd gear	33%
	4th gear	23%
	5th gear	16%
	6th gear	11%