CAMS

5TH CATEGORY - HISTORIC RACING

GROUP N(a)

APPROVED VEHICLE SPECIFICATION

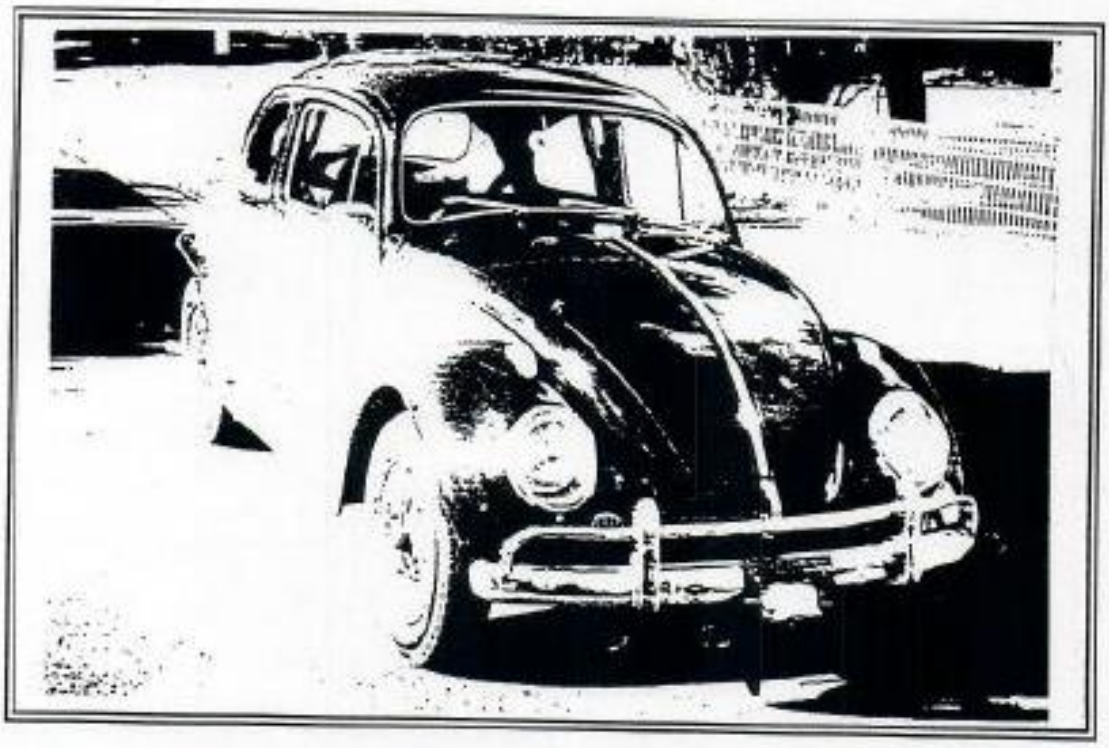
This form details the approved specifications of individual vehicle models in the 5th Category Historic car group. To be issued with an Historic Log Book, cars need to comply with these specifications, the physical appearance shown in the illustrations and the general historic rules as detailed in the current CAMS Manual of Motor Sport.

Make of Car: Volkswagen **Model:** 1200 Sedan (Type 112/114)

Period of Original Manufacture: 1954 - 1958

CAMS Historic Group: N(a)

Date of Issue of this Document: 14/4/2000



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SECTION 1 - CHASSIS

1.1 CHASSIS FRAME

Description:	Backbone Platform Chassis	**Period of Manufacture:**	
Manufacturer:	Volkswagen	1954 - 58	
Chassis no. from:	1 - 781884		
Chassis no. location:	On Rail under Rear Seat		
Material:	Steel		
Comments:	No major Chassis change until 1964		

1.2 FRONT SUSPENSION

Description:	Transverse Torsion Bar		
Spring medium:	Torsion Bar		
Damper Type:	Double Acting Telescopic	**Adjustable:**	No
Anti-sway bar:	1 Single Sway Bar	**Adjustable:**	No
Suspension adjustable:	No	**Method:**	
Comments:	Utilises King and Link Pins		

1.3 REAR SUSPENSION

Description:	Independent - Swing Arm		
Spring medium:	Torsion Bar		
Damper type:	Double Acting Telescopic	**Adjustable:**	No
Anti-sway bar:	Compensator Bar	**Adjustable:**	No
Suspension adjustable:	No	**Method:**	
Comments:	Compensator Bar should be Period Porsche 356 Type		

1.4 STEERING

Type:	Worm & Sector	**Make:**	Volkswagen
Comments:			

1.5 BRAKES

	Front	Rear
Type:	Drum	Drum
Dimensions:	230 x 40	230 x 40
Material of drum/disc	Cast Iron	Cast Iron
No. cylinders/pots per wheel:	One	One
Actuation:	Hydraulic	Hydraulic

Caliper: Make, Material, Type: N/A

Master cylinder make: Volkswagen **Type:** Piston

Adjustable bias: No

Servo Fitted: No

Comments: Tandem/Twin Master Cylinders may be fitted.

SECTION 2 - ENGINE

2.1 ENGINE

Make:	Volkswagen		
Model:			
No. cylinders:	Four	**Configuration:**	Horizontally opposed
Cylinder Block-material:	Aluminium	**Four Stroke**	Yes
Bore - Original:	77	**Max. allowed:**	78.5
Stroke - original:	64	**Max. allowed:**	64
Capacity - original:	1192	**Max. allowed:**	1239
Cooling method:	Fan - Air Cooled		
Identifying marks:	36HP Crankcase has Integral Generator Support.		

Comments: As per HEC decision of December 99, 40HP crankcase may be used subject to sealing of engine by CAMS recognised engine sealer to ensure 36HP internal components are used.

2.2 CYLINDER HEAD

Make:	Volkswagen				
No. of valves/cylinder-	Two	**Inlet:**	One	**Exhaust:**	One
No. of ports total:	Eight	**Inlet:**	Four	**Exhaust:**	Four
No. of camshafts:	One	**Location:**	Crankcase	**Drive:**	Gear
Valve actuation:	Pushrod				
Spark plugs/cylinder:	One				
Identifying marks:					
Comments:					

2.3 LUBRICATION

Method:	Gear Driven Pump	**Oil tank location:**	Sump
Dry sump pump type:	N/A	**Location:**	N/A
Oil cooler standard:	Yes	**Location:**	Top of engine case standard - may relocate

Comments: Oil Cooler may be relocated

2.4 IGNITION SYSTEM

Type:	Coil & Distributor
Make:	Bosch
Comments:	Electronic Components Not Permitted

2.5 FUEL SYSTEM

Carburettor: Make:	Solex	**Model:**	34 PCIT	**Size:**	34mm
Fuel injection Make:	N/A	**Type:**			
Supercharged:	N/A	**Type:**			
Comments	Period carburretors - one choke per two cylinders				

SECTION 3 - TRANSMISSION

3.1 CLUTCH

Make: Volkswagen **Type:** Dry Plate **Diameter:** 200 mm
No. of Plates: One
Actuation: Cable
Comments:

3.2 TRANSMISSION

Type: Four Speed Transaxle Type
Make: Volkswagen **Model:** Split Case
No. forward speeds: Four **Gearbox location:** Rear
Gearchange type and location: Rod & Lever Floor Charge

Case material: Aluminium **Identifying marks:** Longitudinal Separation
Comments:

3.3 FINAL DRIVE

Make: Volkswagen **Model:**
Wheel drive method: Swing Axles
Ratios: 4.43:1
Differential: Hypoid **Type:**
Comments: Transaxle Style Single Unit . Ratios Free.

3.4 TRANSMISSION SHAFTS (EXPOSED)

Number: 2 **Location:** Transaxle to Rear Wheels.
Description: Individual Driveshafts with Universal Joints
Comments:

3.5 WHEELS & TYRES

Wheel type: **Original:** Steel - 5 Stud **Material:** **Original:** Steel
Allowed: Steel - 5 Stud **Allowed:** Steel
Fixture method: **No. studs:**

	FRONT	REAR
Wheel dia. & rim width		
Original:	15 x 4.5	15 x 4.5
Allowed	15 x 5.5	15 x 5.5
Tyre section:		
Original:	560 x 15	560 x 15
Allowed:	195.65 x 15	195.65 x 15
Aspect ratio - minimum:	65	

Comments:

SECTION 4 - GENERAL

4.1 FUEL SYSTEM

Tank Location: Front **Capacity:** 40 Litres
Fuel pump, type and location: Electric - Engine Bay **Make:** Bosch
Comments:

4.2 ELECTRICAL SYSTEM

Voltage: 6 Volt & 12 Volt **Generator fitted**
Battery Location: Under Rear Seat
Comments:

4.3 BODYWORK

Type: Pressed Monocque **Material:** Steel
No. of seats: 4/5 **No. doors:** Two
Comments: Split rear window to 54 small oval rear window to mid 57.
Larger rear window mid 57 onwards.

4.4 DIMENSIONS

Track - Front: 1306 **Rear:** 1288
Wheelbase: 2400 **Overall length:** 4079
Dry weight: 713Kgs
Comments:

4.5 SAFETY EQUIPMENT

Fire extinguisher required
Seat belt required
Rollbar required
Electrical cut off switch required
Safety fuel tank optional

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BEETLE PAST & PRESENT

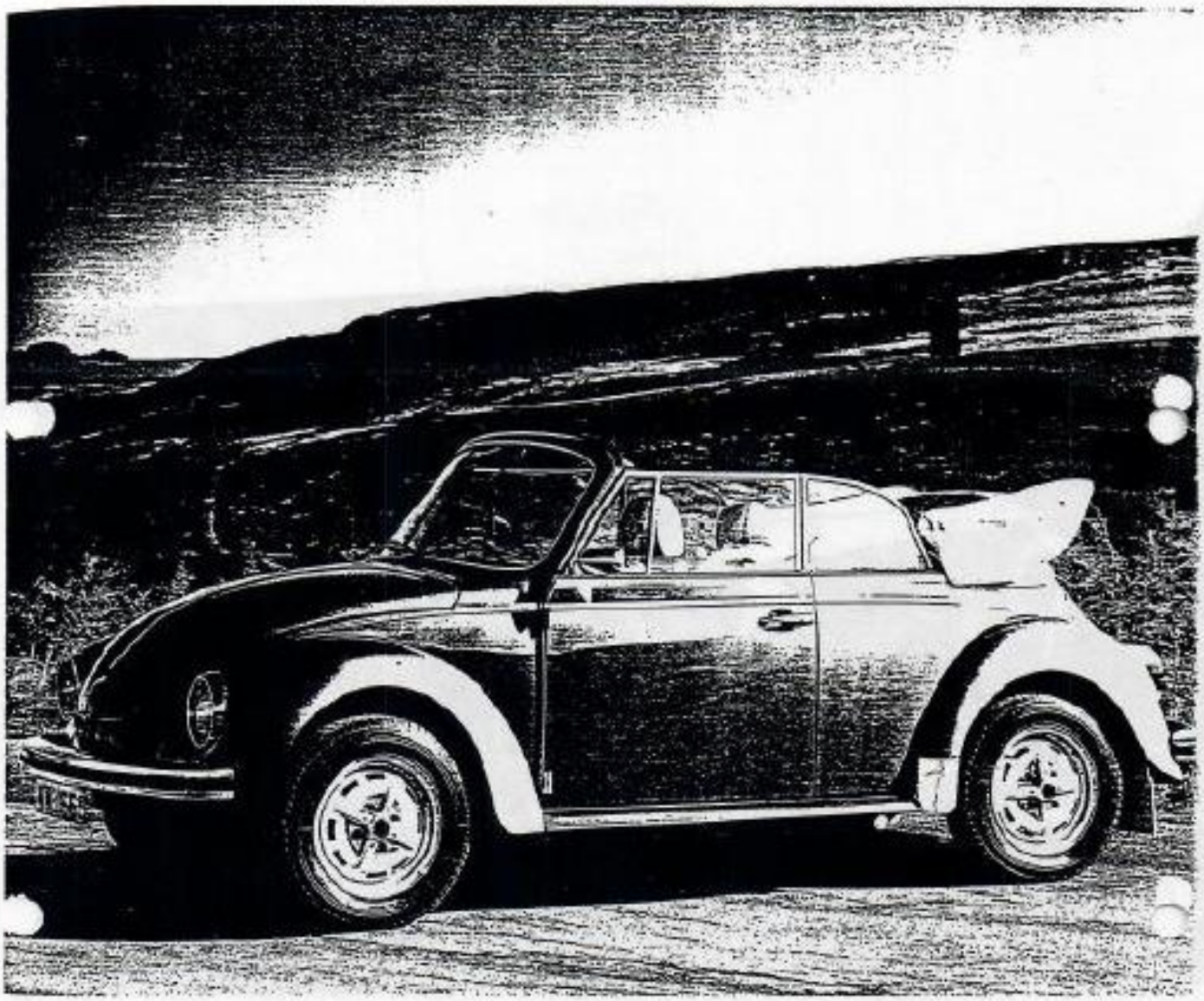
The Volkswagen Beetle is a true classic without peers. Many cars are certainly more powerful, more comfortable, more economical and better suited to modern driving conditions but, without exception, none holds the same fascination, as much charismatic appeal, the same classless status or depth of character. The Beetle is unique. Few motoring folk have ever remained indifferent to the Beetle. Purely and simply, you either love it or hate it, but Beetles are best by far for the 21 million who to date have been persuaded to join the fold.

To the non-converted, all Beetles look alike irrespective of age, but there were in fact many thousands of modifications before German production ceased in 1978, due to the factory's policy of continuously refining the car and making real improvements where and when they were needed.

Until recently, only one item – the metal clamping strip that retains the bonnet and engine lid rubber seals – remained unchanged, but on the latest Mexican Beetles even this tenuous link with the past has gone, the seals now being attached to the bonnet and rear lid rather than the bodywork.

During the late 1940s, there was a concerted effort to make the Beetle more reliable. Improvements were made to the engine's cooling fins, thermostatically controlled flaps decreased the time it took for the engine to reach its optimum operating temperature, and cylinder life was extended by the addition of a higher phosphor content to the metal. Between 1945 and 1948, no changes were made to the bodywork, but by July 1949 there were visible alterations with the introduction of the Export or deluxe model. Glow paint became available and the hub caps, bumpers, door handles and headlamp rims were chromium-plated.

Dawn of the Beetle's days as a big-seller. With the launch of the new Export model in 1949, Beetle sales climbed dramatically, climbing above 100,000 a year for the first time in 1952. This 1951 car, identified by the ventilation flaps fitted behind the front wings, illustrates how the Beetle's appearance in Export guise was enhanced by plentiful use of bright trim.



into the twilight period. This gorgeous 1971 cabriolet with white vinyl trim and hood remains almost how plush the Beetle had become in its declining years. Although the 1303 model – with characteristic bulbous nose and MacPherson strut front suspension beneath – had caused production to plummet in saloon form in 1975, it soldiered on as a cabriolet until 1980.

After 1950, so many changes were made that it is possible to identify Beetles year by year with a reasonable degree of accuracy, but problems frequently arise with 'rogue' cars that do not fit into an established category and whose specification, though genuine enough, appears to contradict official factory records. In such a case, it is not unreasonable to suppose that because of the mind-boggling scale of production at Wolfsburg, the occasional 'hybrid' would have found its way through the factory gates.

Problems over originality frequently occur where owners have, for whatever reason, carried out their own modifications. For example, after 1953, when a small oval rear window replaced the split type, some people decided to update their cars by removing the metal division in order to replace the two small windows with the larger oval, often in the interests of safety. For the same reason, older cars today can be seen sporting more modern indicators because s aphores are not immediately visible in traffic, e cially to younger drivers who were born long these quaint items ceased to be commonplace.

It is far from rare to discover a 1950s body mounted on a much later chassis, but only the todian of such a car is in a position to decide whe such a devation from the original is sufficien warrant major surgery. Other common problem mixed identity involve cars that were destined particular country but found their way into a q different one, cars that were launched in a model year but fitted with the previous year's par that the factory could use up old stock, and cars were converted to a previous year's specificatio VW dealers whose more conservative custo would not accept new features as improvements

So, if your 1966 1500 Beetle has 12-volt elec

e the car was initially supplied to a doctor or a
: nurse, or your 1968 1200 is fitted with slop-
adlights, it may well be genuine and original
: the more generally accepted wisdom that
your car as a wrong 'un.

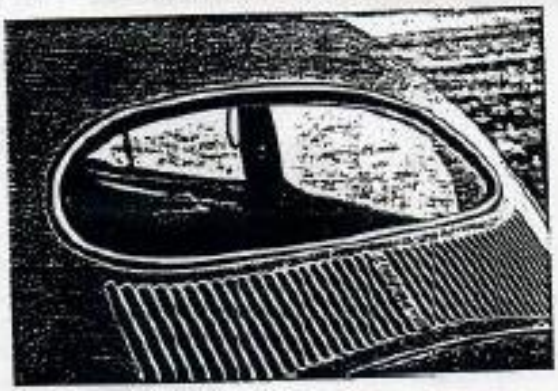
oughout its production life, the Beetle has
old and driven in virtually every part of the
including Antarctica and the world's remotest
habitation, Tristan da Cunha. Many export
s demanded a very different specification
that of the cars we are used to seeing in Europe
North America, body colour and seat cloth per-
sons alone running into many thousands. Back
85, the fact that there were 32,000 versions of
wage mid-range saloon, the Jetta, available
i-wid rves to illustrate perfectly what we are
gainst as restoring a Beetle.

s especially important for anyone who is restor-
Beetle to its original factory specification to
lish the age of the car because Volkswagen's
el year designation introduced for August 1953
nues to confuse even the most knowledgeable
rians. Until that date, new model changes were
ly announced at the beginning of January. Nat-
y, the Beetle was continuously refined and mod-
throughout the course of each year, but, by and
, the Volkswagen model year ran from January
ecember.

1953, the company established the August-to-
ust system of announcing new models to tie in
the factory's annual 'shut-down'. This is why,
ughout this book, I have described the new
iel changes in the year in which they were
ounc' For example, the 1500 Beetle was
ched August 1966 and therefore appears
er th eading '1966', but it was introduced for
1967 model year and its specification was
ined until August 1967, when a substantially
dified and updated car superseded it. To put it
other way, the 1967 6-volt 1500 was launched in
gust 1966 and the 1968 12-volt 1500 was origi-
y announced in August 1967.

The system is easier to remember if you think of it
the same way that schools and universities organ-
their annual calendar. The new year starts after
long summer break, usually in September or
tober, and goes through to the following June or
y. When ordering parts for your car, it will help
ormously if you quote its chassis number and the
onth in which it was manufactured. Do not
ume that because your car was manufactured, for
ample, in November 1972 that it is a '1972' car; it
actually a '1973' car because it was made in the
73 model year.

Over the years, the Beetle has been singled out for
stonishing more than any other make of car. There
ve been beach buggies, Bajas, 'rails' and many
ore, but by far the most successful and prolific fash-



Together with its equivalent on the engine lid, the clamping strip retaining the rubber seal on top of the inner wings, seen on a 1947 car (above left), is the only part of the Beetle that remained unchanged throughout European production. Problems with originality frequently occur in the Beetle world. This is a genuine oval window from a 1953 car (below left), but some 1950s owners of earlier split-window cars updated them to look more modern.

ion in recent times is the conversion of a standard Beetle into what is now universally known as the 'Cal-look' – the Californian look. Basically, it entails denuding the Beetle of its bright trim, painting the bodywork in a vivid colour, fitting alloy wheels, uprating engine power and lowering the suspension. Cal-lookers come equipped with non-standard seats, custom interior panels and a mega-watt stereo system, and in many instances the dashboard will have been transformed by skilful use of welding equipment and copious quantities of body filler in an attempt to create a 'smooth' appearance.

There is little doubt that several examples are masterpieces of modern automotive art, but a Cal-looker is not an ideal basis for a restoration project if you would prefer to own an original car. And a word of warning. The most popular method of lowering the front suspension is to cut the axle beam in two, fit an off-the-shelf device for adjusting the torsion bars, and weld the beam back together again. If the car you intend to buy has been treated to this particular 'tweak', the quality of the welding work should be inspected very carefully indeed. If it has not been done satisfactorily, you may not be able to drive your steed between the hedgerows for as long as you had originally planned.

It is also important to bear in mind that the Beetle was intended as an economical and inexpensive family car to be used for driving over many thousands of trouble-free miles. It was never intended as a precious museum piece and few have ever been treated as such. So, unless you are lucky enough to stumble across a one-owner car in immaculate condition, the slightly rusty hulk that pops and bangs every time you turn the ignition key is likely to be in need of a time-consuming restoration, or at least a little care and attention.

BEETLES BUILT IN GERMANY

Year	Quantity
1945	1,785
1946	10,020
1947	8,987
1948	19,244
1949	46,148
1950	81,979
1951	93,709
1952	114,348
1953	151,323
1954	202,174
1955	279,986
1956	333,190
1957	380,361
1958	451,326
1959	575,407
1960	725,927
1961	796,825
1962	819,326
1963	775,405
1964	867,328
1965	1,008,983
1966	988,533
1967	818,889
1968	1,055,529
1969	1,076,897
1970	1,014,019
1971	1,058,580
1972	914,030
1973	895,801
1974	451,800
1975	114,025
1976	87,463
1977	33,339
1978	700

With earlier Beetles, there are instances where enthusiasts have to ask themselves whether originality is more important than safety. Witness the owner of this 1953 car (above right) has not altered the skywards-pointing brake lights, the owner of this 1957 model (below right) has chosen to add modern flashing indicators to supplement the normal semaphores.

Thanks to the huge classic car movement which has grown up over the past 20 years or so, restoring virtually any older car has never been easier. There are clubs, a wealth of specialist publications, companies involved in the manufacture of high-quality reproduction parts, and engineering firms well equipped to deal with all the problems you may encounter. And where spare parts are concerned, Beetle owners have a head start.

Because the car remains in production, the majority of bits and pieces you are likely to need, especially if you own a post-1967 12-volt car, are available from main dealers and independent specialists. The pre-1967 6-volt cars are a little trickier and even batteries are becoming difficult to obtain 'over the counter' these days, but even this situation need not deter a real enthusiast because, thankfully, there is a large army of VW nuts out there only too willing to help you keep your car running in first-class order.

Beetle owners also have the added advantage that these cars are fairly simple in their construction. However, it is important not to under-estimate the high standards of build quality that went into making your car at the factory, so it naturally follows that restoring a car to such high standards will not be particularly cheap and certainly will not be achieved overnight. There are those who claim to have carried out a comprehensive restoration for just a few hundred pounds and I have listened with a great deal of scepticism to such drivel on several occasions. Indeed, I have seen their pitiful efforts all too often and have walked away with the inevitable conclusion that here is yet another Beetle carved up with a paint job to provide its owner with a fast buck. Such restoration work is entirely useless though. Even the worst can serve as horrible examples.

Part of the purpose of this book is to serve as a guide for those wishing to restore a Beetle to its original factory condition. If Thomas Carlyle was right in saying 'The best effect of any book is that it excites the reader to self-activity', then this humble tome will have done its job.

Although the first production Beetle rolled off the Wolfsburg assembly lines on 15 August 1940 with the chassis number 1-000 001, our story begins in 1945 because until 1944, when American bombers had brought the factory to a virtual standstill, only 630 Beetles had been completed and they were used almost exclusively by senior Nazi officials, including Hermann Goering. Hitler also had a Beetle, but it is safe to assume that it did not get a great deal of use because he was unable to drive. Some examples of these early Beetles survive today, but naturally they are few and far between, and in most cases have already been restored by their enthusiastic owners. The chances of one being discovered in the proverbial barn covered in straw bales, unseen since 1945, are remote to say the least.

The cars that continue to be built in Mexico are similarly excluded on the grounds that they are probably too new to warrant restoration work. Mexican Beetle owners today, safe in the knowledge that the VW factory is working around the clock, can save themselves a great deal of work by purchasing a new one, provided, of course, they are prepared to join a six-month waiting list.

During the 35 years in which I have travelled in, driven, serviced, rebuilt, written about and generally 'mucked around' with Beetles, I have yet to come across two identical examples. All Beetles in my experience have individual characteristics that make each car special in some way. This is why the restoration and preservation of every remaining example is of paramount importance if, like me, you believe that the memory and design legacy of the Beetle should live on in centuries to come.

Several of the highly-original Beetles featured in this book have had one fastidious owner for ... e. Vic Kaye still has ... the sales invoice of the 'World Champion' or 'Marathon' Beetle he bought new in May 1972.

PRODUCTION CHANGES 1954

1-0599 151 (Feb)
Gearbox synchroniser stop ring modified in shape.

1-0611 493 (Mar)
Petrol tank filler cap galvanised inside and outside with hydronalium.

1-0623 266 (Mar)
Diameter of front and rear brake hoses increased from 10mm to 12.2mm.

1-0631 062 (Apr)
Dimensions of oil pump housing modified to clear oil pump shaft.

1-0645 501 (May)
Wheel brake cylinders awarded four mounting bolts instead of two.

1-0696 501 (Aug)
Spare tin belt no longer supplied in tool kit.

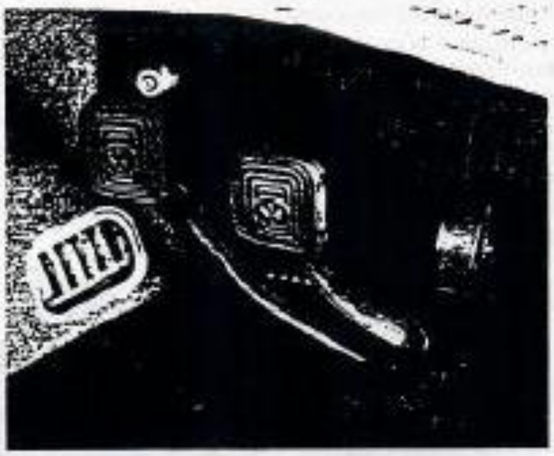
1-0702 742 (Aug)
Compression ratio raised to 6.6:1: 28 PCI carburettor main jet 117.5 and air correction jet 195 (previously 122.5/200).

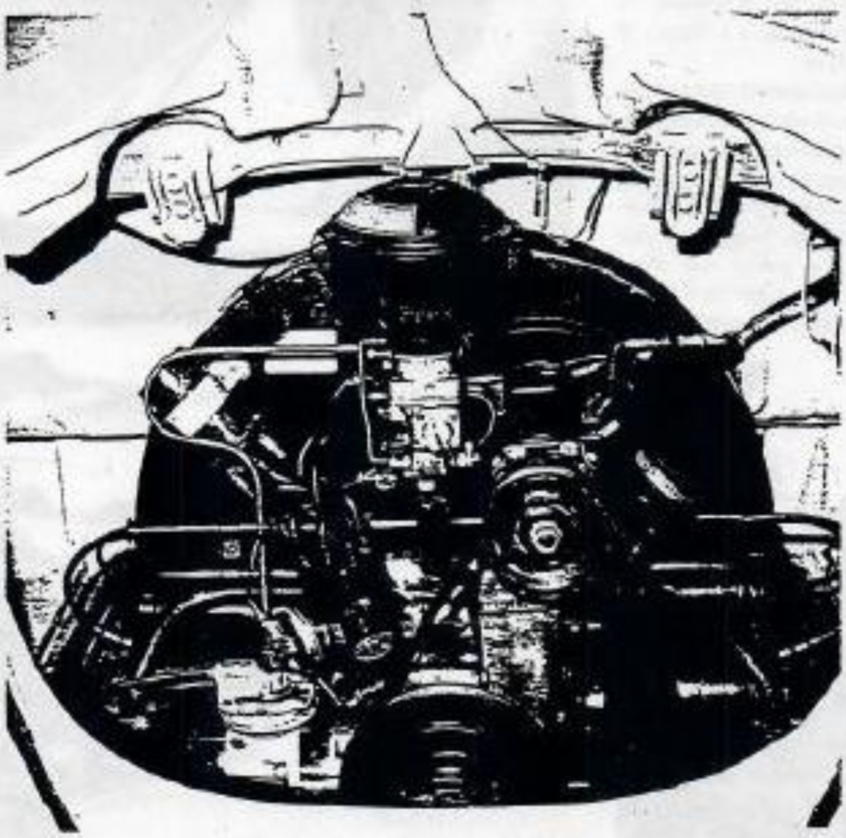
1-0722 916 (Oct)
Stop light window on rear light pods discontinued on US cars.

1-0734 000 (Oct)
Rear light pods fitted with water drainage aperture.

1-0753 096 (Nov)
Fan wheel and small pulley dynamically balanced.

For the greater part of the ...oriol ...roduction life, the ...ood (...) was made with ... ...rior, a plastic headlining and a heavy horsehair and rubber filling. Enlarged heater vents (right) with bright metal surrounds and wire gauze covers appeared in 1954, while the ...utch and brake pedal ...bbers displayed the VW ...mblem. The roller ball ...rottle pedal soldiered on until a more conventional flat ...dal replaced it for the 1958 model year.





Introduced in December 1953, the more powerful 30bhp 1192cc engine is visually indistinguishable from the 25bhp 1131cc unit it replaced, but owners welcomed the power increase with open arms.

...aster cylinder brake reservoir, with a screw ...ap positioned in the ...apron well in 1954.

COLOURS

From January 1954
Black
Strato Silver
Light Blue
Metallic Brown
Iceland Green

These colours were current until August 1955

with a three-spoke steering wheel and black plastic operating knobs on the dashboard, the Export car received a slightly modified version of the two-spoke wheel with a smaller hub and deeper spokes. The front seats were also updated, becoming some 30mm wider and having backrests that were adjustable to three different positions by turning a metal knob situated at the base of the framework. At the same time, the Export Beetle was fitted with attractive vinyl and cloth door panels matched by similar panels in the rear. To prevent the doors opening further than their hinges would naturally allow, they were fitted with strong metal stays to replace the cloth straps which had a tendency to stretch in use.

Because the heater control knob was located further [illegible]ward on the tunnel for easier use by the driver, the gearlever was cranked in the centre. To help prevent car theft, the small handle for opening the quarterlights was redesigned with a more curved shape and was better seated, so as to make it more difficult to open in the event of some sad character prising open the window with a screwdriver.

Although many accessories were available for the Beetle by this stage, some are considerably less useful than others. Particularly popular items which have enjoyed something of a revival in recent times are the 'eyelids' which fit over the top of the headlights, but, cute as they may look to some, they create considerable drag and reduce top speed by 5-10mph. A flower vase for the dashboard, however, is a 'must', if a slightly expensive one these days.

From August 1955, the exhaust system was modified with a single chamber tailbox with a connecting pipe for improved induction pre-heating, and the use on Export cars of two chrome-plated tailpipes in [illegible] of a single pipe. One extremely useful modification beneath the engine lid from August was the reduction in size of the dynamo pulley nut from 36mm to 21mm, which allows the same tool to be used for changing the fan belt and the spark plugs.

PRODUCTION CHANGES 1955

1-0787 449 (Jan)
Tie rods without grease nipples for 1000 Standard saloons, up to chassis number 1-0797 357.

1-0805 122 (Feb)
Reinforced outer ring for horn button housing.

1-0929 746 (Aug)
Significant bodywork and interior modifications, as described in text; spark plug spanner now fits 21mm dynamo pulley nut; single chamber exhaust box with two tailpipes (chromed on Export model, painted black on Standard) and connecting pipe for pre-heating tube; steering gear limited by lateral stops at upper axle tube; steering wheel on Export model modified in shape with spokes arranged lower; heater knob moved forward and gear lever cranked; handbrake cables attached to handbrake lever on Export cars instead of being attached to brake rod; shape of fuel tank modified, filler neck reduced in diameter to 60mm; quarterlight handles redesigned in interests of security.

CHASSIS DATING

Jan	812 662
Feb	823 604
Mar	847 966
Apr	869 399
May	892 300
Jun	916 456
Jul	929 512
Aug	953 486
Sep	981 573
Oct	1008 157
Nov	1034 731
Dec	1060 929

Instead of being mounted on the top of the tail light pods, the brake lights were incorporated into the tail lights, where they were more easily visible.

The V-over-W emblem in the centre of the hub caps (left) was sometimes highlighted in a colour until September 1956, but black was always used by the factory thereafter.

While European and British cars followed in mid 1960 with semaphore indicators (right), Beetles exported to North America gained more modern wing-mounted flashing indicators from 1955.

1956

Through a year in which the Suez oil crisis threatened doom and gloom for motoring folk in general, production continued at Wolfsburg at unabated pace and, surprisingly, the Beetle remained virtually unaltered from the previous year. But changes were made nonetheless, even if it takes a real expert to spot them.

There were no bodywork modifications as such, if the cabriolet's steel hood studs were replaced by corrosion-resistant brass items. From early September, the VW emblem in the centre of the hubcaps was always highlighted in black, whereas previously a variety of colours had been available. Considered to be something rather special at the time, an experimental batch of 800 cars built in June were fitted with 5.60-15 tubeless tyres, which became standard from July. It would be another four years before the British rally driver, Bill Bengry, had the opportunity to go rallying in a Beetle fitted with Pirelli Cinturato tyres for the first time. In March, the ground clearance of the Export model was reduced from 172mm to 155mm.

Engine modifications for this otherwise comparatively barren year included a change from Resitex material to aluminium alloy for the camshaft timing gear. Early Beetles, including the one owned in the mid-1950s by Bill Boddy, editor of *Motor Sport*, had a tendency to strip their timing gears. Having been inconvenienced by this perennial malady, Boddy continued to drive a Beetle with extraordinary enthusiasm for many years, promoting its virtues and apparently ageless character in his esteemed journal whenever the opportunity presented itself.

There are always exceptions to any rule, but the cars produced by Volkswagen from 1954 to the end of 1958 – and particularly those in 1956 – are among the very best in the Beetle's history in terms of build quality and engineering excellence. Many Beetles manufactured at this time remain in sparkling condition, having never been restored by loving owners who often go to quite extraordinary lengths to preserve their steeds in first-class order.

It is often the case that the paintwork retains its remarkably deep shine, the doors still close with a heavy 'clunk', and there is an overall feeling of the kind of solidity only found in expensive luxury saloons from Daimler-Benz and Rolls-Royce. It is surely sufficient testimony to the Beetle's engineering integrity that a former chief engineer at Rolls-Royce, Harry Grylls, who was responsible for the Silver Shadow, bought a Beetle for his retirement in the late 1960s.

Chassis Dating

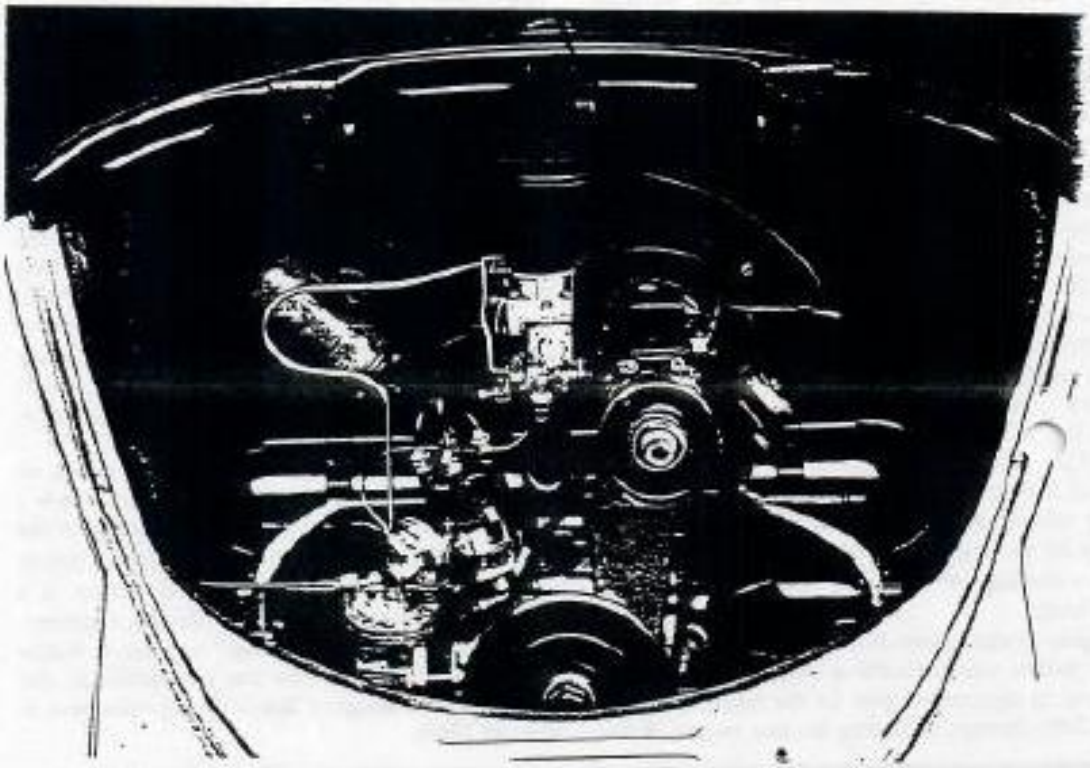
Jan	1089 519
Feb	1117 569
Mar	1146 396
Apr	1173 573
May	1201 428
Jun	1231 530
Jul	1246 318
Aug	1276 742
Sep	1305 701
Oct	1338 159
Nov	1368 326
Dec	1394 119

Simon Parkinson's father bought this Beetle new in April 1957 and clocked up more than 70,000 miles before he sold it in 1963. Nine years later, the Parkinsons bought it back and restored it. The white-wall tyres were particularly popular with American customers.

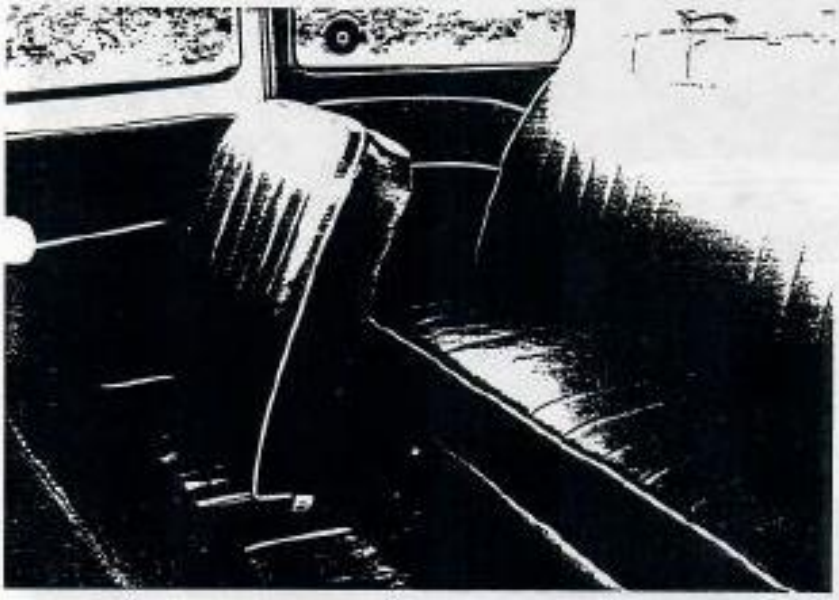
COLOURS

From April 1956

Polar Silver
Black
Coral Red
Diamond Green
Prairie Beige
Horizon Blue



The 30bhp engine had remained virtually unaltered since it was introduced in December 1953, but better sound-proofing material was employed in the compartment from 1956.



In contrast to the Beetle illustrated in the previous model year, this car (above) has red leatherette upholstery, which is much easier to keep clean. The luggage space behind the rear seat (right) can swallow large suitcases, as with this period set that was specially designed to fit the compartment.

PRODUCTION CHANGE 1956

1 084 218 (Jan)
Draught seal at carbon bush in steering column with rubber washer.

1 165 108 (Apr)
Distance from centre of petrol tank to cent neck reduced from 245mm to 215mm.

1 210 230 (Jun)
Vacuum pipe now below throttle control cable (only above air control cable).

1 227 367 (Jun)
Semaphore indicator arms become yellow wit shades on Inca Red cabriolet, yellow shade only August.

1 232 835 (Jul)
Tubeless tyres fitted to 800 vehicles.

1 239 921 (Jul)
Tubeless tyres become standard.

1 243 539 (Jul)
Windscreen wiper motor fitted with "permanent" net (SWF make) in 10,000 vehicles.

1 259 940 (Aug)
Bore for oil pump shaft increased in length from 2 to 25mm.

1 266 678 (Aug)
Timing gear changes from Resitex to aluminium

1 304 254 (Sep)
Transmission oil SAE 80 specified for Octob March, instead of SAE 90.

1 378 864 (Dec)
Clutch: new thrust spring cross-section and clutch sure reduced.

1957

After the traditional factory shutdown in August, a heavily revised Beetle was launched for the 1958 model year, paving the way for a new and altogether more modern era in which safety in particular was soon to become a more prominent issue. To that end, the factory at Wolfsburg waved goodbye to the last of the oval-windowed cars, chassis number 1-0 600439, at the end of July and launched the first of the 'big-window' series.

Apart from replacing the oval glass with a rectangular window which nearly doubled rearward vision, the windscreen – still completely flat at this stage – was also enlarged, a modification achieved by slimming down the A-posts. Whereas 'Ovals' were snug and cosy, the latest offering was bright and airy. Not surprisingly, it was well received by Volkswagen's now exceptionally loyal clientele.

As a direct result of the increased size and altered shape of the rear window, the air-intake louvres for the engine cooling system became less shapely and were shortened considerably. At the same time, the engine lid was redesigned: although the result was pleasing enough, it was less conspicuous, less Beetle-like and much less stylish than the 'W' lids of yesteryear. The cabriolet, which until now had vertical air louvres cut into its engine lid, was modified with horizontal slots which arguably softened the styling for the better. Naturally, the cabriolet's windscreen and rear window were also enlarged. To improve lighting at the rear, spherical bulbs replaced festoon bulbs for the stop, tail and number plate lights.

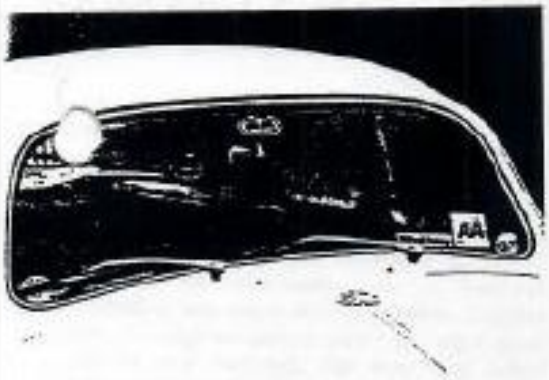
Yet again, the dashboard was completely redesigned: although ergonomically more satisfactory, it was less appealing aesthetically. In short, the 'cosy' factor had been removed to a certain extent, as had a small part of the Beetle's essential character.

The radio speaker was now placed behind a vertically-louvred grille to the left of the speedometer on left-hand-drive cars (to the right for right-hand-drive), while a second grille was sited on the other side of the speedometer for the sake of balance. On Export cars only, a bright moulding strip running horizontally through the centre of the grille was continued across the entire width of the dash panel. The radio was moved to the centre of the dash, higher up than previously. Since a radio was an optional extra, fitting one required the removal of a blanking plate, which was also trimmed with the new moulding. These modifications allowed for a usefully wider glovebox, but this meant that the rather attractive pull-out ashtray of the previous models had to be discarded in favour of a smaller sliding item. Mounted below the radio, it always managed to produce a fearful scraping noise when pulled out or pushed in. The control knobs for the lights and wipers moved to the top of the dash above the radio, while the ignition switch was positioned closer to the driver.

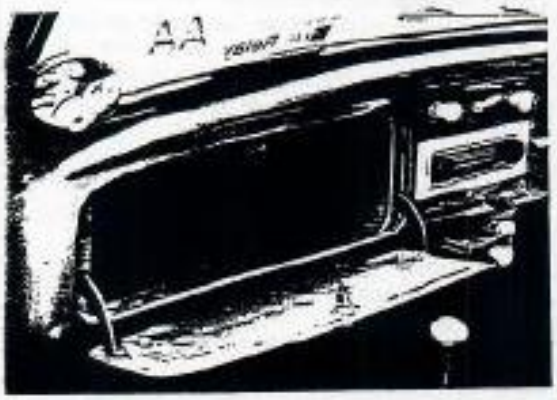
The door and rear side panels were refashioned in

CHASSIS DATING

Jan	1427 291
Feb	1457 750
Mar	1490 537
Apr	1521 753
May	1555 242
Jun	1584 654
July	1600 846
Aug	1637 038
Sep	1671 208
Oct	1709 420
Nov	1742 856
Dec	1774 680



The windscreen was enlarged (far left) by slimming down the A-posts and making the roof shorter at the front. Because the rear window had also been enlarged, the rear view mirror was increased in size. The increased size of the rear window (left) made the cabin brighter, and therefore a little less cosy.



The glovebox was enlarged considerably (far left), the light and windscreen wiper switches were better placed, and the ashtray, which always makes a terrible scraping noise, was placed below the radio. For the first time since October 1952, the dashboard was completely modified (left). The radio speaker grilles were placed either side of the speedometer and, except on the Standard model, bright trim was added.

The 1958 model year saw the arrival of the first of the 'big window' cars, a move which brought the Beetle into its ... age. But ... aphore indicators were retained, which is why this regularly-used car – from a year in which survivors are surprisingly rare – has been updated by owner Ernst Miller with 'bolt-on' flashers. To accommodate the larger glass, the air louvres were shortened and the engine lid was modified.

vinyl rather than a combination of cloth and vinyl as previously, and the driver was treated not only to a larger rear-view mirror but also to a more conventional flat rubber-covered accelerator pedal in place of the roller ball type.

From September 1957, the Beetle also became much quieter, at least from a passenger's point of view, with the introduction of additional sound-proofing material in the rear luggage bay and over the interior surfaces of the rear wheelarches. For restoration purposes, this sound-proofing can cause problems: although the heavy wool materials used are very effective at absorbing engine noise, they are equally good at retaining moisture, with the result that the underlying panels can rot badly.

At the 'business end', the 30bhp engine remained unchanged, but the oil bath air cleaner was modified in shape to become taller and smaller in diameter. The oil cooler was made shorter, and was now brazed instead of soldered.

By this time, Volkswagen of America had been established for just two years, but already Americans were completely sold on the idea of a noisy and cramped car that was almost unimaginably different from their chrome-encrusted V8s. By the time the famous deprecatory advertising campaigns began, the American public no longer needed convincing.

COLOURS

From August 1957
Black
Coral Red
Diamond Grey
Light Bronze
Capri
Fern Blue
Agave

PRODUCTION CHANGES 1957

1 394 163 (Jan)
Heater outlets in front footwells moved back.

1 585 100 (Jul)
Oil cooler to a shorter design and brazed rather t[han] soldered.

1 600 440 (Jul/Aug)
Significant bodywork and interior modifications described in text: windscreen and rear wind[ow] enlarged; distance between wiper arms reduced: la[rger] blades wipe larger area; registration light relocated higher level with light dispersion lens; oil bath cleaner modified, higher but smaller in diameter; pl[astic] bush in steering column 30 per cent smaller (previous synthetic with rubber casing); plastic foam b[oard] between fuel tank and luggage compartment (pr[evi]ously cardboard); engine lid air intake louvres on cabriolet horizontal, previously vertical.

1 649 253 (Sep)
Self-cancelling semaphore indicators introduced; a[ddi]tional sound-proofing for rear luggage bay and wheelarches.

1 676 789 (Oct)
Registration light bulb round instead of festoon ty[pe].

1 708 450 (Oct)
Brake and indicator light bulbs round instead of fes[toon] type.

1958

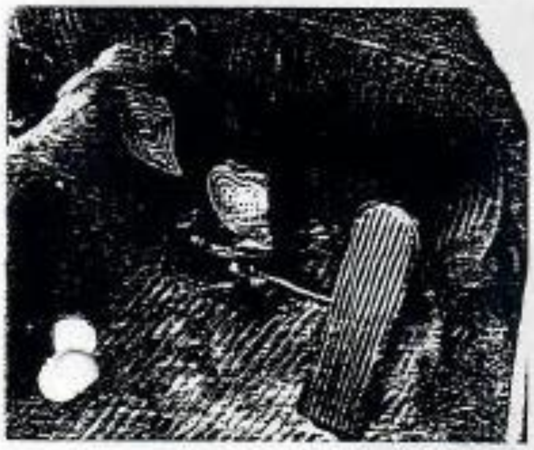
CHASSIS DATING

an	1815 645
eb	1852 703
Mar	1891 481
Apr	1924 948
lay	1962 855
un	2001 110
l	2020 302
g	2060 332
p	2102 988
ct	2149 028
ov	2186 987
Dec	2226 200

Through 1958 and 1959, there were relatively few modifications by Volkswagen's standards, Nordhoff continuing with the idea that change merely for the sake of it was pointless. Customers throughout the world obviously agreed with him because sales continued to soar.

Today, the cars made in this period are not as highly prized as 'Ovals' or 'Splits', but they are, nevertheless, of exceptional quality and have the added advantage of being inexpensive to buy. Spare parts are also more easily obtainable and again cost very little. If you don't feel like stretching your pocket to acquire and run one of the older cars, a '58 or a '59 may well be ideal.

The bodywork remained unchanged and mechanical alterations were confined largely to the gearbox, which gained a very useful magnetic oil drain plug that made an excellent job of gathering up and retaining metallic swarf. The Solex 28 PCI carburettor was fitted with a venturi tube made of nylon instead of alloy, and the spark plug spanner now came with a rubber insert to make servicing a good deal easier.



Among detail changes on the 'big-window' Beetle, the roller ball throttle pedal was at long last replaced by a more conventional flat pedal.

PRODUCTION CHANGES 1958

1 789 807 (Jan)
Oil drain plug in gearbox now magnetic.

1 802 775 (Jan)
Spring for idling screw on 28 PCI carburettor reduced from 13.5mm to 12mm.

1 832 100 (Feb)
Steering gains rubber seal ring at top in place of wax-dipped felt gasket.

1 882 550 (Mar)
Spark plug spanner fitted with rubber sleeve for easier use in servicing.

1 938 979 (May)
Kingpin thrust washer now white plastic, to replace fibre washer.

1 975 105 (Jun)
28 PCI carburettor fitted with nylon venturi instead of aluminium alloy.

COLOURS

rom August 1958
lack
ond Blue
iamond Grey
apri
arnet Red
lightonette
alahari Beige
piter Grey

1959

The Beetle's appearance again remained largely unaltered, but under the skin there were important modifications that would be retained for the car's remaining production life.

The only distinguishing features changed on the outside of the car were new fixed door handles with rectangular push buttons and a new bonnet-mounted emblem depicting Wolfsburg Castle. The latter was redesigned to become, from August, less colourful and simpler, but today these items are just as desirable to the light-fingered brigade.

The Export model's steering wheel received a redesign: although the hub retained its attractive Wolfsburg crest, the two spokes were much more deeply dished and a semi-circular ring was added for operating the horn. Over the years, these horn rings have demonstrated a propensity for snapping (usuall when you are not looking so that everyone who has been near the car in the past 10 years is suspected), but they can easily be replaced, or repaired and rechromed, if necessary.

Front seat passengers were treated to a footrest in the form of a piece of black-painted sheet steel set at a convenient angle, and also to a dished armrest to provide better grip when opening and closing the door. Although still typically firm, the front seats were softened and the backrests were more deeply curved to offer significantly better lateral support under hard cornering.

In the rear, plastic-covered inserts were installed to blank off the gaps under the rear seat between the backbone tunnel and the sills. Apart from tidying up the appearance of the interior, these went a long way to suppressing engine noise inside the cabin. Simple items whose significance is difficult to appreciate until they are removed, the boards make such a big difference that if you take them out while othe restoration work is in progress, it is worth storing them away very carefully.

Further measures to reduce engine noise in the cabin included additional sound-proofing material on the horizontal panel that forms the floor of the luggage well behind the back seat, and bitumen felt applied to the two halves of the floorpan. The latter not only absorbs engine clatter but also damps down with extraordinary effect the racket from stone chippings hitting the underside of the chassis. However, if you are considering a complete restoration of your floorpan, which obviously necessitates the removal of the bitumen, it's not a bad idea to take yourself off to the pub for a couple of hours first – the job is extremely difficult and incomparably messy.

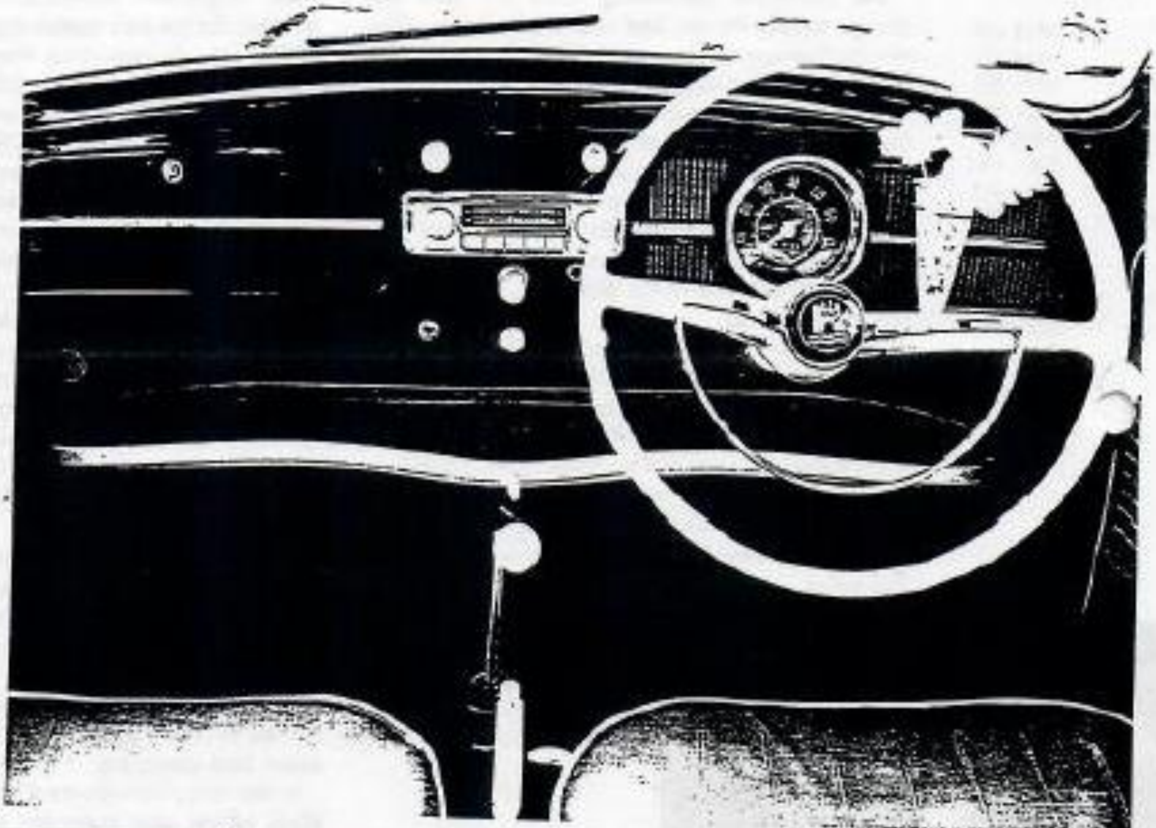
The really important changes in 1959 were made in the handling and roadholding departments. For many years the Beetle had received considerable, but not wholly justified, criticism for its inherent tendency to oversteer. A combination of rear weight bias, swing-axle suspension and narrow rear track

CHASSIS DATING

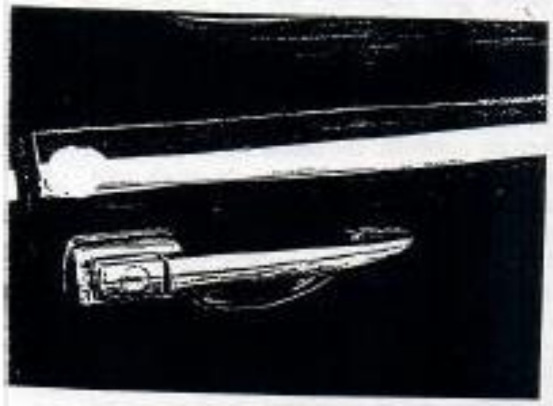
Jan	2 270 326
Feb	2 312 649
Mar	2 355 192
Apr	2 405 422
May	2 447 564
Jun	2 498 431
Jul	2 528 282
Aug	2 574 497
Sep	2 631 447
Oct	2 690 897
Nov	2 745 953
Dec	2 801 613

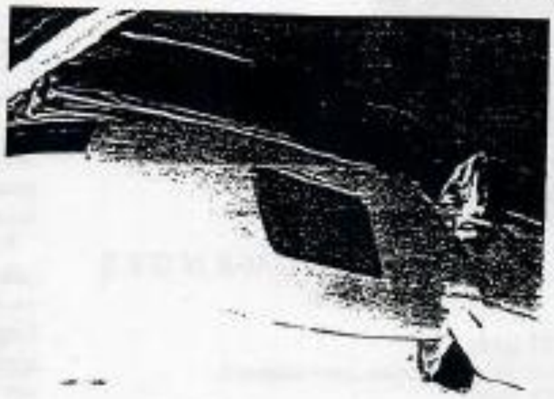
COLOURS

From August 1959
Black
Indian Red
Arena
Flint Grey
Indigo Blue
Jade Green
Mango Green
Ceramic Green



The dashboard layout was unchanged, but the two-spoke steering wheel was redesigned and a semi-circular horn ring was introduced.





Instead of the earlier pull-out style, the new 'safety' door handles that were fixed in position and operated by pressing the rectangular button. Upholstered sun visors fitted replaced the attractive tinted perspex items.

rom August 1959, the onnet-mounted Wolfsburg est (right) was simplified and ecame less colourful. In an fort to reduce sound levels in e cabin, keel boards were nstalled below the rear seat (r right) and bitumen felt s applied to the two halves the floorpan.

1960

had sometimes caught out inexperienced drivers, so, true to form, Volkswagen's engineers went part way to silencing dissent by fitting an anti-roll bar at the front and, at the rear, lowering the pivot point of the swing axles by as much as 15mm by the simple expedient of tilting both the engine and gearbox forward by two degrees.

Both modifications had the effect of making the handling more neutral in normal driving conditions and more predictable on the limit. It is interesting that Bill Bengry, who won the RAC Rally Championship in both 1960 and 1961 driving Beetles, actually removed the front anti-roll bar from his competition cars, insisting that a tail-happy Beetle was quicker through corners.

From May, the connections between the heat exchangers, tailbox and tail pipes were fitted with conical asbestos seals and held in position with clips. From August, the 28 PCI carburettor was modified and the distributor was installed with vacuum advance only.

Thanks to the considerable efforts of Heinz Nordhoff, the Beetle had surpassed all sales expectations. More than 50,000 employees at Wolfsburg were building some 4000 cars per day, but their efforts were still not able to satisfy public demand. Dealers' waiting lists grew even longer, and in America there was even a black market for new Beetles...

PRODUCTION CHANGES 1959

2 245 160 (Jan)
Hub cap removal tool included in tool kit.

2 256 7 (Jan)
Tie rod modified on right-hand-drive cars, length of left rod reduced from 814mm to 807mm, length of right tie rod increased from 318mm to 325mm.

2 303 976 (Feb)
Distributor with vacuum spark timing advance only and carburettor with additional drilling in lower part of body (5000 engines intermittently).

2 409 056 (May)
Modified heater junction box.

2 425 182 (May)
Connection between exhaust boxes, tailbox and tail pipes fitted with conical asbestos seals and secured with clips.

2 528 668 (Aug)
Minor bodywork and interior modifications, as described in text; steering wheel fitted with semi-circular horn rim; ratio of crankshaft pulley/fan drive 1:1.75 (previously 1:2); distance from tip of oil dipstick to upper oil level marking reduced to +10mm from +44mm; anti-roll bar fitted to front suspension.

533 139 (Aug)
Solex 28 PCI carburettor modified and installed with distributor with vacuum advance only.

725 501 (Nov)
Valve stem strengthened at the point where it is welded to the valve head.

The start of a new decade saw a wild escalation in sales figures. Against a social, economic and political background that was so much more buoyant than any other period in human history, the Beetle became a huge success throughout every continent. While European, American and British manufacturers continued to launch completely new models in an attempt to increase sales, Volkswagen retained the Beetle's basic format except that, throughout the 1960s, Wolfsburg's engineering and design teams were kept busier than ever before. To the layman, of course, the Beetle for the 1961 model year was almost indistinguishable from the previous year's cars, but to the increasingly enthusiastic Beetle-buying public the latest offering from Wolfsburg was really a completely different model.

Naturally, the body remained virtually unchanged, but all cars destined for the British and European markets now abandoned semaphore indicators. The B-posts were smoothed out and the Beetle was, at long last, fitted with modern flashing indicators. Although very different from the units fitted to the American Export cars five years earlier, the new indicators were a great improvement from a safety point of view. Mounted on top of the front wings were narrow chrome-plated pods with amber lenses, the whole unit closely resembling a teardrop. At the rear, the indicators were housed in slightly larger stop and tail-light pods, but the lenses were yet to receive a separate amber segment to distinguish the indicators from the two other functions. At the same time, the plastic wing beading and the rubber covers on the running boards were colour-matched to the paintwork.

Inside the car, the ignition switch was fitted with a safety-inspired locking device similar to those found on all modern cars, which demanded that you turn the key back to 'base' in the event of the engine not firing first time. Incidentally, the ignition switch was not moved for the right-hand drive cars, which is why drivers with short arms found themselves having to stretch across the car to turn the key, an inconvenience which continued until the advent of the 12-volt cars in 1967. Another interior change was the inclusion of a soft plastic grab handle fitted to the passenger's side of the dashboard, although perhaps seat belts would have been preferable.

Although the flat-four engine retained a capacity of 1192cc, more power was extracted from it due to several detail changes and an increase in compression ratio from 6.6:1 to 7.0:1. The new engine, which had been introduced in the Type 2 Transporter in May 1959, has very few parts that are interchangeable with the earlier power unit, the modifications including a more rugged crankcase, a stronger crankshaft, a detachable dynamo pedestal, greater spacing of the cylinder barrels and a modified fuel pump drive. The cylinder heads were also redesigned with

CHASSIS DATING

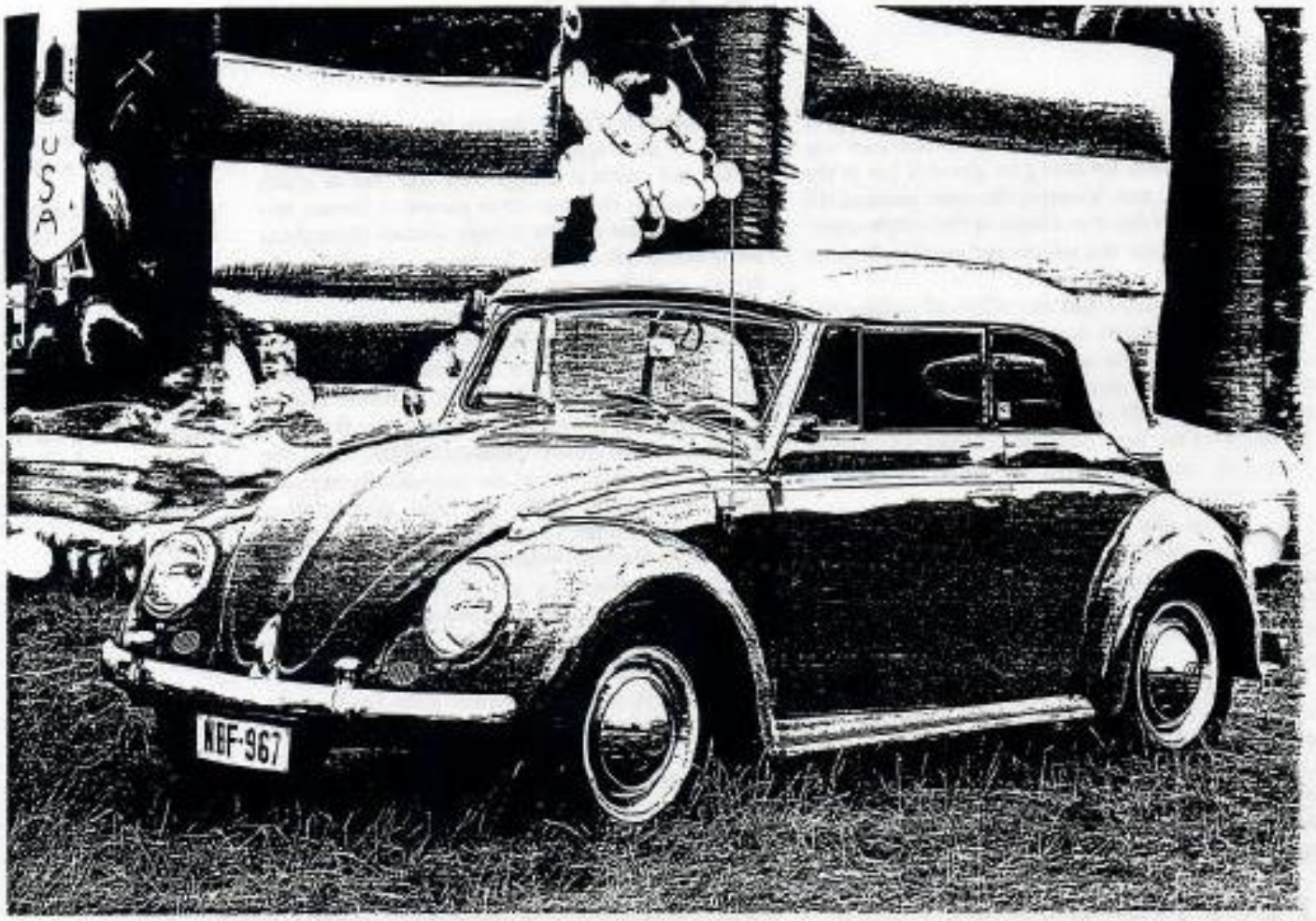
Jan	2 862 052
Feb	2 922 17-
Mar	2 988 36[illegible]
Apr	3 048 36[illegible]
May	3 115 19[illegible]
Jun	3 178 36[illegible]
Jul	3 204 36[illegible]
Aug	3 267 18[illegible]
Sep	3 335 84[illegible]
Oct	3 405 53[illegible]
Nov	3 478 06[illegible]
Dec	3 551 04[illegible]

TECHNICAL OUTLINE

1192cc 34bhp
Capacity 1192cc
Bore and stroke 77×64mm
Compression ratio 7:1
Carburettor Solex 28 PICT up to November 1963, 28 PICT/1 up to July 1970, 30 PICT up to 1978.
Max power 34bhp at 3600rpm
Gear ratios

1st	3.80:1
2nd	2.06:1
3rd	1.32:1
4th	0.89:1

Reverse 3.88:1
Final drive ratio 4.375:1



For the 1961 model year, both the saloon and cabriolet got their semaphore indicators and gained modern flasher units on top of the front wings. This delightful left is owned by Danny Thomas.

wedge-shaped combustion chambers and the valves were placed at a slant.

Bore and stroke remained identical to the older engine, but power output went up from 30bhp to 34bhp. The new engine was also a little quieter thanks to a reduction in the speed of the cooling fan, achieved by using a larger dynamo pulley and a smaller crankshaft pulley. The 34bhp engine also demanded different tappet clearances, modified from .004in on the 30bhp engine to .008in for both inlet and exhaust.

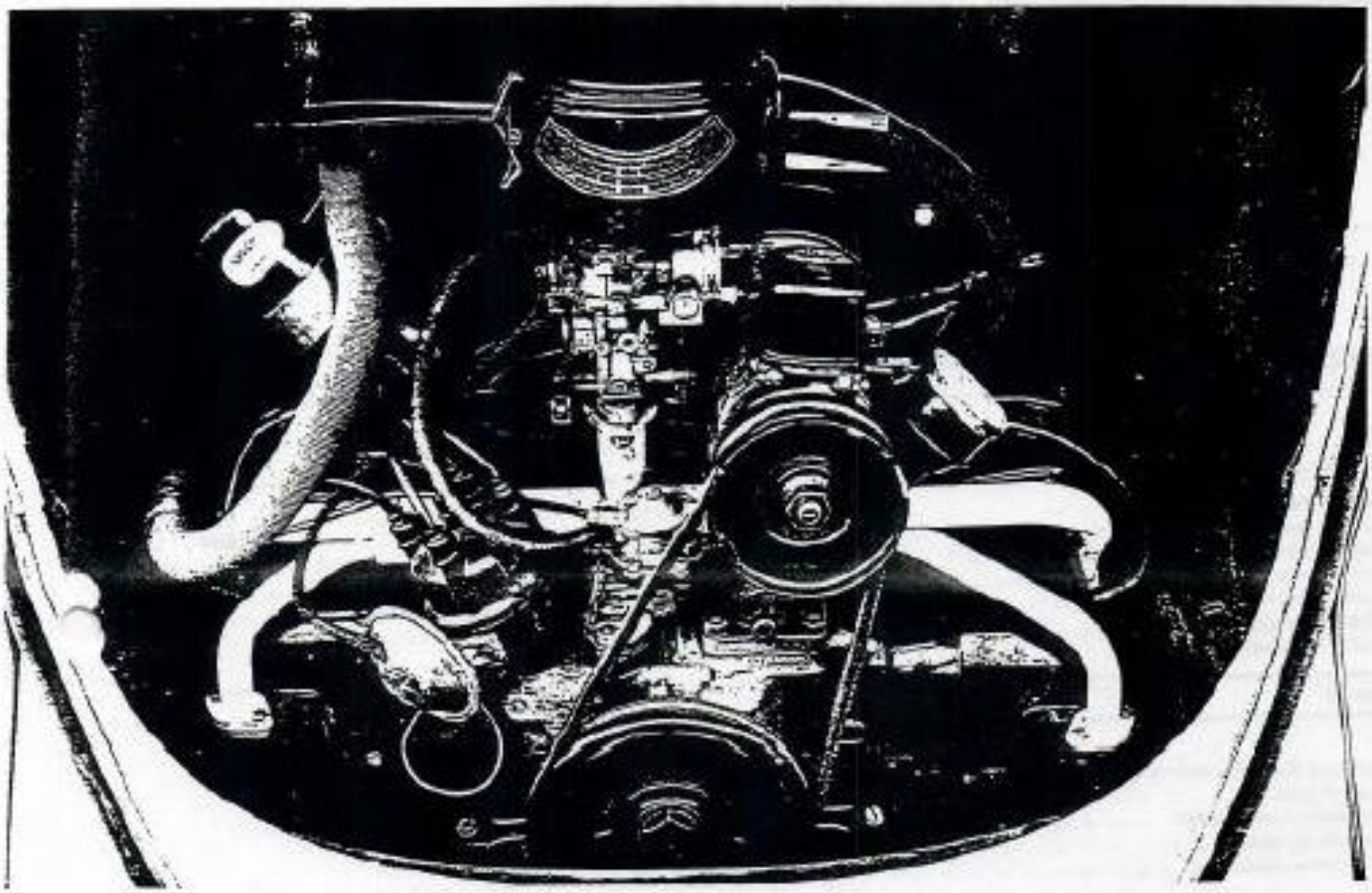
For the 1961 model year, the Solex 28 PCI carburettor was replaced by the 28 PICT, which was fitted with a thermostatically-controlled automatic choke (said by some to have been responsible for increasing the car's fuel consumption) controlled by a bi-metallic spring and heated by a heater element. To improve cold starting further, the left-hand heat exchanger was modified so that a flexible cord-type hose could be fitted to it, the purpose being to utilise warm air from the exchanger and direct it to the air cleaner on top of the carburettor. At the same time, the air cleaner was modified to include an intake fitted with a weighted flap valve in order to feed the carburettor with warm air during cold weather. This modification went some way towards preventing carburettor icing, but did not eradicate the problem altogether.

Again following the lead of the Type 2 Transporter in May 1959, the Beetle was fitted with a new g box. Apart from gaining synchromesh on all forward gears, it had a redesigned one-piece ca (similar to the one employed on the Porsche and revised ratios on third and fourth ge ratios are as follows: first, 3.88:1; second third, 1.32:1; fourth, 0.89:1; reverse, 3.88:1; drive, 4.375:1.

One particularly welcome addition in March a steering damper, which made a real improven to the feel of the Beetle on the road. Exception strong and well-made, a steering damper should a very long time indeed, but a worn item will m its presence felt in no uncertain terms. Repl ments are cheap and easy to fit, a Koni-made being even better than the original if you are lu enough to find one.

The eight-fuse fusebox was removed from the gage compartment behind the dashboard to the rior of the car beneath the dash, and was fitted v a plastic cover.

Mention should be made at this point of the S dard Beetle, which was not fitted with the upr engine in 1961. By August 1961, indeed differe between the Standard and Export models bec particularly pronounced as the former continue be fitted with a crash gearbox and even reta cable brakes, hydraulics not arriving until 1962, 12 years after the Export model was upd



Introduced in August 1960, the revised 1192cc engine was uprated from 30bhp to 34bhp, the Solex 28 PICT carburettor had an automatic choke, and pre-heated air was fed through a tube from the heat exchanger to the air filter to improve engine performance at low revs.

ided to provide real economy motoring, the dard was not fitted with a steering damper or anti-roll bar, and the bumpers, door handles, aps and tail pipes were painted rather than med. Body moulding strips were conspicuously at and a three-spoke steering wheel was fitted ad of the two-spoke version.

ne majority of Standard Beetles were sold in many. They were never officially exported to the S, although there were some private imports and else[illegible]re were negligible. Today, these austere basic cars are particularly coveted by 'vintage' enthusiasts, who claim that they are more representative of a true People's motor. The 'people', however, voted with their pockets, for the Export or de luxe model outsold the Standard vehicle many times over. Interestingly, 30bhp Standard cars tend to be rarer than 30bhp de luxe models for the simple reason that they are a good deal lighter.

ver the years, the Standard model was updated modified, more or less along the same lines as Export Beetle. After 30 October 1964, when it fitted with the synchromesh gearbox, the two were very similar save that the Standard (or 0A as it was known from then on), as its name gests, was more basic in its level of trim.

August 1966, production of the 34bhp 1200 del was temporarily halted although the 1200 ine was available in the 1300 to special order at time. Production of the 1200 resumed in January 1967, and from then on it would be known as 'Ecosonny Beetle'.

PRODUCTION CHANGES 1960

2 921 552 (Feb)
Steering damper introduced.

3 060 711 (May)
Synthetic heater tubes with noise suppressors between body and engine.

3 116 871 (Jun)
Depressions in the spring plate hub to prevent horizontal movement of rear torsion bars.

3 192 507 (Jul)
Flashing indicators fitted to non-US cars; non-repeat ignition/starter switch; passenger grab handle on dashboard; oil pressure switch no longer adjustable; new eight-fuse fusebox with transparent cover now near steering column, previously behind dashboard; windscreen washer combined with wiper switch; headlamps changed from symmetric low beams to asymmetric low beams; 1192cc 30bhp engine replaced by 1192cc 34bhp unit, compression ratio increased from 6.6:1 to 7.0:1; dynamo pedestal now detachable rather than being cast into crankcase; synchromesh on all four forward gears, one-piece gearbox casing; 28 PICT carburettor with automatic choke replaces 28 PCI.

3 335 848 (Oct)
Boge shock absorbers become 35 per cent softer (rear).

3 341 077 (Oct)
Boge shock absorbers become 26 per cent softer (front).

3 405 001 (Oct)
Accelerator pedal mounted higher and rubber cover lengthened at base.

3 503 952 (Dec)
Fichtel & Sachs shock absorbers become 35 per cent softer (rear).

COLOURS

From August 1960
Black
Ruby Red
Gulf Blue
Pearl White
Turquoise
Pastel Blue
Beryl Green

Chapter 7 Transmission. Split casing type

Contents

Specifications

General

Gearbox and final drive main casing	Alloy casing split vertically into two halves.
Number of gears	4 forward, 1 reverse
Synchromesh (where fitted)	Baulk ring
Oil capacity of casing	3.0 litres (5.3 Imp. pints)
Refill quantity required	2.5 litres (4.4 Imp. pints)

Gear Ratios

	Non-synchro	3 speed synchro
1st	3.6 : 1	3.6 : 1
2nd	2.07 : 1	1.94 or 1.88 : 1
3rd	1.25 : 1	1.23 or 1.22 : 1
4th	0.89 : 1	0.82 : 1
Reverse	6.62 : 1	4.63 : 1

Final drive ratio	4.375 : 1
Gear change	Manual, floor mounted lever through remote control mechanical linkage

Torque Wrench Settings

Transmission casing nuts and bolts	14 lb/ft (2.0 mkg) (See text for sequence)
Oil drain plugs	22 - 29 lb/ft (3.0 - 4.0 mkg)
Oil Filler plug	14 lb/ft (2.0 mkg)
Transmission carrier to frame bolts	166 lb/ft (23.0 mkg)
Spring plate bolts/nuts	72 lb/ft (10.0 mkg)
Gear shift cover to carrier nuts	11 lb/ft (1.5 mkg)
Gear carrier to casing nuts	14 lb/ft (2.0 mkg)
Pinion shaft nut (early)	80 - 87 lb/ft (11.0 - 12.0 mkg)
(later - new lock washer)	58 - 65 lb/ft (8.0 - 9.0 mkg)
Input shaft nut	30 - 36 lb/ft (4.0 - 5.0 mkg)
Reverse selector fork screw	14 lb/ft (2.0 mkg)
Selector fork clamp screws	18 lb/ft (2.5 mkg)
Pinion shaft slotted nut (non synchro)	38 lb/ft (5.3 mkg)

1. Transmission - General Description

The basic detail differences between this type of gearbox and the later model are all given in the General Description details of Chapter 6, Section 1.

2. Transmission - Removal and Replacement

The removal and replacement procedures are the same as those described in Chapter 6, Section 2.

3. Transmission - Dismantling

1. The procedures as described for the removal of the whole assembly from the car having been carried out the outer bearings and axle tubes should also have been removed in just the same way as described in Chapter 8. There, however, the similarity stops. It is not possible to remove the axle shafts until after the gear casing has been split.

Chapter 3 Fuel system and carburation

Contents

Specifications

Fuel Pump		
Make and type	Pierburg mechanical	
Delivery rate per min. at 3400 r.p.m.	VW3 300 cc VW7 400 cc	
Delivery pressure (max.)	3.5 lbs. per sq.in.	
Carburettor		
Make	Solex	Solex
Type	28 P.C.I.	28 P.C.I.T. & P.C.I.T.–1
Venturi dia. mm.	21.5	22.5
Main jet	117.5	122.5
Air correction jet	195	130g (incl. emulsion tube)
Pilot jet	g50	g55
Emulsion tube	29	–
Emulsion tube carrier dia. mm.	5.0	–
Float needle valve mm.	1.5	1.5
Float weight grams	5.7	5.7
Accelerator pump capacity cc/stroke	0,4–0,6	1,1–1,4

General Description

The Volkswagen fuel system is conventional in principle.

A fuel tank is mounted in the front luggage compartment and fuel is led to the carburettor by a mechanically operated diaphragm pump which is driven by a push rod actuated by a cam on the distributor drive shaft.

The carburettor is a fixed single choke downdraught type which incorporates a strangler, electrically operated on later models, and an accelerator pump of the diaphragm type. The feed from the accelerator pump can also operate as a subsidiary fuel supply jet under certain conditions. On other, later models there is yet a third fuel supply source in the form of an additional feed from the float chamber into the venturi. This is referred to as the 'power fuel system'. On carburettors fitted with the automatic choke a diaphragm operated push rod overrides the choke spring slightly as soon as there is vacuum on the engine side of the throttle flap.

2. Routine Maintenance

Maintenance is concerned principally with keeping the air filter and fuel filter clean.

Every 1,000 miles or monthly remove the air cleaner and check the oil level in the bath. If it is dirty empty it out, wash out any sludge and refill with oil.

The fuel filter is mounted under the top cover of the pump on those types with a single central cover securing screw. Early and later models have the filter gauze funnel held by a hexagon headed plug in the upper pump body. When removed, both types should be flushed in petrol and blown free of any blockages in the mesh.

3. Air Filter - Removal and Servicing

1. To check the level of the oil in the filter bowl it is necessary only to undo the two clips securing the top cover and lift it off. The oil should be in line with the mark. At the same time the sludge deposits can be ascertained by dipping a suitable probe into the oil. The oil should be no less than 4 - 5 mm deep above any sludge.
2. To remove the sludge the lower half of the unit should be removed from the carburettor.
3. To do this slacken the clip at the base of the cleaner and pull off the air heater and crankcase breather hoses. Lift off the bowl carefully otherwise you may spill oil all over the engine. Empty the contents away and thoroughly flush out the sludge deposits with paraffin. Check the condition of the gasket between the upper and

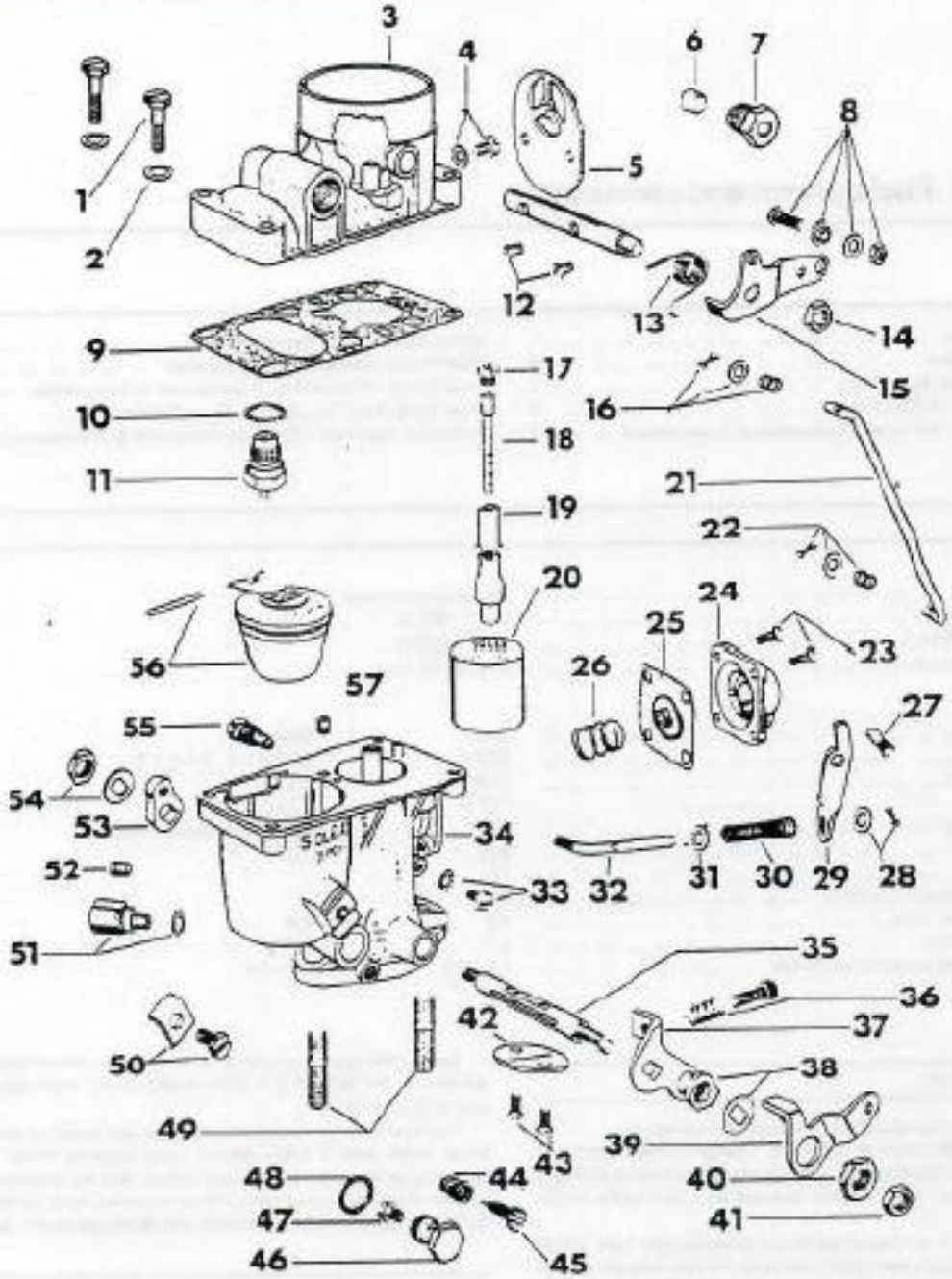


Fig.3.1. SOLEX 28 PCI CARBURETTOR – EXPLODED VIEW

1 Cover screw
2 Washer
3 Cover
4 Securing screw and washer
5 Choke butterfly
6 Petrol pipe olive
7 Petrol pipe union
8 Choke cable connection
9 Gasket
10 Needle valve washer
11 Needle valve
12 Choke butterfly screws
13 Choke spindle return spring
14 Spindle nut
15 Choke lever
16 Connecting rod washer and retaining pin
17 Air correction jet
18 Emulsion tube
19 Emulsion tube support
20 Choke tube
21 Connecting rod
22 Connecting rod washer and retaining pin
23 Cover screws
24 Accelerator pump cover
25 Accelerator pump diaphragm
26 Spring
27 Pump lever pivot pin
28 Washer and split pin
29 Pump lever
30 Return spring
31 Washer
32 Operating rod
33 Securing screw and washer
34 Main body
35 Throttle spindle
36 Throttle stop screw and spring
37 Throttle lever
38 Spindle washer
39 Intermediate lever
40 Spindle nut
41 Lock nut
42 Throttle flap
43 Throttle flap screws
44 Spring
45 Volume control screw
46 Main jet holder
47 Main jet
48 Washer
49 Mounting studs
50 Cable clamp and screw
51 Vacuum pipe (distributor) union
52 Vacuum pipe union olive
53 Intermediate lever
54 Spindle washer and nut
55 Pilot jet
56 Float and pivot
57 Pilot air bleed

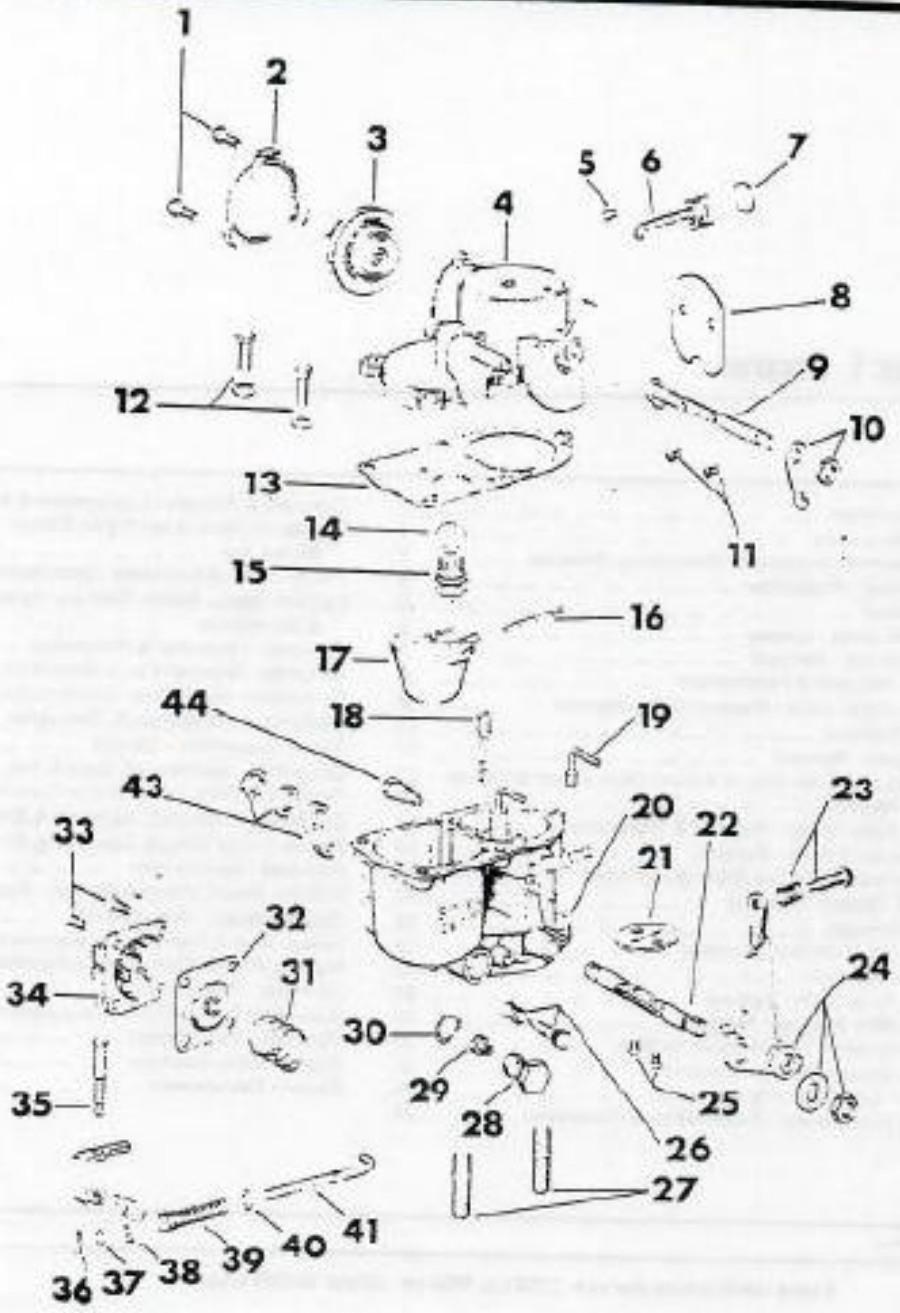


Fig.3.2. SOLEX 28 PICT CARBURETTOR – EXPLODED VIEW

1 Retaining screws
2 Cover retaining ring
3 Automatic choke element
4 Upper body
5 Clip
6 Vacuum piston link
7 Plug
8 Choke butterfly
9 Choke spindle
10 Lever and nut
11 Choke butterfly screws
12 Cover screws
13 Gasket
14 Washer
15 Needle valve
16 Float pivot
17 Float
18 Emulsion tube
19 Accelerator pump discharge
20 Lower body
21 Throttle flap
22 Throttle spindle
23 Throttle stop screw
24 Throttle lever washer and nut
25 Throttle flap screws
26 Volume control screw
27 Mounting studs
28 Main jet carrier
29 Main jet
30 Washer
31 Pump spring
32 Pump diaphragm
33 Pump cover screws
34 Pump cover
35 Pivot pin
36 Split pin
37 Washer
38 Pump lever
39 Spring
40 Washer
41 Pump rod
43 Intermediate lever, washer and nut
44 Pilot jet

Chapter 1 Engine

Contents

Specifications

Engine specifications and data 1192 c.c. 1954 on 30 and 34 DIN b.h.p.

Engine - General	
Type	4 cylinder horizontally opposed flat. Pushrod o.h.v.
Weight	237 lbs. (108 kgs)
Bore	77 mm
Stroke	64 mm
Cubic capacity	1192 c.c.
Compression ratio	30 DIN b.h.p. 6.8:1 34 DIN b.h.p. 7.0:1
Power output	30 DIN b.h.p. at 3400 r.p.m. (up to 1960) 34 DIN b.h.p. at 3600 r.p.m. (1960 on)
Torque (30 DIN b.h.p.)	55.7 ft/lb at 2000 r.p.m.
(34 DIN b.h.p.)	60.76 ft/lb at 2000 r.p.m.
Compression pressure	100 - 128 lb/in^2
Location of No. 1 cylinder	Right hand pair - front
Firing order	1 (R. Front) 4 (L. Rear) 3 (L. Front) 2 (R. Rear)
Engine mountings	Bolted direct to transmission casing 2 bolts, 1 studs
Camshaft and Camshaft Bearings	
Camshaft drive	Lightweight alloy gear direct from crankshaft.
Camshaft bearings - Until 1965	Machined in crankcase
1965 on	Steel backed white metal shells

Camshaft journal diameters	24.99 - 25.00 mm (.9837 - .9842 inch)
Journal/bearing radial clearance	.02 - .12 mm (.0008 - .0047 inch)
End float	.04 - .16 mm (.0016 - .0063 inch)
Gear backlash	.00 - .05 mm (.00 - .0019 inch)

Connecting Rod and Bearings

Type	Steel forging I section shaft
Big end bearings	Three layer thin wall shells
Crankpin (bigend) diameter	54.97 - 54.99 mm (2.164 - 2.1648 inch)
Small end bush	Pressed in steel bush with lead/bronze coating
Undersize big end bearings available	.3, - .25 mm, .50 mm and .75 mm
Crankpin to bearing clearance limits	.02 - .15 mm (.0008 - .006 inch)
Crankpin end float	0.1 - 0.7 mm (.004 - .028 inch)
Gudgeon pin/bush radial clearance limit	.01 - .04 mm (.0004 - .0016 inch)
Gudgeon pin diameter	19.996 - 20.000 mm (.7871 - .7874 inch)
Connecting rod weights - brown/white	487 - 495 grams
grey/black	507 - 515 grams
Maximum crankpin ovality	.03 mm (.0011 inch)

Crankshaft and Main Bearings

Number of bearings	4
Main bearing journal diameter - Nos. 1, 2, & 3	54.97 - 54.99 mm (2.164 - 2.1648 inch)
No. 4	39.98 - 40.00 mm (1.5739 - 1.5748 inch)
Regrind diameters	.25 mm, .50 mm, .75 mm
Bearingshells type - Nos. 1, 3 & 4	Aluminium - lead coated
No. 2	Solit shell, 3 layer steel backed
Journalbearing radial clearance limits - Nos. 1, 3	.04 - .18 mm (.0016 - .007 inch)
No. 2	.03 - .17 mm (.0011 - .0066 inch)
No. 4	.05 - .19 mm (.0019 - .0074 inch)
Crankshaft end float	Taken by flange of No. 1 main bearing and adjusted by shims
End float limits	.07 - .15 mm (.0027 - .006 inch)
Main beiring maximum ovality	.03 mm (.0011 inch)

Crankcase

Main bearing bore diameters - Nos. 1, 2 & 3	65.00 - 65.03 mm (2.559 - 2.5601 inch)
No. 4	50.00 - 50.04 mm (1.9685 - 1.9700 inch)
Oil seal bore diameter (flywheel end)	90.00 - 90.05 mm (3.5433 - 3.5452 inch)
Camshaft bearing bore diameter (direct)	25.02 - 25.12 mm (.9850 - .9889 inch)
(split shells)	27.5 - 27.52 mm (1.0825 - 1.0852 inch)
Oil pump housing bore diameter	70.00 - 70.03 mm (2.756 - 2.758 inch)
Tappet (cam follower) bore diameters	19.00 - 19.05 mm (.748 - .750 inch)

Cylinders

Type	Single barrels - finned - cast iron
Distance between centres	112 mm (4.41 inch)

Cylinder Heads

Type	Aluminium - 1 per pair of cylinders
Port arrangement	Single inlet port per pair of cylinders. One exhaust port for each cylinder.

Gudgeon Pins

Type	Fully floating, machined steel tube retained by circlips
Diameter	19.996 - 20.000 mm (.7871 - .7874 inch)

Lubrication System

Type	Wet sump - pressure and splash
Oil filter	Gauze suction strainer in sump
Sump capacity	2½ Pints (4.4 Imp. pints)
Oil pump type	Twin gear
Oil pressure (SAE 30, 70°C @ 2500 r.p.m.)	42 p.s.i.
Oil pressure warning switch	Comes on between 2.1 - 6.3 p.s.i. (.15 - .45 kg/cm²)
Oil cooler	Pressure fed tube type in fan housing

Oil Pump

Gear/body end clearance (no gasket)	0.1 mm (.004 inch) maximum
Gears backlash	0.0 -0.2 mm (.008 inch)

Oil Pressure Regulating Valve

Spring length loaded at 7.15 kg (17 lbs)	23.6 mm (.928 inch)

Pistons

Type	Light alloy with steel inserts and flat crown
Clearance in cylinder limits	.04 - 0.20 mm (.0015 - .008 inch)
Number of rings	3 - Two compression, one oil control
Ring groove side clearances - Top compression	.07 - .12 mm (.0027 - .0047 inch)
Lower compression	.05 - .10 mm (.0019 - .0039 inch)
Oil control	.03 - .10 mm (.0012 - .0039 inch)
Piston ovenizes available	.2 - .5 mm and 1.00 mm (.020 and .040 inch)
Piston pin bore offset	1.5 mm (.060 inch)

Piston Rings

Top compression ring:	
Thickness	2.5 mm (0.100 inch)
Gap limit	0.30 - 0.90 mm (.012 - .035 inch)
Bearing face	Bevelled, angle facing top of piston
Lower compression ring:	
Thickness	2.5 mm (0.100 inch)
Gap limit	.030 - .090 mm (.012 - .035 inch)
Bearing face	Parallel lower edge cut back
Oil control ring	
Gap	0.25 - 0.95 mm (.010 - .037 inch)

Tappets (Cam Followers)

Type	Cylindrical, flat based
Diameter (early type with pushrod)	14.967 - 15.12 mm (.5893 - .5899 inch)
(later type)	18.96 - 18.89 mm (.7463 - .7471 inch)

Pushrods & Rocker Arms

Pushrod type - (early)	Tube incorporating cam follower
(later)	Tube with hemispherical ends
Length (later type)	272.5 mm
Rocker arm bore size limits (later)	18.00 - 18.04 mm (.7086 - .7093 inch)
Rocker shaft diameter size limits (later)	17.97 - 17.95 mm (.7073 - .7066 inch)

Valves

	30 DIN b.h.p.	34 DIN b.h.p.
Inlet - head diameter	30 mm (1.18 in.)	31.5 mm (1.24 in.)
stem diameter	6.94 mm (.2740 in.)	7.95 mm (.3129 in.)
seat width	1.3 - 1.6 mm (.05 - .06 in.)	1.3 - 1.6 mm (.05 - .06 in.)
seat angle	45°	45°
guide bore diameter	7.00 mm (.2755 in.)	8.00 mm (.3149 in.)
maximum rock in guide	0.8 mm (.031 in.)	0.8 mm (.031 in.)
Exhaust - head diameter	28 mm (1.102 in.)	30.0 mm (1.181 in.)
stem diameter	6.94 mm (.2740 in.)	7.92 mm (.3118 in.)
seat width	1.7 - 2.00 mm (.066 - .08 in.)	1.7 - 2.00 mm (.066 - .08 in.)
seat angle	45°	45°
guide bore diameter	7.00 mm (.2755 in.)	8.00 mm (.3149 in.)
maximum rock in guide	0.8 mm (.031 in.)	0.8 mm (.031 in.)
Seat width correction angles - all valves	Inner 75° Outer 15°	
Timing - inlet opens	2½° BTDC	6° BTDC
inlet closes	37½° ABDC	35½° ABDC
Exhaust opens	37½° BBDC	42½° BBDC
Exhaust closes	2½° ATDC	3° ATDC

Note: 34 b.h.p. figures are the latest models - variations occurred with early versions. Rocker clearances are set at 1 mm (.040 inch) for the purpose of valve timing settings only.

Rocker clearances:

Pre 1960 - 30 DIN b.h.p.	.1 mm (.004 inch) exhaust and inlet
1961 - 65 - 34 DIN b.h.p.	.2 mm (.008 inch) inlet .3 mm (.012 inch) exhaust
1966 on	.1 mm (.004 inch) exhaust and inlet * See Appendix

Note: When the change was made in 1966 stickers indicating the new clearances were fixed to the fanhousings of the engines concerned.

Valve springs

Type	Single coil spring
Loaded length	28 mm @ 33.5 kg (1.1 in. @ 74 lbs) 30 DIN b.h.p. 33.5 mm @ 45 kg (1.31 in @ 96 lbs) 34 DIN b.h.p.

Torque Wrench Settings

Crankshaft pulley nut	33 lb/ft. (4.5 mkg)	
Oil pump nuts	14 lb/ft. (2.0 mkg)	
Oil drain plug	33 lb/ft. (4.5 mkg)	
Oil strainer cover nuts	5 lb/ft. (0.7 mkg)	
Rocker shaft nuts	18 lb/ft. (2.5 mkg)	
Cylinder head nuts 34 DIN b.h.p.	23 lb/ft. (3.2 mkg) See text	
Flywheel screw	217 lb/ft. (30.0 mkg)	
Crankcase nuts and screws M8	14 lb/ft. (2.0 mkg)	34 DIN b.h.p.
Crankcase nuts and screws M12	25 lb/ft. (3.5 mkg)	34 DIN b.h.p.
Connecting rod big end cap nuts/screws	24 lb/ft. (3.3 mkg)	
Engine mounting nuts	22 lb/ft. (3.0 mkg)	
Crankcase nuts and screws M10	22 lb/ft. (3.0 mkg)	30 DIN b.h.p.
Cylinder head nuts 30 DIN b.h.p.	26-27 lb/ft. (3.6-3.8 mkg)	30 DIN b.h.p.

1. Engine - General Description, Changes and Engine Numbers

The Volkswagen Beetle engine is an air-cooled horizontally opposed flat four cylinder design. The short crankshaft runs in aluminium alloy shell bearings located between the two halves of a magnesium alloy crankcase which join vertically. The camshaft runs centrally below the crankshaft and is gear driven from the rear end of the crankshaft. The camshaft is also located between the crankcase halves and in early models the bearings consisted of the crankcase material itself. Later, shell bearings were introduced.

The distributor is driven by a removable shaft from a gear mounted on the rear end of the crankshaft. The same shaft incorporates a cam which operates the fuel pump operating plunger rod.

The gear type oil pump is mounted in the rear of the crankcase, held between the two halves and driven by a horizontal shaft. A tongue on the inner end of the shaft engages in a slot in the end of the camshaft.

The four, finned cylinder barrels are separately mounted and each pair has a common cylinder head containing the valves and rocker gear. The push rods locate in cylindrical flat faced cam followers at the camshaft end and pass through sealed cylindrical tubes clamped between the head and crankcase outside the cylinder barrels. Each rocker cover is held to the head by spring hoops locating in a recess in the cover.

The flywheel is located on the front of the crankshaft by four dowel pegs and secured by a single central bolt which also incorporates needle roller bearings for the gearbox input shaft. The front crankcase oil seal bears on the centre hub land of the flywheel. The rear end of the crankshaft has an oil thrower plate and a helical groove machined in the pulley wheel hub to contain the oil. An oil filter screen is mounted in the bottom centre of the crankcase and the oil suction pipe for the pump comes from the centre of it. There is no other form of oil filter incorporated. The generator, which is mounted on a pedestal above the engine, is driven by a V-belt from the crankshaft pulley. On the forward end of the generator shaft the cooling fan is mounted. This runs in a sheet steel housing which ducts air down to the cylinder barrels.

There is no separate oil sump - the crankcase acting as an oil reservoir of just under 4½ pints.

Engine cooling is regulated by a bellows type thermostat which is mounted in the air flow under the right hand pair of cylinders. This operates a choke ring in the front face of the fan housing, restricting the intake of cold air into the system when the engine is cold. As the engine warms up so the choke flap is opened allowing more cool air to be drawn into the circulation system. On later models the thermostat operates two linked control flaps in the fan housing lower ducting section at left and right.

The car heating system is integral with the engine cooling and is achieved by directing air through ducts which shroud the exhaust pipes. Early models directed air into the heater ducts after it had passed the cylinders. Later on, two separate hoses directed air from the fan housing straight to the heat exchangers - not via the cylinder barrel fins.

The cooling system also incorporates an oil cooler which is a multitube heat exchanger mounted vertically on the crankcase end projecting into the air stream inside the fan housing.

As a guide to some of the main changes made to the engine since 1954 the following should be of interest. It is most important to know your engine and chassis numbers when ordering spares.

1954 on Engine Nos. 696,366 - 3,912,903 30 DIN b.h.p.
Fuel pump mounted below and to the left of the distributor and the generator pedestal is cast as part of the crankcase.
N.B. Nos. 3,400,000-3,580,070 in this series were modified versions used in transporters.

1960 on Engine Nos. 5,000,001 - 9,800,000 34 DIN b.h.p.
Fuel pump mounted to the right of the distributor centrally and the generator pedestal is detachable. Valves were angled in the cylinder heads and separate push rod cam followers were introduced.
N.B. At engine No. 1,326,420 (1963) redesigned cooling and heating arrangements (identified by two large hoses coming out of the fan housing) were introduced. This is the "clean air" system.

When the 1300 and 1500 engines came into production (in 1966 and 1967 respectively) the numbering system was revised and became very complex. It is not intended to detail it here. The chassis number identification is easier to use for determining the mode year (see Page 7).

2. Routine Maintenance

1. At weekly intervals or every 300 miles check the oil level in the crankcase by removing the dipstick, wiping it clean and replacing it and noting the oil level on withdrawing it again. It is important that the car is standing level when this is done as the reservoir is relatively shallow in a Volkswagen. The indicator level mark is much more critical than on cars with a deep sump. Fill up to the level mark but do not overfill. Remember, the Volkswagen engine uses oil, from the day it is new, at a rate of ½ to 2¼ pints per 1,000 miles.
2. Every 3,000 miles undo the oil drain plug when the engine is hot and drain out the oil. Then remove the nuts holding the surrounding plate to the crankcase to remove the oil filter screen. Thoroughly clean this in paraffin or petrol and replace it using two new gaskets and new stud washers (copper). Replace the drain plug with a new washer and fill up once more with 4.4 pints (2.5 litres) of engine oil of the appropriate grade. Note: The 3,000 mile oil change interval is the absolute minimum and if the car is normally driven hard or in hot and dusty conditions or in stop/start heavy traffic conditions a 1,500 mile frequency would be preferable. As the quantity of oil in circulation is relatively small and in general runs at higher

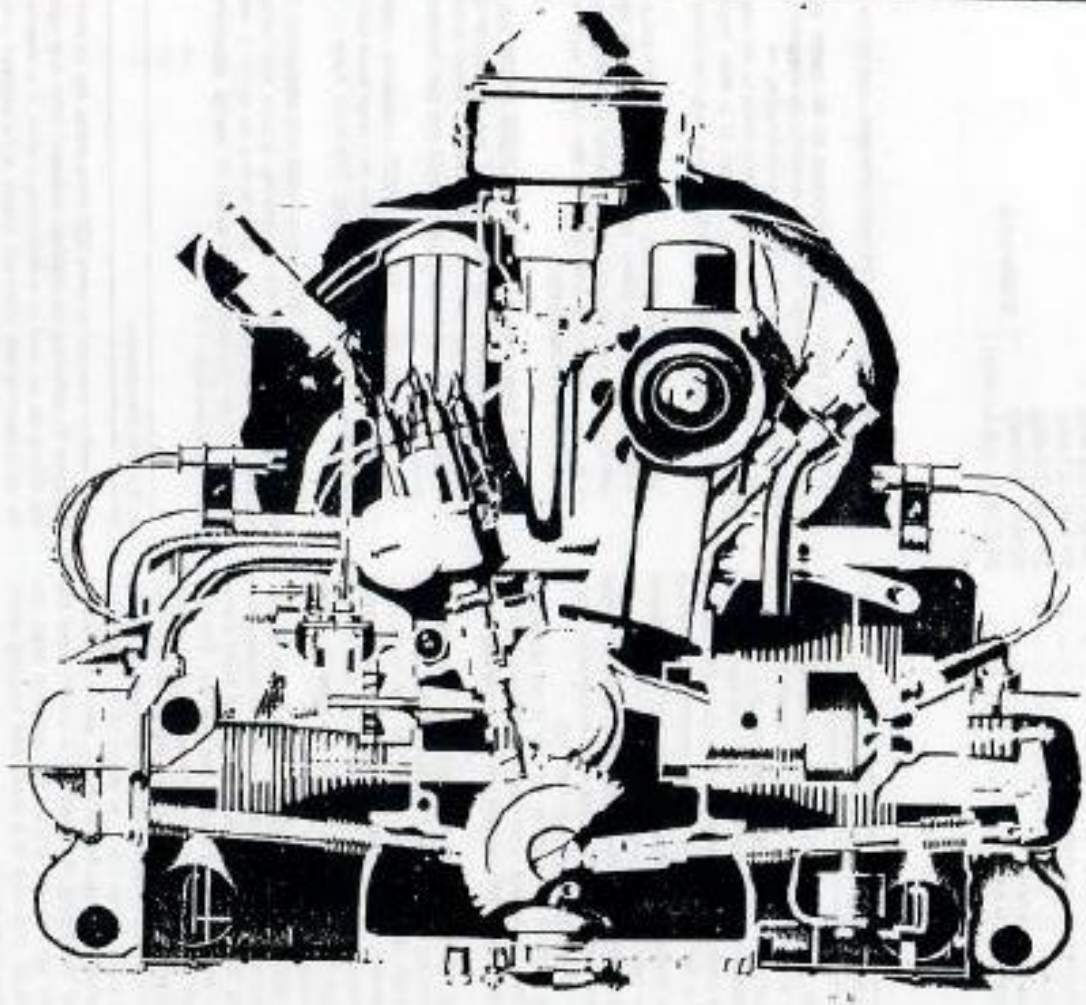


Fig 1.10 CROSS SECTION OF THE 30 BHP BHP ENGINE (EARLY MODEL)
(Compare this with the engine on Page 37)

Chapter 11 Suspension, dampers and steering

Contents

Specifications

Front Suspension

Type	Independent, twin transverse laminated leaf torsion bars each with a trailing arm to the steering knuckle.

Torsion bars

		No. of leaves	Length	Fitting angle
(a)	(Top	8	941.5 mm	49° ± 1°
	(Bottom	6		59° 30' ± 1°
(b)	(Top	10	964 mm	44° ± 30'
	(Bottom	10		39° 30' ± 30'

(a) Up to 1965 inclusive
(b) From 1966 on (Chassis No. 116,000,0001)

Ball joints for steering knuckle (max. wear)

Upper joint vertical play	2.00 mm
Lower ball joint	1.00 mm

Rear Suspension

Type	Independent, single divided transverse solid - torsion bar with trailing spring plate to outer end of each swing axle tube.

Torsion bar

	Length (each side) mm	Diameter mm	Spring plate angle
Up to Chassis No. 929,745 (end 1965)	626	24	13° ± 30'
" " " " 2,232,161 (mid 1959)	626	24	12° ± 30'
" " " " 2,528,667 (end 1960)	626	24	11° ± 30'
" " " " 116,1021297 (end 1966)	552	22	17° 30' ± 50'
1967 on	552	22	18° 30' ± 50'

Steering

Type (a)	Worm and sector
(b)	Worm and roller

(a) Discontinued on standard models as late as 1962 - on others in 1958
(b) Grease packed as opposed to oil filled.

Steering Geometry

Toe-in	30'
Toe-in with 10 kg pressure on wheels	6'
Front wheel camber - straight ahead	30' – 40'

Toe-out on 20° lock (unpressed):		
LHD	left	1° 20'
	right	2° 10'
RHD	left	2° 15'
	right	1° 35'
Rear wheel camber (minimum)	(a)	2° positive
	(b)	0°
	(c)	1° negative

(a) Up to Chassis No. 2,528,667 (1959)
(b) 1959 to 116,1021297 (1966)
(c) 1967 on

Rear wheel toe-out	5'
Dampers	Telescopic, double acting, front and rear
Wheels and Tyres	
Type	Steel disc, bolt fixing
Rim	4J x 15 (standard)

Tyres and Pressures (p.s.i.)

	5,60 – 154 PR		155 SR 15	
	Front	Rear	Front	Rear
Up to two people	16	24	19	27
Fully loaded	17	28	18	27

Torque Wrench Settings

Front Axle

Front damper bolt on side plate	24 lb/ft (3.4 mkg)
Front damper nut on side plate	14 lb/ft (2.0 mkg)
Front damper nut on lower torsion arm	24 lb/ft (3.4 mkg)
Steering ball joint nuts M12	38 lb/ft (6.0 mkg)
" " " M10	33 lb/ft (4.5 mkg)
" " " with split pin	22 lb/ft (3.0 mkg) *
Wheel bearing inner nut	29 lb/ft (4.0 mkg) *
Wheel bearing lock nut	50 lb/ft (7.0 mkg) *
Wheel bearing clamp nut socket screw	9 lb/ft (1.3 mkg) (max.)
Steering damper nut on tie rod	18 lb/ft (2.5 mkg)
Steering damper screw on axle tube	31 lb/ft (4.4 mkg)
Torsion bar setscrew & locknut	33 lb/ft (4.5 mkg)
Link pin clamping screw to torsion arm	32 lb/ft (4.5 mkg)

Rear Axle

Spring plate nuts and bolts	72 lb/ft (10.0 mkg)

* See text for procedure.

1. General Description

The Volkswagen Beetle suspension has always been noted for its strength which is due largely to the use of torsion bars as the method of springing. At the front, two torsion bars - made of leaves clamped together - are mounted across the car, one directly above the other. Each runs in a tube and in the centre it is clamped to the tube. The outer ends fit into the tubular ends of the torsion arms (which support the wheels). These tubular ends of the torsion arms themselves fit inside the axle tubes and pivot on needle roller bearings and plain bushes. The rearward facing torsion arms, two on each side support the king pin carrier (or link) and stub axle. Up till 1965 the torsion bars supported the link on pins running in plain bushes and the steering pivot was a king pin running in plain bushes. After that the function of link pins and king pins was taken over by ball joints, two each side.

A single telescopic hydraulic damper is attached to the lower torsion arm on each side and to a body bracket. An anti-roll bar connects the lower torsion arms on each side also.

The rear axle is in effect incorporated with the gearbox. The axle shafts and their tubes pivot at their inner ends. Two separate torsion bars are used for the rear suspension, so although they are in effect like a single bar clamped in the centre running across the car each half can be removed separately. A centrally mounted splined boss supports the inner ends of each torsion bar and the outer end is splined to the front end of the spring plate. The spring plate trails rearward and the rear end is attached to the outer end of the axle tube. A single double acting hydraulic damper is attached to a bracket which is part of the end of the axle tube.

Steering is by a worm and sector operated drop arm on early models. Later versions use a worm and roller type steering gear.

From the drop arm a single track rod runs directly to the steering knuckle of each front wheel. A hydraulic piston type damper mounted transversely is fitted to absorb transmitted road shock on all but the very early models.

2. Routine Maintenance

1. The front suspension and steering linkage have grease points. The outer ends of the two torsion bars run in needle bearings and there

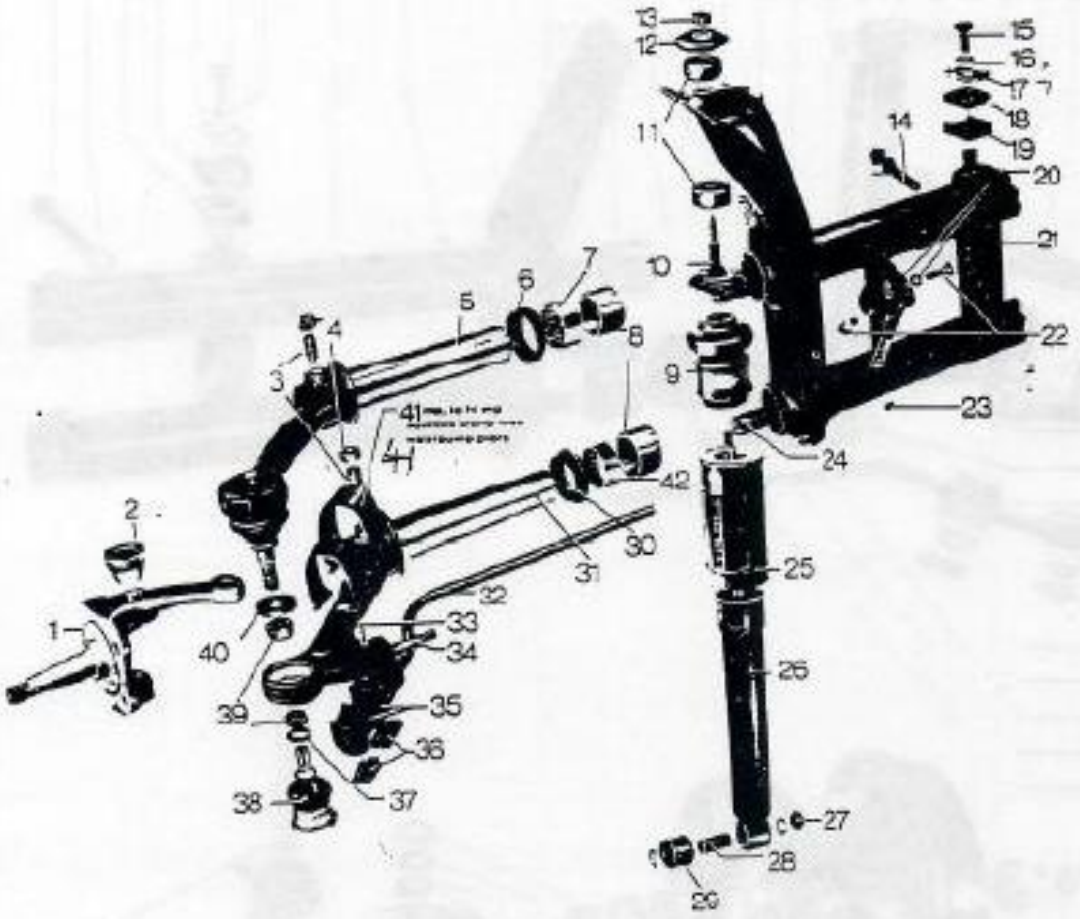


Fig.11.1. FRONT AXLE ASSEMBLY – BALL JOINT TYPE – EXPLODED VIEW

1 Steering knuckle
2 Camber adjuster
3 Grubscrew
4 Nut
5 Upper arm
6 Seal
7 Bearing
8 Bush
9 Buffer
10 Pin
11 Damper ring
12 Plate
13 Nut
14 Bolt
15 Bolt
16 Spring washer
17 Plate
18 Rubber packing
19 Rubber packing
10 Locknut
11 Axle beam
22 Steering stop screw
23 Grease nipple
24 Torsion bar
25 Outer tube
26 Damper
27 Nut
28 Sleeve
29 Bush
30 Seal
31 Lower arm
32 Stabilizer
33 Pin
34 Damper pin
35 Rubber block
36 Clip
37 Washer
38 Ball joint
39 Self-locking nut
40 Washer
41 Clamp
42 Needle bearing

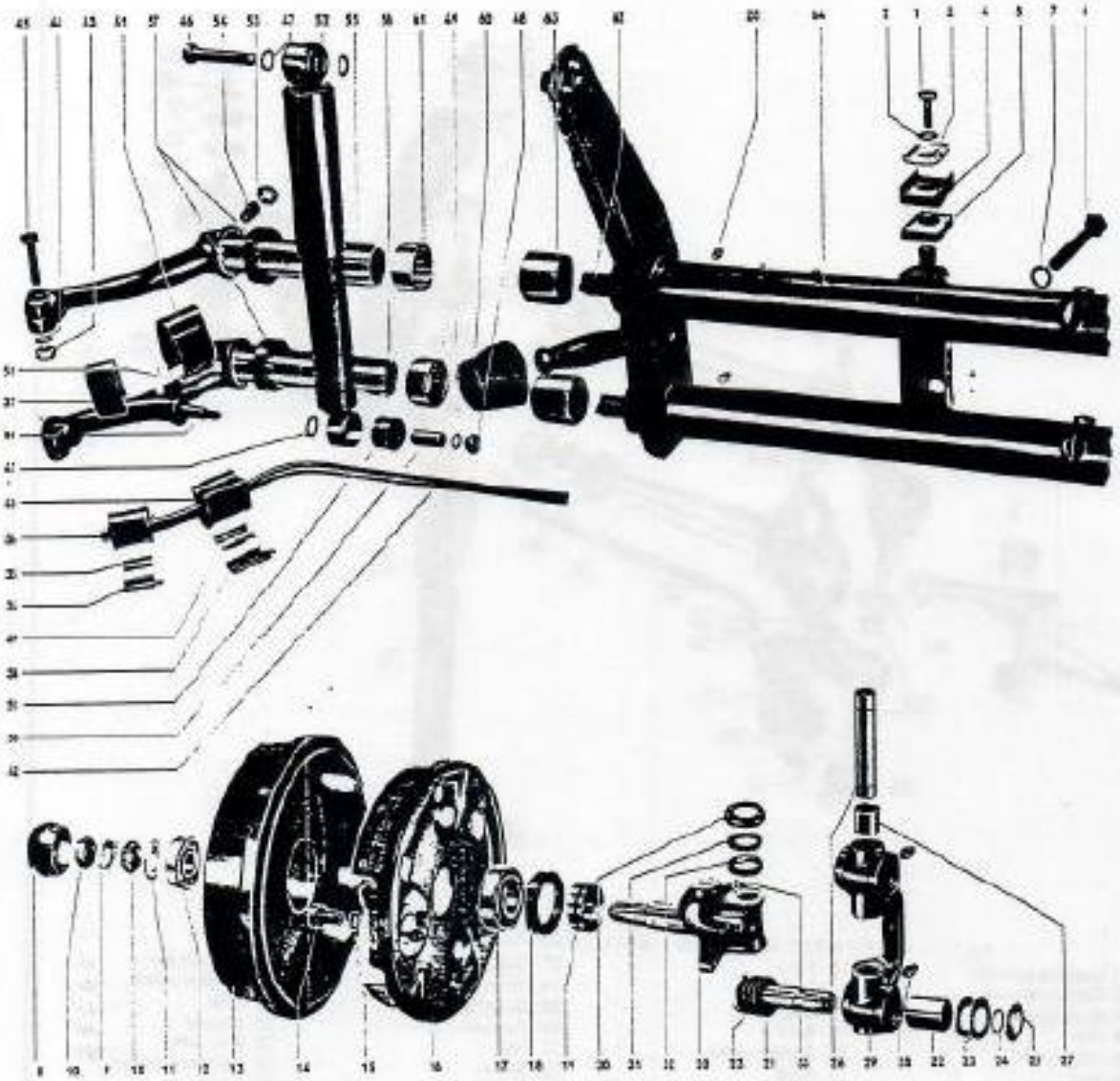


Fig. 11.4. FRONT AXLE ASSEMBLY – LINK PIN TYPE – EXPLODED VIEW

1 Body mounting bolt
2 Washer
3 Plate
4 Rubber packing
5 Rubber packing
6 Axle assembly mounting bolt
7 Spring washer
8 Bearing dust cover
9 Tab washer
10 Adjustment nut
11 Thrust washer
12 Bearing
13 Brake drum
14 Backplate bolt
15 Washer
16 Backplate
17 Bearing
18 Oil seal
19 Spacer
20 Steering knuckle
21 Link pin
22 Bush
23 Shims
24 Seal
25 Seal retainer
26 King pin
27 Bush
28 Grease nipple
29 King pin carrier (link)
30 Cover for thrust washer
31 Thrust washer (plastic)
32 Thrust washer (steel)
33 Dowel pin
34 Clip
35 Plate
36 Rubber mounting
37 Clamp
38 Clip
39 Plate
40 Rubber mounting
41 Clamp
42 Stabiliser bar
43 Link pin pinchbolt nut
44 Washer
45 Link pin pinch bolt
46 Damper mounting bolt
47 Lockwasher
48 Nut
49 Lockwasher
50 Sleeve
51 Rubber bush
52 Damper
53 Locknut
54 Setscrew torsion arm
55 Upper torsion arm
56 Lower torsion arm
57 Seal
58 Dowel pin
59 Damper mounting pin
60 Bump stop
61 Needle bearing
62 Torsion bar (8 leaves)
63 Bush
64 Axle beam (tube)

Fuses (Numberings are from left to right)	
Very early models	6 fuses, 2 near fuel tank for headlamp main beams plus block of 4 under dashboard (as for block 2 below)
Early models	8 fuses in two blocks of four Block 1 (near fuel tank) 1 Main beam R 2 Main beam L and warning light 3 Low beam R 4 Low beam L Block 2 (instrument panel) 1 Interior light and horn 2 Screen wiper, stop lights and indicator lights 3 Parking lights and tail light right 4 Tail light left and number plate light
Later models	Single 8 fuse block (instrument panel) 1 Windscreen wiper, turn signals, horn and stop lights 2 Headlamp main beam left and indicator light 3 Headlamp main beam right 4 Headlamp low beam left 5 Headlamp low beam right 6 Parking lamps left 7 Parking lamps and number plate lamp right 8 Interior light and radio
Torque Wrench Settings	
Generator pulley nut	40 - 47 lb/ft (5.5 - 6.5 mkg)
Fan nut	40 - 47 lb/ft (5.5 - 6.5 mkg)

1. General Description

The system is 6 volt comprising:

A 6 volt battery with negative earth mounted in a carrier under the rear seat.

A.D.C. generator mounted on a pedestal above the engine driven by a belt from the crankshaft pulley. The generator armature shaft also carries the cooling fan at the opposite end.

A voltage regulator and cut-out unit mounted on the generator (or under the back seat in later versions).

A starter motor of the pre-engaged type (that is one which meshes with the flywheel ring gear before the power is switched to the motor).

The battery provides the necessary power storage source for operating the starter and providing the current to operate the lights, accessories and ignition circuit. It is kept in a state of full charge by the generator and the regulator controls the generator output. The control automatically adjusts according to the state of charge of the battery, the electrical load demanded and engine revolutions in such a way that the generator is never overloaded and the battery never over or undercharged. It must be appreciated that indiscriminate additions of electrical accessories can upset this automatic balance.

The starter motor is mounted on the transmission casing. Drive pinion engagement and switching is effected by a solenoid. The pinion is engaged by the solenoid before the same solenoid switches current to the starter motor itself. The pinion is driven through a one-way roller clutch to obviate any damage from over-run.

Due to the 6 volt system the current loadings are double those of 12 volt systems and the cables are consequently heavier.

2. Battery - Removal and Replacement

1. The battery is fixed under the rear seat which must first be lifted up and out. A metal strap and clip hold a cover over the battery and to release the clip the panel on the front edge of the seat needs removing.
2. Take care when removing both strap and cover as it is easy to cause an accidental short circuit with them.
3. Unclamp the battery terminals (earth (or negative) terminal first) and lift the battery out vertically to prevent electrolyte spillage.
4. When replacing the battery see that both terminals and terminal clamps are clean and free from corrosion or deposits of any sort. Smear them with petroleum jelly (not grease) before connection. See also that the insulation on the inside of the cover is intact before replacing it. Never replace the rear seat without the battery cover in position. The springs of the seat can short circuit the terminals and start a fire.

3. Battery - Maintenance and Inspection

1. Normally weekly battery maintenance consists of checking the electrolyte level of each cell to ensure that the separators are covered by ½ inch of electrolyte. If the level has fallen, top up the battery using distilled water only. Do not overfill. If a battery is overfilled or any electrolyte spilled, immediately wipe away the excess as electrolyte attacks and corrodes any metal it comes into contact with very rapidly.
2. As well as keeping the terminals clean and covered with petroleum jelly, the top of the battery, and especially the top of the cells, should be kept clean and dry. This helps prevent corrosion and ensures that the battery does not become partially discharged by leakage through dampness and dirt.
3. Once every three months, remove the battery and inspect the battery tray and battery leads for corrosion (white fluffy deposits on the metal which are brittle to touch). If any corrosion is found, clean off the deposits with ammonia and paint over the clean metal with an anti-rust/anti-acid paint.
4. At the same time inspect the battery case for cracks. If a crack is found, clean and plug it with one of the proprietary compounds marketed by firms, such as Holts, for this purpose. If leakage through the crack has been excessive then it will be necessary to refill the appropriate cell with fresh electrolyte as detailed later. Cracks are

Chapter 10 Electrical system

Contents

Specifications

Battery	
Type	6 volt
Capacity	70 or 88 amp/hours
Earth	Negative
Generator	
Type	Bosch or Volkswagen D.C.
Max. current	45 amps
Mean regulating voltage	7
Nominal output speed	1500 rpm
Commutator minimum diameter	32.8 mm
Segment insulation undercut	0.5 mm
Brush length	End flush with holder (minimum)
Pulley ratio, crankshaft/generator	1: 1.8
* **Regulator**	
Type	Bosch or Volkswagen
* **Starter Motor**	
Type	Bosch or Volkswagen pre-engaged 6 volt
Power	0.5 h.p. nominal

There have been many changes and variatics of starter motors and generators fitted over the years and all types cannot usefully be listed completely here. It could therefore be misleading to quote a few numbers here under the vague definition of 'early' or 'late'. Many are interchangeable - i.e. later types can be fitted to earlier model cars. The main thing to bear in mind is that the generator and regulator are matched. If either of these is faulty it is essential that the replacement is identical with the original. All are marked with serial numbers.

Lights	
Headlamps	Asymmetrical low beam with built in parking light
Headlamp bulb	45/40 w
Parking lamp bulb	4 w
Stop/tail lamp bulb	18/5 w or 21/5 w
Turn indicator lamp bulbs	18 w or 21 w
Rear number plate bulb	10 w festoon
Interior light bulb	10 w festoon
Warning lamp bulbs	2 w or 1.2 w

Chapter 9 Braking system

Contents

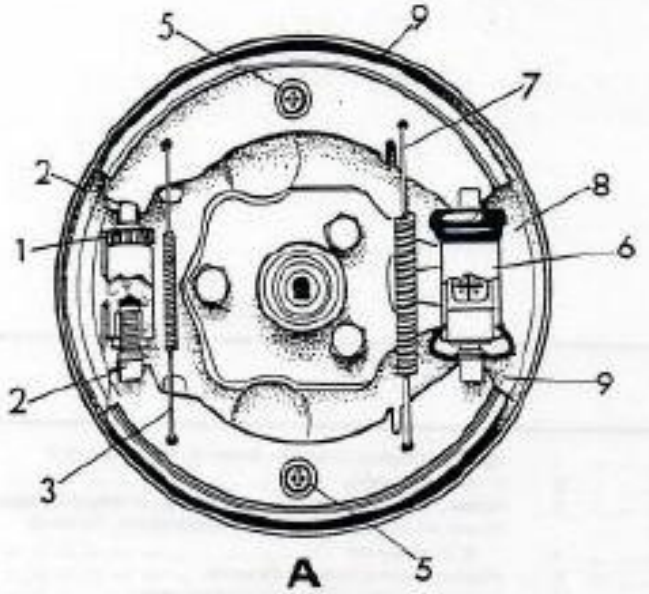
Specifications

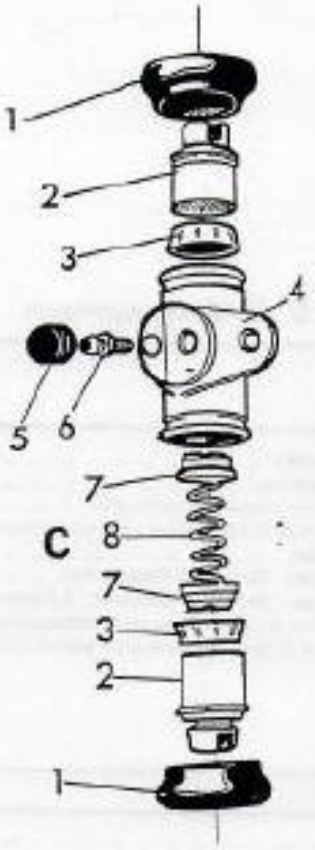
Type	Hydraulically operated shoes to drums front and rear. Handbrake operates a flexible cable to each rear wheel, independently.
Hydraulic Fluid	Volkswagen or Lockheed
Brake Drums	
Internal diameter	230.1 mm (max. 231.5)
Maximum run-out - radial	0.15 mm (.006 inch)
- lateral	0.25 mm (.010 inch)
Brake Linings	
Width	30 or 40 mm, depending on year and model
Thickness (new)	3.8 - 4.0 mm
Master Cylinder	
Bore	17.46 or 19.06 mm
Wheel Cylinders	
Bore (front)	19.05 or 22.20 mm
Bore (rear)	17.44 or 19.05 mm
Torque Wrench Settings	
Master Cylinder to frame bolts	14 - 22 lb/ft (2.0 - 3.0 mkg)
Backplate to steering knuckle screws	36 - 47 lb/ft (5.0 mkg)
Brake hose (flexible) unions	11 - 14 lb/ft (1.5 - 2.0 mkg)
Brake pipe (rigid) unions	11 - 14 lb/ft (1.5 - 2.0 mkg)
Stop light switch	11 - 14 lb/ft (1.5 - 2.0 mkg)

1. General Description

The braking system considered in this book is the hydraulic version. Although the 1200 Standard version of the Beetle was equipped with cable operated brakes as late as 1962 very few of these models ever found their way out of Germany so they are not dealt with here. Hydraulic brakes were fitted on the De Luxe model from 1950 on.

Drum brakes are fitted front and rear and there is a single hydraulic wheel cylinder with two pistons in each drum. This means that there is one leading shoe in each wheel. Each shoe in each drum can be adjusted nearer to the drum by means of a screw type adjuster within the drum.





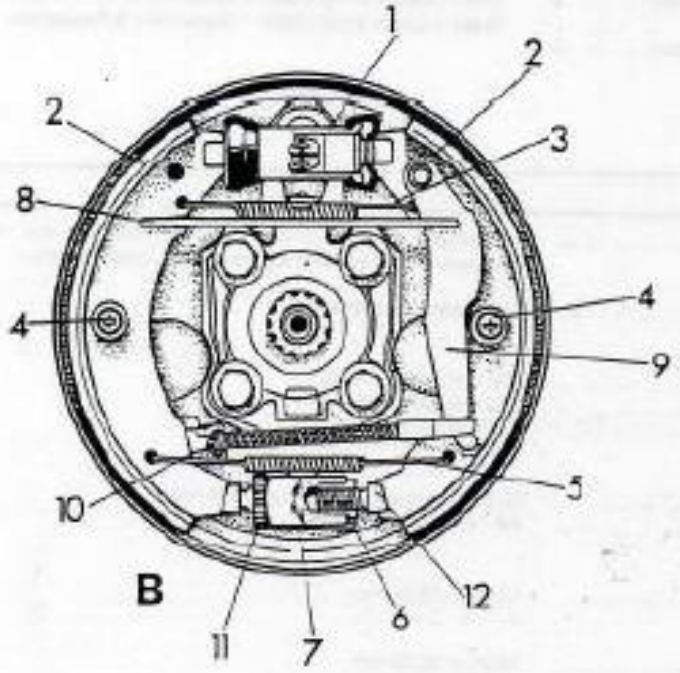


Fig 9.1A FRONT BRAKE ASSEMBLY - COMPONENTS

1 Adjusting wheel
2 Anchor piece
3 Front retractor spring
4 Adjusting screw
5 Steady pin spring and cup retainer
6 Hydraulic cylinder
7 Rear retractor spring
8 Back plate
9 Brake shoe and lining

Fig. 9.1B REAR BRAKE ASSEMBLY - COMPONENTS

1 Hydraulic cylinder
2 Brake shoe and lining
3 Upper retractor spring
4 Steady pin, spring and cup retainer
5 Lower retractor spring
6 Adjusting screw
7 Back plate
8 Connecting plate
9 Handbrake connecting lever
10 Handbrake cable
11 Adjusting wheel
12 Anchor plate

Fig. 9.1C HYDRAULIC WHEEL CYLINDER

1 Dust boot
2 Piston
3 Seal
4 Cylinder
5 Dust cap
6 Bleed nipple
7 Seal expander
8 Expander spring

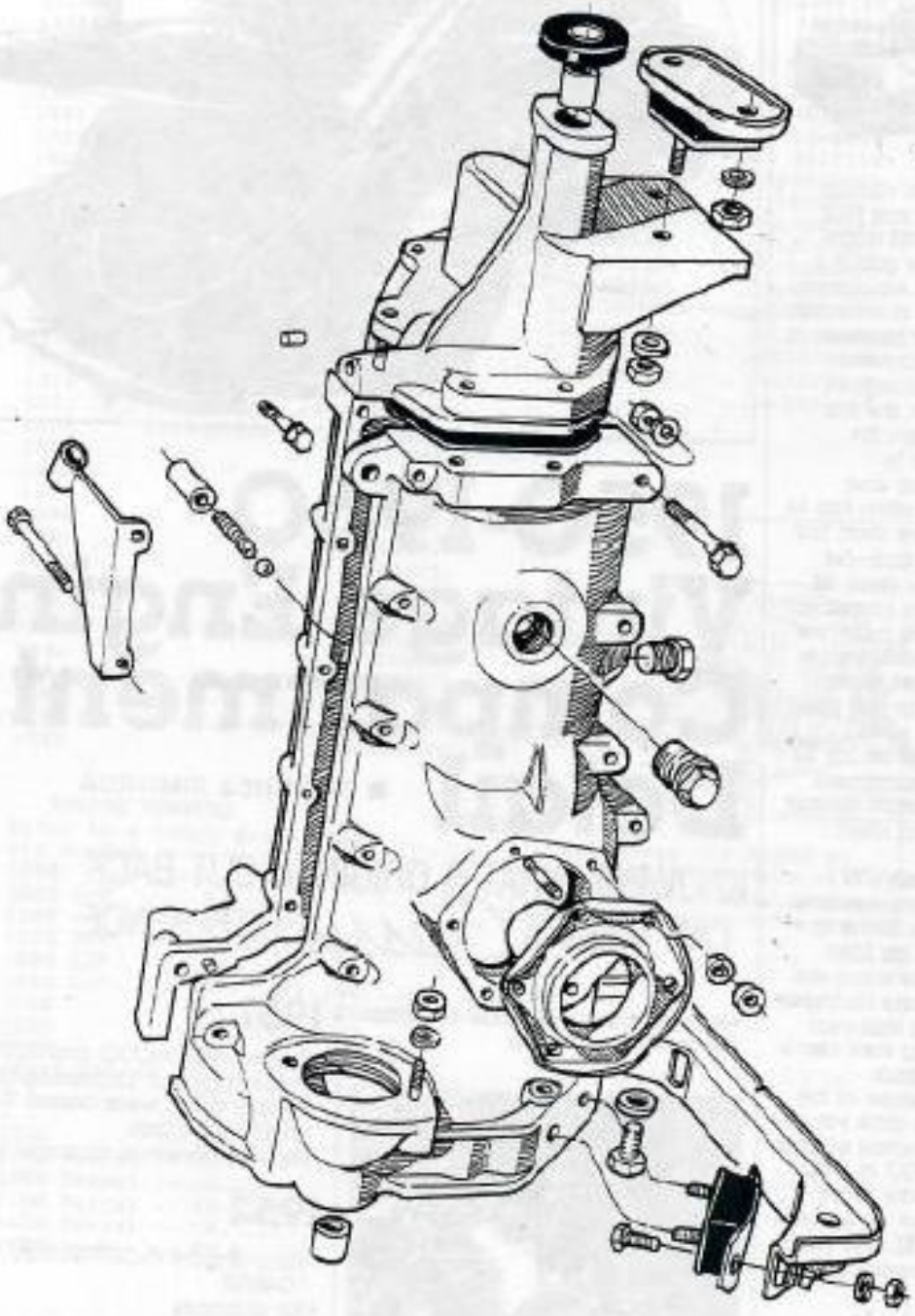


Fig 7.2 GEARBOX AND FINAL DRIVE CASING AND COVERS. EARLY SPLIT TYPE

1950-1960 Vintage Engine Compartment Detail

■ BY BRUCE SIMURDA

KNOWING WHAT'S ORIGINAL OUT BACK CAN MAKE A *Classic* DIFFERENCE

Whether you own a vintage 1950 Deluxe split, late 1953 sunroof oval or 1958 large window, the name of the game is still the same . . . original equipment is where it's at. As many a collector knows, given the choice between a clean runner with replacement parts or a shabby but all-original project of the same year, the car with the OEM parts is often the better value. But in order to determine what's original and what's not the collector often has to take a close look at more than just the interior and exterior trim—he must also look under the deck lid.

A true dyed-in-the-wool classic not only must look the part it must "be" the part. That's true whether you're talking about the bumper, door handle, steering wheel or fuel line. No true collector would even consider a 6mm fuel line on his '52 . . . no way! Engine compartment detailing is just as important as any other part of the car, and often more difficult.

Between 1950 and 1960, VW made many, many refinements to their 1131cc 25hp engine. Some of these changes, such as air filter styles, are obvious, while some are not so clear. Many engine changes were also made during mid-year production runs, making their identification even more difficult.

To help clear away some of the mystery, we're going to give you a rundown on all the external engine changes made from 1950 to 1960, and highlight some of the more important parts to check out. So next time you check out a '52 split, you'll know to check for the seam in the fan housing!

1950

- Engine #1-0169914 thru 1-0265999
- Manual air cooling regulator changed to automatic w/thermostat
- New Solex 26VFIS carb replaces 26VFI (starting with engine #1-0194696 — still no accelerator pump)
- "Coffee Can" air filter replaces "Mushroom" type
- Hot spot added to intake manifold heat riser
- Hand crank starter made an option
- Seamed fan housing

Pre-1950 engine shows that there were many changes early on. This '48 engine featured the early "mushroom" air filter and manual cooling air regulator. Pulley nut was designed for hand starter.

1951

- Engine #1-0266000 thru 1-0379470
- Cases made of aluminum/magnesium alloy, were darker than all aluminum cases
- No other external changes in 1951

1952

- Early Engine #1-0379471 thru 1-0468712
- No changes
- Late engine #1-0468713 thru 1-0519258
- New Solex 28PCI carburetor incorporates accelerator pump
- Seamless fan housing with recessed rear
- Larger 18mm diameter intake manifold with 28mm carb flange
- Heat riser has sharper bend
- Fuel pump inlet and outlet pipes reduced from 6mm. to 6mm.

Please feel free to ring and ask if you have an enquiry re a chassis, gearbox or engine number. We cannot be as precise as we would like in the available space.

YEAR	TYPE 1	TYPE 2	TYPE 3	KG T1	KG T3
1952	1-428156	20-036112			
1953	1-454951	20-047102			
1954	1-781884	20-119604			
1955	1-929746	20-169716		1-929716	
1956	1394119	223217		1394119	
1957	1600440	313209		1649253	
1958	2226206	374811		2226206	
1959	2801613	461506		2528668	
1960	3192607	469506		3192607	
1961	4010995	802986	000001	4010995	00269
1962	4846036	1046063	066740	4846036	138774
1963	5677119	1144282	221975	5677119	221975
1964	115000001	215036651	315000001	145000001	345000001
1965	116000001	216000001	316000001	146000001	346000001
1966	117000001	217000001	317000001	147000001	347000001
1967	118000001	217148459	318000001	148000001	348000001
1968	119000001	218000001	319000001	149000001	348500000
1969	1191200000	219000001	319500001	149120000	349500000
1970	1112000001	2102000001	3102000001	1403100000	
1971	1113200000	2112000001	3112000001	1413100000	
1972	1122000001	2122000001	3122000001	1423200000	
1973	1132000001	2132000001	3132000001	1433200000	
1974	1142000001	2142300000		1442999600	
1975	1152000001	2152000001			
1976	1562000001	2162000001			
1977		2172000001			
1978		2182000001			
1979		2192000001			
1980		24A0070410			
1981		24B095074			
1982		24C069131			
1983		24D062765			
1984		24E081151			
1985		24F175000			
1986		24G000001			
1987		24H000001			
1988		24J000001			
1989		24K000001			
1990		24L000001			

Tech Hint

Check Hoses for leaks at arrowed points. Leaks will deprive the engine of required cooling.

ENGINE NUMBERS

Below is a rough guide only

Air Cooled

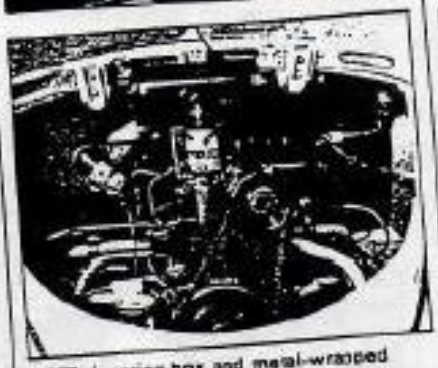
1200	:- D..,.
1300 S/P	:- F..,E..,
1300 D/P	:- AB..,AR..,
1500 S/P	:- H..,L..,B..,
1600 S/P	:- C..,E..,
1600 D/P	:- AD..,AF..,AE..,AH..,AK..,AS..,AJ..,
1700	:- CR..,CA..,CE..,CD..,
1800	:- ED..,AP..,AH..,
2000	:- GE..,CJ..,CD..,

Water Cooled

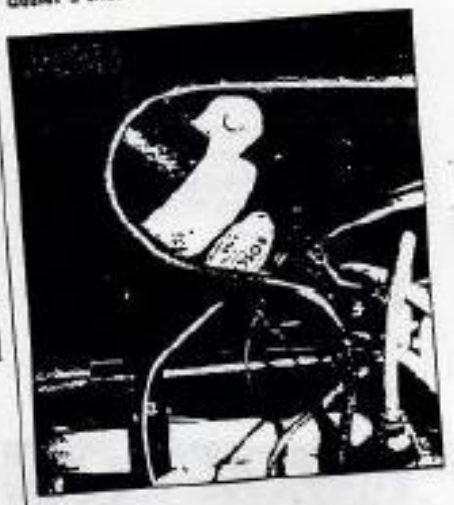
1.9	:- DH..,DF..,DG..,GH..,GW..,
2.1	:- NV..,DJ..,FR..,SR..,
1300	:- ZA..,ZF..,YJ..,
1500 Petrol	:- ZB..,ZC..,
1500 Diesel	:- CK..,
1600 Petrol	:- FN..,FN..,FS..,FV..,FR..,YP..,
1600 Diesel	:- CK..,JK..,CY..,JK..,
1800	:- DX..,

ABOVE, early manual cooling air regulator was changed to fully automatic system in 1950. RIGHT, center-seamed fan housing is a real collector's piece, and was replaced in mid-1952 with the modern seamless unit which was spot-welded together on recess along front edge.

ABOVE, 1950 engine was first to have larger "coffee can" air filter, as well as aluminum "hot spot" on intake manifold to aid fuel atomization. BELOW, interestingly enough, the identification label on the coil was purposely installed upside down so it could be easily read while standing on the dealer's shelf!



LEFT, junction box and metal-wrapped wiring was OEM up until about 1951; braided generator wires were also OEM. ABOVE, 1952 engine was first to add accelerator pump to carburetor; carb size increased from 26mm to 28mm.



1953

- Early engine #1-0510269 thru 1-0555112 (last engine in a split window)
- Late engine #1-0561113 (first engine in an oval window) thru 1-0695281 (last 1131cc 25hp engine)
- No external changes

1954

- Early engine #1-0695282 thru 1-0849904 (6.1:1 compression, 30hp)
- Late engine #1-0849905 thru 1-0945526 (6.6:1 compression, 36hp)
- Larger 1192cc displacement (bore increased from 75mm to 77mm)
- New crank pulley
- New distributor with vacuum and centrifugal advance
- Manifold hot spot relocated to down pipe directly under carburetor
- Oil bath air filter with top clip-strap now standard
- Modified 28 PCI carburetor

1955

- Engine #1-0945527 thru 1-0927745
- New intake manifold w/18mm heat risers, hot spot relocated to horizontal pipe (from engine #1-1038409)
- New air cleaner with two clips installed mid-year
- U.S. Beetles received new muffler with twin tail pipes (from chassis #1-086985[illegible])

1956

- Engine #1-1120615 thru 1495945 (engine type prefix dropped at #277348)
- New oil filler pipe with separate cap
- New balanced Bosch generator/cooling fan (three versions: U9, U7 and U21)
- New generator pulley with two slots instead of four
- Smaller 21mm generator pulley nut
- New Bosch RS/TAA 160/6/1

- New fuel pump w/dome shape or inlet flange

Later 36hp fan housing, without seam. Metal plug wire tubes were used to [illegible]

JULY 1989

1950-1960 Vintage Engine Compartment Detail

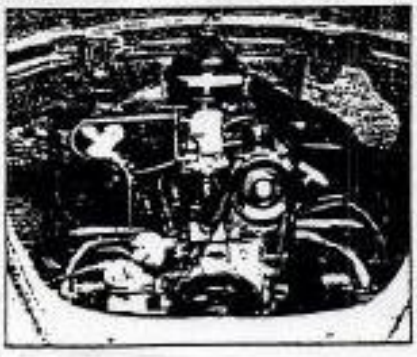
1957

- Engine #14595946 thru 1937449 (the last engine in an oval window)
- New intake manifold with larger 20mm diameter (up from 18mm) and 2mm thick pipes leading to heat risers (from engine #1718770)
- New oil strainer

1958

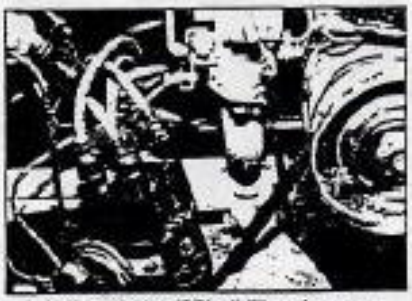
- Engine #1937450 (first engine in larger window) thru 2449249
- No external changes

ABOVE, manifold hot spot was introduced in '50, moved to down pipe right below carb in '54 and returned to horizontal in '56. BELOW, oil filler with separate cap was introduced in '56.

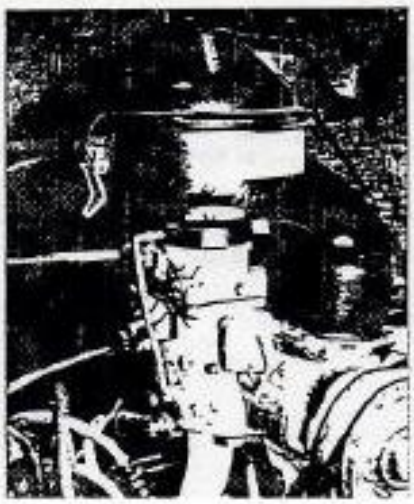


1959

- Engine #3440250 (approx.) thru 3072319
- Radio suppression equipment added to ignition system (suppressed plug wires, connectors and rotor)
- New fuel pump with internal fuel filter on inlet side (from engine #2575068)
- New zinc-coated muffler used modern two-piece clamps with asbestos and metal rings
- New fan housing with rubber grommets to support plug wires instead of metal tubes and clamps (from engine #2938464)

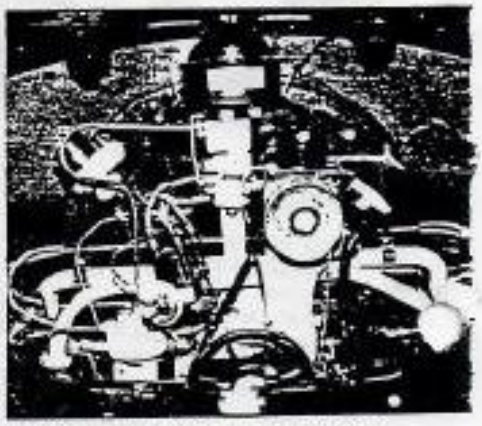


ABOVE, early (to '55) oil filler pipe was secured by a clip. Large hold-down nut on generator pulley was used until '56. BELOW, this 1960 engine looks much like the one we're familiar with today.



1960

- Engine #3072320 thru 3192506
- Powertrain mounted on 2° lower inclination for lower center of gravity and better handling
- New dip stick with relocated oil level marks to account for different engine angle was painted red to identify model year
- New crank pulley
- Oil drain plug moved from bottom of crankcase to center of oil strainer plate
- New muffler with offset pipes to account for changed engine angle



ABOVE, this same '56 includes the later-style balanced generator pulley and two-clip air cleaner. Note that the fuel pump is later model with built-in filter.

LEFT, oil bath air cleaner became standard in '54. Early units only had one clip; two-clip version was mid-'56 update. ABOVE, metal wire tubes were replaced with these rubber subsoil grommets in '59, for radio noise suppression.