Luxclassics

MERCEDES-BENZ 190SL

A pictorial retrospective of the complete restoration

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MERCEDES-BENZ 190SL

RESTORATION IS ALL ABOUT CHOICES – INDIVIDUAL DECISIONS INFLUENCED BY EXPERT ADVICE, AN EYE FOR DETAIL, HISTORY AND AN ARTISTIC APPRECIATION OF FORM AND DESIGN. RESTORING A CLASSIC CAR IS, WE BELIEVE, LIKE RESTORING A PIECE OF ART – A COMPLEX MOVING SCULPTURE.

The object of any restoration is to return a vehicle to its former glory. Whether that be to original factory specification, upgraded for an improved driving experience or simply rejuvenated to reflect the owner's personal tastes, the process ensures that structurally and mechanically it is as good as, if not better, than when it left the factory. Naturally in all cases function should prevail over form.

With every restoration, Parry Chana with LuxClassics strive for excellence, but principally we aim to achieve our customers vision whilst managing and meeting their expectations. We pour thousands of hour of craftsmanship, skill and enthusiasm into every project – this restoration journal documents the process from start to finish.

Parry Chana – LuxClassics

01 | OVERVIEW MERCEDES-BENZ 190SL

The Mercedes-Benz 190SL and the 300SL made history at the New York International Motor Sports Show in February 1954 as the first new production Mercedes to be unveiled outside Germany. It was no coincidence that New York was selected as the stage for the launch of the first two SL models. An American importer, Max Hoffman, had intensively promoted the design and production of the two new sports car models, adopting in historical terms a role similar to that of Emil Jellinek, a major customer of Gottelieb Damiler, who had driven the development of the first Mercedes of 1901.

On the Mercedes-Benz motor show stand in New York, the silver liveried prototype of the 190SL had been positioned between its big brother, the 300SL, and a Mercedes 180 Ponton, looking somewhat lost and inconspicuous. While the Gullwing had already made a name for itself in sports car racing in 1952, the 190's genes clearly stemmed from the modular construction kit of the much more leisurely three-box bodied sedans. It was not meant to be a thoroughbred sports car, but rather a sporty, elegant two-seater touring. The impression given by the 190SL along side the bigger 300SL was neat, sporty and with dashing lines. This was the trait of Mercedes designers Karl Wilfret and Walter Hacket. The statistics tell their own tale as 25,881 units were produced in Sindelfingen between May 1955 and February 1963 - it was a success for Mercedes-Benz.

It was not until the Geneva Spring Motor Show in 1955 that the final production form was displayed. It was available as a roadster with soft top or in coupe form initially with a small rear window hard top (later changed to the elegant wrap round large rear window providing more rearward visibility). The soft top however did not get the same treatment and remained with the small window like the earlier hardtop. Either a roadster could be ordered with a hardtop or a coupe could be ordered with a soft top.

Its engine had four in-line cylinders with a chain driven overhead camshaft and two side draft Solex 44PHH carburetors, delivering a respectable 108 bhp for that era. The body was a monocoque design, welded to the shortened chassis of the type 180 saloon. A racing version with aluminium doors and a small windscreen was never produced although these parts could be ordered from the Factory for weekend racing. A number of discrete changes were made throughout the production run.

02 | BRIEF HISTORY OF THIS VEHICLE

Dr Niemann and Heidbrink from the Mercedes-Benz Classic Centre, Stuttgart, confirmed that this vehicle was assembled in their Sindelfingen plant, Germany, and delivered to the customer through Mercedes-Benz Denmark on 21st September 1960. It was built as a left hand drive coupe with soft top and in European specification. The only option documented on the data card supplied by the Classics Centre is option code 55 128/1 'Soft Top for Coupe supplied loose'. The chassis number confirms that this is a left hand drive 190SL and that it was built as a Coupe.

It is not known when the vehicle was exported out of Denmark as the vehicle was then discovered in Los Angles, USA, where it was commissioned for a full restoration sometime around 1980 with Sherman Oaks Classics, a Mercedes-Benz restoration shop. The bodywork had a colour change to DB 040 'Schwarz' (black) by a previous owner. The 190SL was in need of serious work, to rectify the inevitable deterioration that accumulates after many years of use so the car was taken off the road. The then owner therefore commenced a full restoration and commissioned Sherman Oaks Classics to strip the car. In its stripped state the owner then requested Sherman Oaks Classics to store the car, until such time as he was able to continue the restoration. In 1990 the owner sold the 190SL to Sherman Oaks Classics.

In July 1998 the car was brought over to the UK where again it was stored for many years before it was re-commissioned for restoration. This was completed by May 2010 and the 190SL was back on the road after almost 30 years in a stripped state. Since restoration the vehicle attended major and local Mercedes-Benz UK Club events and has covered some trouble free 1,900 miles.

We are delighted to report that our efforts went rewarded at the highlight of one of these trips, August 2010 Mercedes-Benz UK Club's SL Day at Sandringham where out of over 200 Mercedes-Benz SL's this was awarded 'BEST OF SHOW'.

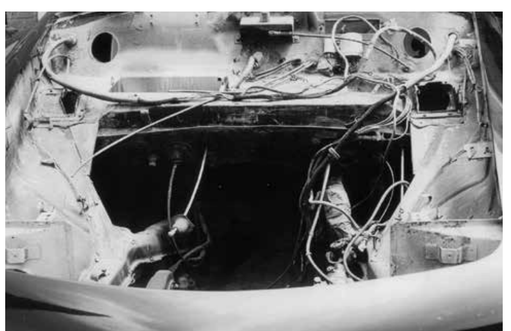
03 | STRIP & INITIAL ASSESSMENT

The 190SL is one of the earliest cars to be built in the 'monocoque' or 'unit body' design. With the exception of the rocker panels, which are screw on, the steel body panels, frame and floors are welded and nailed with special twist nails and held together to form a very strong single unit. The doors, bonnet and boot are aluminium together with the 'A' and 'B' posts and dash cowl and dash. The aluminium parts will generally not need to be replaced but all of the outer body panels are made of steel and may need to be repaired or replaced. It was fortunate that with the exception of one or two minor areas there was virtually no rust on the body panels. These were however, in places an inch thick in body filler.

The first thing to do is to carefully evaluate the car for signs of wear and tear, serious or hidden damage, non originality etc. As any issues arise, they are documented and photographed. At the same time research begins to determine what items were original to that particular model and year, what replacement parts are readily available, and what sorts of materials will be required.

Next stage of the strip is to remove the following parts:

- *Convertible top, interior trim and door glass including winder mechanism & locks*
- *Front windscreen and frame*
- *Steering & steering column, dash, gauges & switches, pedals & hand brake*
- *False floors & electrical looms*
- *Front grill, bumpers, chrome trim and light fittings*



- *Fuel tank & lines, brake lines & master cylinder*
- *Air filter & air plenum chamber, Solex carburetors, exhaust manifold & inlet manifold*
- *Engine ancillary components - heater units, radiator, battery, regulator, fuel filter etc*
- *Engine & transmission*
- *Steering box & remaining wiring loom in engine bay*
- *Front subframe*
- *Rear swing axle*
- *Pedal shaft assembly*
- *Propshaft*

These components are stored for later assessment. It is also worth noting that all screws, bolts, fasteners clamps removed with these were retained and will be reused where usable. These will be later bead blasted and correctly plated. Reference to these processes and in aid of assembly we follow the Mercedes-Benz manual for standard parts or DIN book (Deutsches Institut fuer Nomung), spare parts manual (Edition 'D' for this particular year) and the Mercedes Service manuals (Model 190 Passenger Cars & 190SL Supplement).

During the disassembly process we note any irregular fits in the body panels or trim pieces. The stripped body is mounted onto a wheeled trolley and transferred to our body shop.

04 | CHASSIS & BODY ASSESSMENT

CHASSIS FRAME & FLOOR ASSESSMENT

The next and very important stage was to undertake a detailed and thorough assessment of the chassis (frame/floor assembly) structure. The U-section box reinforcements on the frame and side members received no primer or wax injection at Sindelfingen and generally rust from inside out. The shell was inspected internally with the aid of a Snap-on Video Inspection Scope™. Notes were made of any abnormal rust and chassis structures that need additional attention. A small repair was required on the front right inner chassis rail.

The floor inspection showed pin holes and rust dimples on the cabin side. In keeping with LuxClassics restoration policy, it is usual to renew the floors even though they were solid. Additionally the lower firewall panels were replaced to ensure a perfect leading edge fit against the new floor pans. Although the seat boxes appeared solid internal rust, only viewable on the screen of the Snap-on Video Inspection Scope™, indicated that these should be replaced.

The boot floor was perfect other than surface rust. Small repair panels need to be fabricated in both lower wheel wells around the lower drain holes. Surprisingly the felt strip inserted at the factory between the outer boot floor and rear wings showed no signs of rust.

The chassis was then cleaned back to remove all of the residual oil, grease and general muck that had accumulated over the years. Additionally the inner wheel wells had received a non-genuine coat of underseal which was removed. This was a filthy job, but vital if the soda blast of the structure that followed was to be fully effective in removing all of the surface rust. We are pleased to report that the frame structure was generally sound other than that noted above.

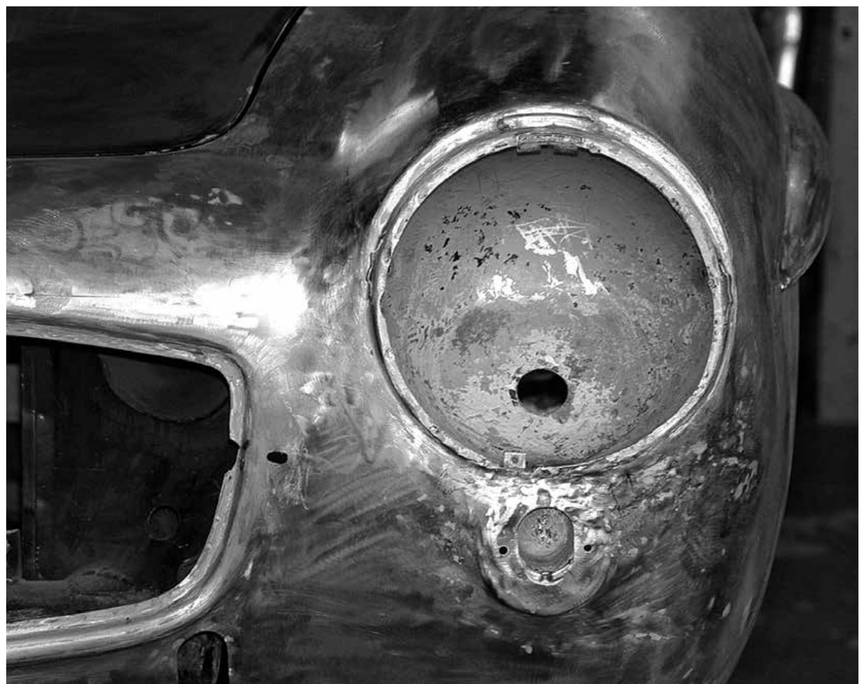
BODY ASSESSMENT

Stripping the many layers of paint and body filler from the outer shell followed, revealing even the slightest old panel damage. Nothing to be too concerned about. The windshield 'A' pillars were removed together with the side sill panels joining the 'A' post to 'B' post at lower door openings. The steel panels attached to the aluminium 'A' and 'B' posts and cowl showed no unusual corrosion, just surface rust.

Corrosion spots are generally found around the wheel arches, headlamp bowls, sills, rear wing stone guard area, boot and floor panels caused by damp and the effects of electrolytic induced corrosion of the steel panels in the proximity of its aluminium supporting frames. The original factory panels are rust free and still attached to the aluminium supporting frames with the special twist nails keeping it's originality and indicating no history of replacement due to collision or rust replacement.

The aluminium doors, boot and bonnet were equally in very good condition. The only repair section required was to the right hand rear wing stone guard area and non-original speaker holes in the interior rear parcel shelf.

Surprisingly the boot weather-strip channel around the rear wings and rear panels showed no signs of rust, again unusual for this age and type of vehicle. Much of the car's inactivity for almost three decades preserved the body.



05 | CHASSIS RECONSTRUCTION

JIGGING

Following the stripping of the chassis, the first step taken in the reconstruction is to mount the chassis on a jig. Additional support to the frame was provided by the use of clamp struts in the door opening between the 'A' and 'B' post frames. This not only ensured that front and rear suspension alignment was always correct but also served to support the chassis during its reconstruction to avoid twist and sag.

Chassis measurements were compared to those detailed in the Mercedes-Benz Data Book for Passenger Cars. It also provided a means whereby past damage could be detected and eliminated. In this case, no particular problems were detected.

CHASSIS RECONSTRUCTION

The chassis reconstruction started with repairs to the front right chassis inner frame, where a six inch rust section was cut, bead blasted, acid washed and a repair panel fabricated and welded, keeping originality. The four seat box sections together with the four floor pans and two front lower firewall repair panels were cut out for replacement, de-rusting as we went along. The replacement floor pans are thicker than the original and zinc coated steel. The zinc coating creates a barrier against rust and can be painted over once prepared well. All chassis members were checked carefully by tapping with a pick hammer to ensure that they are not weak, especially the trailing arm supports which could become critical if the trailing arms were to break loose at high speed. All new replacement Mercedes-Benz panels were either spot welded or plug welded in place before spraying with weld through primer. The lower firewall panel and chassis repair panel were butt welded and ground flat.

DIMENSIONAL CHECKING

On completion of the chassis reconstruction, another careful check was made to ensure that dimensional accuracy, particularly front and rear suspension mountings, sill alignment and 'A' and 'B' posts were still correct and that the alignment of doors, bonnet and boot was retained. In addition, a trial fit of the front and rear suspension was undertaken as a final check and to ensure easy assembly later.

RUST PROOFING AND PROTECTION

In all, the extensive level of reconstruction involved skills in fabrication as every new section had to be shaped to fit and carefully welded into place. All box sections were carefully epoxy primed and zinc coated with weld through primer on the welding contact sections prior to assembly.

Once the reconstruction was completed, the finished chassis was again grit blasted, acid washed and then epoxy primed after which it received two sprayed coats of smooth anti-chip coating. Any joints were seam sealed with Polyurethane sealing compounds. A sealer coat of epoxy primer was followed with three coats of PPG's DAR 4065 'Sandalwood' Semi-Gloss tan/grey underneath.

The inner boot floor, engine bay and inner floor sections were sprayed with three coats of PPG Semi-Gloss black DB167 or RAL7167 (DB164 or DB167 Tiefdunkelgrau Matt). All of the internal sections were then wax injected, thus providing a significantly enhanced level of corrosion protection and retained originality.

06 | BODY RECONSTRUCTION

CORROSION REMOVAL

The steel outer body panels were stripped to bare metal by hand and finished off using a mini air hand sander with 3M™ 2" Roloc Bristle discs. No grit blasting was necessary as there was only surface rust that could be taken care of by hand and chemical de-rusting. Once any hammer work and or lead loading was done the cleaned panels were acid washed before a sealer coat of epoxy primer was applied preventing further rust due to moisture in the air.
The aluminium doors, boot and bonnet were treated similarly but the final sand was with fine sanding pads so as to not marl the soft material. Concurrent to this work the aluminium removable dash panel and glove box lid were chemically stripped and prepared with epoxy primer for later painting. The hard top was bead blasted and sealed with epoxy primer ready for the paint process. The front wing splash panels were blasted of all paint and primer to their bare aluminium state and sealed for later painting with semi-gloss black paint.

PANEL REPLACEMENT

No outer replacement panels were required, retaining factory originality. The nose panel, tail panel and fenders were in perfect rust free condition and only required a little attention with the hammer and dolly to work out small dents and ripples. Previous repairs had been done with polyester filler rather than metal work. These panels were finished off with a small amount of lead filler where required to minimise the use of polyester filler later in the paint stage. Any additional body parts, like chrome mouldings were prefitted at this stage to ensure perfect fit and adjusted accordingly.

PANEL ASSEMBLY

With panels formed smooth by hand, the doors, bonnet and boot were mounted to check correct alignment. The front wing chassis struts were bolted on to ensure that the lower trailing edge matched with the door. The windshield frame was mounted so that the hard top fit could be checked. The dash panel was additionally checked for damage and assembled.

PREFIT, SHAPING & GAPPING

Wear in the door hinges can cause the door to be out of alignment. A shortfall in maintenance means that the hinge pivot points on the 'A' post wear as the bush is made of brass and rubs against the harder steel hinge pin as it rotates. As expected the drivers door bushes required replacement. A special tool was fabricated to remove the old bush as space is restricted to drive these out with a pin punch.

The final stage of preparing the body for painting was to carry out a final shaping and prefit of the front windscreen chrome frames, bumpers, light fittings, door handles, front grill, rear wing stone guards, wing chrome eye brow mouldings, chrome sill mouldings and headlight glass chrome emblems. During the course of this stage the objective was to ensure a perfectly smooth shape so far as it was possible without use of filler. It was also to ensure that the gapping of the doors, bonnet and boot were perfect, all of the external bright trim, light fittings, front grille fit correctly, and gaps and apertures were adjusted as required.

Another aspect of this stage was to ensure that the aluminium surface was filed into a state that would allow the best possible adhesion of the epoxy primer in the initial stage of painting. The doors, bonnet and boot lid were then removed for later painting.

07 | PAINTING THE BODY

EPOXY PRIMING & FINAL SHAPING

The first stage of painting was to epoxy prime the body shell. The objective of epoxy primer is to provide an impermeable barrier to any moisture and to provide the best possible adhesion to the steel and aluminium surfaces and of subsequent primer coats.

This followed with the application of two coats of polyester primer filler followed by 3M™ dry guide coat with primer allowed to fully cure and harden. A long process of dry sanding followed to ensure that a perfectly smooth and flat surface was produced. A second round of sprayable polyester filler and blocking proceeded. Any final shaping of panels was then undertaken to ensure the best possible standard of finish and to ensure the barest minimum of filler was used. A small skim of filler was used where necessary to compensate for any minor deviation of the panel from the perfect shape. The body shell was then given three coats of high build primer, followed by a light guide coat and this was allowed to fully harden. A long process of wet sanding followed to ensure a perfectly smooth and flat surface. This followed with two more rounds of high build primer and wet sanding in between each three coats with progressively finer sand paper. Only when an even guide coat finish was achieved and the surface perfectly smooth was the body shell sealed and passed as fit to move to the final painting stage.

The same process was used for the doors, bonnet, boot lid, hard top and dash panel. Although the polyester spray filler was not coated on the edge and inner surfaces of these panels, but rather a wet-on-wet primer finish for smoothness. The final stage was to refit the doors and other opening panels and to make any final adjustment in the gapping, ensure that adequate clearance was provided and a perfect match of the front and rear body panels with the doors, boot lid and bonnet was achieved.

PAINTING

With the doors, bonnet and boot lid removed the body was masked so that the weather strip channels and door jams could be sprayed. These were given three coats of DB180 base coat and three coats of clear lacquer. The edge of the doors too were given a similar coating to avoid dry spray when mounted. With the boot lid and bonnet removed the inner surfaces were coated with PPG DB167 (Tiefdunkelgrau Matt). Factory standard black semi-gloss. Two coats

of (Silbergrau metallic) base coats were sprayed. The doors, boot lid, bonnet and sills were all painted at the same time to ensure perfect continuity of colour. The paint was then allowed to harden and rubbed down with basecoat sanding pads. Three further coats of base coat followed by three coats of clear lacquer were applied and allowed to fully harden prior to wet sanding followed by three final coats of clear lacquer.

COLOUR SANDING & POLISHING

The fully hardened lacquer coat was then lightly wet sanded using four grades of wet n dry paper to achieve a flat 'orange peel' free surface. The body had to be masked again fully to prevent the semi-gloss black from becoming marked. This process left the surface mat and the next three stages of compound and polish brought back the shine.

What we have achieved is a paint job that has depth and is flat as well. The secret is in the preparation work, priming and final shaping. This stage is where the time has been spent to create the base for the colour coats. The next and final stage was to fit and align the doors, bonnet and boot lid panels before the painted and polished shell was set aside for assembly.

08 | ENGINE STRIP & REBUILD

STRIP & CLEAN

With the engine and gearbox now separated from the car, these were cleaned off and the engine was dismantled, with the first task being to remove all intake and exhaust manifolds, regulator, water pump, fan, fuel pump and distributor. This was followed by the separation of the bell housing and gearbox. The next operation was the removal of the cylinder head. The sump was then removed followed by the removal of the timing chain and camshaft sprocket. The camshaft and camshaft followers were removed. The separation of the cylinder head followed, revealing for the first time the inner state of the cylinders and pistons.

The next stage was to remove pistons and connecting rods, followed by the crankshaft, oil pump and all of the external fittings. The freeze or core plugs in the cylinder block were removed and the block inspected and set aside for later use.

The crankshaft was carefully measured across all main bearing and connecting rod journals, and though a small amount of wear was noted, this was well within acceptable tolerances and therefore indicated that the crankshaft could be safely reground, polished and refitted with oversize bearing shells.

The cylinder head was also dismantled at this stage; revealing that the head had previously been over skimmed by more than 1mm and was warped. The Mercedes-Benz Technical Data Manual is precise about this 1mm as over skimming the head will cause the pistons and valves to contact each other. A replacement head was sourced with no particular problems. Waterways were flushed out and all external fittings were removed as a matter of course and set aside for later examination.

ENGINE BLOCK RESTORATION

The cylinder bore dimensions were checked against the Mercedes Benz workshop data and compared with the wear on the pistons. Although these were within specification it was decided to have the cylinders bored to the next stage and fit new 85.5mm pistons (first stage rebuild). Having assessed the block was fit to reuse, the first stage of the restoration was to thoroughly flush out and ensure all waterway scale was removed.

The machining of the cylinder head and block was entrusted to an experienced machine shop. The cylinder head and block mating surfaces were lightly skimmed to ensure tight fit of the mating surface between the head gasket and block. The final stage in preparing the cylinder block was to hone the cylinders to the correct size consistent with the pistons being used, in this case Mahle™ pistons.

CYLINDER HEAD RESTORATION

As a matter of course all cylinder head valves, guides and valve seatings were removed for scrap. All waterways were then subject to a thorough alkaline wash to remove any water jacket lime scale and the casting checked for any incipient cracking, particularly across valve seatings. Once passed by the machine shop as serviceable the cylinder head facing was lightly machined to obtain a truly flat surface. New seatings were then pressed into position and machined to shape in accordance with the data in the Mercedes Benz Technical Data Manual. Similarly, new phosphor bronze valve guides were carefully pressed into position, taking care to achieve the best possible seal. Valves were then inserted and bedded in. The cylinder head was then pressure tested to ensure no leaks were present.

Dependent on their condition, the camshaft bearing housings may be line bored, though in most cases this is not required. The camshaft was polished and within tolerances so was reused. Valve followers were then assembled and set aside for later assembly with the cylinder head. The cylinder head was then washed down and valves and valve springs etc fitted as the final stage of preparing the cylinder head for final assembly.

ASSEMBLY

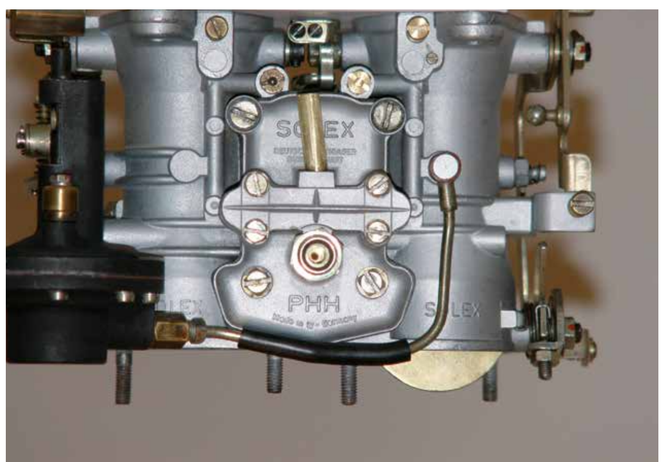
The first stage of the assembly process was to ensure the serviceability of the crankshaft, and journals ground to size as required and then polished. The crankshaft, flywheel, vibration damper, pulley, and clutch cover plate were then individually balanced and progressively balanced as a rotating assembly by the machine shop. The crankshaft was then assembled into the engine and the new pistons and connecting rod assembly fitted. Other new components fitted included the oil pump, timing chains; exhaust manifolds (fabricated in stainless steel as new originals no-longer available) and gaskets. The engine was then reassembled using new washers and nuts throughout, setting the valve clearance and carefully timed for ignition and valve timing.

09 | SOLEX 44 PHH CARBURETOR REBUILD

SOLEX BACKGROUND HISTORY

The Daimler Benz development team back in 1954 chose the twin Solex 44 PHH horizontal two-stage carburetor, a decision which is still the topic of heated discussion today. The reputation that the Solex 44 PHH gained, principally through a lack of knowledge & understanding, caused owners to substitute these for non-original Webbers or Makuni's. We decided on a point of originality to rebuild these units, knowing that they ran perfectly well ever since these cars left the Mercedes-Benz factory. It appears that problems did not start with these units until a full three decades of service. It was only in the nineteen-eighties that the 190SL owners became increasingly disillusioned and this perpetuated the belief that the 44 PHH was temperamental and rather prone to malfunction. Naturally a complete overhaul with these faults in mind was needed to ensure that these Solex's run smoothly:

1. Loose throttle shafts As they are mounted directly in the engine casting the radial lash causes an excessive amount of air to be admitted into the engine. As a result idling remains at a level between 1,500 and 2,000 rpm and can not be adjusted.
2. Distorted housing As a result of the engine's rough idle and ride the carburetor was shaken loose. The problem was further compounded by the absence of the strut which supports the induction pipe - a common ailment. This strut is required so that its entire weight does not have to be borne by the carburetor flange. Washers between the carburetor flange and the rubber flange are often omitted during repairs. If the washers are missing, the bolts are inevitably drawn too tightly, which in turn causes the flange to warp and cut into and requires machining and fabrication of oversized throttle valves.
3. Worn ball neck heads These are often simply worn or the linkage can be out of adjustment. These problems are easily rectified at little cost.
4. Second-stage linkage This linkage and follower are also susceptible to faulty adjustment. From 2,500 rpm upwards this linkage should open the second stage throttle valve as a result of the breakdown of venturi vacuum that sets in at this stage. If it does not have the necessary 1/10 mm clearance when closed, this function is not guaranteed.



STRIP

The carburetors were initially chemically cleaned to assist in removing nuts and bolts. Dismantling involved removing every nut, bolt, bracket and screw attached to the carburetor bodies and checking for wear. In parallel the linkages, fuel pipes, fuel overflow pipes, hot start mechanism and throttle linkage to the carburetors were stripped. The fuel pump and fuel filter were dismantled as part of the carburetor rebuild.

All parts that had been clear-Cadmium plated at the factory were sent to platers to be cleaned, de-rusted and 'Yellow Zinc Passivate Plated' as Cadmium plating in no longer available through environmental legislation.

PRECISION ENGINEERING

The stripped carburetor bodies were carefully checked for any cracks. We can happily report that the bodies were sound. The mating surfaces of the bodies were perfect with equal overall length of the two sets of bodies when placed on a measuring jig. The bores were checked to ensure that these were not distorted and free of the usual wear or grooves in the bores where the throttle plates close, indicating that the throttle plates could be re-used. This additionally indicated that the primary and secondary throttle shaft bores did not have excessive wear. As a matter of course the throttle shaft bores were bored out and new machined bushes were pressed in. New primary and secondary throttle shafts were obtained and the bushes were line-bored together on a specially made jig to accept the new throttle shafts. The air log mounting studs were checked for seating, particularly the one nearest to the fuel injection tube.

PLATING & BODY FINISH

The carburetor bodies and all aluminium / brass parts (idle mixture screws etc) were chemically cleaned in an 'Ultrasonic Cleaning tank'. The Vacuum Secondary Chambers are made of aluminium and the correct finish is brown anodizing and the Throttle Linkage was originally a phosphate finish.

ASSEMBLY

With all parts cleaned the assembly was straight forward. The rebuild was aided with the Mercedes Benz 'D' parts catalogue, 190SL workshop supplement manual and the Solex repair manual. New Mercedes-Benz gaskets, seals, fibre washers and diaphragms were used throughout. All linkages received new ball-ends and ball-caps. The throttle shaft carrier bushes were replaced and the new bushes reamed to the shafts.

BENCH TESTING

The carburetor settings were checked against those suggested in the 190SL Supplement Workshop Manual and set up on the bench and flow tested with vacuum and an airflow Synchrometer. The secondaries indicated that no air was passing and the primaries idle adjustment set to 5kg/h on each carburetor. Final set up will be performed with the carburetors mounted on the engine and with the engine running.

10 | ATE T50 BRAKE BOOSTER REBUILD

GENERAL DESCRIPTION

The ATE T50 Brake Booster is a vacuum assisted hydraulic device which utilises engine intake manifold vacuum and atmospheric pressure for its operation. The brake booster adds to the power created physically in the master cylinder and delivers this combined pressure to the wheel cylinders. On average the brake booster allows the use of 50% less pedal force. It is a self contained unit having no external rods or levers exposed to dirt and moisture. The power unit is mounted in the hydraulic line between the master cylinder and the wheel cylinders. A vacuum line connection is made from the brake booster to the engine intake manifold. Construction of the brake booster is such that in the likely event of vacuum failure, the brakes will function as in a conventional brake system.

REMOVAL FROM VEHICLE

As part of the original strip the booster was removed from the vehicle as follows:

1. The hydraulic lines from the booster were disconnected (The line from the master cylinder is attached to the end plate beneath the slave cylinder tube and the line to the wheel cylinders is attached at the slave cylinder end cap). The open lines were plugged to prevent entrance of dirt and brake fluid leaking.
2. The vacuum line from the end plate vacuum port of the vacuum check valve was disconnected from inside the vehicle.
3. The brake booster was separated from the mounting bracket.

STRIP & CLEAN

With the booster removed from the vehicle this was now stripped, starting with the clamps holding the booster shell from the front section exposing the power piston and spring. The shell was inspected for score marks and was cleaned and finished off with emery paper until smooth before plating. The power piston on this models was made from leather and was in great condition as it was possibly regularly lubricated. This followed removal, strip and inspection of the hydraulic slave cylinder, vacuum check valve, air cleaner, valve cover, diaphragm, valve piston and end plate seals. All parts were carefully cleaned and inspected for wear. All nuts, bolts, spacers, aluminium and steel parts were cleaned in alcohol and then cleaned in an "Ultrasonic Cleaning tank'.

INSPECTION

All moving parts were inspected for abnormal wear. In particular hydraulic slave piston, push rod, and valve piston wear. The bores within which these sit were also inspected and cleaned. All parts showed minimum wear and can be reused. Parts are in short supply and as some key items are no longer available some items generally need to be manufactured. All rubber parts were renewed as a matter of course.

PLATING & FINISH

With all parts cleaned, finished, inspected and passed as reusable, the aluminium bodies were left to one side after 'Ultrasonic Cleaning'. All other steel parts were entrusted to our chosen platers. These were originally either white cadmium or yellow cadmium plated depending on application and were plated either in clear zinc or yellow zinc passivate. After plating the bores and pistons dimensions were checked to ensure these have not changed as a result of the plating process. All parts were laid out for assembly.

ASSEMBLY

The cleaned parts were assembled either with brake fluid as a lubricant or ATE Brake Assembly Paste. Particular attention was paid to the orientation of parts and ease of fit. A special bracket was manufactured to assist assembly of the power piston / push rod within the booster shell.

BENCH TEST

The assembled T50 brake booster was bench tested for leaks and functionality. This was passed and set aside for latter assembly.

Note: It is important to store the booster in an upright position to prevent the power piston oil coming in contact with the rubber parts of the booster. Additionally an assembled booster should not be stored for more than six months without use to prevent congealing of the brake fluid.

11 | ENGINE ELECTRICAL COMPONENTS

BOSCH IGNITION DISTRIBUTOR

The original Bosch VJR 4 BR 24 ignition distributor was original to this year and model of Mercedes-Benz. Initial inspection indicated that the main wearing part, the shaft, did not have any wear. The distributor was fully disassembled, cleaned and inspected. The body was then stripped and repainted in correct DB semi-gloss black. All damaged broken or missing parts were replaced before assembly and all steel parts were plated. The distributor was tested within the running engine and any minor adjustments made then.

GENERATOR

The original generator was stripped, cleaned and inspected before the hardware was sent out for re-plating. The main wear items, bearings, bushes, carbon brushes were changed as a matter of course. The armature was checked for wear and indicated that it could be re-used. Incidentally the Mercedes-Benz Maintenance manual suggests that these should be exchanged as a service item every 32,000 miles. The generator was assembled and bench tested before being put aside for later use.

BOSCH STARTER MOTOR

The original Bosch starters turn over the engine very slowly and delays the time it takes the mechanical fuel pump to pump fuel to the carburetors. To resolve this issue the new high power gear reduction starter by Bosch was installed. This is smaller and lighter than the original and has given excellent results, particularly with quicker start ups.

AVOG WIPER MOTOR

The Mercedes-Benz of this era had either a single speed wiper motor or, as in the case of the 190SL, a two speed wiper motor. The original two speed motor was stripped, cleaned and all hardware replated before it was assembled and tested.

REPRODUCTION TAR TOP BATTERY

The original battery shipped with this 190SL was as per the data card was a Varta period tar top battery. This 56Ah battery is correct in appearance and size. As the 'Varta' battery logos were no longer available these were reproduced from original factory photos. The standard battery provided by the factory was Moll, although one could opt for Bosch, Varta, Hoppecke or for some unknown reason supplied without battery.

BOSCH VOLTAGE REGULATOR

The original Bosch regulator was in poor condition and was replaced with a new identical Bosch item.

BOSCH TWO TONE HORNS

The two Bosch two tone horns were stripped detailed and rebuilt.

12 | FRONT SUSPENSION SUB-FRAME REBUILD

SUB-FRAME REMOVAL

The Sub-frame was removed as one unit and with the engine separated from the sub-frame the following major components stripped and assessed for rebuild:

- *Anti roll bar*
- *Shock absorbers and springs*
- *Steering box, drag link, idler arm, steering shock, tie rods*
- *Brake drums, wheel hubs, shoes, wheel cylinders and backing plates*
- *King pins / steering knuckles, control arms*

With all components removed from the sub-frame each part was assessed for wear before being stripped of paint, grease and dirt by bead blasting and then cleaned and painted ready for reassembly. All hardware, bolts and nuts for the suspension unit were dipped in a metal blackening system and oiled.

All rubber components, wheel bearings, king pins, threaded bushes, drag link, steering shock absorbers and tie rods on the suspension were renewed as a matter of course. With the sub-frame on the workbench, new brake cylinders, shoes and adjusters were installed. The wheel hub with new seals and bearings were installed and the correct end play adjustment set.

Correct operation of the eccentric bolts for cast and camber adjustment were checked after the repainted springs were installed. Final cast and camber settings will be set once the suspension is on the car and again after preliminary road tests.

The steering box was cleaned, stripped and rebuilt with new bearings and seals. Again the outer box was coated with the correct semi-gloss black paint and all hardware was metal blacked. The rebuilt steering box was mounted to the sub-frame. The rebuilt sub-frame was set aside for final assembly into the car.

13 | REAR SUSPENSION & AXLE REBUILD

REAR AXLE REBUILD

- *Brake drums, brake shoes and brake wheel cylinders, hand brake cable*
- *Thrust arms, cross strut*
- *Rear axle half shafts, brake backing plates,*
- *Rear axle tubes, differential*
- *Centre pin, centre supporting strut*

With all components removed from the rear axle, each bearing and seals on the axle half shafts and tubes were removed. Thrust arms were stripped of their thrust arm rubber mounts and body mounts. The right rear axle tube bushes were pressed out with grease nipples. The centre shaft rubber mount was pressed out and bushes. Any work required on the differential was done by a specialist firm due to the nature of the tasks involved.

Each part was assessed for wear before being stripped of paint grease and dirt by bead blasting and then cleaned and painted ready for reassembly. All hardware, bolts and nuts for the suspension unit were dipped in a metal blackening system and oiled.

All rubber components, wheel bearings, gaskets, seals, bushes, wheel cylinders, brake shoes and shock absorbers were renewed as a matter of course. The half shafts with new seals, gaskets and bearings were installed. New bushes pressed and reamed into the right axle shaft and centre bearing. With the rear axle on the workbench new brake cylinders, shoes and adjusters were installed together with the hand brake cable. The rebuilt rear axle was set aside for final assembly into the vehicle.

14 | TRANSMISSION REBUILD

TRANSMISSION REBUILD

The transmission was removed as one unit with the following major components stripped and assessed for rebuild:

- *Pilot bearing, clutch pressure plate and clutch plate*
- *Thrust release bearing, thrust fork and clutch housing*
- *Mainshaft flange, reverse light switch*
- *Transmission top, front and rear covers*
- *Front and rear bearings with main shaft*
- *Counter shaft bearings and counter shaft*

With all components removed from the transmission housing each bearing, gear, shaft and synchronizer were inspected for abnormal wear. There was no significant wear in the gears other than the brass synchronizer gears.

The transmission housing was stripped of paint, grease and dirt by bead blasting and then cleaned and painted ready for reassembly. All hardware, bolts and nuts were either plated or metal blackened ready for assembly. All gaskets, bearings, seals and synchronizers were renewed as a matter of course. Seals for the speedometer drive and front / rear housing were pressed out and new ones driven in. The rebuilt transmission was set aside for final assembly into the vehicle.

15 | CHASSIS & BODY ASSEMBLY

FUEL, BRAKE LINES AND ELECTRICAL WIRING

The first steps in reassembling the car was to install the brake and fuel lines (excluding the fuel tank at this stage). Next the under dash and floor sound insulation material was installed after which the wiring loom was fitted from inside the cockpit to the front of the body and to rear.

UNDER BONNET ASSEMBLY

The next stage was to start assembly of all the components within the engine bay. First to go in was the fuse box and main battery wiring. Next the heater boxes and ventilation systems were installed. All components then attached to the under bonnet electrical systems. Bonnet latches, catches and rubber stops were installed. All installations were kept to ensure the highest possible standard of presentation as it would have appeared when the car left the Mercedes-Benz Zindelfingen factory in Germany when new.

PEDAL ASSEMBLY, BRAKING SYSTEMS & PROPSHAFT

At this stage the pedal assembly was completed from within and under the car. This allowed the brake master cylinder, reservoir and T50 booster assembly lines to be completed. The hand brake, arm and cable to the rear axle were feed and left in place. The Propshaft was temporarily placed within the enclosed transmission tunnel.

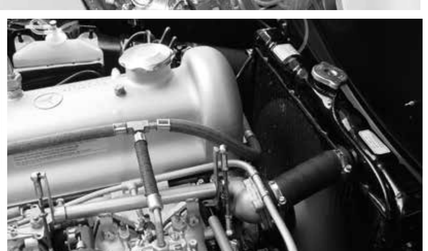
SUSPENSION, ENGINE & GEARBOX INSTALLATION

With the engine and gear box mated the complete unit was wheeled under the car on the front sub-frame assembly and fixed to the frame. The rear suspension/axle was fitted with springs and shock absorbers. Next the Propshaft was connected at the rear axle and gearbox and finally secured at the centre bearing. The clutch linkage was connected and the remaining wiring to the gear box finished together with the rubber brake hoses to the wheel cylinders and the system filled and bled. The fuel tank was fitted together with the exhaust system.

Next the starter motor and dynamo were fitted after which the inlet manifold, exhaust manifold and Solex PHH 44 carburetors were fitted. Accelerator linkages, cold and hot start cables were connected and checked for function. The steering column was installed and connected to the steering box. The final stage was to complete other under bonnet installations like the radiator and hoses.

DOOR & CHROME ASSEMBLY

The door top chrome strip was first to go on followed by the door latches and striker. The doors were built up with the window lifting and door opening mechanisms and the glass fitted. New door and boot rubbers were fitted. All chrome trim was re-plated and fitted carefully. This completed the remaining wiring on the head lights, tail lamps, indicator lights and number plate lights. Front and rear bumpers were fitted as well as a new chrome exhaust trim. The front grill, rear stone guard, sill / eye-brow mouldings and badges were fitted. Wiper motor, mechanism and linkages were rebuilt. Final assembly items like the wheels were attached and the car made ready for the interior trimming and soft top.



16 | TRIMMING THE VEHICLE

The foot washer pump was installed and the lower kick panels were made from hardboard, vinyl covered with material similar in texture and colour to the original and fixed with the correct fasteners.

The seats were assembled with re-chromed hardware and slotted into place on the plated runners. The ivory coloured steering wheel was assembled together with horn ring and final wiring completed at the steering column. The Becker Europa radio was mounted with a mounting bracket fabricated from steel. The restored and re-chromed ash tray lid was trimmed in a piece of skived leather and fitted to the dashboard panel. Sun visors were made using steel frames and cardboard inserts as per original and were fastened with new chrome work.

INSULATION, CARPETING & RUBBER MATS

The interior floor pans were insulated with Dynamax™ sounding deadening material as an improvement to the original material. This was then covered with 'waffle' type felt. Carpeting was then undertaken with German fine weave 'Boucle' carpet material in the rear footwell and storage compartment. The front foot wells, centre tunnel, side sills and boot area was covered with rubber mats similar to when the car was new. The correct fasteners were used to hold the mats in place at the correct points.

LEATHER TRIMMING & INSTRUMENT PANEL ASSEMBLY

Trimming the car requires not only patience but also passion for the detail and workmanship that makes the Mercedes-Benz 190SL what it is. Re-covering the dashboard with leather is the most challenging single task in restoring a 190SL interior. The dash was carefully covered with German fine grain supple 1088 light red leather. As the leather was skived (thinned to half its thickness) it was possible to cover the contours of the dash. The dash is first fitted, stretched and shrunk around the instrument hump, then stretched to fit the rest of the dashboard.

Welting strips were made to fit around the instrument hump and door 'A' and 'B' posts. The rear soft top compartment was additionally covered with the same leather. The seats and door panels were made up, using traditional materials to fill the seats. Next the instrument panel was covered using felt under the leather at knee curves and instruments and switches fitted to the panel. The glove compartment was covered in leather and the glove box lid was trimmed. The windscreen pillars were fitted. The chrome vent strips and vent levers were fitted before the front windscreen and chrome surround was fitted and the dash trimmed to fit. The instrument panel was fitted as were the remaining switches and gauges. The interior wiring was completed together with final fit of dash chrome and glove box lid. The door panels will be fitted once the soft top has been trimmed and final window adjustments.

17 | SOFT TOP REPLACEMENT

SOFT TOP FRAME

The old canvas was stripped, together with all rubber weather strips, chrome mouldings and wooden bows. The bare aluminium frame was stripped of all removable bolts and each section of aluminium frame was hand polished to remove any electrolytic corrosion.

After a fine polish the frame was sealed with 2K clear lacquer.

All pivoting bolts were either chrome plated or renewed. The wooden bows were sealed with a weather shield lacquer before the frame was rebuilt on the car. The frame was covered with original bow-drill material with the correct wafer pattern. New straps were fixed and rear two bow section were as per original given an elastic cord to aid closure. Tops of the bow drill cross section rails were covered with a rubber sections to prevent contact corrosion, a point often forgotten on replacement tops.

SOFT TOP CANVAS

The canvas material is a German Sonnenland-Dralon (Sonnenland) is the brand name for a 3-layer, high quality topping as originally used by Mercedes-Benz. These tops are manufactured in Germany and produced, cut, crafted and sewn carefully using computer technology to original patterns. The outer colour chosen was black with tan wafer-structure on the inner surface. The rear window thickness on these tops is the same thickness as original.

The top was fixed to the frame by our craftsmen and the results show a perfect fit with no wrinkles. The correct placement and number of clips for the soft top cover are often over looked and these were placed from original tops as a reference point. New tensioning wires were attached at the front with the correct M4 chrome plated raised countersunk Phillips head screws. With a new front rubber glued to the top it was clamped to the windscreen frame. This allowed the material to stretch naturally. The chrome weather strip rails were fitted at the door apertures and the rubber weather strips fitted.

WINDOW ALIGNMENT

The final stage of the soft top restoration was to adjust the door glass so that the glass fitted correctly around the window aperture. At this stage it was necessary to pack behind the aluminium 'A' post strip for correct fit at the front of the window. The fit was perfect and passed over for the final inspection and test drive.

18 | TEST & FINAL DETAILING

ROAD TEST & SHAKEDOWN

It is our policy that once a restoration is complete the car is test driven for at least 500 miles to shakedown and reveal any defects and undertake final chassis adjustments and tuning.

No major problems were reported. Final adjustments were made to the Solex carburetors with idle speed. Final geometry checks required tracking and wheel alignment adjustments. Finally the car was given a full MOT test which it passed with flying colours – a testament to our team given that the car has been off the road for almost thirty years!

CLEANING & FINAL DETAILING

The final stage of the restoration was to fit the chrome beauty rings and painted chrome hub caps on the wheels. The body was finally inspected for any defects and we are glad to report that there were only minor marks and scratches that needed attention. A complete clean to Concours standard was then undertaken including the under the bonnet area, floor pans and wheel arches. The paint was polished and given a final coat of Autoglym™ High Definition Wax. Glass was carefully polished inside and out. The interior was fully vacuumed, new number plates fitted, handbook and all other manuals and instructions carefully checked and placed in the car. A new reproduction Mercedes-Benz tool roll with a complete set of restored tools was added and a complete inventory check completed. The spare wheel was carefully checked over and tyre pressures and all fluid levels checked and adjusted. New reproduction stickers were located to the correct place within the engine bay, windscreen and jack within the boot. The windscreen sticker particularly reminds the driver of the need for proper running in speeds.

Finally but by no means least, a Restoration Log Book has been prepared with a full photographic record of all aspects of the car restoration process, together with a final invoice and a full specification.

19 | SPECIFICATIONS

CAR DETAILS

Model Series	Mercedes Benz 190SL 1960
Model Type	W 121.040 Coupe

ENGINE SPECIFICATION

Engine Type	M 121 B II (M 121.921)
Bore & Stroke	85.0 mm x 83.6mm
Displacement	1,897 cc (four inline cast iron block)
Compression	Ratio 8.8 : 1
Output	105 hp at 5,700 / min
Torque	14.5 mkg at 3,200 / min
No. Main Bearings	3
Valve / Camshaft	SOHC Sports Duplex Chain
Induction System	Twin Solex 44PHH Carburetors
Electrical System	12 volt

TRANSMISSION

Type	4-speed manual Fully Synchronized
Gear Ratios	I. 3.52; II. 2.32; III. 1.52; IV. 1.0
Clutch Type	Single Dry Plate
Rear Axle Type	Hypoid Single Joint Swing Axle
Rear Axle Ratio	3.90 : 1

BRAKES

Type	Hydraulic drums, finned for cooling. ATE T50 Vacuum Servo
Drum Diameter	230 mm

CHASSIS & BODY

Frame	Unit Construction Frame & Body
Body Style	2 Seater Convertible with Removable Hard Top
Front suspension	Independent, unequal length wishbones with coil springs & telescopic shock absorbers
Rear suspension	Independent, single low pivot swing axle with coil springs & telescopic shock absorbers
Wheels	5K x 13 Steel Disc
Tyres	185 80 13 Whitewalls

BODY DIMENSIONS & WEIGHTS

Track Width Front	1,430 mm
Track width Rear	1,480 mm
Wheelbase	2,400 mm
Length	4,220 mm
Width	1,740 mm
Height	1,320 mm
Curb Weight (Roadster)	1,160 kg / Coupe 1,180 kg (according to DIN 70020)
Gross Vehicle Weight	1,400 kg

CAPACITIES

Crankcase	4.23 quarts
Cooling System	2.6 gallons
Fuel Tank	65 Litres

BODY SPECIFICATIONS

Paint	Manufacture PPG 2K Deltron
Colour type	Silver Grey (Silbergrau) Metallic
Colour code	DB 180
Leather colour	Light Red
Leather code	1088
Carpet colour	Light Red
Carpet type	Fine Boucle Square Weave