A

- **'A' Series Engined Models**

Morris Minor, Rover Maestro 1.3 Clubman, Austin A40, Morris 1100, Austin Healey Sprite 1098, Riley Kestrel 1300, Austin Allegro, Wolseley 1300, MG 1100, Austin Healey Sprite 1275, MG Midget 1098, Austin A35, Austin 1100, MG Midget 1275, Austin 1300 GT, Wolseley 1100, MG Metro Turbo, Austin A30, Morris Marina 1.3, Austin/Rover Metro MG 1300, Austin Mini-Metro, Riley Kestrel 1100, MG Metro (am I forgetting others?). Not to mention Cooper Formula Junior, Unipower, Mini-Marcos, Ogle, etc.

- **'A+' Block Identification**

The A+ engine came on to the mini scene in 1983. It has a thicker block to box flange and is generally more robust than the standard A series. Operationally it's pretty much identical and is the same capacity. Heads/boxes are swappable.
Here are the A+ distinguishing features:

- Strengthening ribs on the back of the block at the clutch end.
- Thicker block-gearbox flange
- Dizzy clamp is a forked plate with a single bolt into the block.
- Dipstick sits directly in block, not in a tube, and is shorter.
- Verto clutch, slave on plate slanting downwards, short arm.
- Alternator bracket mounting holes are closer to the rad on the A block.
- 'A+' stickers on rocker cover if Metro!

NOTE : The 1275 crank fouls the inside of the gearbox casting on earlier 1960s unless the 'box came off an "S" originally. They standardised in '68 or '69.

- **Acronyms, Commonly associated with Minis**

Dizzy - Distributor
Alto - Alternator
Dyno - Dynomometer <sp?> (Not Dynamo, it's an engine test bed)
RR - Rolling Road
CSD - Cooper S Disc
X-drill - Cross-drilled crank/discs
RTFM - Read the f**king manual
Mowog - Morris Woseley Garages (also the name of the 800lb gorrila who tightened the flywheel bolts at BL!!)
Diff - Differential
LSD - Limited Slip Diff
LCB - Long Centre Branch (exhaust manifold)
Rad - Radiator
SOHC/DOHC - Single/Direct/Dual overhead cam
AI - Aldon Ignitor
ECU - Electronic Control Unit

- **Alarms for your car, usefulness of**

A car-alarm does work if the would-be-thief is one of the opportunity type;
'God I'm bored, let's see if I can nick a car and have some fun.'
Wouldn't do much good against the mail-order car thief though.
'So what year did you want ? Ah yes I know one with a model y alarm just around the block.'
When it comes to protecting your car there a number of people who you have to consider;
Apart from the above mentioned opportunity thief (OT) and mail-order thief (aka Professional, PT) there are the Vandal (V), the Unknown Driver (UD) (people who borrow your car with your consent), People Who Mean No Harm (PWMNH), but can be irritating none the less and somewhat new on the block the Car Jacker (CJ).
All these require different kinds of a(la)rming, some of which are mutually exclusive.
The UD and the Monday-morning-effect (MME) require an alarm that's simple to disarm without too many things you have to remember. The V,OT and PT require one that's clearly visible and looks hard to crack but not of any known type. The V, OT and PT need one that's set off easily, the UD and PWMNH otoh do not.

So what can you do.
Park your car in a safe place. Apart from the PT and the UD none of the others will go into your garage to try and hurt your car. But for most of us, that's not an option.
You can also make your car look like Sh* in such a way that even a V would get worried about his key getting rusty if he used it on your car. Could still be a fun box to drive, but would look like it wouldn't make it till the end of the street. This is one of the most effective 'alarms'.
Against V you can attach those 'breakingglass' sensors to all your windows and on the inside of your lights, install 'break-off' wires on all parts that can easily be removed and possibly a movement-detector inside the car. V will run.
Because of UD and PWMNH (like the parkingattendant clamping your car) things like perimeter alarms are not a real good idea.
For the OT and PT (who really want to take your car with them) you can install some sort of immobilizer. Apart from immobilizing some of the main functions (no fuel, no start, no powerfeed to the engine) it also should be visible else the OT might end up vandalizing your car out of frustration.
Stuff like steering wheel locks and gear selector locks usually aren't worth the money spent on them; using a simple saw the part of the steering wheel or the part under the gearlock can be sawed off, usually leaving enough of the wheel/selector to use it. The pedallocks usually are more effective, but often not as visible until you're inside the car...
Because of the UD and the MME whatever alarm you install must be simple;
only those alarms that sound when really needed are effective alarms.
Apart from a 'rip-off-alarm' (alarm sounding when resistance changes, with cables hooked to all accessories) there's not much you can do against V's unfortunately. I know of nothing you can do against CJ's.
The OT and PT can be discouraged by a clearly visible (even if it's a dud) alarm, movement-detectors (even if they are dud's), is of unrecognizable origin and is complemented with something that looks like an immobilizer. If most are duds there's no problem. A simple immobilizer should cut of the electric fuel feed, the starterengine and the feed to the 'bobine' (coil ?).
I guess you could make an array of switches (3 or 4), possibly of the 'nuclear device armed' type (always have wanted a couple of those on the dash :) which have to be switched in specific order. You should be able to change that order easily, as at some point more and more people will know it.
One of those aftermarket immobilizers cost about UKP 100,= including installation and also has a flashing lef on the keypad.
The cheapest solution I can think of is to go into London (or any other bigger city of your choice), triple park your car,wait for the police to clamp it and then take out your powertools :)
Replace the lock and you can park wherever you want and no OT or PT will try and nick your car.

- **Alternator problems, not charging**

If the red ignition light on your dash is burnt-out/disconnected the regulator won't be able to find it's reference, and this can cause the alternator to not charge, or even worse, not regulate the system voltage, blowing up electronic ignition etc.

- **Alternator Wiring**

The three wires are Fat feed, thin feed, and sense.
The sense wire goes to + via the dash red lamp. You must have this connected to allow the alto to reference itself and give out 13.8V or whatever. I wrecked my electric ignition by having this unconnected. Rev up and + goes to >15V.
Out of the other two only the fat one is needed. They are connected in parallel anyway. I have cut out the thin one and it is fine.

- **Ammeter, Wiring Instructions**

It goes between alternator/car +ive and the battery/starter lines.
When the car starts, the current flows from battery to starter, and NOT through the ammeter.
When the alto is producing enough current to feed the car, nothing flows through the ammeter to the battery. Hence ammeter reads zero, which is correct.
When the car draws current from the battery (eg: main beam on) then some current flows from the battery to the car through the ammeter, hence ammeter reads +ive, which is correct.
When the alto is charging the battery, current passes through the ammeter the other way to the battery, and it reads -ive.
The big trick is to get the ammeter to read everything except the starter. This is done by keeping the (~150A) starter motor on the 'battery side' of the ammeter.

- **Australian Mini Suppliers**

British Auto Parts. Punchbowl, N.S.W. 9707 2466
Mini Kingdom. Revesby, N.S.W. 9774 3388
Mini Car Clinic Padstow, N.S.W. 9774 3366
Mini Auto Spares. Thornleigh, N.S.W. 9980 8399
Mini & Moke World Brookvale, N.S.W. 9905 5753
Mini Cooper Sport Services Telopea, N.S.W. 9684 4815
Mini Spares & Repairs Riverstone, N.S.W. 9627 3314
Minis-R-Us Girraween, N.S.W. 9896 5543
Penith Mini Spares Penrith, N.S.W. 018298745
Mini Mania Stephens, QLD. 1 800 673664
Mini Spares & repairs Seaford, VIC. 03 97860923
English Spare Parts. Redbank, QLD. (014) 897 580
T.K Motors. Toowoomba, QLD. (07) 4638 2066
Northern Mini Parts Heidelberg West, VIC. (03) 9458-2111
M.R Automotive Redcliffe, QLD. (07) 3284 6688
Mini Automotive Ipswich, QLD (07) 3281-4255
Suncoast Automotive Services Maroochydore, QLD (07) 5443-3111
MiniCraft, 22 Bassendean Rd, Bayswater W.A. 08 9370 3403

B

- **Backpressure in exhaust**

Backpressure *IS* bad, but it *IS* a direct result of a high speed flow exhaust.
I think people are muddling up their 'backpressures' and 'gas momentums'!!
It's a bit like saying "big tyres give more grib, but also more drag, therefore drag must be a good thing". It isn't, but we just accept that.
These two quantities come together (eg: RC40 has more backpressure, AND more flow).
One thing that we have all forgotten, is that Newton's law (1st?) says that every action has an equal and opposite reaction, therefore if your exhaust gas has momentum (INERTIA sucking gas out), then it also has INERTIA as seen by the piston trying to accelerate it.
This *IS* seen as backpressure!
You will never get MOMENTUM, but not BACKPRESSURE.
Backpressure is the REACTION of the momentum, or NEGATIVE GAS INERTIA.

- **Batteries, testing health of**

What the testers do is measure the voltage under a small load. A (lead acid) battery with (some or more) charge and not ill will have a very low internal resistance so the current through a resistor, resistance R will be
I=V/R. If the battery is ill (or discharged), internal resistance will be higher (Chemical bit: less ions to carry the charge for the current) so the value for the current will be lower (And the voltage at the terminals will
be lower as well). If the battery is reading 10V (or lower) unloaded then it's likely that the plates in one (or more) of the cells have warped and shorted out the cell (each cell is 2V). If the battery is reading 0V, then something has gone open circuit somewhere.

- **Bore/Stroke ratios, and over-bore sizes.**

Common bores:

cc bore stoke bore/stroke

848 62.94 68.25 92%
998 64.59 76.2 85%
1098 64.59 83.72 77%
1275 70.61 81.28 87%
1293 71.2 81.28 87.5%
1310 71.6 81.28 88%
1330 (1340) 72.14 81.24 88.7%

Some more ratios:

cc Bore/Stroke
997 77%
970 114%
1071103%
138090% 73.5mm bore
140091% 74mm bore
143087% no worse than a stock 1275
144588%

Here are some common 1275cc overbores and their respective engine capacities:

+20 is 1293cc
+30 is 1303cc
+40 is 1310cc
+60 is 1330cc (or usually called 1340cc)
73.5mm is 1380cc
74mm is 1400cc

1430cc is usually 1380cc that is stroked or trick-bored (move the bore centres outwards), but by using both techniques it's possible to get 1600cc.

- **Boost Modulator, What is it?**

A the waste gate is set at a weedy 4psi (ish) the modulator pulses (I think) to bleed off some of the boost to con the waste gate into thinking the boost is lower than it really is so the waste gate doesn't open. The trick here is that the modulator is used at HIGH revs to allow more boost (effectively about 7.5psi I think) and therefore more peak power. The lower boost in the midrange reduces peak torque, thus preventing the engine from tearing the gearbox to bits. They wanted the 'box to last as long as it would in a stock MG Metro, they were not entirely successful. Scrap Metro turbos usually come with scrap gearboxes. That is how I remember it, could be wrong.
If I'm not wrong then dumping the modulator would mean you had LESS boost at the top end thus giving you less peak power, but the same peak torque.
Don't take this as gospel, read DV.
Oh, and as for the high compression ratio, this was to make the engine more responsive and more economical around town. The problem this causes is that the set-up is very close to knocking at high revs, any tuning would take you
over the edge. DV suggests either lowering the CR. (expensive) or building a rudimentary water injection system (sounds like fun) to overcome this.

- **Brake discs, history for 8.4"**

The Mini 25 was the first to go to the 8.4" discs. Mayfairs that were made from January 1985 (late B reg)
onwards had 8.4" discs fitted. By late 1985 (C reg) all minis had them.
I have a 1984 mayfair (B reg), which had drums. I've seen many other B reg
Mayfairs with sunroof, discs and rev counter.
Servos were fitted as standard in 1989 (F).

- **Brake disc, pad change**

One thing to remember is to open the bleeder so the dirty contaminated
fluid goes OUT instead of going back up the brake lines, or you will be
rebuilding brake masters sooner than later!

- **Brake fade**

Standard 8.4 inch disks fade when stopping QUICKLY from 90mph (emergency stop) the last 10mph is VERY difficult to shed off.
Fitting 4 pot metro brakes (solid disks) which have bigger pads so will take longer to fade.

- **Brake pad squeel**

The pads are vibrating at high freuquency resulting in the squeel. If you apply

a smear of copper grease to the BACK on the pad (NOT the friction surface) then the squeel should go away. The pads are probably due for replacement.

- **Brakes, Choices for 10" wheels**

For 10" wheels there are two main choices...the expensive route...and the VERY expensive route.
The first way is to fit 7.5" Cooper S disc assemblies. You should be able to pick up a second hand set in the UK for between 100 and 200 quid. Mine were 120 and have been pretty good (not as good a 8.4" discs, but that's what you get for running 10" wheels). I have fitted grooved discs and will fit fast road pads soon. 7.5" discs do require strong leg muscles, but they do work well if you push hard. You can use 8.4" assembly hubs, driveshafts and CV's. It is often cheaper to buy the S calipers second hand, new discs/flanges and an old set of cheap 8.4's.
The more expensive route is to machine down an 8.4" setup to 7.9" and fit alloy 4-pot calipers, or machined Metro 4-pot calipers. This will give superb braking, but you're looking at best part of 500 quid for it.
Personally, I'd go to shows and buy some S discs for 100-150 quid. They'll be in a state, but with a clean up and recon will be great.

- **Brakes, converting from 7" to 7.5"**

Converting 7" to 'S' 7.5" disc brakes. You will need 'S' calipers, discs and drive flanges.

- **Brakes, Cooper 7" type**

7" 998 Cooper disks are unlikely to give better braking than the '78+ twin leading shoe setup.

- **Brakes, Cooper 'S' 7.5" disc upgrade**

To upgrade drums to Cooper S disc assemblies, you'll need the following:

- S discs
- S flanges
- Mini disk hubs, bearings, CV joints
- S calipers (the expensive bit) and pads
- Shorter 'Disk' brake hoses (drum ones rub the tiebar, MoT failure)

You can keep:

- Drum drive shafts

Not sure about steering arms.
Late mini CV's and hubs are compatible with the 'S' setup, even though the 'S' disk CV's body diameter is slightly smaller. You'll need the late mini outer CV gaiter. All mini disk hubs are the same. The metro 4 pot calipers will fit under 10" wheels if the 8.4" disks are machined down to 7.9" (7.5" is a little small for the pads), and the caliper mounting holes are moved inwards a little. MiniSport sell alloy 4 pot calipers, which are essentually modified Metro 4 pots. These do fit under some 10" wheels, but only deep off-set alloys. Check compatibility with the retailer.

- **Brakes, disc brake history for MkI/II**

The "S" (7.5") brakes are significantly better than twin leading shoe brakes. They aren't as good as 8.4" brakes but these would require larger wheels.
The earliest Cooper disk brakes , used on the 997, were probably not as good the twin leading shoe drums. In fact I'm told they

they are far worse but they are also rare. These used a 7" rotor and 2.120" pads.
The next generation Cooper disk brakes used the same size rotor but a different caliper with a 2.335" wide pad. They seem to be the equivalent or maybe just slightly better than the twin leading shoe brakes.
They tend to be listed as 997 cooper and 998 cooper, but I don't think the changeover came at exactly that time, however some sources say some 997s had the later brakes other sources say early 998 had the earlier type.
The real problem wasn't the pads though (or the calipers which are also different). It was the thickness of the disk, the cooper disks faded badly due to their inability to disipate heat effectively. the 'S' type disks are not only larger they are thicker as well.
If you have 12" wheels the cheapest way to upgrade the brakes is to get the 8.4" brakes. They seem to be quite plentiful and cheap in the UK and they're even cheaper than 'S' brakes in the US where they were never officially imported.

- **Brakes, Fitting Metro discs to Mini**

When fitting Metro disc assemblies, it is important to make sure that you use the correct parts.
Metro bits to use:
- Discs
- Hubs
- CV's
- Calipers

Mini parts to use:
- Drive shafts (the metro ones are longer!)
- Swivel (ball-) joints.
- Steering arms (the metro ones give bad handling due to incorrect Arkaman angles (see under 'A')

The wheel mounting lugs also need cutting off.

Brakes, improving 'S' discs

Buy two sets of pads, standard and high-temp. Put the standard pads on the inboard side of the discs, where there is more airflow. Put the high-temp pads on the outboard side (i/s the wheel), where there is less airflow. Best of both worlds - cold stopping power is preserved, and you still have brakes after the standard pads reach heat-fade temperatures. At in-between temps, the setup is near optimal. The only downside is you pay twice as much since you have to buy two sets of pads. BTW, Ford used this arrangement as standard on some Thunderbirds, probably the supercharged ones.

Brakes, Servicing

Fluid overflow from the top of the reservoir suggests the brakes were serviced (new brake pads) and the fluid had been topped up BEFORE the pads were changed!

Fluid leaking down the pedal levers = end seal leak NO BRAKES!!!! INFINITE TRAVEL!

Plume of fluid visible in the brake fluid reservoir when the pedal is pushed = internal seal leak NO BRAKES OR ONE CIRCUIT WORKING!!!!!! INFINITE TRAVEL!

Brake pedal pumps up but is soft = air in the system SOFT BUT WORKING LONG TRAVEL

Pedal travel long but pedal hard at end of travel = rear/front drums need adjusting HARD PEDAL AFTER LONG TRAVEL

Brake pedal pumps up giving hard pedal but needs pumping up again if the car is pushed along the road = loose wheel bearings wobbling discs pushing caliper pistons into caliper, would feel vibration through brake pedal and
need to repeatedly pump pedal each time it was re-depressed after release (if driving) HARD PEDAL AFTER LONG TRAVEL

Brakes, Upgrading drums to discs

When you use the drums heavily, they heat up, with several effects. The friction decreases. The drums expand slightly and move away from the brake shoes, and the heat is transferred to the brake fluid, which also affects efficiency. All this is seen as less braking effort - brake fade.
To reduce fade, you need to remove the heat as quick as possible. In a drum brake, the heat is contained inside the substantially thick drum, and is not dispersed (to the surrounding air) quick enough. Hence minifins and superfins designed to remove the heat quicker. They're good for rear drums, but still don't remove enough heat from the front brakes on a powerful car, as the front brakes provide far more braking effort, and hence heat, than the rears.
The disc brake is open to the surrounding air, so heat is disipated far quicker. Ventilated discs allow even more air to the surface of the disc to cool it even quicker. The amount of space around the disc determines how much cooling air flow there is, so big discs enclosed in small chunky wheels don't get a lot of air - larger wheels, more 'open' alloys and even air 'scoops' help to increase the air flow.
Separate to the fade issue, the efficiency of the brake depends on the pressure applied to the pad by the 'pot' (ie the piston) on the caliper. More, or larger, calipers mean more pressure on the pad, hence more braking effort (but more need to cool the brakes).
There are three sizes of discs that can be fitted to Minis. 7" were fitted to early coopers, with 10" wheels, 7.5" fitted to later coopers, then 8.4" discs which were fitted to all Minis (with 12"/13" wheels?) since about 1984(?).
If you keep your 10" wheels, you can use the 7" or 7.5" discs, but the 7" are very hard to get hold of, and aren't that great at stopping you anyway. 7.5" are easier to get, but still expensive (?). You can only use 8.4" discs if you use 12 or 13" wheels. but they're cheaper and easier to get because they were used on Metros.
The standard calipers have two pots acting on the disc, one on each side.
The ultimate in braking (for Mini's at least) is the set-up used on the Metro MG Turbo. This has 8.4" (?) ventilated discs, with 4-pot calipers. The discs can be machined down to fit other wheels, but you'd then need different calipers such as those produced by Mini Sport (in a range of go faster anodised alloy colours!). Alternatively, I think (?) you can buy various sizes of vented discs, without having to machine Metro ones.
Here's what I don't know, can anyone else help?
What is the advantage of moving to bigger wheels, other than those above?
If 12" wheels are better, why are there 12" to 10" conversion sets available?
What else is needed apart from the discs and calipers to complete the job?
There are kits available for drum to standard disc conversions, or for standard disc to 4-pot vented conversions. Are there any that convert drums to 4-pot vented, without buying both kits and wasting some bits, or having to know and buy all the bits individually?

Brakes, Upgrading Metro discs to Grooved / Cross-drilled Discs

If you do not machine off the little flanges sticking out of the front of the metro drive flanges.....
(i) your wheels might not fit
(ii) if you do not check when fitting the drive flange over the end of the driveshaft that the hole thru' the end of the shaft is pointing away from these flanges and the wheel studs, insertion of the split pin will be impossible/very difficult

Unless you have someone standing on the brake pedal the only way to get the driveshaft nut done-up or undone is by taking the centre cap out of the wheel- fit the wheel with one nut, lower it down and use a long socket to get at the nut thru the hole in the wheel!
When using the above method it is difficult to see if the nut and the hole in the end of the driveshaft are lined up- mark a line on the end of the shaft to show this or cut a little notch across the end of the shaft so it will be there for next time.
Remember when tightening the nut up there is a chance the split collar will lock on the driveshaft before the bearing has been properly clamped up between CV and drive flange, follow the instructions in the supplement in the mini haynes manual to make a spacer that you can use to compress the assembly before you fit the split collar- if you don't use this washer there is a chance the bearing might loosen/fail prematurely
Metro drive shaft nuts are tightened to 160lb/ft unlike mini GT ones at 150lb/ft BUT by the time you have strained and grunted to get the nut round so the hole is accessible you might have pulled 200lb/ft DON'T use your 150lb/ft torque wrench to pull the nut round to line up the hole USE A LONG ARM - it is obvious the torque will have been exceeded and to try to do this with your torque wrench might render it "knackered"
Steps for removal
jack up wheel, remove road wheel, put car in gear, remove split pin, (replace roadwheel (with centre cap removed and 1 nut & lower jack) OR (get assistant to put foot on brake), slacken driveshaft nut (then jack up and remove road wheel if necessary) and drive flange nuts remove nuts remove caliper remove flange and disc
Steps for replacement
Fit disc to drive flange torque up flange nuts to 38 lb/ft, fit assembly on hub, (line hole in drive shaft clear of wheel studs and projecting flanges) fit spacer washer and driveshaft nut (do up to maximum tightness you can do by hand), (fit caliper and caliper nuts apply brake) OR (fit roadwheel with one nut and lower car), torque driveshaft nut to 150lb ft (then slacken & remove washer, replace with split collar replace nut) OR if wheel method used JUST (only just) slacken nut, jack up, remove road wheel and then remove nut and washer replace split collar and nut.
Repeat above task (wheel on or brake on) with split collar in place of washer torqing up to 150 THEN using a long bar turn the nut until the hole in the end of the shaft and the crown nut slot line up- fit split pin replace road wheel and road test checking for play in the wheel bearing after a mile or so
NEVER have a caliper not on a disc when pressing the brake the pistons will drop out! Do one side at a time roadtest after both are done!
If vibration is felt through the pedal on braking the drive flange nuts may be removed and the disc rotated by 90 degrees and the bolts replaced this can improve disc run-out (side to side wobble) repeat on the side in question up to 3 times (90-180-270) to try to reduce the run out .
Long pedal travel then a firm brake can be caused by a loose drive flange or bearing pushing the caliper pistons in as the disc rotates.

Brakes, Upgrading Mini 8.4" Discs to Metro 4-pot Assemblies

Keep the 12" wheel mini hubs use the metro drive flanges discs and calipers, you need an adaptor kit to convert the twin pipe calipers to single pipe mini system. Buy the conversion kit form minispares so long as they tell you what changes are needed to re-balance the braking system (I changed the rear cylinders to mini 1000 ones from the better 1275gt ones BUT DO NOT DO ANYTHING WITHOUT GETTING EDUCATED ADVICE) MINISPARES used to have a sheet to help you change over.

C

Camshaft endfloat

The Haynes manual says :
"Now refit the camshaft locating plate and tighten the three retaining bolts. Check the camshaft endfloat, referring to the figures given in the specifications."

This is wrong. You must fit the cam sprocket before measuring the end float. That sounds like checking the float between the camshaft flange and the lock plate.

The camgear sets the endfloat, not the lock plate!!

Cam timing

Measure the degrees (ON THE CRANK) between two identical inlet lift points on the rise and fall. Half it and that's the degrees ATDC that the inlet reaches max lift. This is known as the Lobe Centre Angle (LCA) and is usually around 100-120 degrees. Most Kent cams are 106'. MG Metro cam is ~112'. If the cam is timed to this figure it is said to be 'straight up'. SOME cams benifit from a deviation from the LCA. Kent 266-296 cams gain a little extra hp at higher revs by advancing the cam by a few degrees to say 103' ATDC. Usually each tooth on the cam sprocket is 4' as seen by the crank. All cam timing (ATDC, BBDC etc refers to CRANK timing). When measuring the two lift points turn the cam clockwise and anticlockwise. Tappet friction can give different results each way.

Cam timing, advancing Kent cams (276,286,etc)

Kent cams are 'straight-up' at 106'. This is the Lobe Centre Angle (LCA) and is the angle between lob centrelines, and is more easily remembered as the degrees after TDC that the inlet reaches full lift.

Vizard says the power curve is increased and shifted up towards the top end if the cam is advanced by up to 4'.

I run my 276 with 3' advance and it shifts like hell (but I haven't tried it at 0', so who knows!)

BL cams (eg:MG Metro) have an LCA (straight-up) of about 112'.

These do benifit from 1 or 2' advance, but not much more than that.

Castor angle, on standard minis

Many feel the standard mini setup has too much castor angle. The steering is too heavy round FAST (50mph+) corners.

Clutch hose, fitting braided type

Fitting braided hose for the clutch.

Seemed a simple enough job, but still managed to cost me more time than I'd have liked. First of all I removed the fixed pipe from the master cyl. to the bulkhead fitting. Then I slackened off the union in the slave cyl. and undid the bulkhead union - this requires a spanner to hold the union at the bottom and a 1" socket on the nut holding the union on the bracket. (Keep the star washers - the new hose comes supplied without?) The union can now be unscrewed from the slave cyl. As tradition would have it, refitting is the reverse... etc. Remember to fully tighten the union on the slave cyl. first, then fix the bulkhead union (careful not to twist the hose) and finally the fixed pipe.

To bleed the system, I recommend that you undo the engine tie-bar at the block and swing it out of the way. This way it'll be easier to get a spanner on the bleed screw. This needs to be a fairly thin spanner - 11mm or equivalent - to alow the bleed hose to be fixed. The process of bleeding is then fairly straight forward. I would, however, suggest the following; it is fairly tricky to get all the air removed, so finally, close the bleed screw and depress the clutch pedal fully, and fix it in this postion for several hours. (In my case I left it overnight) This will allow any remaining air to escape. (Don't ask me how - I don't know, but I would speculate it seeps out past seals etc. After all, the system is fluid-tight, but not necessarily gas-tight)

The same method of bleeding will also work for brakes.

Now remember to refit the engine steady (and coil - it was stopping you getting the socket onto the steady - wasn't it?) and get that cold beer from the fridge!

Clutch problems - Bite point too low/high

Well, the purpose of the clutch levers etc is to move and disengage the clutch from it's 'normally-engaged' state...therefore...
A 'good' clutch will release near the top of the pedal travel (ie: only push down a little).
A poor clutch will need lots of travel to disengage. This can be caused by a few things, here are some of the favourates:
- Throw-out stop too close to housing. As the release bearing moves in, the throwout stop limits it's travel before the plates have disengaged.
- Worn clutch arm (either worn pivot ball, or worn pivot pin) This will need more pedal travel to disengage.
- Weak diagragm centre spring fingers (Verto clutch) (needs more travel to pull pressure plate off friction plate)
- Slave push rod worn or too short.
You can also have a 'poor' clutch that bites TOO high causing slipage. This is caused by:
- Worn friction/pressure plate.
- Weak diaphragm outer (main) spring.

Clutch slave cylinders

The thread for the hose is different on the Verto slave, but either cylinder will work.

Clutch, Types

What is the difference between Verto and non verto clutches?

I have just been through the what clutch saga for my new 1310.
In the process I found out pretty much everything about mini clutches.

OLD-STYLE:
This clutch was used from early 60's to 1982. It has the pressure plate on the engine side of the flywheel, and the diaphragm sits on the outside pulling the pressure plate into the flywheel, through holes in the flywheel, sandwiching the friction plate. This type of clutch is just as good as the verto, but is prefered by the big-engined mob since more upgraded parts are available/cheaper. Lightened flywheels and fast friction plates are common/cheap. The bad things about the old-style is that it does tend to snatch on (even in standard form).

VERTO:
This newer clutch was fitted from 1983 onwards when the metro came out. It was designed to be lighter operating and have a smoother pickup (springs in middle of friction plate). The diaphragm and pressure plate is all in one and sits on the outer side. This moves towards the engine to squash the friction plate against the flywheel. The diaphragm assembly is more expensive that the old-style but seldom needs renewing, as it's very meaty. The old-style friction plate is directly swappable with a verto plate. MEANING YOU CAN USE UPRATED OLD-STYLE PLATES IN A VERTO. The flywheel has a large centre hole, and it's the diaphragm that sits on the crank, hence it's easier to remove the assembly (still need puller).

For my 1310 (GT block/crank) I used a 90k mile verto assembly from a scrap 998cc A+ and stuck a AP Racing Old-style friction plate in it. This is what the MG Metro Turbo does.
It works fine.

Clutch, Verto introduction

The metro started off in 1980 with a non Verto clutch then went to Verto later on in 1983, then in 86 went to cable operated Verto.

Clutch, Verto throw

The verto clutch requires a greater throw. Hence the use of a shorter clutch arm. If you use the long arm on a verto it won't disengage fully and you won't be able to get in some gears!

Crank case ventilation

On a worn engine combustion gas gets past the rings. This builds up pressure in the sump, reduces power and causes oil leaks. So, we exit the gas via the crankcase breathers. This is on the tappet cover on a 998 and timing/transfer covers on 1275. Flash people, like me, also vent the rocker cover. To comply with car build regs the designers just fed the gas back into the carb to be re-burnt.
Easy?
So what's the problem?
Well, if you've ever looked inside the throat of a carb, you'll see that the vent pipe joins the carb just behind (on the atmosphere side of) the throttle butterfly valve.
Oh no, those clever designers didn't put the vent on the engine side so that the gas is sucked in on max vacuum (decelleration), they thought it would be clever to stick it before the butterfly so that the gas gets sucked in when the vacuum just before the throttle valve is greatest...
When is this?
Well, it's when the throttle is fully open, but the dashpot piston is just starting to rise.
Or to put it in more general terms.....it's when you floor it!!!
All that horrible unburnable gas pouring into your carb just at the moment you want full power?!!!
MAD!!!
Disconnect it! Don't listen to those BL guys! They have designed granny's economical runabout...not a street racer!
So, if you know what's good for you, you'll block the pipe on the carb ONLY. Vent the crank case pipe to air, or to a catch tank or something.
Obviously the down side is that the pressure inside the crank is no longer 'negative' and you may get a slight increase in oil leakage.
If you've got loads of gas coming out of the vents then your engine is dying and the rings are worn.

Crank, cross-drilling

The minicrank is not cross drilled as standard leading to potential problems at high revs as the lack of restriction in the oil flowing out from the centre mains to the ends, leads to centrifugal main bearing oil starvation. Crossdrilling of the big end oil ways and the blanking off of the existing drillings puts more of an obstacle in the way of the oils travel so for extended high rpm without mains failure cross-drilled cranks are the thing. Normally the oil has a line of sight trip out from the main bearing oilways out to the big end oil way outlet drilling

Crank dampers

The crank damper is the 'heavy' crank pulley fitted to all 1275 engines and some 998 engines.
This is basically an iron ring on a rubber inner ring that has it's mass and rubber spring constants matched to the 1st resonant frequency of the 1275 crank. It cancels out the resonances and prolongs crank life.
I think this is done because the crank has cyl 2&3 big ends on the opposite side to cyls 1&4 and at high revs this 'longitudinal' mass imbalance coupled with the spring constant of the iron (yes, it will have one) causes the crank to vibrate slightly. This cannot be solved by crank balancing, but can be solved by 'damping' out these harmonic vibrations.
The 1275 crank has 2 resonant harmonics within the 'usable' frequency range at 5950 and 6250rpm <??? check Vizard's TBASE>.
If you don't use the damper, the crank may fatigue and break.
998 engines don't need a damper as the crank weighes less and therefore the 1st harmonic is beyond the usable range at 12k rpm or something.
That is why the 998 engines have a 'light' pulley, and the 1275's a 'heavy' one.
Putting the heavy pulley (the damper) on a 998 won't do any harm, except adding to the rotational inertia, but putting a 998 pulley on a 1275 is asking for trouble.

Cylinder head casting numbers

12A1456 - 1 3/32"In, 850cc/998cc
12G185 - 1 1/16"In, 1"Ex, 24.6cc, for 997 Cooper, fits as big valve head for 850 & 998
12G202 - 1 5/32"In, 1"Ex, 26.1cc, Austin/Morris 1100, fits as big valve head for 850 & 998, but square formed inlets
12G206 - 1 7/32"In, Early MG 1100
12G295 - 1 7/32"In, 998cc Cooper, MG 1100 and MkIII Sprite
AEG165 - 1 13/32"In, 1 7/32"Ex, 21.4cc, Cooper S, can be used instead of the 11 bolted 12G940
AFG163 - Same as above

From experience, the 12G202 forms a very good basis for 998cc tuning. However, it needs to be skimmed dramatically - >0.060" in order to get the compression ration up to a suitable figure in the smaller displacement engine. There is a danger of cutting into the rocker oil feed gallery above this figure, although I have frequently removed near 0.090" from there heads. They can also be modified and fitted with the larger inlet valve to produce a "poor" man's 12G295.

Cylinder head colours and details

1275 metro : Red

Metro Turbo : Sculpted around tappet cover and heater tap.

D

Dashpot Oil, general theory

The main theory behind dashpot oil is that the viscousity should be thin enough to let the dashpot rise as quick as possible, but not too thin as to give a flatspot (temporary leanening).

The engine needs a richer mixture when accelerating, and the delay whilst the dashpot rises gives this rich boost as the air flow over the jet gets faster.

Every carb/engine is different, so you can't really say "I use xyz oil, it WILL be great for you too!"

Wear on the plunger is a large factor here. If the plunger is minutely smaller than another, then the oil will pass by it easier and a reletively thicker grade of oil will be required.

I use 3in1, but saying this, it is the thinnest oil I have tried. I'll try out the auto/folk/olive oils and report back.

Dashpot Oil, use of motorcycle fork oil

I bought some Catrol Fork Oil (LIGHT) the other day. 3 quid in halfords.

I'm using it in the dashpot. It's very thin, so the dashpot rises very quick.

Here are my findings:

- It's thinner than 3in1 or other stuff.
- It gives you lightening quick throttle response and better acceleration.
- It hasn't given me flatspots on flooring it, but may do if you run lean.
- It elliminates gear-change flat spots caused by the dashpot not falling quick enough.

The only bad thing is I now find myself straining to keep a steady foot. The slightest bumb in the road makes the throttle go "rrRRRrrrRrRRrRr". A bit of a pain for road use, but great on the race track.

Differential, Installation procedure

No shims necessary!? It sounds very unlikely.

Procedure for installing standard diff:

1. Install differential assembly skewed over to clutch side before putting on the casing.
2. Tighten casing nuts ligthly (2-4lb/ft) to allow assembly some freedom to move.
3. Put on end cover and gasket on clutch side.
4. Tighten end cover bolts to 16lb/ft. This will push the diff assembly over to the radiator side.
5. Put on the rad side cover without gasket, and tighten bolts finger tight (too hard will distort cover) and eavenly.
6. Measure with feeler gauges the gap between end cover and diff casing (where the gasket will sit) at several places.
7. If not same measurement, loosen and retighten bolts more eavenly.
8. If you could not get any feeler gauge in, something is probably wrong. You should recheck the diff and bearings.

Now on to finding the correct shim:

A - Your measurement.
X - Shim (pack) thickness.
0.001" - Minimum preload.
0.002" - Maximum preload.
0.007" - Compressed gasket after torque down.

Xmax = 0.001" + 0.007" - A
Xmin = 0.002" + 0.007" - A

Examples:
You measured 0.005".
Xmax = 0.001" + 0.007" - 0.005" = 0.003
Xmin = 0.002" + 0.007" - 0.005" = 0.004

You measured 0.008".
Xmax = 0.001" + 0.007" - 0.008" = 0 (No shim)
Xmin = 0.002" + 0.007" - 0.008" = 1 (Don't bother)

You measured 0.010".
Xmax = 0.001" + 0.007" - 0.010" = -0.002 (Not possible)
Xmin = 0.002" + 0.007" - 0.010" = -0.001 (Not possible)

In the third example, you probably have done something wrong, like not pushing over enough in 1.), or there is a mismatch of components.

Now if you're picky, you may install the shims and then measure again. Then you should come up with 0.008" to 0.009". I would go for 0.009" to get max specified preload. As the bearings are run in, they will loose some preload. I prefer high preload, as no preload makes sounds, wears down bearings and make it more prone to piss oil.

What may have happened to you is:
1.) Not pushing it over, thus having some slack on the clutch side mucking up your measurements.
5.) Being too "finger tight" here, thus not pushing up the left end cover enough.
If you then assemble the whole shebang and torque down the casing nuts before the end covers, the casing will pinch the bearings. Then as you torque down the end covers, they will push the diff and bearings over to the side away from the cover that has no slack against the bearing. The other cover will have air between it and the bearing, but there will be preload. Until the differential assembly gets a sideways force that overcome the pinching force of the cover that is. Such forces may be a result of the helical pinion, or your hammer blow.

OK. All that aside. It is *not* this setting that make your inner flange wobble!

That is the play of the cylindre shaped part of the flange in the bushes of the end cover. Did you check this? What Hines say is to "fit a new cover". (Thank you Mr. Haynes! Got any stock in the spare parts dept.?) The play in the differential gear shafts in the diff cage bushes also affect the sloppiness of the shafts, although they seldom are very worn down.

What you should do is not reinstall parts that does not havea good fit when you put the flange into the cover. Alternatively to grind down the flange until all wear is taken out, then fit and ream a new bushes to the end cover. Oilways must also be carved into these bushes. To my knowledge you cannot buy the needed oversize bushes, and need to make them yourself.

If the fit is sloppy, then your inner CV's will also slop. And the seals will be left with an impossible task, so they will let oil out onto your driveway.

Differential drive ratios

See 'Final Drive Ratios'.

Dipsticks

The A and A+ dipsticks are different. The A+ sits straight in the block and A series one sits in a tube that sits in the block.
The distance from the tip to the max/min markings should be the same, but the length of stick from the tip to the seal is different.
Beware that you have the correct one for your block.

Drive-shafts

Except for the earliest drum brakes ('59-'61?) all Mini drive shafts are
interchangable. There are two types of shaft, the old type that use inboard
pot joints and the later type that don't.

Drop gear ratios

List of drop gears. There exists ratios of:

1:1.00 (Standard ratio)
1:1.04 \
1:1.08 } Special ratios (often Jack Knight, etc)
1:1.09 /

Dump valve, on turbo, explaination of

The compressor draws air in and the compressed air is delivered through the carb. to the inlet manifold. A sensing line from the compressor housing actuates the wastegate diaphragm at a predetermined pressure and opens the wastegatevalve(dumpvalve), thus reducing exhaust gas-flow to the turbine and thereby controlling compressor delivery, A sensing line from the plenum chamber is connected to the ECU and fuel pressure regulator valve. At high engine revs the boost pressure is increased by an electronically controlled

solenoid valve that vents air from the sensing line, this reducing the pressure to the actuator diaphragm and the turbine pressure is allowed to increase to a maximum,
controlled by the dump valve. The fuel regulating valve increases the fuel pressure in proportion to the compressor pressure.

Dynamo to alternator conversion

These are my notes from an article by Keith Calver on instructions according to Peter Calver.

Parts needed:
bracket 12G1053
pulley 12G1054
fan C37222A
belt GCB10825

1. Disconnect battery
2. Remove regulator box from car, carefully marking all connections.
3. Remove dynamo, etc.
4. Fit alternator, new bracket, and new belt.
5. Dismantle regulator (use junk regulator if you have one). Remove coils and contacts. Remove connections to blade terminals.
6. Solder links between terminals A, A1, and D, connecting all three.
7. Solder a link between terminals F and E.
8. Reconnect loom to correct terminals-EXCEPT-connect ignition warning light (brown/yellow) to terminal E.
9. Connect alternator to loom: Large wire to large terminal (output), and small wire to small terminal (sensing).
10. Reconnect battery

If I recall these instructions assume use of Lucas alternator and keeping pos(+) ground. If you convert to neg(-) ground, you need to make sure battery is installed correctly and that the battery connections at the ignition coil are correct.

E

Electric vehicles

Electric cars are less environmentally friendly then petrol ones. It's down to the efficiency, much more energy is wasted in burning fuel, converting that energy into kinetic energy to drive generators, generating electricity, transmitting it over long distances, transforming it down to domestic voltage, charging batteries, then using those batteries to drive an electric motor, than in simply burning fuel to convert into kinetic energy to drive a vehicle. Plus the fact that electric cars are generally heavier than petrol driven ones (all those lead/acid batteries) so take more energy to move around.

Then there's the manufacture of all those lead/acid batteries, and their disposal when they're worn out.

The only advantage of this is to move pollution out of city centres.

The reasons for all these supposedly environmentally friendly initiatives is political. Politicians want to be seen to be doing something about this issue. The problem is that journalists pick up on all these pointless (and expensive) ideas and spread them around as gospel.

In fact according to figures I've read only 5% of pollution is attributable to traffic the rest being generated by industry. Political parties get a lot of funding from large industrial concerns so don't like to hit industry with enormous taxes or stringent anti-pollution regulations or the party will lose funding. So they hit Joe (and Josephine) motorist instead as an easy target. They've now done such a good job of portraying the car as the great evil of the twentieth century that anyone who complains about these measures is branded a right wing loony. However I don't think it was Alec Issigonis who said "Now I am become death, destroyer of worlds" was it?

Engine numbers

Block numbering:

British Model numbering

1st char - Make (Model)
A - Austin, C - Austin, M - Morris, K - Morris, R - Riley, W - Wolseley

2nd char - ?
A

3rd&4th char - Body type
2S - 2 door Saloon

5th char - Series/Mark
1 - Mk, 1 - Riley, Wolseley, 2 - Mk 2 - Riley, Wolseley, 4 - Mk 1 - Morris, 6 - Mk 2 - Morris, 7 - Mk 1 - Austin, B - Mk 2 - Austin

Australian Model numbering

1st char - Country of Origin
Y = Australia

2nd char - Make (Model)
M - Morris (Saloon), K - Morris (Cooper), [JB - Morris Van]

3rd char - Engine size range
A - 848/997/998, G - 1098/1275

4&5th char - Body Type
2S - 2 door Saloon, [V - Van]

6th char - Series/Mark
1 - Saloon, Cooper, 2 - Cooper S Mk 1, Van Mk 1, 3 - Saloon, 4 - Cooper S Mk 2, Van Mk

LIST OFF ENGINE NUMBERS:

Size: 850cc:

8A 850 Austin 34HP until eng.nr. 25000
8MB 850 Morris until eng.nr. 25000
8AM 850 Austin/Morris since nr. 25001
8AH 850 Austin/Morris Automatic
8AJ 850 Austin/Morris with crankcase gas recycling (??)
8AK same as above, Automatic
8WR 850 Wolseley/ Riley
8AC 850 Moke
85H/101 850 from 1969 on

Size: 998cc:

9WR 998 Wolseley/ Riley MK II without crankcase gas recycling 36HP
9AD same, but remote gear, crank case recycling, 39HP
9AE 998 Wolseley/ Riley MK III
99H/-/101 Wolseley/ Riley, Mini Clubman, Mini 1000 from 1970 on with dished pistons
99H/791 Mini 1000 1974 on with dished pistons
99H/997 A+ block from 1980 on with flat pistons and 2.95 diff
99H/A97P A+ with dished pistons, pre-A+ gears, 3.44 diff and 12" wheels

The following are A+ engines from 1985 on with the ungrooved lower main bearings, piston with circlip pin. 42 HP

99H/B81 until eng.nr. 127431 with circlip
99H/B81 since 127432 without circlip
99H/C20 until eng.nr. 105023 with circlip
99H/C20 since 105024 without circlip
99H/997 sine eng. nr. 127422 with 2.9 diff

From 1988 on lead free:

422 with 2.9 diff

99H/G30/32/33 41HP
99H/F15/16
99H/D81
LBB10089

Size: 1100cc:

10AMW/Ta Clubman estate and Austin 1100 45HP
10H791Clubman 1000
10GR/Ta/H MG1100
10GRB/Ta/HMG1100/ Wolseley 1100
10V/Ta/H Vanden Plas 1100

Size: 1273:

12G/Ta/H Wolseley/ Riley/ VP 1300 with S-Conrods
12H739 1275GT with electric fuelpump and dynamo, 53HP
12H380 same with alternator and remote gear
12H389 same as 12H379, but mechanic fuel pump
12H390 same as 12H389, but alternator
12H706 same as 12H380, but rod gear change
12H397 Cooper S MK III with dynamo, 73HP
12H398 Cooper SMK III with alternator
12H/-/ 1275 Allegro, Austion 1300, 53HP
12H610/635 Innocenti Cooper with duplex chain, 64HP
12H719/832 same with simplex chain and tensioner

12H832XH De Tomaso 120L 70HP
12H996AMG Metro
12H959aa MG Metro Turbo 93HP
12A/2A Cooper 1300 from 1990 on without cat
12A/2B Cooper 1300 from 1990 on with cat
12A/2D Cooper 1300 from 1992 on with injection, C/R 9.4:1 or 10.1:1

The following letters are additional to 12A numbers:

G01 C/R 10.1:1, 3.11 diff, catalyst, no oil cooler
G03 C/R 9.4:1, 3.11 diff, catalyst, from may 1992 on
G04 C/R 9.4:1, 2.76 diff, cat, french version
G05 C/R 9.4:1, automatic, cat
F53 C/R 10.1:1, 3.11 diff, cat, oil cooler
F75 C/R 9.4:1, 3.11 diff, cat, injecti

<Immagine>

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F

Final drive ratios

Ratio Teeth Model

2.75:1 ????? 1997+ Coopers
2.95:1 20/59 1982-1985 City/Mayfair with 10" wheels
3.05:1 20/61
3.11:1 59/19 1985+ City/Mayfair with 12" wheels
3.21:1 19/61 Metro Turbo
3.27:1 18/59
3.44:1 62/18 Early 10" wheel minis, 1275GT Feb '71+, Cooper S 1275
3.65:1 17/62 Early 1275 GT's (1969 - beginning of 1971)
3.76:1 17/64 Austin Seven, Minor, Cooper, Countryman/Trav'r, Pickup
3.94:1 16/63
4.13:1 15/62
4.26:1 15/64
4.35:1 15/65
4.53:1 15/68
4.78:1 14/67
4.90:1 11/54

Final drive ratios vs. performance

This subject always causes plenty of discussion amongst hardened mini tuners! There are plenty of final drive ratios to choose from, but it is important that you choose the correct ratio for your own personal driving style.

The final drive ratio (ratio of differential crown gear to it's drive pinion) determines the performance characteristics of a car, and denotes how the engine's power is geared to torque at the wheels.

Confusion begins when people talk about 'high' or 'long' final drives. They are refering to a 'high geared' diff, which will have a smaller ratio and a lower first number (eg: 2.95:1). This FD will give less acceleration because the 'mph per rpm' is greater. The torque at the wheels will be less, and the revs at cruising speeds will be lower. This is more suited to a driver who does lots of motorway cruising at ~80mph, and will often get better mpg as the engine will not rev so much.

If on the other hand you want fast acceleration and are not worried about cruising at elevated revs, then a 'lower' diff ratio would be more suitable. This would have a higher ratio/number, but would be lower geared (eg: 3.76:1). This ratio would give very fast 0-60 times, but top speed would be limited by the fact that the engine would be revving high when cruising at high speed. Good for twisty roads, but not too good for motorways.

Obviously, a very powerful engine could accelerate a high diff, and if you are willing/able to rev high then top speed will still be high (racing minis use ~4.3:1 diffs but still reach 120mph at >8krpm!)

So which diff should you go for?

Here is a table which will hopefully aid your choice:

Diff Ratio Acceleration Typ.Cruising mph (<4k) Revs at 70mph

2.75:1 Weak (1275+ only) 90+ <3k
2.95:1 Poor economy 998 80+ ~3k
3.1:1/3.2:1 Medium (good compromise) ~75 ~3.5k
3.44:1 Good ~70mph ~4k
3.76:1 Very Good ~65mph ~4.5k

As a rough guide:

Choose a diff which gives your usual top cruising speed at your usual top cruising revs. If you drive at 80mph on motorways and don't like pulling more than 4krpm, then a 3.2:1 would be best for you.

If you want economy and do alot of motorway driving, use a 2.95:1
If you want sporty performance, but still ok for motorway use 3.44:1
If you don't use motorways much and you want great 0-60 use a 3.76:1

Final drive ratios vs. tyres

See also 'Speedometer Calibration'

Engine speed @ 60 MPH in 4th gear (1:1 in the gearbox, no dropgear reduction)

TYRE\/ DIFF> 4.33 4.27 4.13 3.76 3.65 3.44 3.11 2.95 2.76

165x70x10= 1056 turns/mile 4576 4506 4365 3976 3851 3637 3279 3115 2917
145x82x10= 1040 turns/mile 4507 4437 4299 3915 3793 3582 3229 3068 2872
165x60x12= 1020 turns/mile 4420 4352 4216 3840 3720 3513 3167 3009 2817
175x50x13= 1013 turns/mile 4390 4322 4187 3814 3694 3489 3146 2988 2798
155x65x13= 965 turns/mile 4182 4117 3989 3633 3519 3324 2997 2847 2665
145x82x12= 938 turns/mile 4065 4002 3877 3531 3421 3231 2913 2767 2591
165x70x12= 938 turns/mile 4065 4002 3877 3531 3421 3231 2913 2767 2591
155x80x12= 925 turns/mile 4008 3947 3823 3482 3374 3186 2872 2729 2555

175x70x12= 925 turns/mile 4008 3947 3823 3482 3374 3186 2872 2729 2555
185x60x13= 925 turns/mile 4008 3947 3823 3482 3374 3186 2872 2729 2555
195x60x13= 908 turns/mile 3935 3874 3753 3418 3312 3128 2820 2679 2508

Miles/hour per 1000 engine RPM in 4th gear, no dropgear reduction

TYREV DIFF> 4.33 4.27 4.13 3.76 3.65 3.44 3.11 2.95 2.76

165x70x10= 1056 turns/mile 13.1 13.3 13.7 15.1 15.6 16.5 18.3 19.3 20.6
145x82x10= 1040 turns/mile 13.3 13.5 14.0 15.3 15.8 16.7 18.6 19.6 20.9
165x60x12= 1020 turns/mile 13.6 13.8 14.2 15.6 16.1 17.1 18.9 19.9 21.3
175x50x13= 1013 turns/mile 13.7 13.9 14.3 15.7 16.2 17.2 19.1 20.1 21.4
155x65x13= 965 turns/mile 14.3 14.6 15.0 16.5 17.0 18.1 20.0 21.1 22.5
145x82x12= 938 turns/mile 14.8 15.0 15.5 17.0 17.5 18.6 20.6 21.7 23.2
165x70x12= 938 turns/mile 14.8 15.0 15.5 17.0 17.5 18.6 20.6 21.7 23.2
155x80x12= 925 turns/mile 15.0 15.2 15.7 17.2 17.8 18.8 20.9 22.0 23.5
175x70x12= 925 turns/mile 15.0 15.2 15.7 17.2 17.8 18.8 20.9 22.0 23.5
185x60x13= 925 turns/mile 15.0 15.2 15.7 17.2 17.8 18.8 20.9 22.0 23.5
195x60x13= 908 turns/mile 15.2 15.5 16.0 17.6 18.1 19.2 21.3 22.4 23.9

Therefore, if you have a 3.44 diff and you want bigger tyres (for that sporty look) you'll have to slip in a 4.13 diff and 185 or 195x13 tyres so you will have the same overall gearing. To the fellow who slipped in the Austin America lump without changing the diff, you can see from above why the engine screams all the time. Change your diff or buy a gazillion $ worth of wheels and tyres.

Looking at the above table, I spoze you could draw a couple of bands through the data which show cut-offs for acceptable performance based on usable HP of the engine. Any plonker engine could turn ratios in the top left corner... even a pokey 850 could acclerate nicely, but over on the RH side of the table it takes a lot of HP to turn those ratios.

Fire Extinguishers, colour codes

Red (building) is water, for cars it is dry powder.
Black is CO
Green (cars and kitchens) is BCF (BromoChlorodiFluoromethane halon gas than removes oxygen kills you and the ozone layer - banned now)
Blue is powder (buildings) I think (don't see many of these around)
Grey is AFFF (Aqueous Film Forming Foam)

Flatspots, caused by weak dashpot spring

A common cause of flatspots is a weak dashpot spring. If the spring is too weak the piston will not fall enough when the throttle is closed during gear changes. When the power is re-applied, the piston will be too high and the air speed over the jet will be too slow. The mixture will temporarily go lean causing a flatspot.

Flatspots, throttle hesitancy

There are 3 causes of hesitancy:

1) The oil in the dashpot is too thin/missing. This causes the dashpot piston to rise too quickly under acceleration and the engine doesn't see the rich boost it needs. The temporary leanening gives a momentary loss in power. This flatspot is more apparent when hitting the throttle from idle. Use a thicker dashpot oil.

2) The dashpot spring is too weak or the oil is too thick. This is 'gear-change hesitancy' and is caused by the dashpot piston not falling enough during gearchanges. When you go back on the throttle the piston is too high and the gas speed is too slow. This leads to a temporary leanening and loss of power. Use a stronger spring and/or thinner dashpot oil.

3) There is a problem with the ignition, like the plugs are scummed/carbonised or the coil only gives good sparks out when the system voltage gets high. Renew plugs/leads etc.

Friction plates

See also 'Clutch Types'.

The friction plate (or driven plate) is the clutch plate that gets sandwiched between the flywheel and pressure plate and takes up the drive when the clutch pedal is released.
The verto plate has anti-judder springs in the middle of it, and both types of plate are interchangable. The Metro Turbo uses an uprated 'old-style' plate in a standard Verto clutch. An AP Racing friction plate is a good choice for fast-road applications. A sinterred or paddle clutch is a race plate and has a very on/off operation characteristic. Not good for road use.

Fuel injection, Converting a carb'd mini to Tbi

As promised here's the recipe to create an electronic injectionized mini:
You require:
1 unsuspecting carby mini
1 preferable complete but totalled Tbi mini
1 spare MG-Metro (or other) cam.
Lots of patience

Some tech. knowledge (like: to fasten; turn clockwise;-)
I think an ordinary (unleaded) 1275 engine will do fine as well

I started by taking the Tbi apart (I bought it as a (totally bent) runner). I'd done some research, and found out the only difference in engine between standard Tbi and Cooper Tbi was a higher CR on the Cooper (probably by means of shorter block and different pistons (less deep dish), because the heads are the same), and a different computer. Since my goal was a little more than the standard 54 Hp, I had the head skimmed to get the CR a lttle over the Cooper's (some 10.3 vs 10.1 (9.4 is standard Tbi). It's also possible to go to a hairier cam, since the MEMS-ECU (Modular Engine Management System Electronic Control Unit) can adapt to "new" circumstances. I opted for a MG-Metro cam; 1. because I read in Minimag that 255 deg is the fastest cam that still makes for a "civil" engine (I do a lot of village/city driving), 2. because it sat jobless on a shelf in the garage. I didn't bother with changing the followers since it was a used cam (we'll see if this was a good plan;-), and I didn't feel like separating the block and 'box. First I removed the head and send it to the machine shop to be skimmed. Then I tilted the unit on the bellhousing (using some wooden blocks for support), and turned the cam a few times before lifting it out vertically. This made sure the followers were way up in their bores. Then I lowered the 'new' cam in the same way (on A+ units there's no loose spiders, or other creepy crawlies to take into account:-) It was precisely on time, but DV writes that this cam works best if timed in at 106-107 deg instead of 110, so this I did. I put the engine together and gave it a nice fresh coat of red paint. I wanted to ditch the cat, because I didn't feel like buying a new RC40 rear section when I had a 1 year old Maniflow LCB/RC40 system already. This was one of the most complex things: the original Lambda sond had to be retained, but in my LCB there was no hole for one to fit, on top of that for some reason the thread on the sond is neither metric nor UNF (but Bosch' own I guess). Luckily with the Tbi came a section of manifold (from the size it looked like a Range Rover V8's!), from which the correct nut (still holding a sond), was ground out (thanks Johnmar) and welded to my LCB. Then: horror! When I offered up the LCB to the engine (still not in car), the sond fouled the fuel pump blanking plate:-(Had to do that all over again. It also turned out the intake manifold's water cooling pipe fouled the center branch (how do Maniflow solve this?). You have to use it because the temp. sensor is in the throttle body now. I had to heat the pipe up really well and had to bend it totally to make it clear the branch (and then foul the bulkhead crossmember, so I did that three times:-). In the end it split but I was able to braze it. In retrospect it could have been done with a little less twisting I think. I also applied some DV tricks to the butterfly and spindle (slimming spindle down, knife-edging butterfly and removing butterfly screws' split ends) After all that I turned to the poor old Parklane, who was suspecting something by now, since his engine had been removed and dropped into the Mayfair to have at least one car on the road. I removed the interior (just for easy acces) including wooden dash and switchpanel (to be replaced by 5 switch type), steering column and pedalbox, heater, fuel tank, complete clutch system, wiring loom except the rear section and master brake cylinder (+ front brake pipes, which needed replacing anyway). Then came the process of planning fuel line routes, putting in the new (2 section) loom in the engine bay (I used some of the rear section too, but that's later). I bought 6 metres of rubber fuel line and laid it out; it was only just enough, since there's a return line as well. It now goes through the 'gap' between rear seat upright and rear wing panel, then through a drilled hole in the LH companion box, along the floor, through holes in the crossmember, upward along the bulkhead and it comes through the bulkhead a bit to the right of the clutch master cyl.,from where the original pipes lead to the injector housing. Nearly the same route is followed by the rear section of the Tbi's wiring loom, which is used only for the in-tank-fuel pump and the screen washer bottle, which now sits in the LH companion box (keeping it a bit warmer during winter, but it's really noisy!). Then I had to install the new servo'd brake system, which was fairly straightforward but involves a new pedalbox and a heavy beam across the width of the car to operate the joined pump/servo (sitting RH on the crossmember, so this doesn't apply to RH cars). I used the Tbi's pipes to connect it all (the location of the brake limiter is slightly different, so no straight swap (later found out they're *not* compulsory in NL, but probably wise to use anyway). Finally time to fit the engine, which was not anymore difficult than usual. Fitting all the wires and hooking up all sensors took me a full day. Then came the big moment; I turned the key to II, the ECU clicked and the fuel pump span. I turned the key to III and it cranked, but that was all:-(No fuel from the injector and no spark. At first I was affraid I had made a bad connection and blown the ECU, but that didn't seem the case, because when I took the key out, it made another clicking noise (which Johnmar told me it was supposed to do). So I tore out the injector, thinking it might be blocked, but that wasn't it. In the end I phoned the dealer. He told me to check if the flywheel TDC sensor received signals. It then started to dawn on me that I could have fitted the wrong flywheel. I ran to the garage and in the corner it sat, waving it's reluctor ring at me;-). After I fitted it the next day the engine burst into life on the third stroke:-). To the delight of various neighbours I took it around the block without the RC40 to celebrate. I was immediately punished when my LH rear wheel overtook me:-}. I was only doing 10 Mph or so, so apart from a damaged (but easely repairable) rear wheelarch no harm was done. Next on the list was the heater. New minis use bigger diam. pipes and they sit on the other side of the heater. Another thing was that the new brake system covered up all the holes in the crossmember. In the end I removed the bulkhead blanking plate and drilled two holes in that, just large enough to put a hose connector through. The only problem now is that the heater mounting points on the bulkhead seem to be useless, because the brake-bar is in the way. I'm still looking for a better solution than the current electricity wire:-) While I had the hole thing apart I fitted the new woodgrain Pioneer 5400 radio, which looks great; it matches the dash grain very well and it sounds brilliant:-). The car is a lot quieter now (when stereo off:-), because I also fitted the more extensive Tbi sound deadening material. I've now driven it for some 70 miles and the ECU is adjusting quite well. At first it would stall when I took my foot off the loud pedal, but it now happily idles at some 850 revs. The plugs have a healthy color and it pulls like a train from 2000 RPM (probably due to the MG cam). At 60 Mph there still seems to be enough power left, but I'll try that once it's all a bit settled. Braking is great too; I'll never go back to non-servo now:-) I'll try and persuade Johnmar to see which one's faster. It also apears to be economic, because in 70 miles, the fuel gauge is now just below the top mark:-) In all I think it was a succesful operation, but it requires plenty of time (I took my time: 2 months, in odd hours and a number of full days) to do properly (and you still will fit the wrong flywheel or worse:-(I thank Johnmar Mulder for his h*lp and lending me Manuel's latest edition (which btw, apart from the new electronic section, is a real step in the wrong direction (no gearbox section, no timing charts (for older engines), not even how to remove the front subframe mountings!, and a lot of "when this problem occurs, refer to your dealer"), so get an old one while you can!). Although it was a bit long I hope you enjoyed the read and are not too discouraged to have a go as well:-)

G

H

Heated Inlet Manifolds

The general rule with heated inlets is:

- Don't heat them. A cool inlet charge is denser and gives more power.

- Heat them only in the depths of winter when the carb may ice up, and use the heater hose. Pull the hose off the heater tap and connext to the inlet. Then run a new hose back over round to the heater tap. You'll be using the heater in winter!

Heater cable, modifications for servo'd minis

Modifying the heater cable on brake servo assisted Minis, 1989 on:

If the heater on these Minis doesn't get hot enough (or does not give cool air), check the connection on the heater valve in the engine bay. The cable is only hooked in the valve, so it is not possibility to adjust the travel of the valve as on the old Minis.

The valve lever travels a distance of about 28mm. But sometimes the cable does not make the same movement. The only way to do an adjustment, is to measure the amount the cable moves. Let's say, it's doing 25 millimeters. So the difference is 3mm. Cut those 3 mm (better 4) from the outer cable.

In this way you have increased the travel of the cable.

HIF6/44 carb, source

HIF6 is 1.75", HIF44 is 44mm...they can be considered the same!

Cars that use the HIF6/44:

Metro 1300s, MGB v8 GTs, Montego 1300 1985 on, Morrris Ital 1300 & auto, Marina 1.7, 2 litre Sherpa vans, 440 Metro vans, Metro 575 vans 1982 on, Mini Cooper 1990 on, Maestro 1.3 HC, 1.3 UL, 1.6, 3.4 manual choke conversion v6 Jaguars 1984 on, ALL Austin Princesses 1976 or 79 on depending on model, Austin Ambassadors, Austin Marina USA 1972 on, 1300 Allegro 1981 on 1500's, 1979 on, 1972-74 Austin 2200 Landcrabs.

History of the Mini

Mini enters middle age with a smile
Thirty-five years ago, the world of automobiles was shaken by the arrival of the BMC Mini. Those of us who were old enough in 1959 to recognize a ground-breaker know what it was like; those who weren't should just consider that in those days a small front-wheel-drive automobile with the engine and transmission mounted transversely was unique. Don't bother trying to count how many of today's automotive offerings use that format; you'll only make yourselves dizzy. Suffice it to say that the Mini (which came before the skirt, by the way) is the only car that can hold a candle to the VW Beetle in longevity and popular appeal.
The strongest evidence for the Mini's strength is that it managed to live through the whole of the British Leyland era. While BL was killing not only individual cars but entire marques like MG, Triumph, Riley and the rest, the Mini soldiered on, even surviving the attentions of BL's so-called "stylists" who gave it a facelift, which did for the car what Hannibal Lecter's mask did for Anthony Hopkins.
Thirty-five years on, the car is still here, now wearing its original 1959 front end again, and thousands of Mini fans were invited to the birthday party, a bash so big it had to be held at Silverstone racetrack. To celebrate the anniversary, John Cooper, the man who created the Mini Cooper (and thus put more fun into an overall length of 10 feet than anybody ever intended), announced the "Grand Prix" Mini Cooper. Cooper is building them in the garage that has become a shrine to enthusiasts, and they will be sold--probably by the time you read this--to the first 35 customers to cross the threshold bearing a check for 13,495 pounds ($20,700).
The lucky buyers will get a car tuned by Cooper's own mechanics to produce 86 horsepower (original Minis made do with just 34) and 20 percent more torque than a standard 1994 model. Acceleration, at 0-60 in just under 9 seconds, and top speed, at 105 mph, aren't shattering by today's standards, but this isn't a car to be measured by today's standards. This is a car to be put among the all-time greats. You can compare Nuvolari and Mansell, or Babe Ruth and Reggie Jackson, only on paper, but you can go out and buy a Mini Cooper Grand Prix--well, 35 of you can.--Ian Norris

Check out the year by year history at http://www.mini.co.uk

Hydrolastic Suspension Units

This is a (incomplete ?) list of the unit numbers for different hydro units:

FRONT:

Part# Application Body# (not exact numbers)

21A1477Cooper to 830000
21A1804Cooper to 1025600
21A2008Cooper 1025600 on
21A1872Cooper 'S' to 1025600
21A2012Cooper 'S' 1025600 on

REAR:

Part# Application Body# (not exact numbers)

21A1477Cooper to 830000
21A1804Cooper to 1025600
21A2008Cooper 1025600 on
21A1874Cooper 'S' to 1025600
21A2014Cooper 'S' 1025600 on

SPECIAL TUNING:

Part# Application Front/Rear Colour Band

C-21A1693 Rally front 1 yellow
C-21A1705 Rally front or rear1 yellow
21A1811Rally front or rear2 orange
C-21A1819 Race front 1 red
C-21A1821 Race rear 2 red
21A1872Race front 1 blue
21A1874Race rear 1 blue

These part numbers are form the Austin and Morris Mini Cooper and Cooper 'S' Mechanical Service Parts Catalog (AKD 3509) form 1965, so they should be correct. It does include exact(?) body numbers for each of the units but the list would be a lot longer....

I

Ignition, LT frequency

LT Frequency (Hz) = RPM / 30

Ignition, coil electrical properties

Typical figures for Lucas Lucas DLB-101 12v coil

Primary (LT):
9.639mH
11.57ohm series resistance

Secondery (HT):
47.33H
52.41kohm series resistance

Import Rules for minis into USA

The answers can be found at the source.
www.nhtsa.dot.gov/cars/rules/import/
Very helpful source of information!
It says unequivocally:
Under 49 U.S.C. § 30112(b)(9) (formerly section 108(i) of the Act), "any motor vehicle that is at least 25 years old" is not subject to importation restrictions.

Insurance tips

Insurance tips:

1) Non-specialist companies are a bit silly and tend to put up the premium for any major mod. Declare you've upgraded your brakes and they'll probably up your premium! Go with a specialist.

2) If you have a good record (full NCB etc.) then mods are less likely to effect your premium. Odd but true.

3) If you are insured fully comp mods are less likely to affect your premium. Equally odd but equally true.

4) An agreed value policy is a good idea (see above).

5) Don't crash your car.

J

<Immagine>

KLMNO

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K

L

Leaded petrol, effects of

"Effect of Leaded petrol in Minis" - Quote from the May 98 issue of Practical Classics.

Suitably tested fuel additives will be available before four-star petrol
is banned on Jan 1,2000, according to a top fuel industry scientist.

Dr Mat Vincent, an expert on fuel and combustion, has been appointed to
the Federation of British Historic Vehicle Clubs Fuels Committee to test
the effectiveness of petrol additives.

He told club delegates....that research is well under way and that the
fuels committee will be able to make recommendations to owners well
before the 2000 lead ban.

Dr Vincent will use BMC A-series engines, which are particularly prone to
valve seat recession and therefore more at risk than most engines.

Research as shown that valve seat recession varies dramatically depending
on engine type and use. At lower engine speeds, damage is negligible, but
at higher revs recession becomes a serious problem.
Dr V said that sustained hard driving on some engines could see a total
loss of valve clearances in less than 500 miles.

He also confirmed that fitting hardened valve seats is the best long-term
solution to running on unleaded fuel." (More, but less relevent)

Lowering car, by cutting down trumpets

Cut off 1/5 of the lowering amount on back. 1/3 at the front. To lower by 1",
chop 1/5" off rear trumpets, 1/3" off fronts. Be aware that it takes over a
week to fully 'sag in'.

Lowered shocks, when to use?

If lowered by more than an inch then use short shocks. When I lower Borris by ~1.5" at the rear he was hitting the shock end stops.

M

Metro Engine Upgrade

What problems will I encounter when I put a 1275 metro engine into a mini and how much will it cost.

Make sure the Engine has;
1) a hydraulic clutch, If you have a none Verto clutch on your mini then you will need a Verto slave cylinder.
2) a blanking plate where the heater valve goes (it maybe filled in)
You will need;
1)An engine!!
A straight metro engine will cost about 130ukp (from a scrappy)
An MG metro engine will cost about 150ukp (from a scrappy) and will give you quite a bit more power 80bhp rather than 70bhp.
Or If you are planning to get even more power get an MG Metro Turbo engine, This engine is quite a bit heavier and has a stronger gearbox, stronger clutch, stronger crank etc so if you are planning to rebore for even more power then this is the engine to look out for. If you have the space try and find a knackered MOT less Metro turbo this can cost as little as 30ukp!!! then you get you self a set of vented disk/4 pot calliper brakes as well!! But you will need a std 1275 Distributor from a scrappy as the Turbo one is electronic.
2) Don't even think of using the std exhaust inlet manifold. Buy a 1275 stage1 kit this will cost about 150ukp,
3) NEW std radiator 40ukp or an uprated one 60ukp(?),
4) An extra engine steady, one the fits to the Thermostat housing 30ukp,
5) New engine mounts, steady bushes (one end of the steady should be polypropylene) and uprated mounts are a good idea but not essential, 10ukp,
6) A 1275 top radiator hose and Radiator top mount, both of these should be available from Any mini specialist. 15ukp,
7) An engine lifter of some description about 20ukp for a weekend,
You will HAVE to do the following to your new engine,
1) Drill a few small holes in the thermostat, Because Metros don't have bypass hoses
2) Fit a mini thermostat housing,
3) Remove all metro engine mounts from the 1275 and put the lower radiator mount from the mini engine onto the metro engine.
4) At least renew the drive shaft seals or even better dismantle and rebuild!! (I didn't and the engine changed it's oil every 3 weeks)
5) Completely new ignition bits,
6) Renew the oil filter,
7) Fit the Radiator before you put the 1275 in the car as this is a b*st*rd with the engine in.
8) You have to use the mini water pump pulley.
9) You have to 'adjust' the crank case breather flame trap on the radiator side of the engine with a large hammer to clear the radiator fan.
10) Drill a few small holes in the thermostat, Because Metros don't have
bypass hoses you need to restore the through flow of the system when the
thermostat is closed. The bypass hose lets water go back into the water
pump from the head this is what the holes the thermostat do but the water
goes via the radiator.
11) Fit a mini thermostat housing, The metro uses different size hoses this
means that if you use the metro one the top radiator hose will not fit.

If you have a bit more money left after all that
1) Fit a hotter cam!!! the hottest that is advised to go is 286 this is a little lumpy and can be a pain around town (I have been told) I am about to do this within the next few weeks. should cost about 50ukp
2) Rebore the engine to 1380!! with a 286 this should be good for at least 100bhp. unknown cost.
3) Fit hardened valve seats. In the UK leaded will no longer be available from the year 2000, fitting hardened seats will allow you to run unleaded petrol.

Metro Parts which can be used on a Mini

Engine, Front disks/caliper/driveflange combination, handbrake grip, instrument pod, master cylinder, horn, radius arms? (if beam axled), clutch parts if non-cable, carb, inlet, radiator & fan (keep hoses) , oil intercooler (MG metro), Rear brakes, brake limiter, bulbs<g>, you could use the seats, the steering wheel, window winders, rear wiper motor if you want to fit a custom rear wiper, washer pumps, indicator/wiper switch assy.

MG Metro, oil intercooler

It doesn't matter how hot the oil is (within reason), it's the viscosity that is important. It's fine to heat it up quick, so long as it doesn't thin out.

The intercooler will basically conduct heat from the hotter fluid to the cooler one.

Water has a greater SHC than water and will require more energy to heat a litre up by a certain temperature. That means the oil will heat up quicker, and will then transfer heat to the water (hence oil 'cooler').

MG Metro Turbo, differences to MG Metro (non-turbo)

- Turbo has lower compression (bigger piston dish volume)
- Different cam (shorter duration?)
- Chunkier gearbox (eg: first motion gear bearing)
- Inlet valves smaller
- Exhaust valves sodium cooled
- Higher geared diff (3.1, as opposed to 3.2?)
- Higher capacity oil pump
- Turbo oil return into old mech fuel pump aperture
- Verto clutch uses AP Racing un-sprung (old-style) friction plate

MOWOG, what does it stand for?

The usual thoughts are MOrris WOrsley Garages, but many believe that Mowog was an 800lb gorilla employed by BL to tighten up the flywheel bolts using a large wrench and a length of scafold pole.

'Multispark', Possible method of operation?

The way in which these things work is kind of a trade secret, but we had a MASSIVE discussion on the list a year ago about the Multispark thing.

We arrived at the conclusion it was infact....
...a broken HT lead!

Yes! It is a lead with a small gap in it. It cannot be anything active as it has no power feed, and personally I don't think it is a capacitor or anything as 70kV would make short work of one of those.

We think the 'gap' causes 'LC' resonance of some sort, leading to the 'multi' sparking you see on the demo stand.
Believe me, you want one BIG spark not a load of small ones.

My argument goes like this:
"Consider a child swinging on a swing. This is the piston cycling in the engine. The child's elder brother (or big sis) is pushing her. What is the best way to push her on the swing? Give her a big shove right at the top? ...or grab the child and shake the swing around before casually letting go?"

N

Needle profile, SU carb, guide to throttle opening

Here is a rough guide of where to file the carb needle (assuming the carb throat diameter is suited to the engine cc):
Top (thick) 10% idle < 2000rpm
Middle 30% mid 2000 - 4000rpm
End (thin) 60% top end >4000rpm

Take care when filing the idle area. It is very sensitive. To leanen an area, file the rest and wind the mixture screw out slightly.

Needle codes for SU carbs

Here are a selection of needles codes and the vehicle specs that they were used in...

EB - 850cc and rebores, 920cc, 1.25SU, 9:1 CR
ADE - 998cc, HIF38, Metro inlet, std filter, free flow exhaust
ABY - 998cc, 12G295 head, HIF-38, Stub Stack, K&N, 3 into 1, RC 40, std cam
AAU - 1100cc, 1.5in SU, 3into1, heated inlet, RC40, K&N
AAA - 1275cc, HIF38, 9.5:1CR, conical filter
BFY - 1275cc, HIF44, Standard Rover Cooper setup
BEJ - 1275cc, Standard 1.3 Metro <??>
AAB - 1275cc, HIF44, LCB, Alloy inlet, RC40, K&N
BDK - 1275, stg1
BDL - 1275cc, HIF44, 9.75:1CR, MG inlet, LCB, RC40, K&N, std head
BDL - 1275cc MG Metro standard
BDL - 1293cc, HIF44, 1:10, heated inlet, LCB, K&N, stub stack
BDL - 1380cc, HIF44, 1:10, heated inlet, LCB, K&N, yellow spring

BDL+ - 1310cc, HIF44, stg2 head, 276 cam, big bore exhaust
BDL+- 1330cc, HIF44, 11:1CR, MG inlet, LCB, RC40, K&N, 37x29, 286
BDR - 1380cc, HIF44, alloy in., LCB, K&N, stub stack, 285, MG Metro head.

'+' denotes that the profile was filed at the top end slightly to richen it.

The Axx and Bxx letters denote jet size. A for HIF38, B for HIF44. A will work in B (rich) but not vice versa.

Negative camber bottom arms

Need adjustable tie rods to re-sort the caster angle. Also you're supposed to fit a plate on top of the upper arm beneath the bumpstop to limit the bump travel.

Nitrocarbusising and tuftriding

Depending on the process, the crank, etc is submerged in a liquid salt (not NaCl, and not disolved in H2O) at some elevated temp 300? F so the chemical/physical reaction takes place. No, I don't know the chemical composition or the actual temps involved, not something to try at home, kiddies.

O

Oil codes (eg: 20w50)

Most oils use a code such as 10w40.

The first figure is the viscosity rating at 0'C, the 'W' stands for Winter (don't worry, it is just to seperate the figures! sometimes you see 10/40), and the second number is the viscosity rating at 100'C.

The second number is the important one, as this is when the engine is hot.

For a mini engine you want 40 minimum, preferably 50. (eg: Valvoline 20W50, GTX 15W50)

The first number is the viscosity when cold. It helps if the oil is thinner when cold, so that it circulates quickly to protect the parts. For a mini 10, 15 or 20 is best.

Viscosity 'Rating' NOT actual viscosity (in cP etc)

Also known as the 'Grade' of the oil (hence Multigrade, Hypergrade names)

All oil reduces in viscosity when it gets hot. This is a behaviour of hydrocarbonous molecules.

If you draw a graph of temp vs viscosity then various oils will make various lines across the graph.

These lines are the grades or ratings.

Natural oils (eg SAE30) will stick to one line, thinning out when hot, but modern oils have those helix molecules added to try to reduce the amount the oil thins out when hot, and make the oil behave like a different natural oil at different temperatures .

You end up with, for example, an oil which acts like a natural grade 15 oil (quite thick cold, very thin hot) when cold and a natural 50 grade (dead thick cold, quite thick hot) when hot.....hence "15W50" (pretty thick cold AND hot)

You can't print the viscosity figure (in CentiPoise etc) on the oil bottle because it varies with temperature. You could show a list of temps, or show a graph...

....or just state the characteristics at 0'C and 100'C. ...which they do.

You can see that a 'perfect' oil would have the same viscosity when cold or hot. This would be something like 0W100 oil. This isn't available (yet), but modern synethetic oils come in 0W60 (eg: mobil1). These are very expensive.

Synethetics are not much good in mini engines due to the shared gearbox. The gears mash up the special chain molecules and thin out the oil.

Synethetics shouldn't be mixed with mineral oils either.

Many cheap 20w50 oils are of poor quality and get far to thin at high temperatures leading to poor oil pressure.

The general favourites for mini owners are Castrol GTX 15W15, Duckhams Q 20W50, Duckhams Hypergrade 15W50 or Valvoline Racing oil 20W50.

Oil Types

The A engine spec says to use 20w50 oil.
The A+ engine spec says to use 10w40 oil.

I agree 10w30 is too thin. The second value is the more important one as this is the 'hot' viscosity. And your engine is usually hot when you drive it.

You really want 50 as the 2nd value, as the gearbox is served too. Cars with seperate gearboxes use 80 or 90 weight oil!!!

The best oil to use would be something with a small value infront of the 'W' (winter) and a large after. Many modern synethetics have this (eg5w50) but are very expensive. This oil would circulate quick when cold and maintain viscosity when hot.

Only use these if you're either loaded, or your mini has no oil leaks (impossible!).

Personally I think a mini should use good old 20w50 like Duckhams Q or Valvoline.

Oil pressure releif valve, ball/spring upgrade

I finally went for the oil pressure valve mod. I recently obtained a spare valve/spring etc. from a scrap engine, so decided it was 'safe' to have a go.

The only other part required is the ball bearing from a Mini CV joint (9/16" dia.) - the same scrap engine also had drive shafts attached ;)

The trickiest part of the procedure is shortening the spring. The way I did it was to score the spring with side-cutters at the point I wanted to cut it, and then to twist the 'offcut' part - due to the fact it is fairly hard, the spring easily snaps at this point. To keep the spring in shape it helps if it is held on a former while this is done - I happen to have a large screwdriver in my tool box which is just the right diameter.

I removed 11mm off the free length of the spring - approx. 3 coils, not counting the 1/2 coil at the end of the spring. (I measured the original spring at 72mm free length, and the cut spring at 61mm.)

Then remove the original spring/plunger, and feed the ball into the valve, followed by the spring (uncut end onto ball) and replace the cap. Run the engine and note the oil pressure - if it's still too high, then remove some more off the spring.

My engine now runs at 50 psi. +/- 5 psi at all revs/temperature! (That I have experienced so far.)
The oil pressure is remarkably constant, only rising a little with revs, although it has a tendency to dip at a certain rev value (probably related to the resonant freq of the spring) during acceleration.

To make a fully adjustable relief valve, the dome nut needs to be drilled/tapped to accept a bolt/locknut - then the bolt can act on the spring (which needs to be slightly shorter for this application) to modify the pressure - the locknut is then tightened to hold the setting.

Overbores

See 'Bore/Stroke Ratios'.

<Immagine>

PQRST

ABCDE FGHIJ KLMNO PQRST UVWXYZ

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P

Pitch Circle Diameter, PCD

PCD is Pitch Circle Diameter - essentially the diameter of a circle whose circumference passes through the centre of all the studs.

Power figures, for various specs

84 bhp : 1293cc, MG Metro cam, Standard rockers, 12g940 head, 10.5:1 CR, HIF44, BDL needle, LCB, RC40

Q

R

Radiator bracket, for 1275 or Metro

Get a "Cooper S" one NOT a "GT" one. The GT one will push the rad over
against the inner wing.

Radar traps

See 'Speed Camera Operation'.

Radius arms

Grinding sound when going round SHARP left hand corners. It's worth taking a close look at the radius arm bearings. No play doesn't *always* mean they're not knackered. I've had ones where the bearings have worn away so badly that the debris have literally "back-filled" on them, ending up with an off-centre, semi-seized, but playless shaft. (This is normally only the result of years of neglect though)

Rear subframe mounting bolts

The problem with these bolts is that the Factory installed ones that are way too long. I have seen some that stick out 1 inch from the captive nut. All those fine threads are exposed to water over the years and develop a healthy coating of rust. They jam in the nut after a few turns when you try to remove them, and off goes the head. I have soaked them for several days with penetrating fluid with little success. I ended up cutting the excess off. Loads of fun that. I made sure that the replacements did not extend more than a couple of threads past the captive nut, and I smeared the exposed threads with a waterproof grease. I use what are referred to as Grade 5 fasteners here in the USA. These have excellent tensile and shear properties. They bend a little rather than just snap.

Registration letters used in UK

Here is a list of the registration--letters as used on UK-registrationplates and the years they were issue:

Postfix (ie XXX 999 A)

A.....Jan 63 to Dec 63
B.....Jan 64 to Dec 64
C.....Jan 65 to Dec 65
D.....Jan 66 to Dec 66
E.....Jan 67 to July 67
F.....Aug 67 to July 68
G.....Aug 68 to July 69
H.....Aug 69 to July 70
J.....Aug 70 to July 71
K.....Aug 71 to July 72
L.....Aug 72 to July 73
M.....Aug 73 to July 74
N.....Aug 74 to July 75

P.....Aug 75 to July 76
R.....Aug 76 to July 77
S.....Aug 77 to July 78
T.....Aug 78 to July 79
V.....Aug 79 to July 80
W.....Aug 80 to July 81
X.....Aug 81 to July 82
Y.....Aug 82 to July 83

Change to Prefix ie X 999 XXX

A.....Aug 83 to July 84
B.....Aug 84 to July 85
C.....Aug 85 to July 86
D.....Aug 86 to July 87
E.....Aug 87 to July 88
F.....Aug 88 to July 89
G.....Aug 89 to July 90
H.....Aug 90 to July 91
J.....Aug 91 to July 92
K.....Aug 92 to July 93
L.....Aug 93 to July 94
M.....Aug 94 to July 95
N.....Aug 95 to July 96
P.....Aug 96 to July 97
R.....Aug 97 to July 98
S.....Aug 98 to July ???

Note : O,Z and I are avoided as these look too much like nos. U is avoided because it looks like V. Q was originally avoided as it looked like a number, but since 84 has been used to denote a car which was ex-military, imported, rebodied or otherwise not all-new, or built from a kit of parts, some of which were not new at time of first register.

Note 2. All cars up to postfix K can legally display a "Vintage" rear no. plate (ie silver letters on black). All others have to display the black letters on reflective yellow plate.

Running-in procedure, recommended

Ensure that the oil pump is primed with light grease or vasaline prior to cranking to give it that initial suction.
Grease the cam and followers, mains, thrusts etc etc well.
Use a cheap'ish lighter oil for the run in (eg: Halfords own brand 10w40). Thinner oil will wash the crap out the engine better durung run in.
DO NOT use synethetics or STP etc as you need the rings etc to bed in.
Run for about a 30 seconds at 1000-2000 rpm varying. Check everything over. Run for another 5 minutes at around 2000rpm.
Drain the oil and renew oil and filter. Check for large chunks of metal.
Swap to a better medium viscosity oil such as Castrol GTX 15w50.
Drive carefully with light throttle and no more than 3000rpm for 500 miles, then change the oil and filter.
After 1000 miles use the full rev range and add in STP/Slick 50 etc to a decent 15w50 or 20w50 oil.

S

Safety, crash behaviour

Supposedly the car rides up over the subframe so the engine goes under the floor and the steering wheel pulls away from the driver. Unfortunately in practice all sorts of weird things can happen, I've seen tests that some crumpleclones don't do what they're supposed to in real accident situations and are really dangerous.

It's just that the regulation tests don't cover all types of real world accident.
One of my favourites I saw involved driving a car hed on into a concrete block at about 15 mph without the brakes on. In a real accident the whole attitude of the car is different as the brakes are generally hard on so the nose of the car is down. In the case of the mini this means that often the front edge of the subframe passes under the other vehicle so the engine takes the impact, this simply tears off it's mountings and heads for the occupants. I have seen a pickup that had a head on with the clocks pushed out of the way by the cylinder head, scary.

Spark plug gaps

If you use one of those spark tester things you'll quite happily get 1" sparks on a 12V coil. This is at atmospheric pressure in air. Highly compressed petrol air mix is more difficult to arc through and hence a gap of greater than 1mm will soot up and misfire.

Speed Camera Operation, Radar type

Ok, this is how I THINK they work.
The 'radar' sensor looks down on the carraigeway (one lane) and detects radar waves bouncing back at it.
Normally none bounce back as the road is not face on to the sensor.
When a car enters the scene the waves bounce back at the sender.
If the car is moving, then the 'Doppler Effect' causes the received wavelength to stretch.
This is why an approaching car/train sounds like "vvvvvvvvvvvvvroooooooooooooooom" as it goes past. The sound is the same to the car, but is squashed then stretched to the onlooker's ear, as the car approaches and then goes away.
The amount the wavelength is 'shifted' is directly proportional to the vehicles speed. This is how they tell if you're speeding or not, and this triggers the camera.
Now, 99% of camera's have white graduations painted on the road sides too.
As a 'second oppinion' the distance travelled by the car down the markings before the flash fires is another measure of your speed.
A lot of cameras take two shots. One as you trigger the radar, and one at a set time after that. This clearly shows the distance travelled in a time, and then they can work out your speed.
New laser cameras detect the time it takes for a laser beam to be reflected back to the camera. Radar and light are both electromagnetic waves, so they use very similar principles.
Because the transmitted radar waves disperse as an expanding 'spere' from the transmitter and then as another sphere from the car back again, this 'double

inverse square' law means that you can detect a radar trap 4 times further away
than it can detect you..of course with equally sensitive receivers.
That is why radar-trap-detectors DO work.
The radar bands used are the K, Ka and J <?> bands and are at 10,16 and 28 GHz
<?>. IR is in the order of 850nm (0.35THz).

Speed Camera Operation, Laser type

This is how they do it.
The laser is infact an infra-red laser, else it may damage people eyes.
It is pulsed at a high frequency, say 1kHz or more.
The beam hits the car and generates a scattered reflection. Some of this
reflection is picked up by the photo-receiver also on the camera unit.
This is why they don't actually need to shine the laser onto a reflective
surface like mini chrome grilles!
Infra-red can reflect off 'non-visibly-reflective' surfaces too.
The received pulses will be delayed by an amount proportional to the distance
the car is away.
The 'time shift' in the received pulses is the delay.
Yes, light does travel at light speed, so the delay is small...only a few nano
seconds, if that.
This is no problem for modern electronics to detect.
As the car approaches the camera, the distance decreases and hence the delay
decreases too.
The rate of delay-decrease is proprtional to the speed.
Bingo!
Requires a laser diode, photo-detector, phase-locked-loop and a few other
components.
Cost about 100 quid (70 of that is the laser diode).
Size...matchbox.
Incedentally, laser guided missiled work in a similar way.
One aircraft shines a laser to the target, and another fires a missile which
homes in on the reflection 'cone'.
So, if you're strolling down the road and you see a big (about 5ft diameter)
red circle on the floor, beware, you may be about to be 'taken out'.

Speedometer Cable Replacement

Standing at the front of the car, locate the cable from the where it comes out of the firewall and follow it with your hand all the way down to its mounting on the transmission. Its a simple 1 inch knurled nut on the cable that most of the time can be removed by hand. You're sort of doing it blind so just make sure your turning the correct way. I used a mirror to help see what I'm doing. If it won't come undone by hand you might try usung channel lock plyers. More likely you'll find it easier to undo one housing bolt (think its 7/16") and remove the entire pickup gear assembly. Then you can work on removing the cable once pulled up to where you can see it. Make sure the new cable is located as far away as possible from the exhaust headers as heat is their enemy. Put a tie strap on the speedo end to prevent that ends nut from sliding down to the trans.

Speedometer Calibration

See also 'Final Drives'.

I half remember seeing a table with part numbers and ratios for alternative speedo drive gears. This morning while in the 'reading room' I found it! March '98 Mini Mag. One of the FAQ's on this list is regarding correction of speedo indicated speed after changing tyres or gearbox (diff) ratio's. Now, there's no simple answer for this cuz there's too many variables. I did a wee bit of work this (Sunday) morning and here's what I found:

TYRES (from an old Sumitomo catalogue):

165x70x10 = 19.1" diameter = 1056 turns/mile
145x82x10 = 19.4" diameter = 1040 turns/mile
165x60x12 = 19.8" diameter = 1020 turns/mile
175x50x13 = 19.9" diameter = 1013 turns/mile
155x65x13 = 20.9" diameter = 965 turns/mile
145x82x12 = 21.5" diameter = 938 turns/mile
165x70x12 = 21.5" diameter = 938 turns/mile
155x80x12 = 21.8" diameter = 925 turns/mile
175x70x12 = 21.8" diameter = 925 turns/mile
185x60x13 = 21.8" diameter = 925 turns/mile
195x60x13 = 22.2" diameter = 908 turns/mile

Now, obviously changing to larger rolling diameter tyres will SLOW DOWN the speedo reading. Here's another table (I hope you can switch to fixed pitch font!) which shows what happens at the speedo head by changing tyres and leaving the diff ratio constant. On top of each column is the diff ratio (the most common ones) and under is the number of turns per mile of the speedo cable:

tyre \/ diff>	4.13	3.76	3.65	3.44	3.01	2.95	2.76
165x70x10 =	1541	1403	1359	1284	1157	1099	1029
145x82x10 =	1517	1382	1339	1264	1140	1083	1014
165x60x12 =	1488	1355	1313	1240	1118	1062	994
175x50x13 =	1478	1346	1304	1231	1110	1055	987
155x65x13 =	1408	1282	1242	1173	1058	1005	941
145x82x12 =	1368	1246	1207	1140	1028	977	914
165x70x12 =	1368	1246	1207	1140	1028	977	914
155x80x12 =	1349	1229	1191	1125	1014	963	902
175x70x12 =	1349	1229	1191	1125	1014	963	902
185x60x13 =	1349	1229	1191	1125	1014	963	902
195x60x13 =	1325	1206	1169	1104	995	945	885

Note that stock speedo heads for 3.76 and 3.44 diffs and 10" wheels are 1408 and 1280 T/mile respectively, which are pretty close to the first entries above. You can read your speedo ratio right off the face of the instrument. It's the number just below the odometer window.
If you change diff ratio, the above table can be read backwards. For example, if you have a stock 998 Mini (3.44 diff, 145x10 tyres and 1280 speedo ratio) and switch in an Austin America lump without switching the diff from its 4.13, your speedo would be reading 1517/1280=18% too high (the least of your problems). Actually I think 4.13:1 is the Austin 1100 ratio and 3.65 was the AA. Not important to this discussion (but it would explain the presence of 2 sets of 3.65 gears under the bench!).
What the Mini Mag article made me think about was if speedo errors could be corrected by replacing the speedo drive gears. Here's what's available:

gears	ratio	change, %
15/7	2.143	24.4
16/7	2.286	19.3

16/6 2.667 5.9
17/6 2.833 0.0 <normal ratio for <1980 cars
18/5 3.600 -27.1

So, as an example, if all you changed in your 998/3.44 diff Mini is to move up to
175/50-13 tyres, you could retain your original speedo by changing the speedo drive gears to the 16/6 gear set (within 2%). Of course, a 998/3.44 drive train would loose substantially in the performance department since this boot change is the same as jumping down to a 3.27:1 diff but that's another discussion.
What this all means is that with 11 different tyre diameters, 7 different differential ratios, 5 speedo drive gear ratios and who knows how many speedo head ratios you have too many variables to have someone tell you what will work and what will not. You have to figure it out for yourself. Here's how you do it:

(wheel turns/mile) x (diff ratio) x (speedo gear ratio) = speedo turns/mile

examples:
*145x10 tyres, 3.44 diff (18/62 teeth), 17/6 speedo gears...
1040 x 62/18 x 6/17 = 1264 turns/mile at the speedo head, reads 1.2 % low
*175-50x13 tyres, 3.44 diff, 16/6 speedo gears...
1013 x 62/18 x 6/16 = 1308 turns/mile at the speedo head reads 2% high
*175-70x12 tyres, 3.76 diff, 1280 speedo:
925 x 64/17 = 3482 / 1280 = 2.72, so 16/6 speedo drive gears (2.666:1)will give an error of only 2%.

Of course, changing the speedo drive gears is an engine-out procedure, so the actual usefulness of this information is questionable, but it does give you some options when designing your custom Mini project.

Stages, of tuning (stage 1, stage 2, etc)

There is no exact definition to what exactly constitutes a "stage"
but here are some guidelines:

Stage1:
 - free flow air filter (K&N, Piper, etc)
 - uprated needle to cope with other changes
 - better inlet manifold
 - LCB exhaust manifold
 - free-flow exhaust system

 end result can be about 12% more torque and 20% more
 power. Definately the best small-tune you can do, and
 the best value-for-money tuning upgrade.

Stage2:
 - Stage 1
 - modified head, usually I think enlarged ports

Stage3:
 - Stage 2

- heavily modified head: gas flowed, etc.

Beyond that it gets really unclear. Usually some really radical head mods such as reground chambers, flowed ports, and all sorts of dark magic performed on the engine in general.

There is of course a lot of play with various cams independently of the "stage" upgrades.

Stalling, and revs dropping too low

"Every time when I stop, the engine drops the revs really low down to 200rpm or so and then slowly comes back to 800rpm (in 3-4 secs). Sometimes it dies completely hot or cold. Why?"

Dashpot oil is too thick.

What happens is, when you lift off the throttle the piston is taking a while to fall due to the thick oil (thicker when cold). This means the needle too far out of the jet and the air speed over the jet is very slow, this gives a lean mixture, and the revs drop low.

As the piston falls to it's correct level, the mixture picks up and the revs rise again.

Use light oil in the carb, not engine oil. '3in1' oil is popular.

Starting difficulty (I)

Check for slack in the choke cable and that the engine runs at the right FAST IDLE with the throttle cam in line with the tick mark on the rotating sector connected to the choke cable,

Check all the things you would in the ignition....., timing, HT leads coil, condenser, dizzy cap, points gap as per the workshop manual.... the most difficult engine to start is a cold engine and will show up weaknesses in componants as much as hard revving will

The points wear gradually as do spark plug gaps... is it running ok once it has started (this is important for isolating the fault).... does it start better from hot than cold?

Do you have a workshop manual? follow the checks listed in it and you may well improve normal driving performance AND starting by finding the fault

Starting difficulty (II)

- Check that the coil has a good supply of +12v on it's + terminal.

- Check that -ive coil terminal rises and fails between 12v and 0v as the dizzy rotates. If not then the dizzy pickup is not working, or has a bad earth in the dizzy, or the LT coil is blown. Check LT resistance, should be a few ohms.
- If LT is fine, then check for HT on coil lead by sticking a screwdriver in it and holding it near the block with pliers whilst cranking.
- No spark, then coil/coil lead is kaput.
- If coil is ok, then check each lead in a similar manner.
- If leads are bad then check dizzy cap/rotor arm too.
- If leads are ok, stick spare plugs in them and check again.
- If there are no plug sparks, clean/regap/replace.
- If plug sparks are ok, then check timing and carb.

Starting difficulty, check battery terminals

Check the battery terminals for dirt.

If they are mucky then starting/charging will be bad, but jump starting (croc clips onto clamps) will be ok, and this often leads to a good battery being thrown in the bin (sorry, taken to you local freindly battery recycling place).

Starting difficulty, use of WD40

The famous big mistake. You don't want WD40 *inside* the cap. It insulates and stops sparks jumping. What happens inside the dizzy cap?

Just dry it out with a cloth.

Starting, solonoid clicks but starter does not turn

If the solonoid clicks, then check:

- battery power
- battery terminals
- solonoid terminals
- starter terminal
- engine earth strap
- starter motor health (eg: brushes)

Somewhere your heavy duty current is not getting through.

Steering rack, checking alignment

Park the wee beast with the right-side front tyre sidewall solidly up against a kerb, so the wheels can't be steered and have somebody try to turn the wheels with the steering wheel and see if there's any play in the rack, rack-mount, ball-joints or steering knuckles. Then try to see if you can sense any play at all by trying to turn the opposite wheel by hand really hard. Then do the exact same test with the left front tyre against a kerb on that side.

Points where play might be introduced are: worn steering knuckles; worn or loose (nut not tightened down and locked) ball-joints; loose rack mounts; worn or loose rack-end-knuckles (inside the rack boots); worn or mis-adjusted rack gears; sloppy subframe mounts; sloppy lower arm pivots; knackered track-rod rubbers; bent axles; loose axle nuts; bad wheel-bearings.

Steering rack gaitor replacement tip

Gaitors are the rubber concertina coverings on the end of the steering rack tube over the ball joints between the steering rack and the track rods. Count the number of turns up the track rod the end is screwed on by AND mark the "virtual end stop" with liquid paper/snopake in case you forget BEFORE you take the track rod end off, replacement is the reverse of removal.

SU dashpot oil

SU Dashpot Oil

The main theory behind dashpot oil is that the viscousity should be thin enough to let the dashpot rise as quick as possible, but not too thin as to give a flatspot (temporary leanening).

The engine needs a richer mixture when accelerating, and the delay whilst the dashpot rises gives this rich boost as the air flow over the jet gets faster.

Every carb/engine is different, so you can't really say "I use xyz oil, it WILL be great for you too!"

Wear on the plunger is a large factor here. If the plunger is minutely smaller than another, then the oil will pass by it easier and a reletively thicker grade of oil will be required.

Suspension Geometry

FRONT Camber Castor Toe-out
Race -1-2' 5-6' 0
Tarmac comp -1.5' 4.5-5' 0-1/16

Hillclimb -1.5' 6-7' 0
Loose comp -1' 3.5' 1/16
Proper Road -0.75-1.0' 3-4' 0-1/16
Rover +1-3'   2-4' 1/16 (1.58mm - close enough)

REAR Toe-in Camber
Race 1/16-1/8 0
Tarmac comp 1/16-1/8 0
H/climb 1/16 -0.5-0.75
Loose comp 1/8 -0.5-1.0
Proper Road 1/16-1/8 0
Rover 1/8   +0.5-2.5 or what day it is, or what side are we on! :-)

T

Tachometer (Rev-Counter), Wiring

Here are some common wire colours and the connections they should make...

Red : +12v (may need to be regulated)
Black : 0v ground
Green : Negative coil LT terminal
White : Illumination (sidelight circuit)

Tail happy?

A few possibilities:

Cracked, or insecure subframe.
Loose radius arm nut(s) ... most likely the inner one.
Bent radius arm .... sideswiped any kerbs lately?
The clearance isn't that great at the best of times, so if
everything checks out as OK *thin* spacers might be the solution.

Temperature Sender, Location on Injection Coopers

It's in the bottom of the inlet manifold, where it's almost impossible to reach.

Torque Steer, theories for causes of

(1) It's because the longer one is less stiff torsionally. Torque applied at the engine end is resisted by the torque at the wheel end, but sudden application of more engine torque winds the shaft up slightly (like a rubber band), driving the car sideways.

(2) Basically, it is to do with the different angles that the driveshafts make with the horizontal. When they accelerate, they gain rotational momentum, and if they are at different angles, then there is a net force... it is very strange.

Torque Tubes

Torque Tubes

Torque tubes increase torque at low revs due to the momentum of the incoming gas ramming extra charge into the cylinders. Kind of like exhaust gas momentum sucking extra charge out.

At high revs the engine is taking the air from the tube quicker than it can be replaced and the volumetric efficiency starts to drop like on a normal setup.

Transmission Types

There are three types of 4-speed manual gear box transmissions over the 39 years of Mini production. All Mini transmissions are mounted directly beneath the engine block in place of an oil pan (to save space), and share the oil with the engine.

The three types are:

"Magic wand" aslo known as "Pudding stick"
This is the earliest type and is the least desirable. It uses a rather long gear stick that came out from the front of the floor board under the heater. Non-synco first gear. Due to its length and general sloppiness it is like stirring pudding.

Remote Change
These have a housing that connects to the trasmission and comes all the way back to about the front of the seats. The housing itself will actually take up some of the rocking motion of the engine.

Rod change
This is the most common today. Although also 'remote' in design, it is so called because it uses two rods that come out of the back of the transmission. It then has a shifter box that connects the rods and the shifter handle. The shifter-box is hung on rubber bushings under the center of the car as far back as the front of the seats. One rod does not move and is used to locate and fix the length from the gearbox to the shifter box. The other rod does the actual shifting.

Various gear ratio's have been available largely because there have been so many engine power variations to take advantage of, as well as different wheel diameters. Short shift kits are available for both the remote and rod change 'boxes which provide less than half the throw of the standard geometry but will require slightly more effort to operate. Proper greasing is essential to all of these. Since the oil is shared between the engine & transmission, proper oil & filter change intervals are vital to the longevity of both.

In addition to these, an automatic was available. 'Jack Knight racing' make a 5-speed box which is the ultimate although rather expensive.

Turbocharging Mini Engines

The ERA Turbo was a nice mini saloon with smart wheels interior and dask and a sexy body kit and a 1275 metro turbo engine setup but with a side mounted radiator EXPENSIVE NEW and USED. Here in the UK the "quick and dirty" method to make a mini turbo is to transplant a MG Metro Turbo engine transmission and fuel/turbo/ecu setup
into a standard mini, bulkhead and cooling/fueling modifications are needed but the end result would be the fraction of the cost of an ERA (but not as nice).

Turbo, mods required for fitting

Fit a MG Metro Turbo engine. You'll need to modify the bulk head. Cost ~100-300 pounds. Buy an old metro and scrap it yourself. You'll get the decent brakes then too.

Tuning 850cc Mini Engines

Somebody a while back asked about tuning an 850 and most responses seemed to be to fit a bigger engine. While I agree that if you want a fast car that's the way to go, if you want to tune an 850 you can and you use essentially the same principles as for any motor - increase the air flow and raise the compression ratio. With small bore engines though you can't just bolt on huge inlets and exhausts as you need to keep gas velocity high.

Whatever your budget I think the first place to start is the head. Whether you use the standard 850 head or one from say a later 1000cc or 1100 you need to get the compression ratio up. Standard is 8.3:1 I think for the manual gearbox motors. If you can get hold of "premium" fuel you should be looking at CRs of around 10:1 or 11:1. This'll be achieved by getting the head skimmed by a machine shop which shouldn't cost too much. You have to work out how much needs to come off though which you can do accurately by measuring the capaity of the combustion chambers or by a certain amount of calculations and guesswork. If you're sure your head, block and pistons are standard it's quite simple to work out how much you can take off the head by measuring the area of the chamber part of the head and making a few assumptions. The 850 inlet ports are really small so you can open these up a bit. If you have access to a die grinder (or the cash for a machine shop) you can deshroud the valves. This involves cutting metal away from the pointy beak area but make sure you can still get the CR up to what you want when you're done. If you've got the know-how, equipment or cash you can have the complete head flowed (or buy a 998 Cooper head and get it skimmed)

Next you can flow the carb. The carb has a thick spindle going through the middle of it and if you've got an HS2 it seems even thicker! This can be cut down and flowed. Inside the carb the port goes from round to square to round again and you can smooth off the sudden changes. Porting out an HS2 is good as you increase the flow whilst keeping the gas velocity. The early 850 air filter arrangements are tiny and you can change these to the later type which are larger and have a cool air feed. You can fit a K&N air filter too if you're not alarmed by possible extra engine wear.

If you've got the engine out you can have the block skimmed which'll mean you'll be able to deshroud the valves more.

850s don't have a lot of torque so have to be revved. Again, if you've got the know-how, equipment or cash you can have the conrods and crank lightened which mean the engine can be revved more and more easily. 850s should rev anyway in theory as the psitons are so small!

Next I guess is replacement parts. If the engine is out you can ("should") replace the cam for something better. On a street 850 you want something of 255 or 266 duration. The 850 block only has a single replaceable cam bearing so anything more would get eaten up really quick anyway. You can get the other two bearings fitted but it costs! The timing of the cam has an affect of altering the power band so you should really get the timing of it checked and fit offset cam keys if necessary. If you've got an early 850 with the weak springs you'll

need to fit standard 998 springs if you plan on revving more than say 5000rpm. Duplex (double row) cam chain and gears is a good idea too as it'll keep the cam in time for longer and will be less noisy. If you can run to it, fitting offset rocker bushes will give you more valve lift.

Just looking at the standard inlet manifold you can tell it was designed to fit in a small space! These are generally crap and you can fit an aftermarket one but again don't go for anything too big, go for flow.

Next I guess is the exhaust. You *can*, if you really want to, keep the standard single box exhaust system but replace the single box with an RC40 box. Exhaust's flow better without the centre box (a common MG-B trick) but they are a little noisier. You'll get the gas speed along the narrow downpipe but you won't get the same back pressure from the silencer. More than that you can get aftermarket long centre branch manifold and slightly larger bore system.

You *need* to get the car rolling road dyno'ed after any changes as an 850'll need every hp it can get. If you've raised the CR and the ignition timing is out you run the run of blowing big holes in your pistons too.

I think I've covered most things. The above's pitched at someone wanting to improve their street motor on a limited budget. Of course if you want to nick the injection and turbo components from a Dihatsu Charade GTti you can.

Article written by Steve Adderson.

Two-pack Paint

Two-pack is nasty stuff. It has cyanide in it! That is why it's illegal to DIY it in the UK, and if you want a really good paint job, then you have to get a spray shop to do it in full breathing gear.

Problems can also occur when spraying cellulose over a two-packed paint job to touch it up. It can bubble up and flake off.

If you want an expensive shine get a two-pack job done, if you want to touch it up use cellulose at home.

Tyre Dimensions

Tyres are described as x/yRd (Eg: 165/70R10)

Where:

x is the width of the tread in mm. Usually accepted as the width of the tyre,
but the tread does tend to go down the sides slightly.

y is the wall height as a percentage of x. The distance from the rim to where
the tread starts.

d is the inside diameter. The wheel diameter in INCHES.

The 'R' means Radial construction. Often a letter preceeding this letter specifies the 'speed rating'. Examples being SR, HR & VR which also mean they'll run cooler at lower speeds. I believe SR is speeds up to 115mph, HR is 120, VR is 130+.

So...

165/70R10

Has 165mm of tread width, and a 70% (of 165mm = 115.5mm) wall height, and fits
on a 10" wheel.

This means that 165/70's have a slightly larger diameter/circumference than 145/70's. Hence your speedo will read low if fitted 10x6 alloy wheels in place of standard 10x4.5 steel wheels.

Low profile tyres have a smaller 'y' figure (eg: 175/50R13)

Normal road tyres have a 70 or 80 profile. Expensive sporty ones have 60 or 50 profile.

Here are some wheel sizes and typical tyres:

10x5 : 145/70R10, 155/70R10
10x6 : 155/70R10, 165/70R10
12x5 : 145/70R12 to 165/70R12
13x7 : 175/50R13

Different widths of tyre can fit different wheel widths. You just get tyre 'overhang' on wider tyres.

Often a letter follows the wheel size. Eg: 10x6J. This is the rim type. Common ones are B & J. You don't normally need to worry about these letters. It's for the tyre fitter.

Tyres, Power Distribution and Cornering Forces

OK 2 things to think about, power distribution and cornering (side) forces. Any tyre will have fixed compound adhesion properties per cm squared of contact area, break away occurs when shear force exceeds the forces
pressing down on the tyre, I guess a total torque of x can be transmitted to the road more easier with a larger contact area (and a lower shear force per cm2, same torque transmitted over a larger area). BUT, cornering (side) forces are more likely to be capable of spinning you off if there is less pressure per cm2 from the weight of the car. SO, F1 cars have big fat tyre TO GET THE POWER DOWN AND NEED THE EXTRA DOWNFORCE TO STOP TYRE BREAKAWAY ON ACCELERATION TOO. BUT ALSO, S**T loads of ground effect stuff to increase the down force to keep it glued on to the road... to increase the force per cm2 of the vehicle weight to act against the side force on cornering IF wide tyres helped cornering better AND to transmit power F1 cars wouldn't need all the wings and things..eh?

So there must be a compromise between tyre width to get more power down and excessive width causing lack of grip on corners...maybe we need to start fitting aerofoils to our Coopers with 175s?

You can't remove the contribution of correct suspension alignments on handling, narrow profile tyres reduce flex of the sidewall, lower the car (and its C of G) and alloys reduce unsprung wieghts to further improve things...take these out of the equation and the use of wider wheels and tyres of the same side height (ie change from 155/70/12 to say 180/60/12s "ficticious") would only be an advantage if you were suffering from wheel spin on acceleration, the force per cm2 from the weight of the car would be reduced so theoretically the car would spin out easier?

Wider tyres change the track and important suspension angles to effect the handling in ways NOTHING to do with the tyres...fit "nutty wide boots" on their own expecting a radical improvement from the tyres and you will be
disapointed, if these new tyres have a lower rolling diameter and are fitted to alloy wheels the improvement in handling might be from the added stability from the lowered Centre of Gravity and unsprung weight NOT from
the fact you got 10cm wider strips of rubber!

U

Unleaded cylinder heads

Leaded fuel leaves a small deposit of lead on the valve and the valve seat which protects them from the hot gases rushing by. The inlet valve is protected naturally as it is constantly cooled by the fresh mixture, so that's not the problem, but the exhaust valve takes the full impact of the heat. Heads which are prepared for use with unleaded fuels have specially hardened materials used for exhaust valves and seats to do without the protection of the lead.

Unleaded Fuel

Minis made after May 1989 can run on premium (95 RON) unleaded or any mixture of the two without modification.

Unleaded with high CR

UL in an engine running a CR > 10:1?

When considering compression ratios the use of leaded/unleaded fuel is irrelevant. Its the octane rating that matters - and while t.e. lead is the cheapest way of raising octane rating - there are lots of other solutions (more expensive and more dangerous that is).

V

Valve clearences, reasons for

The main resons for having a valve clearence are:

- To allow for thermal expansion of valves, block, rods, etc.
- To protect the cam lobe (no gap, valve slams shut from explosion, cam goudged)
- To allow for unevenness in the cam base circle (non-lobe side)
- To allow oil to pentrate under the rocker tip and pushrod cup.

Some people say that the gap closes up a bit when hot, others say the block expansion counteracts valve train expansion. Set the gaps cold, and set to 25-30 thou / 0.6-0.8mm.

Valve Spring Replacement (Without Removing Head!)

Feed some jump-rope sized rope in thru the spark plug hole and fill the chamber with it. Then turn the motor over BY HAND until that piston is coming up and compresses the rope against the valve heads nice and firm.
This allows you to release the keepers and change the spring, evah so clevah. Alternately, get the English fella mowog uses to do-up the rear motor mount on a 1100/1300 or the under-clutch motor mount in a Mini to stick his damn finger in the plug hole and hold the valve shut.

NOTE : Apparently, there is a tool available which pressurises the cylinder through the spark plug hole and change the springs.

Valves, Piston contact at high revs

When the piston hits a valve the valve closes, period. It doesn't care what the cam is doing at that moment. The cam/valve assembly are a loosely coupled system. Only the cam and crankshaft are directly coupled via the timing chain. Once you reach valve float the spring can no longer push the rocker down fast enough to follow the cam. It's not really the valves that float, it's the entire valve train.

So, the valve is down but the cam is at it's closed position so the piston is up. Bang! The piston hits the valve forcing it closed just as the cam comes around to lift. Something has to give. If you're lucky, instead of holing a piston or breaking a rod you'll bend a push rod or break a lifter.

W

Welding, MIG/TIG (I)

MIG stands for Metal Inert Gas. A wire is fed through the welder wand automatically. The Arc is struck from the end of the wire, which deposits the molten wire on the surface to be welded. (which is earthed). The Gas stops it oxidizing and also stops oxygen getting in the weld.

TIG stands for Tungsten Inert Gas. Basically the same but the welder uses a separate rod rather than feeding wire through the wand.

MIG is for iron & steel, whereas TIG can also used for steel or aluminium.

Because both forms of welding use an arc, there are different amperage welders depending on whether you are joining sheet stock or thicker metal. Witness a friend who tried to weld his mini with a MIG welder designed for bar steel - and ended up burning out the A-panel!

A weld should be strong and even. If the arc is not struck properly, this results in what is known as "chickenshit welding" because the wire/rod is unevenly applied due to the resistance, making the weld look like a load of chickens have spent the night there.

Welding MIG/TIG (II)

MIG = Metal Inert Gas
TIG = Tungsten Inert Gas

As you see both use an inert shielding gas. The purpose of which is twofold:
1. To keep the atmosphere (oxygen) out thus avoiding oxidation.
2. To cool down the area around the weld.

MIG use a metal central electrode that is used up as filler material. (The observant mind will now notice it is not possible to do a MIG weld without building up a mound)

TIG use a Thorium/Tungsten electrode that is not used up [1].
If you need filler material you add that using a rod as you do in Oxygen-Acetylene
welding. Indeed TIG welding looks much like O-A welding, and some experience
using this method is an advantage. The best looking TIG welds are the ones
where no filler rod is used, the O-A welder will probably also recognize this from experience.

The shield gas is the same for MIG and TIG. I use Argon, as it is the one I found can be used for most of my purposes. Gas mixes will be better for some uses, but unuseable for others.

The power source for a TIG welder must be continously variable (DC) while you
weld. Some use a pedal, I use a thumb-dial on the torch. Without it, you will still produce a bright light, but then mostly from swearing.
TIG without HF-start is an inconvenience, but as it drives up the price by quite a bit I suggest you do without it. If you plan on using TIG for aluminum, it must have AC which also drives up the price. I would hope that more hobbyists discover TIG, as that will certainly bring down the prices as it did with MIG. It will certainly result in better quality welds, as (with TIG) you usually get a good weld or a big hole, which is easy to tell apart.

The heat is much more local with TIG than with other methods, and also with a much finer control. This makes it possible to weld much closer to objects that do not like heat. It also ma

[1] Unless you contaminate them, which you do a lot when low on experience.
Then you have to grind them up before continuing, or your weld will be porous and weak because of inclusion of impurities.

Trivia:
- You can get TIG torches as small as fountain pens. They can be used for
welding down to aluminum Coke can thicknesses.

Wouldn't that be a nice hobby: restoring Coke cans? :-)
- You can use TIG to heat up without welding as you often do with O-A.
But it will be much more localised, and so useful for shrinking out
old valve seat inserts and the like.
- I know some people that use Geiger counters in their profession. They
Use Thoriated Tungsten TIG electrodes for checking the G-counters, as
these are much easier to bring through airport security than other
isotopes.

Wipers, Self-parking modification

Coming out of the motor (not the park switch) are 3 wires.

Blue - Ground
Red - Slow
Yellow - Fast

These connect on to the back of the park switch and go straight through up to the wiper switch.This leaves 2 wires that come out of the park switch.The actual park switch is basically a change over relay. when the pin is pushed down by the cam on the back of the wiper cog. it switches (not the light green/orange stripe the only one that is left) from the permanent 12V to 0V this shorts the motor out and stops it very quickly. If the motor doesn't stop then this contact is the one that needs attention. When the pin is up (when the wipers are not parked) this lead is connected to the Light green/orange stripe which is the permanent 12V this makes the wipers park when the wiper switch is off.

TO REPAIR PARK SWITCH.
If your wipers either keep going or don't park when switched off then your park switch needs attention.First remove wiper motor from car as described by hynes.Dismantle as per hynes.The bit Hynes doesn't tell you is that there is a small metal clip that attaches the park switch to the motor It is probably hidden under all that grease but if you clean out the motor first you will find it. Slide the clip back and the park switch should come away from the motor.Now you have a choice, you can either go out and buy a new one or take it apart and clean up the contacts. The problem with taking it apart is that you brake it there are small plastic tabs which brake when you open it up.

IMPROVEMENT.
This will be done shortly to my system.Fit A changeover relay in the park switch circuit so that when the wipers aren't parked the coil in energised and connects o/p from the park switch to 12V unenergised connection of the relay is connected to 0V this takes the load off of the park switch so it will last longer.Once this has been done swap the yellow and Red wires over on the back of the park switch this will give you Fast speed auto park, once wipe and swap the fast and slow on the wiper switch.Well worth doing I think I have been running a similar set-up which works really well. I put the relay in a different place which means that I cannot use slow speed anymore I will convert to the above method when I get some time.

X

Y

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z
