



# Pressure Cookers

A PAIR OF POPULAR FULL-BLOODED ITALIANS RECEIVE THE CHARGE-COOLING TREATMENT **WORDS: TONY SOPER PHOTOS: WARD & WARD**

**T**wo iconic Italian sportscars, a Fiat and a Lancia, both red, both fitted with the ultimate road-going derivative of Lampredi's classic twin cam - which would you have? To complicate your choice this pair have been breathed on by Craig Clark and the team at Italian car specialists L&M International.

The original eight-valve Fiat twin cam motor evolved from humble beginnings in the Fiat 124s of the sixties and seventies. Development

of this engine was largely driven by Lancia's various competition activities ranging from Betas and Montecarlos through to Deltas. The final road-going derivative of the engine, as fitted to this Delta Evoluzione, featured 16 valves, twin counter rotating balancer shafts, and a water-cooled Garrett turbo. Power output from these 16-valvers nudged 200bhp in the 16v Integrale, increasing to 210bhp in the Evoluzione and was upped to 215bhp for the final integrale of 1993. The motor was so

good that both Fiat and Alfa Romeo made use of it in the mid-nineties and it also sits within this 1996 Fiat Coupé. In the Fiat it is rated at 195bhp and in all cases the torque on offer is around 225lbsft.

The four-cylinder turbo Coupé is not a common car, it was in production for just two years before being superseded by the five-cylinder 20-valver and is regarded now by many potential purchasers as a bit of a stopgap and rather less desirable than the

later cars. Although rare, values are considerably below the later 20-valve versions and if you can find one they represent good value. I'm a big fan of the 20-valve turbo, but my one drive in a 16-valve Turbo some years ago at Snetterton race circuit had left me with the impression that 195bhp was not really adequate for a sports car weighing some 1,300kg.

Our featured car shattered my perceptions. L&M (Tel 01494 538899) were commissioned by owner Paul Castle to install one of their charge cooler conversions (£1,500 fitted) as well as a Supersprint cat replacement exhaust system (£519 fitted), silicone hose set (£242 fitted), F1 air filter (£47 fitted), Unichip (including bleed valve, £699 fitted), and Koni

dampers with Eibach springs (£840 fitted). Serious money, but the result is a serious car. Sitting on Team Dynamics 17" wheels, this car now comfortably outperforms later 20-valve Coupés. Power feeds forcefully through the front wheels, acceleration is hard and endless, this Fiat feels taut and alive. The conversion has created a car of exceptional balance and driveability combined with superb high speed stability.

The integrale looks refreshingly macho compared to today's curvy effete offerings, it's always a pleasure to see one in the flesh. Current European car design appears to be mirroring our society's gender reversal which celebrates girl power, feisty women, and emasculated little men like the wirrpyhella

on the Mr Musde advert. Our Evo's not ashamed of its gender and it's got big balls. Again fitted with L&M's charge cooler, this car also features a four position boost controller.

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Reaction to the throttle is instant, and with hardly any turbo lag power is also instant; loads of power, in fact too much power and even with four wheel drive the 17" tyres →



**ABOVE** Aftermarket wheels don't always suit the Fiat Coupé, but these look OK. Coupés are a good basis for tuning and lack the complexity of the aging 4WD Delta integrale

scrabble and howl in protest before losing traction on our bone dry test track. The integrale really is a hooligan.

These conversions have transformed each car and the standard of installation of the charge cooling system by L&M looks as if it could be original equipment. But what is a charge cooler and why do you need one? When air is compressed it heats up. We want

to feed the engine a cool air charge, this is good for power and efficiency because the colder the air the more dense it is, therefore more oxygen is available for combustion. A cooler charge is also less likely to detonate spontaneously on compression, allowing more flexibility for ignition timing. Therefore we need to cool the air after it has been compressed by the turbo, this process is called intercooling and is generally accomplished by passing the charge through an air-cooled heat exchanger, or intercooler. Nearly all turbocharged cars will have an intercooler, generally sized by the manufacturer to offer adequate cooling within cost and packaging restraints. →



Any increase in boost pressure, hard use or even abnormally hot weather will mean that the cooling effect of a standard intercooler may become marginal. L&M have recorded engine intake air temperatures of 76°C on standard integrale's after hard use. A bigger intercooler would help but these are not cheap, are difficult to fit, and are still reliant on

**LEFT** The charge cooling installation is well-engineered and fits snugly in the engine compartment – it works, too. Our thanks to Craig Clarke for setting up this test

airflow through the heat exchanger, which means they don't work in slow moving traffic. If you've ever been sat in traffic in your turbo'd motor on a hot day and been embarrassed at your performance from the lights this is the reason.

A better answer is a charge cooler. It cools the air coming out of the intercooler and going into the engine, and uses a water system as the cooling medium. A heat exchanger is fitted and the heat in the charge is transferred into a separate water system which is cooled by an additional radiator (about the size of an oil cooler) at the front of the car. There is also a header tank and an electric pump to circulate the water.

The reduced temperature into the engine means that the engine can sustain full

ignition advance for more time rather than retarding it (which causes power loss) to limit detonation. L&M have seen intake charge temperatures reduce to just a few degrees above external ambient, allowing higher boost pressures to be safely.

For full effect you will need a big dump valve. Why?, well when you are hard on it and your turbo is puffing full boost the inlet charge is entering the engine with no restriction. If you come off the gas to change gear the throttle suddenly shuts off airflow into the engine. At this point the turbo is still spinning fast, resulting in a potentially damaging build-up of pressure which could even stall the turbo. To stop this a dump valve has a vacuum tube that senses pressure in the intake manifold. When the pressure suddenly drops it opens a piston in the dump valve and vents the boosted air upstream from the turbo, giving you that vital tshh-pop sound. For perhaps the largest range of self-fit dump valves contact Le Mans Motorsport (Tel: 01234 268213). ■