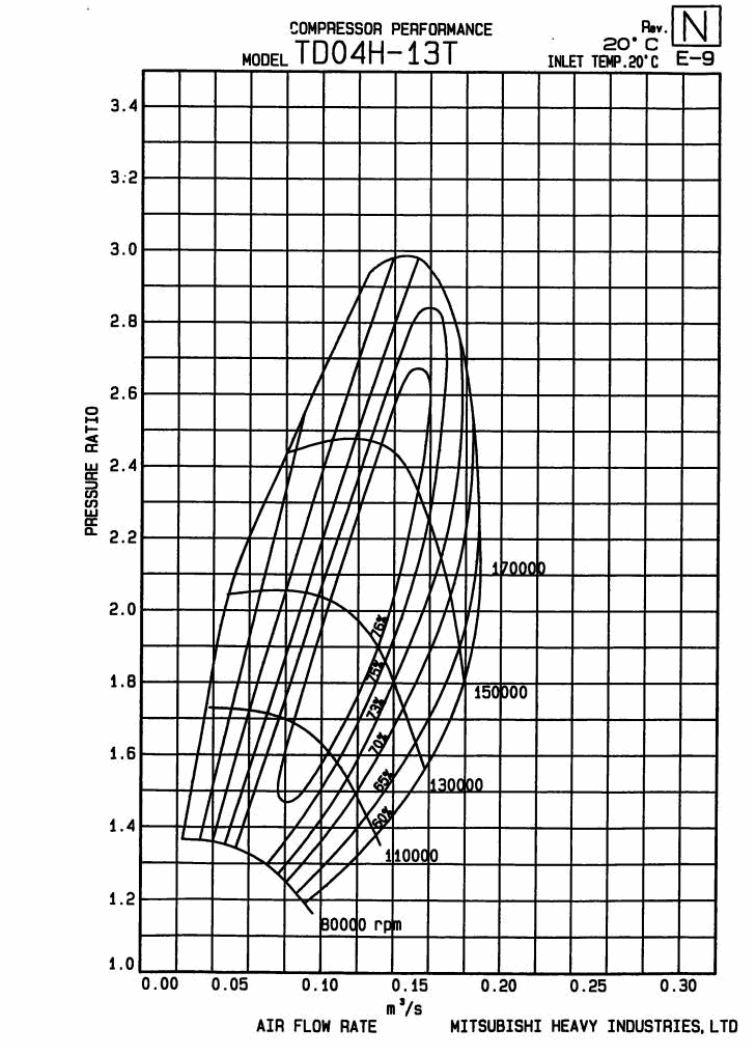
Notes on Pop Off Valves

1. All turbos can produce 2.5 to 3 bar of boost. See the compressor map. The efficiency of the turbo drops as boost pressure goes up. This is due to the heating of the air and the decrease in aerodynamic efficiency as the turbine speed goes up.



2. Typical rally cars all make more than 1.5 bar of boost – or should. A stock older WRX with a restrictor and properly tuned will make 26 psi (1.76bar) of boost. A newer will make 28 psi. (Source Pat R)
3. The misunderstanding comes from the function of the restrictor. The orifice of the restrictor only allows a certain mass flow – which chokes off as flow velocity increases.
4. This means that as rpm rises, the boost pressure drops. The air flow chokes at the same time the intake air consumption increases. This means that if you're getting 25psi of boost at 3000 rpm you might only get 12 psi at 6000 rpm.

5. Larger displacement engines (higher flow) choke earlier and have a narrower usable boost range.
6. Increased boost increases power but also internal stresses on the engine components. Fuel consumption also increases drastically with boost.
7. Boost is usually capped in most racing series. Otherwise you get crazy things happening – ie 1500 hp 1.5litre BMW motors in F1.
8. The pop-off valve isn't the most elegant solution but it is relatively inexpensive, easy to check and doesn't require event resources.
9. Other series have used spec or homologated ECUs, electronic boost monitoring, etc. These require tech inspection or downloading data after an event. This increases the complexity for the event. MoTeC has a "black box" logger for 1200 GBP.
10. Installing the pop off valve is pretty easy. A sandwich plate can be made (cost $200 – 250 is done in quantity). This fits between the throttle body and the intake manifold.
11. Engine remapping isn't really required as any current map will have appropriate fuel and ignition values for the maximum boost allowed by the pop-off valve. Resetting the boost target in the ECU should be all that is required.
12. Boost control is important in controlling costs. Higher boost results in more fuel use, more internal stresses in the engine, more driveline wear. It also removes the need – which was becoming apparent – for very expensive turbos. Some competitors were beginning to install $20k turbos to improve the compressor efficiency at higher pressures.
13. A number of alternatives were discussed at length by the TRC including pump or spec fuels. These were rejected as being too difficult/ expensive to administer and police. It would also require that many, if not most, competitors retune their motors.
14. After considerable discussion it was concluded that the pop-off valve would offer the best containment of costs for the most competitors, especially the top and mid field. For these competitors there would be less of a boost "arms race". Admittedly, there would be less immediate effect on novice or lower budget teams, however the reduction in fuel use and stress on engine and driveline should offset the costs.