



## MTech-UK Associates Ltd Standard Engine Operating Procedures

- These operating procedures only apply to MTech-UK Associates Ltd, hereafter referred to as Mathwall, products.
- Engine applications do vary, please ensure that your specific requirements are discussed with Mathwall prior to engine installation and first fire up.
- Individual engine specific information such as, firing order, fuel specification and tappet clearance check etc is listed within the “Install-Fireup-Run-Procedure” document. This is normally supplied with the engine and via email, along with any other relevant documents. If you have not received these documents, please contact Mathwall before proceeding.

**IF IN ANY DOUBT – PLEASE ASK**

### 1. INSTALLATION – KEY POINTS

- 1.1. It is critical that the oil system is completely cleaned and flushed through. This includes the all external pipe work, oil tank and cooler. If in doubt replace with new parts that have been cleanliness checked.
- 1.2. The external oil system should be primed with the recommended engine oil. The engine should be filled with the same oil to the volume recommended by the vehicle user manual, or by the indicated level marked on the dipstick. Note that time must be allowed for the oil to drain through the engine and settle. Do not over-fill.
- 1.3. The required engine oil for Mathwall racing / higher performance applications is Joe Gibbs XP6\*. This oil must be changed after a maximum of 6 hours of track use. More regular oil changes will be beneficial. The oil level must be kept between min and max limits at all times.
- 1.4. A new intake air filter (if required) and oil filter (both of the correct specification) should be fitted (the latter at each oil change).
- 1.5. The water system should be primed with the recommended water / anti-freeze mix (normally 50/50). The water system must be completely bled to ensure no air locks remain in the system.
- 1.6. A new fuel filter should be fitted prior to engine fire-up and checked for cleanliness at regular intervals thereafter.
- 1.7. \* **Joe Gibbs XP6** product uses additives recommended by Mathwall for most of their high performance engine applications. Please note this oil should only be used for off highway use (i.e. not for use with active catalyst exhaust systems). The additives applied are particularly suitable for areas such as flat tappet/camshaft interface, push-rod/rocker interface and highly loaded valvetrains in general.

### 2. ENGINE FIRE UP – KEY POINTS

- 2.1. The spark plugs should be removed and the engine ignition switched off or safely disconnected. Manually turn the engine over for at least two complete revolutions. Stop if any significant resistance is felt or if any visible fluid is ejected from any of the open spark plug holes.
- 2.2. Initial cranking for oil pressure:
  - 2.2.1. **Wet Sump Engine:** The engine should be cranked until oil pressure is registered above 1.0 bar gauge. If no oil pressure is recorded on the oil pressure gauge after a maximum 10 seconds of cranking, stop, check for leaks and check the plumbing of the oil system. Also check the oil level. If no issues are discovered, then crank again for 10 seconds. If no oil pressure is recorded at this point, further investigations are required before proceeding. Contact Mathwall.
  - 2.2.2. **Dry Sump Engine:** The oil pressure should be manually wound-up via the oil pump drive immediately prior to first engine cranking, pre fire-up. The oil pump pulley belt will need to be removed for this procedure and re-fitted prior to engine fire-up. When oil pressure is recorded, check for leaks around the engine and installation. Re-fit the oil pump drive belt at the correct tension.
- 2.3. The engine should be cranked until oil pressure is registered above 1.0 bar gauge. If no oil pressure is recorded after 10 seconds of cranking, stop, check for leaks and check plumbing of the oil system. Also check the oil level. If no issues are discovered, crank again for 10 seconds. If no oil pressure is recorded at this point, further investigations are required before proceeding. Contact Mathwall.
- 2.4. Refit spark plugs (using the correct tightening torque) and HT leads. Switch on / connect the ignition.
- 2.5. Check that the specified ignition limiter chip is fitted.
- 2.6. Fire engine and run the engine at 2500rpm +/- 250rpm. Monitor oil pressure. Immediately shut down the engine if the oil pressure drops significantly, or rises excessively. Further checks will then be required. Contact Mathwall if in doubt.
- 2.7. Check ignition timing with a timing light on the front pulley (and measuring No 1 cylinder). Ignition timing at circa 2000rpm should be approximately 20deg +/- 5deg BTDC firing. If the timing is not within this window then stop the engine and contact Mathwall.
- 2.8. Check all temperatures and pressures. If there are any concerns or questions, contact Mathwall.
- 2.9. With the ignition timing correct, allow engine to warm up slowly by running between 2500-2750rpm. Monitor water temperature and water level in the header tank. If the level drops significantly or there are large air bubbles entering the header tank, stop the engine, check for leaks, refill the engine and re-bleed the coolant system. If issues persist, contact Mathwall.
- 2.10. Allow the engine coolant (out) temperature to rise to 60-80degC. Monitor oil temp, which should typically be 5-10degC higher than the measured water temperature.
- 2.11. Increase the engine crankshaft speed up to a maximum of 3000rpm when the engine water temperature exceeds 50deg.
- 2.12. The water temperature should not exceed 100degC in any circumstances. The water system pressure should be maximum 2.0 bar absolute (i.e. 1.0 bar gauge).
- 2.13. Check full ignition advance with the engine crankshaft speed held at 4500rpm. Refer to the supplied engine specification for the maximum ignition advance. If in doubt, contact Mathwall.
- 2.14. When fully warm (water temperature at 70degC or above), blip the throttle and check that all injectors / carburettor pump jets are working correctly and delivering fuelling evenly across the cylinders. If in doubt, contact Mathwall.
- 2.15. Check each of the exhaust primary temperatures. These should be within 100degC of each other. If in doubt contact Mathwall.
- 2.16. Shut down the engine and check the engine and full vehicle installation for leaks.
- 2.17. If all is OK, then re-fire the engine, re-check all temperatures and pressures.
- 2.18. Shut down and prepare the car for the first track / road test.



**3. SUGGESTED INITIAL OPERATING PROCEDURE (ASSUMED TO OCCUR AT A SUITABLE RACE CIRCUIT)**

- 3.1. Jack the car up and turn the engine over manually for at least two revolutions.
- 3.2. Fire-up the engine and check oil pressure and check for leaks. Run the engine at 2500rpm +/- 250rpm until at least 50degC coolant outlet temperature is achieved. This increased engine speed reduces the contact load in the valvetrain, which is particularly relevant for an engine with a flat tappet cam follower system.
- 3.3. Warm-up the engine to 80degC. Engine revs should not exceed 3500rpm. Vary between 2250rpm and 3500rpm.
- 3.4. Monitor critical pressures and temperatures at all times. If in doubt, contact Mathwall.
- 3.5. Shut down and check the engine and full vehicle installation for leaks.
- 3.6. If all OK, re-fire the engine, check critical pressures and temperatures.
- 3.7. If all OK, send the driver out to complete one installation lap, with engine speed not exceeding 5000rpm and throttle position always less than 60%.
- 3.8. Return car to pit lane and thoroughly check the installation. Conduct normal checks on the vehicle. Obtain feedback from the driver.
- 3.9. If all OK, send the car out on the circuit for a 5 lap session. This initially should not exceed 6000rpm maximum revs and 70% throttle pedal position, then rising to maximum RPM (refer to engine operating instructions supplied with the engine, or if in doubt contact Mathwall), and 100% throttle pedal position.
- 3.10. Return the car to the pit lane for a thorough inspection and to receive driver feedback.
- 3.11. If all is ok, then full speed practice laps can commence.

**IF YOU HAVE ANY DOUBTS OR QUESTIONS REGARDING THE ENGINE INSTALLATION, FIRE-UP OR RUN-IN PROCEDURE, PLEASE DO NOT CONTINUE ANY FURTHER AND IMMEDIATELY CONTACT MATHWALL VIA TELEPHONE OR EMAIL.**