X-1R Global Ltd

To:	All X-1R distributors	**From:**	Nigel (Mac) McKenzie
Cc:		**Date**	7th July 2011

Subject: Testing Protocol

Again I am being requested to write a definitive testing protocol for testing X-1R. The problem that I have with this request is that there are firstly two product groups to be tested and secondly no two tests are the same. To put it simply here are so many potential testing differences to be taken into consideration that it is virtually impossible to write a protocol that will fit all scenario's.

To date I have actually provided a wealth of information on these issues all of which are within the resource centre within more specifically Engineering Bulletin 02/03/07 and three documents written by Dr Brian Taylor and again in the resource centre under AFD Technical Information, in addition to this there is an excellent body of work carried out by Harold Ledda in the Philippines with NAPOCOR and by us in Malaysia with TNB that should be read by all. In general you need to determine what it is you want to test, this will fall into one or more of four basic areas;

1. Power out-put
2. Fuel economy
3. Emissions reduction
4. Wear and Tear reductions

Once we know what it is to be tested then we need to know the type of machinery followed by the types of fuel and available testing rigs etc.

Thus the following are two blow by blow accounts that detail how to undertake the tests, however, understanding how an engine works and our products work and those factors that can negatively impact your result are a must before you undertake a test. In addition to this I would also recommend some training from either myself, Harold Ledda or Eddie How prior to undertaking any test campaigns.

Static dynamometer testing.

By far the best way to eliminate outside factors are to conduct your tests using dynamometers (DYNO's), basically these are machines that measure force or moment of force (torque). There are two basic types of dynamometer i) Rolling Road Dyno's, and ii) Bench Dyno's. Basically Bench Dyno's are only found in High-end research facilities, high-end engineering concerns or Universities, for the most part we will be dealing with rolling road. These are good for determining peak power increases and reductions in emissions. However, you may not be able to determine fuel economy improvements unless you have a particularly sophisticated rig equipped with flow meters.

1. Select a vehicle that is about three years or more old and has more than about 70,000 km's running time.

2. Ensure that the vehicle you are working with has no known faults
3. Attach vehicle to Dyno and make three to five power runs to establish your benchmark performance
4. Take the average of your results.
5. Treat the vehicle with engine treatment and fuel system treatment
6. Ensure that there is at least half a tank or more of fuel else top it up. Ensure that the petrol treatment is sufficiently mixed into the petrol by adding petrol/diesel to the tank after you have added the product
7. Run vehicle for at least thirty minutes and rev the engine to max RPM two or three times during this time to allow for activation of both products, during this time inspect the exhaust. Additional exhaust emissions may be visible as the engine is cleaned up and thus is expected.
8. Run the Dyno tests again in an identical manner to before, tabulate results and compare with the before run.
9. You should see at least a 2% or more increase in Power. Remember that the fuel treatment may take up to two full tanks run through the engine to come to maximum effectiveness.

There is a calculation that can convert percentage increase in power to a fuel saving figure, I will attempt to find one and let you all have this.

For a bench dynamometer the procedure is the same but you should be able to determine the fuel consumption before and after treatment. This is achieved if the rig has flow meters, when you run the engine at a set RPM (usually through a range) and measure the amount of fuel that flows in to the engine to achieve this. Remember though to ensure a period of running the engine after you have treated the engine and before you retest the performance to allow for the product to go to work. Also always remember that the fuel treatments need to be mixed into the fuel else the product will sit on top of the fuel and will not be circulated through the engine.

On road “live”tests

Many organizations and in particular large plant operators want to test the product in real operating scenarios over a period of weeks or even months. Typically this will involve the setting up of what is really a very complex test and one that is fraught with difficulties. One of the key issues here is the elimination of those variables that will undermine your testing protocol, these are (and in no particular order);

1. Different load conditions such as in bus trials where the number of passengers carried or the exact route is different
2. Different driving conditions where the traffic is lighter or heavy between the two tests
3. Varying routes
4. Different driving styles where the driver is either different or adopts a different driving style for the two tests
5. Varying atmospheric conditions, higher/lower pressure, humidity, temperature or wind.
6. Sampling errors
7. Equipment malfunction
8. And many, many more

Therefore when the customer wants to test “on-the-road” it is best to try and steer them to a dynamometer test, when you cannot do this then it is really essential that you really know the product and have someone with you that has undertaken tests of this nature in the past. The basic protocol will be as follow;

1. Select a vehicle(s) that is representative of the fleet to be tested, if possible select three or more. Ensure that these vehicles are not experiencing any manner of mechanical problems.
2. Determine a route to be driven. If possible if this can be done on some sort of track you can immediately eliminate samples bias due to traffic conditions. Failing this try to select a time and place when the traffic will be minimal such as over night.
3. Preferably the route should be in the region of 50 to 100 kilometres.
4. Fill the tanks of the vehicles to the top (when the pump automatically stops because the tank is full ie the first click).

5. Drive all test vehicles over the set route, ensure that you monitor the time it takes and if possible the average speed.
6. Make sure the load conditions are comparable
7. At the end of the route fill the tanks with petrol again until the first click, this amount is then the amount of fuel that you have used.
8. Treat the vehicle with X-1R Engine and fuel, remember that the fuel treatments need to be mixed into the fuel effectively the most effective way to achieve this is to pour the fuel treatment into a mostly empty tank and then fill the fuel on-top of his, the natural turbulence of filling the tank is sufficient to mix the treatment into the fuel.
9. You will need at least one tank full of petrol + treatment to effectively clean up the engine. Therefore, fill up with fuel and then go for a drive to use up that fuel and thus allow the fuel treatment to go to work.
10. Refill with fuel and treatment and then commence your measured after treatment run, ensure that conditions are similar to the before run.
11. At the end of the test run, refill the tanks with fuel to the first click and then record this figure, this will be the amount of fuel used after treatment.

In general these sort of tests will return about 10-15% saving in fuel used, if the figure is significantly lower than that then there has been a sampling error of some sort and believe me I have seen very many errors in this type of test.

Measurement of wear and tear and oil life

These tests are the most difficult and expensive to undertake. In most regions there will be just a few outfits that can perform the sorts of ASTME tests. We are currently undertake this process with a group in Singapore and thus hope to have some independent tests available soon. There are some less expensive testing materials available but of course these are by no means as accurate. Generally these are treated blotting paper that creates a planar chromatographic effect and thus you can tell if the engine fluids are contaminated. We have this test available in Malaysia but there is a need to undertake training.

Nigel McKenzie
7th July 2011