

FXI

A major breakthrough in fuel and engine treatment



A product of James Day (Lubricants) Ltd - UK

TECHNICAL MANUAL

The story of the pioneer

Jonathan Bird and the Foundation of James Day (Lubricants) Ltd



In the mid 1980's Jonathan Bird decided to dedicate his life to the production of monomolecular friction modifiers working from his Headquarters in Watford England and his joint venture Refinery in Rotterdam Holland.

Jonathan Bird thanks to his life long experience in the field of lubricants completed an in-depth market study that demonstrates without a shadow of doubt, the tendency towards the search and the demand for a better tomorrow.

It was thus the FXI RANGE of additives was born, which have the power to reduce friction on metal surfaces and all moving parts.

The friction reduction to the surfaces are in excess of 70%. By adding FXI to oil at a 5% ratio reduce the friction substantially. Using FXI will increase the working life of (new) machinery in industry by as much as an additional 60%.

The FXI range was met with instant success thanks to its high quality and unique formulation. The ingredients (which are a closely kept secret) are environmentally compatible. Thus it attracts the public to the importance of the ecology in our modern society throughout the world.

From this Jonathan Bird began a long and extensive research program, which after 3 years of trials resulted in the birth of the now famous FXI RANGE OF PRODUCTS, which are recognised on the international markets and represent the finest and highest quality of surface modifiers to industry.

Since the mid 1980's thanks to his vision, tenacity, and his knowledge of the world markets in industry. Jonathan Bird has increasingly expanded into Europe, the Americas and Asia. Today after 15 years James Day (Lubricants) Ltd is a modern company that boasts a first rate technological and commercial organisation dedicated to industry.

A handwritten signature in black ink, appearing to be 'J Bird', with a long, sweeping underline that extends to the right.

Jonathan Bird
Managing Director



Mel Santaub has been involved in the oil industry for the past 15 years and has a vast experience in world wide marketing, supplying and promoting specialist oil products to industry.

It was during the early nineties that Jon Bird head hunted Mel Santaub after a successful launch of a top quality product now being used in the manufacture of FXI. After some months of negotiations between the two parties he joined the James Day organisation as Export Sales Director.

Due to the high quality and inventiveness of James Day (Lubricants) we are now selling FXI in 19 different countries (some of the products are being sold under customers' own label).

James Day (Lubricants) Organisation owe their success to the loyalty and close working family relationship between their directors and staff, who have been with the company for many years.

By keeping a close contact with our clients and listening to their requirements, James Day (Lubricants) are able to produce specialised products for all industrial applications.

We look forward to a close working relationship with all our old and new customers for many years to come.



Mel Santaub
Export Sales Director

FXI

Introduction

Despite the current high level of engine oil technology driven by the demand for ever increasing engine design sophistication, the mandate for fewer emissions and less disposal of used oils, demand still exists for additives that address extreme pressure and boundary lubrication conditions that are not being satisfactorily met by the lubricants industry. This vacuum has created a booming after-market for **FXI**.

FXI is imparted to a lubricant such as an engine oil, a significant amount of friction will be eliminated. This significant friction reduction will result in, as a matter of course, reduced fuel consumption, reduced component wear, increased power and a reduced tendency of the base oil to oxidise.

By re-engineering chloro paraffin's to impart extreme pressure properties, James Day (Lubricants) Ltd has overcome the problems previously associated with highly over based calcium carbonate complex chemistries and has developed a safe and effective alternative to the commonly chlorinated materials in engine oils, gear lubes, greases and speciality lubricants.

The Need for Extreme Pressure Agents in Engine Oil Formulations

While the lubrication industry continues to respond to drivers requiring better base oils and additive packages, it is important to note that most current engine oil formulations do not address the extreme pressure requirements of engines. This stems from the conventional formulation philosophy that there are no extreme pressure conditions inside an engine. Even the American Petroleum Institute (API) tests do not call for extreme pressure performance from engine oils, however numerous studies have confirmed the presence of extreme pressure conditions during cold cranking, sudden accelerations, heavy loads and extremely high temperature operating conditions. At best, engine oils are formulated with anti-wear additives, which are very "mild" extreme pressure agents.

The common chemical compound used as an anti-wear agent is ZDDP or Zinc Diakylidithiophosphate. ZDDP is the anti-wear agent of choice among formulators because of its overall wear agent and an anti-oxidant.

The fact remains that there is much to be gained from incorporating extreme pressure agents in engine oil formulations. There is no argument that extreme pressure conditions do indeed exist in an engine during the course of normal operations. This is especially true for modern engines with tight tolerances. To disregard this in the formulation of lubricants is a great disservice to the motoring public, industry and the environment.

Tribology recognises that the actual engineering surfaces of sliding metals are only 10% to 20% of the actual geometric surfaces. Under extreme magnification, what appears to be a smooth metal surface to the naked eye is actually a landscape of microscopic "hills and valleys" or asperities. The engineering surface or the 10% to 20% of the geometric surface is the actual surface in contact with the same engineering surface of another metal. If the "valleys" are covered with a film, known as a Tribochemical Film, such that the area of the engineering surfaces are increased, the structural load bearing capacity of the sliding metals can be significantly increased. Furthermore, the "hills" that are actually weld points can be smoothed out and effectively reduce the "drag" or coefficient of friction between the sliding surfaces.

Even under boundary lubrication conditions and extreme pressure when the oil film can no longer offer any protection, the Tribochemical Film can actually substitute for the lost oil film and protect the sliding metals from welding, deformation or abrasion.

In the past, a number of chemicals have been used to create this film. The conventional chemicals used in engine oils are based on sulphur and phosphorous chemistries. These chemistries provide weak films.

Previously referred to, ZDDP is a weak extreme pressure agent because it is easily abraded during boundary lubrication conditions and is easily depleted because of its additional role as an anti-oxidant. Furthermore, it is now under close scrutiny for its toxicity and poisonous effects on catalytic converters, thus its permissible amounts in formulations are being limited.

Others use graphite and other solid materials such as Teflon and micro-metal powders suspended in oil, making unsubstantiated claims to their effectiveness while ignoring the tendency for these solids to settle out of suspension and/or agglomerate in oil passage ways. Prior to banning its use, highly toxic lead naphthenate was also marketed.

The most sensationalised additives to date are the chlorinated paraffins and related products found in several "inferior" offerings. These are very strong extreme pressure agents that readily decompose for chlorine to react with metals to form metal chloride films. While effective as an extreme pressure agent, there are a number of serious problems associated with such materials. First of all, chlorinated hydrocarbons work as extreme pressure agents through the reaction of chlorine with iron to form ferric chloride films under critical pressure and temperature. This leaves the decomposed hydrocarbon portion deficient in electrons turning them into sludge precursors. Excess chlorine released during the decomposition reacts with water in the oil to form hydrochloric acid which in turn accelerates the depletion of the alkaline reserves of the oil.

Depletion of the alkaline reserve necessitates an early oil change, increasing stress on the environment by adding to the amounts of waste oil in circulation.

Secondly, government regulators are seriously looking at chlorinated paraffins for possible regulation. The right kind of chlorinated materials can be properly incorporated into an engine oil formulation in order to take advantage of the extreme pressure property while eliminating the side effects of their decomposition products, however, the overall formulation must be done in such a way that the standard additive package is not compromised and unwanted partial oxidation and decomposition products are not formed.

As an experienced oil formulator James Day (Lubricants) Ltd has successfully used chlorine in engine oils and in synthetic oil formulations. Unfortunately, most compounders of chlorinated after-market additives resort to sensationalism instead of sound chemistry. Some in fact recommend treatment rates up to 20% thereby compromising 20% of the required standard additive package as mandated by appropriate API rating.

FXI Technology

James Day (Lubricants) Ltd has developed a highly effective, chlorinated, sulfurized, non-lead extreme pressure agent based on environmental "friendly" re-engineered chlorinated paraffins. Additionally Over based calcium petroleum sulfonate is used as an extra alkaline booster in FXI.

The traditional overbased calcium petroleum sulfonate used by the conventional engine oil formulations have TBN values of 300 or less. These compounds exhibit very little pressure property. There are off-the-shelf overbased calcium petroleum sulfonates in the market today with TBN values of 400 or more, but they are either crystalline or have carbonate molecules in the micelles which do not have the correct critical numbers in the size distribution curve. Moreover, the sulfonate to carbonate ratio has to be exact in order to maintain stability of the micelles in the final oil formulation.

Failure to achieve any of the critical numbers above can result in any of the following quality concerns:

1. Lack of extreme pressure property,
2. Precipitation of carbonates on long term storage,
3. Oil haziness,
4. Phase separation.

The FXI with environmental “friendly” re-engineered chlorinated paraffins with inherent extreme pressure, high alkalinity and anti-corrosion properties is the foundation FXI Technology.

Performed Tests

1. Load Resistance The test evaluates the effect on the extra pressure agents, lubricity and boundary film lubrication of FXI at 5% concentration in system oil. The test proved applied load of 50 to 150 pounds, wear is reduced by an average of 70% with FXI.

2. Thick Film Gamma The test measure the anti-wear property of FXI when mixed with oils by determining the extend- of-weight-loss to moving parts through friction. The test indicated that use of FXI results in 15% less weight loss to parts.

3. Film Affinity Retention The test evaluates the degree of wear protection that the fluid film on the surface of moving elements provides when the lubrication system loses lubrication oil; The test, proved that FXI has a very strong film affinity and thus provides excellent wear protection on moving elements of the lubrication system.

4. Temperature Sensitivity The test evaluates the effect of higher temperatures on the stability and performance of FXI The test data indicates that 149C, the wear reduction rate with FXI is still 71%, which increases the service life of the system by 3.5 times.

5. Additive Stability The test evaluates the possibility of the removal by filtration of FXI active ingredients. Normal oil filter size is 15 microns. The test indicated that oil filters as small as 3 microns did not effect the concentration af ingredients in FXI.

6. Oxidation Corrosion The test evaluates the effect of FXI on the ability of the base oil to resist deterioration at higher temperatures. Oxidation, which is more intense at high temperatures, results in increased viscosity, formation of sticky gum that coats metal and plugs filters and forms heavy sfudge. FXI was tested at 120 C for 72 hours and provided excellent anti-oxidation property.

7. Hydrolytic Stability The test evaluates FXI ability to resist reaction with water when mixed with various oils. This effects the useful life of-the base fluid. The test indicated that FXI treated oils have a weight loss change of less than 0.6% (very minimal).

Fluid Elastomer Compatibility The test evaluates the compatibility of FXI in various oils with the elastomers used for seals, hose lines, etc. The test indicated that FXI is compatible with elastomers such as BUNAN, fluoroelastomers, polyacrylates, etc., which are the most widely used elastomer materials.

MASTER



We have developed two new exciting products derived from our extensive research & development programme, these are "*Petrol MASTER*" and "*Diesel MASTER*".

These products utilise our existing technology and provide the most effective petrol and engine treatment available. We have also developed the same for diesel powered vehicles.

FXI *Petrol* MASTER[®] System

FXI *Petrol* MASTER has been specially developed to meet the demands of all petrol powered engine users.

In today's energy and emission conscious world, FXI *Petrol* MASTER is at the cutting edge of technology. Our chemists, working on lubricants for Space and Military applications have succeeded in re-engineering hydrocarbon molecules with amazing results.

Simply added to oil, the tiny molecules impregnate interior surfaces, smooth out any roughness and create a durable film. This virtually eliminates frictional wear and drag, up to the limits of standard industrial tests.

FXI *Petrol* MASTER engine treatment, The heat-reactive molecules leave no sediment or clogging agents. They assimilate with any oils, including synthetics, and rapidly migrate onto friction faces to provide stable lubrication, wet or dry.

Once attached, the thin anti-corrosive film penetrates the metal pores and is remarkably efficient at extreme pressures and temperatures. Surface wear reduction is as high as 90% and this is far beyond the failure point of many engine oils.

FXI *Petrol* MASTER does not alter viscous properties nor introduce solidifying particles such as PTFE and molybdenum disulfide.

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JAMES DAY (LUBRICANTS) LTD**

P.O. Box 371
Watford,
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Tel: 01923 249474.
Fax: 01923 249477



The Results and Benefits

Completely universal with regular motor oils including synthetics

Virtually reduces all friction

Bonds to internally lubricated engine wearing surfaces

Excellent anti-wear performance

Superb high temperature and turbo protection

Protects immediately from start up (50% of engine wear occurs at start up)

Better fuel economy

Reduces harmful emissions

Completely compatible with all types of oxygen sensors and catalytic converters

FXI *Petrol* MASTER[®] Fuel System

The FXI *Petrol* MASTER fuel system has been developed for use in conjunction with FXI *Petrol* MASTER engine treatment. The two, combined together, provide the most effective petrol treatment available.

FXI *Petrol* MASTER fuel treatment has been designed to improve fuel efficiency and at the same time, to reduce emissions.

When added to the fuel, FXI *Petrol* MASTER literally purges the whole fuel system. It cleans the injectors and prevents carbon build up. At the same time protection is given to the injectors. Lubrication and protection is also added to the valves and the valve seats. When used with FXI *Petrol* MASTER engine treatment, a total protection is added to your engine and fuel system.

HOW TO TREAT YOUR FUEL

The initial purge is given by adding 50ml of FXI *Petrol* MASTER fuel treatment to your fuel tank when you fill up or top up. As a fuel treatment, it will auto-matically blend with fuel as it is added.

After the first tank of treated fuel has been used, a further 50ml is added to the second fuel fill up. Thereafter, only 25ml is added to every 50 litres of fuel that is put into the tank. This will ensure optimum results.



FXI

Petrol
MASTER

How It Works

FXI Petrol MASTER reduces friction to a level of 0.01% and protects metal to metal surfaces against abrasion and thermal damage.

This result is achieved once the operating surfaces have reached 50°C. **FXI Petrol MASTER** then impregnates the metal surfaces to enable them to withstand extreme pressure and temperatures.

FXI Petrol MASTER is not a solid, such as Polytetrafluoroethylene (P.T.F.E.) or Molybdenum Disulphide.

FXI Petrol MASTER is entirely free from resins and congealing agents.

FXI Petrol MASTER does not affect design tolerances.

A typical application, with a 5% mix of **FXI Petrol MASTER** in a conventional engine or gear oils, results in a dramatic increase in engine efficiency and fuel savings.

FXI Petrol MASTER is compatible with all metals, synthetic and mineral oils, including most cutting and hydraulic fluids. It has been developed and tested, conforms with COSHH and has no harmful side effects.

Falex

This is a standard method for measuring the extreme pressure (EP) properties of fluid lubricants, and conforms to ASTM D3233. Falex machines use a rotating pin clamped between two V-shaped jaws. The hardened-steel pin and jaws are immersed in a lubricant sample. The pin is rotated at 290r/min and a load, either constant or incremental, is applied to the jaws by a ratchet mechanism. The load-fail value obtained is a measure of the load carrying properties of the test fluid. For comparison purposes, a top-grade 70W/90 engine oil and a widely available EP-90 gear oil were tested alongside **FXI Petrol MASTER**.

Applications of MFU

Besides the obvious benefit of **FXI Petrol MASTER** in the lubrication systems of engines, both land based and marine, significant benefits can be gained in:

- Pumps ✓
- Gearboxes ✓
- Compressors ✓
- Generators ✓
- Hydraulic Power Plant ✓
- Chains and Conveyors ✓
- Metalworking Operations ✓
- Machine Tools ✓
- General Maintenance ✓

1:20 dilution is all that is normally required, but higher concentrations up to 1:10 can be used. Add **FXI Petrol MASTER**, after a lubricating oil or hydraulic fluid change, and monitor the difference. It can also be added to systems in operation, provided that normal safety procedures are maintained. Thus the life of machinery will be increased as a result of reduced friction and yield a considerable saving in fuel/electrical energy. Apart from the man hours saved, maintenance costs and replacement parts are reduced.

Technical Information

FXI Petrol MASTER surface modifier is monomolecular and this quality provides a surface which naturally rejects other molecules from binding to the metal and creating unwanted friction.

The surface modification which takes place also extends to metallic debris in equipment and renders such deposits less harmful to systems integrity. Oil ways are kept clear and filtration is not impeded.

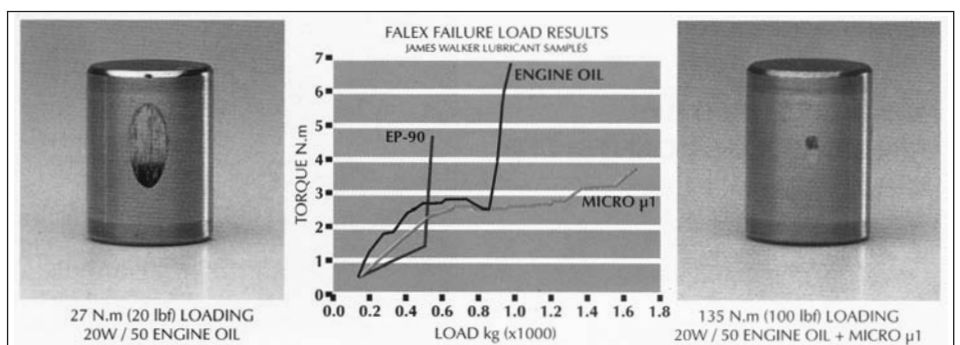
FXI Petrol MASTER, unlike conventional surface modifiers, does not alter the viscous properties of oils by introducing solidifying particles. Heat reactive molecules, measuring just 0.01 pm, leave no sediment or clogging agents. The molecules assimilate with oils and rapidly migrate onto friction faces to provide stable lubrication, both WET or Dry surfaces.

Once attached, the ultra thin, anti-corrosive surface modifier penetrates the metal pores creating a new monomolecular surface layer. This prevents friction occurring at extreme pressures and temperatures.

FXI Petrol MASTER's negatively charged molecules in an oil flow are opposed to each other and so generate a new, powerful surface boundary under compression. This reaction to heat changes the molecules closest to the point of friction and enables bonding to the metal surfaces to take place. The combined effect is thermodynamic flow and surface streamlining.

A typical Falex failed load for a straight mineral oil is 270kg. The EP90 sample failed by seizure at 500kg. The engine oil gave a surprisingly good performance,

failing, through excessive torque, at around 910kg. **FXI Petrol MASTER** eventually failed by excessive wear at a very high load of 1640 kg, but at very low torque value.



FXI Diesel MASTER[®] System

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Simply added to oil, the tiny molecules impregnate interior surfaces, smooth out any roughness and create a durable film. This almost eliminates frictional wear and drag, up to the limits of standard industrial tests.

FXI Diesel MASTER engine treatment, The heat-reactive molecules leave no sediment or clogging agents. They assimilate with any oils, including synthetics, and rapidly migrate onto friction faces to provide stable lubrication, wet or dry.

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FXI

Diesel MASTER

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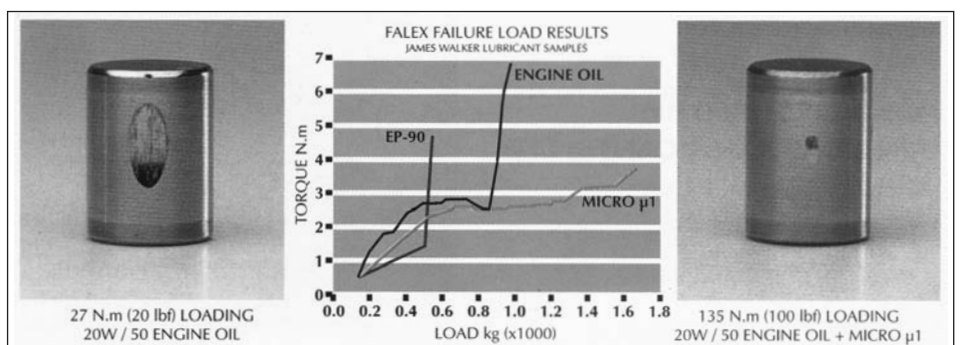
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TUV

NEDERLAND QA

Herewith certifies that

Benelux Research Business B.V. te Ittervoort

has demonstrated an environmental management system
which complies with the requirements of the standard:

NEN-EN-ISO-14001 (1996)

The environmental management system has been
evaluated according to TÜV Nederland QA's certification
scheme for the following scope:

**The development, manufacturing and trade of
chemical products, silicones and lubricants.**

This certification is subject to an annual audit by
TÜV NEDERLAND QA.

Certificate registration number: 2876/6.2

Valid till: 29-11-2005
Date: 29-11-2002



A handwritten signature in black ink, consisting of several loops and a long horizontal stroke at the end.

Managing Director



Accredited by RvA

Notes



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