STEEL SHIELD TECHNOLOGIES

Elevator & Escalator Systems

System Reliability and Maintenance Cost are our priority concern

Steel Shield ABF Technology is able to make a significant improvement

THE **ABF** Technology

www.steelshieldtech.com.hk

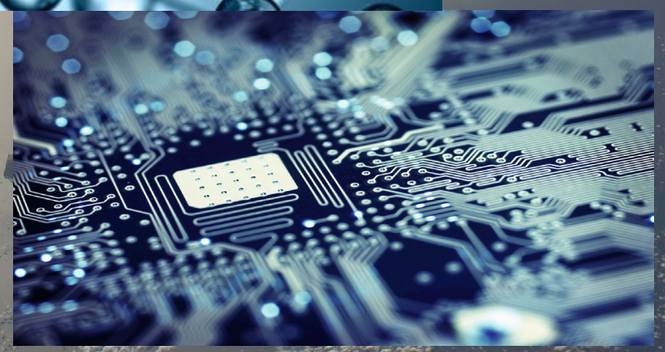
Serving the Industry since 1985

World's 1st Ionic-Maglev Lubrication Technology

CONTENTS

World's 1st Ionic-Maglev Lubrication Technology

WORLD'S 1ST IONIC-MAGLEV
LUBRICATION TECHNOLOGY



1. MAKING A DIFFERENCE IN LUBRICATION

"It is our conviction that to be the best is not sufficient, we are here to make a new World Standard in Lubrication."

Company Vision & Commitment

Steel Shield Technologies sole purpose is to manufacture premier quality metal treatments, additives, greases and lubricant oils that have been tested to exceed the normal parameters of extreme pressure and anti-wear products in the aftermarket, hereby offering matchless performance and unsurpassed protection against wear while saving maintenance costs, downtime, energy and improving overall functionality of your machineries.

Steel Shield, Not Just Oil, It's Technology which makes a difference to the World of Lubrication.

Steel Shield aims at helping customers to achieve the highest return on investment (ROI). Steel Shield is committed to strengthening business and global commerce through manufacturing and distributing, World-wide, the full line of ABF Technology products made in the USA, Singapore and Hong Kong.

2. THE CORPORATION & FACILITIES

Steel Shield Technologies Inc. (USA) with its history traced back to 1985 when in USA, Pennsylvania the scientist Dr. George C Fennell in the research and development of high-end specialty lubricants invented the unique ABF Formula – Ionic Levitation. In the same year Muscle Product Corporation trading as MPC was founded by George Fennell, brother Jay Fennell and father, Richard Fennell and the purpose was to market his invention MT-10. In 2006 at a board meeting held on 22nd May George resigned all his duty from MPC. In the same year George found STEEL SHIELD TECHNOLOGIES INC and renamed his invention MT-10 as Steel Shield. As of then MPC and its products are no longer being supported by George either in performance or quality.

The Company's blending and manufacturing capabilities are state of the art and the ability to produce limitless volume of product is unsurpassed as well as the product quality. The equipment is all stainless steel including the flow lines, pipes and couplers. All pumps and gauges are digitally interpreted and of the highest quality and accuracy to ensure production of the most superior quality lubricants.

STEEL SHIELD TECHNOLOGIES (ASIA PACIFIC) LIMITED WAS INCORPORATED IN 1996 IN HONG KONG TO PROVIDE DISTRIBUTION AND TECHNICAL SUPPORT FOR THE ENTIRE ASIA-PACIFIC RIM.

3. INVENTOR SCIENTIST - DR. GEORGE C FENNELL

Father of ABF Technology
Doctor of Astronomy and Astrophysics

Accreditation:

SAE (Society of Automotive and Aerospace Engineers) Member

ASNE (American Society of Naval Engineers) Member

NCMA (National Contract Management Association) Member

STLE (Society of Tribologists and Lubricant Engineers) Member

In 1985, Dr. George C Fennell, a former scientist in Astronomy and Astrophysics doing consulting and contract work in advanced lubrication and surface Tribology, formulated a revolutionary metal treatment oil additive which can activate "ABF" (Advanced Boundary Film) through a proprietary and unique "electro-chemical ionization" (ECI) process. He has been known in the industry as the "Father of ABF Lubrication".

On the basis of ABF technology, a series of specialty lubricants have been developed to meet the stringent requirements of various purposes and working conditions, as to date is still the most advanced formula in lubrication.

Over the years, there have been countless people trying to resemble Dr. Fennell's unique formula and advanced chemistries, none was found even remotely close. To this date, Dr. Fennell is still the leader in tribology and lubrication.

4. THE BIRTH OF STEEL SHIELD TECHNOLOGY

BIO-ORGANO LUBRICATION TECHNOLOGY

During World War II, the German Science and Technology Research Institute was commissioned to develop a new lubricant technology in meeting the stringent demand for heavy duty military application such as artillery, armored vehicles, tanks, battleships and fighter-aircrafts to avail them in performing their maximum fighting capacity with minimal maintenance.

The scientists proposed the concept of Zero friction, i.e. Faraday's Law Like-Charge-Repel.

Shortly after WW II, a great number of intelligent scientists migrated to the United States from Europe. One of them was the grandfather of Dr. George Fennell, who came to USA along with him a large volume of research data and material about Zero friction. The old scientist continued to pursue his scientific research and eventually in 1986 his grandson Dr. George Fennell came with a breakthrough in the technology. Through Electro Chemical Ionization (also known as Reactive Chemical Bonding) Dr. Fennell was able to realize Maglev between two metallic surfaces and to achieve a close to Zero Friction Coefficients.

The great accomplishment was the result of relentless efforts of 3 generations scientists over half a century. In recognition of the excellent contribution of Fennell's family to the country, the US Government has named the street outside their old factory Fennell Avenue as a compliment.

5. ABOUT ABF TECHNOLOGY

BOUNDARY FILM LUBRICATION THROUGH ADVANCED HALOGENATION TECHNIQUES: OXIRANE ACID SCAVENGING AND ORGANO-METALLIC SUBSTITUTION

BY GEORGE C. FENNELL

Steel Shield Technologies' mechanism of operation is based upon Tribology methods that improve lubricity and load carrying capacity by improving surface characteristics and creating a stable chemical, corrosion controlled halide-based boundary film. Steel Shield's active components react with each other and the contacting asperities of the metallic surfaces to provide five mechanisms of improvement.

1. Advanced chemical boundary film formation through reactive chemical bonding.
2. Ring opening, oxirane acid scavenging and advanced corrosion inhibition.
3. Organo-metallic substitution of surface metal and free radical reactionaries.
4. Improved surface smoothness and rolling out of irregular contacting asperities.
5. Re-conditioning and molecular reconstruction of the original contacting metal surfaces.

The process of advanced boundary film formation is accomplished with an advanced combination of halogens that are controlled and rendered non-corrosive to the base metals of the system and pose no threat to the ozone layer or waste oil recovery systems due to their origins and long chain molecular lengths. These halogens initially react under thermal conditions with the organo-metallic reagents to form surface attaching compounds, thereby limiting and controlling the formation of halides from the base metals themselves. These surface attaching reagents or "electro-negative compounds" seek out and affix themselves to the lower surface areas referred to as micro-pores and fissures, as all metals are crystalline in structure and exhibit a lattice type matrix. This complex process also incorporates Van der Waal forces and dipole-dipole surface reactions. During this process, surface lapping and asperity (irregular microscopic contacting and opposing surfaces) roll-out is also achieved, yielding improved spread characteristics of the surfaces themselves. Due to the increase of film strength by the filling of the micro-pores and fissures, along with thermal modification of the asperities, the resulting effect is a gradual rolling out or flattening of the metal asperities rather than a breaking off or chip-away process, which would create metallic debris in the lubricant leading to abrasive wear from wear metal particles. The resulting improvement in the opposing metal surfaces further increases the fluid film strength, which is dependent on the degree of surface roughness and viscosity.

Viscosity, however, is a lesser consideration when incorporating boundary additives or halogenation techniques.

In general, boundary friction and wear consists of two components, a shear or adhesion component and a plowing or deformation component. Considering the following equation:

$$Fs = SAr$$

Where Fs is the shear component, which predominates except when asperities sink too deeply into a boundary lubricant film or a soft opposing surface. When movement or sliding occurs, the shear friction force depends on the shear resistance per unit area, S, of any "boundary film" in the real load-supporting area between asperities. Dividing by the load, W gives the shear contribution to the friction coefficient, becoming independent of total load and apparent area of contact:

$$fs = S * Ar / W = S / Pp \text{ or } S / Pe$$

The boundary film shear resistance, S, is assumed equal to the plastic flow shear stress, Tp, of an ideal elastic, plastic solid. Such a solid gives shear stress independent of strain and strain rate at strains sufficiently large enough to cause plastic flow. The conditions that produce the "glass transition" from liquid to plastic-like behavior are dependent on the viscosity of the material at normal temperatures and pressures and the variation of viscosity with temperature and pressure. In other words, glass transition depends strongly on chemical composition.

These results show that liquid lubricants act like plastic solids in the films between asperities. Therefore, S=Tp in the previous equation and the friction coefficient is Tp/Pp or Tp/Pe. Since Tp is a weak function of temperature and pressure, and Pp or Pe are independent of apparent contact load, the frictional coefficient for a given combination of lubricant and sliding surfaces tends to be independent of operating conditions.

Elasto-hydrodynamic lubrication (ELH) on an asperity scale deposits film material between sliding surfaces in "micro-rheodynamic" (micro-RHD) lubrication. As one surface slides, each asperity carries with it an aggregation of SST additive. Sufficient pressure and temperature is developed within the film to elastically deform the asperity and to force the extreme pressure reagent between the surfaces or into the micro-pores and fissures. During this time, high thermal conditions involving pressure and asperity contacts initiate a re-conditioning of the surfaces utilizing the existing oil to quench and cool the surfaces in the same process. A thermal restructuring of these asperity contact areas creates a deviation from the normal crystalline structure of the metal, expanding it into an austenitic crystalline pattern, which is more evenly structured and allows the SST additive to bond to the actual lattice of the metal, endowing it with new and unique properties upon cooling.

Organo-metallic substitution is a technique developed and designed to inhibit the process of halide formation from the base metals of the system under reaction. For example, instead of the halogen reacting with the iron in the system to form iron halides, a boundary surface salt, it reacts with a reagent having very similar properties to the iron atom itself, thereby forming a organo-metallic complex without scavenging the target metal surface itself, and depleting the metal in a chemically corrosive wear syndrome.

The process is very similar or analogous to the saponification of organo-metallic compounds in the manufacturing of greases. During this reaction or saponification, compounds react at a certain catalytic temperature and exchange characteristic components to form new compounds. These new chemical compounds are then used to aid in a boundary regime by providing an added protection to the actual surfaces being lubricated. Ring opening oxirane acid scavenging and corrosion inhibition is another chemical technique used to neutralize acids and inhibit oxidation and corrosion. This technique involves the use of specifically engineered complex ethylene oxide; oxirane rings, that possess reactive reagents which will cause a cleavage of the ring when encountering acids or strong alkaline. These reactions occur in the presence of both anionic- and cationic-type catalysts. Anionic catalysts can include alkoxide ions, hydroxides, metal oxides, and some organo-metallic derivatives while Lewis acids and protonic reagents initiate cationic reactions.

O

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n H2C - CH2 n

The lubricity, load carrying capacity, surface improvement, and wear reduction are greatly improved while corrosive aspects of halogenation are virtually eliminated.

References:
CRC "Handbook Of Lubrication, Theory And Practice", Volumes 1 & 2, by E. Richard Booser, Ph.D., Society of Tribologists and Lubrication Engineers (STLE), copyright 1992, Eighth Printing.
"Organic Chemistry" 4th Edition, by Robert Morrison, Ph.D. and Robert Boyd, Ph.D., copyright 1983 by Allen & Bacon.
"Lubrication - A Tribology Handbook", edited by M.J. Neale OBE, BSc(Eng), published by Society of Automotive Engineers (SAE), copyright 1993, Butterworth-Heinemann, Ltd.
CRC "Handbook Of Chemistry and Physics", 1986 Edition, by CRC Press, edited by David R. Lide, copyright 1986 by CRC Press.

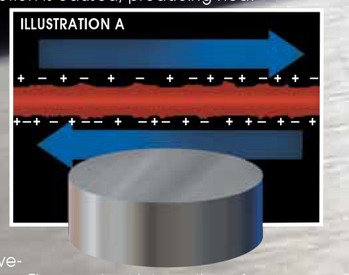
Steel Shield Technologies Has Redefined Lubrication.

Webster's Dictionary defines lubricants as substances capable of reducing friction, heat and wear when introduced between two solid surfaces. From the initial development and use of lubricants, chemical technology has constantly advanced to make them more effective. From changes in refinement processes to the development of additives, the concentration has always been to increase the ability of the lubricant to reduce the friction, heat and wear. **Steel Shield Technologies** has changed the approach to lubrication and, in essence, given new definition to the term. First, there are a few points to consider.

Metal Against Metal

The structure of all metals creates a surface characterized by a series of sharp peaks and valleys, some microscopic and some larger. As two metal surfaces contact each other and move in opposite directions, friction is caused, producing heat and metal deterioration. This friction-causing physical dynamic is heightened by the electromagnetic field created on the surfaces of each metal. The sharp peaks, known as asperities, and valleys, referred to as micro-pores and fissures, have opposite electro-magnetic charges. **Illustration A** shows a new metal with positive-charged asperities and negative-charged micro-pores and fissures. The constant interaction of these opposite-charged features works to weaken the structure of the metal, causing eventual deterioration of the surface of the part.

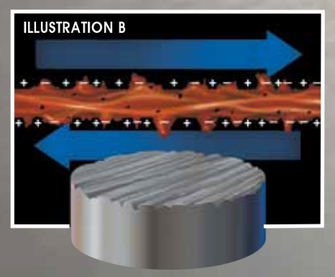
ILLUSTRATION A



Normal Lubricants Help

All lubricants help to slow this process to different degrees. **Illustration B** shows the results after a period of time of use of a typical oil lubricant. The constant friction and electro-magnetic interaction has caused the weakened metal to break off or chip away creating metallic debris in the lubricant leading to abrasive wear from wear metal particles. This fact is evidenced in the need to change the engine oil of automobiles frequently as the lubricant "breaks down" due to the heat and metallic debris.

ILLUSTRATION B



ABF TECHNOLOGY™

Advanced Boundary Film Technology- There Is No Better Protection Against Wear.

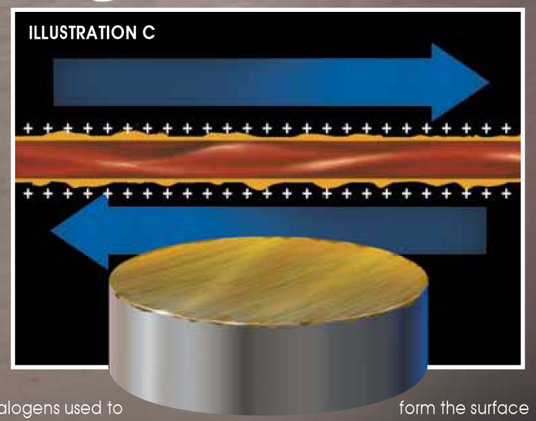
See Extreme Condition Lubrication Test At www.steelshieldtech.com

Steel Shield Technologies has redefined lubrication by breaking away from the standard approach to making the lubricant more effective through adjusting the refinement process or through the use of additives. Instead, **Steel Shield Technologies** approaches lubrication by improving the surface characteristics of the metal through the process of **Advanced Boundary Film** formation. This technological breakthrough is accomplished by addressing the naturally formed asperities, micro-pores and fissures and the electro-magnetic charges they create.

Steel Shield products consist of an advanced combination of halogens which react under thermal (heated) conditions to form electro-negative surface attaching compounds. They seek out and affix themselves to the lower surface areas, filling the micro-pores and fissures. As this process is working, the thermal conditions are effecting the asperities. Instead of breaking off because of a weakened metal state, the asperities gradually roll out or flatten. So while the micro-pores and fissures are filling up, the asperities are flattening for an end result of a metal surface that is greatly improved. Created in this process is a total positive state of polarity. When the metal surface polarity becomes uniform in charge, there is a reduction in friction due to the Faraday reaction of like-charges. This electrochemical process continues at the molecular level to form an **Advanced Boundary Film** on the surface of the metal. **Illustration C** shows the end result of the production of the **Advanced Boundary Film** and the resulting uniform positive polarity.

Another aspect of this advanced technology is the organo-metallic substitution which is the chemical process designed to inhibit halide formation. Here, the

ILLUSTRATION C



halogens used to form the surface attaching compounds react with reagents having similar properties to the iron atom. The halogens, therefore, do not scavenge the target metal surface to find iron with which to react, forming halides and creating a chemically corrosive wear syndrome. Instead, an organo-metallic complex is formed as the basis of the **Advanced Boundary Film.**

Industrial Success Comes To The Consumer

Steel Shield Technologies is now bringing this breakthrough technology to the consumer after great success on the industrial level. The level of commitment to the Steel Shield product in the railroad industry is an indication of its performance in the most extreme conditions imaginable. This same technology is now available to you.

As has been explained, the **Advanced Boundary Film Technology** is a redefining approach to lubrication which provides outstanding benefits to the user.

Practical Elimination Of Metal-To-Metal Wear

Steel Shield Technologies addresses the three areas that cause the weakening and deterioration of the metal surfaces:

- The physical friction of rough surfaces
- The opposite electro-magnetic charges that exist on the metal surface
- The chemical reactions that produce corrosive agents.

Advanced Boundary Film Technology instead strengthens the metal and practically puts an end to metallic debris in the lubricant.

Reduced Operating Temperatures

Friction is reduced so significantly that the operating temperature in treated mechanisms is notably reduced. The end result is a stronger metal that maintains its original specifications and performance level. An example of the reduction of operating temperatures is found in the independent tests that show a drop of an average of 30 Fahrenheit degrees in treated automobile engines.

Increased Effectiveness Of The Lubricant

Whatever lubricant is used as the carrier of the **Steel Shield Technologies** additive, that lubricant is allowed to perform at its maximum efficiency. Lubricant flow will be enhanced with the elimination of rough metal surfaces; the reduction of heat and elimination of metal debris will protect the lubricant from "break down."

STEEL SHIELD TECHNOLOGIES™

7. MAJOR BREAKTHROUGHS IN LUBRICATION TECHNOLOGIES

1. VIRTUAL ZERO FRICTION - RCB IONIC LEVITATION

Faraday's Law like-charges Repel & Dipole-Dipole Reaction

2. DYNAMIC HEAT TRANSFER

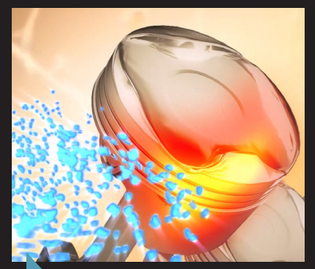
Lubricant accumulates at the hot spot automatically

3. NON CORROSIVE CLEANSING

Metal sludge repelled via induction and removed

Virtual Zero Friction Technology

Lubricants Accumulate at Hot Area & Protect



Clean Engine By Repelling Metal Debris

4. METAL SURFACE RE-HARDENING

From Shear Friction to Surface Lapping

5. ELIMINATE SYSTEM DYSFUNCTION

Not Just Oil, It's Technology

Metal Surface Hardened & Stronger

Engine Keep Running at High Efficiency

8. RCB ELECTROCHEMICAL IONIZATION ADVANCED LEVITATION TECHNOLOGY

Metal Surface Positively Charged

Metals Repel Each Other

Magnetic Levitation

Near Zero Friction

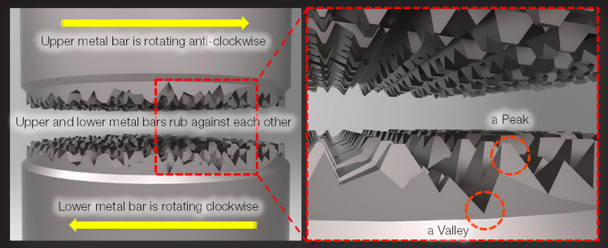
Positively Charged Metal Surface

Repel Each Other

9. ABF TECHNOLOGY DETAILED EXPLANATIONS

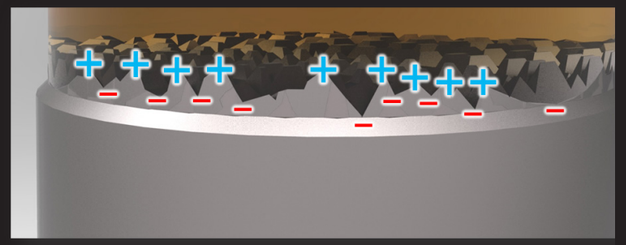
1. METAL SURFACE

Under microscope, metal surface characterized by series of peaks and valleys, Peaks (known as “asperities”), and Valleys (referred to as “micro-pores” and “fissures”).



2. CHARGES OF THE METAL SURFACE

Peaks are positively charged and Valleys are negatively charged.

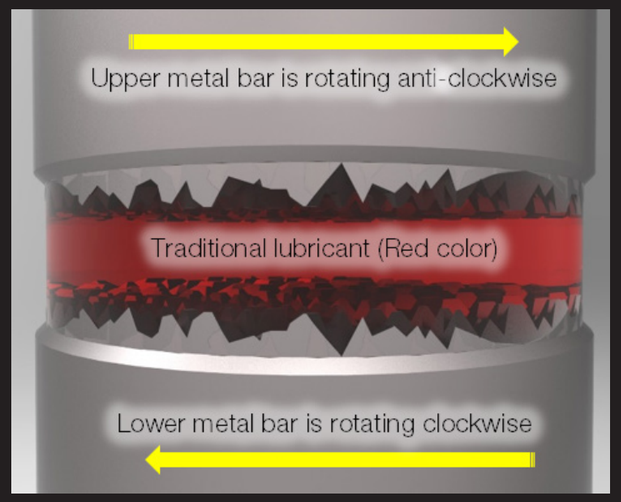


3. TRADITIONAL LUBRICANTS

A. Traditional lubricants help slow the process of heat and friction to some degree.

B. When 2 metal surface contact each other and move in opposite directions, friction is caused, producing heat & metal deterioration.

C. Constant friction & electromagnetic interaction causes the weakened metal to break off creating metallic debris & particles in the lubricants



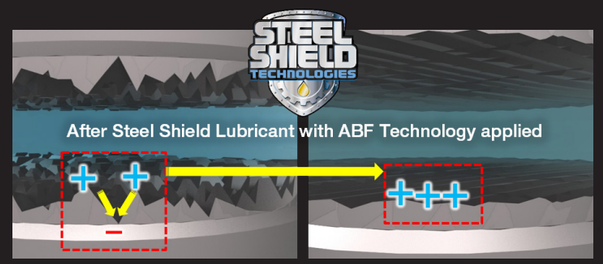
4. STEEL SHIELD TECHNOLOGY

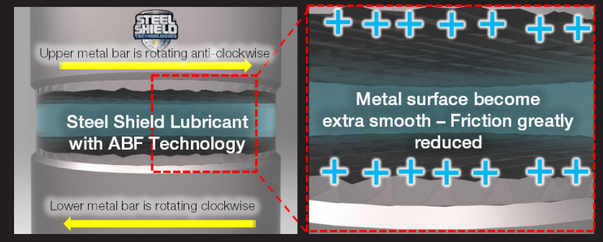
A. Forms electro-negative surface attaching compounds to seek out & affix themselves to lower surface areas filling the micro-pores & fissures.

B. Asperities roll out or flatten creating greatly improved metal surfaces.

C. Created in this process is a total positive state of polarity.

D. When metal surface become uniform in charge, there is a reduction in friction due to Faraday reaction of like-charges.





5. ADVANCED BOUNDARY FILM

A. Advanced methods of tribology that improve lubricity and load carrying capacity

B. Reacts chemically under thermal conditions with the contacting metal surfaces to form a complex surface-attaching film of protection

C. Surface smoothing is accomplished resulting in improved spread characteristics of the surfaces themselves

D. Increases fluid film strength resulting in greatly reduced wear while imparting extreme pressure properties (EP)

10. ADVANTAGES & TARGETED INDUSTRIES

1. Concept

Van der Waals Forces
Dipole-Dipole Surface Reactions

2. Advantages

Reduces Friction and Wear
Provides Smoother Operation
Improves Lubrication
Non-Toxic and Helps Build Green Environment
Improves Machinery Functionality
Improves Fuel Economy
Reduces Operating Temperatures
Protects Moving Metal Parts
Eliminates Cold Start Problems
Reduces Maintenance & Downtime
Extends Component Reliability & Parts Life

4. Targeted Industries

Automotive & Racing, Airlines & Ground Equipment,
Rail & Mass Transit, Shipping
Gas, Oil & Energy Industries, Mining & Drilling
Lifts, Air Conditioning & Cold Storage Systems
Industrial, Agriculture, Construction & Naval Engineering
Military & Law Enforcement units

II. HOW STEEL SHIELD ENHANCE ELEVATOR & ESCALATOR OPERATIONS

"In recent years, accidents relating to elevators and escalators have been increasing, especially in Hong Kong and China. Metal wears and corrosions in wire rope, pulleys or other mechanical structures are the main issues. Serious damages or total system failure, lost in properties and even human lives often happen. Lubrication is one the most important task to ensure safe operations and energy reductions in elevator and escalator products. However, the lubrication technology of the present lubricant products has not been advanced for over 200 years which is far from meeting the stringent requirements of the modern days. The STEEL SHIELD lubricant with ABF Technology is the ONLY solution to metal-to-metal wear. It also provides excellent anti-corrosion, heat reduction, moisture remover and many other awsome features. Let's check it out and learn more!"

1 1A. THE INTRODUCTION

In any building or plant with two or more floors or levels, vertical transportation is an essential service. People ride from floor to floor in passenger elevators while products move in freight elevators or special lifts. Materials may be loaded directly into freight elevators or carried by fork trucks or other vehicles which in turn ride the elevators. Increasingly, elevator like lifts are being integrated with conveyors,guided vehicles, or other means of horizontal movement into completely automated material-handling systems between various locations and levels. Operations in a multistory building or production in a multilevel plant depend on the continuous availability of efficient vertical transportation. Elevators and special lifts must be kept operating at peak efficiency, without unscheduled shutdowns, to provide the necessary interlevel movement safely, dependably, and promptly.Like other essential building and plant systems, vertical transportation consists physically of an installation of elevator equipment integrated with the building structure. The installation is useful only to the extent that it performs a service, in this case moving people and products from level to level. Preventive maintenance becomes the vital link between the vertical transportation system in the building and the service enjoyed by its user.

4 MAIN MAINTENANCE OBJECTIVES

Elevators and elevator like lifts are built and installed by responsible manufacturers to function efficiently and to keep on doing so as long as they are correctly maintained. With proper preventive maintenance an installation will have a service life as long as that of the building or plant itself. The special nature of elevator equipment and its special place in plant operation determine maintenance objectives. Among the most complex and specialized in the entire plant or building, the elevator system integrates electrical, mechanical, and in many cases, hydraulic subsystems. Elevator machinery has no close counterpart in other building equipment. Although elevators are designed for ease of maintenance, installation as an integral building system necessitates locating some critical assemblies and wearing parts at various levels from the basement to the roof. As automation takes over more tasks of elevator operation, equipment becomes more complex and maintenance becomes a weightier responsibility, more difficult to discharge. Each installation requires a preventive maintenance program primarily planned to achieve special objectives: safety, dependability, performance, and economy.

Maintaining Safety. Elisha G. Otis built his first “safety hoister” in 1852, the beginning of the elevator industry. Ever since, quality elevators have been designed and built with attention to the protection of users. For a modern, well-maintained electric or hydraulic elevator to fall is a virtual impossibility. Preventive maintenance keeps door-protective equipment and leveling controls operating as they should to safeguard people at elevator entrances, where most accidents would otherwise occur. During an elevator’s entire lifetime, its safety equipment may never have to operate in an emergency, but safeties must always be maintained in full readiness to function unfailingly, instantly, should the need ever arise.

Dependability. Throughout the working day, continuous availability of elevator transportation isessential to profitable operation, making dependability rank high among maintenance objectives.Even an occasional breakdown can prove costly in lost production or delayed delivery. Like other plant equipment, aging elevators become more vulnerable to possible failure.

Performance. Unless cumulative wear is corrected, power-operated elevator entrances, for example, open andclose more slowly and cars take longer to accelerate, decelerate, and level to a stop. Sluggish operationcuts the number of trips each elevator can complete and the total number of loads it can carry. Preventive maintenance, however, keeps elevators operating like new, even after years on the job.

Economy. "Stitch-in-time" economy is inherent in preventive maintenance. Detecting and correcting wear before performance is impaired and failure occurs prevent a chain reaction that could knock out not only one but an entire series of interrelated elevator parts. In this way, maintenance minimizes costly emergency repairs and the even greater cost of interrupted operation.

Capital conservation, consequently, is a major maintenance objective.

I I B. STEEL SHIELD APPLICATIONS IN ELEVATORS SYSTEM

TRACTION MOTOR
- Smooth operations
- Reduce heat & friction wears
- Extend gear life

GOVERNOR
- Smooth operations of safety system
- Extended life

MAIN ROPE
- Reduce frictions & wears
- Prevent corrosions & rusting
- Extended life & good penetration & adhesion

GOVERNOR ROPE
- Reduce frictions & wears
- Prevent corrosions
- Extended life

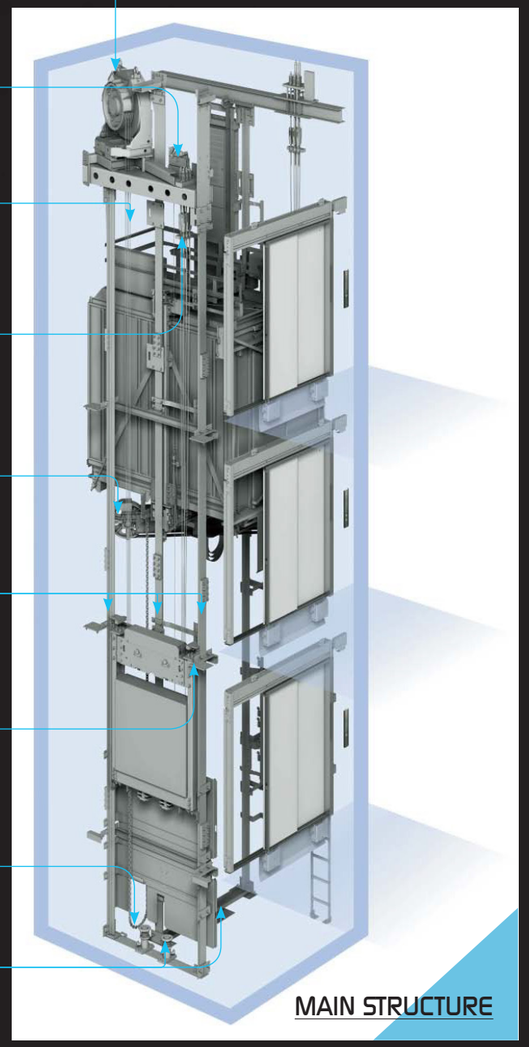
CAR SUSPENSION SHEAVE
- Smooth the tensions of the main ropes
- Extended bearing loadings & lifes

GUIDE RAILS
- Reduced frictions and smooth operations
- Extended metal life
- Reduced noise & vibrations

CAR SHOE
- Reduced frictions and smooth operations
- Extended metal life
- Reduced noise & vibrations

SUSPENSION CHAIN
- Protect chains from corrosions & rusting

WEIGHT BUFFER & CAR BUFFER
- Protect from extreme pressure
- Long-lasting & smooth operations
- Anti-wear & corrosions



CAR DOOR OPERATOR
- Smooth car doors operations
- Slient operations
- Extended components life
- Resistance to corrosions & water

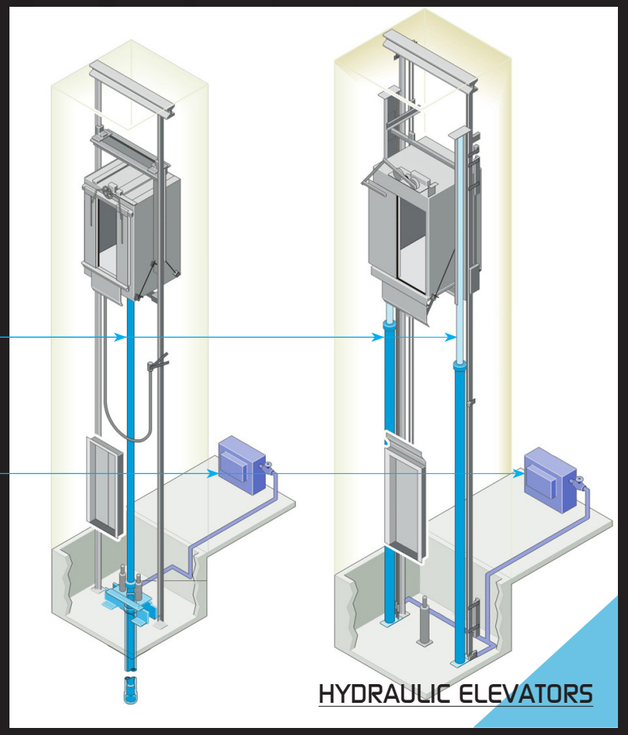
CAR SILL
- Smooth car doors operations
- Slient operations
- Extended components life
- Resistance to corrosions & water

Lube Point	Focus	STEEL SHIELD Products
Traction Motor	Gear box	Steel Shield EPA
		Lithi Shield (for open gears)
		Steel Shield Gear Lubricants
Governor	Any mechanism	Steel Shield EPA
		Lithi Shield (for open system)
Main Rope		Lithi Shield
Governor Rope		Lithi Shield
Car Suspension Sheave	Bearing	Lithi Shield
Guide Rails		Lithi Shield
Car Shoe	Contacts	Lithi Shield
Suspension Chain		Lithi Shield
Car Door Operator	Any mechanism	Lithi Shield
Car Sill	Surface	Lithi Shield
Weight & Car Buffer	Spring	Lithi Shield
	Oil suspension	Steel Shield EPA

I I C. STEEL SHIELD APPLICATIONS IN ESCALATOR SYSTEM

PLUNGER & PISTONS
- Extreme pressure ability
- Excellent anti-wear & weld point
- Smooth operations

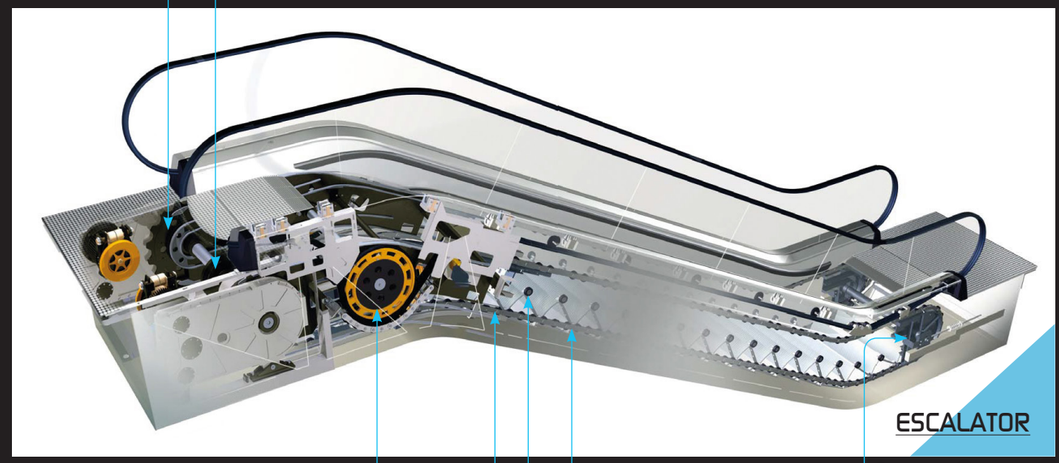
FLUID TANK & HYDRAULIC SYSTEM
- Maintain hydraulic system stabilities
- Protect system from corrosion
- Excellent reliability
- Treats & enhance all metal components
- Remove debris inside pipings



Lube Point	Focus	STEEL SHIELD Products
Plunger & Pistons		Lithi Shield
Fluid Tank System	Hydraulic oil	Steel Shield EPA
		Steel Shield Hydraulic Lubricants

MOTOR & GEARBOX
- Smooth operations
- Extended life
- Reduced metal wears
- Reduce drive energy

STEPS DRIVE SPROCKET & CHAIN SYSTEM
- Smooth operations
- Extended life
- Reduced metal wears
- Reduce drive energy



HANDRAIL DRIVE UNIT
- Smooth operations
- Reduce heat, noise & friction wears
- Extended life
- Resistance to corrosions & debris

STEP UP THRUST DEVICE
- Smooth operations
- Reduce heat, noise & friction wears
- Extended life
- Resistance to corrosions & debris

STEP CHAINS & TRACKS
- Smooth operations
- Reduce heat, noise & friction wears
- Extended life & reliability
- Increased stability

STEP DRIVING ROLLER & TRAILING ROLLER
- Smooth operations
- Extended life
- Reduced metal wears
- Treat & protect contact surface

11D. ELEVATORS & ESCALATORS MAINTENANCE COSTS

Lube Point	Focus	STEEL SHIELD Products
Steps Driving Motor	Bearing	Lithi Shield
		Reel Shield Grease (for high temperature)
Steps Driving Gearbox	Gears & bearings	Steel Shield EPA
		Steel Shield Gear Lubricants
		Lithi Shield (for open system)
Steps Drive Chain System	Bearing, sprocket & jack	Steel Shield EPA
		Lithi Shield (for open systems)
Handrail Drive Unit	Bearing, sprocket & jack	Lithi Shield
Step Chains & Tracks	Chain sprockets & jack	Steel Shield EPA
		Lithi Shield (for open systems)
Step Up Trust Device	Bearing, gear, sprocket	Lithi Shield
Step Rollers	Driving roller & trailing roller	Lithi Shield
Others	All open contact area	Lithi Shield

MAINTENANCE AND COSTS

There are three cost factors that must be considered in designing vertical transportation systems for any type of building. Of initial importance is the cost of the installation. Of parallel importance is the cost of operating the vertical transportation system. The third, but perhaps less definitive, factor is the return that may be anticipated on the initial investment.

OPERATIONAL COSTS

Among the factors considered by building management in considering modernization of a vertical transportation system are the need to reduce downtime of the system, rising maintenance costs, and diminishing system efficiency. Often overlooked in these considerations is the reduction of energy consumption. Many architects and owners are looking to meet the new Leadership in Energy and Environmental Design (LEED) criteria for “green” buildings. The vertical transportation industry has new technology to meet these demands, such as energy-efficient drive units that save consumption of power and options for destination dispatch to group traffic and move the passengers as efficiently as possible.

Although it may still be necessary, on a rare occasion, in some facilities to maintain motor-generator control, the majority of all buildings are utilizing solid-state control drive units when performing modernizations. With new technology, the new drive units are saving in the range of 25–45% of power consumption over motor-generator control. Over the course of a year of operation, power consumption by a vertical transportation system will show a marked reduction through the use of solid-state converters. Some savings in maintenance costs can also be achieved through the elimination of the motor-generator rotational equipment.

The introduction of the microprocessor and destination-based dispatching has improved the system operation efficiency levels to such an extent that the actual number of elevator movements during the course of a normal workday is reduced. Although this reduction is not easily quantified, it does exist and will contribute to a further reduction in power consumption.

RETURN ON INVESTMENT

The factors noted in the preceding section can be reasonably evaluated in appraising a potential return on investment from the modernization of any vertical transportation system.

Perhaps less tangible, but of equal importance to the building management, is the improvement in building image and tenant satisfaction. Dissatisfaction with a vertical transportation system is always at the top of the list of tenant complaints, along with heating and air conditioning. The improvement in equipment reliability after modernization will result in a higher level of tenant satisfaction, achieved by a reduction in downtime and far fewer entrapments, and a much lower potential for liability lawsuits.

It should be noted that visual evidence of modernization in the form of cosmetic improvements to car enclosures and entrances is essential to eliminate tenants’ negative perception: “All that inconvenience was for nothing. These are the same old elevators.”

Although it is difficult to place a dollar value on these improvements, they clearly are a major source of better tenant relations, which subsequently result in higher occupancy levels. Additionally, it allows the owner to charge a higher rentable square foot cost based on the improvements.

Operational Costs and Return on Investment are closely related to lubricants. STEEL SHIELD can minimize metal wears and save huge amount of energy bills and maintenance costs.

ONLY ABF Technology can save your money.

II E. PROPOSALS FOR ELEVATOR MAINTENANCE

TYPICAL INDUSTRY-GENERATED CONTRACT COVERAGE

The following real example shows a typical maintenance coverage.

Extent of Coverage statement: "Under the terms and conditions of this agreement subsequently set forth we will maintain the elevator equipment described in this proposal, using skilled elevator personnel whom we directly employ and supervise. This proposal includes 24-hour emergency adjustment callback service only at no additional charge. We will systematically and regularly examine, adjust, lubricate as required, and, when we consider it necessary, repair or replace components including the following:"

Main Unit	Components (parts require lubrication are highlighted in Yellow)
Machine	Worm shaft bearings—thrust bearing—gear shaft Bearings—slack cable device—machine limit device—regroove drive sheave—gear oil—packing
Motor	Armature—commutator—field coils—interpole coils—brushes—brush holders—rotor—stator windings—slip rings—motor bearings—motor oil
Motor generator	Armature—commutator—field coils—interpole coils—brushes—brush holders—rotor—stator windings—slip rings—motor bearings—motor oil
Brake	Linings—magnet coils—linkage—brushings—contact springs—plunger—dashpot—adjusting screws
Controller	Magnet coils—copper contacts—carbon contacts—shunts—springs—fuses—insulators—resistors—rectifiers—timing devices—solid-state devices—overload heaters
Selector	Sheaves—drive chains—cables and tapes—contacts—floor bars—springs—shunts—reduction gears—selector carriage—advance motors—coils
Wiring	Traveling control cables—hoistway control wiring
Hoistway	Hoistway limit switches—car limit switches—speed governor—bearing boxes—governor tension sheave—interlocks—door rollers—buffers—counterweight guide shoes—bottom door guides
Car	Guide shoes—guide shoe linings—guide shoe rollers—leveling units—car door operator motor—belts—gears—cables—sheaves—gate switch—safety edge—photoelectric devices
Ropes	On a pro-rata basis: hoist—drum counterweight—car counterweight—operating—governor—car safety rope
Signals	Pushbuttons—contacts—indicator lights—hall lanterns

The table above revealed that there are huge of amount of components require lubrication which contribute to HUGE maintenance costs after they wear. STEEL SHIELD saves your money by dramatically extent parts life and maintenance period, and also save driving energy.

OWNER-GENERATED CONTRACT COVERAGE

Here shows an example of some recommended items considered for inclusion in any owner generated maintenance contract coverage. Notice how Steel Shield benefit each of them.

No.	Item	Potential Benefits After Using Steel Shield
1	Number of hours of work to be performed per day, week, or month by a journeyman mechanic for preventive maintenance (trouble calls and overtime callbacks should not be considered as part of this time allowance)	Decrease
2	Hours of work	Decrease
3	Job material inventory on-site	Decrease
4	Spare parts inventory off-site	Decrease
5	Parts storage on-site	Decrease
6	Space required by owner for storage of supplies	Decrease
7	Code requirements	Maintained
8	Job cooperation with owner's personnel and other on-site contractors	Decrease
9	Monitoring of work by owner	Decrease
10	Performance evaluation	Enhanced performance
11	Nonperformance evaluation and cure	Enhanced performance
12	Safety tests	Satisfy requirements
13	Adjustments	Decrease
14	Conditions of service	Maintained
15	Obsolete equipment	Decrease
16	Additional work	Decrease
17	Premaintenance repairs	Decrease

Supported by lots of test reports and testimonies, STEEL SHIELD has been proved to be highly efficient to reduce maintenance related tasks, resources and costs. STEEL SHIELD adds values to your company and favour to your operations.

11F. ELEVATOR HOISTING MACHINE LUBRICATION

ELEVATOR LUBRICANTS SELECTION

Different elevators consist of different components and structures, typically, they compose: Hoisting Machine, Traction Motor, Signage and Wayfinding Systems, Car, Weight Balancing System, Electric Control System, Safety Protection System, etc. There are many components require lubrications, for example, gear motor, wire rope, car door mechanics, hydraulic buffer, etc.

HOISTING MACHINE LUBRICATION

The main function of a hoisting machine is to deliver and transmit power, and move the car. Nowadays, even though the development of permanent-magnet synchronous motors are advancing and becoming more and more common, the geared traction motors are still the major component (over 80%) of elevators in many countries like China.

Basically, geared motors apply worm gear reduction gear box. Most of the worm gears are made of anti-wear bronze, and the shafts are made by carburizing hardened steel which is steel-bronze contact. As gear teeth mesh, they roll and slide together. This combination of sliding and rolling occurs with all meshing gear teeth regardless of type. The two factors that vary are the amount of sliding in proportion to the amount of rolling, and the direction of slide relative to the lines of contact between tooth surfaces. With worm gears, as with spur gears, the same sliding and rolling action occurs as the teeth pass through mesh. Usually, this sliding and rolling action is relatively slow because of the low rotational speed of the worm wheel. In addition, rotation of the worm introduces a high rate of side sliding. The combination of two sliding actions produces a resultant slide, which in some areas is directly along the line of contact.

Also, the contact durations of the gear surface in worm gears is longer than those in typical spur gears. Therefore, the wearing problems in worm gears are more significant.

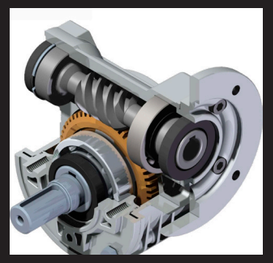


FIGURE 1 - WORM GEAR MECHANISM
- Bronze worm wheel and steel pinion shaft

STEEL SHIELD lubricants with ABF Technology have: excellent anti-wear properties, able to reduce coefficient of frictions, suitable for bronze-steel gear meshing conditons, excellent anti-corrosions properties, cold-start ability, high temperature stability and absorb vibrations in any elevator traction system.

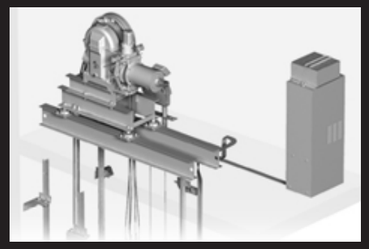


FIGURE 2 - TRACTION METHODS
- Upper: Geared
- Lower: Gearless

The typical viscosities of lubricants for elevator reduction gear systems are usually ISO320 and ISO460 (depends on the machine requirements and other environmental factors). The following table shows some examples of Steel Shield lubricants:

Properties	Standard	Unit	ISO 150	ISO 220	ISO 320	ISO 460
Kinematic Viscosity @ 40 ˚C	ASTM D445	cSt	150	220	320	460
Kinematic Viscosity @ 100 ˚C	ASTM D445	cSt	23	34	51	72
Viscosity Index	ASTM D2270		185	202	220	230
Flash Point (COC)	ASTM D92	˚C	225	225	225	230
Pour Point	ASTM D97	˚C	-30	-30	-30	-27
FZG FAIL LOADING STAGE	DIN 51354-2		12+	12+	12+	12+

TABLE 1 - EXCELLENT PROPERTIES OF STEEL SHIELD SST ECI POWER-AP PAG GEAR OIL

Properties	Standard	Unit	ISO 150	ISO 220	ISO 320	ISO 460	ISO 680	ISO 1000	ISO 1500
Kinematic Viscosity @ 40 ˚C	ASTM D445	cSt	150	220	320	460	680	1000	1500
Kinematic Viscosity @ 100 ˚C	ASTM D445	cSt	14.8	19	24	30	38	44	61.2
Viscosity Index	ASTM D2270		95	95	95	95	90	90	90
Flash Point (COC)	ASTM D92	˚C	240	245	247	250	250	252	255
Pour Point	ASTM D97	˚C	-10	-9	-9	-9	-6	-3	-3
COPPER CORROSION	ASTM D130		1B	1B	1B	1B	1B	1B	1B

TABLE 2 - EXCELLENT PROPERTIES OF STEEL SHIELD SST ECI T-GEAR AP EP GEAR OIL

STEEL SHIELD lubricants with ABF Technology are the ONLY solution of metal-to-metal wears. Their performance exceed any elevator traction oils in the market. Most importantly, STEEL SHELD treats the metal, not the oil, which solve the ROOT CAUSE of frictions and metal wears.

11G. HYDRAULIC ELEVATOR & BUFFER LUBRICATION

HYDRAULIC ELEVATOR & HYDRAULIC BUFFER SYSTEMS

1. Holed hydraulic elevator: With holed hydraulic systems, the elevator car is mounted on a piston that travels inside a cylinder. The cylinder extends into the ground to a depth equal to the height the elevator will rise. As hydraulic fluid is pumped into the cylinder through a valve, the car rises. As the fluid returns to the reservoir, the car descends. This system is often called Inground hydraulic.

2. Holeless hydraulic elevator: It consists of pistons mounted inside the hoistway to raise and lower the car. This is especially a solution for buildings built in bedrock, a high water table or unstable soil conditions locations that can make digging the hole required for a conventional hydraulic elevator impractical. Holeless hydraulic systems use a direct-acting piston to raise the car.

3. Roped hydraulic elevator: Roped hydraulic elevator extends the rise of the holeless elevator to 18 meters (60 ft), without the need for a belowground cylinder. Roped hydraulic elevator systems have the piston attached to a sheave which has a rope passing through it. One end is attached to the car while the other is secured at the bottom of the hoistway. Also, roped hydraulic systems require a governor because the rope is holding the car up.

4. Machine room less hydraulic elevator: It does not require a fixed room to house the hydraulic machinery, instead, the machinery itself is usually installed on the elevator pit and the controller is installed behind a locked cabinet on the wall near the elevator. The benefit of machine room less hydraulic elevator is that it saves construction time and cost. Examples of machine room less hydraulic elevator is Otis HydroFit and ThyssenKrupp Endura MRL.

5. Spring buffer: A spring buffer is one type of buffer most commonly found on hydraulic elevators or used for elevators with speeds less than 200 feet per minute. These devices are used to cushion the elevator and are most always located in the elevator pit.

6. Hydraulic buffer: An oil buffer is another type of buffer more commonly found on traction elevators with speeds higher than 200 ft/min. It uses a combination of oil and springs to cushion a descending car or counterweight and are most commonly located in the elevator pit, because of their location in the pit buffers have a tendency to be exposed to water and flooding. They require routine cleaning and painting to assure they maintain their proper performance specifications. Oil buffers also need their oil checked and changed if exposed to flooding.

The modern elevators have high loading requirements with frequent operations. At lower levels where temperatre is low, the elevator would be serious affected by high humidity, and the demands for more comfort operating conditions is high, therefore, the hydraulic oils must be stable so as to reduce the maintenance frequency, increases reliability, extends machine life and ensures safety. The followings revealed the requirements of elevator hydraulic lubricants:

1. High viscosity index and stabile viscosity under different temperature: In order to increase the reliability of any hydraulic system

2. Excellent abilities in water separation, air release, and anti-foaming: These traits ensure hydraulic pistons can operate smoothly, increase accuracy of controlling and balance of operations which contribute to high system efficiency

3. High anti-oxidiation property: It prevents oil degrade which results in viscosity increase, and debris formations. It extends lubricant's life

4. Cold start ability: Many metal wears are caused by cold start when the lubricant has low fluidity, low flowabilty and high viscosity under low temperature conditions such as winter. The lubricant must be able to flow under such condition in order to protect the metal.

FIGURE 1 - HYDRAULIC SYSTEM & BUFFER

Properties	Standard	Unit	ISO 32	ISO 46	ISO 68	ISO 100
Density @ 15		Kg / L	0.872	0.874	0.881	0.89
Kinematic Viscosity @ 40°C	ASTM D445	cSt	30.4	46	68.5	98.5
Kinematic Viscosity @ 100°C	ASTM D445	cSt	5.23	6.75	8.7	11
Viscosity Index	ASTM D2270		100	100	99	97
Flash Point (COC)	ASTM D92	°C	219	225	230	239
POUR POINT	ASTM D97	°C	-20	-20	-18	-15

TABLE 1 - EXCELLENT PROPERTIES OF STEEL SHIELD SST ECI TV T-POWER HYDRAULIC OIL

Properties	Standard	Unit	ISO 32	ISO 46	ISO 68	ISO 100	SAE 150
Kinematic Viscosity @ 40°C	ASTM D445	cSt	30	45	67	98	145
Kinematic Viscosity @ 100°C	ASTM D445	cSt	5.3	6.7	8.6	10.9	14.5
Viscosity Index	ASTM D2270		99	99	98	97	96
Flash Point (COC)	ASTM D92	°C	212	220	228	245	250
Pour Point	ASTM D97	°C	-12	-12	-10	-10	-10

TABLE 2 - EXCELLENT PROPERTIES OF STEEL SHIELD SST ECI HD-AP HYDRAULIC OIL

STEEL SHIELD hydraulic lubricants with ABF Technology ensure high efficiency operations of any hydraulic system by treating the metals. It provides outstanding viscosity properties, anti-wear especially at COLD START, anti-foaming, water-separation abilities and other essential features under a wide temperate range.

Also, unlike other premium oils, STEEL SHIELD does NOT contain any solid additives which cause metal wear after prolonged use. It's because STEEL SHIELD technology is superior to any lubrication technology in the market.

11H. ELEVATOR WIRE ROPE LUBRICATION

ELEVATOR WIRE ROPE

Wire rope is the main connecting material between the car, the traction system and counter weights. It subjects to wearings in every operation. In many cases like premium class elevators which have air-conditioner installed, and situations such as lack of maintenace, the wire can also affected by water moisture, dust and other impurities. Also, due to high frequency of bending and changing load conditions, the wire fibre would wear internally. Therefore, the wire rope lubricant should exceed the following requirements:

1. Penetrate to the core of the wire rope to prevent rupture of strands and rope break: Prevents excessive rubbing wear of strand on strand and metal fatigue. Surfaces in contact are lubricated and fatigue is reduced. They extend the period of re-lubrication. The speed of the initial oil impregnates from the core squeezes out and passes the inner strands can be slowed down to prevent fatigue happen.
2. Friction between the wires and/or strands is reduced: To minimize the effects of blending stresses, frictions and wears.
3. Act as a buffer or cushion between the wire rope and the pulleys: Reducing metal wears and increases wire life.
4. Adhere to wire and core: Stay on the rope and resist being thrown off when travelling around high speed pulleys.
5. Weather resistant: Resist water wash out Rapid displacement of moisture.
6. Resistant to oxidation: Extend oil life and prevent metal oxidation.
7. Easy to apply: Can be apply by machine, brushing or spraying.
8. Able to withstand the full range of atmospheric temperatures: Cracking of the outer covering can occur in cold weather if manufacturing precautions are not taken and this allows moisture to penetrate.

FACTORS THAT INFLUENCE WIRE ROPE AND CABLE PERFORMANCE

Elevator cable life cycle and performance are influenced by several factors, including type of operation, care and environment. Cables can be damaged by worn sheaves, improper winding and splicing practices, and improper storage. High stress loading, shock loading, jerking heavy loads or rapid acceleration or deceleration (speed of the cable stopping and starting) will accelerate the wear rate.

Corrosion can cause shortened rope life due to metal loss, pitting and stress risers from pitting. If a elevator is to be shut down for an extended period, the cables should be removed, cleaned, lubricated and properly stored. In service, corrosion and oxidation are caused by fumes, acids, salt brines, sulfur, gases, salt air, humidity and are accelerated by elevated temperatures. Proper and adequate lubricant application in the field can reduce corrosive attack of the cable.

Abrasive wear occurs on the inside and outside of wire ropes. Individual strands inside the rope move and rub against one another during normal operation, creating internal two-body abrasive wear. The outside of the cable accumulates dirt and contaminants from sheaves and drums. This causes three-body abrasive wear, which erodes the outer wires and strands. Abrasive wear usually reduces rope diameter and can result in core failure and internal wire breakage. Penetrating wire rope lubricants reduce abrasive wear inside the rope and also wash off the external surfaces to remove contaminants and dirt.

FIGURE 1 - ELEVATOR WIRE ROPES

FIGURE 2 - WIRE LUBRICATED & PROTECTED BY LITHI SHIELD

- Left: Lithi Shield application
- Right: Wire rope absorbed and fully protected by Lithi Shield, and fully penetrated into the core

Only Lithi Shield with unique ABF Technology can reduce millions of wire rope maintenance costs. Lithi Shield exceeded all the elevator wire rope lubricant requirements, and it penetrates deeply and thoroughly into the core of each strand to provide total lubrication and protection especially against salt water and moisture contamination. Lithi Shield is extremely adhesive and repels against water moisture and corrosions which results in dramatically extented wire life.

Most importantly, Lithi Shield enhances the safety of elevator operations, and it is totally environmental friendly.

FIGURE 3 - LITHI SHIELD - THE LAST HOPE OF ANY ELEVATOR WIRE ROPE

- Made in USA
- ABF Technology
- Ultimate quality NLGI 2 grease

III. ELEVATOR & ESCALATOR BEARING LUBRICATION

ELEVATOR & ESCULATOR BEARINGS

When the traction motor operates, the formation of a thin and strong layer of lubricant film on the bearing surface is required so as to protect the bearing and maximize bearing's life under extreme severe operating conditions.

Bearings may be designed as ball or roller bearings, radial or thrust bearings; what they all have in common is the transmission of load and power via rolling elements located between bearing rings. This is a simple and successful principle, at least as long as the contact surfaces remain separated. However, if the surfaces contact one another, there can be trouble ahead: the resulting damage caused may be anything from light, hardly perceptible surface roughening, pronounced sliding and scratching marks, to extensive material transfer that may promote premature bearing failure – with expensive consequences! A vital requirement for low-wear or even wear-free operation of rolling bearings is the sustained separation of the surfaces of rolling elements and raceways, i.e. the friction bodies, by means of a suitable lubricant.

SMALL INVESTMENTS MAKE THE HUGE DIFFERENCE

Steel Shield lubricants can do a lot for your elevator rolling bearings: they extend bearing lifetime, increase the reliability of operation, lower the noise level, allow higher bearing running speeds and make bearings resistant to extreme conditions. The costs for speciality lubricants are outweighed by many benefits, so in reality the lubricant is a small investment that makes a big difference.

LUBRICANT REQUIREMENTS

The following required properties of lubricants revealed why they are necessary in elevator operations:

1. Anti-wear property: The bearings suffer from extreme loading of traction machine. When the operating temperature increase, the viscosity of the lubricant will decrease. It leads to reduction of oil film which results high opportunities of metal-to-metal wears.

2. High welding point: When the loading exceeds the maximum capacity of a bearing, metal-to-metal welding would occur that causes system shut down and endangers users safety.

3. Wide operating temperature range: Temperature directly affects the fluidities and load capacities of lubricants. Also, changing lubricants frequently for season and operating purposes are time consuming and induces costs. Thus, it is necessary to select Steel Shield lubricants as they are stable over wide temperature range and reduce lube change frequencies.

4. High fluidity and flowablity with excellent load carrying capacity: High viscosity will reduce fluidity and flowability which creates high internal frictions inside lubricant, and therefore, the machine needs extra energy to overcome the frictions. The ultimate result is high energy costs. Steel Shield solve this problem by providing outstanding load capacity with greater fluidity, and save your costs.

5. Anti-corrosion properties: Many rolling bearing components are manufactured using carbon steel. When exposed to atmospheric humidity, the most commonly used steel, 100Cr6, has no long-term resistance to corrosion. This affects operational reliability. Unwanted corrosion particles which may form on an unprotected bearing surface may gradually find their way into the bearing leading to increased running noise and thereafter premature bearing failure.

6. Support of grease distribution in the bearing: It is essential that the bearings be manually rotated a few rounds to ensure proper spread of the grease every time when applying new grease. Otherwise, insufficient lubrication of the bearing during its first few rotations may cause irreversible damages leading to the bearings die unexpectedly early. This problem can be prevented by using Steel Shield EPA and Lithi-Shield grease because of it's long lasting metal protection capability.

7. False Brinelling prevention: So-called False Brinelling is the formation of undesirable wear on the bearing raceways and takes place under non-rotational conditions. This phenomenon occurs due to minute oscillating movements in the contact areas of bearings, for example in elevator bearings during transportation of cars or in standby (off-line) compressors. False Brinelling may be prevented by replacing the conventional bearing anti-corrosion oil with a corrosion protection lubricants from Steel Shield ABF Technology.

STEEL SHIELD lubricants such as Lithi Shield and STEEL SHIELD EPA with unique ABF Technology are the ultimate performer for any types of bearings. They are the main contributors to any elevator system against outrages, deratings and machine deprecation. STEEL SHIELD aims to prolong the maintenance intervals and reduce costs by reducing bearings and other components replacements, and reduce the inventory stock of spare parts.

11J. GUIDERAILS & TRACKS LUBRICATION

ELEVATOR GUILDRAILS & ESCALATOR TRACKS

Bearings and flat bearings includes all slides, guides, and ways used on elevators and escalators. The service conditions under which these bearings operate vary widely. Elevator guide rails operate at relatively high speeds under conditions that permit the formation of fluid lubricating films most of the time. The requirements for lubrication usually are not severe.

The lubrication of ways and slides of elevators and escalators can present special problems. At low speeds and under heavy loads, the lubricant tends to be wiped off causing boundary lubrication to prevail. While this results in higher friction, boundary films have the advantage of being almost constant in thickness. With low loads and high traverse speeds, the oil viscosity must be high enough to allow the formation of fluid films that will lift and float the slide. With variations in speed or load, these fluid films can vary in thickness enough to produce wavy surfaces on the parts being machined, or cause them to run offsize. Thus, precision machining generally requires that the slides and ways operate under boundary conditions at all times. This frequently means that friction-reducing and antiwear additives must be included in the oil.

The phenomenon known as stick–slip can be encountered in the motion of slides and ways. If the static coefficient of friction of the lubricant is greater than the dynamic coefficient, more force is required to start the slide from rest than is required to maintain it in motion after it has started. There is always some amount of free play in the feed mechanism; so when force is applied to start the slide in motion, there will be initial resistance. When the force becomes high enough, the slide will begin to move. As soon as motion begins, the force required to maintain motion decreases so the slide will jump ahead until the free play in the feed mechanism is taken up. At low traverse speeds, this can be a continuous process, producing chatter marks on the workpiece. With cross-slides, stick–slip effects can make it extremely difficult to set feed depths accurately. Stick–slip effects can be overcome with Steel Shield ABF Technology that reduce the static coefficient of friction to a value equal to or less than the dynamic coefficient.

With vertical guide rails of elevators, the lubricant tends to drain from the surfaces. To resist this tendency and secure adequate films, special adhesive characteristics are needed. Applying Lithi Shield is the best solution.

LUBRICANT CHARACTERISTICS

On the basis of the foregoing requirements, the characteristics of suitable elevator and escalator lubricants for slides, guide rails, and ways can be summarized as follows:

1. Proper viscosity at operating temperature for ready distribution to the sliding surfaces and for forming the necessary boundary films

2. High film strength to maintain the required boundary films under heavy loads and antiwear capability to control wear under these boundary conditions

3. Proper frictional characteristics to prevent stick–slip and chatter

4. Adequate adhesiveness to maintain films on intermittently lubricated surfaces, especially vertical surfaces, and to resist the washing by any continuous operations

5. Slides and guide rails in open-operations may be exposed to considerable amounts of water. Lubricants for these applications must be specially formulated to resist being washed off

LITHI SHIELD grease with ABF Technology is ideal for any guide rails. It outperforms and defeats any brands in the market in all parameters.

11K. CHAIN DRIVES LUBRICATION

ESCALATOR CHAIN WEARS

Wear is thought of as loss of material due to the chain components working either against each other or against some foreign material. The three most common types of wear in escalator chain system are abrasion wear, adhesive wear, and fatigue wear. The actual amount of wear on a given chain depends on several factors including materials and heat treatment of the chain components, load and speed, lubrication, the presence of abrasive and corrosive substances, and the configuration of the sprockets. Most sliding or dragging chains have wear on the edges of the sidebars and often on the outer surfaces of the bushing of rollerless chains. In drive and elevator applications, wear in the chain joints is usually the limiting factor in determining the life of the chain. In bushed rollerless chains, wear is caused by the movement of the pins in the bushings and by the bushings rubbing on the sprocket teeth. In engineering steel chains with rollers, wear occurs on the outside diameter of the rollers, between the rollers and bushings and between the pins and bushings.

Wear between the pin and bushing causes the chain to elongate (grow longer but not stretch) until the chain will not fit the sprockets correctly or will not maintain correct spacing or timing. Chain wear elongation usually progresses through three stages. First, there is a short period of rapid initial, or run-in, wear. In this first stage, high spots are worn off, the pins and bushings and minor misalignments are quickly worn away. Second, there is gradual wear of the surfaces between the pins and the bushings. In this second stage, the pins are seated properly in the bushings and the bearing areas are normally well lubricated. In the last stage, there is another period of rapid wear. As the clearance between the pin and bushing gets larger, lubrication becomes less ineffective in such a way that the case hardening of the pins and bushings may have worn through, leaving a softer metal that will wear more dramatically. The result of excessive elongation on the sprocket may have caused loads on individual joints to increase dramatically.

Since a chain must articulate over a sprocket, wear occurs between the chain bushings and the pins and cause elongation of the chain or lengthening of the pitch. Sprockets are designed to accept a reasonable amount of elongation (3 to 6% for many styles) from wear, but when the chain elongates beyond this point it no longer fits the sprockets and the escalator system will not operate properly.

LUBRICATION REQUIREMENTS

Each joint in a roller chain is a journal bearing, so it is essential that it receives an adequate amount of proper lubricant to achieve maximum wear life. Most roller chain drives must be either periodically or continuously relubricated to obtain their full potential service life. In addition to resisting wear between the pins and bushings, an adequate flow of lubricant smoothes the engagement of the chain rollers with the sprocket, cushions roller to sprocket impacts, dissipates heat, flushes away wear debris and foreign materials, and retards rust. Lubricants for roller chain drives should have the following characteristics:

1. Sufficiently low viscosity to penetrate into the critical internal surfaces

2. Sufficiently high viscosity, or appropriate additives, to maintain the lubricating film under the prevailing bearing pressures

3. Clean and free of contamination

4. Capability to maintain lubricating qualities under the prevailing operating conditions

These requirements usually are met by a good grade of nondetergent petroleum base oil. Detergents normally are not necessary, but antifoam, antirust, and film strength improving additives are often beneficial. Low-grade or impure oils should be avoided. Low-grade oils cannot provide effective lubrication and acids or abrasive particles in the oil can damage the chain beyond repair. Heavy oils or greases should not be used because they are too thick to penetrate into the internal surfaces of the chain.

STEEL SHIELD EPA keeps the chain system smooth and long-lasting. The drive delivers the highest efficiency with minimum metal wears.

12. COST SAVING ANALYSIS IN ESCALATOR & ELEVATOR SYSTEM

"Our goal is to help you save energy and money while improving reliability with our unique ABF Technology lubricants for new or existing vertical transportation, escalator, moving walk systems and elevator modernization projects. Steel Shield will help transform your machines into a facility that measures up to modern buildings in safety, functionality, and energy savings. "

12A. HOW STEEL SHIELD ENHANCES WIRE ROPE LIFE?

INTRODUCTION

People usually use time as a criteria to estimate the life of wirerope. However, even though they compare two elevators of the same model and configuration, the travelling frequencies are different. Thus, it is not reasonable to use time as an only criteria, instead, it should be more suitable to use travelling frequency to represent the wire usable life. The following section apply a real example to demonstrate how lubricant affects the life of elevator wireropes.

WIREROPE LIFE ESTIMATION

Case: A resident elevator system have the following configurations:

Symbol	Definition	Value	Unit
P	mass of elevator	1200	kg
Q	Rated load	1000	kg
v	Rated speed	1.75	m/s
	Elevated height	50	m
	Single wire	2:1	
q	Balance coefficient	0.48	
S_f	Safety coefficient	13.75	
D	Traction wheel diameter	400	mm
d_s	Wheel groove diameter	10.6	mm
γ	Value of the groove angle	30	°
β	Value of the undercut angle	95	°
	Drift angle	0.65	°
D_p	Sheaves diameters in maintenance room, car & counter-weights	400	mm
n	No. of strands in wire	5	
d	Strand diameter of wire	10	mm
	Wire structure	8X19S-NF	
δ	Nominal diameter of strand	0.65	mm
	Tensile grade of wire	1570	MPa
F_{MBL}	Minimum breaking force of strand	46	kN
	Travelling times per year	200000	

According to the Ken formula of wire rope fatigue life estimation (doi: 10.3969/j. issn. 1003-4226.2014.04.013), the theoratical formula is as follow:

$$N_k = 1.17 N_{R2.5} (K_g K_L) (S_f - 2) (D/\delta)^2 (d^2) (53.5-V_r) / (100000\ N_{equiv})$$

Also, the minimum no. of reverse bends when nonimal radius of wire is 2.5mm is:

$N_{R2.5} = 0.9 N_R ((2.5+\delta/2) / (R+\delta/2))^2$ when R<2.5mm;
$N_{R2.5} = (M_R / 0.9) ((R+\delta/2) / (2.5+\delta/2))^2$ when R>2.5mm

The number of simple bends corresponds to an equivalent number of pulleys Nequiv, which can be derived from:

$$N_{equiv} = N_{equiv(t)} + N_{equiv(p)}$$

A reversed bend is only considered if the distance from the ropes contact on two consecutive stationary pulleys does not exceed 200 times the rope diameter:

$N_{equiv(p)} = K_P (K_{PS} + 4K_{PR})$, and
$K_P = (D_t / D_p)^4$

where:
D_p = Average diameter of all pulleys, traction sheave excluded, *mm*
D_t = Diameter of the traction sheave, *mm*
K_G = Wheel groove coefficient, *1 for semicircle groove; 0.85 for V-shaped groove*
K_L = Lubrication coefficient, *1 to 1.5*
K_p = factor of ratio between sheave and pulley diameters
N_{pr} = number of pulleys with reversed bends
N_{ps} = number of pulleys with simple bends
N_{equiv} = Number of simple bends corresponds to an equivalent number of pulleys
$N_{equiv(t)}$ = Equivalent number of traction sheaves
$N_{equiv(p)}$ = Equivalent number of deflection sheaves
N_k = Travelling times of elevator, *times*
N_R = Minimum no. of reverse bends, *times*
$N_{R2.5}$ = Minimum no. of reverse bends when nonimal radius of wire is 2.5mm, *times*
R = Radius of curvature of supports, *mm*
S_f = Coefficient of safety of elevator
V_r = Travelling speed of wire rope, 2.625 *m/s*

Solution:

According to ISO 4101 standard (Drawn Steel Wire for Elevator Ropes - Specifications 1st edition), when nominal radius of wire is 0.65mm , tensile grade 1570 MPa and radius of curvature of supports 1.75mm, the minimum no. of reverse bends should be 9 times. Therefore, $N_{R2.5}$ is 15 times.

According to BS EN 81-1-1998 standard (Safety rules for the construction and installation of lifts — Part 1: Electric lifts), when β =95°, $N_{equiv(t)}$ =6.7. Both traction sheave and the deflection sheave have the same diameter, so, the sheave diameter coefficient is:

$K_P = (D_t / D_p)^4 = 1$

Also, the most severe location is the position where the wire rope passing through 2 sheaves:

$N_{equiv(p)} = 2\ (1) = 2$

And, $N_{equiv} = N_{equiv(t)} + N_{equiv(p)} = 6.7+2 = 8.7$

Therefore, the wire rope fatigue life estimation result is N_k = 456873 times which is 2.28 years.

The following graph reveals the relationship between the Life of wire rope and the Lubrication coefficient:

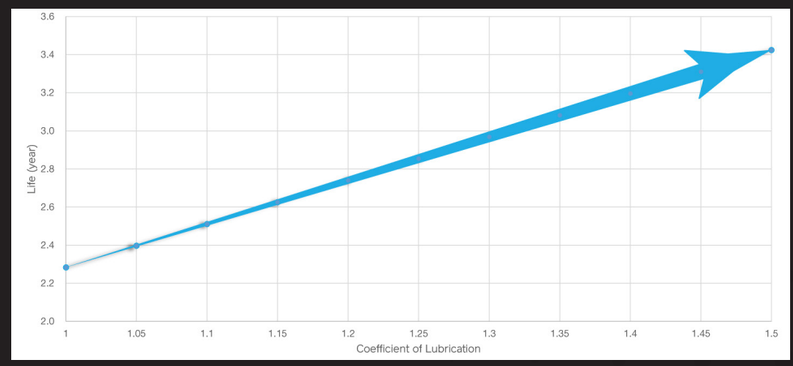


FIGURE 1 - WIRE ROPE LIFE & LUBRICATION RELATIONSHIP

- According to Ken formula, wire rope life is proportional to coefficient of lubrication

Conclusion: With proper lubricant and lubrication method, the life of wire ropes can be extented up to 50% (1.14 years longer from the example). This not only saves the cost of maintenance, but also enhances the safety of elevators.

STEEL SHIELD lubricants has been proved by lots of world class enterprises showing that it is extremely effective to enhance metal life. We are here to save your costs.

12B. ESCALATOR ENERGY COST REDUCTION ANALYSIS

INTRODUCTION

It is important to understand the potential energy cost savings by switching the present lubricants to a better one, like Steel Shield. This chapter utilizes the European Standard: BSI BS EN ISO 25745-3: Energy performance of lifts, escalators and moving walks Part 3: Energy calculation and classification of escalators and moving, to simulate the total annual cost savings of escalator with reductions in frictions, powers, and increase in efficiency.

CALCULATIONS BASED ON POWER MEASUREMENT: A CASE EXAMPLE

Case: An escalator system have the following configurations:

General Data	Symbol	Value	Unit
Rise	H	4.5	m
Length	L		m
Angle of inclination	α	30	degree
Average number of passengers in observation period	N	8000	1/d
Average weight of passengers	m	75	kg
Direction of travel (up, down, horizontal)		up	
Step width	W	1000	mm
Nominal speed	v	0.5	m/s
Nominal motor power	P	7.5	kW

Periods of Operation	Symbol	Value	Unit
Observation period (day, week, month, year)		1	d
Time period of energy consumption	t_{total}	24	h
Time period of standby condition	$t_{standby}$	12	h
Time period of auto start condition	$t_{auto\ start}$	0	h
Time period under nominal speed	$t_{nominal\ speed}$	10	h
Time period of slow speed condition	$t_{slow\ speed}$	2	h
Time period of activated ancillary equipment	$t_{ancillary}$	12	h

Measured Data	Symbol	Value	Unit
Power in standby condition	$P_{standby}$	0.15	kW
Power in auto start condition	$P_{auto\ start}$	0.28	kW
Power in slow speed condition	$P_{slow\ speed}$	0.8	kW
Power in no load condition	$P_{no\ load}$	1.8	kW
Power of ancillary equipment	$P_{ancillary}$	0.3	kW

Step by Step Calculation of Energy and Costs:

Escalator energy consumption in power on condition		
$E_{standby} = P_{standby} \times t_{standby}$	1.8	kWh

Escalator energy consumption in auto start condition		
$E_{auto\ start} = P_{auto\ start} \times t_{auto\ start}$	0	kWh

Escalator energy consumption under no load condition		
$E_{no\ load} = P_{no\ load} \times t_{nominal\ speed}$	18	kWh

Escalator energy consumption at slow speed condition		
$E_{slow\ speed} = P_{slow\ speed} \times t_{slow\ speed}$	1.6	kWh

Escalator energy consumption due to the transport of passengers			
Escalator or inclined moving walk in up direction	$E_{load} = N \times m \times g \times H \times 1/(3\,600\,000 \times \eta) \times (1 + \mu/tg\ \alpha)$	10.66	kWh
Escalator or inclined moving walk in down direction	$E_{load} = N \times m \times g \times H \times \eta \times CF \times 1/(3\,600\,000) \times (-1+\mu / tg\ \alpha)$	0	kWh

where:
α = Angle of inclination (Maximum angle to the horizontal in which the steps, pallets, or belt move)
η = Efficiency due to load condition; 0.75
μ = Friction due to load condition; 0.05
g = Acceleration due to gravity
CF = Correction factor for efficiency η applied to units in downward direction according to section 3.2 of BSI BS EN ISO 25745-3; 3.2

Escalator energy consumption of ancillary equipment		
$E_{ancillary} = P_{ancillary} \times t_{ancillary}$	3.6	kWh

Escalator energy consumption of ancillary equipment		
E_{main} (up direction) = $E_{standby} + E_{auto\ start} + E_{slow\ speed} + E_{no\ load} + E_{load}$	32.06	kWh
E_{main} (down direction) = $E_{standby} + E_{auto\ start} + E_{slow\ speed} + E_{no\ load} + E_{load}$ (E_{load}<0)	21.4	kWh

Total energy consumption of unit with ancillary energy		
E_{total} (up direction) = $E_{main} + E_{ancillary}$	35.66	kWh
E_{total} (down direction) = $E_{main} + E_{ancillary}$	25	kWh

From the previous calculations, the total energy consumptions of the escalator for up and down direction are 35.66kWh and 25kWh respectively. Also, the electrical energy cost is 0.1844 USD/kWh. Therefore, the annual energy cost of the the escalator in up and down direction are 2400 USD and 1682.65 USD respectively.

With a high technology lubricant, it is possible to reduce the friction μ and efficiency η of the escalator, also, the energy consumed in slow speed $P_{slow\ speed}$ and no load $P_{no\ load}$ conditions can be greatly reduced.

As the relationships between friction, efficiency, low speed power consumption and no load power consumption are unknown due to lack of measurements, the power cost analysis are divided into 2 sections to reveal how electricity cost can be reduced by better lubrications.

1. COST REDUCTION WITH HIGHER EFFICIENCY & LOWER FRICTIONS

Supposed that the friction can be reduced from 0.05 to 0.01, and the efficiency can be enhanced from 75% to 95%, the results are formulated and summarized in the following table and graph. It can be concluded that with the lowest friction coefficient (0.01) and highest efficiency (0.95), the annual percentage electricity cost reduction is the largest (7.8%).

FIGURE 1 (UPPER) - ESCALATOR CHAIN & BEARING

- With better bearing, chain, spockets and other mechanical components lubrication, friction can be dramatically reduced

TABLE 1 (LEFT) - ANNUAL ELECTRICITY COST REDUCTION, %

- The power in low speed and no load conditions are kept unchanged

		Friction Coefficient Due To Load Condition									
		0.01	0.015	0.02	0.025	0.03	0.035	0.04	0.045	0.05
Efficiency of Escalator / Moving Walk Due To Load Condition	0.75	1.91	1.67	1.43	1.19	0.95	0.71	0.48	0.24	0.00
	0.77	2.63	2.40	2.17	1.94	1.70	1.47	1.24	1.01	0.78
	0.79	3.32	3.10	2.87	2.64	2.42	2.19	1.97	1.74	1.51
	0.81	3.98	3.76	3.54	3.32	3.10	2.88	2.66	2.43	2.21
	0.83	4.60	4.39	4.17	3.96	3.74	3.53	3.31	3.10	2.88
	0.85	5.20	4.99	4.78	4.57	4.36	4.15	3.94	3.73	3.52
	0.87	5.77	5.56	5.36	5.15	4.94	4.74	4.53	4.33	4.12
	0.89	6.31	6.11	5.91	5.71	5.51	5.30	5.10	4.90	4.70
	0.91	6.83	6.63	6.43	6.24	6.04	5.84	5.65	5.45	5.26
	0.93	7.32	7.13	6.94	6.75	6.55	6.36	6.17	5.98	5.79
	0.95	7.80	7.61	7.42	7.23	7.05	6.86	6.67	6.48	6.29

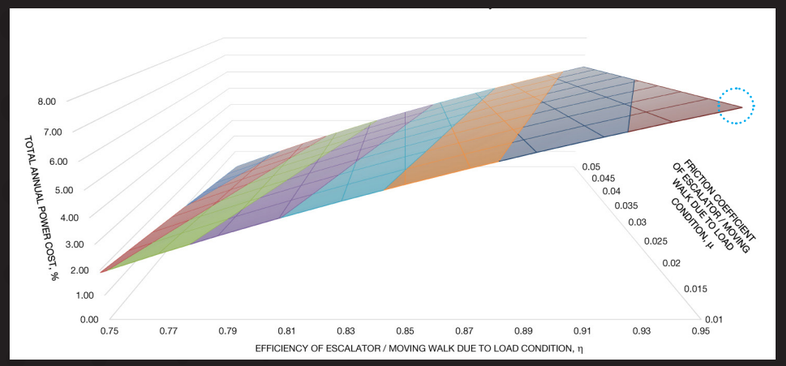


FIGURE 2 - ANNUAL PERCENTAGE ELECTRICITY COST REDUCTION

- The circled point indicated the largest annual electricity cost reduction which is 7.8%

2. COST REDUCTION WITH LOW SPEED & NO LOAD POWER REDUCTIONS

Supposed that the low speed power can be reduced from 0% to 30%, and the no load power can be reduced from 0% to 30%, the results are formulated and summarized in the following table and graph. It can be concluded that with the highest power reductions in low speed condition (30%) and no load condition (30%), the annual percentage electricity cost reduction is the largest (16.49%).

TABLE 2 - ANNUAL ELECTRICITY COST REDUCTION, %

- The friction and efficiency in load conditions are kept unchanged

Slow Speed Condition Power Reduction, % \ No Load Condition Power Reduction, %	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
0	0.00	1.01	2.02	3.03	4.04	5.05	6.06	7.07	8.08	9.09	10.10	11.11	12.11	13.12	14.13	15.14
2	0.09	1.10	2.11	3.12	4.13	5.14	6.15	7.16	8.17	9.18	10.19	11.19	12.20	13.21	14.22	15.23
4	0.18	1.19	2.20	3.21	4.22	5.23	6.24	7.25	8.26	9.27	10.27	11.28	12.29	13.30	14.31	15.32
6	0.27	1.28	2.29	3.30	4.31	5.32	6.33	7.34	8.35	9.36	10.36	11.37	12.38	13.39	14.40	15.41
8	0.36	1.37	2.38	3.39	4.40	5.41	6.42	7.43	8.44	9.44	10.45	11.46	12.47	13.48	14.49	15.50
10	0.45	1.46	2.47	3.48	4.49	5.50	6.51	7.52	8.53	9.53	10.54	11.55	12.56	13.57	14.58	15.59
12	0.54	1.55	2.56	3.57	4.58	5.59	6.60	7.61	8.61	9.62	10.63	11.64	12.65	13.66	14.67	15.68
14	0.63	1.64	2.65	3.66	4.67	5.68	6.69	7.69	8.70	9.71	10.72	11.73	12.74	13.75	14.76	15.77
16	0.72	1.73	2.74	3.75	4.76	5.77	6.78	7.78	8.79	9.80	10.81	11.82	12.83	13.84	14.85	15.86
18	0.81	1.82	2.83	3.84	4.85	5.86	6.86	7.87	8.88	9.89	10.90	11.91	12.92	13.93	14.94	15.95
20	0.90	1.91	2.92	3.93	4.94	5.95	6.95	7.96	8.97	9.98	10.99	12.00	13.01	14.02	15.03	16.04
22	0.99	2.00	3.01	4.02	5.03	6.03	7.04	8.05	9.06	10.07	11.08	12.09	13.10	14.11	15.12	16.13
24	1.08	2.09	3.10	4.11	5.12	6.12	7.13	8.14	9.15	10.16	11.17	12.18	13.19	14.20	15.21	16.22
26	1.17	2.18	3.19	4.20	5.20	6.21	7.22	8.23	9.24	10.25	11.26	12.27	13.28	14.29	15.30	16.31
28	1.26	2.27	3.28	4.28	5.29	6.30	7.31	8.32	9.33	10.34	11.35	12.36	13.37	14.38	15.39	16.40
30	1.35	2.36	3.37	4.37	5.38	6.39	7.40	8.41	9.42	10.43	11.44	12.45	13.46	14.47	15.48	16.49

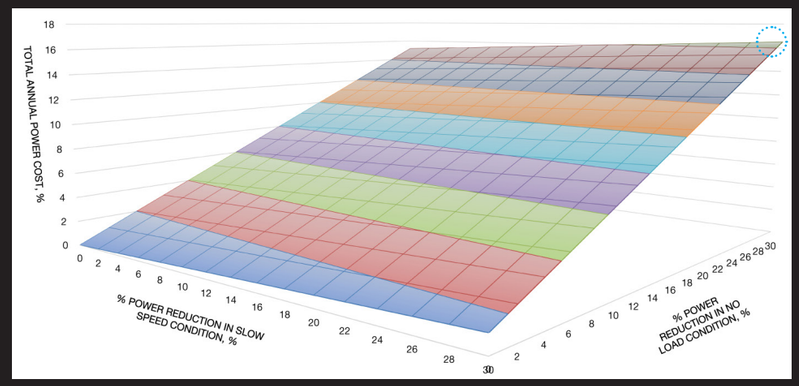


FIGURE 3 - ANNUAL PERCENTAGE ELECTRICITY COST REDUCTION

- The circled point indicated the largest annual electricity cost reduction which is 16.49%

CONCLUSION

With Steel Shield ABF Technology, it is possible that friction and power consumption can drop down which results in huge reduction in annual power cost of escalators. The analysis above only revealed part of the story. In fact, Steel Shield lubrications also lead to large reduction in spare part cost and maintenance cost, and much more. ABF lubrication technology also allows escalator to have higher energy performance, hence, depending on the machine conditions, upgrading Energy Performance Class of the existing machine from A to A+, or even higher.

STEEL SHIELD ABF Technology contribute to any power reduction and performance enhancement by Treating the Metal, NOT the Oil.

12C. ELEVATOR ENERGY COST REDUCTION ANALYSIS

INTRODUCTION

This chapter utilizes the European Standard: BSI BS EN ISO 25745-2: Energy performance of lifts, escalators and moving walks Part 2: Energy calculation and classification for lifts (elevators) to estimate energy consumption based on measured values, calculation, or simulation, on an annual basis for traction, hydraulic, and positive drive lifts on a single unit basis. It is also an energy classification system for new, existing, and modernized traction, hydraulic, and positive drive lifts on a single unit basis.

The mechanical system such as the traction system, the gear box, the pulley system and other guide rail components are the major source of friction and efficiency reduction. The following section reveals how the annual energy cost can be dramatically reduced by better mechanical efficiency and lower friction.

CALCULATIONS BASED ON POWER MEASUREMENT: A CASE EXAMPLE

Case: An elevator system have the following configurations:

Parameters of Traction Lift

Rated Load	1500	kg
Rated Speed	2.5	m/s
Travel	75	m
No. of Floors	20	
Counterbalancing	50	%
Acceleration	1	m/s^2
Jerk	1.25	m/s^3
Door Operation time	8	s

Data Determined by Measurement, Simulation or Calculation

Daily Trips	750	Category 4
Idle Power	500	W
Standby5 Power	300	W
Standby 30 Power	120	W
Reference Cycle Power	170	Wh
Short Cycle Distance	50	m
Short Cycle Energy	120	Wh
Energy Cost	0.1844	USD / kWh

Data from Table

Average Travel Distance	44%	from Table 2 of EN ISO 25745-2
Average Car Load	3.5%	from Table 3 of EN ISO 25745-2
Load Factor (kL)	0.94	from 5.2.6 of EN ISO 25745-2

Step by Step Calculation of Energy and Costs:

Symbol	Formula	Value	Unit
S_{av}	0.44 × 75	33	m
E_{rm}	(170-120)/(75-50)/2	1	Wh/m
E_{ssc}	(170-2 × 1 × 75)/2	10	Wh
E_{rav}	2 × 1 × 33 + 2 × 10	86	Wh
E_{rd}	0.94 × 750 × 86/2	30,399	Wh
t_{av}	33/2.5 + 2.5/1 + 1/1.25 + 8	24.5	s
t_{rd}	750 × 24.5/3,600	5.10	h
t_{nr}	24-5.10	18.90	h
E_{nr}	18.90 × (500 × 45+300 × 18+120 × 37)/100	6,145	Wh
E_d	30,315 + 6,112	36,544	Wh

Threshold Values for Classification

Energy Efficiency Class	Energy Consumption per day	Value	Unit
A	$Ed \leq 0.72 \times Q \times \eta_d \times S_{av} / 1000 + 50 \times t_{nr}$	27,675	Wh
B	$Ed \leq 1.08 \times Q \times \eta_d \times S_{av} / 1000 + 100 \times t_{nr}$	41,985	Wh

The Lift Has Class B

E_y	13,338	kWh (365 days operation)
E_{spc}	0.82	mWh/kgm (Level 2)
E_{spr}	0.76	mWh/kgm

From the calculations, the total annual energy consumptions of the lift is 13,338 kWh which is Level 2 in Performance Level and Class B Energy Efficiency. The annual energy cost is 2,460 USD.

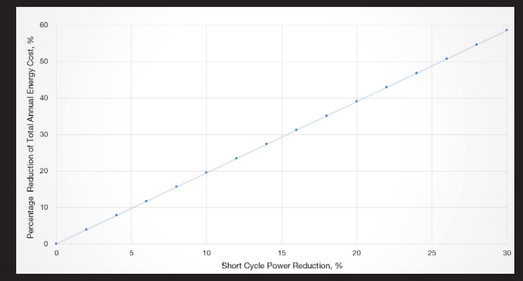
Where:
E_d = Total daily energy consumption
E_{nr} = Daily non running (idle/standby) energy consumption
E_{rav} = Running energy consumption of an average cycle
E_{rd} = Daily running energy consumption
E_{rm} = Average running energy consumption per metre of travel
E_{ssc} = Specific running energy for an average cycle
E_{spr} = Specific running energy for the reference cycle
E_{ssc} = Start/stop energy consumption for each trip
E_y = Annual energy consumption
Q = Rated load, kg
S_{av} = One way average travel distance for target installation
t_{av} = Time to travel the average travel distance, including door times
t_{rd} = Running time per day
t_{nr} = Non-running (idle and standby) time per day
η_d = Number of trips per day according to the selected usage category in Table 1 of EN ISO 25745-2

Energy price = 0.1844 USD / kWh

COST REDUCTION WITH HIGHER CYCLE POWER EFFICIENCY

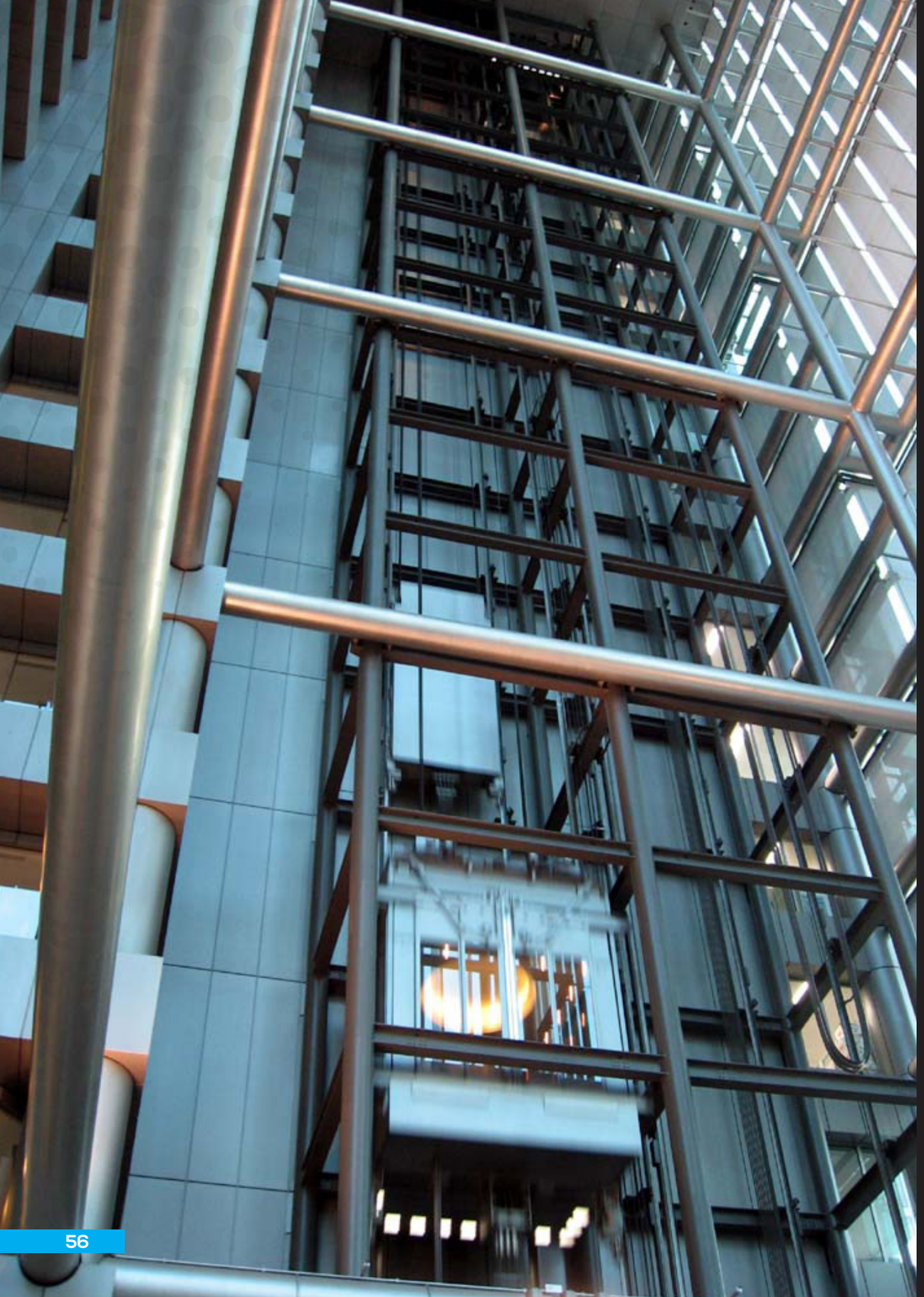
When short cycle energy reduce from 0% to 30%, the annual energy consumption can be reduced as much as 58.5% which turn the elevator to Level 1 and the Energy Efficiency become Class A. The figure 1 indicates the relationship.

FIGURE 1 - ANNUAL PERCENTAGE ELECTRICITY COST REDUCTION



CONCLUSION

Energy wastage in mechanical components of elevators are significant and severe. The analysis proved that energy cost can be greatly reduced by improving cycle efficiency. With Steel Shield ABF lubricants, elevators become have much higher efficiencies and lower energy consumptions, see the test reports for more details.



13. ELEVATOR HVAC SYSTEMS & LUBRICATIONS

"Compressor lubricant is a necessary component in any air conditioning system that uses compressor in its compression system. There are three main purposes of the oil. They are used for lubrication, removal of heat and for sealing. Lubrication cooling is needed in reciprocating compressor as the piston compresses the refrigerant gas. The sealing of the piston in the cylinder needs to be cooled as well."

I 3A. REFRIGERATION AND AIR CONDITIONING INTRODUCTION

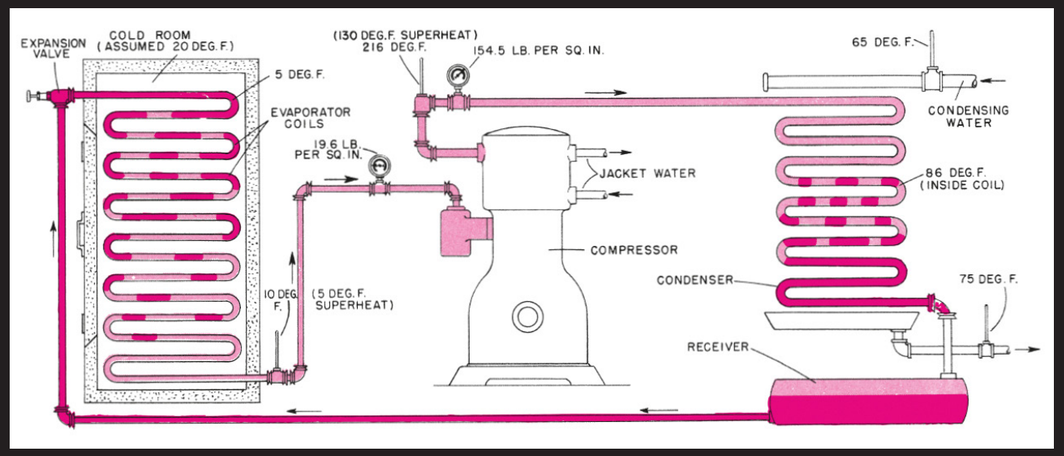
The basic principles of the refrigeration compression cycle are shown in Figure 1. The five essential parts basic to every system are shown: evaporator, compressor, condenser, receiver, and expansion valve (or capillary). Liquid refrigerant flows from the receiver under pressure through the expansion valve to the evaporator coils, where it evaporates, absorbing heat and resulting in a cooling action. The vapor is then drawn into the compressor, where its pressure and temperature are raised. At the higher pressure in the discharge of the compressor, the condensing temperature of the refrigerant is higher than it would be at atmospheric pressure. When the hot, high pressure vapor flows from the compressor to the condenser, the cooling water (air in some applications) removes enough heat from it to condense it. The heat removed from the refrigerant in the condenser is equal to the amount of heat removed from the cold room (cooling action) plus the heat resulting from the mechanical work done on the refrigerant in the compressor that is not removed by the jacket cooling of the compressor. In many commercial installations, the evaporator cools a heat transfer fluid such as brine, which is then pumped through the area to be cooled. Smaller units, such as home refrigerators and freezers, room air conditioners, and automotive air conditioners, have air-cooled rather than water-cooled condensers.

In commercial installations, two or three stages of compression may also be used. If system pressures or cooling capacities dictate the use of two stages of compression, two-stage compressors are used, or a combination of separate single-stage compressors. Rotary sliding vane, scroll, or rotary screw compressors are sometimes used at low to moderate pressures or for booster purposes. Multistage reciprocating compressors are used for large air conditioning installations, with a trend toward the use of more scroll compressors. Reciprocating compressors are commonly used for refrigeration systems, with a trend toward the use of rotary vane. Centrifugal compressors are also used on some commercial refrigeration systems as well as in chillers. Reciprocating, sliding vane, and scroll compressors are used for automotive air conditioning systems, with some screw and axial piston compressors also used. Some very small units such as dehumidifiers may be equipped with diaphragm-type compressors. Reciprocating compressors are used in most other applications.

Most reciprocating compressors for commercial installations are of the single-acting, trunk piston type and have closed crankcases. As a result of refrigerant leakage past the pistons, the crankcases are filled with a refrigerant atmosphere. The same is true of axial piston units used for automobile air conditioning. Crosshead and double-acting compressors have open crankcases. The majority of small to medium-sized electric motor driven refrigeration and air conditioning units are hermetically sealed, with all the operating parts, including the electric motor, inside the sealed unit. Evaporators may operate either dry or flooded. In dry evaporators, only refrigerant vapor is present, while flooded evaporators have both liquid and vapor present.

FIGURE 1 - BASIC SINGLE-STAGE COMPRESSION REFRIGERATION SYSTEM

- The elements shown are common to all compression refrigeration systems, whether refrigeration or air conditioning



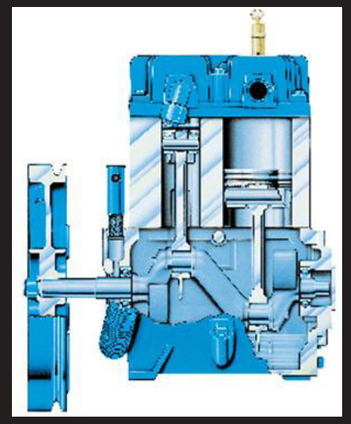
I 3B. COMPRESSOR FACTORS AFFECTING LUBRICATION

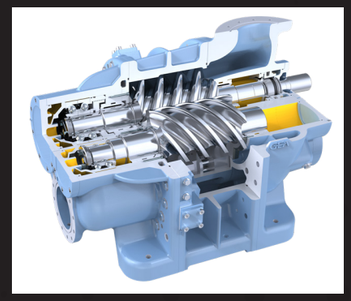
CYLINDER CONDITIONS

The oil film on the cylinder walls of a reciprocating refrigeration compressor is subjected to low temperatures at the suction ports and to moderately high temperatures near the cylinder head. Since viscosity decreases with temperature, the oil near the suction ports will have considerably higher viscosity than the oil near the cylinder head. Nevertheless, the oil must spread in a thin film over the entire working surface. Spreading is accomplished by the piston rings (or the piston itself in small compressors without piston rings) as the pistons move back and forth. The oil must distribute rapidly, but to do this it must not be too high in viscosity. On the other hand, an oil too low in viscosity will not protect against wear.

Oil carried out of the cylinders to the valves and discharge piping is subjected to the temperature of the discharging refrigerant. Ordinarily the temperature of the discharging refrigerant is not high; for example, the discharge temperature of a single-stage ammonia compressor with a compression ratio of about 51 should not be much in excess of 250F (121C). Some single-stage units operate at higher ratios, and higher discharge temperatures; but in most small compressors, the valve temperatures remain moderate because of the relatively large cooling area in proportion to cylinder volume. The discharge temperatures of compressors operating on fluorocarbon refrigerants are lower than those of equivalent machines operating on ammonia, although the compressors of automobile air conditioning systems may operate at quite high discharge temperatures.

When two or more stages of compression are used, the operating temperature in each stage usually is lower than in single-stage machines. In rotary compressors, the discharge temperatures are also usually moderate because of low compression ratios.





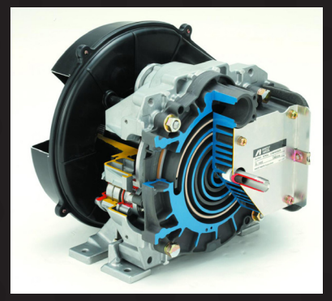


FIGURE 1 - COMMON COMPRESSOR TYPES

- Top Left: Reciprocate compressor
- Top Right: Centrifugal compressor
- Bottom Left: Screw rotary compressor
- Bottom Middle & Right: Scroll compressor

I 3C. HVAC SYSTEM FACTORS AFFECTING LUBRICATION

OXIDATION

In compressors with enclosed crankcases, temperatures are normally moderate and the entire machine is filled with refrigerant vapor. Very little, if any, air is present. Under these conditions, oxidation in the usual sense does not occur, although it is doubtful that it can be avoided entirely. Limited oxidation does not impair the lubricating value of an oil because the initial oxidation products formed are soluble in the oil. If oxidation progresses too far, eventually some of the soluble oxidation products become insoluble when the oil is cooled. These products could plug or restrict capillary tubing or orifices inside the system.

FIGURE 2 - OXIDATION OF A COMPRESSOR INTERNAL SURFACE

BEARING SYSTEM CONDITIONS

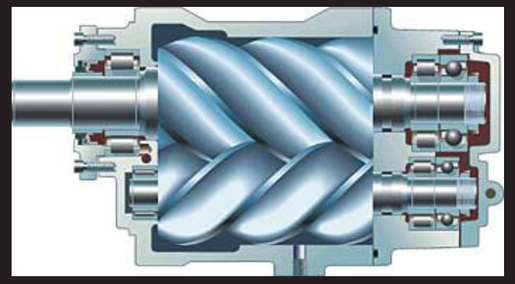
The general requirements of the bearing systems of refrigeration compressors are similar to those of other comparable compressors. However, some special factors must be considered. In the compression of air or gases such as hydrocarbon gases, it is desirable that the oil not be miscible with the gases, whereas in closed refrigeration systems, the oil must be somewhat miscible with the oil to be able to circulate throughout the system and get to all the components in need of lubrication.

In compressors with closed crankcases, there is very little exposure to oxygen, and thus oxidation stability of the oil is not a major concern. If the same oil is used for both bearings and cylinders, as in many small units, however, the oil must have oxidation stability adequate for the cylinder conditions.

When ammonia is used as the refrigerant in compressors with closed crankcases, any additives used in the oil must be types that are not affected by ammonia. A refrigerant that is soluble or partially soluble in the oil, as are the majority of the fluorocarbon refrigerants, will dilute the oil and reduce its viscosity, a sequence of events that must be considered in the selection of the oil viscosity.

The motor in a hermetically sealed unit is completely surrounded by a mixture of refrigerant and oil. Thus the oil must have good dielectric properties, must not affect the motor insulation, and must not react with the copper motor windings or other system materials at elevated temperatures. Since most such units are operated on fluorocarbon refrigerants, the dilution effect of the refrigerant on the viscosity must be considered.

When the crankcase and cylinders are completely isolated from each other, as in compressors having crosshead construction, the oil in the crankcase is exposed to air and there is intimate mixing of the warm oil with air. These conditions are favorable to oxidation and require a chemically stable oil to resist oxidation.



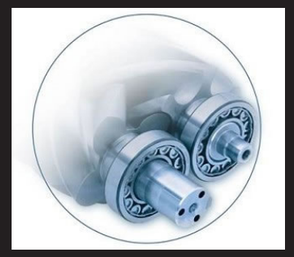


FIGURE 3 - COMPRESSOR BEARINGS

- Top: General bearing locations of a screw compressor
- Bottom: Roller bearings application in a screw components

If the oil carried out of the compressor cylinder forms gummy deposits in the condenser, or congeals or forms waxlike deposits in the evaporator, capillary tube, or expansion valve, there may be serious reduction in the heat exchange capacity. Heat insulating deposits in the evaporator make it necessary to carry a lower evaporator temperature to produce the required refrigeration effect. This in turn requires a lower evaporator pressure and increases the power required by the compressor for a given refrigeration duty, owing to the increased pressure range through which the gas must be compressed. In addition, at the lower suction pressure, the vapor density is lower, forcing the compressor to handle a greater volume of vapor and thus reducing refrigeration capacity. Heat insulating deposits in the condenser increase the temperature difference between the cooling medium (water or air) and the condensing refrigerant. The resulting higher condensing temperature makes higher compression necessary and increases power consumption.

Whether heat insulating deposits will be formed depends on the properties of the lubricating oil, the refrigerant in use, the evaporator temperature, and the equipment used in the system. The effects of some of the common refrigerants are considered separately.

FLUOROROCARBONS

Chlorofluorocarbons (CFCs) are being phased out for use in air conditioning and refrigeration systems because of their potential negative effects on the ozone layer. As a result, more environmentally friendly non-CFC refrigerants are being developed. Several alternative refrigerants have been around for many years, such as ammonia, hydrocarbons, carbon dioxide, methyl chloride, and others that do not pose problems from the ozone depletion standpoint. These will be continued to be used in many applications. Non-CFC fluorocarbon refrigerants such as R-134a, R-123, and blends such as R-404A, R-407C, and R-410A are replacements for the CFCs. The use of these alternative refrigerants is increasing rapidly.

Each of the alternative materials has specific properties and operating characteristics that must be understood and handled appropriately to ensure maximum system performance as well as the safety of the people working with them and the public potentially exposed to them. In many systems, CFCs are and will remain in service. The Montreal Protocol banned the production of CFCs as of January 1, 1996, and hydrochlorofluorocarbons (HCFCs) were limited to production levels as of the same date, with a cease production date in the year 2030.

Air conditioners in older automobiles, as well as, many home refrigerators and air conditioners, were filled with CFCs, and many of these units are still in service. When systems containing CFCs need servicing, they must be refilled with CFCs manufacture before January 1, 1996, use reclaimed CFCs from older systems, or retrofit the systems to accept R-134a or one of the alternative environmentally friendly refrigerants. Gradually, all the CFCs and HCFCs will be replaced by alternative HFC materials, as well as by other gases such as isobutane, propane, and ammonia.

With the refrigerants that are miscible or partly miscible with oil, enough of the refrigerant dissolves in the oil to depress the pour point of the oil sufficiently to prevent congealing of the oil on evaporator surfaces in most cases. However, there is a temperature at which a heavy, flocculent precipitate first appears when a mixture of Freon 12 and 10% of the oil is chilled. The temperature at which this occurs depends on the refrigerant, the percentage of oil in the refrigerant, and on the oil. Refrigeration systems using fluorocarbon refrigerants are often designed to ensure that approximately 10% oil is present in the evaporator. In some cases, the evaporator is actually charged with this amount of oil. Under these conditions, the floc point of the oil (also known as the critical separation temperature) represents the lowest temperature that can be used with that oil.

The waxy materials that precipitate from these oil–refrigerant mixtures can also clog expansion valves and capillary control tubes, preventing their proper functioning. However, the concentration of oil in the refrigerant at the expansion valve is usually lower than in the evaporator, so the floc point is depressed below what it would be at a 10% concentration. As a result, if the oil selected has a low enough floc point for conditions in the evaporator, it usually will not cause difficulties in the expansion valve or capillaries. Difficulties in these areas attributed to mineral oils are frequently due to ice crystals formed by minute quantities of water in the system.

Oil selection can go a long way to minimizing problems related to lubrication in systems using fluorocarbons. The use of highly refined naphthenic or paraffinic mineral oils works satisfactorily with both the CFCc and HCFCs. The base stocks for these oils are usually severely hydroprocessed or acid-treated to remove wax and other materials undesirable from a refrigeration oil standpoint. For HCFCs, alkyl benzene synthetic lubricants provide excellent performance, as does mineral oil. Widely used products for HFCs are polyol esters, polyalkylene glycol, and polyvinyl ether.

AMMONIA, CARBON DIOXIDE

Oil is slightly miscible in anhydrous ammonia and carbon dioxide. Generally, not enough of the gas dissolves in the oil to have a significant effect on the pour point of the oil. Thus, if the pour point of the oil is above the evaporator temperature, oil will congeal on the evaporator surfaces and form an insulating film that interferes with heat flow and efficient performance of the system. To remove the oil, the evaporator must be periodically warmed, liquefying the oil so that it will drain from the surfaces to a location from which it can be removed. With flooded evaporators, refrigerant flow may be so rapid that there is little or no opportunity for the oil to collect on evaporator surfaces, and the pour point of the oil may not be a major concern. Ammonia is not compatible with copper or brass and cannot be used in systems containing these metals. As with CFCs and HCFCs, ammonia works well with highly refined mineral oil. CFCs and HCFCs also can use polyalphaolefins (synthesized hydrocarbons), polyalkylene glycols, and polyol esters.

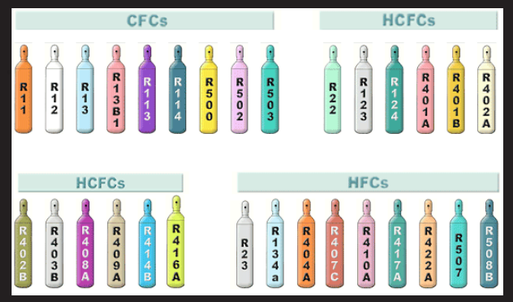


FIGURE 1 - ANSI/ASHRAE STANDARD 34-2010

- Designation and Safety Classification of Refrigerants

HYDROCARBON REFRIGERANTS

Isobutane and propane gases are being used as replacements for CFC refrigerants in some applications. These gases are primarily used in smaller units such as hermetic household refrigerators.

SULFUR DIOXIDE

Sulfur dioxide has a selective solvent action that with conventional lubricating oils results in sludge. It, therefore, requires the use of highly refined white oils or group III base stocks with low levels of additive.

LUBRICATING OIL RECOMMENDATIONS

Table 1 shows general lubricant recommendations by refrigerant type. The lubricants are classified according to base type. The requirements of oils for refrigeration systems can be summarized as follows.

1. The oil should be of proper viscosity to distribute readily at the system's lowest temperatures yet provide adequate films to protect against wear in the cylinders and crankcases.
2. The oil should have chemical stability adequate to resist oxidation and the formation of deposits in crankcases open to the atmosphere, and to resist the deteriorating influence of high temperatures at compressor discharge.
3. In closed systems without oil separators, the oil should be miscible with the refrigerant, to ensure that the oil will circulate through the system and return to lubricate the compressor. In closed systems with separators, it is desirable that the oil not be miscible with the refrigerant, to facilitate separation. In open crankcase systems, it is desirable that the oil not be soluble or miscible with the refrigerant, to minimize dilution.
4. The oil should be able to withstand system temperatures without breakdown, and it should not inhibit the heat transfer characteristics of the refrigerant.
5. The oil must be chemically stable and must not react with the refrigerant or system components. Some additives in the oil can react with the refrigerant to form deposits or sludges.
6. The oil must reduce friction and minimize wear.
7. The oil must keep the system clean and stay in service for extended intervals.

Oil viscosities recommended vary from as low as ISO VG 7 to as high as ISO VG 150.

Refrigerant	Lubricating Oil	
	Mineral Oil [A]	Synthetic [B]
Fluorocarbons		
CFC- 11, 12, 113, 114, 500, 502	Yes	PAO, POE
HCFC- 22, 123, 125, 408A (blend)	Yes	PAO, AB
HFC- 134a, 143a	No	POE, PAG, PVE
Blends 404A, 407C, 410A	Yes	POE, PVE
Ammonia	Yes	PAO, PAG, POE
Carbon dioxide	Yes	PAO

TABLE 1 - LUBRICATING OIL RECOMMENDATIONS BASED ON REFRIGERANTS

Notes:

- A: Mineral oils are to be highly refined paraffinic or naphthenic. White oils or severely hydroprocessed base stocks should be used.
- B: PAO, Polyalphaolefin; POE, polyolester; AB, alkylbenzene; PAG, polyalkylene glycol; PVE, polyvinyl ether.

I 4. STEEL SHIELD APPLICATIONS IN ELEVATOR HVAC

"Lubrication and the knowledge of lubricants not only are subjects of interest to all of us but they are also critical to the cost effective operation and reliability of machinery that is part of our daily lives. Our world, and exploration of regions beyond our world, depends on mechanical devices that require lubricating films. Whether in our homes or at work, whether knowingly or unknowingly, we all need STEEL SHIELD lubricants and some knowledge of lubrication."

APPLICATIONS OF STEEL SHIELD

The ABF Technology of Steel Shield lubricants treats the metal surface. It flattens and rolls out metal surface and greatly reduces friction and metal wear of any mechanical system. Therefore, the pistons, screws, rotary parts or any types of bearing can last much longer, and energy lost due to frictions decreases dramatically.

The work load of electric motors and any power system reduced, and hence increase in efficiency.

When Steel Shield lubricants are applied continously, the system can achieve:

1. *Reduces energy consumption by 3 to 18%*
2. *Protects metals during operation, and suppresses maintenance cost to minimum*
3. *Enhances and extend the life of metal components like bearings to 2 times or much more*
4. *Dramatically reduces noise and keeps system slience during operations*
5. *Reduces heat generation of the system and keeps energy consumptions to minimum*
6. *Boosts the entire HVAC system efficiency to maximum*

NON CORROSIVE CLEANSING IN HVAC

Steel Shield lubricants utilizes ABF Technology can positively charges BOTH the inner surface of metal pipes / tubes and the metal-containing sludge. The results are cleansing / repelling of existing sludge on the tube surface and the prevention of the new sludge formations. These greatly improves the overall efficiency of HVAC system by enhancing the heat conduction efficiency.

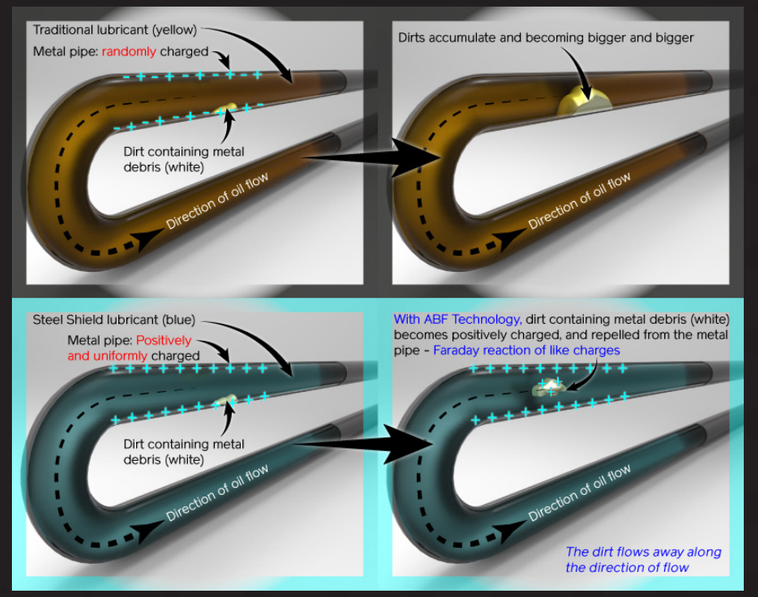


FIGURE 1 - HVAC PIPE WITHOUT TRADITIONAL LUBRICANT

FIGURE 2 - HVAC PIPE WITH STEEL SHIELD LUBRICANT

15. STEEL SHIELD ORIGINAL USA ADDITIVES FOR ELEVATOR & ESCALATOR SYSTEMS

STEEL SHIELD EPA

REEL SHIELD

TOOL SHIELD

LITHI SHIELD

REEL SHIELD GREASE

STRIKE SHIELD

SPRAY SHIELD

Not Just Oil...
IT'S TECHNOLOGY

STEEL SHIELD EPA

STEEL SHIELD Extreme Pressure Anti-Wear (EPA)™ is the ultimate protection for the moving metal parts for industry. Utilizing the most Advanced Boundary Film (ABF) Technology, it protects moving metal parts from heat, friction and wear in engines, transmissions, differentials, transfer cases, hydraulic pumps and motors, gear boxes, and other enclosed lubrication systems, due to boundary conditions of frictional abrasion, extreme pressure torque, dry startup and shutdown. Increased performance and greatly reduced maintenance and downtime are the results. These performance goals are achieved through ABF Technology by lowering the operating temperatures, extending the life of component parts and increasing reliability.

ORIGINAL USA ADDITIVE

Not Just Oil... IT'S TECHNOLOGY

THE ADDITIVE QUALITY

MADE IN THE USA

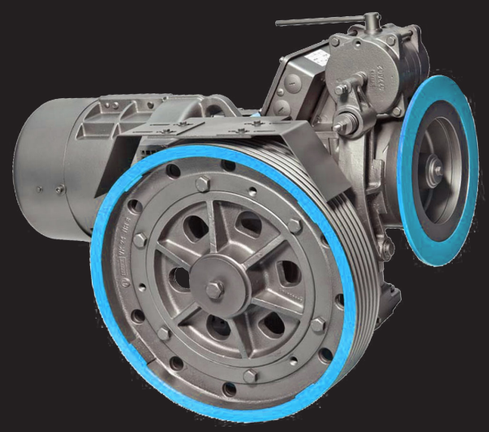
Advantages

- Dramatically reduces wear
- Extends parts life and component realibity
- Improves lubrication
- Protects moving metal parts
- Reduces friction
- Reduces maintenance and downtime
- Reduces operating temperatures
- Smoother operation

Properties	Standard	Unit	Result
Flash Point		℃	226
Boiling point		℃	238
Evaporation rate			<0.01
Vapor pressure			<1@25 ℃
Specific gravity			1.07

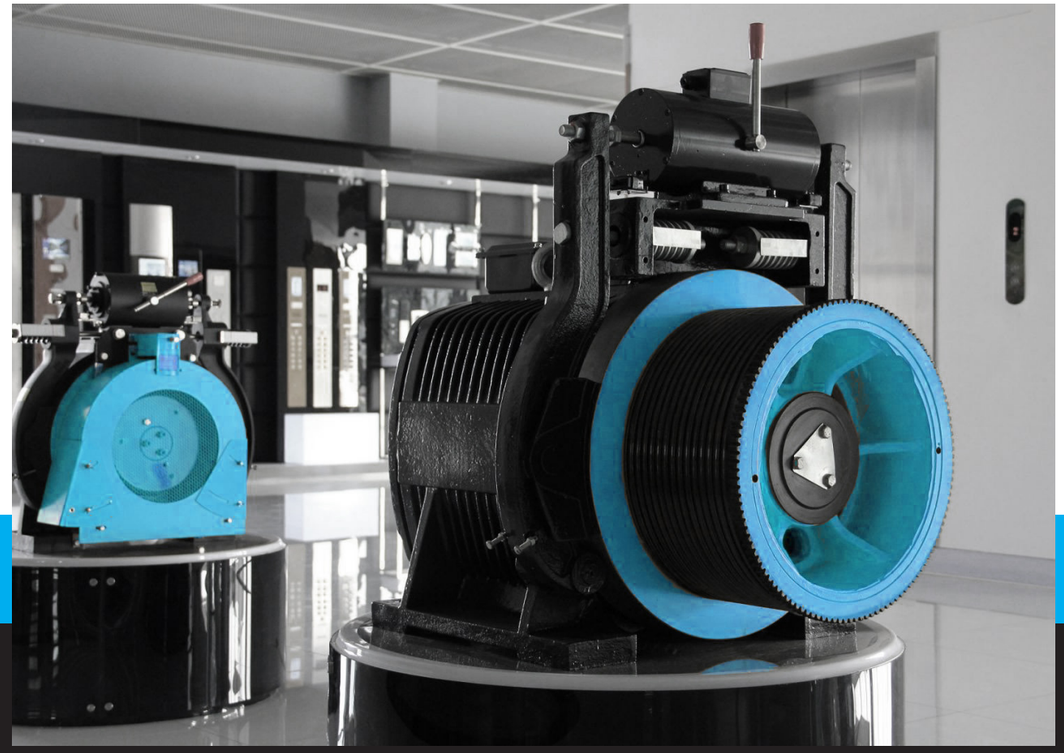
Applications

- All Engines, Transmissions & Differentials
- Hydraulic Systems
- Open Gears
- Gear Boxes
- Gear Reducers
- Gear Couplings
- Electric Motors
- Heavy Machinery
- Weapon Systems



Directions of Usage

- Sasoline And Diesel Engines: Add 2 oz. per quart of oil.
- Auto Transmissions: Add 1 oz. per quart of fluid.
- Manual Transmissions & Differentials: Add 2 oz. per quart of gear lube/oil.
- Gear Boxes: Add 2-3 oz. per quart. Hydraulics: Add 1 oz. per quart of fluid.
- Contains no volatiles or solvents. Contains synthetic hydrocarbons and advanced chemical additive technology. Non-toxic and environmentally friendly.



ORIGINAL USA ADDITIVES

REEL SHIELD

REEL SHIELD™, the ultimate lubricant, cleaner penetrant, and saltwater protectant, has been aggressively designed and formulated for the Sport Fishing Industry. REEL SHIELD™ lubricates and protects against extreme pressure and wear in all moving metal-to-metal parts, in all types of fishing reel and drag systems. REEL SHIELD™ penetrates to the internal moving parts and shields against corrosion in extreme saltwater environments better than any other product to date. This distinguishes REEL SHIELD™ as the ultimate tool in the total care and maintenance of all fishing tackle in both fresh and saltwater fishing. REEL SHIELD™ has been tournament tested in harsh saltwater conditions and proved to be superior in its performance.

ORIGINAL USA ADDITIVE

Advantages

- Cleans And Removes Dirt
- Extends Life Of Reel, Fishing Pliers, Tools And Equipment
- Frees Rusty Fishing Pliers And Tools
- Longer Conventional Casts
- Penetrates Remote Areas
- Protects Against Rust
- Quiets Gears And Reduces Gear Wear
- Shields Against Saltwater Corrosion
- Smoother Operation Of Roller Guides

Properties	Standard	Unit	Result
Flash Point		˚C	226
Boiling point		˚C	238
Evaporation rate			<0.01
Vapor pressure			<1@25 ˚C
Specific gravity			1.07

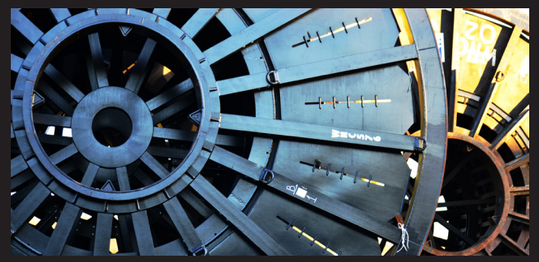
Applications

- Any reel equipments, machines, rollers, toos and engine systems
- Other mechanical systems on ships

Directions of Usage

- Use in accordance with machine / tool manufacturer's instructions.
- Apply to bearings and moving parts. Coat metal surfaces lightly and wipe excess off.
- Contains synthetic hydrocarbons. Non-Toxic. Contains no volatiles. If swallowed, do not induce vomiting due to aspiration in lungs.

"Additional testing has proven REEL SHIELD™ improves casting distances due to its Advanced Boundary Film (ABF) Technology, which reduces coefficients of friction between the gears and other moving metal parts in the reel and roller guides of the rod allowing for smoother casting and overall performance performance and operation."



ORIGINAL USA ADDITIVES

TOOL SHIELD

TOOL SHIELD™ is the ultimate protection for the moving metal parts for automotive and industrial tools. Utilizing the most Advanced Boundary Film (ABF) Technology, it protects moving metal parts from heat, friction and wear due to boundary conditions of frictional abrasion, extreme pressure torque, air line moisture and internal dirt. It works in all piston and rotarytype air tools, stationary and hand-held power tools and many hand tools. Increased power and performance and greatly reduced wear while removing dirt from tool are the results. TOOL SHIELD™ contains ABF (Advanced Boundary Film) for increased lubricity and boundary film lubrication.

ORIGINAL USA ADDITIVE

Advantages

- Cleans & Removes Internal Dirt
- Dramatically Reduces Metal-To-Metal Wear
- Extends Tool Life
- Improves Tool Power & Performance
- Lubricates, Cleans & Protects
- Protects Moving Metal Parts
- Repels Air Line Moisture
- Smooths Tool Operation
- Stops & Inhibits Rust

Properties	Standard	Unit	Result
Flash Point (PMCC)		˚C	61
Boiling point		˚C	186 - 201
Evaporation rate			<0.01
Vapor pressure			<1@25 ˚C
Specific gravity			1.02

Applications

- Air Cutting Tools, Air Drills, Air Grinders, Air Nailers, Air Ratchets, Air Sanders, Air Staplers
- Automatic Oilers
- Hand Tools
- Impact Wrenches
- Piston & Rotary Type Air Tools

Directions of Usage

- Use in accordance with tool manufacturer's instructions.
- Tools may need to be lubricated daily, or several times a day, depending on the frequency and prolonged use of the tool.
- Contains no volatiles or solvents. Contains synthetic hydrocarbons and advanced chemical additive technology. Non-toxic and environmentally friendly.

LITHI SHIELD

LITHI-SHIELD™ is the ultimate in extreme pressure anti-wear lithium complex grease. It exceeds all other lithium complex greases due to the addition of ABF (Advanced Boundary Film)Technology, extreme pressure and antifriction additives added to its formula. LITHI-SHIELD™ treats, seals and smooths metal surfaces to dramatically reduce friction, as well as friction related heat and wear. LITHI-SHIELD's™ unique formulation allows it to exceed the performance of other greases while using smaller quantities. In fact, LITHI-SHIELD™ exhibits great oxidation resistance, over twice that of its nearest competitor.

ORIGINAL USA NLGI No. 2 GREASE

Not Just Oil... IT'S TECHNOLOGY

100% GREASE QUALITY

MADE IN THE USA

Advantages

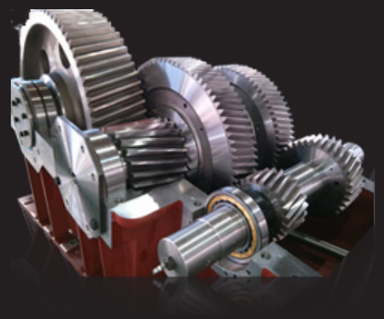
- Maximum Protection Against Wear And Extreme Pressure
- Adheres To Metal Exhibiting Top Performance In Roll Stability
- Provides Constant Lubrication To All Areas
- Offers The Maximum In Friction Reduction
- Resists Water Washout

Applications

- All Extreme Pressure Applications
- Axles, Bearings, CV Joints, Universal Joints, Chassis Fittings, Conveyors, Pumps, Rotating Machinery
- Boat Trailers And Marine Applications
- Heavy Equipment, Mining Equipment, Railroad Equipment

Directions of Usage

- Follow the maintenance manuals of the machines



LITHI SHIELD Outperforms Top Class Greases Made by YAMAMOTO And ATLAS

- Check out the "SOUTHWEST RESEARCH INSTITUTE TEST REPORTS" to learn more

Test Item	Four-Ball Extreme Pressure Properties	Lithi Shield	Yamamoto EP Grease	ATLAS CHISEL LUBE
Loading Ability	Corrected Load	851.1	501.68	302.79
Anti-Wear Ability	Load Wear Index	92.27	66.73	41.23
High Temperature Loading	Weld Point	800	315	315
High Pressure Loading	LNSL	80	63	50

Properties	Standard	Unit	Result
NLGI Grade			No. 2
Penetration, Worked, 60s	D-217		265 - 295
Penetration, Unworked	D-217		265 - 295
Thickener Type	D-217		Lithium Complex
Thickener, %	D128		8 - 11
Color	D128		Light Amber
Texture	D128		Smooth
Dropping point	D-2265	˚C	500
Viscosity @ 40˚C	D-445	cSt	220
Viscosity @ 100˚C	D-445	cSt	19
Viscosity Index	D-2270		95
Flash Point	D-92	˚C	464
Fire Point	D-92	˚C	550
Timken OK load	D-2509	lbs.	60
Rust	D-1743		Pass
Copper Corrosion	D-4048		1B
4-Ball Wear Test	D-2266	mm	0.68
4-Ball EP Weld Test	D-2596	Kg Min.	800 / Pass
Oxidation Induction time @210˚C	D-5483	min	11.47

Properties	Standard	Unit	Result
Water washout @ 79˚C	D-1264		0.027
Mobility at 77˚C	US Steel Mobility Test	g/min	576
Mobility at 60˚C	US Steel Mobility Test	g/min	275.4
Mobility at 40˚C	US Steel Mobility Test	g/min	86.6
Mobility at 20˚C	US Steel Mobility Test	g/min	15.3
Mobility at 0˚C	US Steel Mobility Test	g/min	1.6

REEL SHIELD GREASE

The ultimate lubricant, cleaner, penetrant, and saltwater protectant, has been aggressively designed and formulated for the Sport Fishing Industry. Reel Shield Grease™ lubricates and protects against extreme pressure and wear in all moving metal-to-metal parts, in all types of fishing reel and drag systems. Reel Shield Grease™ penetrates to the internal moving parts and shields against corrosion in extreme saltwater environments better than any other product to date. This distinguishes Reel Shield™ as the ultimate tool in the total care and maintenance of all fishing tackle in both fresh and saltwater fishing. Reel Shield Grease™ has been tournament tested in harsh saltwater conditions and proved to be superior in its performance.

Additional testing has proven Reel Shield Grease™ improves casting distances due to its Advanced Boundary Film (ABF) Technology, which reduces coefficients of friction between the gears and other moving metal parts in the reel and roller guides of the rod allowing for smoother casting and overall performance and operation.

ORIGINAL USA NLGI No. I GREASE

Not Just Oil... IT'S TECHNOLOGY

100% GREASE QUALITY

MADE IN THE USA

Advantages

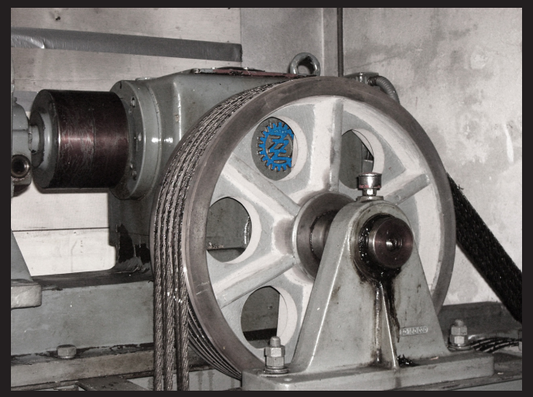
- Dramatically Reduce Gear Water
- Extends Life Of Fishing Pliers, Tools And Equipment
- Extends Reel Life
- Gears Run Smooth & Quiet
- Longer Conventional Casts
- Protects Against Salt Water, Rust & Corrosions
- Smoother Reel Operation

Applications

- All High Temperature Applications
- All Extreme Pressure Applications
- Axles
- Bearings
- Boat Trailers And Marine Applications
- Chassis Fittings
- Conveyors
- CV Joints
- Heavy Equipment
- Mining Equipment
- Pumps
- Railroad Equipment
- Reel, Ship Equipments
- Rotating Machinery
- Universal Joints

Directions of Usage

- Use in accordance with machine / tool manufacturer's instructions.
- Apply to bearings and moving parts. Coat metal surfaces lightly and wipe excess off.
- Contains synthetic hydrocarbons. Non-Toxic. Contains no volatiles. If swallowed, do not induce vomiting due to aspiration in lungs.



Properties	Standard	Unit	Result
NLGI Grade			No. 1
Penetration, Worked, 60s	D-217		310 - 340
Penetration, Unworked	D-217		310 - 340
Thickener Type	D-217		Lithium Complex
Thickener, %	D-128		6 - 8
Color	D-128		Light Amber
Texture	D-128		Smooth
Dropping point	D-2265	˚C	500
Viscosity @ 40 ˚C	D-445	cSt	220
Viscosity @ 100 ˚C	D-445	cSt	19
Viscosity Index	D-2270		95
Flash Point	D-92	˚C	464
Fire Point	D-92	˚C	550
Timken OK load	D-2509	lbs.	60+
Rust	D-1743		Pass
Copper Corrosion	D-4048		1B
4-Ball Wear Test	D-2266	mm	0.7
4-Ball EP Weld Test	D-2596	Kg Min.	800 / Pass

Properties	Standard	Unit	Result
Oxidation Induction time @210˚C	D-5483	min	95
Water washout @ 79 ˚C	D-1264		0.027
Mobility at 77 ˚C	US Steel Mobility Test	g/min	
Mobility at 60 ˚C	US Steel Mobility Test	g/min	515
Mobility at 40 ˚C	US Steel Mobility Test	g/min	257.1
Mobility at 20 ˚C	US Steel Mobility Test	g/min	78.9
Mobility at 0 ˚C	US Steel Mobility Test	g/min	5.4

STRIKE SHIELD

STRIKE SHIELD™ is the ultimate penetrant to rapidly pierce rusted and corroded metal surfaces using a distinctive spreading action to break lose frozen mechanisms while at the same time applying an advanced lubricating film to the surfaces of the metal delivering the highest quality lubrication available in penetrating oil. STRIKE SHIELD™ leaves a unique layer of film on surfaces that helps prevent rust and corrosion along with driving out and dispersing moisture on ignition wires, electrical contacts, circuit boards and other electrical connections to provide protection against future corrosion in extremely tough conditions.

ORIGINAL USA ADDITIVE

Not Just Oil... IT'S TECHNOLOGY

100% Quality SPRAY

MADE IN THE USA

Advantages

- Offers extremely fast penetration and lubrication into remote rusted /corroded areas especially for industrial and marine applications that have seized metal mechanisms
- Provides a quick durable long lasting lubricating film to a variety of different areas including mechanisms in extreme salt water environments
- Inhibits rust and oxidation on metal contacts and surfaces in all weather conditions
- Maximum performance as a moisture displacement on wet electrical switches/boards and electronic systems
- Helps start damp engines by dispersing moisture on ignition wires and electrical systems
- Protects circuit boards from corrosion in all weather conditions including salt spray
- Repels dirt and dust build-up
- Mild and pleasant fragrance

Applications

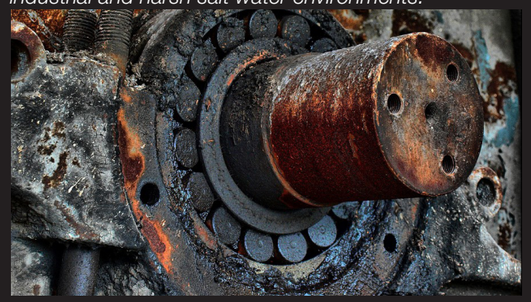
- Frozen or scaled nuts and bolts
- Sticky locks
- Squeaky hinges
- Sliding doors
- Wheels
- Conveyors
- Cables
- Linkages, Shafts, Bushings
- Sliding parts and mechanisms
- Any automotive, marine, farming industrial or commercial application that requires a fast acting penetrate, lubricant and moisture displacement all combined in one product

Directions of Usage

- Spray to any frozen mechanisms

Properties	Standard	Unit	Result
Flash Point (PMCC)		˚C	61
Boiling point		˚C	186 - 201
Evaporation rate			<0.01
Vapor pressure			<1@25 ˚C
Specific gravity			1.02

"STRIKE SHIELD delivers an all in one product that is a fast acting penetrant, extremely durable lubricant and long-lasting rust and corrosion protectant even in tough industrial and harsh salt water environments."



SPRAY SHIELD

SPRAY SHIELD™ is the ultimate multi-purpose lubricant that also penetrates metal surfaces while maintaining highest qualities in corrosive and extreme humidity environments. SPRAY SHIELD™ penetrates into remote areas and delivers long-lasting lubrication in many different applications. SPRAY SHIELD™ works quickly to provide excellent protection and long-lasting lubrication.

ORIGINAL USA ADDITIVE

Not Just Oil... IT'S TECHNOLOGY

100% Quality SPRAY

MADE IN THE USA

Advantages

- Creeps Into Remote, Inaccessible Areas
- Offers Quick, Long-Lasting Lubrication
- Penetrates To Loosen Seized & Corroded Metal Mechanisms
- Provides Free-Flowing Protection
- Provides Protection Against Rust & Corrosion

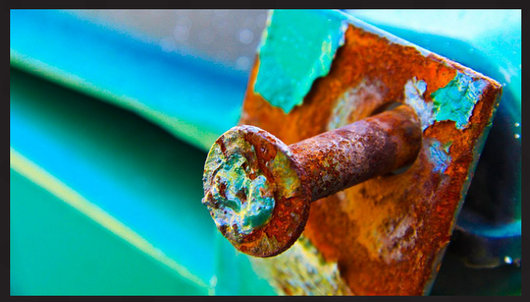
Applications

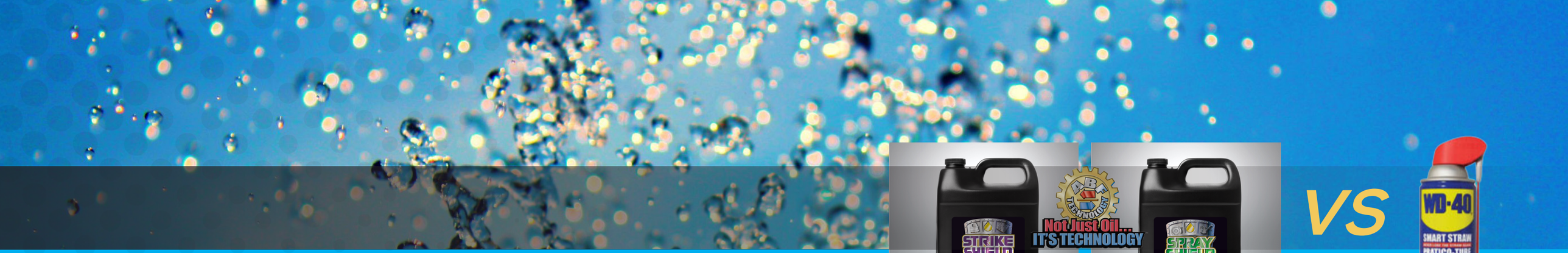
- Metal Mechanisms
- Metal-To-Metal Surfaces
- Chain Drives
- Drag Lines
- Bushings
- Pulleys
- Hinges
- Tools
- Sleeve Bearings
- Open Gears
- Steel Cables
- Couplings
- Linkages
- Wheels
- Augers
- Rusty Nuts & Bolts
- Any Automotive, Industrial or Commercial Areas Of Lubrication That Require An External Heavy-Duty Spray Lubricant For Accessible And Hard-To-Reach Areas

Directions of Usage

- Spray to any frozen mechanisms

Properties	Standard	Unit	Result
Flash Point		˚C	226
Boiling point		˚C	238
Evaporation rate			<0.01
Vapor pressure			<1@25 ˚C
Specific gravity			1.07





15A. STRIKE-SHIELD, SPRAY-SHIELD & WD-40 COMPARISON

VS

When comparing the characteristics of SPRAY-SHIELD (SS) & STRIKE-SHIELD (STKS) to those of WD-40, there are profound differences in product features and benefits.

WD-40 CLAIMS FIVE BASIC FUNCTIONS

CLEANS: WD-40 gets under dirt, grime and grease to clean. It also dissolves adhesives, allowing easy removal of labels, tape, stickers, and excess bonding material.

DISPLACES MOISTURE: Because WD-40 displaces moisture, it quickly dries out electrical systems to eliminate moisture-induced short circuits.

PENETRATES: WD-40 loosens rust-to-metal bonds and frees stuck, frozen or rusted metal parts.

LUBRICATES: WD-40's lubricating ingredients are widely dispersed and hold firmly to all moving parts.

PROTECTS: WD-40 protects metal surfaces with corrosion-resistant ingredients to shield against moisture and other corrosive elements.

SPRAY-SHIELD & STRIKE-SHIELD PROVIDE THE ABOVE FUNCTIONS PLUS MORE

CLEAN: SS & STKS lift and remove dirt, grime and grease from surfaces, including adhesive compounds and bonding agents.

SS & STKS keep surfaces clean by rejecting airborne contaminants, such as dust and smoke, due to its electrochemical surface bonding technique by causing a dipole-dipole interaction and cation exchange on the metal surfaces. This, in effect, creates a greater positive charge on the metal surfaces which react with positive charged airborne contaminants (+ ions) in causing a repulsion between the two.

DISPLACE MOISTURE: SS & STKS are a fast-acting drying agent for quick and thorough moisture displacement in damp or soaked electrical or electronic systems. A migrating film burrows under condensation and moisture, driving it to the surface where they dry or can be wiped off to reactivate circuits. After moisture is displaced, an ultra-thin residual film resists rust and corrosion. SS & STKS do not contain carbon tetrachloride and will not harm insulation.

Areas of Use: Wet or damp ignitions, electrical systems, motors, controls, starters, relays, radios, electronic equipment, etc.

PENETRATE: SS & STKS are the ideal solution to hundreds of different maintenance and production problems involving rust and corrosion. They work quickly and effectively on even the most severe cases of rusted equipment, parts and components. SS & STKS disperse quickly into rusted, corroded areas to loosen scale and free up working mechanisms, tight fitting parts and frozen fastenings. SS & STKS's low surface tension speed penetration even into normally inaccessible areas. SS & STKS will not affect painted surfaces.

Areas of Use: Rusted lugs or bolts, sliding parts, sluggish mechanisms, hinges, tools, products in storage, gear trains, wheels, rotating apparatus, linkages, cams, levers, industrial equipment, etc.

LUBRICATE: SS & STKS are a light, but lasting lubricant. They offer quick, positive, long-lasting lubrication on wide varieties of applications in industry, the shop and garage, the farm and at home. SS & STKS are ideal for automobiles and equipment, flowing and lubricating deeply into hard-to-reach internal areas.

Areas of Use: Metal mechanisms, gears, locks, linkages, wheel bearings, metal-to-metal surfaces, cams, levers, engines, motors, slides, hinges, garden equipment, etc.

PROTECT: SS & STKS stop rust dead in its tracks. These products' unique formulation uses a combination of the best rust and oxidation preventatives available. SS & STKS seek out rust, stop the oxidation process and prevent further rust from forming.

In addition, SS & STKS remove corrosion and corrosion bridges from printed circuit boards after a light spray and "toothbrush" scrubbing. This prohibits corrosion from also returning in the future. After corrosion is removed and excess SS & STKS are wiped from the board, a microfilm layer will remain on the surface of the metals to virtually eliminate the long-term effects of electrolytic bridging.

ADDITIONAL FEATURES OF SPRAY-SHIELD & STRIKE-SHIELD

SS & STKS contain Steel Shield EPA "ABF Technology"TM, one of the leading anti-friction, metal-treating products. EPA is a blend of petroleum products containing no graphite, PTFE, silicones, moly or synthetics. The dielectric strength of SS & STKS is rated at 45 KV (45,000 volts).

SS & STKS are not an aerosol - they are packaged in convenient hand pump spray bottles and conforms to DOT and OSHA regulations. The adjustable nozzle allows you to provide an overall misting of lubrication or pinpoint just the areas you want with jet spray. You can also use SS & STKS with Air Pressurized Sprayer, which works as well as an aerosol, but utilizes compressed air.

Please see the attached page for a quick reference chart on the comparison of these products.

Feature or Benefit	SS & STKS	WD-40
Loosens rusted parts	Within minutes	Within hours
Penetrates deep and fast	Immediately	Slowly
Keeps parts from freezing up	Long term	Short term
Protects metal against corrosion	Long term	Short term
Leaves a barrier film	Long term	Short term
Displaces moisture	YES	YES
Dries electrical equipment	YES	YES
Non-conductive	YES (45,000V DIELECTRIC)	YES (UNKNOWN)
Stops squeaks	Long term	Short term
Gummy residue	NONE	NONE
Long-lasting lubrication	YES	NO
Anti-wear properties	YES	NO
Extreme-pressure properties	YES	NO

TABLE 1 - SPRAY-SHIELD & STRIKE-SHIELD COMPARED TO WD-40

- Strike Shield and Spray Shield win

NOTE: The following disclaimer appeared on the WD-40 web site at the time of this writing: "The uses of WD-40 described on this Web site are provided to WD-40 Company by end-users of the product, and do not constitute recommendations or suggestions for use of WD-40 by WD-40 Company. These uses, including the 'Use of the Day', have not been tested by WD-40 Company. Consumers should exercise common sense whenever using WD-40. Always follow the instructions and take heed of any warnings printed on the WD-40 packaging." WD-40 is a registered trademark of WD-40 Company, San Diego, California, U.S.A.

I 6. GREASE APPLICATIONS OF BEARINGS

I 6A. STEEL SHIELD GREASE COMPATIBILITY

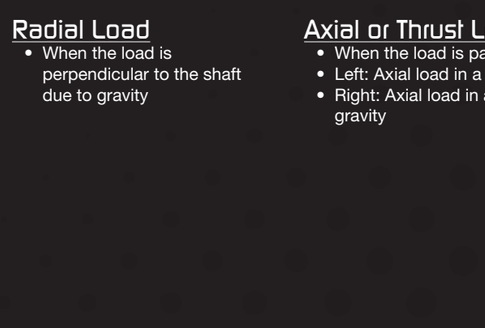
	Aluminum Complex	Barium Complex	Calcium Stearate	Calcium 12-Hydroxy	Calcium Complex	Calcium Sulfonate Complex	Clay (non-Soap)	Lithium Stearate	Lithium 12-Hydroxy	Lithium Complex	Polyurea (Conventional)	Polyurea (Shear Stable)
Aluminum Complex		I	I	C	I	B	I	I	I	C	I	C
Barlum Complex	I		I	C	I	C	I	I	I	I	I	B
Calcium Stearate	I	I		C	I	C	C	C	B	C	I	C
Calcium 12-Hydroxy	C	C	C		B	B	C	C	C	C	I	C
Calcium Complex	I	I	I	B		I	I	I	I	C	C	C
Caclium Sulfonate Complex	B	C	C	B	I		I	B	B	C	I	C
Clay (Non-Soap)	I	I	C	C	I	I		I	I	I	I	B
Lithium Stearate	I	I	C	C	I	B	I		C	C	I	C
Lithium 12-Hydroxy	I	I	B	C	I	B	I	C		C	I	C
Lithium Complex	C	I	C	C	C	C	I	C	C		I	C
Polyurea (Conventional)	I	I	I	I	C	I	I	I	I	I		C
Polyurea (Shear Stable)	C	B	C	C	C	C	B	C	C	C	C	

RELATIVE COMPATIBILITY RATING

- B = Borderline
- C = Compatible
- I = Incompatible
- Note: This chart is a general guide to compatibility. Specific properties of greases can dictate compatibility. Testing should be done to determine if greases are compatible.

I 6B. BEARING TYPES AND GREASES

COMMON APPLICATIONS OF DIFFERENT TYPES OF BEARINGS

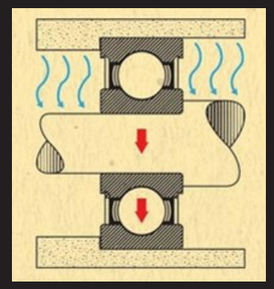


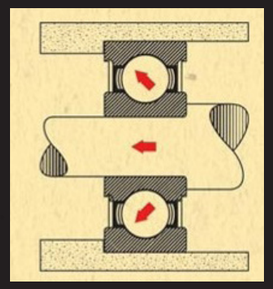
BEARING TYPE AFFECTS GREASE LIFE

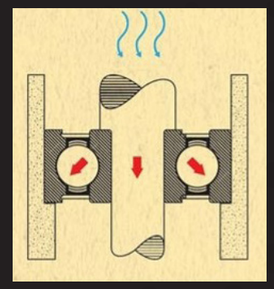
Bearing Type	Relative Type of Grease
Deep-groove, single-row ball bearing	1
Angular contact, single-row ball bearing	0.625
Self-aligning, single-row bearing	0.77 - 0.625
Trust ball bearing	0.2 - 0.17
Cylindrical, single-row roller bearing	0.625 - 0.43
Needle roller bearing	0.3
Tapered roller bearing	0.3
Spherical roller bearing	0.14 - 0.08

Larger bearings and high-speed bearings translate to short grease life. High DN grease is required.

BEARINGS UNDER DIFFERENT KINDS OF LOADS







Radial Load

- When the load is perpendicular to the shaft due to gravity

Axial or Thrust Load

- When the load is parallel to the shaft
- Left: Axial load in a horizontal pump
- Right: Axial load in a vertical pump or electrical motor due to gravity

I 7. HOW TO CHOOSE THE RIGHT GREASE

I 7A. SELECTION GUIDE

BASE OIL VISCOSITY

A common OEM grease specification might be to use an NLGI No. 2 lithium grease of good quality. Using this information alone, one could select the right consistency and thickener type. Other considerations include thickener concentration, consistency, dropping point and operating temperature range, worked stability, oxidation stability, wear resistance, etc.

A common mistake when selecting a grease is to confuse the grease consistency with the base oil viscosity. Because the majority of grease-lubricated applications are element bearings, one should consider viscosity selection for those applications. While most would not use an EP 220 gear oil for an oil-lubricated electric motor bearing, many people will use a grease containing that same oil for an identical grease-lubricated bearing. To determine minimum and optimum viscosity requirements for element bearings, one may use speed factors, commonly denoted as DN or NDm. Speed factors account for the surface speed of the bearing elements and are determined by the following formulas:

DN = (rpm) X (bearing bore)

NDm = rpm X ((bearing bore + outside diameter) / 2)

The NDm value uses pitch diameter rather than bore diameter because not all bearings of a given bore have the same element diameter, and thus have different surface speeds. Knowing the speed factor value and likely operating temperature, the minimum viscosity requirement can be read directly from charts like Figure 1. Figure 1 assumes the base oils' viscosity index. To be more precise, one would need to use a chart that identifies the viscosity at operating temperature, then determine the viscosity grade from a viscosity / temperature chart for a given lubricant.

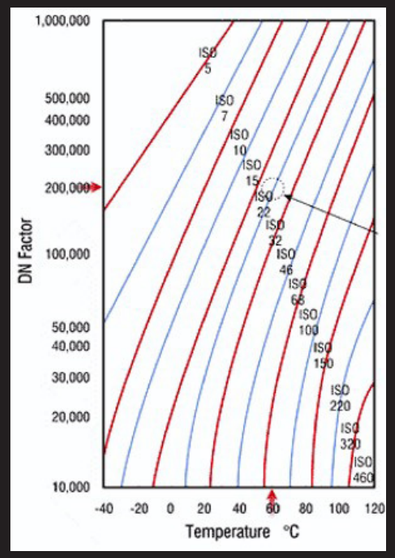


Figure 1
- The minimum viscosity requirement of oils

ADDITIVES AND BASE OIL TYPES

Figure 2 shows some common additive requirements by application. Most greases are formulated using API Group I and II mineral oil base stocks, which are appropriate for most applications. However, there are applications that might benefit from the use of a synthetic base oil. Such applications include high or low operating temperatures, a wide ambient temperature range, or any application where extended re-lubrication intervals are desired.

Additive	Journal Bearings	Ball Bearings	Thrust Bearings	Roller Bearings	Needle Bearings
Antioxidants	•	•	•	•	•
Antifoam Agents	•	•	•	•	•
Antiwear / EP		•	•	•	•
Rust Inhibitors	•	•	•	•	–
Extreme Pressure			–	–	
Demulsibility	•	•	•	•	–
VI Improvers	–	–	–	–	•
Corrosion Inhibitors	•	•	•	•	•

• Required;
– Depends on application

Figure 2
- Common additive requirements by applications

GREASE CONSISTENCY AND THICKENER TYPE

The NLGI has established a scale to indicate grease consistency which ranges from grades 000 (semifluid) to 6 (block grease). The most common NLGI grade is two and is recommended for most applications.

For bearings, speed factor and operating temperature can be used to determine the best consistency or NLGI grade for a given application. It may seem counterintuitive, but higher speed factors require higher consistency greases. Table 1 provides a general guide to selecting NLGI grade based on speed factor and operating temperature.

Numerous types of grease thickeners are currently in use, the most common types are simple lithium soaps, lithium complex and polyurea. Simple lithium soaps are often used in general-purpose greases and perform relatively well in most performance categories at moderate temperatures. Complex greases such as lithium complex provide improved performance particularly at higher operating temperatures. A common upper operating temperature limit for a simple lithium grease might be 250°F, while that for a lithium complex grease might be 350°F. Another thickener type that is becoming more popular is polyurea.

Like lithium complex, polyurea has good high-temperature performance as well as high oxidation stability and bleed resistance. Thickener type should be selected based on performance requirements as well as compatibility when considering changing product types.

Operating Temperature	DN (Speed Factor)	* NIGL No.
-30 to 100 °F	0 - 75,000	1
	75,000 - 150,000	2
	150,000 - 300,000	2
0 to 150 °F	0 - 75,000	2
	75,000 - 150,000	2
	150,000 - 300,000	3
100 to 275 °F	0 - 75,000	2
	75,000 - 150,000	2
	150,000 - 300,000	3

* Depends on other factors as well, including bearing type, thickener type, base oil viscosity and base oil type

PERFORMANCE PROPERTIES

If an application operates continuously at room temperature, properties like dropping and upper operating temperature limits are not as important. If an application operates under heavy loads at low speeds, load carrying tests such as four-ball EP or Timken OK load should be considered. It is also important to review these specifications on a periodic basis to guard against specification creep. While improving a lubrication program can be a tough job, lubricant specification is relatively easy. Armed with a little bit of knowledge and a few widely available tools, it is possible to rest easier knowing that the right grease is being used.

"With Steel Shield ABF Technology, the performance in stability, lubricity and interval of grease can be enhanced and improved to a much higher level."

NEVER USE GREASE OR OILS WITH SOLID ADDITIVES

"Solid additives such as Molybdenum will damage metal surface in the long term, never attempt to try those lubricants."

"Steel Shield lubricating oils and greases utilize unique ABF Technology which perform much better than any solid additives. Steel Shield is your wise choice."

Figure 3

- Upper: Steel Shield Grease - Lithi Shield does not contan any solid additive which have excellent performance in high loading operations without creating any undesire effects to metals
- Lower: Grease contains solid additive (Molybdenum). It will damage metal surface in the long term because it contans solid materials

18. SINGAPORE GEAR LUBRICANTS WITH ABF TECHNOLOGY

SST ECI POWER-AP PAG
GEAR OIL

SST ECI T-GEAR AP EP
GEAR OIL

SST ECI T-SHC AP EP
GEAR OIL

SST ECI HD-AP ATF DIII
AUTO TRANSMISSION FLUID

SST ECI HD-AP EP-GL-5
AUTO-GEAR OIL

SST ECI HD-AP PTF
TRANSMISSION FLUID

Not Just Oil...
IT'S TECHNOLOGY

SST ECI POWER-AP PAG Gear Oils

SST ECI POWER-AP PAG Gear Oils are high performance synthetic gear oils blended with polyglycols and special additives. The oils of natural extremely high viscosity index, and low pour point possess excellent high and low temperature performance and long term hydrolytic stability, exhibit superior anti-oxidation, anti-wear, and anti-corrosion properties. Enhanced with Steel Shield ABF Technology of low coefficient of friction reduces power consumption and operation temperatures effectively. It outperforms any of the aftermarket gear oils.

ISO 150, ISO 220, ISO 320, ISO 460

Advantages

- Reduce deposit and maintain system cleanliness
- Extended oil drain interval
- Low coefficients of friction and traction
- Superior anti-oxidation and anti-rust properties
- Excellent chemical and thermal stability
- Good compatibility with seal materials
- Long term hydrolytic stability
- Good filterability and air release property
- Reduced foam forming tendency
- Reduce downtime 200+%
- Extends the life of system parts up to 400% (conditional to the physical status)
- Reduce noise 3db~9db (conditional to system condition)
- Improves efficiency

Applications

- SST ECI POWER-AP PAG Gear Oils are recommended for worm reduction gear boxes under high temperature, high loads and wet working conditions. The oils are incompatible with most mineral and synthetic oils.

Directions of Usage

- Follow the maintenance manuals of the marine engine systems.

Properties	Standard	Unit	ISO 150	ISO 220	ISO 320	ISO 460
Kinematic Viscosity @ 40 ˚C	ASTM D445	cSt	150	220	320	460
Kinematic Viscosity @ 100 ˚C	ASTM D445	cSt	23	34	51	72
Viscosity Index	ASTM D2270		185	202	220	230
Flash Point (COC)	ASTM D92	˚C	225	225	225	230
Pour Point	ASTM D97	˚C	-30	-30	-30	-27
FZG FAIL LOADING STAGE	DIN 51354-2		12+	12+	12+	12+

SST ECI T-GEAR AP EP Gear Oils

SST ECI T-GEAR AP EP are premium extreme pressure industrial gear oils containing anti-oxidation, anti-corrosion, anti-wear and anti-foam inhibitors. These oils meet the performance requirements of ISO 12925-1:1996 Category CKD, AISE 224, ANSI/AGMA 9005-E02, DIN 51517 Part 3, Cincinnati Lamb P-59 series, Textron David Brown S1.53 101 and pass FZG 12th stage test, etc.

ISO 150, ISO 220, ISO 320, ISO 460,
ISO 680, ISO 1000, ISO 1500

Advantages

- Excellent anti-rust and anti-corrosion properties
- Extended oil drain interval
- Extends the life of engine parts up to 300% (conditional to the physical status)
- Good thermal and oxidation stability
- Improves efficiency in terms of usable output energy
- Outstanding protection against wear and shock
- Prolongs gear equipment life
- Reduce deposit and maintain system cleanliness
- Reduce downtime 200% and more
- Reduce noise 3db~9db (conditional to system condition)
- Superior load-carrying EP capability

Applications

- SST ECI T-GEAR AP EP are recommended for all types of industrial gear both enclosed and open. Also suitable for lubrication of systems containing worm gears, bearings, sliding parts, etc.

Directions of Usage

- Follow the maintenance manuals of the marine engine systems.

Properties	Standard	Unit	ISO 150	ISO 220	ISO 320	ISO 460	ISO 680	ISO 1000	ISO 1500
Kinematic Viscosity @ 40 ˚C	ASTM D445	cSt	150	220	320	460	680	1000	1500
Kinematic Viscosity @ 100 ˚C	ASTM D445	cSt	14.8	19	24	30	38	44	61.2
Viscosity Index	ASTM D2270		95	95	95	95	90	90	90
Flash Point (COC)	ASTM D92	˚C	240	245	247	250	250	252	255
Pour Point	ASTM D97	˚C	-10	-9	-9	-9	-6	-3	-3
COPPER CORROSION	ASTM D130		1B	1B	1B	1B	1B	1B	1B

SST ECI T-SHC AP EP
Gear Oils

SST ECI T-SHC AP EP are all season high performance synthetic extreme pressure industrial gear oils fortified with sulphur-phosphorous and ashless dispersant additives and with ABF Technology to enhance anti-oxidation, anti-corrosion, demulsification, anti-wear and anti-foam properties. These oils meet the performance requirements of API, GL-5, MT-1 and SAE J2360, MIL-PRF-2105E, Scania STO 110, Mack GO-J, etc and particularly for hypoid gears under severe operating conditions.

SAE 75W90,
SAE 75W140

Advantages

- Anti-weld superior load-carrying EP capability
- Excellent anti-rust and anti-corrosion properties
- Excellent shear stability
- Extended oil drain interval
- Improves efficiency in terms of usable output energy and fuel economy
- Outstanding good thermal and oxidation stability at high temperature
- Outstanding protection against wear and shock
- Prolongs gear equipment life up to 300% (conditional to the physical status)
- Reduce deposit and maintain system cleanliness
- Reduce downtime 200% and more
- Reduce noise 3db~9db (conditional to system condition)

Applications

- SST ECI T-SHC AP EP are recommended for all types of industrial gear both enclosed and open as well as automotive hypoid gear in manual transmissions, rear axles, differentials, transfer cases, overdrive units, oil lubricated wheel bearings, oil lubricated universal joints, steering gear boxes, etc particularly under low temperatures and critically severe conditions.

Directions of Usage

- Follow the maintenance manuals of the marine engine systems.

Properties	Standard	Unit	SAE 75W90	SAE 75W140
Kinematic Viscosity @ 40 ˚C	ASTM D445	cSt	110	193
Kinematic Viscosity @ 100 ˚C	ASTM D445	cSt	15.5	26.3
Viscosity Index	ASTM D2270		154	171
Flash Point (COC)	ASTM D92	˚C	200	200
Pour Point	ASTM D97	˚C	-57	-36

SST ECI HD-AP ATF DIII AUTO TRANSMISSION FLUID

SST ECI T-GEAR AP EP are premium extreme pressure industrial gear oils containing anti-oxidation, anti-corrosion, anti-wear and anti-foam inhibitors. These oils meet the performance requirements of ISO 12925-1:1996 Category CKD, AISE 224, ANSI/AGMA 9005-E02, DIN 51517 Part 3, Cincinnati Lamb P-59 series, Textron David Brown S1.53 101 and pass FZG 12th stage test, etc.

SAE DIII

Advantages

- Eliminate spitfire effects to maintain the integrity of the gear components
- Excellent low temperature performance
- Excellent modifying friction
- Good protection against corrosion and wear
- High shear stability
- Reduce deposit and maintain system cleanliness
- Superior thermal and oxidation stability

Applications

- SST ECI HD-AP ATF DIII is a heavy duty oil recommended for use in modern passenger cars and light trucks where Dexron III is required. It can also be used as hydraulic fluid in many automatic systems and Vickers pumps.

Directions of Usage

- Follow the maintenance manuals of the marine engine systems.

Properties	Standard	Unit	SAE 75W90
Kinematic Viscosity @ 40 ˚C	ASTM D445	cSt	34
Kinematic Viscosity @ 100 ˚C	ASTM D445	cSt	7.6
Viscosity Index	ASTM D2270		176
Flash Point (COC)	ASTM D92	˚C	170
Pour Point	ASTM D97	˚C	-35

SST ECI HD-AP EP-GL-5 Auto-Gear Oils

SST ECI HD-AP EP-GL-5 are premium grade automotive gear oils enhanced with unique ABF technology to out-perform any aftermarket products in extreme-pressure, anti-corrosion, antioxidation, demulsification and anti-foam properties. These oils are environmental friendly containing no lead, and meet the performance requirements of API GL-5, MIL-L-2105D, ZF TE-ML 05A, 7A, 12E, 16B, 16C, 16D, 17B, 19B, 21A and MAN 342 Type 2.

SAE 90, SAE 140,
SAE 80W90, SAE 85W140

Advantages

- Eliminate spitfire effects to maintain the integrity of the gear components
- Excellent rust and corrosion inhibition
- Exceptional load-carrying capability
- Extending gear life
- Good oxidative and thermal stability
- Outstanding protection against wear and shock

Applications

- SST ECI HD-AP EP-GL-5 are suitable for automotive hypoid gears, spiral bevel axles, steering boxes, heavy duty axles with final drive and other gears under severe operating conditions.

Directions of Usage

- Follow the maintenance manuals of the marine engine systems.

Properties	Standard	Unit	SAE 90	SAE 140	SAE 80W90	SAE 85W140
Kinematic Viscosity @ 40 ˚C	ASTM D445	cSt	197	450	156	425
Kinematic Viscosity @ 100 ˚C	ASTM D445	cSt	18	30	15.4	30
Viscosity Index	ASTM D2270		96	95	100	97
Flash Point (COC)	ASTM D92	˚C	212	222	205	222
Pour Point	ASTM D97	˚C	-10	-9	-27	-18

SINGAPORE GEAR OILS

SST ECI HD-AP PTF TRANSMISSION FLUID

SST ECI HD-AP PTF is a premium power transmission fluid designed for transmission and Drive Train Oil. The oil enhanced with ABF Technology possesses outstanding anti-wear, anti-rust and anti-oxidation properties, exhibits excellent friction control, less brake noise, good elastomeric compatibility. SST-ECI HD-AP PTF meets and complies with specification requirements of Caterpillar TO-4, Caterpillar TO-4M, Allison C-4, Komatsu 07.868.1, ZF TE-ML 01, 03C and API CF, CF-2, etc.

SAE 10W, SAE 30, SAE 40,
SAE 50, SAE 60

Advantages

- Eliminate spitfire effects to maintain the integrity of the system components
- Excellent friction control
- Good elastomer compatibility
- Prolong the life of brakes and transmissions
- Reduced brake noise
- Superior gear wear protection
- Superior thermal and oxidation stability

Applications

- SST ECI HD-AP PTF is recommended for use in modern Caterpillar transmissions, final drive, oil immersed brake and hydraulic systems fitted to heavy-duty off-road equipment. It can also be used as hydraulic fluid in some automatic systems and Vickers pumps.

Directions of Usage

- Follow the maintenance manuals of the marine engine systems.

Properties	Standard	Unit	SAE 10W	SAE 30	SAE 40	SAE 50	SAE 60
Kinematic Viscosity @ 40 ˚C	ASTM D445	cSt	42	97	141	228	318
Kinematic Viscosity @ 100 ˚C	ASTM D445	cSt	6.5	11.3	14.7	19.2	24
Viscosity Index	ASTM D2270		105	98	97	95	95
Flash Point (COC)	ASTM D92	˚C	205	210	215	225	230
Pour Point	ASTM D97	˚C	-30	-25	-25	-9	-9

19. SINGAPORE HYDRAULIC LUBRICANTS WITH ABF TECHNOLOGY

SST ECI TV T-POWER

SST ECI HD-AP

MADE IN SINGAPORE

ABF TECHNOLOGY™
Not Just Oil...
IT'S TECHNOLOGY

SST ECI TV T-POWER

SST ECI TV T-Power Hydraulic Oil is a premium quality anti-wear hydraulic oils intended for industrial and mobile service application where anti-wear lubricants are required. The oils are formulated with enhanced ABF technology and high quality base oils that results in products that provides many features to improve and prolong equipment life.

ISO 32, ISO 46,
ISO 68, ISO 100

Advantages

- Excellent anti-wear performance reducing pump wear and extending pump life
- Exceptional corrosion protection reduces the negative effects of moisture on system components
- Extends the life of hydraulic components upto 400% (conditional to the physical status)
- Good oxidation stability and good filterability
- Improves efficiency in terms of smoothness
- Reduce downtime 300% and more
- Reduction of sludge and deposit formation in close tolerance components such as servo valves

Applications

- Most of the hydraulic systems under light to moderate operation conditions, particularly for older machines that oil change is more often
- System employing gear, vane, radial and axial piston pumps where anti-wear hydraulic oils are required
- System requiring a high degree of load-carrying capability and anti-wear protection
- System containing gears and bearings where mild and anti-wear characteristics are required

Directions of Usage

- Follow the maintenance manuals of the marine engine systems.

Properties	Standard	Unit	ISO 32	ISO 46	ISO 68	ISO 100
Density @ 15		Kg / L	0.872	0.874	0.881	0.89
Kinematic Viscosity @ 40˚C	ASTM D445	cSt	30.4	46	68.5	98.5
Kinematic Viscosity @ 100˚C	ASTM D445	cSt	5.23	6.75	8.7	11
Viscosity Index	ASTM D2270		100	100	99	97
Flash Point (COC)	ASTM D92	˚C	219	225	230	239
POUR POINT	ASTM D97	˚C	-20	-20	-18	-15

SINGAPORE HYDRAULIC OILS

SST ECI HD-AP

SST ECI HD-AP Hydraulic Oil is a Heavy Duty general purpose anti-wear hydraulic oils formulated with enhanced ABF technology. The oils possess good anti-wear, anti-corrosion and anti-oxidation properties and meet Park Denison HF-0, HF-2 and DIN 51524 Part I, II specifications.

ISO 32, ISO 46,
ISO 68, ISO 100

Advantages

- Excellent protection against wear, rust and corrosion
- Extends the life of hydraulic components upto 400% (conditional to the physical status)
- General purpose economy oils
- Good filterability
- Good oxidation stability
- Improves efficiency in terms of smoothness
- Reduce downtime 300% and more

Applications

- SST ECI HD Hydraulic Oil is recommended for use in most of the hydraulic systems, particularly for older machines that oil change is more often. They are not suitable for use in systems with silver plated components.

Directions of Usage

- Follow the maintenance manuals of the marine engine systems.

Properties	Standard	Unit	ISO 32	ISO 46	ISO 68	ISO 100	SAE 150
Kinematic Viscosity @ 40˚C	ASTM D445	cSt	30	45	67	98	145
Kinematic Viscosity @ 100˚C	ASTM D445	cSt	5.3	6.7	8.6	10.9	14.5
Viscosity Index	ASTM D2270		99	99	98	97	96
Flash Point (COC)	ASTM D92	˚C	212	220	228	245	250
Pour Point	ASTM D97	˚C	-12	-12	-10	-10	-10

20. SINGAPORE AIR COMPRESSOR LUBRICANTS WITH ABF TECHNOLOGY

SST ECI AP COMPRESSO LOW ASH 0.5
AIR COMPRESSOR OIL

SST ECI AP COMPRESSO LOW ASH 0.5

Air Compressor Oil

SST ECI AP Compresso Low Ash 0.5 are air compressor oils blended with highly refined mineral base oils together with Steel Shield ABF advanced technology additives. The oils reduce internal friction, protect metal parts, exhibit good oxidation stability, excellent rust and corrosion protection and demulsificationproperties, meet the requirements of DIN 51506 VD-L.

ISO 32, ISO 46,
ISO 68, ISO 100, ISO 150

Advantages

- Energy Saving average 5~12%
- Excellent chemical stability
- Excellent demulsifibility
- Excellent thermal stability
- Extend oil change interval
- Extend the life of all metal parts
- Good anti-oxidation and anti-rust properties
- Improve efficiency
- Less downtime and save maintenance cost
- Reduce noise
- Resistance to sludge deposit

Applications

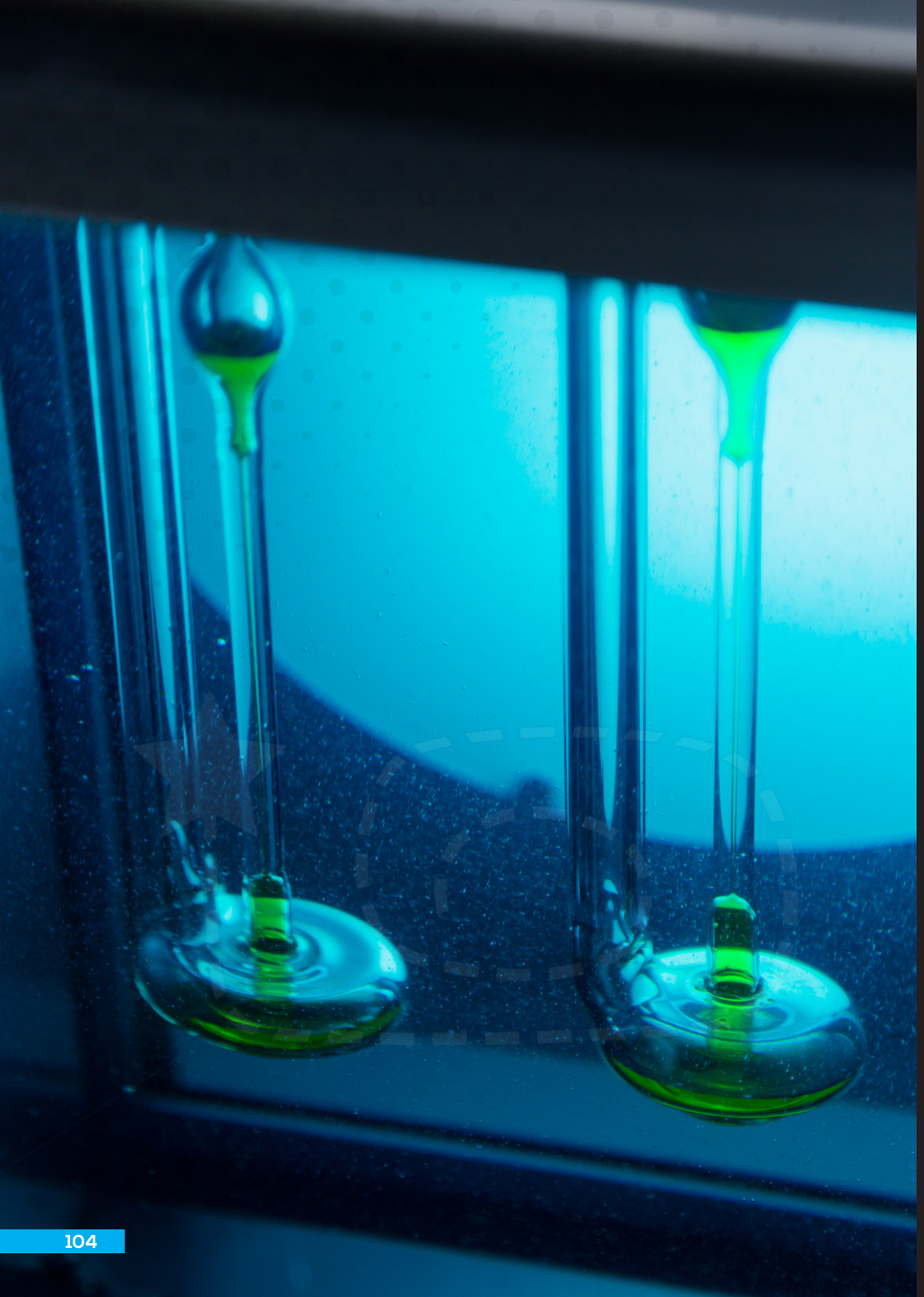
- AP COMPRESSO are recommended for the lubricating of rotary sliding vane, screw air compressors as well as reciprocating air compressors.

Directions of Usage

- Follow the maintenance manuals of the marine engine systems.

Properties	Standard	Unit	ISO 32	ISO 46	ISO 68	ISO 100	ISO 150
Kinematic Viscosity @ 40°C	ASTM D445	cSt	29	46	68	97	150
Kinematic Viscosity @ 100°C	ASTM D445	cSt	5.4	6.8	8.5	11	14.8
Viscosity Index	ASTM D2270		108	105	97	97	97
Flash Point (COC)	ASTM D92	°C	215	220	230	245	248
Pour Point	ASTM D97	°C	-15	-12	-10	-10	-9
POUR POINT	ASTM D97	°C	-20	-20	-18	-15	

"With Steel Shield, any HVAC air conditioning system can save huge amount of maintenance costs, and boost the efficiency to the highest level. This can only be achieved by ABF Technology"



21. SOUTHWEST RESEARCH INSTITUTE TEST REPORTS

“Steel Shield lubricants with ABF Technology is proven to be superior to any other top-class lubricants in the world.”

21A. GAS ENGINE OILS AND COMPRESSOR OILS TESTS

STEEL SHIELD REVEALED POWERFUL PERFORMANCE IN TESTS

Products of the same class

SwRI Lab No.	24564	23728	23252	23727	25250	25251
ASTM D2782 Measurement of Extreme-Pressure Properties of Lubricating Fluids (Timken Method)	SST Gas Engine Oil SAE 40 Ashless Without EPA	Steel Shield Gas Engine Oil GECAT SAE40 Low Ash With EPA	Steel Shield EPA	Steel Shield Compressor Oil ISO #100 / 150	Mobil Pegasus 805SAE 40 Gas Engine Oil	Mobil Pegasus 801SAE 40 Gas Engine Oil
Volume (Gallon)	1	1	1	1	1	1
OK Load (lbs)	40	40	75	55	9	9
Score Load (lbs)	45	45	80	60	12	12
Temperature (°C)	38	38	38	38	38	38

FIGURE 1 - STEEL SHIELD WINS IN Timken TEST (ASTM D2782)

- The SwRI Timken Test report clearly testified Steel Shield products are FAR Superior than Mobil products of the same classes
- Steel Shield outperforms Mobil in OK LOAD parameter by 444 % and in SCORE LOAD by 375 %

Products of the same class

SwRI Lab No.	24564	23728	23252	23727	25250	25251
ASTM D2783 Measurement of Extreme-Pressure Properties of Lubricating Fluids (4-Ball Method)	SST Gas Engine Oil SAE 40 Ashless Without EPA	Steel Shield Gas Engine Oil GECAT SAE40 Low Ash With EPA	Steel Shield EPA	Steel Shield Compressor Oil ISO #100 / 150	Mobil Pegasus 805SAE 40 Gas Engine Oil	Mobil Pegasus 801SAE 40 Gas Engine Oil
Volume (Gallon)	1	1	1	1	1	1
Corrected Load (kgf)	70	109	NA	1	136	74
Load Wear Index (kgf)	35	46	NA	48	34	35
Weld Point (kg)	200	250	>800	250	200	200
Last Non Seizure Load (kg)	80	100	80	100	63	80

FIGURE 2 - STEEL SHIELD WINS IN 4-BALLS TEST (ASTM D2783)

- The SwRI 4-Balls Test testified Steel Shield products are superior than Mobil products of the same classes
- Steel Shield outperforms Mobil in the Weld Point (oil strength in resistant to EP) parameter by 129 % and in the Last Non Seizure Load (wear performance in respect to load) by 159 %.
- *** Remarks: 4-ball test is normally for heavy weight oil and grease.

FIGURE 3 - ORIGINAL TEST REPORTS FROM SWRI (RIGHT PAGE)

SOUTHWEST RESEARCH INSTITUTE®

6220 CULEBRA ROAD 78238-5166 • P.O. DRAWER 28510 78228-0510 • SAN ANTONIO, TEXAS, USA • (210) 684-5111 • WWW.SWRI.ORG

November 20th, 2014

George Fennell
Steel Shield Technologies
3351 Industrial Blvd
Bethel Park, PA 15102-2543
Phone: 1-800-390-1535
Email:

Re: Fuel Analysis Results
SwRI WO# 71111
PO# 120

Dear Mr. Fennell:

Analyses have been completed on your samples in accordance with the tests requested. Twelve samples were received in good condition between July 21st, 2014 and October 7th 2014 in good condition. Eleven samples were received in one gallon plastic containers and one sample was received in a one quart plastic bottle. Sample Identification and testing requesting is shown in the table on the following page. Testing took place between October 13th and November 11th 2014. Test results and sample identifications are shown in the table attached.

Analyses were performed according to the listed ASTM test procedures with no modifications or deviations. Precision should be consistent with those stated in the ASTM test procedures. Sample aliquots were taken in accordance with the various ASTM test procedures. The analyses above pertain only to the sample received by Southwest Research Institute and represent only that sampling lot. This report shall not be reproduced except in full without the express written permission of Southwest Research Institute.

If there are any questions concerning these analyses, or if you need any additional testing on the samples, please contact me at (210) 522-2071. We appreciate the opportunity to be of service to your firm.

Sincerely,

Robert R. Legg
Fuels Laboratory Manager
Fuels & Lubricants Research Department
Office of Automotive Engineering

Benefiting government, industry and the public through innovative science and technology

Test Summary Report
November 20th, 2014
Steel Shield Technologies

SwRI Lab# 24564

SST Gas Engine Oil
SAE 40 Ashless
1 Gallon Plastic Jug

ASTM D2782 Measurement of Extreme-Pressure Properties of Lubricating Fluids (Timken Method)

Okay Load, lbs	40
Score Load, lbs	45
Temperature, °C	38

ASTM D2783 Measurement of Extreme-Pressure Properties of Lubricating Fluids (4-Ball Method)

Corrected Load, kgf	70
Load Wear Index, kgf	35
Weld Point, kg	200
Last Non Seizure Load, kg	80

ASTM D6352 Boiling Range Distribution of Petroleum Distillates from 174 to 700 °C by GC

IBP	285.3	20%	428.8	40%	464.8	60%	497.5	80%	564.9
1%	306.2	21%	431.1	41%	466.4	61%	499.2	81%	570.0
2%	333.2	22%	433.3	42%	467.9	62%	501.1	82%	575.1
3%	351.6	23%	435.4	43%	469.4	63%	503.0	83%	580.6
4%	364.1	24%	437.2	44%	470.9	64%	505.0	84%	586.2
5%	373.5	25%	439.2	45%	472.4	65%	507.1	85%	591.8
6%	380.5	26%	441.2	46%	474.0	66%	509.3	86%	597.5
7%	386.7	27%	443.1	47%	475.6	67%	511.8	87%	603.5
8%	391.9	28%	444.9	48%	477.1	68%	514.5	88%	609.8
9%	396.0	29%	446.7	49%	478.6	69%	517.3	89%	616.3
10%	399.1	30%	448.6	50%	480.2	70%	520.4	90%	623.3
11%	403.0	31%	450.5	51%	481.8	71%	523.7	91%	630.3
12%	406.6	32%	452.1	52%	483.4	72%	527.3	92%	637.6
13%	410.2	33%	453.7	53%	485.1	73%	531.2	93%	645.6
14%	413.5	34%	455.2	54%	486.8	74%	535.3	94%	653.8
15%	416.5	35%	456.9	55%	488.5	75%	539.6	95%	662.7
16%	419.1	36%	458.5	56%	490.2	76%	544.2	96%	672.9
17%	421.8	37%	460.1	57%	492.0	77%	549.2	97%	682.4
18%	424.3	38%	461.7	58%	493.8	78%	554.5	98%	692.4
19%	426.5	39%	463.2	59%	495.7	79%	559.7	99%	704.3
								FBP	713.1

Test Summary Report
November 20th, 2014
Steel Shield Technologies

SwRI Lab# 23728

Biogas Landfill Gas Engine Oil
SAE 40 (Gecat SAE 40 Low Ash)
1 Gallon Plastic Jug

ASTM D2782 Measurement of Extreme-Pressure Properties of Lubricating Fluids (Timken Method)

Okay Load, lbs	40
Score Load, lbs	45
Temperature, °C	38

ASTM D2783 Measurement of Extreme-Pressure Properties of Lubricating Fluids (4-Ball Method)

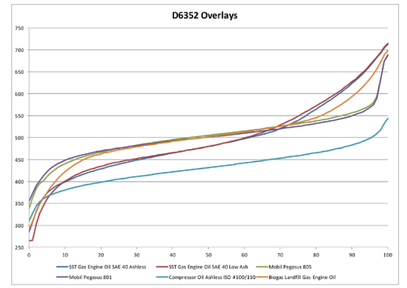
Corrected Load, kgf	109
Load Wear Index, kgf	46
Weld Point, kg	250
Last Non Seizure Load, kg	100

ASTM D6352 Boiling Range Distribution of Petroleum Distillates from 174 to 700 °C by GC

IBP	291.8	20%	462.9	40%	491.3	60%	512.8	80%	545.5
1%	308.9	21%	465.1	41%	492.4	61%	514.0	81%	548.7
2%	331.8	22%	467.0	42%	493.5	62%	515.2	82%	552.3
3%	349.1	23%	468.8	43%	494.7	63%	516.5	83%	556.3
4%	362.7	24%	470.4	44%	495.8	64%	517.8	84%	560.5
5%	374.7	25%	472.0	45%	496.9	65%	519.1	85%	565.1
6%	385.9	26%	473.6	46%	497.9	66%	520.4	86%	569.9
7%	396.5	27%	475.1	47%	498.9	67%	521.8	87%	575.0
8%	406.2	28%	476.5	48%	499.9	68%	523.1	88%	580.8
9%	415.0	29%	477.8	49%	500.9	69%	524.5	89%	586.8
10%	422.4	30%	479.1	50%	502.0	70%	526.0	90%	593.2
11%	429.0	31%	480.4	51%	503.0	71%	527.5	91%	599.9
12%	434.9	32%	481.6	52%	504.0	72%	529.0	92%	607.5
13%	440.2	33%	482.9	53%	505.1	73%	530.7	93%	615.4
14%	444.7	34%	484.2	54%	506.1	74%	532.4	94%	624.3
15%	449.2	35%	485.4	55%	507.2	75%	534.2	95%	633.7
16%	452.5	36%	486.6	56%	508.2	76%	536.1	96%	644.5
17%	455.4	37%	487.8	57%	509.3	77%	538.1	97%	656.4
18%	458.3	38%	489.0	58%	510.5	78%	540.4	98%	671.9
19%	460.7	39%	490.1	59%	511.7	79%	542.8	99%	688.2
								FBP	697.9

Test Summary Report
November 20th, 2014
Steel Shield Technologies

D6352 Overlays



In comparing the curves and D6352 chromatography, it is observed that samples SST Gas Engine oil SAE 40 Ashless and SST Gas Engine Oil SAE 40 Low Ash ar very similar with the exception that the Low Ash oil appears to have an added component that is somewhat lighter than the rest of the oil. The bulk of this oil is lighter than the others; however it does have a larger proportion of heavier compounds. In general it has broader array of hydrocarbons than the other oils. The Mobil Pegasus 801 and Mobil Pegasus 805 are essentially the same oil with the same boiling distribution. They both are a narrower cut reducing the amount of lighter and heavier hydrocarbon species. The Biogas Landfill Gas Engine Oil has a distribution in between the SST Gas Engine Oils and the Mobil Pegasus Oils. The Ashless Compressor oil is a significantly lighter oil than the rest of the samples.

21B. STEEL SHIELD VS. YAMAMOTO AND ATLAS

STEEL SHIELD LARGELY OUTPERFORMS REPUTED GREASES MADE BY YAMAMOTO AND ATLAS

Test Summary Report
November 20th, 2014
Steel Shield Technologies

SwRI Lab# 25252

SST-EPA

1 Gallon Plastic Jug

ASTM D2782 Measurement of Extreme-Pressure Properties of Lubricating Fluids (Timken Method)

Okay Load, lbs	75
Score Load, lbs	80
Temperature, °C	38

ASTM D2783 Measurement of Extreme-Pressure Properties of Lubricating Fluids (4-Ball Method)

Corrected Load, kgf	
Load Wear Index, kgf	
Weld Point, kg	>800
Last Non Seizure Load, kg	80

Test Summary Report
November 20th, 2014
Steel Shield Technologies

SwRI Lab# 23727

Compressor Oil Ashless
ISO #100/150
1 Gallon Plastic Jug

ASTM D2782 Measurement of Extreme-Pressure Properties of Lubricating Fluids (Timken Method)

Okay Load, lbs	55
Score Load, lbs	60
Temperature, °C	38

ASTM D2783 Measurement of Extreme-Pressure Properties of Lubricating Fluids (4-Ball Method)

Corrected Load, kgf	133
Load Wear Index, kgf	48
Weld Point, kg	250
Last Non Seizure Load, kg	100

ASTM D6352 Boiling Range Distribution of Petroleum Distillates from 174 to 700 °C by GC

IBP	310.0	20%	398.6	40%	421.7	60%	442.0	80%	465.5
1%	326.9	21%	400.0	41%	422.7	61%	443.1	81%	466.9
2%	344.5	22%	401.4	42%	423.6	62%	444.1	82%	468.4
3%	354.0	23%	402.7	43%	424.6	63%	445.3	83%	469.9
4%	360.6	24%	404.0	44%	425.6	64%	446.4	84%	471.5
5%	365.4	25%	405.2	45%	426.6	65%	447.5	85%	473.2
6%	369.2	26%	406.4	46%	427.6	66%	448.7	86%	474.9
7%	372.5	27%	407.7	47%	428.6	67%	449.8	87%	476.7
8%	375.5	28%	408.9	48%	429.6	68%	450.9	88%	478.7
9%	378.2	29%	410.1	49%	430.6	69%	452.0	89%	480.7
10%	380.6	30%	411.2	50%	431.6	70%	453.1	90%	483.0
11%	382.8	31%	412.4	51%	432.6	71%	454.2	91%	485.6
12%	384.9	32%	413.4	52%	433.6	72%	455.4	92%	488.3
13%	386.9	33%	414.5	53%	434.6	73%	456.6	93%	491.4
14%	388.9	34%	415.5	54%	435.7	74%	457.8	94%	494.9
15%	390.7	35%	416.6	55%	436.7	75%	459.0	95%	498.8
16%	392.4	36%	417.7	56%	437.7	76%	460.2	96%	503.3
17%	394.0	37%	418.7	57%	438.8	77%	461.5	97%	509.1
18%	395.6	38%	419.7	58%	439.9	78%	462.8	98%	517.6
19%	397.1	39%	420.7	59%	440.9	79%	464.1	99%	531.3
								FBP	544.3

Test Summary Report
November 20th, 2014
Steel Shield Technologies

SwRI Lab# 25250

Mobil Pegasus
805
1 Gallon Plastic Jug

ASTM D2782 Measurement of Extreme-Pressure Properties of Lubricating Fluids (Timken Method)

Okay Load, lbs	9
Score Load, lbs	12
Temperature, °C	38

ASTM D2783 Measurement of Extreme-Pressure Properties of Lubricating Fluids (4-Ball Method)

Corrected Load, kgf	136
Load Wear Index, kgf	34
Weld Point, kg	200
Last Non Seizure Load, kg	63

ASTM D6352 Boiling Range Distribution of Petroleum Distillates from 174 to 700 °C by GC

IBP	338.1	20%	467.0	40%	495.3	60%	515.0	80%	538.2
1%	363.1	21%	468.9	41%	496.4	61%	516.1	81%	539.6
2%	384.2	22%	470.6	42%	497.4	62%	517.1	82%	541.0
3%	396.2	23%	472.3	43%	498.3	63%	518.1	83%	542.6
4%	401.9	24%	474.0	44%	499.3	64%	519.2	84%	544.2
5%	410.8	25%	475.6	45%	500.3	65%	520.3	85%	545.9
6%	419.2	26%	477.1	46%	501.3	66%	521.4	86%	547.7
7%	426.0	27%	478.6	47%	502.2	67%	522.5	87%	549.7
8%	431.6	28%	480.0	48%	503.2	68%	523.6	88%	551.8
9%	436.1	29%	481.5	49%	504.1	69%	524.7	89%	554.1
10%	440.5	30%	482.9	50%	505.1	70%	525.8	90%	556.5
11%	444.1	31%	484.2	51%	506.0	71%	526.9	91%	558.9
12%	447.6	32%	485.6	52%	506.9	72%	528.1	92%	561.8
13%	450.8	33%	486.9	53%	507.9	73%	529.3	93%	565.0
14%	453.5	34%	488.2	54%	508.9	74%	530.5	94%	568.7
15%	456.1	35%	489.4	55%	509.9	75%	531.7	95%	573.2
16%	458.5	36%	490.6	56%	510.9	76%	533.0	96%	580.2
17%	460.8	37%	491.8	57%	511.9	77%	534.2	97%	594.4
18%	463.0	38%	493.0	58%	512.9	78%	535.5	98%	634.2
19%	465.1	39%	494.1	59%	514.0	79%	536.8	99%	674.3
								FBP	689.6

Test Summary Report
November 20th, 2014
Steel Shield Technologies

SwRI Lab# 25251

Mobil Pegasus
801
1 Gallon Plastic Jug

ASTM D2782 Measurement of Extreme-Pressure Properties of Lubricating Fluids (Timken Method)

Okay Load, lbs	9
Score Load, lbs	12
Temperature, °C	38

ASTM D2783 Measurement of Extreme-Pressure Properties of Lubricating Fluids (4-Ball Method)

Corrected Load, kgf	74
Load Wear Index, kgf	35
Weld Point, kg	200
Last Non Seizure Load, kg	80

ASTM D6352 Boiling Range Distribution of Petroleum Distillates from 174 to 700 °C by GC

IBP	355.5	20%	469.5	40%	492.3	60%	510.0	80%	532.2
1%	372.7	21%	470.9	41%	493.3	61%	511.0	81%	533.6
2%	391.1	22%	472.3	42%	494.3	62%	511.9	82%	535.1
3%	401.9	23%	473.7	43%	495.2	63%	512.9	83%	536.5
4%	413.3	24%	475.0	44%	496.2	64%	513.9	84%	538.1
5%	422.1	25%	476.2	45%	497.0	65%	514.9	85%	539.7
6%	429.3	26%	477.4	46%	497.8	66%	516.0	86%	541.4
7%	435.4	27%	478.5	47%	498.7	67%	517.0	87%	543.2
8%	440.6	28%	479.7	48%	499.5	68%	518.0	88%	545.2
9%	444.6	29%	480.8	49%	500.4	69%	519.1	89%	547.4
10%	448.3	30%	481.9	50%	501.2	70%	520.2	90%	549.9
11%	451.6	31%	483.1	51%	502.1	71%	521.3	91%	552.7
12%	454.2	32%	484.2	52%	503.0	72%	522.4	92%	555.8
13%	456.7	33%	485.2	53%	503.8	73%	523.5	93%	559.1
14%	459.0	34%	486.3	54%	504.7	74%	524.7	94%	563.1
15%	461.0	35%	487.3	55%	505.5	75%	525.9	95%	568.2
16%	462.9	36%	488.4	56%	506.4	76%	527.1	96%	575.2
17%	464.7	37%	489.4	57%	507.2	77%	528.3	97%	590.1
18%	466.5	38%	490.3	58%	508.1	78%	529.6	98%	633.5
19%	468.1	39%	491.3	59%	509.0	79%	530.9	99%	673.0
								FBP	687.9

Petroleum Products Research Department
Test Summary Report
Steel Shield Technologies
Purchase Order # 114
October 25, 2013

SwRI Code:	Sample Identification:		20003 Litho Shield	20004 Yamamoto EP grease
D1264	Water Washout of Grease			
	Avg. Grease Washed Out	wt %	1.32	0.66
	Test Temp.	°C	79	79
	Dry Temp.	°C	77	77
D1742	Oil Separation from Lubricating Grease	mass %	2.04	* Note
D2265	Dropping Point	°C	258	307
	Oven Temp.	°C	288	316
D2266	Wear Characteristics (Four-Ball Method)			
	Scar Diameter	kgf	0.75	0.47
D2596	Four-Ball Extreme Pressure Properties			
	Corrected Load	kgf	851.1	501.68
	Load-Wear Index	kgf	92.27	66.73
	Weld Point	kgf	800	315
	LNSL	kgf	80	63

* No oil separation occurred for grease sample "Yamatomo EP grease", therefore, sample is considered "outside the scope of the method".

Benefiting government, industry and the public through innovative science and technology

Petroleum Products Research Department
Test Summary Report
Steel Shield Technologies
Purchase Order # 114
October 25, 2013

SwRI Code:	Sample Identification:		20005 Atlas Chisel lube
D1264	Water Washout of Grease		
	Avg. Grease Washed Out	wt %	1.11
	Test Temp.	°C	79
	Dry Temp.	°C	77
D1742	Oil Separation from Lubricating Grease	mass %	** Note
D2265	Dropping Point	°C	302
	Oven Temp.	°C	316
D2266	Wear Characteristics (Four-Ball Method)		
	Scar Diameter	kgf	0.71
D2596	Four-Ball Extreme Pressure Properties		
	Corrected Load	kgf	302.79
	Load-Wear Index	kgf	41.23
	Weld Point	kgf	315
	LNSL	kgf	50

** No oil separation occurred for grease sample "Atlas Chisel Lube", therefore, sample is considered "outside the scope of the method".

Benefiting government, industry and the public through innovative science and technology

Test Items	Four-Ball Extreme Pressure Properties	Steel Shield Lithi Shield	Yamamoto EP Grease	Atlas Chisel Lube
Loading Ability	Corrected Load	851.1	501.68	302.79
Anti-Wear Ability	Load Wear Index	92.27	66.73	41.23
High Temperature Loading	Weld Point	800	315	315
High Pressure Loading	LNSL	80	63	50

Figure 1
- Grease test report summary
- Steel Shield Lithi Shield is superior to Yamamoto EP Grease and Atlas Chisel Lube in Loading ability, Anti-Wear Ability, High Temperature Loading and High Pressure Loading.

Figure 2
- Steel Shield (right) and Atlas (left)

22. INSURANCE CERTIFICATE & CONFIRMATION OF NO INSURANCE CLAIM

"The most powerful and reliable evidence showing that Steel Shield is the only lubricant you can trust."

22A. CERTIFICATE OF LIABILITY INSURANCE

OVER USD 2,000,000 INSURANCE

ACORD

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 5/14/2014

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER
Best Insurance Agency
340 S. Main St., P.O. Box 670
Butler PA 16003-0670

CONTACT NAME: Jamie McDonald
PHONE (A/C, No, Ext): (724) 283-5670 FAX (A/C, No): (724)283-1160
E-MAIL ADDRESS: jamie@bestinsurancebutler.com

INSURER(S) AFFORDING COVERAGE — NAIC #
INSURER A: Cincinnati Insurance Companies
INSURER B:
INSURER C:
INSURER D:
INSURER E:
INSURER F:

INSURED
Steel Shield Technologies Inc
3351 Industrial Blvd /
Bethel Park PA 15102

COVERAGES — CERTIFICATE NUMBER: coi 2014 - 15 — REVISION NUMBER:

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	GENERAL LIABILITY X COMMERCIAL GENERAL LIABILITY CLAIMS-MADE X OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: X POLICY PRO-JECT LOC			ENP04242014	4/24/2014	4/24/2015	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG	$ 1,000,000 $ 100,000 $ 5,000 $ 1,000,000 $ 2,000,000 $ 2,000,000
	AUTOMOBILE LIABILITY ANY AUTO ALL OWNED AUTOS SCHEDULED AUTOS HIRED AUTOS NON-OWNED AUTOS						COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident)	$ $ $ $
A	X UMBRELLA LIAB OCCUR EXCESS LIAB CLAIMS-MADE DED RETENTION $			ENP04242014	4/24/2014	4/24/2015	EACH OCCURRENCE AGGREGATE	$ 1,000,000 $
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH) Y / N N / A If yes, describe under DESCRIPTION OF OPERATIONS below						WC STATU-TORY LIMITS / OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	$ $ $

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

CERTIFICATE HOLDER
Steel Shield Technologies Inc.
3351 Industrial Blvd.
Bethel Park, PA 15102

CANCELLATION
SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.
AUTHORIZED REPRESENTATIVE

ACORD 25 (2010/05)
INS025 (201005).01

FIGURE 1 - ORIGINAL CERTIFICATE OF LIABILITY INSURANCE

Best Insurance Agency
340 S. Main St., P.O. Box 670
Butler, PA 16003-0670
(724)283-5670 (724)283-1160Fax
Email: Ray@Bestinsurancebutler.com

September 18, 2013

Steel Shield Technologies (Asia Pacific) Limited
22nd Floor, W. Business Centre
4 Kam Hong Street
North Point, Hong Kong

To Whom It May Concern:

Please be advised that Steel Sheild Technologies Inc, manufacturer of specialty lubricants and greases, located in Bethel Park,Pennsylvania, USA, has had no claims, claim related incidents or notices of loss under any General Liability policy issued by our office. We have provided them with General Liability coverage continously since April 24, 2008

If you have any questions or need further information please feel free to contact me. I will be happy to be of further assistance.

Sincerely,

Raymond A. Rosenbauer
Vice President

FIGURE 2 - CONFIRMATION LETTER OF NO INSURANCE CLAIM

- Steel Shield had NEVER been claimed

23. AUTHORITATIVE COMPLIMENTS LETTERS

“Formalized respectful action paid to STEEL SHIELD by the most renowned cooperations in the world. IN STEEL SHIELD, WE TRUST!”

23A. COMPLIMENTS FROM THE US ARMED FORCES

WEAPON SHIELD WAS TRUELY A LIFE SAVER

Mark W. Pushnick
President & CEO
Steel Shield Technologies, Inc
3351 Industrial Blvd
Bethel Park, PA 15102-2543

07 May 2008

Mark,

I wanted to take time to express my sincere thanks to you and Steel Shield Technologies, Inc. for your support while I was deployed overseas in support of the Global War on Terrorism.

Your product, Weapon Shield, was truly a "life saver".

In my first combat tour to Afghanistan in late 2003, not knowing much about your product, I began to use it for my personal weapon and my crew-served vehicle weapon as a just another oil that I received in my care packages from home. I soon became educated on how this product was head and shoulders above the rest.

In the grueling conditions of southwestern Afghanistan, our weapons were subject to severe heat, dust, and even potential rust due to the humidity in the area. Compared to the other oils that we received, Weapon Shield was the only product that stood up to the battlefield environment and did not cause the bolt of the weapons to become "gummy" or "sticky". Weapon Shield actually acted as a "shield" and as a dust repellent.

When I found out that I was deploying back to Iraq in 2007, one of my first calls was to my father to get my hands on Weapon Shield. While conducting pre-deployment training at Fort Bragg, I introduced my soldiers to this product. When it comes to selling to a tough audience, young enlisted men are some of the toughest to buy into a new idea. Within days, all of the men were carrying this product and were even hoarding bottles within their packs.

When we got to Iraq, Weapon Shield bottles became a part of the combat packing list as assigned by my Detachment Sergeant. Weapon Shield was now the Standing Operating Procedure, a small bottle on each man and tube of grease in each truck.

Weapons Shield brought us through over 25 fire fights with great success when other soldier's from different unit's weapons failed. On one occasion on patrol with another unit, their .50 cal machine gun jammed. One of my gunners tossed a bottle of Weapon Shield to them. They broke down their weapon, applied the shield and quickly got back into the firefight. In our mission after action review, my soldiers quickly commented on how their weapons would only be treated with this product.

The bottom line is this... In two combat tours to both Afghanistan and Iraq, weapons treated with Weapon Shield, NEVER jammed. That saved lives. As a unit commander, my most important job was to complete this mission while bringing all of my soldiers home. Weapon Shield was a great contributor to my unit accomplishing that mission. In combat, the only option is perfect. If you are not, you can die. Weapon Shield was PERFECT every time.
Victory!

Craig A. Hickerson
MAJOR, Infantry
USAR

FIGURE 1 (ABOVE) - US SOLIDERS HOLDING STEEL SHIELD BANNER

FIGURE 2 (RIGHT) - EMBLEM OF THE UNITED STATES DEPARTMENT OF THE ARMY

FIGURE 3 (LEFT) - LETTERS OF THANKS AND COMPLIMENTS FROM THE US ARMY

23B. COMPLIMENTS FROM THE SIEMENS

STEEL SHIELD PRODUCTS ARE GREAT CONTRIBUTORS TO SIEMEN'S SUCCESS

SIEMENS
VAI

December 10, 2008

Mark W. Pushnick
President & CEO
Steel Shield Technologies, Inc.
3351 Industrial Blvd.

Mark,

I would like to take this opportunity to thank you for introducing us to Steel Shield Technologies line of lubricants and Metal Treatment products. The performance of your products has been overwhelmingly superior to any other lubricants or metal treatments we have used in the past.

We are currently using the Lithi-Shield grease in our shop and it has proven to work very well in our high temperature applications. We have experienced absolutely no down time due to bearing failure on our high temp furnace since we began using the Lithi-Shield grease. In the past all bearings were replaced on a quarterly basis causing a significant amount of downtime and material cost. We also use the grease in our automated welding equipment and anywhere else frequent greasing is needed. It has out performed our previously used grease in every application and we use it as often as possible.

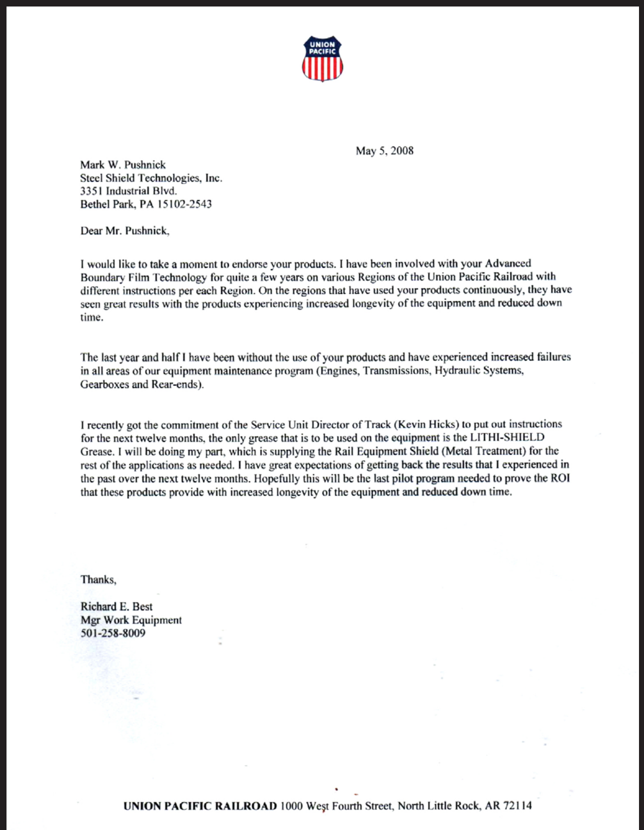
Because of the performance of the Lithi-Shield grease we started using Steel Shield EPA in all of our metalworking equipment. Since its introduction to our machines we have not experienced a significant breakdown of any kind and it has left them running smoother and quieter than ever. The Steel Shield Drill and Tap fluid is also used our shop and has significantly decreased our tooling costs and become a favorite of most of our machinists. The Spray Shield product is used by our maintenance department and it is proving to be superior to anything used here in the past. We are very happy with the cost and performance of Steel Shield Technologies products and I highly recommend them. I am continually looking for ways to reduce costs and downtime Steel Shield products have been a great contributor to our success.

Bob Cavill
Maintenance Department Supervisor
Siemens VAI Services, LLC
2901 Industrial Blvd.
Bethel Park, PA 15102
412-851-6700

FIGURE 1 - THE ORIGINAL LETTER OF COMPLIMENT FROM SIEMENS

23C. LETTERS FROM UNION PACIFIC RAILROAD

UNION PACIFIC RAILROAD USES STEEL SHIELD PRODUCT EXTENSIVELY. STEEL SHIELD HAS BEEN PROVED TO BE FUNCTIONAL AND COST-EFFECTIVE, AND ARE HIGHLY RECOMMENDED



UNION PACIFIC

May 5, 2008

Mark W. Pushnick
Steel Shield Technologies, Inc.
3351 Industrial Blvd.
Bethel Park, PA 15102-2543

Dear Mr. Pushnick,

I would like to take a moment to endorse your products. I have been involved with your Advanced Boundary Film Technology for quite a few years on various Regions of the Union Pacific Railroad with different instructions per each Region. On the regions that have used your products continuously, they have seen great results with the products experiencing increased longevity of the equipment and reduced down time.

The last year and half I have been without the use of your products and have experienced increased failures in all areas of our equipment maintenance program (Engines, Transmissions, Hydraulic Systems, Gearboxes and Rear-ends).

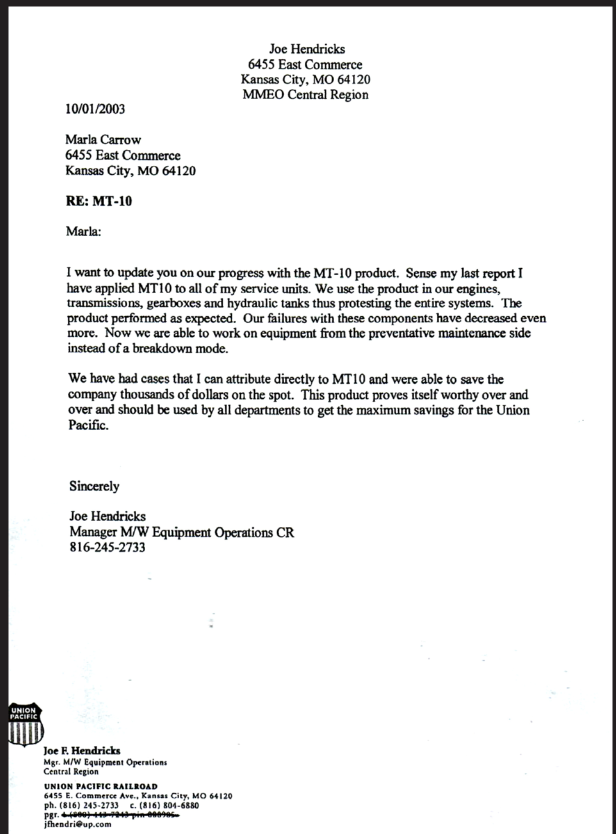
I recently got the commitment of the Service Unit Director of Track (Kevin Hicks) to put out instructions for the next twelve months, the only grease that is to be used on the equipment is the LITHI-SHIELD Grease. I will be doing my part, which is supplying the Rail Equipment Shield (Metal Treatment) for the rest of the applications as needed. I have great expectations of getting back the results that I experienced in the past over the next twelve months. Hopefully this will be the last pilot program needed to prove the ROI that these products provide with increased longevity of the equipment and reduced down time.

Thanks,

Richard E. Best
Mgr Work Equipment
501-258-8009

UNION PACIFIC RAILROAD 1000 West Fourth Street, North Little Rock, AR 72114

FIGURE 1 - THE ORIGINAL LETTER FROM MR. RICHARD E. BEST, THE MANAGER OF THE WORK EQUIPMENT



Joe Hendricks
6455 East Commerce
Kansas City, MO 64120
MMEO Central Region

10/01/2003

Marla Carrow
6455 East Commerce
Kansas City, MO 64120

RE: MT-10

Marla:

I want to update you on our progress with the MT-10 product. Sense my last report I have applied MT10 to all of my service units. We use the product in our engines, transmissions, gearboxes and hydraulic tanks thus protesting the entire systems. The product performed as expected. Our failures with these components have decreased even more. Now we are able to work on equipment from the preventative maintenance side instead of a breakdown mode.

We have had cases that I can attribute directly to MT10 and were able to save the company thousands of dollars on the spot. This product proves itself worthy over and over and should be used by all departments to get the maximum savings for the Union Pacific.

Sincerely

Joe Hendricks
Manager M/W Equipment Operations CR
816-245-2733

UNION PACIFIC

Joe F. Hendricks
Mgr. M/W Equipment Operations
Central Region

UNION PACIFIC RAILROAD
6455 E. Commerce Ave., Kansas City, MO 64120
ph. (816) 245-2733 c. (816) 804-6880
pgr. ~~[illegible]~~
jfhendri@up.com

FIGURE 2 - THE ORIGINAL LETTER FROM MR. JOE HENDRICKS, THE MANAGER M/W EQUIPMENT OPERATIONS CR

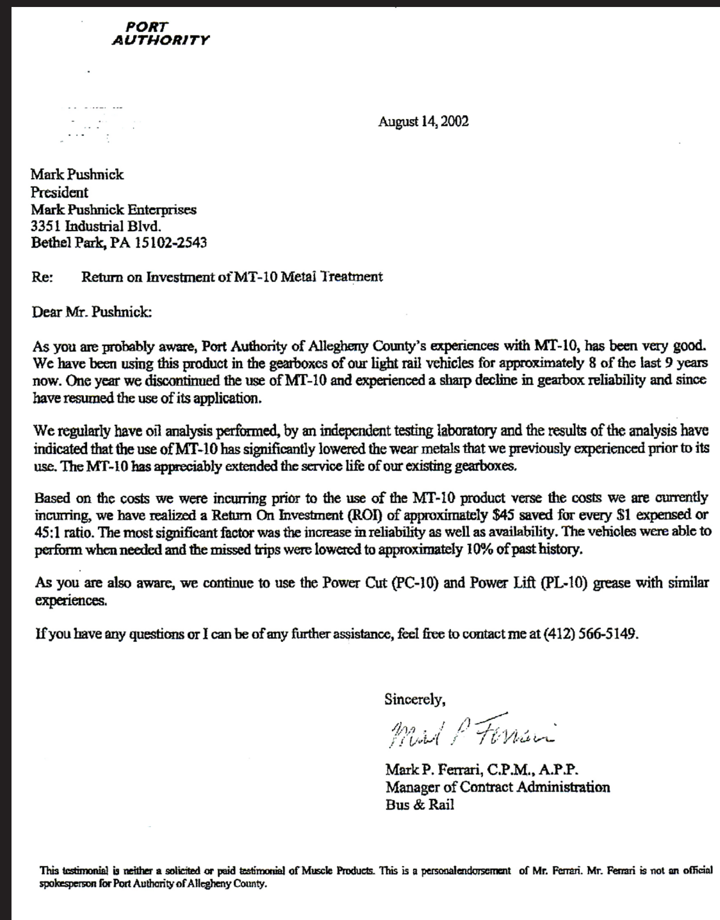
23D. LETTERS FROM THE PA PORT AUTHORITY

SAVED AROUND USD 45 IN MAINTENANCE COST FOR EVERY USD ONE DOLLAR INVESTMENT IN STEEL SHIELD PRODUCTS. ALSO, THE VEHICLES MALFUNCTIONS DROP TO AROUND 10%

FIGURE 1 (TOP RIGHT) - THE ORIGINAL LETTER FROM MR. MARK P. FERRARI, C.P.M., A.P.P., MANAGER OF CONTRACT ADMINISTRATION OF BUS & RAIL

FIGURE 2 (BOTTOM LEFT) - THE GEARBOX SYSTEM OF LIGHT RAILS

FIGURE 3 (BOTTOM RIGHT) - THE LIGHT RAIL VEHICLES OF PORT AUTHORITY



PORT AUTHORITY

August 14, 2002

Mark Pushnick
President
Mark Pushnick Enterprises
3351 Industrial Blvd.
Bethel Park, PA 15102-2543

Re: Return on Investment of MT-10 Metal Treatment

Dear Mr. Pushnick:

As you are probably aware, Port Authority of Allegheny County's experiences with MT-10, has been very good. We have been using this product in the gearboxes of our light rail vehicles for approximately 8 of the last 9 years now. One year we discontinued the use of MT-10 and experienced a sharp decline in gearbox reliability and since have resumed the use of its application.

We regularly have oil analysis performed, by an independent testing laboratory and the results of the analysis have indicated that the use of MT-10 has significantly lowered the wear metals that we previously experienced prior to its use. The MT-10 has appreciably extended the service life of our existing gearboxes.

Based on the costs we were incurring prior to the use of the MT-10 product verse the costs we are currently incurring, we have realized a Return On Investment (ROI) of approximately $45 saved for every $1 expensed or 45:1 ratio. The most significant factor was the increase in reliability as well as availability. The vehicles were able to perform when needed and the missed trips were lowered to approximately 10% of past history.

As you are also aware, we continue to use the Power Cut (PC-10) and Power Lift (PL-10) grease with similar experiences.

If you have any questions or I can be of any further assistance, feel free to contact me at (412) 566-5149.

Sincerely,

Mark P. Ferrari, C.P.M., A.P.P.
Manager of Contract Administration
Bus & Rail

This testimonial is neither a solicited or paid testimonial of Muscle Products. This is a personalendorsement of Mr. Ferrari. Mr. Ferrari is not an official spokesperson for Port Authority of Allegheny County.

23E. LETTER FROM VOLVO CHINA

THE HORSEPOWER OF VOLVO VEHICLES INCREASED BY 8% TO 12% AFTER USING STEEL SHIELD PRODUCTS

中沃汽车有限公司

致：美国离子能源有限公司
香港荃湾德士古道 188-202 号
立泰工业中心二期 11 楼 K 室

感谢 贵司提供神盾润滑油予我司作汽车马力输出测试。于是次测试当中，我司将神盾润滑油使用于 4 辆沃尔沃 Volvo 汽车[型号：沃尔沃 S80]，并将 4 辆汽车分别放上汽车马力输出测试机(Dyno-Shaft On-Vehicle Dynamometer) 进行测试。测试结果显示，4 辆进行测试的沃尔沃 Volvo 汽车在使用神盾润滑油之后，所输出的马力比起未有使用之前增加了 8%－12%。我司非常乐意向客户推荐神盾润滑油。

顺祝

商祺

中沃汽车有限公司
2013 年 11 月 8 日

地址：杭州市滨江区江南大道 3688 号通策广场 2 幢 1613 室 电话:0571-86852031
Http://www.sinoworldcar.com

FIGURE 1 - THE ORIGINAL LETTER FROM VOLVO

Volvo Car Corporation

8th November, 2013

To: Steel Shield Technologies (Asia Pacific) Limited
Unit K, 11/F, Leader Industrial Centre, Phase 2,
188-202 Texaco Road, Tsuen Wan, H.K.

Dear Ms. Eva Lam,

We would like to express our gratitude to Steel Shield Technologies (Asia Pacific) Limited for providing Steel Shield lubricants for our vehicle horse power tests. In this test, our company applied Steel Shield lubricants to 4 Volvo cars (model: Volvo S80). We mounted the 4 cars on the horse power testing machines (Dyno-Shaft On-Vehicle Dynamometer) and conducted the tests individually.

The results indicate that, the 4 Volvo cars which had Steel Shield lubricants applied got horse power boosted by 8% - 12% compared with the same 4 cars without Steel Shield lubricants. Our company will be pleased to recommend Steel Shield to our customers.

Sincerely,
Volvo Car Corporation
R/M 1613, 2th Phase, Tongce Square,3688 Jiangnan Road,
Binjiang, Hangzhou, China
Tel.: 0571-86852031 www.sinoworldcars.com

FIGURE 2 - THE ENGLISH TRANSLATION FROM THE ORIGINAL LETTER OF VOLVO

FIGURE 3 - VOLVO V70

24. STEEL SHIELD HVAC CASE STUDIES

"Concrete feedbacks and appreciations from customers are important for the success of STEEL SHIELD."

1987 - AETOS CONSTRUCTION COMPANY

In 18th May, 1987, 4 oz. Steel Shield EPA was added to the crankcase of a Dunham / Bush 30 HP 4-cylinder refrigeration compressor based on an estimated system oil capacity of 5 gallons (Table 1). In 29th June, 1987, on the recommendation of George Fennel (the inventor and owner of Steel Shield), the compressor crankcase was drained, and refilled with new 4-GS oil and 16 oz. of Steel Shield EPA (Table 2).

Compared with the initial readings before adding Steel Shield EPA, the compressor showed a consistent 5% reduction in current draw with Steel Shield EPA. This reduction in current draw alone would result in an energy savings of USD 285 per year per compressor.

FIGURE 1 - DUNHAM / BUSH 30 HP 4-CYLINDER REFRIGERATION COMPRESSOR SYSTEM

Date	Ambient Temperature	Suction Pressure	Discharge Pressure	L1 Amps	L2 Amps	L3 Amps
5/18	80°F	23	120	44	45	48
5/19	74°F	23	110	44	44	48
5/20	72°F	23	110	43	43	47
5/21	74°F	24	115	44.5	46	48.3

Table 1- COMPRESSOR READINGS ON 5/18/87 - 5/21/87

- Added 40 oz. of Steel Shield EPA to the crankcase of the compressor based on an estimated system oil capacity of 5 gallons

Date	Ambient Temperature	Suction Pressure	Discharge Pressure	L1 Amps	L2 Amps	L3 Amps
6/29	76°F	23	115	44	46	46
6/30	76°F	23	115	42	44	44
7/01	78°F	23	118	42	43	44

Table 2- COMPRESSOR READINGS ON 6/29/87-7/1/87

- On the recommendation of George Fennel, the compressor crankcase was drained, and refilled with new 4-GS oil and 16 oz. of Steel Shield EPA

1989 - GEORGIA-PACIFIC CORPORATION

In the morning of 30th June, 1986, Steel Shield EPA was added to a A Fuller 1000 Vane Compressor. After one hour, the operating current dropped from 7.4 amps (normal condition) to 6.4 amps which reduced energy consumption by 14%.

FIGURE 2 - FULLER 1000 VANE COMPRESSOR

TABLE 3 (BELOW) - TEST LOGS ON 6/30/89

Equipment:	Fuller 1000 Vane Compressor	
Details:	No previous heat problems	
Before:	7.4 amps average consumption	
Activity:	6/30/89 7:00 a.m.	Added Steel Shield EPA
	6/30/89 8:00 a.m.	Average consumption 6.4 amps, 14% reduction

1989 - JOHN BEATTY REFRIGERATION & HEATING

CASE 1

System Configurations: a 10 ft x 20 ft walk-in freezer; R-502 refrigerant; using a Copeland MRA-0500 compressor, 3-phase, approx. 14 years old; Box temperature approx. -10°F.

Problem & Solution: "One of two condenser fans had quit. Compressor, in high ambient conditions, locked up. By reversing directions several times, we were able to break compressor loose, but unit was drawing almost full locked-rotor current. Oil level OK. As a what-do-we-have-to-lose, Steel Shield EPA was added directly to the crankcase. Power was applied, and the motor speed picked up as amperage steadily dropped. This was in the summer of 1986 and unite is still functinoing."

FIGURE 3 - COPELAND MRA-0500 COMPRESSOR

CASE 2

System Configurations: Hill 8 ft Frozen Meat case, upright; Copeland LAM-0310, 3-phase, semi-hermetic compressor; R-502 refrigerant; normal case temp. -5°F to -15°F; June 1989.

Problem & Solution: "Service call on case-high case temp. Case iced up. Case de-iced by over-night shut-down. Restarted next day; refrigerant and oil levels checked and adjusted if necessary. Compressor noisy. After 2 days, case still would not pull below +20. On third day, Steel Shield EPA was added to crankcase; nothing else was donw (or could be, short of changing out compressor). Customer reported next day that case was below zero. System continues to operate satisfactorily."

FIGURE 4 - COPELAND LAM-0310 COMPRESSOR

CASE 3

System Configurations: 8 ft Produce case; Copeland KAJ-0100, 1-phase; R-12 refrigerant; Case temp. +35°F to +38°F; March 1989.

Problem & Solution: "Compressor would run for only a few seconds before going out on overload, due to being mechanically "tight". Oil level low, but within specs. Steel Shield EPA added. Again, system operating normally."

FIGURE 5 - COPELAND KAJ-0100 COMPRESSOR

CASE 4

System Configurations: 8 ft x 8 ft walk-in Cooler; R-12 refrigerant; Tecumseh ¾ hp. hermetic, 1-phase; Temperature approx. +35°F; July 1987.

Problem & Solution: "Similar to case 3 above in symptoms, and again, same excellent results: Steel Shield EPA added and system operating normally."

FIGURE 6 - TECUMSEH 3/4 HP COMPRESSOR

CASE 5

System Configurations: 42" Belt-drive exhaust fan, propeller type; 1" pillow block bearings.

Problem & Solution: "Because of constant start-stop cycling, and also because of just marginal design, fanshaft bearings were a constant replacement item, requiring replacement about every 12-15 months. A new set of the same type were installed, then lubricated with Steel Shield - Lithi Shield. Same set are still in use after over 2 years, with no visible sign of wear."

FIGURE 7 - PILLOW BLOCK BEARING

CASE 6

Problem & Solution: "Countless sleeve-bearing fan motors, many locked or very near locked; Steel Shield EPA mixed with 150 vis. refrigeration oil in about a 50/50 ratio, added directly to bearings. At least 75% of all motors treated responded. The customer used this mix in the routine maintenance of motors, as well in new replacements."

FIGURE 8 - SLEEVE BEARINGS

"We could go on (and on!), but this should give you a little idea of how successful Steel Shield has been for the customers in the HVAC service. We have several customers who insist that we add Steel Shield EPA to any equipment they have or add. Almost without exception, they will add and said that they didn't care what Steel Shield costs, just make sure we add it to their unit!"

25. MAJOR CORPORATE CLIENTS

“Your trust is our motivation.”

25A. THE MOST REPUTED CUSTOMERS

UNITED STATES DEPARTMENT OF DEFENSE

- The most advanced army in the world

SIEMENS

- The largest engineering company in Europe

UNION PACIFIC RAILROAD

- The largest railway company in the US
- New York Stock Exchange No.: UNP

DONG JIANG ENVIRONMENT

- A leading provider for wastes management and environmental services in the PRC
- Hong Kong Stock Exchange No.: 895

26. STEEL SHIELD EVENTS

“Practical experience with STEEL SHIELD lubricants.”

26A. RACING EVENTS SPONSORED BY STEEL SHIELD

61ST MACAU GRAND PRIX 2014

ZHUHAI 3 HOURS MOTORCYCLE COMPETITION 2014

60TH MACAU GRAND PRIX 2013

USA RACING EVENTS

26B. STEEL SHIELD REMARKABLE EXHIBITIONS

HONG KONG MOTORCYCLE SHOW 2014

HONG KONG MOTORCYCLE SHOW 2013

GUANGZHOU LUBRICSHOW 2013

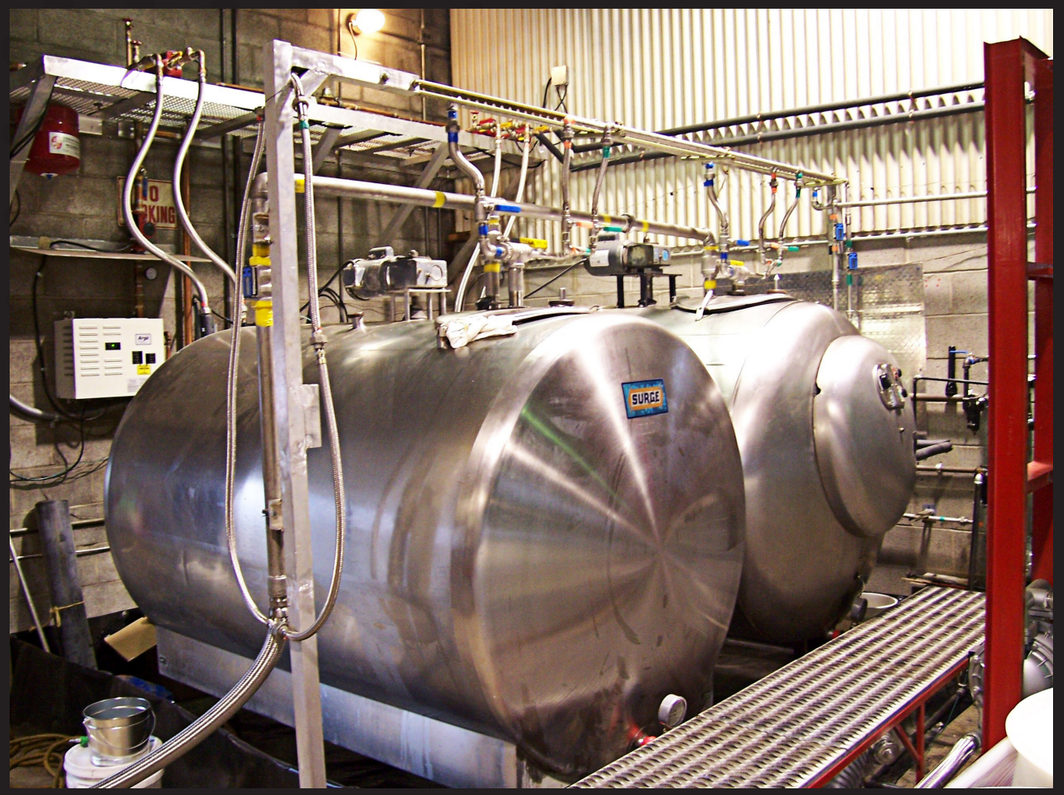
QINGDAO LUBRICANT SHOW 2013

27. STEEL SHIELD OFFICES & FACILITIES

“Consolidated manufacturing plant and management offices enabled STEEL SHIELD to expand the service networks to differenct sectors all over the world.”

27A. STEEL SHIELD TECHNOLOGIES US HEADQUARTER

THE BASE OF ABF TECHNOLOGIES

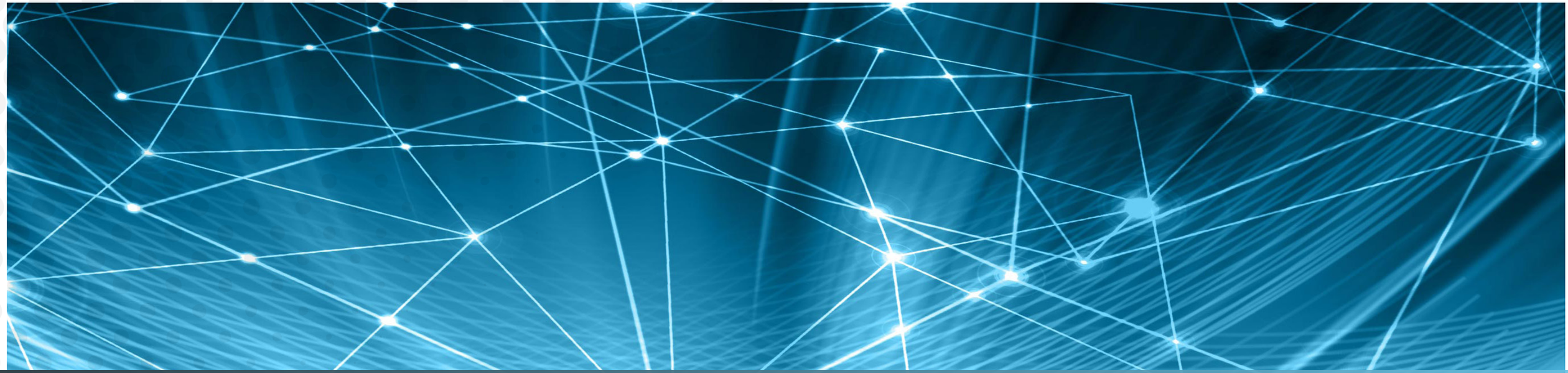


27B. STEEL SHIELD TECHNOLOGIES H.K. OFFICE

HEADQUARTER OF ASIA PACIFIC NETWORK

28. STEEL SHIELD WEBSITE & VIDEOS

“Up-to-Date information and demonstrations are available through mouse clicks.”



STEEL SHIELD VIDEOS PAGE

www.steelshieldtech.com.hk/Media_steel_shield_videos.html

STEEL SHIELD VIDEOS DESCRIPTIONS

STEEL SHIELD TECHNOLOGY INTRODUCTION

- How ABF Technology works?
- What benefits can you gain from Steel Shield?

STEEL SHIELD TECHNOLOGY INTRODUCTION (CHINESE)

- How ABF Technology works?
- What benefits can you gain from Steel Shield?
- Chinese dialogue and subtitles

TIMKEN TEST DEMONSTRATION

- How Steel Shield lubricants defeat other preminum lubricants in the market?
- How ABF Technology dramatically reduce metal wear, maintenance costs and energy?

GUANGDONG SPORT TV INTERVIEW

- Steel Shield being recongized by the Chinese customers and market

STEEL SHIELD MOTORHEAD GARAGE COMMERCIAL

- The original US promotion show introducing Steel Shield products

STEEL SHIELD TECH FULL FEATURE ON MOTORHEAD GARAGE

- The original US video showing how Steel Shield lubricants with ABF Technology enhance engine performance

STEEL SHIELD TECHNOLOGIES

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Not Just Oil... IT'S TECHNOLOGY

HIGH PERFORMANCE IONIC CHARGE