



Steel Shield Technologies

Serving the Industry since 1985

ABF Technology Enlightens the World of Lubrication

We do & fix what others can't!



100% Made In USA

Mass Transit
& Railroad System
Application



World's 1st Ionic Maglev Lubrication Technology

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.

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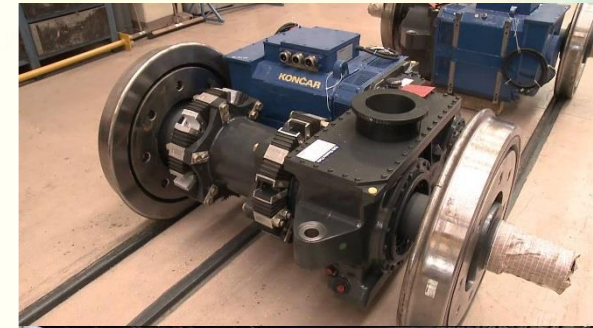
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1. THE CORPORATION & FACILITIES

Steel Shield Technologies Inc. (SST) 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 for motor racing and industrial applications invented the unique ABF Formula – a New Technology in lubrications. Since then Dr. Fennell has been quickly earning his fame in the lubricants society and the product has become a must for the combat units of the US Armed Forces. SST is the only lubricant product in the World to guarantee firearms of any kind free from clogging barrels, feeds and magazines.

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 was incorporated in 2012 in Hong Kong and is the official representative of Steel Shield Technologies (USA) to provide distribution and technical support for the entire Asia-Pacific Rim.



About Us



2. 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”.

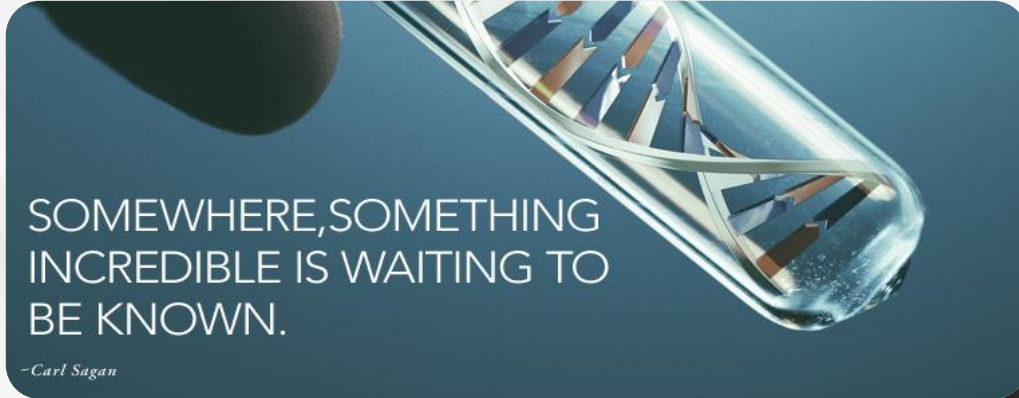
On the basis of ABF technology, a series of specialty lubricants have been developed to meet the stringent requirements of various purposes and working conditions, as to date is still the most advanced formula in lubrication.

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.



3. THE BIRTH OF STEEL SHIELD TECHNOLOGY

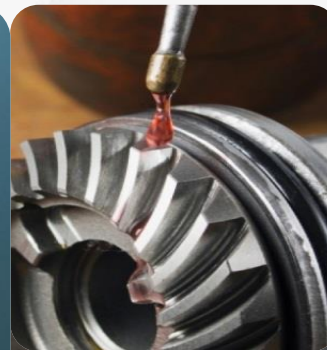
- During World War II, the German Science and Technology Research Institute was commissioned to develop a new lubricant technology in meeting the stringent demand for heavy duty military application such as artillery, armored vehicles, tanks, battleships and fighter-aircrafts to avail them in performing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



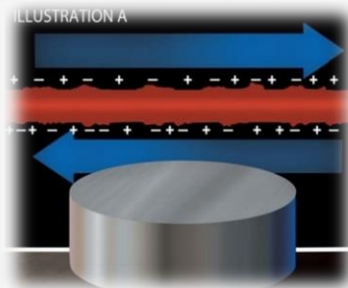
SOMEWHERE, SOMETHING
INCREDIBLE IS WAITING TO
BE KNOWN.

-Carl Sagan

Steel Shield —
Bio-Organo Lubrication Technology



TREATED
ABF Technology
Protects from Wear



Technological Paper 1. ABOUT ABF TECHNOLOGY

BOUNDARY FILM LUBRICATION THROUGH ADVANCED HALOGENATION TECHNIQUES: OXIRANE ACID SCAVENGING AND ORGANO-METALLIC SUBSTITUTION By GEORGE C. FENNEL

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:

$$F_s = SAr$$

Where F_s 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:

$$f_s = S \cdot Ar / W = S / Pp \text{ or } S / Pe$$

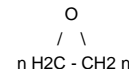
The boundary film shear resistance, S , is assumed equal to the plastic flow shear stress, T_p , of an ideal elastic, plastic solid. Such a solid gives shear stress independent of strain and strain rate at strains sufficiently large enough to cause plastic flow. The conditions that produce the "glass 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, $S = T_p$ in the previous equation and the friction coefficient is T_p/Pp or T_p/Pe . Since T_p 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.

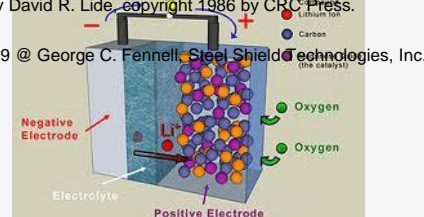
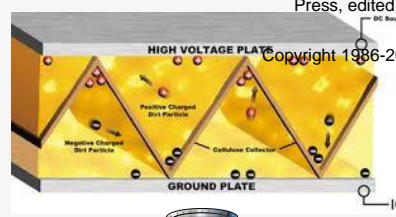
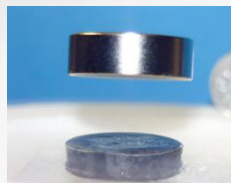
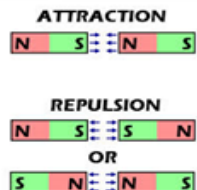
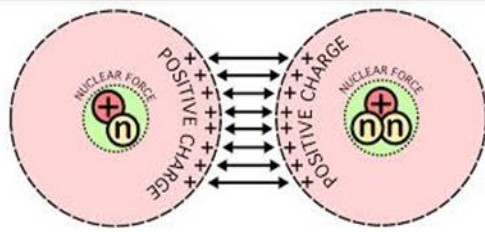
The process is very similar or analogous to the saponification of organo-metallic compounds in the manufacturing of greases. During this reaction or saponification, compounds react at a certain catalytic temperature and exchange characteristic components to form new compounds. These new chemical compounds 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 organo-metallic derivatives while Lewis acids and protonic reagents initiate cationic reactions.



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

References:

1. 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.
2. "Organic Chemistry" 4th Edition, by Robert Morrison, Ph.D. and Robert Boyd, Ph.D., copyright 1983 by Allen & Bacon.
3. "Lubrication - A Tribology Handbook", edited by M.J. Neale OBE, BSc(Eng), published by Society of Automotive Engineers (SAE), copyright 1993, Butterworth-Heinemann, Ltd.
4. CRC "Handbook Of Chemistry and Physics", 1986 Edition, by CRC Press, edited by David R. Lide, copyright 1986 by CRC Press.



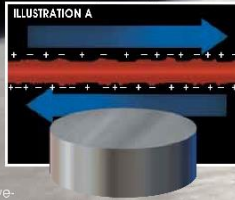
5. HOW ABF WORKS

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.

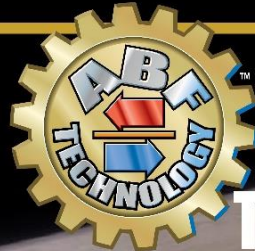
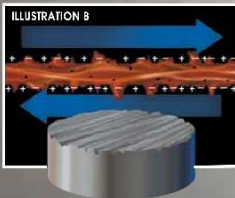
Metal Against Metal

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.



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.

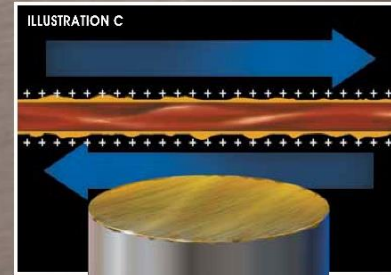


Advanced Boundary Film Technology- There Is No Better Protection Against Wear.

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



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."



6. MAJOR BREAKTHROUGHS IN LUBRICATION TECHNOLOGY

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

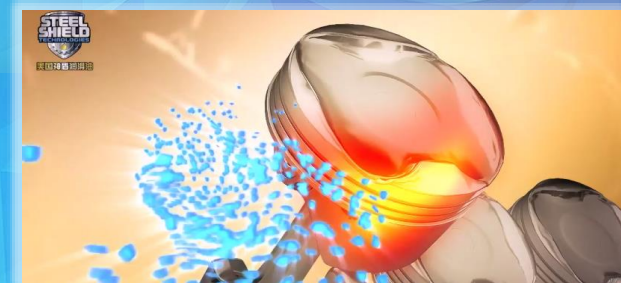
Metal sludge repelled via induction and removed

4. Metal Surface Re-hardening

From Shear Friction to Surface Lapping

5. Eliminate System Dysfunction

Not Just Oil, It's Technology



7. RCB IONIC BOND TRANSFER

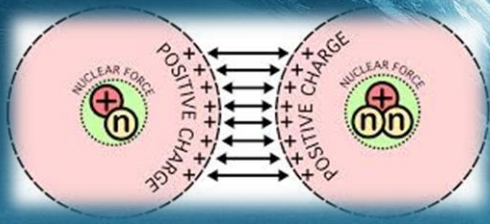


Metal Surface Positively Charged

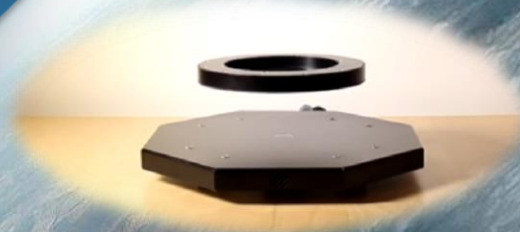
Metals Repel Each Other

Magnetic Levitation

Near Zero Friction



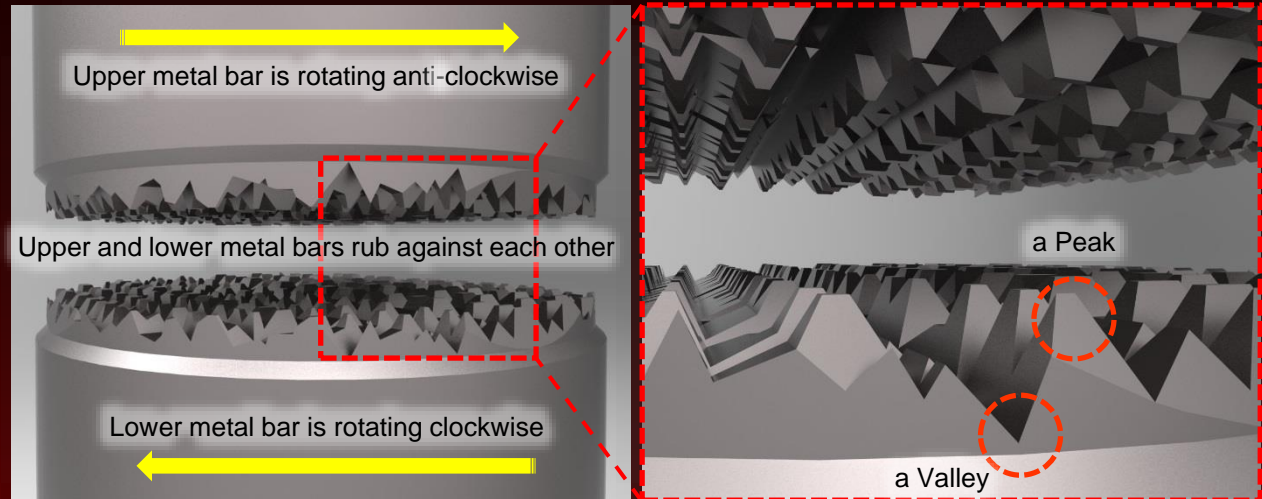
Positively Charged Metal Surface Repel Each Other



8. ABF TECHNOLOGY DETAILED EXPLANATIONS

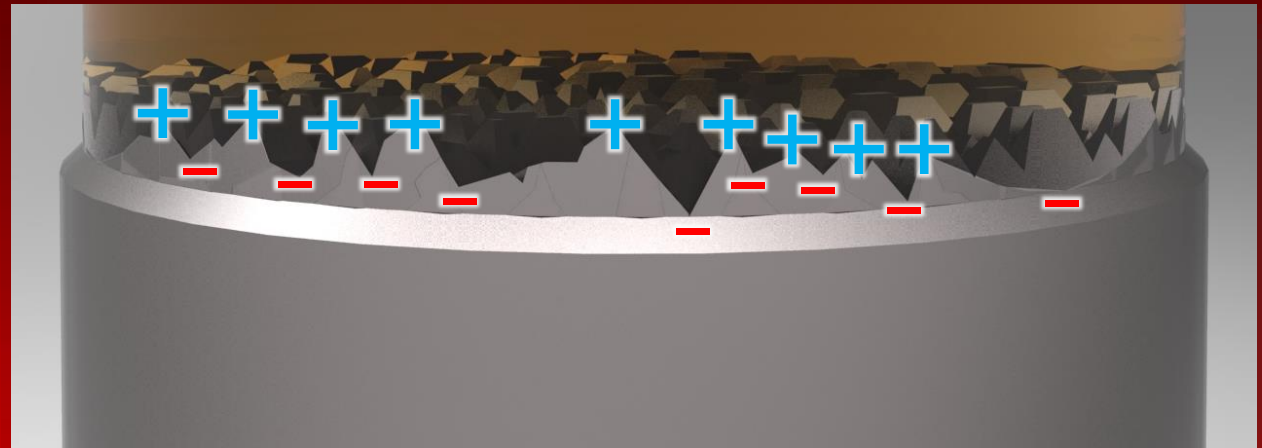
1. Metal Surface

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

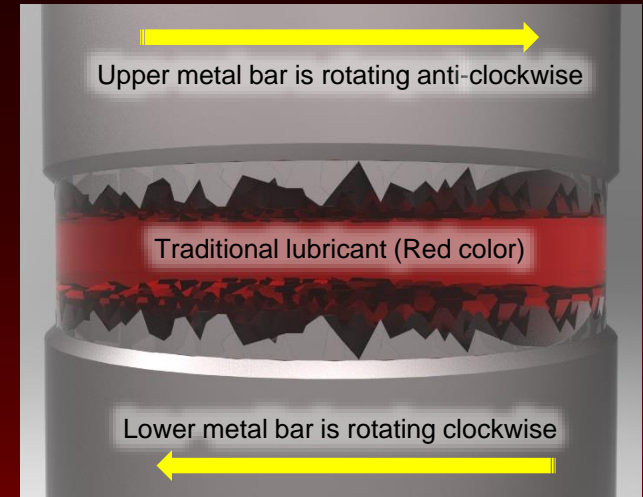
Peaks are positively charged and **Valleys** are negatively charged



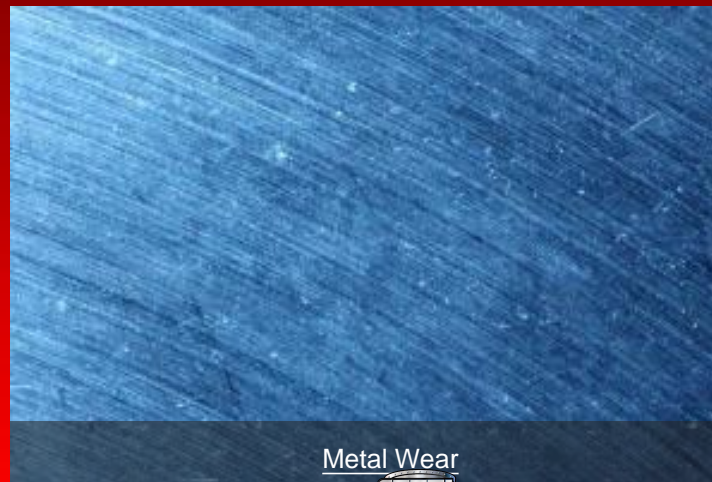
8. ABF TECHNOLOGY DETAILED EXPLANATIONS

3. Traditional Lubricants

- Traditional lubricants help slow the process of heat and friction to some degree.
- When 2 metal surface contact each other and move in opposite directions, friction is caused, producing heat & metal deterioration.
- Constant friction & electromagnetic interaction causes the weakened metal to break off creating metallic debris & particles in the lubricants



Lubricant additives damage metal surface



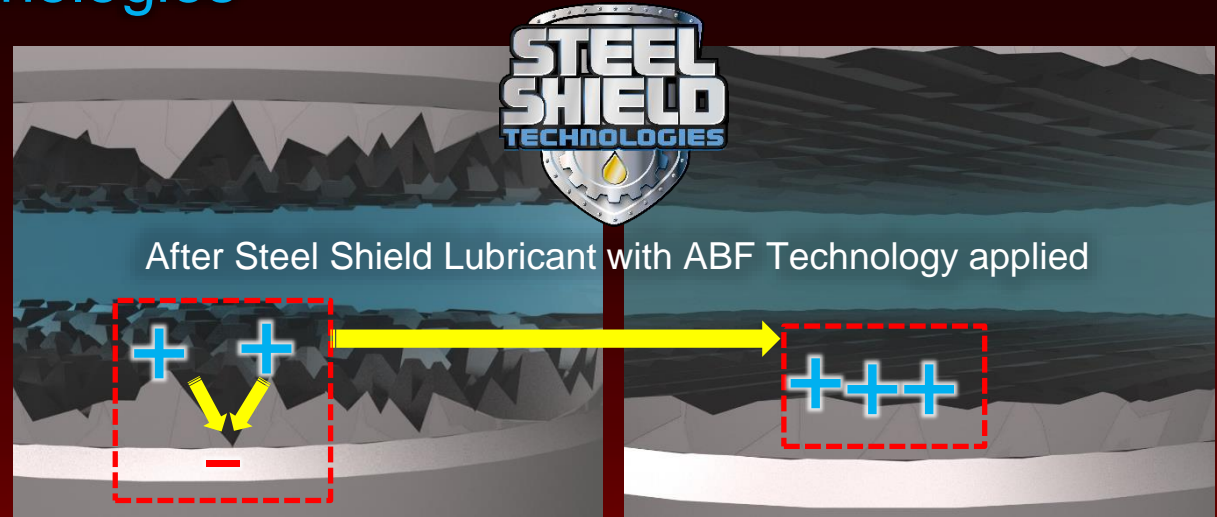
Metal Wear



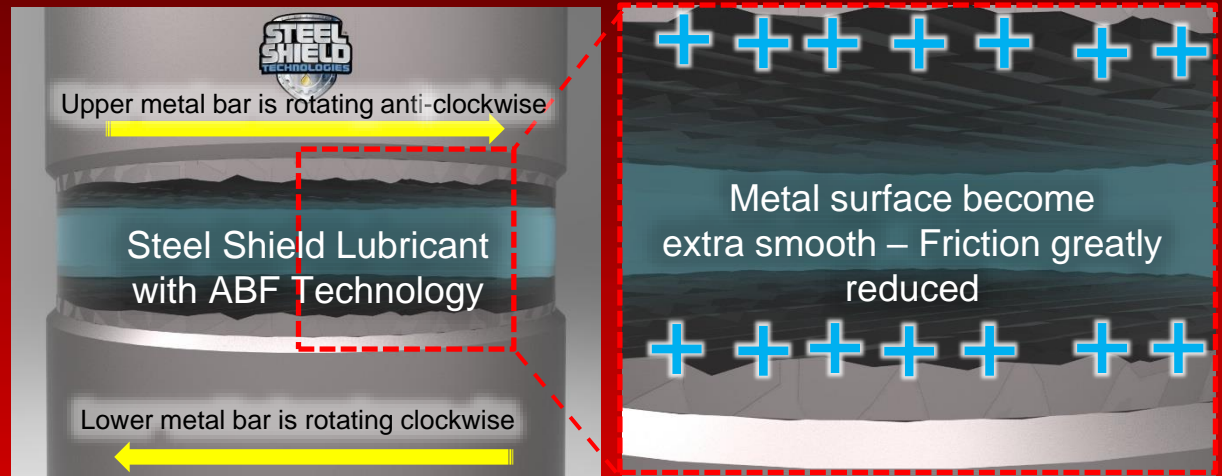
8. ABF TECHNOLOGY DETAILED EXPLANATIONS

4. Steel Shield Technologies

- Forms electro-negative surface attaching compounds to seek out & affix themselves to lower surface areas filling the micro-pores & fissures
- Asperities roll out or flatten creating greatly improved metal surfaces



- Created in this process is a total positive state of polarity
- When metal surface become uniform in charge, there is a reduction in friction due to Faraday reaction of like-charges



8. ABF TECHNOLOGY DETAILED EXPLANATIONS

5. Advanced boundary Film of Steel Shield

- Advanced methods of tribology that improve lubricity and load carrying capacity
- Reacts chemically under thermal conditions with the contacting metal surfaces to form a complex surface-attaching film of protection
- Surface smoothing is accomplished resulting in improved spread characteristics of the surfaces themselves
- Increases fluid film strength resulting in greatly reduced wear while imparting extreme pressure properties (EP)



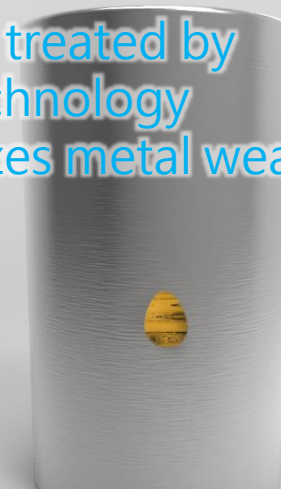
Roller bearing

Untreated metal surface causes huge wear



Roller bearing uses traditional lubricant

Surface treated by ABF Technology minimizes metal wear



Roller bearing uses Steel Shield



WIN



9. ADVANTAGES & TARGETED INDUSTRIES

CONCEPT

- Van der Waals Forces
- Dipole-Dipole Surface Reactions

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

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



10. SPECIALTY PRODUCT LINES



www.steelshieldtech.com.hk
www.facebook.com/steelshieldtech



11. PRODUCTS

Marine Shield



Lithi Shield



Rail Shield



Steel Shield EPA



Strike Shield



Spray Shield

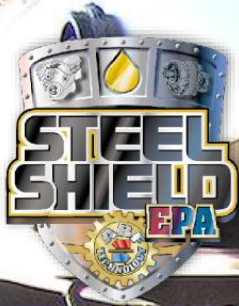


Tool Shield



Drill & Tap Shield



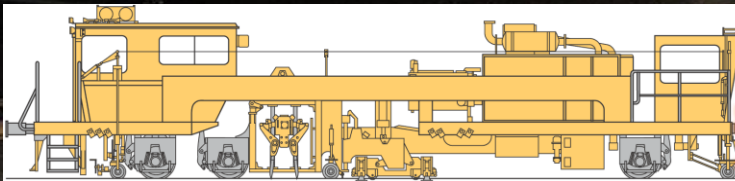


12. STEEL SHIELD EPA

LOCOMOTIVE REBUILDING & MAINTENANCE:

STEEL SHIELD Extreme Pressure Anti-Wear (EPA)™ in traction motor split journal bearings:

Actual usage by Conrail (over a seven-year period) and Union Pacific (over a three-year period) in the rebuilding of these journal bearings show that Steel Shield EPA reduces lubricant-related failures to nearly zero. This process has been so successful that STEEL SHIELD EPA has been added to the standard maintenance requirements for both major railroad systems. STEEL SHIELD EPA is also added to the end-caps of the Hyatt Roller bearing, producing analogous results in wear and failure



MAINTENANCE of WAY (Railway and Track Maintenance):

When used in the hydraulic fluids of the CATs (Continuous Action Tamperers), STEEL SHIELD EPA reduces wear and increases operational pressures.

It also reduces wear and increases operational pressures when added to the hydraulic fluids of front-end loaders and heavy equipment hydraulics.

STEEL SHIELD EPA has proven to reduce failures and downtime, along with increasing mileage and equipment life, when used as a supplement to the engine, transmission and differential oils of fleet vehicles.

WHEEL MOUNTING:

STEEL SHIELD EPA is added to the wheel mounting machine's hydraulics in a 1 oz per quart ratio. It causes more effective pressures, along with an increased lubricity to the pump, valves and solenoids. Apply to axle, shaft & bearing will make the wheel mounting work easy and smooth.





13. RAIL EQUIPMENT SHIELD

MSDS DATA

- Flash Point: 226°C
- Non-hazardous
- Non-flammable
- Synthetic Hydrocarbons

PHYSICAL DATA

- Boiling Point: 238°C
- Insoluble in water
- Evaporation rate: < 0.01
- Vapor pressure: < 1 @25°C
- Specific gravity: 1.07
- Medium to dark amber

PERFORMANCE DATA

- Reduce Wear
- Improves oil flow
- Increases horsepower
- Reduces maintenance & downtime
- Reduces costly repairs
- Increases parts life
- Smoother operations
- Reduces metal debris in oil
- Reduces operating temperatures
- Reduces chain & roller stretching
- Increased train velocity
- Reduces friction

APPLICATION DIRECTIONS

- Vehicle engines like natural gas, diesels: Add 16:1 Rail Equipment Shield
- Large or old vehicle engines: Add 32:1 Rail Equipment Shield
- Automatic transmission: Add 32:1 Rail Equipment Shield
- Manual transmission, differential system: Add 10 ~ 16:1 Rail Equipment Shield

ITEM NO.	ITEM DESCRIPTIONS	CASE PACK
RES-MT-16	Rail Equipment Shield – 16 Oz (473 ml)	12 / Case
RES-MT-128	Rail Equipment Shield – 1 Gallon (3.785 L)	4 / Case
RES-MT-5G	Rail Equipment Shield – 5 Gallon (18.93 L)	
RES-MT-55G	Rail Equipment Shield – 55 Gallon (208 L)	
RES-MT-300G	Rail Equipment Shield – 300 Gallon (1135 L)	

Rail Shield being transported to operating parts



Reduce friction, lower temperature and prevent oxidation of metal

Reduce operation and maintenance costs; Increase train speed and minimize delays

Achieve highly smooth, durable and reduced noise operations

LOCOMOTIVE REBUILDING & MAINTENANCE:

RAIL EQUIPMENT SHIELD™ Traction Motor Gear Case Additive™ :

Usage of RAIL EQUIPMENT SHIELD in traction motor gear cases increases gear life significantly while cooling the overall system and affecting an extreme-pressure boundary film that protects against wear and gear damage. We have been told that **even in the case of lubricant loss, when RAIL EQUIPMENT SHIELD was present, no gear failure or appreciable damage occurred.**





14. TOOL SHIELD

MSDS DATA

- Flash Point: 226°C
- Non-hazardous
- Non-flammable
- Synthetic Hydrocarbons

PHYSICAL DATA

- Boiling point: 238°C
- Insoluble in water
- Evaporation rate: < 0.01
- Vapor pressure: < 1 @25°C
- Specific gravity: 1.07
- Medium to dark amber

RECOMMENDED USES

- Rotary-type air tools
- Air cutting tools
- Piston-types air tools
- Air grinders
- Impact wrenches
- Air nailers
- Air ratchets
- Air staplers
- Air sanders
- Automatic oilers
- Air drills
- Hand tools

APPLICATION DIRECTIONS

- Use in accordance with tool manufacturers' 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.

Greatly increase the metal surface hardness

Reduce friction, lower temperature, prevent oxidation of metal

Increase efficiencies of tools;
Reduced maintenance cost

Achieve highly smooth, durable and silence operations



TOOL SHIELD™ is the ultimate protection for the moving metal parts for automotive and industrial tools. It protects moving metal parts from heat, friction & wear due to boundary conditions of frictional abrasion, extreme pressure torque, air line moisture and internal dirt. **It works in all piston and rotary type 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.

ITEM NO.	ITEM UPC#	ITEM DESCRIPTIONS	CASE PACK	CASE DIMENSIONS (W x H x D)	CASE CUBE	CASE WEIGHT	TI / HI
TS-1	8-94630-00141-0	Tool Shield – 1 oz. (29.5 mL)	24	6.875"X 3.875"X 4.625"	0.07 inch ³	2.5 lb	48 / 12
TS-4	8-94630-00143-4	Tool Shield – 4 oz. (118 mL)	12	5.5"X 6.5"X 7.125"	0.16 inch ³	3.8 lb	40 / 8
TS-16	8-94630-00144-1	Tool Shield – 16 oz. (473 mL)	12	10.75 X 10.75 X 8	0.54 inch ³	15 lb	20 / 5
TS-128	8-94630-00145-8	Tool Shield – 1 Gallon (3.785 L)	4	9.25 X 12.5 X 14.5	0.97 inch ³	34 lb	12 / 4
TS-5G	8-94630-00126-7	Tool Shield – 5 Gallon (18.93 L)	1			42 lb	
TS-15G	8-94630-00127-4	Tool Shield – 1 Gallon (56.78 L)	1			125 lb	
TS-55G	8-94630-00128-1	Tool Shield – 1 Gallon (208 L)	1			455 lb	



PRODUCT SPECIFICATIONS

- NLGI Grade: No. 2
- Anti-wear metal treatment: Steel Shield

ASTM TESTS

• D-217	Penetration, Worked, 60s	265 - 295
• D-217	Penetration, Unworked	265 - 295
• D128	Thickener Type	Lithium Complex
	Thickener, %	8 - 11
	Color	Light Amber
	Texture	Smooth
• D-2265	Dropping point	500°F
• D-445	Viscosity @ 40°F, cst	220
• D-445	Viscosity @ 100°F, cst	19
• D-2270	Viscosity Index	95
• D-92	Flash Point, °F	464
• D-92	Fire Point, °F	550
• D-2509	Timken OK load (lbs.)	60
• D-1743	Rust	Pass
• D-4048	Copper Corrosion	1B
• D-2266	4-Ball Wear Test, mm	0.68
• D-2596	4-Ball EP Weld Test, Kg Min.	800 / Pass
• D-5483	Oxidation Induction time @210°C, min	11.47
• D-1264	Water washout @ 79°C	2.7 %
	Mobility at 77°F, g/min	576
	Mobility at 60°F, g/min	275.4
• US Steel Mobility Test	Mobility at 40°F, g/min	86.6
	Mobility at 20°F, g/min	15.3
	Mobility at 0°F, g/min	1.6



5. LITHI SHIELD (NLGI #2)

Greatly increase the metal surface hardness

Reduce friction, temperature, prevent oxidation of metal

Reduce operation and maintenance costs

Achieve highly smooth, durable and silence operations



LOCOMOTIVE REBUILDING & MAINTENANCE:

LITHI-SHIELD™ in Traction Motor Support (roller) Bearings:

In newer style traction motor support bearings of the roller bearing type, LITHI-SHIELD surpasses the previously used greases in reliability, heat endurance and wear prevention.

LITHI-SHIELD™ in Traction Motor Armature Bearings:

The use of LITHI-SHIELD in the armature bearings of the locomotive power plant generators has reduced failures and wear significantly.

RECOMMENDED USED

- All extreme pressure applications
- Universal joints
- Rotating machinery
- Heavy equipment
- Railroad equipment
- Boat trailers and marine applications
- Conveyors
- Bearings
- Chassis fittings
- Pumps
- CV joints
- Axies

ITEM NO.	ITEM UPC#	ITEM DESCRIPTIONS	CASE PACK	CASE DIMENSIONS (W x H x D)	CASE CUBE	CASE WEIGHT	TI / HI
LS-T	8-94630-00181-6	Lithi-Shield Lithium Complex Grease – 59.14 mL/Case	24	9.25"X 6.5"X 4.75"	0.16 inch ³	1.9 lb	40 / 8
LS-C	8-94630-00182-3	Lithi-Shield Lithium Complex Grease – 414 mL/Case	40	12"X 10.75"X 19.5"	1.45 inch ³	42 lb	6 / 5
LS-LB	8-94630-00183-0	Lithi-Shield Lithium Complex Grease – 473 mL/Case	12	13.5"X 6.25"X 3.5"	0.17 inch ³	15.2 lb	36 / 8
LS-5LB	8-94630-00184-7	Lithi-Shield Lithium Complex Grease – 2.365 L/Case	4	14.125"X 6.75"X 9.5"	0.53 inch ³	23.4 lb	12 / 8
LS-P	8-94630-00185-4	Lithi-Shield Lithium Complex Grease – 16.5 L/Case	1			38 lb	
LS-K	8-94630-00186-1	Lithi-Shield Lithium Complex Grease – 56.8 L/Case	1			132 lb	
LS-D	8-94630-00187-8	Lithi-Shield Lithium Complex Grease – 189 L/Case	1			437 lb	



PRODUCT SPECIFICATIONS



16. Reel Shield Grease (NLGI #1)

• NLGI Grade: No. 1 • Anti-wear metal treatment: Steel Shield

ASTM TESTS

• D-217	Penetration, Worked, 60s	310 - 340
• D-217	Penetration, Unworked	310 - 340
	Thickener Type	Lithium Complex
• D128	Thickener, %	6 - 8
	Color	Light Amber
	Texture	Smooth
• D-2265	Dropping point	500°F
• D-445	Viscosity @ 40°F, cst	220
• D-445	Viscosity @ 100°F, cst	19
• D-2270	Viscosity Index	95
• D-92	Flash Point, °F	464
• D-92	Fire Point, °F	550
• D-2509	Timken OK load (lbs.)	60+
• D-1743	Rust	Pass
• D-4048	Copper Corrosion	1B
• D-2266	4-Ball Wear Test, mm	0.7
• D-2596	4-Ball EP Weld Test, Kg Min.	800 / Pass
• D-5483	Oxidation Induction time @180°C, min	95
• D-1264	Water washout @ 79°C	2.7 %
	Mobility at 77°F, g/min	
• US Steel	Mobility at 60°F, g/min	515
Mobility	Mobility at 40°F, g/min	257.1
Test	Mobility at 20°F, g/min	78.9
	Mobility at 0°F, g/min	5.4

RECOMMENDED USED

- Smoother Reel Operation
- Extends Reel Life
- Protects Against Corrosion
- Longer Conventional Casts
- Extends Life Of Fishing Pliers, Tools
- And Equipment

Greatly increase the metal surface hardness

Reduce friction, temperature, prevent oxidation of metal



Reduce operation and maintenance costs

Achieve highly smooth, durable and silence operations

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

ITEM NO.	ITEM UPC#	ITEM DESCRIPTIONS	CASE PACK	CASE DIMENSIONS (W x H x D)	CASE CUBE	CASE WEIGHT	TI / HI
LS-T		Reel Shield Lithium Complex Grease – 59.14 mL/Case	24	9.25"X 6.5"X 4.75"	0.16 inch³	1.9 lb	40 / 8
LS-C		Reel Shield Lithium Complex Grease – 414 mL/Case	40	12"X 10.75"X 19.5"	1.45 inch³	42 lb	6 / 5
LS-LB		Reel Shield Lithium Complex Grease – 473 mL/Case	12	13.5"X 6.25"X 3.5"	0.17 inch³	15.2 lb	36 / 8
LS-5LB		Reel Shield Lithium Complex Grease – 2.365 L/Case	4	14.125"X 6.75"X 9.5"	0.53 inch³	23.4 lb	12 / 8
LS-P		Reel Shield Lithium Complex Grease – 16.5 L/Case	1			38 lb	
LS-K		Reel Shield Lithium Complex Grease – 56.8 L/Case	1			132 lb	
LS-D		Reel Shield Lithium Complex Grease – 189 L/Case	1			437 lb	



17. Lithi Shield & Reel Shield Grease Compatibility Chart

	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
Barium 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
Calcium 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.





18. STRIKE SHIELD

MSDS DATA

- Flash point: 61°C PMCC (Pensky –Martens closed-cup test)
- Non-hazardous
- Combustible
- Synthetic hydrocarbons
- Do not store or expose above 61°C
- Do not spray near sparks or open flames
- If swallowed, do not induce vomiting and call a physician immediately
- In case of contact with eyes, flush thoroughly with water for 15 minutes
- Avoid breathing of vapor and prolonged contact with skin
- Contains petroleum aliphatic hydrocarbons

PHYSICAL DATA

- Boiling point: 186 - 201°C
- Evaporation rate: < 0.01
- Specific gravity: 1.02
- Insoluble in water
- Vapor pressure: < 1 @25°C
- Light to dark amber

RECOMMENDED USED

- Frozen or scaled nuts and bolts
- Sticky locks
- Squeaky hinges
- Sliding doors
- Linkages
- Shafts
- Bushings
- Sliding parts and mechanisms

APPLICATION DIRECTIONS

- Apply Strike Shield on surfaces that require penetrating and lubricating oil. Reapplication may be necessary on extremely rusted and corroded conditions.
- When used on electrical systems, make sure electrical system is not live or energized.



STRIKE SHIELD™ is the ultimate penetrant to rapidly pierce rusted and corroded metal surfaces using a distinctive spreading action to break loose 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.

It leaves a unique layer of film on surfaces that prevents 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**

ITEM NO.	ITEM UPC#	ITEM DESCRIPTIONS	CASE PACK	CASE DIMENSIONS (W x H x D)	CASE CUBE	CASE WEIGHT	TI/HI
STKS-4WS	8-94630-00104-5	Strike Shield – 4 oz. (118 mL)	12	6.625"X 7"X 5"	4 inch ³	0.13 lb	56 / 7
STKS-16WS	8-94630-00105-2	Strike Shield – 16 oz. (473 mL)	12	10.125"X 10"X 7.625"	14 inch ³	0.44 lb	20 / 5
STKS-128	8-94630-00109-0	Strike Shield – 1 Gallon (3.785 mL)	4	15.625"X 11.875"X 8.125"	33.5 inch ³	0.17 lb	12 / 4
STKS-5G		Strike Shield – 5 Gallon (18.93 L)	1		42.5 inch ³		
STKS-15G		Strike Shield – 15 Gallon (56.78 L)	1		126.5 inch ³		
STKS-55G		Strike Shield – 55 Gallon (208 L)	1		461 inch ³		



19. SPRAY SHIELD

MSDS DATA

- Flash Point: 226°C
- Non-hazardous
- Non-flammable
- Synthetic Hydrocarbons

PHYSICAL DATA

- Boiling point: 238°C
- Insoluble in water
- Evaporation rate: < 0.01
- Vapor pressure: < 1 @25°C
- Specific gravity: 1.07
- Medium to dark amber

RECOMMENDED USES

- Metal mechanisms
- Steel cables
- Metal-to-metal surfaces
- Couplings
- Chain drives
- Linkages
- Drag lines
- Wheels
- Bushings
- Augers
- Pulleys
- Rusty nuts & bolts
- Hinges
- Any automotive, industrial or commercial areas of lubrication that require an external heavy-duty spray lubricant for accessible and hard-to-reach areas
- Tools
- Sleeve bearings
- Open gears

APPLICATION DIRECTIONS

- Apply Spray Shield to surfaces requiring lubrication. Reapplication may be necessary for extremely rusted or corroded situations.
- Contains NO volatiles or solvents.
- Contains synthetic hydrocarbons and advanced chemical additive technology.
- Non-toxic and environmentally friendly.



LOCOMOTIVE REBUILDING & MAINTENANCE:

SPRAY SHIELD™ is the ultimate multi-purpose lubricant that also penetrates metal surfaces while maintaining highest qualities in corrosive and extreme humidity environments. It 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.

ITEM NO.	ITEM UPC#	ITEM DESCRIPTIONS	CASE PACK	CASE DIMENSIONS (W x H x D)	CASE CUBE	CASE WEIGHT	T/H I
SS-1	8-94630-00146-5	Spray Shield – 1 oz. (29.5 mL)	24	6.875" X 3.875" X 4.625"	0.07 inch ³	2.5 lb	48 / 12
SS-4	8-94630-00148-9	Spray Shield – 4 oz. (118 mL)	12	5.5" X 7" X 7.125"	0.16 inch ³	3.8 lb	40 / 8
SS-16	8-94630-00149-6	Spray Shield – 16 oz. (473 mL)	12	10.75" X 10.75" X 8"	0.54 inch ³	15 lb	20 / 5
SS-128	8-94630-00150-2	Spray Shield – 1 Gallon (3.785 L)	4	9.25" X 12.5" X 14.5"	0.97 inch ³	34 lb	12 / 4
SS-5G	8-94630-00129-8	Spray Shield – 5 Gallon (18.93 L)	1			42 lb	
SS-15G	8-94630-00130-4	Spray Shield – 15 Gallon (56.78 L)	1			125 lb	
SS-55G	8-94630-00150-2	Spray Shield – 55 Gallon (208 L)	1			455 lb	



20. DRILL & TAP SHIELD



MSDS DATA

- Flash Point: 226°C
- Non-hazardous
- Non-flammable
- Synthetic Hydrocarbons

PHYSICAL DATA

- Boiling point: 238°C
- Insoluble in water
- Evaporation rate: < 0.01
- Vapor pressure: < 1 @25°C
- Specific gravity: 1.07
- Medium to dark amber

RECOMMENDED USES

- Direct cutting lube / coolant
- Milling
- Additive to improve performance of insoluble oils
- CNC
- Drilling
- Broaching
- Taping
- Sharpening
- Machining
- Wet grinding
- Cutting

APPLICATION DIRECTIONS

- Drill & Tap Shield™ can be used as a direct replacement for currently used cutting fluids and lubrication / coolants in a 100% undiluted application.
- NOTE: Drill & Tap Shield™ is not compatible with water glycol compounds or triphenol butylated phosphate oils.
- Contains NO volatiles or solvents.
- Contains synthetic hydrocarbons and advanced chemical additive technology. Non-toxic and environmentally friendly.



LOCOMOTIVE REBUILDING & MAINTENANCE:

DRILL & TAP SHIELD™ in Axle Grinder / Finisher – Axle-End Thread Tapping:

When used as the lubricant / coolant for axle grinding and finishing machines, DRILL & TAP SHIELD will provide improved final finishes of the axles to well within specified tolerances, which in some cases, were unachievable otherwise.

ITEM NO.	ITEM UPC#	ITEM DESCRIPTIONS	CASE PACK	CASE DIMENSIONS (W x H x D)	CASE CUBE	CASE WEIGHT	TI/HI
DTS-1	8-94630-00171-7	Drill & Tap Shield – 1 oz. (29.5 mL)	24	6.875"X 3.875"X 4.625"	0.07 inch ³	2.5 lb	48 / 12
DTS-4	8-94630-00172-4	Drill & Tap Shield – 4 oz. (118 mL)	12	5.5"X 7"X 7.125"	0.16 inch ³	3.8 lb	40 / 8
DTS-16	8-94630-00173-1	Drill & Tap Shield – 16 oz. (473 mL)	12	10.75"X 10.75"X 8"	0.54 inch ³	15 lb	20 / 5
DTS-128	8-94630-00174-8	Drill & Tap Shield – 1 Gallon (3.785 L)	4	9.25"X 12.5"X 14.5"	0.97 inch ³	34 lb	12 / 4
DTS-5G	8-94630-00175-5	Drill & Tap Shield – 5 Gallon (18.93 L)	1			42 lb	
DTS-15G	8-94630-00176-2	Drill & Tap Shield – 15 Gallon (56.78 L)	1			125 lb	
DTS-55G	8-94630-00177-9	Drill & Tap Shield – 55 Gallon (208 L)	1			455 lb	

21. STEEL SHIELD PRODUCT COMPATIBILITY

- ▶ In order to help you further understand and determine compatibility issues, we are publishing this three-part test to assist you in determining if oils or fluids are compatible with Steel Shield EPA (SST EPA) and other Steel Shield (SST) products while in the field. Doing these three steps can identify a compatibility issue within 95% accuracy.
- ▶ First: Examine the material safety data sheet for the oil to which the SST EPA is to be added. Look for key words in Section 2, Hazardous Ingredients/Identity Information, which may indicate either product compatibility or incompatibility. Standard petroleum oils are usually referred to as “severely hydrotreated naphthenes” or “paraffinic base stocks”. Other key words are “contains mineral oil” or “synthetic hydrocarbons”. All of these oils have the characteristics of petroleum oil and are compatible with SST products.
- ▶ Key words such as “alky-(compound), alkynol, glycol, alkanolamine, esters, mono esters, polyol or amines” are direct indications of additives and base fluids that are NOT compatible with SST products. For these chemicals, we will provide special SST products that is compatible but only upon request.
- ▶ Second: A good test for compatibility is to mix equal amounts of the base oil in question and SST products. After both are thoroughly blended, allow the mixture to stand for 10 to 15 minutes. If no separation occurs, the likelihood of compatibility is very good. An occurrence of a radical separation indicates the oils are incompatible, and do not mix properly because of chemical differences.
- ▶ Third: After the test above is completed to your satisfaction, the final phase is to perform a lubricity test. Run the base oil in question first to determine its lubricity and load carrying characteristics. Then, mix a proper ratio of SST product with the base oil and run the mixture on the Falex machine. Note the result. If a full-scale reading can be achieved without grinding or damaging the bearing, then you can safely assume the oil and SST product are compatible. However, if only a slight to moderate increase in lubricity can be achieved over the base oil by itself, it must be assumed that there is something present that is inhibiting the formation of the boundary film, which would indicate the base oil and SST product are NOT compatible.
- ▶ When these steps are followed, compatibility issues can be solved in nearly every situation. However, if you have followed through with these steps and still are not able to make a definite decision on compatibility, please do not hesitate to contact our Technical Department to research and verify compatibility issues.

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22. STEEL SHIELD EPA COMPATIBILITY

Item	Base Oil	Compatible with SST-EPA ?	SST Product to Use
1	Petroleum, Mineral Oil	• Yes	• SST-EPA
2	SHC (Synthetic Hydrocarbon) A. Alkylated Aromatics B. Olefin Oligomers e.g. Amsoil, Mobil 1, Castrol Syntec	• Yes	• SST-EPA
3	Halogenated Hydrocarbons A. Chlorotrifluoroethylene, Polytetrafluoroethylene, (PTFE). e.g. Insoluble cutting oil, radiation resistant oil, some heavy duty gear oil, load carrying oils.	• Yes	• SST-EPA
4	Glycol Synthetic Esters A. Alkanolamines B. Polyol Glycols e.g. Fire proof hydraulic fluids, cutting fluids, R-134A Refrigerant Oils, etc.	• No	• On Request
5	Organic Ester Synthetics A. VME - Vegetable Methyl Ester e.g. Some food grade oils, specialty biodegradable oils	• No	• On Request
6	Phosphate Esters A. Triphenol Butylated Phosphate B. Trisecyl Phosphate C. Tricresyl Phosphate e.g. Turbine Oils	• No	• On Request
7	Silicone Oils A. Methyl Silicone B. Phenyl Methyl Silicone C. Silicate Ester/Disiloxane	• No	• None
8	Synthetic Ether A. Polyphenyl Ether B. Chlorinated Diphenyl Ether C. Perfluorinated polyether	• No	• On Request

Keywords to look for on MSDS or Product Description/Technical Sheets

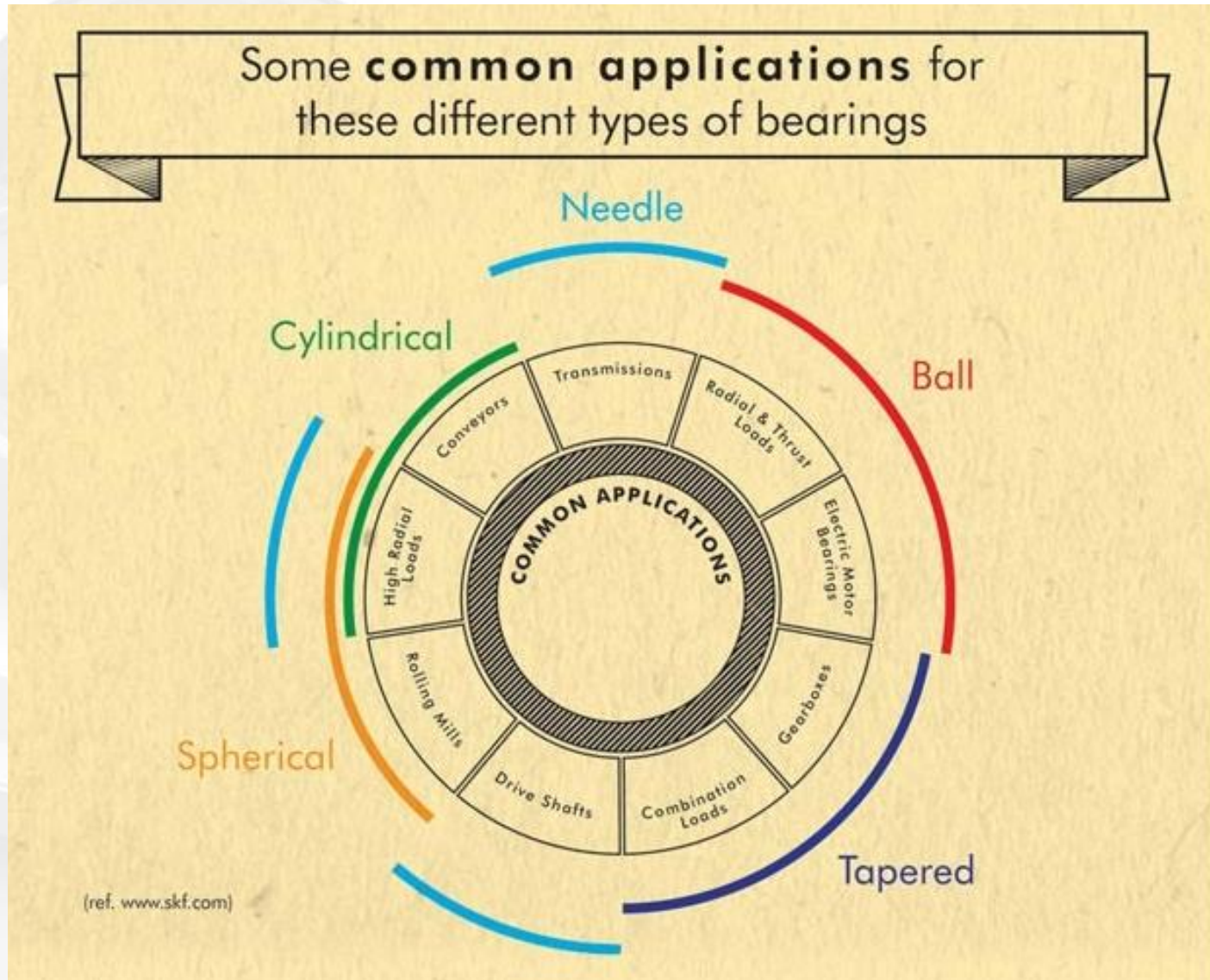
"Glycol" "Alkanolamine"
"Ether" "Ester"
"Phosphate" "VME" "Phenyl/Phenol"
"Silicate"
"Boron Oxide *"

• Boron Oxide is a common additive to Alkanolamine cutting fluids.

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23. GREASE APPLICATIONS OF BEARINGS



23. GREASE APPLICATIONS OF BEARINGS

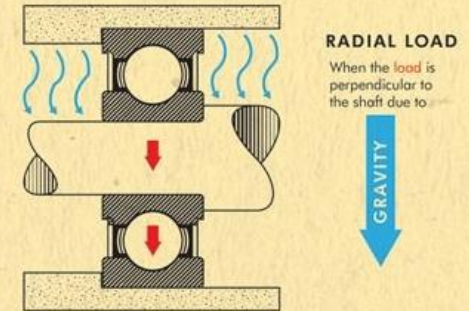
Remember, bearing type affects **grease life**.

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

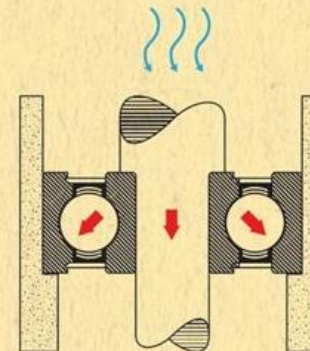
BEARING TYPE	RELATIVE TYPE OF GREASE
Deep-groove, single-row ball bearing	1
Angular contact, single-row ball bearing	0.625
Self-aligning ball bearing	0.77 - 0.625
Thrust ball bearing	0.2 - 0.17
Cylindrical, single-row roller bearing	0.625 - 0.43
Needle roller bearing	0.3
Tapered roller bearing	0.25
Spherical roller bearing	0.14 - 0.08

(ref. Booser, Bloch, ML)

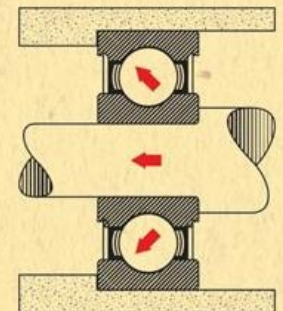
Bearings also work under different kinds of **loads**.



..... AXIAL OR THRUST LOAD (When the load is parallel to the shaft)



Axial load in a vertical pump or electric motor due to gravity



Axial load in a horizontal pump

(ref. www.skf.com)

23. GREASE APPLICATIONS OF BEARINGS

HOW TO CHOOSE THE RIGHT GREASE?

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.

Base Oil Viscosity

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:

$$DN = (\text{rpm}) \times (\text{bearing bore})$$

$$NDm = \text{rpm} \times ((\text{bearing bore} + \text{outside diameter}) / 2)$$

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.

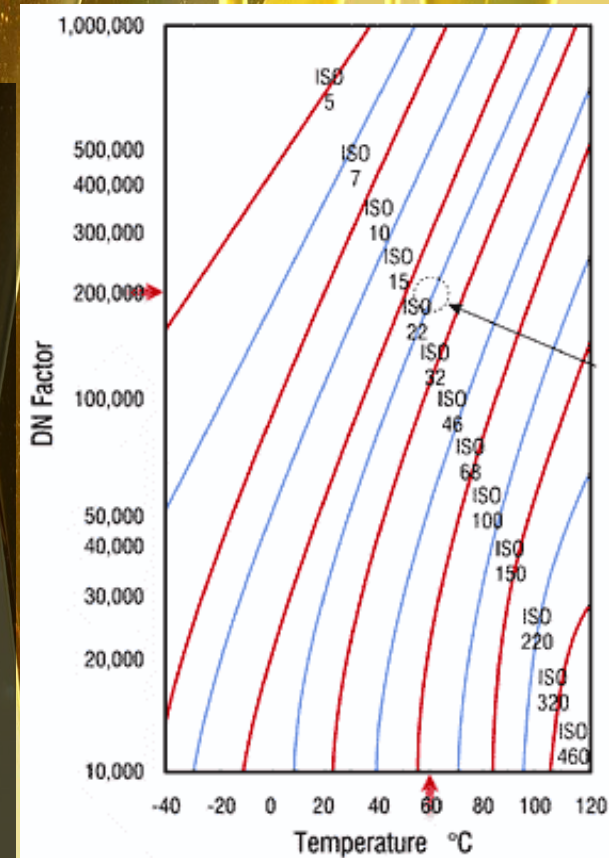


Figure 1

23. GREASE APPLICATIONS OF BEARINGS

HOW TO CHOOSE THE RIGHT GREASE?

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.

Additives and Base Oil Type

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

23. GREASE APPLICATIONS OF BEARINGS

HOW TO CHOOSE THE RIGHT GREASE?

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)	NLGI No.*
-30 to 100°F	0 - 75,000	1
	75,00 - 150,000	2
	150,000 - 300,000	2
0 to 150°F	0 - 75,000	2
	75,00 - 150,000	2
	150,000 - 300,000	3
100 to 275°F	0 - 75,000	2
	75,00 - 150,000	3
	150,000 - 300,000	3

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

23. GREASE APPLICATIONS OF BEARINGS

HOW TO CHOOSE THE RIGHT GREASE?

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.



24. STEEL SHIELD APPLICATIONS IN RAILWAY SYSTEMS

GENERAL LOCATIONS OF THE RAILWAY APPLICATIONS

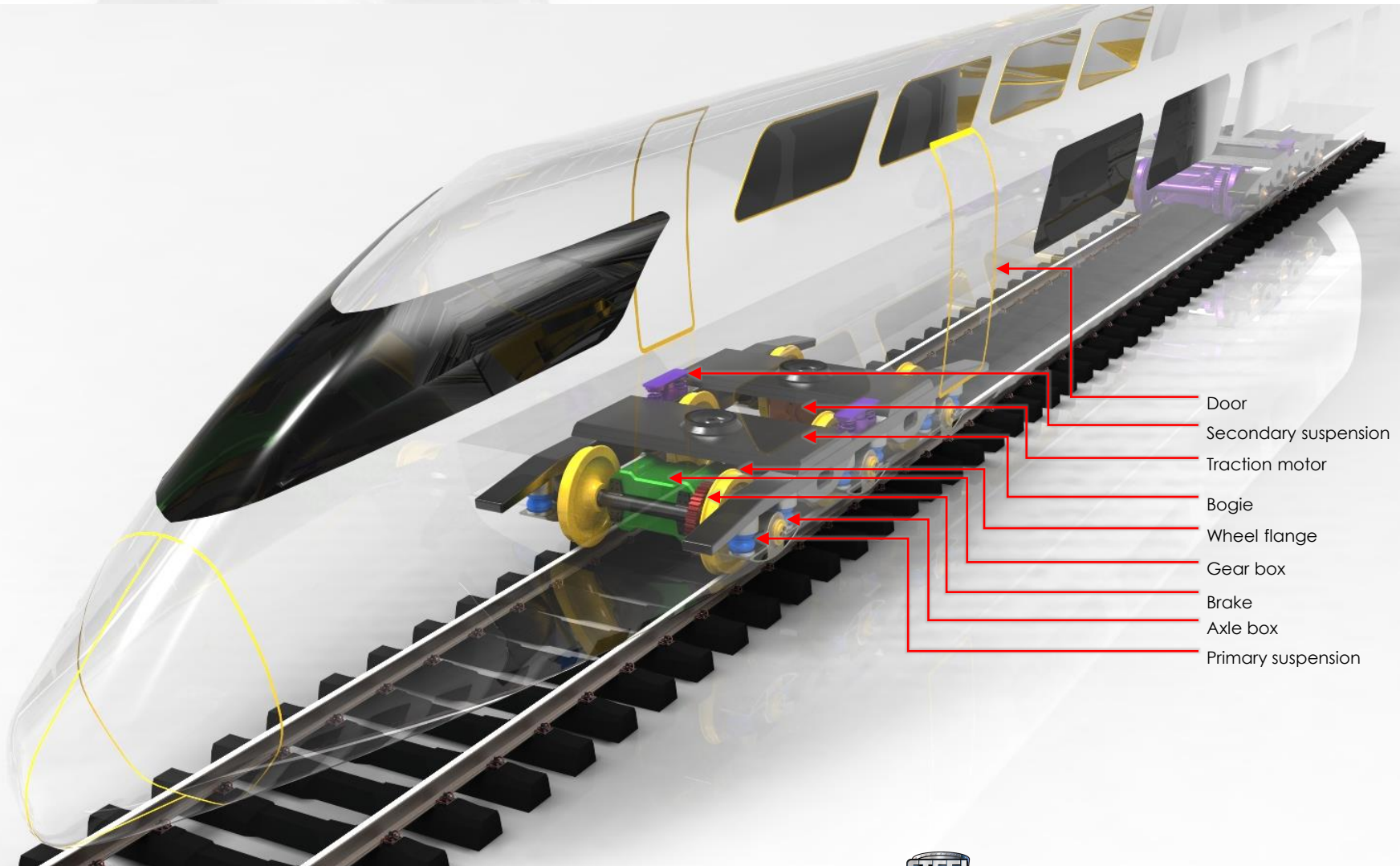
Steel Shield is Suitable for All Types of Trains



24. STEEL SHIELD APPLICATIONS IN RAILWAY SYSTEMS

GENERAL LOCATIONS OF THE RAILWAY APPLICATIONS

Steel Shield General Application Locations



24. STEEL SHIELD APPLICATIONS IN RAILWAY SYSTEMS

GENERAL LOCATIONS OF THE RAILWAY APPLICATIONS

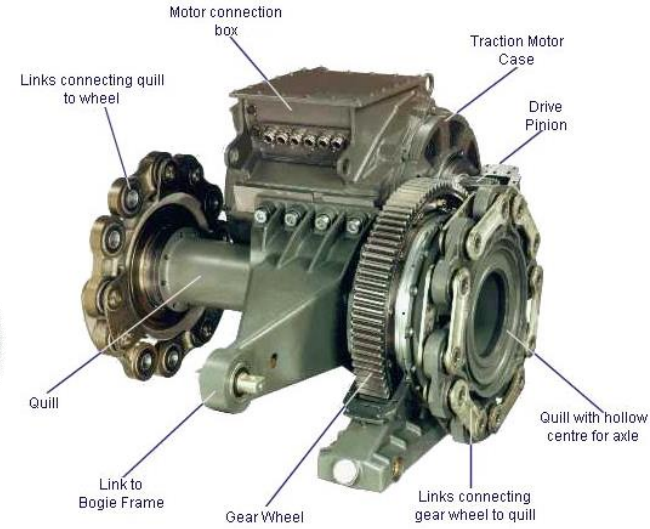
The Drive System



All Types of Traction Motor



Wheelset Gear Box System



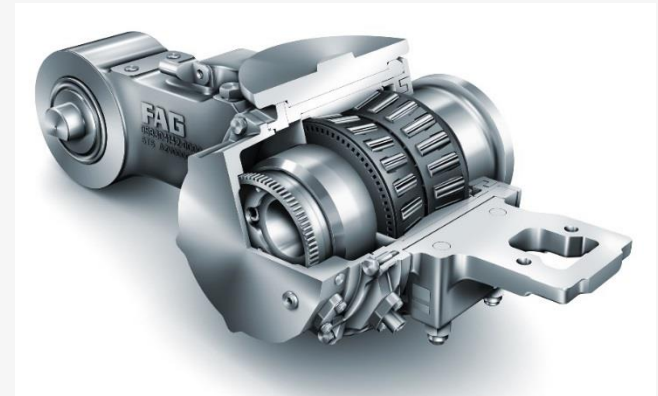
Adtranz Quill Drive System for Austrian Locomotive
All Types of Coupling Systems



Universal Joints



Brake Systems

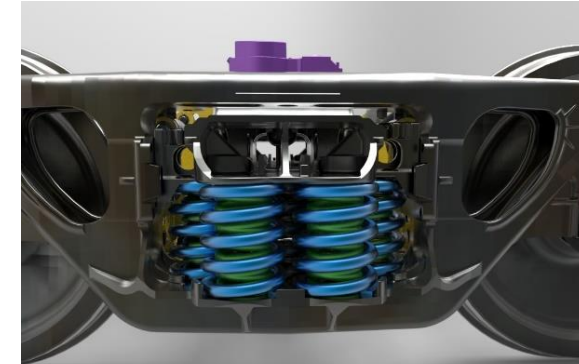
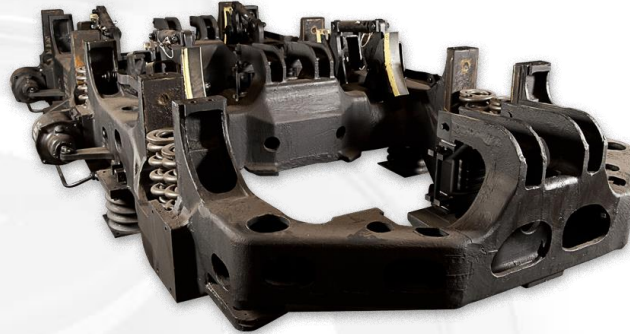
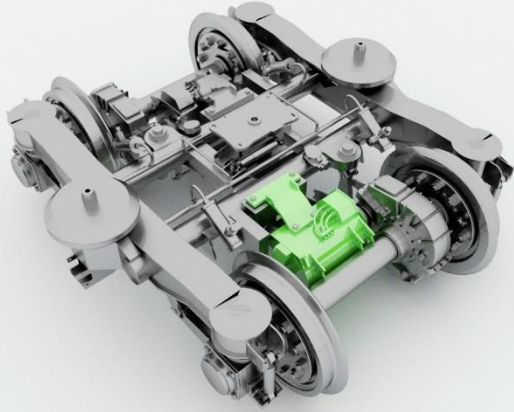


Wheelset Axle Boxes

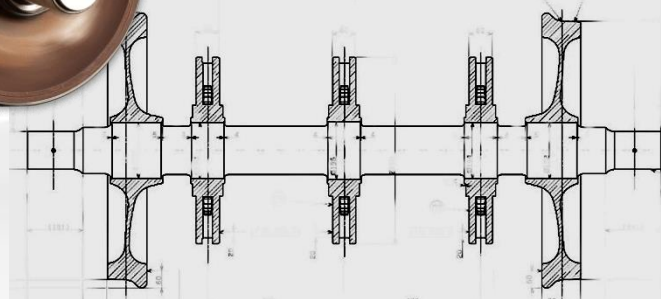
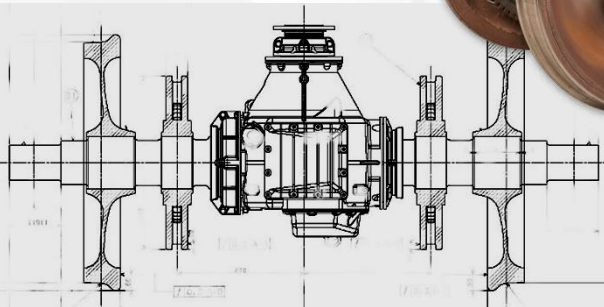
24. STEEL SHIELD APPLICATIONS IN RAILWAY SYSTEMS

GENERAL LOCATIONS OF THE RAILWAY APPLICATIONS

The Bogie System



All Types of Bogies

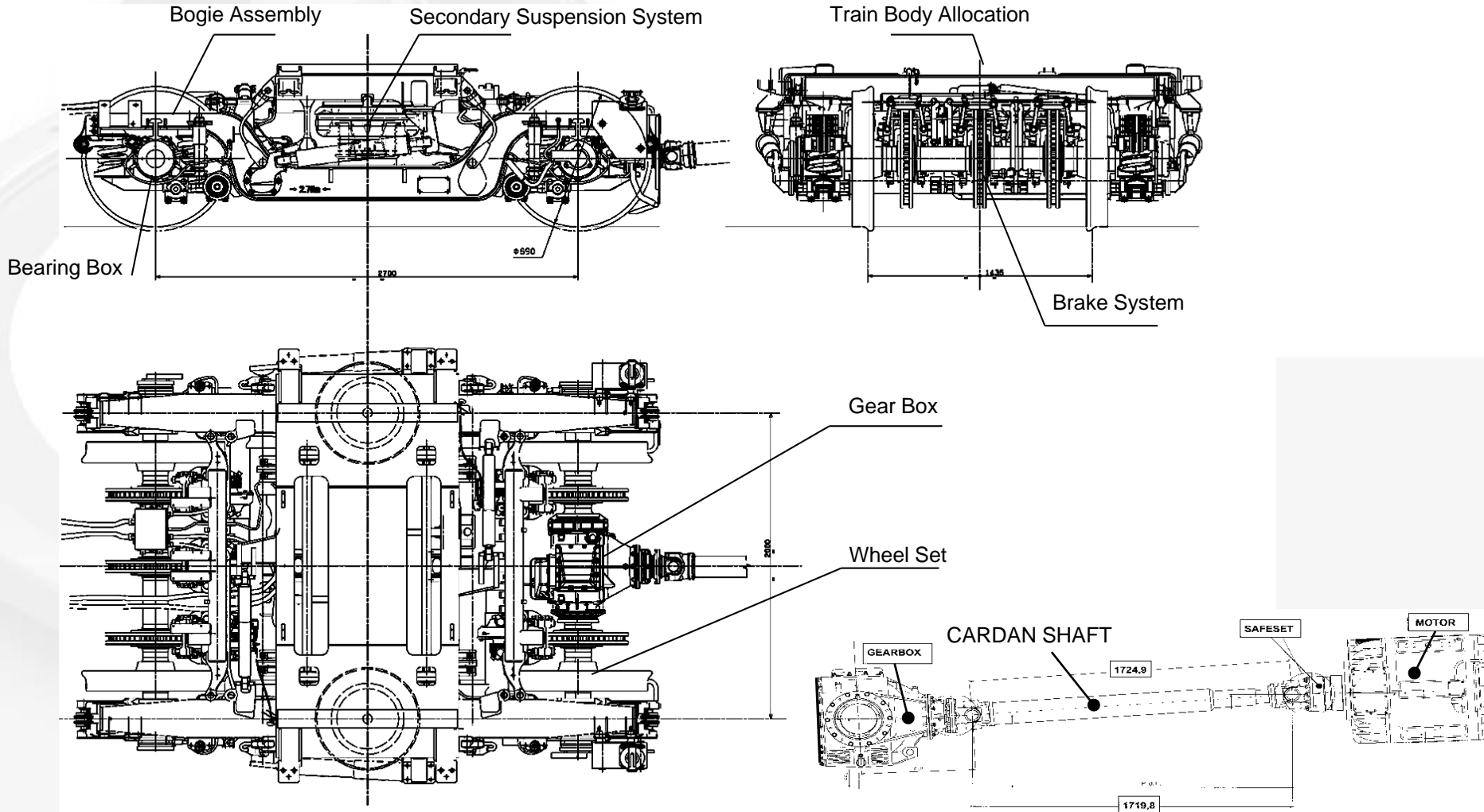


Wheelsets with Traction Motor (Left) and Without Traction Motor (Right)

24. STEEL SHIELD APPLICATIONS IN RAILWAY SYSTEMS

GENERAL LOCATIONS OF THE RAILWAY APPLICATIONS

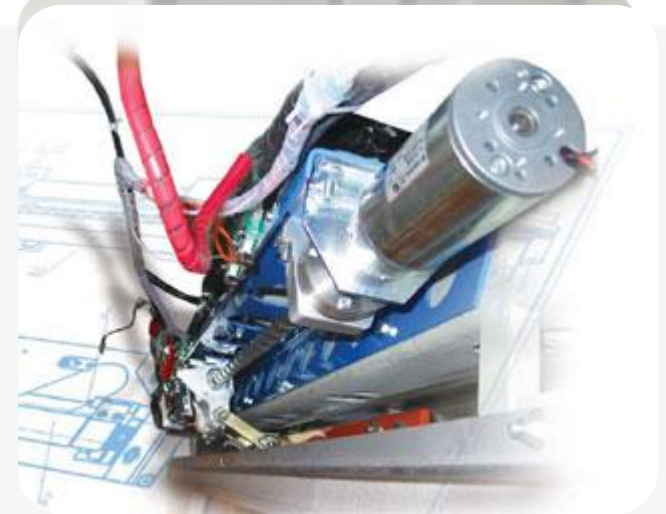
The Bogie System



24. STEEL SHIELD APPLICATIONS IN RAILWAY SYSTEMS

GENERAL LOCATIONS OF THE RAILWAY APPLICATIONS

The Door System

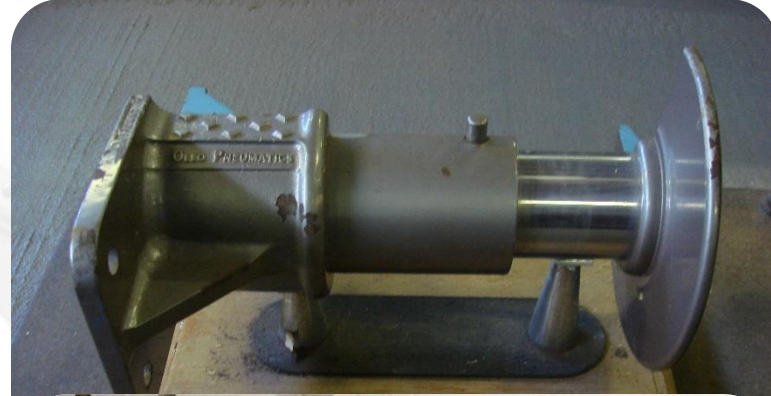


Both Pneumatic Type and Screw Type Systems

24. STEEL SHIELD APPLICATIONS IN RAILWAY SYSTEMS

GENERAL LOCATIONS OF THE RAILWAY APPLICATIONS

Railway Buffer Heads



24. STEEL SHIELD APPLICATIONS IN RAILWAY SYSTEMS

GENERAL LOCATIONS OF THE RAILWAY APPLICATIONS

Railway Couplings

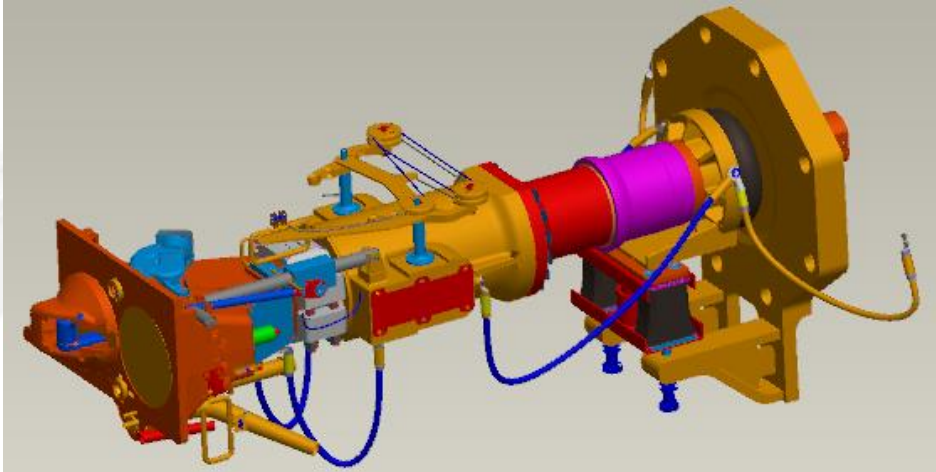


Automatic Couplings and Screw Couplings

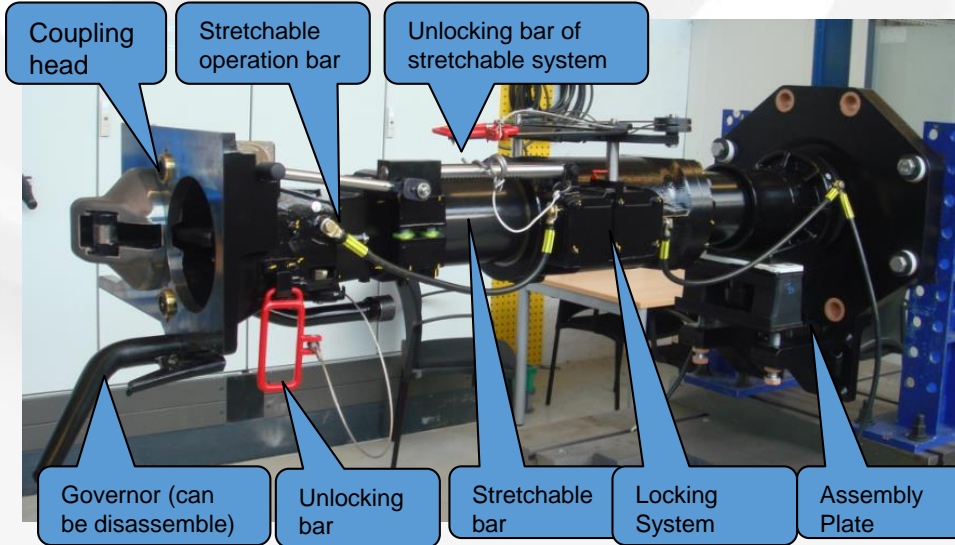
24. STEEL SHIELD APPLICATIONS IN RAILWAY SYSTEMS

GENERAL LOCATIONS OF THE RAILWAY APPLICATIONS

Railway Couplings



Semi-Automatic Coupling System



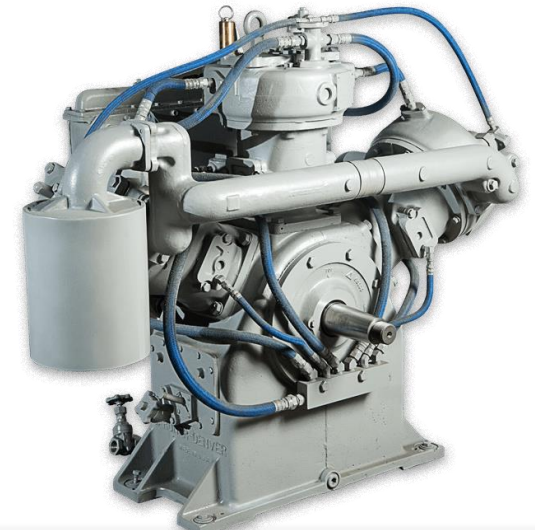
24. STEEL SHIELD APPLICATIONS IN RAILWAY SYSTEMS

GENERAL LOCATIONS OF THE RAILWAY APPLICATIONS

Railway Air Compressor Systems



Air compressor with white pipes going to and from it



Water Cooled Air Compressor



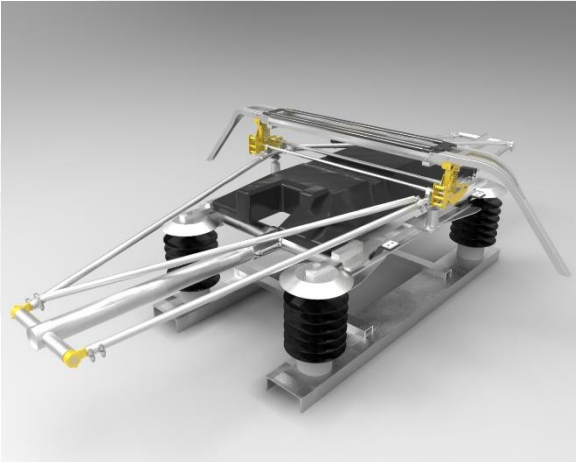
Oil-injected Screw Compressor



24. STEEL SHIELD APPLICATIONS IN RAILWAY SYSTEMS

GENERAL LOCATIONS OF THE RAILWAY APPLICATIONS

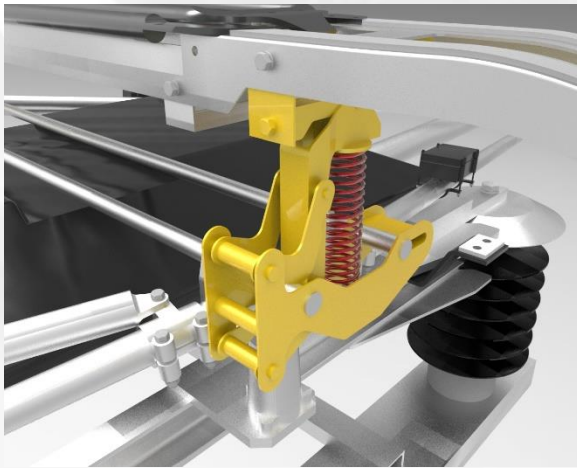
The Power System



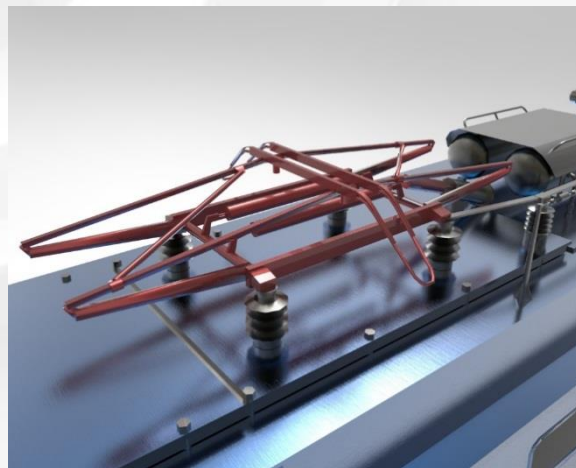
Pantograph (movable joints in yellow)



Pantograph



Movable joints with spring system of a pantograph



Pantograph on train (red)

24. STEEL SHIELD APPLICATIONS IN RAILWAY SYSTEMS

GENERAL LOCATIONS OF THE RAILWAY APPLICATIONS

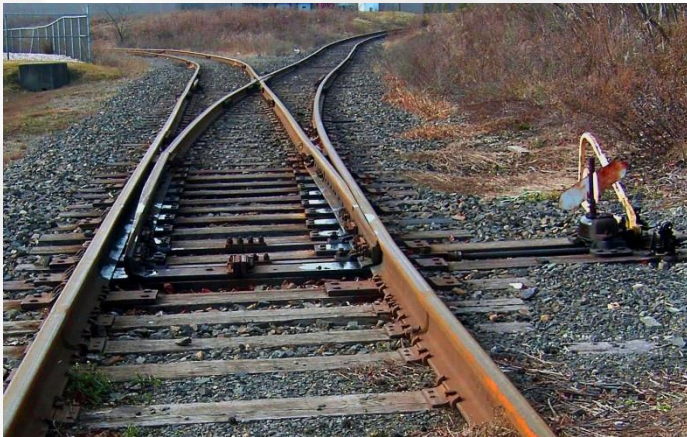
Infrastructures



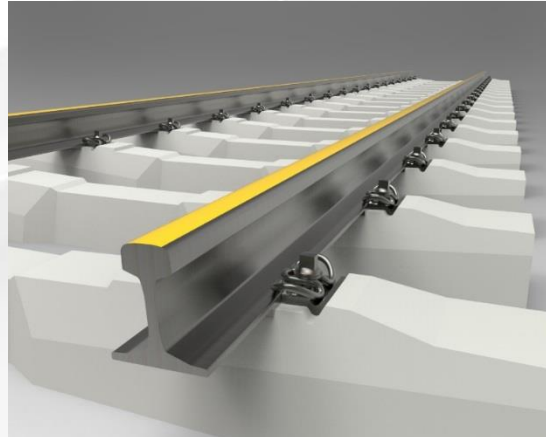
Switch blades and crossings



Switch system



Switch system



Rail head (yellow)

24. STEEL SHIELD APPLICATIONS IN RAILWAY SYSTEMS

UNION PACIFIC RAILROAD EMD AND GE TRACTION MOTOR LUBRICATIONS (ONLY SHOWS PROCEDURES INVOLVED LUBRICATIONS)

PART 1: Approved Lubricants for Locomotives

COMPRESSO Air-Compressor Low Ash 0.5 Oil



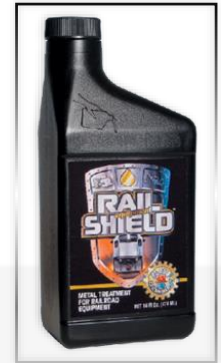
ABF-ECI M7 Energy 15W40



Lithi Shield



Rail Shield



ABF-Lite E3 Doza 15W40



Steel Shield EPA



Strike Shield



Tool Shield



24. STEEL SHIELD APPLICATIONS IN RAILWAY SYSTEMS

UNION PACIFIC RAILROAD EMD AND GE TRACTION MOTOR LUBRICATIONS (ONLY SHOWS PROCEDURES INVOLVED LUBRICATIONS)

PART 1: Approved Lubricants for Locomotives

ELECTRICAL APPARATUS

NO.	PART	STEEL SHIELD LUBRICANT
1	Traction Motor Gear Case All Applications	Rail Shield
	Traction Motor Armature Bearings	Lithi Shield
2	EMD Alternator and Generator Bearings	Lithi Shield
	Auxiliary Generator Bearings, GE	Lithi Shield
	Exciter Bearings, GE	Lithi Shield
	Motor Bearings (Except Traction Motors)	Lithi Shield
3	Reverser Segments (Rotary)	Lithi Shield
	Controller Cams, Segment Fingers	Lithi Shield
4	Alternator or Generator Gear Train Sump, GE	ABF-ECI M7 Energy 15W40 ABF-Lite E3 Doza 15W40
5	Controller Bearings	SST-ECI AP COMPRESSO Air-Compressor Low Ash 0.5 Oil
6	Dynamic Brake Motor, Fan End Bearing	Lithi Shield
7	Dynamic Brake Motor, Commutator End Bearing	Lithi Shield
8	Traction Motor Roller Type Support Bearings	Lithi Shield
9	Traction Motor Support Bearings	Lithi Shield
10	Vibration Mount Accelerometer Interface	Lithi Shield



STEEL SHIELD
LUBRICANTS FOR UPR

DIESEL ENGINE

NO.	PART	STEEL SHIELD LUBRICANT
1	Crankcase	ABF-ECI M7 Energy 15W40 ABF-Lite E3 Doza 15W40
2	Engine Governor	ABF-ECI M7 Energy 15W40 ABF-Lite E3 Doza 15W40
3	Control Linkage, GE Crankcase Exhauster Bearings	Lithi Shield Lithi Shield
4	EMD Power Assembly Pilot Diameters	Lithi Shield

AIR COMPRESSOR AND AIR BRAKE

NO.	PART	STEEL SHIELD LUBRICANT
1	Gardner Denver and All WABCO Air Compressors	SST-ECI AP COMPRESSO Air-Compressor Low Ash 0.5 Oil
2	Air Compressor Flexible Drive Coupling (GE Only)	Lithi Shield

24. STEEL SHIELD APPLICATIONS IN RAILWAY SYSTEMS

UNION PACIFIC RAILROAD EMD AND GE TRACTION MOTOR LUBRICATIONS (ONLY SHOWS PROCEDURES INVOLVED LUBRICATIONS)

PART 1: Approved Lubricants for Locomotives

LOCOMOTIVE CAR BODY		
NO.	PART	STEEL SHIELD LUBRICANT
1	Cooling Fan Gear Case	ABF-ECI M7 Energy 15W40 ABF-Lite E3 Doza 15W40
	Panel Bath Engine Air Filters	ABF-ECI M7 Energy 15W40 ABF-Lite E3 Doza 15W40
	Blower Shaft Gear Case	ABF-ECI M7 Energy 15W40 ABF-Lite E3 Doza 15W40
2	GE Radiator Fan, Upper Bearings	Lithi Shield
3	Hand Brake Sheave	Steel Shield EPA
	Bell Ringer	Steel Shield EPA
4	Speedometer (Mechanical) Instrument	SST-ECI AP COMPRESSO Air-Compressor Low Ash 0.5 Oil
	Speedometer (Mechanical) Gear Box	SST-ECI HD-AP EP-GL-5 Auto-Gear Oil SAE 90
LOCOMOTIVE TRUCK		
NO.	PART	STEEL SHIELD LUBRICANT
1	Truck Center Bearings	Steel Shield EPA
	Journal Bearings (Plain and Hyatt Roller)	Steel Shield EPA
	Traction Motor Suspension Bearings	Steel Shield EPA
	Traction Motor Suspension Bearing Additive Hyatt Roller Bearing	Steel Shield EPA
2	Journal Bearings (Except Hyatt Roller)	Lithi Shield
3	Axle Generator	Lithi Shield



STEEL SHIELD
LUBRICANTS FOR UPR



24. STEEL SHIELD APPLICATIONS IN RAILWAY SYSTEMS

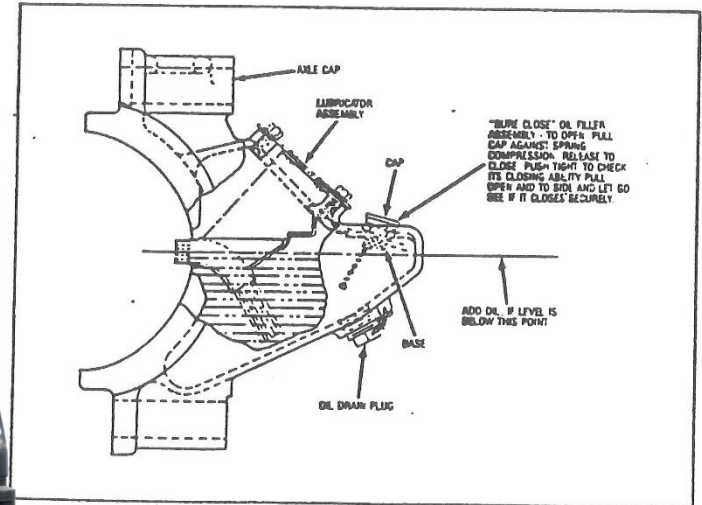
UNION PACIFIC RAILROAD EMD AND GE TRACTION MOTOR LUBRICATIONS (ONLY SHOWS PROCEDURES INVOLVED LUBRICATIONS)

PART 2 – Maintenance and Application Procedures for Traction Motor Support Bearings

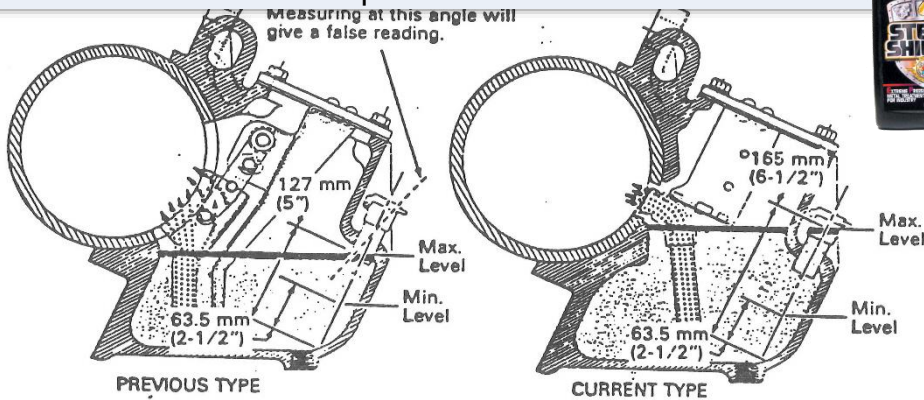
1. AXLE CAPS

LUBRICATION

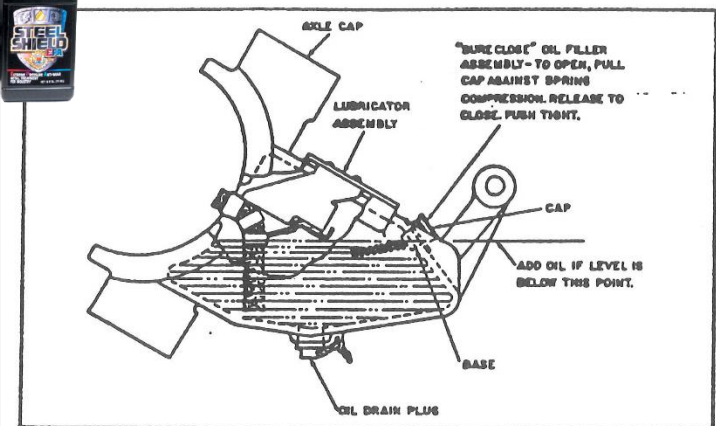
STEP	ACTION
1	Add and Mix Steel Shield EPA to journal box oil as per guidance will provide ultimate protection against wear and double the life of the equipment..
2	Check the motor manufacturer's instructions for minimum and maximum oil levels (see figures of <u>motor support bearing oil level</u> on this page for examples).
3	Terminals that receive motor and wheel assemblies will store motors in their normal position and fill the wick reservoirs.



GE 752E Type Motor



EMD Type Motor



GE 752AF and AG Type Motor

24. STEEL SHIELD APPLICATIONS IN RAILWAY SYSTEMS

UNION PACIFIC RAILROAD EMD AND GE TRACTION MOTOR LUBRICATIONS (ONLY SHOWS PROCEDURES INVOLVED LUBRICATIONS)

PART 2 – Maintenance and Application Procedures for Traction Motor Support Bearings

2. GEAR CASES

LUBRICATION

STEP

ACTION

1 Use sodium soap base gear lubricant for AC and DC traction motor combos with standard support bearing type motor utilizing 4" dia. wheels. Use synthetic gear oil for traction motor combos, or any converted 42" dia. wheel traction motor combos with conventional support bearings. Use synthetic gear lubricant for use on AC and DC locomotives.

Additionally, add Rail Shield to gear case lubricant per guidance, it helps to eliminate spitfire effects while the gear is in operation.

2 Use the following amounts of gear lubricant:

a. Initial lubrication – AC and DC locomotives:

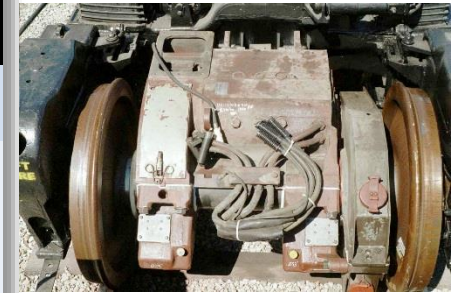
- 1) Standard gear case: 11 lbs / 5 Kgs of gear lubricant and 16 oz / 474 ml. of Rail Shield.
- 2) Increased capacity gear case: 13 lbs / 6 Kgs of gear lubricant and 16 oz / 474 ml of Rail Shield.

b. Initial lubrication – AC and DC locomotives (lighter application):

- 1) Traction motor gear case: 18 lbs / 8.17 Kgs of gear lubricant and 16 oz / 474 ml of Rail Shield.

c. 45-day and periodic lubrication: Inspect and add accordingly 4 lbs / 1.8Kgs of gear lubricant and 16 oz / 474 ml of Rail Shield.

NO TE If the bull gear teeth are not fully immersed in lubricant, more gear lubricant must be added. The amount added shall be sufficient to provide and maintain the lubricant level for gear teeth immersion into the lubricant. When there is doubt, the locomotive should be rolled and more lubricant added accordingly. Four 1 lb. bags equals approximately 1" of lubricant height.



24. STEEL SHIELD APPLICATIONS IN RAILWAY SYSTEMS

UNION PACIFIC RAILROAD EMD AND GE TRACTION MOTOR LUBRICATIONS (ONLY SHOWS PROCEDURES INVOLVED LUBRICATIONS)

PART 2 – Maintenance and Application Procedures for Traction Motor Support Bearings

3. PROCEDURES FOR APPLYING WHEEL SETS TO TRACTION MOTORS

ASSEMBLY

STEP	ACTION
1	Check the traction motor pinion gear and axle drive gear to insure proper gear matching in accordance with specifications. Refer to tables for correct fraction motor application and current gear match.
2	Clean rust and corrosion preventative from the wheel axle set, using solvent.
3	Measure axle journal size and select the proper size motor support bearings. The motor support bearings are matched sets, and upper and lower bearing halves must have the same serial number. Check to be sure that the bearing serial numbers match. See tables for axle sizes and tables for corresponding suspension bearings.
4	Install support bearing halves (bearing half without cutout) in the traction motor frame. Be sure that the bearing half seats properly.
5	Wipe the bearing with soft, clean cloth, taking care not to mar the bearing surface. Pour a coating of 16 oz / 474 ml Steel Shield EPA on the bearing halves.
6	With a soft clean cloth, wipe the inboard journals, being careful not to mar the bearing surface. Place the axle in the traction motor frame, being careful not to unseat the support bearing halves from the traction motor frame. Turn the wheel set in the traction motor to insure that the axle drive gear and pinion gear are properly meshed.
7	Pour coating of 16 oz / 474 ml Steel Shield EPA on the axle inboard journals. Install the mating halves of the support bearings (halves with the cutouts). Insure that the bearing shell flanges contact the mating surface on the motor frame to prevent possible lateral movement.



24. STEEL SHIELD APPLICATIONS IN RAILWAY SYSTEMS

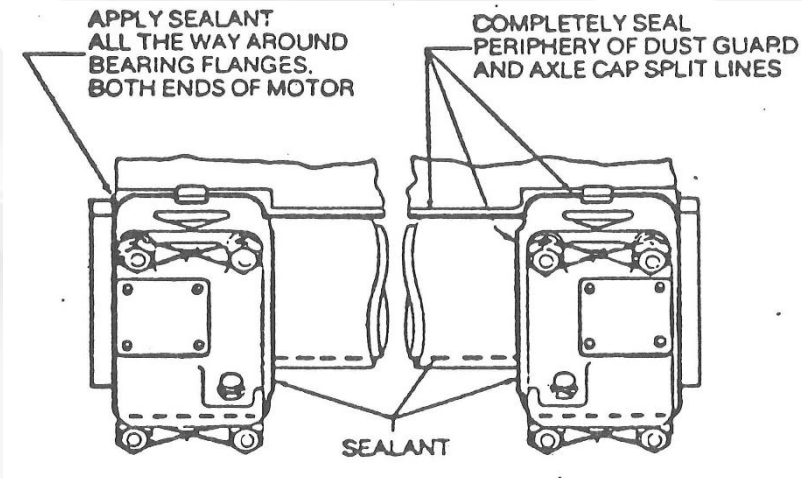
UNION PACIFIC RAILROAD EMD AND GE TRACTION MOTOR LUBRICATIONS (ONLY SHOWS PROCEDURES INVOLVED LUBRICATIONS)

PART 2 – Maintenance and Application Procedures for Traction Motor Support Bearings

3. PROCEDURES FOR APPLYING WHEEL SETS TO TRACTION MOTORS

ASSEMBLY

STEP	ACTION
8-11	(Details are ignored as they are not related to lubrications)
12	Gear Cases Assembly (details are ignored):
13	Charge gear cases with 18 bags of 1 lb. sodium base gear lubricant for combos with standard support bearings utilizing 40" wheels or 18 lbs / 8.2 Kgs of synthetic gear oils for 42" wheel combo and 1 bottle of 16 oz / 474 ml Steel Shield EPA .
14	Apply RTV sealant to axle cap split lines, bearing flanges, and axle dust guard. See reference picture below.



24. STEEL SHIELD APPLICATIONS IN RAILWAY SYSTEMS

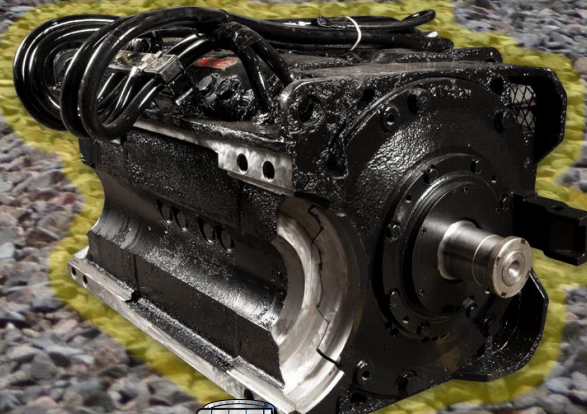
UNION PACIFIC RAILROAD EMD AND GE TRACTION MOTOR LUBRICATIONS (ONLY SHOWS PROCEDURES INVOLVED LUBRICATIONS)

PART 2 – Maintenance and Application Procedures for Traction Motor Support Bearings

4. ASSEMBLY PROCEDURES FOR ROLLER TYPE SUPPORT BEARINGS

EMD TYPE MOTORS

STEP	ACTION
1-10	Inspect mounting rails and surfaces on both the wheel assembly and motor frame for cleanliness and damage. Both surfaces must be free of metal chips, dirt, grease or self-adhesive rubber strips. <ul style="list-style-type: none">· (Details are ignored as they are not related to lubrications)
	Apply Huck bolts and collar with one hardened flat washer under the huck bolt head and one under the collar.
11	Charge the gear case with 14 bags of 1 lb. Traction Motor Gear Lubricant, and 2 bottles of 16 oz / 474 ml Steel Shield EPA, <u>Rail Shield</u> for all 40" dia. And 42" dia. wheel BTR type traction motor combos. Charge the gear case with 8 quarts of synthetic gear lubricant for 45" dia. wheel traction motor combos.



24. STEEL SHIELD APPLICATIONS IN RAILWAY SYSTEMS

UNION PACIFIC RAILROAD EMD AND GE TRACTION MOTOR LUBRICATIONS (ONLY SHOWS PROCEDURES INVOLVED LUBRICATIONS)

PART 2 – Maintenance and Application Procedures for Traction Motor Support Bearings

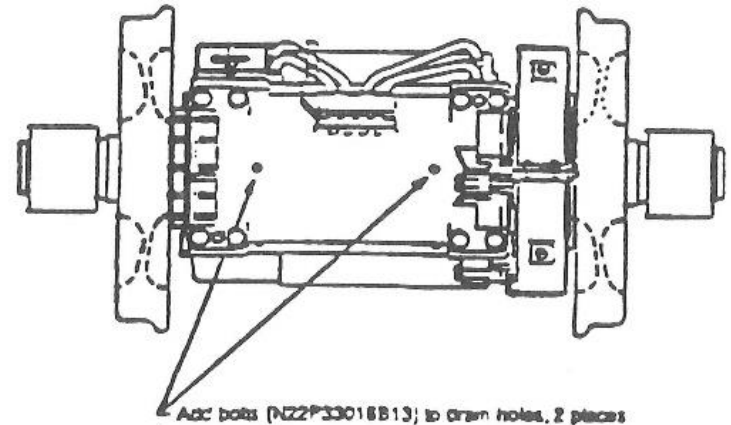
4. ASSEMBLY PROCEDURES FOR ROLLER TYPE SUPPORT BEARINGS

GE TYPE MOTORS

- | STEP | ACTION |
|-------|--|
| 1 - 9 | Inspect the mounting rails and mating surfaces on both the wheel assembly and the motor frame for cleanliness and damage. Both surfaces must be free of metal chips dirt, greases or RTV sealant.

(Details are ignored as they are not related to lubrications)

Tighten the gear case mounting bolts. Gear case to motor frame bolts, torque gear case half bolts and torque gear case mounting lug bolts. |
| 10 | Charge the gear case with 18 bags of 1 lb. Traction Motor Gear Lubricant, and 2 bottles of 16 oz / 474 ml <u>Rail Shield</u> for all 40" dia. And 42" dia. wheel combos. |
| 11 | On a one-year periodic basis, apply 12 oz cartridge of <u>Lithi Shield</u> , to the commutator and pinion side roller support bearings or until grease starts to purge from the seals on all traction motor combos not marked synthetic grease. Do not attempt to lubricate any wheel set stenciled synthetic grease applied. |
| 12 | Assure that the two drain holes have been plugged as shown in below picture. Add one bolt to each of the two drain holes on the U-tube assembly as shown. Torque bolts to specific ft.-lbs. or apply ½" cap lug thread protector. |



INBOARD BEARINGS



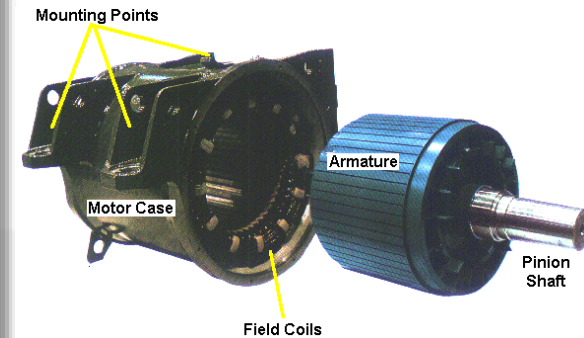
24. STEEL SHIELD APPLICATIONS IN RAILWAY SYSTEMS

UNION PACIFIC RAILROAD EMD AND GE TRACTION MOTOR LUBRICATIONS (ONLY SHOWS PROCEDURES INVOLVED LUBRICATIONS)

PART 3 – EMD Traction Motor Wheel Set Assembly

AXLE PREPARATION

STEP	ACTION
1	Clean the axle protective coating or old oil off using appropriate towels and cleaner either diesel fuel or mineral spirits. NOTE: Use a hand motion that goes around the axle rather than a sideways action along the axle length.
2	Using a portable TALYSURF check the micro-finish of the support area. The micro-finish must be between 3-7 micro-inches. (Process 2 & 3 are wheel shop procedures) They may be used as a Quality Assurance check by the Quality person as an inbound check.
3	<ul style="list-style-type: none">• Check the wheel and gear hub face's micro-finish too.• Maximum is 16 micro-inches.• This check ensures that good thrust surfaces are available for gear case seals



TRACTION MOTOR FRAME PREPARATION

STEP	ACTION
1	Be sure the motor has passed all electrical qualifications
2	Clean all bearing seats and joint faces on the frame.
3	Make sure the number on the support caps match the number on the motor frame. If they do not match do not use the motor.
4	Verify that the support bearing keys are installed and check for the proper height and distance from the frame edge.
5	TAP OUT ALL MOTOR SUPPORT HOLES. NOTE: This is a traction motor shop process.

24. STEEL SHIELD APPLICATIONS IN RAILWAY SYSTEMS

UNION PACIFIC RAILROAD EMD AND GE TRACTION MOTOR LUBRICATIONS (ONLY SHOWS PROCEDURES INVOLVED LUBRICATIONS)

PART 3 – EMD Traction Motor Wheel Set Assembly

INSTALL SOLID HALF OF BEARING

STEP	ACTION
1	BE SURE THAT MOTOR FRAME HAS QUALIFIED PER THE MOTOR FRAME PREPARATION SECTION OF THIS PROCEDURE.
2	Be sure all surfaces are clean and any residue removed. NOTE: Use re-qualified brass on commutator end only.
3	Apply <u>Steel Shield EPA</u> on the support bearing area of the motor frame.
4	Apply a bead of RTV sealant behind the support bearing flanges. The bead is to be approximately 1 / 4 inch to 3 / 8 inch in thickness. The sealant must close the gap between the motor frame chamfer and the radius at the base of the bearing flange. Be sure the sealant doesn't get on the flat sections of the bearing, this will prevent proper seating of the bearing. The purpose of the sealant is to help keep water and dirt from entering the support bearing surface area.
5	Install the solid bearing half to the motor frame. If the sealant squeezes out, wipe it off to prevent interference problems with the other half of the bearing. Press the bearing tight to the motor frame. Use a feeler gauge to ensure the maximum allowable gap between the motor frame and bearing flange is within specific range.



24. STEEL SHIELD APPLICATIONS IN RAILWAY SYSTEMS

UNION PACIFIC RAILROAD EMD AND GE TRACTION MOTOR LUBRICATIONS (ONLY SHOWS PROCEDURES INVOLVED LUBRICATIONS)

PART 3 – EMD Traction Motor Wheel Set Assembly

WHEEL AXLE ASSEMBLY

STEP	ACTION
1	Apply <u>Steel Shield EPA</u> on the bearing halves already installed. DO NOT JUST POUR OIL ALL OVER THE SURFACE
2	Apply <u>Steel Shield EPA</u> on the motor support areas of the axle. NOTE: Be sure that in handling the axle that no nicks, scratches, or grooves are apparent. If present you must return the axle to the wheel shop for repair.
3	<ul style="list-style-type: none">• With a crane, place the axle assembly into the traction motor frame.• Mate the pinion with the bull gear.• Spin the wheel to ensure that the gears are properly mated.• Be careful not to move the SOLID bearing halves.
4	<ul style="list-style-type: none">• USE CLEAN GLOVES WHEN PERFORMING THIS OPERATION. NOTE: you could use cheap cotton or rubber gloves, and simply throw them away at the end of the day.• Insert nylon rings.• Spread and then thread the rings around the axle in the 9 / 16 inch groove provided in the bearings.• Lock the seals in place by extending the tension spring and snapping it in place. There are two seals per bearing; a total of FOUR for the motor. <p>DO NOT INSTALL RINGS BEFORE THE AXLE IS INSTALLED. DO NOT GET RTV ON THE NYLON RING INSERTS.</p>



24. STEEL SHIELD APPLICATIONS IN RAILWAY SYSTEMS

UNION PACIFIC RAILROAD EMD AND GE TRACTION MOTOR LUBRICATIONS (ONLY SHOWS PROCEDURES INVOLVED LUBRICATIONS)

PART 3 – EMD Traction Motor Wheel Set Assembly

SUPPORT BEARING CAP INSTALLATION

STEP	ACTION
1-15	Use a 0.010 thick shim between the traction motor frame and the axle end cap flange. Install the shims with a cut outside turned out on the upper and lower split line. (Details are ignored as they are not related to lubrications) Check interior of motor support cap for debris. Make sure the receivers are clean and nothing has damaged the axle. Apply a clean wick gasket.
16	Apply 4 oz / 119 ml of <u>Steel Shield EPA</u> to support bearing cap reservoir. Apply an appropriate pre-soaked wick. NOTE: Be sure the wick face comes in contact with the axle. Make sure the tabs are properly lined.
17	Apply locking tab bar pan.
18	Using a properly calibrated torque wrench. Apply new cap screws and torque to specific foot-lbs. Check due date on calibration sticker.
19	Bend up ALL tabs so tabs are flat against the bolt head.
20	Stencil shop initials on the wick cap.
21	Hook the two (2) middle leads of the traction motor together and hook the two outside leads to a welder. Turn the welder on and let the motor run while applying 14 bags of gear lube.
22	Disconnect the motor from the welder and apply gear case caps.
23	Apply a silicone bead around the traction motor support bearing cap edges for weather protection.
24	Using your quality stamp, stamp all lines of completed work. File the buildup sheet with the write up man.



25. TUNNEL BORE ENGINEERING

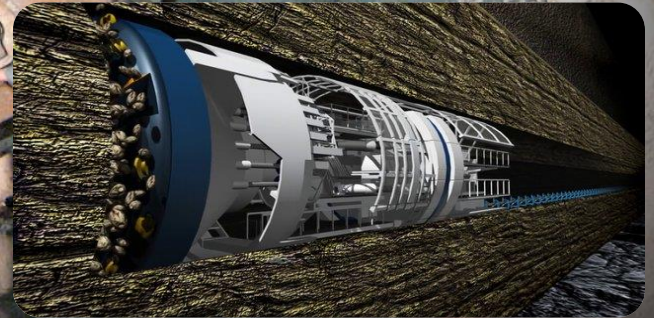
Tunnel Boring Machine (TBM) is used to excavate tunnels with a circular cross section through a variety of soil and rock strata. It can finish the entire boring of tunnel 5 times faster than traditional methods. But, TBMs may cost billions to construct, and can be difficult to transport.



Steel Shield applies to all tunnel bore engineering

STEEL SHIELD applies to all tunnel bore engineering machines to ensure less downtime :

- Engines, power systems
- Hydraulic, pneumatic systems
- All types of gear systems
- All railways, transportation systems



26. UNION PACIFIC RAILROAD REPORT

MUST READ

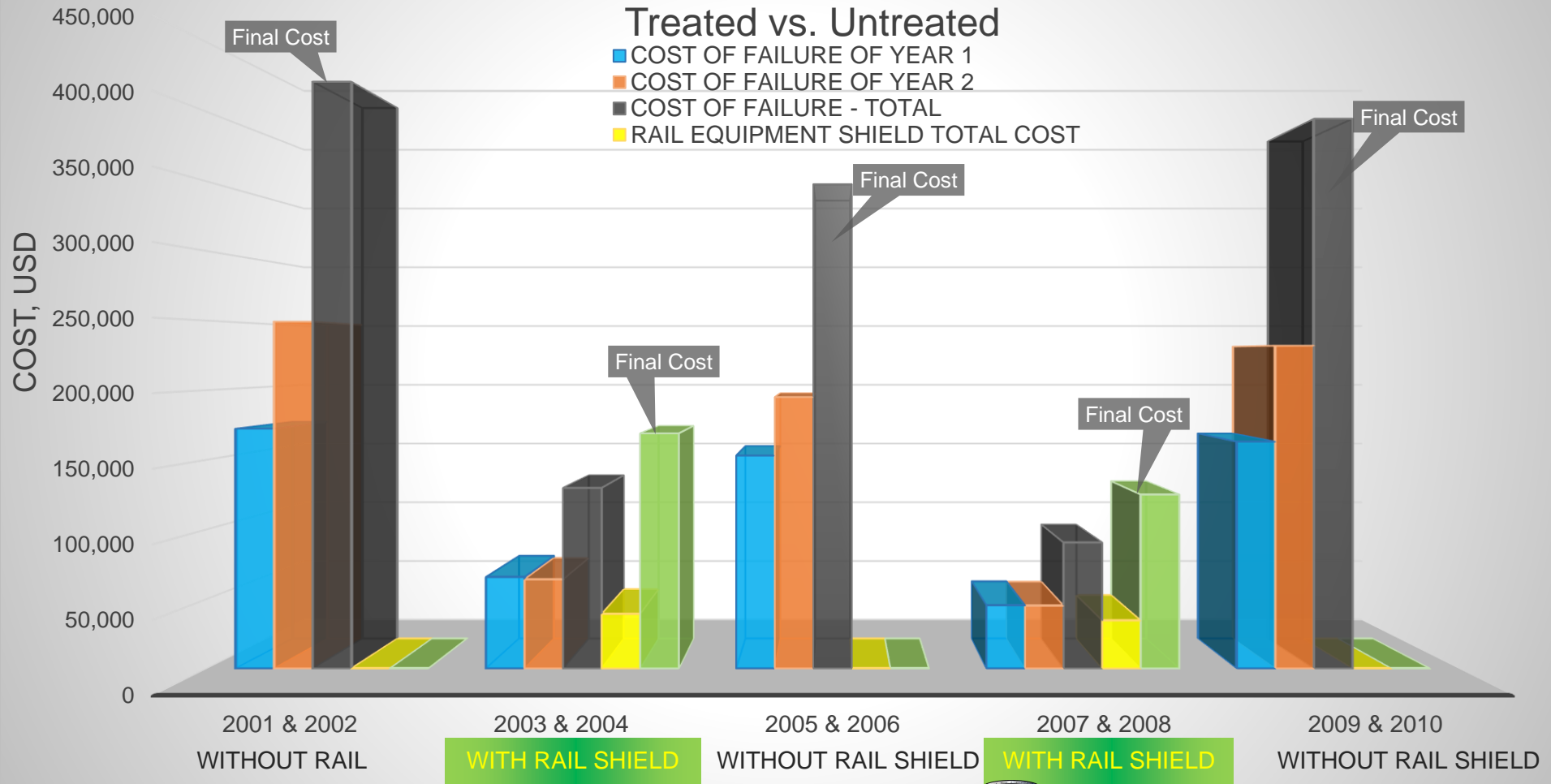
UPRR M/W COST OF FAILURE COMPARISON TREATED VS UNTREATED

EXHIBIT A

UPRR M/W COST OF FAILURE COMPARISON

Treated vs. Untreated

- COST OF FAILURE OF YEAR 1
- COST OF FAILURE OF YEAR 2
- COST OF FAILURE - TOTAL
- RAIL EQUIPMENT SHIELD TOTAL COST



26. UNION PACIFIC RAILROAD REPORTS



More Production and Less Down Time
Rail Equipment Shield-Metal Treatment
with ABF Technology is the Solution



26. UNION PACIFIC RAILROAD REPORTS

RAIL EQUIPMENT SHIELD WITH ADVANCED BOUNDARY FILM TECHNOLOGY

- Advanced methods of tribology that improve lubricity and load carrying capacity
- Reacts chemically under thermal conditions with the contacting metal surfaces, to form a complex surface-attaching film of protection
- Surface smoothing is accomplished resulting in improved spread characteristics of the surfaces themselves
- Increases fluid film strength resulting in greatly reduced wear while imparting extreme pressure properties (EP)

BENEFITS OF USING RAIL EQUIPMENT SHIELD METAL TREATMENT

- Increases Train Velocity
- Improves On-Time Train Performance
- Extends Parts Life and Component Reliability
- Reduces Maintenance and Downtime
- Reduces Metal-To-Metal Wear
- Reduces Fuel Consumption
- Reduces Operating Temperatures
- Provides Smoother Operation
- Protects Moving Metal Parts



**COST
SAVING**



26. UNION PACIFIC RAILROAD REPORT

MUST READ

M/W EQUIPMENT CENTRAL REGION (POWER UNITS ONLY)

CASE STUDY 1

- Rail Equipment Shield-Metal Treatment (RES-MT) was not used in Power Units or any other M/W components in 2001 and 2002
- In January 2003 RES-MT was added to the Power Units as well as transmissions, hydraulic systems, gearboxes and differentials
- In 2004 RES-MT was used in the same capacity as 2003
- RES-MT was purchased and added to M/W equipment components even though Case Study 1 is only showing the savings for Power Units

Cost Saving Comparison of Union Pacific Railroad During 2001-2004



Not Just Oil... IT'S TECHNOLOGY

2001 & 2002 (Without RES-MT)		2003 & 2004 (With RES-MT)	
Cost of Failures	= \$172,296 + \$249,476 = \$421,772 (average \$210,886 per year)	Cost of Failures	= \$65,722 + \$64,021 = \$129,742 (average \$64,871 per year)
		Cost of RES-MT	= \$21,195 + \$18,000 = \$39,195 (average \$19,598 per year)
		Total Cost to Union Pacific	= \$168,937 (average \$84,469 per year)
		Savings to Union Pacific	= \$252,835 (average \$126,417 per year)
		Return on investment (ROI) with RES-MT	= $\frac{\$252,835}{\$39,195}$ = 5.45 (545% Returned)

60% COST SAVED



Days on investment: $\frac{\text{savings} - \text{cost}}{\text{cost}} = \text{ROI}$



26. UNION PACIFIC RAILROAD REPORT

MUST READ

UPRR COST SAVING ANALYSIS FROM 2005 TO 2008

CASE STUDY 2

- On January 1st of 2007 UPRR began using **Rail Equipment Shield-Metal Treatment**
- The following analysis is the data collected from UPRR (New Construction) 2007 and 2008 when **Rail Equipment Shield-Metal Treatment** was used in contrast with 2005 and 2006 when it was not

Note: All repair cost are averaged due to core damage and applications
 All repairs are due to poor lubrication and excessive wear
 Repair costs do not include man hours, downtime, rentals or delays



	Unit Repairs to	Cost Per Unit	Unit Repairs 2005		Unit Repairs 2006		Unit Repairs 2007		YTD Unit Repairs 2008	
			Units	Cost	Units	Cost	Units	Cost	Units	Cost
Total Cost of Units per Year	Engine	12,000.00	4	48,000.00	6	72,000.00	1	12,000.00	0	0
	Transmissions	11,000.00	3	33,000.00	4	44,000.00	0	0	1	24,000.00
	Differentials	1,300.00	2	2,600.00	4	5,200.00	1	1,300.00	0	0
	Hydraulic Pumps	4,000.00	10	40,000.00	8	32,000.00	4	16,000.00	5	14,000.00
	Valve Failures	935.00	3	2,800.00	3	2,800.00	0	0	2	2100
	Hydraulic Cylinders	600.00	12	7,200.00	15	9,000.00	6	3,600.00	5	3,800.00
	Hydraulic Motors	2,500.00	8	20,000.00	12	30,000.00	5	12,500.00	1	1200
Total Cost of Repairs per Year				\$153,000.00		\$195,000.00		\$45,400.00		\$45,100.00



26. UNION PACIFIC RAILROAD REPORT

MUST READ

CASE STUDY 2

UPRR COST SAVING ANALYSIS FROM 2005 TO 2008

- UPRR started using **Steel Shield Technologies Metal Treatment** Jan 1, 2007
- UPRR purchased **\$20,394.00** of **Rail Equipment Shield** in 2007
- UPRR purchased **\$14,100.00** of **Rail Equipment Shield** in 2008



Year	2005	2006	2007	2008
Cost of Failures:	153,000.00	195,000.00	45,400.00	45,100.00
Cost of Rail Equipment Shield:			20,394.00	14,100.00
Total Cost:	153,000.00	195,000.00	65,794.00	59,200.00

Cost Saving Comparison of Union Pacific Railroad During 2005-2008

2005 & 2006 (Without RES-MT)		2007 & 2008 (With RES-MT)	
Cost of Failures	= \$153,000 + \$195,000 = \$348,000 (average \$174,000 per year)	Cost of Failures	= \$45,400 + \$45,100 = \$90,500 (average \$45,250 per year)
		Cost of RES-MT	= \$20,394 + \$14,100 = \$34,494 (average \$17,247 per year)
		Total Cost to Union Pacific	= \$124,994 (average \$62,497 per year)
		Savings to Union Pacific	= \$223,006 (average \$111,503 per year)
		Return on investment (ROI) with RES-MT	= $\frac{\$223,006 - \$34,494}{\$34,494}$ = 5.46 (546% Returned)



Not Just Oil... IT'S TECHNOLOGY

64% COST SAVED

* (Note) This savings does not include man hours, rentals, downtime costs or delays

26. UNION PACIFIC RAILROAD REPORTS

STORE STOCK ITEM NUMBERS

- RES-MT-16oz # 310-4437-0
- RES-MT-128oz # 310-4440-0
- RES-MT-5G # 310-4441-0
- RES-MT-55G # 310-4444-0
- RES-MT-300G # 310-4446-0

SUMMARY

- **Rail Equipment Shield** has increased train velocity, improved on-time train performance, extended parts life and component reliability and reduced maintenance and downtime by treating the metal surfaces to reduce friction, heat and wear
- After more than 8 years of use experience shows that Rail Equipment Shield has had no negative or detrimental effects
- It helps UPRR save 60~64% maintenance cost per year



27. SOUTHWEST RESEARCH INSTITUTE TEST REPORTS

STEEL SHIELD LARGELY OUTPERFORMS REPUTED GREASES MADE BY YAMAMOTO AND

Report 1

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



STEEL SHIELD LITHI

SwRI	Sample ID:	20003	20004
Code:	Sample Identification: SHIELD	Litho Shield	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 "Yamamoto EP grease", therefore, sample is considered "outside the scope of the method".

WIN

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



SwRI	Sample ID:	20005
Code:	Sample Identification:	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 outside the scope of the method".

Steel Shield Lithi Shield

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

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benefiting government, industry and the public through innovation.



27. SOUTHWEST RESEARCH INSTITUTE TEST REPORTS

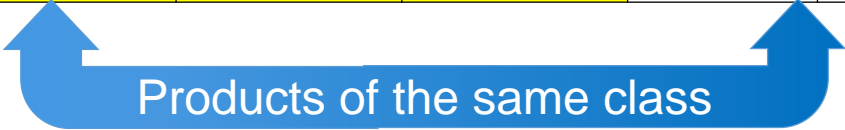
STEEL SHIELD GAS ENGINE OILS AND COMPRESSOR OILS ASTM D2782 TIMKEN

THE TEST REPORT FROM SOUTHWEST RESEARCH INSTITUTE – Timken ASTM D2782

Test Report
2014 / 11 / 20
Steel Shield Technologies

Report 2

SwRI Lab No.	24564	23728	25252	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 805 SAE 40 Gas Engine Oil	Mobil Pegasus 801 SAE 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



SOUTHWEST RESEARCH INSTITUTE website: www.swri.org

Results

Steel Shield Wins :
Steel Shield outperforms Mobil in OK LOAD parameter by 444 % and in SCORE LOAD by 375 %.

The SwRI Timken Test report clearly testified Steel Shield products are FAR Superior than Mobil products of the same classes



27. SOUTHWEST RESEARCH INSTITUTE TEST REPORTS

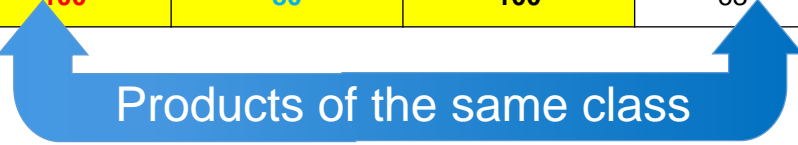
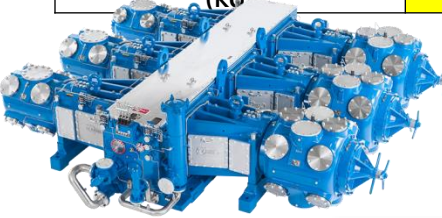
STEEL SHIELD GAS ENGINE OILS AND COMPRESSOR OILS ASTM D2783 FOUR BALLS TESTS

THE TEST REPORT FROM SOUTHWEST RESEARCH INSTITUTE – 4-Ball ASTM D2783

Test Report
2014 / 11 / 20
Steel Shield Technologies

Report 2

SwRI Lab No.	24564	23728	25252	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 SAE 40 Low Ash With EPA	Steel Shield EPA	Steel Shield Compressor Oil ISO #100 / 150	Mobil Pegasus 805 SAE 40 Gas Engine Oil	Mobil Pegasus 801 SAE 40 Gas Engine Oil
Volume (Gallon)	1	1	1	1	1	1
Corrected Load (kgf)	70	109	NA	133	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



Results

Steel Shield Wins :
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.

The SwRI 4-Balls Test testified Steel Shield products are superior than Mobil products of the same classes

SOUTHWEST RESEARCH INSTITUTE website:
www.swri.org



27. SOUTHWEST RESEARCH INSTITUTE TEST REPORTS

STEEL SHIELD GAS ENGINE OILS AND COMPRESSOR OILS ASTM D2782 Timken, D2783 4-Ball & D6352 GC — Original Documents

Report 2

SOUTHWEST RESEARCH INSTITUTE®

8220 CULEBRA ROAD 78238-5166 • P.O. DRAWER 28510 78228-0510 • SAN ANTONIO, TEXAS, USA • (210) 584-6111 • 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:

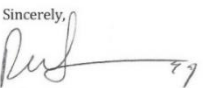
Re: Fuel Analysis Results
SwRI WO# 71111
PO# 120

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,


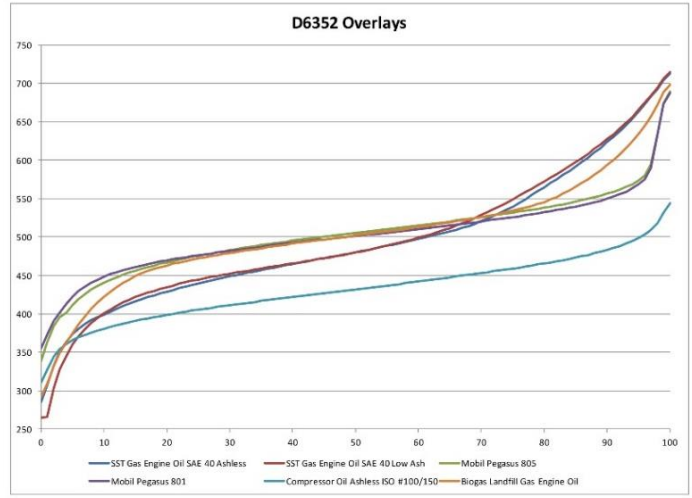
Robert R. Legg
Fuels Laboratory Manager
Fuels & Lubricants Research Department
Office of Automotive Engineering



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



Test Summary Report
November 20th, 2014
Steel Shield Technologies



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 are 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.



27. SOUTHWEST RESEARCH INSTITUTE TEST REPORTS

STEEL SHIELD GAS ENGINE OILS AND COMPRESSOR OILS ASTM D2782 Timken, D2783 4-Ball & D6352 GC – Original Documents

Report 2



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



27. SOUTHWEST RESEARCH INSTITUTE TEST REPORTS

STEEL SHIELD GAS ENGINE OILS AND COMPRESSOR OILS ASTM D2782 Timken, D2783 4-Ball & D6352 GC — Original Documents

Report 2



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

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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



27. SOUTHWEST RESEARCH INSTITUTE TEST REPORTS

STEEL SHIELD GAS ENGINE OILS AND COMPRESSOR OILS ASTM D2782 Timken, D2783 4-Ball & D6352 GC — Original Documents

Report 2



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
		39%	491.3	59%	509.0	79%	530.9	99%	673.0
								FBP	687.9



28. INSURANCE CERTIFICATE & CONFIRMATION OF NO INSURANCE CLAIM



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 Shield 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 continuously 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



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: (724)283-5670 FAX: (724)283-1160 E-MAIL: jamie@bestinsurancebutler.com ADDRESS: Jamie@bestinsurancebutler.com
INSURED Steel Shield Technologies Inc 3351 Industrial Blvd / Bethel Park PA 15102	INSURER(S) AFFORDING COVERAGE INSURER A: Cincinnati Insurance Companies INSURER B: INSURER C: INSURER D: INSURER E: INSURER F:


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	ADOLISUBR INSR LTR	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS
A	GENERAL LIABILITY <input checked="" type="checkbox"/> COMMERCIAL GENERAL LIABILITY <input type="checkbox"/> CLAIMS-MADE <input checked="" type="checkbox"/> OCCUR		ENP04242014	4/24/2014	4/24/2015	EACH OCCURRENCE \$ 1,000,000 DAMAGE TO RENTED PREMISES (EA OCCURRENCE) \$ 100,000 MED EXP (Any one person) \$ 5,000 PERSONAL & ADV INJURY \$ 1,000,000 GENERAL AGGREGATE \$ 2,000,000 PRODUCTS - COMP/OP AGG \$ 2,000,000
A	UMBRELLA LIAB <input checked="" type="checkbox"/> EXCESS LIAB DED RETENTION \$		ENP04242014	4/24/2014	4/24/2015	EACH OCCURRENCE \$ 1,000,000 AGGREGATE \$



DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101)

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 
--	--

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29. MAJOR CORPORATE CLIENTS



US ARMY



SIEMENS



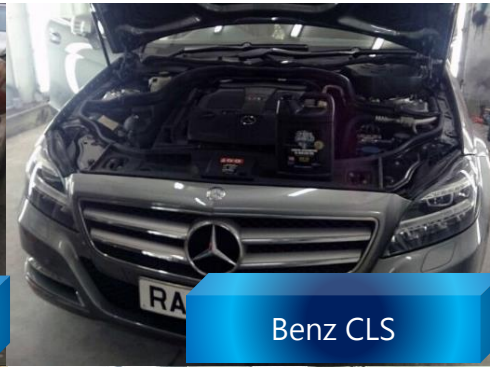
UNION PACIFIC RAILROAD
(NEW YORK STOCK EXCHANGE
NO.: UNP)



DONGJIANG
ENVIRONMENT
(HONG KONG STOCK EXCHANGE
NO.: 895)

30. SUPER CAR USERS

Super performance cars using Steel Shield help reducing engine noise, more power at the wheels, swift response, extends battery life and cleaner engine. These car owners were **surprised to see the cars behaved just like NEW !** Cruising on the highways they gained an average **12-15% less fuel.**



31. Compliments from the US ARMED FORCES

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

Original



Letters of Thanks and
Compliments from the US Army
"Weapon Shield was truly a life
saver"

December 10, 2008

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

SIEMENS Letter of Gratitude

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

Original



33. Letters from Union Pacific Railroad & PA Port Authority

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 protecting 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



The letter states that the Union Pacific Railroad uses Steel Shield product extensively. Steel Shield has been proved to be functional and cost-effective, and are highly

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.

This letter states that they save around USD 45 in maintenance cost for every USD 1 investment in Steel Shield products. Also, the vehicles malfunctions drop to

Sincerely,

Mark P. Ferrari

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



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. 4-8800-143-7243 pm-880906
jfhendri@up.com



34. Letter from VOLVO China

中沃汽车有限公司



Original

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



电话:0571-86852031



Volvo Car Corporation

8th November, 2013

English

To: Steel Shield Technologies
Unit K, 11/F, Leader Industrial Centre, Phase 2,
188-202 Texaco Road, Tsuen Wan, N.T., H.K.

Dear Ms. Eva Lam,

We would like to express our gratitude to Steel Shield Technologies 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



This letter states that the horsepower of Volvo vehicles increased by 8% to 12% after using Steel Shield products.



35. MACAU GRAND PRIX AND EVENTS

61st Macau Grand Prix (2014)



Exhibition & Events



36. STEEL SHIELD TECHNOLOGIES (USA HEADQUARTER)



Reception Area



Steel Shield Lubricant Storage Facility



Steel Shield Unique Additive Production Machine



Steel Shield Unique Additive Production Machine

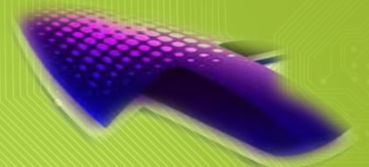
37. Steel Shield Technologies



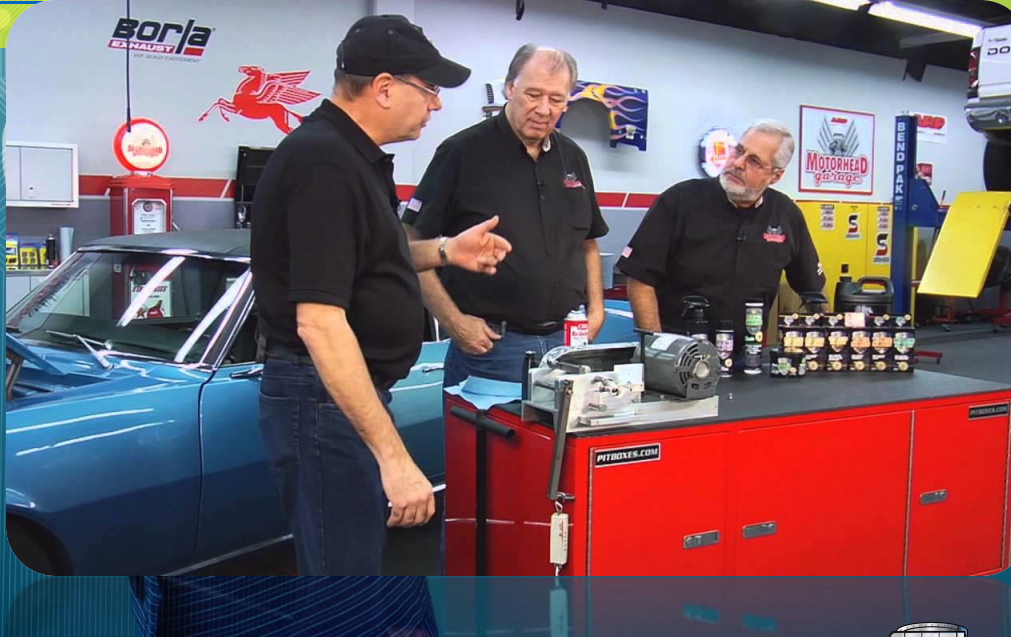
Steel Shield Products

38. STEEL SHIELD VIDEO DEMONSTRATIONS

- [Steel Shield ABF Technology – How it works?](#)
- [Steel Shield ABF Technology – Timken Demonstration.](#)
- [Steel Shield Technology Demo 1](#)
- [Steel Shield Technology Demo 2](#)
- [Steel Shield Tech Full Feature on Motorhead Garage](#)
- [Steel Shield Motorhead Garage Commercial](#)
- [Steel Shield Interviewed by the Guangdong Sport TV in the China International Lubricants and Technology Exhibition](#)



Please click the links



39. Contact US

Steel Shield Technologies

Company Address :

809B, 8/F., Block B,

Goodview Industrial Building,

11 Kin Fat Street, Tuen Mun, N.T., HK

Tel : +852 2545 8029

Fax : +852 2545 8030



**Not Just Oil...
IT'S TECHNOLOGY**



Not All Oil is Same !



100% Made In USA

100% Imported From USA

電郵 : steelshieldtech@yahoo.com

公司網址 : www.steelshieldtech.com.hk

Facebook: www.facebook.com/steelshieldtech

微博 : www.weibo.com/steelshield