The industry experts in Thin Film Technology

TECH LINE Coatings

Bearings
Pistons
Brakes
Gears
Valves
Crankshafts
Radiators
Wheels
Cylinder Heads
Exhaust Manifolds
Intake Manifolds

It's all about Power!

Manage friction and heat for greater performance!

techlinecoatings.com

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TECH LINE COATINGS, INC. was established over 30 years ago to bring the advantages of Aerospace coating technology to the automotive aftermarket. Rather than simply utilize already existing coating technology, Tech Line has modified formulas and created new ones to fit the specific needs of performance vehicles. Rigorous testing, including both lab and track testing is carried out to assure that the coatings will meet the high standards of our customers.

In addition, Tech Line recognized that for the greatest benefit to be realized, coatings would have to be made available at the local level. In the past, time and cost constraints made it difficult for many to have coatings applied to their project vehicles and components. Tech Line works with professional applicators, manufacturers, engine builders and machine shops around the world to make previously unavailable coating technology more accessible and affordable.

Although the focus of this brochure is automotive, we have many industrial clients as well. Tech Line is known for modifying coating technology to meet the specific needs of industrial applications. More information on our industrial coatings can be found in this brochure or by calling our office.

Tech Line works with the best materials currently available, yet also recognizes that those materials are constantly changing. Research and development is ongoing and we intend to remain at the forefront of such development. One our main areas of focus now is on environmentally friendly coating solutions. Both for new development and in reformulating our current technologies, we intend to make the best coatings with minimal environmental impact. Water based coatings. lower volatile organic compounds (VOCs) and lower toxicity is top of mind as we move forward.

PRODUCT PACKAGING

Tech Line makes coatings available in easy to use packaging, appropriate to the hazard level and shipping regulations. Most of our coatings are only available to professional applicators, although we do make some coatings for the do-it-yourself market. Many of our coatings require professional curing in an oven that is not used for food contact of any kind. Consult the Technical Data Sheet and Safety Data Sheet (SDS) available on our website or call our sales office for assistance. Unless otherwise specified, the coatings listed below are sold only to commercial accounts.

HIGH TEMPERATURE COATINGS

Tech Line Coatings produces a full range of the most technologically advanced high temperature coatings suitable for use on vehicle and industrial exhaust systems. These coatings include the most popular type of coating in use today, CermaKrome™ metallic ceramic coating. CermaKrome™ is used by everyone from original equipment manufacturers to race teams and is applied by professional applicators in thousands of shops around the world. Depending in the resin system, most of our high temperature coatings will maintain adhesion above 2000°F base metal temperature. Although some coatings may display color change at such high temperatures, it does not reflect a failure of the coating as color stability is secondary to the protective function. Therefore, temperatures referred to below will be those at which the coating remains color stable. The use of insulating base coatings and/or inside diameter coatings can improve the protective function and color stability of all the following coatings.

COVERAGE (APPROXIMATE) ALL EXHAUST SYSTEM COATINGS

SMALL V8 HEADERS AND CAST IRON MANIFOLDS: 4 OZ. PER PAIR

MEDIUM V8 HEADERS: 6 TO 8 OZ. PER PAIR

LARGE V8 HEADERS: 10 TO 12 OZ. PER PAIR

INDUSTRIAL: 400 SQUARE FEET PER GALLON

BLACK SATIN™ (BHK)
Originally formulated as a protective coating for the fuselage of the X-30 Aero-Space Plane, this ceramic reinforced coating withstands 2000°F substrate temperature while reducing radiated heat. The result is lower under- hood temperatures and increased exhaust gas velocity producing more horsepower and torque. Applying Black Satin (BHK) over HHBK will further increase the thermal barrier function. Recommend full oven cure at 750°F. Can air dry and cure with exhaust heat.

CERMAKROME™ METALLIC CERAMIC
CermaKrome is the highest performing metallic ceramic coating available. Capable of maintaining adhesion and color stability on substrate up to 1500°F (over 1800°F EGTs). CermaKrome has surpassed most salt spray tests (ASTM 117B) to over 6500 hours. Full oven cure at 400°F for one hour. Polishes to a chrome-like finish (recommend vibratory polisher). Water based with no hazardous solvents and nonhazardous for shipping.

CERMAKROME™ LOW HUMIDITY
CermaKrome is available in a special formulation for low humidity environments and to control drying. CermaKrome LH has all the same properties as the standard version.

CERMABLUE™ * CERMASSTEEL™
Similar to CermaKrome, these metallic ceramic coatings provide excellent temperature resistance and polish out to provide a polished blue or stainless-steel finish. Water based and no VOCs.

CILOXIDE™ SERIES COATINGS
Ciloxide is a family of ceramic coatings capable of providing extremely high levels of thermal protection in very thin films. When properly applied, Ciloxide will withstand substrate temperatures of over 1800°F and environmental temperatures of up to 2000°F. In addition, direct flame will not cause delamination if the substrate temperatures do not exceed 1800°F. Ciloxide coatings have excellent corrosion and chemical resistance. Ciloxide dries to the touch after approximately one hour, will partial cure at 400°F for one hour with the use of Activator (ACT), and full cure at 750°F. The coating cures to a very hard surface with excellent adhesion. Ciloxide is solvent based with low VOCs. Available in a wide range of colors with a satin finish.

COLORGARD™ SERIES COATINGS
ColorGard series coatings reduce temperature under the hood and on the exhaust manifold surface. ColorGard also improves exhaust gas velocity and increases horsepower. Colorgard coatings will withstand substrate temperatures over 1300°F, some colors over 2000°F. ColorGard will full cure at 650°F to 750°F (depending on color). ColorGard Stainless may be buffed to achieve a polished stainless-steel appearance. Available in a wide range of colors with a slight glossy finish.

TURBOX™ SERIES COATINGS
TurboX is an extreme temperature exhaust system coating designed especially for the exhaust side of turbos. Applied to exhaust components, it will also reduce temperatures under the hood and on the exhaust manifold surface while improving exhaust gas velocity and horsepower. TurboX will handle substrate temperatures over 1600°F (over 2000°F for short periods). Recommend full cure in oven at 650°F to 750°F. Available in Black and Blue with a matte finish.

REPELO™/REPELEX™ AIR CURE COATINGS
Designed as an air curing high temperature resistant coating. Repelex can handle substrate temperatures over 1800°F and has good corrosion resistance. Repelex may be applied over any of our base coats to increase the thermal barrier function and corrosion resistance. Available in a range of colors, solvent based with low VOC content.

CLEAR TOP COATS
A variety of clear top coats are available to enhance the surface finish and impart a mild gloss to any of the above coatings. Increases the thermal barrier function and corrosion resistance. Low VOCs. See specific instructions for the cure temperatures needed for each variation.

HIGH HEAT BASE COAT BLACK™
HIGH HEAT BASE COAT BLUE™
Designed as base coats for a variety of top coats, imparting higher temperature resistance and improved corrosion resistance. Will withstand substrate temperatures over 2000°F and reduce thermal transfer. Excellent for hiding flaws in substrate. Water based and no VOCs. Cures at 400°F for one hour. Must be top coated.

MCS™ INSULATING BASE COAT
MCS is a base coat capable of handling temperatures over 2000°F, providing excellent thermal barrier protection and increasing the temperature the top coat can withstand. MCS also improves corrosion resistance. Water based and cures at 400°F for one hour. Water based and no VOCs. Must be etched and top coated.

Ri128™ CORROSION INHIBITOR
Ri128 is a base coat designed to improve corrosion resistance for high temperature top coats. Ri128 can handle substrate temperatures over 2000°F. Recommend oven cure at 500°F for one hour. Water based and no VOCs.

INTERNAL ENGINE COATINGS

Tech Line Coatings makes a wide range of power enhancing and part life extending coatings for engine components. These coatings are being applied by professional coating shops, engine builders, race teams and performance part manufacturers who specialize in the high-performance aftermarket. A limited line of products is available in retail packaging for those who wish to do their own work.

POWERKOTE C-LUBE™ DRY FILM LUBRICANT
C-LUBE is a water based ceramic dry film lubricant coating best applied to rigid surfaces such as piston skirts, cam lobes, gears and similar. C-lube handles extreme pressure and is an excellent fluid-retaining coating, reducing oil loss and reducing hot spots. It is applied in a very thin film so that no clearance changes are required. Any buildup may be burnished down with '0000' steel wool or green "Scotch Brite™" pads without affecting coating function. Reduces friction, scuffing, galling while increasing part life, horsepower and torque. Requires oven curing at 350°F for one hour.

POWERKOTE DFL-1™ DRY FILM LUBRICANT
DFL-1 is the best dry film lubricant for rod and main bearings and any part subject to sliding or rotational friction. A unique water based binding system reduces friction even under extreme pressure, reduces galling and scuffing while increasing part life for both soft and hard substrates. Does not affect clearances, can be burnished to near zero buildup while still performing. Requires oven curing at 300°F for one hour. Available to professionals and do-it-yourselfers.

POWERKOTE CBC1™ THERMAL BARRIER COATING
CBC1 is a water based thermal barrier coating that provides a hard, durable surface on any component. Formulated to be used in any engine running compression ratios of less than 12.5:1. Excellent for combustion chambers, piston tops, valve faces and cylinder heads. CBC1 manages thermal transfer, reducing part temperature and helping to reduce or eliminate detonation. Results include increased fuel efficiency, power and torque. Requires oven curing at 300°F for one hour. Available to professionals and do-it-yourselfers.

POWERKOTE CBC2™ THERMAL BARRIER COATING
Similar to CBC1 (above), this coating can be polished to a chrome-like finish. Requires oven curing at 350°F for one hour.

POWERKOTE CBX™ THERMAL BARRIER COATING
Formulated for performance engines running compression ratios greater than 12.5:1, turbo/supercharged or using nitrous oxide. Managing heat in critical engine components extends life and increases horsepower, torque and efficiency. Requires oven curing at 350°F for one hour.

POWERKOTE PKSX™ DRY FILM LUBRICANT
PKSX is an extreme pressure and temperature lubricant designed for cylinder walls, lifter bores and valve guides. It can carry extreme loads and reduces friction, wear and improves ring seal and leak down. Bonds at approximately 25-millionths of an inch, so it does not impact clearances. Dry powder coating, simply buff on. Available to professionals and do-it-yourselfers.

POLYPHEN™ TLML DRY FILM LUBRICANT
TLML is an extreme pressure bonded dry folm lubricant coating that is best for valve springs and other flexing parts. It does not change the clearance and can be buffed back with '0000' steel wool if desired, or it will burnish during use, remaining fully functional. Reduces friction, scuffing, galling while improving part life, horsepower and torque. Can also be used as a top coat over TLMB (see below). Solvent based, requires oven curing at 300°F for one hour.

POLYPHEN™ TLMB BASE BUILDUP COATING
TLMB is a high load buildup coating for piston skirts and other components where buildup will benefit the assembly. It is used in very high RPM engines as well as engines where long strokes are common. TLMB may be used as a stand alone coating where a conformal coating is needed. Top coat with TLML (see above) for increased lubrication. Solvent based, requires oven curing at 300°F for one hour.

POLYPHEN™ GOLD THERMAL BARRIER COATING (TL-PTG)
Extremely effective thermal barrier coating for combustion chamber surfaces, piston tops, valve faces, cylinder heads, etc. Increases engine efficiency, creates more horsepower and torque and reduces or eliminates detonation. For use in all types of engines. Gives a unique gold finish to parts. Requires oven curing at 300°F for one hour.

POLYPHEN™ THERMAL DISPERSANT COATING (TLTD)
TLTD is designed to rapidly disperse heat away from any component. It aids in cooling by evenly distributing and dispersing heat over a surface. Excellent for intake manifolds, radiators/intercoolers, turbo intake housings, oil pans, brake calipers, wheels and more. It is an excellent oil shedder with excellent chemical and corrosion resistance. Available in black and dark gray. Requires oven curing at 300°F for one hour.

POLYPHEN™ TLHB HOT STOP THERMAL BARRIER
TLHB is designed as a thermal barrier that can be applied to a variety of surfaces. It provides a smooth heat barrier to intake and exhaust ports, the inside diameter of exhaust manifolds/headers/pipes, brake pads, brake calipers and even on wheels to reduce tire temperature (best when combined with Thermal Dispersant). Requires oven curing at 300°F for one hour.

REPELO™ THERMAL DISPERSANT (REPTD)
Repelo TD is designed to rapidly disperse heat away from any component. It aids in cooling by evenly distributing and dispersing heat over a surface. Excellent for intake manifolds, intercoolers, turbo intake housings, oil pans (inside and out), brake calipers, wheels and more. It is an excellent oil shedder with good chemical and corrosion resistance. It is available in matte black only. air cures at ambient temperature.

REPELO™ LOW TEMP CLEAR (LTC)
Designed to provide a clear protective film to any part. Increases chemical and corrosion resistance and is a non-stick material so it sheds mud and other debris. Can be used over polished metal with our *Brilliance* dye additives for a wide variety of translucent to solid color finishes. Air curing.

SPECIALTY COATINGS

ANEALON™
Anealon™ is a surface modification coating that creates an extremely thin, self-lubricating ceramic film on any substrate that can handle the temperatures and pressures needed to form the active film during operation.

Most common lubricants, in a liquid or a coating form, cannot handle the temperatures and pressures that Anealon™ can. When an oil film breaks down and pressures and heat rapidly rise, galling and part damage occurs. Anealon™ forms a self-lubricating ceramic film below the temperatures at which galling occurs. Anealon™ can work at temperatures above 2000°F. *Available under license.*

DIAMONDYZE™ ANODIZING ADDITIVE
A breakthrough in both Type II Anodizing and Type III Hardcoat. Using unique technology, this advanced formulation will make Type II anodized parts have a wear resistance equal to or greater than Type III Hardcoat. When used with Type III anodizing processes, hardcoat is enhanced. Corrosion resistance and wear is superior to any anodizing treatment available. DiamonDyze™ is water based and nonhazardous for shipping. *Available under license.*

IC-1™ INSULATING COATING
IC-1 is an air curing coating designed to reduce thermal transfer. Excellent for floorboards and firewalls, it is a reflective silver color and provides an effective thermal barrier above exhaust systems and other heat sources. Can be sprayed, brushed or rolled on.

LIQUIPOWDER™ (L_20)

LiquiPowder is a water-based suspension agent for powder coating, allowing the application of powder to any surface without the need for elsectrostatic equipment. It can be applied to metal, glass, plastic, ceramics, wood and a variety of other materials that can handle the cure temperature of powder coating. In addition, other dry powdered materials can be added, such as pearls, metal flakes, pigments and similar items. This allows for multicoating, using decals for "embossed" designs, and other artistic embellishments that cannot be applied with standard powder coating or paint applications. Excellent for powder coating repairs in the shop or in the field. Water based and nonhazardous. Can be applied with standard spray paint guns or brushes. Cures at recommended powder cure temperature.

REPELO CLEAR FOR CHROME™ (CFC™)

Designed to be appled to the exterior of a chrome exhaust component to prevent it from turning blue up to base metal temperatures of 1100°F. For applications exceeding that temperature, a thermal barrier such as MCS™ Insulating Base Coat could be applied to the inside of the chrome part to further reduce temperature. CFC™ has been used for many years by manufacturers of chrome exhaust stacks for over the road trucks. Application requires Primer for Chrome (PFC™) over the chrome part, then top coat with CFC™. Can air cure over 24 hours or oven cure at 400°F for one hour.

REPELO™ LTMC™ MARINE COATING

Designed for boat hulls and equipment in fresh or salt water (outboards, props, etc.) to reduce friction, cavitation and biological growth. Can be sprayed or wiped on. Air curing.

LUBRICANTS

RSI™ RING SEAL IMPROVER

RSI is designed to improve ring seal on start up. It provides lubrication even after long term storage and will not "wipe" off during the initial revolutions of the engine. It enhances lubrication, protecting the rings and bore against excessive wear and allows the rings to seal efficiently and with minimal wear. RSI can be applied during assembly or to engines that have been in storage for an extended period, without removing the heads. RSI will protect until the engine oil pressure is at normal levels and then simply become part of the oil, providing additional lubrication benefits.

ULTRA GEL TECH™ ASSEMBLY LUBE

Ultra Gel Tech (UGT) is an extreme pressure assembly lubricant that protects bearings, cams, cranks, valve stems, pushrod ends, lifters, gears and more. Used by many race teams, it is suitable for any 2-stroke, 4-stroke, rotary, top fuel, alcohol, supercharged, turbocharged or normally aspirated applications.

INDUSTRIAL COATINGS

Tech Line Coatings produces coatings for harsh chemical environments, extreme pressure applications, corrosion resistance, electrical insulation and electrical flow improvements, anti-biological growth and anti-graffiti. We specialize in thermal management coatings including thermal barriers and thermal dispersants and extreme temperature applications from sub zero to above 3000°F.

For more information contact our technical department and we will be happy to assist you in identifying the appropriate product or possibly creating a new product for your application.

TECHTREX™ is a series of coatings created from PEEK™. Several formulas are available to fit specific needs. It can be used in the Automotive Industry, Oil Exploration Field, Chemical Industry, Marine, Printing and Copying, Electrical, Transportation and a host of others. TechTrex™ is a water based dispersion and is not hazardous for shipping. Existing TechTrex™ formulations are:

71000 is pure PEEK suspended in a water based carrier resistant to a wide range of chemicals and capable of being used in extremely hostile environments. It has excellent dielectric characteristics and is ideal for electrical applications. 71000 is resistant to gamma radiation at high dose levels. 71000 is a heat setting thermoplastic with no hazardous solvents, and is not regulated for shipping.

72000 allows a user to benefit from the advanced performance benefits commonly found in molded PEEK, combined with the release properties of PFA, and in a spray applied coating.

73000 allows a user to benefit from the advanced performance benefits commonly found in molded PEEK, combined with the low co-efficient and excellent release properties of PTFE, and in a spray applied coating.

74000 allows a user to benefit from the advanced performance benefits commonly found in molded PEEK, with extreme wear and abrasion resistant fillers, in a spray applied coating.

75000 allows a user to benefit from the advanced performance benefits commonly found in molded PEEK, with the added benefits of **Extreme Pressure Lubricants**, in a spray applied coating.

76000 allows a user to benefit from the advanced performance benefits commonly found in molded PEEK, with the added benefits of **Extreme Pressure Ceramic Fillers**, in a spray applied coating.

AMADENE™ Is a series of coatings formulated from a highly modified polymer. In a thin film, the Amadene™ 80000 Series allows a user to benefit from the advanced performance benefits commonly found in molded polymer plastics, in a spray applied coating. The Amadene™ Series has excellent chemical, tribological, and corrosion resistance, in one package. The formulation can be modified to suit specific customer needs for lubrication, release, wear resistance, etc.

SOLTECH™ is a water based dispersion of Polyaryletherketone thermoplastic. SolTech™ is resistant to a wide range of chemicals. SolTech can be used in a wide range of applications or blended with additional materials such as PTFE, PFA, molybdenum, graphite, ceramics, etc., to increase the range of uses. It has no hazardous solvents, and is not regulated for shipping.

POLYPHEN™ SERIES COATINGS

TLTD™ is a thermal transfer coating designed to rapidly disperse heat away from any component. It aids in cooling by evenly transferring, distributing and dispersing heat over a surface. TLTD enhances the rate at which heat is moved, aiding in reducing part temperature, and extending the life of a component. Excellent chemical and corrosion resistance and oil shedding. Beneficial for use on electric motors, alternators, lighting, cooling coils such as radiators, intercoolers and refrigeration/air conditioning condensers. Available in black and dark gray. Requires oven cure at 300°F for one hour. See page 7 for an example of how TLTD improves efficiency.

TLHB™ is designed as a chemical and acid resistant thermal barrier that can be applied to a variety of surfaces. It provides a smooth heat barrier to parts where managing the flow of heat is important. Beneficiall for use on heat exchangers where it is resistant to phosphate buildup. In oil field applications it is impervious to sulfuric acid and can provide lubrication to parts exposed to the acid. It also has excellent anti-coking properties, shedding the material and reducing the buildup. It can be used on coil springs exposed to salt, chemicals and acid and has extended their life significantly. TLHB has also passed Cryogenic/Thermal Cycling Testing from a low of -273°C (in liquid nitrogen) and then exposed to a high of 1300°C repeatedly for a period of 8 hours with no failure. Requires oven curing at 300°F for one hour.

TLHC™ is a version of TLHB™ that incorporates very hard ceramics to increase the wear resistance and hardness without any deterioration of the other characteristics. Application and curing process is the same as TLHB™.

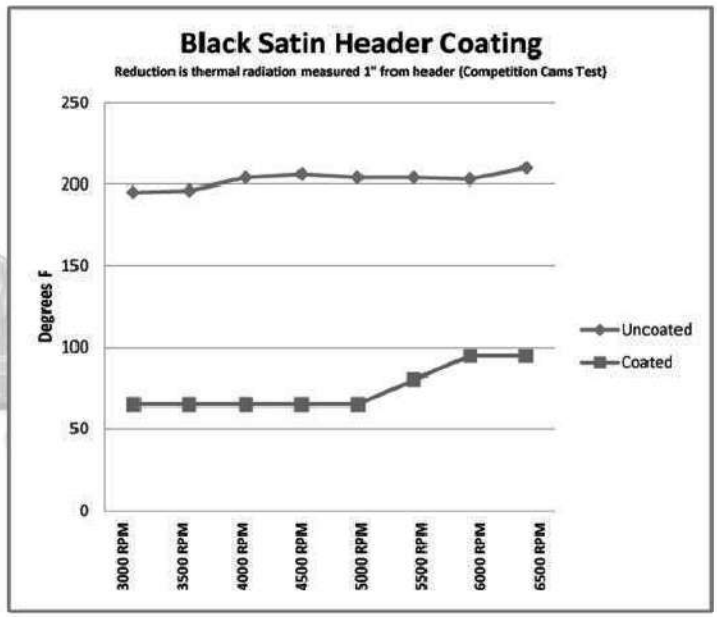
REPELO™/REPELEX™ AIR CURE COATINGS

REPELO TD™ is an air-curing version of PolyPhen TLTD™ and has the same characteristics and performance benefits. Excellent for use on larger components that cannot be cured in an oven or for field aplication. It can handle temperatures over 1000°F. Available in Black and Gray with a matte finish.

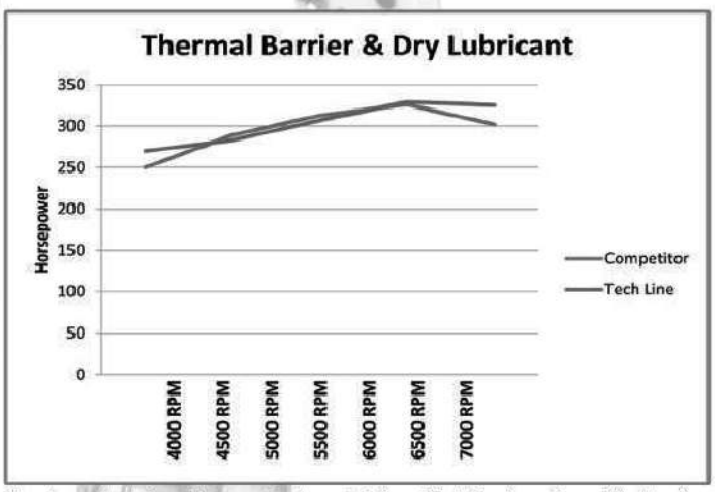
REPELO™ LTMC™ MARINE COATING

Designed for boat hulls and equipment in fresh or salt water (outboards, props, etc.) to reduce friction, cavitation and biological growth. Can be sprayed or wiped on. Air curing.

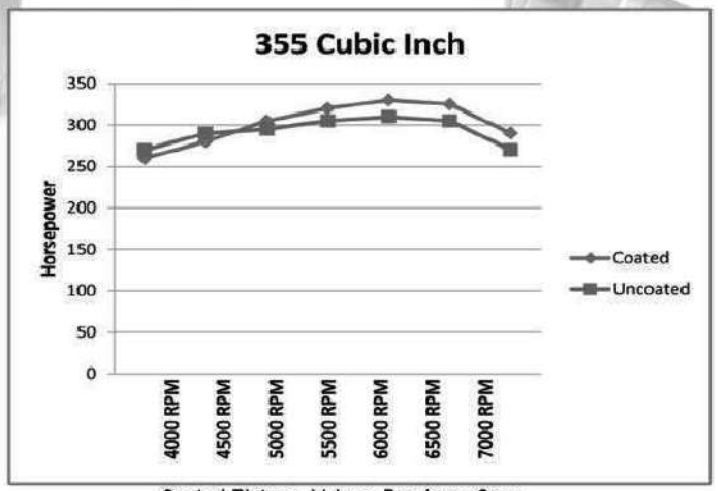
PERFORMANCE REPORTS



EGT's reached 1510F in this test. Temperatures for both coated and uncoated were measured 1"away from header surface.



The above chart shows the superior characteristics of Tech Line's coatings. The blue line shows the power generated by a 355 cu. in. engine completely coated by a competitor at about $1,000. The red line shows the power generated by a virtually identical engine ONLY PARTIALLY coated by Tech Line for about $350. NOTE that ONLY the piston tops were coated in the Tech Line engine while the entire combustion chamber was coated with ceramics by our competitor. Tech Line produced comparable horsepower and torquewith greater power just before valve float. What if Tech Line had coated ALL the parts? Think of the POWER!!

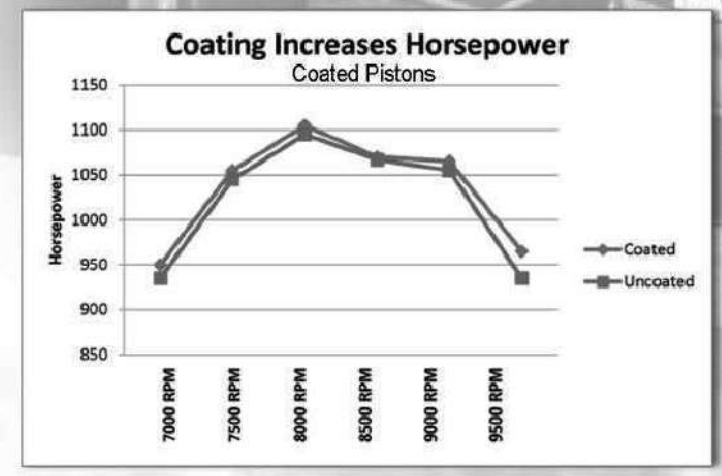


Coated Pistons, Valves, Bearings, Cam

TLTD Thermal Efficiency Test
High Performance Alternator

Degrees F	Terminal #1	#2	#3	Average	Stack	SRE*	DE	H.P. In	H.P. Out
Coated Inside Only	195.98	167.54	195.62	186.26	153.68	118.04	142.34	3.07	1.87
Uncoated	229.10	184.82	215.42	209.84	158.18	101.84	159.80	3.12	1.66
Improvement	-33.12	-17.28	-19.80	-23.58	-4.50	16.20	-9.70	-0.05	0.21

*Note: The SRE was the only point that showed a temperature increase, demonstrating the transfer by the coating into the aluminum. The front DE is where the initial airflow is. Consequently, the cooling effect will be stronger than at the rear SRE that is shrouded and generally closer to a heat source, such as an exhaust manifold. Terminal #1, #2 and #3 are the respective rectifier terminals inside the alternator, the hottest points in the unit. The Stack temperature is the second hottest point. This is the steel core of winding into which the current is induced. The SRE is the back of the alternator, the Slip End Ring. The DE is the front of the alternator, where the pulley is, the Drive End frame.



DAN PRESS INDUSTRIES
D. P. I. Sierra Brakes

Reference: Coated Brake Caliper Test

Using Southwest tour car, Lance Hooper at Saugus and Bakersfield Speedways, uncoated calipers and pads ran rotor temps at 580° F to 600° F Calipers ran 380° F. Test consisted of 400 laps. Same test was done with coated calipers and pads, rotor temps were 580° F to 600° F, caliper temps were 140° F.

CERMAKROME™ (MCX) INDEPENDENT TESTING

EXTREME TEMPERATURE CYCLE TEST

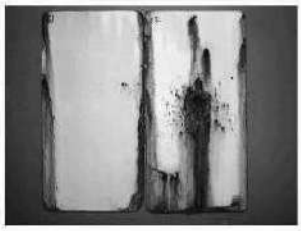
1. Plates fully immersed in liquid nitrogen (-273°C) for one hour.
2. Plates immediately heated by blow torch to +1300°C
3. Plates re-immersed in liquid nitrogen.
4. Continues cycle of test for 8 hours

NO FAILURE/NO DELAMINATION

SUPERIOR SALT/CORROSION PROTECTION
(INDEPENDENT TESTING)

CERMAKROME COATED TEST PANELS AFTER 6524 HOURS OF SALT SPRAY:

COMPETITORS TEST PANELS AFTER 4000 HOURS:



AUTOMOTIVE APPLICATION MANUAL

This manual has been designed to give you general information regarding the benefits of coating a variety of components.

EXHAUST MANIFOLDS & HEADERS

Exhaust Manifolds can either be a cast iron factory-type manifold, or a tube steel header typically used in performance applications, though they are becoming very common in OEM applications. There are a variety of reasons for coating an exhaust manifold/-header.

Exterior Protection: The manifold/header will be more resistant to corrosion, last longer and maintain appearance. Whether it is for performance or show, coating an exhaust manifold creates value.

Thermal Barrier: Keeping the heat in the manifold or header accelerates exhaust velocity, reduces back pressure and reduces fuel contamination due to reversion. Managing the heat radiated to the surface of exhaust components reduces under-hood temperature, reduces the temperature of air being drawn into the engine, and improves the operation of neighboring components like starters, alternators and electronics.

Tech Line makes a wide variety of suitable high temperature coatings in many colors and finishes for use on exhaust manifolds or headers. Some of these coatings should be oven cured, though our air curing line continues to expand. Examples of colors can be found on our website. All the coatings in this category are only available for application by professionals.

Recent customer feedback is that new stock vehicles are running hotter than ever before due to the fuel economy and emissions regulations imposed on them. For these and any extreme temperature applications, using an insulating base coat can improve the thermal radiation characteristics and color stability of the top coat.

The most popular of our high temperature coatings is CERMAKROME™ which gives a near chrome finish, tremendous corrosion protection and is an excellent thermal barrier. On the stock side, our COLORGARD™ cast iron gray is extremely popular, especially with restorers, since it imparts an original dark cast iron appearance, rather than the lighter appearance that is more typical of a bead blasted finish, which is not truly stock. Some customers willl blend custom colors from our ColorGard™ or Ciloxide™ lines. The opening pages of this catalog and our website cover all the various high temperature coatings available.

If coating cast iron parts, due to the porosity, we recommend applying a base coat such as MCS or even CermaKrome, oven cure, lightly sandblast, thoroughly clean, spray the coating and cure according to directions.

Thermal radiation characteristics can be improved by coating the inside diameter of exhaust components. MCS is an extremely effective thermal barrier for this application. PolyPhen TLHB has been used for years on the inside of chrome headers to reduce bluing.

TECH TIP: While we recommend sandblasting with 120 grit aluminum oxide for most parts, 80 to 100 grit gives a better profile on both cast iron and tube steel manifold applictions, phosphating instead may be acceptable.

INTAKE MANIFOLDS

There are two reasons for coating the intake mainifold, performance and appearance.

Performance: Heat is the enemy and it is generated by the engine and from the hot oil that is tossed up to the underside of the intake manifold. Typically, a normally aspirated engine will see a 1% improvement for every 10° drop in carburetor air inlet temperature. A turbocharged engine will see a 2% increase. Keeping the manifold cooler than normal helps the engine generate more horsepower. Apply a thermal barrier coating (CBC1/CBC2, CBX, TL-TPG, MCX, etc.) to the bottom of the intake manifold, the flange area where it would bolt to the head, and the flange area where the carburetor would bolt to the intake manifold. This will reduce the amount of heat that enters the manifold itself, keeping the manifold cooler.

In addition, coat the manifold exterior with a Thermal Dispersant. This will help any heat that does get into the intake manifold to be more rapidly dispersed into the air moving over it, thus cooling the intake manifold further. This gives you a greater chance of creating more horsepower by reducing the inlet temerature.

You can also coat the inside of the runners of the intake manifold with a Dry Film Lubricant such as DFL-1, C-LUBE, or TLML. These are "fluid retaining" coatings, so as the fuel/air mix passes through an intake manifold on a carbureted engine it is treated like a "fluid in motion". The coatings will tend to create a small amount of boundary layer turbulence, which will reduce fuel dropout. Another option for the runners is to apply a thermal barrier first, then dry film over it. This not only creates boundary layer turbulence, but further reduces the amount of heat that enters the fuel/air mix.

Appearance: A Thermal Dispersant on the exterior will improve performance, but the color may not be suitable for show. CERMAKROME or another high temperature (exhaust) coating can be used. Since these coatings are thermal barriers, we recommend that you coat the top and bottom. In this way, while the amount of heat that can be dispersed from the top of the manifold is reduced due to being coated with a thermal barrier, using the same coating on the bottom will reduce the amount of heat that can be absorbed by the manifold. This creates equilibrium rather than unbalanced, excessive heat. These coatings are high temperature resistant, and CermaKrome does not blue or discolor like chrome, and does not oxidize significantly, as a polished aluminum surface will. You can maintain a very nice, high-polished surface not affected by fuel, oils and solvents.

TECH TIP: Be sure that ALL abrasives used in preparing the manifold, especially the runner and plenum area, are removed. Inspect for small voids or casting flaws where abrasives could be lodged. At engine start-up, the abrasives could become dislodged and damage the engine.

VALVE TRAIN COMPONENTS

The valve train sees many benefits from the use of Dry Film Lubricant coatings. All the parts are minimally lubricated by engine oil. Consequently, excessive wear is always a concern, especially at start-up or after the engine has been sitting for an extended period.

By using an extreme pressure bonded lubricant, we can provide protection well beyond that expected from even the best motor oils. The primary components to be coated are the cam, lifters and push rods. A film of oil that is either pumped or splashed onto the part provides normal lubrication but heat causes oil film breakdown. By applying a permanent lubricating coating, the ability of the oil to lubricate even after the oil film fails is enhanced.

Typical motor oils will fail at pressures below 10,000 PSI. Properly formulated and bonded lubricants can withstand pressures more than 350,000 PSI.

The Dry Film Lubricant functions in two ways. (1) As an "oil retaining material" rather than an oil shedding material, Like Teflon®. This means that it increases the ability of a small amount of oil to flow rapidly over the coated surface. In doing this, it reduces friction, as the remaing oil slides between the mating surfaces and allows the parts to move more freely. This action also reduces the likelihood of the oil film being "pushed off" the surface.

A secondary benefit to this action is that it allows the oil to absorb more heat, thus helping to cool the parts more efficiently. The enhanced sliding action can be demonstrated by the way a "slip and slide" functions. This slick piece of plastic does not allow a body to slide over it until a film of water is present. The layers of water moving at different speeds act like little "rollers" that allow free movement. The Dry Film Lubricant creates the same effect by retaining a small amount of slower moving oil on the coated surface, thus allowing easier movement of the parts.

(2) The second function takes over when the oil film would normally break down due to pressure or high heat allowing metal to metal contact. The bonded coating does not "break down" at high pressure or temperatures, thus maintaing a lubricious film between the mating surfaces. This film provides a second layer of protection that normally will lubricate at loads above the "crush" or deformation point of the base metal. This is especially critical at start-up when a well-defined mating surface is desired and excessive wear due to the lack of lubrication can do significant damage.

Camshafts especially benefit from the application of a bonded lubricant at start-up, where a cam can be damaged if the lubrication film is not maintained during break-in. The use of a bonded lubricant such as C-LUBE can in many instances eliminate the need to break-in the cam using low pressure valve springs.

When we combine these features, not only do we see better mating surfaces, we can also expect to see: (1) Less wear, (2) reduced friction, (3) attendant power gains and (4) longer part life.

In addition, this can allow the performance engine builder to reduce the amount of oil flow to these parts, thus directing more oil to the crank assembly. The recommended coating for these applications are DFL-1, C-LUBE, and TLML.

TECH TIP: When deciding which parts to coat, the following information will help. (1) Coat the softer of the two sides first or (2) coat the larger of the two swept areas first. (3) Coating one surface will give maximum friction and wear reduction. Coating both surfaces will increase wear resistance significantly, but will only have a small additional effect on friction reduction.

VALVES

The purpose of coating a valve is to manage heat and reduce friction which will extend part life. Coatings are suitable for both the intake and exhaust valves.

The **Intake valve** seals the combustion chamber on the intake port side of the head. Prior to that, it is opening to allow air and fuel to enter the combustion chamber. Therefore, the primary concern is lubricating the valve stem and seat. Applying a Dry Film Lubricant DFL-1, C-LUBE or TLML can reduce friction, particularly in engines where the oil flow is restricted to the head. The Dry Film takes over the bulk of the lubrication chores.

It is also advisable to coat the face of the valve with a Thermal Barrier coating to help retain heat in the combustion chamber. Coating also reduces the operating temperature of the valve so the incoming air/fuel mix does not pick up as much heat from the valves as if it were uncoated. We recommend using CBC1, CBC2, CBX or TL-PTG.

Normally, it is not necessary to coat the back of the valve, though it can be done if you wish. Use a Dry Film Lubricant same as the valve stem and seat.

On the **exhaust side,** a more severe environment exists because the valve is seeing combustion chamber temperatures, which on a normally aspirated engine, can easily be at 1350°F. Other engines can run even hotter. Again, it is recommended to coat the face of the valve with a Thermal Barrier (CBC1, CBC2, CBX or TL-PTG) to reduce the heat that the valve absorbs. Then coat the back of the stem with a Dry Film Lubricant (DFL-1, C-LUBE or TLML).

It is very critical to coat the exhaust valve stem because heat reduces the ability of oil to lubricate. Consequently, the permanently bonded, high pressure, high temperature lubricants work extremely well at reducing friction and wear on the valve and the guide. In some cases, it is advisable to coat the back of the exhaust valve, such as a titanium valve, with a Thermal Barrier as well. Here you can have metal erosion due to hot gas and flame passing over the raw titanium. On other valves it is still preferable to coat the back with the Dry Film to to contribute to carbon shedding so you do not get a carbon build-up on the back of the valve, which can create turbulence in the exhaust flow.

Also, by coating the back of both the intake and exhaust valve after all machine work is done, you permanently bind the lubricant to the areas that will contact the valve seat, thus reducing wear in this area and creating a better long-term seal.

TECH TIP: All machine work should be done on valves before coating. By applying a Dry Film Lubricant to the machined surface, the valve/seat interface will be lubricated. This reduces valve and seat wear and is especially beneficial on heads that do not run hardened seats or burn alcohol or propane.

VALVE SPRINGS

Valve Springs are subject to two types of friction: (1) internal friction that occurs due to the movement of the spring as it flexes and (2) external friction that is developed as the spring moves against another surface.

Even single spring sets develop friction through rubbing against the head/shim and the retainer. The result of this friction is heat and wear. By far, heat is the greatest enemy of steel springs. Steel springs will fatigue if the temperature of the spring reaches 400°F. At this point, the spring will lose a significant amount of its designed tension and will be essentially useless for performance use. Stainless steel springs can generally handle temperatures approaching 900°F. By applying a properly formulated Dry Film Lubricant, the life of the spring can be enhanced significantly.

In testing, valve spring life on performance applications has shown increases from two to ten times the norm. This is accomplished through more efficient thermal transfer.

In addition, the lubricity of the coating will reduce the heat that is generated by externally induced friction. This heat can cause a spring to break, not just fatigue. This might be likened to flexing a piece of steel. If flexing is rapidly repeated, the metal will eventually break at the point showing the most deflection. Many times, this is the thinnest area. That point will also be hot to the touch as the internal friction is highest at that point. The amount of heat that is generated by a valve spring in motion will vary over the surface of the spring. When multiple springs are run together in a stack, the heat due to friction is increased.

Coating a spring reduces the heat that can build up in two ways: (1) through the reduction in externally generated friction and (2) through distributing the heat more evenly over the surface of the spring reducing the likelihood of producing a hot spot leading to breakage. Some coating systems insulate the spring from the oil which can have a detrimental effect on spring life. A properly formulated coating will aid in transferring the generated heat to the oil more rapidly, which cools the spring.

The ability of a coating to reduce friction also means it will reduce wear. Since valve springs do not uniformly contact another surface, the wear pattern is not even. As wear occurs, the spring can become weaker in these areas and ultimately break. This is particularly true in multiple spring stacks, but is also seen in single spring applications. In many racing applications springs will barely survive the race. So, any increase in the ability of the spring to maintain proper seat pressure is desirable. By combining reduced friction and wear with reduced heat generation and enhanced cooling of the spring, spring life and performance can dramatically increase. Our PolyPhen™ TLML Dry Film Lubricant has proven to be the best coating to use on valve springs. DFL-1 may be used in coat-it-yourself applications.

TECH TIP: In many case springs do not need to be sandblasted before coating. Degrease and then soak them in solvent such as Xylene, MEK or similar material for one-half hour. Rinse in clean solvent. When dry, apply coating. Test for adhesion. Press a piece of masking tape on cured coating and pull off rapidly. Small pieces of coating are okay but if large patches are removed, this indicates poor adhesion.

CRANKSHAFT

There are two primary reasons for coating a crankshaft: (1) Provide increased lubrication to the journals. (2) Aid in shedding oil from the counterweights. (Depending on the intended use, a different coating may be requred for the counterweights.)

Normally on a crankshaft, a film of oil provides lubrication. The rotational action of the crank coupled with the pressure-fed oiling system, aids in keeping a film of oil in place at higher pressures. However, when pressures exceed what the oil can carry, such as in high performance applications, the oil will flow away from the point of contact. All of Tech Line's Dry Film Lubricant Coatings can lubricate at pressures exceeding 350,000 PSI, which is well beyond the pressure you would expect to see in use. In addition, these coatings are "fluid retaining," helping to keep a layer of oil in place and becoming more lubricious or slippery as pressure increases, which enhances the protective friction reducing action.

When evaluating coatings for this application, the type of lubricating solids used have a major effect on the ability of the coating to provide protection and lubrication. Certain ingredients such as Teflon® are very slick only at low pressures and rotational speeds. Traditional lubricants like graphite do not lubricate in environments where moisture is not present. Tech Line utilizes Molybdenum Disulfide (MoS_2) as well as other extreme pressure lubricants that can carry tremendous loads while producing extreme rotational or sliding speeds. The unique resin system also helps to maintain the bond with the substrate under the same conditions.

Crank journals should be coated with a Dry Film Lubricant such as DFL-1, C-LUBE or TLML. C-LUBE is recommended since it cures to a thinner film than either DFL-1 or TLML. By coating with a Dry Film Lubricant, you increase the lubrication levels, reduce friction and add a protective layer.

The counterweights can be coated with either TLTD or TLHB. Both coatings have good oil shedding characteristics. TLTD will be used in most cases, as it not only sheds oil, but also helps cool the crank by transferring the heat generated in the crank to the oil more rapidly. TLHB should only be used in drag racing or similar applications where the engine will only be run for a short period of time. TLHB is a thermal barrier like Teflon® and other polymers and will trap heat in the crank.

TECH TIP: When coating a crankshaft, be sure to mask off oil holes. Putting a small piece of pinstriping tape over the holes works well. The little area under the tape that will not be blasted will not be a problem. Always thoroughly clean the oil passages in the crank. Advise your customers to do the same, as a little residue of the abrasive will cause damage.

Excessive buildup of Dry Film Lubricant coatings can be burnished with green "Scotch Brite™" pads or similar material. Properly done, there should be no need to change the clearances to allow for the coating. The coating will burnish to a near "0" dimension during running. DO NOT assemble the crank and bearings "tight."

ENGINE BEARINGS

A bearing is designed to carry tremendous loads while also being soft enough to allow small particles to "embed" in the bearing material. The various designs of bearings all address these primary needs. In addition, a bearing is a sacrificial part, in that it is easier and less expensive to replace bearings due to wear than to replace a crankshaft. Lubrication is critical to the life of a bearing.

Coatings come in two basic formulations, Solid Film and Dry Film. While the two terms can be interchangeable, when it comes to bearings, the differences are important.

> A **Solid Film** lubricant derives its name from the resin film formed during curing. This film has greater internal bond strength than the bond to the substrate, in this case, the bearing.
>
> A **Dry Film**, on the other hand, has a greater bond to the substrate than to itself. When these features are applied to a bearing, the Dry Film is superior.

Since no coating is 100% friction-free material, some pressure will be exerted against the coating. In a rotational application, such as bearings, the coating needs to be able to minimally abrade or flake away when such pressure is reached. Otherwise, the coating can delaminate. DFL-1 functions in this manner.

Tech Line designed PowerKote DFL-1™ Dry Film Lubricant primarily as a bearing coating. Generally, the particle size that may be

abraded is under 1 micron. The coating is capable of withstanding pressures in excess of 350,000 PSI while continuing to lubricate. This is well beyond the strength of the bearing itself. As pressure increases, the coating becomes more lubricious.

In addition, DFL-1 is a "fluid retaining" material that holds oil in place on the bearing. One of the most important features of DFL-1 is its ability to maintain its full lubrication characteristics, even in extremely thin films. DFL-1 typically will be applied in a film thickness from .0003" to .001".

Coatings that form a "harder" film will also reduce friction and provide a protective layer to the bearing. However, as these coatings begin to wear, clearances will open up. DFL-1 does not have this problem. When the coating approaches or exceeds .001", clearance can be affected. After curing, check the thickness and burnish with Scotch-Brite™ or similar material untill the film thickness is no more than .0003". During use, the coating will burnish to near "0" dimension. This characteristic allows the bearing to be run with its normal installed clearance.

Because of its unique formulation, DFL-1 extends the life of a bearing while reducing friction, particularly in instances where normal oil film failure could lead to bearing failure. DFL-1 is an easy to apply, water based material that has a low cure temperature of 300°F. It can be sprayed or brushed, though a spray application is recommended for best results.

TECH TIP: Where clearance is critical, such as on bearings and valve stems, reduce coating buildup by buffing with green Scotch-Brite™ pads or similar material.

PISTONS

The piston is one of the first parts that should be considered for coating. Pistons in a stock engine at full throttle can be subjected to nearly 10 tons of force every .02 seconds as repeated explosions heat the metal to more than 600°F. As automakers pursue higher efficiency, pistons will be subjected to even greater heat and pressure. Performance and race engines demand even more. Coating the piston can reduce friction, wear, part operating temperature and detonation. Coatings can also increase horsepower and torque, allow for higher compression and tighter clearance for a better ring seal.

For maximum performance, pistons can be completely coated with up to three different systems: (1) Thermal Barrier, (2) Dry Film Lubricant, and (3) Thermal Dispersant. These coatings can be beneficial on all pistons whether four stroke, two stroke, gas, alcohol, diesel, reciprocal or rotary engine.

PISTON TOP: For the top or crown of a piston, a Thermal Barrier coating is recommended to insulate the piston against damaging heat transfer, which in turn keeps more of the heat generated by combustion pushing down on the piston (rather than passing through) for greater power. By retaining minimal heat on the surface of the piston, less heat is transferred to the incoming fuel mixture, leading to a reduction in pre-ignition, which leads to detonation.

Thermal Barrier coatings also help to spread heat more evenly over the surface reducing hot spots and reflect heat into the chamber for more even distribution of heat, allowing more efficient combustion of the fuel. This allows more of the fuel molecules to be oxidized, which in turn, means less fuel is needed for optimum power.

The result is an engine that: (1) makes more power, (2) can be run with leaner air/fuel mix, (3) may need less initial timing, and (4) has less themal expansion due to less absorbed heat.

CBC1, CBC2, CBX or TL-PTG are Thermal Barrier Coatings that can be applied to the top of the piston. CBX is recommended for all high compression (12.5:1 and higher), turbocharged, supercharged, or engines running nitrous oxide.

PISTON SKIRT EXTERIOR: Applying a Dry Film Lubricant to the piston skirt exterior will reduce friction, galling and wear. The lubricants in these coatings can carry loads beyond the crush point of the piston. In addition, the lubricants are "fluid retaining" materials that can hold oil to the surface beyond the pressure where the oil would normally be squeezed off. The ability to carry greater loads, up to 350,000 PSI, while increasing lubricity (reducing friction) allows tighter piston to wall clearance to be run. This leads to better sealing with no increase in friction.

DFL-1 and C-LUBE are the most used Dry Film Lubricant coatings for piston skirts. TLML is also used, especially over TLMB for buildup.

PISTON SKIRT INTERIOR: By applying a Thermal Dispersant coating to the underside of the piston (as well as the wrist pin and connecting rod), oil that is splashed onto this area to cool and lubricate will shed rapidly. Heat transfers more rapidly when there is a large difference in temperature. The longer oil clings to a hot surface the hotter the oil becomes. By shedding the oil more rapidly, cooler oil is splashed over the surface more frequently. The result is a piston that stays cooler and expands less, allowing tighter piston to wall clearances and improved ring seal.

TECH TIP: To mask off ring lands, cut a strip of paper as wide as the ring lands and long enough to overlap. Tape the paper to itself to reduce glue residue. Remove paper before baking.

CYLINDER HEAD

One of the best applications for coatings is in combustion chamber areas. Coating the combustion chamber of a cylinder head can increase performance significantly. In addition, higher compression can be run, as the proper coating can provide resistance to detonation. Coating the intake and exhaust runners can also impact performance. Coating the exterior and the area under the valve cover can improve heat management.

By coating the combustion chamber, you reduce the amount of heat that escapes during the power stroke, which means that more of the heat generated is utilized in "pushing" the piston down. Coatings also insulate the surfaces so they absorb less heat, reducing the load on the cooling system, and reducing the amount of dimensional change the head may see from the heat it absorbs. Depending on the component and coating used, the following is affected:

(1) Thermal Barrier coatings to keep heat in and/or reflect heat into cooler or shrouded areas of the chamber.
(2) Thermal Barrier coatings retain less residual heat from combustion, transferring less heat to the incoming fuel charge.
(3) Thermal Dispersant coatings to more effectively radiate heat over the surface to reduce hot spots.

Combining these features increases power levels, reduces operating temperatures, aids in reducing detonation and can increase fuel efficiency and reduce emissions. By transferring less heat to the fuel charge, detonation is reduced, as pre-ignition which causes

detonation, is generally the result of excessive heat absorption by the fuel as it enters the combustion chamber. By allowing the heat of combustion to be more efficiently used, the fuel charge is better combusted. In most cases, this allows more compression while reducing fuel comsumption and increasing power. By accelerating the burn rate of fuel, through better heat management, less timing is needed to have the optimum burn occur at top dead center.

CBC1 or CBC2 Thermal Barrier Coating is the standard for combustion chambers, TL-PTG can also be used. CBX is recommended for very high compression motors (12.5:1 and higher) or for engines that have tight quench areas, as well as turbocharged, supercharged and engines using nitrous oxide systems. Coating the ports helps with flow and provides additional thermal benefits.

Coating the intake runner with a Dry Film Lubricant can reduce fuel drop out while insulating the incoming fuel from the heat of the head. Coating the exhaust port with TLHB can improve flow by creating a very slick surface, while reducing the amount of heat that can pass from the hot exhaust flow into the head. CBC2 or CBX may also be used in exhaust ports, though they are not as "slick" asTLHB.

Coating the exterior of the head with a Thermal Dispersant allows for faster transfer of heat that is absorbed from combustion into the airflow around the head, thus allowing the head to run cooler. This will impact the amount of heat transferred to the intake manifold as well as reduce the heat that accessories mounted on or near the head will be exposed to. When a Thermal Dispersant is applied to the area under the valve cover, better oil drain back is achieved, as well as better thermal transfer to the oil, resulting in improved cooling of the head and valve springs.

TECH TIP: To mask the valve seat area, drop in a valve that will also need to be coated. Then apply the coating. This way the seat is covered and both the chamber and valve face can be coated. After the coating has dried, remove the valve so the back of the stem can be coated.

ROCKER ARMS

Rocker Arms carry tremendous loads while generally being splash lubricated. While full roller rockers see minimal friction at the fulcrum, the same is not true of the standard stamped or cast steel rockers. The fulcrum area sees the greatest range of movement and will suffer if friction increases. The rocker can become worn, which will affect the geometry of the rocker in relationship to the valve and push rod. It will also increase friction which can impact the free movement of the rocker.

Therefore, stamped rockers, full roller rockers and even roller tip rockers can benefit from the application of a Dry Film Lubricant in the push rod tip cup.

By applying a coating to the fulcrum and the contact area of the rocker, friction can be significantly reduced. This will: (1) Improve part life, (2) aid in maintaining proper geometry, (3) Reduce frictional losses. Dry Film Lubricant coatings can handle loads far more than the ability of the engine oil and will become even more lubricious with use. This applies regardless of the design and will work very well on both stud and shaft mounted rockers.

All rocker arms will benefit from an application of Dry Film Lubricant to the push rod cup area. The loads at this point are tremendous, especially when running very high valve spring pressures. In addition, the contact patch is very small. These factors combine to increase friction, galling and wear. By applying a coating, the friction at the push rod tip cup interface is significantly reduced.

In independent testing, we have consistently seen a small increase in horsepower when the push rod itself was coated. The same effect should be seen if the rocker arm is coated. Most friction reduction however, is accomplished by coating only one surface; if a second is coated, there will be no significant reduction in friction. But coating two mating surfaces will extend part life further than if only one is coated.

DFL-1, C-LUBE or TLML may be applied to the critical points on the rocker arm. All should work equally as well in this application, though we generally recommend C-LUBE.

TECH TIP: When using stock stamped-type rocker arms that ride on a ball and stud, pre-bake rocker balls at 300°F for at least 20 minutes to force out any oil, which they will contain, before coating.

GEARS

Gears are another part in the driveline that can greatly benefit from Dry Film Lubricant coatings. Gears are generally subjected to extreme pressure, have minimal lubrication and minimal cooling.

The most critical part of the load is found in the ring and pinion. From here,the direction of power turns 90 degrees. This is the highest point of friction and load in the entire driveline. Applying a Dry Film Lubricant to the gears, whether rear end or transmission gears, this helps the gears remain lubricated under heavy load and extreme pressure up to 350,000 PSI. The benefits are reduced friction, heat and wear. Reduced friction really means that more of the power that is generated in the engine will reach the drive wheels rather than being absorbed by trying to turn the gears.

A second benefit in coating gears is that you can now use a lighter weight lubricant. There are two benefits to running a lighter weight lubricant.

Reduced Drag: For a gear to turn in a heavier fluid takes more power. The lighter the fluid, the less power is lost simply to tun the gears in this fluid.

Greater Cooling Capability: A lighter weight lubricant has greater capacity to cool the part from the heat generated by friction. A lighter weight fluid will carry that heat easier and transfer it to the case more readily than a heavier gear lube.

Obviously, different gear lubes have different thermal properties; but a lighter gear lube will always have better characteristics. Coating the ring and pinion, transmission gears, quick change gears, spider gears, etc., will reduce friction, extend part life, reduce the operating temperature, reduce drag by running lighter weight lubricants, resulting in more power to the drive wheels. The engine may not make more power, but the improved gear efficiency translates to more power to the ground. Additionally, the transmission will shift much easier with coated gears.

We recommend using any of our Dry Film Lubricant coatings, DFL-1, C-LUBE or TLML, which are simple to apply.

TECH TIP: When coating any gear, ALWAYS reduce the buildup of the coating by buffing with a green "Scotch Brite™" pad or similar material. On the ring and pinion, this is especially important as clearances need to be set and excessive buildup of the coating WILL affect the setup. Dry Film Lubricants need to be buffed or "run in" to show their full lubrication potential.

OIL PAN

To many the purpose of having an oil pan is simply to keep the oil from running onto the ground. However, the pan provides additional functions. It allows the oil to accumulate in an area for the pick up to draw continuously from, and it aids in the cooling of the oil. Many people ask that their oil pans be Teflon® coated to aid in oil shedding. While a speedy return of the oil to the oil sump is desirable, it may not be the best way to go for overall performance. Teflon® and similar materials are themal barriers and would inhibit the pan from cooling the oil. Painting an oil pan for appearance, using a typical paint, can reduce the ability of the pan to radiate heat. Chrome plating further aggravates the problem.

It would be better to use a coating that not only has good oil shedding abilities, but also helps rather than hinders the ability to transfer heat from the hot oil to the pan.

The solution is to use our Thermal Dispersant coatings both inside and out (TLTD or REPTD). These are oil shedding thermal dispersants with excellent corrosion inhibiting characteristics.

Coating the interior of the oil pan with a Thermal Dispersant helps the oil return to the sump faster and the thermally active ingredients carry heat away faster than bare metal.

Aditionally, coating the exterior of the pan with a Thermal Dispersant will enhance the surface transfer of heat to the surrounding air, further cooling the entire oil pan. The oil shedding lubricants contained in the coating also reduce the accumulation of dirt and other debris on the outside of the pan. The lack of corrosion, dirt and debris buildup allows the entire surface of the oil pan to disperse heat rapidly.

When all the characteristics of a Thermal Dispersant coating are combined, the oil pan functions in the best possible manner and keeps the oil running cooler.

The exception to the above would be in the case of engines used in very short competitive periods such as Drag Racing. This type of activity tends to cause oil temperatures to be inconsistent due to the time spent staging followed by quick bursts of speed. In these instances, an oil shedding thermal barrier such as PolyPhen TLHB should be used. TLHB will allow the oil to return to the sump faster and retain heat in the oil while sitting in the staging lanes.

TECH TIP: It is best to avoid sandblasting oil pans with multiple baffles or trap doors as abrasives can be trapped in these areas. Either phosphate the oil pan instead of sandblasting or sandblast and apply the coatings to the exterior only.

RADIATORS/HEAT EXCHANGERS

Radiators, oil and transmission coolers, intercoolers and any component used as a heat exchanger, will benefit from the application of a Thermal Dispersant coating. These coatings enhance the ability of the device to transfer heat by taking advantage of the following:

SIZE: In some instances, there is limited space available to mount a radiator or other heat exchanger, and therefore, size becomes an issue. Coating a heat exchanger expands the surface area versus bare metal. The larger the surface is, the more effecient it is at transferring heat. That is why a radiator has rows upon rows of fins. This is to expand the surface area available to transfer heat.

THIN COATING: Typical paint goes on three to five thousandths thick which expands the surface area but also holds heat in. Our Thermal Dispersant coating applies extremely thin, one-thousandth to less than half-a-thousandth of an inch which expands the surface area without excessive thickness. This means maximum surface area available for thermal transfer.

COLOR: Dark colors are best for transferring heat, which is why our Thermal Dispersant coating is black or dark gray. White, silver or aluminum are most inefficient for transferring heat.

ACTIVE INGREDIENTS: Our Thermal Dispersant coatings contain additives that are thermally friendly and have a higher rate of thermal transfer, faster than the base metal whether it be steel, brass or aluminum.

PROTECTIVE: These coatings have high corrosion resistance so that the metal itself does not oxidize. An oxide layer not only reduces the surface area, but also creates a thermal barrier effect. For example, when aluminum oxidizes, it creates aluminum oxide, which is a very dense material and is not conducive to thermal transfer. A lubricant additive helps to prevent debris from sticking to the surface. This helps the component to continue cooling efficiently, makes cleaning much easier and keeps it clean longer.

Customer feedback and independent testing has shown an average 20% improvement in thermal efficiency. For vehicles in competition where space and weight are at a premium, using these coatings allow the use of a smaller radiator with the same efficiency. This helps to reduce weight and by extension reducing the air opening in the front, can improve aerodynamics and reduce drag. These coatings can also be used on any surface or component where it is desirable to radiate away heat.

TECH TIP: Do not be concerned about coating the inside of a radiator. Theoretically, it can be done, but it is involved. Coating the exterior and tanks will provide the majority of benefits.

BRAKE ASSEMBLY

This is an area that, while it doesn't generate power, the use of coatings can dramatically improve vehicle performance. In competition, it is critical to lower the operating temperature of the brake system, especially the brake fluid. Let us look at how this is done.

Increased temperature is generated by the pad coming into contact with the rotor, or, in the case of drum brakes, the shoe meeting the drum. Braking a vehicle generates tremendous heat, sometimes to the point of glowing red even generating flames from the brake components. That heat also causes an increase in the temperature of the brake fluid. This will give you a spongy pedal or a long pedal and decrease braking efficiency. It can also lead to failure of the brake pads themselves or a warped rotor which can lead to less effective braking. Managing the heat created during braking is critical.

ROTOR: Starting with the rotor, coat the non-contact surfaces with Thermal Dispersant (TLTD or REPTD). This allows heat that is generated by the braking action to be radiated away from the rotor faster and tends to distribute the heat more evenly over the rotor itself. For drum brakes, only coat the non-contact portion of the drum.

HUB EXTERIOR: We can also coat the exterior surface of the hub to increase the radiating surface for the rotor. Taking it a step further, it is possible to coat the inside of the hub where the bearings ride to reduce the amount of heat that is transferred into the bearings and

the bearing lubrication. On disk and drum brakes, you can also coat the backing plate.

PAD BACK: Moving the other way, we coat the back of the pads with a Thermal Barrier. such as TLHB. Any of Tech Line's Thermal Barrier coatings (CBC1, CBC2, CBX and BHK) will work for this application. All of these will provide similar function. In testing, TLHB seems to be the best overall material. This coating will reduce the amount of heat that moves from the pad to the caliper.

CALIPER EXTERIOR: The exterior of the caliper should be coated with a Thermal Dispersant such as TLTD or REPTD. This will allow heat that gets into the caliper to be more rapidly transferred to the air surrounding it, cooling the caliper and the fluid.

CALIPER INSIDE CURVE: Again we recommend that this be coated with one of our Thermal Barriers. Generally TLHB is recommended because it is compatible with TLTD, which we put on the exterior curve of the caliper. However, any of the Thermal Barriers can be utilized to reduce thermal transfer into the caliper, thus reducing the fluid temperature.

PUCK OR PISTON: The puck or piston that holds the pad against the rotor should be coated. Coat the face that contacts the pad with a Thermal Barrier coating. You can also coat the skirt or the side of the piston with a Dry Film Lubricant such as C-LUBE or DFL-1, and in some cases, it is appropriate to buff on PKSX which reduces wear on the 'O ring' or seal for this piston.

When you combine the Thermal Barrier and the Termal Dispersant function of these coatings, you will see a dramatic drop in brake fluid temperature leading to improved braking. In competition, this allows vehicles to go deeper into a corner before they get on the brakes. They will slow or stop faster, giving them the advantage over cars that are running hotter functioning brake systems.

TECH TIP: Coating the back of the brake pad not only reduces thermal transfer, but can reduce brake squeal.

WHEELS

The general concern about wheels is not so much the temperature of the wheel, but the effect of wheel temperature on the tire. Three things affect tire temperature:

(1) Environment.
(2) Heat from the brake system, since the wheel is bolted directly to it.
(3) The contact between the tire and the road surface, which generates heat.

The key is to manage all the sources of heat. Although environmental temperatures can't be controlled, coatings can help manage the flow and transfer of environmental heat. Heat from the road surface is also uncontrollable, and can even be a help. For example, racers may try to heat up their tires when they are just starting or have been driving under a caution and the tires have cooled. The combination of heat from all these sources can have adverse effects on wheels, tires and brakes.

Consider the different areas of the wheel and how to manage heat:

INSIDE BELL: With the wheel being bolted directly to the brake system, it itself becomes a heat sink. The inside bell of the wheel that is turned toward the braking system should be coated with a Thermal Barrier coating, such as TLHB, CBC1, CBC2, CBX, BHK or any of our thermal barrier coatings. PolyPhen TLHB is preferred because along with being a very good thermal barrier, it has a 300°F cure temperature and is a very smooth material. In addition to reducing radiated heat, it prevents debris from adhering to the wheel. Additionally, coating parts of the brake system, can also help to manage the heat that affects wheels and tires.

RIM: When the tire seals to the wheel, the rim is in contact with the air inside the tire. By coating the rim with TLHB, it reduces the amount of heat that transfers from the wheel into the air contained inside the tire.

OUTSIDE BELL: The outside bell (exterior of the wheel that is visible) can be a heat radiating surface. Most commercial coatings for appearance become insulators because of color and/or thickness. Therefore, we recommend that a Thermal Dispersant coating be used so that the exterior of the wheel is an effective heat radiating surface, especially for competition use. The heat absorbed by the wheel will be transferred faster to the airstream, thereby allowing the wheel and tires to run cooler. In addition, the heat that is transferred from the brakes will be drawn away from the brakes, into the wheel faster, helping to reduce the load on the brake itself. It is a little bit like bolting a radiator to your brakes.

Regarding the visible appearance of the wheel, a dark black or gray coating like our Thermal Dispersant is a very common color in racing. It looks nice, has tremendous corrosion protection, and helps to keep the surface clear of debris accumulation. However, for those who would like the performance benefits of a Thermal Dispersant coating on bright finished or colored wheels, simply apply the coating to the areas between the spokes that are not as visible. Otherwise, coating the other parts of a wheel as explained above will significally reduce thermal transfer into the wheel and tire. Coating other areas not highly visible with the Thermal Dispersant will gain some of the benefits of the coating and still allow the finish you prefer showing on the exterior of the wheel.

The coating system described above has been effective on over the road trucks that are subject to severe loads on their brakes. For vehicles that are subject to extreme braking heat such as trucks encountering steep grades, we manufacture a special High Heat Thermal Dispersant for these applications. It has been proven to: (1) Improve pad life, (2) Improve braking efficiency, (3) reduce cracking of rotors and (4) shown an improvement in tire life. The application of coatings to manage heat in wheels and brakes has value in every type of vehicle.

TECH TIP: Whenever possible, we recommend using the combination of TLHB and TLTD on the different areas of a wheel because then only one cure is required.

TECH LINE Coatings

"All three cars are using Tech Line Coatings and finished 1, 2, 3"

"YOU Can Run With The Best Or Run With The Rest"

Cat# 110117