

The Next-Generation
Integrated Lubrication System

LHL System

Lube Hybrid Lubrication



Keeping machinery running all over the world

An innovation in lubrication technology

Purpose of the LHL system

The LHL system protects important machinery and factory equipment and provides a safer and more hygienic production environment.

Features of the LHL system

The LHL system provides precision delivery of the exact amount of lubricant required at a precise timing in order to promote the optimum performance of production machinery being operated under harsh conditions. In addition, the revolutionary lubricant developed for the LHL system helps to provide a cleaner and healthier factory environment. The LHL system is an exciting new solution that boosts the value of your production.



CEO **Eijiro Horikoshi**

Eijiro Horikoshi

To help the precision equipment and parts manufacturers that form our customer base in the 21st century to overcome the global environment problems they face today, we will continue to consider the relationship between lubrication technologies and our customers' needs. To this end, we aim to continue achieving energy and resource savings through wear reduction and prevention and to maintain mechanical part performance and stable machine functions, as advocated in tribology.

We will give careful consideration to the various conditions in which precision machines are used around the world, and continue to verify in-house the convenience, reliability, and

durability of maintenance conducted by using lubrication technologies. In doing so, we hope to be able to share our problem awareness with machine users and manufacturers throughout the world, who provide support for basic industries, as if we were a single team.

We have made it our mission to stick to the origin of value creation. In other words, we have determined to continue responding to the various applications of our worldwide customers and providing services that make our customers truly happy, while adhering to continuous improvement of the LHL lubrication equipment and the LHL system concepts.

Benefits of the LHL System

Cost savings

- Unlike conventional lubrication oil, LHL grease creates and maintains an ideal oil film over your machines' mechanical parts without being washed away by coolant, thereby substantially extending their life. The extended life of these parts reduces not only maintenance costs, but also machine downtime.
- The LHL system uses only a fraction of the quantity of lubricant compared to conventional oil lubrication systems. This significantly reduces the potential for the lubricant to end up in the coolant tank, thereby preventing degradation and extending the performance of the coolant.
- Compared to conventional oil lubrication systems, the LHL system offers tremendous cost savings by substantially reducing the consumption of lubricant required to create and maintain a perfect oil film on your machines' mechanical parts.
- If the LHL System is universally adopted throughout an entire facility, facility inventory management will be streamlined and made so much easier as the need to keep many different kinds of spare parts and lubricants for different lubrication systems is eliminated.

Performance enhancement

- The Automated LHL System eliminates the need for inspection and checking processes normally associated with conventional manual grease systems, and prevents operator errors that can cause machine downtime or even machine failure.
- Unlike conventional lubrication oil, LHL grease comes in cartridges so it is fully protected against external contaminants during refilling, resulting in a significant reduction in lubrication system problems.
- Unlike conventional lubrication oil, LHL grease creates and maintains an ideal oil film on your machines' mechanical parts without being washed away by coolant, thereby reducing wear of the mechanical parts and ensuring stable machine performance and improved longevity.

Automation

- Because of its significantly lower lubricant consumption compared to conventional oil lubrication systems, the LHL system requires far less refilling work. This reduces the operator workload and minimizes interruptions, thereby boosting production efficiency.
- Unlike lubrication oil, LHL grease is not a hazardous material and it does not require special management and monitoring of storage quantities, which helps save on storage space.
- Because the LHL system requires only a fraction of the quantity of lubricant compared to conventional oil lubrication systems, it significantly reduces the potential for the lubricant ending up in the coolant tank. As a result, the coolant lasts longer and there is almost no need to skim tramp oil off the coolant. Furthermore, treating waste oil in the coolant upon disposal becomes quite easy.

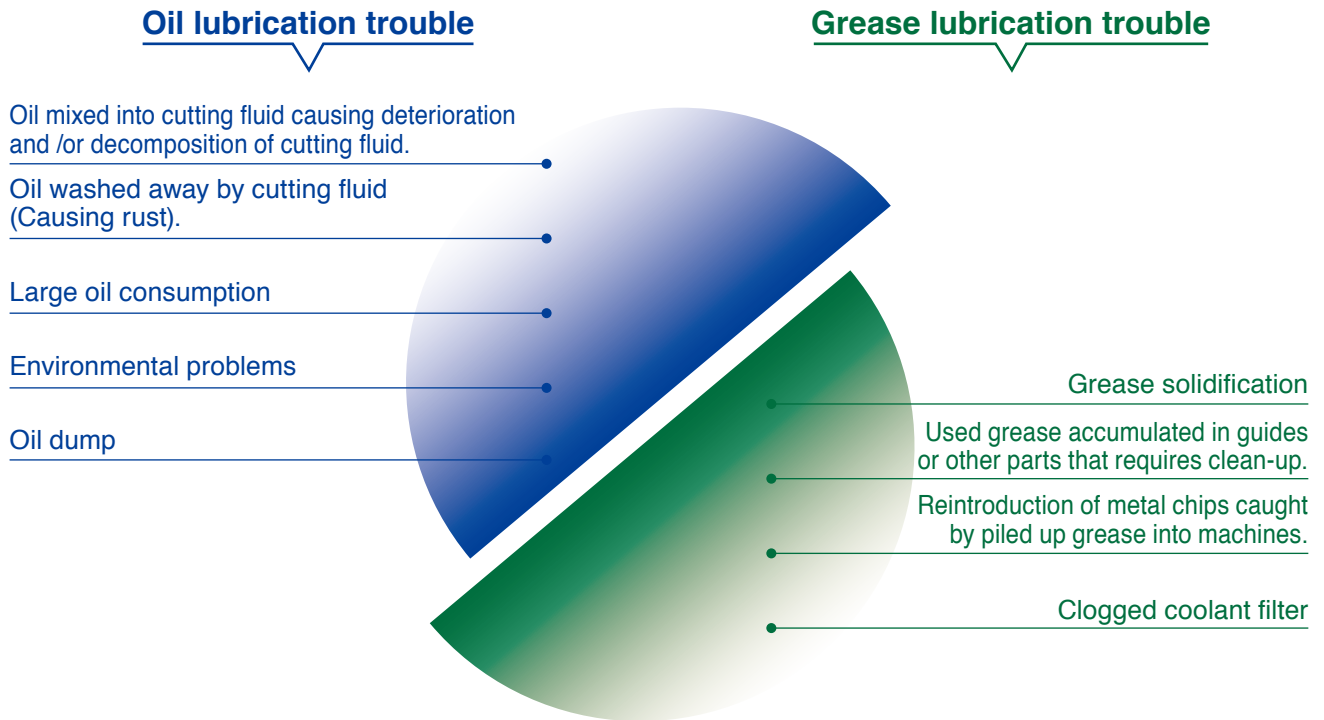
Environment

- Because the LHL system requires only a fraction of the quantity of lubricant compared to conventional oil lubricant, it helps to prevent coolant degradation and associated odors, thereby contributing to a more pleasant working environment.
- The fact that LHL grease comes in cartridges eliminates the problem of lubricant spills on the floor, thereby contributing to a cleaner working environment.
- Since die-casting machines require a great deal of lubrication, the oil often drips onto the factory floor. Switching to the LHL system resolves this problem, resulting in a cleaner working environment.

The purpose of LHL system development

Role of the LHL system in Machinery and Equipment Problem Prevention.

What are the problems which machine tools users are facing?

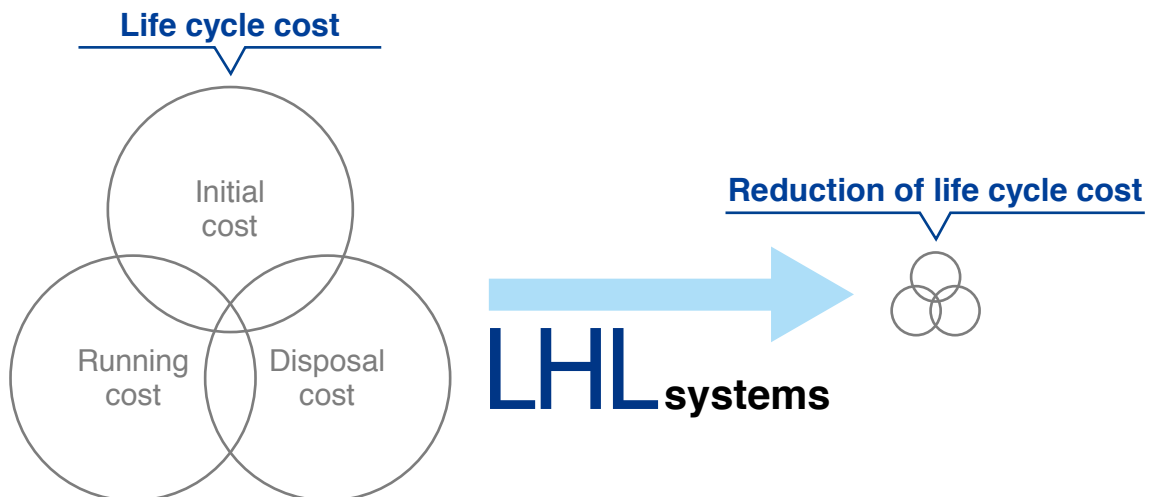


The relationship between maintenance and LHL system

Proactive maintenance generates economical effects

The purpose of maintenance is to minimize the life cycle cost of machines. It doesn't only mean to ensure the best longevity of the machines but also to generate economical effects as we

maintain them. In this sense, a proactive maintenance is very important.



Next-generation lubricant which contributes environment and human

- Preventing the crush and excessive abrasion of high-load liner motion guide bearings
- No emulsification and preventing rust with excellent anti-rust property
- Forming and maintaining a strong oil film on rolling surfaces of liner-guide bearing
- Offering an ideal lubrication effect with a proper lubricant volume at proper time

Integrating the advantage of Oil and Grease

Advantages of Oil Liquidity Excellent transport property No solidification	+	Advantages of Grease High Load-carrying capacity Wear resistance Water resistance Excellent oil film maintenance property Adherent property
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LHL-X100

Typical Properties of LHL-X100

Test items		
Appearance		Semi-fluid
Color		yellow
Worked penetration		460
Drip Point °C		180
Copper Corrosion (100 deg°C/ 24h)		Pass*
Evaporation Loss (99deg°C/ 22h) w.t.%		0.31
Oil separation (100deg°C/ 24h) w.t.%		N/A
Oxidation Stability (99deg°C/ 100h) kPa		5
Four Ball N & (kgf)	LNL	1236
	WL	1569
	LWI	480
Thickener		Urea
Base oil viscosity mm ² /s (100°C)		12.2
Based oil viscosity index		97

*No change in color into green or black on copper plate is observed.

LHL resolves oil lubrication problems.

The oil lubrication problems which machine tools users are facing

<ul style="list-style-type: none"> • Lubricant cost • Man-hours of refilling (lost productivity) • Contamination of machines and workshops • Storage and transportation of oil 	<ul style="list-style-type: none"> • Plenty of lubrication oil getting into cutting oil • Undesirable working environment due to foul smell • Deteriorated cutting fluid • Waste cutting fluid disposal 	<ul style="list-style-type: none"> • Poor oil film maintaining capacity • Rust and abrasion caused by cutting fluid washing oil away • Lubrication trouble due to different lubricant
Reducing lubricant consumption	Preventing the deterioration and decomposition of cutting fluid	Reducing the abrasion of machine parts

Comments about LHL from Machine Elements Manufacturers

One of the advantages of oil lubrication is its good penetration between mechanical parts. We can expect the same penetration from LHL too, since it has properties close to oil.

We had problems with mixtures of different types of grease. So, we think the dedicated cartridge for LHL is a great idea.




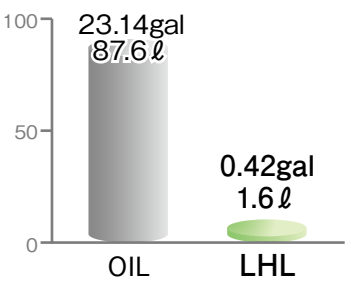
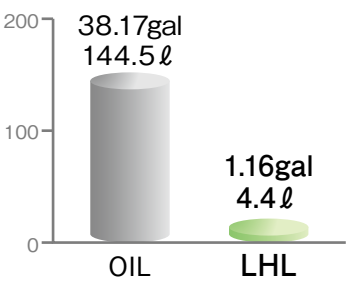
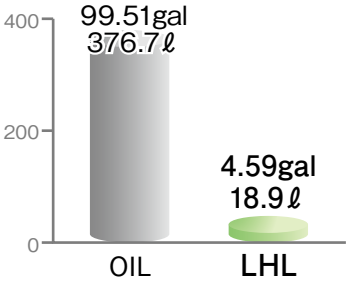
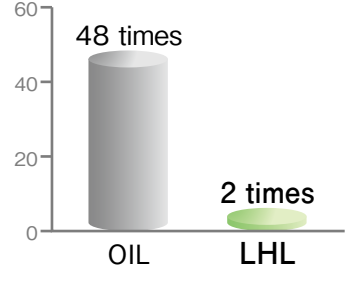
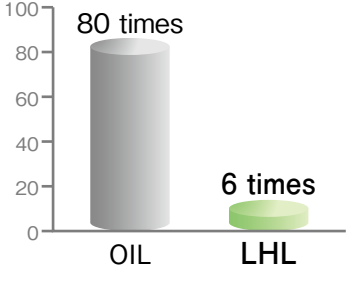
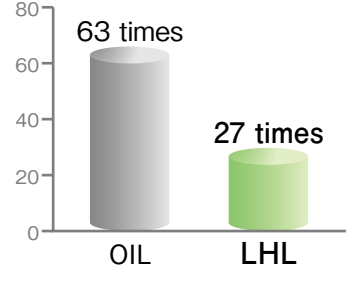
Depending on the place where parts were attached or their direction, we had oil being washed away, which led to lubrication failures. Naturally, then, water resistance is also important.

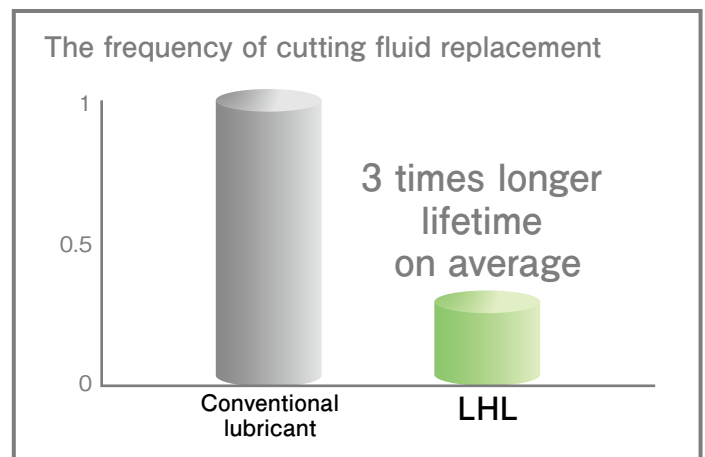
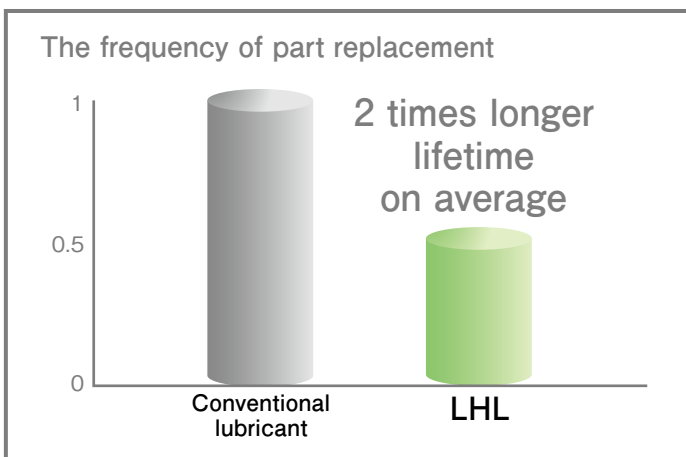
For machines used in environments exposed to water in particular, we have high expectations of LHL's sealing properties, an advantage of grease, and of the water-resistance of urea grease.

Benefits of LHL system

Production Cost Reduction

Comparison between lubricant consumption and machine tool costs

Machining center	BT-30		BT-40		BT-50	
						
Lubrication system	Oil	LHL	Oil	LHL	Oil	LHL
Number of lubrication points	23		23		36	
Lubricant	OIL#68	LHL-X100	OIL#68	LHL-X100	OIL#68	LHL-X100
Cutting fluid	Soluble		Soluble		Soluble	
Lubricant consumption/cycle	2.5ml	1.45ml	5.5ml	2.5ml	4.3ml	8.8ml
Comparison of Annual Lubricant Consumption						
Comparison of Number of Refills per Year						



※These comparisons are just examples. Actual results vary depending on machine operating conditions and environments.

※Please ask our sales staff for further details.

Reasons of Adopting the LHL System and Comments from LHL System Users

The reasons why LHL systems are purchased

Work pieces 4%

Auto parts manufacturer: K Company

·The reports from our factory workers say that because almost no LHL gets into the coolant, it produces minimal coolant contamination (it doesn't make the coolant slimy). → Very low lubricant content in the coolant enables work pieces to be cut without any oil remaining on their surfaces.

Pipe fixtures manufacturer: S Company

·We have had no problems whatsoever since upgrading to LHL two years ago. Refilling work has become quite easy. Furthermore, no oil sticking to the chips during dry cutting has made it very easy to recycle the materials, hence eliminating wastage.

Cleanliness of machinery 9%

Farming machinery engine manufacturer: Y Company

·We are located next to a lake and subject to stringent environmental conditions. Disposing of waste fluids containing lubricating oil and cutting fluids was a major problem. Since we changed from oil to the LHL system, there has been far less lubricant in the coolant tank and the tramp oil problem has disappeared, which we see as a major environmental benefit.

Motorcycle parts manufacturer: K Company

·Oil spills were an inevitable part of the oil refilling process, but with LHL there are no more spills and the factory is much cleaner as a result.

Auto parts manufacturer: F Company

·Die cast machines require a great deal of lubrication, and oil drips down from the machines onto the floor, making a mess. The LHL system is much cleaner and there are no pools of oil on the factory floor any more. It is not only better for the environment, but we also no longer have to worry about workers slipping over on oil spills.

Grease solidification 2%

Auto manufacture: S Company

·We no longer have grease solidification issues since switching from a progressive grease system to the LHL system. The progressive system we had been using discharged large quantities of grease, much of which mixed with the coolant. The LHL system produces a good oil film on the ball screws and guides.

Auto parts manufacturer: T Company

·We have switched to LHL in order to eliminate the grease solidification issues we had. After switching to LHL, we feel much safer as our visual inspections (although limited to parts that can be visually inspected from outside the machine) prove that all parts are properly lubricated. This is a huge improvement.

Lifespan of machine parts 37%

Auto manufacturer: H Company

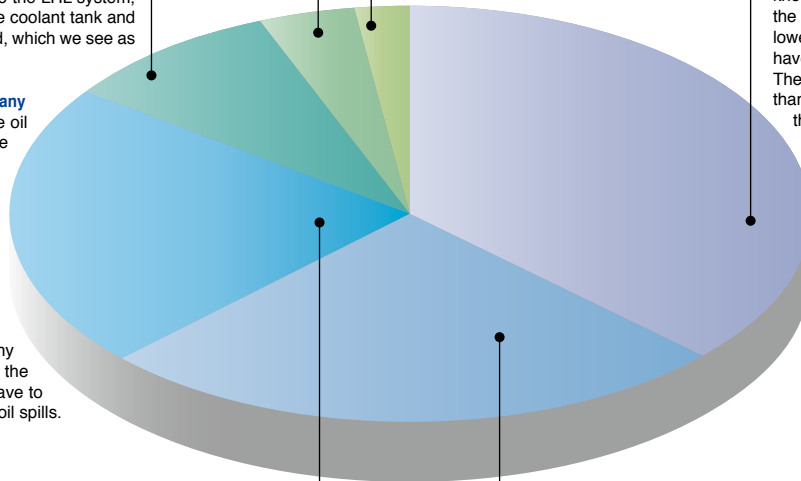
·Excellent lubricant penetration is observed on LM guides. Our impression is that the machine is under considerably less load when moving.

Auto parts manufacturer: M Company (lubrication of sliding surfaces)

·With oil lubrication, the machine had to be overhauled every three years, including replacing the Turcite, at a cost of around 6 million yen (\$73,860 USD). Since switching over to LHL more than three years ago, we have found that static accuracy remains good and an overhaul is still not required. The Turcite also lasts much longer.

Auto parts manufacturer: S Company

·Although we are too busy to calculate the precise numbers from the repair history, we know that when we were using oil lubricant, the ball screws and support bearings on the lower toolpost failed on a regular basis. We have been upgrading to LHL progressively. The first upgraded machines are now more than three years old, and there is no doubt that we are experiencing far fewer failures thanks to LHL.



Coolant life 22%

Motorcycle parts manufacturer: K Company

·The workers are pleased that the coolant tank no longer smells so bad. The LHL system delivers environmental benefits and we are thinking of implementing it on a factory-wide basis as part of our ISO environmental program.

Valve manufacturer: S Company

·Every year at the end of summer the workers would complain about the coolant smell so we would replace it at the start of autumn. Since changing to LHL last year, we have not had any complaints. I feel sure that the improvement is due to LHL.

Auto parts manufacturer: J Company

·Without a doubt, there is less dripping from the vertical axis guides with LHL compared to normal oil and the oil film lasts longer, which helps to extend the life of these parts.
·Unlike oil, LHL-X100 does not mix with coolant. Even if it gets into the coolant tank, LHL-X100 simply floats on the coolant surface. Therefore, it can easily be removed to prevent the coolant from becoming sticky. LHL-X100 is not only easier to use than oil, but it also makes the coolant last longer.

Using less lubricant 26%

Engine parts manufacturer: N Company (lubricating box ways)

·The LHL system uses less lubricant and requires less refilling work compared to conventional oil lubrication, thereby dramatically reducing contamination of water-soluble coolant and making it easier to clean the coolant tank when replacing the coolant.

Industrial electric machinery manufacturer: H Company

·The LHL system is more than just a cost-effective solution. We appreciate the regular visits by your representatives and the fact that only three LHL cartridge replacements are required per machine per year, exactly as stated in your cost-benefit document. Everyone in our plant is asking for LHL upgrades.

Industrial plastic parts manufacturer: S Company

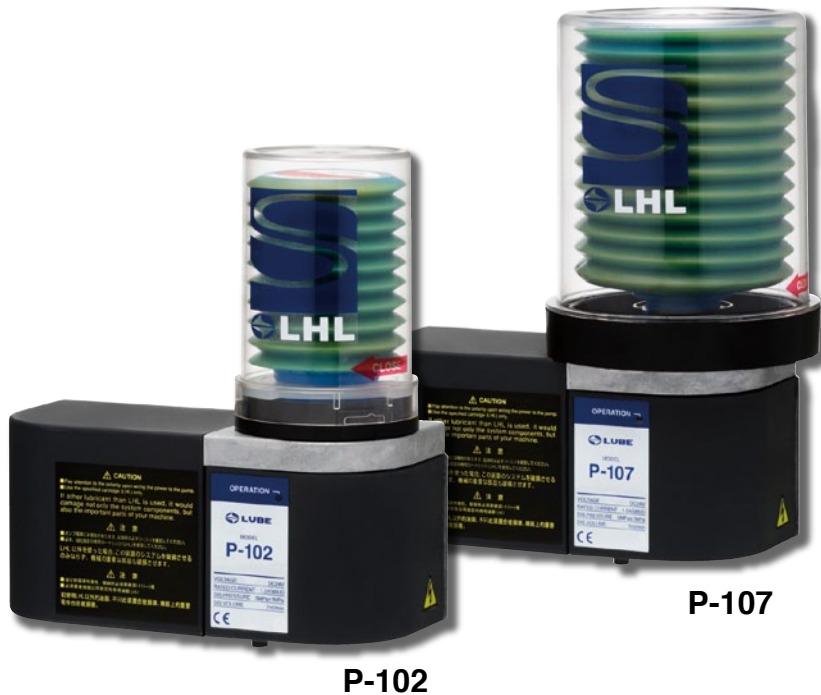
·Conventional oil lubrication systems require frequent refilling work. Some machines have lubrication pumps installed in hard-to-reach locations, which makes refilling work even harder. The LHL system offers an easy way of refilling and our people love it.

LHL major Clients

■AISIN SEIKI ■KOYO MACHINE INDUSTRIES ■CITIZEN SEIMITSU ■Jatco ■TAIYO KOKI ■TSUGAMI ■DENSO
 ■TOSHIBA MACHINE ■TOYOTA ■HINO MOTORS ■FANUC ■SUBARU ■BROTHER ■HOWA MACHINERY
 ■HONDA ■MAKINO ■MITSUBISHI HEAVY INDUSTRIES ■MINEBEA ■MURATEC ■MORI SEIKI ■UD Trucks
 ✳LHL systems have been installed many Die-Cast machines as well with successful results.

S Series LHL Specialized pump for LHL

Developed based on our 45-year history of failures and successes



Specifications

Power: DC24V
 Power Consumption: 24W
 Discharging pressure: 5MPa/8MPa
 Discharging time : No restriction
 Interval time : More than 10 seconds
 Wiring method: Terminal connection
 Manual override switch: With (Optional)
 Grease level switch: With
 Cover: Non combustible plastic (UL94-V0)
 Protection class: IP54
 CE approval: With
 Pump air bleeding: No restriction

Examples of the installation on machine tools



Color variation



Specialized metering valves for LHL

Direct pressure valve with straight thread and push-to-connect fitting offer easier tail tubing connection and installation into junctions.



①②③④⑤ S series Model: MU
 ⑥⑦ Junction for MU metering valve

LHL System service

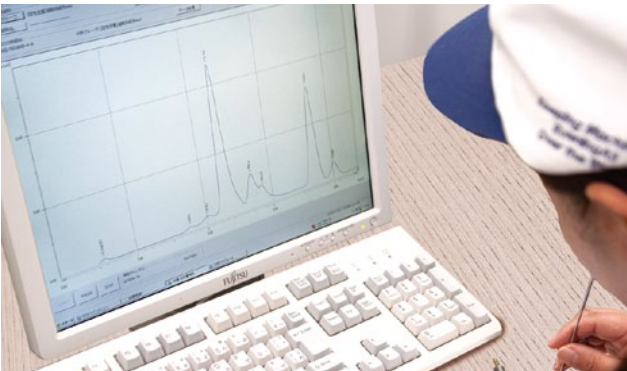
Installation on production machines

You can install the LHL system on any production machines currently operating in Japan, as well as those overseas to be up-graded.



Diagnostic Analysis for Machine Life Extension

LRA analysis (fluorescent X-ray analysis) enables real-time analysis of wear conditions of machine components operated at your production site. Based on the results of such analyses and abundant previous data, we understand the lubrication conditions that best fit your machines (in terms of environment and other conditions.) We provide minimum quantity lubrication (MQL) information based on our findings.



3D Piping diagram management

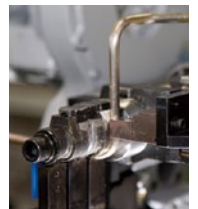
We can make a three-dimensional drawing of a system kit for the lubrication system you adopt and deliver it as a data storage/ system kit.

This reduces the total cost of piping and installation work, and enables you to install the system more safely and securely without any trouble.

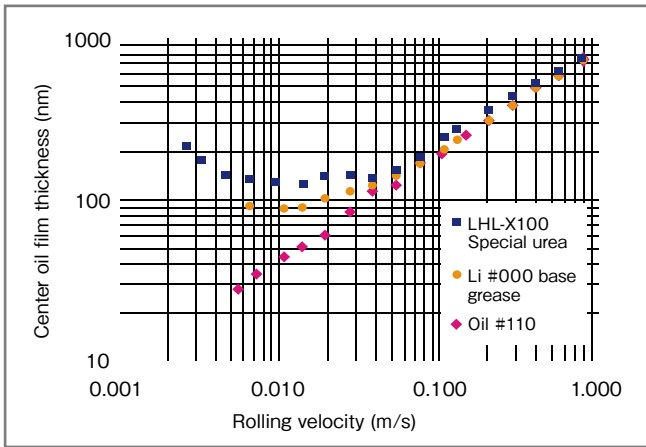


Automated steel pipe bending using "Bending machine"

- High-precision bending that maintains machine aesthetics when installed.
- Automated processing improves quality consistency.
- The pipes are pre-bent into ready-to-install configurations—No need for specialized bending techniques.
- Rigidity of steel piping eliminates need for troublesome pipe-clamping work.
- As steel piping improves lubricant flow, pump operating time can be shortened to save energy.
- Adapts to external environment (heat, deterioration, external shocks).



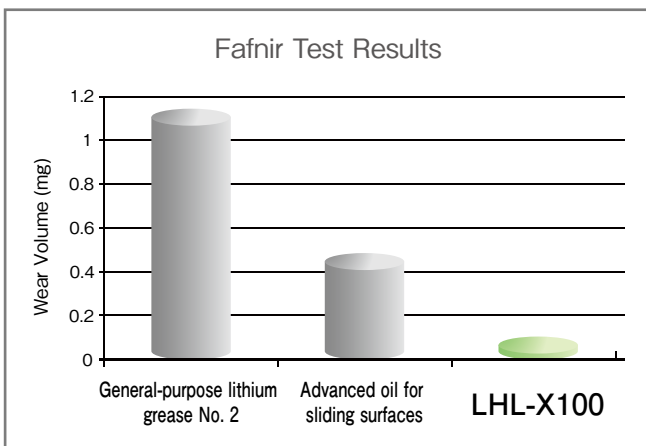
Basic Oil Film Thickness Evaluation Test



LHL-X100 special urea grease can thicken films at a speed that is lower than that of oil-soap grease.

Test results on oil film thickness as a basis of lubrication performance shows that the oil film is thinnest when rolling velocity is zero (or closer to zero). Compared to oil, grease can form thicker oil films. However, this special urea grease can form thicker oil films than lithium grease can, so it prevents insufficient oil films.

Fretting Resistance Test

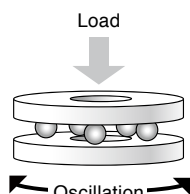


1. Evaluation method

Fafnir test (as per ASTM D 4170)

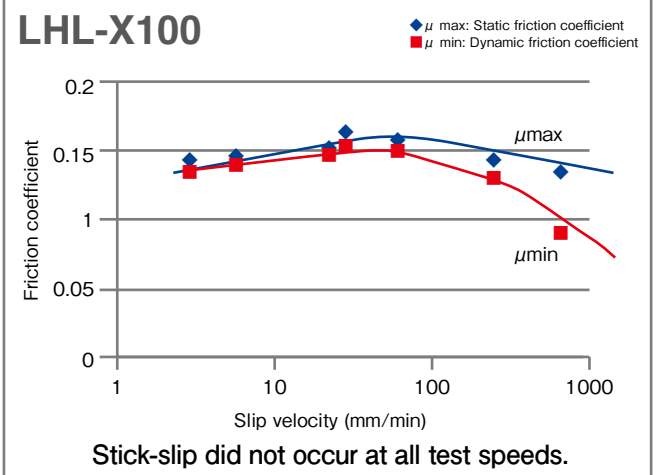
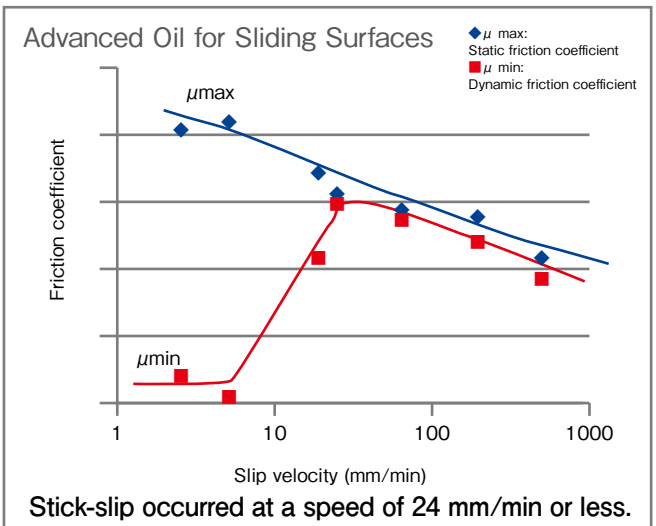
2. Test conditions (ASTM D 4170)

Bearings: ANDREWS W 5/8 (Use 2 sets.)
 Load: 2450 N (Contact pressure: 1861 MPa)
 Angle of oscillation: 12 degrees (Average rolling speed: 0.065 m/s)
 Oscillation cycle: 25 Hz
 Time: 22 hours
 Temperature: 25 degrees C
 Amount of grease per bearing set: 1.0 ± 0.05 g
 Measured amount of wear: Measured amount of wear: Wear of each race way grinder per bearing set is reduced. (Gross mass wear of the test race way grinder is halved.)



Friction Coefficient Test (Stick-Slip Resistance Performance)

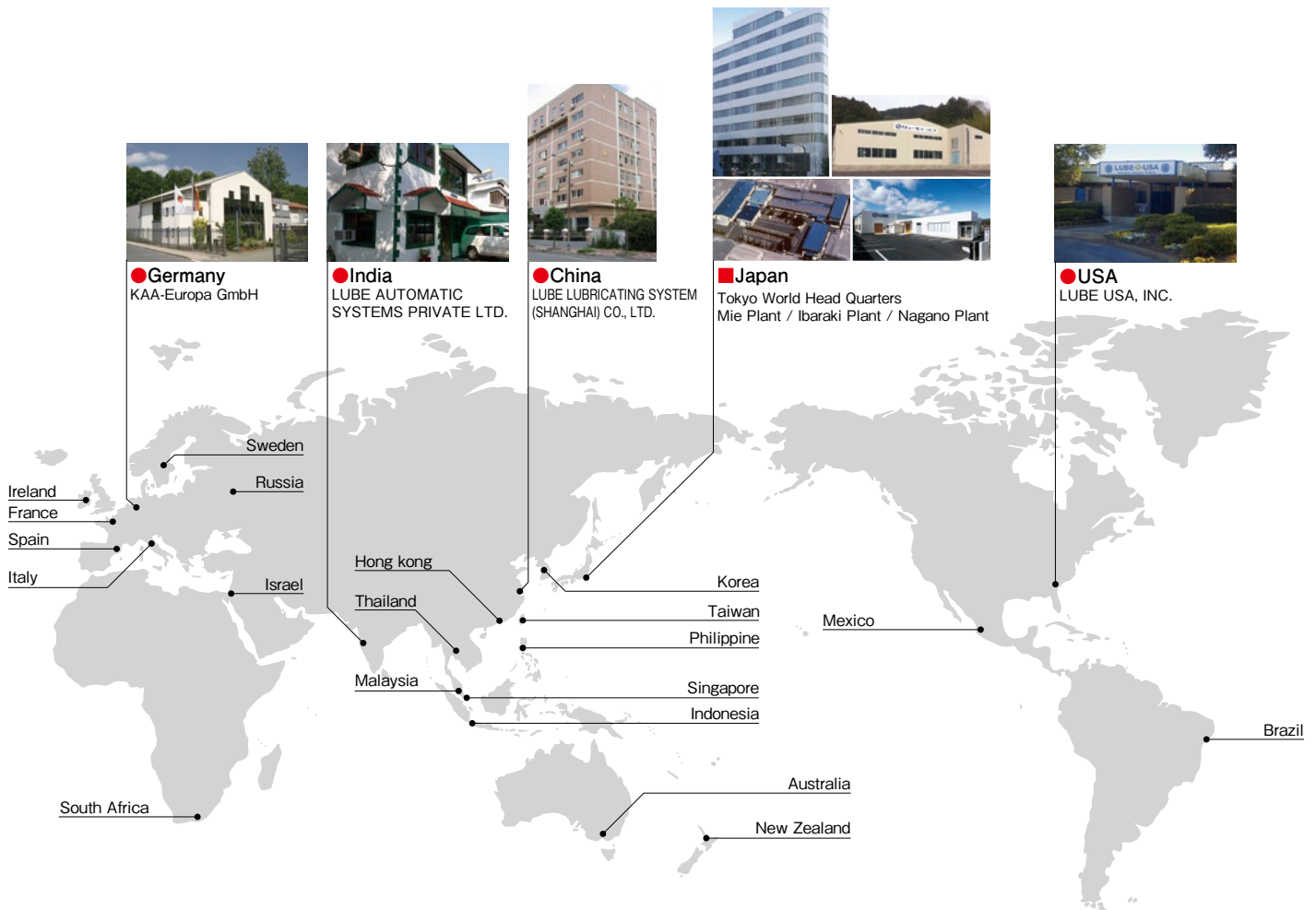
LHL-X100 did not cause stick-slip at all test speeds. Compared to even the most advanced oils for sliding surfaces, LHL forms lubrication films on metallic sliding surfaces successively to avoid metallic contact, even in low-speed areas because of special urea structure and additive.



● Test method

1. Tester: Bowden tester
2. Test conditions Material: Steel-Steel Temperature: Room temperature Load: 4 kgf Speed: 3, 6, 24, 30, 60, 240, 600 mm

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