

High-Performance Multiuse (HPM) Grease Certification

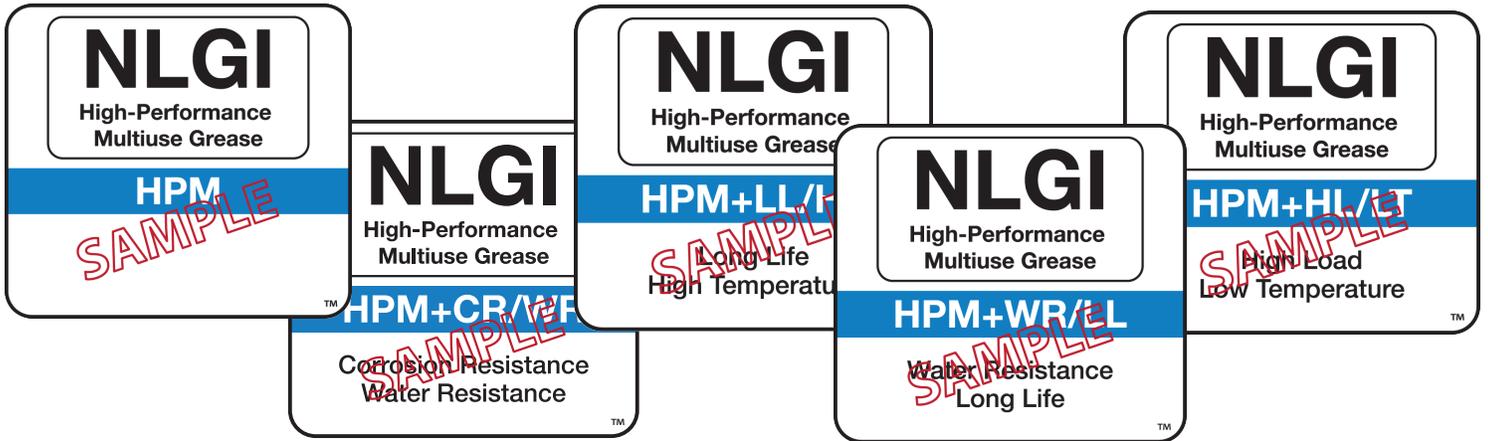


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High-Performance Multiuse (HPM) Grease Specifications

History

NLGI currently licenses lubricating grease through their Certification Mark program which includes the well-known GC-LB Performance Classification. The GC-LB specifications were developed beginning in 1966 and finally published in 1989 as ASTM D4950. This certification program has provided an internationally-recognized grease specification for grease and equipment manufacturers, users, and consumers since that time. Today, over 300 total products are licensed by 85 different companies. Although originally conceived as an automotive chassis and wheel bearing specification for after-market service greases, GC-LB today is still recognized as a mark of quality for grease specifiers.

In 2015, NLGI began efforts to upgrade the GC-LB specification due to advancements in materials, technologies, and applications, as well as precision issues with several of the D4950 tests. In July 2019, the decision was made to develop a new set of specifications with higher performance and broader utility to the industry. These new specifications evolved into what today is known as NLGI's High-Performance Multiuse (HPM) Grease Specifications. An additional goal was to define specifications for greases that meet core HPM specification **and** sub-categories with tests and limits for **enhanced performance** in the following areas (Figure 1).

In September 2020, NLGI finalized the HPM specifications and encouraged companies to begin formulating products. In December 2020, NLGI launched the HPM certification, along with four performance enhancement tags. The first approved product was announced in August 2021.

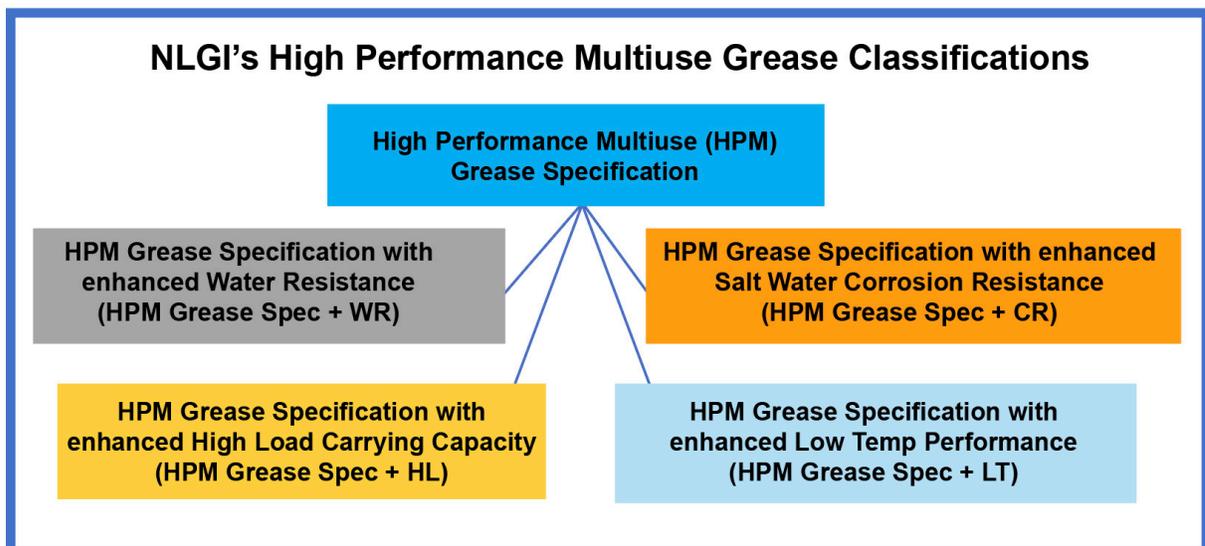


Figure 1 – HPM Plus Enhanced Tags

HPM Specification Details

	Property	Test Conditions	Test method	Units	Min	Max
HPM Spec	Cone Penetration of Lubricating Grease	Worked 60 Strokes	ASTM D217	dmm	220	340
	Cone Penetration of Lubricating Grease	Prolonged worked penetration ($\Delta 100k$)	ASTM D217	dmm	- 30	+ 30
	Elastomer compatibility of Lubricating Greases and Fluids [using SRE-NBR 28/P or SRE-NBR 28/PX elastomer per ISO 13226]	168 hours @ 125 °C	ASTM D4289	Δ Hardness (Shore A points)	-15	+2
				Δ Volume percent	-5	+30
	Oxidation Stability of Lubricating Greases by the Oxygen Pressure Vessel Method	Pressure drop after 100hrs @ 100 °C	ASTM D942	kPa (psi)		35 (5.1)
	Determining the Water Washout Characteristics of Lubricating Greases	60 minutes @ 79 °C	ASTM D1264	wt%		10
	Low Temperature Torque of Ball Bearing Grease	-20 °C	ASTM D1478			
	Starting torque			mNm (g·cm)		1000 (10,200)
	Running torque @ 60 minutes			mNm (g·cm)		100 (1,020)
	Oil Separation from Lubricating Grease During Storage	24 hours @ 25 °C	ASTM D1742	wt%		5.0
	Oil Separation from Lubricating Grease (Conical Sieve Method)	30 hours @ 100 °C	ASTM D6184	wt%		7.0
	Roll Stability of Lubricating Grease [using 1/2 scale penetration]	2 hours @ Room Temperature	ASTM D1831	dmm	-10%	+10%
	Wear Preventive Characteristics of Lubricating Grease (Four-Ball Method) Wear Scar Diameter	75°C, 1200 rpm, 60 minutes	ASTM D2266	mm		0.60
	Measurement of Extreme-Pressure Properties of Lubricating Grease (Four-Ball Method), Weld point	1770 rpm @ 27 °C	ASTM D2596	kgf	250	
	Determining Corrosion Preventive Properties of Lubricating Greases	48 hours @ 52°C	ASTM D1743	rating	Pass	
	Determination of Corrosion-Preventive Properties of Lubricating Greases Under Dynamic Wet Conditions (Emcor Test)	Distilled Water, 2 bearings	ASTM D6138	rating		0,1
	Detection of Copper Corrosion from Lubricating Grease	24hours @100°C	ASTM D4048	rating		1B

Table 1- HPM “core” Specification

In the HPM core Specification, seven tests are common to the GC-LB specification, but may have more restrictive limits: Cone Penetration (ASTM D217), Elastomer Compatibility (ASTM D4289), Water Washout (ASTM D1264), Oil Separation (ASTM D1742), 4-Ball Wear (ASTM D2266), 4-Ball EP (ASTM D2596), and Corrosion Prevention (ASTM D1743). Other tests, not included in the GC-LB specification include two mechanical stability tests: Extended Worker Penetration (100,000 strokes by ASTM D217), and Roll Stability (ASTM D1831). Two corrosion tests were added: EMCOR Rust Test (distilled water by ASTM D6138) and Copper Corrosion (ASTM D4048). Two high temperature tests were added: Oxidation Stability (ASTM D942) and High Temperature Oil Bleed (ASTM D6184). And finally, Low Temperature Torque of Ball Bearing Grease (ASTM D1478) replaced Low Temperature Torque of Wheel Bearing Grease (ASTM D4693). All of these tests are intended to raise the level of performance compared to GC-LB and to make the specification more relevant to multiuse industrial applications.

HPM+WR Specification

	Property	Test Conditions	Test method	Units	Min	Max
HPM +WR	Determining the Water Washout Characteristics of Lubricating Greases	60 minutes @ 79°C	ASTMD1264	wt%		5.0
	Determining the Resistance of Lubricating Grease to Water Spray	5 minutes @ 38°C	ASTM D4049	wt%		40
	Roll Stability of Lubricating Grease in Presence of Water (10% by wt distilled water) [using 1/2 scale penetration]	2 hours @ Room Temperature	ASTM D8022	dmm	-15%	+15%

Table 2 – HPM+WR specification

The HPM+WR Specification includes three tests intended to demonstrate an increased level of performance over the HPM core Specification in wet or water wash environments. Water Washout (ASTM D1264) is the same test as used in the HPM core Specification, but has a more restrictive limit. Water Spray Off (ASTM D4049) demonstrates a grease's ability to resist water spray, while Wet Roll Stability (ASTM D8022) evaluates the effect of water on grease mechanical stability.

HPM+CR Specification

	Property	Test Conditions	Test method	Units	Min	Max
HPM + CR	Corrosion-Preventive Properties of Lubricating Greases in Presence of Dilute Synthetic Sea Water Environments	10% Synthetic seawater (as in ASTM D665)	ASTM D5969	rating	Pass	
	Determination of Corrosion-Preventive Properties of Lubricating Greases Under Dynamic Wet Conditions (Emcor Test)	100% Synthetic seawater (as in ASTM D665)	ASTM D6138	rating		1 , 2
	Determination of Corrosion-Preventive Properties of Lubricating Greases Under Dynamic Wet Conditions (Emcor Test)	0.5N solution (~ 3% NaCl solution)	ASTM D6138	rating		2 , 3

Table 3 – HPM+CR Specification

The HPM+CR Specification includes three tests intended to demonstrate improved corrosion resistance over the HPM core Specification in saltwater environments. Saltwater Rust (ASTM D5969) is similar to ASTM D1743 in the HPM core Specification, but uses 10% synthetic sea water. Two versions of EMCOR Rust (ASTM D6138) evaluate corrosion protection in both 100% synthetic sea water and 0.5 N sodium chloride solution.

HPM+HL Specification

	Property	Test Conditions	Test method	Units	Min	Max
HPM +HL	Wear Preventive Characteristics of Lubricating Grease (Four-Ball Method) Wear Scar Diameter	75 °C, 1200 rpm, 60 minutes	ASTM D2266	mm		0.50
	Measurement of Extreme-Pressure Properties of Lubricating Grease (Four-Ball Method), Weld point	1770 rpm @ 27°C	ASTM D2596	kgf	400	
	Determining Extreme Pressure Properties of Lubricating Greases Using a High-Frequency, Linear-Oscillation (SRV) Test Machine, Pass Load	(Procedure B at 80°C)	ASTM D5706	N	800	
	Fretting Wear Protection by Lubricating Greases <i>*See Note</i>	Average of 2 runs, 22 hours @ Room Temperature	ASTM D4170	mg		5.0
	Determining Fretting Wear Resistance of Lubricating Greases Under High Hertzian Contact Pressures Using a High-Frequency, Linear-Oscillation (SRV) Test Machine	50°C, 100N, 0.300mm, 4 hours	ASTM D7594	mm		0.500

*As of November 2020, submitting D4170 data is optional. After ASTM approves the D4170 revisions, submitting D4170 data will be required.

Table 4 – HPM+HL specification

The HPM+CR Specification includes five tests intended to demonstrate improved load carrying capability over the HPM core Specification. Both the 4-Ball Wear (ASTM D2266) and 4-Ball EP (ASTM D2596) tests are the same tests as in the HPM core Specification, but have more challenging limits. Extreme Pressure Properties by SRV (ASTM D5706) and Fretting Wear by SRV (ASTM D7594) are included to further demonstrate improvement in these properties over the HPM core Specification. Fretting Wear by FAFNIR test (ASTM D4170) is also included with a tighter limit than the same test in the LB Specification.

HPM+LT Specification

	Property	Test Conditions	Test method	Units	Min	Max
HPM +LT	Low Temperature Torque of Ball Bearing Grease	-30°C	ASTM D1478			
	Starting torque			mNm (g·cm)		1000 (10,200)
	Running torque @ 60 minutes			mNm (g·cm)		100 (1,020)
	Grease Mobility	-20°C	US Steel	g/min	10	
	Determination of flow pressure of lubricating greases according to Kesternich method	-30°C	DIN 51805	mbar		1400

Table 5 – HPM+LT specification

The HPM+CR Specification includes three tests intended to demonstrate improved low temperature performance over the HPM core Specification. Low Temperature Torque of Ball Bearing Grease (ASTM D1478) is the same test as used in the HPM core Specification, but is run at a lower temperature. Grease Mobility (U.S. Steel Method) demonstrates grease resistance to flow at low temperatures, while Flow Pressure (by Kesternich method DIN 51805) is another way to look at flow at low temperatures.

Pricing Information

MEMBER PRICING

CORE PRODUCTS

Core Product Registration Tag Pricing (per tag)

2021	2022
\$2,900	\$3,900

	2021	2022
1 Tag	\$870	\$1,170
2 Tags	\$566	\$761
3 Tags	\$479	\$644
4 Tags	\$435	\$585

CORE PRODUCTS Renewal

Core Product Renewal Tag Renewal (per tag)

2021	2022
	\$2,535

	2021	2022
1 Tag		\$761
2 Tags		\$494
3 Tags		\$418
4 Tags		\$380

*Reprocessing Fees

HPM Core	First Tag	Each Additional Tag
\$2,000	\$1,500	\$500

NON-MEMBER PRICING

*Non-members with re-branded products will be charged as below. If interested in joining NLGI for discounted pricing, please contact nlgi@nlgi.org

CORE PRODUCTS

Core Product Registration Tag Pricing (per tag)

2021	2022
\$3,625	\$4,875

	2021	2022
1 Tag	\$1,088	\$1,463
2 Tags	\$707	\$951
3 Tags	\$598	\$804
4 Tags	\$544	\$804

CORE PRODUCTS Renewal

Core Product Renewal Tag Renewal (per tag)

2021	2022
	\$3,169

	2021	2022
1 Tag		\$951
2 Tags		\$618
3 Tags		\$523
4 Tags		\$475

*Reprocessing Fees

HPM Core	First Tag	Each Additional Tag
\$2,500	\$1,875	\$625

RE-BRAND PRICING

*Available to NLGI Members Only

**First product must be registered at full fare. Remaining products can be registered at re-brand pricing.

CORE PRODUCTS

Core Product Registration Tag Pricing (per tag)

2021	2022
\$580	\$780

	2021	2022
1 Tag	\$174	\$234
2 Tags	\$174	\$234
3 Tags	\$174	\$234
4 Tags	\$174	\$234

CORE PRODUCTS Renewal

Core Product Renewal Tag Renewal (per tag)

2021	2022
	\$507

	2021	2022
1 Tag		\$152
2 Tags		\$152
3 Tags		\$152
4 Tags		\$152

*Reprocessing Fees

HPM Core	Each Additional Tag
\$500	\$200

Certification and Renewal Process

Certification – Applicants submit the appropriate registration and certification mark user agreement forms found on the NLGI.org website under “certifications”, as well as the appropriate certification fees. A data set including all tests and results for the relevant specifications is submitted along with a 2 pound sample of production grease.

Renewal – Each certification holder submits a 1 pound sample of each certified grease on the anniversary of the certification date to renew their registration, along with appropriate renewal fees. These samples are subject to audit testing.

“How Do I Register My Products?”

To register your products, visit

www.centerforqa.com/hpm-contact/.

From there, you will need to request access to the licensing documents. Once you receive the documents, please submit paperwork and test sample directly to CQA.

Frequently Asked Questions

Are some thickener systems or chemistries required to meet the HPM grease specifications?

No. One will notice that the thickener type or grease chemistry is never mentioned in the HPM grease specifications. Since new technology or breakthrough approaches for manufacturing grease may be developed at any time in the future, there is no limit to the raw materials, chemistry or manufacturing process that is used to create a product certified as a High-Performance Multiuse grease. We like to think of the HPM and HPM+ specifications as “chemistry neutral”. The underlying requirement is that the product pass the performance requirements defined by NLGI’s HPM grease specifications.

What about the specifications for specialized industries or specialized applications that need even higher performance?

The HPM grease specifications will not satisfy all applications or industries. Since specialized applications typically have their own specifications, the new HPM grease specification will not replace those specialized specifications. However, a user or manufacturer creating specialized specifications may build upon the HPM or HPM+ grease specifications for their individualized specification

What about bio-based greases? Are there special limits or designations for greases registered under a bio-based standard?

Biobased grease is not addressed by the HPM grease specification. Users or specifiers can define their own requirements as to whether a grease must meet certain bio-based requirements. Early in the HPM grease project, it was noted that there are bio-based grease products that meet the GC-LB specification without any modification to the test procedures or limits. Therefore, the HPM grease specification does not differentiate between bio-based and other grease products. All greases must meet the performance limits defined by the core HPM grease specification and the applicable sub-categories.

What are the Core Performance Requirement and Additional Performance Requirements?

Since greases in some applications experience certain conditions (e.g., low temperature or exposure to liquids), different sub-categories (tags) with additional performance requirements were defined as part of the overall specification. In these sub-categories, a grease must meet the performance of the core HPM grease specification plus the additional testing related to (a) water resistance (+WR), and/or (b) high load-carrying capacity (+HL), and/or (c) salt water corrosion resistance (+CR), and/or (d) low temperature performance (+LT).

NLGI continues to work on a “Long Life” sub-category but this specification will require a new grease life test method, which is not expected until the 2023-2025 timeframe. Just for reference, we often talk about the additional performance requirements as “tags” attached to the “core HPM grease specification.

How will the end-user ensure that greases of different chemistries certifying to the HPM specifications will be compatible in real application situations?

Because the HPM and HPM + enhanced specifications are “chemistry neutral”, there is a possibility for different HPM-certified greases to be incompatible, even if the greases are from the same supplier. If NLGI were to include some sort of compatibility requirement in the HPM specifications, it would likely lead to exclusion of some types of grease thickener technologies, which goes against the HPM specification “chemistry neutral” design principles. Given the wide variety of chemistries utilized in grease products, there is no way to include such a compatibility requirement in the HPM specifications.

What type of applications will an HPM certified grease work in?

While the NLGI HPM grease specifications are designed to ensure a high level of performance for many different applications (multiuse), they are not suitable for all applications. We consider that multiuse applications may include the following:

- Conveyor Bearings
- Pillow Block Fan Bearings
- Industrial Gearbox Bearings
- Ball Screws
- Linear Bearings
- Plain Bearings
- Hinges
- Rollers
- Presses
- Winches
- Bushings
- Rolling Element Bearings
- Electric Motor Bearings
- Thrust Bearings
- Pump Bearings
- etc.

What is critical to remember is that the *HPM specification should not to be used as a short cut to grease selection*. Each application should be evaluated for its requirements, based on speed, load, temperature and operating environment. These parameters will affect the choice of base oil viscosity, consistency, thickener type and additive needs. An HPM-certified grease may or may not meet these requirements. *Consult an application engineer from your grease supplier to find out if an HPM grease is right for your application.*

The enhanced performance tags which may be included with the HPM core specification (+WR, +CR, +HL, +LT) are designed to provide improved performance in the areas of water resistance, corrosion resistance, load-carrying, or low temperature performance compared with the core HPM specification. However, note that the HPM specifications may not ensure adequate performance for some specialized applications, such as those with extremely high loads, extremely high or low temperatures, extremely high speeds, extremely high water wash conditions, or any combination of the above.

Future Plans – HPM and Beyond

NLGI has created a steering committee that will focus on the following:

- Continue work on High Temperature and/or Long Life categories (2 to 5 years) as well as considering initiation of work on other categories or applications as is deemed appropriate
- Work on current test reproducibility issues in conjunction with ASTM. Example: when the reproducibility issues with ASTM D4170 Fretting Wear test are resolved, the limits will become a requirement for HPM+HL registration or renewal, eliminating the “provisional licensing” status.
- Continue to refine test requirements and adjust or add to specifications as needed to reflect testing capabilities and industry needs with the intention to treat the specifications as “Living Documents”.

“Since NLGI does not dictate chemical, additive, lubricant or viscosity properties, formulators are free to get creative in order to create viable, quality products that meet HPM specifications”

- Crystal O’Halloran, NLGI Executive Director



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Additional Information

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