MOLYKOTE®

FROM DOW CORNING

Molykote® Food Grade Products

Oils • Greases • Pastes • Spray Oils • Silicone Fluids • Sealants

Molykote® Food Grade Products

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What is the HACCP system?

- The Hazard Analysis and Critical Control Point System (HACCP) dates back to the 1960s, when it was developed by the American Space Agency, NASA, in order to make risk-free food for astronauts.
- This concept is the basis for the need to use food grade lubricants in food processing plants.
- NASA identified points where contamination is likely to occur so that appropriate process controls could be implemented during production. That system is now federally mandated in the USA for use as a critical contamination prevention programme under the Food Safety Initiative in seafood, meat and poultry processing facilities.
- The European Union (EU) also employs the HACCP system to regulate all EU companies involved in handling foodstuffs

HACCP involves seven principles:

1. Analyze hazards.
   Potential hazards associated with a food and measures to control those hazards are identified. The hazard could be biological, such as a microbe; chemical, such as a toxin; or physical, such as ground glass or metal fragments.
2. Identify critical control points.
   These are points in a food's production--from its raw state through processing and shipping to consumption by the consumer--at which the potential hazard can be controlled or eliminated. Examples are cooking, cooling, packaging, and metal detection.
3. Establish preventive measures with critical limits for each control point. For a cooked food, for example, this might include setting the minimum cooking temperature and time required to ensure the elimination of any harmful microbes.
4. Establish procedures to monitor the critical control points.
   Such procedures might include determining how and by whom cooking time and temperature should be monitored.
5. Establish corrective actions to be taken when monitoring shows that a critical limit has not been met.
   For example, reprocessing or disposing of food if the minimum cooking temperature is not met.
6. Establish procedures to verify that the system is working properly
   For example, testing time-and-temperature recording devices to verify that a cooking unit is working properly.
7. Establish effective recordkeeping to document the HACCP system.
   This would include records of hazards and their control methods, the monitoring of safety requirements and action taken to correct potential problems. Each of these principles must be backed by sound scientific knowledge: for example, published microbiological studies on time and temperature factors for controlling foodborne pathogens.

Conclusions of HACCP:

- Contamination of food from lubricants used in food processing does occur.
- Good engineering and operational practices can minimize, but not eliminate, these threats.
- Any food or beverage manufacturer who is not using food grade lubricants is operating under an unnecessary risk.
- For these reasons it is vital for companies to identify and monitor any potential lubrication contamination hazards.

The NSF Food-Grade Lubricants Approval Program

- The Prior Approval Program for Non-food Compounds and Proprietary Substances was, in the past, the responsibility of the USDA's Food Safety & Inspection Service (FSIS)
- The approval process was primarily based on a review of the formulation ingredients of the lubricant provided by the manufacturer. It did not include testing.
- The FSIS announced the end of the program in 1998
- The National Sanitation Foundation (NSF) has, with guidance from the USDA and the FDA, resumed control of the food grade lubricant monitoring program.
- It basically mirrors the former USDA process
- Products authorized by the USDA were listed by NSF at http://www.nsf.org/usda/psnclistings.asp
- New products may be added by completing the NSF Registration Process.
- NSF registered products are highlighted in blue in the NSF “White BookTM” Listing.

Registered Molykote® Food Grade Lubricants can be found at

http://www.nsf.org/Certified/Common/Company.asp?CompanyName=dow+corning

Click at “NSF Registered Proprietary Substances and Nonfood Compounds”

The Food-Grade Lubricants Classification System

Category Code H1
“Lubricants with incidental food contact”

- NSF H-1 authorized lubricants are compounds that are permitted on equipment where food may potentially be exposed to the lubricated part of the machine.
- These instances are referred to by the USDA/FSIS as “Incidental Food Contact”
- **Note:**
  - **All Molykote® L-XXXXFG products are authorized as to category H1**
  - **Level of lubricant in the food must not exceed 10 ppm**
- Ingredients used in H1 approved lubricants must comply with
  - 21CFR 178.3570
  - 21CFR 178.3620 (Technical white oil)
  - Part 172 - FOOD ADDITIVES PERMITTED FOR DIRECT ADDITION TO FOOD FOR HUMAN CONSUMPTION, e.g. 172.800ff. MULTI-PURPOSE ADDITIVES
  - 21CFR 172.878
    (United States Pharmacopoeia-designated (USP) mineral oils)
  - 21CFR 172.882
    (Synthetic isoparaffinic hydrocarbons)
  - Part 182 - SUBSTANCES GENERALLY RECOGNIZED AS SAFE
  - 21CFR 182 With 9 Subheadings
    (Substances generally recognized as safe, such as phosphoric acid or zinc oxide)

Category Code H2
“Lubricants with no food contact”

- No „Food-Grade“, usually containing nontoxic ingredients
- May be used in food-processing plants on equipment in locations where there is no possibility of the lubricant or lubricated part of the machine to contact edible products
- Must only be used in locations where there is no possibility of the lubricant contacting edible products
- Products must not contain:
  - Heavy metals such as Sb, As, Cd, Pb, Hg, Se
  - Carcinogens, Mutagens, Teratogens, Mineral Acids,
  - Odorous Compounds

Category Code H3
“Soluble Oils”

- Refers to water-soluble oils. The machined part has to be cleaned and free of the emulsion before reuse
- Primarily being used as anti-rust agents and release agents
- Typical H3 Lubes:
- Edible oils (e.g. corn oil, soybean oil, etc.)
- Mineral oils complying with 21CFR 172.878
- GRAS substances
  - Section 182: Substances generally recognized as safe
  - Section 184: Direct Food Substances generally recognized as safe
- **Note: Molykote does not have H3 lubricants in its product line**

When to select Food Grade Products?

All companies that deal with or process food and beverage products have a need for using food-grade lubricants.
Perception used to be that “food-grade” synthetic lubricants will meet regulatory requirements but do not perform as well as non food grade lubricants.
This was mainly caused by limitations due to the poor availability of oxidation resistant base oils as well as due to the additive packages that did not comply with the listing requirements.
Due to the evolution of food-grade lubricant technology, nowadays modern H1 lubricants are made out of high performance base oils. E.g. the highly refined and saturated molecules in PAO’s are highly resistant to both emulsion and chemical degradation by dissolved water. Newer additive technology improves oxidation resistance.
That means, **modern food grade products last longer, perform better and are economically competitive to traditional non-food grade lubricants.**

Converting to Food-Grade (H1) Lubricants Strategy 1: Entire Plant

PRO

- No risk to mix up with non Food-Grade Lubricants
- Eliminate duplicate inventory of H1 and H2 products with similar performance
- Modern Food Grade Lubricants are high performance products
  - Reduce Maintenance Cost
  - Reduce Power Consumption
  - Reduce Equipment Break Down Costs

CONTRA

- Food Grade Lubricants usually have higher purchasing prices
- Eventually not available for all applications (due to performance limitations)

Converting to Food-Grade (H1) Lubricants Strategy 2: Specific Risk Areas Only

- This approach requires a clear definition of these risk areas, and a higher level of training to the lubrication technicians
- Can you define these areas precisely?
- Higher Risk of Mixing up Food-Grade Products with H2 Products
- Higher Inventory Cost

Converting to Food-Grade (H1) Lubricants Strategy 3: Machine-by-Machine

- Considerations:
  - Highest Risk of Mixing up Food-Grade Products with H2 Products
  - Potentially higher Inventory Cost
  - Clear Tagging of Lubricant Containers and Equipment Needed

Molykote® Food Grade Industrial Oils

Name	ISO VG	Base Oil	Additive Package	Viscosity @40°C [cSt.]	Viscosity @ 100°C [cSt.]	Viscosity Index ASTM D2270	Pour Point ASTM D97 [°C]	Flash Point ASTM D92 [°C]	Fire Point ASTM D92 [°C]	FZG ASTM D5182	Corrosion ASTM D130
GEAR OILS											
L-0115FG	150	MO/PB	R&O + AW	150	15.4	100	-18	260	277	12+	1a
L-0122FG	220	MO/PB	R&O + AW	219	20.0	101	-21	254	266	12+	1a
L-0146FG	460	MO/PB	R&O + AW	441	33.1	107	-18	302	327	12+	1a
L-1115FG	150	PAO/PB	R&O + AW	149	17.4	129	-48	266	293	12+	1a
L-1122FG	220	PAO/PB	R&O + AW	217	24.0	127	-39	260	288	12+	1a
L-1146FG	460	PAO/PB	R&O + AW	460	39.2	147	-36	285	313	12+	1a
AIR COMPRESSOR OILS/SEPARATOR FLUIDS/VACUUM PUMP OILS											
L-1232FG	32	PAO	R&O	30	5.7	138	-60	241	268	---	1a
L-1246FG	46	PAO	R&O	47	7.9	138	-42	246	274	---	1a
L-1668FG	32	PAO/MO	R&O	63	9.0	113	-18	229	241	---	1a
HYDRAULIC OILS/MULTI-PURPOSE OILS											
L-0532FG	32	MO	R&O + AW	31	5.3	103	-18	216	229	---	1a
L-0510FG	100	MO	R&O + AW	105	12.0	103	-15	257	282	---	1a
L-1346FG	46	PAO/MO	R&O + AW	45	7.4	131	-42	238	285	---	1a
L-1368FG	68	PAO/MO	R&O + AW	61	9.3	128	-42	243	296	---	1a
CHAIN OILS											
L-0460FG	68	MO	R&O/AWT/ PPD	66	8.3	100	-12	241	249	---	1a
L-1468FG	68	PAO	R&O/AWT/ PPD	66	9.3	131	-54	271	296	---	1a

Molykote® Food Grade Greases

Name	Color	NLGI	Worked Penetration [mm/10]	Base Oil viscosity @40°C [cSt]	Service Temperature Range [°C]	Drop Point [°C]	4-Ball-Tester, Weld Load [N]	Corrosion ASTM D130
MINERAL OIL GREASES								
G-0050FG	White	0	355-385	70	-20 to +150	216	>3150	0
G-0051FG	White	1	310-340	70	-20 to +150	232	>3150	0
G-0052FG	White	2	265-295	115	-20 to +150	246	>3150	0
SYNTHETIC GREASES; PAO								
G-4500	White	2	265-295	108	-40 to +150	270	3200	1
G-4501	White	1	310-340	110	-40 to +150	260	3600	0
SYNTHETIC GREASES; PFPE								
HP-300	White	2	265-295	160	-35 to +250	None	3300	---
SYNTHETIC GREASES; Silicone								
G-5032	White	2	265-295	500 (@25°C)	-40 to +200	None	1180	---

Molykote® Food Grade Pastes

Name	Color	Unworked Penetration [mm/10]	Density @20°C [g/ml]	Base Oil Viscosity @40°C [cSt.]	Service Temperature Range [°C]	4-Ball-Tester, Weld Load [N]	4-Ball-Tester, Wear Scar, 300 N Load [mm]	Press-fit	Screw Test in Boltet Connection µ Thread µ Head	Corrosion ASTM D130	Water Resistance @90°C
MO BASE OIL PASTE											
P-1900	White	290-340	1.1	85	-30 to +300	3,200	0.9	0.1	0.1	0	1

Molykote® Food Grade Spray Oils

Name	Base Oil	Color	Service Temperature Range [°C]	Base Oil viscosity @40°C [cSt]	Density @20°C	Pour Point ASTM D97 [°C]
MO BASE OIL						
Food Grade Spray Oil	MO	Transparent	-10 to +120	96	0.86	< -10
SILICONE BASE OIL						
Separator Spray	PDMS	Transparent	-40 to +200	3,000	0.97	-43

Molykote® Food Grade Compounds

Name	Base Oil	Color	Service Temperature Range [°C]	Unworked Penetration [mm/10]	Worked Penetration 60 Strokes [mm/10]	Drop Point [°C]	Oil Bleed 24 h@200°C [%]	Oil Evaporation 24 h@200°C [%]
SILICONE BASE OIL								
111 Compound	PDMS	White, translucent	-40 to +200	185	260	None	0.5	2.0

Dow Corning® Food Grade Silicone Fluids

Name	Color	Viscosity @25°C [cSt]	Flash Point ASTM D92 Open Cup [°C]	Flash Point ASTM D92 Closed Cup [°C]	Pour Point ASTM D97 [°C]	Specific Gravity @25°C	Viscosity Temperature Coefficient[1]
200® FLUIDS							
350 cSt.	Transparent	350	> 315	> 100	-65	0.970	0.60
500 cSt.	Transparent	500	> 315	> 100	-50	0.971	0.60
1,000 cSt.	Transparent	1,000	> 321	> 100	-50	0.971	0.61
5,000 cSt.	Transparent	5,000	> 321	> 100	-50	0.975	0.61
10,000 cSt.	Transparent	10,000	> 321	> 100	-50	0.975	0.61
12,500 cSt.	Transparent	12,500	> 321	> 100	-46	0.975	0.61
30,000 cSt.	Transparent	30,000	> 321	> 100	-43	0.975	0.61
60,000 cSt.	Transparent	60,000	> 321	> 100	-41	0.976	0.61
100,000 cSt.	Transparent	100,000	> 321	> 100	-33	0.977	0.61

[1] Calculated: 1-(Viscosity at 99°C/Viscosity at 38°C)

In case, lower viscosity grades are needed you may consider

- Dow Corning® 360 MEDICAL FLUID, 20 CST.
- Dow Corning® 360 MEDICAL FLUID, 100 CST.

Dow Corning® Food Grade Adhesives/Sealants

The requirements for Silicone Adhesives/Sealants approved for use in contact to food are different to the requirements of lubricants.

Silicone Adhesives/Sealants are treated as rubber articles.

Products suitable for food contacts shall meet the requirements of the F.D.A. regulation "Code of Federal Regulations 21 CFR" concerning food contact applications if used in accordance with its **Section 177.2600**:
"Rubber articles intended for repeated use".

This document can be obtained at

http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/CFRSearch.cfm?FR=177.2600

Following Dow Corning Products comply with these requirements

Name	Color	Special Purpose	Temper-ature Range [°C][1]	Skin Over Time [min.]	Tack Free Time [min]	Extrusion Rate [g/min]	Viscosity at 23°C [mPa•s]	Hardness [Shore A]	Tensile Strength [MPa]	Elongation at Break [%]	Specific Gravity	Listings/ Specifications
ACETOXY CURE SYSTEM												
732	Clear White Black	Multi-Purpose	-60 to +180 (205)[1]	7	20	350	---	25	2.3	540	1.04	FDA177.2.600 UL-94 HB NSF 51 NSF 61 MIL-A-46106
734	Clear White	Flowable	-65 to + 180	7	13	---	45,000	27	1.5	315	1.03	FDA177.2.600 UL-94 HB NSF 51 MIL-A-46106
736	Red	High Temper-ature	-60 to +260 (315)[1]	10	17	390	---	26	2.4	600	1.04	FDA177.2.600 UL-94 HB NSF 51 MIL-A-46106
NEUTRAL CURE SYSTEM (ALKOXY)												
748	White	Multi-Purpose	-55 to +177	15	46	145	---	35	1.9	350	1.3	FDA177.2.600 UL-94 HB MIL-A-46106

[1] Intermittent Exposure to higher Temperatures

General Mills Corporate Approved Lubricant List

The following Molykote® Lubricants have been listed
on General Mills Corporate Approved List by
Tom Trautman, Sr. Principal Scientist, Toxicology and Regulatory Affairs:

- Molykote® G-4501 Multipurpose Synthetic Grease
- Molykote® L-0460FG Chain Oil
- Molykote® L-1146FG Synthetic Gear Oil
- Molykote® L-1468FG Synthetic Freezer Chain Oil
- Molykote® L-0532FG Multi-Purpose Light Oil
- Molykote® L-1115FG Synthetic Blend Gear Oil
- Molykote® L-1246FG Synthetic Compressor Oil
- Molykote® Food Grade Spray Oil
- Molykote® L-1668FG Synthetic Blend Vacuum Pump Oil

Alfa Laval specifications (from Joakim Selin, GA Lindberg, June 2004)

Equipment	Food/Non-Food grade	Application	Molykote product	Drawing number
Separators	Food grade	Threaded connections & assembly	Foodslip EP2 (P-1900 in test)	537086-07
Separators	Non Food grade	Threaded connections & assembly	1000 Paste	537086-02
Separators	Non Food grade	Assembly	D-321 R Spray	535586-01
Separators	Non Food grade	O-Rings	111	539474-02
Separators	-	O-Rings	55 M	99992002-22
Separators	-	Assembly	G-n Plus	537086-01
MRO use	-	Bearings	BR2 Plus	538121-01

Tetra Pak Lubricants Recommendation

Equipment	Doc No.	Lubrication code	Specification No.	Material No.	Parts No.	Supplier Product
Spiraflow Heat Exchangers	OM-81686-2401	L Silicone grease	M 1255.322	55322-30	90 296-9	**Dow Corning 7 Compound**
						Klüber Unisilikon L 250L
Tetra Cap Applicator 21	OM-1381685-0101	L Silicone grease			90 296-9	**Dow Corning 7 Compound**
						Klüber Unisilikon L 250L
		Q Low friction assembly paste			90 296-12	**Molykote G-n Plus**
						Klüber Unimoly Plus
TCB 70 Wrapper	MM-1365982-0101	L Silicone grease	M 1255.322	55322-30	90 296-9	**Dow Corning 7 Compound**
						Klüber Unisilikon L 250L
TBA 8 Filler	MM-80291-0106	L Silicone grease			90 296-9	**Dow Corning 7 Compound**
						Klüber Unisilikon L 250L
		Q Low friction assembly paste			90 296-12	**Molykote G-n Plus**
						Klüber Unimoly Plus
TPA 19 Filler	MM-822337-0108	L Silicone grease			90 296-9	**Dow Corning 7 Compound**
						Klüber Unisilikon L 250L
		Q Low friction assembly paste			90 296-12	**Molykote G-n Plus**
						Klüber Unimoly Plus

Molykote® Lubrications Applications

PRODUCT	APPLICATION	BENEFIT USING MOLYKOTE
L-1122FG	Gear Box for SIG Filling M/C	H1 approved and able to cope with variable speeds
L-1468FG	Chain Inside Reverse Vending M/C takes plastic bottles to crusher	Extended equipment life Use on all chains Lower maintenance costs
G-4500	Diafragma Pump to empty excess deck-water - Pumps for Marine	Reduced Temperature Lasted 1000 hrs without overheating, where competition failed Now used in Production
G-5032	Gilde Meat Processing Plant Hooks to transport meat througout factory	Longer Life. Reduced wear H1 Approved Excellent steam and water protection
G-4500	Toothracket of a sliding system were the elevators are hanging and move on	H1 Approved Suitable for repackaging (Voice of the customer)
G-4500	Used in Actuators, which have to open or close valves and are pneumatically powered	Speciality lubricant that combines the benefits of wide operating temperature and broad compatibility with varied materials
111	Lubrication of valves taps	Drinkable water approval (KTW)
L-1115FG	Gear for Vacuum Screw Pump in Pharma Industry	Oil is needed to bind solvent in the production process (special process used in the pharma industry)
L-1668FG	Rotary Vane Vacuum Pump	10 times longer lifetime as competitors product
L-0532FG	Bearings, Gearboxes, Compressors	High performance
L-1115FG	Helical steel drive for a meat-slicing blade	Reduced friction of internal components lowered the operating temperature of the gearbox by 20°C
P-1900	Stainless steel threads on pumps and filters in a Pharmaceutical Plant	No related re-build problems FDA Approval
L-1246FG	Lubrication of a rotary screw compressor in a food processing plant	Extend compressor lifetime and oil drain interval (up to 6000h)

Molykote® Lubrications Applications

PRODUCT	APPLICATION	MARKET SEGMENT/COMPANY
L-1468FG	Lubricating chain running through blast freezer	Bakery
L-xxxxFG	Using Food Grade Oils	Biery Cheese
Gear Oils	Gearboxes on reducers	Christe Brown
L-0510FG	Assortment of gar reducers	Dawn Foods
L-0146FG / L-1232FG	Gearing Oils / Compressor Oils	Driggs Farm
G-4500 L-1122FG	All other greasing points and Gear Boxes of potato slicer (possibility of water entering the G/B)	Frito-Lay
P-1900	Screw of Extruder (FG)	Frito-Lay
Food Grade Spray Oil	Chains & Moving parts (FG)	Frito-Lay
L-1115FG / L-1122FG	Gear Boxes recommended oil ISO VG 150 / ISO VG 220	Frito-Lay
L-1146FG	ISO VG 460 Bearings of ID fans, blowers, peddastal blocks	Frito-Lay
L-1346FG	Hydraulic Oil	Frito-Lay

Food Grade Oils/Fluids Cross-Over List

ISO VG	MOLYKOTE	ARAL	BEL-RAY	CASTROL	EXXON	KLÜBER	MOBIL	SHELL
CHAIN OILS								
32		Eural Chain 32	No-Tox Chain Lubricant 65	Castrol Viscoleb 32		Klüberoil 4 UH1 - 32 N		
68	L-0460FG L-1468FG							
150	L-1115FG			Viscoleb 150 Vitalube GS 150				
220	L-1122FG	Eural Chain 220						
460	L-1146FG	Eural Chain 460	No-Tox Chain Lubricant 2500					
				Castrol Viscoleb 1500				
COMPRESSOR OILS								
32	L-1232FG				Sigma Lubricant FG	Summit FG 100	DTE FM 32	
46	L-1246FG	Eural Comp 46					DTE FM 46	Cassida CR 46
68	L-1668FG	Eural Comp 68				Summit FG 200	DTE FM 68	
GEAR OILS								
150	L-0115FG L-1115FG	Eural Gear 150	No-Tox Gear Lubricant 6208		Univis 150	Klüberoil 4 UH1 - 150 N Klübersynth UH1 6 - 150	DTE FM 150	Cassida GL 150 Cassida GLE 150
220	L-0122FG L-1122FG	Eural Gear 220	No-Tox Gear Lubricant 6208	Tribol FoodProof 1800/220 1810/220	Univis 220	Klüberoil 4 UH1 - 220 N Klübersynth UH1 6 - 220	DTE FM 220	Cassida GL 220 Cassida GLE 220
320		Eural Gear 320	No-Tox Gear Lubricant 6208	Tribol FoodProof 1800/320 1810/320	Univis 320	Klüberoil 4 UH1 - 320 N Klübersynth UH1 6 - 320	DTE FM 320	Cassida GL 320 Cassida GLE 320
460	L-0146FG L-1146FG	Eural Gear 460	No-Tox Gear Lubricant 6208	Tribol FoodProof 1800/460 1810/460	Univis 460	Klüberoil 4 UH1 - 460 N Klübersynth UH1 6 - 460	DTE FM 460	Cassida GL 460 Cassida GLE 460

Food Grade Oils/Fluids Cross-Over List

ISO VG	MOLYKOTE	ARAL	BEL-RAY	CASTROL	EXXON	KLÜBER	MOBIL	SHELL
HYDRAULIC OILS								
32	L-0532FG	Eural Hyd 32		Tribol FoodProof 1840/32 Vitalube HS 32	Nuto FG 32	Klüberoil 4 UH1 - 32 N	DTE FM 32	Cassida HL 32
46	L-1346FG	Eural Hyd 46		Vitalube HS 46	Nuto FG 46	Klüberoil 4 UH1 - 46 N	DTE FM 46	Cassida HL 46
68	L-1368FG	Eural Hyd 68	No-Tox Gear Lubricant 6232	Tribol FoodProof 1840/68 Vitalube HS 68	Nuto FG 68	Klüberoil 4 UH1 - 68 N	DTE FM 68	Cassida HL 68
100	L-0510FG					Klüberoil 4 UH1 - 100 N	DTE FM 100	
SILICONE FLUIDS								
N/A	Dow Corning 200 Fluids							Cassida Silicone Fluid
N/A	Separator Spray							
VACUUMPUMP OILS								
32	L-1232FG							
46	L-1246FG							
68	L-1668FG							