

KEEPING DAIRY OPERATIONS RUNNING

**A LUBRICATION & RELIABILITY
PLAYBOOK FOR DAIRY PROCESSORS**



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LE OPERATES UNDER AN ISO 9001 CERTIFIED QUALITY SYSTEM.



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CHAPTER 1

Why Reliability Matters in Dairy Processing

An Industry Built on Perishability

Dairy is one of the largest and most demanding segments of the American food supply. U.S. dairy manufacturing and marketing supports more than three million jobs, generates roughly \$198 billion in wages, and contributes on the order of \$779 billion in total economic output. Demand is strong and growing: Americans consumed about 651 pounds of dairy per person in 2024, near the highest level since the USDA began tracking consumption in 1975, with butter reaching an all-time high of 6.8 pounds per person and yogurt up 6% to 14.5 pounds per

person. Globally, the dairy products market is projected to grow from roughly \$496 billion in 2023 to about \$640 billion by 2030.

Processors are investing accordingly. U.S. dairy companies have committed record capital – more than \$8 billion in recent processing-capacity expansions – to meet surging demand for cheese, butter, high-protein products and dairy ingredients. In this environment, every hour of production matters, and unplanned downtime is not merely an inconvenience. It is a direct threat to margin, to product, and to food safety.

\$30,000
ESTIMATED COST
PER HOUR OF UNPLANNED
DOWNTIME IN FOOD
PROCESSING

651 lbs
DAIRY CONSUMED
PER PERSON IN 2024,
NEAR AN ALL-TIME HIGH

\$8b
RECORD
U.S. DAIRY PROCESSING
CAPACITY INVESTMENT



The Perishability Penalty

What makes dairy uniquely unforgiving is the product itself. Raw milk is a highly perishable, temperature-sensitive commodity moving continuously through a chain of tightly linked equipment. Milk arrives by tanker on a schedule, must be chilled and stored within tight temperature windows, and then flows through separation, pasteurization, homogenization and downstream processing with little room for delay.

Industry estimates place the cost of unplanned downtime in food processing facilities at roughly \$30,000 per hour, and in some high-volume operations far higher. Critically, direct production loss represents only a portion of the total – often 35% to 60%. The rest is hidden: dumped or downgraded product, cleaning and restart costs, missed shipments, customer penalties, and the compliance burden that follows any food-safety interruption. When a pasteurizer, separator or filler goes down unexpectedly, the clock starts immediately, because warming milk cannot wait.

How Lubrication Failure Cascades

In a dairy plant, equipment is interdependent. Receiving pumps feed storage silos, which feed separators and clarifiers, which feed pasteurizers and homogenizers, which feed cheese vats, butter churns, cultured-product lines, ice cream freezers and filling lines. A bearing seizure or gearbox failure on any one stage can back up or halt the stages around it within minutes.

Lubrication failures are especially insidious because they usually begin as invisible degradation. Water contamination in a gearbox,

grease washout on a bearing, or film breakdown on a high-speed separator spindle can advance for weeks before a catastrophic seizure. By the time the symptom is visible, the damage is done: bearings have scored, gears have pitted, and the plant is scrambling for an emergency repair while product sits at risk.

Consider the chain reaction. A separator bearing fails mid-run. Standardization stops. Milk backs up in raw storage and approaches temperature limits. The pasteurizer downstream loses feed and must divert. Cultured and cheese lines lose their scheduled milk supply. Within an hour, thousands of pounds of product may be off-spec, quality holds may be triggered, and the plant faces both financial loss and a potential food-safety event.

The Market Imperative

Dairy processing is concentrated among large, sophisticated operators. Dairy Farmers of America, the nation's largest cooperative, reported roughly \$23 billion in net revenue and handled more than 55 billion pounds of milk in a single year. Other leaders, such as Land O'Lakes, Prairie Farms and Darigold, run extensive multiplant networks. For all of them, reliability is not just a maintenance concern; it is a competitive advantage.

A plant that runs consistently, with fewer unplanned stops and longer asset life, holds a structural cost advantage over competitors still trapped in reactive firefighting. In a business defined by perishable inventory, thin margins and strict food-safety expectations, that advantage begins with the lubrication program.



CHAPTER 2

Critical Dairy Process Equipment & Their Lubrication Pain Points

A dairy plant is a hostile environment for lubricants. From near-boiling pasteurization and hot CIP cycles to sub-zero ice cream freezers, from constant high-pressure washdowns to continuous exposure to caustic and acidic sanitizers, every lubrication point faces conditions that would destroy standard products within days. Understanding these zone-by-zone challenges is the first step toward building a reliability program that works. The plant's primary enemies are moisture,

Raw Milk Receiving & Storage

⚙️ **Key Equipment:** Tanker unloading pumps, positive-displacement and centrifugal milk pumps, silo and tank agitators, and transfer conveyors.

⚠️ **Operating Conditions:** Continuous or near-continuous duty, frequent washdowns, and exposure to moisture and cleaning chemicals. Agitator gearboxes run long hours under variable load.

🛢️ **Lubrication Challenge:** Bearings and gearboxes must resist water washout and emulsification. Food-grade coverage is required wherever incidental product contact is possible, and rust protection is essential in this constantly wet zone.

Separation & Clarification

⚙️ **Key Equipment:** High-speed centrifugal separators and clarifiers that spin at very high rpm to remove cream, solids and sediment.

⚠️ **Operating Conditions:** Sustained high rotational speed generates heat and demands precise, clean lubrication of spindle bearings and drive gearing. Continuous production duty leaves little window for service.

🛢️ **Lubrication Challenge:** Separator gear and bearing oils must provide thermal stability and strong anti-wear protection at high speed, resist oxidation over long runs, and shed water. Contamination control is critical because particle ingress at these speeds shortens bearing life quickly.



Pasteurization & Homogenization

⚙️ **Key Equipment:** HTST and UHT pasteurizers, plate and tubular heat exchangers, and high-pressure homogenizers with heavy-duty crankcase drives, plungers and crossheads.

⚠️ **Operating Conditions:** Pasteurization exposes equipment to sustained heat and hot CIP cycles, while homogenizers place extreme, cyclic mechanical loads on gears, bearings and hydraulic systems. Steam, condensate and washdown moisture are constant.

🛢️ **Lubrication Challenge:** Homogenizer crankcase oils must carry heavy shock loads and resist water, while food-grade coverage is required near product-contact points. Lubricants must remain thermally stable and oxidation-resistant through repeated heat and CIP cycles.

Cultured Products & Cheesemaking

⚙️ **Key Equipment:** Cheese vats, agitators, curd mills, cheese presses and fillers, whey separators, and tank agitators for cultured products.

⚠️ **Operating Conditions:** Warm, humid, acidic environments with frequent sanitation. Presses and fillers apply repeated mechanical loads to slides, cams, bushings and bearings, often in direct proximity to product.

🛢️ **Lubrication Challenge:** NSF H1 food-grade lubricants are mandatory on contact-zone bearings, slides and cams. Products must resist washout and acidic sanitizer attack while providing dependable anti-wear protection.





Butter & Ice Cream Production

⚙️ **Key Equipment:** Butter churns and continuous butter-making boats, butter packing and wrapping machines, ice cream freezers, fillers and hardening equipment.

⚠️ **Operating Conditions:** Butter and packing machines apply high-speed, high-cycle and shock loads, sometimes reversing direction, which tends to pound grease out of bearings and cams. Ice cream lines run into deep-cold territory approaching -40 degrees, where conventional grease thickens and drags.

🛢️ **Lubrication Challenge:** Contact-zone lubricants must be food-grade, extremely water-resistant, and mechanically stable enough to stay in place under shock and reversal. Cold-zone products must remain pumpable and maintain film strength at very low temperatures.

Drying & Powder Processing

⚙️ **Key Equipment:** Spray dryers, drum and roller dryers, fluid-bed dryers, high-speed atomizers, and their exhaust and supply fans, blowers and drive gearboxes used to produce powdered milk, whey and other dry dairy ingredients.

⚠️ **Operating Conditions:** Sustained high heat, hot air and dry particulate, combined with high-speed fan and atomizer bearings

and long continuous run times. Drive components run below the line, while some bearings sit near product-contact zones.

🛢️ **Lubrication Challenge:** Bearings and gearboxes require lubricants with strong thermal stability and oxidation resistance that will not melt out or form sludge and varnish at sustained high temperatures. Food-grade coverage is required wherever incidental product contact is possible, and extended drain intervals help on hard-to-access, elevated equipment.

Filling, Packaging & Labeling

⚙️ **Key Equipment:** Fillers, cappers, cartoners, baggers, tray packers, labelers, case packers and palletizers, plus centralized grease systems, chains, cams, bushings and bull gears.

⚠️ **Operating Conditions:** High-speed, precise motion with frequent product contact and constant sanitation. Inaccurate motion from worn components causes rejects, jams and lost throughput.

🛢️ **Lubrication Challenge:** NSF H1 registration is required across contact points. Lubricants must protect precision gears, cams and bearings, resist washout during cleaning, and flow reliably through centralized systems and air-line lubricators.



Utilities & Below-the-Line Equipment

⚙️ Key Equipment: Ammonia and other refrigeration compressors, air compressors, vacuum pumps, hydraulic power units, electric motors, and mobile and material-handling equipment.

⚠️ Operating Conditions: These assets run long hours in support of production. Refrigeration compressors face wide temperature ranges, hydraulics face moisture and pump wear, and motors face heat and regreasing challenges. Direct food contact is not a factor, so H2 lubricants are appropriate below the line.

H2 refers to the former USDA approval designation for nonfood compounds used in food plant equipment where there is no possibility of incidental food contact. Uses for H2 lubricants include any nonfood contact areas of a food or beverage plant. These applications are usually below the production line and include oven chains, air compressors, oil circulating systems, enclosed gears, industrial turbines, hydraulics, and oiled bearings.

H2 lubricants cannot contain any of the following: antimony, arsenic, cadmium,

carcinogens, lead, mercury, mineral acids, mutagens, selenium, teratogens, and other intentionally heavy metals.

🛢️ Lubrication Challenge: High-performance H2 oils and greases must provide thermal stability, water separation, oxidation resistance and extended drain intervals. Reliable lubrication protects the entire plant because a compressor or hydraulic system failure can halt production just as quickly as a production-line failure.

On the Farm: Milking Equipment

⚙️ Key Equipment: Vacuum pumps and related drives on milking systems.

⚠️ Operating Conditions: Continuous vacuum duty with sanitation exposure and the potential for incidental contact with the milk stream.

🛢️ Lubrication Challenge: Vacuum pumps require food-grade grease and compatible compressor oil to maintain an effective seal, protect components and support compliance during long, uninterrupted operating cycles.

The Bottom Line:

Standard lubrication fails in a dairy plant. Water washout, chemical degradation, extreme temperatures and contamination are inevitable without a sealed, protected system designed specifically for these conditions.



CHAPTER 3

Choosing the Right Lubricant for Dairy Plants

NSF H1 Food-Grade Compliance: A Non-Negotiable Standard

Using H1 lubricants in critical processing zones helps reduce the risk of chemical contamination from incidental food contact, while properly selected H2 lubricants remain appropriate in non-food-contact areas of the plant. A well-documented lubrication program – with clear product approvals, zone-based lubricant selection, employee training, labeling, storage controls and application procedures – supports compliance with GFSI-recognized audit schemes such as SQF, BRCGS and FSSC 22000. This approach helps protect dairy processors from costly product recalls, operational disruption and reputational damage related to lubricant misuse or chemical contamination.

Dairy processors gain an additional layer of assurance. Lubrication Engineers' H1 lubricants are NSF-registered for incidental food contact and formulated in accordance with applicable FDA requirements. The Orthodox Union certifies LE's H1 lubricants, except H1 Machine Oil, as Kosher Pareve, while IFANCA certifies them as Halal. These third-party certifications provide added confidence for processors serving specialized and export markets.

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The Chemistry Advantage: Proprietary Additives

Not all food-grade lubricants perform equally. The difference lies in additive technology – the engineered chemistry that determines how well a lubricant protects equipment under real-world conditions. Lubrication Engineers has developed four proprietary additives, each designed to help LE lubricants outperform conventional products.

Additive	Type	Key Benefit	Dairy Application
Quinplex®	Impact- & water-resistant	Forms a water-resistant barrier; extremely tacky	Forms a tacky, water-resistant barrier that stays in place through washdowns; ideal for butter, cheese, packaging and all wet zones
Almasol®	Solid wear-reducing	Withstands extreme loads and high temperatures	Withstands extreme loads and high temperatures; ideal for heavy-load bearings and hot-running gearboxes
Monolec®	Liquid wear-reducing film	Reduces friction and heat generation	Reduces friction and heat generation; ideal for general bearings, motors, conveyor drives and hydraulic systems
Duolec®	Dual-acting EP additive	Activated by heat and pressure for extreme protection	Activated by heat and pressure for extreme protection; ideal for enclosed gearboxes

Washdown Resistance

Daily high-pressure washdowns and caustic or acidic sanitizing chemicals can strip standard lubricants from bearings within hours. LE food-grade greases formulated with calcium sulfonate complex thickener systems and proprietary tackifiers remain in place, resisting spray-off even under direct high-pressure streams. In dairy applications, this can reduce grease consumption and maintenance labor while significantly extending bearing life. Documented dairy testimonials show lubrication intervals increasing from daily to weekly after conversion to LE food-grade grease.



Extreme Temperature Performance

A dairy plant demands lubricant performance across an enormous range – from sub-zero ice cream freezers near -40 degrees to hot pasteurization and CIP cycles and high-temperature compressor and dryer duty. No single mineral oil-based product handles that range. Synthetic formulations based on PAO, PAG and ester chemistries provide the thermal stability, low-temperature fluidity and oxidation resistance these extremes require.

See our Equipment-to-Product Mapping of the Complete LE Lubricant Portfolio for Dairy Plants on the next several pages.





Complete Lubricant Portfolio for Dairy Processing

Lubrication Engineers offers a comprehensive line of oils and greases designed for the applications and operating conditions found across dairy farms and processing operations, including both food-grade lubricants (NSF H1-registered for incidental food contact) and non-food-grade lubricants (H2 for below-the-line and other equipment with no chance of direct food contact). Selecting the right lubricant means matching product chemistry to the specific failure mode in each zone. The two tables that follow map LE's solutions first for in-process equipment, then for utilities, below-the-line and mobile equipment.

PROCESSING EQUIPMENT: Food-Grade Contact-Zone Recommendations

These NSF H1-registered products are suitable wherever incidental food contact is possible:

Application Area	Critical Challenge	Recommended LE® H1 Solution	Key Attributes
Butter Churns/ Boats – bearings	Water washout, frequent washdowns	H1 Quinplex® Food Machinery Lubricant (4022-4025)	NSF H1 grease offers extreme water resistance; protects bearings from wear, rust and corrosion
Butter Churns/ Boats – gearboxes	Heavy and shock loads	H1 Quinplex® White Gear Lubricant (4090)	NSF H1 white oil protects gears under heavy and shock loads from wear, rust and corrosion
Butter Churns/ Boats – hydraulics	Moisture and oxidation	H1 Quinplex® White Oil (4010); H1 Quinplex® Synthetic Food Grade Oil (4046)	NSF H1 oils feature clean, stable film that maintains hydraulic response and resists oxidation
Centrifuges – bearings	Sustained high speed	H1 Quinplex® White Oil (4030)	NSF H1 white oil protects high-speed bearings and supports compliance
Separators/ Clarifiers – gearboxes	High-speed continuous load	H1 Quinplex® White Oil (4030); H1 Quinplex® White Gear Lubricant (4090)	NSF H1 white oils protect gears under continuous load
Dryers (spray, drum, fluid-bed) – fan & atomizer bearings	Sustained high heat, near-product zones	H1 Quinplex® Food Machinery Lubricant (4025)	NSF H1 grease protects high-temperature bearings where incidental food contact is possible
Dryers (spray, drum, fluid-bed) – gearboxes	Heat, continuous load	H1 Quinplex® White Gear Lubricant (4090)	NSF H1 white oil withstands severe loading conditions and protects at a wide range of operating temperatures

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PROCESSING EQUIPMENT: Food-Grade Contact-Zone Recommendations

continued

Application Area	Critical Challenge	Recommended LE® H1 Solution	Key Attributes
Homogenizers/ Pasteurizers – bearings	Water washout, high humidity	H1 Quinplex® Food Machinery Lubricant (4025)	NSF H1 grease resists washout and protects against wear and corrosion
Homogenizers/ Pasteurizers – gearboxes	Heavy loads, heat	H1 Quinplex® White Oil (4030); H1 Quinplex® White Gear Lubricant (4090)	NSF H1 white oils protect gears and bearings against heat and oxidation
Homogenizers/ Pasteurizers – hydraulics	Moisture and pump wear	H1 Quinplex® White Oil (4010); H1 Quinplex® Synthetic Food Grade Oil (4046)	NSF H1 oils are formulated with clean, stable film that resists oxidation
Cheese Fillers/ Presses – bear- ings & slides	Wear, water, acidic sanitizer	H1 Quinplex® Food Machinery Lubricant (4025); H1 Quinplex® White Oil (4030)	NSF H1 grease and white oil protect contact-zone bearings and slides in wet, sanitized areas
Cheese Fillers/ Presses – cams	High-cycle contact-zone motion	H1 Quinplex® Food Machinery Lubricant (4025 aerosol)	NSF H1 aerosol grease for high-cycle contact-zone cams
Ice Cream Fillers & Freezers – bearings & slides	Extreme cold to -40°F	H1 Quinplex® Food Machinery Lubricant (4025); H1 Quinplex® White Oil (4030)	NSF H1 grease and white oil protect food-zone bearings and slides at low temperatures
Ice Cream Fillers & Freezers – chains	Extreme cold	H1 Quinplex® Food Machinery Lubricant (4025 aerosol)	NSF H1 aerosol grease provides high-cling chain protection at temperature extremes
Ice Cream Fillers & Freezers – gearboxes	Heavy and shock loads	H1 Quinplex® White Gear Lubricant (4090)	NSF H1 white oil protects gears under heavy and shock loads from wear, rust and corrosion
Ice Cream Fillers & Freezers – valves	Contact-zone lubrication	H1 Quinplex® White Oil (4010 & 4040)	NSF H1 white oil is colorless and odorless; lubricates valves without risk to product
Chain Drives & Conveyors – bearings	Washdown, contamination	H1 Quinplex® Food Machinery Lubricant (4025); H1 Quinplex® White Oil (4030)	NSF H1 grease and oil protect conveyor bearings against wear and water
Chain Drives & Conveyors – chains, guides & open gears	Washdown, fling-off, stretch	H1 Quinplex® Food Machinery Lubricant (4025 aerosol)	NSF H1 aerosol grease clings to chains and guides, resisting fling-off and reducing wear
Chain Drives & Conveyors – gearboxes	Heavy and shock loads	H1 Quinplex® White Gear Lubricant (4090)	NSF H1, formulated to withstand severe loading conditions

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PROCESSING EQUIPMENT: Food-Grade Contact-Zone Recommendations continued

Application Area	Critical Challenge	Recommended LE® H1 Solution	Key Attributes
Filling, Packaging & Labeling – air lines	Rust and gumming	H1 Quinplex® White Oil (4010)	NSF H1 white oil prevents rust and gumming
Filling, Packaging & Labeling – bearings	Washdown, contamination	H1 Quinplex® Food Machinery Lubricant (4023 & 4025)	NSF H1 grease protects against wear and water
Filling, Packaging & Labeling – cams, bushings, bull gears	Precision motion, food contact	H1 Quinplex® Food Machinery Lubricant (4024 & 4025)	NSF H1 grease delivers wear and corrosion protection in contact zones
Filling, Packaging & Labeling – centralized grease system	Pumpability, food contact	H1 Quinplex® Food Machinery Lubricant (4023)	NSF H1 pumpable grease flows through centralized systems
Filling, Packaging & Labeling – chains & open gears	Washdown, fling-off	H1 Quinplex® Food Machinery Lubricant (4025 aerosol)	NSF H1 aerosol grease clings to chains and open gears, resisting fling-off and high-temperature washdown service
Filling, Packaging & Labeling – gearboxes	Heavy and shock loads	H1 Quinplex® White Gear Lubricant (4090)	NSF H1 white oil protects gears under heavy and shock loads from wear, rust and corrosion
Tank Agitators – bearings	Wear and water washout	H1 Quinplex® Food Machinery Lubricant (4025)	NSF H1 grease protects agitator bearings from wear and washout
Tank Agitators – gearboxes	Long-run load	H1 Quinplex® White Gear Lubricant (4090)	NSF H1 gear oil with crucial water resistance and anti-wear protection for agitator gearboxes
Tank Agitators – valves	Contact-zone lubrication	H1 Quinplex® White Oil (4010 & 4040)	NSF H1 white oil lubricates valves without risk to product
Milking Equipment – vacuum pumps	Sealing, continuous duty	H1 Quinplex® Food Machinery Lubricant (4025)	NSF H1 tacky grease protects vacuum pump components and supports food-contact compliance

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PROCESSING EQUIPMENT: Below-the-Line (H2) Component Recommendations

The products below are non-food-grade (H2). They are appropriate only on below-the-line components of the same processing equipment, where there is no chance of direct food contact. They are not NSF H1 registered and must not be used in contact zones.

Component (Below the Line)	Typical Use	Recommended LE® H2 Solution	Key Attributes
General bearings & grease points	Bearings, chassis and multipurpose grease points on butter, cheese, ice cream, homogenizer, agitator, conveyor and milking equipment, outside contact zones	Almaplex® Industrial Lubricant (1275); Almagard® Vari-Purpose Lubricant (3752)	H2; high-film aluminum and lithium complex greases that stay in place under heavy and shock loads and resist water
Enclosed gearboxes	Butter, ice cream, conveyor, agitator, separator, homogenizer, dryer and packaging gearbox drives	Duolec® Industrial Gear Oil (1601-1610)	H2; dual-action EP additive; filterable, water-shedding, long-drain protection under heavy and shock loads
Hydraulic power units	Below-the-line hydraulic systems on churns, homogenizers and packaging lines	Equipower® Ultra Hydraulic Oil (6132-6168); Multilec® Industrial Oil (6801-6807)	H2; anti-wear hydraulic and circulating oils that resist sludge, varnish and oxidation
High-temperature bearings (dryers & hot zones)	Hot spray-dryer fan and atomizer bearings running outside any contact zone	Almasol® High Temperature Lubricant (1250-1251); Monolec® Syn Industrial Oil (9460)	H2; nonmelting, oxidation-resistant grease and high-viscosity synthetic oil for sustained high heat
Compressor, turbine, clutch & circulating oils	Centrifuge, separator and homogenizer bearings, freezer clutches, air lines and R&O circulating duty below the line	Monolec® R & O Compressor / Turbine Oil (6401-6407); Multilec® Industrial Oil (6801-6807); Monolec® Industrial Lubricant (4701)	H2; rust- and oxidation-inhibited oils and industrial grease for high-speed and circulating below-the-line duty
Chains & open gears	Chain, guide and open-gear drives outside contact zones	Syntemp® Synthetic Lubricant (9102)	H2; synthetic high-temperature lubricant that penetrates and clings, resisting fling-off



EQUIPMENT-TO-PRODUCT MAPPING: Utilities & Mobile Equipment

Application Area	Critical Challenge	Recommended LE® H2 Solution	Key Attributes
Compressors (refrigeration, air, centrifugal)	Hot or cold duty, varnish	H1 Quinplex® Synthetic Food Grade Oil (4032-4068); H1 Quinplex® White Oil (4010-4040); Endure® Turbine Oil (6481-6482); Monolec® Centrifugal Compressor Oil (6260); Monolec® R & O Oil (6404-6407); Multilec® Industrial Oil (6804-6807); Monolec® Syn Industrial Oil (9032-9680)	Synthetic and R&O-inhibited oils resist varnish, oxidation and heat for extended service life
Hydraulic Systems	Moisture and pump wear	H1 Quinplex® White Oil (4010); H1 Quinplex® Synthetic Food Grade Oil (4046); Equipower® Ultra Hydraulic Oil (6132-6168); Equipower® Ultra HVI Hydraulic Oil (6532-6546); Multilec® Industrial Oil (6801-6803)	Food-grade or H2 options provide anti-wear protection and stable, clean operation across temperatures
Mobile Equipment – chassis & wheel bearings	Heavy loads, shock, washout	Almaplex® Industrial Lubricant (1275); Almagard® Vari-Purpose Lubricant (3752)	Tacky, water-resistant greases stay in place under heavy loads and weather exposure
Mobile Equipment – differentials & transmissions	Load, heat, smooth shifting	Duolec® Industrial Gear Oil (1605 & 1606); Almasol® Pure Mineral Gear Lubricant (401); Dexron® VI ATF (1136); Monolec® Syn Multi-Vehicle ATF (1150)	Matched gear oils and transmission fluids protect drivetrains and support smooth shifting
Mobile Equipment – engine crankcase & fuel	Wear, deposits, combustion	Monolec® GFS Engine Oil (8430); L-X® Heavy Duty Chemical Supplement (2300)	Monolec-fortified oil reduces wear and deposits; fuel supplement improves stability and combustion
Mobile Equipment – hydraulics	Wide temperature range	Equipower® Ultra Hydraulic Oil (6132, 6146, 6168); Equipower® Ultra HVI Hydraulic Oil (6522, 6532, 6546)	High-VI oils maintain stable viscosity and clean operation across temperatures



CHAPTER 4

Lubrication Best Practices for Continuous Uptime

Choosing the right lubricant is only part of the equation. How that lubricant is stored, handled, dispensed and monitored determines whether your investment translates into actual reliability improvement. This chapter outlines the operational practices that separate world-class lubrication programs from the reactive status quo.

BEYOND THE OIL CHANGE: A Holistic Program

The old way of managing lubrication – reactive maintenance, changing oil only when it breaks down, chaotic inventory, and cross-contamination risk – leaves plants vulnerable to the very failures they are trying to prevent. A modern lubrication reliability program is comprehensive, covering storage, handling, dispensing and contamination control as an integrated system. The goal is to shift from asking “what oil should I use?” to managing the entire lubricant lifecycle.

1. Correct Greasing Intervals & Volumes

Over-greasing is just as damaging as under-greasing. Excess grease generates heat, blows seals and attracts contamination, while under-greasing leads to metal-to-metal contact and premature wear. The right approach uses manufacturer specifications as a starting point, adjusted for actual operating conditions in each zone.

Use bearing manufacturer calculations (speed, load and operating environment) to establish base intervals. Adjust for washdown frequency, because bearings in wet processing zones may need far more attention than those in dry utility rooms. Monitor grease condition using visual inspection – clear grease guns let operators see exactly what is being loaded – and oil analysis results. Document everything: a lubrication management system that tracks application points, products, intervals and quantities is essential for consistency. As documented in LE dairy testimonials, switching to a high-performance food-grade grease has allowed processors to extend intervals from daily to weekly while reducing wear.



2. Cleanliness Control: The #1 Failure Driver

Contamination is the single largest cause of premature bearing and gear failure. In a dairy plant the sources are relentless: water from washdowns, chemical residues from CIP and sanitizing, milkstone and organic matter, and airborne dust in receiving and dry-ingredient areas. Controlling contamination requires discipline at every stage of the lubricant's lifecycle.

✓ **Storage & Identification**

Clean, organized lube rooms are the foundation. LE's Xpel® storage system uses stackable bulk units to ensure oil cleanliness and strict inventory control. Color-coded tags, labels and wall charts prevent misapplication, such as accidentally putting hydraulic fluid in a gearbox, which is one of the most common and costly maintenance errors.

✓ **Contamination Exclusion**

Standard OEM breathers allow moisture to enter gearboxes during washdowns and temperature swings, a phenomenon called thermal breathing. LE's Xclude® desiccant breathers absorb moisture and filter particulates before they enter the asset, while quick-connect couplers prevent contamination during refill and top-up. The principle is simple: stop the water and dirt before they enter the oil.

✓ **Filtration**

Rather than changing oil on a calendar schedule, portable kidney-loop filtration systems clean oil while equipment is running. This removes contaminants without taking the asset offline, dramatically extends drain intervals, and reduces both lubricant consumption and disposal cost.

3. Lubrication System Design

The design of the delivery system matters as much as the product. Centralized lubrication systems ensure that critical assets receive consistent, precise amounts of lubricant without relying on manual intervention. Single-point lubricators, gas or electromechanical, deliver grease to isolated bearings on a set schedule, eliminating the risk of missed or inconsistent manual greasing. For dairy plants, automated systems are especially valuable in areas that are difficult to access during production – elevated gearboxes, enclosed conveyor drives and equipment behind guarding – where manual greasing is impractical and often skipped.



CHAPTER 5

Reliability Solutions: Measure, Predict, Prevent

Moving from reactive repairs to proactive reliability requires a comprehensive framework of monitoring, analysis and automation. This chapter covers the tools and disciplines that turn lubrication from a maintenance task into a strategic asset management practice.

Oil Analysis Programs: The Equipment Blood Test

LE's Xamine® Oil Analysis program acts as a diagnostic blood test for your equipment. Regular oil sampling identifies abnormal conditions – elevated wear metals, water contamination, additive depletion, rising particle counts – months before a catastrophic failure. Results are delivered through a web-based platform and reviewed by trained lubrication experts who provide actionable recommendations.

What to Test

- ✓ **Wear metals** (iron, copper, aluminum, chromium) indicate which internal components are degrading and how fast.
- ✓ **Water content (ppm)** Matters enormously in dairy, where even 200 ppm of water in a gearbox can cut bearing life significantly, and washdown-zone assets routinely see far higher levels.
- ✓ **Particle counts (ISO cleanliness codes)** Quantify solid contamination and track filtration effectiveness.
- ✓ **Viscosity changes** Shifts in viscosity signal oxidation, thermal breakdown or cross-contamination with the wrong product.
- ✓ **Additive depletion** Monitors the remaining useful life of the lubricant's protective chemistry.

Typical Warning Signs

- **Iron levels rising steadily over three consecutive samples** – indicate accelerating gear or bearing wear.
- **Water content above 500 ppm in a gearbox operating in a washdown zone** – points to compromised breather or seal integrity
- **Sudden viscosity drop** – suggests contamination with a lighter oil or CIP solvent.
- **Silicon levels spiking** – indicates ingress of airborne dust, common in receiving and dry-ingredient areas.



Using Lubrication KPIs to Drive Better Decisions

Data without action is waste. A strong program tracks key performance indicators that connect lubricant condition to equipment health and business outcomes:

- **Mean Time Between Failures (MTBF):** Tracked per asset type, shows whether bearing and gearbox replacements are trending down.
- **Lubrication Compliance Rate:** Measures the percentage of scheduled tasks completed on time, with a target of 95% or better. .
- **Oil Consumption:** Per production shift, declining while reliability holds or improves, indicates program maturity.
- **Unplanned Downtime Events:** Should be categorized by root cause, with the number of lubrication-related events driven toward zero.
- **Extended Drain Intervals Achieved:** Supported by documented oil analysis, translate directly into cost savings.

The Full Circle of Reliability

LE's approach to reliability goes beyond selling lubricants. It is an integrated system – the **Full Circle of Reliability** – that covers every stage of the lubricant's lifecycle:

- ✓ **LE® Enhanced Lubricants:** Engineered with proprietary additive technology for superior performance.
- ✓ **Xtract® Filtration:** Portable and inline systems that remove contaminants while equipment runs.
- ✓ **Xtract® Sight Glasses:** Oil sight glasses for visual oil level and condition monitoring without shutdown.
- ✓ **Xclude® Breathers:** Desiccant breathers that prevent moisture and particulate ingress.
- ✓ **Xport® Application:** Precision dispensing tools such as single-point lubricators and clear grease guns for accurate, contamination-free application. .
- ✓ **Xpel® Storage & Identification:** Transfer containers, bulk storage units, and color-coded tagging systems for clean, organized lube rooms.
- ✓ **Xamine® Analysis:** Oil analysis and expert-reviewed diagnostics that drive condition-based maintenance decisions.

Real-World ROI:

Dairy processors that adopt a full reliability program consistently report fewer unplanned stoppages, longer asset life, reduced lubricant and parts consumption, and lower total cost of ownership. As documented in LE's dairy case studies, converting to the right food-grade products and reliability practices has cut grease consumption, extended lubrication intervals, and eliminated wear-related production losses.



CHAPTER 6

Playbook for Dairy Processors: From Chaos to Control

Theory is valuable, but results are what matter. This chapter presents real-world results from LE dairy customers and a step-by-step quick-win checklist that any dairy facility can begin implementing immediately.

Case Study: A Large Cooperative Creamery

The Facility

A large cooperative creamery in Tulare, California, produces powdered milk, milk, butter, cream cheese, yogurt and cottage cheese, processing more than 15 million pounds of raw milk per day. Among its most demanding assets are Benz Hilgers butter wrapping machines, which mold, wrap and box solid blocks of butter at rates of 60 to 80 boxes per minute and run roughly 15 hours a day, five days a week..

The “Before” Status

Each Benz Hilgers wrapper is a complex, expensive machine with two bull gears and 135 grease fittings. Running a conventional food-grade grease, the maintenance team faced a punishing routine:

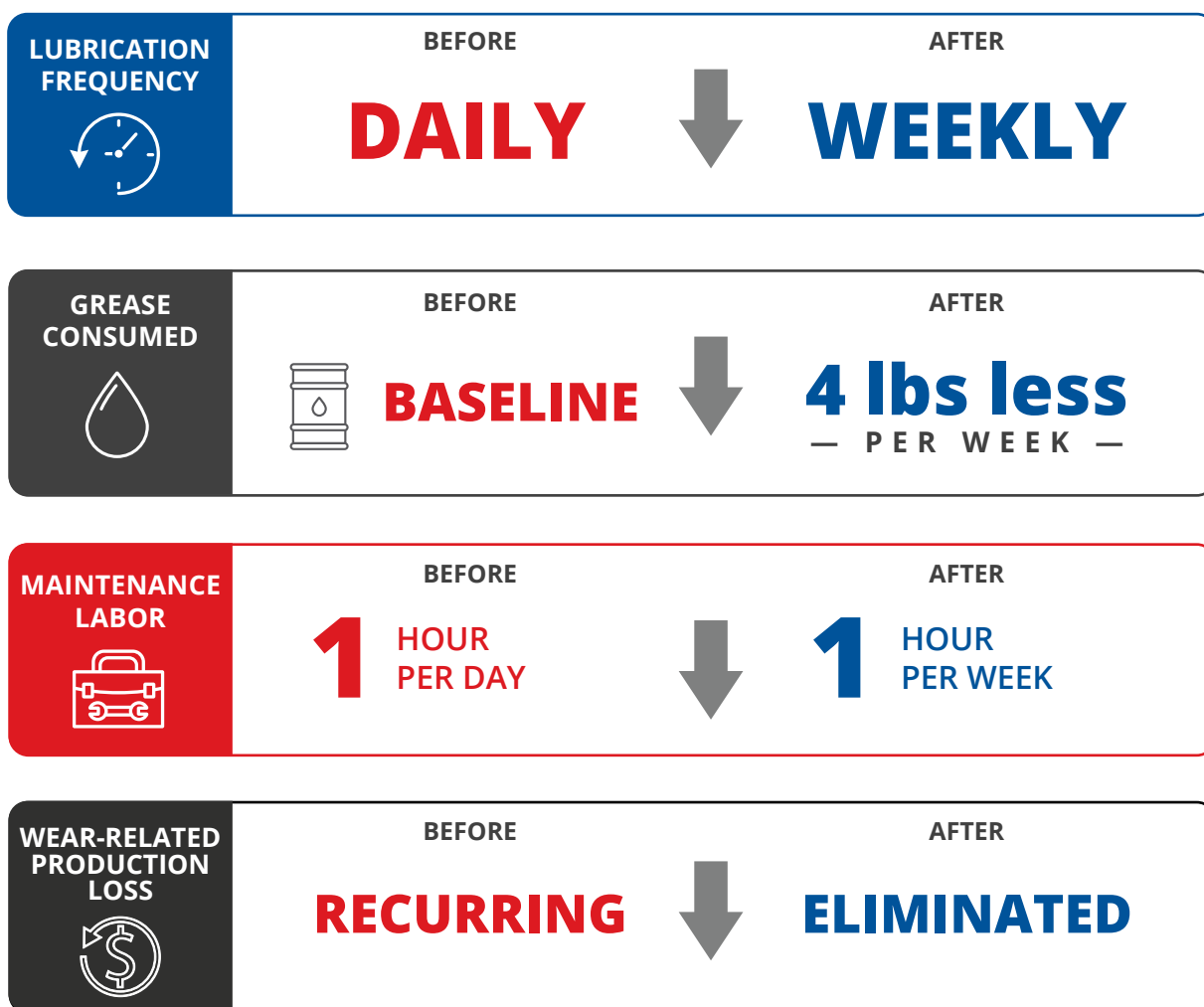
- Lubrication required about one tube of grease per machine and roughly one hour of labor – every single day.
- Even with daily greasing, the units suffered cam, bushing and bearing wear faster than the team considered normal.
- The co-op evaluated a range of conventional EP greases and specialty food-grade products without finding meaningful improvement.



The Intervention: From Chaos to Control

On the recommendation of an LE lubrication consultant, the creamery converted the wrappers to Quinplex Food Machinery Lubricant (4024), which is NSF H1 registered for food processing. The switch targeted the exact failure mode – grease being pounded and washed out of high-cycle contact points – with a tacky, water-resistant, mechanically stable food-grade grease.

The Results: Data-Driven Success



By matching the right food-grade product to the application, the co-op turned a daily lubrication burden into a weekly task, freed maintenance hours for higher-value work, and eliminated lost production from lubricant-related wear.



Supporting Results Across Dairy

Eliminating Downtime in Texas.

A nationally known dairy processor in Fort Worth, Texas, processing raw milk into powdered milk and butter, struggled with washdowns forcing water into its butter packing machines, causing oxidation, corrosion, jamming and shock-load grease loss on machines that reverse 180 degrees.

After converting to Quinplex 4024 and 4025 food machinery lubricants, the plant reported smooth restarts even after days of downtime.



In the maintenance team's words:

"We did have downtime; a long time ago.

Downtime is a thing of the past with 4024 and 4025."

Consolidating to a Single, Reliable Standard.

Darigold's plant in Bozeman, Montana – producing milk, ice cream, natural cheese and powdered milk – wanted to work with one supplier and consolidate inventory while staying within OEM specifications.

Through a phased plant-wide lubrication survey, Darigold moved to 100% LE products and eliminated five commercial lubricants from inventory, matching a specific LE product to each application from grease points and gearboxes to compressors, homogenizers and vacuum pumps.



Quick-Win Checklist for Lubrication Upgrades

You don't have to overhaul your entire program at once. The following high-impact, low-effort improvements can begin immediately:

1. **Audit your current lubricant inventory.** How many products are in use? Can you rationalize to fewer, better-performing options? Consolidation cuts misapplication risk and simplifies training, as Darigold demonstrated by eliminating five commercial products.
2. **Install desiccant breathers on all critical gearboxes and reservoirs.** This single step can dramatically reduce water contamination and is one of the highest-ROI reliability investments available in a washdown environment.
3. **Add oil sight glasses to gearbox drain lines.** Let operators visually check oil condition and water presence during routine walkarounds, without opening the reservoir or shutting down.
4. **Implement color-coded lubricant identification.** Tags, labels and wall charts at every lubrication point prevent the #1 human error: putting the wrong product in the wrong asset.
5. **Start an oil analysis program on your top 10 most critical assets.** Begin where failure would cause the most downtime – separators, pasteurizers, homogenizers, key compressors – and build from there.
6. **Evaluate your greasing intervals in washdown zones.** Switch to high-performance, washdown-resistant food-grade grease and test whether you can extend intervals from daily to weekly, reducing labor and waste.
7. **Deploy portable filtration on large gearbox and hydraulic sumps** Clean the oil rather than changing it, saving both lubricant cost and the downtime of oil changes on hard-to-access equipment.
8. **Move toward an NSF H1 standard in contact zones.** Reduce cross-contamination risk between food-grade and non-food-grade products, simplify audit preparation and protect your brand.
9. **Request an Xpert™ onsite reliability assessment.** LE's local lubrication consultants will map your equipment, assess current conditions, and deliver a detailed blueprint recommending lubricants, application methods, intervals and reliability hardware, at no obligation.
10. **Invest in lubrication training for your maintenance team.** LE's Xpert™ Training program offers customized onsite workshops, best-practice instruction on storage and handling, and preparation for ICML and STLE professional certifications.



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