



# Introduction to Hydraulic Fluids

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## Bio-Ultimax™ & Hydro Safe®

In the world of hydraulic systems, the compatibility of fluids with materials and components is paramount for optimal performance and longevity.

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**Renewable Lubricants, Inc**

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# Introduction

Bio-Ultimax™ and Hydro Safe® Hydraulic Fluids are revolutionary, meticulously designed to seamlessly integrate with a wide range of hydraulic system materials.

What sets Bio-Ultimax™ and Hydro Safe® Hydraulic Fluids apart is their remarkable compatibility with both mineral oil based and most synthetic based fluids. These fluids have undergone rigorous testing and have proven their compatibility not only with conventional fluids, but also with synthetic PAO (polyalphaolefin) based hydraulic fluids.

This compatibility simplifies the transition process, as no engineering design changes are required when incorporating these advanced fluids into existing hydraulic systems.

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# Key Advantages

One of the standout features of Bio-Ultimax™ and Hydro Safe® Hydraulic Fluids is their adaptability to a diverse range of system components. They seamlessly operate within systems that contain plastic nylon composites, bearing composites, fluorocarbon, polytetrafluoroethylene (Teflon), fluorosilicone, polyurethane, and more. Whether the system involves static, mid-dynamic, or dynamic areas, these fluids prove their compatibility and performance across the board.

The elastomer compatibility of these fluids is equally impressive. They exhibit harmonious interactions with various elastomers and rubbers, as demonstrated by their compatibility with Nitrile rubber (Buna-N), Hydrogenated Nitrile rubber (HNBR), Fluoroelastomer (Viton), Polyurethane, Polysulfide, and other elastomers. This extensive compatibility assures users that these fluids can operate effectively in systems designed for different elastomer formulations.

Additionally, Bio-Ultimax™ Technology Fluids, particularly Bio-HVO2™ Hydraulic ISO 46 and 68 FR Fluids, showcase compatibility with EPDM elastomers. Notably, they contain specific biodegradable, biobased oils that enhance their compatibility with EPDM. While Bio-HVO2™ Fluids have demonstrated remarkable performance in hydraulic systems containing EPDM elastomers, it's essential to review the Technical Data Sheet (TDS) for compatibility details, as ISO 32 Grade is not compatible with EPDM.

In the pages that follow, we will delve deeper into the compatibility, advantages, and considerations of Bio-Ultimax™ and Hydro Safe® Hydraulic Fluids. Whether you're seeking to enhance the performance of your hydraulic systems, ensure longevity, or make environmentally conscious choices, these fluids stand as a testament to cutting-edge technology in fluid engineering.

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# Chapter 1: Unlocking Compatibility

The World of Bio-Ultimax™ Technology Fluids  
and Petroleum-Mineral Oil Based Fluids

## Formulated for Excellence

At the heart of Bio-Ultimax™ Technology Fluids lies an ingenious fusion of natural esters and other synthetic base oils, collectively known as BioSynthetic. This intricate formulation boasts a majority of plant-based oils, with natural esters sourced from rapeseed, canola, soy, sunflower, and more. This unique blend has been meticulously curated to align with petroleum/mineral and synthetic/PAO (polyalphaolefin) base oils, creating a fluid that is not only compatible but also elevates performance standards across the board.

An essential component of Bio-Ultimax™ Technology Fluids is the presence of patented antioxidants known as *Stabilized*. This game-changing addition, combined with the inherently biosynthetic nature of these fluids, propels them into a league of their own. The result? Enhanced compatibility, improved oxidation stability, and impressive cold temperature performance that outshines even the most competitive plant-vegetable/HETG and unsaturated synthetic esters HEES type fluids. This innovation is particularly evident in their ability to seamlessly replace conventional mineral oil based hydraulic fluids or gear oil formulations, all while containing Group I, Group II, Group III, and synthetic PAO base oil formulations, without the need for viscosity index (VI) improver additives.

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# A Seamless Transition

Bio-Ultimax™ Technology Fluids herald a new era of fluid compatibility, streamlining the transition process regardless of the base oil being used. For systems operating with non-multigrade fluids (fluids lacking VI improvers), the conversion process is as simple as draining and recharging. These fluids have been expertly designed to align with fluids containing specific VI improvers, ensuring that compatibility remains a cornerstone of this technological leap.

Should any doubts arise regarding compatibility or replacement options, the experts at Renewable Lubricants Inc. (RLI) stand ready to provide recommendations and conduct comprehensive compatibility studies. The expertise of RLI's lab can guide users toward the most suitable replacement fluid, ensuring a smooth and successful transition.

## To Flush or Not to Flush?

While compatible fluids eliminate the need for flushing, scenarios involving dirty fluids or uncertain maintenance histories require careful assessment. In such cases, RLI recommends using only Bio-Ultimax™ Technology Fluids for flushing.

Moreover, these advanced fluids can serve as top fill options in conjunction with compatible fluids, allowing for a gradual shift as the existing fluid is converted according to maintenance schedules. This approach simplifies the change-over procedure and minimizes disruptions.

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# The Power of Monitoring

UOA

## Universal Oil Analysis

Implementing a Universal Oil Analysis (UOA) Program adds a layer of intelligence to your fluid management strategy. Regardless of the decision to flush or not, consistent monitoring of fluid performance through scheduled UOA assessments is crucial. This practice, coupled with adherence to filter inspection and oil change intervals, upholds the system's health and efficiency.

OEM

## Original Equipment Manufacturers (OEMs)

Such maintenance practices, commonly recommended by Original Equipment Manufacturers (OEMs), are essential during and after the transition to Bio-Ultimax™ Technology Fluids. They play a pivotal role in minimizing contaminant-related issues that can arise during servicing and part replacements.

# The Path Forward

Embracing Bio-Ultimax™ Technology Fluids isn't just about adopting a new fluid; it's a commitment to unlocking the full potential of your hydraulic systems. Whether considering the flush dilemma or the seamless compatibility with diverse components, Bio-Ultimax™ Technology Fluids are designed to safeguard your equipment, optimize performance, and reduce long-term costs.



## Chapter 2: Navigating Compatibility

### The Realm of Compatibility with Synthetic Based Fluids

In the world of hydraulic fluids, the journey towards optimal performance and seamless compatibility is a complex one. As we dive into the intricacies of synthetic based fluids, we uncover a realm where Bio-Ultimax™ Technology Fluids stand as a beacon of innovation, ready to harmonize with a diverse array of fluid types.

#### **Polyalphaolefins (PAOs): Crafting Harmony with Precision**

Among the stars of the synthetic lubricant universe, Polyalphaolefins, affectionately known as PAOs, have garnered a reputation for their exceptional compatibility and performance. Widely used in the synthetic lubricant market, PAOs are formulated to meet hydraulic system compatibility requirements, mirroring those of mineral oil fluids. The compatibility between Bio-Ultimax™ Technology Fluids and PAOs is a testament to the meticulous design of these advanced fluids.

Transitioning from a system using PAOs to one embracing Bio-Ultimax™ Technology Fluids follows a familiar route. The procedure parallels that of moving away from petroleum oil-based systems, a process streamlined by the inherent compatibility between these fluid types.

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# Synthetic Esters

Venturing further, we encounter synthetic esters, a diverse family of fluids with varying properties. Here, Bio-Ultimax™ Technology Fluids rise to the occasion, showcasing a high degree of compatibility with most synthetic ester-based fluids. Polyolesters and diesters, for instance, harmonize seamlessly with Bio-Ultimax™ Technology Fluids, forming a compatibility that underscores their shared purpose.

Yet, this journey does have its nuances. In the intricate world of complex ester fluids and multifaceted VI improvers used in multigrade formulations, compatibility may require extra consideration. Resilient seals and components—such as NBR medium to high nitrile, HNBR, FPM, FKM, and PTFE—take the forefront in maintaining fluid integrity.

## A Symphony of Compatibility

Transitioning a system from synthetic esters to Bio-Ultimax™ Technology Fluids echoes the procedure seen in other fluid shifts. The roadmap remains consistent, highlighting the adaptability and ease of these advanced fluids.

*“Navigating the seas of synthetic based fluids is a journey marked by discovery, insight, and careful considerations. Bio-Ultimax™ Technology Fluids rise as a partner in this expedition, adapting seamlessly to the diverse landscape of fluid compatibility.”*



# Uncharted Waters

## **Polyalkalene Glycol (PAG), Polyethylene Glycol (PEG), and Water Glycol (HFC)**

As we tread into uncharted waters, we confront the challenges posed by fluids such as Polyalkalene Glycol (PAG), Polyethylene Glycol (PEG), and water glycol (HFC). In this realm, Bio-Ultimax™ Technology Fluids take a step back, exhibiting incompatibility with most PAG, PEG, and water-based fluids. The crux lies in the density and emulsification with water, creating a barrier that these fluids cannot transcend.

However, exceptions exist. Certain oil-based PAGs might achieve compatibility, provided rigorous compatibility studies are conducted for verification. The directive for water-based fluids is clear: they must be meticulously drained from the system, making way for Bio-Ultimax™ Technology Fluids to take center stage. The process of transitioning in this context is marked by thorough flushing and purifying, a practice well-documented in ASTM D 4174-89.

## **Phosphate Esters: A Delicate Balance**

In the realm of phosphate esters, compatibility becomes a delicate dance. Bio-Ultimax™ Technology Fluids find their footing with some phosphate ester fluids, but not all. Testing stands as the ultimate arbitrator, guiding the path of compatibility before full-scale conversion.

But it's not just about fluid compatibility. The harmony extends to seal compatibility as well, demanding attention to the elastomers in use. Butyl rubber and EPDM emerge as the champions in the realm of phosphate esters, showcasing their prowess in aligning with these specialized fluids. A notable paradox arises: while Butyl rubber and EPDM exhibit limited compatibility with mineral/petroleum hydraulic oils, they flourish in the presence of phosphate esters.

# A Journey of Compatibility

From the precision of PAOs to the intricacies of synthetic esters, and even into the complexities of water glycols and phosphate esters, these fluids illuminate a path towards a harmonious coexistence between technology and nature. As we delve deeper into the chapters ahead, the story of compatibility continues to unfold, offering insights that will redefine how we approach hydraulic fluid selection and optimization.





## Chapter 3: Equipment Longevity

### Elevating Equipment Longevity through Professional Technical Services

This chapter delves into the world of Professional Technical Services offered by Renewable Lubricants Inc. (RLI), a realm where the synergy between technology and expertise is harnessed to safeguard and enhance the lifespan of your valuable equipment.

#### **Guiding Your Machinery's Health: Fluid Analysis and Conversion**

RLI's arsenal of Professional Technical Services encompasses hydraulic fluid system analysis and conversion recommendations. A cornerstone of this strategy is the regular hydraulic fluid analysis program, an invaluable tool in the maintenance arsenal. The frequency of these analyses, whether every six months or on a tighter schedule, depends on the application and system in use. This customized approach ensures that the health of your equipment is constantly monitored and optimized.

Empowerment lies in your hands. By engaging RLI's technical services, you access a wealth of knowledge geared towards maximizing the potential of your hydraulic system. When questions arise regarding material and fluid compatibility, the doors to RLI's technical services are wide open, ready to guide you towards the most effective solutions.

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# Fluid Life Expectancy

As machinery pulses with vitality, the intricate choreography of fluid life expectancy unfolds. Where time and temperature are the guiding forces. Variables like moisture, environmental conditions, and system design interweave, influencing the fluid's journey.

RLI's wisdom suggests changing fluid and filters with a frequency mirroring mineral oil (HLP) formulations, even as we recognize the unique ecosystem each machine inhabits.

OEMs offer guiding principles. They recommend forging a constant partnership with lubricant manufacturers, securing expert support for fluid selection, maintenance, care, and analysis. RLI, standing as an embodiment of this philosophy, provides an analysis program that extends not just to equipment, but to the very fluid coursing through its veins.

## Flushing and Cleaning: A Precise Touch

Drawing from experience, we unearth a reassuring truth. RLI's Bio-Ultimax Patented Technology Fluids flaunt aging characteristics that are on par with, or even surpass, HLP mineral oil counterparts. As we traverse the ever-evolving landscape of technology and knowledge, RLI is poised to empower you to shepherd your machinery towards a future where longevity and performance coalesce.

In the upcoming chapters, we delve further into the intricacies of machinery maintenance, unraveling the threads that bind performance, sustainability, and innovation.



## Chapter 4:

# Hydraulic Filtration

### Unveiling the Filtered Path: Navigating Hydraulic Filtration with RLI

This chapter invites you to dive into the world of hydraulic filtration, a critical partner in safeguarding the health of your machinery, as championed by Renewable Lubricants Inc. (RLI) and Original Equipment Manufacturers (OEMs).

#### **Guardians of Purity: Inspection and Change**

A principle set in stone: every hydraulic filter element must be vigilantly inspected and replaced according to the mandates of the OEM maintenance manual. Regular maintenance inspections offer a proactive stance, ensuring that your system's filters remain in peak condition. When your system first takes its maiden journey, bear in mind that achieving the requisite minimum cleanliness class can often necessitate system flushing. The vestiges of past oil contamination, coupled with the challenges posed by startup and changeover, underscore the importance of meticulous filtration.

#### **Flushing: Navigating the Transition**

The fluid in your system before the changing of the guard can speak volumes. If PAG, PEG, or water-based fluids have coursed through its veins, compatibility dictates that the system must undergo a meticulous draining and flushing process, paved by RLI's recommended fluid. The golden rule of flushing echoes in alignment with the chosen formulation—the very elixir best suited to pamper your system.

# Fluid's Tale: A Dance with Filters

The story unfolds in harmony with the present state of knowledge: hydraulic fluids, irrespective of their additive composition, harmonize effortlessly with customary filter materials across all filtration ratings, up to the minuscule scale of  $<0.8 \mu\text{m}$ . Amidst this symphony, RLI's groundbreaking, zinc-free additive system assumes a star role. It presents a triumvirate of strengths:

## Hydration Harmony

Even in the presence of a modest 0.2% water addition, RLI's fluid demonstrates exceptional filterability. An important caveat stands—operations should cease if the water content breaches the 1% threshold.

## Ageless Efficacy

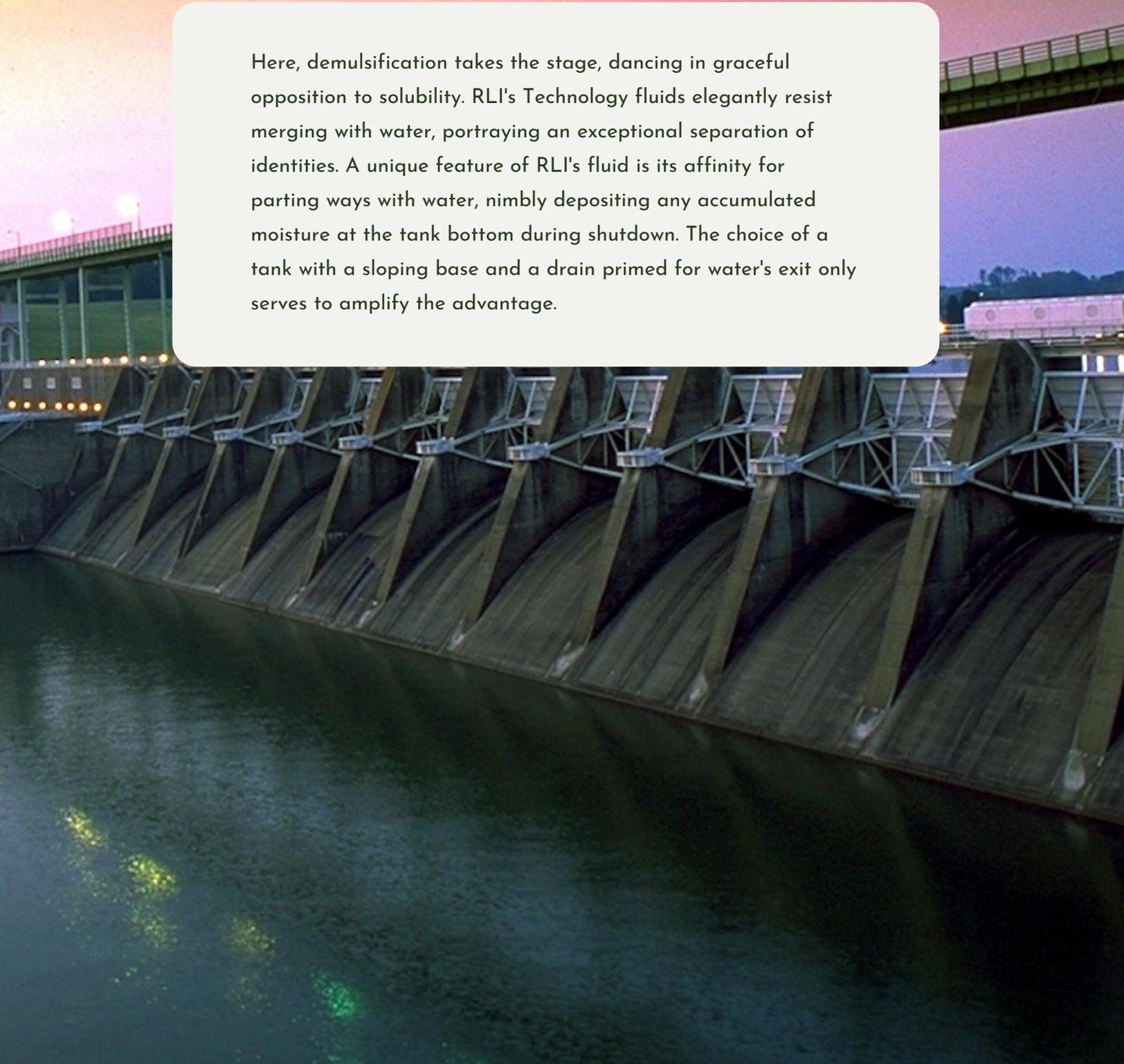
Over time, additives persist steadfastly within the formulation, refusing to be filtered out. This endurance breeds reliability, underpinned by years of service.

## Pressure Partners

This additive marvel goes above and beyond, eclipsing stringent requirements for anti-wear in high-pressure systems and pumps.

# Demystifying Demulsification: Fluid's Dance with Water

Here, demulsification takes the stage, dancing in graceful opposition to solubility. RLI's Technology fluids elegantly resist merging with water, portraying an exceptional separation of identities. A unique feature of RLI's fluid is its affinity for parting ways with water, nimbly depositing any accumulated moisture at the tank bottom during shutdown. The choice of a tank with a sloping base and a drain primed for water's exit only serves to amplify the advantage.





## Chapter 5: Green and Pristine

### The Pursuit of Hydraulic Cleanliness

Within the domain of hydraulic systems, a new emblem emerges—an emblem that signifies a leap towards eco-conscious operations, uncompromising purity, and performance par excellence. This emblem is the ISO Green logo, a beacon of promise that shines upon products that embody biodegradability, eco-nontoxic attributes, and the rigorous benchmarks of ISO cleanliness standards.

### The Complex Interplay with Impurities

Where fluid dynamics execute intricate maneuvers, the challenge of solid particle contamination surfaces as a formidable adversary. Fear not, for Renewable Lubricants Inc. (RLI) rises to the occasion. Glimpsing into the future, RLI has made it possible for you to access particle counts on the newly delivered fluid, courtesy of the Certificate of Analysis.

Moreover, the ISO Green logo, adorning our labels like a crown atop a drum, stands as your guarantee that our stringent ISO cleanliness standards have been embraced, setting the stage for worry-free utilization. As you embark on the journey of hydraulic maintenance and changeovers, RLI's Universal Oil Analysis (UOA) holds your hand, leading you through the labyrinth of contaminants.

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# Particles & Performance

## Particles: The Mischievous Mischief-Makers

Solid particles in hydraulic fluids wield the power to sow chaos in systems. Whether grandiose or minuscule, particles carry consequences. Larger particles, often solitary, can directly trigger system malfunctions, while their smaller counterparts conduct a noiseless orchestration of component and seal wear. Enter the ISO 4406 code—a numerical expression of cleanliness. Akin to a secret language, this three-digit code signifies the quantity of particles residing in a hydraulic fluid. Notably, the infusion of foreign particles must not exceed 50 mg/kg.

A minimum cleanliness class of 20/18/15, aligned with ISO 4406, is the baseline for environmental-friendly hydraulic fluids, encompassing both mineral oils and synthetic fluids. The mandate becomes even more stringent for specialized servo valves, where cleanliness classes of 18/16/13 take the spotlight. A mere step down in cleanliness class signifies a halving of particle quantity, emblematic of heightened purity. Pursuing lower numbers in ISO cleanliness classes emerges as an ode to extended fluid and component lifespans. The cleanliness needs of the most finicky component dictate the cleanliness of the entire system.

## Precision in Performance: Beyond the Surface

Amid this pursuit of purity, do not overlook the resonance between physical attributes and system performance. Viscosity and its temperature sensitivity, density, and the elusive pour point—these variables hold dominion over the prowess of pumps and systems alike. RLI's formulations are no mere concoctions; they are meticulously crafted to not only fulfill but exceed the physical and performance benchmarks set by mineral-based formulas like HLP and HVLP. The secret lies in the chemistry, an arrangement that harmonizes as one with the mandates of technical data sheets and safety data sheets.



# Cleansing Rituals

When most hydraulic fluids from competitors fall short of these stringent cleanliness prerequisites upon arrival, a tale of meticulous filtering unfolds. During operations, and particularly during the delicate act of replenishment, vigilant filtration becomes paramount.

Here, RLI steps in as a guardian, providing you with the ISO cleanliness class of the delivered hydraulic fluids. This information ensures your compliance with ISO-mandated cleanliness and simplifies the transition in hydraulic systems. Irrespective of the fluid's origin—petroleum or biobased—etiquette demands a pristine lubricant transfer system before your hydraulic system receives the infusion of new life.

## Your Fluid's Sanctuary

This endeavor resonates with the wisdom of maintaining a clean tank breather filter, ensuring that the reservoir's lid, fill cap, and breather filter stand as sentinels of purity. And for the humid environs, breathers adorned with air drying elements step in as vigilant allies. If your hydraulic fluid boasts a lineage of PAG, PEG, or water-based composition, be prepared for an extra layer of care, as these formulations necessitate specialized equipment to wrestle condensation, foreign water, and contaminants into submission.

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# Chapter 6:

## The Art of Viscosity

### Navigating Hydraulic Fluid Flow

The delicate balance of viscosity holds the key to unlocking optimal performance, and its harmonious flow should be meticulously observed, much like an artist perfecting each brushstroke.

#### **Viscosity: The Heartbeat of Performance**

At the heart of hydraulic fluid dynamics lies viscosity—a critical attribute that should never be overlooked. Think of it as the rhythmic heartbeat that fuels the fluid's journey through the system. Through the lens of ASTM D445, RLI's Universal Oil Analysis (UOA) program peers into the core of your hydraulic operations, monitoring viscosity with unwavering precision. This vigilance ensures that your hydraulic performance never misses a beat.

#### **Setting the Stage: Viscosity's Impact**

While the allure of viscosity is undeniable, it's the marriage of its value to temperature that truly sets the stage for hydraulic prowess. The viscosity at operating temperature wields the control, dictating the response nuances of closed control loops, the stability and damping of systems, the elusive efficiency factor, and even the degree of wear. Imagine this value as the conductor guiding each instrument in the orchestra—the lower viscosity for vibrant energy, the higher for resolute stability.

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# Navigating the Viscosity Range

PVR

## Permissible Viscosity Range

In this hydraulic symphony, adhering to the permissible viscosity range is paramount. Imagine this range as a carefully curated spectrum, where each note represents the permitted viscosity of OEM equipment. This ensemble demands meticulous attention to each individual component's preferences. Remember, each component carries its own tune—a tune that resonates with the permissible temperature range prescribed by the OEM.

CRF

## Crafting Resilient Fluidity

As the narrative unfolds, OEM equipment component data sheets and manuals illuminate the path, revealing insights into viscosity limitations and cleanliness requirements. These documents provide a portal into the realm of "Viscosity Limitations and Required Cleanliness Classes of Hydraulic Components." It's here that you uncover the fine print, the roadmap to crafting fluidity that's both agile and robust.



## **Balancing Act: Viscosity Above and Below**

The performance tale takes a dramatic twist when viscosity strays from its intended range. If viscosity soars beyond the permitted threshold, mechanical losses rise—an energy sacrifice at the altar of inefficiency. However, this exchange gifts lower internal leakage losses in return.

Yet, this imbalance poses risks: the pressure level may not be reached, leading to unwelcome guests like foam and cavitation. On the flip side, if viscosity takes a plunge below the permissible range, chaos reigns—increased leakage, heightened wear, vulnerability to contamination, and a shortened equipment lifespan. The hydraulic system, much like a skilled tightrope walker, requires the perfect balance.

## **RLI: The Symphony of Viscosity Mastery**

As you traverse the realm of viscosity management, the ensemble of Renewable Lubricants Inc. (RLI) emerges as your guiding conductor. With an array of ISO viscosity fluids at its disposal, RLI crafts a harmony of resilience and lubrication. An astonishing viscosity index of over 150 VI is a testament to RLI's commitment to high-performance fluidity across diverse temperature ranges.

Whether your equipment braves the outdoors or navigates dusty environs, RLI's formulations step in as the safeguard against wear, pumpability struggles, moisture woes, and temperature extremes.

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# Harmony Beyond Limits

Within the treasure trove of RLI's offerings, the Bio-Ultimax™ Technology Hydraulic Fluids stand tall. Diverse in formulation series and viscosities, these fluids redefine compatibility, anti-wear attributes, corrosion protection, and more. Their capabilities even extend to the frigid realms, with cold temperature pumpability as low as  $-50^{\circ}\text{C}$ , as showcased in the Bio Ultimax 1200LT series TDSs. With a harmony that resonates across seals, filters, and materials, these fluids transform the hydraulic landscape.

As the curtain rises on the viscosity chapter, the lesson is clear—viscosity shapes hydraulic excellence. And with RLI's expertise by your side, your hydraulic system is destined for greatness.



# Chapter 7:

## Diving into Density

### Managing Moisture and Performance

Density emerges as a vital player, impacting the delicate dance between hydraulic fluids and the intricate system they power. As we venture into the realm of density, we'll unravel the enigmatic relationship between moisture, polyglycols, and the intricacy of system design.

### Density and Moisture

In this hydraulic performance, moisture and density join hands, waltzing through the intricate steps of fluid interaction. The spotlight falls on Polyethylene Glycols (PEG) and Polyalkylene Glycols (PAGs), two players that are known to sway in the presence of moisture. Their susceptibility to hydrolysis and their tendency to embrace water through emulsification create a mesmerizing yet challenging duet. Their affinity for water raises a curtain on a series of intricate challenges, ultimately reshaping the hydraulic narrative.

### Density's Variations

Density directs the rhythm of hydraulic operations. The tale of density takes an intriguing twist as we explore the world of polyglycol PAG/HEPG. With a density that surpasses 1 g/ml, these glycols stand in stark contrast to the mineral-based HP and HLP formulas, characterized by densities below 0.90. This contrast becomes evident when considering pump suction pressures. Lower suction pressures are the anticipated outcome for pumps submerged in these glycols.

## **Unlocking the Flow: Density's Challenges and Solutions**

OEMs offer guidance to prevent these types of system problems. Their recommendation? Adjust the pump's maximum speed as needed and optimize suction conditions if the fluid's density breaches the 1.0 mark on the Specific Gravity scale at 15.6°C. The pumping speed undergoes scrutiny as well, with a notable pump OEM advising a 20% reduction in the maximum permissible speed of self-aspirating pumps when handling fluids with densities surpassing 1 g/ml.

## **The RLI Resonance: Fluid Performance**

RLI's formulations emerge as the virtuoso, delivering a seamless melody of performance and fluidity. With density gracefully balanced at less than 1 g/ml, the BioUltimax and Bio-Fleet formulations dance to their own rhythm, sidestepping the challenges that plague higher density fluids.

## **Moisture: The Intriguing Intruder**

Moisture, like an uninvited guest, brings its own set of challenges to the hydraulic soirée. With PAGs in the limelight, the aversion to water's embrace becomes a priority. Water's entry distorts the fluid's physical characteristics, disrupting its chemical structure. And for fluids that embrace water, separation becomes an arduous journey—requiring the introduction of vaporization equipment or permanent off-line water separation.

# An Artful Compatibility Arrangement

In concluding our examination of hydraulic compatibility, it's evident that PEG, PAGs, and water-based fluids necessitate a distinct approach, given their intricate requirements which do not align with RLI's steadfast BioUltimax and Bio-Fleet formulations. Combining these incompatible elements carries the risk of complicating the hydraulic system, obscuring fluid performance, and undermining overall efficiency.

As we draw this chapter focused on density-driven dynamics to a close, the lesson is quite clear—density's influence significantly shapes hydraulic performance. Within the realm of hydraulic fluid dynamics, selecting the right partner holds utmost importance, and within RLI's formulations, the interplay with density finds its perfect match, resulting in a seamless hydraulic system.

# Bio-Ultimax™ & Hydro Safe® Hydraulic Fluids



## Bio-Ultimax™

Offering superior anti-wear performance & environmentally friendly, zinc-free additive systems that meet or exceed industry standards.

1000 Series - ISO 32 | 46 | 68 | 100

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1200 Series - ISO 15 | 22 | 32 | 46

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1500 Series - ISO 22 | 32 | 46 | 68

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2000 Series - ISO 32 | 46 | 68

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Direct Replacement for  
Premium, Major Oil Fluids.

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## Hydro Safe®

Designed by elevator engineers and is approved by Otis, Mitsubishi, United Elevator, and many other elevator manufacturers.

Hydro Safe® Select

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Hydro Safe® Premium

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VG 32 | 46 | 68

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Ultimately Biodegradable

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