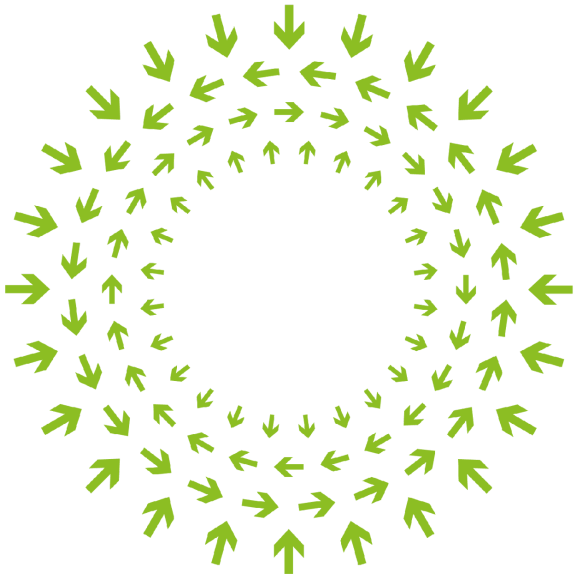


Base Specification for Single-Phase Propylene Glycol-Based Cold Plate Coolants (PG 25)

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Base Specification
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1 License

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2 Compliance with OCP Tenets

The Open Compute Project (OCP) is a collaborative initiative aimed at redesigning hardware technology to support the growing demands of compute infrastructure efficiently. At its core, OCP is guided by five foundational tenets that shape its contributions and community standards, including:

- Openness
- Efficiency
- Impact
- Scale
- Sustainability

This section outlines how the Base Specification complies with each tenet.

2.1 OPENNESS

The development of this Base Specification reflects the Open Compute Project's core tenet of Openness through its collaborative and transparent approach. Created in partnership with fluid suppliers and industry experts, both within and outside the OCP community, the specification embodies the spirit of shared innovation.

Prior to formal submission, the document will be made publicly available for review, inviting feedback from the broader OCP community as well as external stakeholders. This inclusive process ensures that diverse perspectives are considered and that the specification evolves to meet the needs of a wide range of users and applications. Furthermore, the workgroup responsible for this specification is committed to ongoing dialogue and responsiveness. Should future changes be necessary, the group will actively revise and resubmit the specification, maintaining its relevance and utility over

time.

By fostering open collaboration, public review and iterative improvement, this Base Specification exemplifies the OCP tenet of Openness, ensuring that innovation is accessible, inclusive and community driven.

2.2 EFFICIENCY

This Base Specification supports the tenet of Efficiency by enabling the adoption of advanced cooling solutions—specifically, the use of PG25-based liquid cooling in place of traditional air cooling methods. This shift results in significantly improved thermal management, reduced energy consumption and enhanced system performance. By lowering Power Usage Effectiveness (PUE) compared to air cooling, the specification contributes to more sustainable and cost-effective data center operations. Additionally, the standardized guidance ensures consistent implementation across suppliers, further streamlining deployment and maintenance while maximizing operational efficiency.

Through these improvements, the Base Specification exemplifies OCP's commitment to driving innovation that reduces waste, optimizes resources and enhances overall infrastructure performance.

2.3 IMPACT

This Base Specification represents advancement in data center cooling technology. As the first propylene glycol (PG)-based fluid specification tailored for both current and future IT equipment, the specification sets a new industry benchmark for liquid cooling solutions. This document not only provides foundational guidance for propylene glycol-based fluids used in cold plate cooling applications but also establishes a framework for future enhancements and discussions. By enabling the use of alternative PG-based fluids, the specification supports a more resilient and diversified supply chain, reducing dependency on single-source formulations and enhancing global availability.

Through its pioneering approach and forward-looking adaptability, the specification exemplifies the OCP tenet of Impact by driving innovation, shaping industry standards and enabling scalable, sustainable infrastructure for the future.

2.4 SCALE

This Base Specification is designed to support global scalability by providing clear, standardized guidance for suppliers on the minimum production requirements. By

defining a consistent offering of supplemental chemicals and operational protocols, the specification ensures that suppliers across regions can reliably produce and maintain systems that meet OCP standards.

This consistency enables seamless deployment and maintenance of infrastructure at scale, reducing variability, simplifying training and enhancing operability across geographies. The specification also supports scalable operations by addressing long-term maintenance needs, ensuring that systems remain efficient and serviceable throughout their lifecycle.

In doing so, the specification directly supports the OCP tenet of Scale, enabling widespread adoption and streamlined operations in diverse environments.

2.5 SUSTAINABILITY

This Base Specification promotes a more sustainable approach to liquid cooling in data center environments. By enabling the use of propylene glycol (PG)-based fluids, the specification supports environmentally conscious alternatives to traditional cooling methods.

This guidance empowers fluid vendors to align their products with their own company-specific sustainability goals, fostering innovation in formulations and manufacturing practices. The specification also encourages broader adoption of liquid cooling technologies that reduce energy consumption and improve thermal efficiency which are key factors in lowering the environmental footprint of IT infrastructure.

Through its emphasis on energy-efficient cooling and support for vendor-driven environmental initiatives, the specification exemplifies the OCP tenet of Sustainability and helps to advance responsible and resilient data center operations.

3 Scope

3.1 IN SCOPE

This specification is intended for PG25 suppliers and defines the technical and quality requirements placed upon manufacturers of propylene glycol-based fluids (e.g. PG25) intended for use in single-phase cold plate cooling systems.

3.2 OUT OF SCOPE

This specification does not define or mandate a common formulation across suppliers and is not intended to require different PG25 suppliers to produce identical products, nor does the specification seek to standardize proprietary inhibitor packages or additive chemistries. Each fluid supplier may utilize proprietary and confidential additives, selected based on their own formulation strategies, intellectual property and performance objectives. Disclosure of detailed additive composition beyond what is required for safety, regulatory compliance and specification conformance is not required.

Compliance with this Base Specification does not imply that PG25 fluids from different suppliers are interchangeable or functionally equivalent.

This specification also does not define full system-level design requirements, nor does the specification provide exhaustive compatibility requirements for all possible materials (e.g., plastics, elastomers, seals, or adhesives) used in liquid cooling systems.

4 Base Specification Overview

4.1 DESCRIPTION

This specification establishes a foundational framework for fluid suppliers providing propylene glycol-based inhibited heat transfer fluids (PG25), designed for use in single-phase, direct-to-chip (D2C) liquid cooling systems. By defining a common baseline, the specification enables global consistency in production requirements and deployment while remaining modular and extensible within the OCP specification framework. This allows future workgroups to build upon the specification with supplemental documents addressing specific use cases, performance metrics, or regional considerations.

Developed through open collaboration with fluid suppliers and industry experts, both within and outside the OCP community, this specification supports the broader mission of OCP by promoting innovation and openness in data center infrastructure. Future revisions will be guided by community input and evolving industry needs.

Within the OCP ecosystem, this specification serves as a key enabler for efficient, scalable and sustainable liquid cooling solutions. To be compliant with this specification, fluid suppliers must meet the minimal criteria across the following key areas for finished products:

- **Composition** – Adherence to specified propylene glycol concentration and purity as well as avoidance of unapproved inhibitors
- **Product Consistency** – Consistent product composition, globally, with minimal contaminants.
- **Corrosion Protection** – Protection of systems metals, as defined by testing in this baseline specification
- **Physical Properties** – Stability across expected operating temperatures
- **Documentation** – Transparent, verifiable data on formulation, testing, and handling.
- **Manufacturing Practices** – Robust quality control ensuring repeatability, traceability and compliance with industry best practices.

4.2 GOALS AND VISION

This specification outlines the essential requirements for PG25 suppliers to ensure fluids meet the minimum performance for deployment in high-performance computing environments. Particularly, the specification aims to enable:

- **Efficient thermal management** – ensure reliable and consistent heat removal from high-density electronic components in D2C cooling systems
- **Long-term system reliability** – minimize corrosion, scaling and degradation to extend the operational life of cooling systems and reduce maintenance frequency
- **Compatibility for use with common materials** – ensure chemical compatibility with commonly used metals

  Note: It is important to consider compatibility with plastics and elastomers commonly used in liquid cooling infrastructure, however, this is not addressed in this document due to the variety of materials used in various systems. Refer to “Guidelines for Using Propylene Glycol-Based Heat Transfer Fluids in Liquid Cooled Racks” document for guidance on testing.
- **Product purity** – use of high purity propylene glycol to reduce the likelihood of impurities and ensure performance, reliability and safety
- **Product consistency** – consistency across all regions to provide predictable performance which is critical for OEMs and operators managing large-scale global deployments

5 Product Composition Requirements

PG25 fluids which are compliant with this specification must meet the general composition criteria outlined in this section.

5.1 PROPYLENE GLYCOL PURITY

PG25 fluids which are compliant with this specification must be formulated using high-purity propylene glycol, such as PG USP/EP grade, with a minimum purity of 99.5%. This ensures optimal thermal performance and system reliability. Suppliers are required to provide clear documentation, such as Technical Data Sheets (TDS) or Product Bulletins, that explicitly states:

- Source of propylene glycol (e.g., virgin or recycled)
- Verified purity level

This transparency supports informed decision-making by end users and integrators and helps ensure consistent performance across diverse deployments. This transparency also aligns with OCP's commitment to openness and quality assurance in infrastructure design.

5.2 CHEMICAL COMPOSITION

PG25 fluids which are compliant with this specification must contain 25–28% propylene glycol by weight (approximately 24.5 - 27.5% by volume), along with corrosion inhibitors that are compatible with common system metallurgy, including, but not limited to, copper, brass and stainless steel and must not degrade or damage typical plastics and elastomers used in Technology Cooling Systems (TCS).

The fluid must also include a dye additive to support leak detection and fluid identification during operation and maintenance.

To ensure long-term system reliability and material compatibility:

- Silicate-based additives are prohibited, due to their potential for causing residue buildup and fouling of component surfaces.
- Siloxane-based antifoam agents may be acceptable at concentrations below 10 ppm (as silicon)
- Amines are not recommended, due to their potential reaction with nitrite to form nitrosamine. If nitrites are not present, the use of amines may be acceptable.

- Refer to: https://ntp.niehs.nih.gov/sites/default/files/ntp/roc/content/profiles/nitrosamines.pdf

5.3 READY-TO-USE REQUIREMENTS

PG25 fluids which are compliant with this specification must be supplied as ready-to-use (pre-diluted) solutions which are blended to contain 25–28% propylene glycol by weight (approximately 24.5 to 27.5% by volume, depending on specific formulation). This eliminates the need for any additional dilution, mixing or preparation by the end user, ensuring consistency, ease of deployment and reducing the risk of improper handling.

Providing fluids in a ready-to-use format supports streamlined integration and aligns with OCP's goals of efficiency, reliability and user-friendly implementation across diverse operational environments.

5.4 WATER QUALITY REQUIREMENTS

During the manufacturing process, high-purity water shall be used for blending PG25 fluids. Manufacturers must maintain an internal specification for water quality (e.g. quarterly or bi-annually) and have a strategy in place to ensure water quality remains consistent.

The criteria outlined in Table 1 represent target water quality limits intended to ensure fluid stability, corrosion resistance and system longevity. Water quality should be maintained within these limits for routine production. Acceptable sources typically include distilled, deionized or reverse osmosis (RO) water.

Table 1: Target Water Quality Limits

Component	Acceptable Level	Method
Chloride (Cl)	<10 ppm	ASTM D5827
Sulfate (SO_4)	<10 ppm	ASTM D5827
Calcium (Ca)	<2 ppm	ASTM D6130
Magnesium (Mg)	<2 ppm	ASTM D6130
Total Hardness ($CaCO_3$)	<15 ppm	ASTM D6130
pH	5-8	ASTM D1287

Iron (Fe)	<2 ppm	ASTM D6130
Bacteria	<100 CFU/mL	ASTM D5465
Electrical Conductivity, 20°C	<25 µS/cm	ASTM D1125

Note: *While softened water effectively removes calcium and magnesium, softened water may not adequately eliminate chloride and sulfate, which are critical to control in order to maintain fluid integrity and prevent corrosion or scaling.*

5.5 FLUID PH

PG25 fluids which are compliant with this specification must exhibit a stable pH between 7.5 and 10.5, as measured in its ready-to-use state. The exact pH value within this range will depend on the specific additive package used, including corrosion inhibitors and stabilizers.

5.6 IMPURITIES

PG25 fluids which are compliant with this specification must contain low levels of impurities, consistent with high-performance requirements for data center liquid cooling applications, as outlined in Table 2.

Table 2: Impurity Limits for PG25 Fluids

Impurity	Limit	Method
Copper (Cu)	<2 ppm	*ASTM D6130
Iron (Fe)	<2 ppm	*ASTM D6130
Aluminum (Al)	<2 ppm	*ASTM D6130
Chloride (Cl)	<5 ppm	ASTM D5827
Sulfate (SO_4)	<10 ppm	ASTM D5827
****Calcium (Ca)**	<5 ppm	*ASTM D6130
****Magnesium (Mg)**	<10 ppm	*ASTM D6130
Silicon (Si)	<10 ppm	ASTM D6130

***Note:** Analytical testing should be conducted using Inductively Coupled Plasma (ICP) methods, such as those described in ASTM D6130. It is important to note that the Limit of Detection (LOD) for ICP instruments may vary depending on the laboratory, instrument calibration, sample preparation and matrix effects. The LOD represents the lowest concentration of an analyte that can be reliably distinguished from background noise. To account for this variability, the impurity limits specified in this document are set conservatively, recognizing that values near or below the LOD may fluctuate and carry reduced analytical certainty. Nonetheless, it is expected that metal concentrations in the final product will remain minimal, supporting the fluid's suitability for use in sensitive cooling environments.*

***Note:** A common strategy for stabilizing phosphate in fluids is via the use of a small amount of Ca or Mg cations in combination with an anionic polymer.*

5.7 PRODUCT CONSISTENCY

PG25 fluids which are compliant with this specification must demonstrate consistent formulation and quality across all regions and production batches. For any given product name, the fluid must maintain uniformity in:

- Chemical composition and additive levels
- Color and appearance
- Performance characteristics

This consistency is critical to ensure predictable behavior, system compatibility and ease of integration across global deployments. This consistency also supports OEMs and operators in managing large-scale infrastructure with confidence, reducing variability and simplifying qualification processes.

Suppliers must implement robust quality control measures and maintain traceable records to verify that products meet the same standards regardless of manufacturing location.

5.8 FINAL PRODUCT FILTRATION

PG25 fluids which are compliant with this specification must undergo final filtration by the manufacturer prior to being transferred into containers such as totes, drums, ISO tanks, or transport vehicles. This step is crucial to maintaining fluid cleanliness standards suitable for high-performance data center cooling systems.

Filtration must be performed using filters rated at 50 microns or finer (with 25 micron or less preferred), which are specifically approved for use with propylene glycol to avoid chemical incompatibility or degradation. To ensure consistent product quality, filters must be routinely inspected. Disposable filters must be replaced at regular intervals in accordance with documented maintenance protocols. Reusable filters (e.g., stainless steel mesh) must be routinely inspected and cleaned to maintain filtration effectiveness.

This filtration requirement is justified by the need to minimize the presence of particulate matter in the final product. Low particle levels are critical to preventing fouling, clogging and wear in sensitive cooling system components, thereby ensuring long-term system reliability and performance.

6 Performance Requirements

6.1 OVERVIEW

To support the use of PG25 fluids in liquid cooling systems for data center environments, this section outlines a baseline set of performance criteria to demonstrate compliance with this specification. These requirements are intended to provide representative performance data, such as corrosion protection and thermal stability, that demonstrate fundamental suitability for data center liquid cooling applications. These requirements are not intended to be exhaustive, nor do these requirements replace additional testing, qualification or validation that may be required based on specific system designs, operating conditions, materials of construction or customer requirements. Together, these minimum criteria provide a consistent reference point for assessing fluid performance while recognizing that broader evaluations are often necessary to ensure long-term reliability and system integrity.

6.2 CORROSION PROTECTION

PG25 fluids which are compliant with this specification must be formulated with effective corrosion inhibitors to protect the internal metallurgy of liquid cooled systems, particularly components made from copper, brass and stainless steel. These additives are essential to ensure long-term system reliability and minimize degradation under use.

To validate corrosion protection performance, fluids must be tested according to a modified ASTM D8040 test, utilizing copper, brass and stainless steel coupons as these

are common wetted materials. Testing must be conducted using the final product (e.g. 25% inhibited propylene glycol without further dilution) with the inclusion of corrosive salts as specified in the method. The test should be performed in triplicate at 88°C for a duration of two weeks, with continuous air bubbling through the fluid.

Fluids must meet or exceed weight loss limits for all metals outlined below, assuming ASTM D8040 requirements are followed regarding coupon dimensions. These thresholds are designed to ensure that the fluid provides adequate protection against scaling and degradation, thereby supporting long-term performance.

Table 3: Acceptable Corrosion Rates

Metal	Weight Loss, max	**Estimated Corrosion Rate, max *(mils per year)*
Copper UNS C11000 (SAE CA110)	5 mg	0.2 mpy
Brass UNS C26000 (SAE CA 260)	5 mg	0.2 mpy
Stainless Steel 304/304L	2 mg	0.1 mpy
Stainless Steel 316/316L	2 mg	0.1 mpy

****Note:** Corrosion rates are based on standard coupon dimensions (1/16” x 2” x 1”)

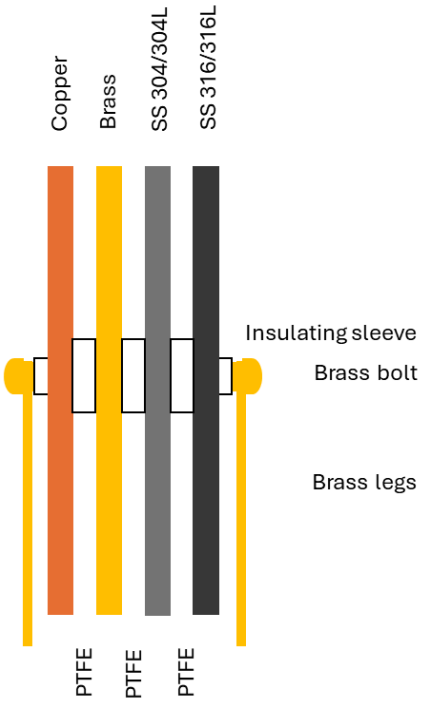


Figure 1: Metal coupon bundle arrangement according to modified ASTM D8040 test

6.3 THERMAL STABILITY

To assess thermal and chemical stability under representative stress conditions, PG25 fluids should demonstrate resistance to degradation when exposed to elevated temperatures and common sources of hardness contamination. This evaluation is performed using a modified ASTM D7437 method, which examines the effect of calcium and magnesium ions on fluid stability under thermal stress. These ions may be introduced through elastomers (e.g., hoses), dilution water or raw materials.

This test is intended as a screening-level indicator of fluid stability under thermal stress and does not, by itself, ensure long-term operational reliability across all data center liquid cooling applications. Results from this test should be considered alongside additional performance data and system-specific qualification requirements.

The procedure involves blending 98.5 mL of PG25 fluid with 1.5 mL of hard water stock solution, as indicated in Table 4, and aging the mixture at 90 °C for two weeks in a conical glass centrifuge tube, in duplicate. At the conclusion of the test, the volume of precipitate formed is measured. Fluids producing less than 0.25 mL of precipitate are considered to demonstrate good resistance to scaling or additive breakdown

under the defined test conditions. Refer to the ASTM method for applicable rotation rates, exposure times and additional procedural details.

Note: *The standard ASTM method also calls for testing at 60°C without hard water added, however, this portion can be omitted from the modified test.*

Table 4: Stock Solution for Thermal Stability Test

Component	Amount
Calcium chloride dihydrate	3.668 grams
Magnesium chloride hexahydrate	8.363 grams
Demineralized water *(refer to ASTM method for water specifications)*	1 liter

Note: *This equates to 15 ppm calcium and 15 ppm magnesium once introduced into the test fluid (1.5 mL of stock solution in 98.5 mL PG25)*

7 Transportation and Storage Requirements

7.1 OVERVIEW

Proper handling, storage and transportation of PG25 fluids are essential to maintaining product integrity and preventing contamination. The following subsections outline the minimum requirements for preserving fluid quality throughout the supply chain.

7.2 TRANSPORTATION

All PG25 fluids must be transported in a manner that safeguards the chemical stability and cleanliness. This includes implementation of strict cleaning protocols for all tanks, trucks and containers prior to loading. Residual materials from previous loads must be completely removed to prevent cross-contamination. Transport equipment must be constructed from materials compatible with the formulated product.

7.3 TOTE STORAGE

Totes used for storage and transport must be made from materials known to be compatible with formulated propylene glycol and water blends, such as high-density polyethylene (HDPE). Totes should be stored under controlled environmental conditions, including:

- Protection from direct sunlight to avoid UV-induced breakdown of both the container and the fluid
- Storage in temperature-stable environments to avoid thermal stress
- Clean, dry storage areas to minimize contamination risks

If totes are to be reused by the manufacturer, the totes must undergo a thorough cleaning protocol to eliminate all residual contaminants and ensure fluid integrity across all batches.

7.4 DRUM STORAGE

Drums used for storing PG25 fluids must be constructed from materials compatible with formulated propylene glycol and water blends such as HDPE. If carbon steel drums are used, the drums must be internally lined with a suitable corrosion-resistant material to protect against degradation, particularly in the vapor space. Drums should be stored under controlled environmental conditions to preserve fluid quality. This includes:

- Protection from direct sunlight to avoid UV-induced breakdown of both the container and the fluid
- Storage in temperature-stable environments to avoid thermal stress
- Clean, dry storage areas to minimize contamination risks

7.5 TANK STORAGE

All tanks used for bulk storage or blending must be constructed from stainless steel, suitably lined carbon steel, HDPE or other plastics which offer the necessary chemical resistance and durability for long-term storage. Special attention must be given to the vapor space, where exposure to oxygen can promote corrosion or additive breakdown.

Proper tank selection and maintenance are critical to preserving fluid quality, minimizing contamination and ensuring consistent performance across deployments.

8 Documentation Requirements

8.1 PRODUCT LABELING

All packaged PG25 fluids must be clearly and accurately labeled to support traceability, quality assurance and regulatory compliance throughout the supply chain. This includes products stored in ISO containers, totes, drums, pails and bottles.

Each label must include the following information:

- Product name
- Batch or lot number
- Date of production or expiration date

Labels must be durable and resistant to premature fading or peeling. This ensures that critical product information remains legible and accessible throughout transport, storage and use.

Proper labeling is essential for enabling effective inventory management and supporting root-cause analysis in the event of performance issues or recalls.

8.2 CERTIFICATE OF ANALYSIS

A Certificate of Analysis (COA) must accompany every shipment of PG25 fluid or be made readily accessible to the customer upon delivery. The COA serves as a critical quality assurance document, verifying that the product meets the required specifications for performance and consistency.

At a minimum, the COA must include:

- Propylene glycol concentration (expressed as % by weight or volume)
- Alternatively, the refractive index may be provided, along with the temperature at which the measurement was taken
- pH value of the final product, including temperature of measurement

Additional data may be included to support transparency and traceability, such as batch number, production date, and results from impurity or performance testing. The COA ensures that end users can confidently validate product quality and compatibility with their systems, in alignment with OCP standards.

8.3 TECHNICAL DATA SHEET

Manufacturers must provide a Technical Data Sheet (TDS) or equivalent product literature, that clearly outlines the typical physical and thermal properties of the formulated PG25 fluid. These values must be measured directly on the final product and not sourced solely from publicly available data or base chemical references.

At a minimum, the following properties must be disclosed, with values reported across the expected operating temperature range, including the lowest anticipated temperature the fluid may encounter (e.g., during transportation or storage):

- Viscosity
- Heat Capacity
- Density
- Thermal Conductivity

If publicly available data is used to supplement or support reported values, the source must be clearly cited to maintain transparency and traceability. This requirement ensures that end users have access to accurate, application-specific data for system design, performance modeling, and operational planning

8.4 SAFETY DATA SHEET

It is the responsibility of the fluid manufacturer to provide up-to-date, region-specific Safety Data Sheets (SDS) that are fully compliant with all applicable chemical safety regulations. These documents must be made readily available to customers and accompany shipments as required. SDS documentation must adhere to the standards set forth by relevant regulatory bodies, including but not limited to:

- The Globally Harmonized System (GHS) for Classification and Labeling of Chemicals
- The European Chemicals Agency (ECHA) REACH Regulation
- The United States OSHA Hazard Communication Standard (HCS)

All known hazards associated with the fluid and additive components must be accurately reported, including:

- Toxicity
- Environmental persistence
- Hazard classification

Manufacturers must incorporate the most current hazard and classification data available from their suppliers and recognized regulatory databases (e.g., ECHA CHEM). SDS documents must be updated in accordance with regulatory timelines, for example, within 90 days of receiving new information in the United States. Maintaining accurate and compliant SDS documentation is essential for ensuring safe handling and regulatory transparency.

8.5 TRACEABILITY

To ensure traceability and support root-cause analysis in the event of a quality issue, suppliers must implement a comprehensive batch tracking system for all PG25 fluids. Each production batch must be traceable to a retained physical sample, which may include material from the tank, truck, drum, ISO container or other packaging format. These samples must be retained for a minimum of six months following production.

Batch records, including physical property data, blend sheets manufacturing location, and any relevant quality control documentation, must be retained for a minimum of five years.

This level of traceability ensures that any performance concerns or non-conformities can be investigated thoroughly and efficiently.

8.6 ANALYTICAL RECORD RETENTION

Suppliers are required to maintain detailed records of all analytical testing conducted on PG25 fluid batches produced for a minimum of three years. These records must include results from quality control testing and be maintained in a secure, well-organized manner. Each record should be clearly linked to the corresponding batch number and production date to ensure traceability.

Maintaining thorough and accessible analytical documentation is essential for enabling root-cause investigations, supporting continuous quality assurance and ensuring consistency across production batches.

9 Product Maintenance and Support

9.1 REMEDIATION CHEMICALS

Fluid suppliers must be capable of providing effective solutions to restore both glycol concentration and inhibitor levels in the event of overdilution or depletion of inhibitors. This can be achieved through the following options:

- **Supplemental Chemicals** - The original fluid manufacturer must offer compatible additive packages to re-inhibit the fluid when analytical parameters fall outside the manufacturer’s specified limits.
- **Concentrated Solution** - A higher-concentration fluid (e.g., PG 50, PG 55, or greater) must be available from the original manufacturer to restore glycol

concentration if the concentration drops below 25%. This formulation must contain the same additive package as the standard PG25 fluid and be produced in accordance with the guidelines outlined in this document (e.g., water quality, documentation, analytical verification, etc.).

9.2 TECHNICAL SUPPORT

The fluid manufacturer must offer comprehensive technical guidance on the operational conditions and performance parameters of the heat transfer fluid. This guidance should include, but not be limited to, recommended temperature ranges, material compatibility, startup/commissioning procedures and remediation.

9.3 ANALYTICAL SUPPORT

The original fluid manufacturer must offer technical support and analytical services to assess fluid condition, either through in-house laboratories or qualified third-party laboratories approved by the manufacturer. These services should be readily accessible to the end user and supported by clear procedures for sample submission, testing and interpretation of results.

At a minimum, qualified laboratories must be capable of testing the following parameters:

Table 5: Analytical Requirements for PG25 Evaluation

Parameter	Method	Notes
Propylene Glycol Concentration	ASTM D7922, D3321, E202	When using refractive index to determine propylene glycol concentration, a fluid-specific refractive index table must be available to interpret results, as refractive index will vary depending on additive package. **Note:** Test strips are not an acceptable method as test strips are not highly accurate
Fluid pH	ASTM D1287	**Note:** Test strips are not an acceptable method as test strips are not highly accurate

Reserve Alkalinity	ASTM D1121	**Note:** Test strips are not an acceptable method as test strips are not highly accurate
Corrosion Inhibitors	Per supplier recommendations	Test via Ion Chromatography (IC) or Liquid Chromatography (HPLC)
Chloride	ASTM D5827	Test via Ion Chromatography (IC) or Inductively Coupled Plasma (ICP), for example
Sulfate	ASTM D5827	Test via Ion Chromatography (IC)
Total Hardness, as $CaCO_3$	ASTM D6130	Test via Inductively Coupled Plasma (ICP) for calcium and magnesium
Propylene Glycol Degradation Compounds	ASTM D5827	Test via Ion Chromatography (IC)
Metals	ASTM D6130	Test via Inductively Coupled Plasma (ICP) for copper, iron, lead, tin, zinc, silicon, chromium, molybdenum, nickel, aluminum

Note: *Although ASTM methods are referenced, equivalent methods are also acceptable (e.g. EPA, ISO, etc.).*

10 Compliance

Below is a summary of the requirements necessary to be compliant with this specification:

5 Product Composition Requirements		
5.1	**Propylene Glycol Purity**	PG25 fluids must be formulated using high-purity propylene glycol, such as PG USP/EP grade, with a minimum purity of 99.5%. Source of propylene glycol and purity must be disclosed in documentation.

5.2	**Chemical Composition**	PG25 fluids must contain 25–28% propylene glycol by weight, along with corrosion inhibitors that are compatible with common system metallurgy. The fluid must also include a dye additive to support leak detection and fluid identification during operation and maintenance. Silicate-based additives are prohibited
5.3	**Ready-to-Use Fluid Requirements**	PG25 fluids must be supplied as ready-to-use solutions which are blended to contain 25–28% propylene glycol by weight (approximately 24.5–27.5% by volume, depending on specific formulation).
5.4	**Water Quality Requirements**	High-purity water, meeting the requirements in Table 1, must be used for blending PG25 fluids. Manufacturers are required to maintain an internal specification for water quality and conduct routine testing
5.5	**Fluid pH**	PG25 fluids must exhibit a stable pH between 7.5 and 10.5, as measured in its final, ready-to-use state.
5.6	**Impurities**	PG25 fluids must contain low levels of impurities, as indicated in Table 2.
5.7	**Product Consistency**	PG25 fluids must demonstrate consistent formulation and quality across all regions and production batches
5.8	**Final Product Filtration**	PG25 fluids must undergo final filtration by the manufacturer prior to being transferred into containers such as totes, drums, ISO tanks or transport vehicles. Filtration must be performed using filters rated at 50 microns or finer. Note: If filtration >25 micron is used, particle size and distribution data may be required.

6 Performance Requirements		
6.2	**Corrosion Protection**	PG25 fluids must meet or exceed the corrosion rate limits outlined in Table 3, as determined by a modified ASTM D8040 test method.

6.3	**Thermal Stability**	PG25 fluids must produce less than 0.25 mL of precipitate when tested according to a modified ASTM D7437 method.

7 Transportation and Storage Requirements		
7.2	**Transportation**	PG25 fluids must be transported in a manner that safeguards the chemical stability and cleanliness.
7.3	**Tote Storage**	Totes used for storage and transport of PG25 fluids must be made from materials known to be compatible with formulated propylene glycol and water blends, such as high-density polyethylene (HDPE). Totes should be stored under controlled environmental conditions.
7.4	**Drum Storage**	Drums used for storing PG25 fluids must be constructed from materials compatible with formulated propylene glycol and water blends such as HDPE. If carbon steel drums are used, they must be internally lined with a suitable corrosion-resistant material to protect against degradation, particularly in the vapor space. Drums should be stored under controlled environmental conditions to preserve fluid quality.
7.5	**Tank Storage**	All tanks used for bulk storage or blending of PG25 fluids must be constructed from stainless steel, suitably lined carbon steel or HDPE, which offer the necessary chemical resistance and durability for long-term storage.

8 Documentation Requirements		
8.1	**Product Labeling**	All packaged PG25 fluids must be clearly and accurately labeled to support traceability, quality assurance and regulatory compliance throughout the supply chain.

8.2	**Certificate of Analysis**	A Certificate of Analysis (COA) must accompany every shipment of PG25 fluid or be made readily accessible to the customer upon delivery. This document must included propylene glycol concentration (or refractive index) and pH, at a minimum.
8.3	**Technical Data Sheet**	Manufacturers must provide a Technical Data Sheet (TDS) or equivalent product literature, that clearly outlines the typical physical and thermal properties of the formulated PG25 fluid.
8.4	**Safety Data Sheet**	It is the responsibility of the fluid manufacturer to provide up-to-date, region-specific Safety Data Sheets (SDS) that are fully compliant with all applicable chemical safety regulations. These documents must be made readily available to customers and accompany shipments as required. SDS documentation must adhere to the standards set forth by relevant regulatory bodies.
8.5	**Tracking**	To ensure traceability and support root-cause analysis in the event of a quality issue, suppliers must implement a comprehensive batch tracking system for all PG25 fluids. Retains from every batch produced must be maintained for a minimum of six months, with records being retained for a minimum of five years.
8.6	**Analytical Record Retention**	Suppliers are required to maintain detailed records of all analytical testing conducted on PG25 fluid batches produced for a minimum of three years.

9 Product Maintenance and Support		
9.1	**Remediation Chemicals**	Fluid vendors must be capable of providing effective and compatible solutions to restore both glycol concentration and inhibitor levels in the event of overdilution or depletion of inhibitors.

9.2	**Technical Support**	The fluid manufacturer must offer comprehensive technical guidance on the operational conditions and performance parameters of the heat transfer fluid.
9.3	**Analytical Support**	The original fluid manufacturer must provide technical support and analytical services to assess coolant condition, either through in-house laboratories or qualified third-party laboratories approved by the manufacturer.

11 Referenced Methods

This section outlines the standardized test methods referenced in this specification. The listed ASTM methods serve as the technical foundation for assessing key performance attributes, ensuring consistency, reliability and comparability across submissions.

Methods included in Table 6 have been selected based on relevance to physical, chemical and thermal properties critical to the application of PG25 fluid.

Table 6: ASTM Methods

Method	Title	Purpose
ASTM D7922	Standard Test Method for Determination of Glycol for In-Service Engine Oils by Gas Chromatography	Quantification of propylene glycol concentration
ASTM D1121	Standard Test Method for Reserve Alkalinity of Engine Coolants and Antirusts	Determination of reserve alkalinity
ASTM D1125	Standard Test Methods for Electrical Conductivity and Resistivity of Water	Determination of electrical conductivity
ASTM D1287	Standard Test Method for pH of Engine Coolants and Antirusts	Determination of fluid pH
ASTM D1881	Standard Test Method for Foaming Tendencies of Engine Coolants in Glassware	Assessment of foaming behavior
ASTM D3321	Standard Test Method for Use of the	Estimation of propylene

	Refractometer for Field Test Determination of the Freezing Point of Aqueous Engine Coolants	glycol concentration via refractive index
ASTM D5465	Standard Practices for Determining Microbial Colony Counts from Waters Analyzed by Plating Methods	Determination of microbial contamination in dilution water
ASTM D5827	Standard Test Method for Analysis of Engine Coolant for Chloride and Other Anions by Ion Chromatography	Determination of anions (e.g. chloride, sulfate, degradation acids, etc.)
ASTM D6130	Standard Test Method for Determination of Silicon and Other Elements in Engine Coolant by Inductively Coupled Plasma-Atomic Emission Spectroscopy	Quantification of metals and elements (e.g. copper, iron, calcium, magnesium, silicon, etc.)
ASTM D7437	Standard Test Method for Temperature and Hard Water Stability of Engine Coolants	Evaluation of fluid stability in presence of heat and hard water
ASTM D8039	Standard Specification for Heat Transfer Fluids (HTF) for Heating and Air Conditioning (HVAC) Systems	Reference for acceptable foam characteristics
ASTM D8040	Standard Test Method for Corrosion Test for Heat Transfer Fluids in Glassware	Evaluation of the effects of heat transfer fluids on metal specimens under controlled laboratory conditions
ASTM E202	Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols	Quantify propylene glycol concentration

Note: Referenced ASTM methods are guidelines, however, equivalent methods are also acceptable.

12 References

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Note: *This document is currently under revision as of 7/14/2026*

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