

## ナノポンプ® Nanopump® Nanoliter(nl) discharge pump

ナノポンプ®は、転がり軸受がその性能を最大限に発揮するために必要な極少量の潤滑を実現するために開発されました。従来の潤滑技術では不可能だった精密な潤滑供給を可能にし、機械の効率を飛躍的に向上させる革新的な技術です

*The Nano Pump® was developed to achieve the precise minimal lubrication required for rolling bearings to perform at their maximum potential. This groundbreaking technology enables an unprecedented level of precision in lubrication supply, which was unattainable with conventional methods, dramatically enhancing the efficiency of machinery.*

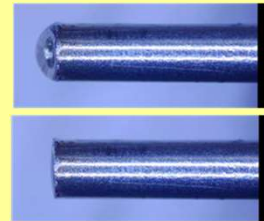
ナノポンプ®は、外径1mm以下の吐出ノズル先に、表面張力を利用して潤滑油が半球状に50nl近傍量で保持されるように吐出する設計がなされた極少量吐出ポンプです

*The Nanopump® is an ultra-precise dispensing pump designed to discharge minute amounts of lubricant, approximately 50 nanoliters, at the tip of a nozzle with an outer diameter of less than 1 mm. By leveraging surface tension, the lubricant forms and remains as a hemispherical droplet at the nozzle tip, ensuring precise and controlled application.*



Various Nanopump®

Each discharge is independent, with a volume of about 10nl to 90nl.



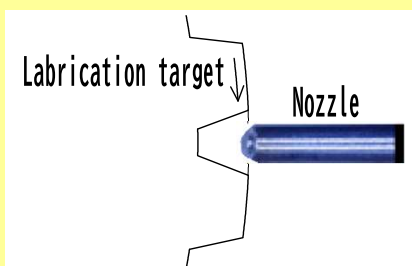
At the nozzle tip:

Top: After one-shot discharge  
Bottom: Before discharge

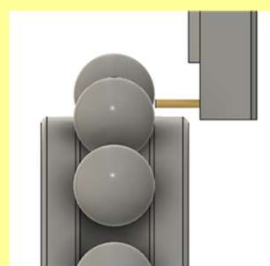
## ナノリットル(nl) 潤滑技術 Nanoliter(nl) lubrication technology

1. ナノリットルレベルの超微量の潤滑油を所定時間ごとに吐出し、この吐出した潤滑油を、その表面張力を利用してノズルの先端に保持し、
2. ノズルに対して非接触状態で相対移動する潤滑対象を、ノズル先端に保持した潤滑油に接触させて、先端の潤滑油の一部を潤滑対象へ均一かつ安定的に供給する方法

1. *The Nanopump® dispenses an ultra-small amount of lubricant, measured at the nanoliter level, at regular intervals. This dispensed lubricant is held at the tip of the nozzle using surface tension.*
2. *Without making direct contact with the nozzle, the moving lubrication target comes into contact with the lubricant held at the nozzle tip. A portion of the lubricant is then transferred uniformly and stably to the target surface, ensuring precise and efficient lubrication.*



Example of nl Lubrication for Gears



Example of nl Lubrication for Rolling Bearings

# ナノポンプ®の特徴

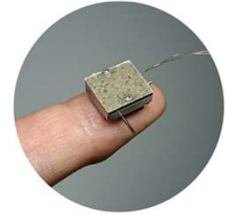
”Unveiling the Unique Features of the Nanopump®”

## ナノポンプ®の特徴は, Features:

- 極少量液体を近接した所へ吐出するだけのポンプ
- 1回の吐出量は,およそ10~90nl
- 必要量は,吐出間隔で設定 1~999秒
- オーステナイト系ステンレス鋼製
- 電気代は連続1年使用で,約0.07円
- A pump designed to discharge extremely small amounts of liquid to a nearby target area.
- Single discharge volume: approximately 10–90 nanoliters.
- Discharge intervals can be set between 1 and 999 seconds to match required amounts.
- Made from austenitic stainless steel.
- Power consumption: approximately ¥0.07 for one year of continuous operation.

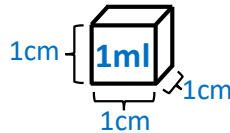
## ナノポンプ®の注意点は, Precautions:

- ろ過した清浄な液体しか吐出できないこと
- エア噛みすると吐出できないこと
- Only filtered and clean liquids can be discharged.
- Unable to discharge if air enters the system.



## ナノポンプ®にとって, 1mlの意味は, For the Nanopump®, the significance of 1 ml is:

- 1ml=1,000µl=1,000,000nl
- 1回吐出量 50nlの場合
- 1ml/50nl=20,000回吐出分
- 1分間隔吐出で20,000分潤滑可能
- =333h=1か月分(16.7h稼働/1日)



- 1 ml = 1,000 µl = 1,000,000 nl
- For a single discharge volume of 50 nl:
- 1 ml ÷ 50 nl = 20,000 discharges.
- With 1-minute intervals, it provides lubrication for 20,000 minutes = 333 hours = 1 month (16.7 hours/day operation).

1mlの潤滑油の価値が,  
1分50nl潤滑, 1日16h稼働で  
→ 1ヶ月分の潤滑費  
1分50nl潤滑, 1日8h稼働で  
→ 2ヶ月分の潤滑費

The value of 1 ml of lubricant:  
•50 nl/min, 16 hours/day  
→ 1 month of lubrication.  
•50 nl/min, 8 hours/day  
→ 2 months of lubrication.

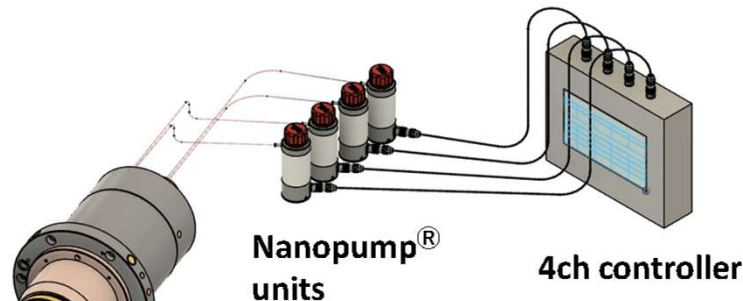
## ナノポンプ®ユニット, Nanopump® unit

- ナノリットル潤滑を手軽に導入できるようにしたのが, ナノポンプ®ユニットです
- ナノポンプ®とオイルタンクを一体化することで,設置が容易です
- コントロール線と潤滑油チューブもワンタッチで接続できます



- The Nano Unit makes it easy to implement nanoliter-level lubrication.
- By integrating the Nanopump® and oil tank into a single unit, installation is simplified.
- Control lines and lubrication tubes can be connected with a simple one-touch mechanism.

Nanopump® unit



Spindle

1つの軸受を1つのナノポンプ®で潤滑するので,  
軸受ごとに,きめ細かく最適な極少油量潤滑ができます

Each bearing is lubricated by a dedicated Nanopump®, allowing for precisely tailored and optimal ultra-low oil lubrication for each individual bearing.

Nanoliter Lubrication System for Machine Tool Spindles



Bearing Spacer Type  
One-Touch nl Lubrication Attachment



Bearing Shield Type  
One-Touch nl Lubrication Attachment

# 潤滑油の供給量を減らすことの意味

## "The Significance of Reducing Lubricant Supply"

潤滑油が不要な場所への過剰供給を防ぐことで、世界中で使用される潤滑油の消費を劇的に削減し、SDGs達成や地球環境の保護に大きく貢献できます。仮に消費量を1/10に削減できれば、以下のような多方面での恩恵が期待されます

### 1. 地球環境への恩恵

- 温室効果ガス削減:** 製造過程や廃油処理によるCO<sub>2</sub>やメタン排出量が大幅に減少します
- 原油資源の節約:** 貴重な化石燃料の枯渇を遅らせることができます
- 環境汚染の抑制:** 土壌や河川への漏出防止で、生態系への悪影響を軽減します
- 持続可能性の向上:** 「責任ある消費と生産」や「気候変動対策」への直接的な貢献となります

### 2. 経済への恩恵

- コスト削減:** 潤滑油の購入や廃油処理費用を削減し、製品価格の低下につながります
- 効率向上:** 摩擦やエネルギー損失の低減により、機械の効率と寿命が向上します
- 新産業の創出:** 精密供給技術や摩擦低減技術の発展が、新たな市場を切り開きます

### 3. 社会への恩恵

- 生活の質向上:** 機械の静音化やメンテナンスコスト削減により、快適な生活環境を提供します
- 健康リスクの低減:** 工場での油ミスト被害や食物汚染リスクが軽減されます
- 地球規模の影響:** 発展途上国での機械寿命延長や経済成長を支援します

潤滑油削減の取り組みは、環境保護、経済発展、そして生活の質向上に繋がる重要なステップです。この変革は地球全体に恩恵をもたらす、持続可能な未来を築く鍵となるでしょう

By preventing the excessive application of lubricants in unnecessary areas, we can dramatically reduce the global consumption of lubricating oil, significantly contributing to the achievement of the SDGs and the preservation of our planet. If we were to cut lubricant use to one-tenth of current levels, the following wide-ranging benefits could be realized:

### 1. Environmental Benefits

- Reduction of Greenhouse Gas Emissions:** Manufacturing and waste disposal processes for lubricants generate substantial CO<sub>2</sub> and methane emissions. Reducing consumption would markedly lower these emissions.
- Conservation of Crude Oil Resources:** Lower demand for lubricants would slow the depletion of finite fossil fuel reserves.
- Prevention of Environmental Pollution:** Minimizing leaks into soil and waterways would mitigate harm to ecosystems.
- Promotion of Sustainability:** This initiative would directly support SDGs, such as "Responsible Consumption and Production" and "Climate Action."

### 2. Economic Benefits

- Cost Reduction:** Decreasing lubricant purchase and waste disposal costs would lead to lower production expenses and reduced consumer prices.
- Efficiency Improvements:** Lower friction and energy loss would enhance machine efficiency and longevity.
- Creation of New Industries:** The development of precision dispensing technologies and friction-reducing coatings would open new markets and create job opportunities.

### 3. Social Benefits

- Improved Quality of Life:** Quieter machines and reduced maintenance costs would create more comfortable and convenient living environments.
- Reduced Health Risks:** Decreased exposure to oil mists in workplaces and contamination risks in food production would improve public health.
- Global Impact:** Efficient lubricant use in developing countries would extend machine lifespans, bolster infrastructure, and support economic growth.

Efforts to reduce lubricant consumption represent a pivotal step toward environmental protection, economic progress, and enhanced quality of life. This transformation holds the potential to bring profound benefits to our world and serves as a cornerstone for building a sustainable future.

# 潤滑油の無駄を改善するための進め方

## "Approach to Reducing Waste in Lubricating Oil"

多くの機械では過剰な潤滑油が供給されているのが現状です。『潤滑が不足すると故障や損傷が発生する』という懸念からですが、必要以上の供給は、かえって非効率や環境への負荷を増大させています。まず、自社の機械を調べてみましょう。

### 1. 現状の把握 自社での潤滑油の使用状況把握が重要。以下の点を確認しましょう:

- 潤滑油の使用量と頻度
- 接触箇所以外に油が供給されていないか
- 油漏れや廃油の発生状況
- 機械の稼働時に発生する摩耗や温度上昇のデータ

無駄の発生箇所や具体的な改善の余地があれば次に進みましょう

### 2. 「まずは、小さく始めよう」

全体ではなく、1台の機械や1つの部品だけを対象に効果確認ポイントを決めましょう  
もっとも摩耗が多い所とか、潤滑油使用の多い所とかを、選定してみましょう

### 3. 「まずはナノリットル潤滑を試してみよう」

選定箇所にナノポンプ®ユニットを装着し短時間だけ試して下さい。

極少潤滑が成立し、低振動、低騒音、低昇温等のメリットが確認できれば次のステップを検討下さい。

In many machines, excessive lubricant is currently being supplied. This is often due to concerns that "insufficient lubrication can lead to failures or damage." However, over-supplying lubricant actually reduces efficiency and increases environmental impact.

Let's start by examining your own machinery.

### 1. Understand the Current Situation

It is crucial to assess how lubricant is currently being used in your operations. Check the following points:

- The amount and frequency of lubricant usage
- Whether lubricant is being supplied to areas beyond the intended contact points
- The presence of oil leaks or waste oil
- Data on wear and temperature increases during machine operation

If you identify areas where waste occurs or where there's room for improvement, proceed to the next step.

### 2. "Start Small: Choose One"

Instead of focusing on all equipment, select a single machine or one component to test the effects.

Choose areas with the highest wear or the highest lubricant usage for the trial.

### 3. "Try Nanoliter Lubrication First"

Install a Nanopump® unit on the selected area and conduct a short trial.

If ultra-low lubrication proves effective—yielding benefits such as reduced vibration, noise, and temperature increases—you can consider expanding to the next step.

## Design & Development

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