



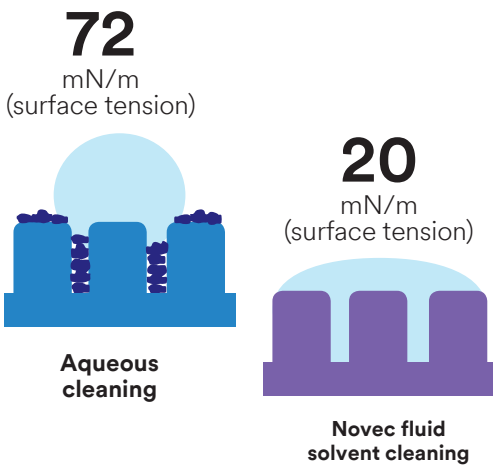
Novec[™]
Brand

Don't tap into water's hidden costs

Benefits of Vapor Degreasing with 3M™ Novec™ Engineered Fluids vs. Aqueous

High performance solvent cleaning technology using 3M™ Novec™ Engineered Fluids helps you overcome the higher total costs of aqueous cleaning – while maintaining your commitment to worker health and safety, environmental responsibility and product quality! Here's how:

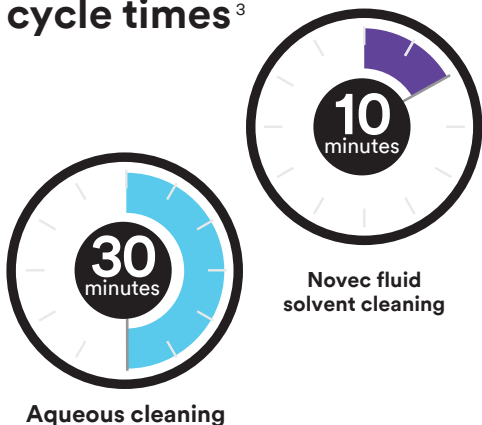
Better penetration of tight spaces¹



Zero residue²

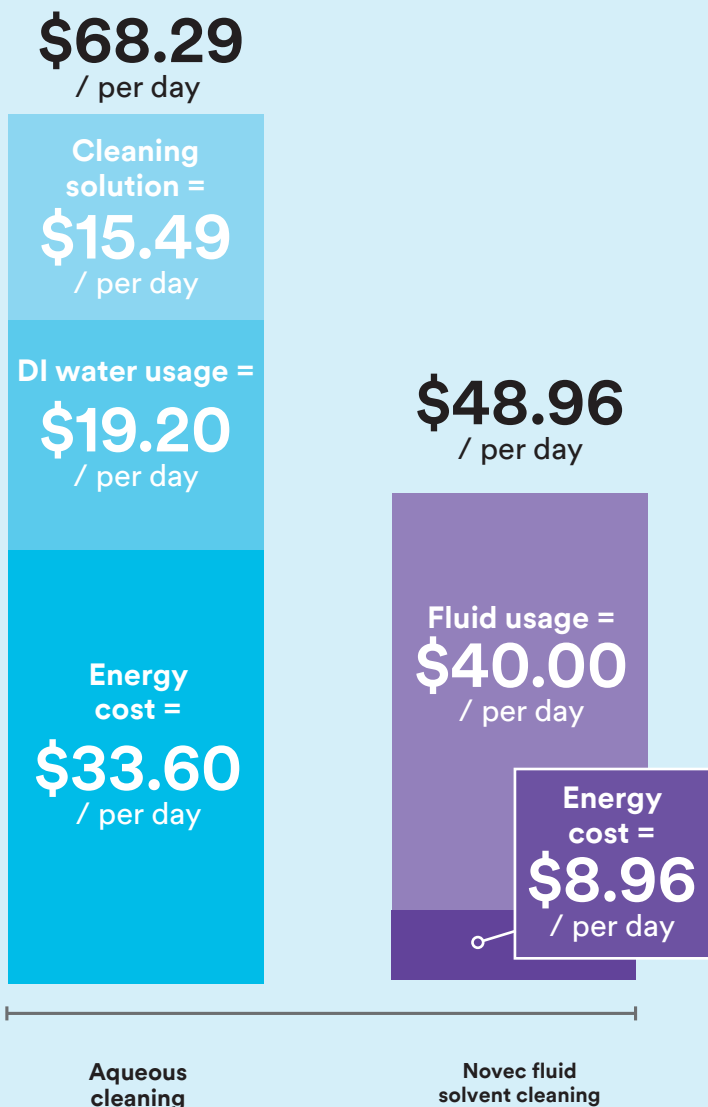


Shorter cycle times³



Explore the value of vapor degreasing with 3M™ Novec™ Engineered Fluids as compared to aqueous cleaning*

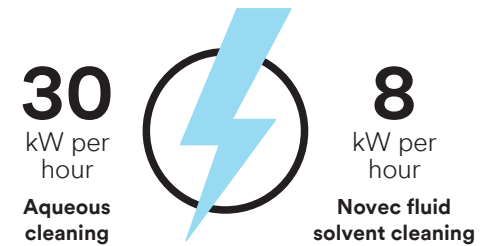
Consumables cost / per day^{4,5,6}



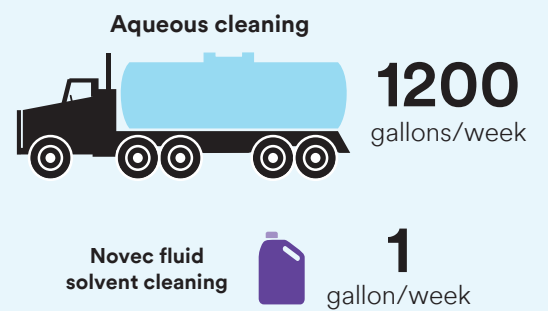
- Novec fluid is ready to use as delivered – incoming water requires a water treatment system
- Water and oil don't mix, but Novec fluid is engineered to dissolve common greases and oils used in manufacturing

*Not for specification purposes. Results may vary. These results are typical based on batch cleaning processes with the same sump dimensions (12" x 16" x 12") for a non-closed loop aqueous system vs. a solvent vapor degreaser cleaning system. To dive in deeper on the numbers, refer to the footnotes on the back or contact our technical experts.

Less energy usage⁵

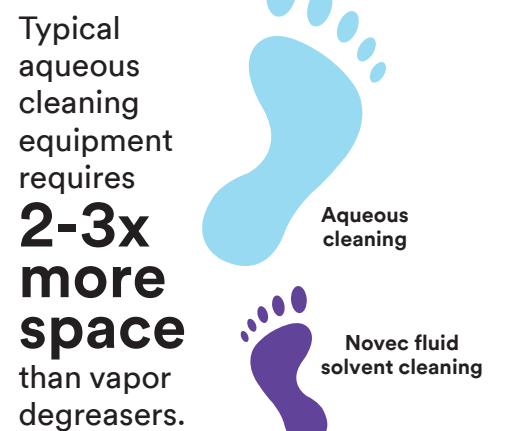


Reduced fluid usage⁶



It's also important to consider the significant cost of waste water treatment and the extensive use of water, a precious natural resource.

Smaller equipment footprint⁷



3M Novec Engineered Fluids

- Cleans a wide range of soils
- Evaporates quickly with no residue
- Variety of Novec fluids to meet your cleaning and materials compatibility needs
- Can be used in vapor degreasing, spray cleaning and hand wipe applications
- Non-flammable with a wide margin of worker safety
- Zero ozone depletion potential (ODP) and very low global warming potential (GWP)

Smart. Safe. Sustainable.

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Benefits of Vapor Degreasing with 3M™ Novec™ Engineered Fluids vs. Aqueous

- 1 Low surface tension of Novec fluid allows more effective cleaning, rinsing and drying.
- 2 Novec fluid evaporates quickly with zero residue, eliminating the need for chemical rinsing or hot air drying.
- 3 Shorter cycle times for vapor degreasing with 3M Novec fluid can help increase throughput and productivity.
 - Aqueous cleaning typically requires 30 minutes cycle time per batch.
 - ▶ 5 minute wash
 - ▶ 5 minute rinse #1
 - ▶ 5 minute rinse #2
 - ▶ 15 minute hot air drying
 - ▶ Two batches run concurrently
 - Vapor degreasing with 3M Novec fluid typically requires 5-10 minutes cycle time per batch. For this analysis, we used a ten minute cycle time.
 - ▶ 6 minutes pre-wash and immersion with ultrasonics
 - ▶ 3 minute vapor rinse
 - ▶ 1 minute freeboard dry
 - ▶ One batch at a time
- 4 This data is representational and may vary. It is based on the following assumptions.
 - What are we cleaning?
 - ▶ 10" x 10" printed circuit boards, 10 boards per cycle
 - How many boards per day?
 - ▶ Aqueous: 320 boards per day (4 cycles per hour, 8 hours per day)
 - ▶ Solvent: 480 boards per day (6 cycles per hour, 8 hours per day)
 - What is the production schedule?
 - ▶ 5 days a week, 8 hours a day, 52 weeks per year
 - Aqueous cleaning solution cost:
 - ▶ Price of concentrate: \$38 per gallon
 - ▶ Cleaning solution concentration (diluted for use): 10%
 - ▶ Diluted cleaning solution usage: 0.5 gallons per hour (4 gallons per day) = \$15.20 per day
 - ▶ Changeouts: 2 per year, 10 gallons diluted cleaning solution per changeout = \$0.29 per day
 - Deionized (DI) water usage cost:
 - ▶ \$0.08 per gallon
 - Solvent cost:
 - ▶ Price: \$100 per gallon
 - ▶ Usage: 1 gallon per week for evaporative and drag-out losses = \$20 per day
 - ▶ 2 fluid changeouts per year at 26 gallons per changeout = \$20 per day
 - ▶ Changeout cost can be reduced by using a boil down process to conserve fluid. Contact our technical experts for details.
- 5 Solvent cleaning with 3M Novec fluids can result in significantly less energy usage.
 - Aqueous cleaning requires more energy to heat the water and for hot air drying:
 - ▶ Electricity costs are based on \$0.14 per kWh per U.S. average from U.S. Bureau of Labor Statistics
 - ▶ Electricity usage:
 - Aqueous requires 30 kW per hour (i.e. 14 kW per hour for washing and drying (ultrasonic tank, rinse tank heat, dryer heat, cleaning tank ultrasonics, rinse tank ultrasonics and pump and filter systems), plus 16 kW per hour external water heater)
 - Solvent cleaning with Novec fluid requires 8 kW per hour (i.e. heat, ultrasonics, pump, and primary and sub-zero chillers)
- 6 DI water usage for aqueous cleaning is 30 gallons per hour, or 240 gallons per day. Based on non-closed loop aqueous system. Solvent cleaning includes evaporative and drag-out losses.
- 7 Aqueous: 54 square feet. 4' x 12' equipment plus 3' x 2' for external DI water heater. Solvent: 24 square feet. 4' x 6' equipment.



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