

# Fuel School





# Are you Fuel Ready?

## Three Components of Fuel Maintenance

- Sampling and Testing
- Chemical Treatments
- Mechanical Remediation

# Diesel Contamination – Why?

*Ongoing fuel quality management is essential to ensure operations aren't impacted by contamination.*

## Why Contamination Occurs:

- Effects of Contamination
- Best Practices:  
Remediation & Prevention

# Why Contamination Occurs?

Quality of Crude

Advanced Refining Process

Government Regulation:  
Advent of ULSD

Water Intrusion

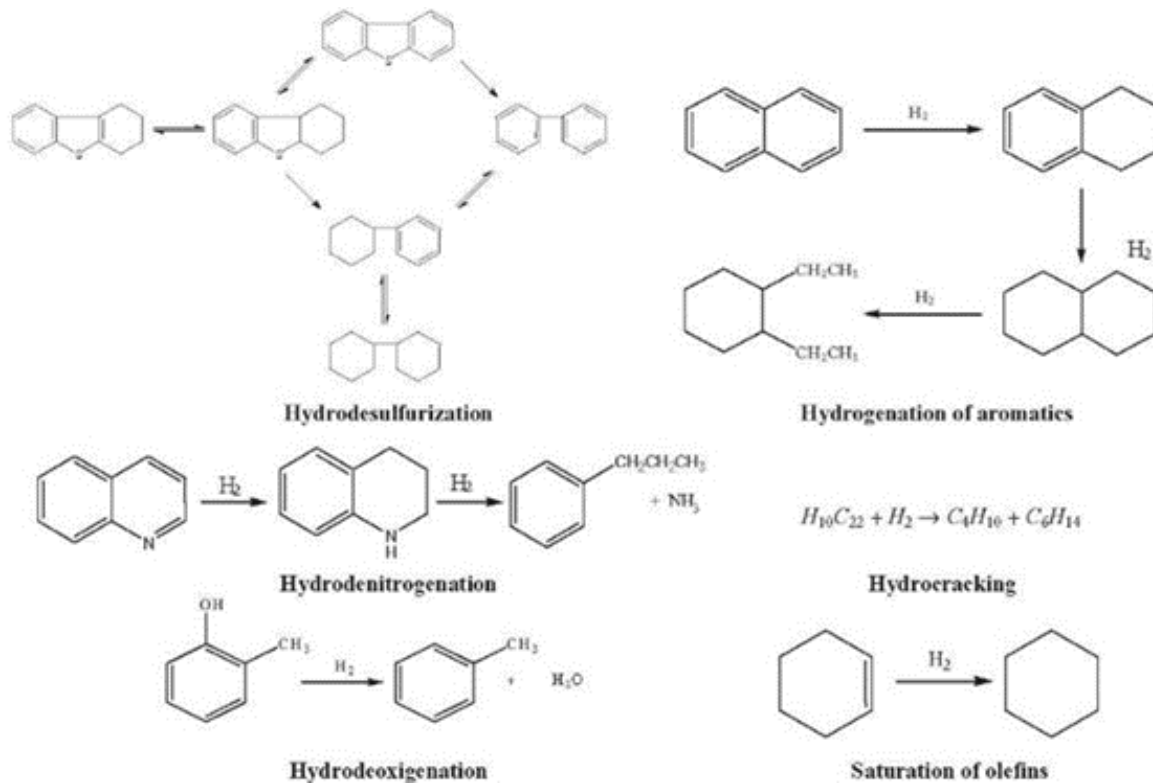
Introduction of Bio-Diesel

# Why Contamination Occurs - Quality of Crude

Crude Quality



# Why Contamination Occurs – Advanced Refining Process



- Strict specifications and goal to produce as much fuel at lowest cost creates unstable fuel
- Mostly distillation < 2006
- More catalysts introduced after 2006
  - Hydrocracking / hydrodesulfurization

2006 EPA Clean Air Act:  
Required sulfur in diesel  
fuel to be reduced to  
from 5000ppm to 15ppm.  
Contamination Occurs -  
ULSD

Hydrosulfurization  
removes chemistry  
essential to preventing  
microorganism growth.

**ULTRA LOW  
SULFUR  
DIESEL  
FUEL ONLY**

# Why Contamination Occurs – Water Intrusion

***Not a new issue, but a new problem***

- Low sulfur and unstable fuel creates an environment for microbial contamination and quick degradation
- Microbes degrade fuel quality, advance tank and advance corrosion



# Water Intrusion – How?

- More Water in Fuel from the Refinery
- Condensation Formed on Tank Walls
- Tank Vents, Expose Fuel to Humidity & Water Absorption
- Water from Fuel Distributor Tanker
- Spill Buckets Full of Water



# Why Contamination Occurs – Introduction of Biodiesel

Most common biodiesel concentrations are B2, B5, & B20

Biodiesel has a higher lubricity rating than straight diesel but contains less energy

Biodiesel has one-fourth the shelf life than straight diesel has, and it is more susceptible to microbial growth

Biodiesel tends to gel at higher temperatures than straight diesel

Biodiesel chemistry bonds easily with water



# Diesel Contamination in Generators - Effects

*Ongoing fuel quality management is essential to ensuring operations aren't impacted by contamination*



## Why Contamination Occurs

- Effects of Contamination
- Best Practices: Remediation & Prevention

# Diesel Contamination - Effects on Engines

- Fuel Filter Plugging
- Combustion Chamber Deposits
- Lacquering of Injection System Components & Valves
- Excessive Soot Accumulation in DP Filters
- Reduced Engine Power
- Greater Engine Wear due to Particulate
- Reduced Fuel Economy

**80%**

Related to Poor Fuel Quality

*Critical System Power Failure*



## Why Contamination Occurs – Water Intrusion

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*Examples of what we see in the field...*





# Diesel Contamination - Effects



Plugged fuel filter caused by  
bio-mass & microbe excreted waste



Asphaltenes removed from tank bottoms  
developed due to unstable fuel

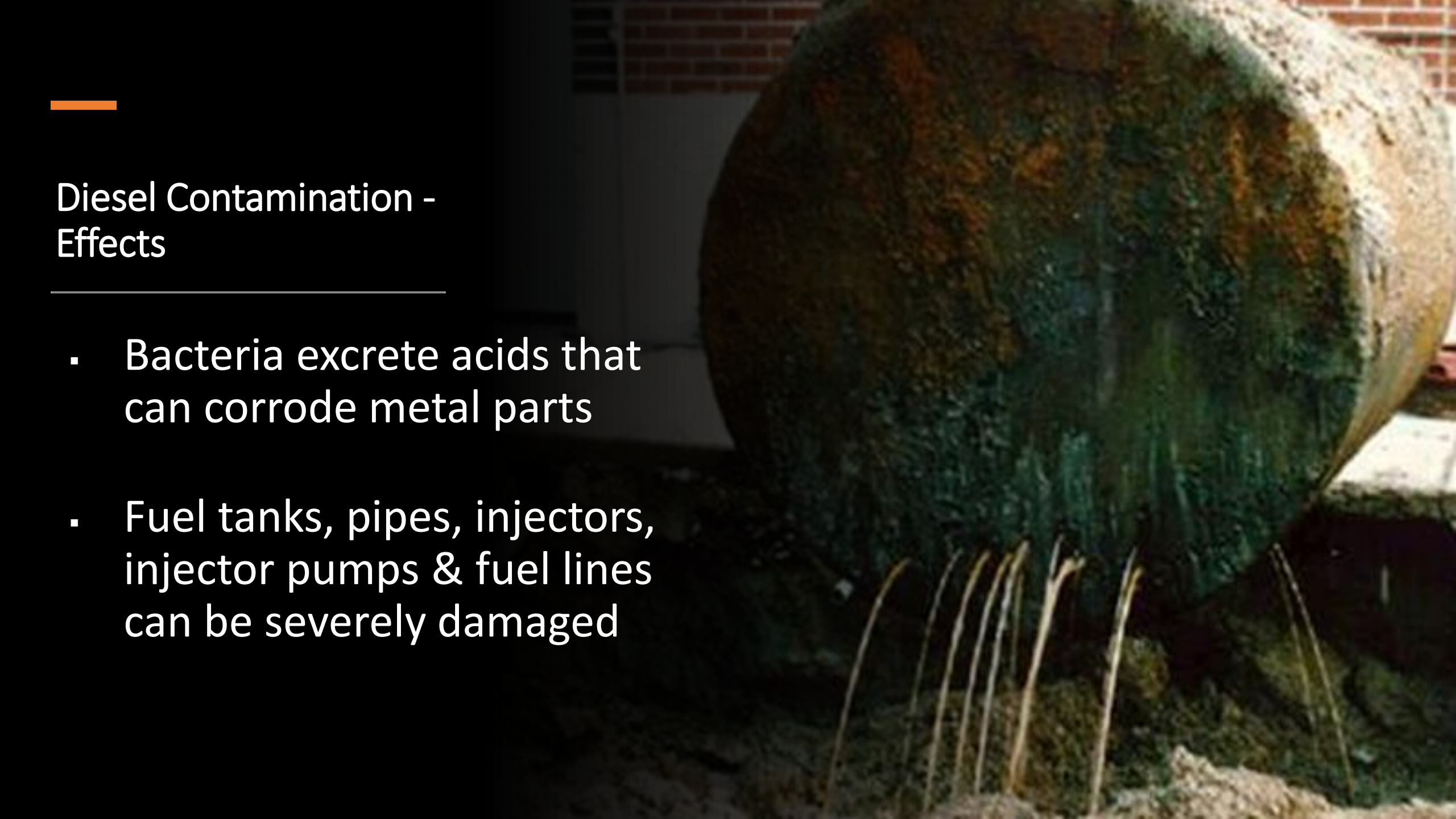


# Diesel Contamination - Effects

***Biomass: Microbes can multiply from one cell to 246,000 in six hours***



***Microbes can come from the air, moisture or during tank filling***

A large, rusted metal tank, likely a fuel tank, is shown with several leaks spraying out liquid. The tank is heavily corroded, with significant rust and peeling paint. The background is dark and indistinct.

## Diesel Contamination - Effects

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- Bacteria excrete acids that can corrode metal parts
- Fuel tanks, pipes, injectors, injector pumps & fuel lines can be severely damaged

# Diesel Contamination – Best Practices

## Three Components of Managing Fuel Quality

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1. In-field Sampling & Testing
2. Chemical Treatment
3. Mechanical Tank Cleaning & Fuel Filtration





# *Sampling & Testing*

Diesel Contamination – Best Practices

# Condition Monitoring & Sampling - Mythologies

## Sampling practices ASTM D4057 vs. D7464

- Bottom and 2-phase samples
- Proper handling of instruments
- Sterilization between samples
- Temperature Control
- Time Sensitive Testing



Designation: D7464 – 14

Standard Practice for  
Manual Sampling of Liquid Fuels, Associated Materials and  
Fuel System Components for Microbiological Testing<sup>1</sup>



# Suggested “Mission Critical” Testing Criteria

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Testing Consists Of...

- D86 Distillation
- D93 Flash Point
- D130 Copper Strip Corrosion
- D287/D4052 API Gravity
- D976 Cetane Index
- D2709 Water & Sediment
- D6304/D7546 Water by Karl Fischer
- D2622/D5453/D7035 Sulfur Content



# Other Testing Methods

|                                                                                                                            | ATP By Filtration | Dipslides | Microb Monitor2 | FuelStat Resinae | LiquiCult |
|----------------------------------------------------------------------------------------------------------------------------|-------------------|-----------|-----------------|------------------|-----------|
| Fast results (enables real time decisions)                                                                                 | ✓                 | ✗         | ✗               | ✓                | ✗         |
| Results are quantitative (easier to interpret)                                                                             | ✓                 | ✗         | ✗               | ✗                | ✗         |
| Inexpensive to use                                                                                                         | ✓                 | ✓         | ✓               | ✗                | ✓         |
| Counts both active and dormant microbes                                                                                    | ✗                 | ✗         | ✗               | ✗                | ✓         |
| Easy/Simple to run (lessens chance of technician error)                                                                    | ✓                 | ✓         | ✓               | ✓                | ✓         |
| Lower chance of <u>inadvertent error</u> through sample contamination                                                      | ✓                 | ✗         | ✓               | ✓                | ✓         |
| Has ASTM test number associated with it (the test method is vetted and approved by scientists as being valid and reliable) | ✓                 | ✗         | ✓               | ✓                | ✓         |
| Ability to baseline test materials (to confirm if materials are “still good”)                                              | ✓                 | ✗         | ✗               | ✗                | ✗         |



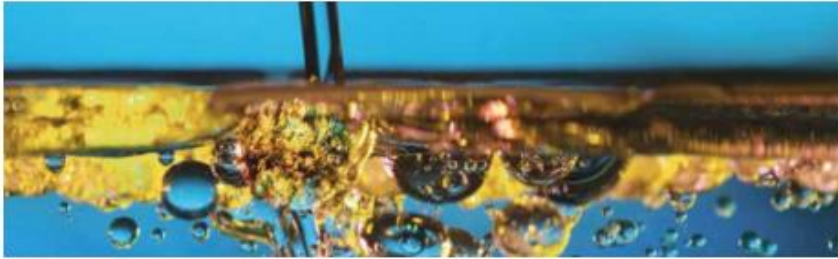
A close-up photograph of laboratory glassware. In the foreground, a 100 mL Erlenmeyer flask is filled with a bright yellow-green liquid. Behind it, another flask contains a similar liquid, and a graduated cylinder is visible. To the right, a larger flask contains a clear, colorless liquid. The glassware is resting on a reflective surface, creating clear reflections. The background is softly blurred, showing more laboratory equipment.

# Chemical Solutions

## Bellicide & Clearkill Biocides *Biocide*

*Choosing the right biocide is important. Solving bacteria and fungus problems is serious business. It's important to make the right decision.*

| BIOCIDE TREATMENT                                                                     |                                                                            |
|---------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
|    | <b>Contact time to a complete kill</b> (how long does it take to work?)    |
|    | <b>Effectiveness after 1 week</b> (is it still working after one week?)    |
|   | <b>Effectiveness after 4 weeks</b> (is it still working after four weeks?) |
|  | <b>Sensitivity to pH</b><br>(do acidic environments keep it from working?) |



EMULSION  
BREAKER/DEHAZER  
FORMULAS



WATER-  
CONTROLLING  
SURFACTANT  
absorbs water  
into the fuel so that it  
can be combusted.

**Water Control  
Chemistries**

DFS Plus and  
Demulsified EB

# Bell SDF

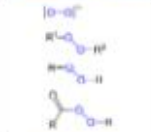
## *Sludge Dispersant*

*Sludge dispersants are an important tool for the health of your stored fuels.*

| SLUDGE DISPERSANTS<br>FOR STORED FUEL                                                 |                                    |
|---------------------------------------------------------------------------------------|------------------------------------|
|    | Petro-<br>Sludge<br>Dispersion     |
|    | Biomass<br>Dispersion              |
|    | Blend<br>Mixing<br>Assistance      |
|   | Corrosion<br>Surface<br>Protection |
|  | Low treat<br>rate                  |

## Dee Zol Life & Bio Dee-Zol Life Stabilizer

*Fuel stabilizers are essential for stored fuel health. When it comes to stability improvers for diesel fuels, there are lots of options to consider.*

| DIESEL FUEL STABILIZERS                                                               |                      |
|---------------------------------------------------------------------------------------|----------------------|
|    | Anti-oxidant         |
|    | Acid-base stabilizer |
|    | Dispersant           |
|    | Corrosion inhibitor  |
|    | Metal deactivator    |
|   | Anti-peroxidal       |
|  | Low treat rate       |

# Additional Chemical Solutions

- Cold Flow Improver
- Super - Tane
- Dee-Zol
- Marine Dee-Zol
- Ethanol Defense



# Mechanical Remediation

Sweep / Chemically Treat / Circulate



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graph TD; A[Sweep / Chemically Treat / Circulate] --> B[Full Filtration]; B --> C[Phase Separation];
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The diagram illustrates a three-step mechanical remediation process. It begins with a grey box containing the text 'Sweep / Chemically Treat / Circulate'. A white arrow points down from this box to an orange box labeled 'Full Filtration'. Another yellow arrow points down from the orange box to a darker orange box labeled 'Phase Separation'.

Full Filtration

Phase Separation

# Real World Examples

*Sweep Treat  
Aerate*



# Real World Examples

*Full Filtration*



# Real World Examples

## *Phase Separation*





# Reach Out Today

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