Work safety in magnetic particle and penetrant testing

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Abstract: Consumables for magnetic particle and penetrant testing have different potential hazards for personnel and the environment. However, safety data sheets and information on the package labels make this transparent even for users without any basic knowledge of chemistry. The official hazard ratings are becoming more and more strict as a result of new findings about raw materials.

The manufacturer can only achieve an unchanged or even improved product classification through high development efforts and substitution of ingredients. The issues of raw material availability leads to a further increase in complexity.

What should be taken into account when using the products and what developments can be expected in the future?
WORK SAFETY IN MAGNETIC PARTICLE AND PENETRANT TESTING
AGENDA

| PFINDER FACTS
| SUSTAINABILITY
| HAZARD CLASSIFICATIONS + PICTOGRAMS
| TECHNICAL EXCELLENCE
| APPLICATION EXAMPLES (PT/MT)
| CONCLUSION
HISTORY

1884
Foundation in Ulm

1913
Relocation to Stuttgart

1959
Relocation to Böblingen

1960
Start of supply: Consumables for MT + PT

1990
PFINDER is a pioneer: Readily biodegradable penetrants

2005
Market leadership: Penetrant testing automotive

2011
Foundation of Subsidiaries:
PFINDER Chemical Shanghai Co. Ltd
PFINDER Chemical US LP

2015
Starting GREEN NDT product philosophy

2019
PFINDER is a pioneer again: Penetrants, free of any hazardous components

2020
PFINDER penetrants: Approved according to AMS 2644
FACTS

PFINDER RIDES ALONG

More than 80 automotive plants worldwide work with our products. PFINDER products are used in every second preserved vehicle worldwide. That is more than 20 million vehicles per year.

CERTIFIED QUALITY

IATF 16949 (since 2018)
OHSAS 18001 (since 2017)
ISO 14001 (since 2003)
ISO 9001 (since 1995)

WE ARE GROWING CONTINUALLY

Employees

<table>
<thead>
<tr>
<th>Year</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>158</td>
<td>155</td>
<td>177</td>
<td>172</td>
<td>181</td>
<td>182</td>
</tr>
</tbody>
</table>

Production volume / t

<table>
<thead>
<tr>
<th>Year</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>19.900</td>
<td>20.700</td>
<td>21.600</td>
<td>18.000</td>
<td>18.500</td>
<td>20.600</td>
</tr>
</tbody>
</table>
NDT CONSUMABLES AND EQUIPMENT

**PENETRANT TESTING (PT)**
- Color contrast penetrant testing
- Fluorescent penetrant testing
- Cleaners / removers + developers

**MAGNETIC PARTICLE TESTING (MT)**
- Magnetic particle testing (black / daylight)
- Fluorescent magnetic particle testing
- Cleaners + carriers (testing oils)
MAKE YOUR PROCESS READY FOR THE FUTURE!

PFINDER’S PRODUCT PHILOSOPHY SINCE 2015

- Technically leading performance
- Best health and safety conditions
- Care for environment
- Highest cost efficiency
SUSTAINABILITY IN GENERAL

ECOLOGY

SOCIAL

ECONOMY
ECNDT 2023
WORK SAFETY IN MAGNETIC PARTICLE AND PENETRANT TESTING

SUSTAINABILITY
APPROACH TO INDUSTRY

ENVIRONMENT

WORK SAFETY

COST EFFICIENCY

ECNDT 2023
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ENVIRONMENT

WORK SAFETY

COST EFFICIENCY
SUSTAINABILITY

WORK SAFETY

- minimization of hazard potential
  - aspiration toxicity
  - serious eye damage
  - skin irritation
  - solvent vapors
  - flammability
- optimization of interpretability
SUSTAINABLE PROCESSES: WORK SAFETY

HAZARD CLASSIFICATIONS + PICTOGRAMS

- legal base: “Globally Harmonized System of Classification and Labeling of Chemicals (GHS)”
- internationally agreed-upon standard
- managed by the United Nations
- standardized hazard testing criteria
- universal warning pictograms
- harmonized safety data sheets
SUSTAINABLE PROCESSES: WORK SAFETY

HAZARD CLASSIFICATIONS + PICTOGRAMS

- showing possible effects on the health and safety of the user and/or the environment when using the product
- easily visible / based on H-statements
- come with precautionary statements (how to handle to minimize risks)
- details available
  - on the product’s label
  - in the MSDS (material safety data sheet)
### SUSTAINABLE PROCESSES: WORK SAFETY

### COMMON HAZARD CLASSIFICATIONS + PICTOGRAMS ON NDT CONSUMABLES

<table>
<thead>
<tr>
<th>Source of hazard exemplary</th>
<th>Precautionary statement exemplary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GHS 02</strong> flammable</td>
<td>do not spray on an open flame or other ignition source</td>
</tr>
<tr>
<td>flammable aerosols (due to propellant)</td>
<td></td>
</tr>
<tr>
<td><strong>GHS 07</strong> harmful</td>
<td>use only in well-ventilated areas / outdoors</td>
</tr>
<tr>
<td>eye / skin irritation (due to solvents or dyes)</td>
<td></td>
</tr>
<tr>
<td>Drowsiness or dizziness (due to solvents)</td>
<td></td>
</tr>
<tr>
<td>Wear protection glasses</td>
<td></td>
</tr>
</tbody>
</table>

**GHS 02** flammable

**GHS 07** harmful

**Precautionary statements**
- do not spray on an open flame or other ignition source
- use only in well-ventilated areas / outdoors
- Wear protection glasses
# Sustainable Processes: Work Safety

## Hazard Classifications + Pictograms with High Hazard Impact

<table>
<thead>
<tr>
<th>Source of hazard</th>
<th>Hazard Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GHS 08</strong> health hazard</td>
<td>aspiration toxicity (due to hydrocarbons) may be fatal if swallowed and enters airways suspected of causing cancer (due to dyes)</td>
</tr>
<tr>
<td><strong>GHS 05</strong> corrosive</td>
<td>may cause skin corrosion and / or serious eye damage (due to wetting agents)</td>
</tr>
<tr>
<td><strong>GHS 09</strong> environmental hazard</td>
<td>acute / chronic hazards to the aquatic environment toxic to aquatic life with long lasting effects (due to anti-foaming / agents)</td>
</tr>
</tbody>
</table>
SUSTAINABLE PROCESSES

IN LINE WITH TECHNICAL EXCELLENCE

- Technically leading performance
- Best health and safety conditions
- Care for environment
- Highest cost efficiency
SUSTAINABLE PROCESSES

IN LINE WITH TECHNICAL EXCELLENCE: APPROVALS & CONFORMITIES

EN ISO 3452: Non-destructive testing - Penetrant testing
- Part 2: Testing of penetrant materials
- Part 5: Penetrant testing at temperatures higher than 50 °C
- Part 6: Penetrant testing at temperatures lower than 10 °C

AMS 2644: Inspection Material, Penetrant

ASTM E 165: Standard Practice for Liquid Penetrant Examination for General Industry

ASTM E 1417: Standard Practice for Liquid Penetrant Testing

ASME Boiler & Pressure Vessel Code - Section 5: Nondestructive Examination
- Article 6: Liquid penetrant examination

PMUC: Specification of EDF (France)
SUSTAINABLE PROCESSES: WORK SAFETY
IN LINE WITH TECHNICAL EXCELLENCE

PFINDER 900W
PENETRANT – WATERBASED
FLUORESCENT
Type I | Sensitivity level 0,5

| sensitivity cross-check
| reference Block No. 1 (50 µm)
| acc. ISO 3452-3
| benchmarking brilliant and bright indications

PFINDER 900W
Comp. 1
Comp. 2
SUSTAINABLE PROCESSES: WORK SAFETY

IN LINE WITH TECHNICAL EXCELLENCE

PFINDER 900W

PENETRANT – WATERBASED FLUORESCENT

Type I | Sensitivity level 0,5

- sensitivity cross-check
- reference Block No. 1 (20 µm)
- acc. ISO 3452-3

- benchmarking brilliant and bright indications
**SUSTAINABLE PROCESSES: WORK SAFETY**

**IN LINE WITH TECHNICAL EXCELLENCE**

**PFINDER 900W**

**PENETRANT – WATERBASED**

**FLUORESCENT**

Type I | sensitivity level 0,5

- free of hazardous components
- no hazard pictograms
- highest level for work safety

<table>
<thead>
<tr>
<th>Hazard Pictograms</th>
<th>PFINDER 900W</th>
<th>others 1</th>
<th>others 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/a</td>
<td><img src="#" alt="Pictogram" /></td>
<td><img src="#" alt="Pictogram" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hazard Statements</th>
<th>PFINDER 900W</th>
<th>others 1</th>
<th>others 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/a</td>
<td>Causes skin irritation. Causes serious eye damage. May be fatal if swallowed and enters airways.</td>
<td>Causes serious eye damage.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source</th>
<th>PFINDER 900W</th>
<th>others 1</th>
<th>others 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MSDS / March 21st, 2022</td>
<td>MSDS / August 10th, 2021</td>
<td>MSDS / February 11th, 2022</td>
</tr>
</tbody>
</table>
SUSTAINABLE PROCESSES: EXCERPT ENVIRONMENT

READILY BIODEGRADABLE PENETRANTS: COMMON MISUNDERSTANDINGS

- water based or mineral oil free penetrants are not generally biodegradable
- special formulation of penetrant required
- ISO standard certificate must proof biodegradability

- note well hazard pictograms and statements on label and MSDS
- H318 “serious eye damage” is a common hazard statement of water based penetrants (comes with pictogram GHS05)
SUSTAINABLE PROCESSES: WORK SAFETY
IN LINE WITH TECHNICAL EXCELLENCE

PFINDER 240
MAGNETIC PARTICLE SUSPENSION
FLUORESCENT
Water-based | Ready to use

- sharp and clear indications
- low background = high contrast
- great particle mobility = quick indications
## SUSTAINABLE PROCESSES: WORK SAFETY

IN LINE WITH TECHNICAL EXCELLENCE

### PFINDER 240

**MAGNETIC PARTICLE SUSPENSION**

**BLACK**

Water-based | Ready to use

- free of hazardous components
- no hazard pictograms
- highest level for work safety

### Hazard Pictograms

- PFINDER 240: none
- others: Extremely flammable aerosol.

### Hazard Statements

- PFINDER 240: Pressurized container: May burst if heated.
- others: Pressurized container: May burst if heated. Repeated exposure may cause skin dryness or cracking.

<table>
<thead>
<tr>
<th>Source</th>
<th>PFINDER 240</th>
<th>others</th>
</tr>
</thead>
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<tr>
<td>MSDS / January 7th, 2022</td>
<td>MSDS / January 7th, 2022</td>
<td>various MSDS</td>
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</table>
CONCLUSION

- material safety data sheets should be read and compared carefully
- safety information are as well visible on product labels
  - hazard + precautionary statements are important
- PT/MT consumables with low health hazards are available
- work safety can be improved easily without quality compromises
CONTACT

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