Motor Condition Monitoring Devices
K6CM series

Application Guide

Pump system application

Transport system application

Stirring system application
## Degradation Progress and Failure Mode

Please select the optimal model for the type of failure mode you want to detect.

<table>
<thead>
<tr>
<th>Failure mode</th>
<th>Setup period</th>
<th>Operation period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inside the motor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulation degradation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bearing abnormality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abnormality of rotary shaft</td>
<td></td>
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<tr>
<td>· Rotor/stator abnormality</td>
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<tr>
<td>· Imbalance</td>
<td></td>
<td></td>
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<tr>
<td>· Misalignment</td>
<td></td>
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</tr>
<tr>
<td>Load abnormality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>· Cavitation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>· Device abnormality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>· Overload</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>K6CM-CIM</th>
<th>(Comprehensive current diagnosis type)</th>
</tr>
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<tbody>
<tr>
<td>Faulty installation</td>
<td>Faulty centering etc.</td>
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<td>Faulty mounting</td>
<td>Faulty operating condition</td>
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<td>Faulty load part</td>
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<table>
<thead>
<tr>
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<th>(Vibration &amp; temperature monitoring type)</th>
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</table>
## Motor and load condition

<table>
<thead>
<tr>
<th>Degradation progress period</th>
<th>Breakdown period</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Insulation degradation</strong></td>
<td><strong>Insulation breakdown</strong></td>
</tr>
<tr>
<td><img src="image1" alt="K6CM-ISM" /> (Insulation resistance monitoring type) [Insulation degradation]</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Bearing damage</strong></th>
<th><strong>Bearing breakdown</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image2" alt="K6CM-VBM" /> (Vibration &amp; temperature monitoring type) [Velocity/Acceleration]</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Degradation progress of motor</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3" alt="K6CM-VBM" /> (Vibration &amp; temperature monitoring type) [Velocity]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Degradation progress of load</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image4" alt="K6CM-CIM" /> (Comprehensive current diagnosis type) [Degradation level]</td>
</tr>
</tbody>
</table>

Please select the optimal model for the type of failure mode you want to detect.
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I. Pump system application

K6CM Target Application

Washing pumps for automotive components

Facility details

Pump for washing.
Motor-driven pump sends washing water to the washing tank.

Motor operation conditions

11kw/200V/4poles
Inverter drive frequency: 60Hz

Failure mode

Load abnormality (Cavitation)

Detection parameters

Degradation level

Degradation level measurement results obtained from K6CM-CIM

The current waveform data *

![Current Waveform](image)

Normal Condition

Measurement value under normal operation: **20**

Abnormal Condition

Measurement value under abnormal operation: **75**

Abnormal operation: Air bubble has entered the pump, causing an air lock

Alarm threshold degradation levels for this application (examples)

<table>
<thead>
<tr>
<th>Alarm threshold (Warning)</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm threshold (Critical)</td>
<td>50</td>
</tr>
</tbody>
</table>

Expected implementation effects

Detects air locks in pumps and other abnormal conditions so that the system can be maintained before degradation causes it to shut down.
I. Pump system application

K6CM Target Application

Cooling water circulation pumps

Facility details

Pump for circulating water throughout the facility.

Motor operation conditions

110kW/380V/4poles
Inverter drive frequency: 52Hz

Failure mode

Bearing anomalies

Detection parameters

Acceleration

Acceleration measurement results obtained from K6CM-VBM

Measurement value under abnormal operation:

1.5 G or more

Bearing not sufficiently lubricated

Measurement value under normal operation:

around 0.6 G

Alarm threshold acceleration for this application (examples)

<table>
<thead>
<tr>
<th>Alarm threshold (Warning)</th>
<th>0.99G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm threshold (Critical)</td>
<td>4.08G</td>
</tr>
</tbody>
</table>

Expected implementation effects

Detects when bearing grease has degraded or dried up, or when foreign matter has entered the system.
I. Pump system application

K6CM Target Application

Hydraulic pumps

Facility details
Motors for hydraulic pumps in hydraulic facilities

Motor operation conditions
37kW/200V/6poles
Direct connection to commercial power supply: 60Hz
* Measured at fixed hydraulic pressure

Failure mode
Deterioration over time

Detection parameters
Degradation level

Degradation level measurement results obtained from K6CM-CIM

Normal Condition

Measurement value under normal operation: 32
Pump initial installation

Warning Condition

Measurement value under warning operation: 47
Pump installed over 10 years ago

Alarm threshold degradation levels for this application (examples)

<table>
<thead>
<tr>
<th>Alarm threshold (Warning)</th>
<th>45</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm threshold (Critical)</td>
<td>55</td>
</tr>
</tbody>
</table>

Expected implementation effects
Enables the user to assess the right timing for maintenance based on the degree of deterioration instead of elapsed time.
Automatically notifies the user when to perform maintenance.
II. Fan system application

K6CM Target Application

Oven cooler fan motors

Facility details
Cooling fan for metal can drying oven.

Motor operation conditions
18.5kW/200V/4poles
Inverter drive frequency: 30Hz

Failure mode
Deterioration over time

Detection parameters
Acceleration

Acceleration measurement results obtained from K6CM-VBM

Measurement value of motor that has not been maintained for seven years
1.25 G
Abnormal condition value

Threshold for this application (examples)

- Alarm threshold (Warning) 0.13G
- Alarm threshold (Critical) 0.57G

Expected implementation effects
Enables the user to assess the right timing for maintenance based on the degree of deterioration instead of elapsed time.
Automatically notifies the user when to perform maintenance.
II. Fan system application

K6CM Target Application

Ventilation fans in odorous gas treatment facilities

Facility details
Ventilation fans in odorous gas treatment facilities Purifies air before releasing it outside by removing odorous components using activated carbon.

Motor operation conditions
22kW/400V
Driving the motor by direct connection to commercial power supply: 50Hz

Failure mode
Deterioration over time

Detection parameters
Acceleration/Velocity

Acceleration/Velocity measurement results obtained from K6CM-VBM

Example of Acceleration alarm threshold

<table>
<thead>
<tr>
<th>Measurement value under normal operation:</th>
<th>Measurement value under abnormal operation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.15G Normal</td>
<td>1.30G motor making abnormal noise</td>
</tr>
</tbody>
</table>

Example of Velocity alarm threshold

<table>
<thead>
<tr>
<th>Measurement value under normal operation:</th>
<th>Measurement value under abnormal operation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.9mm/s Normal</td>
<td>2.9mm/s motor making abnormal noise</td>
</tr>
</tbody>
</table>

Expected implementation effects
Enables remote detection of motor failure.
Detects degradation of bearings so users can replace them before they lock up.
II. Fan system application

K6CM Target Application

Cooling tower fans

**Facility details**

Cools cooling water sent to production facilities. If temperatures rise during the day, fans are turned on to cool the fins, which in turn cool the cooling water.

**Motor operation conditions**

5.5kW/200V/4poles
Driving the motor by direct connection to commercial power supply: 60Hz

**Failure mode**

Deterioration over time

**Detection parameters**

Degradation level, Acceleration

### Degradation level measurement results obtained from K6CM-CIM

<table>
<thead>
<tr>
<th>Component</th>
<th>Measurement value</th>
<th>Alarm threshold (Warning)</th>
<th>Alarm threshold (Critical)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Condition</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit 1</td>
<td>Measurement value under normal operation 32</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>After maintenance</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Before maintenance</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abnormal Condition</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit 2</td>
<td>Measurement value under abnormal operation 44</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>After maintenance</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Before maintenance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit 1</td>
<td>Measurement value under abnormal operation 71</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>After maintenance</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>Before maintenance</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Expected implementation effects**

Enables the user to assess the right timing for maintenance based on the degree of deterioration instead of elapsed time. Automatically notifies the user when to perform maintenance.

<table>
<thead>
<tr>
<th>Current (A)</th>
<th>Measurement data</th>
<th>Ideal sine wave</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.01</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.02</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.03</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.04</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.05</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.06</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.07</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.08</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

The current waveform data deviates largely from the ideal sine wave.
II. Fan system application

K6CM Target Application

Cooling tower fans

Degradation level measurement results obtained from K6CM-CIM

Alarm threshold degradation levels for this application (examples)

Current (A) Measurement data Ideal sine wave

The current waveform data

Unit 2

Unit 1

Measurement value under normal operation 29

Measurement value under abnormal operation 71

Normal Condition Abnormal Condition

Before maintenance After maintenance

After maintenance

Measurement value under normal operation 32

Measurement value under abnormal operation 44

Regularly replace pulleys, bearings, belts, etc.

Before maintenance

After maintenance

Measurement value under normal operation 0.25G

0.11G

0.44G

0.08G

Alarm threshold acceleration for this application (examples)

Alarm threshold (Warning) 0.32G

Alarm threshold (Critical) 1.35G

Expected implementation effects

Detects degradation of bearings so users can replace them before they lock up.

Note: Bearing anomalies can be detected earlier by vibration than by comprehensive current diagnosis. Load anomalies that cause bearing anomalies, however, are better detected using comprehensive current diagnosis.

Facility details

Motor operation conditions

Failure mode

Deterioration over time

Detection parameters

Degradation level, Acceleration

Expected implementation effects

Enables the user to assess the right timing for maintenance based on the degree of deterioration instead of elapsed time. Automatically notifies the user when to perform maintenance.

Vibration/Temperature monitoring type

Comprehensive current diagnosis type
II. Fan system application

K6CM Target Application
Fan motors for air handling units

Facility details
Air conditioner that sets the temperature and humidity of the air to comfortable levels before sending it inside.

Motor operation conditions
22kW/200V/4poles
Inverter drive frequency: 50Hz

Failure mode
Deterioration over time

Detection parameters
Acceleration

Acceleration measurement results obtained from K6CM-VBM

Measurement value under abnormal operation: 2.84G motor making abnormal noise

Alarm threshold accelerationo for this application (examples)

- **Alarm threshold (Warning)**: 0.37G
- **Alarm threshold (Critical)**: 1.54G

Expected implementation effects
Enables remote detection of motor failure.
Detects degradation of bearings so users can replace them before they lock up.
### K6CM Target Application

#### Conveyor system

**Facility details**
Elevating device powered by a single motor that carries luggage, etc. up and down.

**Motor operation conditions**
5.5kW/200V/4poles
Driving the motor by direct connection to commercial power supply: 50Hz

**Failure mode**
Load abnormality

**Detection parameters**
Degradation level

---

**Degradation level measurement results obtained from K6CM-CIM**

![Graph showing degradation level and current over time]

**Measurement value under critical operation**

- With weight mounted: 29
- Without weight mounted (average value): 12

**Alarm threshold degradation levels for this application (examples)**

<table>
<thead>
<tr>
<th>Alarm threshold (Warning)</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm threshold (Critical)</td>
<td>35</td>
</tr>
</tbody>
</table>

**Expected implementation effects**

Prevents degradation by detecting anomalies that are not evident in electric current values.

Also detects load anomalies, e.g. when weight is too heavy.
IV. Other applications

K6CM Target Application

Well pumps

**Facility details**
Pump for extracting water from a well.

**Motor operation conditions**
7.5kw/200V/4poles
Inverter drive frequency: 25Hz

**Failure mode**
Deterioration over time

**Detection parameters**
Degradation level

**Expected implementation effects**
Enables the user to assess the right timing for maintenance based on the degree of deterioration instead of elapsed time.
Automatically notifies the user when to perform maintenance.

K6CM Target Application

Seamers

**Facility details**
Device for binding lids on cans (e.g. drink cans).

**Motor operation conditions**
2.2kw/200V/4poles
Inverter drive frequency: 15Hz

**Failure mode**
Bearing abnormality

**Detection parameters**
Acceleration

**Expected implementation effects**
Detects bearing damage.
IV. Other applications

K6CM Target Application

Homogenizers

Facility details

Device that mixes and stirs a liquid (such as milk) into a consistent emulsion so it does not separate.

Motor operation conditions

90kW/200V
Driving the motor by direct connection to commercial power supply: 50Hz

Failure mode

Load abnormality (Piston rubber gasket deterioration)

Detection parameters

Degradation level

Expected implementation effects

Enables early detection of facility anomalies to reduce production loss. Improves production quality by detecting facility anomalies.

K6CM Target Application

Dryers (for spray-drying powders)

Facility details

Air is sprayed while the air broom is rotated by a motor to prevent powder from accumulating on the inner wall of the conical drum. Rollers are installed along the inner wall of the conical drum.

Motor operation conditions

1.5kW/200V/4poles
Driving the motor by direct connection to commercial power supply: 50Hz

Failure mode

Load abnormality

Detection parameters

Degradation level

Expected implementation effects

Enables early detection of facility anomalies to reduce production loss. Improves production quality by detecting facility anomalies.
Authorized Distributor:

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- Solid State Relays

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- Programming & Configuration • Runtime

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