

# Grease Steel Dust Meter SDM-72

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## Instruction Manual

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- Keep this instruction manual available for quick reference when needed.
- Read this instruction manual carefully before use.



**NEW COSMOS ELECTRIC CO., LTD.**

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# 1. Introduction

We thank you for purchasing the Portable Grease Steel Dust Meter Model SDM-72 for the measuring of steel dust in the lubricating grease.

The Portable Grease Steel Dust Meter employs a magnetic balance type electromagnet induction method as the measuring principle, and is a useful simplified diagnosis tool for the inspecting the abrasion status of the bearings and gears.

The steel dust can be measured simply by collecting from the waste (expelled) grease sample in a sampling container when fresh grease is applied to the machinery.

This Manual describes the specifications, functions and operating instructions, carefully read and thoroughly understand this manual before operating the Portable Grease Steel Dust Meter SDM-72

## 2. Features

- The employed magnetic balance type electromagnetic induction method is a highly sensitive for the detection of the abrasion in the initial stage.
- Suitable for diagnose of irregularity in the ultra slow speed revolution range where diagnosis by vibration method is difficult.
- Very simple operate.  
Only requiring the sampling container to be filled with the grease sample and inserted for instant measurement.
- Compact portable instrument and useful for field measurement.




## 3. Safe Operation

### Explanation of symbols:

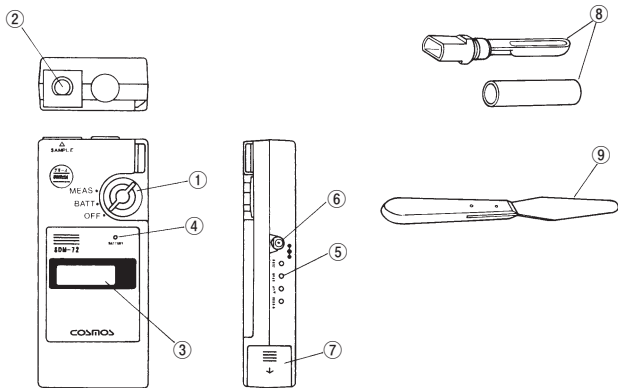
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The following symbols are used for safety purposes:

 <b>DANGER</b>	Indicates a hazardous situation that may result in serious injury or death, if not avoided.
 <b>WARNING</b>	Indicates a potentially hazardous situation that may result in serious injury or death, if not avoided.
 <b>CAUTION</b>	Indicates a potentially hazardous situation that may result in minor injury or physical damage, if not avoided.
<b>NOTE</b>	Indicates an operational advice.

## 4. Product Layout and Functions

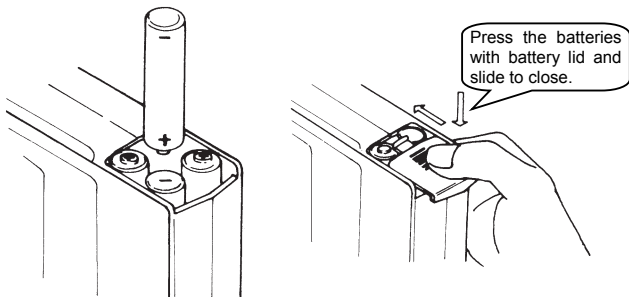


No.	Name	Function
1	Selector switch	Rotates the switch to "MEAS" position to commence measurement.
2	Sampling port	Insert port for grease sample.
3	Display	Indicates a digital reading of the steel dust in the grease sample, and a battery voltage.
4	BATTERY alarm lamp	Indicates the low battery status (below 3.6V) with lighting or blinking.
5	Calibration buttons	Calibration buttons of the indicated value. (The instrument is calibrated at factory prior to shipment. Do not attempt to make any calibrations.)
6	DC jack	The exclusive jack to accept the plug of AC adapter (Japan use only).
7	Battery compartment	Accommodates 4 AA size dry cell batteries.
8	Sampling container	A quantitative sample container to collect 0.8ml of grease sample.
9	Spatula	A tool used for the collection of grease sample.

## 5. Operating Procedure

### 5-1. Installing Batteries

Open the battery lid and insert 4 AA size (LR6) alkaline dry batteries correctly with respect to their polarity (+ and -). Do not mix old and new batteries.



### 5-2. Battery Check

Rotate the selector switch from "OFF" position to "BATT" position. After indicating ---- on LCD for a period of 2 - 3 seconds, the battery voltage will be displayed.

- **Example of battery voltage display**

b 5. 6 Battery voltage is 5.6

- **BATTERY alarm lamp**

If the voltage is higher than 3.6V, it is ready to start measurement.

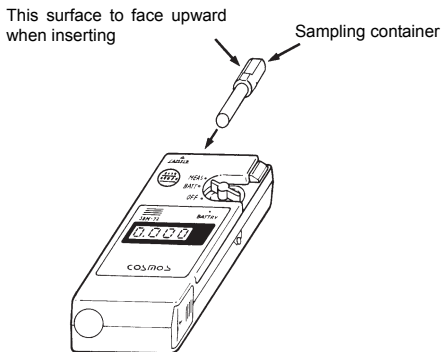
BATTERY alarm lamp will lights up when the voltage is lower than 3.6V. Replace batteries.

When the voltage drops below 3.2V, BATTERY alarm lamp will blink and buzzer sounds. It needs to replace batteries for reliable measurement.

**NOTE** BATTERY alarm lamp lights up when the battery voltage drops below 3.6V while measuring at "MEAS". If it drops below 3.2V, BATTERY alarm lamp blinks and buzzer sounds.

### 5-3. Measurement

- 1) Rotate the selector switch to "MEAS" to shift to measurement mode.
  - 2) Check to see that the display indicates 0, and insert the sampling container containing the sample grease into the sample port. (Refer to 5-4. *Collection of Grease Sample* for sampling procedure of oil sample.)
- \* The sampling container must be inserted with the collected grease facing upward (same direction as the front surface of the instrument.)



- 3) An audible beep will sound for 2-3 seconds after the sampling container has been inserted indicating the measurement has been completed, and the reading is held, read and record the reading.
- 4) When the sampling container with the holder is removed from the sample port, the display will return to zero by the automatic zero adjustment function.
- 5) After the measurement, make sure to return the selector switch to "OFF" position.

**CAUTION**

- When the reading exceeds the upper limit of the numeral display reading (approximately 6.5%Wt), the display will indicate “----”.

**CAUTION**

- It is recommended to insert the sampling container gently. Do not apply an impact when inserting the sampling container. If the insert is too slow, the reading may drift and may not be accurate. In such case pull out the sampling container once and reinsert for the measurement.
- After the sampling container has been inserted for measurement, do not move the instrument until the “BEEP” sound for the completion of the measurement. If the instrument is moved the reading may drift.
- For the measurement, do not hold the portion of the sampling container to be inserted, as the body temperature of the operator may effect the measurement. Hold the ejected portion of the sampling container when handling and for insertion.
- If the collected sample grease is of high temperature, allow it to cool to normal room temperature before measurement.

**CAUTION**

- This instrument employs the electromagnetic induction method as the measuring principle, and should not be operated in the vicinity where a strong electromagnetic wave is generated.

(Example: inverter controlled motor, welding machine, electric spark machine)

It is recommended to conduct measurement in a location not effected by such electrical equipment.

- Do not operate the instrument in a location where walkie-talkie or cellular phone may be used.
- During measurement do not use or place a metal tool (object) near the sample port.

**NOTE**

In case the collected grease sample contains large volume of iron oxide, the reading of the measurement may indicate a slight difference from the SOAP method analyzed value.



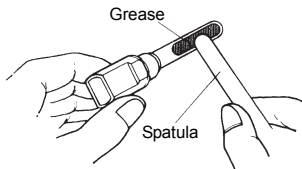
## 5-4. Collection of Grease Sample

For the measurement of steel dust to be conducted with this instrument, the grease sample is to be collected from rotating portion of the machinery. When a fresh supply of grease supplied to bearing, the old discolored waste grease is expelled, collect this waste grease with the spatula and fill sampling container.

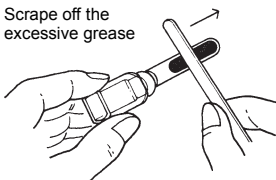
The grease expelled from the bearing is the discolored waste grease expelled from the interior of bearing together with a layer of the freshly supplied grease. Therefore, the collect and use the discolored waste grease for the measuring purpose.

## 5-5. How to Fill the Sampling Container

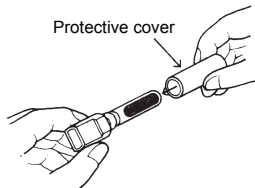
The sample container has a quantitative groove to accommodate the waste grease sample, use the spatula and fill this groove with a sufficient amount of waste grease.



Use the edge of the spatula and scrape off the excessive waste grease to obtain a quantitative volume of 0.8ml.



Then wipe off any excessive waste grease that may adhere to sampling container with tissue or a soft cloth, and cover the collected waste grease sample with the protective cover.



**CAUTION**

- When sampling the grease, make sure not to mix dust, dirt or rust around the bearing.

**NOTE**

- Readings may vary according to the sampling position, as the steel dust in waste grease is not distributed evenly. Measure the value at least 3 to 4 times and take an average or maximum value.
- Refer to Appendix for correlation between the abrasion of the bearing and steel dust concentration in the grease.

## 6. Error Message

This instrument has a function of indicating error messages.

Read along with "8. Troubleshooting" on page 11 to take measures.

Error Message	Cause	Measure
Blinking [ ---- ]	Zero adjustment could not be performed, because the power was turned on while the syringe holder was inserted.	Remove the syringe holder and confirm the indication becomes 0 before using.
	Measurement error. The syringe holder was removed before the measurement is completed.	Remove the syringe holder again and restart measurement.
[ P. OFF ]	The power supply was forced to shut down due to the power supply voltage drops.	Turn the selector switch to "OFF" and then turn to "BATT" or "MEAS" again.
[ Err. E ]	Malfunction. Writing error of non-volatile memory.	Turn the selector switch to "OFF" and then turn to "BATT" or "MEAS" again.  If the indication is still the same, it is in need of repair.
[ Err. r ]	Malfunction. Reading error of non-volatile memory.	
[ Err. S ]	Malfunction. Sum check error of non-volatile memory.	
[ Err. A ]	Malfunction. There is no response from AD converter.	

## 7. Handling and Storage



### CAUTION

- This instrument is not explosion-proof. It must be used in a safe location.
- Remove the batteries and store the instrument if it is not be used for a long time.
- Do not disassemble or modify the instrument or change the structure or electric circuits.
- Do not leave the instrument in high-temperature or highly humid places.
- Keep the instrument away from radical temperature or humidity changes, walkie-talkie, mobile phone, or its performance may be adversely affected.
- Do not drop, hit, or apply a strong mechanical shock to the instrument, or its performance may be adversely affected.
- The instrument is not drip-proof. Keep the instruments away from water.

## 8. Troubleshooting

Before requesting for repairs, please walk through the Troubleshooting below

<b>Problem</b>	<b>Cause</b>	<b>Remedy</b>
No indication appears on the display when the selector switch is set to "BATT" or "MEAS".	<ul style="list-style-type: none"><li>• Battery life.</li><li>• Battery polarity is reversed.</li></ul>	<ul style="list-style-type: none"><li>• Remove the batteries and insert again (page 4).</li><li>• Insert batteries correctly with respect to their polarity (page 4).</li></ul>
The battery alarm lamp is lit or blinking when selector switch is set to "BATT" or "MEAS".	<ul style="list-style-type: none"><li>• Battery life.</li></ul>	<ul style="list-style-type: none"><li>• Replace batteries (page 4).</li></ul>
The reading of the display does not stabilize in the measurement.	<ul style="list-style-type: none"><li>• The temperature of the grease sample is too high to measure.</li><li>• The sampling port becomes warm.</li></ul>	<ul style="list-style-type: none"><li>• Lower the temperature of the grease sample and measure.</li><li>• Hold a finger grip of sampling container and measure again.</li></ul>

## 9. Warranty

New Cosmos Electric Company Limited (New Cosmos) offers the following as the sole and exclusive limited warranty available to the customer.

This warranty is in lieu of, and customer waives, all other warranties of any kind or nature, expressed or implied, including without limitation, any warranty for merchantability or fitness for a particular purpose. The remedies set forth herein are exclusive.

New Cosmos warrants to the original purchaser and no other person or entity (the customer) that the gas detection product supplied by New Cosmos shall be free from defects in materials and workmanship for a period of one (1) year from the date of purchase. This warranty does not include consumables, such as fuses, filters, etc. Certain other accessories not specifically listed here may have different warranty periods.

After examination of an allegedly defective product returned to New Cosmos, with freight prepaid, should the product fail to conform to this warranty, the customer's only remedy and New Cosmos's only obligation shall be, at New Cosmos's sole option, replacement or repair of such non-conforming product or refund of the original purchase price of the non-conforming product. In no event will New Cosmos be liable for any other special, incidental or consequential damages or losses of any kind whatsoever, including but not limited to, loss of anticipated profits and any other loss caused by reason of non-operation of the product.

This warranty is valid only if the product is maintained and used in accordance with New Cosmos's instructions and/or recommendations. New Cosmos shall be released from all obligations under this warranty in the event repairs or modifications are made by persons other than its own or authorized service personnel or if the warranty claim results from physical abuse or misuse of the product.

## 10. Specifications

Items	Specifications	Remarks
Model	SDM-72	
Measuring Principle	Magnetic balance type electromagnetic induction method.	
Applicable to	Concentration of iron particles in waste grease	
Measurement Range	0 - 5.000 %Wt	%Wt = weight ratio%
Indicator	4 digit liquid crystal display	
Minimum Solution	0.001 %Wt	
Accuracy	$\pm(10\% \text{rdg} + 10 \text{ dgts})$ The analyzed value of standard grease by atomic absorption method	%rdg = measured value%
Zero adjustment	Automatic adjustment	
Sample volume	0.8 ml	
Power Source	4 AA size dry batteries	
Battery Life	Approx. 30 consecutive hours	With alkaline batteries
Operating Temperature	0 to 40 degrees C	
Dimensions	84 ( W ) x 40 ( D ) x 190 ( H ) mm	
Weight	Approx. 500g including batteries	
Standard Accessories	Spatula for collecting grease sample Sampling container SMC-01-G AA size dry batteries Carrying case Operation Manual	1 pc 1 box 4 pcs 1 pc 1 pc (10 pcs/box)
Consumables	Sampling container (10pcs/box) SMC-01-G	
Approval	CE (EMC Directive 2004/108/EC)	

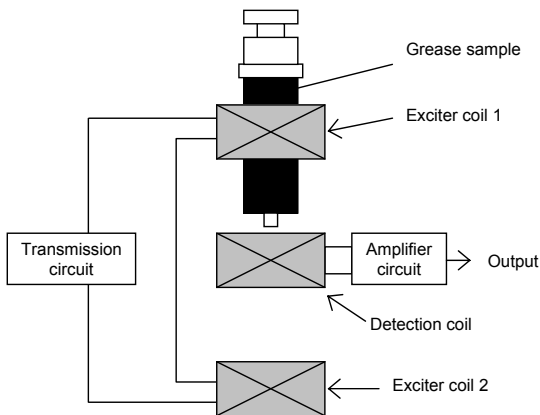
# Appendix

## Reference Materials

### 1. Measuring Principle

The measuring principle of the magnetic balance electromagnetic induction method is shown in the illustration below, the magnetic circuit sensor is composed of an exciter coil connected to the both sides of the detection coil, the magnetic field generated by both exciter coils are blanketed in the vicinity of the center detection coil.

Normally, the center detection coil does not generate an induction voltage, on the other hand when the sampled oil containing iron particles is inserted into the exciter coil, the magnetic field is offset by the magnetic permeability variation, and an induction voltage is generated in the detection coil. The induction voltage can measure the concentration of the iron particles in the sampled oil.





## 2. Metal Materials Measurable

**Table 1 of Metal Materials that can be Measured**

(OK: Measurable, NA: Not measurable)

Metal and Materials	Magnetism	Measurable	Remarks
Iron, nickel, cobalt	Ferromagnetism	OK	
Aluminum, chrome, manganese, titan, stainless steel (SUS-304, SUS-316)	Para magnetism	NA	
Copper, silver, lead, zinc, tin	Diamagnetic	NA	
Sodium, calcium, lithium, molybdenum	Para magnetism	NA	Raw material of thickener for grease
Iron oxide ( $\alpha$ -Fe <sub>2</sub> O <sub>3</sub> ) Ferruginous (Hydroxide iron)	Para magnetism	NA	*1
Iron oxide ( $\gamma$ -Fe <sub>2</sub> O <sub>3</sub> , Fe <sub>3</sub> O <sub>4</sub> )	Ferromagnetism	OK	
Sodium, calcium, lithium, molybdenum	Para magnetism	NA	*2

\*1: Iron oxide has several isomers, as can be noted from the table above there are substance that can be measured with the Oil Steel Dust Checker and substance that can not be measured. Specially in case the environment allows the oxidation of iron particles easily and where the collected sample contains red rust the measurement conduct may indicate a reading lower than the actual concentration.

\*2: When the grease contains a filler agent, the Grease Steel Dust Meter does not have any sensitivity against such substance, and does not affect the measured reading.

### 3. Practical Use

#### 1) Management and Simplified Diagnosis of Oil Lubricated Bearings & Gears

- To be used to diagnose the steel dust contents in the oil used for lubrication of low speed rotation to high speed rotation machinery. Most useful for the diagnosis of the abrasion of the bearing and gears used at low speed rotation and difficult to diagnose with the vibration method, and to improve the accuracy of diagnosis when jointly used with the vibration method for medium and high speed rotation machinery.
- Preliminary diagnosis for SOAP method, ferrography method, etc. Useful tool for preliminary diagnosis as a cost saving for maintenance.
- Example of various use



Pumps & Motors



Agitators



Fan-blower·Compressor



Cooling tower·Air fin cooler



Mixer·Kneader



Rotary drier



Paper-marking machinery



Mill·Crusher·Refiner



Metal rolling machinery



Conveyor



Crane·Hoist·Lift



Civil engineering machinery



Rolling stock·  
Transportation



Elevator



Escalator·  
Moving sidewalk



Parking tower

- 2) Correlation between the Abrasion of the Bearing and Steel Dust Concentration in the Grease.

Table 2 shows the inspection results of correlation between the abrasion of the bearing and steel dust concentration by disassembling and inspecting the bearing of various rotating machinery such as motors, pumps and blowers.

**Table 2 Correlation between the Abrasion of the Bearing and Steel Dust concentration in the Grease**

Fe concentration %Wt	Number of bearing and status of abrasion
0.3 – 1.0	◆◆◆
0.1 – 0.3	●●▲▲▲▲
0.05 – 0.1	●●●●●
0.03 – 0.05	○○
0.01 – 0.03	○○○○○○○○○○
0 – 0.01	○○○○○○○○○○○○
Table number of bearings 36 pieces	
◆ = Large damage (continuous flaking of inner and outer rings)	
▲ = Medium damage (partial flaking of inner and outer rings)	
● = Slight damage (slight flaking, discolored abrasion of inner and outer rings)	
○ = No abnormality	

- 3) Criterion

The following table is an example of the criterion.

This criterion is relatively strict in order to carry out appropriate corrective lubrication improvements, to detect the abnormal trend at an early stage.

**Table 3 Criterion of the Steel Dust Concentration in the Grease**

	Criterion	Countermeasure
Normal value	Smaller than 0.05%	Management of steel dust contents in the grease at normal cycle
Precaution value	0.05 – 0.1%	Repeat grease lubrication and remeasure the steel dust concentration 1 month later.
Irregular value	Greater than 0.1%	Countermeasure for improvement of lubrication, precision diagnosis at short cycle management.

#### 4) Cycle of Measurement

The cycle of measurement of the grease steel dust concentration is related to collection of extracted grease at the cycle of lubrication of fresh grease to the rotating machinery.

The cycle of grease application would differ with the kind and the specifications of the rotating machinery used, and must be determined with the condition of operation, the table below show an example of the cycle of measurement.

**Table 4 Cycle of Measurement of the Steel Dust**

<b>Kind of Rotary Machinery</b>	<b>Cycle of Measurement</b>
Low speed rotary machinery at normal temperature	3 – 6 months
Medium and high speed rotary machinery at normal temperature	3 – 6 months
Low speed rotary machinery at high temperature	1 – 4 months

#### **Concentration in the Grease**

When an abnormal trend of the measured steel dust concentration in the grease is detected, the cycle of measurement shorten depending on the degree of abnormality. Also, improving the cycle of grease lubrication may reduce progress of abrasion; as a result the countermeasure would lead to the extension of the machinery life span.

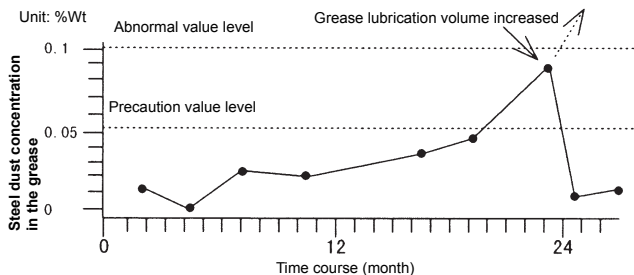
## 5) Simplified Diagnose of the Management Trend and Abrasion of the Bearing

The simplified diagnose of the steel dust concentration in the grease would provide abrasion status of the bearing, the criterion can be made with a single measurement data, also important for the management trend by conducting periodical measurement.

Generally, the steel dust concentration in the grease of the bearing is a low development, but with the progress of abrasion the steel dust concentration shows a conspicuous increase.

The management trend is possible by obtaining the increase trend of steel dust concentration in the early stage of abrasion, by conducting an appropriate lubrication countermeasure at the early stage of abrasion, for the life extension of the bearing.

The graph below shows the management trend of the steel dust concentration at the stage of insufficient lubrication of the bearing used in an agitator.







## Manual Revision History

<b>Edition No.</b>	<b>Date</b>	<b>Revision</b>
SDM-72 CEET	June 2008	00
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### **Manufacturer:**

New Cosmos Electric Co., Ltd.  
2-5-4 Mitsuya-naka,  
Yodogawa-ku,  
Osaka 532-0036, Japan  
TEL: +81-6-6309-1505  
FAX: +81-6-6308-8129  
<http://www.new-cosmos.co.jp/en/index.html>