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Equipment Reliability Measures & Initiatives towards predictive maintenance

NIPPON PAPER INDUSTRIES CO.,LTD.

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About Us

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Nippon Paper Industries Co., Ltd

- Headquarters : Ochanomizu Tokyo
- Established : 1st Auguest, 1949
- Number of Employees : approximately 5,000 (consolidated approximately 15,900)
- Paid-in Capital : 104.8 billion yen
- Domestic Mills : 18 mills

1.Maintenance & Engineering Organizational Chart

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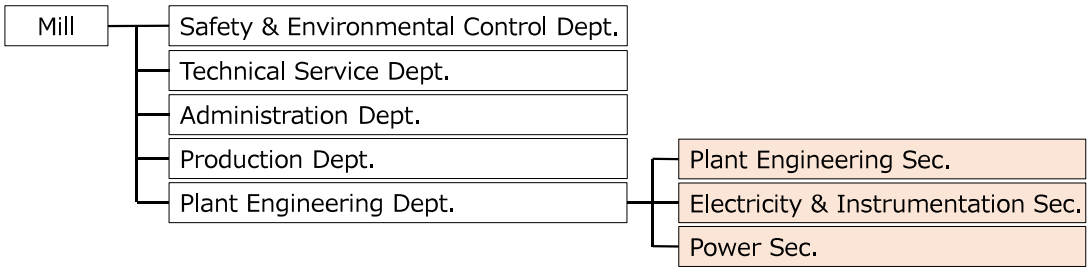
・Organizational Chart



- **Maintenance Personnel :** 20-100 persons/mill (depends on mill size)
- **Work system :** Day shift

2.Maintenance Budget

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・Decision-Making Process for Maintenance Budget

Zero based budgeting : Mill
estimate first draft budgets for each equipment
(5 year forecast)

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Interview : Headquarters, Mill and Sales dep.

↓

Final budgets proposal : Headquarters

↓

Budgets approval : President

3.Maintenance Work

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・**Setting of equipment to be maintained for each department and setting of equipment management responsibilities among departments**

To ensure smooth and seamless maintenance of the same equipment by multiple departments

・**Setting of facility (equipment) importance level**

・**Setting of maintenance methods (preventive maintenance and breakdown maintenance) and inspection methods**

3.Maintenance Work

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・**Establishing Maintenance Objectives and Policies**

↓

・**Formulating and Implementation of Maintenance Plans**

↓ Inspection & Diagnosis、Repair & Maintenance、Lubrication Management、Cleaning & Painting、Modification & Improvement

・**Maintenance records(Maintenance management system) Data analysis, Root cause analysis**

↓

・**Evaluation of maintenance results**

3.Maintenance Work

・Setting Maintenance Method

Breakdown Maintenance（BM）

Preventive Maintenance（PM）

Time Based Maintenance(TBM)

Equipment with S-rank importance and legal requirements for maintenance and inspection periods.

Condition Based Maintenance(CBM)

Equipment with real-time abnormality detection during operation for early identification

・Setting Equipment Importance

Setting equipment importance based on impact levels for safety, environment, quality, and production (S~C ranking)

4. Measures to Ensure Equipment Reliability

・MP（Maintenance Prevention）Design

Based on the results of past maintenance efforts, it is recommended to design, select, and install reliable and highly maintainable equipment

・Daily Maintenance Work

Thorough inspection & diagnosis, maintenance, lubrication management, cleaning & painting, aging renewal, remodeling & improvement

・Securing Sufficient Shutdown Period for Maintenance

5.Maintenance System Tools

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- **Vibration Monitoring System （e-MusenJunkai, etc.）**

- **Maintenance Management System （MNotes, etc.）**
  Maintenance history, work daily reports, work plan
  The power sec. has adopted PLM(Plant Log Meister)system

- **Predictive Failure Detection System**
  Several systems are under verification in the power sec.

- **Major Failure Information Data Base & Search System**

6.e-MusenJunkai

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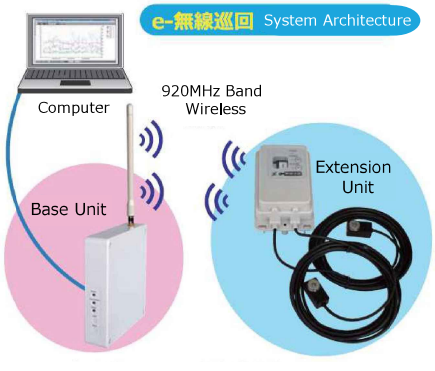
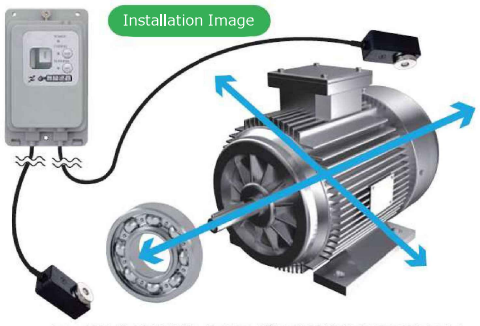
Compressors, separators, air conditioning equipment, washers, hydraulic pumps, etc,
It is easy to install on rotating machines and electric motors and to add more sub-units as needed

"Visualization" of equipment for an easy and inexpensive start

IoT wireless device constant monitoring of "temperature" and "vibration acceleration" of mill equipment





・Installed in motor drives and bearings to sense actual vibration
・Installation is possible anywhere

6.e-MusenJunkai

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Preventive Maintenance is crucial for reducing losses due to equipment failures

	Comparison of Maintenance Method	
	Time Based Maintenance	Condition Based Maintenance
Pros	Easy to plan	Reduced over-maintenance Easy to prevent breakdowns
Cons	Prone to over-maintenance	Diagnostic effort & skill required

Difficult to apply CBM due to time consuming and high cost

6.e-MusenJunkai

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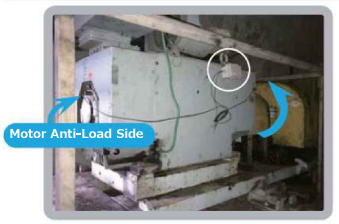
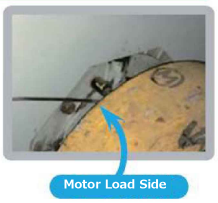
Case Study Nippon Paper Industries, Shiraoi Mill, Large motor (250kw) bearing failure

Overall view of large motor





Bearing detail

Trend graph of temperature and vibration acceleration

By installing e-MusenJunkai, the replacement could be carried out with a planned shutdown

6.e-MusenJunkai

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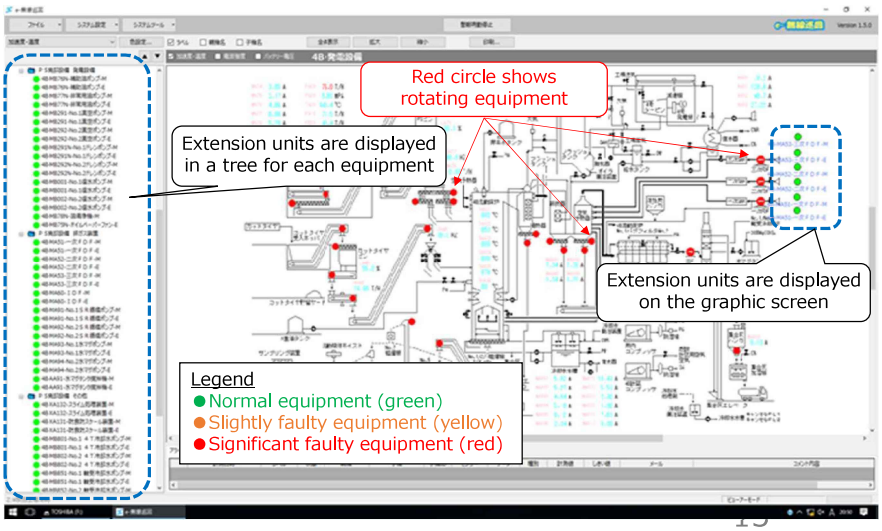

・Improved visibility with tree and map display
・DCS tag numbers are also displayed on the equipment → Easy for operators to identify

7.Maintenance Management System

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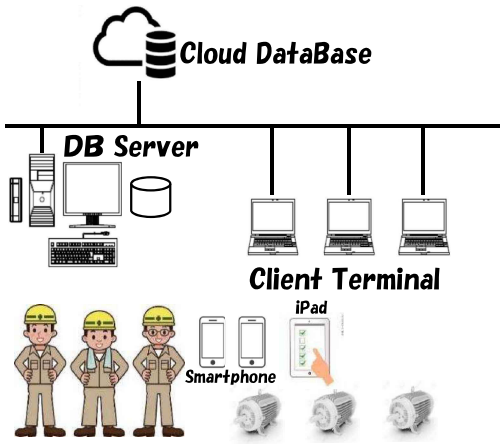
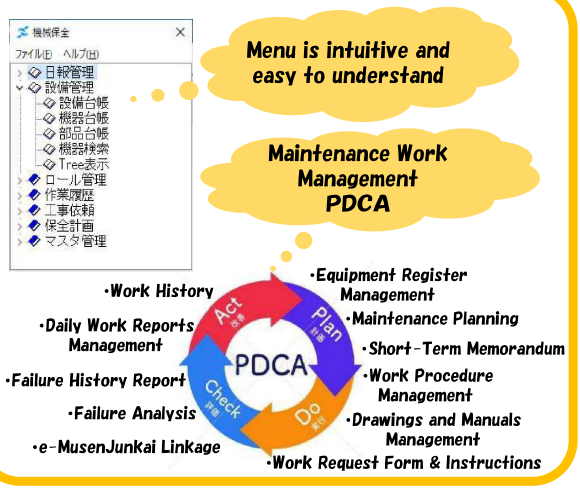
Maintenance information management starting with daily work reports

System Architecture Example

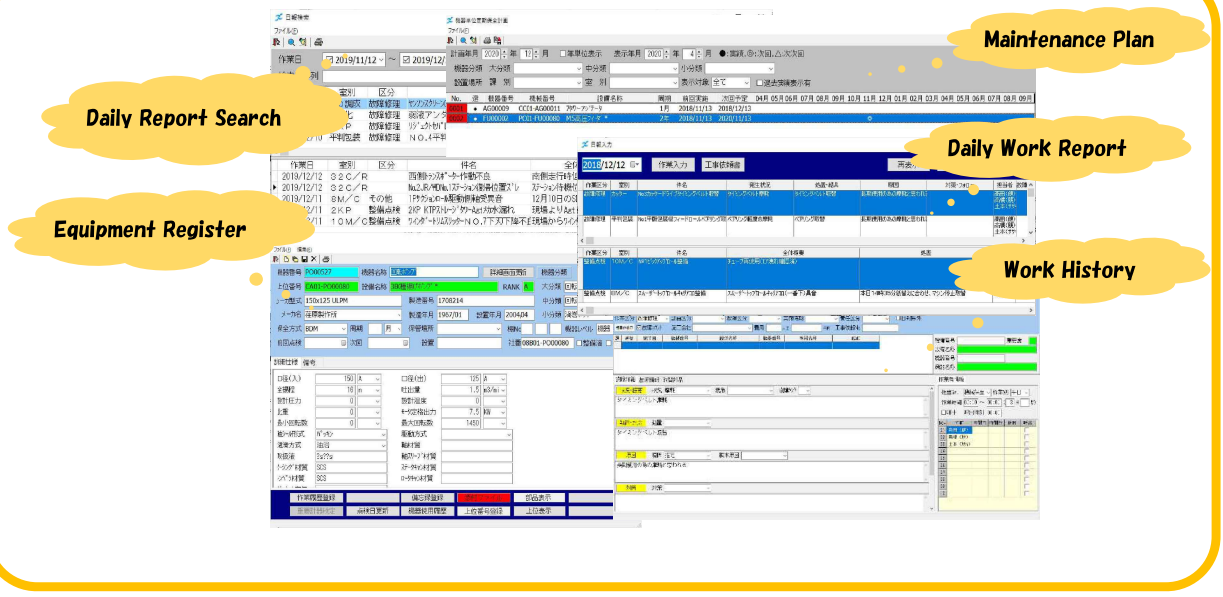


Menu & Functions



7.Maintenance Management System

Operation Screen Example



8.PLM System

Background of System Introduction in the Power Sec.

・Decrease in experienced employees due to retirement and increase in percentage of young staff

・Paper-based information sharing makes intergenerational skill transfer difficult

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・Equipment reliability is declining due to an increase in similar failures and lack of technical and knowledge skills

・The shortage of personnel is a major concern due to the future decline in the working population

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Supporting the reliable operation of ageing facilities with maintenance workers is limited.

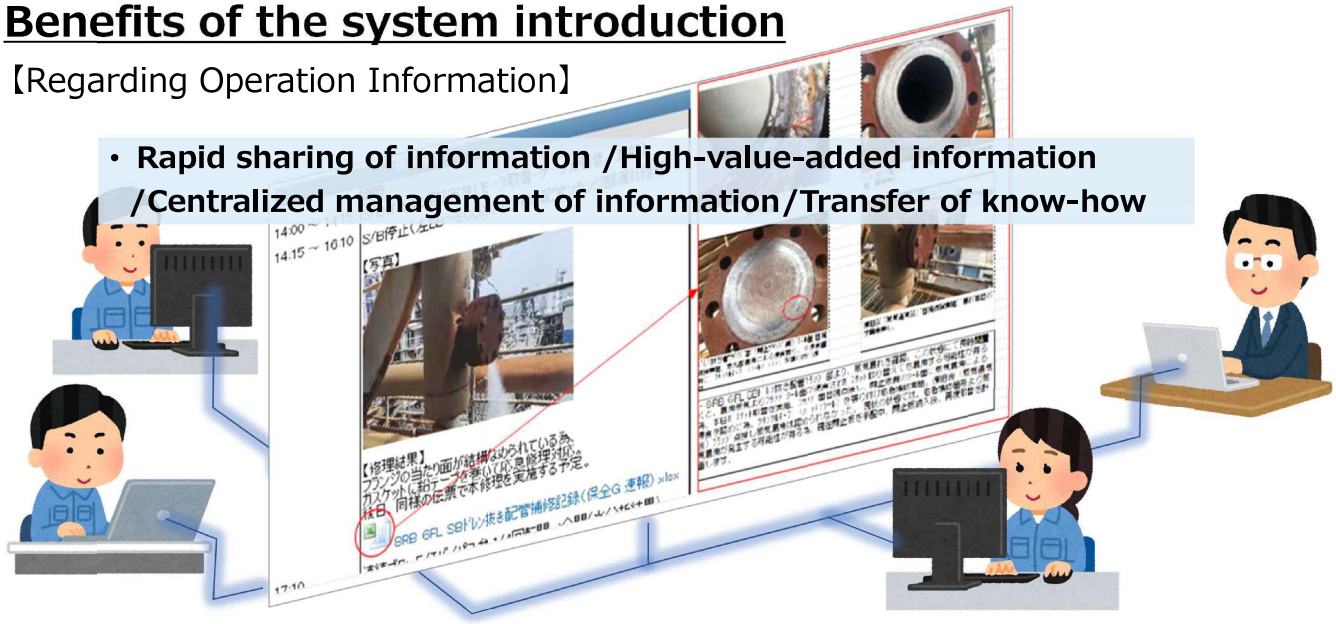
↳ **Installation started in 2019, to be completed in all mills by 2026**

8.PLM System

Benefits of the system introduction

【Regarding Operation Information】

・ **Rapid sharing of information /High-value-added information /Centralized management of information/Transfer of know-how**



8.PLM System

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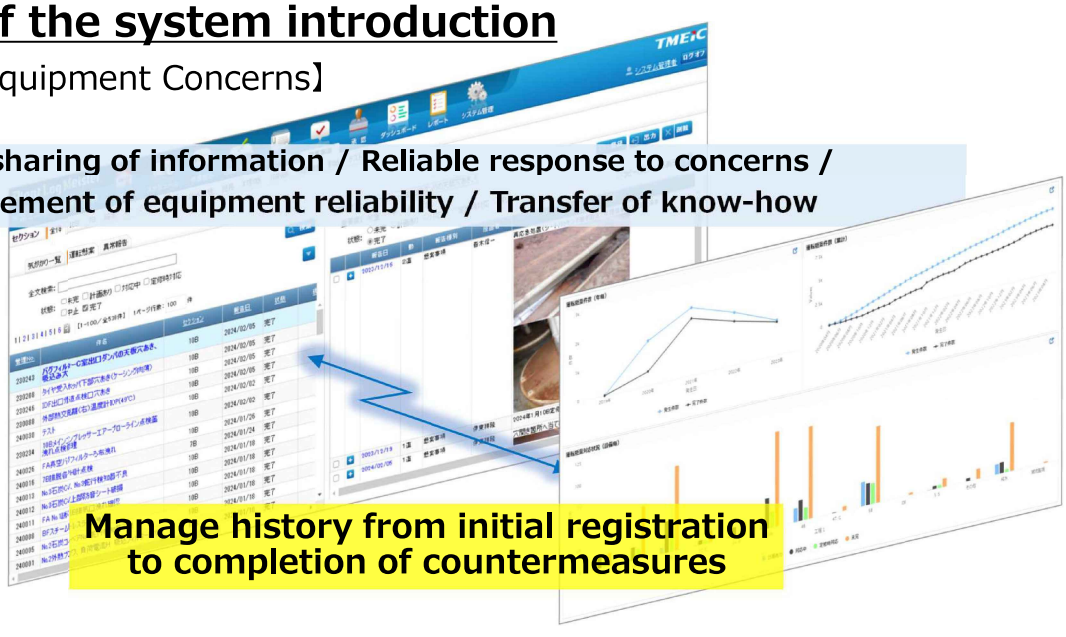
Benefits of the system introduction

【Regarding Equipment Concerns】

・**Rapid sharing of information / Reliable response to concerns / Improvement of equipment reliability / Transfer of know-how**



Thanks for listening