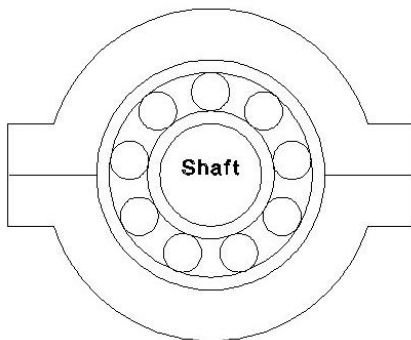


Predictive Maintenance Program

PMP

A Quality Rotating Machinery Predictive Maintenance (PM) Program for your facility will return your investment many times over. This type of PM Program is based on periodic vibration measurements of your Rotating Machinery. In many cases, a Return On Investment (ROI) of less than one year (six months typical) is quite common. A Contract PM Program eliminates the initial capital investment required to conduct your own PM Program.

Rolling Element Bearing



There are three classifications of machinery maintenance methods: Breakdown, Preventative, and Predictive Maintenance. Each method has its own associated costs and benefits.

Breakdown Maintenance, by its own nature, is the most expensive method of plant maintenance. This method has no scheduled maintenance until a machine destroys itself, and it must be replaced at great cost. The machine breakdown often brings the production process to an immediate halt. Breakdown Maintenance has high costs in manpower, replacement parts, and lost production.

Preventative Maintenance, the next logical method, relies on a periodic inspection the machines. During the inspection, machine damage is found and corrected. This method requires a large inventory of replacement parts prior to the machine's inspection. Preventative Maintenance has a lower associated cost because manpower can be planned in advance.

Predictive Maintenance involves monitoring the machine's vibration characteristics or symptoms to diagnose its condition. This method relies on the machine's condition to accurately schedule the repair interval. The machine's condition also determines the required replacement parts. Predictive Maintenance has the lowest cost of the three methods with the highest possible savings.

A Machinery PM Program is beneficial to all industries that have rotating machinery on their site such as:

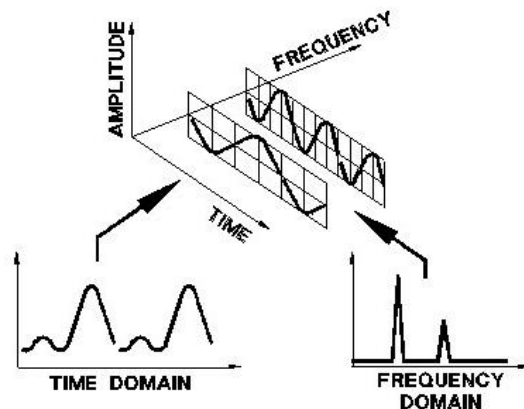
Petroleum	Chemical
Power Generation	Co-Generation
Pulp and Paper	Water Treatment
Building Services	HVAC
Mining	Food Processing

Typical Rotating Machinery commonly included in a Machinery PM Program include but are not limited to the following:

Electric Fans	Motors Pumps
Turbines	Gear Boxes
Paper Machines	Compressors
Blowers	Reciprocating Machines
Chillers	Machine Tools
	Conveyors

PM Program

A Rotating Machinery PM Program involves the scheduled collection of vibration data from the various machines. All rotating machinery vibrates, and this vibration ~~can~~ increase as the equipment wears. The periodically collected vibration data can be analyzed by a trained engineer or technician to determine the cause and the required machinery repair. An initial machine inspection is usually done to determine the machinery parts that are subject to wear.



PM Program Benefits

Quality PM Programs from many industries have shown that Rotating Machinery PM Programs will:

1. Reduce Capital Investment
2. Reduce Machinery Depreciation
3. Reduce Machinery Breakdowns
4. Increase Machinery Life
5. Increase Maintenance Staff Productivity
6. Reduce Dissatisfied/Lost Customers
7. Reduce Penalties
8. Reduce Unnecessary Machinery Repairs
9. Reduce Rework
10. Reduce Scrap
11. Reduce Warranty Claims
12. Reduce Power Consumption
13. Reduce Spare Parts Inventory
14. Reduce Defects on New Machinery
15. Reduce "Wrong" Repairs
16. Reduce Insurance Costs
17. Increase Credibility and Reliability
18. Reduce Overtime
19. Increase Safety and Reduce Penalties
20. Reduce Injuries

PM Program Survey

To see if a PM Program is beneficial to you, STI will survey your facility. STI will then help you complete a "PM Program Justification Form". This no-charge survey will include:

1. Review machinery and layout.
2. List all applicable machinery.
3. Review current and past problems.
4. Determine machinery classifications.
5. Determine the number of data points.
6. Determine time needed to collect data.
7. Determine data collection schedule.
8. Start collection of the information required to complete a Program Justification.

After all the information has been acquired to complete a "PM Program Justification Form", a complete proposal will be sent to you for approval and comment.

PM Program Implementation

A PM Program can be implemented in several ways. One of which will be suitable to your facility, current knowledge, and budget. You may choose to make a capital investment for the hardware, software, and training, or a complete Machinery PM Program may be contracted from STI. A contract PM Program reduces capital investment to zero, and permits the PM Program to start in a timely fashion. When you are ready to acquire the appropriate hardware, software, and training to proceed on your own, the complete PM Program package can be turned over to you.

Once you have determined that a contract PM Program works best for you, an STI vibration engineer or technician will return to your facility. They will do a complete facility survey to identify machinery, locate data collection points, possibly determine bearings, and formulate the data collection route. After this information is acquired, they will complete the following off site using a state of the art PM Program Software Package:

1. Program facility and machinery information into PM Software.
2. Program appropriate bearing and alarm information into software.
3. Establish trending and exception list reporting.
4. Establish Stage 1 to Stage 4 bearing failure criteria for all machinery.

Once the survey information has been properly programmed, the STI vibration engineer or technician will schedule a return trip to your facility to do the following:

1. Collect initial baseline vibration data.
2. Review overall vibration data for immediate action.
3. Provide a written report.

Scheduled PM Program

Once the initial survey and initial baseline information is programmed, the STI vibration engineer or technician will return on a scheduled basis. For a reliable PM Program, the normal schedule is either once or twice a month. During these visits, vibration data will be collected along with a visual inspection. After the visit, you will receive the following:

Before leaving the facility:

1. Exception report showing items requiring immediate attention.

By delivered report:

1. Exception report of items requiring future attention.
2. Report of all machines showing categories Stage 1 to Stage 4 bearing failure.

Advantages to Contract PM Programs

There are several important advantages in contracting your initial Machinery PM Program with STI:

1. Immediate Results

By using a highly trained and experienced STI vibration engineer or technician, immediate results

are usually apparent. After several visits, the credibility and reliability of the program will be proven.

2. No Capital Investment

A quality PM program requires state of the art Data Collectors, Software, Computer Hardware, and Training. No capital investment is required for a contract PM Program.

3. No Training Required

All of STI's engineers and technicians have many years of experience in the field of machinery vibration. Therefore, your maintenance personnel do not require training to initiate a PM Program. If you desire, your maintenance personnel can accompany STI personnel during their surveys and learn how a PM Program works.

PM Program Justification

A. Direct Machinery Costs

1. Labor

a. Regular Labor for Unscheduled Repairs
_____ Hr. x _____ \$/Hr. = \$ _____

b. Overtime Labor for Unscheduled Repairs
_____ Hr. x _____ \$/Hr. = \$ _____

c. Regular Labor for Avoidable Repairs
_____ Hr. x _____ \$/Hr. = \$ _____

d. Overtime Labor for Avoidable Repairs
_____ Hr. x _____ \$/Hr. = \$ _____

Total Labor Costs (1) \$ _____

2. Parts and Materials

1. Good Parts Replaced \$ _____

2. Premium Cost Parts \$ _____

3. Replacement Machinery \$ _____

Total Parts and Materials (2) \$ _____

Total Direct Costs

Labor/Parts and Materials (1 + 2) \$ _____

B. Indirect Costs

1. Lost Production
_____ Hr. x _____ \$/Hr. = \$ _____

2. Outside Repair Services \$ _____

3. Excessive Parts Inventory \$ _____

4. Cost to Maintain Standby
Equipment \$ _____

5. Excessive Insurance Costs \$ _____

6. Out of Specification/Scrap
Material \$ _____

Total Indirect Costs \$ _____

Total Potential Cost Reduction

Direct + Indirect Costs \$ _____

C. STI PM Program Costs

1. PM Program Survey \$ _____

2. Initial Setup and Baseline \$ _____

3. Scheduled Data Collection
_____ Visits/Yr. x _____ \$/Visit = \$ _____

Total PM Program Costs for One Year \$ _____

D. Summary

1. Total Direct and Indirect
Costs (From Above) \$ _____

2. Machinery Maintenance
@ 35% of Total Potential
Reduction (Line 1 x 0.35) \$ _____

3. Savings generated by 50%
Reduction of Machinery
Maintenance (Line 2 x 0.50) \$ _____

4. STI PM Program Costs
(From Above) \$ _____

5. Annual Savings
(Line 3 - Line 4) \$ _____

PAYBACK

6. (Line 4 / Line 3) Years _____