Paper Making Process Diagnostic Services

We help paper makers save millions of dollars every year
ABB Optimization services provide documented savings of 5%–20% and ROI of 10%–1,000%

How is this possible?

Paper making optimization has been the goal of the paper industry for many years. There are many barriers which can reduce production and conversion efficiencies, resulting in lost profits. The optimization process provides an engineered approach that allows ABB to identify these barriers through system and process analysis. Production disturbances and improvement opportunities are identified, and solutions are provided through a customized improvement implementation plan.

Optimization engineers analyze every algorithm, input and output to identify production disturbances, to find improvement opportunities, and to deliver profitability.

Once every detail has been reviewed and evaluated, improvement recommendations are provided, as well as the exact financial return expected from each improvement.

Once improvements have been made and optimization goals have been met, ABB expertise is available to sustain the financial and operational benefits gained through the optimization process.

The optimization process
Three step improvement process.
- Diagnose. Valuable diagnostic report to identify machine reliability problems
- Implement. Hands-on delivery of improvement services to increase reliability
- Sustain. Manage and continue the improvement process through renewable services

Optimization report
The included detailed report, which contains collected system data and analyses as well as system performance improvement recommendations, is a valuable component of the optimization service.

Our guys are so good you won’t want them to leave.
You haven’t seen anything like this before. Turn us loose on your mill.

We call it optimization.

Saving starts with a Fingerprint
An ABB performance diagnostic Fingerprint service is the first step to optimizing paper-making assets – and big savings.

A wide range of Fingerprint services are available to address specific areas of the mill, with new services constantly in development.

Once the Fingerprint has been completed, ABB optimization engineers will present the findings and improvement recommendations. A plan will be scheduled to implement agreed upon improvements and begin the optimization process.

The following Fingerprint services are available today

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<td>Profile Grade</td>
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<td>Transition Profile Recovery</td>
<td>$70,000 – $150,000</td>
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<td>Paper Machine Drives Runnability</td>
<td>not documented</td>
<td>31</td>
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<td>Paper Machine Drives Speed</td>
<td>not documented</td>
<td>33</td>
</tr>
<tr>
<td>Alarm Management</td>
<td>not documented</td>
<td>35</td>
</tr>
</tbody>
</table>

Call us now to start saving money
Contact your Service Account Manager today

You haven’t done anything like this before.
Boiler benchmarking establishes current performance level and a basis for evaluating and identifying improvement opportunities, recommendations for improvement, and associated estimated ROI.

**Benefits**
- Executive report facilitates management decision process by focusing on high impact opportunities for improvement
- Improvement plan provides clear path to quickly close performance gaps
- Provides a solid foundation for continuous improvement based on data analysis methodology

**Features**
- Access to ABB optimization experts
- Boiler Performance Benchmarking
- Detailed ROI-based improvement plan

The ABB Industrial Boiler Fingerprint diagnostic service compares existing controls to industry standards, as well as actual operating data to expected capability. It generates both a performance benchmark and an actionable improvement plan.

The fingerprint includes the collection of data to identify efficiency improvement opportunities, including steps to reduce unplanned outages (trips), and to improve availability.

**Boiler Performance Indicators**
The Industrial Boiler Fingerprint includes comprehensive testing, measurement and analysis of four key performance indicators. The indicators are used to assess performance and improvement potential:
- Instrumentation
- Control System Performance
- Capacity
- Combustion Control and Efficiency

**Boiler Audit and Testing**
The Fingerprint uses a bottom-up approach to performance improvement. Data collected verifies that basic instrumentation is working as needed, for good operation and control. Configured signal conditioning options are also examined and verified.

Closed loop control of fuel and air flow, draft, steam temperature, and drum level are examined under steady load conditions, and during load ramps. Disturbance rejection, setpoint tracking, actuator mechanical issues and loop interaction are evaluated.

Where maximizing steam generation capability is desirable, the constraining condition is identified. Examination of process control system logic ensures that the improvement capacity is not artificially constrained by the process control system.

Combustion control logic is evaluated and existing process control system controls are compared to ABB standards, Figure 1.

Cross limiting is examined for effect on load rate of change. Proper use of scaling in the cross limits is verified. The integration of O2 trim with cross limiting system is checked. Efficiency is accurately evaluated using the losses method.

Typical savings potential: $50,000 – $250,000
Reporting
At the end of the evaluation period, findings are presented to select members or groups of the site. An Executive Report and Technical Report are provided to disclose the findings and recommendations of the boiler diagnosis.

- **Technical Report** provides supporting data collected during the boiler diagnosis, trends and calculations.
- **Executive Report** provides benchmark results, summary of findings, financial impact of recommendations and an actionable improvement plan, based on the boiler diagnostic steps.

**Improvement Plan**
The improvement plan provides recommendations for resolving performance issues, and how to move towards optimal performance.

Recommendations may include actuator maintenance, repair/replace/purchase instrumentation, process control system configuration or tuning changes, physical and capital improvements or changes in standard operating procedures.

The ABB Industrial Boiler Fingerprint is the first step in achieving and sustaining higher boiler performance.

**Delivery Schedule**

<table>
<thead>
<tr>
<th>Day</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>Project kick off meeting, Setup data collection software, Begin collecting standard operating data to analyze instrumentation and control loop performance, Collect historical data</td>
</tr>
<tr>
<td>Day 2</td>
<td>Instrumentation survey, Process inspection and documentation, Data collection under forced steady operation</td>
</tr>
<tr>
<td>Day 3</td>
<td>Data collection during load step changes, Examination of combustion controls</td>
</tr>
<tr>
<td>Day 4</td>
<td>Maximum load test, Efficiency calculation, Exit meeting, initial findings</td>
</tr>
<tr>
<td>Day 5-7</td>
<td>Data Analysis, Write executive and technical reports</td>
</tr>
</tbody>
</table>

**Communication with the plant precedes scheduled activities to ensure coordination with ongoing plant activities. Daily activities list is provided, which includes items completed during the day, a summary of findings, and a plan for the following the day.**

The Boiler Fingerprint is the first step in achieving and sustaining higher performance levels. Annual Fingerprint, Implementation, and Sustaining services are recommended as part of your service contract agreement to achieve and continue the improvement process. These can be schedules within a single- or multi-year service contract agreement.

**Boiler Instrumentation Survey**

- Fuel flow
- Burner Pressure
- Feed water flow
- Drum pressure
- Steam Temperature
- Draft
- \( \text{O}_2 \), CO/Combustibles
- \( \text{SO}_2, \text{NO}_x \), Opacity
- Air flow
- Windbox \( \Delta \text{P} \)
- Drum Level
- Steam flow
- Attemperator flow
- Fan amps
- Exhaust gas temperature

**Additional Options**

- Multiple fuels
- Pulverizers
- Scrubbers
- Sootblowing
- Fuel/Air calibration curves
- Include Plant Master

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The ABB Batch Digester Fingerprint identifies and documents opportunities for process improvements in the batch digester process. Analysis of pulp variability, cook response, chemical loading and steam flow stability are used to establish performance benchmarks. The resulting diagnostic report provides improvement recommendations and associated estimated return on investment.

**Benefits**
- Facilitates management decision process by focusing on high impact opportunities for improvement
- Provides clear path to quickly close the performance gaps by using the proposed improvement plan
- Provides a solid foundation for continuous improvement based on data

**Features**
- Access to ABB optimization experts
- Batch Digester performance benchmarking
- Detailed ROI-based improvement plan
- Clear communications during data collection and of diagnosis activities

The ABB Batch Digester Fingerprint is a process diagnostic service for batch digester optimization. This diagnosis is a platform-independent, non-invasive service that can be applied to an existing batch digester process where improved quality and productivity are desired.

The fingerprint includes executing a series of specialized diagnostic and benchmarking methodologies for the batch digester process to identify barriers that hamper stable and productive digester performance. The analysis generates both a performance benchmark and an improvement plan for enhancing the batch digester process performance and improving profitability.

**Batch digester performance indicators**

- Pulp Variability
- Cook Response
- Chemical Loading
- Steam Flow Stability

**Batch digester analysis**

Each performance indicator is made up of a series of indices derived from repeated testing of individual digesters and species. The resulting index is used to evaluate the performance level of different aspects of the batch digester operation, including but not limited to:
- Kappa Variability and H-factor Biasing
- Temperature, Steam Flow, Pressure and Relief response and repeatability
- Liquor Strength, Liquor Target Management and Charging accuracy
- Steam Quantity and Variability

The performance indicators are defined by specific tests and data analysis associated with the performance indicator (see Figure 2).

The complete fingerprinting process involves performing multiple levels of testing and analysis. The process requires the collection of digester Blow Report data, digester Trend data, main steam flow(s) Trends, setup parameters, kappa values and white/black liquor strength values. On line kappa measurement or extensive kappa lab testing is required. Analysis and recommendations are based on this information.
Once ABB performs the fingerprint, the steps to optimize the process are identified. The implementation plan is developed using the fingerprint information.

**Reporting**

An Executive Report and a Technical Report are provided to disclose the findings and recommendations of the Batch Digester diagnosis.

- **Technical Report** provides supporting data collected during the fingerprinting process.
- **Executive Report** provides benchmark results, summary of findings, financial impact of recommendations, and an actionable improvement plan, based on the batch digester diagnosis.

**Improvement plan**

The improvement plan defines how to resolve the performance related issues and steps to take to improve pulp variability, cook response, chemical loading and steam flow stability.

In addition, the associated financial impact for each recommendation is provided.

Based upon the findings, recommendations may include, but are not limited to, management of H-factor biasing, transmitter recalibration, scheduling modifications, updating operating procedures, and adding control logic.

**Delivery Schedule**

**Preliminary**

- Project introduction meeting
- Setup and verify data collection
- Collect 5 to 10 digester cycles
- Collect hardwood and pine grades

**Analysis**

- Perform detailed data analysis
- Identify kappa variability and digester dependent characteristics (H-factor bias)
- Identify profile repeatability for temperature, steam, pressure and relief
- Verify liquor quality and repeatability
- Identify liquor charging accuracy (liquor/wood and alkali/wood ratios)
- Evaluate impact on steam usage (quantity and variability)
- Complete ROI analysis based on recommendations

The Batch Digester Fingerprint Service is the first step in achieving and sustaining higher performance levels. ABB offers the following services to complete the continuous improvement cycle.

**Other ABB Services**

**Process Performance Implementation Service**

ABB offers this service to implement the improvement plan outlined in the Batch Digester Fingerprint report. An ABB Utilization Engineer, experienced in pulp and paper controls and process improvement, is assigned to lead the improvement activities.

**Process Performance Sustaining Service**

Once identified process improvements are achieved, sustaining services are available to maintain optimal performance. These may include annual/seasonal fingerprints and implementation services, coupled with a plan to monitor performance and provide site personnel with timely recommendations to maintain improved performance levels.

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Loop performance benchmarking establishes current process and control performance levels and provides a basis for evaluating and identifying improvement opportunities. The resulting implementation plan provides improvement recommendations and associated estimated ROI.  

**Typical savings potential: $90,000 – $220,000**

**Benefits**
- Executive report facilitates management decision process by focusing on high impact opportunities for improvement
- Improvement plan provides clear path to quickly close performance gaps
- Provides a solid foundation for continuous improvement based on data analysis methodology

**Features**
- Access to ABB optimization experts
- Process performance benchmarking
- Detailed ROI-oriented improvement plan

The Loop Performance Fingerprint diagnostic service compares existing controls to industry standards, as well as actual operating data to expected capability. It provides a platform independent, noninvasive service that can be applied to any automated process.

**Loop Performance Indicators**

The Loop Performance Fingerprint provides comprehensive data mining techniques that are based on ABB’s proven loop performance indicators, ABB’s standard service methodology, and the experience and training of our people. The results measure performance and provide insight into improvement potential. These include:
- Control Loop and process assessments
- Root cause or interaction analysis
- Controller setup and tuning cluster measures

The Fingerprint uses a bottom-up approach to performance improvement. Data is collected to verify that basic instrumentation is working as needed, for optimized operation and control.

**Process Evaluation**

Each performance index is a function of specifically designed ABB indicators. The resulting indices are used to evaluate performance levels as well as provide the following insights:
- Ensure solutions are applied to process disturbance rather than band aids added to process symptoms
- Distinguish between tuning problems and physical hardware issues such as stuck or broken actuators
- Quantify signal conditioning setup problems as opposed to actual instrumentation short comings

**Implementation Plan**

The improvement plan provides recommendations for resolving identified performance bottlenecks and the steps required to move towards optimal performance. In addition, the associated financial return for each step is provided.

Based upon the findings, recommendations may include valve replacement, correcting the sources cyclic process problems, cleaning up signal conditioning problems, optimizing or adding control logic, recommend tuning techniques, updating standard operating procedures, or re-tuning controls for optimal performance.
Communication between ABB and the plant precedes scheduled daily activities to insure the agenda is clearly communicated and coordinates with ongoing plant activities. A daily activity list produced at the end of each day of the Fingerprint diagnostic, includes items completed during the day, summary of findings, and a plan for the following day.

Reporting
At the end of the evaluation period, findings are presented to select members or groups of the site.

An Executive Report and Technical Report are provided to disclose the findings and recommendations of the process performance diagnosis.

- **Technical Report** provides supporting data collected during the process diagnosis, trends and calculations.
- **Executive Report** provides benchmark results, summary of findings, financial impact of recommendations and an actionable improvement plan, based on the process diagnostic steps.

The Loop Performance Fingerprint is the first step in achieving and sustaining higher performance levels. Annual Fingerprint, implementation, and regular loop performance checks with ABB’s sustaining service, LoopScan, are recommended as part of your service contract agreement to achieve and continue the improvement process. These can be scheduled within a single- or multi-year service contract agreement.

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**Delivery Schedule**

**Day 1**
- Project introduction meeting
- Setup data collection software and hardware
- Begin collecting DCS data for Process Stability analysis
- Define influencing ROI factors

**Day 2**
- Check data and update collection
- Define process areas and loop criticality

**Day 3**
- Complete process data collections
- Conduct operator interviews

**Day 4–5**
- Finalize DCS data collection and extract DCS PID loop tuning parameters
- Prepare initial Summary of Findings and perform exit presentation

**Day 6–8 (off site)**
- Complete final data analysis and generate Executive and Technical reports

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Current process and control performance is benchmarked, to determine stock approach stability improvement opportunities. A comprehensive evaluation report is provided, which outlines recommendations for improvement and associated estimated ROI.

**Typical savings potential:** $45,000 – $160,000

**Benefits**
- Facilitates management decision process by focusing on high impact opportunities for improvement
- Provides clear path to quickly close the performance gaps by using the proposed improvement plan
- Provides a solid foundation for continuous improvement based on data

**Features**
- Access to ABB optimization experts
- Process performance benchmarking
- Detailed ROI-based improvement plan
- Clear communications during data collection and diagnosis activities

**Stock Approach Fingerprint**
The ABB Stock Approach Fingerprint is a platform independent, non-invasive service that can be applied to any paper machine.

The fingerprint generates both a performance benchmark and an improvement plan, consisting of a set of improvement opportunities, which are prioritized based on estimated economic benefits.

The benchmark measures product variability from the high density storage through the stock approach system, to the headbox of the paper machine. This benchmark provides the basis for improvement recommendations.

**Process Performance Indicators**
The Stock Approach Fingerprint involves comprehensive testing and analysis including:
- High Frequency Analysis
- Process Stability
- Control Loop Assessment

These Performance Indicators measure stock approach process performance and improvement area potential (see Figure 1).

**Machine Testing**
Each performance index is made up of a series of indicators derived from specific machine tests. High speed data is collected from the most upstream on-line scanner and several pressure taps are monitored in key pieces of equipment in the stock approach area. The resulting performance indices are used to evaluate the performance level of the stock approach area of the paper making process including:
- Mechanical vibration and rotational frequencies originating in the stock approach
- Frequency content of the sheet
- Mechanical issues such as bad valves and cavitation
- Signal conditioning issues including quantized signals and over filtering
- Process control issues including output oscillation and over control
- Control Loop tuning validity

Identifying that a stock approach process area is under performing is the first step in the improvement process. Understanding the problem and having the expertise to provide solutions is assured through ABB’s extensive experience in coater controls.
Reporting
An Executive Report and a Technical Report are provided to disclose the findings and recommendations of the process performance diagnosis.

- **Technical Report** provides supporting data collected during the machine diagnosis.
- **Executive Report** provides benchmark results, summary of findings, financial impact of recommendations, and an actionable improvement plan, based on the machine diagnosis.

Improvement Plan
The improvement plan defines how to resolve the performance bottleneck and improve performance. In addition, the financial impact for each recommendation is provided.

Based upon the findings, recommendations may include valve replacement, correcting the sources of high frequency machine problems related to: rolls, pumps, screens, machine clothing, cleaning up signal conditioning problems, optimizing or adding control logic, updating standard operating procedures, or re-tuning controls for optimal performance.

The Stock Approach Fingerprint is the first step in achieving and sustaining higher performance levels. Annual Fingerprint, Implementation, and Sustaining services are recommended as part of your service contract agreement to achieve and continue the improvement process. These can be scheduled within a single- or multi-year service contract agreement.

ABB is the world leader in pulp and paper applications. In depth knowledge and experience in this area allows comprehensive evaluation, diagnosis, remedial recommendations and implementation, and the ability to maintain and support process performance improvement.

Delivery Schedule

<table>
<thead>
<tr>
<th>Day</th>
<th>Activity</th>
</tr>
</thead>
</table>
| Day 1 | Project introduction meeting  
Setup data collection software and hardware  
Begin collecting stock approach  
DCS data for Process Stability analysis |
| Day 2 | Complete the scanner single point collection for the High Frequency Analysis test  
Begin setup for pulsation study which requires locating and hooking into pressure taps |
| Day 3 | Complete high speed data collection of pressure tap data |
| Day 4–5 | Finalize DCS data collection and extract DCS PID loop tuning parameters  
Prepare initial Summary of Findings and perform exit presentation |
| Day 6 | Complete final data analysis and generate Executive and Technical reports  
Communication with the mill precedes scheduled activities to ensure coordination with ongoing mill activities |

A daily activity list includes items completed during the day, a summary of findings, and a plan for the following day.

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Paper Machine benchmarking establishes current machine performance and provides a basis for evaluating and identifying improvement opportunities. The resulting diagnostic report provides improvement recommendations and associated estimated ROI.

**Typical savings potential: $150,000 – $350,000**

**Benefits**
- Facilitates management decision process by focusing on high impact opportunities for improvement
- Provides clear path to quickly close the performance gaps by using the proposed improvement plan
- Provides a solid foundation for continuous improvement based on data

**Features**
- Access to ABB optimization experts
- Process performance benchmarking
- Detailed ROI-based improvement plan
- Clear communications during data collection and diagnosis activities

**Paper Machine Fingerprint**
The ABB Paper Machine Fingerprint is ABB's process performance diagnostic service for paper machine optimization. The fingerprint generates both a performance benchmark and an improvement plan, consisting of a set of improvement opportunities, which are prioritized based on estimated economic benefits. It is a platform-independent, non-invasive service that can be applied to any paper machine.

**Process Performance Indicators**
The fingerprint involves comprehensive testing and analysis designed to measure four key performance indicators. These performance Indicators are used to assess machine performance and improvement area potential (see Figure 1).
- Product Variability
- Machine Response
- Stock Approach Stability
- Profile Capability

Historical data is used to validate test results.

**Machine Testing**
Each performance indicator includes a series of indexes derived from specific machine tests. Each test is performed inside product specifications, utilizing ABB's diagnostic tools and methodologies. The resulting index is used to evaluate the performance level of different areas of the paper process including:
- Mechanical vibration and rotational frequencies
- Machine and cross direction controls
- Lab testing procedures
- Sheet break recovery
- Process control system performance
- Coordinated speed control
- Grade change control

Identifying machine area under-performance is the first step in the improvement process. Understanding the problem and having the expertise to provide solutions is assured through ABB's extensive experience in paper machine control.

**Implementation Modules**
In order to provide practical solutions for problems often identified in the paper making process, ABB has developed defined, logical optimization steps for each machine area. The numerical result or index of each test points to the machine area problem and also points to the bottleneck location in the optimization sequence.

Once the entry point has been established for each machine area, the solution to the performance bottleneck and the remaining steps to optimize the process become clear.

The Machine Response indicator is used to determine a performance index for the machine direction controls (see Figure 2). The test entry point is defined by the specific machine tests and data analysis associated with this performance indicator.
The Machine Response indicator includes multi-level testing and analysis applied to Dry Stock, Weight, Moisture, Rush/Drag, and Ash Controls. Similar testing methodologies are involved with each performance indicator.

Complete Machine Area testing sequences require three to five working days to collect the data required for the diagnosis and to compare improvement recommendations.

**Reporting**

An Executive Report and a Technical Report are provided to disclose the findings and recommendations of the process performance diagnosis.

- **Technical Report** provides supporting data collected during the machine diagnosis.
- **Executive Report** provides benchmark results, summary of findings, financial impact of recommendations, and an actionable improvement plan, based on the machine diagnosis.

**Improvement Plan**

The improvement plan defines how to resolve the performance bottleneck and improve performance. In addition, the associated financial impact for each recommendation is provided.

Based upon the findings, recommendations may include valve replacement, isolating high frequency machine problems related to: rolls, pumps, screens, machine clothing, cleaning up signal conditioning problems, optimizing or adding control logic, updating standard operating procedures, or re-tuning controls for optimal performance.

The Paper Machine Fingerprint is the first step in achieving and sustaining higher performance levels. Annual Fingerprint, Implementation, and Sustaining services are recommended as part of your service contract agreement to achieve and continue the improvement process. These can be scheduled within a single- or multi-year service contract agreement.

ABB is the world leader in pulp and paper applications. In depth knowledge and experience in this area allows comprehensive evaluation, diagnosis, remedial recommendations and implementation, and the ability to manage and sustain process performance improvement.
Measurement of variability in the coat weight, sheet moisture, machine response, profile control capability and coater kitchen stability provides a benchmark for overall performance on the OMC. The resulting diagnostic report provides improvement recommendations and associated estimated ROI.

\[
\text{Typical savings potential: $75,000 – $175,000}
\]

**Benefits**
- Facilitates management decision process by focusing on high impact opportunities for improvement
- Provides clear path to quickly close the performance gaps by using the proposed improvement plan
- Provides a solid foundation for continuous improvement based on data

**Features**
- Access to ABB optimization experts
- Process performance benchmarking
- Detailed ROI-based improvement plan
- Clear communications during data collection and diagnosis activities

**Off-Machine Coater Fingerprint**
The ABB Off-Machine Coater (OMC) Fingerprint is ABB’s process diagnostic service for coating application. The Fingerprint generates both a performance benchmark and an improvement plan consisting of a set of improvement opportunities, which are prioritized based on estimated economic benefits. The ABB OMC Fingerprint is a platform-independent, non-invasive service.

**Coating Performance Indicators**
The OMC Fingerprint involves comprehensive testing and analysis designed to measure five key Performance Indicators. These Performance Indicators are used to assess coating performance and identify potential improvement areas (see Figure 1).
- Product Variability
- Machine Response
- Profile Capability
- Coater Kitchen Stability
- Historical Analysis

**Process Testing**
Each performance indicator is made up of a series of indices derived from specific process tests. Each test is performed inside product specifications utilizing ABB’s diagnostic tools and methodologies. The resulting index is used to evaluate the performance level of different areas of the coating process including:
- Mechanical vibration & rotational frequencies
- Process control system performance
- Machine & cross direction controls
- Machine startup & sheet splicing operation

Identifying that a coating process area is under performing is the first step in the improvement process. Understanding the problem and having the expertise to provide solutions is assured through ABB’s extensive experience in coater controls.

**Off-Machine Coater Implementation Modules**
In order to provide practical solutions for problems often identified in the coating process, ABB has developed logical optimization steps for each coating process area. Once the entry point has been established for each process area, the solution to the performance bottleneck and the remaining steps to optimize the process become clear. The Machine Response indicator is used to determine a performance index for the machine direction controls (see Figure 2).

The “test entry point” is defined by the specific machine tests and data analysis associated with this Performance Indicator. The Machine Response indicator includes multi-level testing and analysis.
applied to coat weight and moisture controls. Similar testing methodologies are involved with each Performance Indicator.

Complete Process Area testing sequences require three to five working days to collect the data required for the diagnosis and to complete the improvement recommendations.

Reporting
An Executive Report and a Technical Report are provided to disclose the findings and recommendations of the process performance diagnosis.

- **Technical Report** provides supporting data collected during the machine diagnosis.
- **Executive Report** provides benchmark results, summary of findings, financial impact of recommendations, and an actionable improvement plan, based on the machine diagnosis.

Improvement Plan
The improvement plan defines how to resolve the performance bottleneck and how to move towards optimal performance. In addition, the associated financial impact for each recommendation is provided.

Based upon the findings, recommendations may include isolating high frequency machine problems related to coater applicator rolls, cleaning up signal conditioning problems, optimizing or adding control logic, updating machine startup and roll splice operator procedures, applying MD and CD control presets, or retuning control loops for optimal performance.

The Off-Machine Coater Fingerprint is the first step in achieving and sustaining higher performance levels. Annual Fingerprint, Implementation, and Sustaining services are recommended as part of your service contract agreement to achieve and continue the improvement process. These can be scheduled within a single- or multi-year service contract agreement.

ABB is the world leader in pulp and paper applications. In depth knowledge and experience in this area allows comprehensive evaluation, diagnosis, remedial recommendations and implementation, and the ability to manage and sustain process performance improvement.

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Machine benchmarking establishes current process and control performance levels and provides basis for evaluating and identifying improvement opportunities. The resulting diagnostic report provides improvement recommendations and associated estimated ROI.

**Benefits**
- Facilitates management decision process by focusing on high impact opportunities for improvement
- Provides clear path to quickly close the performance gaps by using the proposed improvement plan
- Provides a solid foundation for continuous improvement based on data

**Features**
- Access to ABB optimization experts
- Process performance benchmarking
- Detailed ROI-based improvement plan
- Clear communications during data collection and diagnosis activities

**Pulp Dryer Fingerprint**
The ABB Pulp Dryer Fingerprint is a process performance diagnostic service for pulp dryer optimization. It is a platform-independent, non-invasive service that can be applied to any pulp dryer. The diagnostic fingerprint includes an engineered troubleshooting methodology to identify barriers to optimized performance and improved profitability. It generates both a performance benchmark and an improvement plan, consisting of a set of improvement opportunities, which are prioritized based on estimated economic benefits.

**Performance Indicators**
The fingerprint involves comprehensive testing and analysis designed to measure four key performance indicators. These performance Indicators are used to assess machine performance and improvement area potential (see Figure 1).
- Product Variability
- Machine Response
- Stock Approach Stability
- Profile Capability

Historical data is used to validate test results.

**Machine Area Testing**
Each performance indicator includes a series of indexes derived from specific machine tests. Each test is performed inside product specifications, utilizing ABB’s diagnostic tools and methodologies. The resulting index is used to evaluate the performance level of different areas of the pulp drying process including:
- Mechanical vibration and rotational frequencies
- Machine and cross direction controls
- Lab testing procedures
- Sheet break recovery
- Process control
- System performance
- Coordinated speed control
- Dryer management control

Identifying machine area under-performance is the first step in the improvement process. Understanding the problem and having the expertise to provide solutions is assured through ABB’s extensive experience in pulp dryer control.

In order to provide practical solutions for problems identified in the pulp drying process, ABB has developed defined, logical optimization steps for each machine area. The numerical result or index of each test points to the machine area problem and also points to the bottleneck location in the optimization sequence.

Once the entry point has been established for each machine area, the solution to the performance bottleneck and the remaining steps to optimize the process become clear.

For example, the Machine Response indicator is used to determine a performance index for the machine direction controls (see Figure 2). The test entry point is defined by the specific machine tests and data analysis associated with this performance indicator.

Typical savings potential: $100,000 – $250,000
The Machine Response indicator includes multi-level testing and analysis applied to Dry Stock, Weight, Moisture, and Rush/Drag. Similar testing methodologies are involved with each performance indicator.

Complete Machine Area testing sequences require three to five working days to collect the data required to complete the diagnosis and develop improvement recommendations.

**Reporting**

An Executive Report and a Technical Report are provided to disclose the findings and recommendations of the process performance diagnosis.

- **Technical Report** provides supporting data collected during the machine diagnosis.
- **Executive Report** provides benchmark results, summary of findings, financial impact of recommendations, and an actionable improvement plan, based on the machine diagnosis.

**Improvement Plan**

The improvement plan defines how to resolve the performance bottleneck and improve performance. In addition, the associated financial impact for each recommendation is provided.

Based upon the findings, recommendations may include valve replacement, isolating high frequency machine problems related to: rolls, pumps, screens, machine clothing, cleaning up signal conditioning problems, optimizing or adding control logic, updating standard operating procedures, or re-tuning controls for optimal performance.

The Pulp Dryer Fingerprint is the first step in achieving and sustaining higher performance levels. Annual Fingerprint, Implementation, and Sustaining services are recommended as part of your service contract agreement to achieve and continue the improvement process. These can be scheduled within a single- or multi-year service contract agreement.

ABB is the world leader in pulp and paper applications. In depth knowledge and experience in this area allows comprehensive evaluation, diagnosis, remedial recommendations and implementation, and the ability to manage and sustain process performance improvement.
Variability measurement in finishing properties, machine response, profile control capability and roll tracking from the supercalender’s feeder machine provides a benchmark for overall calendering performance. The resulting diagnostic report provides improvement recommendations and associated estimated ROI.

**Typical savings potential: $100,000 – $250,000**

**Benefits**
- Facilitates management decision process by focusing on high impact opportunities for improvement
- Provides clear path to quickly close the performance gaps by using the proposed improvement plan
- Provides a solid foundation for continuous improvement based on data

**Features**
- Access to ABB optimization experts
- Process Performance Benchmarking
- Detailed ROI-based improvement plan
- Clear communications during data collection and diagnosis activities

**Supercalender Fingerprint**
The ABB Supercalender Fingerprint is ABB’s process diagnostic service for calendering machines. It is a platform-independent, non-invasive service. The fingerprint generates both a performance benchmark and an improvement plan consisting of a set of improvement opportunities, which are prioritized based on estimated economic benefits.

**Calendering Performance Indicators**
The Supercalender Fingerprint involves comprehensive testing and analysis designed to measure five key performance indicators. These performance indicators are used to assess calendering performance and identify potential improvement areas (see Figure 1).
- Product Variability
- Profile Capability
- Historical Analysis
- Machine Response
- Roll Tracking

**Process Testing**
Each performance indicator is made up of a series of indices derived from specific process tests. Each test is performed inside product specifications utilizing ABB’s diagnostic tools and methodologies. The resulting index is used to evaluate the performance level of different areas of the calendering process including:
- Mechanical vibration & rotational frequencies
- Machine and cross direction controls
- Process control system performance
- Machine startup and shutdown operation

Identifying that a calendering process area is under-performing is the first step in the improvement process. Understanding the problem and having the expertise to provide solutions is assured through ABB’s extensive experience in sheet finishing control.

**Supercalender Implementation Modules**
In order to provide practical solutions for problems often identified in the calendering process, ABB has developed defined, logical optimization steps for each calendering process area. Once the entry point has been established for each process area, the solution to the performance bottleneck and the remaining steps to optimize the process become clear.

The Machine Response indicator is used to determine a performance index for the machine direction controls (see Figure 2). The “test entry point” is defined by the specific machine
tests and data analysis associated with this Performance Indicator. The Machine Response indicator includes multilevel testing and analysis applied to top and bottom gloss controls. Similar testing methodologies are involved with each Performance Indicator. Complete Process Area testing sequences require three to five working days to collect the data required to complete the diagnosis and develop improvement recommendations.

**Reporting**

An Executive Report and a Technical Report are provided to disclose the findings and recommendations of the process performance diagnosis.

- **Technical Report** provides supporting data collected during the machine diagnosis.
- **Executive Report** provides benchmark results, summary of findings, financial impact of recommendations, and an actionable improvement plan, based on the machine diagnosis.

**Improvement Plan**

The improvement plan defines how to resolve the performance bottleneck and how to move towards optimal performance. In addition, the associated financial impact for each recommendation is provided.

Based upon the findings, recommendations may include isolating high frequency machine problems related to calendar rolls, cleaning up signal conditioning problems, optimizing or adding control logic, updating machine startup-shutdown operator procedures, balancing MD and CD control objectives based on available control range, or re-tuning control loops for optimal performance.

The Supercalender Fingerprint is the first step in achieving and sustaining higher performance levels. Annual Fingerprint, Implementation, and Sustaining services are recommended as part of your service contract agreement to achieve and continue the improvement process. These can be scheduled within a single- or multi-year service contract agreement.

ABB is the world leader in pulp and paper applications. In depth knowledge and experience in this area allows comprehensive evaluation, diagnosis, remedial recommendations and implementation, and the ability to manage and sustain process performance improvement.

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**Delivery Schedule**

| Day 1 |
| Project introduction meeting  |
| Setup data collection software  |
| Begin collecting QCS data for the Product Variability, Machine Response, Profile Capability, and Roll Tracking studies  |

| Day 2 |
| Complete the single point collections for the Product Variability test  |
| Perform step testing on Gloss and Caliper for Machine Response test  |
| Collect machine startup trends for startup time evaluation  |

| Day 3 |
| Complete Machine Response testing  |

| Day 4 |
| Collect steady-state profiles  |
| Perform cross direction bumps to complete Profile Capability testing  |

| Day 4-5 |
| Perform initial data analysis for Summary of Findings exit meeting  |

| Day 6-10 (off site) |
| Conduct Exit Meeting  |
| Complete final data analysis, generate executive, technical reports  |

Communication with the mill precedes scheduled activities to ensure coordination with ongoing mill activities. A daily activity list includes items completed during the day, a summary of findings, and a plan for the following day.

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Tissue Machine benchmarking establishes current machine performance and provides a basis for evaluating and identifying improvement opportunities. The resulting diagnostic report provides improvement recommendations and associated estimated ROI.

Typical savings potential: $150,000 – $350,000

Benefits
- Facilitates management decision process by focusing on high impact opportunities for improvement
- Provides clear path to quickly close the performance gaps by using the proposed improvement plan
- Provides a solid foundation for continuous improvement based on data

Features
- Access to ABB optimization experts
- Process performance benchmarking
- Detailed ROI-based improvement plan
- Clear communications during data collection and diagnosis activities

Tissue machine fingerprint
The ABB Tissue Machine Fingerprint is ABB’s process performance diagnostic service for tissue machine optimization. The fingerprint generates both a performance benchmark and an improvement plan, consisting of a set of improvement opportunities, which are prioritized based on estimated economic benefits. It is a platform-independent, non-invasive service that can be applied to any tissue machine.

Process performance indicators
The fingerprint involves comprehensive testing and analysis designed to measure four key performance indicators. These performance Indicators are used to assess machine performance and improvement area potential (see Figure 1).
- Product Variability
- Machine Response
- Stock Approach Stability
- Profile Capability

Historical data is used to validate test results.

Machine testing
Each performance indicator includes a series of indexes derived from specific machine tests. Each test is performed inside product specifications, utilizing ABB’s diagnostic tools and methodologies. The resulting index is used to evaluate the performance level of different areas of the tissue process including:
- Mechanical vibration and rotational frequencies
- Machine and cross direction controls
- Lab testing procedures
- Sheet break recovery
- Process control system performance
- Coordinated speed control
- Grade change control

Identifying machine area under-performance is the first step in the improvement process. Understanding the problem and having the expertise to provide solutions is assured through ABB’s extensive experience in tissue machine control.

Implementation modules
In order to provide practical solutions for problems often identified in the tissue making process, ABB has developed defined, logical optimization steps for each machine area. The numerical result or index of each test points to the machine area problem and also points to the bottleneck location in the optimization sequence.

Once the entry point has been established for each machine area, the solution to the performance bottleneck and the remaining steps to optimize the process become clear.
The Machine Response indicator is used to determine a performance index for the machine direction controls (see Figure 2). The test entry point is defined by the specific machine tests and data analysis associated with this performance indicator.

The Machine Response indicator includes multi-level testing and analysis applied to Dry Stock, Tissue Weight, Moisture (hood temperature and Yankee steam), and Rush/Drag. Similar testing methodologies are involved with each performance indicator.

Complete Machine Area testing sequences require three to five working days to collect the data required for the diagnosis and to compare improvement recommendations.

### Reporting

An Executive Report and a Technical Report are provided to disclose the findings and recommendations of the process performance diagnosis.

- **Technical Report** provides supporting data collected during the machine diagnosis.
- **Executive Report** provides benchmark results, summary of findings, financial impact of recommendations, and an actionable improvement plan, based on the machine diagnosis.

### Improvement plan

The improvement plan defines how to resolve the performance bottleneck and improve performance. In addition, the associated financial impact for each recommendation is provided.

Based upon the findings, recommendations may include valve replacement, isolating high frequency machine problems related to: rolls, pumps, screens, machine clothing, cleaning up signal conditioning problems, optimizing or adding control logic, updating standard operating procedures, or re-tuning controls for optimal performance.

The Tissue Machine Fingerprint is the first step in achieving and sustaining higher performance levels. Annual Fingerprint, Implementation, and Sustaining services are recommended as part of your service contract agreement to achieve and continue the improvement process. These can be scheduled within a single- or multi-year service contract agreement.

ABB is a world leader in pulp and paper applications. In depth knowledge and experience in this area allows comprehensive evaluation, diagnosis, remedial recommendations and implementation, and the ability to manage and sustain process performance improvement.

### Delivery Schedule

**Day 1**
- Project introduction meeting
- Setup data collection software and hardware
- Begin collecting QCS data for the Product Variability and Stock Approach Stability tests

**Day 2**
- Complete the single point collections for the Product Variability test
- Perform step testing on Weight and Moisture (Yankee steam and hood temperature) for the Machine Response test

**Day 3**
- Complete Machine Response testing with Headbox Step tests

**Day 4**
- Collect steady-state profiles
- Perform cross-direction bumps to complete Profile Capability testing

**Day 4-5**
- Perform initial data analysis for Summary of Findings exit meeting
- Conduct Exit Meeting

**Day 6-8 (off site)**
- Complete final data analysis and generate executive and technical reports

Communication with the mill precedes scheduled activities to ensure coordination with ongoing mill activities. A daily activity list includes items completed during the day, a summary of findings, and a plan for the following day.

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Analysis of color measurement variability, dye delivery, color response, and utilization provide a benchmark for overall color performance. The resulting diagnostic report provides improvement recommendations and associated estimated ROI.

**Benefits**
- Facilitates management decision process by focusing on high impact opportunities for improvement
- Provides clear path to quickly close the performance gaps by using the proposed improvement plan
- Provides a solid foundation for continuous improvement based on data

**Features**
- Access to ABB optimization experts
- Process Performance Benchmarking
- Detailed ROI-based improvement plan
- Clear communications during data collection and diagnosis activities

**Color Fingerprint**
The ABB Color Fingerprint is ABB's process diagnostic service for paper machine-color applications. The Fingerprint generates both a performance benchmark and an improvement plan that prioritizes improvement opportunities based on estimated economic benefits. It is a platform-independent, non-invasive service that can be applied to machines with colored or optically brightened paper grades.

**Color Performance Indicators**
The Color Fingerprint uses comprehensive testing and analysis to measure five key Performance Indicators. These assess color performance and improvement-area potential (see Figure 1).
- Color Variability
- Utilization
- Historical Analysis
- Color & OBA Control
- Color Control Configuration
- On-line and off-line color sensors
- Shade Change
- Level 1 Dye Control
- Startup and sheet break recovery

Identifying that a color process area is under-performing is the first step in the improvement process. Understanding the problem and having the expertise to provide solutions is assured through ABB's extensive experience in paper machine color measurement and control.

In order to provide practical solutions for problems often identified in the color process, ABB has developed defined, logical optimization steps for each color process area.

Once engineers have established the entry point for each color process area, the solution to the performance bottleneck and the remaining steps to optimize the process become clear.

The Color Response indicator helps to determine a performance index for the color and OBA controls (see Figure 2). The "test entry point" is defined by the specific machine tests and data analysis associated with this performance indicator.

The Color Response indicator includes multi-level testing and analysis applied to Color, OBA, and Level 1 Dye Controls.

Each Performance Indicator involves similar testing methodologies. Complete Color Process Area testing sequences require three to five working days to collect the data required to com-
complete the diagnosis and develop improvement recommendations (see Delivery Schedule).

**Reporting**
An Executive Report and a Technical Report are provided to disclose findings and recommendations of the process performance diagnosis.
- **Technical Report** provides supporting data collected during the color process diagnosis.
- **Executive Report** provides benchmark results, a summary of findings, a financial impact of recommendations statement, and an actionable improvement plan based on the color process diagnosis.

**Improvement Plan**
The improvement plan defines how to resolve the performance bottleneck and move towards optimal performance. The plan also identifies the associated financial impact for each recommendation.

Based upon the findings, recommendations may include improving dye delivery, isolating color product variability related to process interactions, optimizing or adding control logic, updating operator procedures for shade change, startup, and sheet break recovery, or re-tuning color control loops.

The Color Fingerprint is the first step in achieving and sustaining higher performance levels. Annual Fingerprint, Implementation, and Sustaining services are recommended as part of your service contract agreement to achieve and continue the improvement process. These can be scheduled within a single- or multi-year service contract agreement.

ABB is the world leader in pulp and paper applications. In depth knowledge and experience in this area allows comprehensive evaluation, diagnosis, remedial recommendations and implementation, and the ability to manage and sustain process performance improvement.

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Analysis of transition time, control and moisture response, and setpoint prediction, provides a transition performance benchmark. The resulting diagnostic report provides improvement recommendations and associated ROI.

Typical savings potential: $60,000 – $120,000

Benefits
- Facilitates management decision process by focusing on high impact opportunities for improvement
- Provides clear path to quickly close the performance gaps by using the proposed improvement plan
- Provides a solid foundation for continuous improvement based on transition data

Features
- Access to ABB optimization experts
- Transition Process Performance Benchmarking
- Detailed ROI-based improvement plan
- Clear communications during data collection and diagnosis activities

The Transition MD Grade Change Fingerprint is a process performance diagnostic service for paper-making transition or grade change optimization. It is a platform-independent, non-invasive service that can be applied to machines with frequent grade changes. Most machines that average one to two grade changes a day can benefit from this fingerprint.

The diagnostic fingerprint includes an engineered troubleshooting methodology to identify barriers to optimized performance and improved profitability. It generates both a performance benchmark and an improvement plan, consisting of a set of improvement opportunities, which are prioritized based on estimated economic benefits.

Transition Performance Indicators
The fingerprint involves comprehensive testing and analysis designed to measure five key Performance Indicators.

These Performance Indicators are used to assess transition performance and improvement area potential (see Figure 1).
- Transition Time
- Moisture Response
- Control Response
- Setpoint Prediction
- Historical Analysis

Transition Process Analysis
Each performance indicator is made up of a series of indices derived from 25 to 35 collected historical transition data. The resulting index is used to evaluate the performance level of different areas of the paper transition process including but not limited to:
- Level 1 control response
  - Stock flow, fillers, steam, total head, and speed
- Level 2 control response
  - Weight, moisture, ash, and headbox
- Grade change configuration
- Limiting product specification limits
- Control constraint handling and setup

Identifying that a transition process area is under-performing is the first step in the improvement process. Understanding the problem and having the expertise to provide solutions is assured through ABB’s extensive experience in paper machine transition control.

In order to provide practical solutions for problems often identified in the transition process, ABB has developed defined, logical optimization steps for each transition process area.

Once ABB performs the fingerprint, the steps to optimize the process and remove the performance bottleneck are identified. The improvement plan is developed using this information.
Benchmarking
The initial performance benchmark is defined by the specific machine tests and data analysis associated with the Performance Indicators (see Figure 2).

The Transition Response indicator includes multilevel testing and analysis applied to Transition, Level 1 Controls, and Level 2 Controls Performance Indicator. Complete Transition Process Area testing sequences require 25 to 35 collected transition data to complete the diagnosis and develop improvement recommendations.

Reporting
An Executive Report and a Technical Report are provided to disclose the findings and recommendations of the process performance diagnosis.

− **Technical Report** provides supporting data collected during the transition process diagnosis.

− **Executive Report** provides benchmark results, summary of findings, financial impact of recommendations, and an actionable improvement plan, based on the transition process diagnosis.

Improvement Plan
The improvement plan defines how to resolve the performance bottleneck and how to move towards optimal performance. In addition, the associated financial impact for each recommendation is provided.

Based upon the findings, recommendations may include but are not limited to level 1 PID control, level 2 MD control, optimizing or adding control logic, updating operator procedures for grade change, or re-tuning transition setup.

The Transition MD Grade Change Fingerprint is the first step in achieving and sustaining higher performance levels. Annual Fingerprint, Implementation, and Sustaining services are recommended as part of your service contract agreement to achieve and continue the improvement process. These can be scheduled within a single- or multi-year service contract agreement.

ABB is the world leader in pulp and paper applications. In depth knowledge and experience in this area allows comprehensive evaluation, diagnosis, remedial recommendations and implementation, and the ability to manage and sustain process performance improvement.

Additional ABB Optimization Services:

Shade Transition Fingerprint
Based on the analysis of observed shade changes during the Transition Fingerprint, a Shade Transition Fingerprint may be recommended. This fingerprint requires detailed analysis and quantification of up to one month of shade changes.

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Profile improvements in steady-state operation are identified through analysis of profile responses to tests performed through the profiler. Benchmarks are established for profile-to-actuator alignment and response magnitude variability between and within grade groups. The resulting diagnostic report provides improvement recommendations and associated estimated ROI.

**Benefits**
- Facilitates management decision process by focusing on high-impact opportunities for improvement
- Provides clear path to quickly close the performance gaps by using the proposed improvement plan
- Provides a solid foundation for continuous improvement based on data

**Profile Grade Performance Indicators**
- Profile Capability
- Global Dimensional Variability
- Mapping Variability
- Profile Response Variability

**Features**
- Access to ABB optimization experts
- Profile performance and response benchmarking
- Detailed ROI-based improvement plan
- Clear communications during data collection and of diagnosis activities

The ABB Profile Grade Performance Fingerprint is a process diagnostic service for paper machine profile control optimization. Since profiles are affected by an array of process and system influences, machines that run diverse grade groups and average one to two grade changes every two to three days can benefit from the Profile Grade Performance Fingerprint.

The fingerprint includes executing a series of specialized diagnostic and benchmarking methodologies for profile control to identify accuracy and variability in critical components of profile control.

The diagnosis is a platform-independent, non-invasive service that can be applied to any paper machine.

**Machine Testing**
Each performance indicator is made up of a series of indices derived from repeated testing on select and major grade groups, during production of these groups on different dates. The resulting index is used to evaluate the performance level of different aspects of profile control, including but not limited to:
- Grade dependency
- Mapping linearity versus non-linearity
- Response modeling
- Sheet edge detection and setup

The performance indicators are derived from multiple levels of testing and analysis. The complete fingerprinting process involves testing major grade groups and testing these groups on four to six different production dates to establish stability in critical profile control aspects (see Figure 2).
Identifying variability in the critical aspects of profile control is the first step in the improvement process. Understanding the problem and possessing the expertise to provide solutions is assured through ABB’s extensive experience in paper machine profile control.

Once ABB performs the fingerprint, the steps to optimize the process and profile control are identified to remove performance bottlenecks. The implementation plan is developed using the fingerprint information.

In order to provide practical solutions for problems often identified for profile control, ABB has developed and defined logical optimization steps to manage the critical components of profile control.

**Reporting**
An Executive Report and a Technical Report are provided to disclose the findings and recommendations of the profile state performance diagnosis.

- **Technical Report** includes supporting data collected during the fingerprinting process.
- **Executive Report** includes benchmark results, summary of findings, financial impact of recommendations, and an actionable improvement plan, based on the Profile Grade Performance diagnosis.

**Improvement Plan**
The improvement plan defines how to resolve the performance bottleneck and improve performance. In addition, the associated financial impact for each recommendation is provided. Based upon the findings, recommendations may include, but are not limited to, re-tuning CD control, introducing CD grade tuning, modifying or changing sheet detecting and measuring devices, updating operating procedures, or adding mapping optimization controls.

The Profile Grade Performance Fingerprint is the first step in achieving and sustaining higher performance levels. Annual Fingerprint, Implementation, and Sustaining services are recommended as part of your service contract agreement to achieve and continue the improvement process. These can be scheduled within a single- or multi-year service contract agreement.

ABB is the world leader in pulp and paper applications. In depth knowledge and experience in this area allows comprehensive evaluation, diagnosis, remedial recommendations and implementation, and the ability to manage and sustain process performance improvement.

**Additional ABB Optimization Service**
**Transition Profile Recovery Fingerprint**
Based on analysis of observed steady-state profiler settings during the Profile Grade Performance Fingerprint, a Transition Profile Recovery Fingerprint may be recommended. This Fingerprint requires detailed analysis and quantification of up to 25 to 30 transitions, including grade changes and break and machine startup recoveries.
Profile recovery performance following machine transitions (sheet break, grade change, machine startup) is measured. Analysis of recovery time, profile control response, and steady-state setpoint comparison provides a transition performance benchmark. The resulting diagnostic report provides improvement recommendations and associated estimated ROI.

Benefits
- Facilitates management decision process by focusing on high impact opportunities for improvement
- Provides clear path to quickly close the performance gaps by using the proposed improvement plan
- Provides a solid foundation for continuous improvement based on data

Features
- Access to ABB optimization experts
- Profile transition performance benchmarking
- Detailed ROI-based improvement plan
- Clear communications during data collection and of diagnosis activities

The ABB Transition Profile Recovery is a process diagnostic service for paper machine profile control optimization. This diagnosis is a platform-independent, non-invasive service that can be applied to machines with frequent grade changes or experience profile recovery time longer than twice the natural response time of the profile following a transition event.

The fingerprint includes executing a series of specialized diagnostic and benchmarking methodologies for profile control to identify barriers that hamper profile recovery performance. The analysis generates both a performance benchmark and an improvement plan for enhancing the profile recovery performance and improving profitability.

**Transition Profile Recovery Performance Indicators**
The fingerprint involves comprehensive testing and analysis designed to measure four key performance indicators (see Figure 1). These indicators are used to assess profile recovery performance and identify potential areas for profile control improvement.

- Transition Time
- Steady-State Setpoint Correlation
- Profile Capability
- Profile Control Response

**Profile Transition Recovery Analysis**
Each performance indicator is made up of a series of indices derived from 25 to 35 historically collected transition events, including breaks, grade changes and startups. The resulting index is used to evaluate the performance level of different areas of profile control and the profile transition process, including but not limited to:

- Profile control response
- Profile measurement availability
- Profiling constraint
- Profiler system readiness

The performance indicators are defined by specific tests and data analysis associated with the performance indicator (see Figure 2).

The complete fingerprinting process involves performing multiple levels of testing and analysis. The process requires the collection and observation of 20 to 25 break/startup events and 5 to 10 grade change events, from which recovery diagnosis is performed and improvement recommendations are based upon.

Once ABB performs the fingerprint, the steps to optimize the process and profile recovery time are identified to remove performance bottlenecks. The implementation plan is developed using the fingerprint information.
In order to provide practical solutions for problems often identified for profile recovery following a transition event, ABB has developed and defined logical optimization steps for different types of transition events.

**Reporting**

An Executive Report and a Technical Report are provided to disclose the findings and recommendations of the Transition Profile Recovery diagnosis.

- **Technical Report** provides supporting data collected during the fingerprinting process.
- **Executive Report** provides benchmark results, summary of findings, financial impact of recommendations, and an actionable improvement plan, based on the profile state diagnosis.

**Improvement Plan**

The improvement plan defines the steps needed to resolve the performance bottleneck and improve performance.

Based upon the findings, recommendations may include, but are not limited to, re-tuning CD control, introducing event triggered tuning dependency, introducing setpoint presets, updating operating procedures, or adding control logic.

The Transition Profile Recovery Fingerprint is the first step in achieving and sustaining higher performance levels. To achieve and continue the improvement process, annual diagnostic fingerprint, implementation, and sustaining services are recommended as part of your annual service contract agreement.

ABB is the world leader in pulp and paper applications. In depth knowledge and experience in this area allows comprehensive evaluation, diagnosis, remedial recommendations and implementation, and the ability to manage and sustain process performance improvement.

**Additional ABB Optimization Services**

**Profile Grade Performance Fingerprint**

The Profile Grade Performance Fingerprint complements the Transition Profile Recovery Fingerprint. This fingerprint involves comprehensive testing and analysis designed to measure inter- and intra-variability in control mapping and response modeling of major grade groups.
Drives specialists provide on-site measurement and analysis to reduce sheet breaks, improve machine sequence, and decrease downtime.

**Benefits**
- Improve machine production capacity with minimum investment

**Features**
- Actionable improvement plan
- Executive report facilitates management decision process by focusing on high impact improvement opportunities

The ABB Paper Machine Runnability Fingerprint investigates drive system bottlenecks that limit increased production capacity, solves runnability problems, and identifies improvement opportunities. It provides steps to prevent stripes, wrinkles, and roll formation problems and reduce web breaks.

Available exclusively from ABB, the fingerprint generates both a performance benchmark and an actionable improvement plan. Savings can be measured in improved productivity and more satisfactory machine operation.

**Applications**
This service is applicable to the following machines:
- Paper machine
- Board machine
- Tissue machine
- Pulp dryer
- Off machine coater
- Winder
- Calender
- Rereeler

The fingerprint is modular, applicable to specific machine areas or the entire machine, and concentrates on the following:
- Web tension
- Machine sequence
- Control accuracy
- Static/dynamic load
- Web-break
- Web-threading
- FFT measurements (vibration)

**Auditing and testing**
All auditing and testing measurements are completed using the drive system’s tools. These can be completed in one to three days. Production losses can be minimized when site measurements are completed during scheduled shutdown. In some instances measurements may be required during normal production.

Depending on the machine runnability issues, investigation may concentrate on specific machine areas, such as transformer, incomer section, drive section, cable, motor, application software or drive settings. The powertrain can be investigated from the drive system point of view. In some cases multiple machine areas must be investigated to clarify bottlenecks.

Various drive production set-ups require tuning to maintain the correct control response. This is determined, for example, by wear of production machinery, grade variations or greater than expected set-up changes. A wide variation of grades or greater than expected set-up changes usually necessitate specific fine-tuning of control settings in order to maintain the desired response from the drive controls.

All collected and measured data is analyzed by the ABB Pulp and Paper Drives Optimization Team, which has a great deal of global experience with the evaluation, calculation and identification of solutions to improve productivity, within budget and with minimum investment.

**Vibration analysis**
When production is increased, vibration may become an issue. By measuring powertrain vibrations, ABB can assess any
remedial action required to reduce vibration and unplanned machine shutdowns. For machines with the latest generation of drives, measurements are obtained directly from the drive system without the need to install additional vibration sensors.

**Drive types**
The ABB Paper Machine Runnability Fingerprint can be performed for all ABB drives, for older Strömberg drives, and for related controllers.

<table>
<thead>
<tr>
<th>Drives</th>
<th>Controllers</th>
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<tbody>
<tr>
<td>ACS800</td>
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**In-depth support and expertise**
ABB competencies in the following areas deliver in-depth diagnostic and implementation services for improved drive runnability.
- Extensive competence with drive controls and features
- Experienced process knowledge of paper industry machines
- Educated vibration analysis (FFT)
- Proprietary software and tools

The ABB Pulp and Paper Drives Optimization Team is available to provide assistance and best practice support leading to productivity improvement opportunities, supported by their expert knowledge of the drive system, controls, and process.

**Reporting**
The Fingerprint Report generates both a performance benchmark and an actionable improvement plan. Findings are presented in formal reports. An Executive Report and Technical Report are provided to disclose the findings and recommendations of the machine diagnosis.
- **Technical Report** provides trends, calculations and supporting data collected during the machine diagnosis.
- **Executive Report** provides benchmark results, summary of findings, financial impact of recommendations statement, implementation, and an actionable improvement plan, based on the machine diagnostic findings.

**Improvement Plan**
The improvement plan provides recommendations for resolving runnability issues, and identifies specific actions required to move towards optimal performance. Recommendations may include:
- Drive control changes (e.g. load sharing, settings, tail threading)
- Modification of application software (e.g. speed reference chain, grouping of sections, control modes, ramp times, machine sequence, latest software improvements)
- Hardware changes (construction changes, existing drives, motors, other components)
- Retuning drives due to machine aging (e.g. compensations, timings, regulator functions)

The fingerprint is the first step in achieving and sustaining higher machine productivity.

**Paper Machine Drives Runnability Fingerprint Request for Proposal**
To obtain a quote, the following types of information are required. Additional information may also be requested based upon the drive types and configuration at your site.

**Machine type:**
- Paper machine
- Board machine
- Tissue machine
- Pulp dryer
- Off machine coater
- Winder
- Calender
- Rereeler

**Machine ID:**
(e.g. PM1) ___________

**Machine details:**
- Width ___________
- Paper grades ___________
- Design speed ___________
- Normal production speed ___________
- Start-up year ___________
- Rebuild/modified year ___________

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<thead>
<tr>
<th>Type</th>
<th>Amount</th>
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<td>Drive section*</td>
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<td>Incomer section</td>
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<tr>
<td>Motor</td>
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<td>Controller</td>
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<td>Control panel</td>
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<tr>
<td>Tension control system</td>
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</table>

*Please provide motor list with drive section details

**Explanation of identified problems:**

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

**List of issues to be improved:**

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

**For more information:** [www.abb.com/pulpandpaper](http://www.abb.com/pulpandpaper)

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A comprehensive drive speed analysis, based on a thorough investigation of the drive system configuration, production settings, and equipment base; to identify drive system performance improvement opportunities.

Benefits
- Harness unused machine production potential
- Reach or exceed design speed
- Increase production with minimum investment
- Identify opportunities to improve drive system performance

Features
- Actionable improvement plan
- Executive report facilitates management decision process by focusing on high impact improvement opportunities

The ABB Paper Machine Drives Speed Fingerprint is available exclusively from ABB. It provides a diagnostic service which identifies drive system bottlenecks and improvements required to attain machine target and maximum speed. Benefits can be measured in increased production, reduced sheet breaks and greater energy efficiency.

Applications
The fingerprint diagnostic identifies improvements to help meet the production objectives of the following:
- Paper machine
- Board machine
- Tissue machine
- Pulp dryer
- Off machine coater
- Winder
- Calender
- Rereeler

Analysis
All measurements are completed by trained, local, service engineers, using the drive system’s tools. These can be completed in one to three days. Installation of external measuring devices is not required. Some tests, such as acceleration, are completed during production breaks. Others may require short production breaks in order to prepare measurements taken during production. Production losses can be minimized when site measurements are completed during scheduled shutdown.

While measurements are being taken, incomer sections, excitation units, cables, gear boxes, shafts and tension system are observed. Existing frictions and inertias are measured to clarify correct compensations to ensure smooth operation can be maintained in the new, higher speed range.

All collected and measured data is analyzed by the ABB Pulp and Paper Drives Optimization Team, which has a great deal of global experience with the evaluation, calculation and identification of solutions to reach a higher speed, within budget and with minimum investment.

A thorough analysis will reveal production limiting bottlenecks; each issue will be accompanied by a recommended solution and tailored improvement plan.

Vibration
When speed is accelerated, vibration may become an issue. Mechanical safety and continuous machine production is greatly impacted by vibrations. By measuring powertrain vibrations, ABB can assess any remedial action required to reduce vibration and unplanned machine shutdowns.

For ABB PPS200, PMC200 and PMC800 drive systems, measurements are obtained directly from the drive system without...
the need to install additional vibration sensors. Utilizing fast Fourier transform (FFT), this innovative measurement method is fast, reliable, and cost effective. For continuous monitoring applications, PMC800 drives vibration measurements can be integrated with the PMC800 Datalogger system.

**Drive types**
The ABB Paper Machine Drives Speed Fingerprint is applicable to all ABB drives, from older Strömberg drives, and related controllers, to our latest technology including the following:

<table>
<thead>
<tr>
<th>Drives</th>
<th>Controllers</th>
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<tbody>
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<td>ACS800</td>
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**In-depth support and expertise**
ABB competencies in the following areas deliver in-depth diagnostic and implementation services for improved production speed.
- Experienced process knowledge of paper industry machines
- In-depth understanding of drive system characteristics
- Educated vibration analysis (FFT)
- Quick drives tools

The ABB Pulp and Paper Drives Optimization Team is available to provide assistance and best practice support – discovering speed increase opportunities even for older paper machine drives installations – supported by their expert knowledge of the drive system, controls, and process.

**Reporting**
The Fingerprint Report generates both a performance benchmark and an actionable improvement plan. Benefits can be measured in increased web speed and higher paper machine production capacity.

Findings are presented in formal reports. An Executive Report and Technical Report are provided to disclose the findings and recommendations of the machine diagnosis.
- **Technical Report** provides supporting data collected during the machine diagnosis, trends and calculations.
- **Executive Report** provides benchmark results, summary of findings, financial impact of recommendations statement, and an actionable improvement plan, based on the machine diagnostic steps.

**Improvement plan**
The improvement plan provides recommendations for improving speed, and identifies specific actions required to move towards optimal performance. Actions to reach new target speed may include:
- Modifications of hardware
- Modifications of application software
- Drive control changes
- Retuning of the drives

Other recommendations to improve speed and productivity, utilizing existing hardware, may include software upgrades to match current generation machines, and modifying machine sequence.

The fingerprint is the first step in achieving and sustaining performance improvement.

Fingerprint, Implementation, and Sustaining services are recommended as part of your service contract agreement to achieve and continue the improvement process. These can be scheduled within a single- or multi-year service contract agreement.

**Paper Machine Drives Speed Fingerprint Request for Proposal**
To obtain a quote, the following types of information are required. Additional information may also be requested based upon the drive types and configuration at your site.

**Machine type:**
- Paper machine
- Board machine
- Tissue machine
- Pulp dryer
- Off machine coater
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**Machine ID:**
(e.g. PM1)

**Machine details:**
- Width
- Paper grades
- Design speed
- Normal production speed
- Desired new target speed
- Start-up year
- Rebuild/modified year

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*Please provide motor list with drive section details

**Explanation of identified problems:**

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Typical alarm management issues

- Alarm management policies and procedures are not documented
- Alarm response actions are not clearly defined
- The standing alarms list is too long — difficult to identify important alarms
- Alarms are not effectively prioritized
- Alarm system performance is not monitored or reported
- Nuisance alarms move in and out of alarm states, causing operators to ignore them
- A small number of signals generate a large percentage of all alarms
- Control room environment, layout, sound and HMI are not configured for effective alarm management

Solution

Diagnostic Step
The ABB Alarm Management Fingerprint benchmarks current performance levels and provides a basis for evaluating and identifying improvement opportunities. Fingerprint activities include the following:

- Review documented procedures and current practices
- Conduct structured interviews with key personnel — including operators, supervisors, engineers, and production management — to determine causes and effects of alarms
- Examine the control room environment to determine the impact of layout, use of sound, and human-machine interfaces (HMI)
- Incorporate “the human factor” into the resolution of alarm issues
- Conduct a systematic analysis of alarm data and compare alarm statistics with EEMUA 191 guidelines
- Deliver a prioritized improvement plan

Reporting

ABB provides executive and technical reports of findings and recommendations of the fingerprint.

- The Executive Report highlights current best practices, and summarizes EEMUA 191 benchmark findings, maturity of site alarm handling practices, procedures and culture.
- The Technical Report provides site data and analysis of alarm rates, frequency, priorities, and operator response times, with comparisons to EEMUA 191 guidelines. The report also compares the management of the alarm system relative to best practices.

Improvement plan

The Improvement Plan provides recommendations for corrective actions, prioritized by severity and effort required to achieve solutions.

Frequently, the actual number of alarms per hour is far greater than the EEMUA recommended alarm rate of 6 per hour.

Typically, a small number of devices generate a large percentage of the alarms.

Recommendations typically address:

- Developing and implementing a logical alarm system management strategy
- Performing an alarm rationalization review to define alarm actions, prioritize alarms, and reduce number of alarms
Alarm Management Fingerprint
Define and manage alarm specifications to ensure plant safety and improve operator efficiency

<table>
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<tr>
<th>Benefits</th>
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<tbody>
<tr>
<td>Configuration and implementation standards are defined</td>
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<td>Alarm designs are documented and available for operational and maintenance personnel</td>
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<td>Alarms are given clear purpose and priorities</td>
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<td>Specific importance and hazard levels are assigned to alarms so that immediate attention can be given to high priority alarms</td>
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<td>Appropriate operator response actions are defined</td>
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<td>Management of change procedures</td>
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<td>Procedures are established to control any change to the alarm system</td>
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<td>Proposed changes are thoroughly analyzed</td>
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<td>The consequences of proposed changes are reviewed</td>
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<td>Changes that are approved are documented</td>
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<tr>
<td>Standing and nuisance alarms addressed to reduce alarm rates and improve operator efficiency</td>
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<td>Alarm reports and alarm system trends are generated automatically for plant operators, engineers, and management</td>
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<tr>
<td>A foundation for continuous improvement is established</td>
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<td>Enhanced process safety and reliability</td>
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Service availability
The Alarm Management Fingerprint is available for ABB control systems and for non-ABB systems, when an appropriate log of alarm data is available. Alarm management support and development for new systems is also available.

Service delivery
An on site evaluation is completed in two to three days, followed by off site analysis and reporting.

Annual Fingerprints are recommended to sustain improvements.

North America Customer Service Center
29801 Euclid Avenue
Wickliffe OH 44092 1832, USA
Tel: 1 800 HELP 365 (1 800 435 7365) option 2
Outside USA/Canada: +1 440 585 7804
Fax: +1 440 585 5087
E-mail: NA_service_info@us.abb.com

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Optional Implementation Services
Bundling corrective implementation services with the Fingerprint delivery provides the best value and most efficient path to resolving alarm management issues. Implementation services can be delivered entirely by ABB, in conjunction with site personnel, or under the guidance of an ABB project manager.

Why ABB’s solution is best
With extensive experience in providing alarm management services, ABB understands alarm system performance, alarm statistics, and the management of alarms.

Aspects of your current system design, documentation, configuration, and management are evaluated relative to EEMUA 191 guidelines, resulting in solutions for operator alarm overload, removal of nuisance alarms, and defined and prioritized alarms.