A study of the textile industry shows that there is a significant variation in fuel consumption across mills. The opportunity to save fuel between the worst and the best plant is to the tune of 49%.

**Key reasons for variations**
- Design and operation of steam system
- Operating practices followed in the plants
- Variation in process cycles
- Liquor ratio
- Product type

### Specific Fuel Consumption (kg fuel / kg cloth)

<table>
<thead>
<tr>
<th></th>
<th>Best Plant</th>
<th>Average Plant</th>
<th>Worst Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific Fuel Consumption (kg fuel / kg cloth)</td>
<td>1.1</td>
<td>1.5</td>
<td>2.2</td>
</tr>
</tbody>
</table>

### Avenues to Reducing Fuel and Utility Consumption

- **Trap selection and health**
  - Plants collecting condensate by trap pressure
  - Main line traps leaking steam
  - Bypass valve open in many places due to back pressure

- **Operating practices**
  - Bypasses kept open (25% to 60%) to achieve required temperature
  - Dyeing master’s recipe not followed
  - MLR not maintained

- **Dye Liquor Heat Recovery**

- **Temperature controls**
  - No temperature control in most plants, if installed not working

**By improving S:F**
- 14%

**By improving SSC**
- 35%

**By addressing the steam system**
- 17%

**Proper equipment design, process parameters, controls, operating practices**
- 18%
The dyeing process involves steps which use water, chemicals, dyes and steam to get the desired output. The conventional systems are operator dependent and more often than not the water used in grey wash, chemical wash, dyeing and final wash cycles, is according to the operator’s judgement rather than as recommended by the dye master. Typically, we find utility consumption to be higher by between 30 to 60%. This not only increases the amount of water required for processing, but also has repercussions on batch times, steam consumption and need for rework.

Conventional System Architecture

Higher water usage results in higher steam consumption as more water needs to be heated during the chemical wash and dyeing cycles.

Higher water quantities also result in longer heating cycle times.

Changed / diluted MLR results in additional use of chemicals and dyes, and then also increased ETP loads.

Increased water load increases time taken to fill and drain the machine.
The dyeing process involves steps which use water, chemicals, dyes and steam to get the desired output. The conventional systems are operator dependent and more often than not the water used in grey wash, chemical wash, dyeing and final wash cycles, is according to the operator’s judgement rather than as recommended by the dye master. Typically, we find utility consumption to be higher by between 30 to 60%. This not only increases the amount of water required for processing, but also has repercussions on batch times, steam consumption and need for rework.

### Forbes Marshall System Architecture

- **Forbes Marshall Automated MLR and temperature control package** is a one-step solution designed to optimise water consumption, reduce steam consumption, reduce processing times (thereby improving capacity utilisation) and reduce rejection and rework.

### Forbes Marshall System Architecture

- **Forbes Marshall Mini DCS**
  - Common for multiple machines
  - Individual Forbes Marshall intuitive user interface close to each machine
  - Common Forbes Marshall control system for 3-5 machines on the backend

### System Overview

- **Operator Interface**

<table>
<thead>
<tr>
<th>Step</th>
<th>Desired/Actual time</th>
<th>Desired/Actual temperature</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grey wash</td>
<td>30 / 30 min</td>
<td>- / -</td>
<td>Completed</td>
</tr>
<tr>
<td>Chemical wash</td>
<td>80 / 80 min</td>
<td>110 / 110 deg C</td>
<td>Completed Gradient 1:5</td>
</tr>
<tr>
<td>Wash</td>
<td>30 / 30 min</td>
<td>- / -</td>
<td>Completed</td>
</tr>
<tr>
<td>Dyeing</td>
<td>93 / 34</td>
<td>130 / 85 deg C</td>
<td>Running</td>
</tr>
</tbody>
</table>
Key Features

System
- Completely automated cycle
- Sequencing based on pre-defined recipes and quantity of cloth being dyed
- No manual bypass arrangement on the panels
- Simple and intuitive operator interface for ease of operation
- Operator acknowledgement required on display at critical stages like addition of chemicals or dyes in the side tank, for the system operation to continue
- Precision sensors used leading to reliable system
- Single point service and support

MLR control
- Precise addition of water through Forbes Marshall flow meters
- Class 6 (zero) leakage valves to ensure no loss of liquor during cycle
- Enhanced precision of MLR as liquor outflow is also monitored and used as input for next step water addition

Dyeing
- Liquor temperature based addition for best dyeing results
- Pulsed addition to ensure no colour patches on cloth

Temperature control
- Based on both heat exchanger and dyeing machine outlet temperatures resulting in better gradient control
- Precise control with use of stepless modulating valves for bigger size machines
- Use of PWM based control for smaller size machines instead of simple on/off controls
- Automatic air venting from the heat exchanger - better temperature control and increased life of heat exchanger
- Forbes Marshall ball float traps for condensate evacuation

MLR Control

Flowmeter

Piston Actuated Valve

Control Valves

Compact Module Two Orifice

Float Trap
(Patented)

Air Vent

© All rights reserved. Any reproduction or distribution in part or as a whole without written permission of Forbes Marshall Pvt Ltd, its associate companies or its subsidiaries (“FM Group”) is prohibited.

Information, designs or specifications in this document are subject to change without notice. Responsibility for suitability, selection, installation, use, operation or maintenance of the product(s) rests solely with the purchaser and/or user. The contents of this document are presented for informational purposes only. FM Group disclaims liabilities or losses that may be incurred as a consequence of the use of this information.