

# Sample Paper Machine Operator Curriculum

This curriculum is designed to upgrade basic knowledge of plant operations employees. The five courses selected are not a comprehensive curriculum, but should have the maximum impact based on a short term program for an established work force. They will create a base level of knowledge around:

- Temperature
- Pressure
- Specific gravity
- Density
- Ideal gas laws
- Principles of steam trap operation
- How to prepare and read basic graphs
- Types of instrumentation used for measuring and controlling basic process variables and how they work
- How to read and use piping and instrumentation diagrams.

This core set of skills will prepare operators to approach their work from a basis of knowledge that will allow them to better understand the "why" associated with proper procedures and enhance their ability to identify abnormal situations before they result in downtime, poor yield or an environmental incident. The curriculum consists of approximately 74 hours of training costing \$4.11 per hour of instructional content or a total cost of \$304.00 per employee. The avoidance of a single process abnormality is likely to earn a handsome return on this training investment.

<b>Course #</b>	<b>Course Title</b>	<b>Hours</b>	<b>Unit Price</b>
49	Plant Operator Series-Fundamentals of Physics	16.0	\$55.00
131	Introduction to Steam Traps	2.0	\$12.75
78	Plant Mathematics-Reading & Preparing Simple Graphs	20.0	\$39.75
205	Fundamentals of Process Instrumentation	30.0	\$150.00
203	Reading A P&ID	6.0	\$47.00
<b>Totals:</b>		<b>74</b>	<b>\$304.50</b>
<b>Total Curriculum - Cost/Hour of Instruction:</b>		<b>\$4.11</b>	

The following page provides a description of the content of each course.

---

## **Plant Operator Series – Fundamentals of Basic Physics**

Basic principles of physics with which all new plant operators should be familiar: concepts of weight, form, volume, temperature, pressure, density, specific gravity, condensates, and vapors: conversion of “psi” to “feet of water” and “inches of mercury” and vice versa; absolute, gauge, and atmospheric pressure, and vacuum; effects of temperature and pressure on gas volumes (Ideal Gas Laws); compression and expansion; and the effects of temperature and pressure on liquids, vapors, and condensates.

*Familiarity with multiplication and division of whole numbers and the use of fractions and decimals.*

---

## **Steam Traps – Introduction**

Information on the five types of steam traps in general use: thermostatic, float-thermostatic, impulse, thermodynamic (disc), and inverted bucket. The principle of operation and the critical operational part of each type of trap are discussed.

*A general nontechnical understanding of steam.*

---

## **Plant Mathematics – Reading and Preparing Simple Graphs**

The reading and preparation of simple bar and line graphs.

Bar Graphs: recognition of the parts of a bar graph, identifying bars and reading their value; interpolation of values between scale divisions; selection of the proper bar graph based on content; preparation of simple bar graphs in both vertical and horizontal position, including selection and ordering of data, setup of scales, and drawing the bars; use of interrupted amount scale for clarity; and reading and preparing component bar graphs.

Line Graphs: identification of scales on line graphs; point coordinates and the proper way to write them; determining the value of a missing coordinate given one coordinate and curve; the concept of positive and negative coordinates; reading values from curve families and multi-scale graphs; plotting points with both positive and negative coordinates; recognition that two points do not determine curve shape; requirements for and setup of scales; preparation of smooth curves from raw data; and use of curve families and multi-scale graphs.

---

## **Fundamentals of Process Instrumentation**

An over view of the physics associated with understanding instrumentation and process variables. Direct read instruments, how to read them and how they work. The concept of a simple control loop. The different types of temperature, pressure, level, flow and weight sensors and how they work. The role of a transmitter and how its output and input are related. Types of controllers and control modes. Types of recorders and how they are read. Control valves and other final control elements. Simple, cascade, feedforward and ratio control. The course is divided into three books, Part I - Introduction, Part II - Sensors and Part III - Control Loops and Their Elements. There is a Completion Exercise associated with each book to provide a means of evaluating how the trainee has learned the material.

*Familiarity with multiplication and division of whole numbers and the use of fractions and decimals. Ability to read simple line graphs.*

---

## **Reading A P&ID**

Highlights include parts of a P&ID (body, title block, revisions etc.), using the Master Sheet, equipment symbols, instrument symbols, line designations and identifying process lines, tracing process flow and following instrument control loops

*Understand the basic concepts of process equipment such as pumps, check valves, heat exchangers and control valves.*