INTER-OFFICE CORRESPONDENCE

# BETHLEHEM STEEL

August 23, 1974

FILE REF. 1004-16

FROM M. H. Bayewitz, Engineer, Ironmaking
E. J. Minner, Engineer, Ironmaking

TO J. A. Angstadt, Supervisor, Ironmaking

SUBJECT TESTING OF A NEW DRYER FOR TOP GAS ANALYSIS

## Summary

The ability of the Perma Pure Dryer to continuously dry top gas samples going into gas analyzers was examined. Drying by the Perma Pure Dryers was found to be considerably better than drying by the Hankison Dryer and Drierite system now in use. Furthermore, the Perma Pure Dryers have no moving parts and require no maintenance. On the basis of our study, we recommend purchase of Perma Pure Dryers to replace the drying systems currently in use on all top gas analyzers.

## Introduction

Dissatisfaction has existed with the current continuous drying system (Figure 1) for top gas samples going to gas analyzers because of the system's questionable and non-uniform performance, the maintenance needed to regenerate the Drierite and the cost of new Drierite. Perma Pure Products, Inc. claimed that their new type of dryer would provide us with more efficient drying and would require no maintenance or operating costs. The purpose of our study was to test their dryers.

## Description of Drying Process

Perma Pure Dryers use permeation distillation to dry gases. With this new technique, a wet gas flows continuously into a bundle of tubes which are permeable to water vapor and are enclosed in a shell. Continuous drying can be accomplished by using plant compressed air, which has been expanded to atmospheric pressure, to purge the permeated water vapor out of the shell. The Perma Pure Dryer has a configuration similar to a shell and tube heat exchanger as shown in Figure 2. Instead of transferring heat, water vapor is transported continuously across a semi-permeable membrane. The driving force is a difference in water vapor pressure between the gas streams.

Curves relating product dew point with flow rate for a feed at a 72-75°F dew point were provided by the manufacturer and are shown in Figure 3 for the 12", 48" and 72" 50 tube dryers. According to the manufacturer, only two requirements must be met to reach the dew points shown in Figure 3: (1) the volumetric flow rate of purge gas must be at least 50% greater than the volumetric flow rate of wet feed gas and (2) the dew point of the purge gas must be less than the dew points shown in Figure 3 for the given flow.

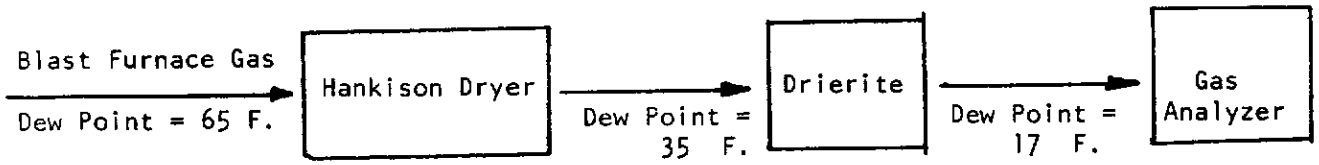


Fig. 1. CURRENT BLAST FURNACE SAMPLE GAS DRYING SYSTEM AND DEW POINTS TAKEN WHEN DRIERITE WAS ONE DAY OLD

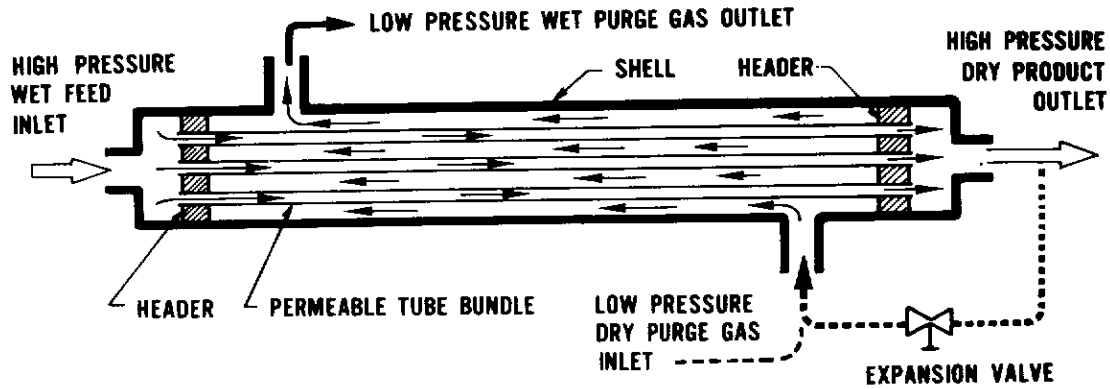


Fig. 2. DRYING SYSTEM USING PERMA PURE DRYER AND PLANT COMPRESSED AIR