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Guide for increasing the maximum allowable working pressure of cast iron, ASME constructed paper machine dryers

Scope

The intent of this document is to provide a guide that may be used to increase the maximum allowable working pressure of American Society of Mechanical Engineers certified paper machine dryers. This process, in which no physical change is made to the dryer, is defined as an “alteration” by the National Board Inspection Code. Machine capacity may be increased by increasing the dryer steam pressure. This benefit may be accompanied by an increase in machine speed. Any increase in machine speed will also need to be considered as dryer rotational velocity additive to the internal pressure stress. This guideline does not address determination of additional stress due to increased machine speed. This guide also provides insight on jurisdictional and insurance provider acceptance, which may be required before any pressure increase is implemented.

This guide does not address a paper machine dryer that was not originally certified to the ASME Boiler & Pressure Vessel Code. A dryer manufactured for use in a jurisdiction or country that does not recognize the ASME Code or follows an alternate set of design and manufacturing standards is not addressed in this guide. Seek guidance elsewhere for dryers that were not certified to ASME Code.

Definitions

VT – Visual testing or inspection
PT – Penetrant testing or examination
MT – Magnetic particle testing or examination
UT – Ultrasonic testing or examination
AE – Acoustic emission examination
MAWP – Maximum allowable working pressure
ASME – American Society of Mechanical Engineers
ASME Code - ASME Boiler & Pressure Vessel Code, Rules for Construction of Pressure Vessels
NB – National Board of Boiler and Pressure Vessel Inspectors
NBIC – National Board Inspection Code
NDE – Nondestructive Examination
AI – Authorized Inspector

Safety precautions

There are no safety precautions associated with the implementation of this guide. The guidance provided involves analysis of information, not how to obtain that information.

MAWP alteration process

Review documentation to determine if dryer is suitable for continued operation. No dryer should be considered that is in a poor operating condition. All related components such as steam and condensate joints, syphons, spoiler bars, gaskets for the inspection openings and head to shell joints, dryer balance weights, bearings, bearing lubrication system, dryer alignment and drive components should be in satisfactory operating condition (1).

The steps in this process are:

1. Obtain Documentation
2. Obtain Authorization for Rerating
3. Perform Required Inspections and Tests
4. Stamping of Dryer with New Operating Pressure
5. Documentation of Rerating

1. Obtain documentation

DESIGN CALCULATIONS

ASME DATA REPORT
(U-1 OR U-1A) FOR DRYER (S)

NONDESTRUCTIVE
EXAMINATION REPORTS

The following is a detailed explanation of the above documentation requirements:

a. Design calculations:

Calculations verify that the original design of the paper machine dryer can safely operate at a higher steam pressure. By “safely” it is meant that the stresses induced by the higher steam pressure are within the specified allowable stress of the construction code for a given material. Note that an increase in machine speed will also increase stress in the dryer.

ASME Code, Section VIII, Division 1, provides the basic dryer design requirements, with cast iron specific requirements in Part UCI (2). The original dryer manufacturer or a qualified engineering firm can provide calculations to document that the original design, with the higher pressure desired, and meets the design criteria of the ASME Code. Qualified individuals who are knowledgeable in paper machine dryers and paper machine operations should perform these calculations. This evaluation must consider the following imposed loads on the individual dryer components:

- Desired new steam pressure
- Thermal loads resulting from the drying process
- Centrifugal force from rotation of the dryer in the paper machine at new design speed
- Mass of the dryer and its related affects on the shell, journals and fasteners
- External loads such as dryer fabrics
- Condensate load

Calculation methods or documented tests to destruction (per ASME Code rules) under hydrostatic loads can determine the adequacy of the dryer heads. Calculations of dryer head journal strength, due to the imposed loads, may also be required.

