STANDARDS

for

DIRECT CONTACT BAROMETRIC

and

LOW LEVEL CONDENSERS

NINTH EDITION

Heat Exchange Institute, Inc.

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HEAT EXCHANGE INSTITUTE, INC.

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FOREWORD

The Ninth Edition of this Standard has been developed by the Vacuum Technology Section of the Heat Exchange Institute, Inc. with the intention of assisting those engaged in writing specifications and, ultimately, the selection of equipment.

These Standards provide practical information on nomenclature, dimensions, construction, and testing of direct contact barometric condensers.

The Standards are continually reviewed at scheduled meetings of the HEI Vacuum Technology Section. Suggestions for improvement are welcome and should be sent to the following:

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In preparing this Standard, consideration has been given to the work of other standards organizations, such as the American Society of Mechanical Engineers, and others. Credit is hereby given to all those whose standards may have been helpful in this work

1.0 INTRODUCTION

1.1 Purpose

This Standard contains a set of criteria for the specification, construction, and installation of Direct Contact Barometric and Low Level Condensers. It intends to provide a common understanding to which purchasers and manufacturers may make reference.

The guidelines described herein are meant to maximize the usefulness and benefits of Direct Contact Barometric and Low Level Condensers and work to eliminate any difficulties in their supply. The purpose is to provide practical methods by which a purchaser's requirements can be assured.

1.2 Scope

This Standard concentrates on those issues which can be standardized in an agreement between a purchaser and manufacturer of Direct Contact Barometric and Low Level Condensers. The issues are those which set the minimum requirements for construction and installation. No attempt is made to comprehensively describe the sizing, operational behavior, maintenance, or troubleshooting of direct contact condensers. These are issues left to individual manufacturer's determination and purchaser's choice.

2.0 FUNDAMENTALS

2.1 Nomenclature

With the intent of establishing standard terminology, four types of barometric condensers shown in Figs. 1, 2, 3, and 4 will be used. These drawings are merely illustrative for the purpose of indicating names of parts.

2.2 Operating Principles

Direct contact condensers are constructed to effect condensation of steam and other condensible vapors by means of direct contact with the condensing water. There are two principle types, namely, *counterflow* and *parallel flow.*

2.2.1 Counterflow condensers are so constructed that the steam or vapor and the condensing fluid flow in opposite directions.

2.2.2 Parallel flow condensers are so constructed that the steam or vapor and the condensing fluid flow in the same direction.

2.3 Arrangements for Water Removal

Counterflow and parallel flow condensers are further classified according to the method by which the mixture of condensing water and condensed vapor is removed, namely, barometric and low level.

2.3.1 A barometric condenser is elevated to a sufficient height to permit drainage through a tailpipe by gravity alone, without mechanical assistance.

2.3.2 A low level condenser requires a pump for removal of the condensing water/condensate mixture.

2.4 Definitions of Terms

Definitions of terms used in these Standards are given as follows:

a) Condenser Load consists of condensible vapors and non-condensible gases, expressed separately in pounds per hour.

b) Condenser Duty is the total net heat absorbed by the condensing water, expressed in Btu per hour.

c) Absolute Pressure is the pressure measured from absolute zero, i.e., from an absolute vacuum.

d) Static Pressure is the pressure measured in the vapor in such manner that no effect on the measurement is produced by the velocity of the vapor.

e) Suction Pressure is the absolute static pressure prevailing at the vapor inlet of the condenser expressed in pounds per square inch, inches or millimeters of mercury.

*f) Gas-Vapor Outlet Pressure is the absolute static pressure prevailing at the gas-vapor outlet of the condenser expressed in pounds per square inch, inches or millimeters of mercury.

g) Inlet Vapor Temperature is the total temperature of the vapor at the condenser inlet.

h) Inlet Water Temperature is the temperature of the condensing water at the condenser water inlet.

i) Outlet Water Temperature is the temperature of the condensing water at the condenser water outlet.

j) Outlet Temperature is the temperature of the gas-vapor mixture leaving the condenser or external air cooler.

k) Temperature Rise is the difference between outlet and inlet water temperatures as defined in i) and h) above.

l) Terminal Difference is the difference between the temperature corresponding to the partial absolute pressure of the condensing vapor at the condenser inlet and the outlet water temperature.

m) Gas-Vapor Approach is the difference between the vapor outlet temperature and the condensing water inlet temperature.

n) Condenser Pressure Drop is the difference between the suction pressure and the gas-vapor outlet pressure described in e) and f) above.

o) Suction Lift is the vertical distance the condensing water can be elevated due to the reduced pressure prevailing in the condenser. This dimension is referred to the centerline of the water inlet if the connection is on the side of the condenser shell, or is referred to the face of the inlet if the connection is on the top of the shell.