PIP VESSP002
Supplemental Design and Fabrication Specification for Shell and Plate Heat Exchangers
ASME Code Section VIII, Divisions 1 and 2
PURPOSE AND USE OF PROCESS INDUSTRY PRACTICES

In an effort to minimize the cost of process industry facilities, this Practice has been prepared from the technical requirements in the existing standards of major industrial users, contractors, or standards organizations. By harmonizing these technical requirements into a single set of Practices, administrative, application, and engineering costs to both the purchaser and the manufacturer should be reduced. While this Practice is expected to incorporate the majority of requirements of most users, individual applications may involve requirements that will be appended to and take precedence over this Practice. Determinations concerning fitness for purpose and particular matters or application of the Practice to particular project or engineering situations should not be made solely on information contained in these materials. The use of trade names from time to time should not be viewed as an expression of preference but rather recognized as normal usage in the trade. Other brands having the same specifications are equally correct and may be substituted for those named. All Practices or guidelines are intended to be consistent with applicable laws and regulations including OSHA requirements. To the extent these Practices or guidelines should conflict with OSHA or other applicable laws or regulations, such laws or regulations must be followed. Consult an appropriate professional before applying or acting on any material contained in or suggested by the Practice.

This Practice is subject to revision at any time.

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## Table of Contents

1. **Introduction** ............................................................... 2
   1.1 Purpose ........................................................................ 2
   1.2 Scope .......................................................................... 2

2. **References** ................................................................. 2
   2.1 Process Industry Practices ........................................... 2
   2.2 Industry Codes and Standards .................................... 3
   2.3 Government Regulations ............................................ 3

3. **Definitions** ................................................................. 3

4. **Requirements** .......................................................... 4
   4.1 General ......................................................................... 4
   4.2 Mechanical Design ................................................... 5
   4.3 Thermal Design ........................................................ 6
   4.4 Hydraulic Performance ............................................. 6

Appendix A – Shell and Plate Nomenclature Sketch ........ A-1
1. Introduction

1.1 Purpose
This Practice provides mechanical design and fabrication requirements for shell and plate heat exchangers constructed in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1 or Division 2, henceforth referred to as the Code. Requirements that are specific to Code, Section VIII, Division 2 are shown in braces {  }.

1.2 Scope
This Practice describes the mechanical design, fabrication, examination, inspection, testing, and documentation requirements for shell and plate heat exchangers constructed in accordance with Code, Section VIII, Division 1 {or 2}.

This Practice is supplemental to the requirements of PIP VESV1002, Design and Fabrication Specification for Pressure Vessels, ASME Code Section VIII Divisions 1 and 2.

2. References
Applicable parts of the following Practices, industry codes and standards, and references shall be considered an integral part of this Practice. The edition in effect on the date of contract award shall be used, except as otherwise noted. Short titles are used herein where appropriate.

2.1 Process Industry Practices (PIP)
- PIP VESV1002 - Design and Fabrication Specification for Pressure Vessels, ASME Code Section VIII Divisions 1 and 2
- PIP VEDSP003 - Documentation Requirements for Shell and Plate Heat Exchangers
- PIP VEFV1100 - Vessel/S&T Heat Exchanger Standard Details
  The following details apply:
  - PIP VEFV1101 - Vessel; Nameplate Bracket
  - PIP VEFV1102 - Vessel; Tolerances (Orientation)
  - PIP VEFV1103 - Vessel; Grounding Lug
  - PIP VEFV1105 - Vessel; Horizontal, Saddles Supported on Concrete
  - PIP VEFV1106 - Vessel; Horizontal, Saddles Supported on Steel
  - PIP VEFV1128 - Vessel Skirt Attachment
- PIP VESPMI01 - Positive Material Identification Specification
2.2 Industry Codes and Standards

For each of the following reference documents, if Code Table U-3 \{1.1\} lists an edition or addenda different than the edition listed in the reference, the edition listed in Code, Table U-3 \{1.1\} shall be used.

- American Society of Mechanical Engineers (ASME)
  - ASME Boiler and Pressure Vessel Code (Code)
    - Section II, Part D - Properties
    - Section V - Nondestructive Examination
    - Section VIII - Pressure Vessels, Divisions 1 and 2
    - Section IX - Welding and Brazing Qualifications

2.3 Government Regulations

The following reference is applicable to U.S. installations or as specified by Purchaser.

- U. S. Department of Labor, Occupational Safety and Health Administration (OSHA)
  - OSHA 29 CFR 1910.146(k)(3)(ii) - Permit-Required Confined Spaces for General Industry

3. Definitions

*Code*: The ASME Boiler and Pressure Vessel Code, Section VIII, Division 1 \{or 2\} and its referenced Sections (e.g., Section II, Section V, and Section IX) and any Code Cases permitted by the User. References to Division 2 are shown in braces \{\}.

*construction*: An all-inclusive term comprising materials, design, fabrication, examination, inspection, testing, certification (i.e., Code stamp and Manufacturer’s Data Report), Manufacturer’s Design Report, and pressure relief.

*Manufacturer*: The party entering into a contract with the Purchaser to design and construct a heat exchanger in accordance with the requirements in this Practice and the contract documents. In accordance with the *Code* definition, the Manufacturer is the party that possesses a valid Certificate of Authorization to manufacture pressure vessels with the ASME Mark.

*Comment*: Purchaser may duplicate portions or all of the heat exchanger design.

*National Board*: The National Board of Boiler and Pressure Vessel Inspectors, an organization comprised of chief inspectors of various governmental jurisdictions in the United States and Canada.

*Owner*: The party who owns the facility wherein the heat exchanger will be used. The Owner is typically also the User.

*Purchaser*: The party who awards the contract to Manufacturer. Purchaser may also be the Owner, User, or Owner’s or User’s Designated Agent (e.g., engineering contractor).

*User*: The party who establishes construction criteria in accordance with the *Code* philosophy and service hazards. User is the operator of the facility wherein the heat exchanger will be installed.
4. Requirements

4.1 General

4.1.1 Overall Responsibilities

4.1.1.1 Heat exchangers shall be provided in accordance with this Practice and the following:

a. *PIP VECV1002* for the mechanical design and fabrication of all pressure boundary components and attachments.

b. *PIP VEDSP003* including the following Purchaser’s forms:

   (1) PIP VEDSP003-D Data Sheet

   (2) PIP VEDSP003-T Inspection and Testing Requirements Sheet or equivalent

   (3) PIP VEDSP003-R Documentation Requirements Sheet

   (4) PIP VEDSP003-F Welded Pressure Joint Requirements

   c. The *Code*

   d. Design criteria that may supersede the requirements of this Practice but not take exception to the requirements of the *Code*

   e. *PIV VEFV1100* details: VEFV1101, VEFV1102, VEFV1103, VEFV1105, VEFV1106, VEFV1116, VEFV1117, VEFV1118, VEFV1125, VEFV1127, and VEFV1128

   f. Other codes and standards referenced in this Practice

   g. Local requirements

   h. Other contract requirements furnished by Purchaser

4.1.1.2 Heat exchangers shall be stamped in accordance with *Code*.

4.1.1.3 Heat exchangers stamped with “U-” (U2-) shall be National Board (NB) registered.

4.1.1.4 Deviations from this Practice shall be submitted in writing for approval by Purchaser.

4.1.1.5 If a conflict is identified between this Practice, the design drawings, data sheets, referenced codes and standards, or any supplementary specification, written clarification shall be obtained from Purchaser before proceeding with any work.
4.1.1.6 All aspects of the work shall be in accordance with applicable local, county, state, and federal rules, regulations and standards at installation site including but not limited to the rules and standards established by the EPA and OSHA, or equivalent national standards, if applicable, as designated by Purchaser. See Purchaser’s PIP VEDSP003-D Data Sheet.

4.1.1.7 If Purchaser furnishes a heat exchanger or heat exchanger component design, Manufacturer shall not be relieved of his responsibility to comply with the requirements of this Practice and the contract documents.

Comment: Certain non-Code-design functions may be performed solely by Purchaser (e.g., design of heat exchanger internals).

4.1.1.8 Release for shipment by Purchaser’s inspector shall not relieve Manufacturer of his responsibility to comply with the requirements of this Practice and the contract documents.

4.1.1.9 If certain requirements of this Practice and PIP VE CV1001 are to be performed by Manufacturer, the assigned requirements shall be specified on Purchaser’s PIP VEDSP003-D Data Sheet.

4.1.1.10 Positive material identification shall be performed in accordance with PIP VESP M101.

4.1.2 Documentation Responsibilities

4.1.2.1 Heat exchanger documentation shall be provided in accordance with Purchaser’s PIP VEDSP003-R Documentation Requirements Sheet.

4.1.2.2 The data required by Part B of Purchaser’s PIP VEDSP003-D Data Sheet shall be provided with the approval drawings.

4.1.2.3 Nameplates shall be located on the heat exchanger shell in an accessible location. The nameplate location shall be shown on the dimensioned outline drawing.

4.2 Mechanical Design

4.2.1 If Purchaser’s PIP VEDSP003-D Data Sheet specifies that heat exchanger is to be designed for differential pressure, the nameplate shall show this requirement.

4.2.2 Placing vents and drains in a plate-side nozzle neck to facilitate specific process requirements shall be considered.

4.2.3 If applicable, impingement protection type shall be specified on Purchaser’s PIP VEDSP003-D Data Sheet.

4.2.4 For orders of multiple heat exchangers of the same type, size, and material, either stacked or parallel, the heat exchangers shall have interchangeable components to the maximum extent possible.
4.3 Thermal Design

4.3.1 General

4.3.1.1 Thermal design of shell and plate heat exchangers shall consider safety, operation, maintenance, and initial cost aspects of the intended service.

4.3.1.2 Each heat exchanger unit shall be independently designed.

4.3.1.3 The thermal design method used shall be approved by User.

4.3.2 Fouling Factors

4.3.2.1 Purchaser shall specify percentage of excess surface area to compensate for fouling deposits.

4.3.2.2 The percentage of excess surface area shall be approved by User.

4.3.2.3 The clean heat exchanger performance shall be reviewed by User.

4.4 Hydraulic Performance

Pressure drop design factors shall be approved by User.
Appendix A – Shell and Plate Nomenclature Sketch

**Figure 1:** Shell & Plate Nomenclature: Removable Core Design

**Figure 2:** Joined Shell & Fixed Core
ISO View

**Figure 3:** Joined Shell & Removable Core
ISO View

**Figure 4:** Shell & Core, Removable Core Design