

Safety Analysis Report
for the
NCI-21PF-1 Protective Shipping Package

Revision 3
July, 1997

Submitted by:
Eco-Pac Specialty Packaging
125 Iodent Way, Suite B
Elizabethton, Tennessee 37643

Prepared by:
Transnuclear, Inc.
Four Skyline Drive
Hawthorne, New York 10532

9707170030 970709
PDR ADOCK 07109234
C PDR

LIST OF CHANGES

CHANGES INCLUDED IN REVISION 3

SAR Page Number	DESCRIPTION OF CHANGE	REVISION BASIS
Cover Pages	Corrected revision number and date of submittal to Revision 3, July 1997	Editorial
i, v, 1-i, 1-3, 1-7, 2-5, Chapter 8	Corrected footers to indicate Rev. 3, 07/97	Editorial
i and 1-i	Added Section 1.2.4	Editorial
v and 8-i	Corrected Pagination in Chapter 8	Editorial
1-3, Table 1-1	Corrected Material Reference of Aluminum Insert. Only standard ASTM B26 Alloy 514 has been referenced.	Response to NRC
1-7, Section 1.2.4	Added Section 1.2.4 referencing the drawing of the valve protection device insert gauge.	Response to NRC
Drawing VPD-0002	Corrected aluminum material reference. Added aluminum insert "ordering information" to drawing.	Response to NRC
Drawing VPD-0003	Added drawing of valve protection device insert gauge.	Response to NRC
2-5	Corrected Material Reference to standard ASTM B26 Alloy 514	Response to NRC
8-2	Corrected reference to drawing number.	Editorial
8-2 and 8-3	Added Section 8.1.3.1, Valve Protection Device Fit-Up Test	Response to NRC
8-6	Added in requirements for re-performance of VPD Fit-Up Test under Section 8.2.3	Response to NRC

"REVISION BASIS" Descriptions:

Editorial - Format correction.
 Response to NRC - Pages revised in response to NRC request for additional information on May 27, 1997.

SAFETY ANALYSIS REPORT
FOR THE
NCI-21PF-1 PROTECTIVE SHIPPING PACKAGE

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**CHAPTER ONE
GENERAL INFORMATION**

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**Table 1-1
Materials of Construction**

<u>Item</u>	<u>Material</u>
Cylinder and valve	In accordance with ANSI N14.1
Valve Protection Device	
Aluminum Insert	ASTM B26, Alloy 514
Spacer	ASTM A36 Carbon Steel, Painted
Spider	ASTM A36 Carbon Steel, Painted
Overpack	
Skin	ASTM A240 Type 304 or 304L SST
Plates	ASTM A240 Type 304 or 304L SST
Angles	ASTM A276 Type 304 or 304L SST
Toggle Castings and Swing Pins	17-4PH SST
Toggle Bracket and Base Castings	Type 304 or 304L SST
Pipe	ASTM A312 Type 304 or 304L SST
Boat Nails, Lag Screws, Set Screws, Pad Eyes, and Washers	300 SST 18-8 or 17-4PH SST
Wood	Oak
Foam	Phenolic Foam
Gasket	Silicone

1.2.4 Valve Protection Device Insert Gauge

Prior to first use of the cylinder-valve combination with the valve protection device, a valve protection device fit up test (described in Section 8.1.3) must be performed. The gauge insert has been developed by incorporating the worst case dimensions of the primary VPD insert. Drawing VPD-0003 (Appendix 1.3) provides the gauge dimensions and tolerances.

2.3 MECHANICAL PROPERTIES OF MATERIALS

The mechanical properties of materials used in the design of the NCI-21PF-1 packaging are presented below:

Component	Material	Yield Stress (psi)	Ultimate Stress (psi)	Reference See Notes Below
30B Cylinder	ASTM, A516 Grade 55	30,000	55,000	1
Overpack	ASTM, A240 Type 304	30,000	75,000	1
	17-4PH SS	105,000	135,000	1
	Oak - Perpendicular to Grain	2,070	N/A	3
	Oak - Parallel to Grain	7,920	N/A	3
	Foam - Perpendicular to Rise	42 - 81	N/A	4
	Foam - Parallel to Rise	44 - 93	N/A	4
Valve Protection Device	A 36 Carbon Steel	36,000	58,000	1
	ASTM B-26 Aluminum Alloy 514	9,000	22,000	2

1. ASME Boiler and Pressure Vessel Code 1995, Section II, Part D. Weakest cylinder material has been selected. In accordance with ANSI N14.1, the 30B cylinder can be fabricated using ASTM A516 Grade 55, 60, 65 or 70.
2. These values are the minimum values specified in ASTM B26, Alloy 514.
3. Wood data is provided in Appendix 2.10.1.
4. Foam data is provided in Appendix 2.10.2.

CHAPTER EIGHT
ACCEPTANCE TESTS AND MAINTENANCE PROGRAM

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CHAPTER EIGHT ACCEPTANCE AND MAINTENANCE PROGRAMS

This chapter describes the activities to be performed in compliance with Subpart G of 10 CFR 71 to assure that the NCI-21PF-1 package conforms to the requirements of this Safety Analysis Report and remains in conformance following loading.

8.1 ACCEPTANCE TESTS

8.1.1 Acceptance Tests for the NCI-21PF-1 Overpack

Each completed overpack shall be inspected to document compliance with the following drawing requirements:

- (a) Final dimensions as described below:
 - Inner cylinder cavity dimensions.
 - Outer shell dimensions.
 - Toggle clamp locations.
 - Bolt center locations and hole diameters in tie down supports and in lifting/stacking frames.
 - Flatness of gasket surface.
- (b) Installation of gaskets and cylinder support pads.
- (c) Lid to body fit.
- (d) Toggle clamp adjustments and locking of adjustment nuts.
- (e) Installation of lifting eye-bolts and security seal pads.
- (f) Actual weights of lid and bottom halves.
- (g) Final assembled weights.
- (h) Proper permanent marking and nameplates per 10 CFR 71.85(c), 49 CFR 1178,121-5, and ANSI N14.1 (latest revision).

8.1.2 Acceptance Tests for the Valve Protection Device

Each completed valve protection device shall be inspected to document compliance with the following drawing requirements:

- (a) As-built dimensions.
- (b) Clamp adjustments
- (c) Actual weights of steel spider, steel space, primary insert and each secondary insert.
- (d) Final weight of entire valve protection device.
- (e) Proper permanent marking of each component per drawing VPD-0002.

8.1.3 Acceptance Tests for the 30B Cylinder

Acceptance tests for the 30B cylinder shall be in accordance with ANSI N14.1. In addition, the fitup of the Valve Protection Device to the cylinder shall be performed as specified below.

Reports, certifications, and records of the 30B cylinder shall be in accordance with ANSI N14.1.

8.1.3.1 Valve Protection Device Fit-Up Test

Prior to first use of each cylinder-valve combination with a valve protection device, a fit up test will be performed to verify that the valve protection device fits properly in the cylinder. This fit up test will verify the clearances in two locations:

- g, clearance between the valve and the underside of the bridge; and
- Gap, clearance between the underside of the valve protection device and the cylinder head.

The (g - Gap) value as specified on Figure 2.7-8 shall be at least 3/16" (5 mm).

The acceptance test will consist of the following steps:

- (a) The cylinder (horizontal) shall be oriented with the valve in the twelve o'clock position.
- (b) One secondary aluminum insert shall be placed into the cylinder skirt.
- (c) The next secondary aluminum insert shall be placed into the cylinder skirt.

- (d) Once the two pieces have been placed inside of the cylinder skirt, a two to three inch space should exist between the two pieces.
- (e) The gauge insert (see Appendix 1.3 for drawing) shall be placed over the valve. A steel spacer shall be placed between the three pieces.
- (f) Install the metal spider of the valve protection device among the inserts. Verify that the bridge of the gauge insert covers the cylinder valve and is centered on the centerline of the valve.
- (g) Clamp the metal spider of the valve protection device in place.
- (h) Measure g , the clearance between the valve tip and the underside of the gauge insert bridge.
- (i) Measure Gap , the clearance between the underside of the gauge insert and the cylinder head on the scribe line at the centerline of the $3/4$ " radius hole.
- (j) Calculate $(g - Gap)$.
- (k) If $(g - Gap)$ is greater than $3/16$ " (5 mm) then the cylinder and its valve are certified for use in the NCI-21PF-1 overpack.
- (l) If $(g - Gap)$ is less than $3/16$ " (5 mm) then the cylinder with its valve may not be shipped in an NCI-21PF-1 overpack with a valve protection device.
- (m) Once complete, unclamp the metal spider of the valve protection device.
- (n) Remove the metal spider from among the inserts.
- (o) Remove the metal spacer from among the inserts.
- (p) Carefully remove the gauge insert from the cylinder skirt.
- (q) Remove the secondary location inserts from the cylinder skirt.

8.2 MAINTENANCE PROGRAMS

8.2.1 Maintenance Programs for the NCI-21PF-1 Overpack

The user shall establish written procedures for the periodic maintenance and inspection of each Model NCI-21PF-1 overpack requiring the following as a minimum:

8.2.1.1 Annually

- (a) Check that the lifting/stacking frames, lifting eyebolts, closure clamps, and tie-down supports are sound and free from weld cracks, damage and deterioration.
- (b) Check that the closure clamps properly adjust and lock. Check torque on the overpack closures using the following method:
 - Loosen set-screws in collar bolts.
 - Adjust toggle closures to securely close overpack.
 - Engage toggle clamps and close toggles, alternating first corner to corner (4 closures) followed by side to side (6 closures).
 - Torque closures to 110 ± 10 foot-pounds.
 - Tighten set screws.
- (c) Check that all vents are properly sealed.
- (d) Check that the inner and outer shells are free of holes, cracks, tears, and broken welds, and the inner shells are free of debris and standing water.
- (e) Check that the wood cover plates are sound and undamaged, and gasket sealing surfaces meet drawing requirements.
- (f) Individually weigh each half (lid and bottom) of each packaging to verify that neither half has gained more than 25 pounds. Weight gain must be assumed to be water. If either half exhibits a gain of more than 25 pounds, the packaging must be removed from service and dried to within 10 pounds of its original nameplate weight. New weights of each packaging half must be established after any modifications, refurbishment, or repainting. After drying each packaging must be inspected, as above.
- (g) Check that gaskets are in place, intact, and not damaged or deteriorated.

8.2.1.2 Every Three Years

- (a) Perform all annual inspections as listed above.
- (b) Replace and inspect gaskets.

8.2.1.3 Every Five Years

The owners are responsible for recertifying the NCI-21PF-1 overpack every five years to meet original design specifications. The following inspections shall be performed:

- (a) Perform all routine inspections stated in Chapter 7 and all annual inspections stated above. (If it is time to replace the gasket, this shall be performed as well).
- (b) Full visual inspection of all welds for the presence of cracks. Any questionable condition of a weld shall be subject to further examination to assure that no cracks are present. Weld defects shall be repaired.
- (c) Check the base and lid for warpage and/or distortion which could prevent tight closure. Check that the gasket sealing surfaces meet design specifications.
- (d) Probe all base vent and lid vent holes to ascertain the rigidity and presence of insulation. Assure that vent holes are properly sealed.
- (e) Verify that inner and outer shells are free of corrosion, pitting, cracks, broken welds and pinholes.
- (f) Assure that security seal holes are functional and capable of maintaining their integrity when seals are used.
- (g) Permanently mark the exterior nameplate listing the date of recertification, the individual base and lid weights, and the name of the recertifying company.
- (h) The overpack shall receive a full visual inspection for rusting and the presence of corrosion. This inspection shall include assurance that corrosion has not reduced the skin wall thickness by 10% of the nominal thickness. When visual inspection cannot assure sufficient wall thickness, other examinations shall be utilized, such as ultrasonic testing, to assure acceptability.
- (i) All repairs shall be performed by competent sources. All repairs that require welding shall be made by welders who are qualified in accordance with Section IX of the ANSI/ASME Boiler and Pressure Vessel Code or Section 5 of ANSI/AWS D1.1. The repair shop shall provide certification of weld procedures and welder qualifications.

8.2.2 Maintenance Programs for the Valve Protection Device

In addition to routine operational inspections, the valve protection device shall be inspected every five years to verify compliance with original design criteria. As a minimum this maintenance and inspection shall include:

- (a) Perform all routine inspections outlined in Chapter 7.
- (b) Perform full visual inspection of all welds for the presence of cracks. Any questionable condition of a weld shall be subject to further examination to assure that no cracks are present. Weld defects shall be repaired.
- (c) All repairs shall be performed by competent sources. All repairs that require welding shall be made by welders who are qualified in accordance with Section IX of the ANSI/ASME Boiler and Pressure Vessel Code or Section 5 of ANSI/AWS D1.1. The repair shop shall provide certification of weld procedures and welder qualifications.
- (d) Perform full visual inspection of painted surfaces; any discontinuity in paint coverage shall be corrected.

8.2.3 Maintenance Program for the 30B Cylinder

Maintenance of the 30B Cylinders shall be performed in accordance with ANSI N14.1.

The valve protection device fit up test (Section 8.1.3) shall be performed on the same schedule as the Periodic Inspections and Tests requirements of ANSI N14.1.

**THIS PAGE IS AN
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OR FIGURE,**

**THAT CAN BE VIEWED AT
THE RECORD TITLED:
DWG. NO. VPD-0001, REV. 0
ASSEMBLY FOR 2 ½ TON
CYLINDER VALVE
PROTECTOR
WITHIN THIS PACKAGE...OR,
BY SEARCHING USING THE
DRAWING NUMBER:
VPD-0001, REV. 0**

NOTE: Because of this page's large file size, it may be more convenient to copy the file to a local drive and use the Imaging (Wang) viewer, which can be accessed from the Programs/Accessories menu.

D-1

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DWG. NO. VPD-0002, REV. 2
2 ½ TON CYLINDER VALVE
PROTECTION DEVICE DETAILS
& NOTES**

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VPD-0002, REV. 2**

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D-2

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VALVE PROTECTOR DEVICE
GAUGE**

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VPD-0003, REV. 0

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D-3