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Rockwell International Corporation

CODE IDENT NO. 09874

NUMBER ST0620NA0095	REVISION LETTER <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div>	PAGE 1.1
------------------------	--	-------------

MASTER

TABLE OF CONTENTS

<u>Title</u>	<u>Paragraph</u>	<u>Page</u>
SCOPE	1.	2
APPLICABLE DOCUMENTS, EQUIPMENT AND MATERIALS	2.	2
Applicable Documents	2.1	2
Equipment	2.2	2
Installation Equipment	2.2.1	2
Seal Removal Equipment	2.2.2	3
Materials	2.3	3
Installation Materials	2.3.1	3
Removal Materials	2.3.2	3
REQUIREMENTS	3.	4
Safety	3.1	4
Shop Safety Practices	3.1.1	4
Solvents	3.1.2	4
Unpackaging Seals	3.2	5
Identification	3.3	6
Handling	3.4	6
Cleaning	3.5	6
Seals	3.5.1	6
Seal Glands and Seal Runners	3.5.2	6
Pre-Installation Inspection	3.6	6
Seal Installation	3.7	6
Preparation of Adhesive	3.7.1	7
Application of Adhesive	3.7.2	8
Seal Installation Procedure	3.7.3	9
Lubrication	3.7.4	11
Closure	3.7.5	11
Seal Removal and Gland Cleanup	3.8	11
Seal Removal Procedure	3.8.1	11
Seal Lubricant Removal	3.8.2	12
Epoxy Removal	3.8.3	12
QUALITY ASSURANCE PROVISIONS	4.	13
Inspections	4.1	13
Cleanliness and Installation	4.1.1	13
Inflatable Seal Leak Test	4.1.2	13
PREPARATION FOR DELIVERY	5.	13
NOTES AND DATA	6.	13

Rockwell International Corporation

CODE IDENT NO. 09974

NUMBER ST0620NA0095	REVISION LETTER								PAGE 1.2

TABLE OF CONTENTS (CONTINUED)

<u>Title</u>	<u>Page</u>
Figure 1 - Seal Nomenclature and Component Parts Identification	14
Figure 2 - Adhesive Application Tools	15
Figure 3 - Seal Seating Tools	16
Figure 4 - Use of Seal Roller Press	17
Figure 5 - Seal Base-Seating Roller	18
Figure 6 - Extruding Band of Adhesive into Gland	19
Figure 7 - Use of Spreading Tool	20
Figure 8 - Inflation Port in Gland	21
Figure 9 - Inflation Stem with Adhesive	22
Figure 10 - Use of Seal Seating Press Roller	23
Figure 11 - Removal of Epoxy Bonded Inflatable Seal	24

Rockwell International Corporation

CODE IDENT NO. 09974

NUMBER	ST0620NA0095	REVISION LETTER	PAGE
			2

SPECIFICATION FOR

SEAL, DYNAMIC INFLATABLE TEST, INSTALLATION AND REMOVAL OF

1. SCOPE This specification establishes the requirements and procedures (using epoxy adhesive) for the installation and removal of the dynamic inflatable test seal for the Fast Flux Test Facility (FFTF), In-Vessel Handling Machine (IVHM) Reactor Refueling Plug (RRP).

2. APPLICABLE DOCUMENTS, EQUIPMENT AND MATERIALS

2.1 Applicable Documents The following documents of the exact issue shown, form a part of this specification to the extent specified in Sections 3, 4, and 5 of this specification. In the event of conflict between documents referenced here and other detail content of this specification, the detail content of this specification shall be considered a superseding requirement.

American National Standards Institute (ANSI)

ANSI A11.1-1973

Industrial Lighting, Practice for

2.2 Equipment The equipment used to perform the operations of this specification shall be as shown in the following subparagraphs.

2.2.1 Installation Equipment Equipment used for installation shall be as follows:

Lint free gloves.

Plug, for 0.297-inch diameter hole. Buna N or equivalent elastomer (no cork shall be used or other material that may crumble).

Seal Seating Tools (See Figure 3).

Adhesive Application Tools (See Figure 2).

Balance, Beam type, Capacity 200 grams or greater, accuracy ± 0.1 gram.

Scale, Capacity 1000 grams, accuracy ± 10 grams.

Seal Base Seating Tool.

Rockwell International Corporation

CODE IDENT NO. 09974

NUMBER ST0620NA0095	REVISION LETTER <table border="1"><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>									PAGE 3

2.2.2 Seal Removal Equipment Equipment used for seal removal shall be as follows:

Gloves, Polyethylene or Neoprene.

Face Shield.

Brushes for spreading solvents.

Putty Knife or dull Wood Chisel, Maximum width 3/4 inch.

Plug, for 0.297-inch diameter hole. Buna N or equivalent elastomer (no cork shall be used or other material that may crumble).

2.3 Materials

2.3.1 Installation Materials The following materials (or equivalent) will be required in installing the seal:

Adhesive, Hughson Chemlok 304-1, 2 pound container, 304-2 1-1/2 pound container. Manufactured by Hughson Chemical Corporation, Erie, Pennsylvania.

Solvents (Reagent Grade):

Acetone

Methyl Ethyl Ketone

Lubricant, Dow Corning 55M silicone grease

Gauze

2.3.2 Removal Materials The following materials (or equivalent) shall be used in removing the seal:

Cheesecloth or similar material.

Solvents:

Oakite Stripper 157 (Berkely Height, New Jersey)

Moore M-6 or M-114 Manufacturer by John B. Moore Corporation
South Amboy, New Jersey

Rockwell International Corporation

CODE IDENT NO. 09974

NUMBER	ST0620NA0095	REVISION LETTER	PAGE
			4

2.3.2 Removal Materials (Continued)

Solvents: (Continued)

Isochemstrip 708 LV, Lincoln, Rhode Island.

Turco 5122 or 5351 (Wilmington, California)

NOTE: Turco 5122 or 5351 should be stored in a cool place.

Distilled Water

Acetone

3. REQUIREMENTS

3.1 Safety

3.1.1 Shop Safety Practices Rockwell International Corporation shop safety practices shall be in effect and shall be complied with during all of the operations specified in this document.

3.1.2 Solvents Special care shall be taken in the use of all solvents as specified in the following subparagraphs.

3.1.2.1 Methyl Ethyl Ketone (Butanone) Methyl ethyl ketone (MEK) shall be used only in the presence of spark-proof equipment and with care to avoid any sources of ignition. Health hazards associated with the use of MEK shall be treated as follows:

1. Exposure to high vapor concentration can cause narcotic symptoms. If this should occur, remove the individual to fresh air and call the medical department.

NOTE: This condition is unlikely since the vapors are repulsive.

2. MEK can cause drying and irritation of the skin. In the event of excessive exposure, remove any contaminated clothing promptly and flush the skin with plenty of water.
3. In case of eye burns, rinse with water for 10 minutes.
4. Do not take internally.
5. Wash hands thoroughly before eating or smoking.

Rockwell International Corporation

CODE IDENT NO. 09974

NUMBER	ST0620NA0095	REVISION LETTER	PAGE
			5

3.1.2.2 M-6 and M-114 Gloves shall be worn during use and any solvent contact with the skin shall be avoided. The person using M-6 or M-114 shall wash hands, and any other skin coming in contact with these chemicals, with soap and water.

3.1.2.3 Oakite Stripper 157 Oakite Stripper 157 contains chlorinated solvents and ammonia. Contact with skin, eyes and clothing shall be avoided. The stripper shall be used with plenty of ventilation. Face shields or goggles, and protective solvent-resistant clothing shall be worn by personnel using the stripper.

3.1.2.4 Turco 5122 and 5351 Turco 5122 and 5351 contain chlorinated solvents and ammonia. Contact with skin, eyes and clothing shall be avoided. The stripper shall be used with plenty of ventilation. Face shields or goggles, and protective solvent-resistant clothing shall be worn by personnel using the stripper.

ANTIDOTE: Skin Contact - Wash with rubbing alcohol and follow with soap and water.

Eye Contact - Rinse with plenty of water for fifteen minutes, call First Aid

Internal - Give a tablespoon of salt in a glass of water and repeat until vomit fluid is clear. Give milk and white of eggs beaten with water. Call First Aid.

3.1.2.5 Chemlok 304-1 and 304-2 Chemlok 304-1 contains Butyl Glycidyl Ether. Both Chemlok 304-1 and 304-2 may cause eye irritation or allergic skin reaction and shall be harmful when swallowed. Contact with skin or eyes shall be avoided. In case of contact with skin, promptly wash with soap and water. In case of contact with eyes, rinse with plenty of water and contact a physician.

3.1.2.6 Isochemstrip 708 LV Isochemstrip 708 LV contains organic solvents and alcohols. Precautions shall be taken to prevent prolonged breathing and contact with skin or eyes. In case of contact, promptly wash with plenty of water.

3.2 Unpackaging Seals The seals shall be unpackaged immediately prior to installation and laid out flat on a clean surface at least 6-feet square. Subsequent handling and installation operations shall also be performed in a clean area.

Rockwell International Corporation

CODE IDENT NO. 09974

NUMBER	ST0620NA0095	REVISION LETTER	PAGE
			6

3.3 Identification The serial number of the seal, identification number, and cure date shall be noted and recorded upon unpackaging the seals.

NOTE: This information will be inked on each seal bottom near the inflation stem. The identification number will be either XX-170 or XX-169, and denote either an inner diameter seal (XX-169) or an outer diameter seal (XX-170).

3.4 Handling The seals shall be handled in a manner to prevent physical damage and contamination with foreign materials. Handling of unpackaged seals shall be accomplished by personnel wearing clean, lint free gloves. When moving each seal, prevent seal contact with the floor or other surfaces. The seal shall remain on a clean surface until installation.

3.5 Cleaning

3.5.1 Seals All seal surfaces shall be cleaned by wiping with a clean, white, lint-free cloth moistened with methyl ethyl ketone, and then repeating the process with acetone. After cleaning, there shall be no evidence of oil, grease, dirt or other foreign materials on seal surfaces. The seal surfaces shall be allowed 24 hours minimum for drying.

3.5.2 Seal Glands and Seal Runners The seal glands and seal runners shall be cleaned by wiping with a clean, white, lint-free cloth moistened with methyl ethyl ketone and then repeating the process with acetone. The plug shall be in place in the inflation port hole to assure that no solvents enter the port. After cleaning, there shall be no visible evidence of oil, grease, dirt, or other foreign material on the gland or runner surfaces. The seal glands and seal runners shall be allowed a 1/2 hour minimum for drying.

3.6 Pre-Installation Inspection The critical sealing surface (refer to Figure 1) of each seal shall be free of defects such as nicks, cuts, voids, depressions, and hairline nonflow marks. Each seal inflation stem shall be examined to insure freedom from resin and metal burrs, and to insure that the inflation port is clear and unobstructed.

3.7 Seal Installation The two seals shall be installed one at a time. The inner seal shall be installed first in accordance with the requirements of 3.7.1 through 3.7.3. The outer seal shall then be installed in the same manner.

Rockwell International Corporation

CODE IDENT NO. 09974

NUMBER ST0620NA0095	REVISION LETTER						PAGE 7

3.7.1 Preparation of Adhesive The epoxy shall be mixed in the weight ratio of 4 parts of 304-1 to 3 parts of 304-2 as follows:

1. A total of 250 grams, consisting of 143 grams of 304-1 and 107 grams of 304-2, shall be prepared for the 19 feet of inner seal.

NOTE: Even though only 135 and 141 grams are used for the inner and outer seal respectively, the extra amount shall be used in the squeeze tube (Refer to Figure 2) for easier use. The same amount of epoxy shall be mixed for the inner and outer seals (disregard length difference).

2. The materials (304-1 and 304-2) shall be mixed with a spatula or similar tool, on a flat surface.

CAUTION: Only the amount required for one seal shall be mixed at one time. The pot life of the mixed epoxy is approximately 1-1/2 to 2 hours.

3. The materials have different colors, and shall be mixed until the two colors blend uniformly into one.

CAUTION: Do not overmix. Overmixing will cause heat buildup and shorten pot life.

4. When filling the squeeze tube, pack tightly to minimize air pockets. Flatten the large open end and attach the extruding tool as shown on Figure 2, then flatten the orifice to an 0.065 - inch x 0.5 inch opening.

5. Prior to application of the adhesive to the bottom surface of the gland, the weights of the adhesive extruding tool and squeeze tube, with the adhesive added, and the approximate amount of gauze to be used for cleaning, shall be added and recorded.

Rockwell International Corporation

CODE IDENT NO. 09974

NUMBER	ST0620NA0095	REVISION LETTER	PAGE
			8

3.7.2 Application of Adhesive

3.7.2.1 Practice Prior to Application Prior to use for the seal application, practice in the use of the adhesive extruding tool shall be conducted. Using a different batch, spread the adhesive on a piece of heavy grade paper by weighing and spreading over a 3-4 foot surface in a uniform manner, and then measure and reweigh the spread to determine the average grams spread per foot. The completed spread shall be approximately 7 grams ± 10 percent each foot.

NOTE: Distribution of 135 grams ± 15 grams over the 19 feet feet x 1-inch gland circumference shall result in approximately 0.030-inch thickness of adhesive.

3.7.2.2 Application of Adhesive to the Gland The adhesive shall be applied as follows:

1. Install a Buna N plug (or equivalent) in the inflation port to protect it from the adhesive.
2. Apply adhesive to the center of the bottom surface of the smaller diameter seal gland by extruding a 0.065 x 0.5-inch band of adhesive into the gland from the squeeze tube. (Refer to Figure 6)

NOTE: The final layer will cover the bottom surface of the retainer gland to a depth of approximately 0.03 inch. Avoid getting adhesive in the gland inflation port or on the gland walls above the ridges. Any adhesive inadvertently smeared on the gland walls shall be wiped up with a clean, lint-free cloth.

3. Apply small amounts of adhesive to the top side of the gland ridges to act as a lubricant during the pressing of the seal into the gland. (Refer to Figure 4)
4. Using the adhesive application template (refer to Figure 2-b) smooth out the band of adhesive along the gland bottom. (Refer to Figure 7)

NOTE: While applying the adhesive, take care to keep the adhesive 3/16-inch away from the inflation port to assure that no adhesive enters the port. (Refer to Figure 8)

Rockwell International Corporation

CODE IDENT NO. 09974

NUMBER	ST0620NA0095	REVISION LETTER	PAGE
			9

3.7.2.2 Application of Adhesive to the Gland (Continued)

5. Apply adhesive to the seal surface around the base of the inflation stem to account for the 3/16-inch area around the inflation port (Refer to Figure 9)
6. After application of the adhesive is complete, inspect the entire gland to ensure that no adhesive is in the inflation port or on the gland walls.
7. After application of the adhesive, weigh the extruding tool, squeeze tube with the remaining adhesive, and all gauze used for wiping the excess adhesive and record the total weight. Subtract the weight of the above total from the recorded quantity of 3.7.1-8. The amount of adhesive used shall be approximately 135 ± 14 grams for the inner seal and 141 ± 14 grams for the outer seal.

NOTE: If the amount of adhesive applied exceeds the tolerance, clean excess with spatula and weigh until the proper amount is left. If amount of adhesive applied is less than 120 grams, then add adhesive to sections looking sparse or apply the adhesive uniformly around the gland until the proper amount of 135 grams is used.

3.7.3 Seal Installation Procedure The seal shall be installed as follows:

1. Place two O-rings on the inflation stem and apply a light coat of DC 55M to the O-rings. (Refer to Figure 1)
2. Lift the seal from a flat clean surface making sure that the seal is held in four different locations along its surface and move the seal to approximately one foot above the gland.

NOTE: In handling the seal, personnel shall wear clean, lint-free gloves.

3. Remove the plug from the inflation port.
4. Grasping the seal in both hands, pinch the seal walls together and guide the inflation stem into the gland inflation port being careful that no adhesive gets into the inflation port hole.

Rockwell International Corporation

CODE IDENT NO. 09974

NUMBER ST0620NA0095	REVISION LETTER						PAGE 10

3.7.3 Seal Installation Procedure (Continued)

5. Force the stem into the port taking care to push straight down. The top of the seal should be level with the gland top when the stem is fully seated. The seal seating roller or hand press (refer to Figures 3 and 4) may be used to help force the stem into the port.
6. Seat the seal 3-4 inches on either side of the stem, then seat the base of the stem. The base seating roller tool (refer to Figure 5) shall be used in this procedure using approximately 75 pounds of force.
7. Lay the seal in the gland so that it rests on the gland ridges. A slight stretching of the seal will be necessary to fit the seal in the gland.

CAUTION: Do not lift the seal out of the gland once it is set, the adhesive applied for lubrication (refer to 3.7.2.2-3) will smear on the gland sidewalls.

8. Moving away from the inflation stem in either direction, press 3-4 inches of the seal at a time into the gland with the roller or hand press (refer to Figure 10). Continue this process until the entire seal is seated.

NOTE: Rolling, in this manner, will push the air out from under the seal.

9. In reaching the last 3-4 inch strip of the seal, an air pocket will form causing a hump in the seal. To remove the air pocket, apply a wrap of adhesive tape to a thin bladed screwdriver and force the taped blade between the seal and the gland ridge. Roll over the hump in the seal with a press roller while the blade is inserted. This will force the air bubble out from under the seal.
10. Completely re-roll the entire seal with a base seating roller tool (refer to Figure 5) to assure the seating of the seal.
11. Check the entire seal for proper seating in the retainer gland by running a hand lightly over the seal top and the gland. The seal top should be even with the gland top. High spots denote an unseated portion of the seal. Seat high spots by hand or using the seal press.

Rockwell International Corporation

CODE IDENT NO. 09974

NUMBER	ST0620NA0095	REVISION LETTER	PAGE
			11

3.7.3 Seal Installation Procedure (Continued)

12. Check to insure that no adhesive has been deposited on the critical 0.20-inch seating radius on the seal. (Refer to Figure 1)
13. Water and rags shall be used for cleaning of all uncured adhesive from the tools.
14. Allow the adhesive to cure for 48 hours minimum at room temperature, before inflating the seal. The seal shall not be touched or otherwise moved during the cure period. Clamping or weighing the seal during curing is not required.

3.7.4 Lubrication The seals shall be lubricated just prior to mating with the seal runners. Each seal shall be lubricated with 60 ± 6 grams of DC 55M silicone grease spread evenly over the entire seal wear surface length.

3.7.5 Closure The seal runners (refer to Figure 1) shall be installed in a manner as to insure a straight, linear closing motion. To prevent damage to the seals, care shall be taken not to twist, oscillate, or jiggle the mating seal runners and seals during closure for assembly. The runners shall be set to just contact the seal at the sealing radius.

3.8 Seal Removal and Gland Cleanup

3.8.1 Seal Removal Procedure The seal shall be removed as follows (refer to Figure 11):

1. Cut a rectangular section out of the top of the seal. The cutout shall be large enough to insert a 1/2 diameter rod, approximately 3/4 by 2 inches in size.
2. Insert a 1/2-inch diameter rod into the seal and pry up.
3. Cut through the entire seal; under the bar, including the bead under the gland ridges, and in the area where the seal is stressed to obtain a free end. Avoid scratching the retainer gland. An effort shall be made to confine any scratches to the bottom of the gland.

Rockwell International Corporation

CODE IDENT NO. 09974

NUMBER	ST0620NA0095	REVISION LETTER	PAGE
			12

3.8.1 Seal Removal Procedure (Continued)

4. After the seal is cut through, insert a putty knife or dull chisel under the seal and break through the epoxy adhesive.
5. Continue around the seal using the pry bar inside one foot sections of the seal, and the putty knife or chisel to separate the seal from the gland. An effort shall be made to separate the epoxy from the bottom of the gland rather than the seal.

NOTE: Periodically remove the pry bar and cut off the seal as needed to permit effective use of the bar.

6. Insert a stopper in the inflation port hole immediately after it is uncovered to prevent chips or solvents from entering into the port.
7. After the seal is removed, very carefully scrape out as much of the retaining epoxy as possible to minimize the amount of chemical stripper needed for cleanup.

NOTE: A thin bladed screwdriver or 1/8 diameter wire bent in a hook-type fashion may be used to clean adhesive from under gland ridges.

3.8.2 Seal Lubricant Removal The Dow Corning 55M silicone lubricant shall be removed with a cloth soaked in Moore solvent M-6 or M-114.

3.8.3 Epoxy Removal One of the following strippers shall be brushed on any remaining Chemlok Epoxy 304 until it is removed:

1. Oakite Stripper 157
2. Turco 5122
3. Turco 5351
4. Isochemstrip 708LV

To minimize the exposure of the retainer gland to the stripper, the stripper shall be applied to an area just large enough to cover the epoxy residue and extend past the edges approximately 1/6 inch. Significant softening of the epoxy will develop within 30 minutes. During this time the residue shall be removed with a putty knife or chisel. Immediately upon removal of the residue, the stripper shall be wiped off and the area wiped down with acetone and distilled water, and dried. Smooth over any scratched areas with fine emery cloth.

Rockwell International Corporation

CODE IDENT NO. 09974

NUMBER ST0620NA0095	REVISION LETTER	PAGE 13

4. QUALITY ASSURANCE PROVISIONS

4.1 Inspections Surveillance shall be provided during installation and removal of the seals to verify conformance to the requirements of 3.2 through 3.8.

4.1.1 Cleanliness and Installation The seals and seal glands shall be visually examined to determine conformance with the requirements in 3.5, 3.7, and 3.8. Visual examination shall be performed with the unaided eye (except for correction to achieve normal visual acuity). The level of light on surfaces being inspected shall be at least 100-foot candles of intensity as defined in ANSI A11.1. Evidence of contaminants on item surfaces shall be cause for recleaning the item in question and reinspecting for cleanliness. Seals that are damaged during installation or that are improperly sized for the application shall be rejected.

4.1.2 Inflatable Seal Leak Test The seal shall be inflated, after final closure of the seal runner assembly to 15 psig. The seal pressure shall then be isolated. After an initial minimum time period of 10 minutes to allow for pressure and temperature stabilization, there shall be no seal pressure loss greater than 0.1 psig over an additional minimum time period of one hour.

5. PREPARATION FOR DELIVERY Not applicable.

6. NOTES AND DATA Not applicable.

NUMBER	ST0620NA0095	REVISION LETTER	PAGE
			14

CODE IDENT NO. 09874

Figure 1. Seal Nomenclature and Component Parts Identification

NUMBER ST0620NA0095	REVISION LETTER										PAGE 15

a) Squeeze Tube and Extruding Tool

b) Adhesive Template

Figure 2. Adhesive Application Tools

Rockwell International Corporation

CODE IDENT NO. 09974

NUMBER	REVISION LETTER	PAGE
ST0620NA0095		16

a) Roller Press

b) Hand Press

Figure 3. Seal Seating Tools

NUMBER		ST0620NA0095		CODE IDENT NO. 09974	
REVISION LETTER				PAGE	
				17

Figure 4. Use of Seal Roller Press

Rockwell International Corporation

CODE IDENT NO. 09974

NUMBER	REVISION LETTER	PAGE
ST0620NA0095		18

Figure 5. Seal Base-Seating Roller

Rockwell International Corporation

CODE IDENT NO. 09974

NUMBER ST0620NA0095	REVISION LETTER <table border="1"><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>									PAGE 19

Figure 6 Extruding Band of Adhesive into Gland

Rockwell International Corporation

CODE IDENT NO. 09974

NUMBER ST0620NA0095	REVISION LETTER								PAGE 20

Figure 7 Use of Spreading Tool

Rockwell International Corporation

CODE IDENT NO. 09974

NUMBER ST0620NA0095	REVISION LETTER <table border="1"><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>											PAGE 21

Figure 8 Inflation Port in Gland

Rockwell International Corporation

CODE IDENT NO. 09974

NUMBER ST0620NA0095	REVISION LETTER <table border="1"><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>									PAGE 22

Figure 9 Inflation Stem with Adhesive

Rockwell International Corporation

CODE IDENT NO. 09974

NUMBER	ST0620NA0095	REVISION LETTER							PAGE	23

Figure 10 Use of Seal Seating Press Roller

NUMBER	ST0620NA0095	REVISION LETTER	PAGE
			24

a) Starting Cutout

b) Cutout Complete

c) Cutting through Seal

d) Removing Seal with Epoxy

Figure 11
REMOVAL OF EPOXY BONDED INFLATABLE SEAL