

# “Target Hot Cell Adsorbers”

**Radial-flow carbon adsorber for  
removal of radio-mercury**

**NUCON International, Inc  
Columbus, OH 43229  
[www.nucon-int.com](http://www.nucon-int.com)**

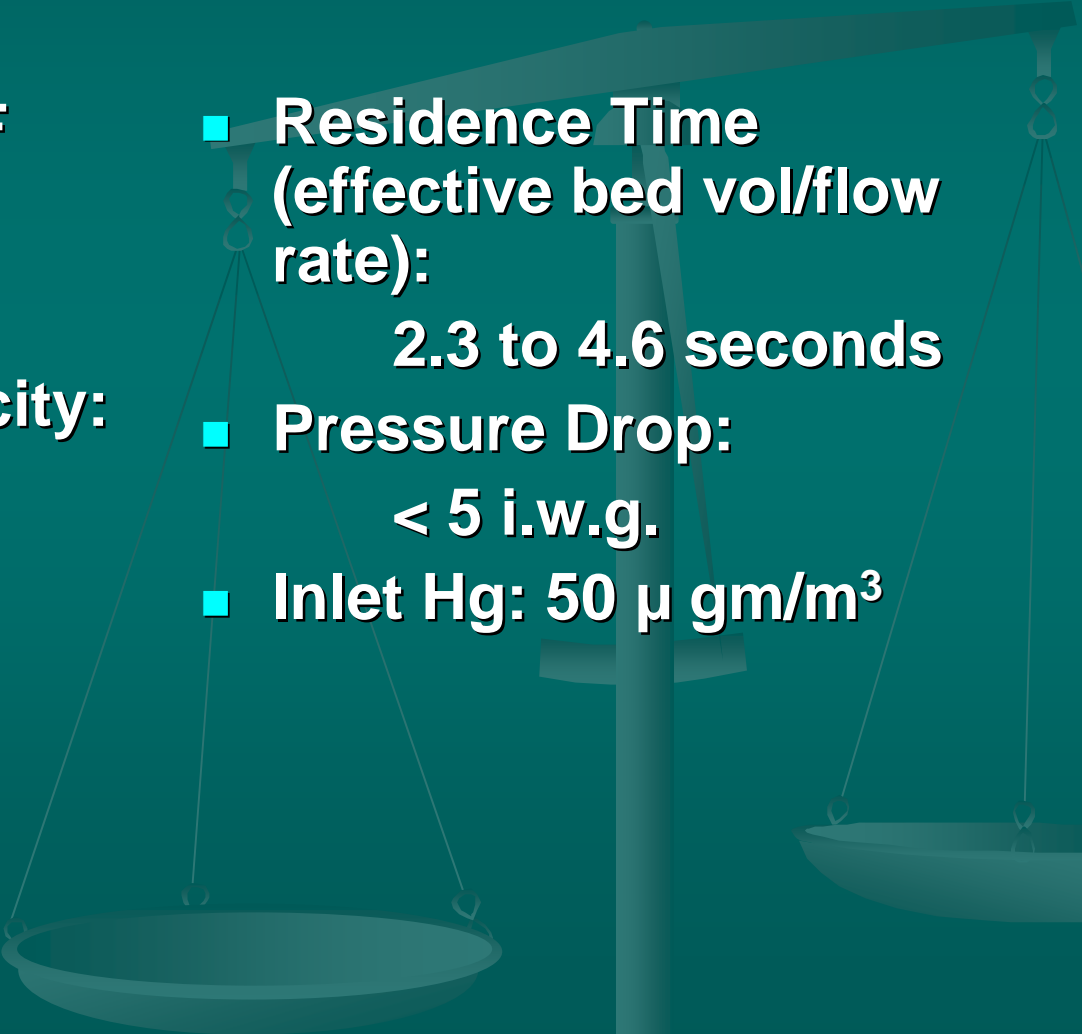
# Abstract

- **Design, manufacture and test a radial-flow adsorber system for installation at ORNL for removal of radio-mercury.**
- **Hardware and adsorbent design and performance “based” on ASME N509-1989 and ASME AG-1-1997, with specific exceptions**

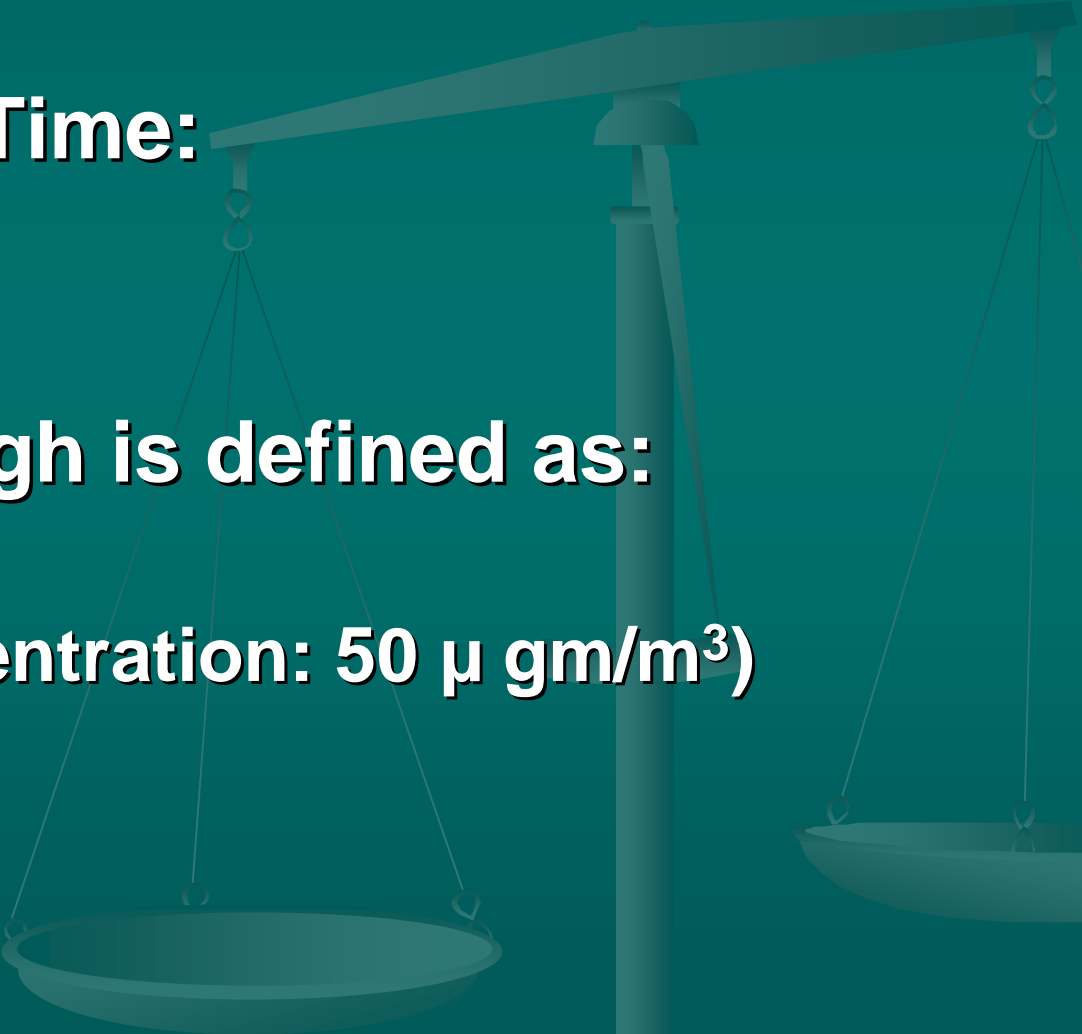
# Design Requirements

- **ASME AG-1-1997, Article FE, Type III adsorber, except:**
  - Removable/Replaceable Adsorber Cartridge
- **ASME AG-1-1997, Article FF, except:**
  - Adsorbent for radioactive mercury removal
- **ASME N-509-1989, except:**
  - No adsorbent handling system

# Operating Conditions

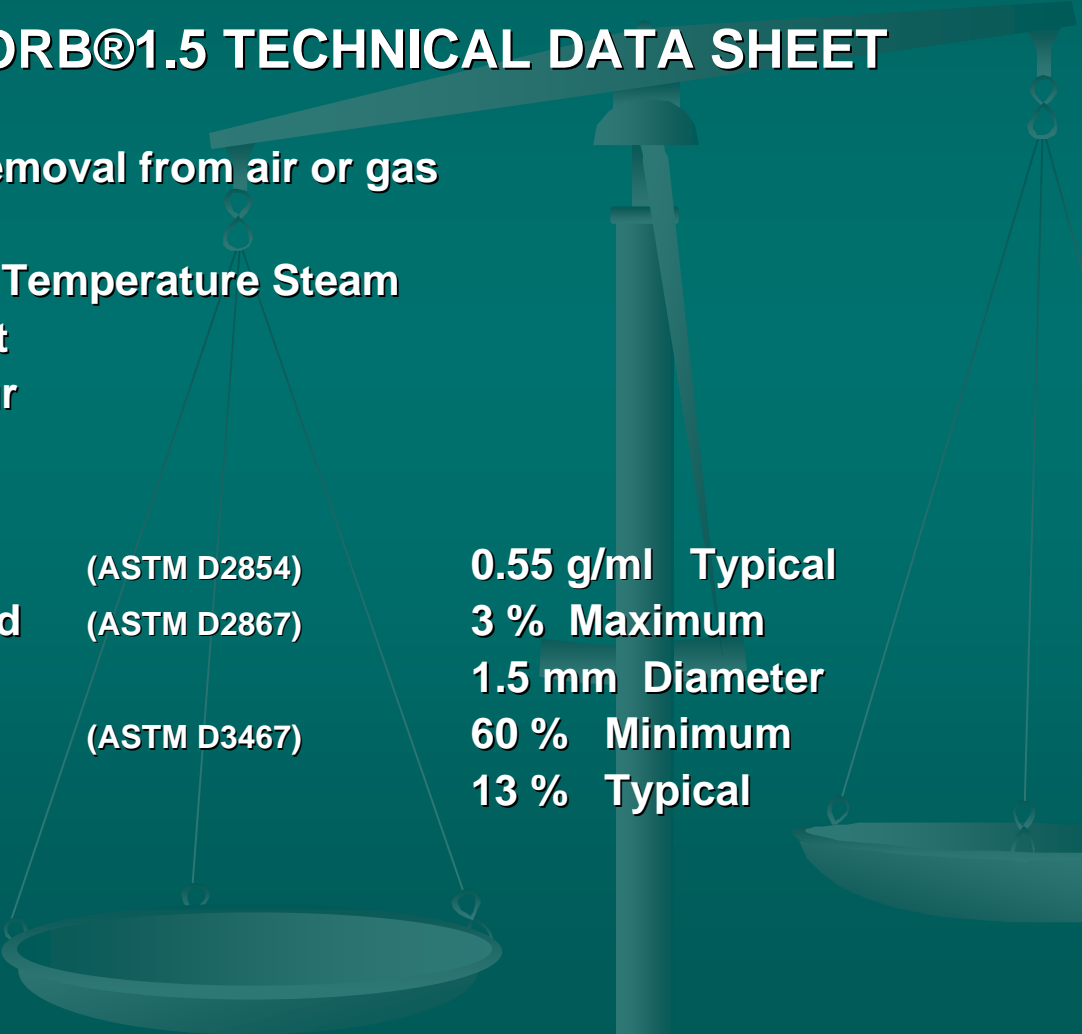
- Temperature: 100° F
  - RH: 25-50%
  - Bed Depth: 13 in.
  - Superficial Air Velocity: 30 ft/min
  - Min. Bed Vol. 30 ft<sup>3</sup>
  - Max. Flow Rate: 440 acfm
  - Residence Time (effective bed vol/flow rate): 2.3 to 4.6 seconds
  - Pressure Drop: < 5 i.w.g.
  - Inlet Hg: 50 μ gm/m<sup>3</sup>
- 

# Performance Requirements

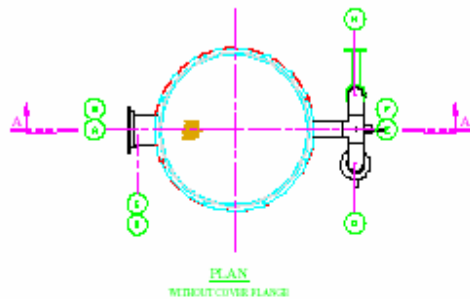
- **Breakthrough Time:**  
200-400 days
  - **Hg Breakthrough is defined as:**  
0.01  $\mu\text{ gm/m}^3$   
(Inlet Hg concentration: 50  $\mu\text{ gm/m}^3$ )
- 

# Mercury Removal Adsorbent

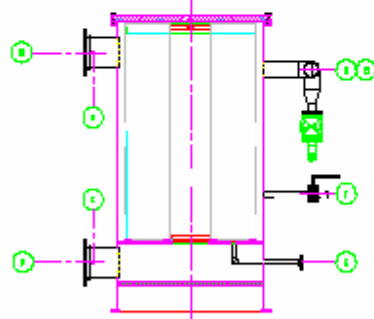
## ■ NUSORB® MERSORB®1.5 TECHNICAL DATA SHEET



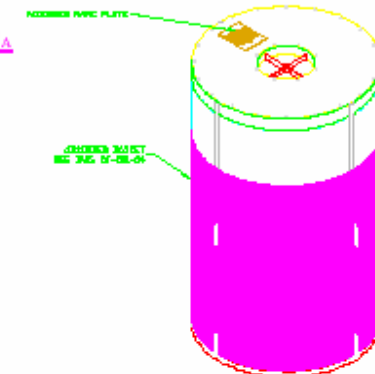
■ Typical Applications	Hg removal from air or gas	
■ Raw Material:	Coal	
■ Activation Method	High Temperature Steam	
■ Particle Type:	Pellet	
■ Impregnant	Sulfur	
■ PHYSICAL PROPERTIES:		
■ Apparent Density	(ASTM D2854)	0.55 g/ml Typical
■ Moisture Content, as packaged	(ASTM D2867)	3 % Maximum
■ Particle Size		1.5 mm Diameter
■ Carbon Tetrachloride Activity	(ASTM D3467)	60 % Minimum
■ Sulfur Content		13 % Typical



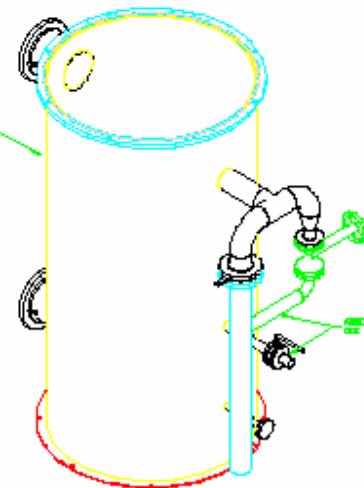
PLAN  
WITHOUT COVER PLATE



SECTION A-A



ADSORBER HOUSING  
SEE DWG. CF-501-01



EXPLODED ISOMETRIC

NOZZLE SCHEDULE					
ITEM	SIZE	CLASS	TYPE	SERVICES	
1	8"	LSM	RF SLOP DM	INLET	
2	8"	LSM	RF SLOP DM	OUTLET	
3	1/4"	-	PPY	DIFF. PRESSURE	
4	1/4"	-	PPY	DIFF. PRESSURE	
5	3"	LSM	RF SLOP DU W/ DR. FLG.	TEST PORT	
6	1/2"	LSM	RF SLOP DM	FIRE PROTECTION	
7	1/2"	LSM	RF SLOP DM	SAFETY VENT	
8	8"	LSM	RF SLOP DM	MANUAL VENT	

DESIGN & FABRICATION	
ASME SECTION VIII, DIV. 1, SEEN	
OPERATING	
PRESSURE (PSI)	0
TEMPERATURE (°F)	400 (M), 400 (M)
WIND LOAD	30 E -15
FLOW RATE (MGD)	1/2
PRESSURE (PSI) (M)	440
SEISMIC FOR WIND (FROM CLASSIFIED CODE)	0.2500 (M) (M)
CONSTRUCTION ALLOWANCE	0"
HYDROGRAPH EXPERIMENT	NONE
D.P. IMPROVED FILTER HOUSING	NUCON PROCEDURE
FRAME SEAL WELD	700-126 REV 7
MATERIALS	
SHIELD	ASME B31.1
HEAD	ASME B31.1
NOZZLE HOUSING	304L STAINLESS STEEL
REINFORCED FRAME (INTERNAL)	NONE
REINFORCED FRAME (EXTERNAL)	NONE
NOZZLE FLANGES	ASME B31.1, 304L STAINLESS STEEL
VACUUM RING	NONE
BOLTS	SAE-A286 COLD WORKED BOLT
FLUTS	NONE
GASKETS & O-RINGS	NEOPRENE
LUTERALS	304L STAINLESS STEEL
FILTER SUPPORT	304L STAINLESS STEEL
SUPPORT BOLT & BARE NUT	ASME B31.1, STAINLESS STEEL
TYPE OF HEAD	FLAT PLATE
WELDING	ASME SECT. II, 2001 EDITION
HEAT TREATMENT	NONE
TEST PROCEDURE	PRELIMINARY - 0 PFG
FORMING WELD ALLOW. LEAKAGE	200 FC TO 600 FC IN 1" DIA.
TEST PROCEDURE	NUCON TORQUE (PARAMETRIC)
WEIGHT EMPTY	2,300 LBS
OPERATING WEIGHT	3,000 LBS
WEIGHT FULL OF WATER	4,100 LBS
OPERATING STAINLESS	SEE 45-1
SAFETY CLASSIFICATION	NONE
PER. RACON PROCEDURE	17-03 REV 8
LEAK TEST FILTER	940 TUCKER/1/1/1
PER. RACON PROCEDURE	70-103 REV 4
PER. RACON PROCEDURE	70-103 REV 4
PER. RACON PROCEDURE	70-103 REV 4



HOUSING NAME PLATE  
SEE NOTE 4



ADSORBER NAME PLATE  
SEE NOTE 5

- NOTES
- SEE DWG. CF-501-01 & 02 FOR HOUSING DETAILS
  - SEE DWG. CF-501-01 & 02 FOR ADSORBER DETAILS
  - SEE DWG. CF-501-01 FOR PIPING DETAILS
  - XXX - 181, 182 TO 184 FOR
  - YY - 01, 02 THROUGH

NO.	DATE	BY	CHKD.	APPV.	REVISION
1	10/10/00	JAC	JAC	JAC	REV. 1
2	10/10/00	JAC	JAC	JAC	REV. 2
3	10/10/00	JAC	JAC	JAC	REV. 3
4	10/10/00	JAC	JAC	JAC	REV. 4
5	10/10/00	JAC	JAC	JAC	REV. 5
6	10/10/00	JAC	JAC	JAC	REV. 6
7	10/10/00	JAC	JAC	JAC	REV. 7
8	10/10/00	JAC	JAC	JAC	REV. 8
9	10/10/00	JAC	JAC	JAC	REV. 9
10	10/10/00	JAC	JAC	JAC	REV. 10

REVISION RECORD

**NUCON**

7000 HANCOCK ROAD, COLUMBIA, MD 21046-0001

KNIGHT/JACOBS  
SRS PRODUCT SIGHT

NUCONRY ADSORBER  
ASSEMBLY

REV. 10  
D CF-501-01

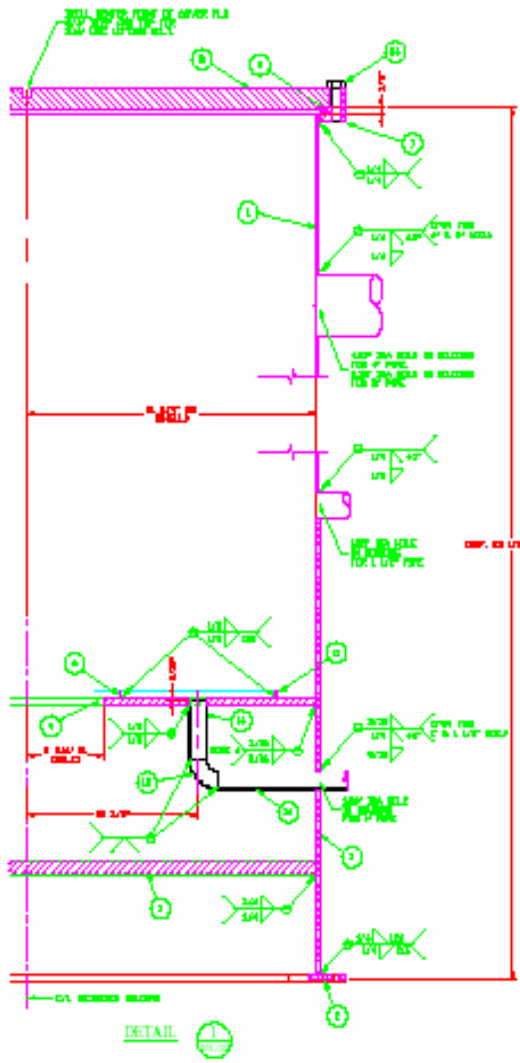
# General Arrangement

30000

# Housings



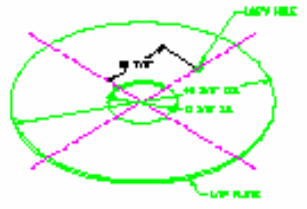




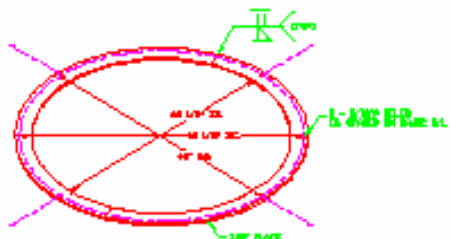
DETAIL 1



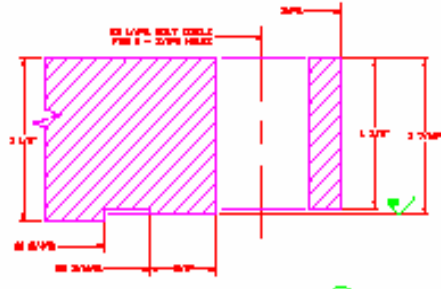
SEAL RING DETAILS - ITEMS 1 & 2



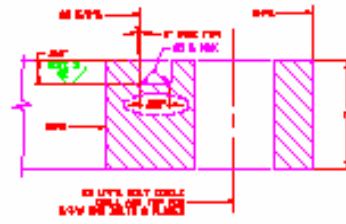
ADSORBER SUPPORT PLATE DETAIL - ITEM 3



BASE PLATE DETAIL - ITEM 4



COVER FLANGE DETAIL - ITEM 5



WELDED FLANGE DETAIL - ITEM 6

# Housing Detail

- NOTES**
- 1 SEE DWG. CP-501-B FOR MIDDLE SCHEDULE
  - 2 SEE DWG. CP-501-C FOR ADDITIONAL HOUSING DETAILS
  - 3 FINISH TOP FOR INSIDE OF WELD ISLAND
  - 4 LUGS SUBJECT TO INSPECTION PER INDUCTION PROCEDURE
  - 5 SEE-103 REV 7
  - 6 MAKE 3/16" X 1/2" HOLES & PIPES TO BE FINISH WITH INSIDE OF HOUSING WALL

Q	DATE	REVISION	BY	CHKD.	APP'D.	REV. NO.
<b>REVISION RECORD</b>						
<b>NULON</b>						
2000 Huntingdon Columbus, Ohio 45006-0000						
KNIGHT/MOORE 3045 SPEEDFIT DRIVE						
LITTLERY ADMINISTRATIVE HOUSING DETAILS - INT 2 OF 3						
CP-501-03						0

# Adsorber/Cartridge



# Housing-Bottom View



# Adsorber Cartridge- Bottom View



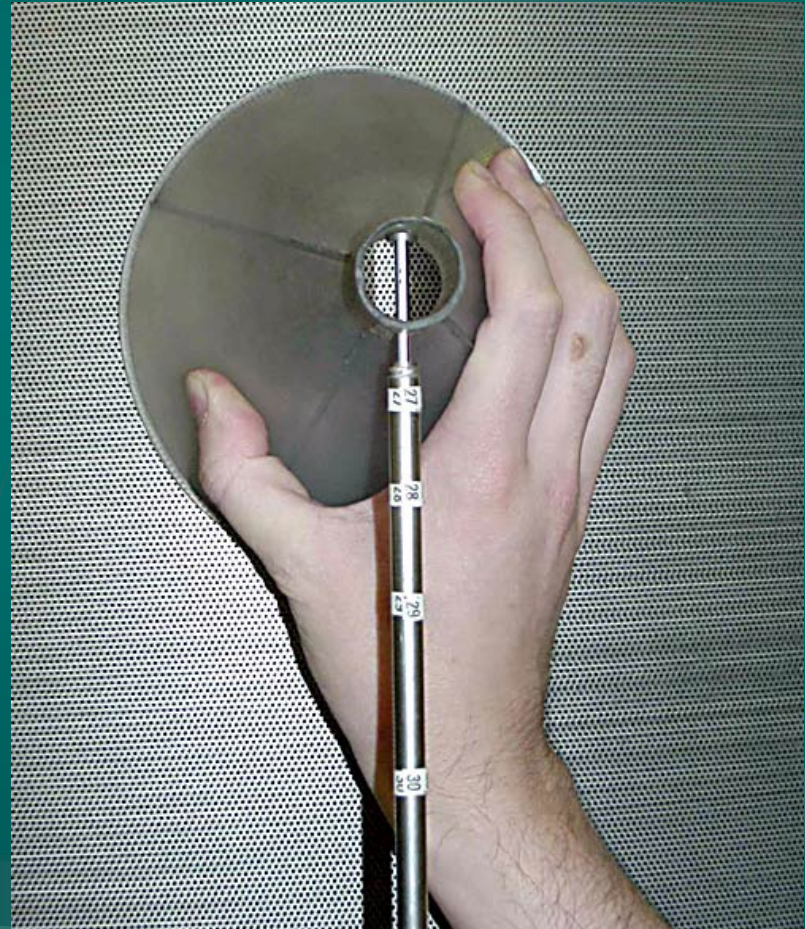
# Filling



# Bed Sampling



# Flow Distribution Testing



# Filled Weight



**Filled:** ~1720 lbs  
**Empty:** ~ 300 lbs  
**Net charge:** ~ 1420 lbs



# Seven of Eight

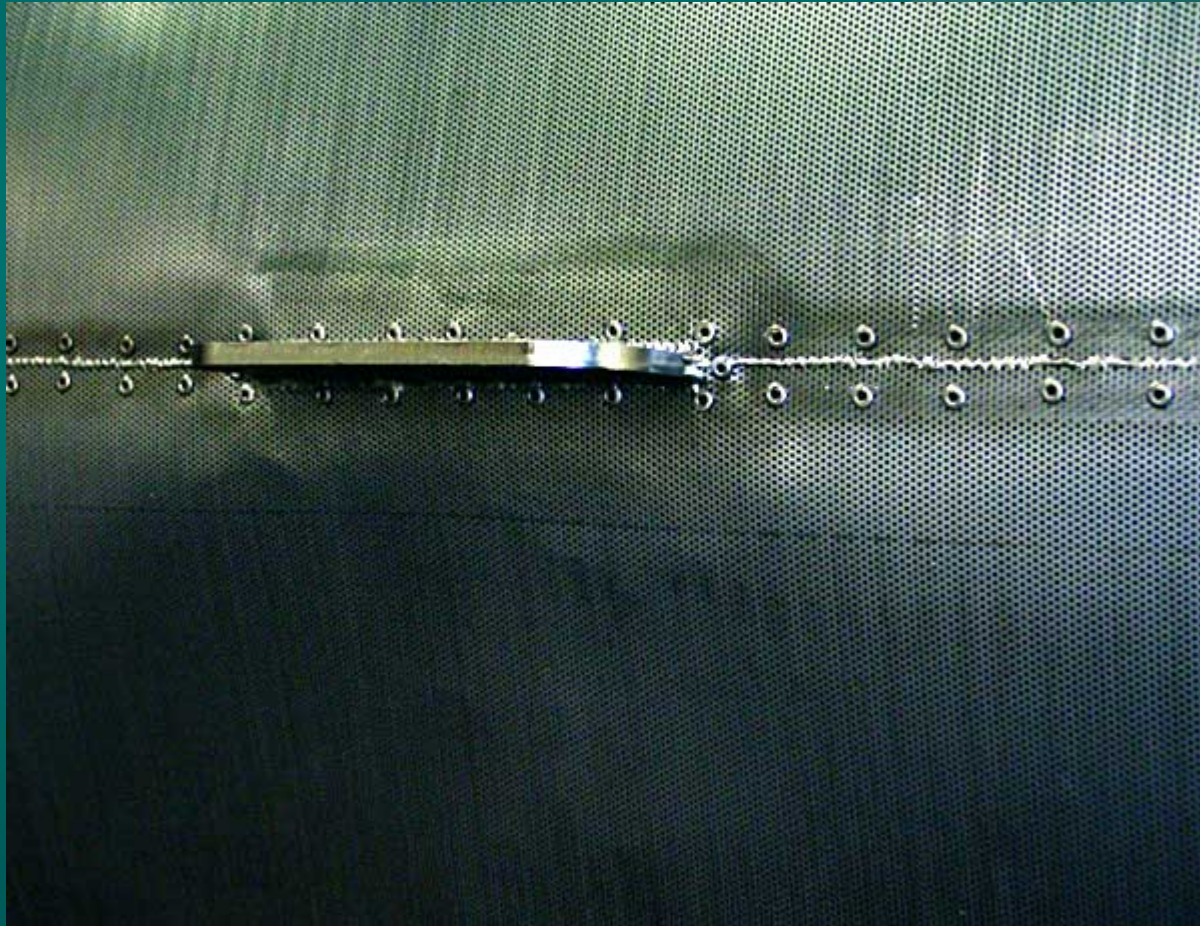


# Cartridge

(“guides” are spacers)



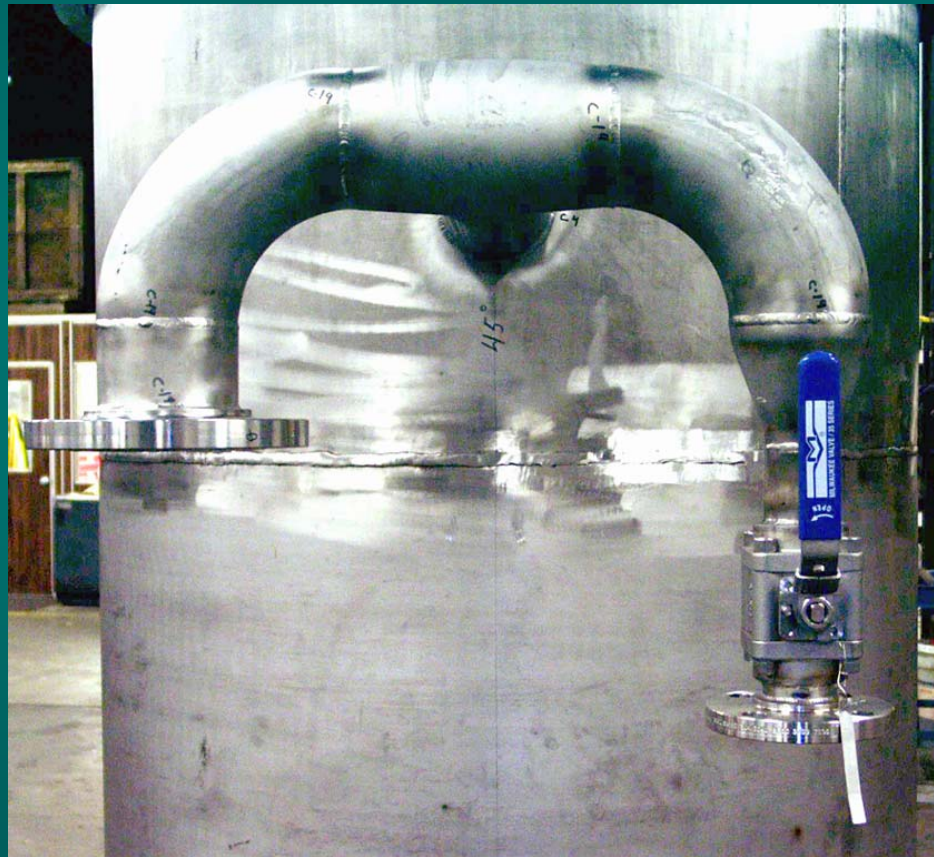
# “Guide” Detail



# Final Inspection

	Bed Depth	Tolerance	Diameter OD	Tolerance	Height	Tolerance	Part.	Rivet	Date	Name Plate	Adsorber Insertion
Serial #	13 3/4"	± 1/8"	39 1/2"	± 1/8"	64 3/16"	± 1/8"	Condition	Condition			Clearance
01	13 5/8	- 1/8	39 1/2	0	64 3/16	-0	Sat	Sat	28 Oct. 2008	Sat	Sat
02	13 5/8	- 1/8	39 1/2	0	64 3/16	-0	Sat	Sat	28 Oct. 2008	Sat	Sat
03	13 5/8	- 1/8	39 1/2	0	64 3/16	-0	Sat	Sat	28 Oct. 2008	Sat	Sat
04	13 5/8	- 1/8	39 1/2	0	64 3/16	-0	Sat	Sat	28 Oct. 2008	Sat	Sat
05	13 5/8	- 1/8	39 1/2	0	64 3/16	-0	Sat	Sat	28 Oct. 2008	Sat	Sat
06	13 5/8	- 1/8	39 1/2	0	64 3/16	-0	Sat	Sat	28 Oct. 2008	Sat	Sat
07	13 5/8	- 1/8	39 1/2	0	64 3/16	-0	Sat	Sat	28 Oct. 2008	Sat	Sat
08	13 5/8	- 1/8	39 1/2	0	64 3/16	-0	Sat	Sat	28 Oct. 2008	Sat	Sat

# Pressure Relief Fittings



# Completed/Filled Cartridge



# Completed Cartridge



# Ready for Shipment





# Thank You

**Larry Shaffer; Chief Engineer**

**Chris Ellis, Project Manager**

**Bill White, Designer**

**Burt Burgoon; Shop Manager**

**Tim Keller, QA Lead**

**Mark Preston, QA Chief Inspector**

**NUCON International, Inc**

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