“Target Hot Cell Adsorbers”

Radial-flow carbon adsorber for removal of radio-mercury

NUCON International, Inc
Columbus, OH 43229
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^3
- 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^3

Performance Requirements

- **Breakthrough Time:**
  200-400 days

- **Hg Breakthrough is defined as:**
  0.01 μ gm/m³
  (Inlet Hg concentration: 50 μ gm/m³)

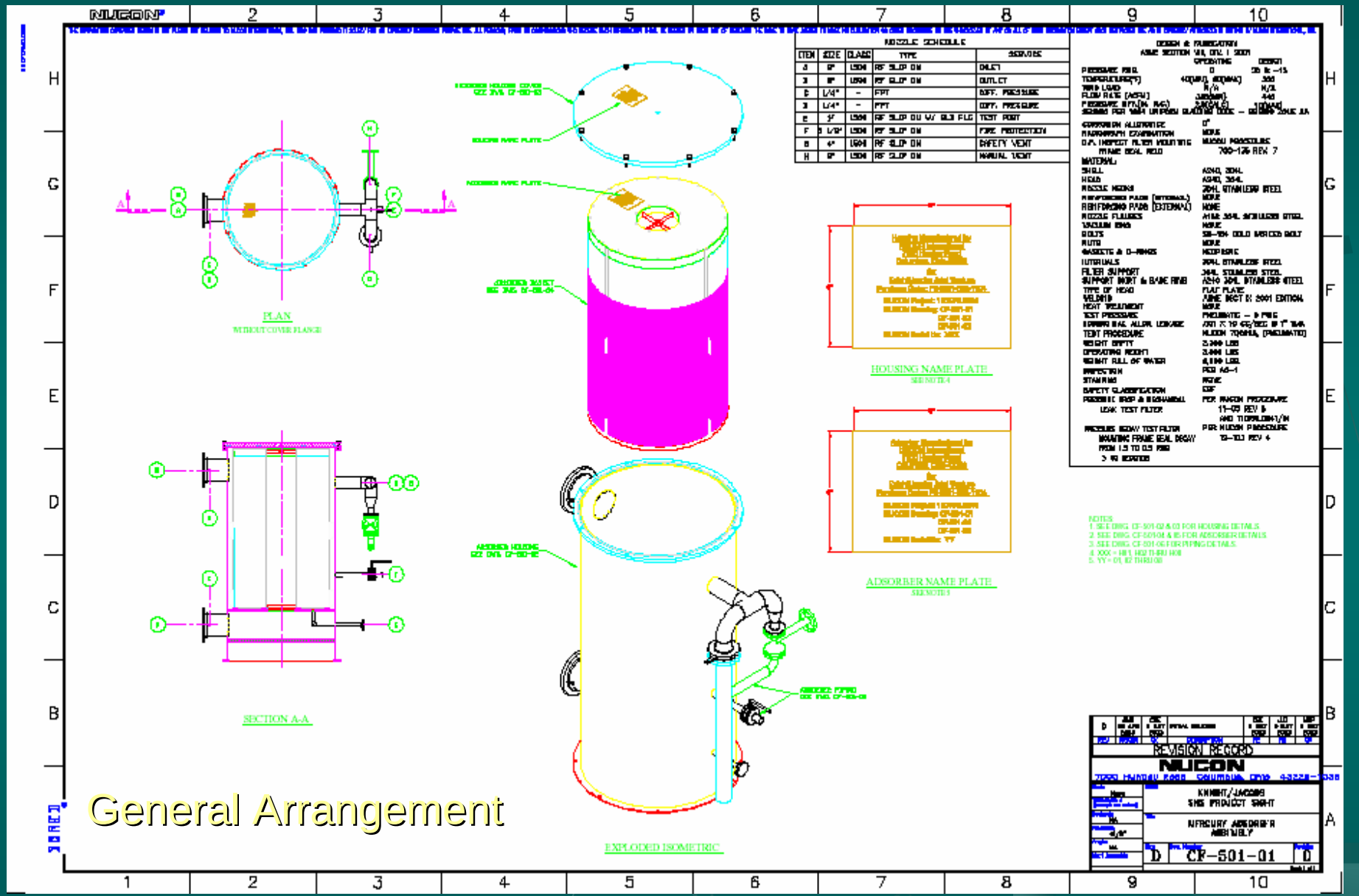
Mercury Removal Adsorbent

- **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**

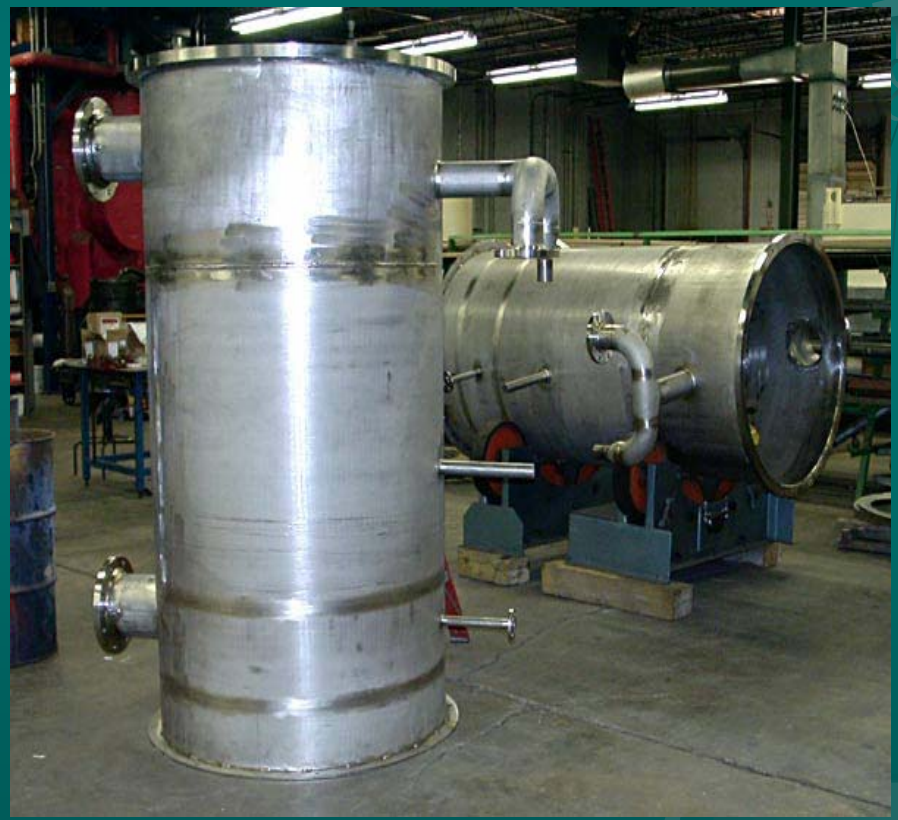
- **PHYSICAL PROPERTIES:**

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**

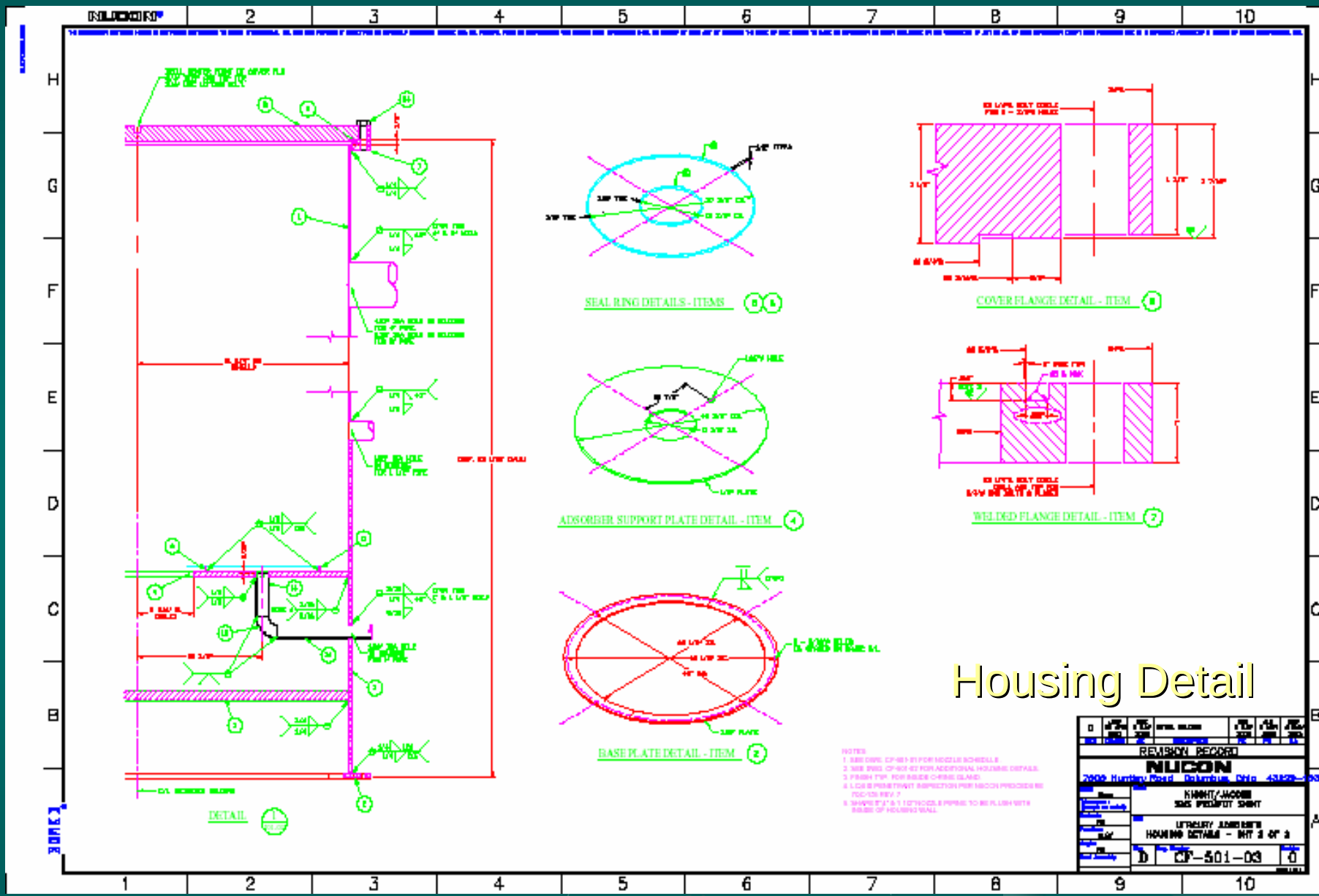


General Arrangement

Housings



Housing Detail



Adsorber/Cartridge

Housing-Bottom View

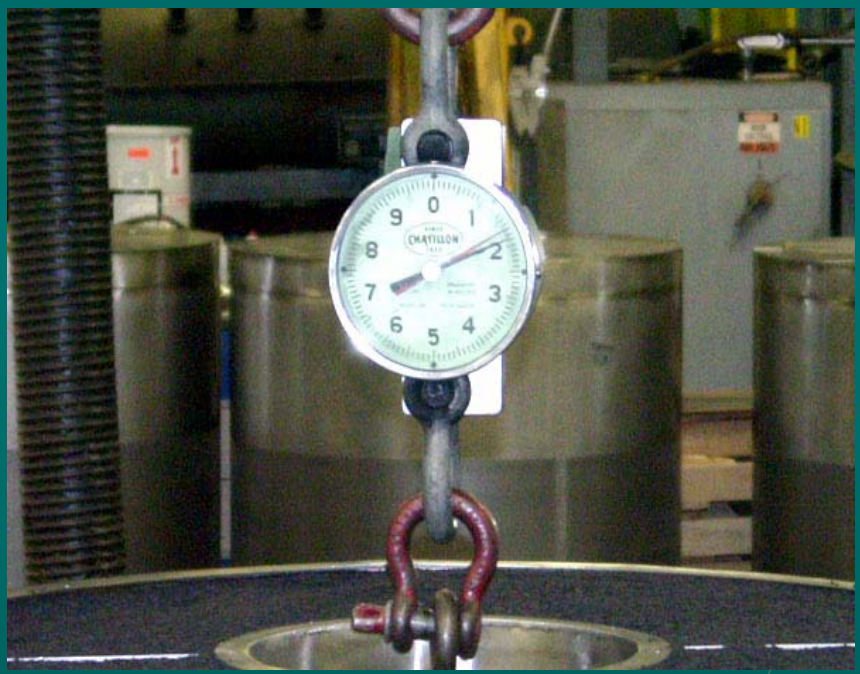
Adsorber Cartridge- Bottom View

Filling

Bed Sampling

Flow Distribution Testing

Filled Weight



Filled: **~1720 lbs**

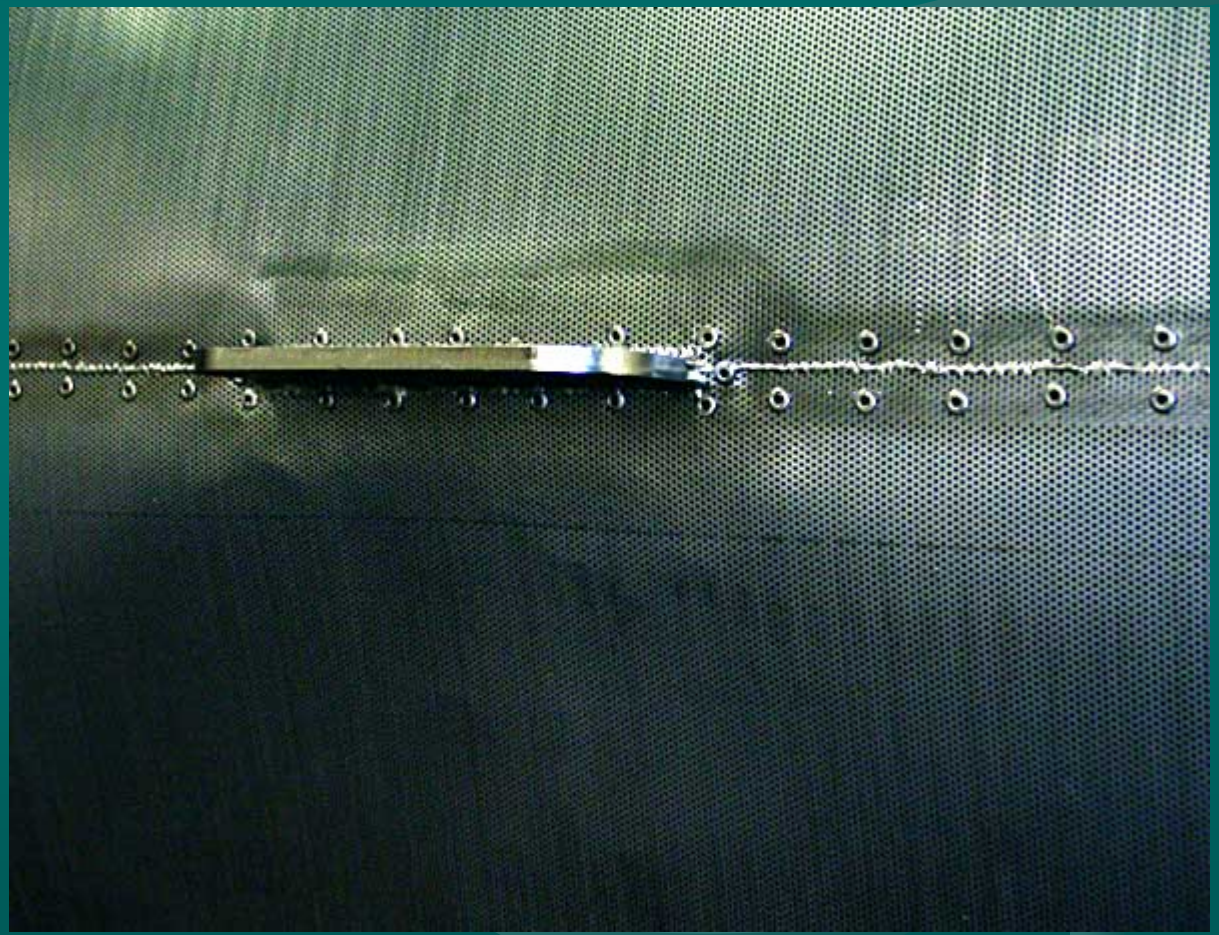
Empty: **~ 300 lbs**

Net charge: **~ 1420 lbs**

Seven of Eight

Cartridge
("guides" are spacers)

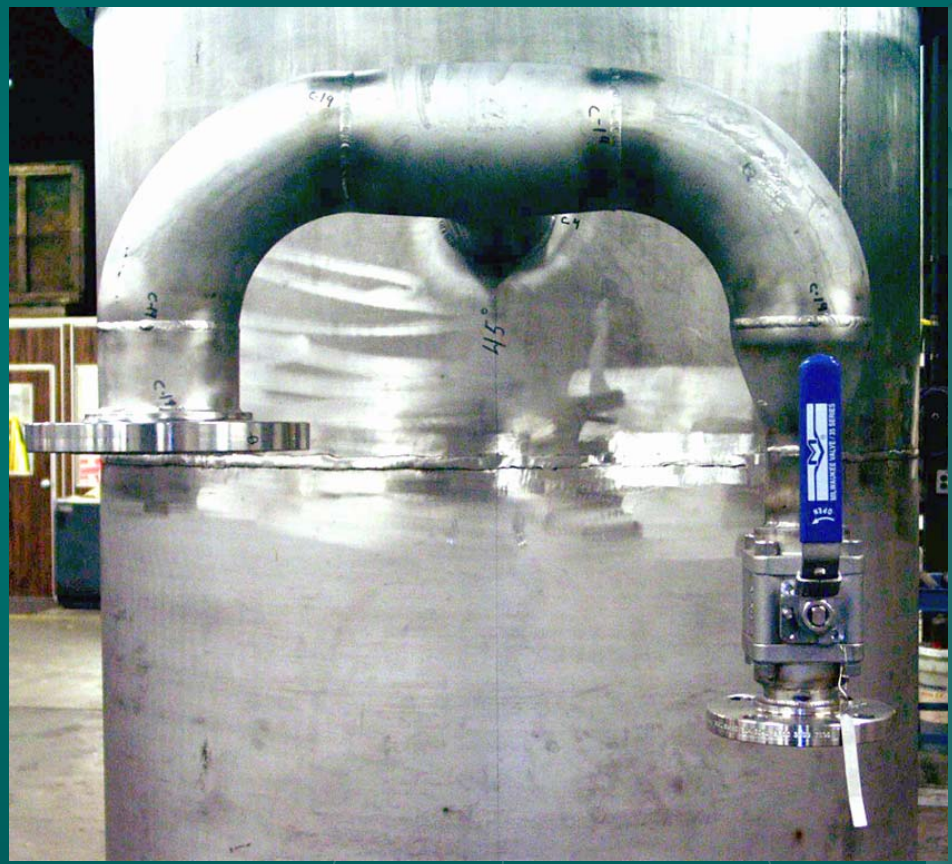
“Guide” Detail



Final Inspection

	Bed Depth	Tolerance	Diameter OD	Tolerance	Height	Tolerance	Perf.	Rivet	Date	Name Plate	Absorber 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. 2003	Sat	Sat
02	13 5/8	- 1/8	39 1/2	0	64 3/16	-0	Sat	Sat	28 Oct. 2003	Sat	Sat
03	13 5/8	- 1/8	39 1/2	0	64 3/16	-0	Sat	Sat	28 Oct. 2003	Sat	Sat
04	13 5/8	- 1/8	39 1/2	0	64 3/16	-0	Sat	Sat	28 Oct. 2003	Sat	Sat
05	13 5/8	- 1/8	39 1/2	0	64 3/16	-0	Sat	Sat	28 Oct. 2003	Sat	Sat
06	13 5/8	- 1/8	39 1/2	0	64 3/16	-0	Sat	Sat	28 Oct. 2003	Sat	Sat
07	13 5/8	- 1/8	39 1/2	0	64 3/16	-0	Sat	Sat	28 Oct. 2003	Sat	Sat
08	13 5/8	- 1/8	39 1/2	0	64 3/16	-0	Sat	Sat	28 Oct. 2003	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

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