



HOT CELL SERVICES *corporation*



**"ENGINEERING VIEWING SOLUTIONS FOR
RADIATION SHIELDING APPLICATIONS"**



HOT CELL SERVICES *corporation*

Reference: Viewing Products and Services for Radiation Shielding Applications

Dear Customer:

Hot Cell Services Corporation has been providing radiation shielding windows and services to the nuclear and medical industries for over 40 years.

We design and manufacture shielding windows from very small lead glass bricks, to large dry lead glass or oil filled lead glass windows, measuring up to six feet thick and weighing in excess of 24,000 pounds, (11,000 Kg).

We also manufacture shielding windows for gloveboxes with gloveport holes machined to your specification. Framed or unframed glovebox panels are available in lead glass, acrylic, lead acrylic and safety glass, or any combination laminated to meet your requirements.

We provide shielding window refurbishment in our facility and installation, extraction and maintenance services at the Customers facility. Our skilled technicians are Radworker II qualified and specifically trained to deal with radioactive contamination.

Our products are manufactured under a Quality Assurance Program that conforms to ASME NQA-1. The program covers all aspects of our work including design, shielding calculations, metal fabrication, glass processing, assembly, and testing within our facility.

Contained in our catalogue are brochures describing our products and services. Specifications for our radiation shielding glass can be found in the appendix. If we can be of assistance, please give us a call. You may also view our products and services on our website at www.hotcell.com. We look forward to working with you on your next radiation shielding project.

Sincerely,

Hot Cell Services Corporation
Zbigniew Tomalik
Managing Director



PRODUCTS

- Radiation Shielding Windows
- Lead Glass Bricks
- Lead Glass Slabs
- Neutron Shielding (acrylic & poly)
- X-Ray Glass
- Safety Glass
- Shielded Gloveboxes
- Glovebox Windows
- Shielded Fork Lift & Crane Windows
- View Ports
- Medical Protective Products

Pages 1-5

SERVICES

- Consulting and Engineering
- Shielding Analysis
- Shield Window Extraction/Installation
- Shield Window Refurbishment
- Shield Window Modification
- Glass Cutting, Grinding, & Polishing
- Maintenance Service
- Precision Waterjet Cutting Services
- Oil Testing

Pages 6-9

SUPPLIES

- Radiation Shielding Oil
- Oil Fill & Drain Kit
- Neoprene Bellows
- Stainless Steel Oil Expansion Tank
- Laboratory Towels
- Industrial Glass Cleaner
- Crystal Air Dryer
- Over Pressurization Tank
- Gaskets

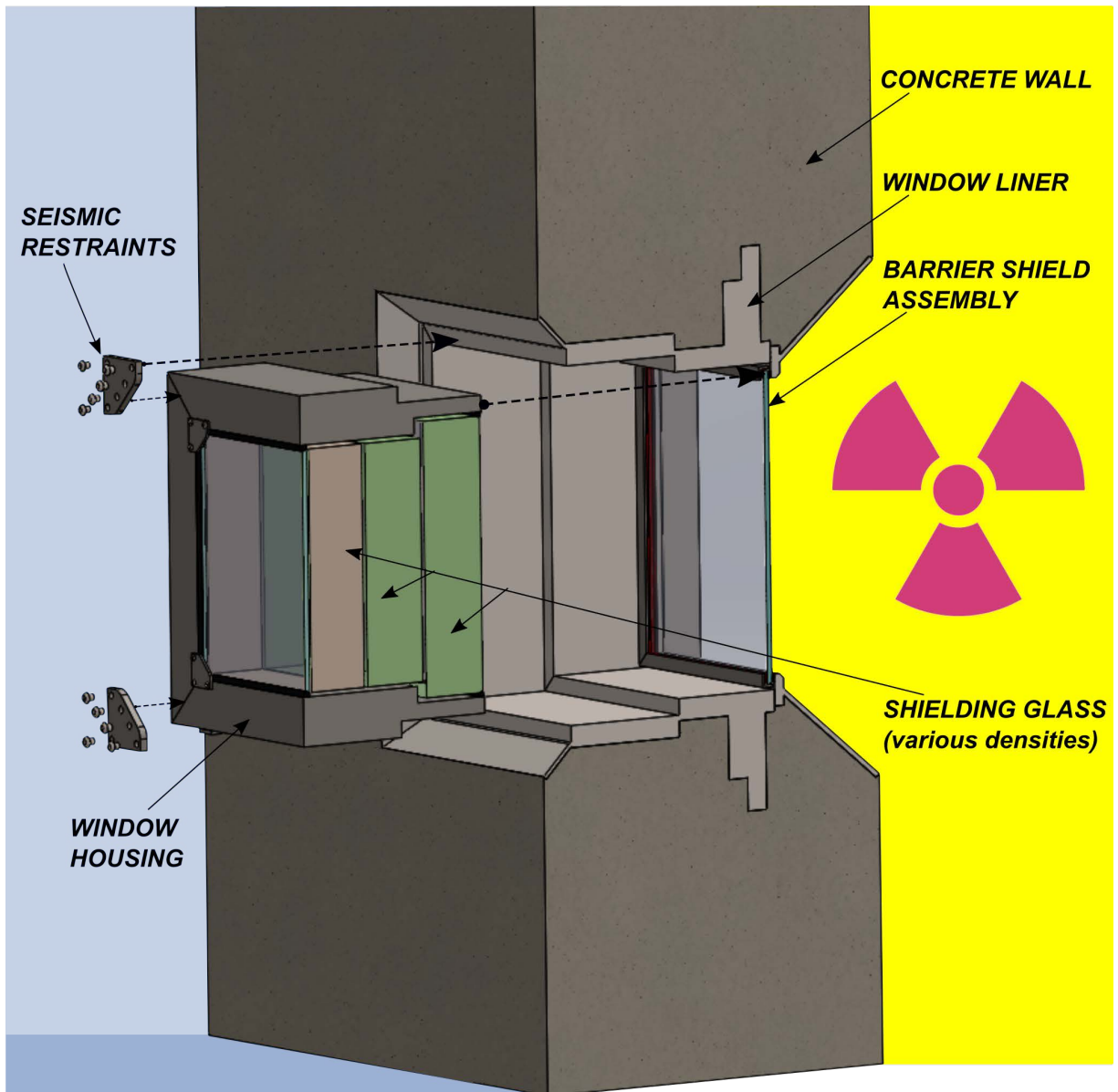
Pages 10 -12

APPENDIX

- Glass Specifications
- URA-RAD Gasket Specifications
- Oil fill and Drain Kit



SHIELDING WINDOW COMPONENTS



American Welding Society



NQA-1
COMPLIANT



RADIATION SHIELDING WINDOWS & VIEW PORTS

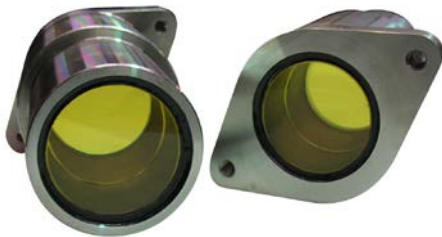
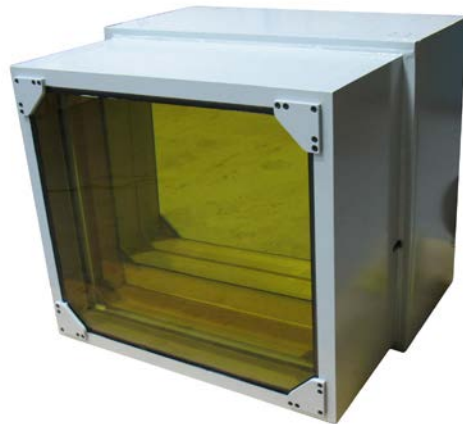
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- Dry Lead Glass Windows
- Oil Filled Lead Glass Windows
- Glovebox Windows
- X-Ray Glass Windows
- View Port Style Windows
- Neutron Windows

Our windows are designed in accordance with ASTM C1572/C1572M and manufactured under a quality assurance program which conforms to ASME/ANSI NQA-1. Welding meets specifications ASME Section IX or AWS D1.1/D1.6. Glass meets the requirements of ASTM C1572/C1572M and ASTM C1036. Certifications can be supplied on most window components.

We can design your window to meet general requirements or a detailed specification. Our engineers can provide recommendations to minimize the cost of new windows.

Shielding glass used in the windows is carefully selected to provide radiation shielding, prevent browning and protect against dielectric discharge. We use glass with the highest value of light transmission, and the best optical qualities available.



We have a large inventory of glass available which permits quick response to short lead times or emergency requirements.

Shielding window installation is available using our skilled technicians.

ASK ABOUT THESE NEW WINDOW OPTIONS

New Window Using Remanufactured Glass

Converting from Hot Side to Cold Side Load



LEAD GLASS BRICKS



Lead glass bricks are mounted in stainless steel frames with lead packing. The lead packing is covered with a black radiation resistant sealant.

These highly versatile lead glass bricks provide excellent visibility coupled with effective radiation attenuation. The lead glass bricks have a wide variety of applications and can be used in either permanent or temporary construction. The bricks are ideal for laboratory use.

The optical quality lead glass has a density of 5.2 g/cm^3 . It is available in both 2" and 4" thicknesses with shielding equivalences of 0.91" of lead and 1.83" of lead respectively.

The 5.2 density glass is water white which permits clear and natural viewing. Its internal light transmission is greater than 98% per inch thickness at 589 nm wavelength.

AVAILABLE SIZES AND FREEVIEW

External Frame Dimensions inch(cm)
Thickness: T = 2"(5cm) or 4"(10cm)

4 (10) x 8 (20) x T
8 (20) x 8 (20) x T
8 (20) x 12 (30.5) x T
12 (30.5) x 12 (30.5) x T
12 (30.5) x 16 (40.6) x T

Freeview inch(cm)

3.375 (8.6) x 7.375 (19)
7.375 (19) x 7.375 (19)
7 (17.8) x 11 (28)
11 (28) x 11 (28)
11 (28) x 15 (38)

Special sizes are also available.

Lead glass bricks are also available in 3.2 and 6.2 g/cm^3 density



MEDICAL PROTECTIVE PANELS

Used in light shielding applications including x-ray windows, gloveboxes, and in custom design laminations

Protection from devices which propagate x-rays is critical for the workplace safety of medical personnel. Our high quality x-ray shielding glass provides excellent light transmission and shielding characteristics.

Special applications for these panels include: Shielding glass bonded with ordinary float glass for use in glovebox panels. Multiple laminations of shielding glass for specified shielding and impact resistant characteristics. Custom etching of part numbers and logos. Anti-reflective glass panels bonded to shielding glass. Custom laminations can also include polycarbonate sheets such as Lexan, etc.

AVAILABILITY

Standard Thickness	5.7 - 7mm
	7 - 9mm
	8.5 - 10mm
	11 - 13mm
Lead Equivalence @ 150 kVolts	1.6 - 3.2mm (higher Pb equiv. available upon request)
Maximum Dimensions	1050 x 2100mm
Physical Properties	Density: 4.8g/cc
	Refractive Index (Nd): 1.75-1.79
	Light Transmission (550nm): ≥85%



X-Ray Window Panel

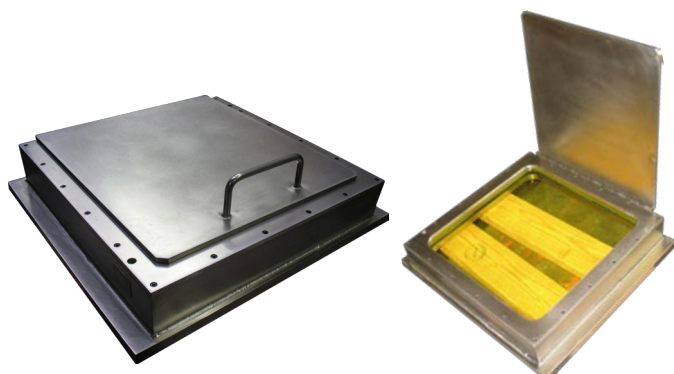


Glovebox Panel with Glove Ports



SPECIAL WINDOW PROJECTS

**We will engineer shielding
windows for your specialty
application**



Hot Cell Services can provide shielding windows in various configurations to meet your special requirements. This floor-mounted stainless steel housing uses a door to protect the glass when the window is not in use.

Hot Cell Services converted a large Zinc-Bromide window to an oil-filled window for our customer. Once completed this new window weighed in excess of 20,000 pounds. The original window viewing area was reduced to minimize the glass sizes, and a special housing was engineered to fit into the existing wall to provide adequate shielding. Our field service technicians both extracted and reinstalled this window for the customer.



Side Window
Panel



Hot Cell Services has engineered the only radiation shielding and bullet resistant glass panels. Our customer required these panels for a specialty vehicle that is both armored and shielded against radiation. Our manufactured panels were purpose tested to our customer's satisfaction.



FACTORY REFURBISHMENT OF RADIATION SHIELDING WINDOWS

Page 6

Radiation shielding windows can be completely refurbished to like new condition in our facility.

Existing windows are completely disassembled and each piece of shielding glass is removed from the weldment. The glass is chemically cleaned, reprocessed and machine polished.

The existing paint on the weldment is stripped away and any contaminants that may have penetrated the steel are removed. The weldment is inspected for cracks, repaired as necessary, sandblasted, leak tested and then recoated with a radiation resistant coating.

The newly polished glass slabs are reinstalled within the weldment using the latest techniques and new materials including lead, gaskets, sealant, hardware and oil. Seismic restraints are fabricated and installed as required. All materials used in the windows have been tested for compatibility. The shielding windows are leak tested and certified for usage.





CUSTOMER ON-SITE WINDOW REFURBISHMENT

For windows that cannot be shipped to our facility, we offer comprehensive on-site refurbishment services.

On-site window refurbishments will dramatically increase viewing through an older window that has experienced degraded optical clarity.

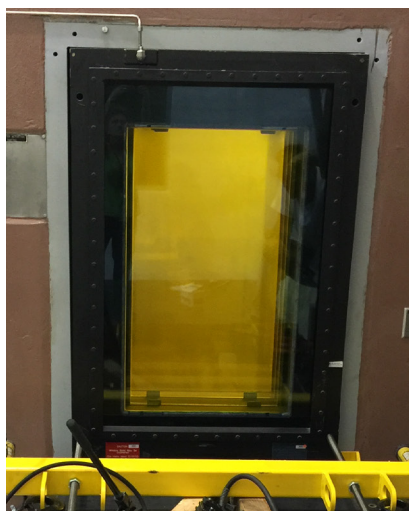
The process usually begins with a site visit from one of our engineers to determine the scope of your project and to identify any glass slabs that may require reconditioning or replacement. In most cases at least one piece of glass needs to be sent to our facility for processing.

Work begins when our technicians arrive on site. They extract the window, clean and inspect every accessible piece of glass, and returned to our facility any glass slabs that need to be reconditioned. We minimize downtime by making shipping arrangements in advance.

The window is reassembled with standard replacement items such as gaskets, oil, bolts, seismic restraints and lead packing where applicable. Finally, the shielding windows are leak tested, reinstalled into the wall and certified for usage.

Our field service technicians have decades of combined radiation window service experience, and each member of our team is rad worker certified.

BEFORE



AFTER





ADDITIONAL ON-SITE SERVICES

Our highly experienced field service technicians can help you with your radiation shielding windows. We offer a variety of services for the continued maintenance of your shielding windows, and we are always happy to provide you with our expert advice for your upcoming projects.

INSPECTION & CONSULTATION

Inspection and consultation are an important part of the overall services offered. Considerable savings can often be provided by identifying specific requirements or problems and developing a well planned maintenance program.

INSTALLATION & EXTRACTION SERVICES

We have skilled technicians and custom handling equipment for both the installation and extraction of your radiation shielding windows. Technique is extremely important due to the risk of dielectric discharge and glass damage.

Supervisory technicians are also available to assist the customer with extraction and installation of shielding windows.



OIL SERVICES

- Change
- Flush
- Test

Oil-filled shielding windows require regular maintenance. We recommend changing your oil every 1-3 years depending on in-cell conditions. If the window has not been serviced on a regular basis, then we can flush the oil to remove contaminants. Our oil testing service will provide you with a comprehensive report so that you can make an informed decision.

GASKETS SERVICES

- Replace
- Remanufacture
- Redesign
- Consult

A shielding window requires a variety of gaskets to achieve a proper seal. We offer highly radiation resistant URA-RAD gaskets, custom designed EPDM gaskets, and general rubber gaskets for sealing.

On-site window gasket changes are performed by our field service technicians. See pages 11-12 for additional gasket information.



OTHER SERVICES

- Engineering
- Shielding Analysis

Over the last 40 years, Hot Cell Services has developed comprehensive manufacturing processes relating to radiation shielding windows.

GLASS SIZING, GRINDING, & REPOLISHING

Existing glass blocks can be resized to remove defects and to meet new design requirements. Lead glass shielding slabs are easily scratched, chipped, etched or stained. The glass slabs can be ground to remove surface defects. The glass optical surfaces can then be repolished to a new finish which meets or exceeds the original polish quality.



Glass Slab Resizing

PRECISION WATERJET CUTTING

Our trained waterjet operators have developed proprietary cutting techniques for glass slabs, laminated panels, rubber and metal plates to meet your specifications. All parts are inspected and certified through our NQA-1 program.



Waterjet Cut Glass and Aluminum





STANDARD SUPPLIES

We carry an inventory of
certified spare parts for
all of your window
maintenance needs

Page 10

Each of the items offered below are certified through our NQA-1 program. For any questions about our standard supplies, or if you want to purchase items, please contact us at hotcell@hotcell.com.

ITEM	STOCK NO.
Shielding Oil (processed, purged & tested)	
Sontex 100LT1, 55 gal. drum	1100SO
One Case, (4) 1 gal. jugs	1108SO
One Can, 5 gal.	1109SO
Stainless Steel Oil Expansion Tank	
8" x 8" x 12"	1101ETL
5" x 5" x 12"	1101ETS
Neoprene Bellows – 3 liter capacity	1102NB
Air Dryer Assembly (w/ crystal element)	1104CR
Air Dryer Replacement Element	1104CRE
Rubber & Gasket Adhesive	
Case (36) 5 oz tubes	1107RGAC
(1) 5 oz tube	1107RGAT
1 Qt.	1107RGAQ
Non-Scratch Glass Cleaning Towels	
Box	1109ST
Case, (10) boxes	1109CS
Optical Glass Cleaner	
19 oz. Spray Can	1105CN
Case, (12) 19 oz. Spray Cans	1105CS
Helium Gas Leak Detector	1202HGD
Oil Fill and Drain Kit	1201QD*
*see appendix for details	



Shielding Oil
Sontex 100LT



Expansion Tank
1101ETL



Bellows
1102NB



Air Dryer Assembly
1104CR



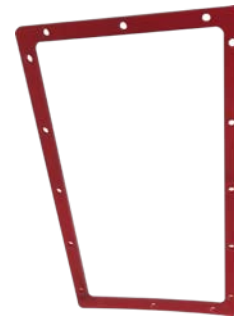
GASKETS

**We will manufacture
custom gaskets for your
window sealing application**

We offer various gasket materials for sealing radiation shielding windows. Our engineers can advise you on which gasket would be best for your application. All of our gaskets are custom made to meet your specifications. When cut or extruded, all of our gaskets are NQA-1 certified. See below for typical applications of each material. We have extensive experience designing and installing all types of gaskets. Please contact us about your special application.

URA-RAD

URA-RAD gasket material is a radiation resistant cast urethane elastomer. It has been radiation tested to 1×10^9 Rads without significant degradation. Available in 75 and 85 Shore A durometer hardness. Standard sheets are available up to 1/2" thicknesses and 48" wide. Other sizes and thicknesses can also be manufactured. URA-RAD is commonly used to seal oil filled shielding windows and should be replaced during regular maintenance. See appendix for material specifications.



Precision cut URA-RAD gaskets typically used in oil windows

KVC-RAD

KVC-RAD gaskets are very durable and offer excellent chemical resistance. Available in thicknesses up to 1/4" and maximum widths of 48", and offered in 75 and 80 durometer harnesses. KVC-RAD is used in both dry and oil filled shielding windows in high dose environments.



New windows are manufactured with the gasket materials that best meets your application



GASKETS

NEOPRENE

Neoprene gaskets are typically offered in extruded form for use around glovebox panels and other low dose applications. Custom cross-sections can be designed for your specific application, and multiple grades are available.



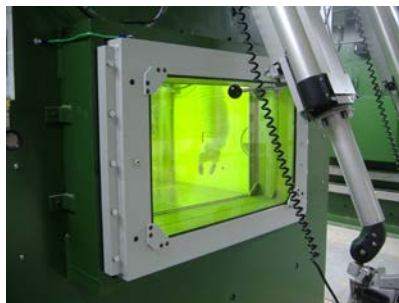
Extruded neoprene gasket with molded corner

EPDM

EPDM gaskets offer excellent resistance to ozone and water-based chemicals. They are available in sheets or extrusions from 40 to 80 durometer. Several thickness options are available up to 1/2" and widths up to 48". EPDM is typically used to seal dry shielding windows in high dose environments. Multiple grades are available.



Precision cut EPDM gasket typical for cover glass frames

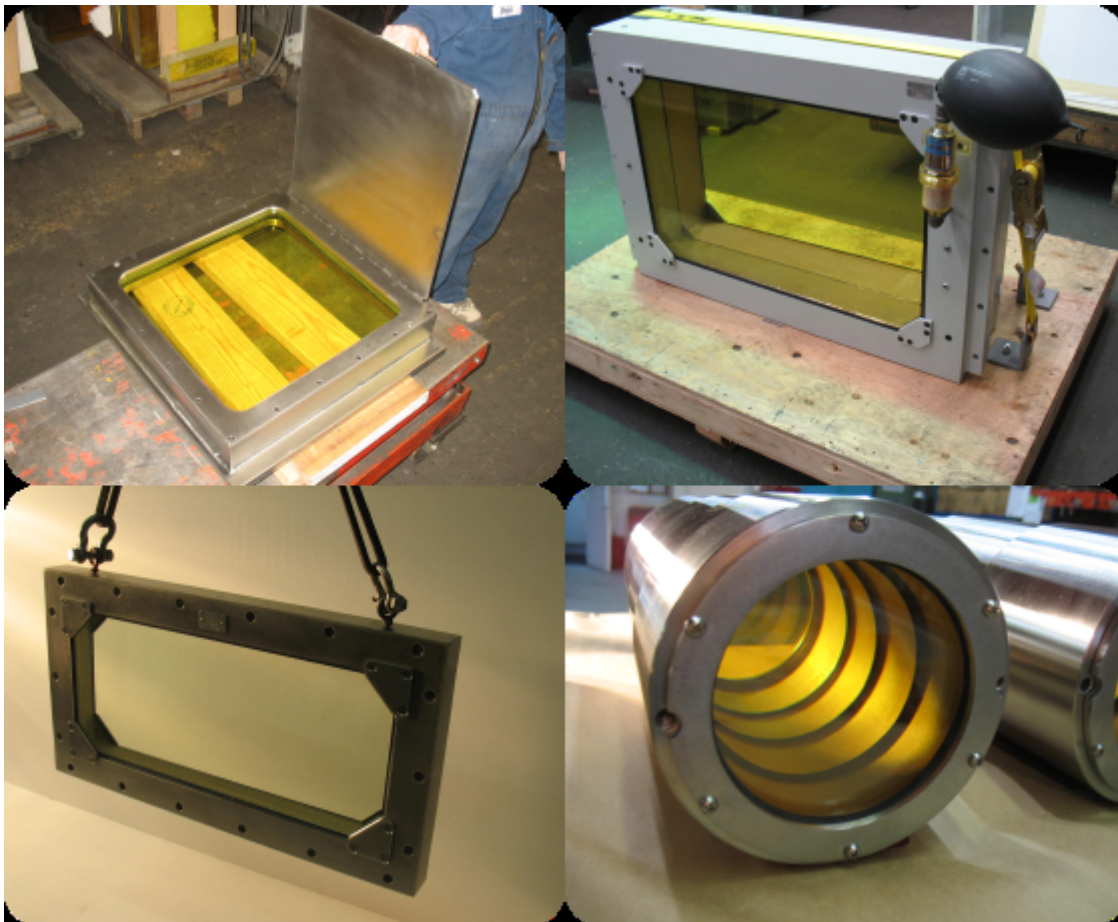


Worn-out gaskets can cause loss of containment and/or loss of shielding oil. Our professional field service technicians can replace your window's gaskets on-site.



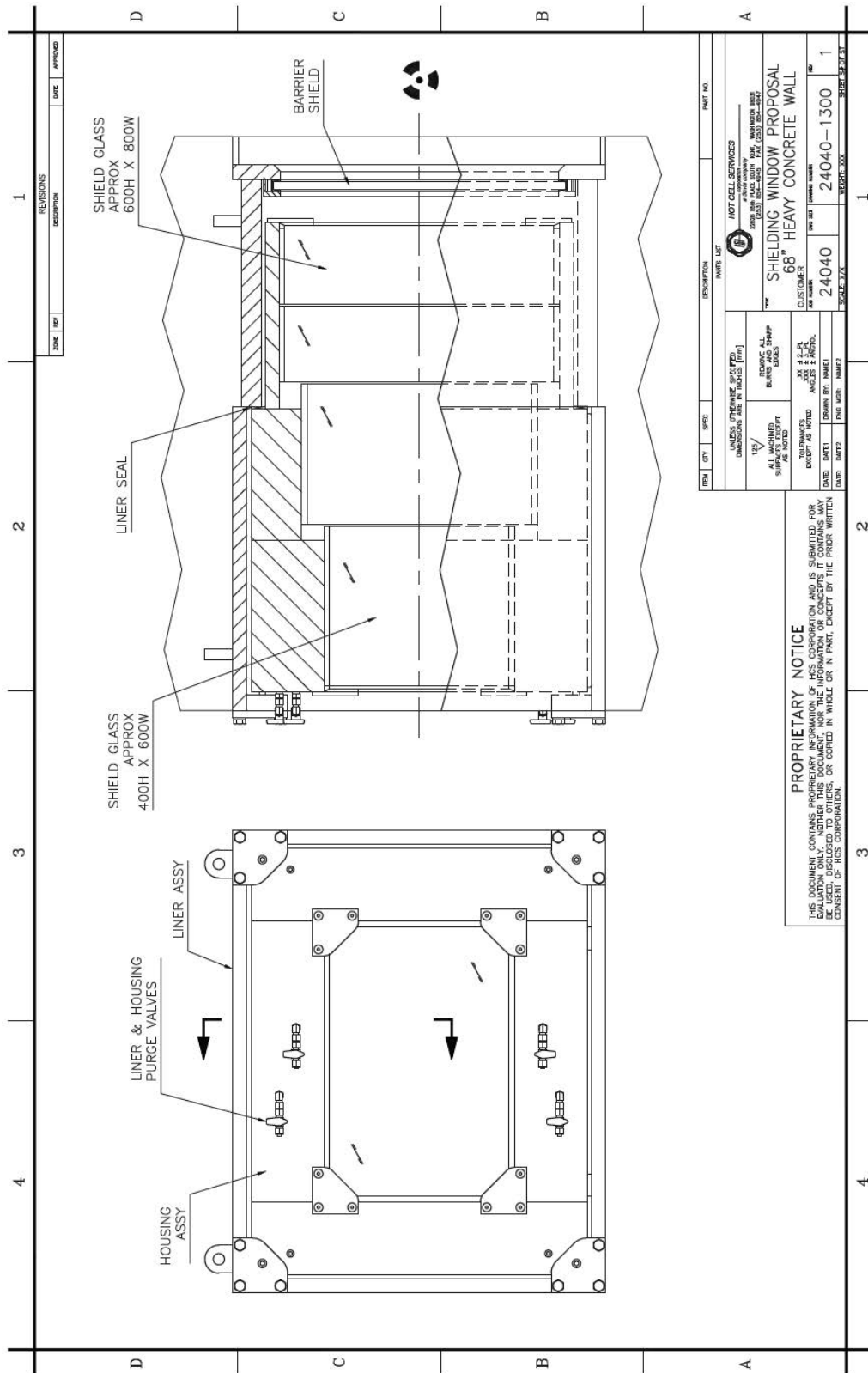
APPENDIX

- Window Drawings A1-A3
- Glass Specifications A4-A13
- URA-RAD Gasket Specifications A14
- Oil fill and Drain Kit A15





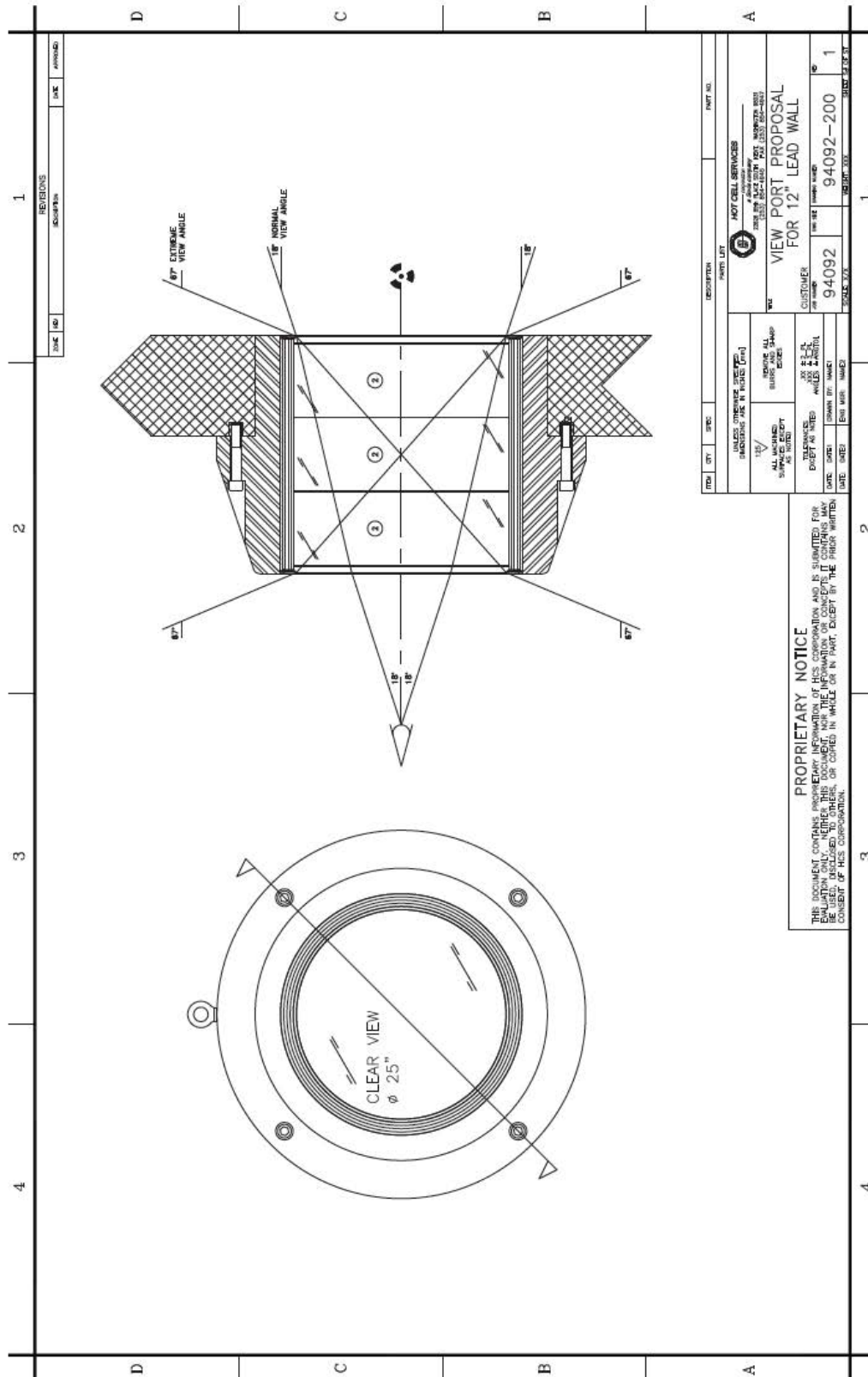
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A1



ITEM	QTY	SPEC.	DESCRIPTION	PARTS LIST	PART NO.
<p>PROPRIETARY NOTICE</p> <p>THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION OF HES CORPORATION AND IS SUBMITTED FOR YOUR INFORMATION ONLY. IT IS NOT TO BE REPRODUCED, COPIED, OR USED IN WHOLE OR IN PART, EXCEPT BY THE PRIOR WRITTEN CONSENT OF HES CORPORATION.</p>					
<p>SHIELDING WINDOW PROPOSAL</p> <p>8" LEAD WALL</p>					
<p>CUSTOMER: 02061</p> <p>DATE: 02/01/01</p> <p>SCALE: 1/2" = 1'-0"</p>					
<p>PROJECT NO.: 02061-100</p> <p>DATE: 02/01/01</p> <p>SCALE: 1/2" = 1'-0"</p>					
<p>DESIGNED BY: HES CORPORATION</p> <p>DRAWN BY: HES CORPORATION</p> <p>CHECKED BY: HES CORPORATION</p> <p>APPROVED BY: HES CORPORATION</p>					



A3



A4

TYPE 2.5

RADIATION SHIELDING GLASS
HCS DATA SHEET NO. 102

APPLICATION

A very clear, non-leaded, borosilicate glass. More than 10% oxides of boron to provide good neutron shielding. Main application for shielding windows is neutron shielding in dry windows.

CHARACTERISTICS

Density (g/cm ³)	2.50 min
Lead Oxide	0%
CeO Content (stabilization against radiation)	0%
Refractive Index (589.3 nm wavelength)	1.520
Internal Light Transmission (per 100mm)	98%
Reflection per surface (untreated)	4.25%

Application limits

Integrated dose:	10 ³ Gy (10 ⁵ rads)
At dose rate of:	0.1 Gy/h (10 rads/hr)

ACCEPTANCE STANDARDS

Inclusions

1. Area $S \leq 0.022\% \times st$
S: projected area of all inclusions
St: glass slab central viewing area
2. Permissible number: 112
for a 2477cm² central viewing area
3. Maximum Size: 1.5 mm dia.
In central viewing area

All in accordance with ASTM C1572

Machining

1. Typical dimensional tolerances:
Length & Width: -6 / +0 mm
Thickness: +/- 2 mm
2. Wedge: within dimensional
3. Chamfering: $\leq 1\%$ of length of
respective edge or radius
4. Edge Chips: shall be machined up
to 2% of maximum glass size,
maximum absolute value is 20mm



TYPE 2.5 NON-BROWNING
RADIATION SHIELDING GLASS
HCS DATA SHEET NO. 109

APPLICATION

This very highly stabilized borosilicate glass provides the strongest radiation resistance available. Boron also provides good neutron shielding. The main applications for shielding windows are the hot side slab or cover glass.

CHARACTERISTICS

Density (g/cm ³)	2.50 min
Lead Oxide	0%
CeO Content (stabilization against radiation)	2.5%
Refractive Index (589.3 nm wavelength)	1.520
Internal Light Transmission (per 100mm)	89.5%
Reflection per surface (untreated)	4.25%

Application limits

Integrated dose:	10 ⁸ Gy (10 ¹⁰ rads)
At dose rate of:	10 ⁴ Gy/h (10 ⁶ rads/hr)

ACCEPTANCE STANDARDS

Inclusions

1. Area $S \leq 0.022\% \times st$
S: projected area of all inclusions
St: glass slab central viewing area
2. Permissible number: 112
for a 2477cm² central viewing area
3. Maximum Size: 1.5 mm dia.
In central viewing area

All in accordance with ASTM C1572

Machining

1. Typical dimensional tolerances:
Length & Width: -6 / +0 mm
Thickness: -0 / +2 mm
2. Wedge: within dimensional
3. Chamfering: $\leq 1\%$ of length of
respective edge or radius
4. Edge Chips: shall be machined up
to 2% of maximum glass size,
maximum absolute value is 20mm



A6

TYPE 2.5 WATER-WHITE

RADIATION SHIELDING GLASS

HCS DATA SHEET NO. 121

APPLICATION

A very clear, non-leaded, low iron, soda-lime glass. Main application for shielding windows is the cold side cover glass.

CHARACTERISTICS

Density (g/cm ³)	2.50 min
Lead Oxide	0%
CeO Content (stabilization against radiation)	0%
Refractive Index (589.3 nm wavelength)	1.518
Internal Light Transmission (per 100mm)	98%
Reflection per surface (untreated)	4.25%

Application limits

Integrated dose:	10 ³ Gy (10 ⁵ rads)
At dose rate of:	0.1 Gy/h (10 rads/hr)

ACCEPTANCE STANDARDS

Inclusions

1. Area $S \leq 0.022\% \times st$
S: projected area of all inclusions
St: glass slab central viewing area
2. Permissible number: 112
for a 2477cm² central viewing area
3. Maximum Size: 1.5 mm dia.
In central viewing area

All in accordance with ASTM C1572

Machining

1. Typical dimensional tolerances:
Length & Width: -5 / +1.5 mm
Thickness: +/- 2 mm
2. Wedge: within dimensional
3. Chamfering: $\leq 1\%$ of length of
respective edge or radius
4. Edge Chips: shall be machined up
to 2% of maximum glass size,
maximum absolute value is 20mm



TYPE 3.2 NON-BROWNING
RADIATION SHIELDING GLASS
HCS DATA SHEET NO. 112

APPLICATION

This medium density lead glass provides good gamma shielding and is highly stabilized to resist high levels of radiation. The main applications for shielding windows are the hot side slab, or the intermediary hot side slab depending on the application.

CHARACTERISTICS

Density (g/cm ³)	3.22 min
Lead Oxide	33%
CeO Content (stabilization against radiation)	1.7%
Refractive Index (589.3 nm wavelength)	1.584
Internal Light Transmission (per 100mm)	94%
Reflection per surface (untreated)	5.1%

Application limits

Integrated dose:	5x10 ⁶ Gy (5x10 ⁸ rads)
At dose rate of:	10 ² Gy/h (10 ⁴ rads/hr)

ACCEPTANCE STANDARDS

Inclusions

1. Area $S \leq 0.022\% \times st$
S: projected area of all inclusions
St: glass slab central viewing area
2. Permissible number: 112
for a 2477cm² central viewing area
3. Maximum Size: 1.5 mm dia.
In central viewing area

All in accordance with ASTM C1572

Machining

1. Typical dimensional tolerances:
Length & Width: -5 / +1.5 mm
Thickness: +/- 2 mm
2. Wedge: within dimensional
3. Chamfering: $\leq 1\%$ of length of
respective edge or radius
4. Edge Chips: shall be machined up
to 2% of maximum glass size,
maximum absolute value is 20mm



A8

TYPE 3.6

RADIATION SHIELDING GLASS HCS DATA SHEET NO. 103

APPLICATION

This medium density lead glass provides good gamma radiation shielding and excellent light transmission. The main application for shielding windows is the cold side slab.

CHARACTERISTICS

Density (g/cm ³)	3.6 min
Lead Oxide	45%
CeO Content (stabilization against radiation)	0%
Refractive Index (589.3 nm wavelength)	1.62
Internal Light Transmission (per 100mm)	98%
Reflection per surface (untreated)	5.6%

Application limits

Integrated dose:	10 ³ Gy (10 ⁵ rads)
At dose rate of:	0.1 Gy/h (10 rads/hr)

ACCEPTANCE STANDARDS

Inclusions

1. Area $S \leq 0.022\% \times st$
S: projected area of all inclusions
St: glass slab central viewing area
2. Permissible number: 112
for a 2477cm² central viewing area
3. Maximum Size: 1.5 mm dia.
In central viewing area

All in accordance with ASTM C1572

Machining

1. Typical dimensional tolerances:
Length & Width: -5 / +1.5 mm
Thickness: +/- 2 mm
2. Wedge: within dimensional
3. Chamfering: $\leq 1\%$ of length of
respective edge or radius
4. Edge Chips: shall be machined up
to 2% of maximum glass size,
maximum absolute value is 20mm



TYPE 4.2

RADIATION SHIELDING GLASS HCS DATA SHEET NO. 104

APPLICATION

This medium density lead glass provides good radiation shielding and excellent light transmission. The main applications for shielding windows are the cold side slab, or the sole slab for a lead or steel wall.

CHARACTERISTICS

Density (g/cm ³)	4.20 min
Lead Oxide	58.6%
CeO Content (stabilization against radiation)	0%
Refractive Index (589.3 nm wavelength)	1.689
Internal Light Transmission (per 100mm)	98%
Reflection per surface (untreated)	6.6%

Application limits

Integrated dose:	10 ³ Gy (10 ⁵ rads)
At dose rate of:	0.1 Gy/h (10 rads/hr)

ACCEPTANCE STANDARDS

Inclusions

1. Area $S \leq 0.022\% \times st$
S: projected area of all inclusions
St: glass slab central viewing area
2. Permissible number: 112
for a 2477cm² central viewing area
3. Maximum Size: 1.5 mm dia.
In central viewing area

All in accordance with ASTM C1572

Machining

1. Typical dimensional tolerances:
Length & Width: -5 / +1.5 mm
Thickness: +/- 2 mm
2. Wedge: within dimensional
3. Chamfering: $\leq 1\%$ of length of
respective edge or radius
4. Edge Chips: shall be machined up
to 2% of maximum glass size,
maximum absolute value is 20mm



A10

TYPE 4.2 NON-BROWNING

RADIATION SHIELDING GLASS

HCS DATA SHEET NO. 113

APPLICATION

This medium density lead glass provides good gamma radiation shielding and is stabilized to resist high levels of radiation. Main applications for shielding windows are the hot side slab, or an intermediary slab depending on the application.

CHARACTERISTICS

Density (g/cm ³)	4.20 min
Lead Oxide	58.3%
CeO Content (stabilization against radiation)	0.7%
Refractive Index (589.3 nm wavelength)	1.689
Internal Light Transmission (per 100mm)	85%
Reflection per surface (untreated)	6.6%

Application limits

Integrated dose:	10 ⁶ Gy (10 ⁸ rads)
At dose rate of:	10 Gy/h (10 ³ rads/hr)

ACCEPTANCE STANDARDS

Inclusions

1. Area $S \leq 0.022\% \times st$
S: projected area of all inclusions
St: glass slab central viewing area
2. Permissible number: 112
for a 2477cm² central viewing area
3. Maximum Size: 1.5 mm dia.
In central viewing area

All in accordance with ASTM C1572

Machining

1. Typical dimensional tolerances:
Length & Width: -5 / +1.5 mm
Thickness: +/- 2 mm
2. Wedge: within dimensional
3. Chamfering: $\leq 1\%$ of length of
respective edge or radius
4. Edge Chips: shall be machined up
to 2% of maximum glass size,
maximum absolute value is 20mm



TYPE 5.2

RADIATION SHIELDING GLASS HCS DATA SHEET NO. 106

APPLICATION

This high density lead glass provides excellent gamma radiation shielding and light transmission. The main applications for shielding windows are cold side slab, or sole slab for lead or steel walls.

CHARACTERISTICS

Density (g/cm ³)	5.18 min
Lead Oxide	71%
CeO Content (stabilization against radiation)	0%
Refractive Index (589.3 nm wavelength)	1.805
Internal Light Transmission (per 100mm)	98%
Reflection per surface (untreated)	8.2%

Application limits

Integrated dose:	10 ³ Gy (10 ⁵ rads)
At dose rate of:	1 Gy/h (10 ² rads/hr)

ACCEPTANCE STANDARDS

Inclusions

1. Area $S \leq 0.022\% \times st$
S: projected area of all inclusions
St: glass slab central viewing area
2. Permissible number: 112
for a 2477cm² central viewing area
3. Maximum Size: 1.5 mm dia.
In central viewing area

All in accordance with ASTM C1572

Machining

1. Typical dimensional tolerances:
Length & Width: -5 / +1.5 mm
Thickness: +/- 2 mm
2. Wedge: within dimensional
3. Chamfering: $\leq 1\%$ of length of
respective edge or radius
4. Edge Chips: shall be machined up
to 2% of maximum glass size,
maximum absolute value is 20mm



A12

TYPE 5.2 NON-BROWNING

RADIATION SHIELDING GLASS

HCS DATA SHEET NO. 107

APPLICATION

This high density lead glass gives excellent gamma radiation shielding and is stabilized to resist high levels of radiation. The main application for shielding windows is the hot side slab for multiple slab windows in lead walls.

CHARACTERISTICS

Density (g/cm ³)	5.18 min
Lead Oxide	71%
CeO Content (stabilization against radiation)	0.35%
Refractive Index (589.3 nm wavelength)	1.805
Internal Light Transmission (per 100mm)	81.5%
Reflection per surface (untreated)	8.2%

Application limits

Integrated dose:	10 ⁶ Gy (10 ⁸ rads)
At dose rate of:	10 Gy/h (10 ³ rads/hr)

ACCEPTANCE STANDARDS

Inclusions

1. Area $S \leq 0.022\% \times st$
S: projected area of all inclusions
St: glass slab central viewing area
2. Permissible number: 112
for a 2477cm² central viewing area
3. Maximum Size: 1.5 mm dia.
In central viewing area

All in accordance with ASTM C1572

Machining

1. Typical dimensional tolerances:
Length & Width: -5 / +1.5 mm
Thickness: +/- 2 mm
2. Wedge: within dimensional
3. Chamfering: $\leq 1\%$ of length of
respective edge or radius
4. Edge Chips: shall be machined up
to 2% of maximum glass size,
maximum absolute value is 20mm



TYPE 6.2*

RADIATION SHIELDING GLASS HCS DATA SHEET NO. 116

APPLICATION

This highest density lead glass provides excellent gamma radiation shielding and good light transmission. The main applications for shielding windows are the cold side slab, or the sole slab for lead or steel walls.

CHARACTERISTICS

Density (g/cm ³)	6.15 min
Lead Oxide	75%
CeO Content (stabilization against radiation)	0%
Refractive Index (589.3 nm wavelength)	1.90
Internal Light Transmission (per 100mm)	85%
Reflection per surface (untreated)	9.6%

Application limits

Integrated dose:	10 ³ Gy (10 ⁵ rads)
At dose rate of:	1 Gy/h (10 ² rads/hr)

ACCEPTANCE STANDARDS

Inclusions

1. Area $S \leq 0.022\% \times st$
S: projected area of all inclusions
St: glass slab central viewing area
2. Permissible number: 112
for a 2477cm² central viewing area
3. Maximum Size: 1.5 mm dia.
In central viewing area

All in accordance with ASTM C1572

Machining

1. Typical dimensional tolerances:
Length & Width: -5 / +1.5 mm
Thickness: +/- 2 mm
2. Wedge: within dimensional
3. Chamfering: $\leq 1\%$ of length of
respective edge or radius
4. Edge Chips: shall be machined up
to 2% of maximum glass size,
maximum absolute value is 20mm

*Limited Availability



A14

URA-RAD

POLYURETHANE GASKET SPECIFICATION UR-SPEC-03

	ASTM TEST METHOD	Typical In-Lb	Value Units
Shore Hardness	D-676	75A	85A
Specific Gravity	D-792	1.24	1.24
Tensile Strength (psi)	D-412	6500	7500
100% Tensile Modulus (psi)	D-412	500	625
300% Tensile Modulus (psi)	D-412	1000	1700
Ultimate Elongation %	D-412	500	600
Tear Resistance	D-624 (Die C)	320	420
Compression 22 hrs. 70 F Method B Set 22 hrs. @ 160F	D-395 D-395	37% 50%	23% 35%
Water Absorption – 24 hrs. %	D-570	0.8	0.8
Water Resistance 32 – 129 F 129 – 160 F		(G) (M)	(G) (M)
Oil Resistance		(E)	(E)
Organic Solvent Resistance		(E)	(E)
Acid Resistance 5% 20%		(M) (P)	(M) (P)
Ozone Resistance		(E)	(E)
Heat – Continuous Loading		200 F	200 F
Temperature Stiffness	D-1053	50 F	50 F

(E) Excellent
(M) Moderate

(G) Good
(P) Poor



OIL FILL AND DRAIN KIT

A15

MODEL NO. 1201QD

DESCRIPTION

The HCS oil fill and drain kit is designed to facilitate the changing of oil in an oil filled Radiation Shielding Window. A variable speed peristaltic pump is mounted on a wheeled cabinet. The cabinet is fitted with shelves and a drawer to store the equipment, instruments, and fittings included with the kit.

TYPICAL COMPONENTS LIST: (customized per application)

- Portable Cabinet
- Operation Manual (HC-OM-001)
- Peristaltic Pump (Heavy duty, variable speed)
- Manometer (Open end)
- Manometer Fluid
- Fill Fitting Assembly (Fits 55 gallon drum)
- Neoprene Bellows
- Crescent Wrench
- Bung Wrench
- Hoses (color coded with stainless steel quick disconnect fittings)
- 20' Neoprene tubing for pump
- Oil Spill Recovery Kit



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NQA-1
COMPLIANT

