B3110 / B3112

Risø Wedge Array Card

DESCRIPTION/APPLICATION

The B3110 and B3112 Risø Wedge Array Cards are placed in the *GEX Part# P4701, Risø Aluminum Energy Wedge* and used for electron dose distribution and beam energy estimation for electron beams operating in the range of 2 to 12 MeV. Generally, these activities are part of the qualification of the electron beam process (IQOQ) and subsequent verification and re-validation of the electron beam.

SPECIFICATIONS

Material:	80#, uncoated, white paper that has been precision die-cut; WINdose radiochromic dosimeters mounted in 30 positions in an array.
Unit Dimensions:	4.750” x 4.688”
Color:	White
Printing:	GEX Logo and “B3110/B3112” Part Number; A, B, and Utility “Card Position Marks” (used for GEX 2-4 MeV Wedge only); Dosimeter position numbers 1 through 30; circular “window” outline at each position.
Packaging:	Pouch with tear notch. Top side transparent with UV barrier. Bottom side aluminum layered.
Labeling:	Pouch and Box label with GEX Part No., Description, Batch ID, dosimeter average thickness and uncertainty.
Packaging Configuration:	1 card/pouch, 20 pouches/box
Pouch Dimensions:	6.000” x 6.000” ± 0.125""
Pouch Seal Width:	0.188” ± 0.0625"
Box Dimensions	8.00” (L) x 7.00” (W) x 1.625” (H) (±0.5”)
Box Weight:	0.6 lbs.

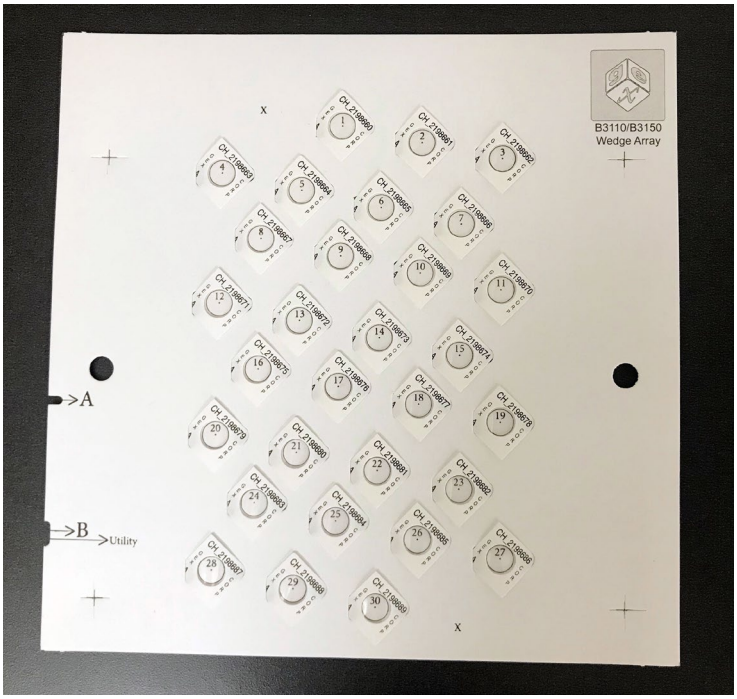
B3110:

Energy Range:	4 - 12 MeV
Number of Dosimeters:	30

B3112:

Energy Range:	4 to 5 MeV
Number of Dosimeters:	15

PRODUCT PHOTO



Features:

- Along the bottom left edge, A, B and Utility cutouts and marking lines (these are not used and may be ignored).
- Two holes to fit over the posts of the P4701 Risø Aluminum Wedge.
- Numbered dosimeter positions 1 to 30 with sequential ID WINdose dosimeters mounted in each position.
- Product ID and logo in top right corner.

Dose Range:

Ideally, the target dose to the wedge is suggested to be 15 kGy to prevent temperature build up in the wedge from having a minor impact on the result. Surface doses up to 25 kGy are acceptable but the user should exercise caution going above this as the effects on the result, if any, are not understood.

Packaging:

The product is supplied in sealed pouches to protect the B3 dosimeters from UV light and maintain the moisture content of the film. Peel pouch to open.

Pre-Irradiation Storage:

Store in accordance with *GEX Doc# 100-101, B3 WINdose and DoseStix Dosimeters Product Specification and Usage*.

Shelf Life:

5 years from date of manufacture.

Certificate of Compliance:

Includes date of manufacture, dosimeter Batch ID, average dosimeter thickness, and uncertainty with every shipment.

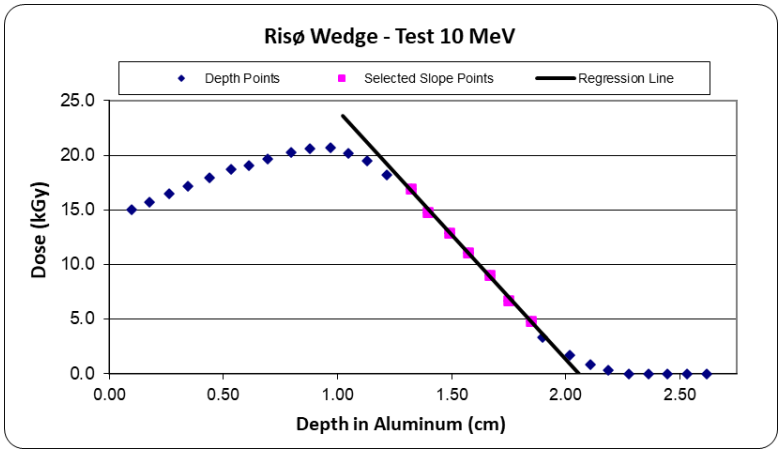
Shipping/Delivery:

- Product is shipped in cardboard boxes designed to withstand the duration of expected travel. Inspect all packages upon receipt and report any damage or discrepancies to GEX with photographs.
- GEX includes irreversible temperature monitoring labels inside every shipping box to monitor maximum temperature in transit. Any shipment exposed to 45°C or higher requires additional testing upon receipt as irreversible damage may have occurred. Contact GEX upon delivery in event of such incident.

USAGE

1. Keep pouch sealed until just before use.
2. Refer to *GEX Doc# 100-119, Risø Aluminum Wedge Product - Specification and Usage* for additional instructions for loading the B3110/B3112 cards and their irradiation.
3. Please follow the dosimeter handling and measurement practices as specified in *GEX Doc# 100-101, B3 WINdose and B3 DoseStix Dosimeters - Product Specification and Usage.*
    a. As with all B3 dosimeters, it is important to heat treat the B3110/B3112 Risø Wedge Card Arrays after irradiation to complete and stabilize the response.
    b. The array card can be heat treated simply by placing the entire card into a large enough incubator. The dosimeters do not need to be removed from the array card prior to heat treatment.
    c. Measurement of dosimeters prior to post-irradiation heat treatment will cause an unknown bias in the result.
4. Measure the dosimeters in sequence by numerical ID.
    a. The cards are always loaded with the dosimeter with the lowest number at the top of the card and the highest number at the bottom; dosimeters must be kept in sequence for proper data analysis.
    b. It is suggested to place each dosimeter in the same orientation into the dosimeter holder when measuring for depth-dose analysis. There are very small dose gradients across the dosimeter due to the ever-increasing depth of the aluminum between the dosimeter and the incident electrons. Maintaining the same orientation (such as serial number facing upward in the holder) help ensure the smoothest curve possible. It is not suggested that this has any effect on the accuracy or precision because it has not been studied.
5. Use the depth values provided in Annex 2 of this document to plot each dose measurement (y-axis) against the corresponding depth (x-axis) for the position number of that dosimeter in the wedge. See the example below.

6. Once the data is plotted, the user must determine the slope of the downward portion of the curve and the y-intercept.
7. These values are then used to calculate an estimated energy in keV using equations found in *ISO/ASTM 51649, Practice for Dosimetry in an Electron Beam Facility for Radiation Processing at Energies Between 300 keV and 25MeV.*
8. GEX provides analysis worksheets in Microsoft Excel free of charge.



Example Data Plot of B3110 Energy Wedge Array Card – 10 MeV from Risø Aluminum Wedge

ACCESSORIES

GEX Part No.	Description	Purpose
P4701	Aluminum Wedge	Using the B3110/B3112 Risø Wedge Array Card for 10 MeV / 5 MeV.

LIMITATIONS/PRECAUTIONS

- The B3 dosimeters in the card are sensitive to UV. Exposure to UV lighting or daylight should be avoided before and after use. Refer to *GEX Doc 100-101, B3 Dosimeters – Product Specifications and Usage (PSU) for details*.
- There is some variation in the positioning of the dosimeters on the card. The user should review the card prior to use to ensure that the dosimeters are held in proper position using the circles printed on the card as a guide to adjust any that have come out of position during shipment and handling.
- New users of this product for new ebeam installations please refer to Annex 2 for the depth values to use with this product with the Riso Aluminum Energy Wedge.
- Different depths have been assigned to the wedge card throughout its lifetime. Existing ebeam facilities that used the original version of this product, pictured in Annex 1, are required to use different depth values than those given in Annex 2 of this document. Refer to document *GEX Doc# 100-204, Ebeam Energy Calculation Using GEX Wedge Array Cards in an Aluminum Wedge – Technical Report,* for more information.
- Per ISO/ASTM 51261, the purpose of measuring electron beam energy is to ensure consistent operation of the electron beam and the dose deposition in the products being irradiated. Various imprecisions in the formulas used to determine electron energies in the ASTM standard exist.
- Depth values given in the Annex are based on the known nominal thickness of the Riso wedge at the time of the release of this document which is 2.93 cm thick at the pins (center of the surface length on either edge where the pins are located). GEX can assist with precision estimates of beam energy based on precise measurement of a specific wedge, if necessary.

HEALTH/ENVIRONMENTAL INFORMATION

B3110 and B3112 Risø Wedge Card Arrays are non-toxic and can be safely discarded in general waste receptacles.

REFERENCES

1) ISO/ASTM 51649 - Practice for Dosimetry in an Electron Beam Facility for Radiation Processing at Energies Between 300 keV and 25MeV.

RELATED DOCUMENTS

- GEX Doc# 100-101, B3 WINdose and B3 DoseStix Dosimeters - Product Specification and Usage
- GEX Doc# 100-119, P4701 Risø Aluminum Wedge - Product Specification and Usage
- GEX Doc# 100-204, Ebeam Energy Calculation Using GEX Wedge Array Cards in an Aluminum Wedge – Technical Report

REVISION HISTORY

DATE	CHANGE DESCRIPTION	REVISION
06/05/2020	Initial release in new format	A
11/24/2020	Amended B3110 spec to "2-12 MeV". Added a new Annex 1 and moved current Annex to 2; changed all references thereto. Fixed transposition of depth value in Annex #1, #3 and #4. ECO 70543.	B
04/05/2021	Revised Annex 2 per ECO 70564. Biased depth values moved to GEX Doc# 100-204 – added as new related document. Edited Limitations section. Revised spec table on Page 1 for new packaging. ECO 70564.	C

Annex 1

Photo of Old Revision of the Wedge Array Card

Compare with image on page 1 of this document to view the visible differences in the two revisions of the product.

Annex 2

Depth Values for using the Array Card with the P4701 Risø Aluminum Energy Wedge

Please contact cs@gexcorp.com to request a copy of the values below in an MS Excel workbook suitable for copy/paste.

The values below should be used for new ebeam installations or when accuracy of the energy calculation is most important. Users of the previous version of the array card, pictured in Annex 1, should consult *GEX Doc# 100-204, Ebeam Energy Calculation Using GEX Wedge Array Cards in an Aluminum Wedge*.

	New Ebeams
Dosimeter Positon (D)	Use These Depth (R) cm
1	0.1523
2	0.2398
3	0.3273
4	0.4148
5	0.5024
6	0.5899
7	0.6774
8	0.7649
9	0.8524
10	0.9399
11	1.0274
12	1.1150
13	1.2025
14	1.2900
15	1.3775
16	1.4650
17	1.5525
18	1.6401
19	1.7276
20	1.8151
21	1.9026
22	1.9901
23	2.0776
24	2.1651
25	2.2527
26	2.3402
27	2.4277
28	2.5152
29	2.6027
30	2.6902