

U.S. Nuclear Regulatory Commission
Attn: Hector Rodriguez-Luccioni, Ph.D.
Materials Safety Licensing Branch
Division of Material Safety, State, Tribal and Rulemaking Programs
Office of Nuclear Material safety and Safeguards
Washington, DC 20555-0001

Subject: Docket No. 030-36971
Mail Control No. 58874
Hess Fine Art Exempt Distribution License Renewal Application
License No. 09-23920-01E

Dear Dr. Rodriguez-Luccioni:

The following are answers to the Third Request for Additional Information Regarding Hess Fine Arts, Inc., Exempt Distribution License Renewal Application. The answers are enumerated in accordance with the questions.

A. Information required by 10 CFR 32.14 and 32.22.

1. Your understanding of the model numbers is partially correct. In regards to the left-most characters, some models will always contain tritium. Some models will not contain tritium with one exception. If, as part of that model number that normally does not contain tritium, the second group of alphanumeric characters contains an "A" (for Arabic) or "R" (for Roman), the timepiece has been especially modified to contain tritium.
 - a. See Attachment "A" for a list of mb-microtec sources in each Ball Watch timepiece.
 - b. See Attachment "A" for a list of all timepieces with activity per dial, activity per hand and total activity per timepiece, for timepieces distributed under 10 CFR 32.14.
2. Engineering drawings
 - a. See Attachment "B" containing images of all timepieces, with the location of sources, being distributed under 10 CFR 32.14. See Attachment "C" containing images of all timepieces, with the location of sources, being distributed under 10 CFR 32.22.
 - b. Results are in English.

B. Information required by 10 CFR 32.22.

1. See Attachment "D" for prototype testing. See Attachment "E" for results of prototype testing.
2. The results obtained were not the fluence rate but the raw counts per second and were not compensated for efficiency. The efficiency of the detectors has been

requested but was not received prior to the due date of this submission. As soon as this information arrives, results will be provided.

Please contact me if you need further clarification on the answer.

Sincerely

/s/Jerry Sirois

Jerry Sirois
Hess Fine Art
1131 4th Street North
St. Petersburg, FL 33701

ATTACHMENT A

Timepieces subject to 10 CFR 32.14

Model	Hour Hand		Minute Hand		Second Hand		GMT Hand		Numerals			Total		
	P/N	GBq	P/N	GBq	P/N	GBq	P/N	GBq	P/N	Qty	GBq	Sources	GBq	mCi
GM2020	400/1	0.070	400/1	0.090	N/A		N/A		400/1	11	0.440	13	0.60	16.2
GM3010	400/1	0.137	400/1	0.137	N/A		N/A		400/1	11	0.383	13	0.66	17.8
NL2080	400/1	0.060	400/1	0.070	N/A		N/A		400/1	12	0.420	14	0.55	14.9
NL2098	400/1	0.057	400/1	0.070	N/A		N/A		400/1	12	0.545	14	0.67	18.2
NL2110	400/1	0.060	400/1	0.070	N/A		N/A		400/1	12	0.545	14	0.68	18.2
NM1058	400/1	0.107	400/1	0.137	400/1	0.035	N/A		400/1	12	0.444	15	0.72	19.5
NM1098	400/1	0.045	400/1	0.107	N/A		N/A		400/1	12	0.444	14	0.60	16.1
NM2080	400/1	0.110	400/1	0.140	N/A		N/A		400/1	12	0.545	14	0.80	21.5
NM2198	400/1	0.045	400/1	0.107	N/A		N/A		400/1	12	0.444	14	0.60	16.1
NM2288	400/1	0.110	400/1	0.140	400/1	0.035	N/A		400/1	12	0.600	15	0.89	23.9
NM3010	400/1	0.140	400/1	0.070	N/A		N/A		400/1	10	0.702	12	0.91	24.6
NM3098	400/1	0.066	400/1	0.137	400/1	0.040	N/A		400/1	12	0.650	15	0.89	24.1
NM3888	400/1	0.040	400/1	0.110	N/A		N/A		400/1	12	0.444	14	0.59	16.1
NT1050	400/1	0.107	400/1	0.137	400/1	0.035	N/A		400/1	12	0.444	15	0.72	19.5
NT3010	400/1	0.140	400/1	0.140	N/A		N/A		400/1	12	0.545	14	0.83	22.3
NT3888	400/1	0.110	400/1	0.140	N/A		N/A		400/1	12	0.444	14	0.69	18.8
PM3010	N/A		400/1	0.137	400/1	0.137	N/A		400/1	8	0.440	10	0.71	19.3

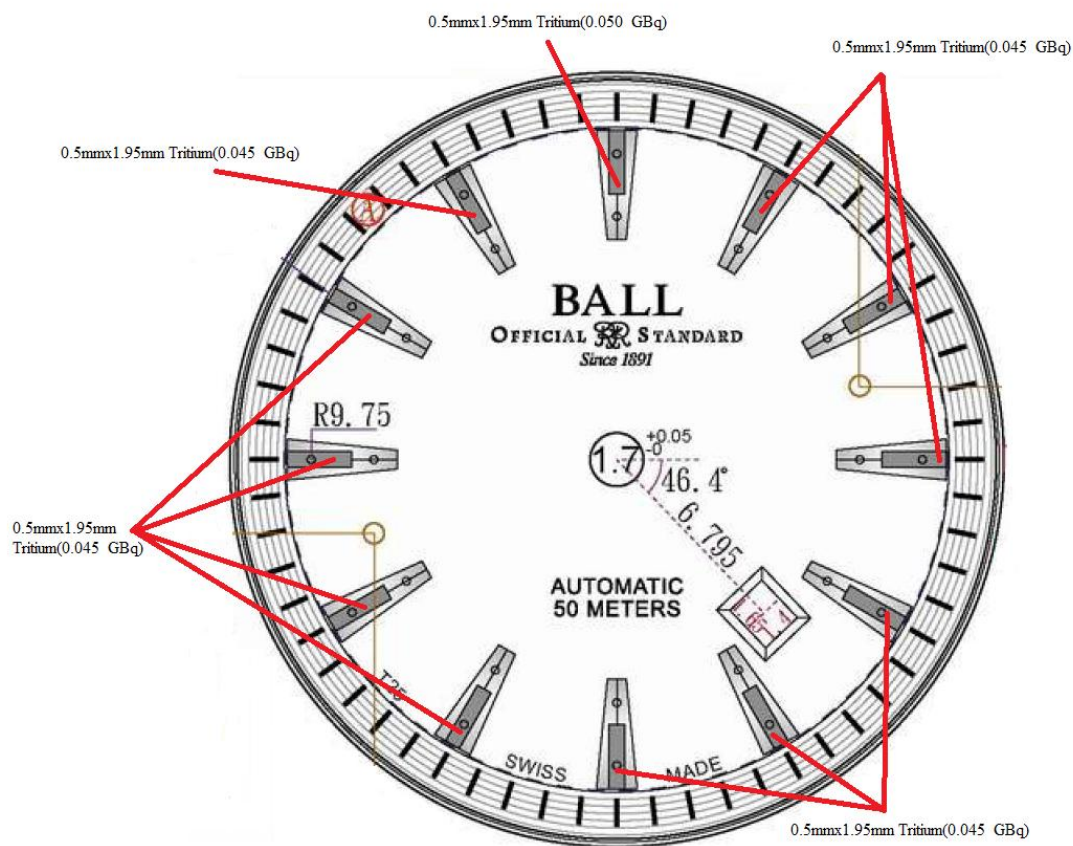
Timepieces subject to 10 CFR 32.22

Model	Hour Hand		Minute Hand		Second Hand		GMT Hand		Numerals			Total		
	P/N	GBq	P/N	GBq	P/N	GBq	P/N	GBq	P/N	Qty	GBq	Sources	GBq	mCi
DM2036	N/A		N/A		N/A		N/A		400/1	28	1.678	28	1.68	45.4
GM1056	400/1	0.070	400/1	0.140	400/1	0.040	N/A		400/1	12	0.730	15	0.98	26.5
GM1086	400/1	0.035	400/1	0.056	400/1	0.137	400/1	0.056	400/2	12	1.320	16	1.60	43.4
GM2026	400/1	0.110	400/1	0.140	400/1	0.035	N/A		400/1	12	0.657	15	0.94	25.5
GM3090	N/A		N/A		N/A		N/A		400/1	25	1.477	25	1.48	39.9
NL1026	400/1	0.560	400/1	0.057	400/1	0.035	N/A		400/1	12	1.488	15	2.14	57.8
NL1038	400/1	0.040	400/1	0.140	400/1	0.040	N/A		400/1	12	1.484	15	1.70	46.1
NL1068	400/1	0.057	400/1	0.110	N/A		N/A		400/1	21	1.657	23	1.82	49.3
NM1020	400/1	0.035	400/1	0.107	400/1	0.137	N/A		400/1	24	1.306	27	1.59	42.8
NM1038	400/1	0.107	400/1	0.137	400/1	0.035	N/A		400/1	11	1.488	14	1.77	47.8
NM1056	400/1	0.450	400/1	0.107	400/1	0.035	N/A		400/1	12	1.488	15	2.08	56.2
NM1080	400/1	0.056	400/1	0.137	400/1	0.035	N/A		400/2	12	2.040	15	2.27	61.3
NM2026	400/1	0.107	400/1	0.137	400/1	0.035	N/A		400/1	28	1.538	31	1.82	49.1
NM2038	400/1	0.660	400/1	0.137	N/A		N/A		400/1	12	0.510	14	1.31	35.3
NM2068	400/1	0.057	400/1	0.140	N/A		N/A		400/1	28	1.828	30	2.03	54.7
NM2082	400/1	0.137	400/1	0.107	400/1	0.035	N/A		400/1	12	1.488	15	1.77	47.8
NM2088	400/1	0.080	400/1	0.137	400/1	0.035	N/A		400/1	12	0.740	15	0.99	26.8
NM2098	400/1	0.107	400/1	0.137	N/A		N/A		400/1	12	1.488	14	1.73	46.8
NM2110	400/1	0.137	400/1	0.107	N/A		N/A		400/1	12	0.717	14	0.96	26.0
NM2188	400/1	0.107	400/1	0.137	400/1	0.035	N/A		400/1	12	2.712	15	2.99	80.8
NM3022	400/1	0.070	400/1	0.110	400/1	0.040	N/A		400/2	12	1.017	15	1.24	33.4
NM3082	400/1	0.110	400/1	0.140	N/A		N/A		400/1	25	2.650	27	2.90	78.4
PM2096	400/1	0.070	400/1	0.140	N/A		N/A		400/1	28	1.290	30	1.50	40.5

ATTACHMENT B
TIMEPIECES SUBJECT TO
10 CFR 32.14

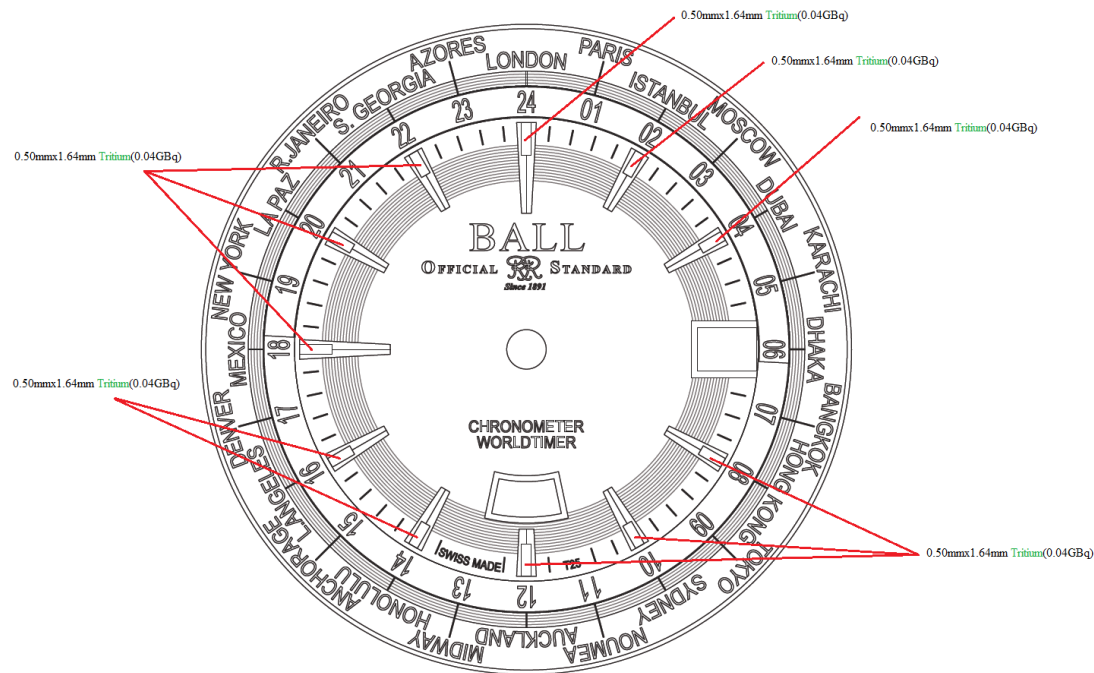
NL2098

Dial



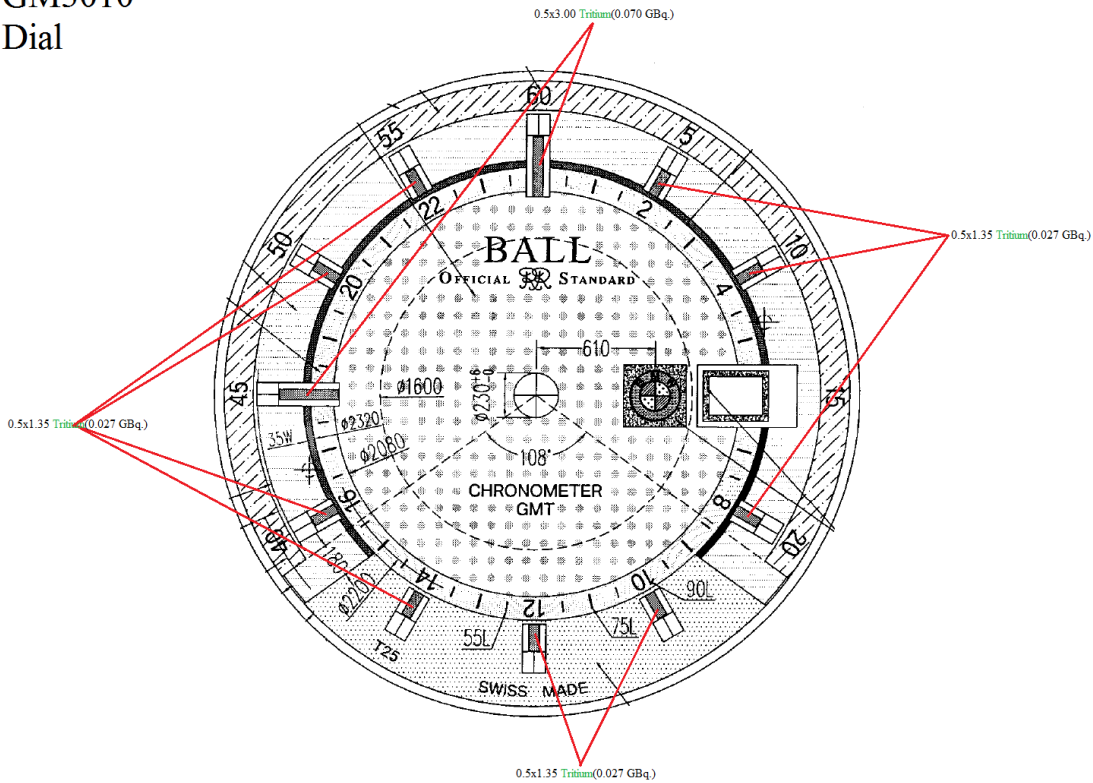
11 each	0.5mm x 1.95mm (0.045 GBq)	total = 0.495 GBq	Dial 1-11H
1 each	0.5mm x 1.95mm (0.050 GBq)	total = 0.050 GBq	Dial on 12H
1 each	0.5mm x 2.5mm (0.057 GBq)	total = 0.057 GBq	Hour hand
1 each	0.5mm x 3.5mm (0.070 GBq)	total = 0.070 GBq	Minute hand

GM2020
Dial



1 each 0.50mm x 3.50mm (0.07 GBq)	total = 0.07GBq	Hour hand
1 each 0.50mm x 5.0mm (0.09 GBq)	total = 0.09GBq	Minute hand

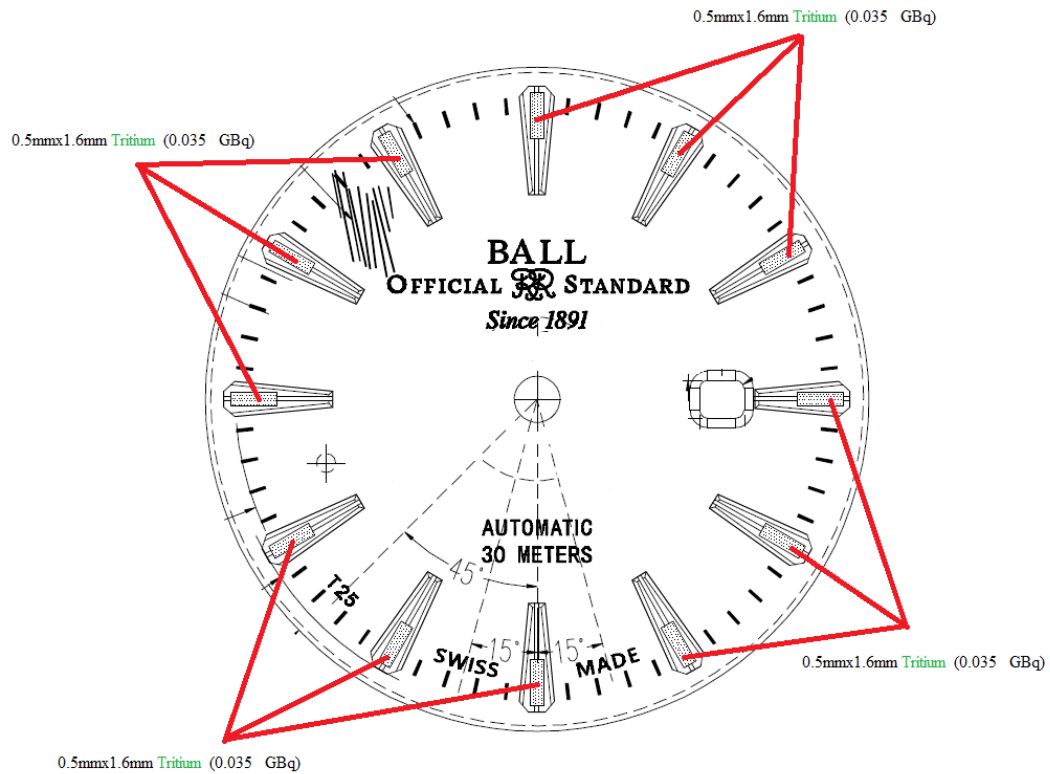
GM3010
Dial



1 each 0.5mm x 6.50mm (0.137 GBq) total = 0.137 GBq Hour hand
1 each 0.5mm x 6.50mm (0.137 GBq) total = 0.137 GBq Minute hand

NL 2080D

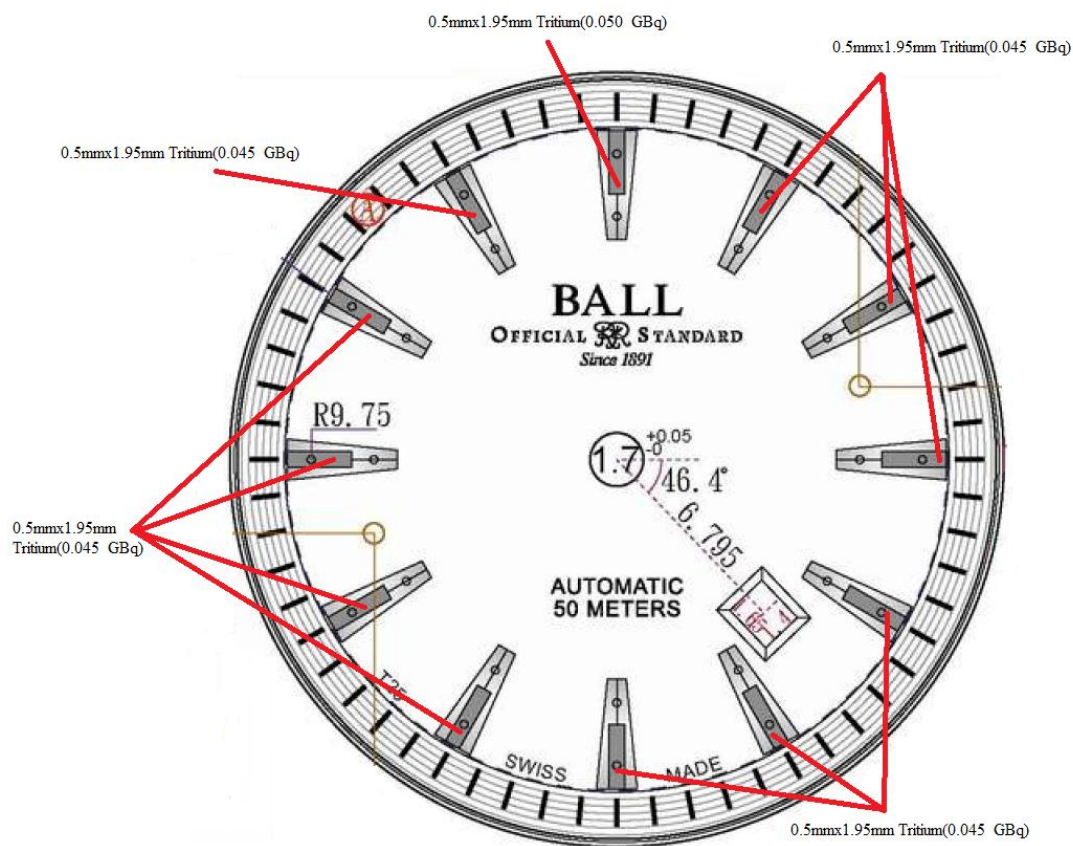
Dial



11 each	0.5mm x 1.6mm	(0.035	GBq)	total = 0.385	GBq	Dial 1-11
1 each	0.5mm x 1.6mm	(0.035	GBq)	total = 0.035	GBq	Dial 12h
1 each	0.5mm x 2.5mm	(0.060	GBq)	total = 0.060	GBq	Hour hand
1 each	0.5mm x 3.5mm	(0.070	GBq)	total = 0.070	GBq	Minute hand

NL2098

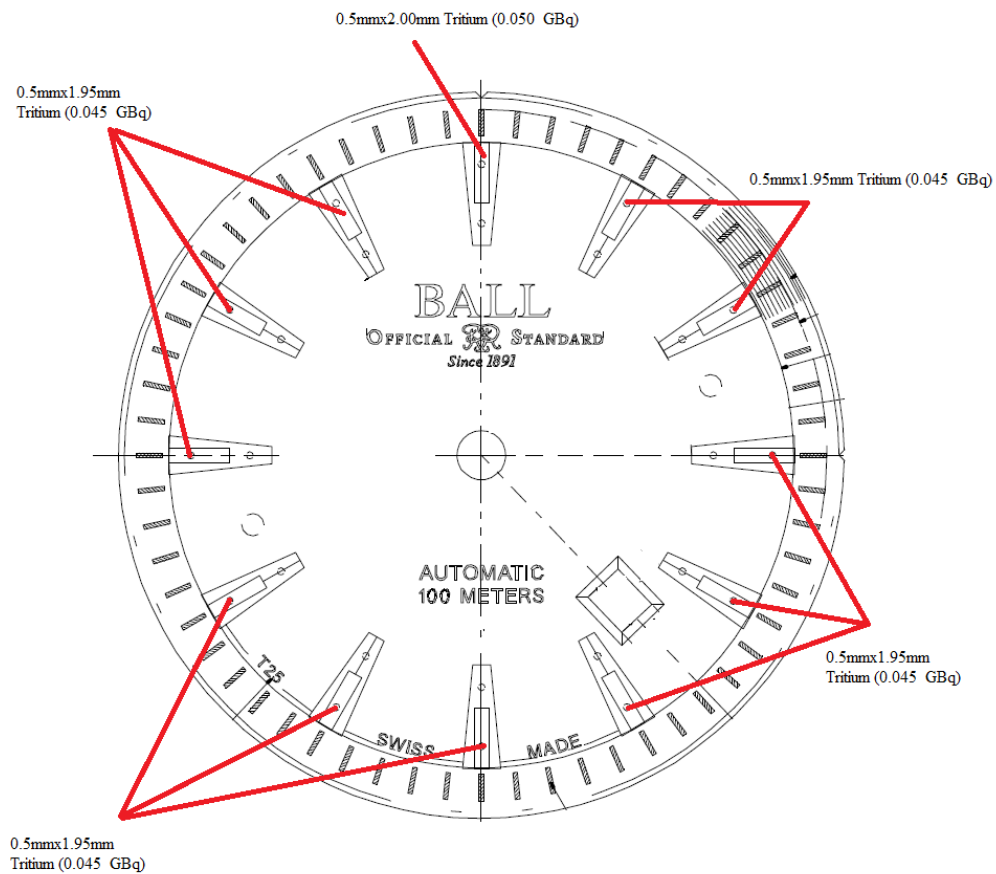
Dial



11 each	0.5mm x 1.95mm (0.045 GBq)	total = 0.495 GBq	Dial 1-11H
1 each	0.5mm x 1.95mm (0.050 GBq)	total = 0.050 GBq	Dial on 12H
1 each	0.5mm x 2.5mm (0.057 GBq)	total = 0.057 GBq	Hour hand
1 each	0.5mm x 3.5mm (0.070 GBq)	total = 0.070 GBq	Minute hand

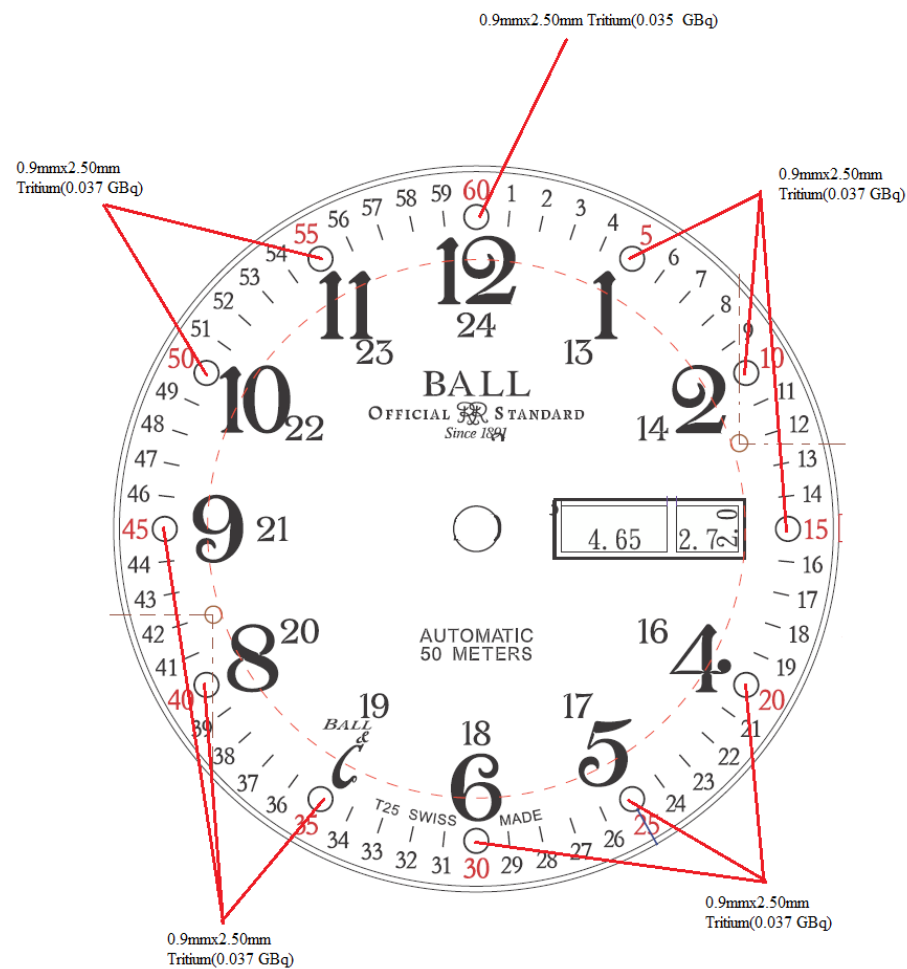
NL2110

Dial



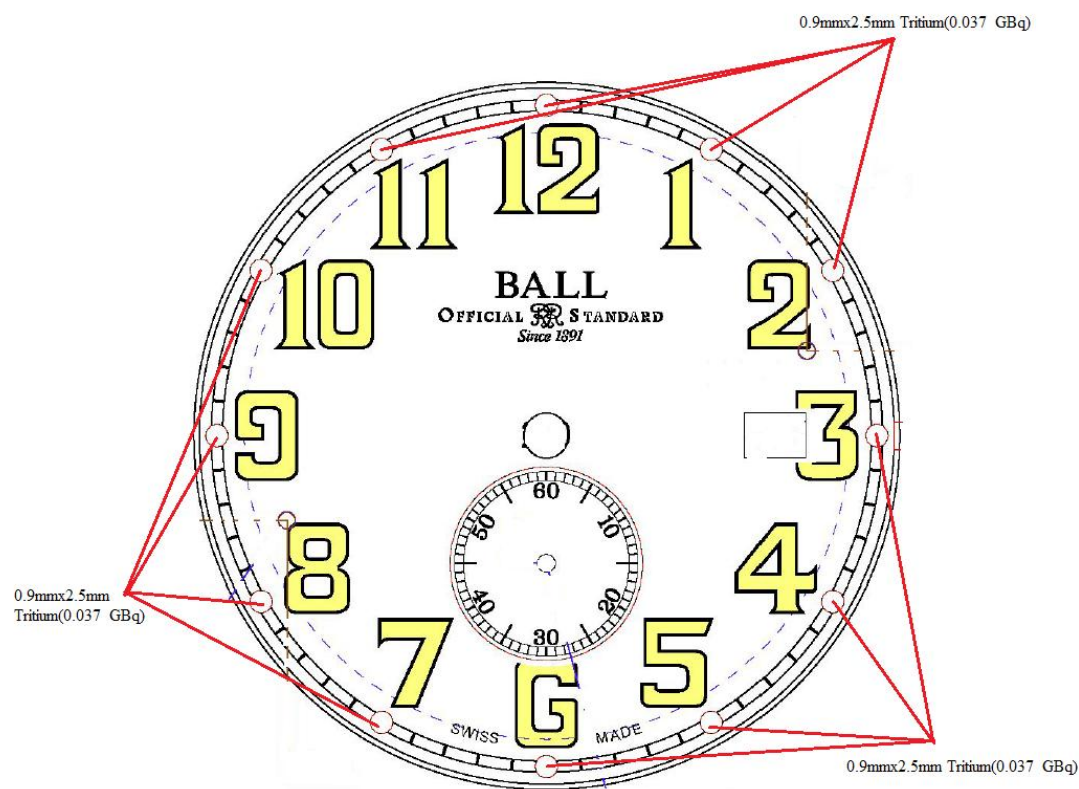
11 each	0.5mm x 1.95mm (0.045 GBq)	total = 0.495 GBq	Dial 1-11H
1 each	0.5mm x 2.00mm (0.050 GBq)	total = 0.050 GBq	Dial on 12H
1 each	0.5mm x 2.4mm (0.060 GBq)	total = 0.060 GBq	Hour hand
1 each	0.5mm x 3.5mm (0.070 GBq)	total = 0.070 GBq	Minute hand

NM1058
Dial

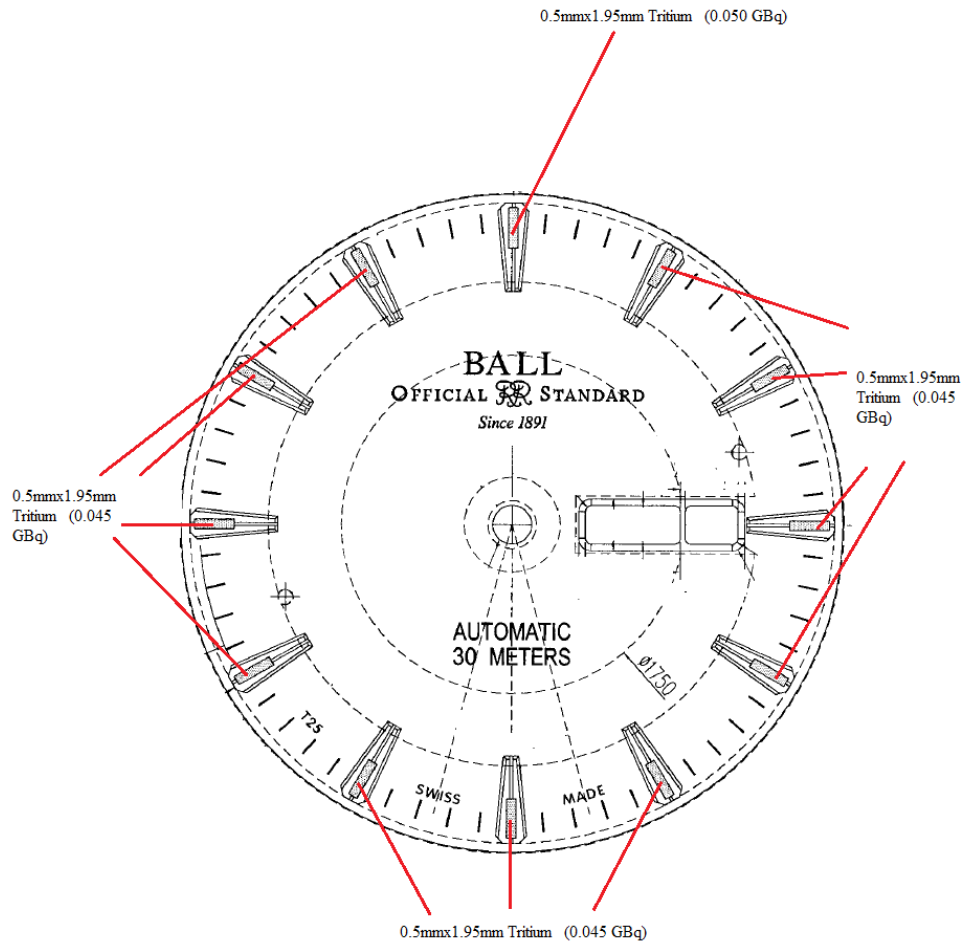


11 each	0.9mm x 2.50mm	(0.037 GBq)	total = 0.407 GBq	Dial 1-11h
1 each	0.9mm x 2.50mm	(0.035 GBq)	total = 0.035 GBq	Dial 12h
1 each	0.5mm x 2.00mm	(0.040 GBq)	total = 0.040 GBq	Hour hand
1 each	0.5mm x 4.50mm	(0.110 GBq)	total = 0.110 GBq	Minute hand
1 each	0.5mm x 1.64mm	(0.040 GBq)	total = 0.040 GBq	Second hand

NM1098
Dial



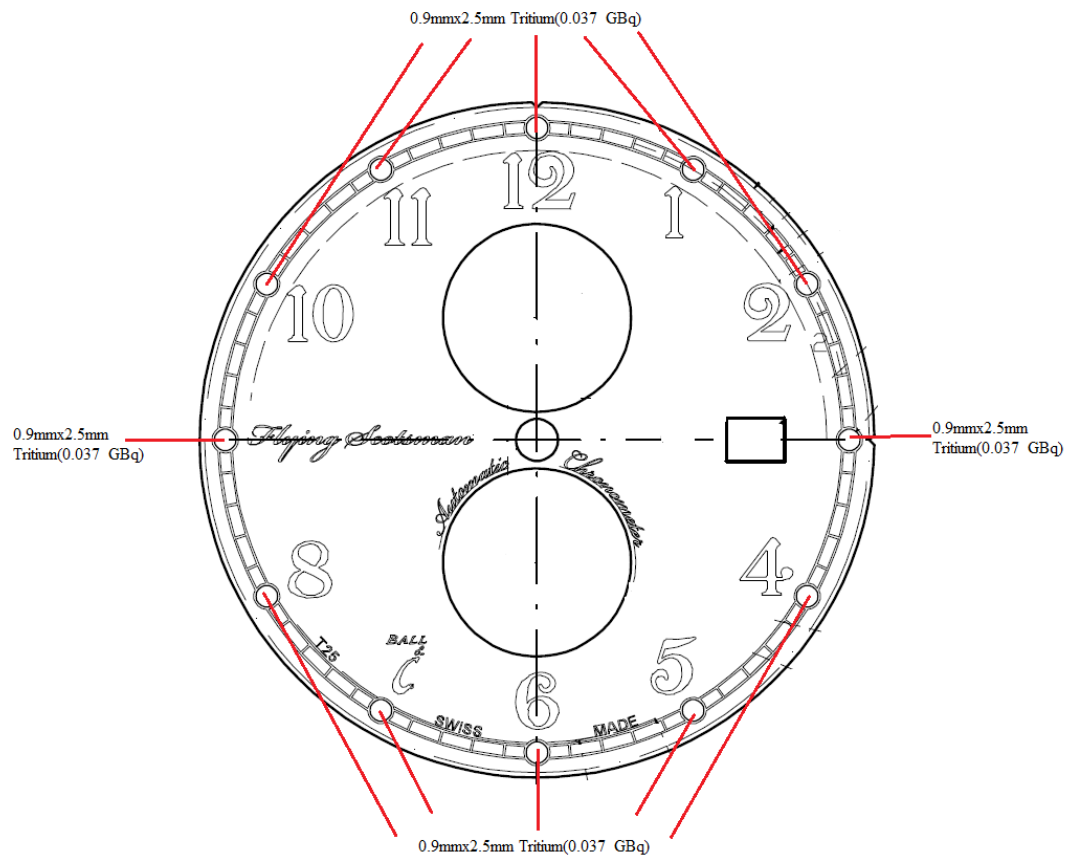
11 each	0.9mm x 2.5mm (0.037GBq)	total = 0.407	GBq Dial at 1-11h
1 each	0.9mm x 2.5mm (0.037GBq)	total = 0.037	GBq Dial at 12h
1 each	0.5mm x 2.0mm (0.045GBq)	total = 0.045	GBq Hour hand
1 each	0.5mm x 4.5mm (0.107GBq)	total = 0.107	GBq Minute hand

NM2080
Dial

11 each	0.5mm x 1.95mm	(0.045 GBq)	total = 0.495	GBq	Dial 1-11h
1 each	0.5mm x 1.95mm	(0.050 GBq)	total = 0.050	GBq	Dial on 12h
1 each	0.5mm x 4.45mm	(0.110 GBq)	total = 0.11	GBq	Hour hand
1 each	0.5mm x 6.5mm	(0.14 GBq)	total = 0.14	GBq	Minute hand

NM2198

Dial

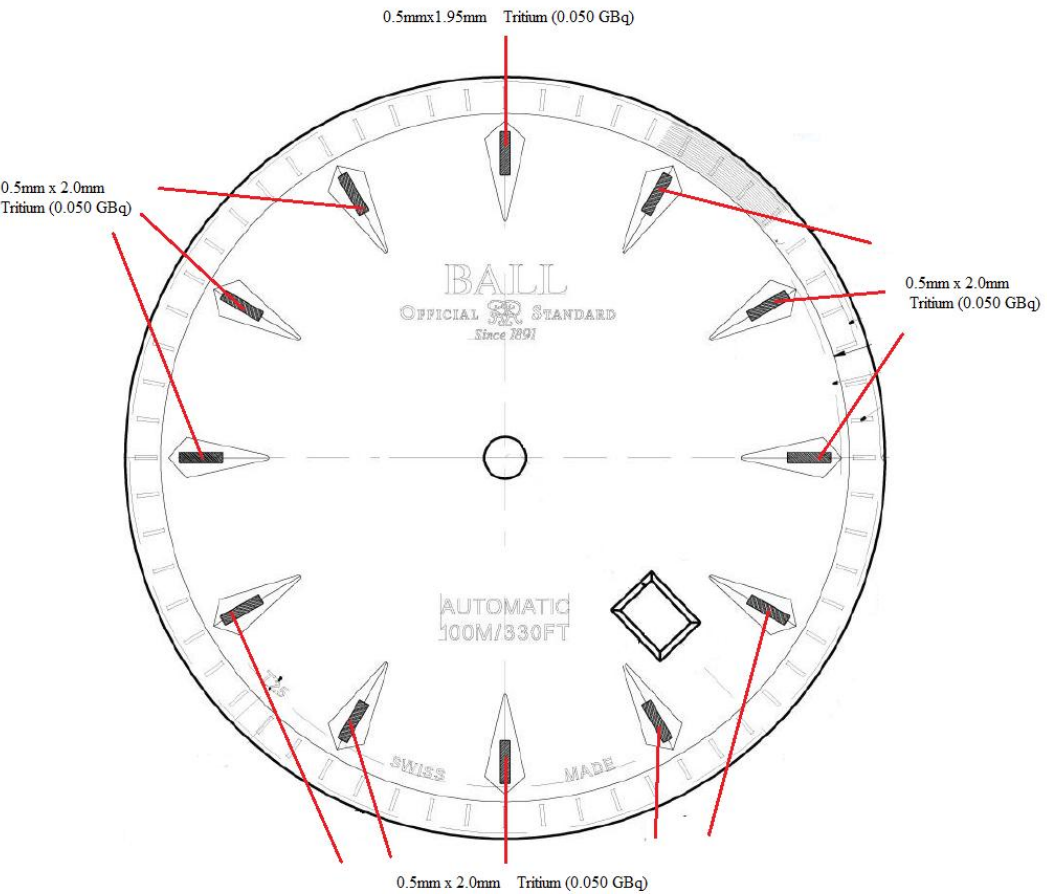


11 each	0.9mm x 2.5mm (0.037 GBq)	total = 0.407	GBq Dial at 1-11h
1 each	0.9mm x 2.5mm (0.037 GBq)	total = 0.037	GBq Dial at 12h

1 each	0.5mm x 2.0mm (0.045 GBq)	total = 0.045	GBq Hour hand
1 each	0.5mm x 4.5mm (0.107 GBq)	total = 0.107	GBq Minute hand

NM2288

Dial

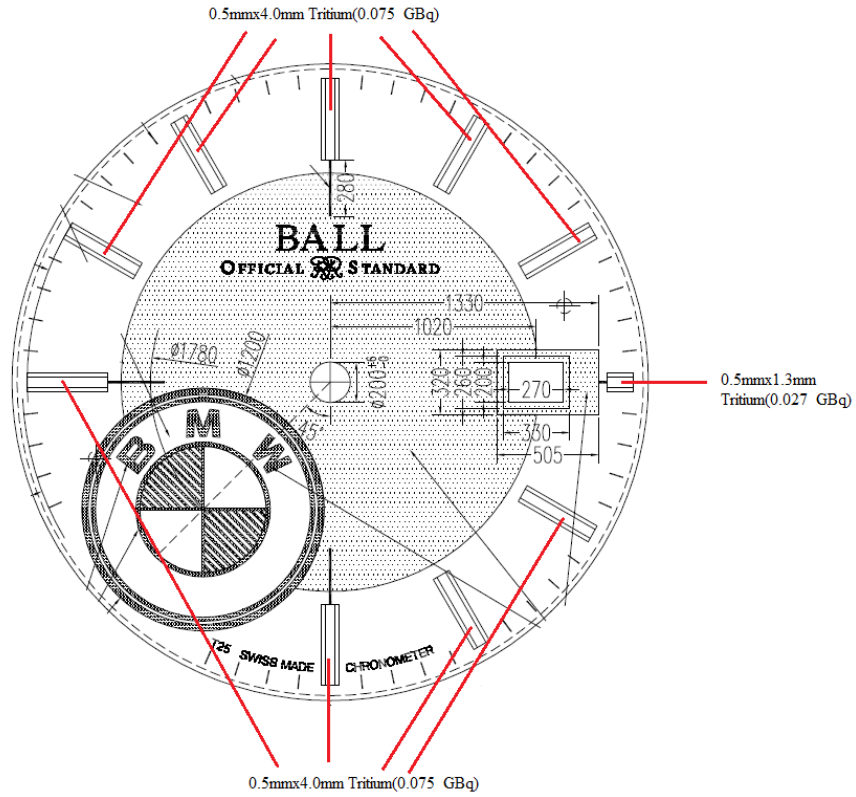


1 each	0.5mm x 1.95mm	(0.050 GBq)	total = 0.050	GBq	Dial 12h
11 each	0.5mm x 2.00mm	(0.050 GBq)	total = 0.550	GBq	Dial 1-11h

1 each	0.5mm x 1.64mm	(0.040 GBq)	total = 0.035	GBq	Second hand
1 each	0.5mm x 4.5mm	(0.110 GBq)	total = 0.110	GBq	Hour hand
1 each	0.5mm x 6.5mm	(0.140GBq)	total = 0.140	GBq	Minute hand

NM3010

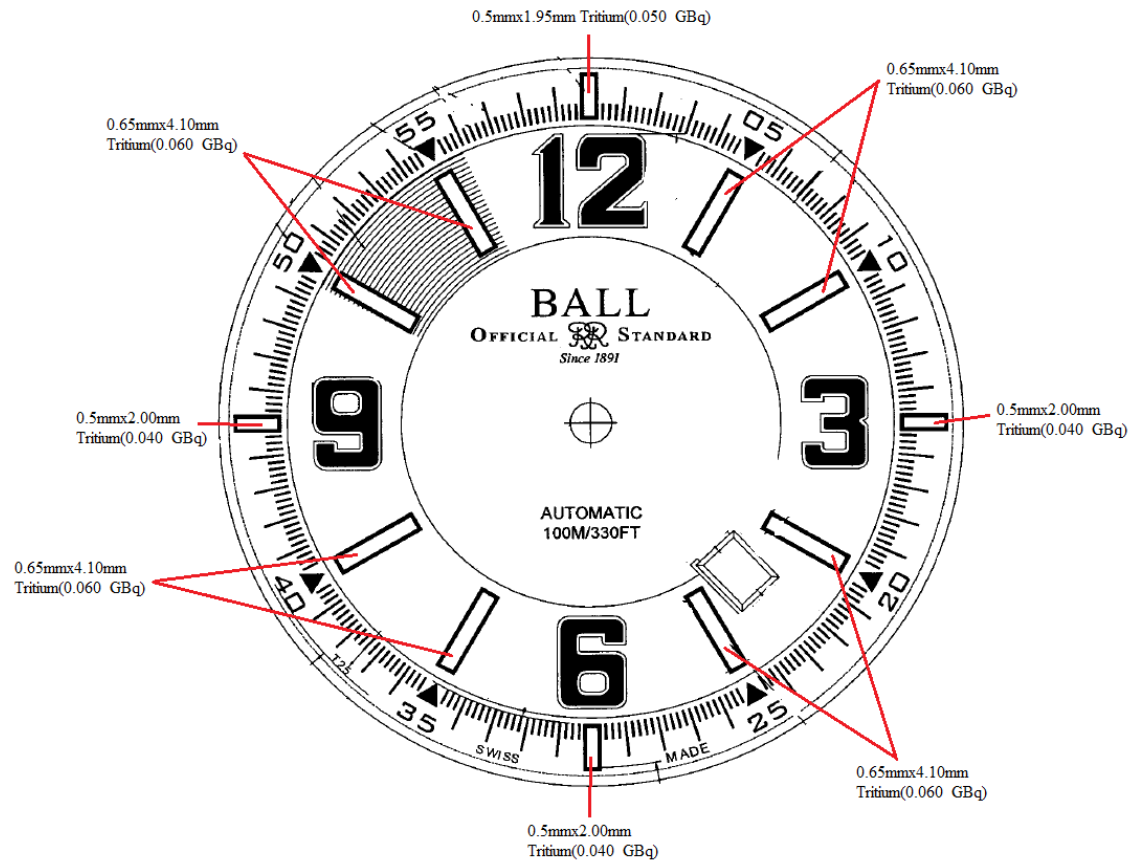
Dial



8 each	0.5mm x 4.0mm	(0.075 GBq)	total = 0.600 GBq	Dial index
1 each	0.5mm x 1.3mm	(0.027 GBq)	total = 0.027 GBq	Dial 3h
1 each	0.5mm x 4.0mm	(0.075 GBq)	total = 0.075 GBq	Dial 12h
<hr/>				
1 each	0.5mm x 6.5mm	(0.140 GBq)	total = 0.140 GBq	Minute hand
1 each	0.5mm x 3.5mm	(0.070 GBq)	total = 0.070 GBq	Hour hand

NM3098

Dial

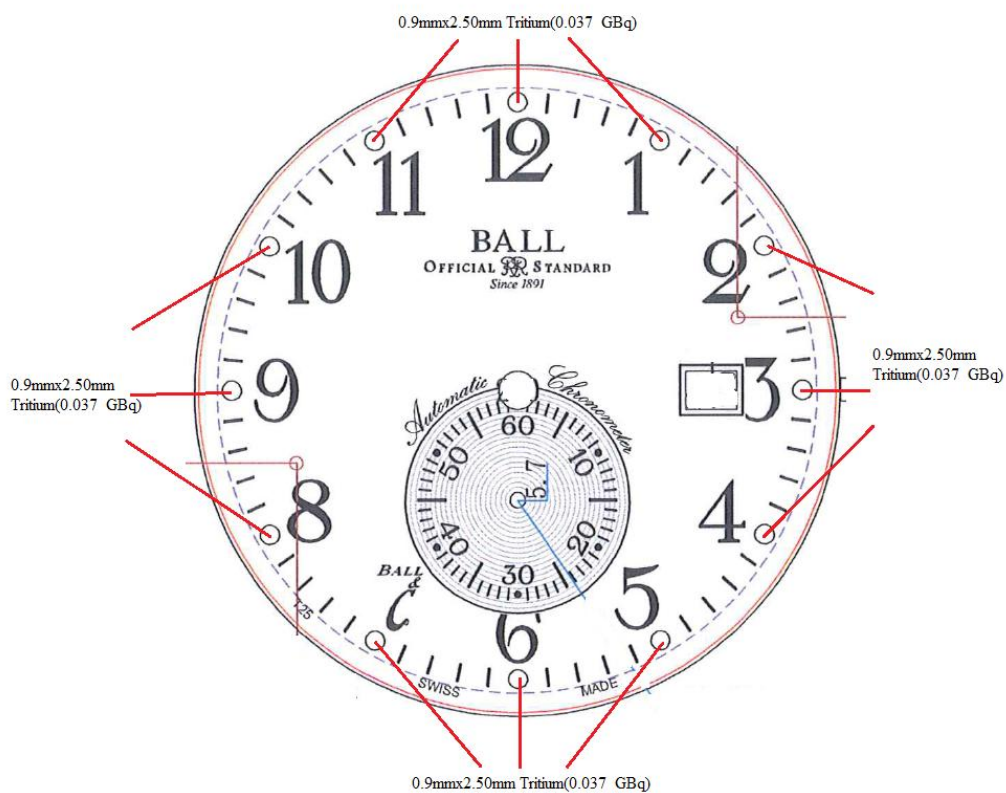


8 each	0.65mm x 4.10mm	(0.060 GBq)	total = 0.480 GBq	Dial 1-11h
3 each	0.5mm x 2.00mm	(0.040 GBq)	total = 0.120 GBq	Dial 3,6,9h
1 each	0.5mm x 1.95mm	(0.050 GBq)	total = 0.050 GBq	Dial 12h

1 each	0.5mm x 3.00mm	(0.066 GBq)	total = 0.066 GBq	Hour hand
1 each	0.5mm x 6.50mm	(0.137 GBq)	total = 0.137 GBq	Minute hand
1 each	0.5mm x 1.64mm	(0.040 GBq)	total = 0.040 GBq	Second hand

NM3888

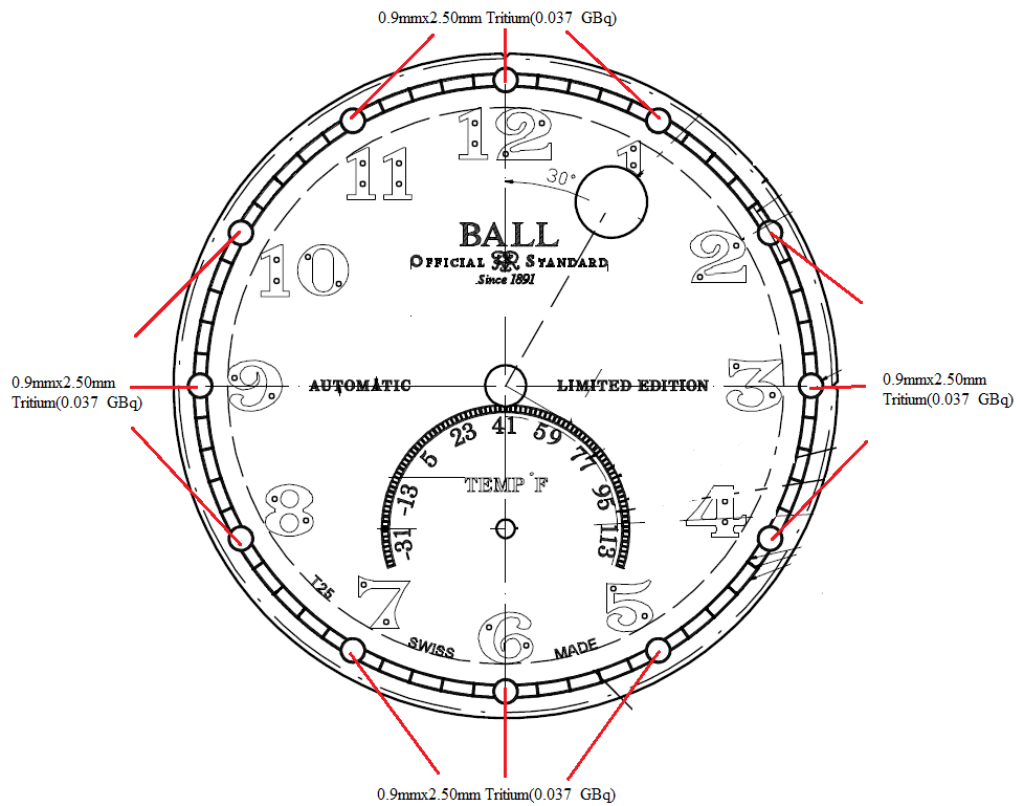
Dial

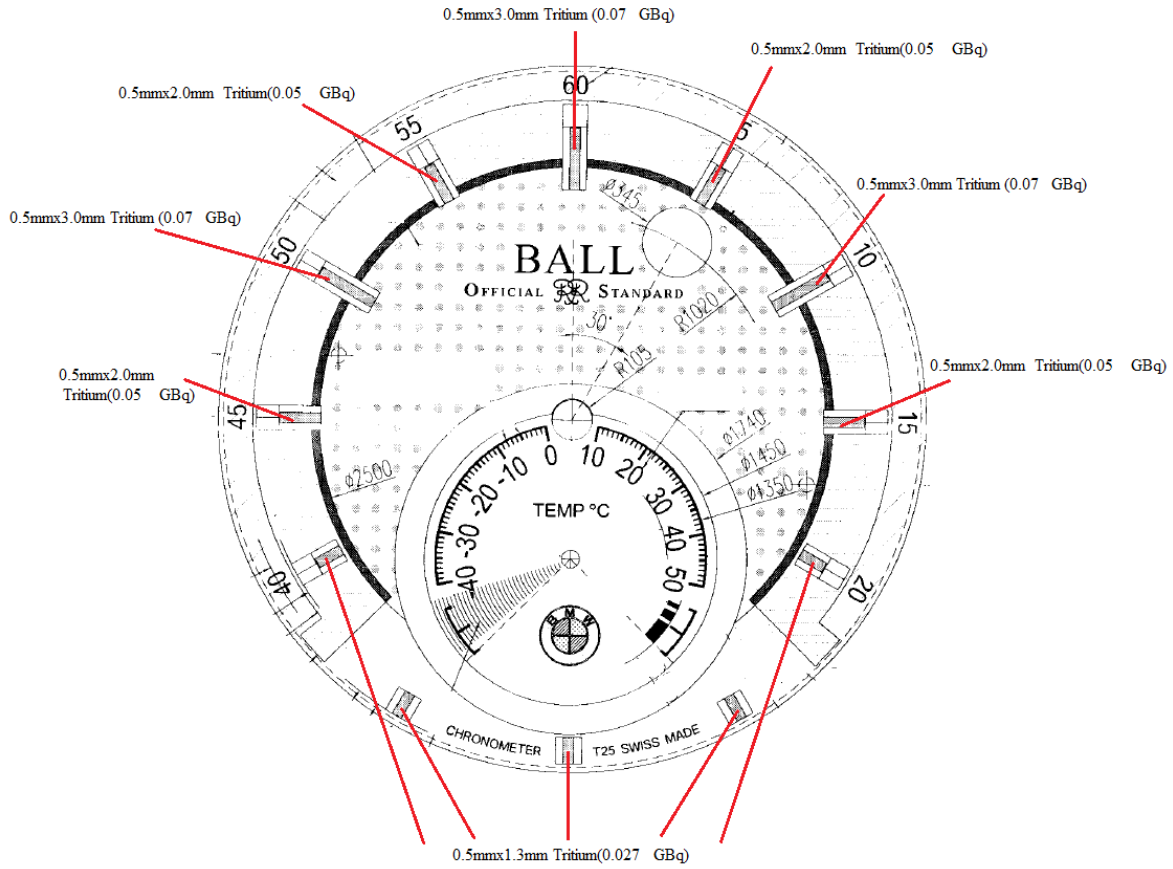


11 each	0.9mm x 2.50mm	(0.037 GBq)	total = 0.407 GBq	Dial 1-11h
1 each	0.9mm x 2.50mm	(0.037 GBq)	total = 0.037 GBq	Dial 12h
1 each	0.5mm x 2.00mm	(0.050 GBq)	total = 0.040 GBq	Hour hand
1 each	0.5mm x 4.50mm	(0.110 GBq)	total = 0.110 GBq	Minute hand

NT1050

Dial

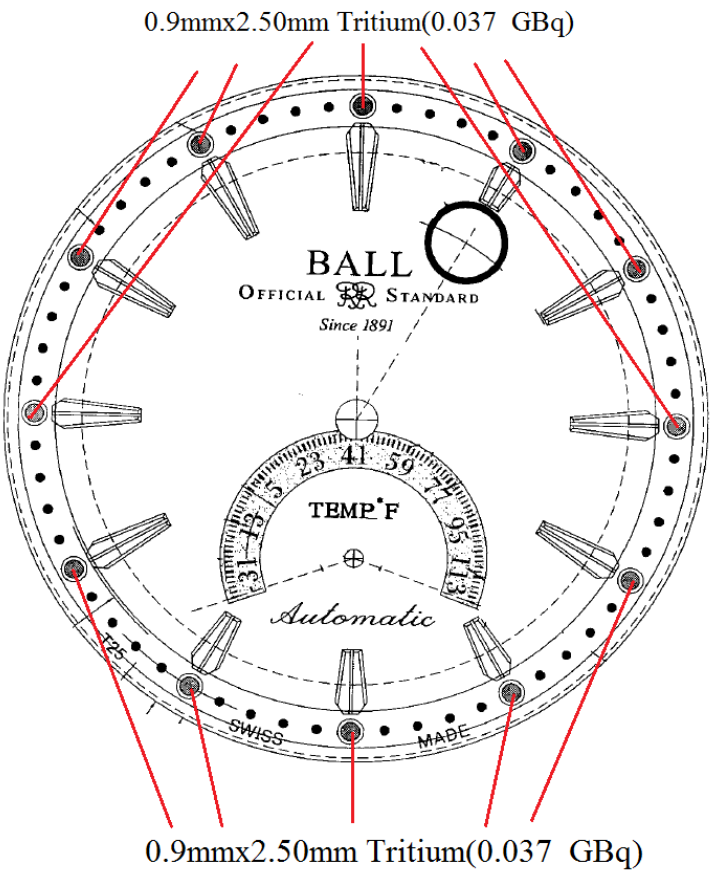


NT3010
Dial

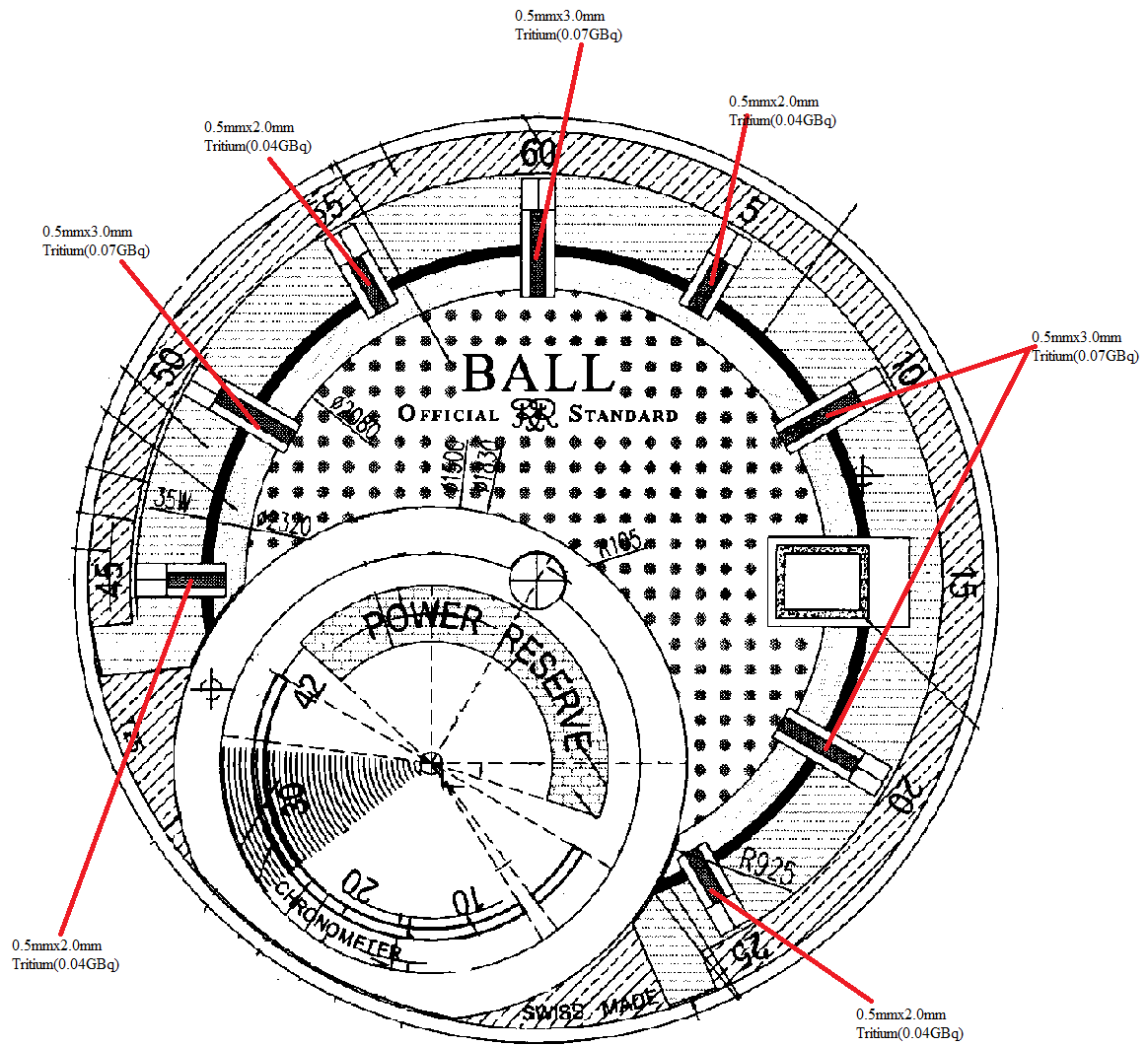
1 each	0.5mm x 3.0mm (0.07 GBq)	total = 0.07 GBq	Dial 12h
2 each	0.5mm x 3.0mm (0.07 GBq)	total = 0.14 GBq	Dial 2, 10h
4 each	0.5mm x 2.0mm (0.05 GBq)	total = 0.200 GBq	Dial 1,3,9,11h
5 each	0.5mm x 1.3mm (0.027 GBq)	total = 0.135 GBq	Dial 4,5,6,7,8h

1 each	0.5mm x 6.5mm (0.14 GBq)	total = 0.140	GBq	Hour hand
1 each	0.5mm x 6.5mm (0.14 GBq)	total = 0.140	GBq	Minute hand

NT3888
Dial



11 each	0.9mm x 2.50mm	(0.037 GBq)	total = 0.407	GBq Dial 1-11h
1 each	0.9mm x 2.50mm	(0.037 GBq)	total = 0.037	GBq Dial 12h
1 each	0.5mm x 4.45mm	(0.11 GBq)	total = 0.110	GBq Hour hand
1 each	0.5mm x 6.50mm	(0.14 GBq)	total = 0.140	GBq Minute hand

PM3010
Dial

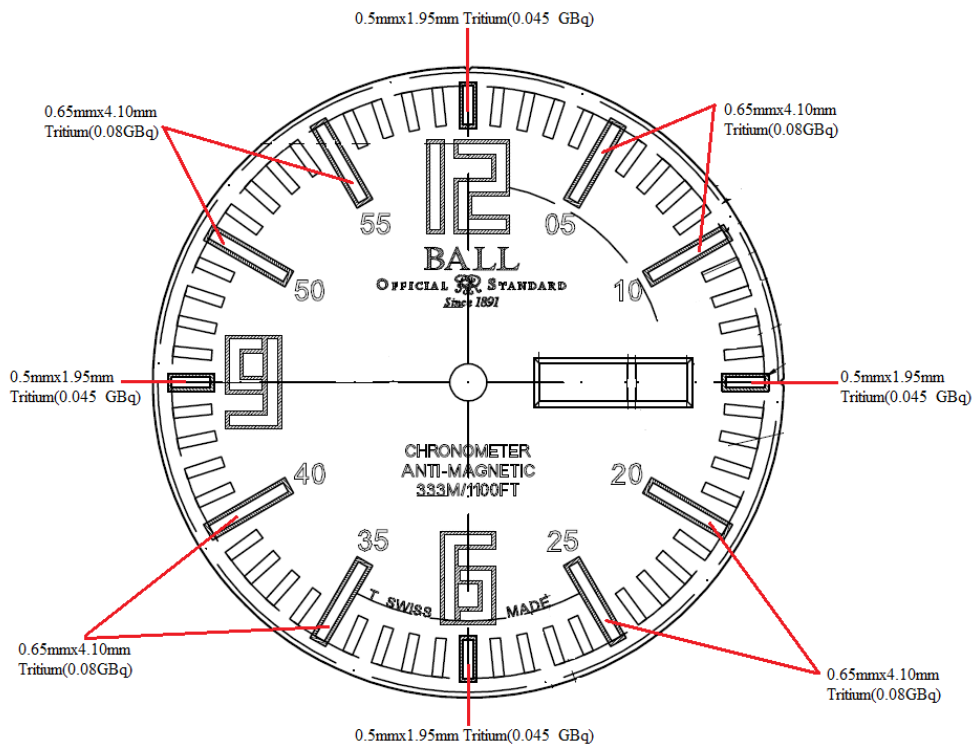
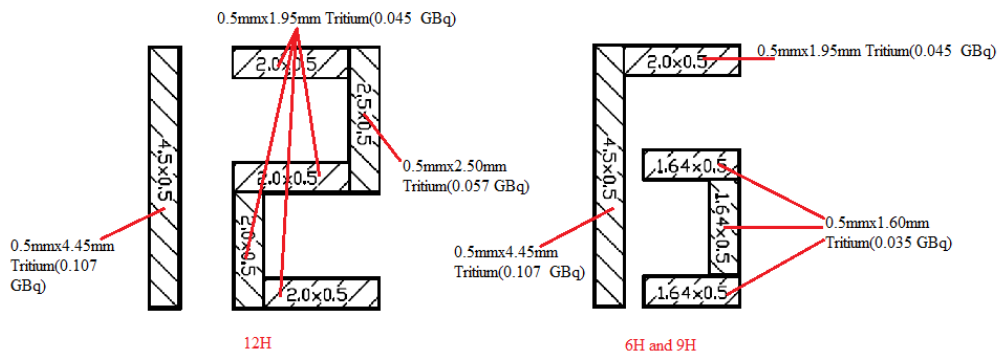
4 each	0.5mm x 2.0mm	(0.04 GBq)	total = 0.16	GBq	Dial index
3 each	0.5mm x 3.0mm	(0.07 GBq)	total = 0.21	GBq	Dial index
1 each	0.5mm x 3.0mm	(0.07 GBq)	total = 0.07	GBq	Dial 12h
1 each	0.5mm x 6.5mm	(0.137 GBq)	total = 0.137	GBq	Minute hand
1 each	0.5mm x 6.5mm	(0.137 GBq)	total = 0.137	GBq	Second hand

ATTACHMENT C
TIMEPIECES SUBJECT TO
10 CFR 32.22

DM2036

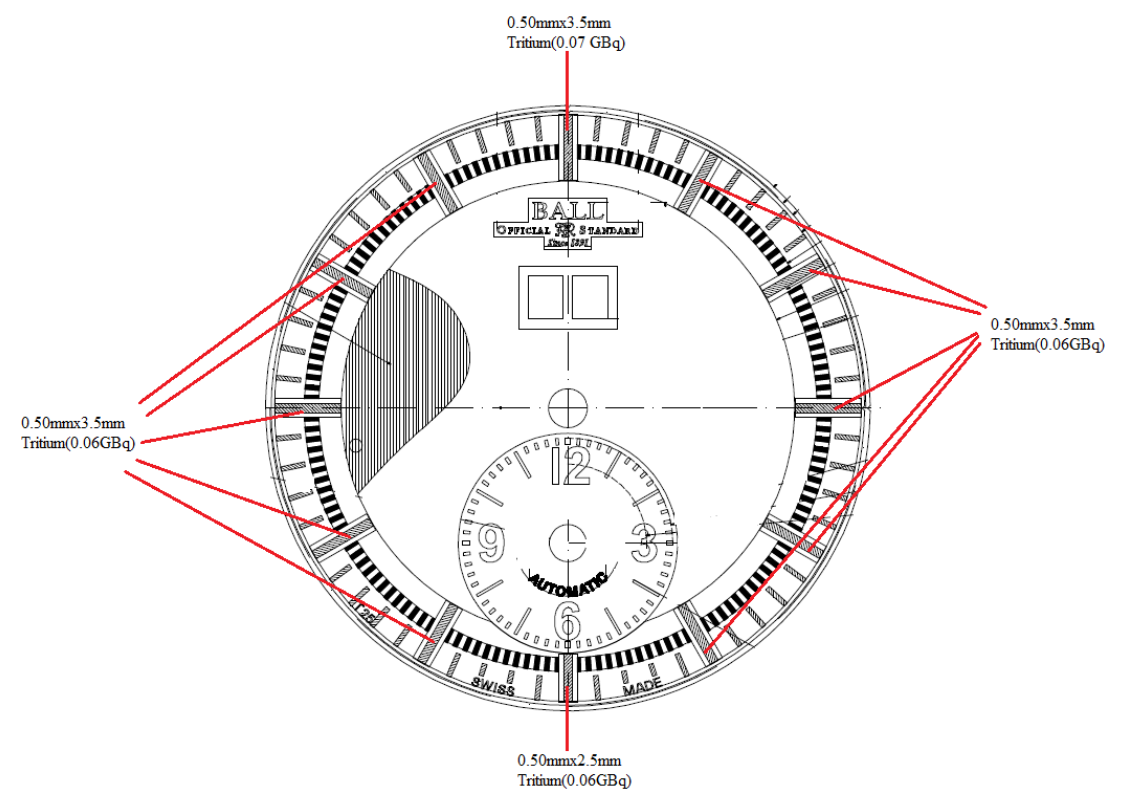
Dial

1 each	0.5x2.50	(0.057 GBq)	total = 0.057	GBq	Dial
6 each	0.5x1.60	(0.035 GBq)	total = 0.21	GBq	Dial
3 each	0.5x4.45	(0.107 GBq)	total = 0.321	GBq	Dial
8 each	0.65x4.10	(0.08 GBq)	total = 0.64	GBq	Dial
10 each	0.5x1.95	(0.045 GBq)	total = 0.45	GBq	Dial



GM1056

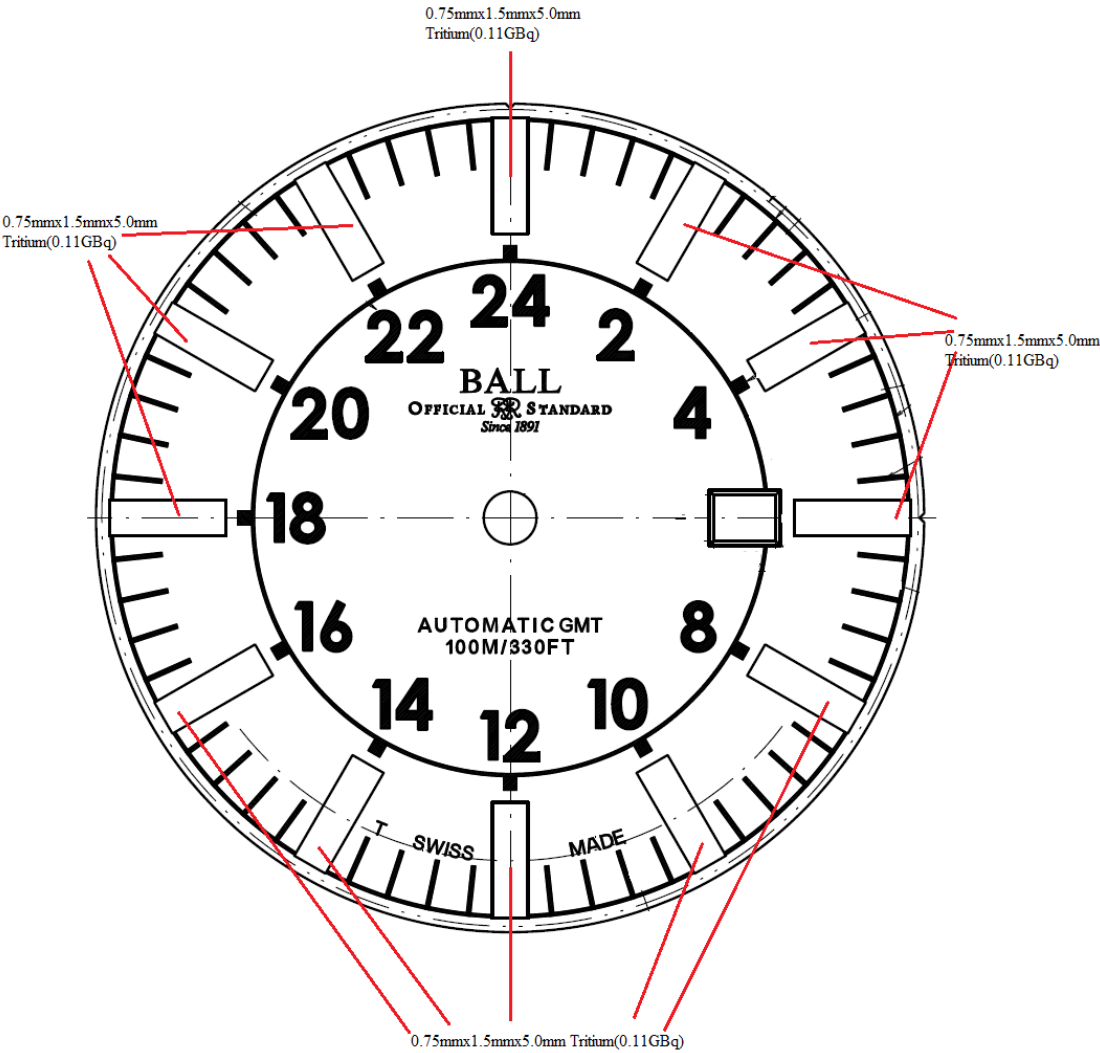
Dial



1 each	0.50mm x 3.5mm	(0.07 GBq)	total = 0.07	GBq	Dial at 12H
10 each	0.50mm x 3.5mm	(0.06 GBq)	total = 0.60	GBq	Dial index 1-11
1 each	0.50mm x 2.5mm	(0.06 GBq)	total = 0.06	GBq	Dial at 6H
1 each	0.50mm x 3.5mm	(0.07 GBq)	total = 0.07	GBq	Hour hand
1 each	0.50mm x 6.5mm	(0.14 GBq)	total = 0.14	GBq	Minute hand
1 each	0.50mm x 1.6mm	(0.04 GBq)	total = 0.04	GBq	Second hand

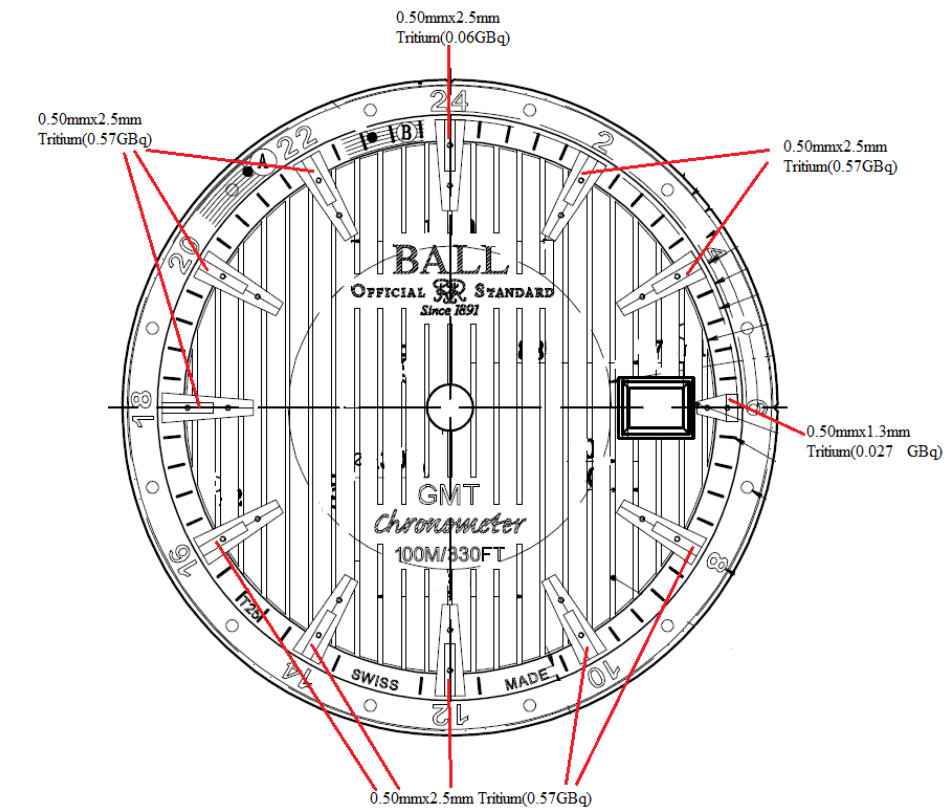
GM1086

Dial



1 each	0.75mm x 1.5mm x 5.0mm	(0.11 GBq)	total = 0.11	GBq	Dial at 12H
11 each	0.75mm x 1.5mm x 5.0mm	(0.11 GBq)	total = 1.21	GBq	Dial index 1-11
1 each	0.50mm x 1.64mm	(0.035 GBq)	total = 0.035	GBq	Hour hand
1 each	0.50mm x 3.5mm	(0.056 GBq)	total = 0.056	GBq	Minute hand
1 each	0.50mm x 6.5mm	(0.137 GBq)	total = 0.137	GBq	Second hand
1 each	0.50mm x 3.5mm	(0.056 GBq)	total = 0.056	GBq	GMT hand

GM2026
Dial

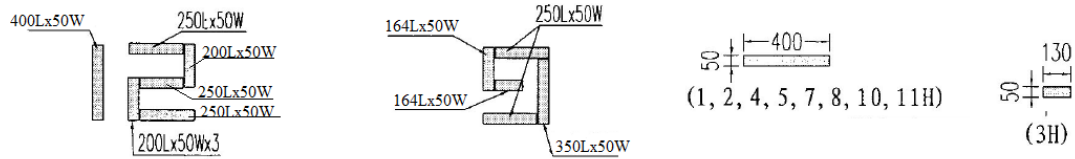


1 each	0.50mm x 2.50mm	(0.06 GBq)	total = 0.06 GBq	Dial at 12H
10 each	0.50mm x 2.50mm	(0.057 GBq)	total = 0.57 GBq	Dial index 1,2,4-11H
1 each	0.50mm x 1.3mm	(0.027 GBq)	total = 0.027 GBq	Dial at 3H

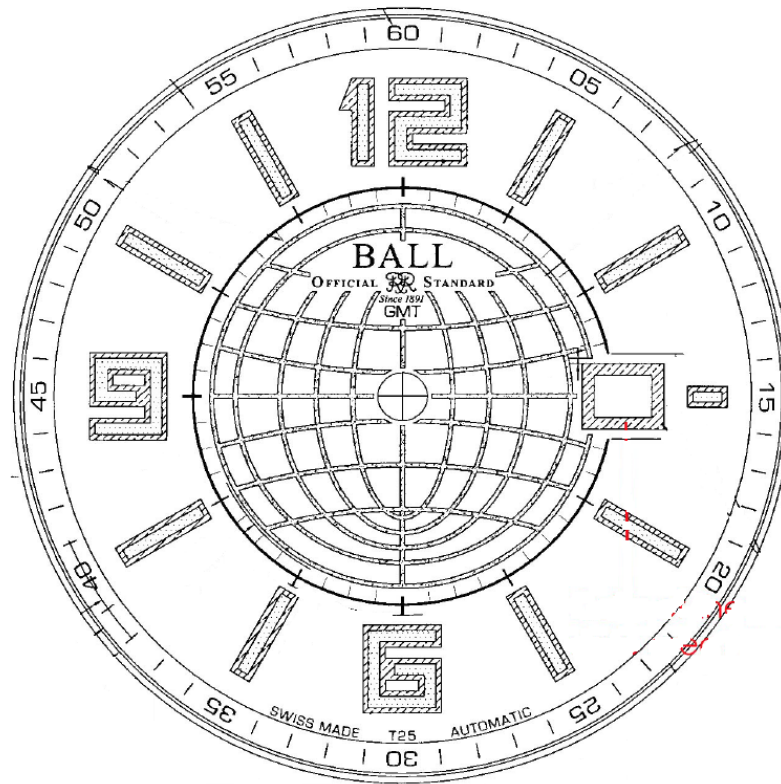
1 each	0.50mm x 4.45mm	(0.11 GBq)	total = 0.11 GBq	Hour hand
1 each	0.50mm x 6.5mm	(0.14 GBq)	total = 0.14 GBq	Minute hand
1 each	0.50mm x 1.6mm	(0.035 GBq)	total = 0.035 GBq	Second hand

GM3090

Dial

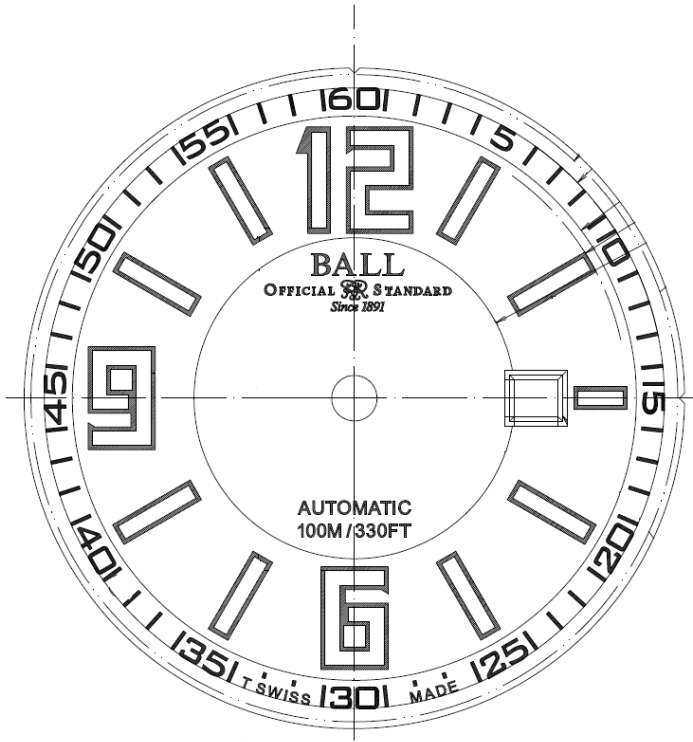
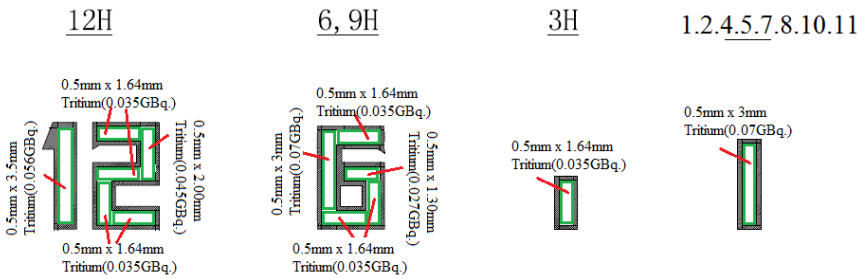


8 each	0.5mmx4.0mm	Tritium (0.070 GBq.)	total = 0.560	GBq.	Dial, 1,2,4,5,7,8,10,11h
1 each	0.5mmx1.3mm	Tritium (0.027 GBq.)	total = 0.027	GBq.	Dial 3h
4 each	0.5mmx2.5mm	Tritium (0.060 GBq.)	total = 0.240	GBq.	Dial 6,9h
2 each	0.5mmx3.5mm	Tritium (0.070 GBq.)	total = 0.140	GBq.	Dial 6,9h
4 each	0.5mmx1.64mm	Tritium (0.040 GBq.)	total = 0.160	GBq.	Dial 6,9h
1 each	0.5mmx4.0mm	Tritium (0.070 GBq.)	total = 0.070	GBq.	Dial 12h
3 each	0.5mmx2.5mm	Tritium (0.060 GBq.)	total = 0.180	GBq.	Dial 12h
2 each	0.5mmx2.0mm	Tritium (0.050 GBq.)	total = 0.100	GBq.	Dial 12h



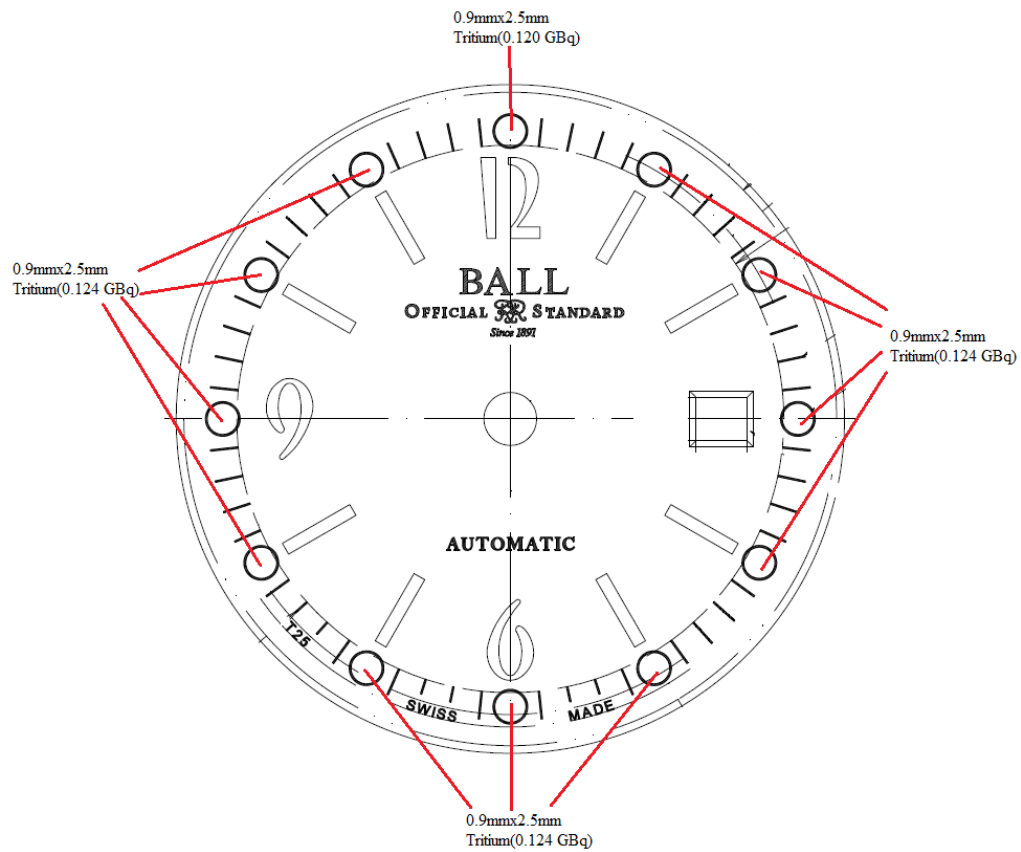
NL1026
Dial

8 each	0.5mm x 3.00 mm (0.07GBq)	total = 0.56	GBq	Dial 1,2,4,5,7,8,9,10h
1 each	0.5mm x 2.00mm (0.05GBq)	total = 0.05	GBq	Dial 12h
1 each	0.5mm x 3.50mm(0.07GBq)	total = 0.07	GBq	Dial 12h
4 each	0.5mm x 1.64mm (0.04GBq)	total = 0.16	GBq	Dial 12h
7 each	0.5mm x 1.64mm (0.04GBq)	total = 0.28	GBq	Dial 3,6,9h
2 each	0.5mm x 1.3mm (0.027GBq)	total = 0.08	GBq	Dial 6,9h
2 each	0.5mm x 3.0mm (0.07GBq)	total = 0.14	GBq	Dial 6,9h



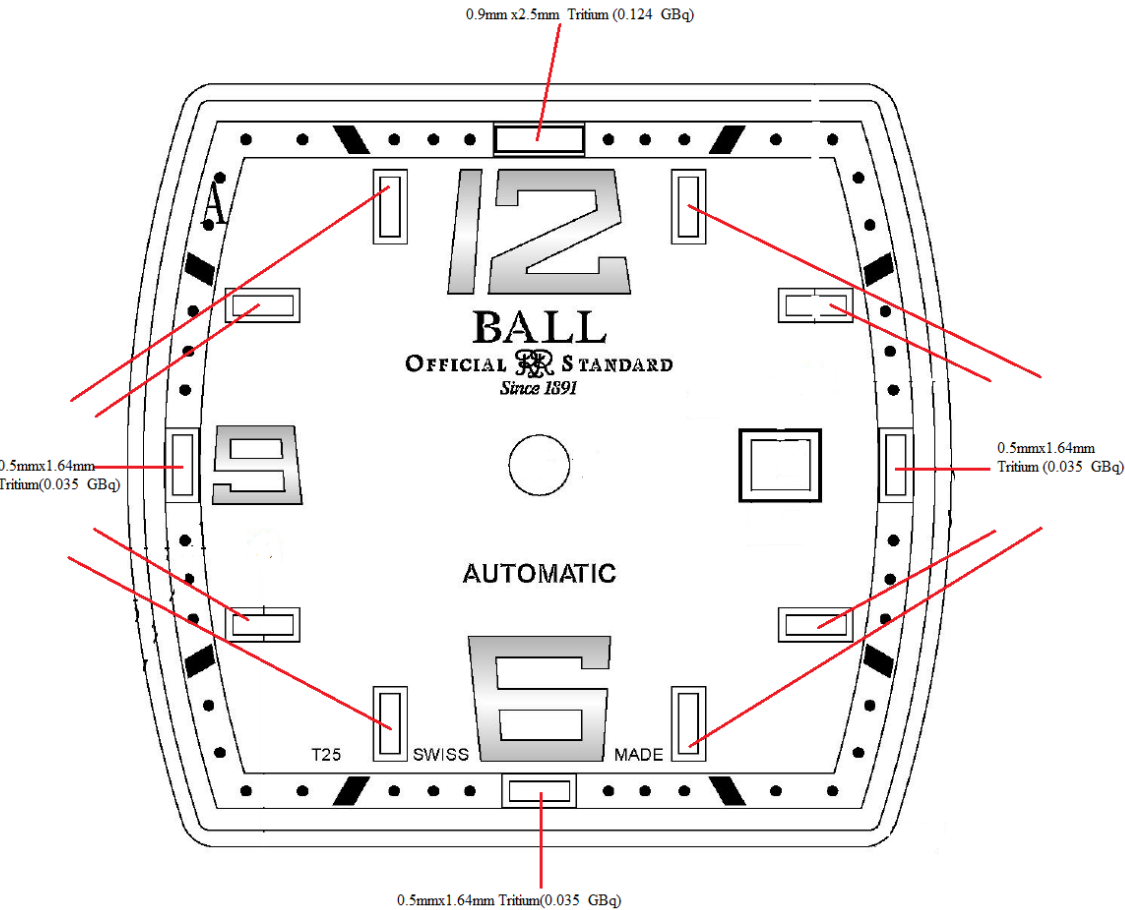
1 each	0.5mm x 2.50mm (0.057 GBq.)	total = 0.0400	GBq	Hour hand
1 each	0.5mm x 3.50mm (0.056 GBq)	total = 0.0560	GBq	Minute hand
1 each	0.5mm x 1.64mm (0.035 GBq)	total = 0.0350	GBq	Second hand

NL1038
Dial



11 each	0.9mm x 2.5mm	(0.124 GBq)	total = 1.364	GBq	Dial 1-11h
1 each	0.9mm x 2.5mm	(0.120 GBq)	total = 0.120	GBq	Dial on 12h
1 each	0.5mm x 1.64mm	(0.040 GBq)	total = 0.04	GBq	Hour hand
1 each	0.5mm x 2.4mm	(0.14 GBq)	total = 0.14	GBq	Minute hand
1 each	0.5mm x 1.64mm	(0.040 GBq)	total = 0.040	GBq	Second hand

NL1068
Dial

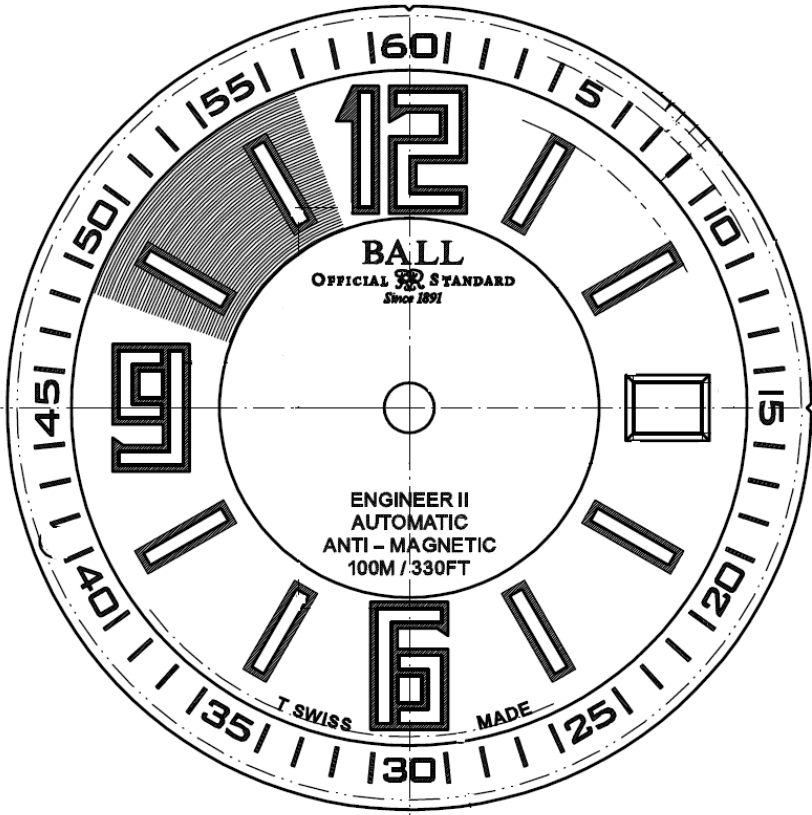
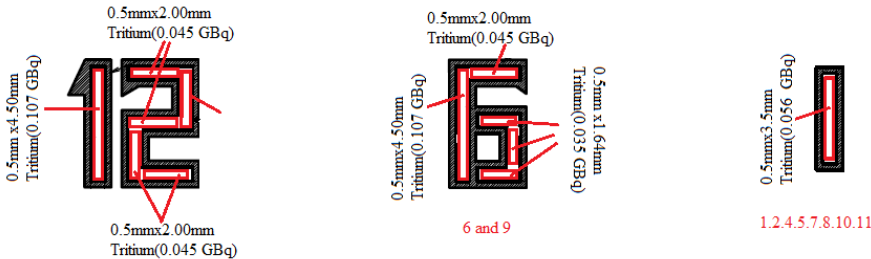


11 each	0.5mm x 1.64mm (0.035 GBq)	total = 0.385 GBq	Dial 1-11H
1 each	0.9mm x 2.5mm (0.124 GBq)	total = 0.124 GBq	Dial on 12H
1 each	0.5mm x 2.5mm (0.057 GBq)	total = 0.057 GBq	Hour hand
1 each	0.5mm x 4.5mm (0.107 GBq)	total = 0.107 GBq	Minute hand
1 each	0.5mm x 2.0mm (0.450 GBq)	total = 0.450 GBq	Second hand

NM1020

Dial

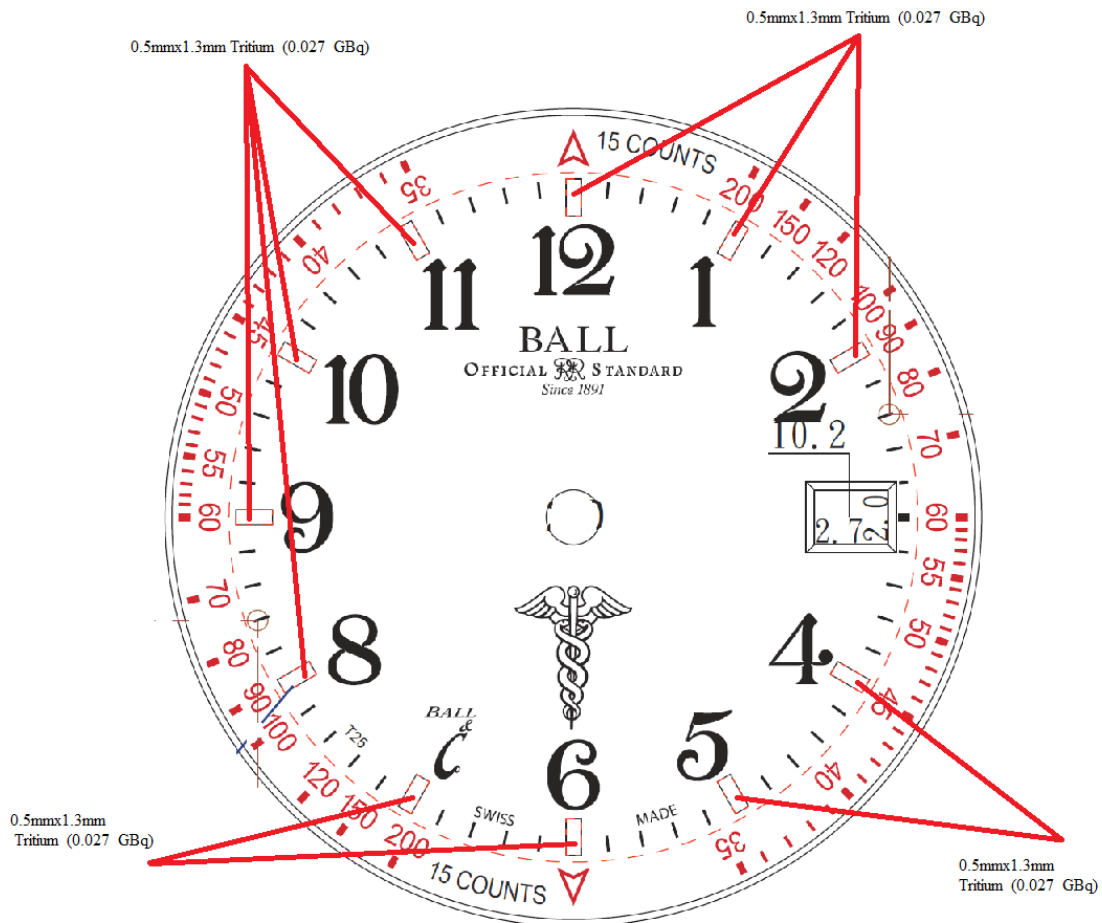
6 each	0.5x1.64	(0.035 GBq)	total = 0.210	GBq	Dial 6h,9h,12h
6 each	0.5x2.00	(0.045 GBq)	total = 0.270	GBq	Dial 6h,9h,12h
1 each	0.5x2.50	(0.057 GBq)	total = 0.057	GBq	Dial on 12h
3 each	0.5x4.50	(0.107 GBq)	total = 0.321	GBq	Dial 6h,9h
8 each	0.5x3.5	(0.056 GBq)	total = 0.448	GBq	Dial 1-2h,4-5h, 7-8h. 10-11h



1 each	0.5x1.64(0.035 GBq)	total = 0.035	GBq	Hour hand
1 each	0.5x4.5(0.107 GBq)	total = 0.107	GBq	Minute hand
1 each	0.5x6.5(0.137 GBq)	total = 0.137	GBq	Second hand

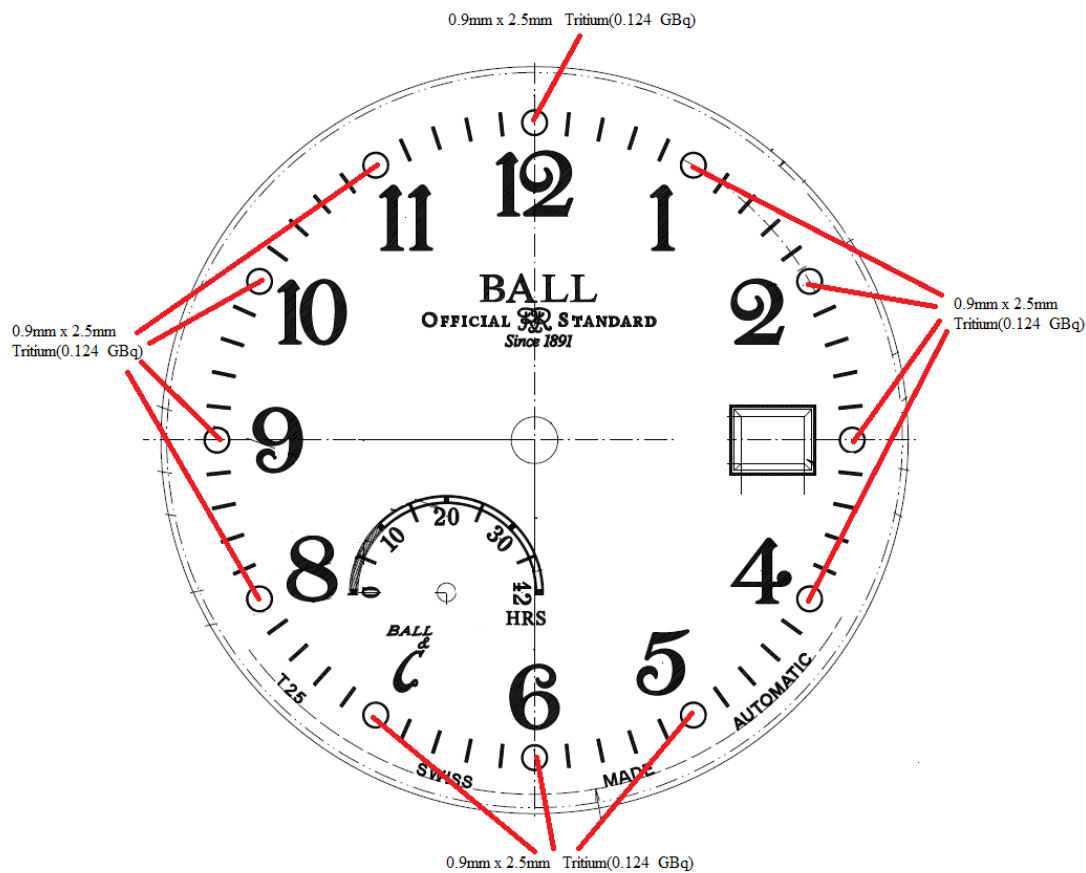
NM1038

Dial



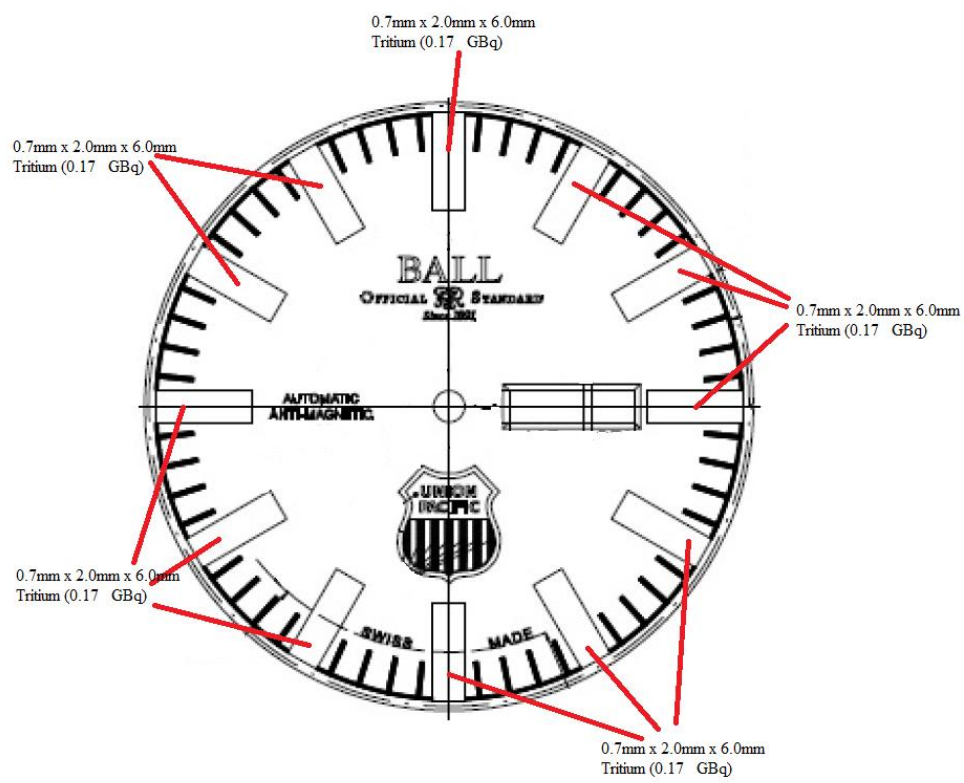
10 each	0.5mm x 1.3mm	(0.027 GBq)	total = 0.270 GBq	Dial 1-11H
1 each	0.5mm x 1.3mm	(0.027 GBq)	total = 0.027 GBq	Dial 12H
1 each	0.5mm x 6.5mm	(0.050 GBq)	total = 0.050 GBq	Hour hand
1 each	0.5mm x 4.50mm	(0.130 GBq)	total = 0.130 GBq	Minute hand
1 each	0.5mm x 1.64mm	(0.040 GBq)	total = 0.040 GBq	Second hand

NM1056
Dial



1 each	0.5x2.0 (0.450 GBq)	total = 0.450 GBq	Hour hand
1 each	0.5x4.50 (0.107 GBq)	total = 0.107 GBq	Minute hand
1 each	0.5x1.64 (0.035 GBq)	total = 0.035 GBq	Second hand

NM1080
Dial

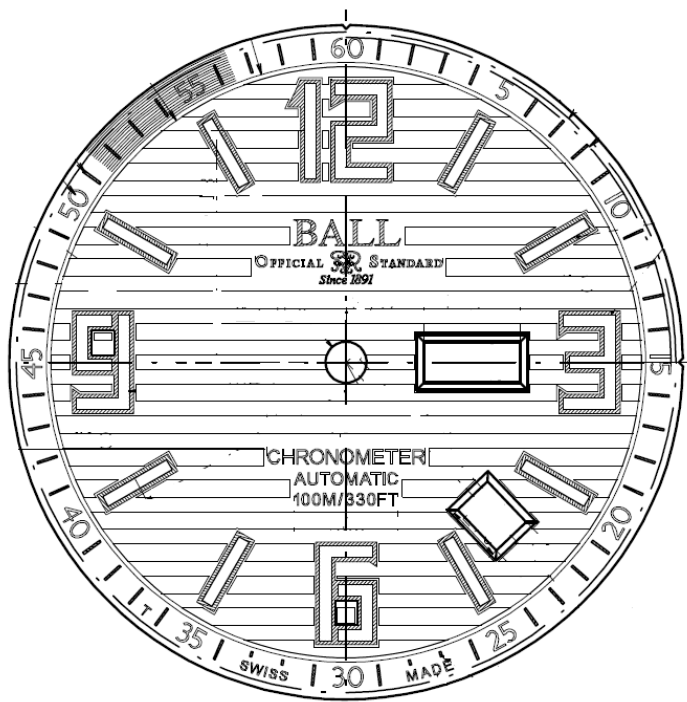
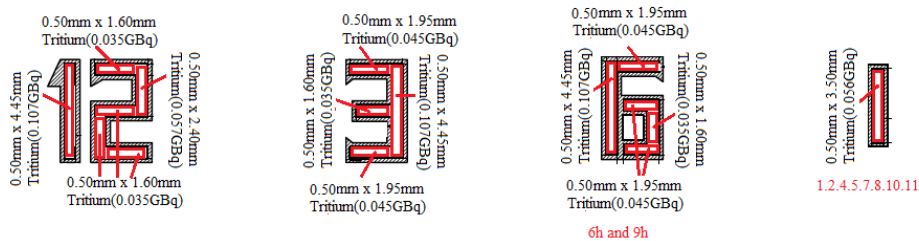


1 each	0.5x3.50	(0.056 GBq)	total = 0.056	GBq	Hour hand
1 each	0.5x6.50	(0.137 GBq)	total = 0.137	GBq	Minute hand
1 each	0.5x1.64	(0.035 GBq)	total = 0.035	GBq	Second hand

NM2026

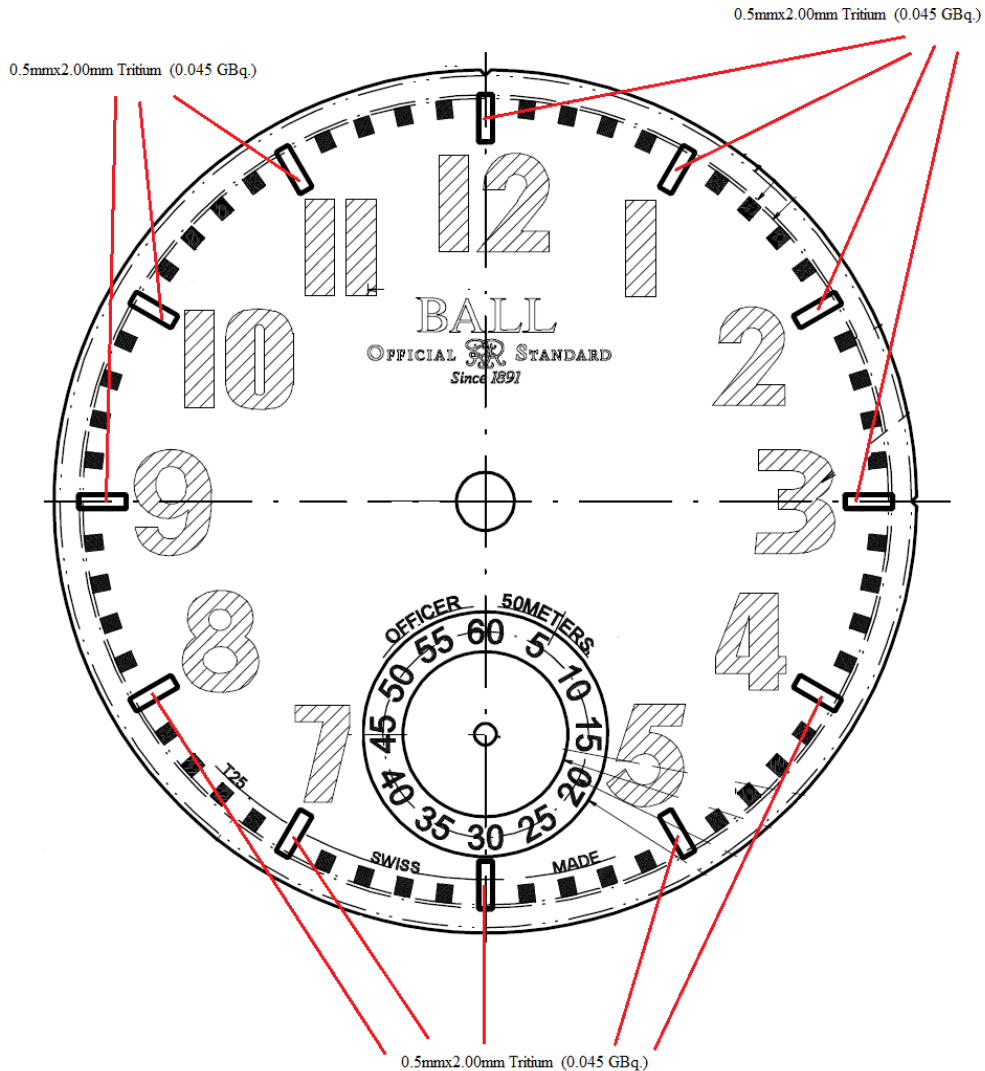
Dial

7 each	0.50x1.60	(0.035 GBq)	total = 0.245	GBq	Dial 12,3,6,9h
8 each	0.50x1.95	(0.045 GBq)	total = 0.360	GBq	Dial 1,2,4,5,7,8,10,11
1 each	0.50x2.40	(0.057 GBq)	total = 0.057	GBq	Dial 12h
4 each	0.50x4.45	(0.107 GBq)	total = 0.428	GBq	Dial 12,3,6,9h
8 each	0.50x3.50	(0.056 GBq)	total = 0.448	GBq	Dial 12,3,6,9h



1 each	0.50x6.50	(0.137 GBq)	total = 0.137	GBq	Minute hand
1 each	0.50x4.50	(0.107 GBq)	total = 0.107	GBq	Hour hand
1 each	0.50x1.64	(0.035 GBq)	total = 0.035	GBq	Second hand

Dial

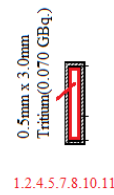
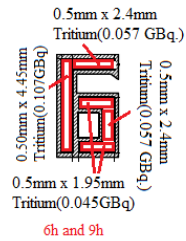
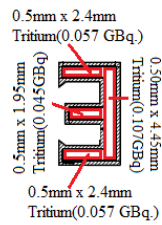
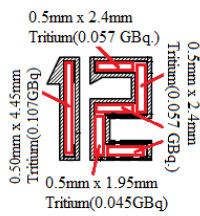


11 each	0.5mm x 2.00mm	(0.045 GBq.)	total = 0.4950 GBq	Dial 1-11h
1 each	0.5mm x 2.00mm	(0.045 GBq.)	total = 0.0450 GBq.	Dial 12h
1 each	0.5mm x 3.00mm	(0.066 GBq.)	total = 0.0660 GBq	Hour hand
1 each	0.5mm x 6.50mm	(0.137 GBq)	total = 0.1370 GBq	Minute hand

NM2068

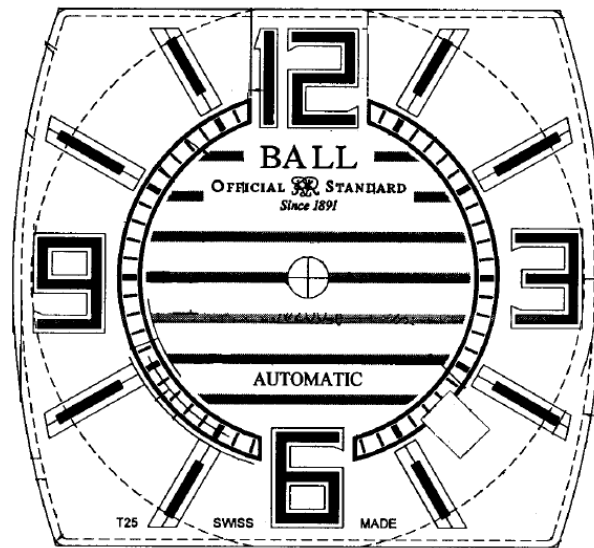
Dial

10 each	0.5mm x 2.4mm	(0.057 GBq.)	total = 0.570 GBq.	Dial 3,6,9,12h
8 each	0.5mm x 3.0mm	(0.070 GBq.)	total = 0.560 GBq	Dial 1.2.4.5.7.8.10.11h
6 each	0.5mm x 1.95mm	(0.045 GBq)	total = 0.270 GBq	Dial 3,6,9,12h
4 each	0.5mm x 4.45mm	(0.107 GBq)	total = 0.428 GBq	Dial 3,6,9,12h



1.2.4.5.7.8.10.11

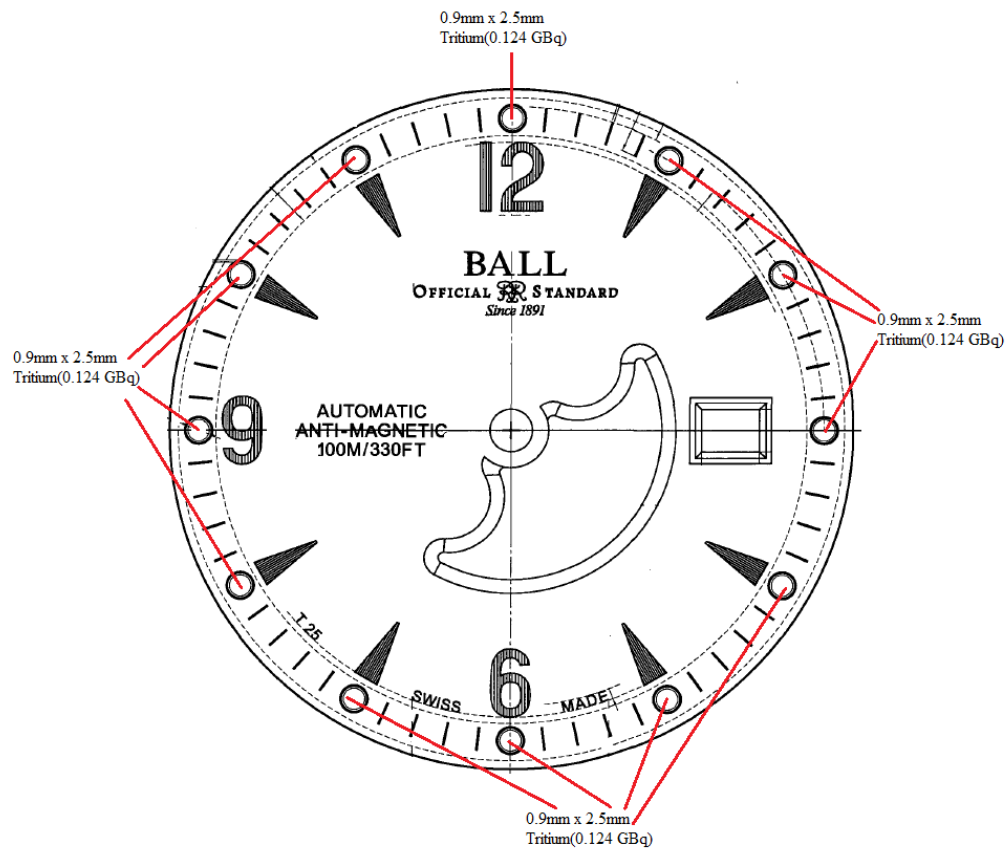
6h and 9h



1 each	0.5x3.5	(0.056 GBq.)	total = 0.057 GBq	Hour hand
1 each	0.5x1.64	(0.035 GBq.)	total = 0.140 GBq	Minute hand

NM2082

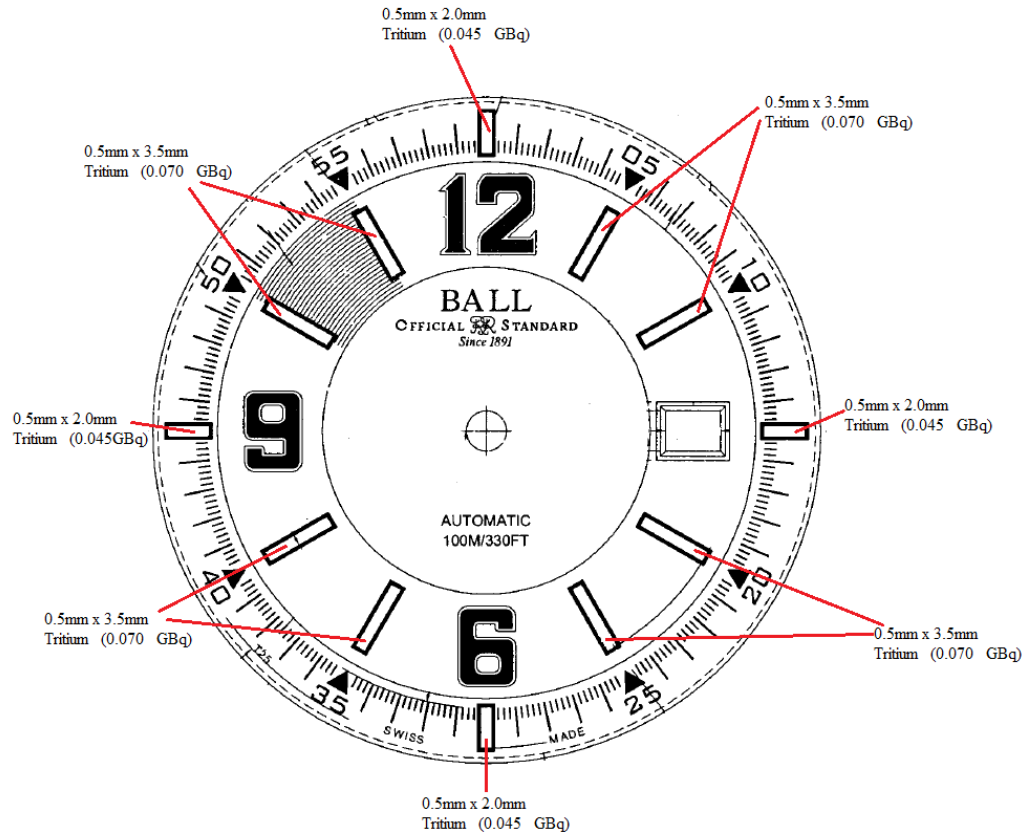
Dial



1 each	0.5mm x 6.5mm	(0.137 GBq)	total = 0.137 GBq	Hour hand
1 each	0.5mm x 1.64mm	(0.035 GBq)	total = 0.035 GBq	Second hand
1 each	0.5mm x 4.5mm	(0.107 GBq)	total = 0.107 GBq	Minute hand

NM 2088

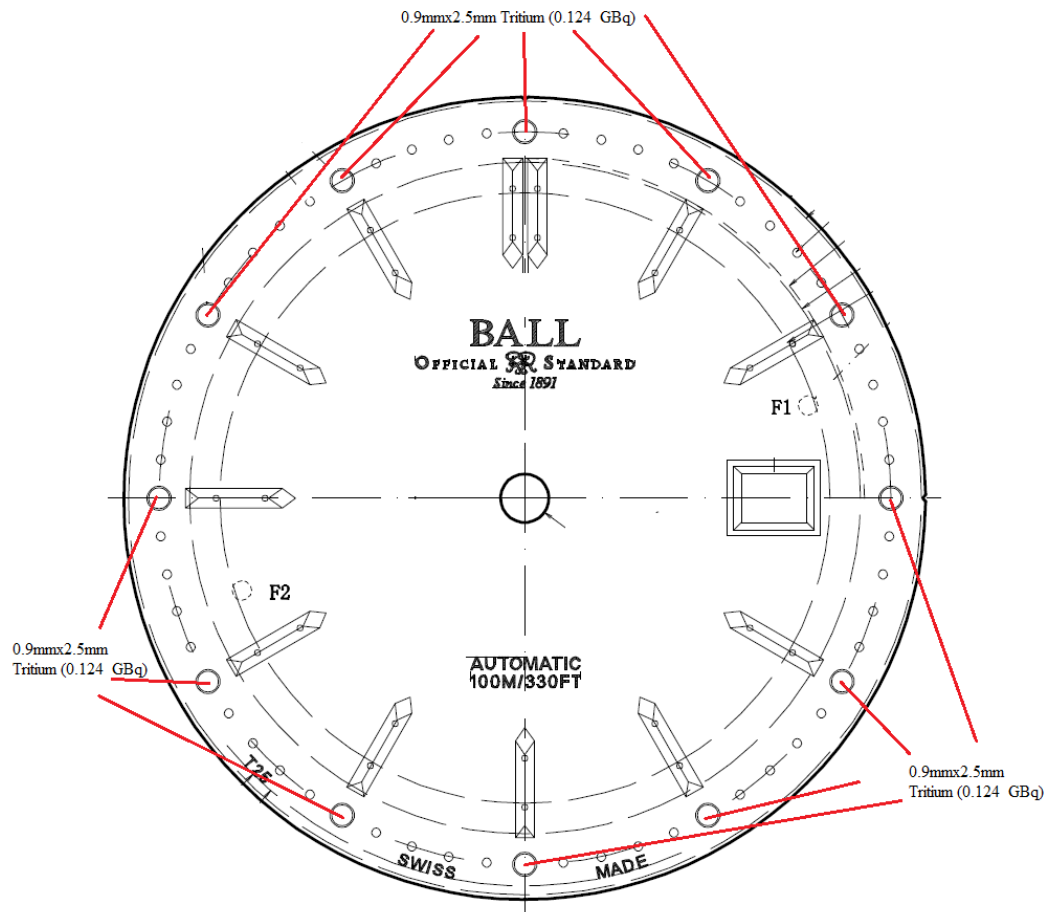
Dial



1 each	0.5mm x 3.0mm (0.080 GBq)	total = 0.080 GBq	Hour hand
1 each	0.5mm x 6.5mm (0.137 GBq)	total = 0.137 GBq	Minute hand
1 each	0.5mm x 1.64mm (0.035 GBq)	total = 0.035 GBq	Second hand

NM2098

Dial



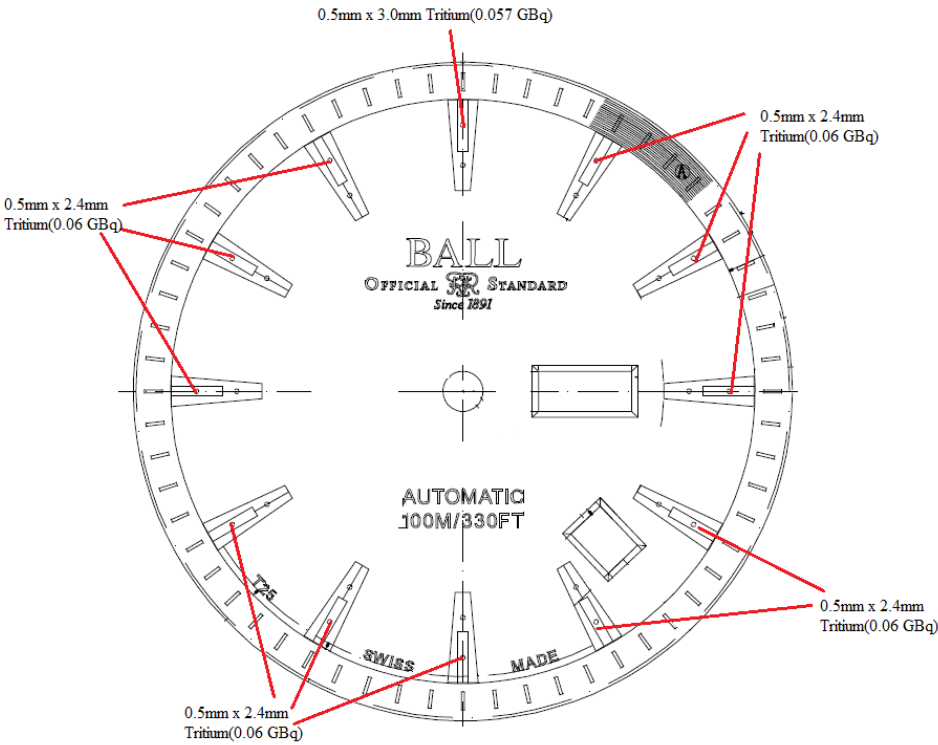
11 each	0.9mm x 2.5mm	(0.124 GBq)	total = 1.364 GBq	Dial 1-11H
1 each	0.9mm x 2.5mm	(0.124 GBq)	total = 0.124 GBq	Dial on 12H

1 each	0.5mm x 6.5mm	(0.137 GBq)	total = 0.137 GBq	Minute hand
1 each	0.5mm x 4.5mm	(0.107 GBq)	total = 0.107 GBq	Hour hand

NM2110

Dial

11	each 0.5mm x 2.4mm	(0.06 GBq)	total = 0.660	GBq	Dial 1-11h
1	each 0.5mm x 3.0 mm	(0.057 GBq)	total = 0.057	GBq	Dial on 12h

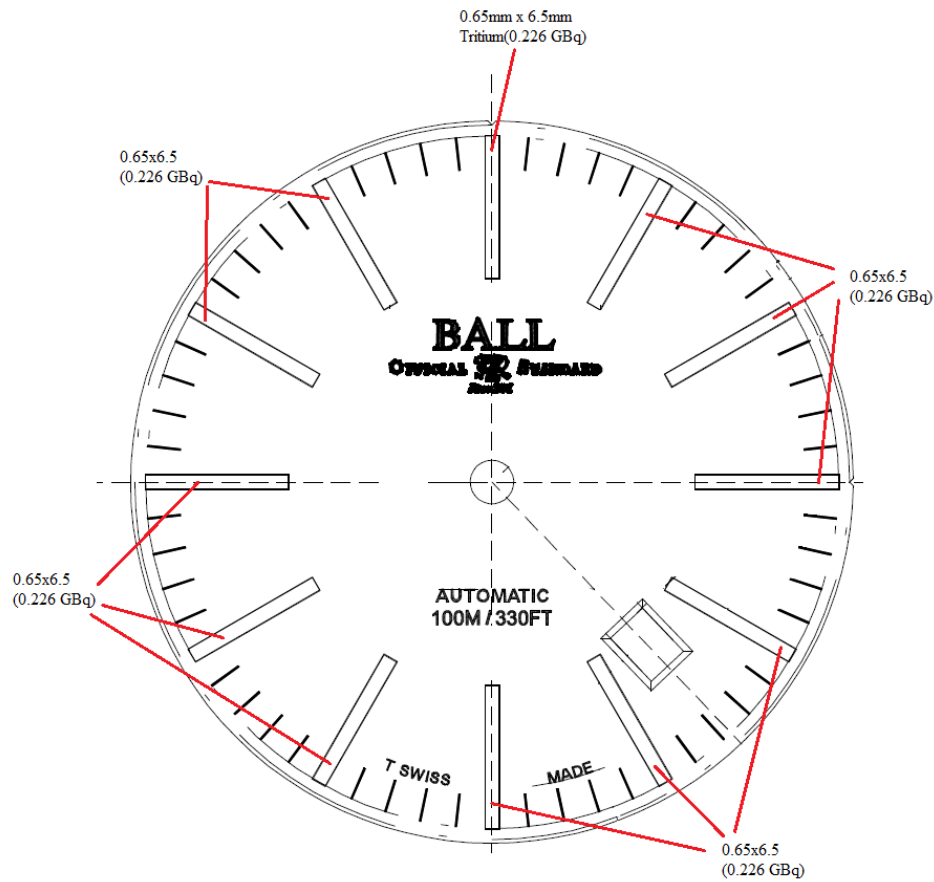


1	each 0.5mm x 6.5mm	(0.137 GBq)	total = 0.137	GBq	hour hand
1	each 0.5mm x 4.45mm	(0.107 GBq)	total = 0.107	GBq	minute hand

NM2188

Dial

11	each	0.65mm x 6.5mm	(0.226 GBq)	total = 2.486	GBq	Dial on 1-11h
1	each	0.65mm x 6.5mm	(0.226 GBq)	total = 0.226	GBq	Dial on 12h
1	each	0.5mm x 2.5mm	(0.107 GBq)	total = 0.107	GBq	hour hand
1	each	0.5mm x 6.5mm	(0.137 GBq)	total = 0.137	GBq	minute hand
1	each	0.5mm x 1.64mm	(0.035 GBq)	total = 0.035	GBq	Second hand

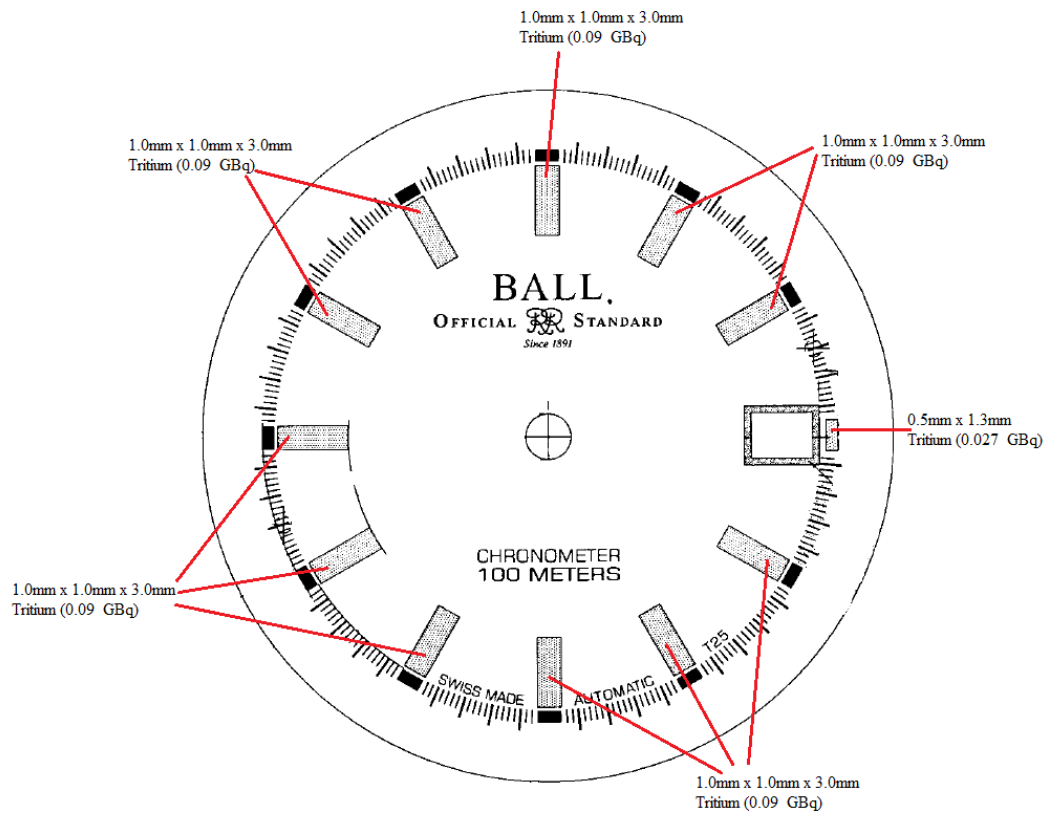


NM3022

Dial

10 each	1.0mm x 1.0mm x 3.0mm	(0.09 GBq)	total = 0.900 GBq	Dial 1-11H
1 each	1.0mm x 1.0mm x 3.0mm	(0.09 GBq)	total = 0.090 GBq	Dial 12H
1 each	0.5mm x 1.3mm	(0.027 GBq)	total = 0.027 GBq	Dial at 3H

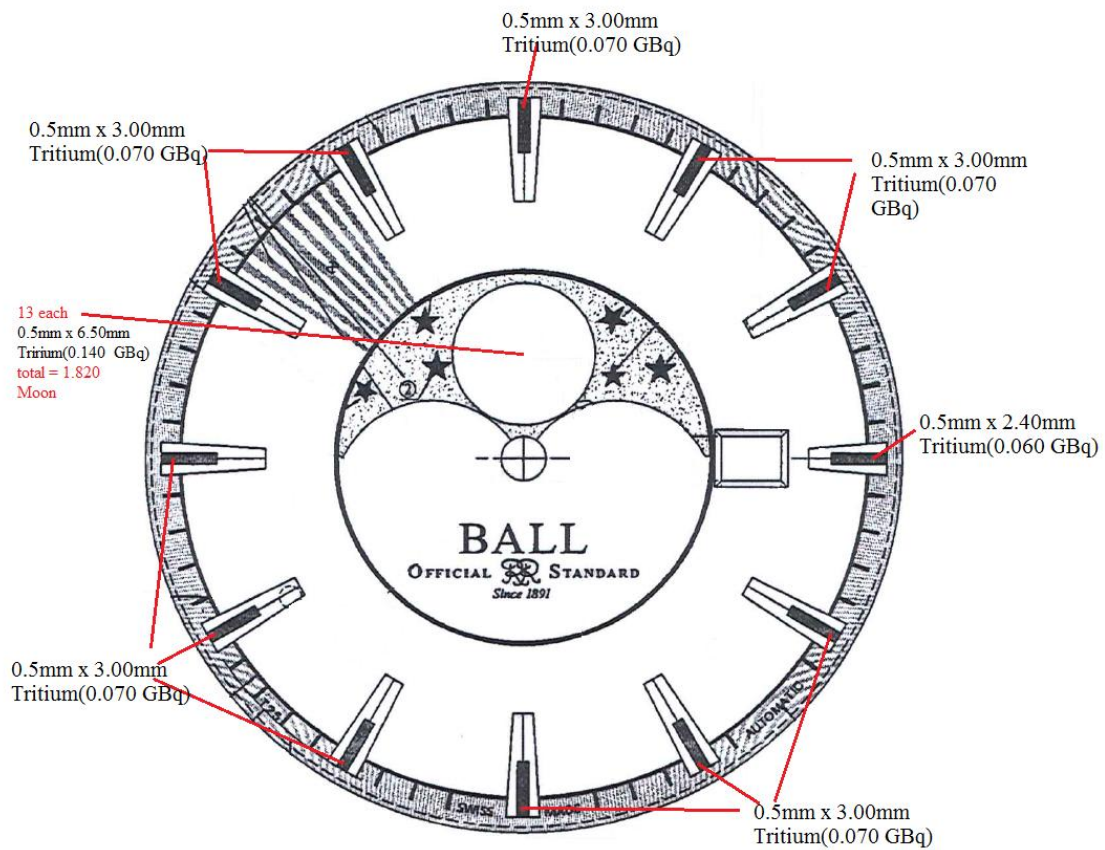
1 each	0.5mm x 3.0mm	(0.07 GBq)	total = 0.070 GBq	Hour hand
1 each	0.5mm x 6.0mm	(0.11 GBq)	total = 0.110 GBq	Minute hand
1 each	0.5mm x 1.60mm	(0.04 GBq)	total = 0.040 GBq	Second hand



NM3082

Dial

1 each	0.5mm x 3.00mm	(0.070 GBq)	total = 0.070	GBq	Dial, 12h
10 each	0.5mm x 3.00mm	(0.070 GBq)	total = 0.700	GBq	Dial, 1-11h
1 each	0.5mm x 2.40mm	(0.060 GBq)	total = 0.060	GBq	Dial 3h
13 each	0.5mm x 6.50mm	(0.140 GBq)	total = 1.820	GBq	Dial moon
1 each	0.5mm x 4.50mm	(0.137 GBq)	total = 0.110	GBq	Hour hand
1 each	0.5mm x 6.50mm	(0.027 GBq)	total = 0.140	GBq	Minute hand

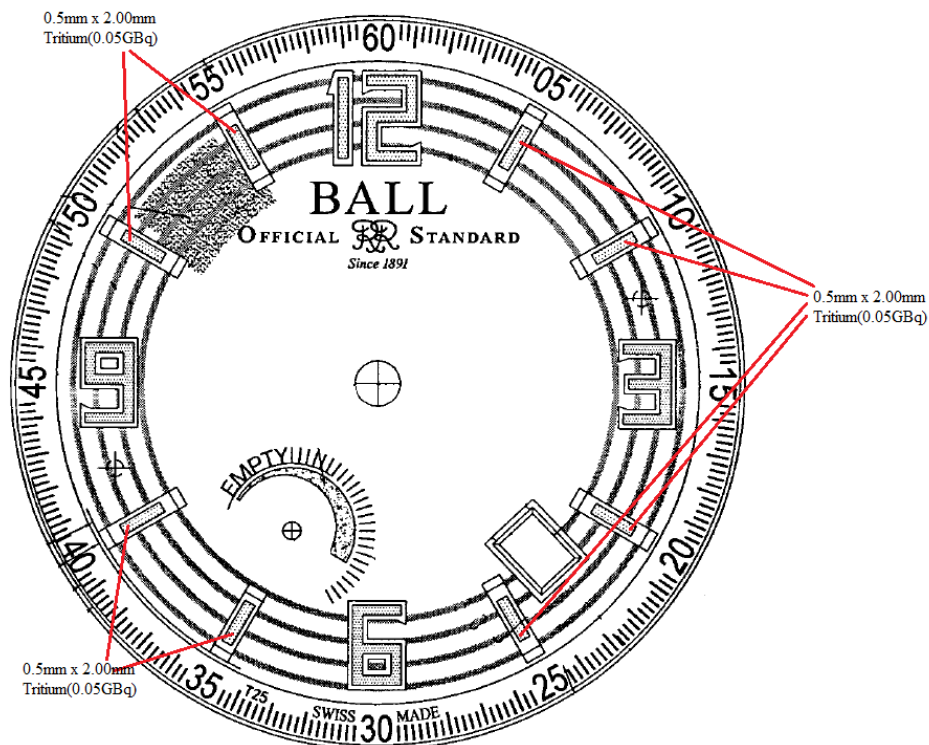
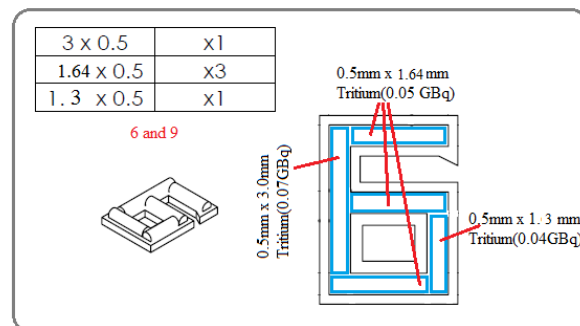
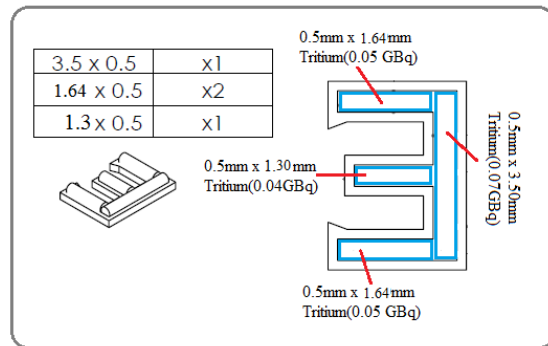
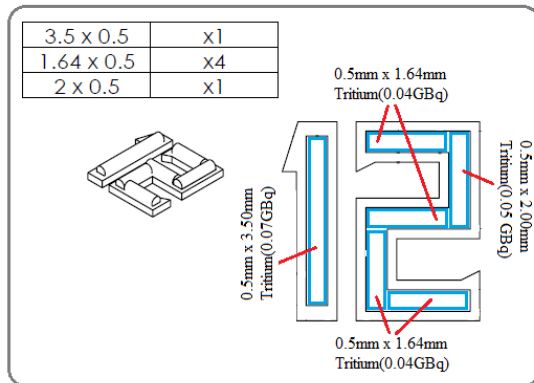


PM2096

Dial

8 each	0.5mm x 2.00mm (0.05GBq)	total = 0.40	GBq	Dial 1,2,4,5,7,8,9,10h
1 each	0.5mm x 2.00mm (0.05GBq)	total = 0.05	GBq	Dial 12h
1 each	0.5mm x 3.50mm (0.07GBq)	total = 0.07	GBq	Dial 12h
4 each	0.5mm x 1.64mm (0.04GBq)	total = 0.16	GBq	Dial 12h
1 each	0.5mm x 3.50mm (0.07GBq)	total = 0.07	GBq	Dial 3h
8 each	0.5mm x 1.64mm (0.04GBq)	total = 0.32	GBq	Dial 3,6,9h
3 each	0.5mm x 1.3mm (0.027GBq)	total = 0.08	GBq	Dial 3,6,9h
2 each	0.5mm x 3.0mm (0.07GBq)	total = 0.14	GBq	Dial 6,9h

1 each	0.5mm x 3.5mm (0.07GBq)	total = 0.07	GBq	Hour hand
1 each	0.5mm x 6.5mm (0.14GBq)	total = 0.14	GBq	Minute hand



**GENERAL QUALITY AND
TECHNICAL REQUIREMENT**



INTRODUCTION

1.1 Purposed:

We have defined requirement to ensure our suppliers deliver the components up to our quality requirement.

1.2 Responsibility:

Each supplier totally fulfils for the quality of the product deliver our quality requirements.

1.3 Delivery

Component shall be delivered directly to Ball Watch after successful final inspection is made.

1.4 Modification:

All component modification by the supplier must be submitting the approval samples to our engineering department.

1.5 Technical Advice

Since new product launching, new product requirement and inspection standard will be updated to factories by “Technical Advice” which is issued to watch factories whenever necessary.

1.6 Coverage in New Product

When we find out the new developed styles may not suitably covered by this quality manual, please contact our Engineering Department to clarify the standard before submitting “Technical Sample”.

GENERAL QUALITY AND

TECHNICAL REQUIREMENT



COMPONENT SPECIFICATION

SECTION 1 - CASE

COMPETE CASE

Case must pass the following reliability test:

- Artificial Sweat Test
- Drop test, case must be withstand the dropped from 1meter high on to the hard wood in 3 directions; crystal, back, 9 o'clock side. No parts not loose or fall out.
- Water resistant test, refer to order information.

MATERIAL

- 316L
- Titanium Grade 2
- YUS190 component (dial seat plate, movement holder, cassiolette) for anti-magnetic watch.

CRYSTAL

DIMENSION

Steps of 0.5mm must terrace the diameters of the crystals used in all round shaped assemblies. The thickness are standardized:

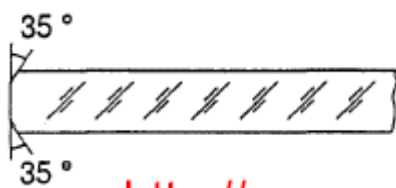
Water Resistant	Min. Thickness
3 ATM	0.7mm.
10ATM	1.0mm. ($\phi \leq 22\text{mm}$)
10ATM	1.2mm. ($\phi \geq 22.5\text{mm}$)
20ATM	1.2mm. ($\phi \leq 22\text{mm}$)
20ATM	1.5mm. ($\phi \geq 22.5\text{mm}$)

BEVEL

The bevels of the crystal are 2X35° as figure below:

GENERAL QUALITY AND

TECHNICAL REQUIREMENT



CRYSTAL HARDNESS

- The hardness of mineral crystal should be a minimum of 500 Vickers
- The hardness of sapphire crystal should be a minimum of 1700 Vickers
- The crystal material used when specified on P.O. and / or specification sheet.

CLEARANCE BETWEEN CRYSTAL AND SECOND HAND

The space between the seconds-hand (gas light tube+0.45mm) and the crystal should be a minimum of 0.50mm.

HOLDING FORCE

The minimum holding force should be 5kg.

UN-EVEN ACCEPTED LEVEL

The crystal setting un-even accepted level 0.05mm

CRYSTAL GASKET

3ATM. Min height 0.6mm

10ATM Min height 0.90mm for $\phi \leq 22\text{mm}$

10ATM Min height 1.00mm for $\phi = 22.5\text{mm}$

20ATM Min height 1.00mm for $\phi \leq 22\text{mm}$

20ATM Min height 1.30mm for $\phi \geq 22.5\text{mm}$

MATERIAL

- Hytrel

BEZEL

The bezel should not be moved 1kg/m. The fitting of the bezel should be sufficient to avoid it to be raised.

HOLDING FORCE

The minimum holding force should be 5kg.

GENERAL QUALITY AND



TECHNICAL REQUIREMENT

CROWN

The screw crown must be screw down or out without problem, Max 0.3kg-cm torsion pull out force for hand setting.

PUSHING FORCE

- The crown pushing force should be 0.9kg \pm 0.05kg, when find out the movement may not suitably covered by this standard, please contact Ball Watch Engineering Department to clarify the standard before submitting Sample.
- The screw crown for mechanical movement should be turnabout, for quartz movement should be non-turnabout crown.

CROWN RECESS

Crown recess on case body, minimum 0.30mm > crown diameter.

SETTING

- For all resistant watches, the O-ring of crown must be functionally in contact with tube even when it is pulled outmost position, and the water resistance must be withstand at least 3atm.
- Winding the crown at the rest position should not cause change of calendar or time.
- Screw crown when pressed and screw down should be return to rest position; it should not cause change of calendar or time.

CLEARANCE BETWEEN THE CROWN AND THE CASE

- Maximum 0.05mm

CASE BACK

SCREW BACK

No chips coming from the threading, it will not disturb the functioning to the movement

SECURED BY SCREWS

GENERAL QUALITY AND



TECHNICAL REQUIREMENT

Screw out torsion not less than 0.1kg-cm.

GAP BETWEEN THE CASE AND BACK

The gap between the middle case and the back is maximum 0.10mm.

SPRING BARS

- The choice depends on the type of construction.
- Only “Capsa” spring bar or equivalent quality should be used.

HOLDING FORCE

Spring bars and lugs to be able to withstand tensile pull of 10 Kg without deforming or falling.

MATERIAL

- 316L

PUSHER

- The pushers should travel smoothly when pressed and return to rest position when pressure is released.
- All water-resistant pushers should not be activated by specified pressure (i.e. 3ATM,...etc).
- The case should be water-resistant when pusher pressed.
- Pusher activation force from 0.3kg to 0.7kg.

O’ RING GASKET

DIAMETER OF GASKET SECTION

3atm	Min. 0.5mm (ladies)
3atm	Min. 0.6mm (gents)
10atm	Min. 0.8mm
20atm	Min.1.0mm

MATERIAL

- NBR

TOLERANCES FOR FUNCTIONAL DIMENSION

Generally the tolerance on functional position is +/-0.03mm are accepted.

- Stem centre

GENERAL QUALITY AND



TECHNICAL REQUIREMENT

- Spring bar hole location for integrate solid end-piece
- Case inside opening... etc

SECTION 2 – BRACELET

COMPLETE BRACELET

Bracelet must pass the following reliability test:

- Artificial Sweat Test
- Traction and Torsion Test – 5000 cycles, Tension 5Kg, Torsion 6Kg/cm.
- Shaking Test – 5000 cycles.

VISUAL CHECK

- No scratch, dirt, dust can be seen under 30cm distance.
- No pin mark on fixed link of bracelet side.
- No accepted the shape edge or burrs on the bracelet.

MATERIAL

Only following materials are to used in bracelet manufacturing:

- 316L
- Titanium Grade 2
- Others material used when specified on P.O. and / or specification sheet.

ADJUSTABLE LINK

- Only screws for adjustable link.
- Adjustable screw must withstand a torque of 0.10Kg-cm when screw out and pass vibration test. “Loctite 222 accepted for adhesive purposed

Tension and Torsion force

GENERAL QUALITY AND



TECHNICAL REQUIREMENT

- Bracelet should be able to withstand pull force of 10Kg without falling part or deforming.
- Buckle opening force to be 0.6 to 1.5kg and the force should be kept at least after 3,000 times close and open, no attachment not loose or fall out.
- The bracelet which side and centre link are individual, it must be withstand minimum 8Kg side pulling force.

END PIECE FITTING

- Integrated solid end-piece to case, it should not turn from the watch head.

SECTION 3 – DIAL

ROUND

- The total diameter of the dial is equal to the diameter of the opening Min. +0.5mm. The tolerance of the total diameter are $-0.02/+0.05\text{mm}$

SHAPED

- The total size of the dial (3-9H and 6-12H) is equal to the size of the opening + 1mm. The tolerances of the total diameter are $-0.02/+0.05\text{mm}$

THICKNESS

- 0.4mm of thickness is recommended for all watches. The tolerance is $\pm 0.03\text{mm}$.
- When find out the dial may not suitably covered by this standard, please contact Ball Watch Engineering Department to clarify the standard before submitting Sample.

FLATNESS

For dials having a diameter or diagonal of:

0.01mm <20mm

0.02mm >20mm

DROP TEST

Dial must be withstand the dropped 3 times from 30cm high, No indexes or attachment not loose or come out.

ADHESION TEST

To stick and remove a piece of tape Scotch 810 on the dial surface. No peel off of

GENERAL QUALITY AND

TECHNICAL REQUIREMENT

printing or sticker.



UV LIGHT TEST

The dial exposure under UV light for 72 hours is approximately equal to exposure under normal sunlight for 6 months.

SECTION 4 – HANDS

- Only “Universo” hands or equivalent should be used.
- Only second hands with counter weights as indicated on the movement manufacturers specification data.
- Hole of hands to be free form burrs.
- Height of Tube used when specified on P.O. and / or specification sheet.

TESTING AND PROCEDURE

BL-001

TRACTION AND TORSION TEST

1.0 Purpose

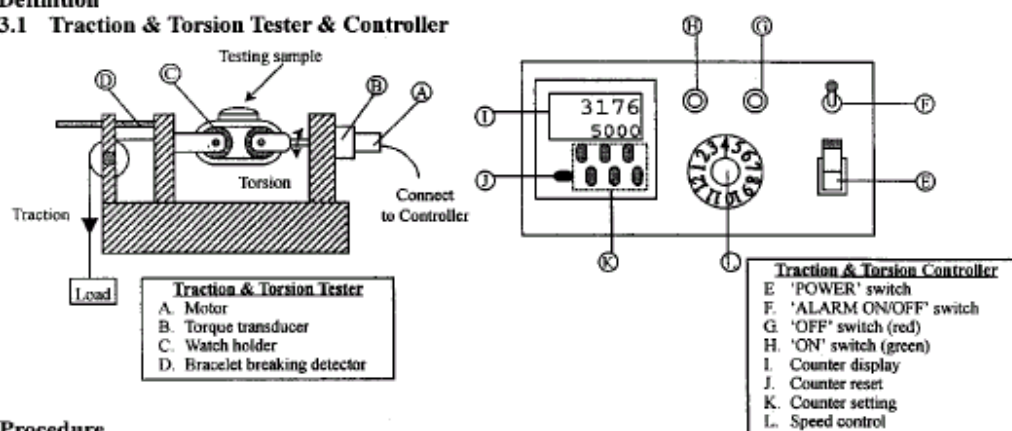
To testify the tensile strength & torsion strength of complete watch under a simulated normal motion.

2.0 Scope

It is applicable for testing the longitudinal & latitudinal strength of watch construction.

3.0 Definition

3.1 Traction & Torsion Tester & Controller



4.0 Procedure

4.1 Sample checking

4.1.1 To check & measure the characteristic of the sample as the following table.

Item	Parts	Checking method	Specification
1	Overall appearance	Visual check	No come-off part, No loosening, cracking or breaking part
2	Screw (if applicable)	Torque meter	Torque ≥ 0.14 Kg·cm
3	Pin (if applicable)	Pull meter	$1.5 \text{ Kg} \leq \text{Pushing Force} \leq 7 \text{ Kg}$
4	Side link (if applicable)	Pull meter	Pulling Force $\geq 7 \text{ Kg}$ (Gent) Pulling Force $\geq 5 \text{ Kg}$ (Lady)
5	Function, accuracy	Functional check	No malfunction

4.2 Setup

4.2.1 To fasten the sample by fixing the bracelet with the two holders, tighten with the watch holder into bracelet. (as section 3.1)

4.2.2 To adjust the position of bracelet breaking detector within 2mm to 3mm, fasten the screw to prevent movement.

4.2.3 To set the counter setting as follows.

Tension		5 Kg
Torsion		6 Kg·cm
Frequency	(leather/plastic)	3000 cycles
	(metallic)	5000 cycles

4.2.4 To adjust the speed controller to the index '4' or above. (i.e. at least 20 cycles/min.).

4.3 Result Evaluation

4.3.1 To check & measure the characteristics of the sample as section 4.1.

4.3.2 If all the above characteristics are still within the specification, the sample passes in the test. Otherwise, the sample fails in the test.

TECHNICAL REQUIREMENT

BL-002

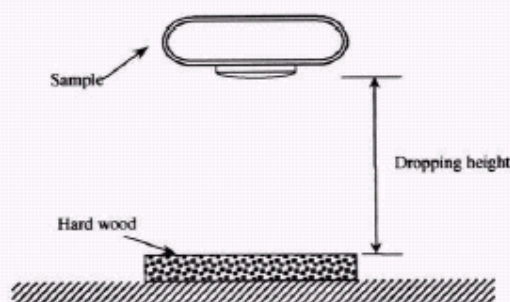
DROP TEST

1.0 Purpose

To testify the rigidity of watch with/without packing under the simulated impact in transportation.

2.0 Scope

It is applicable for testing the watch assembly and watch with carton packing.

3.0 Definition**4.0 Procedure****4.1 Sample checking**

4.1.1 To visual check the appearance of sample & to ensure no loosing part, no crack & no breakage.

4.1.2 To check the accuracy and functions of sample & to ensure the functions are within the specification.

4.2 Setup

4.2.1 Locate a piece of hard wood on the ground. (The thickness of the wood is at least 25 mm.)

4.2.2 The sample is allowed to free fall on the hard wood surface as the following individual level or combined level.

Plan	Direction	Height	# of drops	Total
I	Watch is vertical to the ground at 9H position	1 m	1	3
	Watch is parallel to the ground with case back facing to the ground	1 m	1	
	Watch is parallel to the ground with crystal facing to the ground	1 m	1	
II	Watch is vertical to the ground at 9H position	0.3 m	1	3
	Watch is parallel to the ground with case back facing to the ground	0.3 m	1	
	Watch is parallel to the ground with crystal facing to the ground	0.3 m	1	
III	Watch with carton packing	Faces	1 m	10
		Edges	1 m	
		Corners	1 m	

Note: Plan I is used for all watches in general. Plan II is only applied to pocket watches only.

4.3 Result Evaluation

4.3.1 To check the above characteristics of the sample as section 4.1.

4.3.2 If the characteristics of the sample are still within the specification, the sample passes in the test. Otherwise, the sample fails in the test.

TECHNICAL REQUIREMENT

BL-003

UV LIGHT AGING

1.0 Purpose

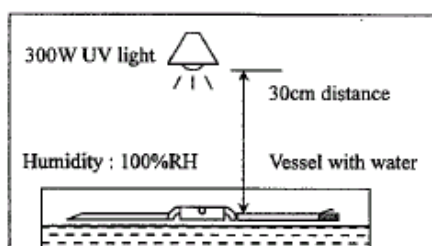
To testify the ageing resistance of material, dye color, coating under simulated sun light condition.

2.0 Scope

It is applicable for testing all components with PU material.

3.0 Definition

3.1 The exposure under 300W UV light from 30 cm distance for 72 hours is approximately equivalent to exposure under normal sunlight in Switzerland for 6 months.

3.2 Facility**4.0 Procedure****4.1 Sample checking**

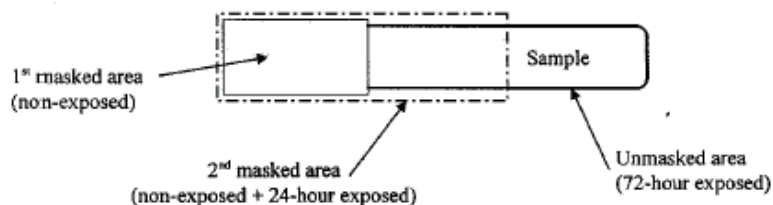
4.1.1 To visual check the initial appearance of sample & to ensure no peeling off, cracking or color changing.

4.2 Setup

4.2.1 Before the test, partially mask around 1/3 testing area of the sample with aluminum foil. (for color comparison between UV exposed and non-exposed area.)

4.2.2 Place the sample under a 300W UV light source with 100% RH for 24 hours.

4.2.3 Partially mask around another 1/3 testing area of the sample with aluminum foil (for color comparison between 24-hour and 72-hour exposed time.). Therefore, totally 2/3 testing area of the sample is masked.



4.2.4 Idle the sample under a 300W UV light for another 48 hours.

4.2.5 Remove all the aluminum foil and compare the color between 3 sections

4.3 Result Evaluation

4.3.1 Check the appearance of sample and to ensure no peeling-off, cracking or brittle part.

4.3.2 Compare the color with the gray scale (ISO 105-A02) as follows.

Gray scale	Fossil Specification
3 – 5	Accept
2.5	Conditional Accept
Below 2.5	Reject

TECHNICAL REQUIREMENT

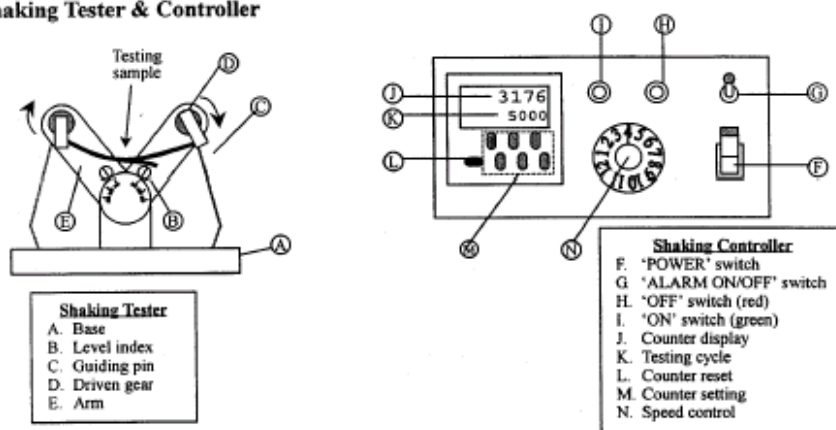
BL-004

SHAKING TEST**1.0 Purpose**

To testify the rigidity of complete watch, bracelet assembly, buckle, fixing pin and clasp under a simulated shaking motion.

2.0 Scope

It is applicable for testing complete watch, bracelet assembly, buckle & clasp.

3.0 Definition**3.1 Shaking Tester & Controller****4.0 Procedure****4.1 Sample checking**

4.1.1 To check the sample as the following table.

Item	Parts	Checking method	Specification
1	Whole sample	Visual check	No come-off part, No loosening, cracking or breaking part
2	Pin	Push gauge	$1.5 \text{ Kg} \leq \text{Pushing Force} \leq 7 \text{ Kg}$
3	Screw	Torque meter	$\text{Torque} \geq 0.14 \text{ Kg} \cdot \text{cm}$
4	Clasp	Pull gauge	$\text{Pulling force} \geq 1 \text{ Kg}$

4.2 Setup

4.2.1 To adjust the angle of both arms as 70 – 90% total length of the testing sample.

4.2.2 To fasten the bracelet to the arms (as section 3.1)

4.2.3 To set the speed controller to index '4' or above. (i.e. at least 15 cycles/min.).

4.2.4 To set the counter cycle to 50000 times and then start the test.

4.3 Result Evaluation

4.3.1 To check the characteristic of sample mentioned as 4.1.

4.3.2 If all the above characteristics are still within the specification, the sample passes in the test.
Otherwise, the sample fails in the test.

TECHNICAL REQUIREMENT

BL-005

WATER-RESISTANCE**1.0 Purpose**

To testify the ability of water resistance for watch.

2.0 Scope

It is applicable for testing the watch with water resistance construction.

3.0 Definition

3.1 All water-resistant watches (except alloy watches) should pass in both tests as below in general. For alloy watches, the sample should first be tested in air leakage test (test 2), then some of the samples are selected based on MIL-STD-105D Level S-1 to test in "Roxer".

3.2 Test 1 : "Roxer"

- a. "PV-8" /or "PV-15" /or "PV-25"
- b. "Natator"

3.3 Test 2 : Air leakage test

- a. "Hormec" water resistant tester with vacuum and pressure test /or
- b. "Witschi" ALC 2000 Electronic water-resistant tester with vacuum and pressure test /or
- c. "Sigma" SM8810 Electronic water-resistant tester with vacuum and pressure test.

4.0 Procedure**4.1 Sample checking**

- 4.1.1 To visual check the appearance of sample & to ensure no loosening, cracking or breaking part, no improperly assembled gasket.
- 4.1.2 To check the moisture inside of the sample according to the Condensation Test Procedure (ENWI-019).

4.2 Test 1(A) : Roxer "PV-8 /or PV-15 /or PV-25"

- 4.2.1 Place the sample on the tray & immerse the sample in water
- 4.2.2 Withdraw the air pressure until near vacuum to observe the bubble coming out of the sample.
- 4.2.3 If large amount of bubble come out, sort out the sample. The sample fails in the test.
(Note: This step is to sort out defective sample with serious leaking. For ease of identification of bubble from the case, remove the turning bezel from case (if possible) before the test begins.)
- 4.2.4 Increase the air pressure while the sample is immersing in water and hold for adequate time as shown below.

Water-resistance	Duration
≤ 10 ATM	5 min.
> 10 ATM	20 min.

(Note: Water is forced into the sample through weak point, which will be revealed in condensation test. ENWI-019)

- 4.2.5 Reduce the air pressure (Gent's case : 0.4 bar, Lady's case : 0.2 bar) & hold for 5 min. to make sure the crystal can be held tightly with case.
- 4.2.6 Release to normal pressure.
- 4.2.7 Check the moisture inside of sample according to the condensation test (ENWI-019).
- 4.2.8 If the sample passes in the above tests, the sample passes in the "Roxer" water-resistant test. Otherwise, the sample fails in the test.

4.3 Test 1(B) : Roxer "Natator"

- 4.3.1 Place the sample into the test vessel
- 4.3.2 Pour water into the vessel until water flow out.
- 4.3.3 Close the vessel & lock the knob to ensure no spacing inside the vessel
- 4.3.4 Increase the air pressure while the sample is immersing in water and hold for adequate time as shown below.

BL-005

ATER-RESISTANCE (CONTINUE)

Water-resistance	Duration
≤ 10 ATM	5 min.
> 10 ATM	20 min.

(Note : Water is forced into the sample through weak point, which will be revealed in condensation test. ENWI-019)

4.3.5 Release to normal pressure.

4.3.6 Check the moisture inside of sample according to the condensation test (ENWI-019).

4.3.7 If the sample passes in the above tests, the sample passes in the “Roxer” water-resistant test. Otherwise, the sample fails in the test.

4.4 Test 2(A) : “Hormec” Air Leakage Test - Pressure Test

4.4.1 Trial run the tester without sample inside so as to ensure no deviation between containers.

4.4.2 10 pcs. of sample (all should be same model) are placed in each chambers of the pressurizer.

4.4.3 Increase the air pressure as specification and wait for 10 min. to allow the air pressure flow through the sample in case of leakage.

4.4.4 Then, withdraw the air from the chamber until nearly vacuum and hold for 5 min.

4.4.5 If the oil level indicator reduce to 8mm or more, the sample fails in the “Hormec” air leakage test - pressure test.

4.5 Test 2(B) : “Hormec” Air Leakage Test - Vacuum Test

4.5.1 Trial run the tester without sample inside so as to ensure no deviation between containers.

4.5.2 Turn the knob of the tester and allow the liquid to fall to the lower mark and close the knob.

4.5.3 Observe the difference between the liquid level of each column.

4.5.4 The greater level drop of liquid compared with others that indicate serious sealing fault. The sample fails in the “Hormec” air leakage test - vacuum test.

4.6 Result Evaluation

4.6.1 For alloy sample, after the air leakage test, it should be selected according to MIL-STD-105D Level S-1 to carry out the “Roxer” water-resistant test.

4.6.2 If the sample passes in both tests (1 & 2), the samples passes in the water-resistant test.

4.6.3 If the sample passes either test 1 or test 2, the result should be based on the “Roxer” water-resistant test.

TECHNICAL REQUIREMENT

BL-006

RADIATION LEAKAGE

1.0 Purpose:

To be confirm the gas light without radiation leakage, during incoming to assembly processing.

2.0 Scope:

It is applicable for monitoring the component, assembly, and complete watches.

3.0 Definition:

Gas filled detector – SCINTREX TRITIUM-IN-AIR MONITOR MODEL 209J



4.0 PROCEDURE:

4.1 Turn on the gas filled detector monitoring before start the processing, when the gas light radiation leakage, gas filled detector will be alarm on.

ATTACHMENT E

RESULTS OF PROTOTYPE TESTING

Results of prototype testing in accordance with NUREG 1556, Volume 3, Revision 2, Section 10.5 can be shown through a review of the operational history of timepieces to demonstrate the timepiece's ability to maintain its integrity when subjected to conditions of normal use and likely accident conditions.

All timepieces are constructed with Swiss manufactured movements. The movements are encased in 316L stainless steel. The crystal hardness must be 500 Vickers for mineral crystals and 1700 Vickers for sapphire crystals.

H-3 has been used as a light source in timepieces for approximately 25 years. Not all Ball Watch timepieces contain H-3. Only select models have been enhanced with H-3. The construction of those timepieces does not vary from non-H-3 timepieces.

All H-3 sources are fixed in the timepieces in the same fashion. The longer sources are bonded to the minute and hours hands using elastomeric adhesives applied in a double layer. The shorter sources are placed on the watch dial and held in place by clamping pressure created when a plastic holder ring having U-shaped channels for the sources is press-fitted into the back of the dial. The ring is then adhesively bonded to the dial. Since its inception, no H-3 sources have breached the binding process.

The Ball Watch timepieces were originally constructed in the late 1800's. Over that period, the construction of the timepieces has evolved to meet extreme needs. The Ball Watch timepieces are routinely used today by explorers of extreme conditions without a reported mishap.

1. Specially blended Swiss watch oils used on a selection of ultimate watches expand the operating temperature range from -40°C to 60°C (-40 to 140°F).
 - a. Anthony Powell has been working in Antarctica with his wife Christine for many years. After over 10 years (9 winters) of filming, his documentary "Antarctica: A Year on Ice" is now complete.
 - b. Edurne Pasaban is a Spanish professional mountaineer that has lead over 20 expeditions to the Himalayas and is the first woman in history to conquer the 14 eight-thousander peaks found on the planet.
 - c. Hervé Barmasse is the only climber to have soloed the 1,500m South Face of the Matterhorn. He also conquered unclimbed and what were considered as unscalable routes such as his first ascent of 6,970m Beka Brakai Chhok in Pakistan and the smooth granite walls of Cerro Piergiorgio in Patagonia.
2. Ball Watch timepieces have shock resistance up to 5,000Gs. The shock resistance test is conducted according to the International Standard ISO 1413 using a pendulum impact-testing machine. The mechanism sets off a circular movement that brings the weighted pendulum to hit the watch from one meter.

- a. On October 4, 2004, former U.S. Navy aviator Brian Binnie piloted the private rocket SpaceShipOne to an altitude of 69.6 miles, winning the US\$10 million Ansari X Prize and opening a new era in space exploration.
 - b. John "Mad Cow" Hembel was among the first Americans to break 150mph on skis. In 2003, he took the overall World Cup Championship.
 - c. Dr. Josh Wurman chases one of the most destructive forces on Earth, tornadoes, for a living. As the president of the Center for Severe Weather Research, he has pioneered techniques for tracking and analyzing tornadoes.
3. Water resistance is tested by immersing the watch completely in distilled water containing a wetting agent of 1% by weight and under the prescribed atmospheric pressure for at least five minutes. To be qualified, the watch must not show any evidence of water leakage.
 - a. Guillaume Néry is a French free-diving champion, specialized in deep diving with a single breath to depths of 125 meters.
 - b. Richard Limeburner is currently working as a Senior Research Specialist in the Physical Oceanography Department at Woods Hole Oceanographic Institution with a wide range of research projects. He works on the dynamics of the coastal ocean such as the general circulation, buoyancy and wind forcing, tidal rectification, sea ice annual cycles, mixing, LaGrangian (drifter) trajectories, circulation under Antarctic ice shelves, and climate change.

Performance of the timepieces in these extremes sufficiently demonstrates the timepiece's ability to operate when subjected to conditions of normal use and likely accident conditions.

ATTACHMENT F

EXPOSURE RATE FROM BALL WATCH TIMEPIECES

Handheld devices are incapable of measuring the exposure rate from individual GTLS timepieces. Tritium emits beta particles which do not exit the GTLS tubes. Photons do penetrate the GTLS tubes. These photons are derived from Bremstrahlung whereby the electromagnetic radiation is produced by the rapid deceleration of the beta particles emitted from Tritium. Tritium has an 18.6 keV beta particle which can only create a very low energy photon. This energy is less than 20 keV which is below most detectors capability. The quantity and energy of photons created can be measured using a high-purity Germanium spectroscopy system.

A sample watch containing 119.73 mCi of tritium was placed within a high-purity germanium gamma spectroscopy system. The quantity of photons and their energy were recorded for a twelve-hour period with the watch face downward on the germanium crystal to measure the quantity and energy of photons emitted from the face of the watch. The test was repeated with the watch face upward to measure the quantity and energy of photons emitted from the back of the watch.

FACE	keV	cps	dps
	13.04	0.319	11387
	14.03	0.451	16098
	15.82	0.271	9673

BACK	keV	cps	dps
	9.87	0.046	1642
	13.22	0.014	500
	16.15	0.024	857

The mass energy absorption coefficients for the energies measure were determined using the mass energy absorption coefficient for soft tissue provided by the National Institute of Standards and Technology and extrapolating the required values.

Mass Energy Absorption Coefficient
(Soft Tissue)

Energy	μ_{en}/ρ
(keV)	(cm ² /g)
5	41.35
9.87	5.93
10	4.987
13.04	2.81
13.22	2.68

14.03	2.10
15	1.402
15.82	1.26
16.15	1.21
20	0.5663

The exposure rates were calculated at 5 cm and 25 cm from the surface of the watch using standard equations for calculating exposure rates and most clearly articulated in “Relationship Between Radionuclide Gamma Emission and Exposure Rate”, by George Chabot, CHP, PhD.

$$\dot{X} = 5.263 \times 10^{-6} \times [\text{fluence rate}] \times [\text{energy}] \times (\mu_{\text{en}}/\rho) / r^2$$

In his article, Dr. Chabot determined the fluence rate by multiplying the number of disintegrations per second by the fractional yield of photons. In the calculations for the GTLS watches, the fluence rate can be directly measured taking into account the efficiency of the detector. The fluence rate, in disintegrations per second, is derived from the raw counts per second measure by the detector. To create a conversion factor from counts per second to disintegrations per second, a calibrated tritium source with similar geometry was measure. This tritium source had a corrected activity of 4,462 disintegrations per second and measured 0.125 counts per second on the detector. This created the needed efficiency.

	keV	cps	eff	dps
FACE	13.04	0.319	4,462 dps per 0.125 cps	11387
	14.03	0.451		16098
	15.82	0.271		9673
BACK	9.87	0.046		1642
	13.22	0.014		500
	16.15	0.024		857

To calculate the exposure rate, the fluence rate is multiplied by the photon energy and mass energy absorption coefficient and divided by the distance of travel. The NRC has requested a distance of travel of 5 and 25 cm. The exposure rate, in mR/hr, at each energy measured is then summed to provide the total exposure rate from the face of the watch and the back of the watch at both 5 cm and 25 cm.

			μ_{en}/ρ	\dot{X}	\dot{X}
			cm^2/g	mR/h @ 5 cm	mR/h @ 25 cm
FACE	13.04	11387	2.81	8.78E-05	3.51E-06
	14.03	16098	2.1	9.99E-05	3.99E-06
	15.82	9673	1.26	4.06E-05	1.62E-06
			TOTAL	2.28E-04	9.13E-06
BACK	9.87	1642	5.93	2.02E-05	8.09E-07
	13.22	500	2.68	3.73E-06	1.49E-07
	16.15	857	1.21	3.52E-06	1.41E-07
			TOTAL	2.75E-05	1.10E-06

Background exposures rates average 7 – 10 uR/hour (7E-03 mR/h to 1E-02 mR/h). At any distance from the GTLS watch, the exposure rate from the timepiece is below background.