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TO: VALMET AUTOMATION Inc.

ATT: Jim Hoey DATE: 24.5.1996

CC: \_\_\_\_\_ NUMBER OF PAGES: ~~40~~ 8  
(Include. this sheet)

FROM: Tapio Makkonen

RE: \_\_\_\_\_

Jim,

Mr. Erkki Rantanen has callbrated Smart Ion yesterday and Mr. Väisälä has measured BW-5h23 today. The radiation source was 500 mCi. I hope now is OK.

Best Regards,

*Tapio*  
Tapio Makkonen

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TO: ERIC 404-362-2653

FROM: JIM HOEY  
VALMET

**Application to AECB for Approval of Nuclear Gauging Device - Basis Weight Gauge**  
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**D) Details of Source Mounting and Retention Within the Device**

Means for mounting the source and source holder in the Device: the top cover plate is attached with four crosshead screws. The radiation source is in the lead housing. The retainer of the radiation source carries the source with a 3 mm threaded tap through the lead housing.

**E) Details of Safety Features**

The gauge consists of two housings. The upper contains the beta source, shutter assembly, and associated electronics. The lower contains the detector and its electronics.

The main parts of the gauge are made of aluminum (97.4% Al).

The shutter of the gauge is controlled by the measurement computer, so it is impossible to turn the shutter open manually without disassembling some parts of the gauge. The interface board to the shutter has been designed so that power off, shutter open and shutter closed have different status values, allowing the computer to notify and warn of error conditions.

When the computer signals the interface board to open the shutter, the interface board activates the torque solenoid. The shutter disk turns to move its opening under the radioactive source. Two conditions are absolutely required before the shutter will open: 1) power must be on to both the Analyzer and the computer and 2) the computer must be sending the shutter-open signal to the interface board. Whenever the electrical current is decreased (to less than 25% of nominal) or turned off to the system, an integrated spiral spring in the torque solenoid returns the shutter disk to the OFF or closed position.

The position indicating disk connected at the other end of the axle of the torque solenoid turns to a position that gives a "shutter open" indication to the position sensor. The signals of the position sensor are interpreted by the interface board and sent to the computer to provide position status information. The computer interface on the interface board is isolated to give immunity to ground loops and to protect electronic circuits. The open state of the shutter is indicated with a red light and the off or closed state of the shutter is indicated with a green light. These lights are seen on the upper corners of the top cover plate when the system is operating.

The gap between source housing and detector housing (where the paper web runs) is 1.5 mm wide. It is not possible for the shutter disk (2 mm thick) to drop off in case of defect in the torque solenoid.

There are lead shields in the detector holder to stop the radiation that is coming down through the detector and the preamplifier boards. Minimum thickness of the lead shields is 10 mm (0.4 in.). No radiation over background is expected to come through the detector (nor does, as shown on the radiation profiles for the Device).

Means of securing the Device in its installed position on the Analyzer: the Device is attached with two 6 mm thread screws from inside of the Analyzer. It is not possible to remove the Device from the mount without opening the locked doors on the Analyzer.

As is demonstrated by the radiation profile for this Device, it is very well shielded against emitting much scattered radiation. The primary radiation beam is inaccessible, because the Device is designed with only 1.5 mm gap between the source and detector housings. The primary radiation beam is shielded from penetrating through the detector housing by lead shields.

The 2 mm thick shutter disk lies normally in the OFF, source-shielded, or closed position. Only under the conditions where there is adequate power to the Device and the signal from the computer says "open" will the shutter disk move to the OPEN or source-exposed position. A position indicating disk is integrated into the shutter control mechanism. It sends the OPEN/CLOSED status information to the computer and also causes the red or green warning light on the Device itself to be lit, indicating at a glance the shutter status.

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The Device is mounted in a fixed position on the TAPIO Paper Machine Analyzer. The Analyzer itself provides significant shielding and limited access directly behind the Device. The Analyzer also has attached as a protective barrier a bar (painted yellow) preventing anyone from standing to either side of the Device (where radiation profiles indicate the only significant stray radiation is found). See Attachment 1 for a photograph (from manufacturer's sales brochure) of the complete Analyzer system.

**Safety Analysis**

This Device can be safely operated by persons not having training in radiological protection. The primary beam is inaccessible. The narrow gap between the source and detector housings (1.5 mm) prevents any human body parts from being placed in the path of the radioactive beam. Standard red and green warning lights are used to inform personnel when the shutter is open or closed. The shutter is open only if there is power to the Device and the computer connected to it is sending the "shutter open" signal. Safety functions are thoroughly tested by the manufacturer as part of the quality control process.

Under ordinary conditions of handling, storage, and use, radioactive material will not be released or inadvertently removed from the Device. The Device is permanently mounted and used only on the manufacturer's Paper Machine Analyzer--and only in laboratory settings. Warning labels are prominently displayed on the Device. Warnings on the labels and in the Operator's Manual warn against opening or otherwise servicing the Device except by properly authorized persons.

It is unlikely that any person will receive in 1 year a dose in excess of 10% of the annual limits specified in Schedule II, Table 1 (Maximum Permissible Doses). The radiation profile shows low "leakage" around the Device. Highest is on the surface at the gap itself (on both sides) where the reading ~~is 240 µSv/hr (or 26 µB/hr) using a 7 m<sup>2</sup>/cm<sup>2</sup> window. The~~

any person would receive an external radiation dose in excess of those specified in Schedule II. No significant fire, explosion, or corrosion hazard is expected in the intended environment in which the Device will be operating. The ANSI/ISO classification of the source used is C.33222, meeting in every test category the minimum performance requirements given in ISO.2919 for the use of sealed sources for beta gauges (i.e., 33222).

- F) Details of Positive Fastening of Shutter for Transportation - Not applicable as source is shipped separately of the Device. The Device housing is shipped already installed on the Analyzer, but without the source installed. Source is shipped separately in the original manufacturer's (Amersham's) packaging

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**Q) Classification as per ANSI N538**

**BW-5h23 Classification**

**ANSI classification for BW-5h23 Basis Weight Sensor:**

**ANSI - 12 - 599 - 999 - R1**

The BW-5h23 Basis Weight Sensor is designed as an option on the Tapio Paper Machine Analyzer. The Analyzer is designed to be a laboratory device, hence the operating temperature is restricted to +18°C - +25°C. The BW-5h23 is not used separately, so it is operating in normal room temperatures only. This gives 12.

The stray radiation measurements were performed by Jaakko Tikkinen of the Finnish Centre for Radiation and Nuclear Safety on April 27, 1995.

The classification is based on the results of these measurements. Measurements were performed in both the shutter-open and shutter-closed positions.

**Radiation Source ON**

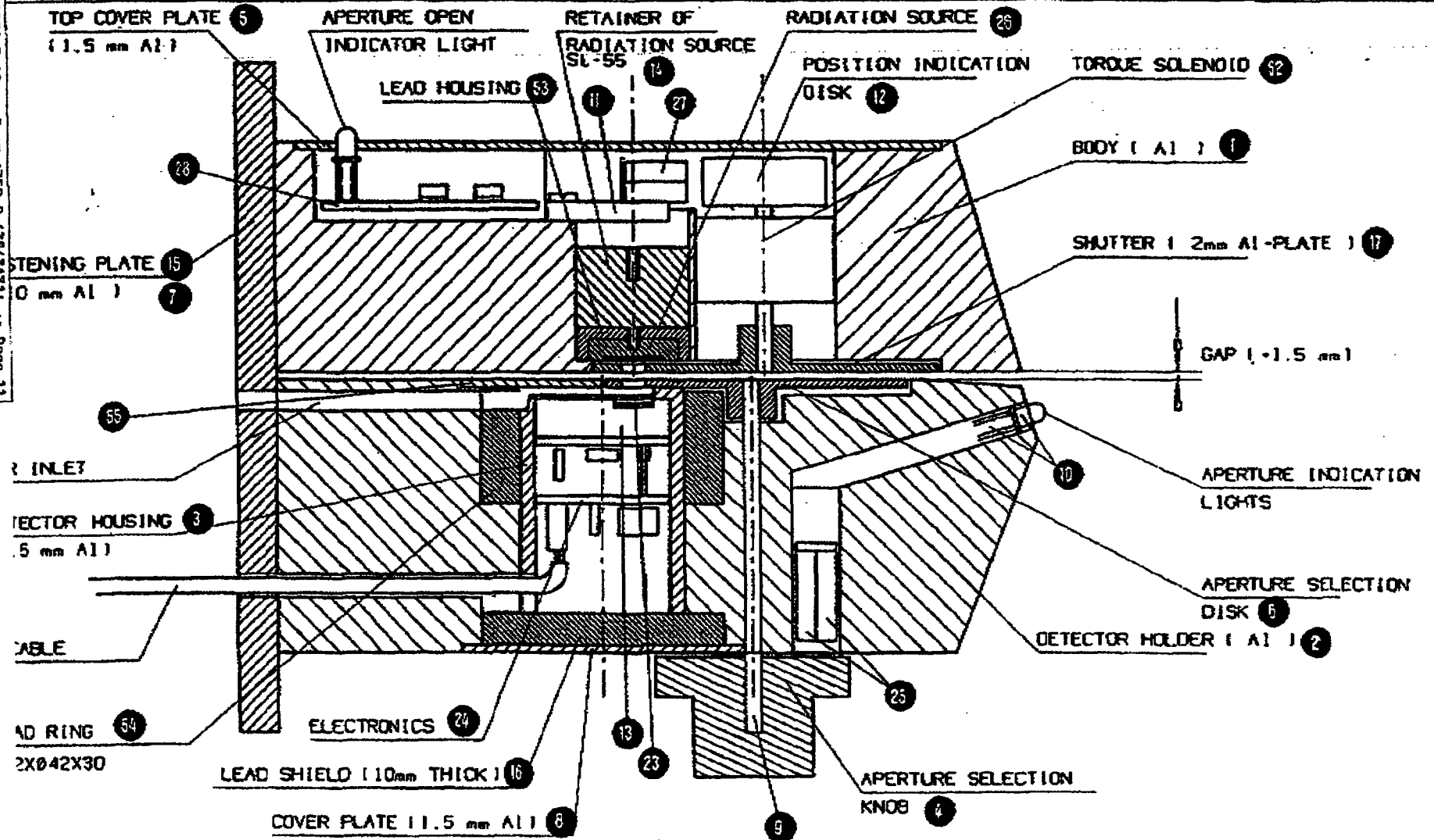
The classification is based on the highest absorbed dose rate measured with a 7 mg/cm<sup>2</sup> window at the 5 cm, 30 cm, and 100cm isodistance lines on the left side on the sensor. At 5 cm, the reading was 6.5 mR/hr. At 30 cm, there was no measurable exposure in any direction. Hence there cannot be any stray radiation at 100 cm isodistance line. This gives a classification of 599 for the "source on" test.

**Radiation Source OFF**

The classification is based on the highest absorbed dose rate measured with a 7 mg/cm<sup>2</sup> window at the 5 cm, 30 cm, and 100cm isodistance lines on the left side on the sensor. At 5 cm, the reading was 0.1 mR/hr. At 30 cm, there was no measurable exposure in any direction. Hence there cannot be any stray radiation at 100 cm isodistance line. This gives a classification of 999 for the "source off" test.

The BW-5h23 Basis Weight Sensor uses a radioactive source to make beta-radiation. The radiation source is PHC.80955 (or PHC.80952) of Amersham International plc. The radiation source has run the safety performance tests according to ISO standard (ISO.2919) and has ISO classification C53222. This gives R1.

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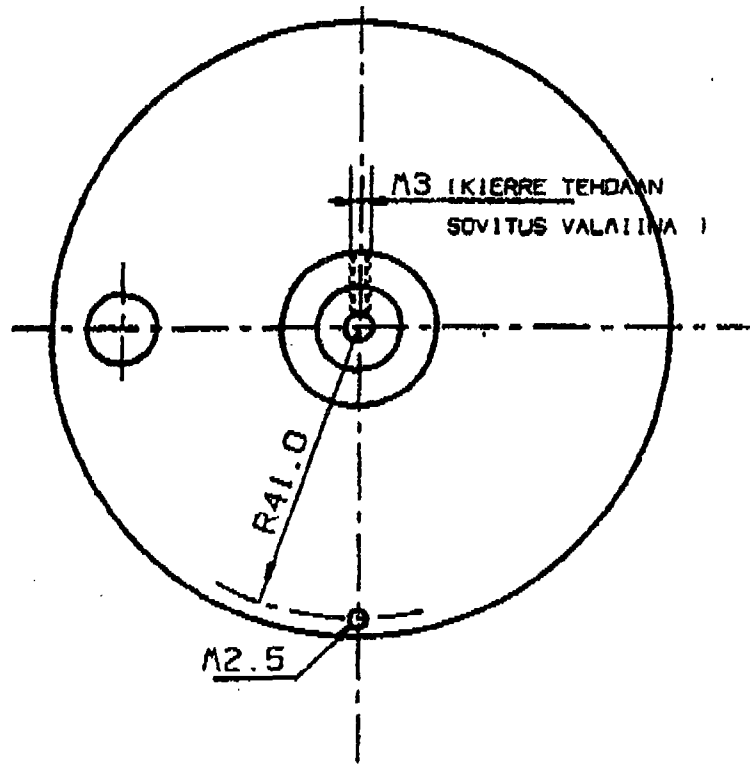
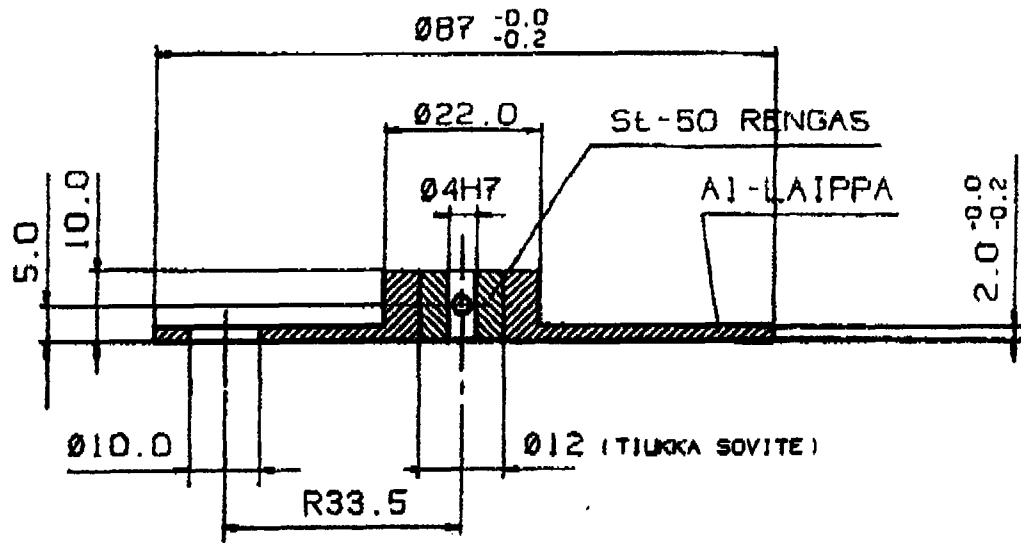
	Part No	Quantity	Part No
	Material BASIS WEIGHT SENSOR BV-5h23	Quantity MOL	Part No 9.3.-95
TAPIO TECHNOLOGIES	SIMPLIFIED DRAWING	Scale 1	Quantity BV-5h23
	THIS DRAWING IS NOT EXACT IN DIMENSIONS 1		No 5TBV3-50-3A

MAY-28-1996 15:56 FROM UAU NORCROSS  
 24/05/96 14:49  
 TAPIO TECHNOLOGIES UAU  
 914043622653 P.05

BASIS WEIGHT SENSOR BW-5h23

Components list

- 1 Body
- 2 Detector holder
- 3 Detector housing
- 4 Aperture selection knob
- 5 Top cover plate
- 6 Aperture selection disk
- 7 Fastening plate
- 8 Cover plate
- 9 Shaft
- 10 Aperture indication lights
- 12 Position indication disk
- 13 Preamplifier
- 14 Retainer of radiation source
- 15 Fastening plate
- 16 Lead shield
- 17 Shutter
- 23 Sensor
- 24 Electronics
- 26 Radiation source
- 52 Torque solenoid
- 53 Lead housing
- 54 Lead ring



	Arvio	AI-ELOKS. AU	Luokka	ADL	Päivä	12.7. -95
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	BASIS WEIGHT SENSOR BW-5h23 SHUTTER DISK		Suure 1:1	Luokka BV-5h23
				Nro 5TBW3-17-4M