



**Systems & Electronics Inc.**

201 Evans Lane  
St. Louis, MO 63121-1126

6 November 2003  
In Reply Refer To  
DEFE - 20513

United States Nuclear Regulatory Commission  
Material Safety Branch  
Division of Industrial and Medical Nuclear Safety  
Washington, DC 20555-0001

Subject: Application for Material Registration and Material Distribution License

Enclosure: (I) Application for Material Registration and Evaluation Fee  
(II) Application for Material Distribution License and Evaluation Fee

Dear Sir or Madam:

Systems & Electronics Inc. (SEI), located in St. Louis, Missouri, hereby submits an original and one copy each of Enclosure (I) Application for Material Registration and Enclosure (II) Application for Material Distribution License for review and approval.

As required, each application is accompanied with a check for the one time evaluation fee.

SEI is in the process of completing the Application for Material Possession License and will forward the application, with a check for the one time evaluation fee, to the Materials Licensing Branch in Region III.

Should there be any questions or comments, please contact me at 314-553-4335.

Sincerely,

A handwritten signature in black ink, appearing to read 'Allan K. Kaste', written over a horizontal line.

Allan K. Kaste  
Vice President, Human Resources

**Application for Material Registration  
And  
Evaluation Fee**

**Fee Category 9B**

## Application for Material Registration

### 10.1 Summary Information

#### 10.1.1 Manufacturer and Distributor

Systems & Electronics Inc.  
201 Evans Lane  
St. Louis, MO 63136

#### 10.1.2 Custom User

Not Applicable

#### 10.1.3 Other Companies Involved

Manufacturer:

SRB Technologies (CANADA) Inc.  
320-140 Boundary Road  
Pembroke, Ontario K8A 6W5

Distributor:

SRB Technologies  
2580 Landmark Dr.  
Winston Salem, NC 27013

#### 10.1.4 Definitions

Equipment: This refers to the Main Electronics Assembly (MEA) and Tripod Adapter Plate of the Man portable Surveillance and Tracking Radar System (MSTAR) produced by SEI. The MSTAR system is a ground surveillance RADAR.

Device: Refers to the circular/cylindrical level that is the subject of this application described in attachment 1 and attachment 2.

#### 10.1.5 Model Number, Sealed Source or Device Type, and Principal Use Code

| Manufacturer               | Part Number | Sealed Source or Device | Principal Use Code         | Licensing requirement |
|----------------------------|-------------|-------------------------|----------------------------|-----------------------|
| Systems & Electronics Inc. | ES 6510-01  | Level gauge             | Self Luminous Light Source | Exempt                |

#### 10.1.6 Radionuclides Used in the Product

| Radionuclide | Activity (Ci) | Maximum Activity (Ci) | Currently Registered | Sealed Source Mfr.             | Model Number           | Registration Number |
|--------------|---------------|-----------------------|----------------------|--------------------------------|------------------------|---------------------|
| Tritium (H3) | 0.18          | 10.0                  | Yes                  | SRB Technologies (CANADA) Inc. | Betalight 152080G0400B | NC585S102S          |

#### 10.1.7 Leak Test Frequency

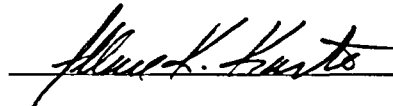
The SEI part number ES6510-01 (SRB part number 1544003) is leak tested at the manufacturer (SRB Technologies Inc.) in accordance with an industrial standards ANSI-N43.4 (ANSI-N540) as described in the SRBT Radiation Safety Manual, document # RSP-006 rev E (attachment 3).

Systems and Electronics Inc. will verify Leak Test results by reviewing documentation, provided by SRBT, upon receiving inspection of the device and perform an inspection of the device as well as an inspection of the next higher level of assembly following installation of the device in accordance with SEI quality procedures S QAI-33, *MSTAR TRITIUM LEVEL INSPECTION*, (attachment 4).

### ***10.1.8 Certification and Signature of a Management Representative***

The following person is a legal representative of Systems & Electronics Inc. and is authorized to make binding commitments and to sign official documents on behalf of Systems & Electronics Inc.

Signature:

 Date: 11/8/03

Mr. Allan Kaste (Vice President of Human Resources)  
Systems & Electronics Inc.  
St. Louis, MO 63136  
(314) 553- 4335  
akaste@seistl.com

## **10.2 Conditions of Use**

### ***10.2.1 Types of Users***

The device will be attached to a man portable RADAR that will be used to perform artillery fire correction, surveillance and target acquisition operations. The operators of the RADAR system will be primarily security/military personnel.

### ***10.2.2 Locations of Use***

The locations of use will be outdoors along the perimeter of positions that are of strategic and tactical interest. The climatic and geographical ranges are wide and are more appropriately defined by the environmental conditions delineated in the RADAR system specification (see 10.2.6). The device is part of the system when installed and must operate within the same environmental conditions as the system.

### ***10.2.3 Proximity to user***

Based on the configuration of the RADAR system (vehicle mounted or man portable) and the activity (set-up or operation) the user will be anywhere from the immediate position (set-up) of the device up to 30 meters away (maximum dismounted operation).

### ***10.2.4 Frequency of use***

The set-up and leveling of the equipment and use of the device is dependant on the mission scenario but reasonably the operator could be expected to perform a set-up at least once every 24 hours and no more than once every 2 hours over a 24 hour period.

### ***10.2.5 Likelihood that device will be used as part of another system***

The device is designed to be used with equipment it is attached to. Functionally, it provides a visual indication to the operator that the equipment is level. The device is not compatible with stand alone operations. The device requires unique design criteria be applied to its installation in other equipment. Certainly, it could be installed in another system or application if that system provided the specific physical interface to allow its installation.

### **10.2.6 Environmental Conditions**

The leveling device, as attached to the RADAR, may be exposed to one or more of the following environmental conditions during use, handling, storage or transportation.

#### **10.2.6.1 Corrosion**

No dissimilar materials are used in the design or construction of the device. Corrosive agents may be used in the maintenance of the attached equipment although because of the aluminum and glass construction of the device, it will tolerate corrosive agents for periods of time associated with maintenance activities. There are no exposed rubber seals that would degrade if exposed to hydrocarbon based cleaners.

#### **10.2.6.2 Vibration**

The equipment shall withstand the vibration spectra described in MIL-STD-810E 514.4, I-3.4.7 Category 8 - Ground Mobile, using vibration data of Table 514.4-AII without degradation.

#### **10.2.6.3 Impact**

The equipment shall withstand shocks associated with handling (mounting, dismounting, carrying, stowing) without degradation. Handling shock shall be defined as: 1/2 sine pulse acceleration of 30g for duration of 11 milliseconds using MIL-STD-810C, Method 516.2 Procedure 1.

#### **10.2.6.4 Puncture**

There is no system level requirement that addresses a puncture threat. It would be extremely difficult to drive, even an ice pick, let alone a screwdriver, through the device far enough and with enough force to penetrate the machined aluminum cylinder that houses the GTLS or the aluminum bossing that the cylinder is surrounded by. During maintenance, if it is necessary to remove the device using a screw driver, there is a minor risk of puncturing the bubble vial on top of the device. There would have to be a repeated attempts, with intent, to break the bubble vial (on top) and then to penetrate the thicker phosphor coated glass on the bottom of the vial. This glass is supported by packed epoxy that is used to suspend the GTLS in the device. Certainly, it could be done but it would require a tool not used in maintenance and repeated attempts with intent.

#### **10.2.6.5 Compressive Loads**

There are no compressive loads applied to the equipment or device during its operation or maintenance.

#### **10.2.6.6 Explosion**

There are no explosive risks associated with the device or equipment the device is attached to. Since the system is used by a military force, there are munitions carried by the user, the user may be targeted by enemy forces, or the user may traverse areas that are mined.

#### **10.2.6.7 Flooding**

The climatic and geographical areas where the device will be deployed may include areas that are susceptible to flooding. Certainly, the system or device would not be knowingly placed in a location with an emanate risk of flooding.

#### **10.2.6.8 Poor Air quality**

The climatic and geographical areas where the device will be deployed may include areas that are susceptible to poor air quality.

#### **10.2.6.9 Temperature**

Operation from -40°C to 55°C, Storage from -46°C to +71°C.

#### **10.2.6.10 Temperature Change**

Not Specified

#### **10.2.6.11 Power cycling**

Not applicable. The power source used by the device for illumination is the sealed Tritium gas source. No external power source interfaces with the device.

#### **10.2.6.12 Working Life of Sources**

The expected working life of the source used in this device is between 15 and 20 years.

### **10.3 Construction of the Product**

The body of the ES 6510-01 (shown in attachment 1) is a machined aluminum cylinder with an attached aluminum flange. The flange has three equally spaced counter bored holes around its perimeter used to attach the assembly to the next higher assembly. The next level of assembly has an aluminum boss of appropriate size to accommodate the level. A bubble vial is inserted and epoxied to the upper interior portion of the machined aluminum cylinder. The bubble vial is a sealed glass container that contains mineral water. The inside of the bubble vial is coated with phosphor on one side. The Tritium gas vial is suspended and compacted in epoxy underneath the bubble vial.

#### ***10.3.1 Operational summary***

The bubble within the level indicates the offset between the gravity vector and the normal vector (as mounted) from the surface represented by the mounting flange. A centered bubble with respect to the assembly indicates that the level assembly and attached hardware are level with respect to gravity by finding the marked center of the vial. The bubble is back lit by the gaseous tritium light source (GTLS) that is self illuminating by way of the beta particles emanating from the vial of tritium and exciting the phosphor that is coated on the lower interior of the bubble vial.

#### ***10.3.2 Primary Components***

- The machined aluminum cylinder with attachment flange
- The bubble vial
- The enclosed sealed source

#### ***10.3.3 Safety Features***

The safety features are included in the overall design of the level as opposed to a specific component. The glass enclosure of the Tritium vial will prevent the emission of the beta particles from going beyond the sealed source. The layout and design of the level effectively protects the sealed source within the device from exposure to the environment or breakage from improper or unexpectedly harsh handling of the equipment the device is attached to. The device is also protected from damage by the assemblies that it is installed into.

### **10.4 Labeling**

The SEI part number ES6510-01, NRC registration number, and Trefoil symbol will be attached to the device. The Engraving method or Label material, attachment method and durability will be specified on the drawing. (attachment 1).

## **10.5 Prototype Testing**

### **10.5.1 Sources**

The source used as a component of this device is registered with the NRC as NCS585S102S by SRB Technologies Inc. as a Self-illuminated Hydrogen 3 ( $H_3$ ) sealed source type D Disc, Radial Pip.

### **10.5.2 Devices**

The leveling device is manufactured by SRB Technologies (CANADA) Inc. In accordance with the procedures and policies imposed by the Canadian Nuclear Safety Commission (CNSC), this device is certified to be in accordance with applicable Canadian Nuclear Safety Guidelines. In obtaining this certification, SRB Technologies was required to provide evidence that the subject device was designed to survive without leakage during and after exposure to risk environments and hazards as defined by the CNSC.

## **10.6 Radiation Profiles**

There is no measurable radiation emitted from the device as Beta radiation will not penetrate the glass of the vial that contains the gaseous tritium ( $H_3$ ).

## **10.7 Quality Control and Quality Assurance**

SEI is an ISO 9000 registered company. SEI's ISO 9000 registration letter is attached as attachment 5. SRB is a ISO 9000 registered company. SRB's ISO 9000 registration letter is attached as attachment 6. The applicable receiving inspection procedures are followed for the SRB manufactured level device. SRB will provide certificate of conformance verifying that testing has been performed in accordance with ANSI-N540 specification. SEI will inspect this evidence, the level itself and the associated next higher assemblies in accordance with their quality assurance procedure S QAI-33.

## **10.8 Installation, Servicing, and Instructions to Users**

Maintenance of the level device as part of the assembly will only involve removal and replacement of the device. Removal of the level device is performed by removal of three screws that attach the level device to the boss hole created for its installation. SEI has a documented Replace or Repair process in place for the Level devices in accordance with the quality assurance procedure S QAI-33. Placement and location of the level on the portable RADAR MEA and adapter plate are shown in attachment 7. The level is installed into the MSTAR per the 599020 drawing included as attachment 8 (see applicable installation notes on drawing) and the 599114 drawing included as attachment 9.

**DWG NO.**

## REVISIONS

| REV | DESCRIPTION            | DATE     | APPROVED     |
|-----|------------------------|----------|--------------|
| -   | INITIAL RELEASE        | 94-08-23 | AI           |
| A   | REVISED PER ECF CE4481 | 94-11-16 | AI <i>ph</i> |
| B   | REVISED PER ECF CE4506 | 95-01-23 | AI <i>ph</i> |
| C   | REVISED PER ECF CE4587 | 95-06-13 | AI <i>ph</i> |

METRIC

**SPECIFICATION CONTROL DRAWING**

[illegible]

SH 2  
ES6510  
DWG NO.

# REQUIREMENTS

1. SCOPE. THIS DRAWING ESTABLISHES THE DETAIL REQUIREMENTS FOR A CIRCULAR, BUBBLE LEVEL. ES6510-01 IS ILLUMINATED BY A GASEOUS TRITIUM LIGHT SOURCE AND ES6510-02 OMTS THE LIGHT SOURCE.
2. CONFIGURATION AND DIMENSIONS. THE CONFIGURATION AND DIMENSIONS SHALL BE AS DETAILED IN FIGURE 1.
3. MATERIALS. THE MATERIALS USED IN THE CONSTRUCTION OF THE LEVEL SHALL BE OF SUFFICIENT QUALITY TO ASSURE THAT THE LEVEL CAN WITHSTAND THE OPERATING AND STORAGE ENVIRONMENTS DEFINED HEREIN.
4. ENVIRONMENTAL. THE OPERATING AND NON-OPERATING ENVIRONMENT SHALL BE AS SPECIFIED IN TABLE I.
5. LIGHT SOURCE. THE LIGHT SOURCE USED TO ILLUMINATE THE LEVEL SHALL BE A GASEOUS TRITIUM TYPE THAT COMPLIES WITH GREAT BRITAIN DEFENSE STANDARD 62-4 (CAGE CODE K0851) FOR ES6510-01 ONLY.
- 5.1 SAFETY CONSIDERATIONS. THE GASEOUS TRITIUM LIGHT SOURCE CONTAINS RADIOACTIVE MATERIALS. ALL SAFETY CONSIDERATIONS DEFINED IN DEFENSE STANDARD 62-4 SHALL BE FOLLOWED.
6. PERFORMANCE. THE LEVEL SHALL MEET THE PERFORMANCE REQUIREMENTS SPECIFIED IN TABLE II.
7. MARKING. THE GRADUATIONS ON THE VIAL OF THE LEVEL SHALL SHOW NO SIGN OF BEING WATER SOLUBLE. THE GRADUATIONS SHALL BE FREE FROM DISTORTION WITH CLEAR SHARP EDGES AND SHALL NOT RUB OFF. THE PARTS SHALL BE IDENTIFIED IN ACCORDANCE WITH MIL-STD-130 WITH THE MANUFACTURER'S IDENTIFICATION AND PART NUMBER. THE UNIT SHIPPING CONTAINER SHALL BE MARKED WITH THE ELECTRONICS & SPACE CORP. (E&S CORP.) CONTROL NUMBER.
- 7.1 E&S CORP. CONTROL NUMBER.

ES6510-01

DASH NUMBER DEFINING CONFIGURATION  
-01 WITH LIGHT SOURCE  
-02 NO LIGHT SOURCE

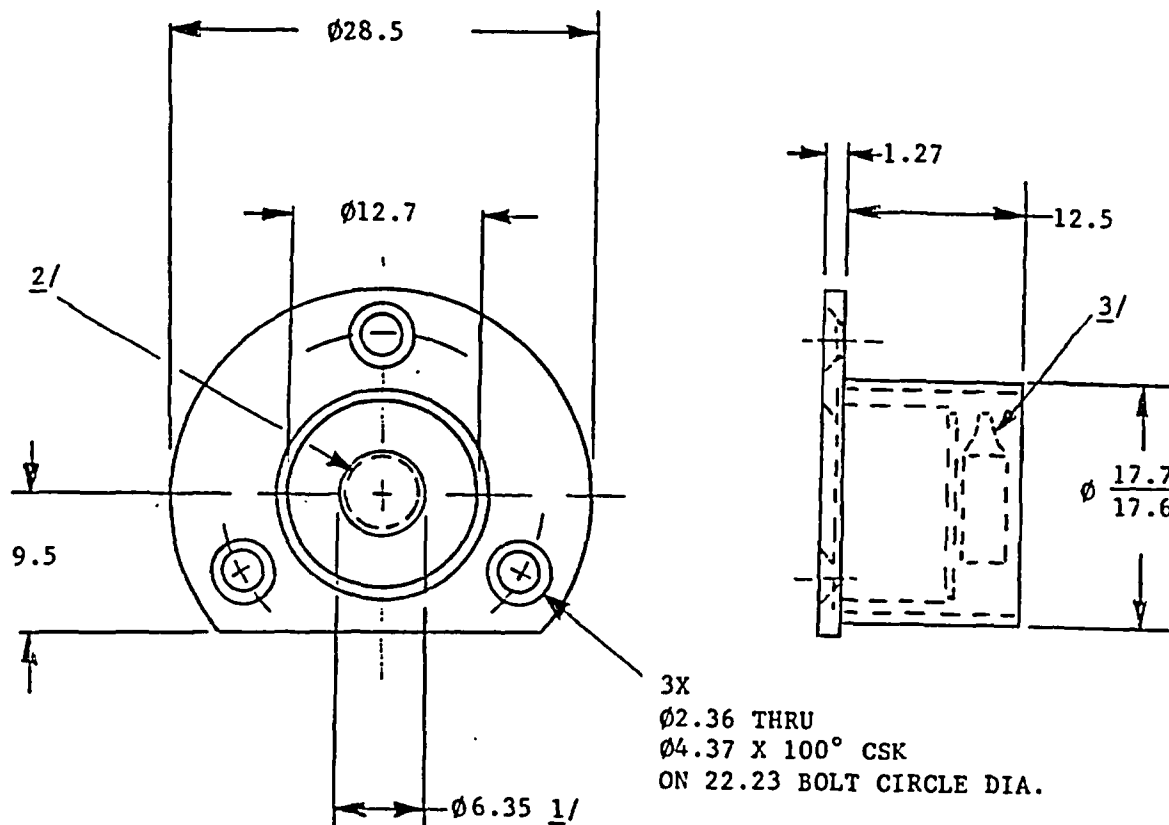
DRAWING NUMBER

|                  |                          |            |  |
|------------------|--------------------------|------------|--|
| SIZE<br><b>A</b> | CAGE NO.<br><b>20418</b> | ES6510     |  |
| SCALE<br>NONE    | REV<br>C                 | SHEET<br>2 |  |

SH 3

ES6510

DWG NO.



DIMENSIONS ARE IN  
MILLIMETERS  
TOLERANCE UNLESS  
OTHERWISE SPECIFIED  
.X =  $\pm 0.3$   
.XX =  $\pm 0.1$

- 1/ ENGRAVED BLACK LINE 0.2 TO 0.3 WIDE ON INNER SURFACE OF GLASS COVER.
- 2/ BUBBLE DIAMETER 4.0 MIN TO 4.5 MAX.
- 3/ LIGHT SOURCE PER PARA. 5. ON ES6510-01 ONLY.

FIGURE 1. CONFIGURATION AND DIMENSIONS.

|       |          |         |
|-------|----------|---------|
| SIZE  | CAGE NO. | ES6510  |
| A     | 20418    |         |
| SCALE | NONE     | REV C   |
|       |          | SHEET 3 |

SH  
4

DWG NO. ES6510

TABLE I. ENVIRONMENTAL.

|   |  |
|---|--|
| TEMPERATURE RANGE<br>OPERATING<br>NON-OPERATING | -40°C TO +55°C<br>-62°C TO +71°C   |
| HUMIDITY  | MIL-STD-810E, METHOD 507.3, PROCEDURE I, 45 CYCLES   |
| SHOCK<br>NON-OPERATING                          | SHALL NOT BE DAMAGED BY HANDLING SHOCK<br>DEFINED AS 1/2 SINE PULSE, ACCELERATION OF<br>30g FOR DURATION OF 11 ms USING MIL-STD-810E,<br>METHOD 516.2, PROCEDURE I |
| VIBRATION<br>NON-OPERATING                      | SHALL NOT BE DAMAGED BY EXPOSURE TO<br>MIL-STD-810E, METHOD 514.4, I-3.4.7, CATEGORY<br>8 - GROUND MOBILE, USING VIBRATION DATA OF<br>TABLE 514.4-A11              |
| FUNGUS  | THE UNIT SHALL BE FUNGUS INERT   |

TABLE II. PERFORMANCE.

|                          |   |
|--------------------------|---|
| COALESCENCE              | WHEN THE LEVEL IS SHAKEN VIGOROUSLY, THE<br>BUBBLES SHALL COALESCE INTO ONE LARGE BUBBLE<br>WITHIN ONE SECOND AT 15°C TO 32°C         |
| PRECIPITATE OR SOLID     | NO PRECIPITATE OR SOLID SHALL FORM AT -62°C   |
| BUBBLE MOVEMENT AND SIZE | THE BUBBLE SHALL HAVE A UNIFORM MOVEMENT OVER<br>THE GRADUATED PORTION OF THE LEVEL AND SHALL<br>BE OF THE SIZE SPECIFIED IN FIGURE 1 |
| SENSITIVITY              | 10 TO 12 ANGULAR MINUTES PER MILLIMETER OF<br>RUNOUT  |

SIZE

A

CAGE NO.

20418

ES6510

SCALE

NONE

REV

-

SHEET

4

SH 5

DWG NO. ES6510

8. QUALITY CONFORMANCE INSPECTION.

8.1 VISUAL AND MECHANICAL. THE PARTS SUPPLIED TO THIS DRAWING SHALL BE SUBJECTED TO A VISUAL AND MECHANICAL INSPECTION TO ASSURE COMPLIANCE WITH FIGURE 1 AND PARA 7.

9. PACKING AND PACKAGING. THE PARTS SHALL BE PACKAGED IN A MANNER SUFFICIENT TO ASSURE ARRIVAL AT DESTINATION WITHOUT DAMAGE WHEN SHIPPED BY COMMON COMMERCIAL CARRIER.

10. VENDOR(S) SHALL MAKE NO CHANGE TO PRODUCT(S) SUPPLIED TO THIS DRAWING WHICH WOULD AFFECT INTERCHANGEABILITY OR DEGRADE EITHER PERFORMANCE OR RELIABILITY OF THE PRODUCT WITHOUT PRIOR NOTICE.

11. IDENTIFICATION OF THE "SUGGESTED SOURCE(S) OF SUPPLY" HEREON IS NOT TO BE CONSTRUED AS A GUARANTEE OF PRESENT OR CONTINUED AVAILABILITY AS A SOURCE OF SUPPLY FOR THE ITEM(S).

| E&S CORP.<br>CONTROL<br>NUMBER | SUGGESTED SOURCE(S) OF SUPPLY |             |   |
|--------------------------------|-------------------------------|-------------|---|
|                                | SUPPLIER DATA                 |             |   |
|                                | CAGE CODE                     | PART NUMBER | NAME AND ADDRESS  |
| ES6510-01                      | K5628                         | 1544003     | SAUNDERS-ROE DEVELOPMENTS LTD<br>MILLINGTON ROAD<br>HAYES MIDDX UB3 4NB ENGLAND |
|                                | OTBT2                         | 1544003     | SRB TECHNOLOGIES, INC.<br>2580 LANDMARK DR.<br>WINSTON SALEM, NC 27103          |
| ES6510-02                      | K5628                         | 1544003-1   | SAUNDERS-ROE DEVELOPMENTS LTD<br>MILLINGTON ROAD<br>HAYES MIDDX UB3 4NB ENGLAND |
|                                | OTBT2                         | 1544003-1   | SRB TECHNOLOGIES, INC.<br>2580 LANDMARK DR.<br>WINSTON SALEM, NC 27103          |

|                  |                          |            |  |
|------------------|--------------------------|------------|--|
| SIZE<br><b>A</b> | CAGE NO.<br><b>20418</b> | ES6510     |  |
| SCALE<br>NONE    | REV<br>C                 | SHEET<br>5 |  |

|   |  |   |
|---|--|---|
| SECURITY CLASSIFICATION<br>SERVICE ORG. No. | 3rd ANGLE PROJECTION<br>IF IN DOUBT ASK<br>DRAWING TO BE READ IN CONJUNCTION WITH BS 308 | <div style="text-align: center;"> </div> <p style="text-align: center;"><u>SECTION A-A</u></p> <div style="position: absolute; top: 200px; right: 100px;"> <p><u>NOTE:</u></p> <ol style="list-style-type: none"> <li>1 ITEM 2 TO BE PRE-POSITIONED CONCENTRIC IN ITEM 1 USING A SMALL QUANTITY OF ITEM 4</li> <li>2 ASSEMBLE ITEM 6 CONCENTRIC WITH ITEM 2 GRADUATION CIRCLE &amp; SECURE IN PLACE WITH ITEM 5</li> <li>3 IN FILL WITH ITEM 3.</li> <li>4 A RANDOM VISIBLE INTERFACE MAY EXIST WHEN VIEWING THE B/LIGHT THRU THE FRONT FACE. NO AIR BUBBLES SHOULD BE VISIBLE TO THE NAKED EYE WHEN VIEWED THRU THE FRONT FACE</li> </ol> </div> |
|---|--|---|

|              |                  |                 |                  |              |                  |   |          |                   |                 |                                    |                       |                         |                                  |                        |                 |
|--------------|------------------|-----------------|------------------|--------------|------------------|---|----------|-------------------|-----------------|------------------------------------|-----------------------|-------------------------|----------------------------------|------------------------|-----------------|
| APPROVED<br> | DATE<br>23-11-94 | CHECKED<br><br> | DATE<br>23-11-94 | DRAWN<br>RGB | DATE<br>23-11-94 | TOLERANCES UNLESS OTHERWISE STATED<br>DIM. XX ± .10<br>DIM. X ± .3<br>DIM. X ± .1<br>AND OVER | MATERIAL | PROTECTIVE FINISH | SURFACE TEXTURE | SCALE<br>DIMENSIONS IN MILLIMETRES | RESPONSIBLE AUTHORITY | SECURITY CLASSIFICATION | SROL DRAWING NUMBER<br>D 1544003 | SERVICE DRAWING NUMBER | SHEET<br>1 OF 2 |
|--------------|------------------|-----------------|------------------|--------------|------------------|---|----------|-------------------|-----------------|------------------------------------|-----------------------|-------------------------|----------------------------------|------------------------|-----------------|

 1544003  
 SH1

|   |  |  |   |
|---|--|--|---|
| SECURITY CLASSIFICATION<br>SERVICE DRG. NO.<br>USED ON                        | 3RD ANGLE PROJECTION<br>IF IN DOUBT ASK<br>DRAWING TO BE READ IN CONJUNCTION WITH BS 308   |  |   |
| OPERATING SPECIFICATION<br>1. SENSITIVITY OVER FULL RANGE: 10-12 min/mm RUN   |  | NOTE!<br>THIS SHEET IS FOR CUSTOMER REFERENCE ONLY.<br>ASSEMBLY TO BE MANUFACTURED TO SHEET 1. |   |
| APPROVED<br>DATE 21-11-94<br>CHECKED<br>DATE<br>DRAWN J.C.M.<br>DATE 21-11-94 | TOLERANCES UNLESS OTHERWISE STATED<br>DIM. X.XX ± 0.15<br>DIM. X.X ± 0.5<br>DIM. X. ± 1.0<br>ANGLES ± 0.5°<br>REMOVE ALL SHARP EDGES 0.5 RAD MAX | MATERIAL<br>SURFACE TEXTURE<br>PROTECTIVE FINISH<br>SCALE 2:1<br>DIMENSIONS IN MILLIMETRES     | SAUNDERS-ROE LIMITED<br>RESPONSIBLE AUTHORITY<br>TITLE LEVEL ASSY |
|   |  | SECURITY CLASSIFICATION<br>SRL DRAWING NUMBER D1544003<br>SERVICE DRAWING NUMBER               |   |

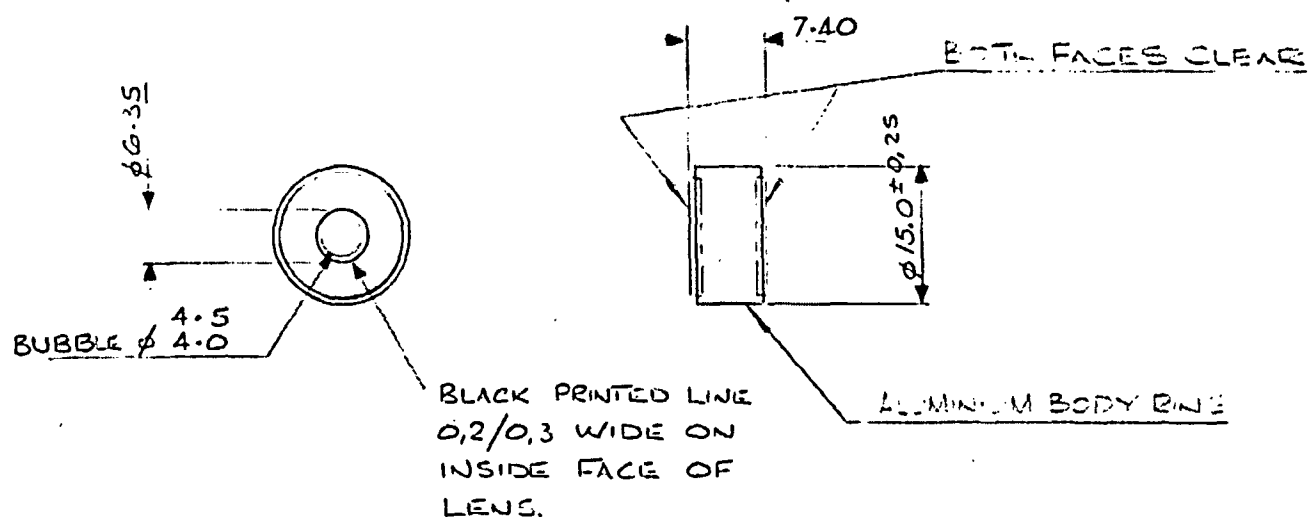
1544003  
SHT 2

|   |  |  |   |   |          |      |     |   |        |      |     |      |      |             |        |
|---|--|--|---|---|----------|------|-----|---|--------|------|-----|------|------|-------------|--------|
| SECURITY CLASSIFICATION<br><br>SERVICE DRG. NO.<br><br>USED ON<br>D1544002  | 3RD ANGLE PROJECTION  IF IN DOUBT ASK<br><br>DRAWING TO BE READ IN CONJUNCTION WITH BS 308 | <p>3 HOLES <math>\phi 2.39</math> C'S'K <math>\phi 4.37 \times 100'</math><br/>EQUI-SPACED ON 22.23 P.C.D.</p>   |   |   |          |      |     |   |        |      |     |      |      |             |        |
| <div style="font-size: small;">           SAUNDERS-ROE LTD. 1981<br/>           Copyright reserved. No part of this data may be reproduced or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or by any information storage and retrieval system, without the prior written permission of Saunders-Roe Limited. It contains confidential information and may not be copied or used for any purpose other than that for which it is supplied without the express written authority of Saunders-Roe Limited.         </div> |  | <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td>2</td> <td>28-10-94</td> <td>2752</td> <td>/11</td> </tr> <tr> <td>1</td> <td>6-9-91</td> <td>2715</td> <td>/14</td> </tr> <tr> <td>ISS.</td> <td>DATE</td> <td>CH.NOTE NO.</td> <td>SIGNED</td> </tr> </table> |   | 2 | 28-10-94 | 2752 | /11 | 1 | 6-9-91 | 2715 | /14 | ISS. | DATE | CH.NOTE NO. | SIGNED |
| 2   | 28-10-94   | 2752   | /11   |   |          |      |     |   |        |      |     |      |      |             |        |
| 1   | 6-9-91   | 2715   | /14   |   |          |      |     |   |        |      |     |      |      |             |        |
| ISS.  | DATE   | CH.NOTE NO.  | SIGNED  |   |          |      |     |   |        |      |     |      |      |             |        |
| APPROVED<br>DATE 1 9 94<br>CHECKED<br>DATE<br>DRAWN J.C.M.<br>DATE 6-9-91   |  | TOLERANCES UNLESS OTHERWISE STATED<br>DIM. X.XX $\pm 0.15$<br>DIM. X.X $\pm 0.5$<br>DIM. X. $\pm 1.0$<br>ANGLES $\pm 0.5^\circ$<br><br>REMOVE ALL SHARP EDGES<br>0.5 RAD MAX   | MATERIAL ALUMINIUM ALLOY<br>BS1474-2014A-TF<br><br>SURFACE TEXTURE<br><br>PROTECTIVE FINISH<br><br>SCALE 2:1<br>DIMENSIONS IN MILLIMETRES |   |          |      |     |   |        |      |     |      |      |             |        |
| SAUNDERS-ROE LIMITED<br>RESPONSIBLE AUTHORITY<br>TITLE LEVEL HOUSING  |  | SECURITY CLASSIFICATION<br>SRL DRAWING NUMBER D1544101<br>SERVICE DRAWING NUMBER   |   |   |          |      |     |   |        |      |     |      |      |             |        |

D1544101

|                         |   |  |   |                   |   |   |   |   |    |    |
|-------------------------|---|--|---|-------------------|---|---|---|---|----|----|
| 1                       | 2 | 3  | 4 | 5                 | 6 | 7 | 8 | 9 | 10 | 11 |
| SECURITY CLASSIFICATION |   | 3RD ANGLE PROJECTION                         |   | IF IN DOUBT - ASK |   |   |   |   |    |    |
| SERVICE DRG. NO.        |   | DRAWING TO BE READ IN CONJUNCTION WITH BS308 |   |                   |   |   |   |   |    |    |

USED ON  
D1544002



*SENSITIVITY: 10'-12' PER 1mm RUN*  
*STORAGE & OPERATING TEMPERATURE*  
*-40 TO +50°C TO STANAG 2895*  
*A2 THROUGH C2*

APPROVED  
6.9.94

DRAWN  
J.C.M.  
DATE  
6.9.94

TOLERANCES  
UNLESS OTHERWISE STATED  
DIM XX ± .10  
DIM X ± .03  
DIM X ± .01  
AND OVER

REMOVE ALL SHARP EDGES  
0.5 RAD MAX

MATERIAL  
—  
SURFACE TEXTURE  
—

PROTECTIVE FINISH  
—  
SCALE  
DIMENSIONS IN MILLIMETRES

SAUNDERS - ROE LTD ©1992  
RESPONSIBLE AUTHORITY  
TITLE  
*CIRCULAR LEVEL*

|       |        |          |        |
|-------|--------|----------|--------|
|       |        |          |        |
| 1     | 6.9.94 | 2715     |        |
| ISSUE | DATE   | CH NOTED | SIGNED |

SECURITY CLASSIFICATION  
S-R DRAWING NUMBER  
D1544102  
SERVICE DRAWING NUMBER

D1544102

|   |                        |                   |                |             |
|---|------------------------|-------------------|----------------|-------------|
| SRB Technologies (Canada) Inc.<br>Radiation Safety Manual |                        | Document #<br>RSP | Section<br>006 | Page 1 of 2 |
| Revision:<br>E  | Date:<br>June 26, 2003 |                   | Approved:      |             |

## SURFACE CONTAMINATION ASSESSMENT OF GTLS's

### 1. PURPOSE:

The purpose of this procedure is to describe the method of analysis used at SRBT to determine the amount of removable radioactive contamination in the form of tritium on the product material prior to placement in storage, for submission to assembly, or preparation for shipping.

### 2. SCOPE:

This procedure describes the Soak Testing procedure for tritium filled light sources to assure compliance with the applicable regulations and/or standards. The standards used are ANSI-N43.4, *Classification of Radioactive Self-Luminous Light Sources*, and Def. Stan. 62-4/4. The standard used is dependent upon the customer-stated requirement(s) and/or the regulatory requirement(s).

### 3. APPARATUS:

The following items are required to perform the procedures as described herein:

- 3.1 Liquid Scintillation Counting System
- 3.2 Liquid Scintillation Cocktail: Ultima Gold™ XR high flash point LSC-cocktail, or similar
- 3.3 LSC vials 7-ml plastic with appropriate rack
- 3.4 Sampler Eppendorf 1,000ul pipetter with 1-ml pipette tip, or similar
- 3.5 NIST tritium reference standards: Wallac Internal Standards, Cat. No.1210-120, or similar
- 3.6 Holding rack for samples (optional)

### 4. PROCEDURE:

#### Note:

All sample, blank and standards preparations are performed wearing protective gloves to both protect the operator from possible contamination and the samples, blanks and standards from cross contamination. Gloves are to be changed often during the process to assure that the possibility of cross contamination is minimized. Use unique identifiers for bins and vials.

- 4.1 The following procedure describes the steps for leach testing of GTLS's:
  - 4.1.1 Place one or more Betalights in a clean wash bin *noting the number of lights*.
  - 4.1.2 Add a *known volume* of water to the bin, usually 100 or 1,000 ml.
  - 4.1.3 Add the *same volume* of water to a clean empty bin to be assessed as background.
  - 4.1.4 Cover the bins and allow to remain undisturbed for 4 hours in accordance with Def.Stan. 62-4/4, or for 24 hours in accordance with ANSI-N43.4. Uniquely identify bins for scintillation purposes.
  - 4.1.5 Take a 1ml. sample of water from each bin, including the required number of samples from the background bin and place in *uniquely identified* vials. Indicate the identification and number of lights on the vial caps.
  - 4.1.6 Add 4ml. of LSC cocktail solution to each vial, cap and shake vigorously.
  - 4.1.7 Analyze vials on the Liquid Scintillation Counter in accordance with the protocol set up for the LSC instrument being used.
  - 4.1.8 Transfer the betalight information and calculated results to the Results form.
  - 4.1.9 Segregate passes from failures and forward passed lights to assembly.
  - 4.1.10. Complete information documents as per document procedures.
  - 4.1.11. File reports.

|   |                        |                   |                |             |
|---|------------------------|-------------------|----------------|-------------|
| SRB Technologies (Canada) Inc.<br>Radiation Safety Manual |                        | Document #<br>RSP | Section<br>006 | Page 2 of 2 |
| Revision:<br>E  | Date:<br>June 26, 2003 |                   | Approved:      |             |

## 5. LIQUID SCINTILLATION COUNTING:

The samples are analyzed using liquid scintillation counting methods and in accordance with the SRBT(C)I LSC QA Program.

## 6. CALCULATIONS:

The following formula is used to calculate the activity in solution due to leaching, leaking and/or dissolution of tritium into the water during the 4-hour or 24-hour leach testing:

$$6.1 \quad \text{Activity (Bq)} = \frac{[X \text{ (cpm)} - \text{bkgd (cpm)}] \times \text{volume (ml)}}{\text{efficiency (cpm/dpm)} \times 60\text{sec/min} \times \text{no. of lights}}$$

where X is the number of cpm for the sample determined by LSC.

The following procedure is used to determine the amount of removable contamination by wipe test. It is used when requested by the customer:

## 7. Acceptance Criteria

For the leach testing, the acceptable maximum activity per light is 185 Bq.(5.0 nCi) as per Def.Stan. 62-4/4 or 1850 Bq. (50.0 nCi) as per ANSI-N43.4.

## 8. Procedure Review:

The Corporate Health Physicist reviews this procedure at least annually and makes revisions as required.

## 9. Responsibilities

### President

The President is responsible for the daily operations of the SRBT(C)I facility located in Pembroke, Ontario.

### Corporate Health Physicist

The Corporate Health Physicist is responsible for the radiation and industrial safety programs of the SRBT(C)I facility located in Pembroke, Ontario.

### QA Manager

The QA Manager is responsible for the quality assurance and quality control programs of the SRBT(C)I facility located in Pembroke, Ontario.

### LSC Analyst

The analyst is responsible to follow the procedures as stated in the Radiation Safety Procedures Manual.

## 10. Procedural Deviation

The Corporate Health Physicist or a designate may only authorize any deviation from this procedure. The deviation must be noted on the report form and signed and dated by the Corporate Health Physicist or designate.

## 11. Document Control

Documentation relative to Betalight Scintillation is maintained by the Health Physics department.

Records are retained in accordance with Section 28 of the CNSC document General Nuclear Safety & Control Regulations. Section 28 requires that records be retained for a period ending 1 year after the expiry of the license that authorizes the activity in respect of which the records are kept.

# QUALITY ASSURANCE INSTRUCTION (QAI)

NO. S QAI-33 REV. ATITLE: MSTAR TRITIUM LEVEL INSPECTIONINITIAL RELEASE DATE: 7/2/03PAGE 1 OF 1

## INITIAL ISSUE

## LATEST REVISION

T. MINER 7/2/03  
*PREPARED BY* *DATE*

LARRY PETERSON 9/19/03  
*Prepared By* *Date*

William Almstedt 7/2/03  
*APPROVED BY* *DATE*

William Almstedt 9/19/03  
*Approved By* *Date*

APPROVED BY DATE

Approved By Date

### 1.0 PURPOSE

The purpose of this document is to provide visual inspection instructions for inspection of the tritium level used on the MSTAR System.

### 1.1 APPLICABILITY

This document applies to all MSTAR programs and all assemblies that require the tritium level.

### 2.0 APPLICABLE DOCUMENTS

### 3.0 PROCEDURE

#### 3.1 RECEIVING INSPECTION LEVEL

3.1.1 Review the supplier Certificate of Conformance for conformance to the requirements in the Purchase Order Quality Provisions.

3.1.2 Visual inspect level for any visual damage either to the housing or bezel.

3.1.3 Visual inspect level for any leakage.

3.1.4 Tilt level and observe level bubble moves.

3.1.5 Verify that level illuminates in darkness.

3.1.6 Indicate acceptance by stamping AEC card.

#### 3.2 INSPECTION TRIPOD ADAPTER

3.2.1 Visual inspect level for proper assembly per drawing.

3.2.2 Check that mounting screws are tight.

3.2.3 Visual inspect level for any damage.

3.2.4 Visual inspect level for any leakage.

3.2.5 Verify that the Trefoil marker has been applied, is secure legible and in correct location per drawing.

3.2.6 Tilt Adapter and observe level bubble moves.

3.2.7 Verify that the level illuminates in darkness.

3.2.8 Indicate acceptance by stamping ELWA.

#### 3.3 INSPECTION MAIN ELECTRICAL ASSEMBLY (MEA)

3.3.1 Visual inspect level for proper assembly per drawing.

3.3.2 Check that mounting screws are tight.

3.3.3 Visual inspect level for any damage.

3.3.4 Visual inspect level for any leakage.

3.3.5 Tilt MEA and observe level bubble moves.

3.3.6 Verify that level illuminates in darkness.

3.3.7 Verify that the Trefoil marker has been applied to the cover, is secure and legible.

3.3.8 Indicate acceptance by stamping the ELWA

| REVISION INDEX | SHEET REVISION | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
|----------------|----------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
|                | A              |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |



## CERTIFICATE OF REGISTRATION

*This is to certify that the Quality Management System of:*

**SYSTEMS & ELECTRONICS INC.  
201 EVANS LANE  
ST. LOUIS, MISSOURI 63121**

*has been assessed and approved by National Quality Assurance,  
U.S.A., against the following quality assurance management system  
standard:*

**ISO 9001: 2000**

*The Quality Management System is applicable to*

**DESIGN, DEVELOP, INTEGRATE, MANUFACTURE, INSTALL  
AND SERVICE COMPLEX MECHANICAL SYSTEMS,  
ELECTRO-MECHANICAL EQUIPMENT AND ELECTRONIC  
COMPONENTS FOR DEFENSE AND COMMERCIAL MARKETS**

*The approval is subject to the company maintaining its system to the  
required standards, which will be monitored by NQA, U.S.A.*

Certificate No: 10346

Date: July 9, 1998

Reissued: June 24, 2002

Valid Until: August 7, 2004



*Stephen J. Margulies*  
For and on behalf of NQA, U.S.A.



# Certificate of Registration

This is to certify that KPMG Quality Registrar has registered the Quality System of

## SRB Technologies (Canada) Inc.

320 - 140 Boundary Road, Pembroke, Ontario K8A 6W5

to the Quality System Standard

**ISO 9001:1994**

The Quality System is applicable to

Design and manufacture of tritium filled light sources (Betalights ®),  
self powered luminous signs, markers and emergency lighting  
for military, commercial, aerospace and scientific applications.

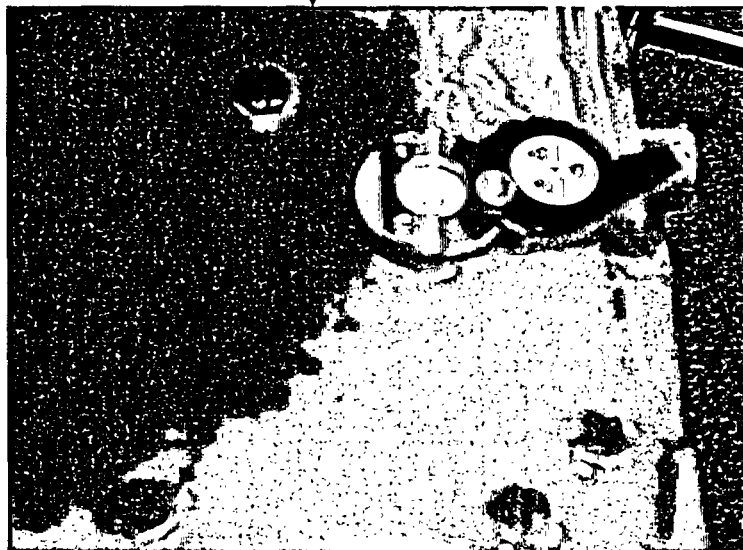
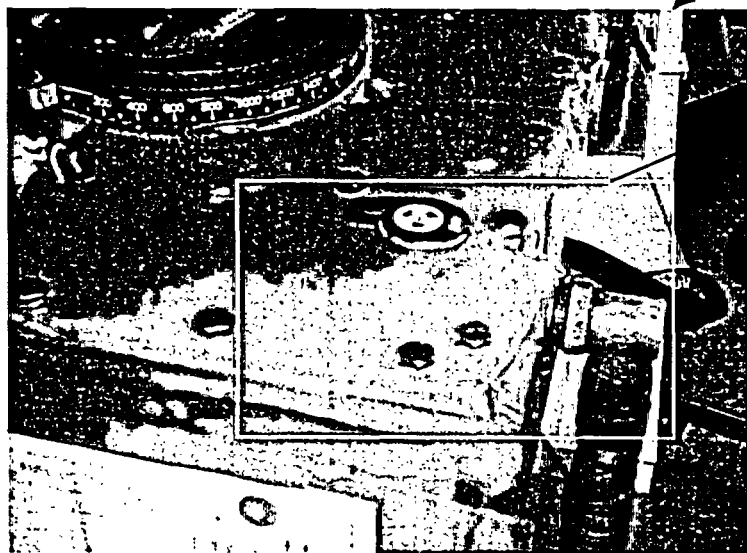
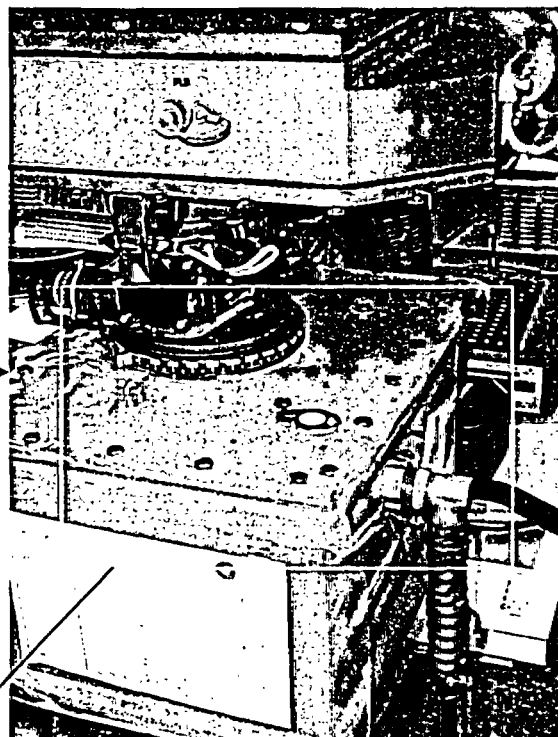
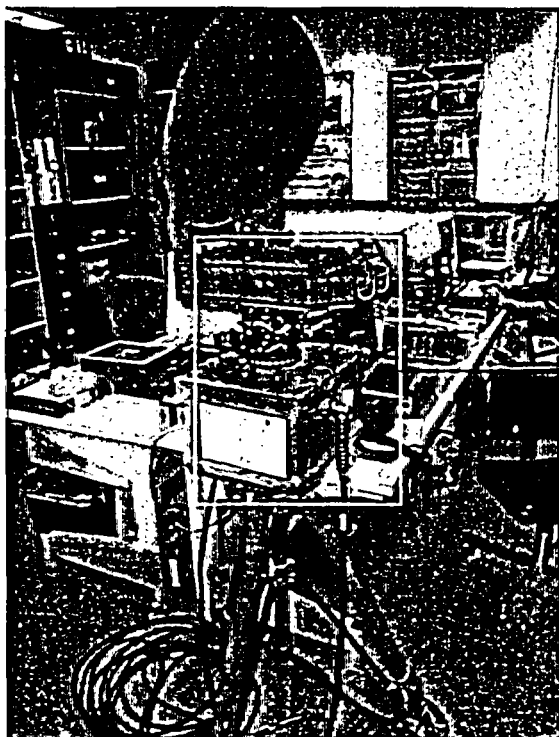
This registration is given subject to the terms and conditions governing the use of this certificate as  
described in the agreement between KPMG Quality Registrar Inc. and the holder thereof. Registration  
does not assure the effectiveness of the Quality System or the products or services produced by it.

Registration Number: 683  
Issue Date: September 19, 1997  
Renewal Date: January 17, 2001  
Expiry Date: September 18, 2003



*Mark J. O'Sullivan*

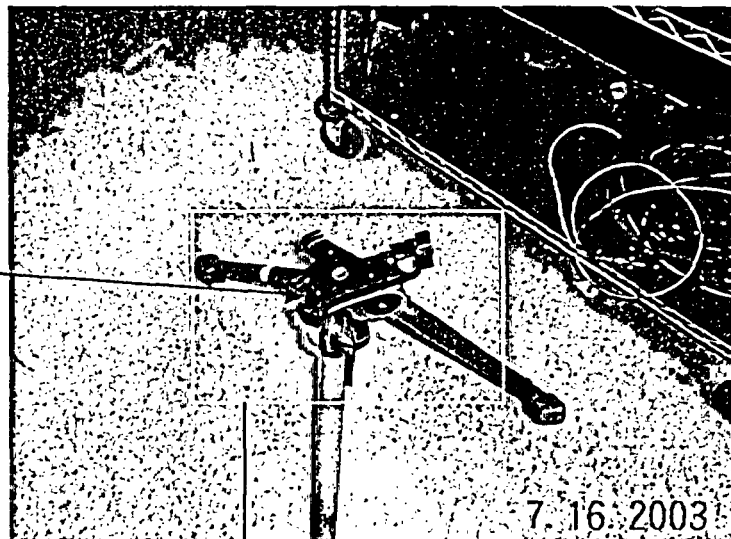
Mark J. O'Sullivan  
President  
KPMG Quality Registrar Inc.  
Toronto, Ontario, Canada M5L 1B2



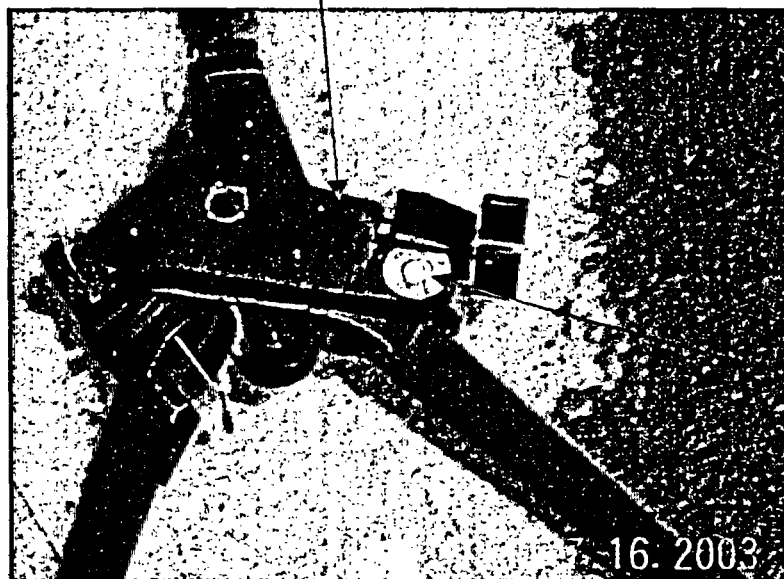
Main Electronics Assembly (MEA)  
Location of ES6510-01 (Level, Cylindrical)  
on the MSTAR man portable RADAR  
Attachment 7 (1 of 2)



Tripod Assembly



Adapter Plate is the mechanical interface between the MEA and the tripod

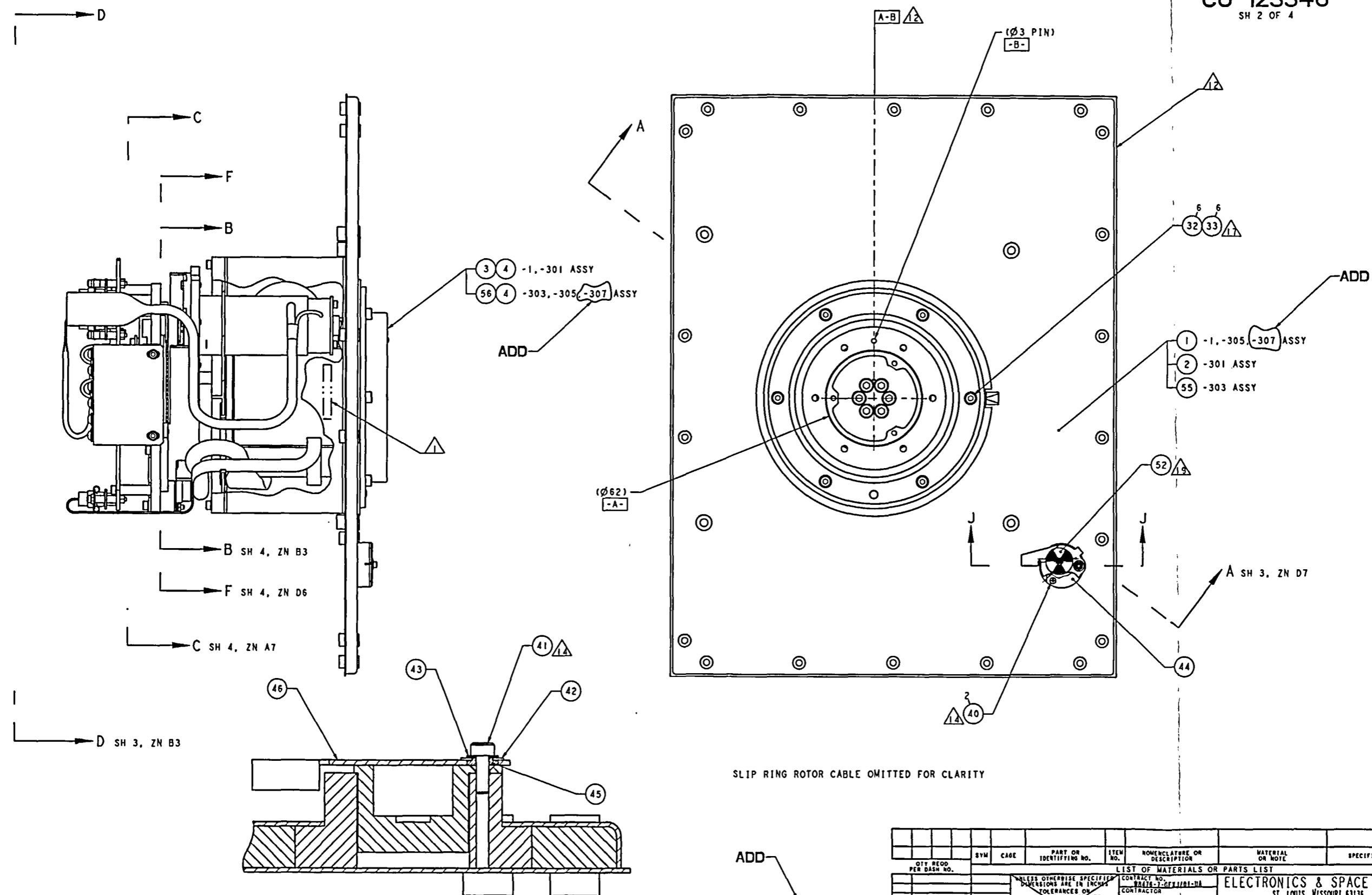


ES6510-01 Bubble level assembly

Adapter Plate Assembly (Tripod)  
Location of ES6510-01 (Level, Cylindrical)  
on the MSTAR man portable RADAR  
Attachment 7 (2 of 2)




CO 123346  
SH 2 OF 4



SLIP RING ROTOR CABLE OMITTED FOR CLARITY

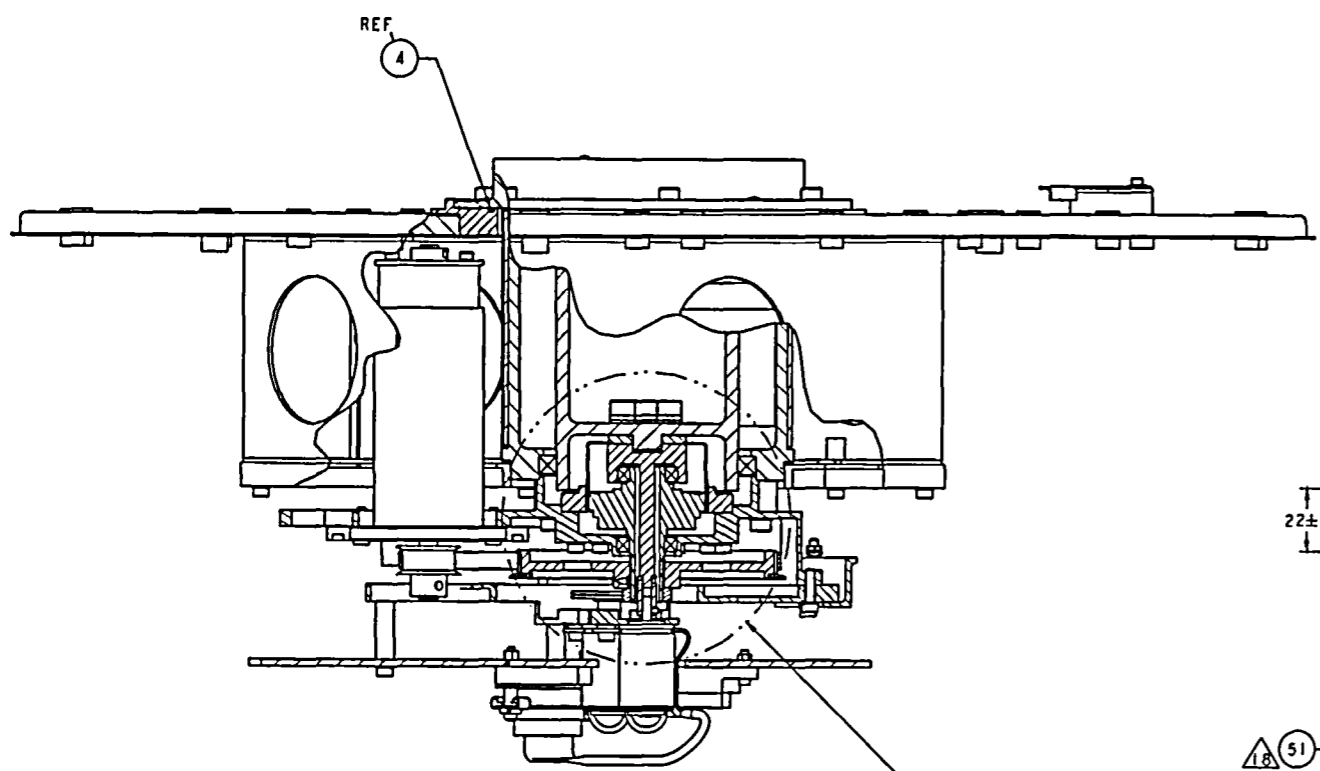
SECTION J-J  
SCALE 4.000

-1, -301, -303, -305, -307 ASSY

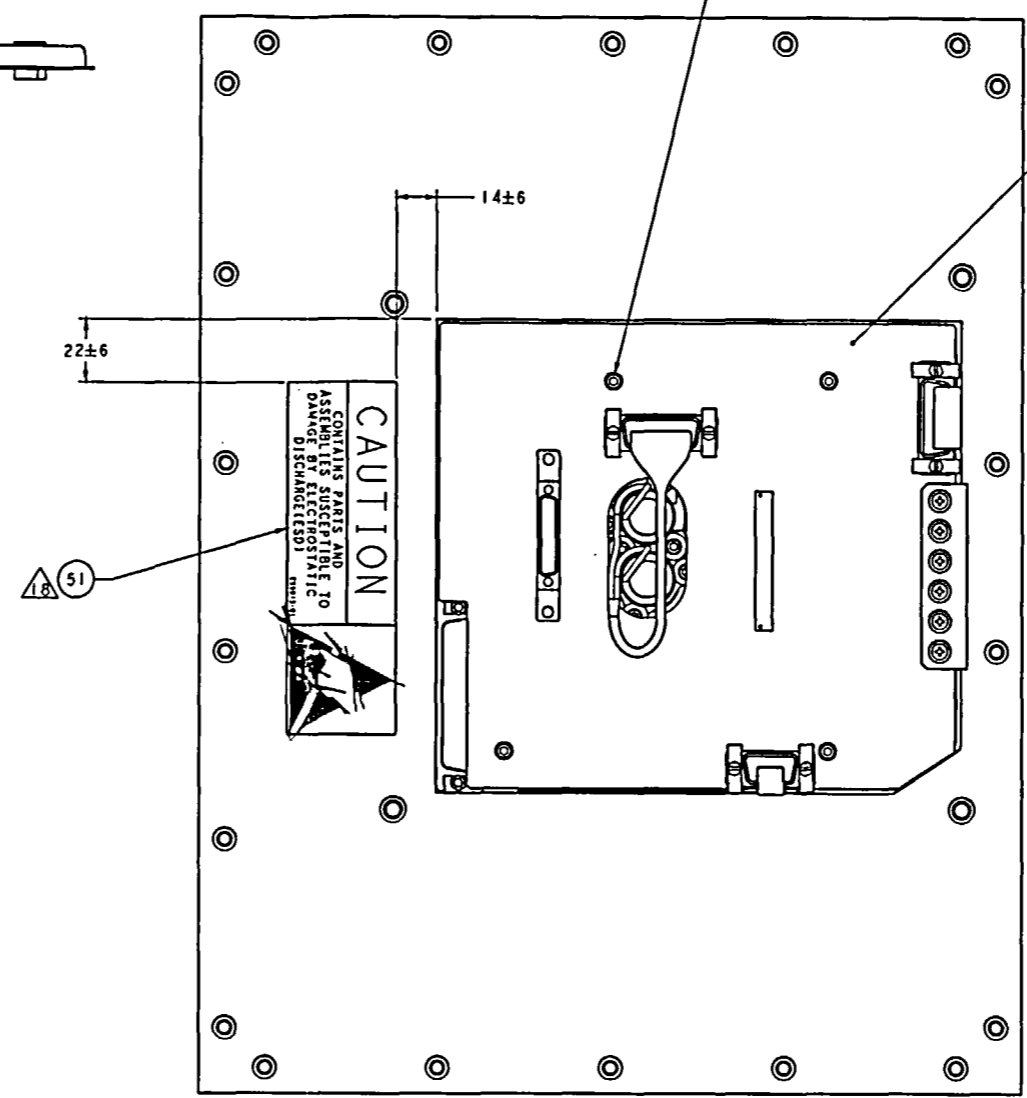
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|---|---------------------------|--|-----|------|--|----------|-----------------------------|------------------|----------------|
|   |                           |  | SYM | CASE | PART OR IDENTIFYING NO.  | ITEM NO. | NOMENCLATURE OR DESCRIPTION | MATERIAL OR NOTE | SPECIFICATIONS |
| QTY REQD PER DASH NO.   |                           |  |     |      | LIST OF MATERIALS OR PARTS LIST                                  |          |                             |                  |                |
|   |                           |  |     |      | ELECTRONICS & SPACE CORP.<br>ST. LOUIS, MISSOURI 63136           |          |                             |                  |                |
|  |                           |  |     |      | BASE ASSEMBLY-<br>ANGULATION HEAD                                |          |                             |                  |                |
| DASH NO.  | NEXT ASSEMBLY APPLICATION |  |     |      | REF NO.  | PROJECT  |                             |                  |                |
|   |                           |  |     |      | DRAWN BY G. RUSSELL JR. 12-71<br>CHECKED APVD PROJECT APVD       |          |                             |                  |                |
|   |                           |  |     |      | SIZE CASE CODE PQR NO. F 20418 599020 SCALE 1/1 UNIT BT INCHES 2 |          |                             |                  |                |

| REVISIONS |     |                       |             |          |
|-----------|-----|-----------------------|-------------|----------|
| ZONE      | REV | DESCRIPTION           | DATE        | APPROVED |
|           | A   | ADD SH PER 46ECP-0103 | GB 09-09-01 | RJT      |
|           | C   | REV PER CO 118161     | GB 01-03-09 | GRL      |
|           | E   | REV PER CO 122015     | JF 02-00-12 | GRL      |
|           | F   | REV PER CO 122165     | GB 02-09-09 | GRL      |

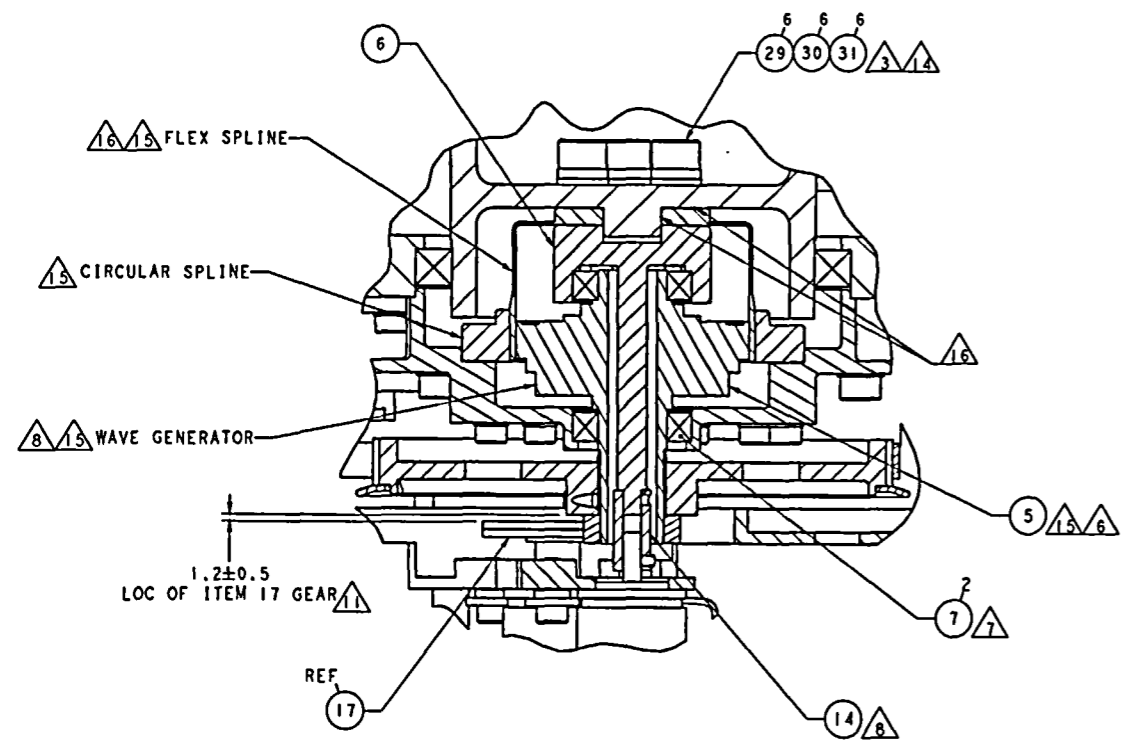
CO 123346  
SH 3 OF 4



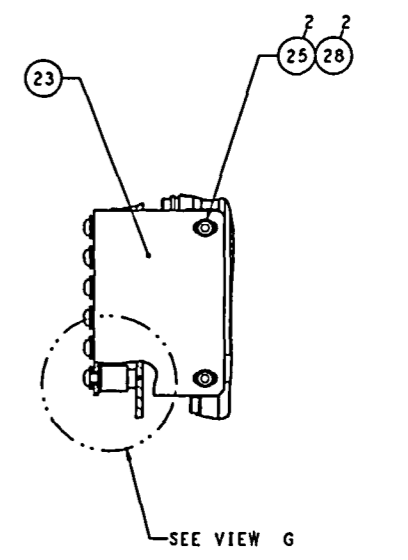
SECTION A-A  
ROTATED 37 CCW  
SH 2 ZONE C2



VIEW D-D  
SH 2 ZN B7



VIEW E  
SCALE 2.000



VIEW G  
SCALE 4.000

| SYM                             | CAGE | PART OR IDENTIFYING NO. | ITEM NO. | NOMENCLATURE OR DESCRIPTION   | MATERIAL OR NOTE | SPECIFICATIONS |
|---------------------------------|------|-------------------------|----------|-------------------------------|------------------|----------------|
| LIST OF MATERIALS OR PARTS LIST |      |                         |          |                               |                  |                |
| CONTRACT NO. W428-7-REV/01-NA   |      |                         |          | ELECTRONICS & SPACE CORP.     |                  |                |
| CONTRACTOR                      |      |                         |          | ST. LOUIS, MISSOURI 63136     |                  |                |
| DRAWN G. RUSSELL 98-12-21       |      |                         |          | BASE ASSEMBLY-ANGULATION HEAD |                  |                |
| CHECK                           |      |                         |          | F 20418 599020                |                  |                |
| APVD                            |      |                         |          | SCALE 1/1 UNIT BY             |                  |                |
| PROJECT                         |      |                         |          | SHEET 3                       |                  |                |
| APVD                            |      |                         |          | SD FORM 402-ACB (11-20-94)    |                  |                |

The diagram illustrates the electrical connections for the motor control system. A circular component labeled "MOTOR 598922" is connected to a large rectangular block labeled "CCA 599065". The CCA block has two input terminals at the top, labeled "P1" and "J3", and two output terminals at the bottom, labeled "J4" and "J5". Each of these bottom terminals is also labeled "P1". A "SLIP RING 598931" is connected to the "P1" terminal at the top of the CCA block. To the right of the CCA block is a dashed-line box labeled "RESOLVER ASSEMBLY 599060". Inside this box are two smaller rectangular blocks: "B1 COARSE RESOLVER" and "B2 FINE RESOLVER". Wires from the "J4" and "J5" terminals of the CCA block connect to the bottom of the B1 and B2 resolver blocks, respectively. These two lines then converge and connect to a common ground point labeled "E1" at the bottom right of the diagram.

INTERCONNECT DIAGRAM  
-1, -301, -303, -305, -307 ASSY

ADD

This diagram shows an exploded view of a mechanical assembly. The central component is a rectangular plate with a complex internal structure, including a large circular opening and several smaller circular features. Surrounding this central plate are various other components, including a large circular flange on the left, a cylindrical component on the right, and several smaller circular parts. The components are labeled with circled numbers: 3, 5, 6, 13, 15, 16, 18, 25, 28, and 35. Some numbers are repeated, indicating multiple instances of a part. The diagram is a technical drawing showing the relative positions and assembly sequence of the parts.

SECTION C-C  
SH 2, ZN 87

SETSCREW THREADS  

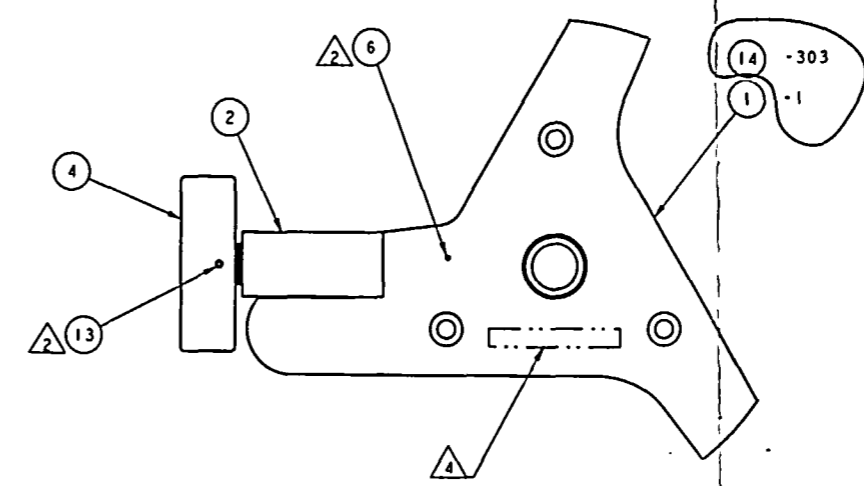
ITEM 14 SETSCREW LOCATIONS

**ADD-**

-1, -301, -303, -305, -307 ASSY

SECTION B-B  
SH 2. ZN C7

[illegible]



ADD

ADD—

- NOTES:

QW NO 599114 SM REV

|      |         |        |        |
|------|---------|--------|--------|
| 5122 | 242 200 | 000 00 | 599114 |
|------|---------|--------|--------|

 .005  
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