

BF-3 Tube Replacement

Neutron "Remball" Detectors: Replacing BF3 Tubes with 3He Tubes



Model 12-4



Model 42-30

The neutron "remball" detector has been the standard for measuring neutron fields for more than 50 years. At about 23 pounds, it is not a well-loved detector, especially at the end of a long day. However, thousands of these detectors still exist and are heavily relied upon today. Currently IATA (International Air Transport Association) regulations prohibit the shipping of these detectors due to the poisonous nature of the BF3. The result is that the international shipping of these detectors has become very expensive or practically impossible.

Ludlum Measurements now offers two alternatives to this problem: 1) a Model 42-41 PRESCILA, or 2) replacement of the tube inside your existing detector with an identically sized 3He tube. The remainder of this article clarifies the second alternative.

The following is a list of differences and similarities between BF3 and 3He tubes:

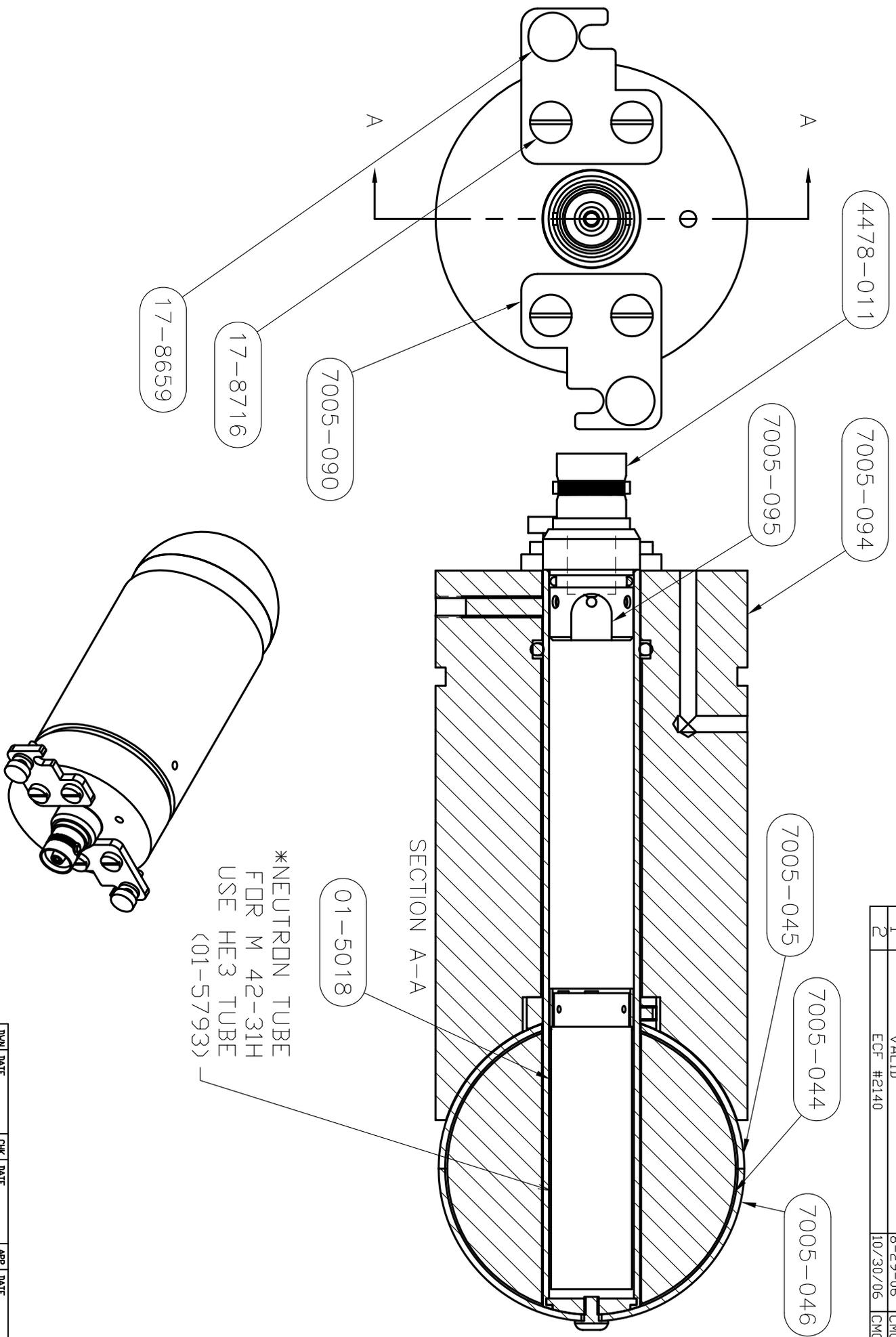
- Pressure: Replacement 3He tubes have less than 2.7 atmospheres of pressure and are therefore exempt from any shipping requirements.
- Energy Response: There is no change in energy response which still follows the inverse-RPG curve.
- Crosstalk: Gamma interference or "crosstalk" is the same for both the BF3 and 3He tubes. Crosstalk is less than 10 counts per minute at 10 R/hr (137Cs).
- High Voltage: Operating HV is normally about 1100 Vdc for the 3He tube, where the BF3 tube requires about 1700 Vdc.
- Count rate: The 3He tube has approximately four times the count rate of the BF3 tube at a given neutron dose rate. This difference is mostly beneficial because it reduces statistical error. However, a resistor change-out is needed in some of our older electronics in order to calibrate the top range.

To keep these modified detectors distinguishable from those unmodified at our facility, we are taking the following actions:

1. New detectors will have a new model number and model name that includes an "H", as in the Model 42-30H, and the Model 42-31H. For the Model 5, the new detector model number is Model 42-14H.
2. Modified detectors and electronics will have a small circular label with an "H" placed in a highly visible location.
3. Modified detectors will receive a new serial number label with the new model number. Before shipping your detector internationally to Ludlum Measurements for modification, the BF3 tube will need to be removed. Download the instructions on the removal of the BF3 tube by clicking [BF3 Tube Replacement Instructions](#) or contact Ludlum Measurements' Sales Department.

Tube Replacement Part Number: 01-5793

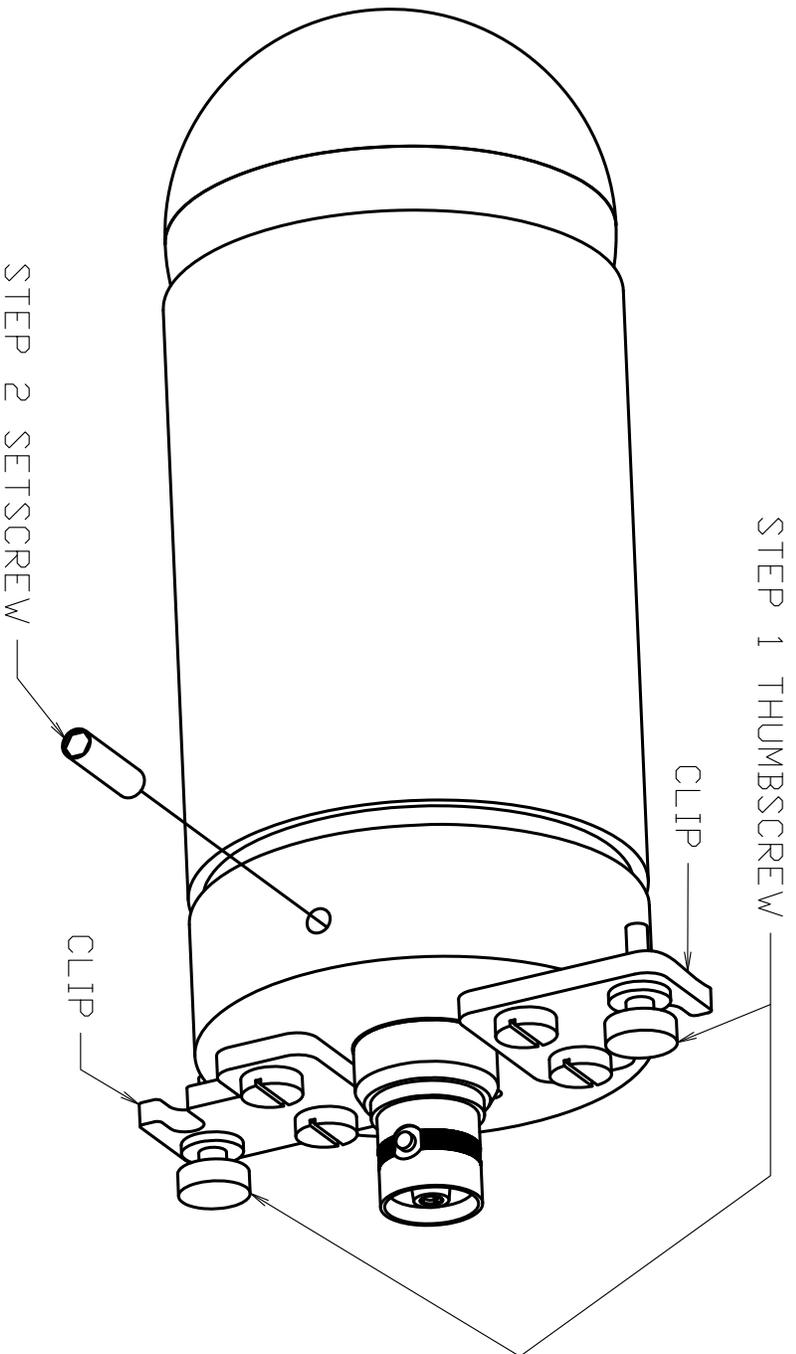
REV #	ALTERATIONS	DATE	BY
1	VALID	8-29-06	CMC
2	ECF #2140	10/30/06	CMC



*NEUTRON TUBE
FOR M 42-31H
USE HE3 TUBE
(01-5793)

DWG DATE	CHK DATE	APP DATE
CMC 10/30/06		
DWG NUM: 4005-023	SCALE: FULL	OTHER <input checked="" type="checkbox"/>
TITLE M 42-31, M 42-31H DETECTOR		
LUDLUM MEASUREMENTS, INC. 501 DAK STREET SHELVATER, TEXAS 75556		SHEET 17A

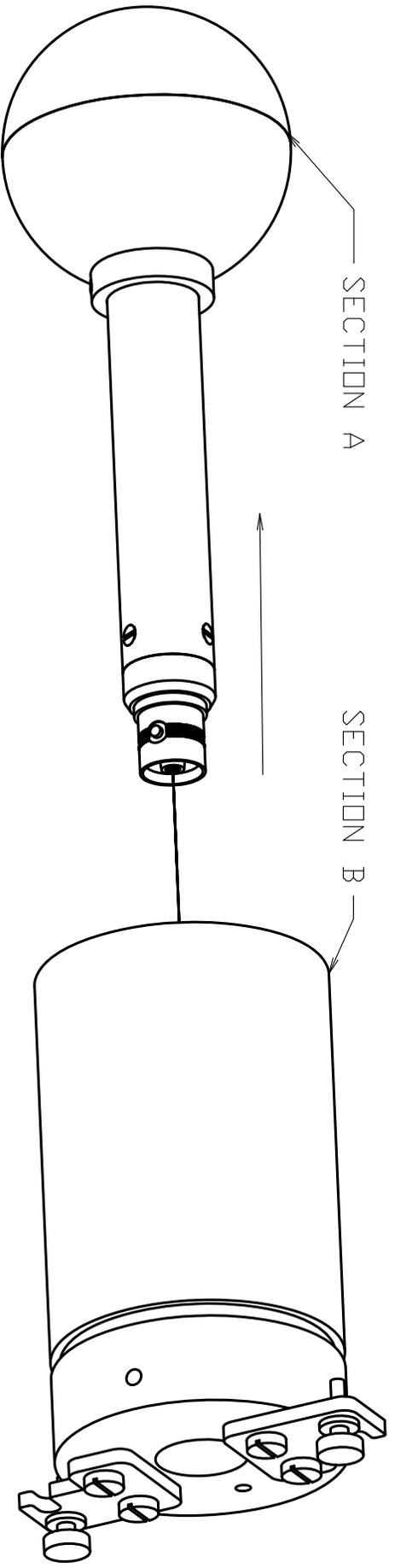
REV #	ALTERATIONS	DATE	BY
1	VALID	10/30/06	PW



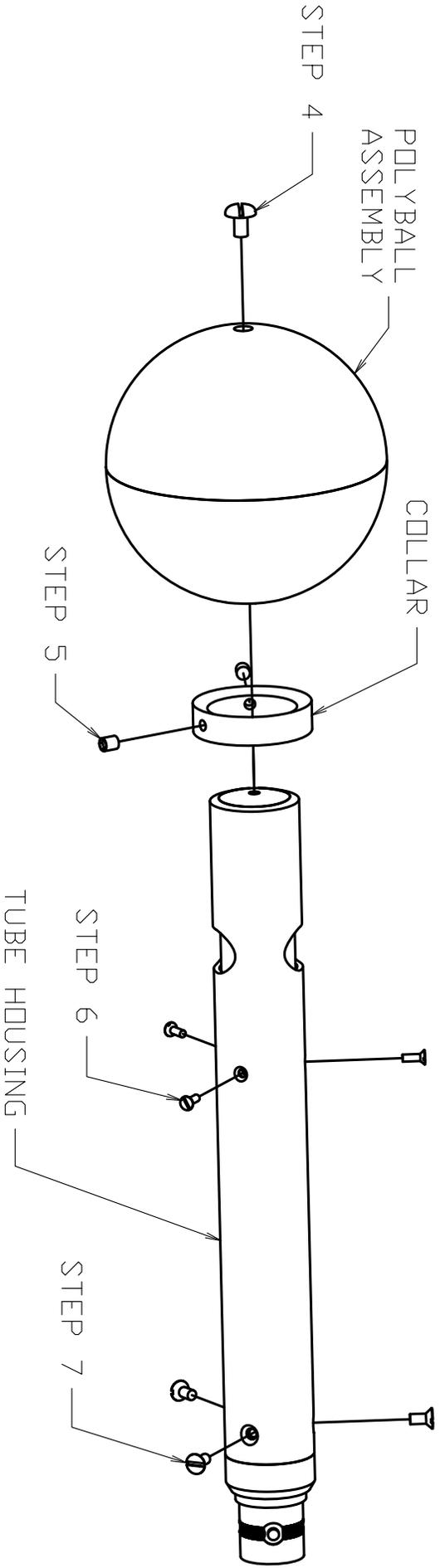
STEP 1-REMOVE THIS SECTION FROM THE POLYETHYLENE BALL BY REMOVING THE TWO THUMBSCREWS AND PULLING THIS SECTION OUT BY THE CLIPS.
 STEP 2-REMOVE THE SETSCREW FROM THE SIDE WITH A 1/8" ALLEN HEX WRENCH.

DWG DATE	CHK DATE	APP DATE
PW 10/30/06		
DWG NUM: 4005-023	SCALE: FULL	<input checked="" type="checkbox"/> FULL <input type="checkbox"/> OTHER
TITLE M 42-31 BF3 TUBE REMOVAL		
LUDLUM MEASUREMENTS, INC. 501 OAK STREET SHELVATER, TEXAS 75956		SHEET 17B

REV #	ALTERATIONS	DATE	BY
1	VALID	10/30/06	PW



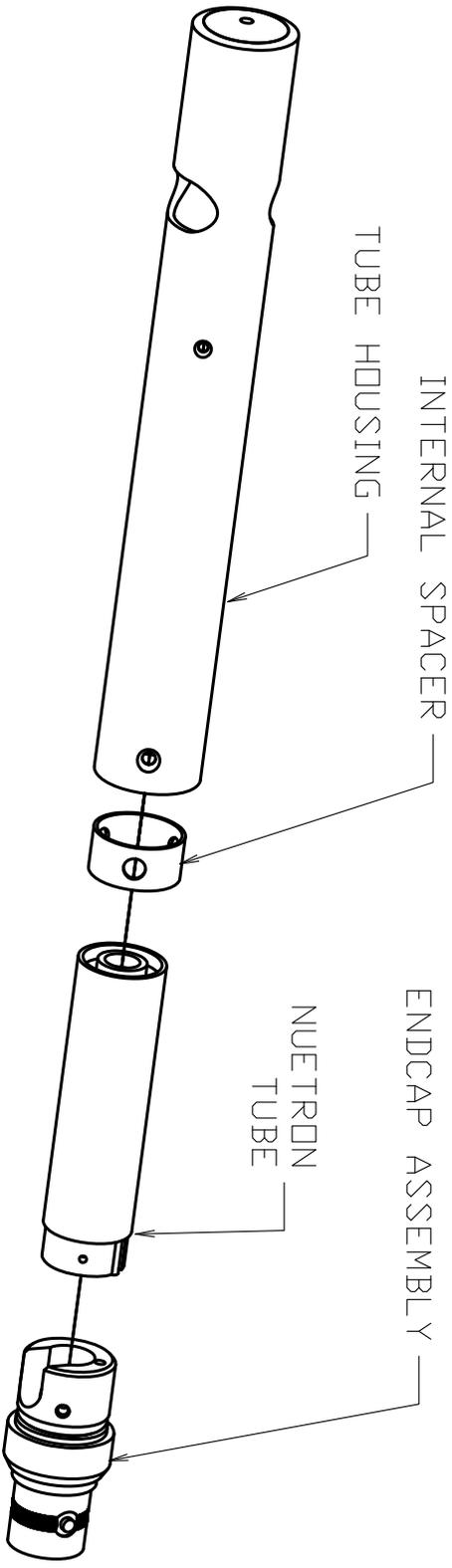
STEP 3-REMOVE SECTION A FROM SECTION B.



- STEP 4-REMOVE SCREW FROM END OF POLYBALL ASSEMBLY AND REMOVE POLYBALL ASSEMBLY.
- STEP 5-REMOVE SETSCREWS FROM THE COLLAR USING A 1/16 ALLEN HEX WRENCH AND REMOVE COLLAR.
- STEP 6-REMOVE 2-56 SCREWS (3 EA.) FROM TUBE HOUSING.
- STEP 7-REMOVE 4-40 SCREWS (3 EA.) FROM TUBE HOUSING.

DWG DATE	CHK DATE	APP DATE
PW 10/30/06		
DWG NUM: 4005-023	SCALE: FULL	OTHER
TITLE M 42-31 TUBE REMOVAL		
LUDLUM MEASUREMENTS, INC. 501 DK STREET SHELVATER, TEXAS 75956		SHEET 17C

REV #	ALTERATIONS	DATE	BY
1	VALID	10/30/06	PW



- STEP 8-REMOVE ENDCAP ASSEMBLY, NEUTRON TUBE AND INTERNAL SPACER FROM TUBE HOUSING.
 - STEP 9-UNWELD THE WIRES FROM NEUTRON TUBE AND DISPOSE OF NEUTRON TUBE PER LOCAL, STATE AND FEDERAL REGULATIONS.
 - STEP 10-REASSEMBLE THE DETECTOR WITHOUT THE NEUTRON TUBE IN REVERSE ORDER AND SHIP THE MODEL 42-31 WITH THE MODEL 12-4 BACK TO
 LUDLUM MEASUREMENTS INC.
 ATTN: REPAIR DEPARTMENT
 501 OAK ST.
 SWEETWATER TX 79556
- *
 ND RMA NUMBER IS NEEDED BUT A NOTE WITH A CONTACT NAME AND PHONE NUMBER IS.

DWG DATE	CHK DATE	APP DATE
PW 10/30/06		
DWG NUM: 4005-023	SCALE: FULL	OTHER <input checked="" type="checkbox"/>
TITLE M 42-31 TUBE REMOVAL		
LUDLUM MEASUREMENTS, INC. 501 OAK STREET SWEETWATER, TEXAS 79556		SHEET 17D