INNOVET SELECT™

Veterinary Radiographic System

Installation & Service Manual

K286

Rev T

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1.0 MANUAL REVISION CHART

TABLE 1

InnoVet Select™ Installation and Service Manual Text Revisions (K286-T)			
Revision	**Date**	**Description of Revision**	**Ecr No.**
A	OCT 1998	REFORMATTED AND EXPANDED TEXT/FIGURES	-
B	JUNE 1999	REVISED TEXT IN SECTION 9.1	-
C	JUNE 2000	ADDDED 4TH POTENTIOMETER FOR KVP CALIBRATION	-
D	FEB 2002	CONVERTED TO MS WORD	-
E	APRIL 2002	REVISED TUBEARM INSTALLATION/LEVELING	2564
F	JULY 2002	REVISED INSTALLATION INSRUCTIONS FOR ADDING TRIM WEIGHT TO THE TUBE-STAND COUNTERBALANCE	2667
G	OCT 2002	ADDED RC TIMER BOARD, EXPOSURE COUNTER INFORMATION	2815
H	OCT 2004	EXPANDED TROUBLESHOOTING GUIDE	4335
J	JUL 2006	ADDED 50 HZ. REFERENCE AND TIME STATIONS	5195
K	MAR 2008	ADDED NOTE TO 6.2-4 CONCERNING TUBE STATOR IMPEDANCE & ADDED L805 TO 10.0	5595
L	JUNE 2008	UPDATED MANUAL TO SPECIFY WIRE TYPE IS COPPER IN TABLE 3	6091
M	JUNE 2010	UPDATED TROUBLESHOOTING GUIDE FOR “FIL2” ERROR	6801
N	AUG 2011	ADDED SUMMIT TUBES ON PAGE 7-11	7269
P	JUNE 2014	PG 3-2:REPLACED REFERENCES TO PIN AND RING WITH BOLT AND NUT. PG 5-10: REPLACED REFERENCES TO PIN AND RING WITH BOLT AND NUT, REVISED FIG 9	8399
R	JULY 2014	PG 3-2, 5-10, FIG. 9: REPLACED REFERENCES TO BOLT AND NUT WITH PIN AND RETAINING RINGS.	8448
S	DEC 2015	REVISED FIG. 1 THRU 3. UPDATED INSTRUCTIONS IN SEC. 5.3.2 AND 6.1	8918
T	JULY 2017	UPDATED ADDRESS TO NILES, IL.	9607

2.0 UNPACKING

The ***InnoVet Select***™ Radiographic System is delivered in three packages:

- High voltage transformer, control, x-ray tube (palletized).
- Table, collimator and accessories.
- Tubestand.

It is the installer's responsibility to inspect the shipment for damage and proper count. Upon receipt of the merchandise, any visible damage to the cartons should immediately be examined while the shipper is present. If the visible damage to the cartons also includes damage to the merchandise, the installer is responsible for making all claims with the shipping company.

If there is hidden damage to the merchandise, it is the installer's responsibility to discover that damage within a reasonable amount of time and contact the shipping company.

3.0 RADIATION AND MECHANICAL/ELECTRICAL WARNING

3.1 RADIATION

WARNING

X-rays are dangerous to both operator and others in the vicinity unless established safe exposure procedures are strictly observed.

The useful and scattered beams can produce serious, genetic or potentially fatal bodily injuries to any persons in the surrounding area if used by an unskilled operator. Adequate precautions must always be taken to avoid exposure to the useful beam, as well as to leakage radiation from within the source housing or to scattered radiation resulting from the passage of radiation through matter.

Those authorized to operate, test, participate in or supervise the operation of the equipment must be thoroughly familiar and comply completely with the current established safe exposure factors and procedures described in publications such as Sub-Chapter J of Title 21 of the Code of Federal Regulations, "Diagnostic x-ray Systems and their Major Components," and the National Council on Radiation Protection (NCRP) No. 33, "Medical x-ray and Gamma-Ray protection for energies up to 10 MeV-Equipment Design and Use," as revised or replaced in the future.

Failure to observe these warnings may cause serious, genetic or potentially fatal bodily injuries to the operator or those in the area.

3.2 ELECTRICAL

WARNING

Failure to comply with the following may result in serious or potentially fatal bodily injuries to the operator or those in the area.

Only properly trained and qualified personnel should be permitted access to any internal parts. Live electrical terminals may be deadly; be sure line disconnect switches are opened and other appropriate precautions are taken before opening access doors, removing enclosure panels, or attaching accessories.

Do not remove the flexible high voltage cables from the x-ray tube housing or high voltage transformer or the access covers from the generator until the main and auxiliary power supplies have been disconnected.

When disconnecting high voltage cables, they must be grounded immediately in order to dissipate any electrical charge that may remain on the cables or the tube.

3.3 MECHANICAL

WARNING

Particular care should be taken when servicing the inside of the tubestand. There is an extreme threat of mechanical pinching between the vertical slide and counterweight due to their close proximity and opposite directions of motion.

The control is secured to the table with an air cylinder, clevis pin and two retaining rings. Once the pin and rings are removed, care must be taken to ensure that the control does not swing forward in an uncontrolled manner.

All of the movable assemblies and parts of x-ray equipment should be operated with care. Only properly trained and qualified personnel should be permitted access to any internal parts.

4.0 SPECIFICATIONS

4.1 TECHNICAL RATINGS

TABLE 2 – TECHNICAL RATINGS

	300mA Station	400 mA Station (Optional)
Rated Line Voltage –	240 VAC, 50 / 60 Hz., Single Phase.	240 VAC, 50 / 60 Hz., Single Phase.
Acceptable Line Voltage Regulation at Maximum Line Current	Not to exceed 5%.	Not to exceed 5%.
Maximum Line Current (240 VAC input)	140A @ 300mA	187A @ 400mA
Technique Factors that Constitute the Maximum Line Current	300 mA @ 125 kVp.	400mA @ 100kVp
Control Rating – Output Current	100 mA and 300mA are standard. Three mA stations of 30, 100, and 300 mA are available as an option.	Three mA stations of 100, 300, and 400 mA are available as an option.
Control Rating – Output Voltage	40 to 125kVp	40 to 125 kVp
Control Duty Cycle –	100 mA @125 kVp-4% 300 mA @ 125 kVp-1%	100 mA @125 kVp-4% 300 mA @ 125 kVp-1% 400 mA @ 100 kVp-1%

4.2 SPACE REQUIREMENTS

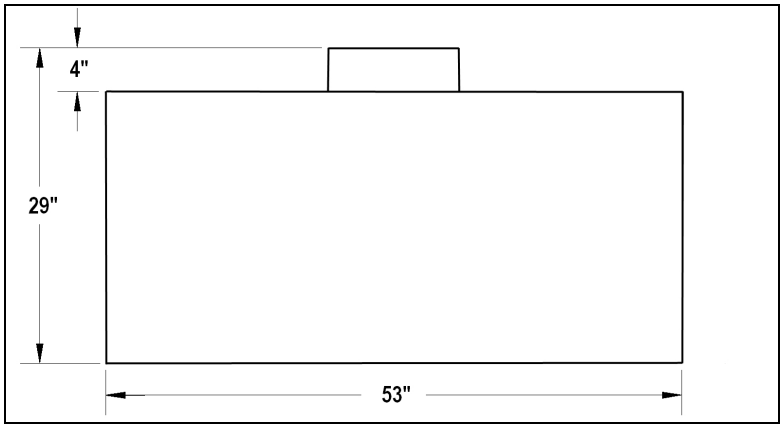

Figure 1: Fixed Tabletop

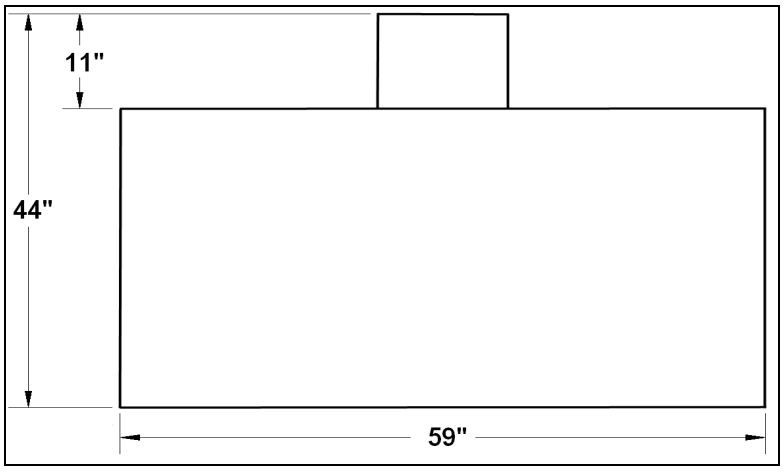

Figure 2: 2-Way Floating Tabletop

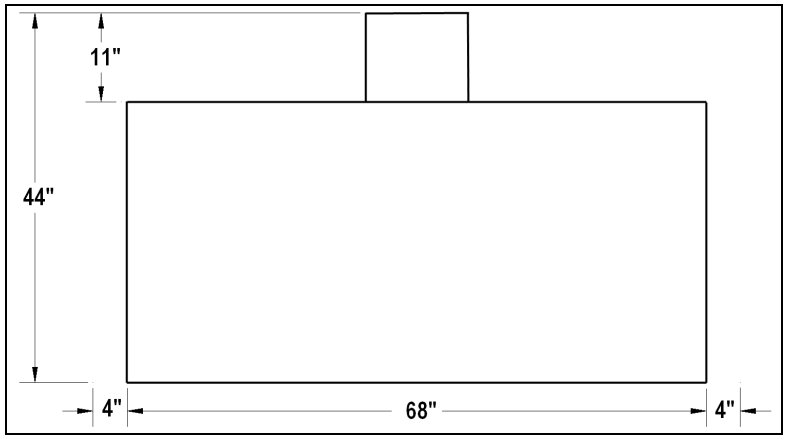

Figure 3: 4-Way Floating Tabletop

All models have an 82 ½" height clearance requirement for tubestands

4.3 ELECTRICAL REQUIREMENTS

TABLE 3 – ELECTRICAL POWER SUPPLY REQUIREMENTS

	300mA Station	400 mA Station (Optional)
Equipment Category	300mA @ 125 kVp, Single Phase	400mA @ 100 kVp. Single Phase
Nominal Line Voltage	240 VAC, 50 / 60 Hz., Single Phase	240 VAC, 50 / 60 Hz., Single Phase
Line Voltage Range Allowed (Alternate line voltages which will provide normal operation.)	194-284 VAC.	194-284 VAC.
Maximum Momentary Line Current	140 amperes (at 240 VAC)	187 amperes (at 240 VAC)
Note: Maximum momentary line current at alternate line voltages can be determined using the formula:	$I_2 = \frac{140 \times 240}{V_2}$ V_2 = alternate line voltage I_2 = maximum line current at the alternate line voltage, "V_2."	$I_2 = \frac{187 \times 240}{V_2}$ V_2 = alternate line voltage I_2 = maximum line current at the alternate line voltage, "V_2."
Line Voltage Regulation under load	The line voltage drop under load is not to exceed 5% at maximum line current.	The line voltage drop under load is not to exceed 5% at maximum line current.

Calculating line voltage regulation	$\frac{(V_{NL} - V_L)}{V_L}$ X100 V_{NL} = line voltage under "no load" conditions V_L = line voltage under "full load" conditions	$\frac{(V_{NL} - V_L)}{V_L}$ X100 V_{NL} = line voltage under "no load" conditions V_L = line voltage under "full load" conditions
Minimum Over Current Protection Rating (Service disconnect)	50% of maximum line current rating or greater. (100 Amps is recommended.)	50% of maximum line current rating or greater. (100 Amps is recommended.)
Distribution Transformer Requirements	Minimum 30 kVA dedicated to the x-ray control	Minimum 37.5 kVA dedicated to the x-ray control
Copper Wire Size from Power Transformer to Disconnect Switch	for 50 feet use #2 AWG; for 100 feet use #00AWG; for 200 feet use 250 mcm	For 50 feet use #2 AWG; for 100 feet use #00AWG; for 200 feet use 250 mcm

The information provided in Table 3 above and text below is taken from NEMA standards. *Minimum Power Supply Requirements for x-ray Machines*, and *National Electric Code.*

Connection to Supply Circuit (taken from N.F.P.A. 70-1984)
A disconnecting means of adequate capacity for at least 50% of the input required for the momentary rating shall be provided in the supply circuit. The disconnecting means shall be operable from a location readily accessible from the x-ray control. Underwriters Laboratories also requires that this disconnecting means to be mounted on either the wall behind the x-ray control or the wall directly adjacent to it.

5.0 PRELIMINARY MECHANICAL ASSEMBLY

5.1 RADIOGRAPHIC TABLE

1. During shipment, the table top is banded to the table base. Cut loose the banding and set the table top aside for assembly later. Loosen the hold-down screws underneath the front rail of the table to release the grid cabinet. Remove packing material from rear of grid cabinet.

2. Install the five leveling feet by threading them into the holes at the two front corners of the table and at the ends and middle of the back rail. The two feet with a 4" long body should be installed at the front corners of the table. The three feet with a 1" long body should be installed at the back rail. (In the accessory bag there are six blue and six red "U" shaped plastic spacers. When leveling the table fully tighten the foot until the shoulder of the foot is firmly against either these spacers or the bottom of the table/back rail). Use of the spacers makes the table base/leveling feet union a solid "one piece" structure, minimizing any wobble or table base motion.

3. Position the table close to its final location, using the leveling feet and spacers to bring the table close to level at this time. Final leveling can be done at end of assembly.

5.2 HIGH VOLTAGE TRANSFORMER

1. Verify that the oil level in the HV transformer is approximately ½" to ¾" below the underside of the cover. Refill with "Shell Diala oil AX" or remove oil as necessary.

2. Using a piece of cardboard to protect the floor, push the transformer onto the transformer shelf in the table by tilting the transformer and sliding it up onto the shelf. Once the transformer is in place, loosen the screw on the vent plug to allow for oil expansion. Cover the vent plug and flange with one of the loose fitting plastic covers provided with the HV transformer to prevent contaminants from entering the oil.

   Note: The high voltage transformer must be installed before the control is put in place. It is also recommended that the transformer be installed before the tubestand is mounted to the table for maximum stability during installation.

5.3 TUBESTAND INSTALLATION

The sequence of assembly is slightly different between Fixed-Top and Floating Tabletop tables.

For Fixed-Top (standard) tables proceed directly to section 5.3.1 below.

For Floating Tabletop (optional) tables the tabletop frame must first be elevated before the tubestand can be mounted. Skip ahead to section 5.3.2 for instructions for this type of table.

5.3.1 For Standard Fixed-Top Table

1. Remove tubestand stop from the left end of the table's lower rear rail. See Figure 4.

Figure 4: Tubestand stop at lower left rail

Figure 5: Tubestand Positioning

2. Position the tubestand so that it is a few inches from the end of the back rail of the table with the lower tubestand bearings in line with the back rail. See Figure 5.

(The tubestand shown in Figures 5 and 6 is for a Floating Tabletop table, but mounting the tubestand to the rail is done the same for either configuration.)

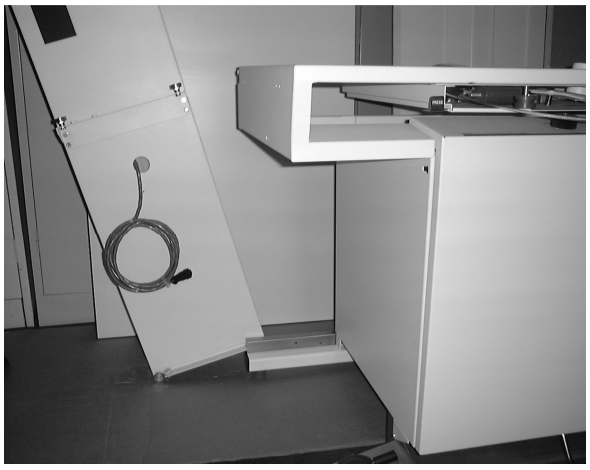

Figure 6: Mounting Tubestand on Rail

3. Carefully tilt the tubestand away from the table until the elevated tubestand bearing can be pushed into the lower bearing rail. Now straighten the tubestand and push it completely into the upper and lower bearing rails. See Figure 6.

4. Reinstall the tubestand stop on the lower rail. If leveled properly in step 5.1, the tubestand should glide easily from end to end and stay in position without drifting to either side.

5.3.2 For Optional Floating Tabletop Table (Refer to photos on preceding pages for reference.)

If the InnoVet table has a 4-Way Floating Tabletop, proceed as shown below. If the table has a 2-Way Floating Tabletop, skip to step 2.

1. Remove the front left rail cover by removing the two flat head screws as shown in Figure 7.

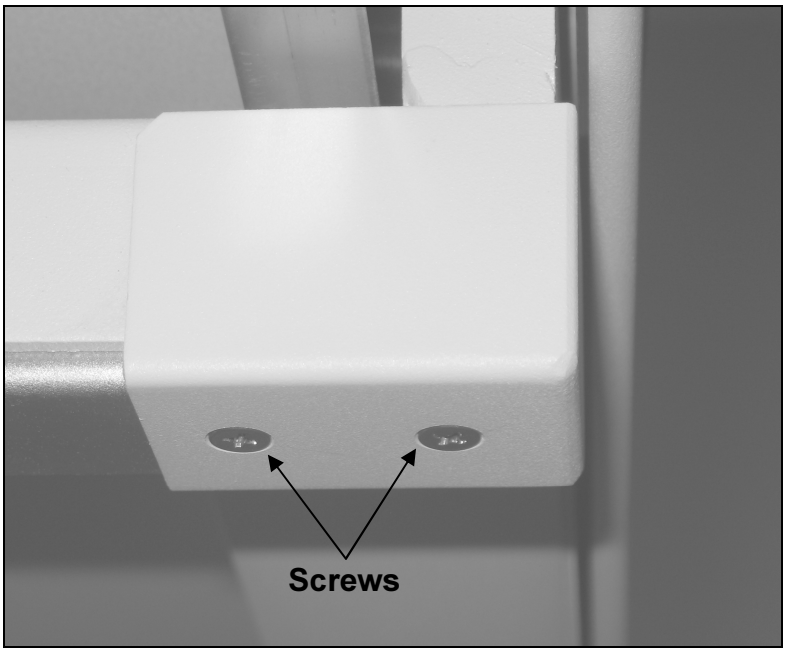

Figure 7: Front Rail Cover

2. Mount the tubestand bearing carriage to the tubestand using the four (4) ¼"-20 x 3/8" hex head screws provided. Figures 5 and 6 show a tubestand with a mounted bearing carriage. **Verify that the safety rollers are mounted on the tubestand bottom to prevent the table from tipping backwards from the weight of the tubestand.** (This may occur if the voltage transformer is not yet installed.)

3. Manually release the transverse locks and slide the tabletop fully forward.

4. Remove the screws at the front and rear of the transverse rail, one at each end. On the 4-Way Floating Tabletop, these are button-head Allen screws, as shown in Fig. 8. On the 2-Way Floating Tabletop, these are Phillips head screws inserted from the opposite side, as shown in Fig. 9.

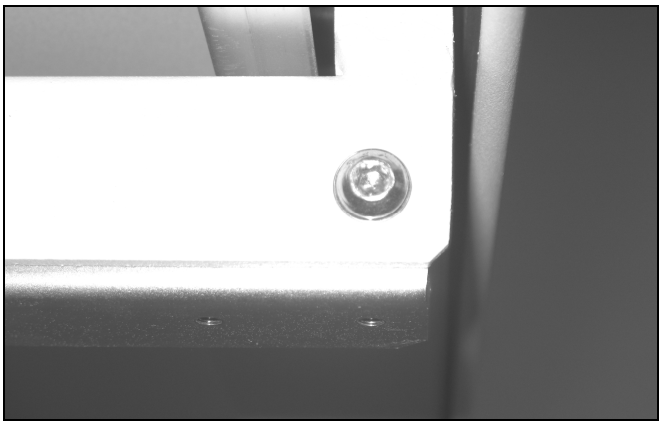

Figure 8: Allen Screws on 4-way Floating Tabletop

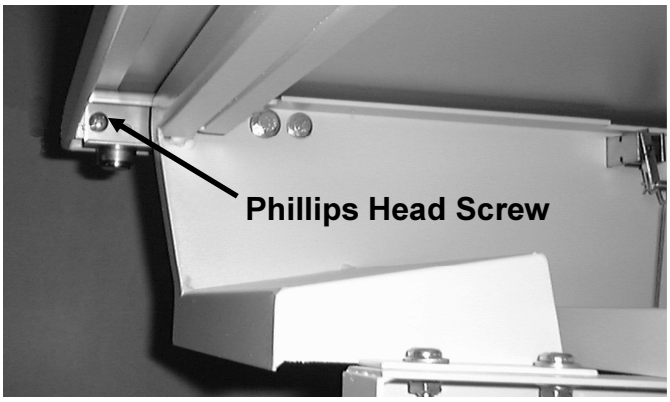

Figure 9: Phillips Screw on 2-way Floating Tabletop

5. Raise the tabletop and insert a support between the tabletop and the frame rail to keep the tabletop elevated and then remove the four flat head screws in the transverse slide rail as shown in Figure 10. Slide the rail forward to gain access to the tubestand upper bearing rail.

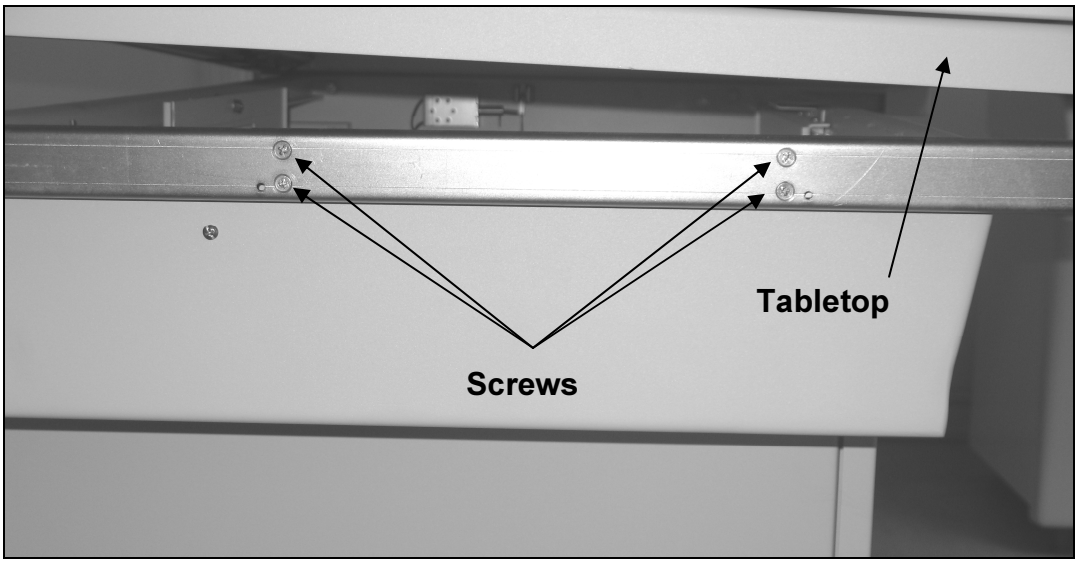

Figure 10: Transverse rail mounting screws

6. Proceed with Step 1 in Section 5.3.1 “For Standard Fixed-Top Table”. After Step 4 of Section 5.3.1, reinstall the transverse rail mounting screws and button-head Allen or Phillips head screws removed in steps 5 and 4 of Section 5.3.2 “For Optional Floating Tabletop Table”. If the table has a 4-Way Floating Tabletop, also reinstall the front rail cover removed in step 1 of Section 5.3.2.

5.4 TUBE ARM, X-RAY TUBE AND COLLIMATOR INSTALLATION

1. Install the tube mount by inserting the 1-1/2” diameter tube arm of the tube mount into the collar on the face of the tubestand. Be sure to fully insert the tube arm. Secure the tube arm by tightening the two set screws on the outside diameter of the collar.

Note: Do not remove the two hex head shipping bolts which lock the main counterweight and vertical carriage together until the tube, collimator and high voltage cables have been mounted.

2. Mount the x-ray tube and collimator. **When using the standard tube and collimator, two 1/8” spacers will achieve the proper field size coincidence.** The standard tube has a part number of C458, and the

collimator G800 (refer to their respective manuals for detailed instructions as needed). Refer to Final adjustments Section 8 for central ray to grid cabinet adjustments after x-ray to light field verification and generator calibration is completed later in this manual.

3. Install the high voltage cables. Cable drape brackets are included with the hardware accessories bag. The cable drape brackets are installed above and below the handle on the right side of the tubestand. Loosely drape the HV cables with the collimator and stator cables within the brackets until the vertical slide has been freed to move. The cables will route directly into the right rear of the table base, not beneath the lower tubestand rail.

WARNING

*Particular care should be taken when servicing the inside of the tubestand. There is an **extreme** threat of mechanical pinching between the vertical slide and counterweight due to their close proximity and opposite directions of motion. All of the movable assemblies and parts of x-ray equipment should be operated with care. Only properly trained and qualified personnel should be permitted access to any internal parts.*

4. Remove the shipping bolts which lock the main counterweight and vertical carriage together, taking care to ensure that the counterbalance is adequate to avoid uncontrolled motion of the vertical slide. The trim weights provided in the hardware kit should be used to achieve proper counterbalancing of the tubestand. Remove the back panel of the tubestand, and then insert trim weights as needed into the channels at the top of the main counterweight.

5.5 FOOT TREADLE INSTALLATION (skip ahead to 5.6 if using standard foot switch)

If the *InnoVet Select*™ has the latching prep Foot Treadle Option, the treadle must be installed prior to mounting the control into the table. (If the Foot Treadle Option is being added to an installed system as a field upgrade, refer to Section 9 "Options for Field Installation".)

1. Put the treadle in position across the front of the table base.

2. Thread the spring guide pins located at either end of the treadle up through the table base and lock each guide pin in place with the cotter pin provided.

3. Bolt the foot treadle bracket to the table base using the hex head bolts provided.

4. Plug the foot treadle cable into the S7 location of the junction box at the right side of the table frame. Refer to Figure 17 as needed.

5.6 FILM BIN INSTALLATION

(skip ahead to 5.7 if no film bin is to be installed)

The film bin must be installed prior to mounting the control into the table base. The film bin comes in either a right-hand or left-hand configuration. Slide the PEM studs of the film bin through the holes in the front edge of the appropriate side of the table and secure it using the hardware provided. Bolt the back side of the film bin to the rear of the table using the bolts provided. Install the plastic organizer in the top drawer of the film bin. Note that for left-hand film bins the control serial tag may be partially obscured. Be certain to record the control's serial number in the user and installation manual if this is the case.

5.7 GENERATOR INSTALLATION

1. Lay the control face down on cardboard, centered in front of the table.

2. Adjust the table legs to measure 34-5/8” between the V grooves of the pivot rollers at the base of the table.

3. Engage the notches on the bottom of the control with the pivot rollers and lift the control so that it hinges up into the table base.

4. Connect the air cylinder to the control using the clevis pin and two retaining rings as shown in Figure 11. **Note that there is no other device holding the control within the table. If the pin is ever to be removed from the air cylinder, exercise caution to maintain balance of the control within the table.**

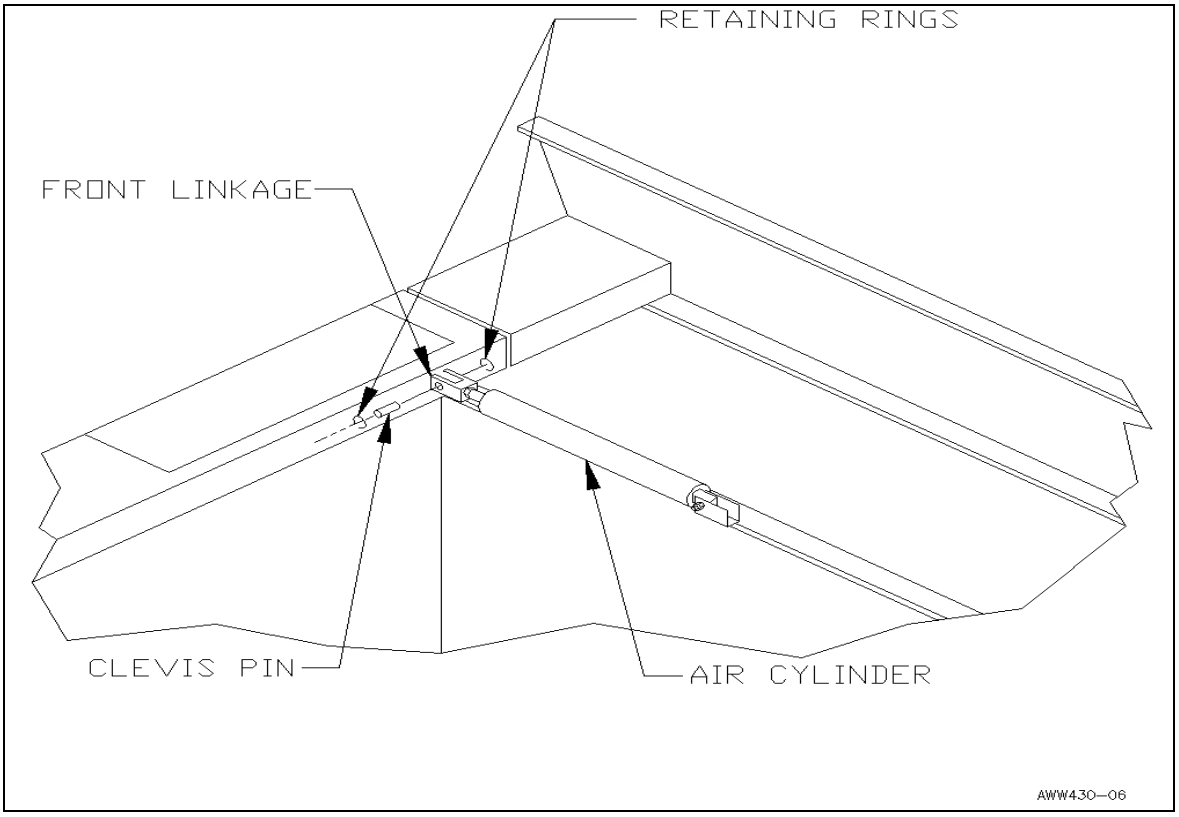

Figure 11: Air Cylinder Attachment – AWW430-06

5. Bolt the foot loop to the bottom of the control as shown in Figure 12.

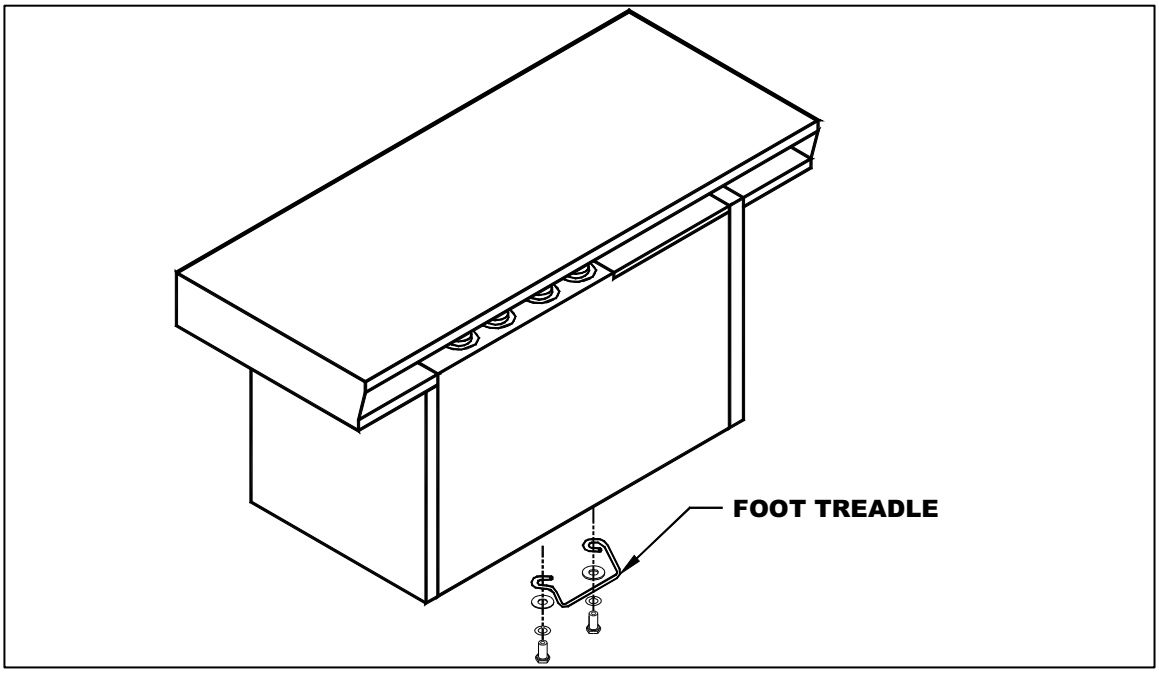

Figure 12: Mounting the Foot Loop – AWW430-07

6. Center the control within the table opening by adjusting the two front feet. If the left side of the control is too close to the left pedestal leg, raise the left front corner of the table slightly. If the right side of the control is too close to the right pedestal leg raise the right front corner slightly. Use the red or blue shims as required to achieve a snug fit between the top of the leveling feet and the bottom of the table for maximum stability.

6.0 ELECTRICAL CONNECTIONS

6.1 LOCATION OF ELECTRICAL CONNECTIONS

1. Remove the technique select knobs, each of which are secured to their respective switch shafts by two Allen set screws. Remove the two Phillips head screws with rubber gaskets at the top of the control cover. Remove the two shoulder bolts from the bottom corners of the control cover and lift cover away as shown in Figure 13 below.

Figure 13: Removing the Front Cover

Once the front cover has been removed, the interfacing terminal strips within the control will be accessible as shown in Figure 14 below.

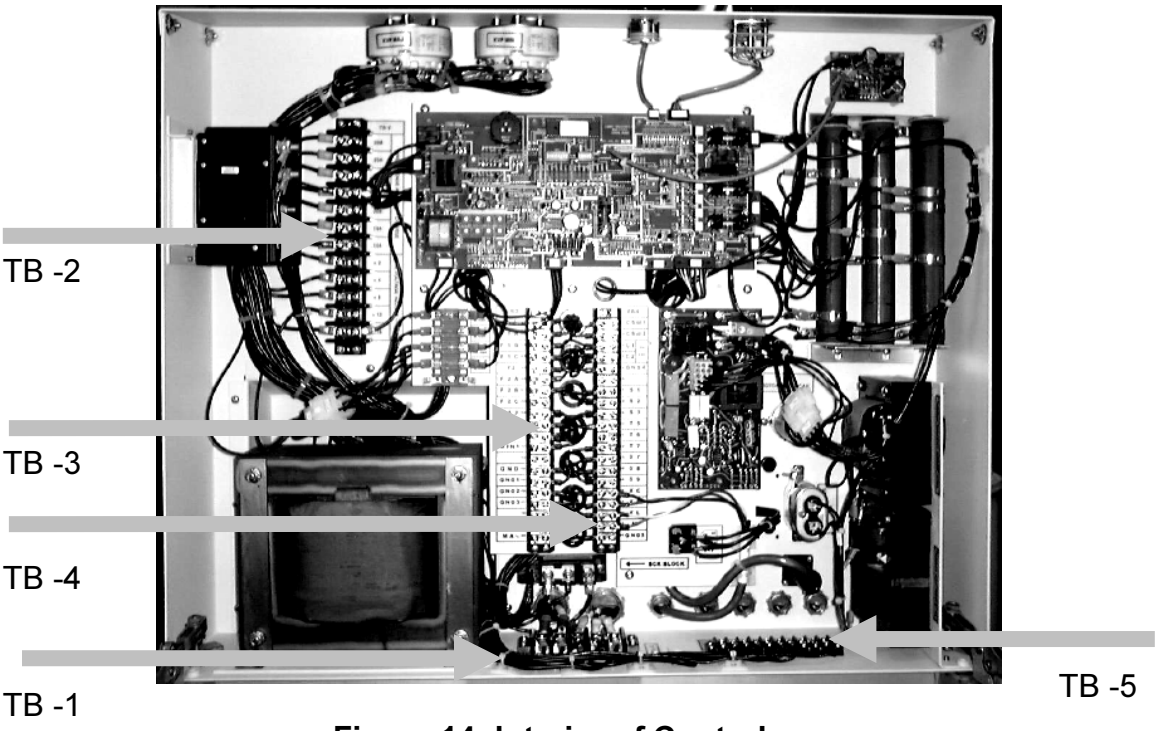

Figure 14: Interior of Control

2. If not already done, remove the phenolic table top panel for access to the rear of the control. The table top panel can be removed by a hex nut at each underside corner of the table top. The Line, Primary, Filament, Collimator, Stator, Foot Switch and Table Interface cables will all enter the control as shown in Figure 15 below.

Figure 15: Rear of Control Showing Cable Entry Points

3. There is a "Table Interface Junction Box" where the cables for all Options will plug in. (Refer to Figure 16 below.) There will be one cable from this Junction Box which will enter the control and connect to TB – 5, acting as the interface between the control and all possible table options. The connections will be described in detail in section 6.2.

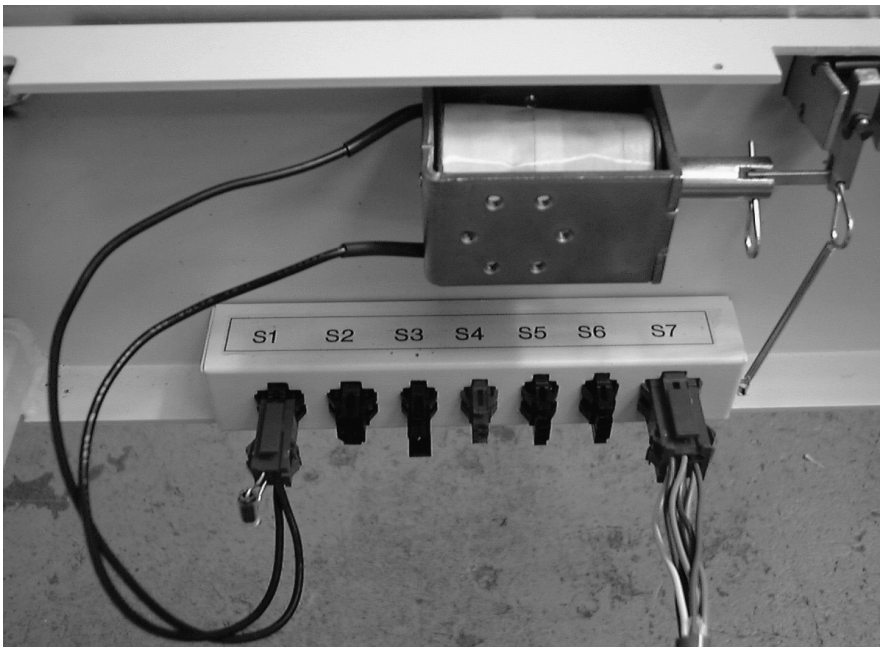

Figure 16: Table Interface Junction Box

4. On 2-Way and 4-Way Floating Tabletops, all electrical connections unique to that option are made at the factory. These connections are made at the junction box in Figure 16, and a relay box beside it. See Table 4 for a reference of these connections.

Table 4 – Floating Tabletop Connections

Terminal	Connection
H1	S0
H2	Tabletop Locks
S0	H1
S1	Left Side Solenoid
S2	Right Side Solenoid
S3	Optional Hip Switch
S4	Optional Treadle Switch
S5	Left Side Lock Switch
S6	Right Side Lock Switch
S7	TB5

6.2 MAKING CONNECTIONS

1. Connect the Primary cable (labeled P1, P2 and GND) and the Filament cable (labeled XS, XL, XC and GND) to the High Voltage transformer terminals which carry the same markings.

2. Route the collimator cable (labeled CSW1, CSW2, C1, C2 and GND) through one of the openings in the rear of the control and connect it to TB – 4 terminals 21, 22, 23, 24 and 25 respectively, which are labeled the same as the cable. (Refer to Figure 17 for reference).

3. Route the tubestand display cable out of the tubestand and into the black connector on the back of the generator. The connectors are keyed for proper orientation. This cable, as the stator and collimator cables, must not limit nor be strained by tubestand motion.

4. Route the x-ray tube stator cable (labeled T5, T6, 07, 08 and 09) through one of the openings in the control and connect to TB -4 terminals 31, 32, 33, 34 and 35 respectively, which are labeled the same as the cable. Refer to Table 5 and Figure 17 for reference. Remove jumper between terminals T5 & T6 of TB4 when connecting tubes thermal cut-out SW.

Table 5 – Common Stator Cable Designations

DESCRIPTION		COLOR CODE FOR STATOR CABLE		
TERMINAL TB4 MARKINGS	**CONNECTIONS**	**EUREKA TUBES**	**MACHLETT TUBES**	**SUMMIT & TOSHIBA TUBES**
T5	THERMAL CUTOUT SWITCH	ORANGE/ BROWN	---	YELLOW
T6	THERMAL CUTOUT SWITCH	BROWN/ ORANGE	---	BLUE
07	RUN WINDING OF TUBE STATOR	BLACK	BLACK	BLACK
08	START WINDING OF TUBE STATOR	RED	GREEN	RED
09	COM. LEAD OF TUBE STATOR	WHITE	WHITE	WHITE

*The Rotor Start Circuit in this Control is compatible with the following Tube Stator Impedance:

STATOR RESISTANCE:

Common to Main 25-30 OHMS
Common to Phase 50-60 OHMS
Main to Phase 75-90 OHMS

5. If the system is using the standard two-position Foot Switch, route the cable (labeled S1, S2 and S3) through one of the openings in the control and connect to TB – 4 terminals 27, 28 and 29 respectively, which are labeled the same as the Foot Switch cable. (Refer to Figure 17 below for reference.)

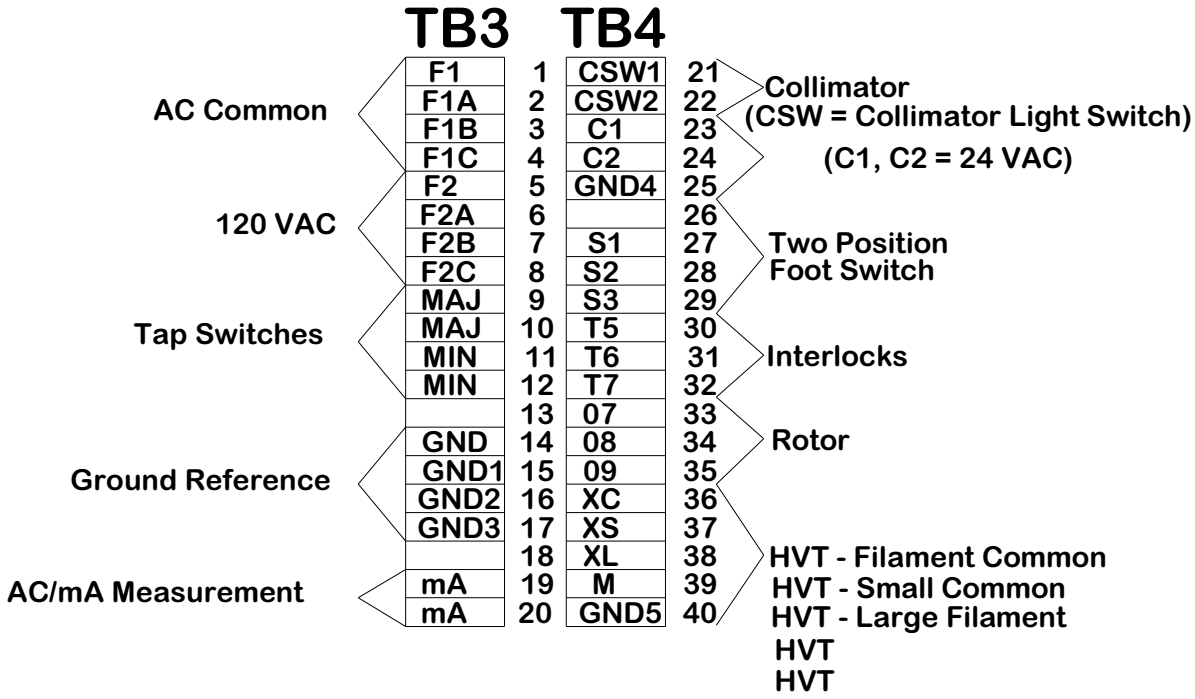

Figure 17: TB3 and TB4 Terminal Designations

6. If the latching prep Foot Treadle option has been installed, push the air hoses from the foot pads on the air cylinder nozzles protruding from the rear of the control. Plug the two conductor cable from the treadle into the Table Interface Junction Box at S4 (refer to Figure 17 above).

7. At the Table Interface Junction Box plug the interface cable into S7. Route this cable through an opening in the rear of the control and connect it to TB - 5 as show in Table 6 below. (Note that there are no connections made to terminal 1 or 3 on TB - 5).

Table 6 - Interface Cable From Table to Control

S7 Interface Cable Wire Color	Goes To Control
Brown	TB 5 - 2
Blue	TB 5 - 4
Red	TB 5 - 5
Green	TB 5 - 6
Orange	TB 5 - 7
Violet	TB 5 - 8
Black	TB 5 - 9
White	TB 5 - 10

8. All options (such as table locks, collimator hip switches, latching prep foot treadle) plug into the Table Junction Box. The Junction Box is designed so that each cable can only plug into the proper connector. If a plug will fit into more than one connector then it is a parallel circuit and can go in either connector. Refer to the Electrical Schematic Section 10 for detailed information about how the Junction Box is wired and how it fits into the overall electrical system as needed.

9. Connect the high voltage cables, taking note of the following important points:
   A) Be careful of the three pins at each end of the cables as they can break if the cable is dropped.

   B) Route the cables into the rear of the table so that they do not limit or restrict tubestand motion and they are not stressed by the tubestand motion.

   C) The pins at the end of the HV cables should not be pinched tightly together but be slightly spread apart, about the thickness of a utility knife blade. (For old style split-pins only).

   D) The HV cable terminals must be thoroughly cleaned and then coated with Vapor Proofing Compound (normally provided with x-

ray tube) prior to insertion into the x-ray tube or HV transformer receptacles. It is common to use dielectric oil in the HV transformer, and vapor proofing compound in the x-ray tube.

E) Be sure that "Anode" of HV transformer connects to "Anode" of x-ray tube, and "Cathode" to "Cathode". Insert the HV cable terminals into the appropriate receptacle and screw the cable nut as tightly as possible by hand – Do not use tools for tightening.

NOTE: Be certain to verify that the control's on/off switch is in the "OFF" position, and that the main incoming power at the service disconnect is also in the "OFF" position. It is strongly recommended that a meter be used to confirm no voltage is present before connecting the Line cable to the service disconnect switch.

10. Route the line cable under the lower tubestand rail and wire it into the safety disconnect. Connect "L1" to one leg of the incoming line power, "L2" to the other incoming leg of line power and "G" to the ground lug.

7.0 CALIBRATION

7.1 PRECALIBRATION CHECKS

1. It is recommended that the assembler read and understand the information provided with the x-ray tube prior to making any x-ray exposures. Particular attention should be given to:

   A) Initial seasoning of the x-ray tube
   B) Single exposure tube ratings
   C) Accumulated heat and anode ratings of tube

2. Line voltage adjustments:

   Terminals on TB2 are provided for coarse and fine adjustments of line voltage. Measure the line voltage at the disconnect switch and relocate wires marked "LVAC" and "LVAF" to two terminals where the sum of the two terminals markings equal the measured line voltage, ±2 VAC. For example: If line voltage is 240 VAC, connect "LVAC" to "224" and "LVAF" to "+16".

3. Prior to turning "on" power, set each selector switch as follows:

TABLE 7 – Selector Switch Settings

Power "On-Off"	"Off"
kVp major and minor	Fully Counterclockwise
mA selector	300L
Time selector	1/120 sec. for 60 Hz. (or 1/100 sec. for 50 Hz.)

4. In order to prevent accidental production of x-rays during initial check-out, disconnect the leads marked P1 and P2 from TB 1 and install a jumper from TP – 13 to TP – 4 of J400 board (this will hold the SCR open). Switch the power safety disconnect switch "On" and then switch the control's "on-off" switch to "On." Observe the following:

TABLE 8 – Display Readings

mAs display indicates	2.5
kVp display indicates	<40

5. Rotate kVp knobs so that display indicates >40 kVp. While observing the tube filaments through the port of the x-ray tube, verify that the correct filament is lit for each mA station. The small focal spot should illuminate for 30 or 100 mA, and the large focal spot should illuminate for 300 or 400 mA.

6. Verification of Rotor circuit.

   A) Traditional Foot Switch
   Depress the foot switch to the 1st stage (PREP), or the "PREP" button on the optional remote switch, and verify anode rotation and filament boost. The bottom status display should show "WAIT" momentarily, then "PREP".

   B) Foot Treadle with Latching Prep
   Depress and release the foot switch. The bottom status display on the tube stand should show "WAIT", then "PREP". Verify anode rotation and filament boost. The unit will automatically remain in PREP mode for about 20 seconds, then return to idle condition.

7. The kVp meter circuit is factory adjusted, but display accuracy should be checked prior to other calibration steps.

   1. With power "Off" connect an AC voltmeter capable of reading 0-300 VAC across the wipers (center terminals of tap switches) of the kVp selector switches (major and minor) of TB3 terminals 9 and 10. This will allow measurement of the "no-load" primary voltage.

   2. Turn on power and adjust the kVp selector switches to achieve 220 VAC on the voltmeter. Refer to Table 9 for correct kVp display values

   3. Reset the kVp tap switches to achieve 160 VAC on the meter. Refer to Table 10 for the correct kVp display values.

TABLE 9 – kVp/mA Readings @ 220 VAC

mA Station	kVp display on tubestand
30 (if included)	116
100	114
300	87
400 (if included)	70

TABLE 10 – kVp/mA Readings @ 160 VAC

mA Station	kVp display on tubestand
30 (if included)	82
100	80
300	53
400 (if included)	-

If the kVp meter varies by more than 5 kVp to the above values, proceed to the kVp calibration procedure **7.4** before adjusting mA.

4. Switch the disconnect switch to "Off' and reconnect the leads P1 and P2 to TB 1 on the control. **Be sure to remove the jumper between TP – 13 and TP – 4 on the J400 PCB.**

7.2 mA CALIBRATION

Achieving maximum accuracy of tube current (mA) involves two types of adjustments:

- Overall mA level (bands of filament resistor RX), and
- mA balance throughout the useful kVp range (bands of space charge compensating resistor RSCC).

The leads connected to the resistor bands of resistor RX (the third resistor on the right of the three at the right corner of the Control Board) are marked with letters which correspond to the mA stations (small-SM, medium-MD, large-LG). Moving one of these bands upwards increases the mA for the corresponding mA station.

The leads connected to the bands of RSCC are also marked with SM, MD, LG which correspond to the mA stations. Moving one of these bands upwards increases the space charge compensation, which increases mA at low kVp, and reduces mA at high kVp. Moving one of these bands down reduces the space charge compensation, decreasing mA at low kVp and increasing mA at high kVp.

Normal mA tracking will result in values slightly high at 80 kVp and mA values roughly equal to one another but slightly low at the high and low ends of the kVp range (125 and 50). See Figure 18 below for a visual representation of this effect.

(2) terminals, of TB3, are marked "mA" (term #19 & 20). Remove the factory installed jumper from these 2 terminals & connect an mA_{AC} meter to these terminals to measure tube current.

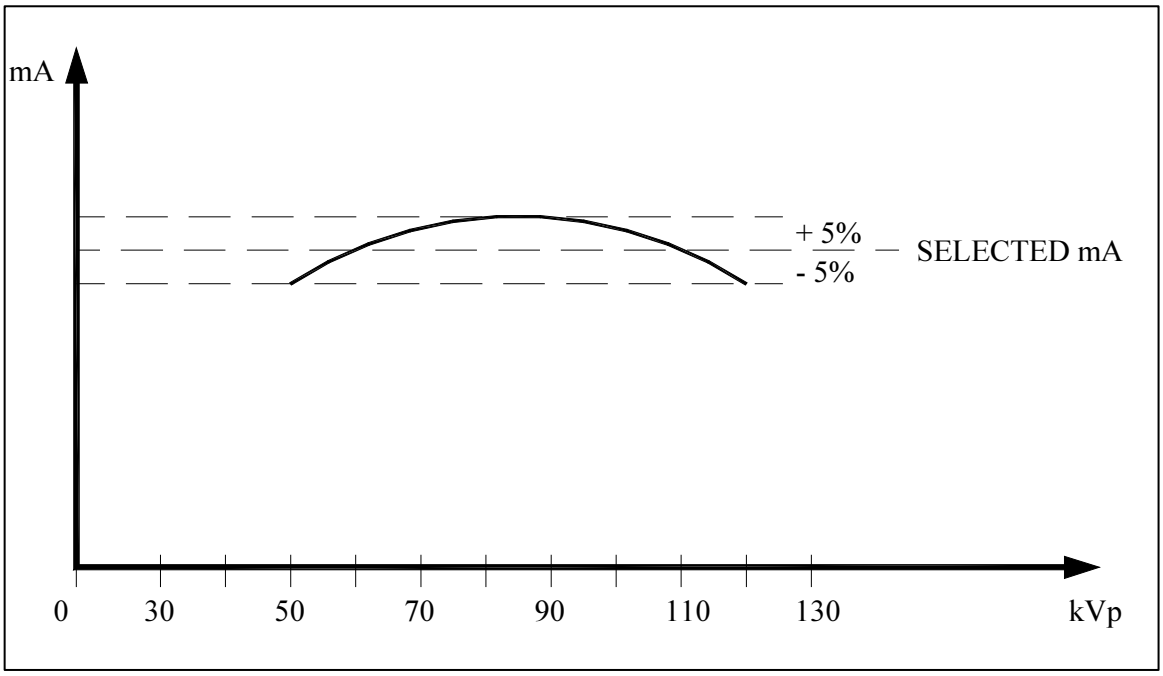

Figure 18: mA Tracking Example

For the following steps, use mA values and band designations in the table below:

Table 11 – mA Stations/Band Labels

mA Station	100/300 Configuration	30/100/300 Configuration	100/300/400 Configuration
30mA	--	SM	---
100mA	SM	MD	SM
300mA	MD	LG	MD
400mA	---	---	LG

7.2 mA Calibration (continued)

In the following procedures, use the SM, MD or LG bands as appropriate for the mA stations available per this unit's configuration according to Table 11 above. Calibration is typically started with the 100mA station.

1. Connect a Dynalyzer or **AC** mAs meter to perform the following procedure. An AC mAs meter can be inserted into the circuit by removing the jumper between TB3-19 "MA~" and TB3-20 "MA~" and connecting the meter to those terminals (**AC readings only**). Be certain to replace the jumper after removing meter.

2. Select 100 mA and 80 kVp.

3. Adjust the appropriate band of filament resistor RX for the mA station chosen to produce the desired mA. Moving the band upward increases mA.

4. Select 50 kVp and note the mA produced.

5. Select 120 kVp and note the mA produced.

6. If the mA at 120 kVp is higher than the mA at 50 kVp, move the band of RSCC appropriate for the selected mA station upward. If lower, move the band downward. Achieve relative balance per Figure 18 above. The unit is capable, by fine tuning, to track within ±5% of selected value.

7. Repeat steps (3) through (6) until no further adjustments are necessary.

8. Repeats steps 2 through 7 above for the one or two remaining mA options available on your station.

9. Replace jumper after removing the AC mAs meter.

7.3 kVp CALIBRATION

The *InnoVet Select*™ kVp compensation circuit has four offset potentiometers (one for each possible mA station), and four slope potentiometers. These adjustment pots are located on the J400 control board. See Figure 19 – Electrical Control Board Component Identification for component orientation below.

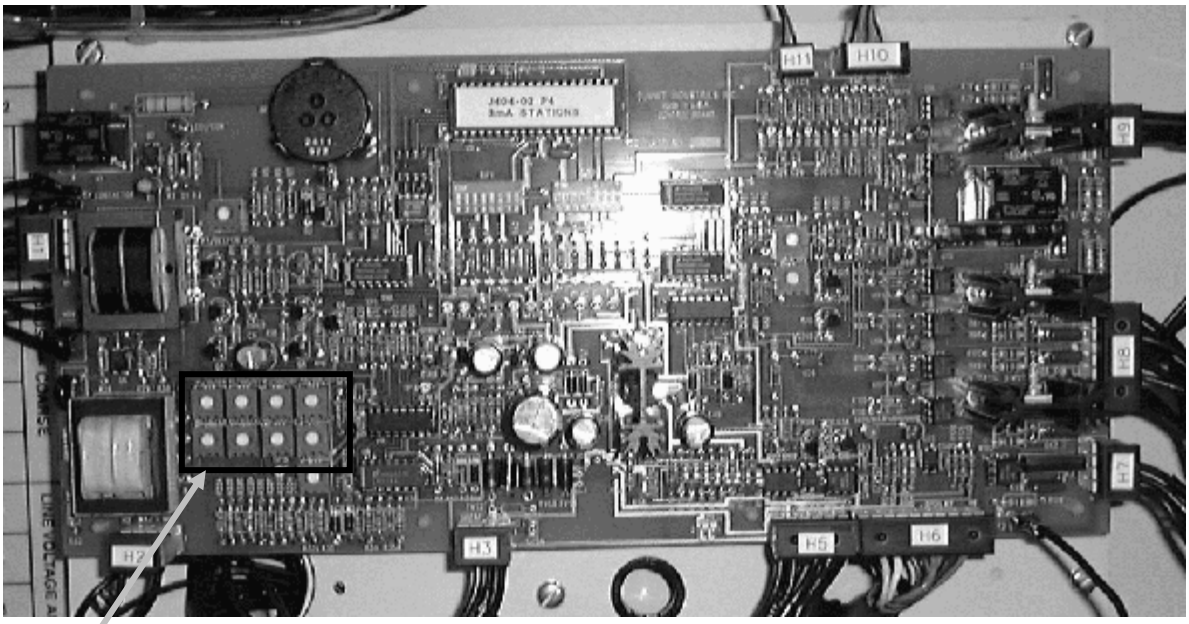

Figure 19: Control Board Component Identification

7.4 kVp CALIBRATION WITH A MEANS TO MEASURE ACTUAL kVp

Note: In order to make a valid comparison between the actual kVp output and the kVp meter's preread indication, the tube current must be calibrated accurately per section 7.2. Failure to do so will result in miscalibration of kVp.

For the following steps, use values in the table 12 below"

TABLE 12 – Adjustment Pot Identification

Adjustment Pot	mA Configuration
P1	**30** mA offset
P2	**100** mA offset
P3	**300** mA offset
P10	**400** mA offset
P4	**30** mA slope
P5	**100** mA slope
P6	**300** mA slope
P11	**400** mA slope

In the following procedure, fine tuning of the kVp display calibration depends on the assumption that mA has been calibrated.

1. *Offset Adjustment:*

   a. Select 50 kVp and 100 mA. While monitoring mA and kVp output, compare the measured kVp to the kVp meter's readings.

   b. Adjust the kVp offset pot (from Table 12 above) that corresponds to the mA of your Station (For a 100 mA station the pot is P2) until the kVp meter's preread indication matches the actual measured kVp output.

2. *Slope Adjustment:*

   c. Select 120 kVp. Make an x-ray exposure and adjust the slope pot (See Table 12 above) until the kVp meter's preread indication matches the measured kVp output. Repeat steps 1 and 2 until no further adjustments are necessary.

3. Verify that the kVp display tracks well throughout the kVp range.

4. Repeat steps 1, 2 and 3 above for each mA Station, using Table 12 as a guide for identifying the appropriate adjustment potentiometer.

The offset and slope adjustments are interdependent; as an adjustment in the offset is made, it will affect the slope, and as an adjustment is made in the slope it will affect the offset. By anticipating the interactive response it will reduce the number of adjustments required to achieve the desired accuracy of kVp display at each end of the kVp range.

Under normal conditions the kVp meter's indication will not deviate from the measured kVp output by more than 5 kVp.

7.5 CALIBRATION OF kVp WITHOUT A MEANS TO MEASURE ACTUAL kVp

The preceding Tables 11 – (mA Stations/Band Labels) and 12 – (Adjustment Pot Identification) contain settings and readings referred to in the following section. In the following procedures, an mA will be chosen, a kVp tap switch voltage will be set, and the kVp display will be adjusted to indicate the value shown in the column on the left side of Table 13 below.

Typically if the 50 kVp and highest (120 or 100) kVp are set in this manner, all values in between will also be correct. The tap switch voltages for kVp outputs between 50 and 100 kVp shown below are not needed for this procedure, but are provided for reference.

TABLE 13 – TYPICAL KVP TAP SWITCH VOLTAGES

kVp	30 mA Station Unloaded Tap Switch Voltage	100 mA Station Unloaded Tap Switch Voltage	300 mA Station Unloaded Tap Switch Voltage	400 mA Station Unloaded Tap Switch Voltage
50	104	108	155	183
60	121	125	173	201
70	139	143	190	218
80	156	160	208	236
90	174	178	225	253
100	191	195	243	271
110	209	213	260	-
120	226	230	278	-

7.5 CALIBRATION OF kVp WITHOUT MEANS TO MEASURE ACTUAL kVp (continued)

1. Connect an AC voltmeter capable of measuring 0-300 VAC to the common terminals of the minor and major kVp tap switches, or to TB3 terminals 10 and 11.

2. Select an mA station. Adjust the kVp tap switches to achieve the voltage which should result in 50 kVp per Table 13 above. (For example, at the 100 mA station adjust the tap switches to achieve 108 VAC).

3. Adjust the kV offset pot shown in Table 12 for the mA station selected. (For 100 mA offset adjust P2), until the kVp meter reads 50 kVp

4. Readjust the kVp tap switches to achieve the voltage which should result in 120 kVp per Table 13. (For example, for the 100 mA station adjust the tap switches to achieve 230 VAC.)

5. Adjust the appropriate slope pot until the kVp meter reads 120 kVp.

6. Repeat steps 2 through 5 until no further adjustments are required.

7. Repeat these steps, adjusting tap switch voltages, then offset and slope pots, until the kVp display indicates the appropriate value across the operating range for each mA station.

7.6 CONTROL BOARD DIP SWITCH SETTINGS

The InnoVet Select™ has a variety of dip switch settings to enable or disable various functions and to configure the system for the type of x-ray tube used in the system. These switches are typically set at the factory, but can be changed to accommodate the desires of the operator or the needs of the application. The dip switch combinations are shown in Figure 20 below.

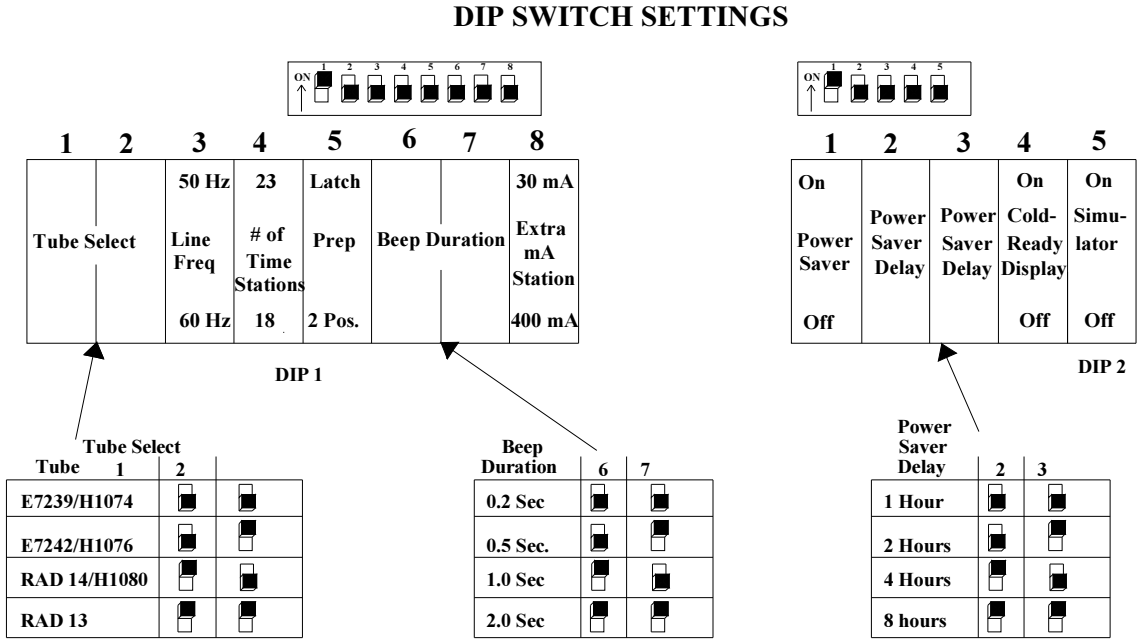

Figure 20 – DIP Switch Settings for Configuring Options and Features

7.7 X-RAY TERMINATION BEEPER VOLUME CONTROL

(See Figure 17 – Electrical Control Board Component Identification)

The volume of the x-ray termination beeper can be adjusted by P7, located on the control board. Turning P7 counter-clockwise increases the volume from quiet to very loud. Note: The front cover of the control will quiet the sound considerably so test the sound with the cover in place.

7.8 TUBESTAND DISPLAY MESSAGES

The following Messages are displayed by the bottom display on the InnoVet Select™ tubestand. The COOL and READY features can be disabled via DIP2-4 (see Figure 20).

WAIT PREP has been requested but the tube is not warmed up yet. The message clears as soon as the tube is ready for an exposure. This typically takes between one and two seconds.

PREP The tube is warm and now ready for an exposure.

XRAY Exposure is occurring. Ionizing radiation is present.

GOOD JOB Exposure completed successfully. The message is cleared when the exposure switch is released.

TUBE Indicates that the singe shot tube power limits are exceeded by the selected techniques. It is accompanied by an error beep and prep is not allowed. The message clears when allowed techniques are selected.

EXPOSURE COUNT With the kVp major, kVp minor and mA selector knobs turned fully counter-clockwise, the kVp display the bottom display will indicate "EXPO". The mAs and the kVp display will indicate the total number of exposures taken on this x-ray control.

HEAT Indicates tube heat interlock. The message is accompanied by an error beep and cleared as soon as the x-ray tube cools. PREP is locked out.

ZCO Line voltage zero crossing signal not detected. Accompanied by error beep. PREP locked out. Message clears as soon as zero crossing signal detected.

FOOT Foot switch released before exposure is finished. Accompanied by error beep. The message is cleared when any of the techniques change or PREP is requested.

ROTR Tube rotor error. Accompanied by error beep. PREP is terminated. The message is cleared when any of the techniques change or PREP is requested.

FIL1 Standby filament current too low, or not present. Accompanied by error beep. PREP locked out. Message clears when standby filament current is acceptable.

FIL2 Standby filament current too high. Accompanied by error beep. PREP locked out. Filament circuit disabled. Message will not clear without rebooting system and resolving cause of high idle current.

FIL3 Boost filament current too low. Accompanied by error beep. PREP locked out. The message is cleared when any of the techniques change, PREP is requested, or cause of low boost current is found and resolved.

FIL4 Boost filament current too high. Accompanied by error beep. PREP locked out. The message is cleared when any of the techniques change, PREP is requested, or cause of high boost current is found and resolved.

COLD The control is cold. Exposures are possible, but the outputs will not be at their maximum accuracy. "COLD" will change to "READY" once the unit is on for about ten minutes.

READY READY scrolls across the tubestand display once the unit has warmed up to a level that delivers the most accurate outputs, about ten minutes after initial turn-on.

ZZZZ Sleep timer is 5 minutes away from turning off system. Accompanied by error beep. Active in power saving mode only.

7.9 Detailed Troubleshooting Guide for K200 Generator

I. CIRCUIT BREAKER TRIPS AT TURN ON

A. Confirm mechanical latching of breaker

1. Turn OFF main input power at the wall breaker
2. Flip the control circuit breaker ON and OFF several times to confirm the breaker will mechanically latch in the ON position. If not, replace breaker.

B. Check for shorted or leaking SCR

1. With the control turned OFF, select DEMO mode by setting DIP2-5 of J400 board to the ON (up) position.
2. If the control turns on, look for voltage between P1 and P2. If more than 4 VAC is present, replace the SCR. If control does not turn on see C below.

C. Confirm valid kVp input and J400 board

1. If the breaker still trips when in DEMO mode, disconnect the wire from terminal W2 on the J400 board and turn the control ON. If the display is stuck in “EXPO” mode, the kVp tap switch input voltage is missing at the J400 board header H2. Check the wire-to-plug and plug-to-board connections at H2, and the kVp tap switches for open/resistive contacts or connections.
2. If the kVp display is not stuck in “EXPO” mode, and shows a valid selection between 40 kVp and 125 kVp, replace the J400 board.

II. CIRCUIT BREAKER TRIPS AT EXPOSURE

The circuit breaker will trip due to either excessive mA or excessive line current. It may appear to be related to a specific mA station, or occur above a specific kVp range, or occur at longer time stations.

A. Determine if the mA calibration is valid

1. Remove the jumper between TB3-19 and TB3-20 and connect a mAs meter between these points, ensuring that the meter is set to read AC mA. *The range of the meter scaling must be set to maximum.*
2. Typical filament voltage between XC/XS for 100 mA is 39 VAC during PREP (+/- 2 VAC). Typical filament voltage between XC/XL for 300 mA is 51 VAC during PREP (+/- 2 VAC). Under no circumstances does this voltage need to be more than 56 VAC.
3. Take exposures and measure the mA or mAs output. Readjust the filament voltage as needed to bring mA into range.

4. If the filament voltage is correct but the output is ½ the expected mAs the SCR or high voltage transformer may be half-waving. See II.D below.

B. Determine if the line voltage drop is excessive (this test is only valid after the mA calibration has been verified).

1. Place a voltmeter (set for min/max reading or to the hundreds of volts scale) between L1 and L2 of the control. Record the no-load line voltage. Measure and record the line voltage during an exposure of 90 kVp, 300 mA, 300 mAs. The drop should be less than 7%. If the lights dim, the supply wires rattle in the conduit or the wall breaker buzzes, the wire gauge or distribution transformer may be undersized.

C. Determine if high voltage breakdown is present (hypot test)

1. Inspect the high voltage cables, cable ends, and high voltage receptacles for carbon tracking and evidence of high voltage breakdown.
2. Verify that the anode rotates and has no visible melt marks.
3. With the high voltage cables removed from the A700 transformer, fill the receptacles with at least two inches of dielectric oil.
4. Remove the jumper between TB3-19 and TB3-20 and insert a mAs meter set for AC and at maximum range. Connect a jumper between TP12 and TP15 (near kVp comp pots lower left of board).
5. Remove U14 from the J400 board. Turn on the control and adjust P12 to achieve 1.8 VDC (+/- 0.1VDC) at TP15, referenced to TP1.
6. Adjust tap switches for 170 VAC between kVp major and minor common. This will produce a no-load potential of 110 kVp on the transformer.
7. Take exposures. Does the breaker trip or is mA present? If yes, the diode sticks in the transformer are shorting and must be replaced. If no, there may be a problem with the tube or cables not found with visual inspection.

D. Identification of poor SCR gating or half-waving transformer

1. Select 50 kVp, 100 mA, and 100 mAs. During exposure there should be about 108 VAC measured between P1 and P2 of the transformer. If the voltage at P1 and P2 is 108 VAC, replace the diode sticks. If the voltage is near 54 VAC, verify the SCR gate leads are tight, replace the SCR.
2. A heavy groan from the transformer during exposure (that worsens as time and power are increased) is likely due to half-waving from the SCR.

3. Open diode sticks will appear as high current draw with one-half the expected mA (when the filament voltages are normal as described in II.A above, and the test equipment is used properly). Non-invasive kVp meters may indicate an 8 millisecond exposure regardless of selected time, due to their resetting during the missing pulse.

III. CIRCUIT BREAKER TRIPS WITH ROTATION OF KVP TAP SWITCH

A. Look for a broken connection or poor solder joint on the noise suppression assembly between the common poles of the kVp major and minor tap switches. Replace if suspect, as this problem can damage rectifier sticks in the high voltage transformer.

IV. "FIL 1" ERROR (low filament current in standby/idle mode)

A. Open connection at H8 or H9 of J400 board
   1. This could be a pin-to-plug or plug-to-board connection.

B. Open/loose terminal at either end of filament cable (XC, XL, XS)

C. Open F1 or F2 fuse in control

D. Open between resistor and resistor band (RSCC or RX)

E. Open or loose cathode cable, open filament of x-ray tube
   1. Remove the cathode cable from the tube end. Use a collimator bulb as a dummy filament load by connecting it between XC/XS or XC/XL pins and see if it will light – use standby (idle) mode only. If the collimator bulb lights the tube filament may be open. If not, cathode cable may be open.
   2. Switch cables anode for cathode. If collimator bulb now lights replace the cable formerly in the cathode side.

F. Check the J400 board
   1. Once it is confirmed there are no open primary connections or open secondary loads, check for about 1.7 VDC (+/- 0.2 V) between TP12 and TP1. If the voltage is missing, confirm LED4 is illuminated. If the light is OFF, jumper pin 3 to pin 4 of U18 optocoupler. Replace U18 optocoupler if function returns, or the J400 board.

V. "FIL 2" ERROR (high filament current during standby/idle)

A. Confirm J400 operation (resetting P8 and P9 potentiometers)

1. Select 100S mA and turn on power to the generator. Use a Fluke 87 meter to measure the **DC** voltage at U14 pin 8 with respect to TP1 (GND). Adjust P9 so that this measured voltage is between -0.02 VDC and 0.02 VDC (or as close to 0 VDC as possible). Recycle power to the generator. FIL2 error should disappear by now - stop and replace the board if FIL2 error is still present. Adjust P9 again so that the DC voltage from U14 pin 8 to TP1 is between -0.02 VDC and 0.02 VDC. Next, measure & record the **AC** voltage from TP11 to TP1 (ex. 0.30 VAC). Then, measure the **DC** voltage at TP12 with respect to TP1. Adjust P8 so that this measured voltage is equal to the voltage at TP11 multiply by 5.88 (ex. 0.30 x 5.88 = 1.76) with ±0.01 VDC tolerance.

VI. "FIL 3" ERROR (low filament current during prep)

A. Confirm contact of boost resistor band to the resistor

B. Confirm connection at H8 pins 7 and 8

1. These contacts close to bypass most of the boost resistor. If contacts are good at H8 but closure does not occur at prep, replace A455 motor start board.

VII. "FIL 4" ERROR (high filament current during prep)

A. Gross miscalibration

1. Filament voltage is set too high.
   a) 54 VAC at prep (XC to XS) is more than enough to achieve 300mA. A resistive cathode cable, filament cable or a miswire of XC/XL/XS (causing both filaments to be illuminated at one time) would require setting the filament voltage above this level and create the error.
   b) 54 VAC at prep will produce about 2.68 VDC at TP12.
2. Faulty or misused test equipment may give an improperly low reading for mA, causing an over-adjustment of the filament circuit and a "FIL4" error. Meters must be set to AC mA, and if equipped with an adjustable range scale (20, 200, 2000) *it must be set to maximum*.
3. Functional test equipment does not see the mA produced.
   a) Always remove the jumper between the two "AC mA" terminal locations when measuring mA, and always replace the jumper when finished.
   b) Ensure spark gap on top of the HV transformer at "M1" is not shorted to ground.
4. Failure of J400 board. This is by far the least likely possibility.

VIII. DIGITAL DISPLAY PROBLEMS

A. Status display does not change or is at wrong state

1. On J400 board set DIP2-4 to OFF (down), disabling "ready/cold" feature. If the display now updates, the "ready/cold" feature is not available with the display's software version. Update the software or leave switch OFF.
2. If locked in "wait" check for shorted footswitch.

B. Scrambled characters/missing segments

1. Verify that each of the conductors on the cable going into H6 of J400 board is secured to the plug by looking beneath the plug cover.
2. Confirm the Mate & Lock plug pins of the display cable at the rear of the control are seated and making contact.
3. Confirm the plug and wires are well seated at J350 board in tubestand.

C. Blank display

1. Verify the Display cable connections at the H6 header of the J400 board, the pins in the Mate & Lock plug at the back of the control, and at the J350 display board.
2. Confirm +20 VDC at TP3, +12VDC at TP5 of J400.

D. kVp changes without tap switch adjustment

1. Select 100 mA and 143 VAC between the leads of MOV1 on the J400 board, located near H2. 70 kVp should be displayed. If the voltage varies check H2 and kVp tap switch connections.
2. Confirm a stable 1 VAC between the junction of R35A/R36 and TP1. If this voltage is unstable replace the J400 board. If the voltage is stable and the kVp is still variable replace the J350 board.

E. "HEAT" Error

1. Verify TB4 "T5/T6" tube thermal switch connections are closed.
2. Verify zero ohms on J400 board between U22 pin 1 and pin 2.
3. Replace U22 or J400 board.

F. "TUBE" Error

1. Select 70 kVp and 10 mAs. The "Tube" Error should go away.
2. If 70 kVp and 10 mAs cannot be selected, the J400 board may not be getting a valid kVp, time or mA input, or the board may be bad.
    a) Adjust kV major/minor tap switches to achieve 180 VAC between the two leads of MOV1 on the J400 board. If no

voltage is present inspect H2 and kVp tap switch common poles for open connection.

b) Remove the H10 plug from the J400 board. Place a jumper between pins 1 and 3 on the board. If the "Tube" error is cleared inspect the connections at the cable plug, replace time selector.
c) Remove the H11 plug from the board, and jumper pin 1 to pin 2. If the error clears, inspect the switch and connections, replace the mA selector.
d) If the error still exists replace the J400 board.

G. "ZCO" ERROR

1. Verify 14 VAC between TP1 and TP2 on J400 board. If voltage is present switch the wires in H3 pins 2 and 3. If error is still present, switch the wires back to their original locations and replace the J400 board.

IX. LONG "WAIT" DISPLAY, "ROTR" ERROR AT EXPOSURE ATTEMPT

A. Verify rotor circuit

1. The A455 motor start board controls rotor delay time. 240 VAC is applied between stator main (07) and common (09) for 1.5 seconds, and then the voltage drops to 50 VAC. The red LED on the motor start board turns on at that time. If the voltage stays at 240 VAC for longer than 1.5 seconds, adjust R17, replace C4, or replace the board.
2. If the red LED on the A455 board does not light, confirm 240/50 VAC at 07-09 stator connections of the control and at tube end. Verify stator resistance (30 ohms 07-black to 09-white, 60 ohms 08-red to 09-white, 90 ohms 07-black to 08-red), replace A455 board if voltages and connections are correct.

X. EXPOSURE BEEP or PREP AT TURN ON

A. Check for shorted exposure switch.

1. If Latching Prep option is installed, verify open contacts between TB5-2 and TB5-4. If a short is measured, remove red and black wires from air switches at TB5-1 and TB5-4 and recheck measurement to determine if the short is in the air or strip switches.
2. If a two-position foot switch is installed, confirm open contacts between S1, S2 and S3 on TB3.
3. Remove H5 at J400 board. If problem continues replace J400.

XI. mAs DISPLAY IS INCORRECT FOR SETTINGS

A. Verify mA switch inputs

1. Confirm proper number of switch positions (two and three mA station units are available). If three positions are available on a two mA station unit, rotate switch fully CCW and remove the switch. With shaft pointing upwards, move the stop tab to the fully CCW position.
2. Remove H11 plug on J400 to force in a good low mA station selection. Jumper pin 1 to pin 2 on J400 board H11 for medium mA station. Jumper pin 1 to pin 3 for high mA station (if third station exists). If mAs display responds to change of mA station replace mA switch, if not, replace J400 board.

B. Verify time selector switch inputs

1. Select 100 mA. Remove H10 plug from J400 board. Without H10 connected mAs display should be 0.83. Jumper pin 1 to pin 3 on the board, and display should change to 8.3. If it does, change time selector switch. If not, replace J400 board.

XII. NO mA MEASURED WITH RADIATION PRESENT

A. Spark gap is shorted to top of transformer.

1. The metal tab should not make contact with transformer lid. Normal spacing is equal to the thickness of radiographic film.

B. Jumper is still present between TB3-19 and TB3-20.

C. Faulty mA / mAs meter or leads.

XIII. UNIT WILL NOT GO INTO SLEEP MODE

A. Ensure DIP2-1 on J400 is set to UP (ON) to enable feature.

B. Poor connection between “W2” on J400 and mA overload coil of ON/OFF breaker.

C. Shorted spark gap on top of transformer between M1 and GND.

1. Proper spacing is the thickness of a piece of radiographic film.

D. High line voltage fluctuation; new software may be less sensitive.

8.0 FINAL ADJUSTMENTS AND QUALITY ASSURANCE

8.1 LEVELING THE TUBE ARM

An adjustment screw for leveling the tube arm is provided on the front of tubestand, just below the tube arm base. Turn the Allen screw clockwise to raise the tube arm or counterclockwise to lower the tube arm.

8.2 40 INCH SID DETENTS

To position the tube 40” from either the table top or the film cassette, detents are provided. These detents are factory adjusted, however some adjustment is provided if needed. Access to the adjustments are from the rear of the tubestand.

8.3 VERIFICATION OF X-RAY TO LIGHT FIELD COINCIDENCE

The coincidence of x-ray to light field must be verified. Specific instructions can be found in the manual for the G800 collimator.

8.4 VERIFICATION OF X-RAY TO IMAGE RECEPTOR ALIGNMENT

Any left-to-right adjustment required to achieve coincidence between the central ray and the center of the image receptor can be achieved by adjusting the grid cabinet-to-tubestand interlock bracket, located on the lower front surface of the tubestand.

1. Any front-to-back adjustment of the central ray necessary (after the arm has been leveled from 8.1 above) can be achieved by the slotted holes in the tube mounting platform. Slightly loosen the collimator mounting bolts, shift the tube and collimator as required, and re-tighten the mounting bolts.

8.5 SECURING TABLE TO FLOOR

Once the table is in final position and all checks have been made, it can be secured t the floor using the four (4) clamps provided with the feet. Merely slide the clamp into the notch at the base of each foot, turn at 45° to the table and secure with a lag screw.

9.0 OPTIONS FOR FIELD INSTALLATION

Many options for the *InnoVet Select* ™ will arrive at the jobsite pre-installed. However, all of the following features can be added after the installation is complete if the user so desires.

9.1 FILM BIN

The film bin comes in either a right hand or left hand configuration. See instructions that are provided with film bin kit.

9.2 TABLE TOP EXTENSION (For Fixed-Top tables only)

The table top extension adds 12" of additional table top surface and can be mounted on either end of the table. To attach the extension align notches in extension with buttons mounted on end of table support and slide over buttons as shown in Figure 21.

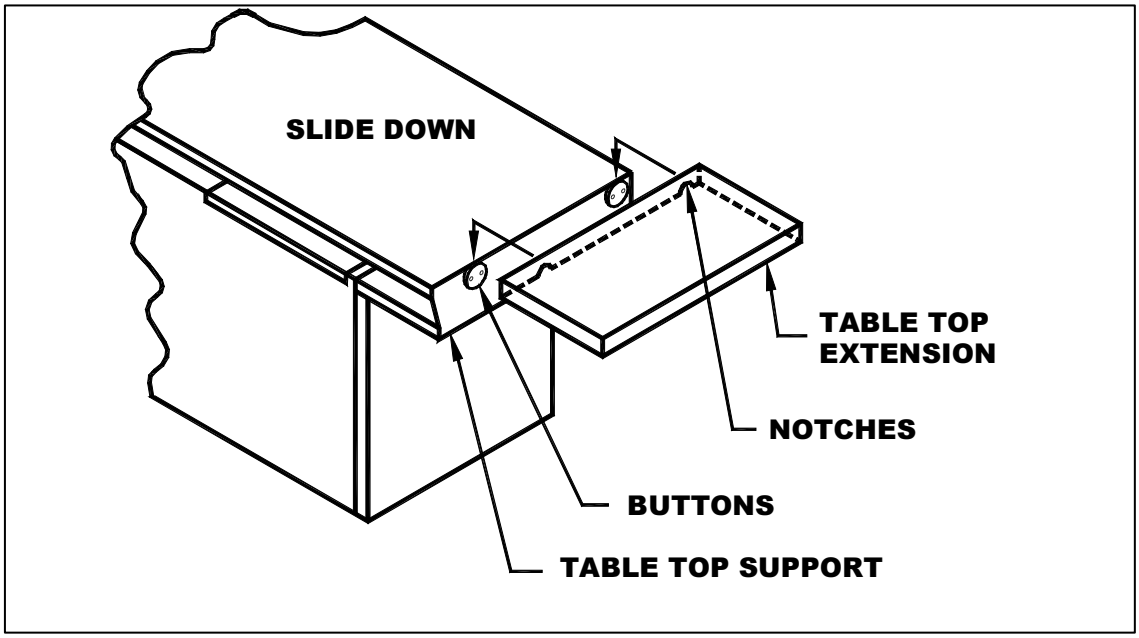

Figure 21: Table Top Extension – AWW430-08

9.3 ANIMAL RESTRAINTS

The animal restraints used are nautical style tie-down cleats. They are screwed to the underside of the table top frame at either end of the table. This prevents lead aprons from snagging on the cleats.

9.4 FOOT TREADLE

If the *InnoVet Select* ™ has the latching prep Foot Treadle Option, the treadle must be installed prior to mounting the control into the table. If the Foot Treadle Option is being added to an existing system, the control will need to be removed from the table base and laid flat on the floor to install the treadle.

1. Remove the control from the table base by unclipping the retaining ring and extracting the hinge pin which hold the control to the air cylinder. Lay the control face down on cardboard and pull it slightly away from the table.

2. Put the treadle in position across the front of the table base.

3. Thread the spring guide pins located at either end of the treadle up through the table base until they protrude out the top of the base, securing each guide pin in place with cotter pin provided.

4. Bolt the foot treadle brackets to the underside of the table base using the hex head bolts provided.

5. Plug the foot treadle cable into the S4 location of the junction box at the right side of the table frame.

6. Slide the control so that the notches engage the pivot rollers, lift the control up into the table opening and resecure the control to the air cylinder using the pin and locking ring.

7. Remove the front panel of the control. Install the air switch packets using the screws and nuts provided so that the nozzle of each exits the rear of the control.

8. Connect the wires from the air switches to TB5-2 and TB5-3 in the bottom of the control. Connect the air hoses to the air switches by pushing them over the nozzles which exit the rear of the control.

9. Place a jumper between TB5 – 1 and TB 5 – 2, and another jumper between TB5-3 and TB5-4. Verify on the J400 control board that switch 5 of DIP 1 is in the UP position. (To enable the Latching Prep mode as shown in Figure 20, page 7-11).

10. If any existing exposure switches are to be left in the system, alert the user that they will now operate like the Treadle; that is step on and release to start PREP, then step on and release to start EXPOSURE. Generally, removing these old two-position switches is recommended.

10.0 ELECTRICAL SCHEMATICS AND DIAGRAMS

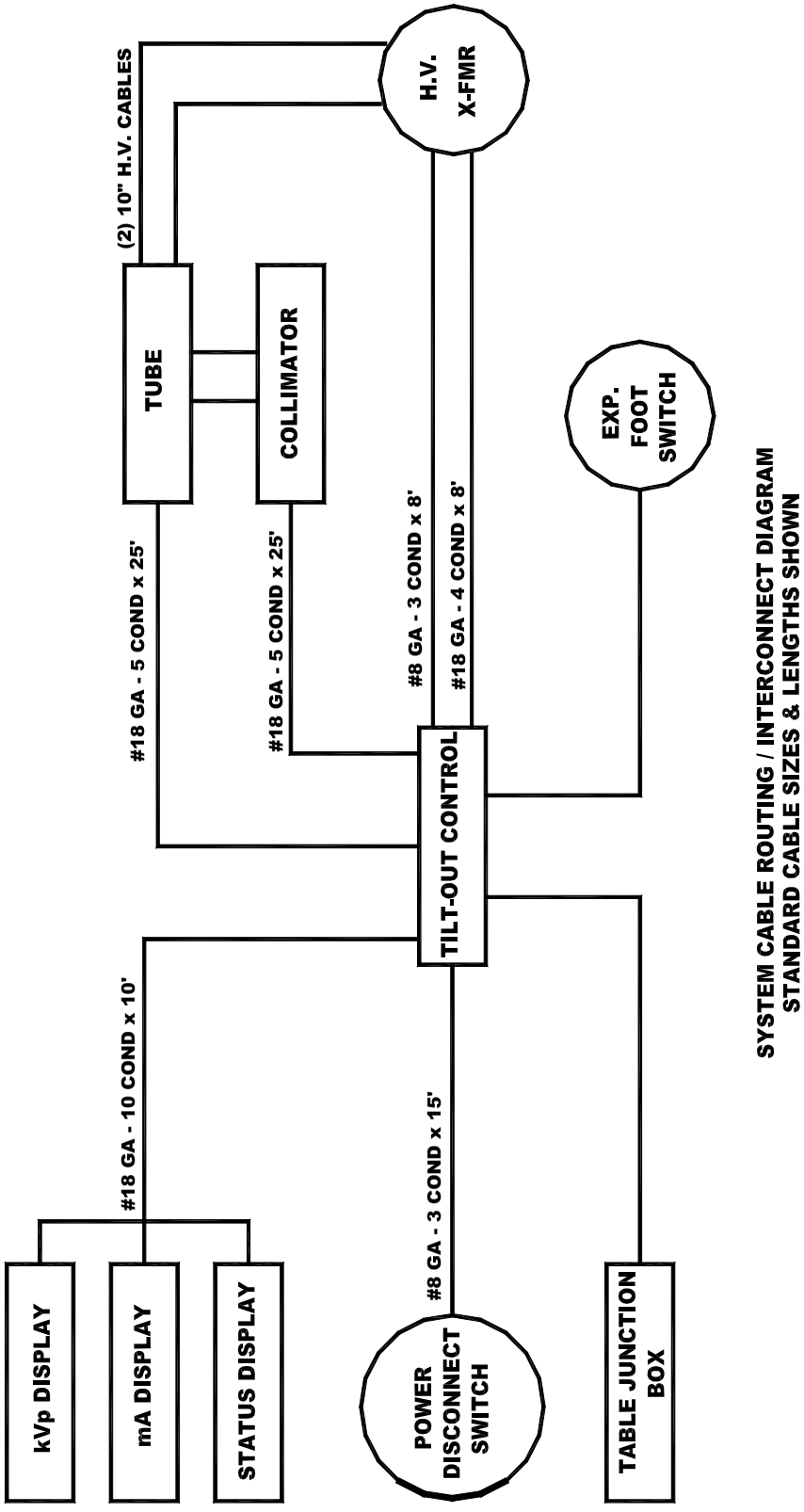

Figure 22: System Cable Routing – AWW430-09

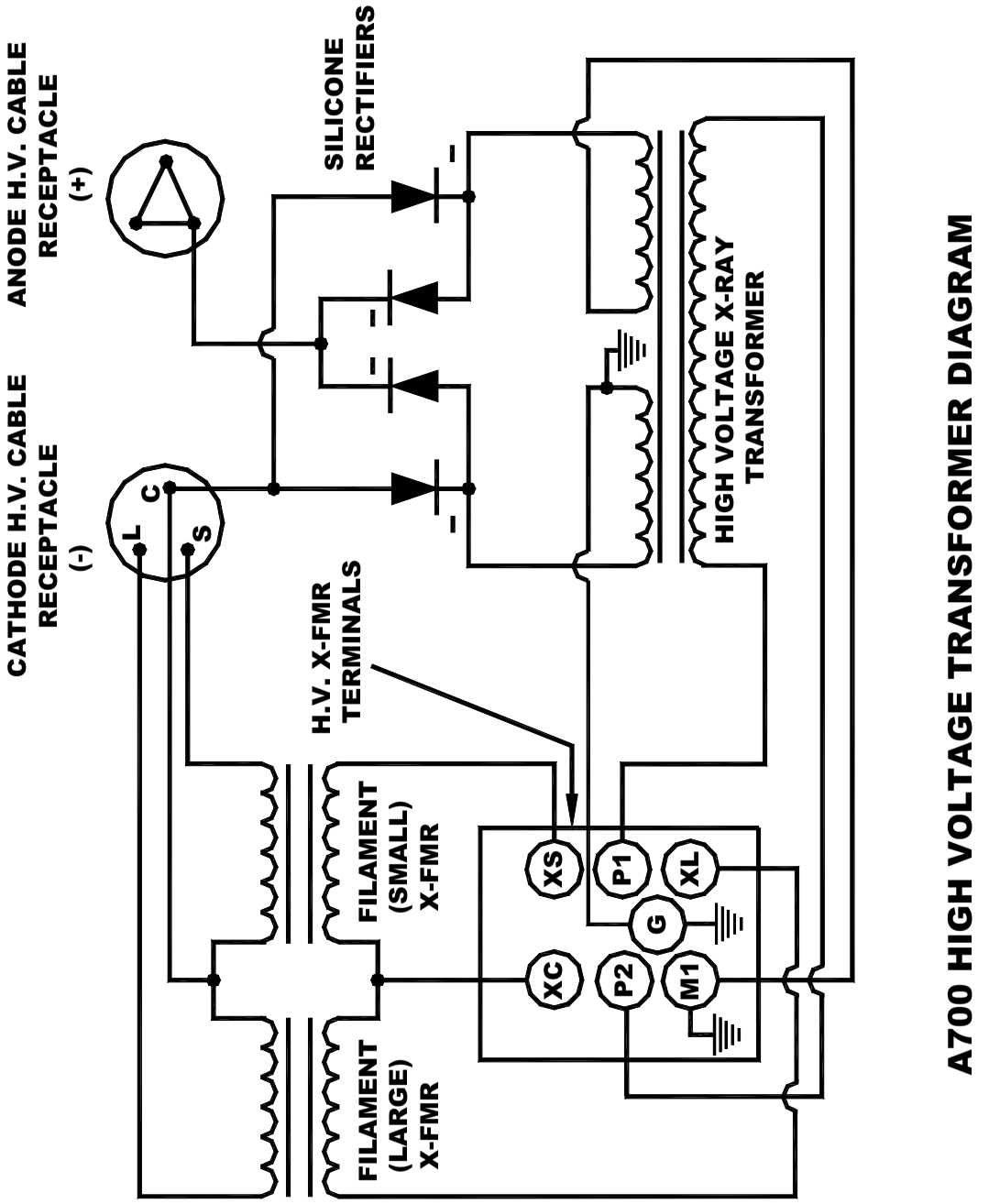

Figure 23: <u>High Voltage Transformer Diagram</u> – AWW430-10