SERVICE BULLETIN

Purpose: This service bulletin provides updated inspection and maintenance instructions and general information for the exposure devices listed below. The information is to be used in conjunction with the applicable operating instruction manuals:

- **Model 460 exposure device**
- **Model 660 exposure device**
- **Model 660E exposure device**
- **Model 660A exposure device**
- **Model 660AE exposure device**
- **Model 660B exposure device**
- **Model 660BE exposure device**
- **Model 684 exposure device**
- **Model 684E exposure device**
- **Model 684A exposure device**
- **Model 684AE exposure device**
- **Model 684B exposure device**
- **Model 684BE exposure device**
- **Model 741exposure device**
- **Model 741E exposure device**
- **Model 741A exposure device**
- **Model 741AE exposure device**
- **Model 741B exposure device**
- **Model 741BE exposure device**
- **Model 680 exposure device**
- **Model 680E exposure device**
- **Model 680A exposure device**
- **Model 680AE exposure device**
- **Model 680B exposure device**
- **Model 680BE exposure device**
- **Model 676 exposure device**
- **Model 676E exposure device**
- **Model 676A exposure device**
- **Model 676AE exposure device**
- **Model 676B exposure device**
- **Model 676BE exposure device**

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Daily inspection of the system:

A daily inspection of the gamma radiography system for obvious defects is essential to ensure the equipment is in a safe and proper operating condition. It's important that radiographers perform or supervise this inspection prior to the first radiographic exposure of the shift regardless of any previous inspections that may have been performed that day. As an example, damage to the system could possibly occur during transport of the equipment to the job-site. If damaged equipment was used without detection, the result is generally an inability to retract the source assembly into the exposure device and secure it.

The results of a daily inspection should be recorded and include the date, the name of the inspector and what specific equipment was inspected. If any defective or damaged components are discovered during the daily inspection, the component must be removed from service and identified with a status indicator (tag, label, or tape) to prevent inadvertent use by other radiography personnel. Defective or damaged components must be repaired or replaced before reuse in radiographic operations. The three main components of the radiography system consisting of the radiographic exposure device, remote controls and source guide tubes must be inspected in addition to accessories such as lab stands, collimators, J-tubes, magnetic lab-stands and pipe-clamping apparatus.

Radiographers must take a proactive role in preventing incidents, by performing or directly supervising a simple, but thorough daily inspection of the radiography system. The implications that affect safety and the importance of the daily inspection must be emphasized and understood by the entire radiography staff.

Daily inspection of the exposure device:

Survey the surface of the exposure device to ensure the radiation level is less than 200 mR/hr (2 mSv/hr), even when containing a source assembly with the maximum allowable activity. This survey provides an operability check of the survey instrument to measurable radiation intensities on the device, in addition to providing the radiographer with a reference measurement that can be compared to each confirmatory survey after terminating a radiographic exposure.

Inspect the labels on the exposure device to ensure they are legible and securely attached to the exposure device. The warning label containing the trefoil should be legible from a distance of at least three feet (1 meter). This label warns the individuals in the immediate vicinity of the presence of radioactive materials and permits them to take measures to minimize their exposure to radiation. Both printed verbiage and the radiation symbol must be legible. The trefoil symbol becomes the warning for those individuals who cannot read or understand the written warning, "Caution *or* Danger, Radioactive Material". Verify the legibility and attachment of the source identification tag that describes the radioactive source contained within the exposure device.

Inspect the exposure device locking mechanism to ensure the protective cap is installed over the source assembly connector. Inspect the plunger-lock to ensure the lock engages when the plunger is depressed and the key is removed. Grasp the entire lock mechanism with one hand and try to move the lock to determine that the fastening hardware has not loosened due to vibration. Unlock the plunger-lock and remove the protective cap. Ensure the shipping plug is installed in the outlet port of the exposure device.

Daily inspection of the source guide tube(s):

Remove the protective caps from the swaged fittings on the source guide tubes. Inspect the swaged fittings to ensure the threads are not stripped, clogged with dirt, grease or sludge.

Inspect each length of source guide tube to be used from cuts, inward dents and heat damage. The inspection is primarily a visual one, but it should include the radiographer using his hands to feel for the inward dents. This is necessary due to the fact the outermost surface of the source guide is a flexible waterproof material that can mask dents. During a visual-only inspection, a dent in the source guide tube may retain a circular appearance on the exterior, while having an inward dent in the metallic conduit directly below the waterproof material. This type of masked dent can be felt by the radiographer's hands. Dents in the source guide tube are the primary cause of source hang-ups.

Inspect the attachment of the collimator to the source guide tube (exposure head) if one is used during operations.

Daily inspection of the remote controls:

The remote control consists of a hand-crank, a control cable with a swivel-type connector swaged at one end, two control cable sheaths and a connector plug assembly.
Remote controls are available in standard lengths of 25 feet (7.6 meters), 35 feet (10.7 meters) and 50 feet (15 meters).

The hand-crank contains a diagonally cut gear that matches the outer helical winding of the control cable. This worm-gear arrangement of the hand-crank gear and the control cable provides the radiographer with a reliable means to project and retract the source assembly from and to the exposure device. The hand-crank is equipped with a lever brake that retains the source assembly while in the exposure head. Beneath the hand-crank is a label that provides written instructions indicating the direction for “expose” and “retract” during use in addition to “on” and “off” positions for the brake. Hand-cranks are available with an odometer to provide the radiographer with the approximate travel distance of the source assembly. The travel distance is indicated in increments of feet and tenths of a foot. Radiographers can count the number of rotations of the hand-crank when using hand-cranks that are not equipped with odometers to obtain an approximation of the travel distance. One full revolution of the hand-crank is equal to approximately 10 inches (25.4 cm) of travel.

Two remote control conduits (sheaths, housings) are attached to the control crank. One conduit contains the working side of the control cable that drives the source assembly out of the exposure device and through the projection sheaths. The second conduit is the reserve conduit containing the length of the control cable necessary for projection of the source assembly. The remote control conduits provide a degree of protection of the control cable against the elements common to the working environments that industrial radiography is performed.

Attached to the opposite end of the remote control sheaths is a connecting plug assembly that is used for attachment of the remote controls to the locking mechanism of the exposure device. The connecting plug assembly and the control cable connector are designed with minimal tolerances. A connection of the source assembly connector to the control cable connector must be completed before the remote control connecting plug assembly can be attached to the locking mechanism of the exposure device. A protective end-cap must be installed after use of the remote controls. The protective cap provides protection to the connecting plug assembly and the control cable connector and prevents the ingress of water, mud, sand or other foreign matter.

The drive cable (control cable) is a flexible, carbon steel cable with an outer helical winding. The length of drive cable is approximately twice the length of the remote controls. Attached to one end of the drive cable is a male swivel-type connector. The drive cable when used in conjunction with the remote control as a system provides a positive mechanical control of the source assembly from a distance. The drive cable is a critical link of safe operation and the radiographer’s only means of control over the source assembly. Therefore, the drive cable’s storage, use, daily inspection and quarterly maintenance are critical elements to the prevention of a drive cable failure. In almost all cases, repairs for a drive cable are not possible, with the exception of replacing the drive cable’s Model 550 male connector every five years (or earlier whenever excessively worn or damaged). Damaged or defective control cables must not be used and removed from service.

Daily Inspection of the remote control:

Control crank inspection: Uncoil the remote controls at the site. Inspect the hand-crank to assure all fastening hardware is present and not loose. Check the crank handle to verify it is also properly secured to the control crank. If the crank is equipped with an odometer, zero the odometer while the crank is fully retracted. If the control crank has an odometer, it must be functional.

Ensure the written instructions on the control crank's label are legible. These written instructions are important to safety, especially when new assistants are being trained or during an emergency. Without the written instructions, it's conceivable a radiographer could become confused as to which direction the crank must be rotated to "retract" or "expose" the source.
Ensure the brake is operational. Resistance should be felt while rotating the crank handle with the brake in the "on" position. Test the control conduit fittings to verify they are secured to the control crank by attempting to unscrew them with your hands.

Control housing inspection: Visually inspect the control housing where it is swaged onto the fittings that mount on the control crank. There should be no evidence of cracks or breaks in the yellow PVC conduits. Also, look for bulges in that area that result from repeated flexing at that area.

Visually inspect the entire length of both control conduits looking for dents, cuts and thermally damaged areas. During this inspection, the radiographer should use his hands to feel for inward dents. Cuts and melted areas on the control conduits should be sealed with PVC tape to prevent against the ingress of water.

Inspect the control conduits where they are swaged to the swage fittings that are mounted to the connecting plug assembly. There should be no evidence of cracks, breaks or bulges in the yellow PVC sheath.

Remove the protective cap from the connecting plug assembly. Inspect the connecting plug assembly to verify the movable jaws are not excessively loose and the connector collar pins are not excessively loose or bent. Check the control conduit swage fittings to verify they are not loose where they are joined to the connecting plug assembly.

Drive cable inspection:

Inspect the drive cable connector as it protrudes out of the connecting plug assembly. The drive cable connector should not be bent or at an angle exceeding 15 degrees relative to the drive cable. If a drive cable connector is repeatedly bent at an angle greater than 15 degrees, damage to the drive cable may be introduced by straightening the bend. Closely inspect the drive cable (male) connector to verify that the shank and ball of the connector is not bent or cracked. Attempt to twist and pull the connector off the drive cable using moderate hand pressure.

Pull approximately 12 inches (30.5 cm) of drive cable out of the connecting plug assembly and inspect for the following anomalies directly behind the connector:

- Cuts, breaks, nicks or fraying of the spiral windings of the drive cable.
- Areas with kinks or permanent bends.
- Rust (a red oxide) present on the inner core of the drive cable.
- Uniformity of the spacing between the outer spiral windings. Also check for flattened areas and wear.
- Bend the connector section of drive cable back towards itself and release the cable to test for flexibility or "spring" of the control cable. A cable that's been subjected to the flexibility test and remains in the bent position after the test provides an indication of internal corrosion and must be **removed from service**.
- Verify that a light coating of mil-spec grease (page 14) is present on the control cable. The light coating of grease is necessary to prevent the penetration of water and chemicals that can oxidize and permanently damage the drive cable.

Check for freedom of movement of the drive cable within the remote controls by moving the control crank back and forth approximately ¼ turn. During this test, take care to avoid cranking the drive cable on the ground exposing it to dirt and sand. If any resistance is felt during this check, re-inspect the control conduits for dents or depressions. If dents are not present on the remote control conduits, the drive cable may be rusted stiff somewhere within the controls.

A final check of the drive cable connector and source assembly connector is accomplished by use of a Model 550 No Go gauge to check for significant long-term wear on the connectors that would affect safety. Without using excessive force, check the four positions as described in the operating manual instructions.

Do not use any components that fail any of the NO GO gauge tests, because a failure indicates significant wear that could allow safety features of the design to be defeated.

Warning: Do not compromise on safety. Always perform a daily inspection of the exposure device, remote controls and source guide tubes prior to the first radiograph of the workday. Defective equipment discovered during the daily inspection must be labeled as defective and removed from use until repaired.

LEAK TESTING

Leak test of the radioactive sealed source:

Periodic leak tests of the radioactive sealed source are required by most national regulations. The leak test provides a confirmation of the integrity of the hermetically welded sealed source by determining the amount of removable contamination. In most regulatory jurisdictions, a leak test of a sealed source must be performed every 6 months or prior to it's first use after removal from storage. Acceptable results of a radio-assay must indicate removable contamination is less than 0.005μCi. (<185Bq.) To perform a wipe of the radioactive sealed source using a Model 518 leak test, perform the following steps;

1- Survey the exterior surface of the exposure device to ensure the dose/rates are less than 200 mR/hr (2 mSv/hr).
2- Prepare a Model 518 wipe test swab according to the instruction sheet. Fill in all of the required information fields on the leak test form. Omission of the isotope, source model and serial number, etc. will delay processing of the wipe test.
3- Remove the shipping plug from the outlet port.
4- Fully insert the wipe test wand into the s-tube and move back and forth to obtain the sample.
5- Carefully withdraw the wipe test swab from the outlet port while observing the survey instrument. Withdraw the plastic bag over the wipe test wand without touching. Always assume the sample is contaminated.
6- Install the shipping plug into the outlet port.
7- In a low background (no radiation) area, switch the survey meter to the lowest scale and obtain a background measurement. Leaving the survey meter stationary, move the plastic wrapped swab towards the survey meter's detector to determine if a gross quantity of contamination is on the wipe test. If the survey meter measures greater 0.1 mR/hr (1μSv/hr), contact AEA Technology QSA for instructions. If there is no measurable increase above background, the sample may be sent to a laboratory for radio-assay. The laboratory will send a leak test certificate after performing the radio-assay. Retain this certificate in your records. If using an alternative leak test kit, follow the manufacturer's instructions.

In the event you are informed by the radio-assay laboratory that your leak test results indicate greater than 0.005 μCuries, (>185 Bq.), you must immediately remove from service the radioactive sealed source, the exposure device and all remote controls, source guide tubes, collimators, lab stands, etc., used in conjunction with the sealed source. You must cause the equipment to be repaired or decontaminated and notify the regulatory agency (USA) within 5 days. Contact the sealed source manufacturer for assistance.

Leak test for depleted uranium (DU):

Some regulatory jurisdictions require periodic leak tests of all projection-type exposure devices that utilize DU for shielding. The purpose of the leak test is to detect the long-term wear through of the device's source tube that may consequently expose the (DU) shielding. A wipe-test wand that is both flexible and long enough to reach a bend radius or a wear point within the shield is required to perform an effective leak test for DU. The wand must permit direct contact of the swab with the (DU) where the device's source tube has worn through. A direct wipe of the DU is required due to the low specific activity of depleted uranium. The wipe test for (DU) is obtained in the same fashion as a leak test of a sealed source utilizing the same radiation safety procedures. Exposure devices that utilize a straight-through tube design may require transferring the source assembly into a source changer to accomplish the DU wipe test.

Some regulatory jurisdictions require exposure devices using depleted uranium (DU) shielding to be leak tested at intervals not to exceed 12 months. The analysis performed on the wipe test must be capable of detecting the presence of 0.005μCuries (185 Bq.) of radioactive material on the test sample. If the test sample reveals 0.005μCuries (185 Bq.) or more of removable DU contamination, the exposure device must be removed from service until an evaluation of the wear on the s-tube has been made. Should the evaluation reveal that the source tube is worn through, the exposure device may not be used again.

DU shielded devices do not have to be tested for DU contamination while in storage and not in use. Before using or transferring a device that has been in storage for more than 12 months, the exposure device must be leak tested for DU contamination prior to use or transfer. Please contact AEA Technology QSA if you require leak test kits, radio-assay services or assistance in the disposal of worn through exposure devices.

I. Inspection and Maintenance for the Sentinel exposure devices: (Annually or sooner based on environmental conditions of use)

Tools required for complete maintenance of exposure devices:

- 5/32” Allen wrench for the 10-32 socket head lock and selector-ring screws.
- 3/32” Allen wrench for the lock’s socket head screw.
- #30 Drill bit and pop-rivet gun for removal and installation of 1/8” s/s rivets.
- Tamperproof tool bit for Co-60 locking mechanism plate screws.
- Calibrated torque wrench (inch/pound). Calibrated foot-pound wrench required for Co-60 device side frames.
- Small slot screwdriver for source identification tag 4-40 screws.
- U-tool (part # SK1761) for functional checks of lock mechanism.
- Model A424-9 XL mock source assembly and short length control cable for lock mechanism operational tests after servicing.

Materials required for complete maintenance of exposure devices:

- Mil-spec grease MIL-G-23827B or MIL-G-23827C (or equivalent radiation resistant grease).
- Temporary Lock-tite™ or Vibra-tite™ thread sealant for 10-32 X 1 ¼” lock mechanism socket-head screws.
- Recommended solvents for cleaning and degreasing operations: clean mineral spirits (Follow manufacturers safety precautions for use, handling, storage and disposal)
- Clean lint-free rags.
- 12-gauge gun patches or any lint-free cloth for cleaning the S-tube.
- Large pan for use in cleaning and degreasing the remote drive cable and mechanical parts.
- Stainless steel, brass or synthetic bristle brush to be used during degreasing and cleaning of parts.
- Light viscosity oil, such as 3-in-1™ oil to lubricate plunger lock.
- Device label if required and 1/8” stainless steel rivets.
- Number 4 Scott-drive fasteners for Co-60 device labels.
- Replacement springs (Qty 1- compression spring-part # SPR006, Qty 1- compression spring-part # SPR005, Qty 2 – compression spring-part # SPR004) for the lock mechanism.
- Source guide tube for operational tests of the outlet port.

II. Inspection and Maintenance for the remote controls (Every 3 months or sooner based on environmental conditions of use)

Tools required for complete maintenance of Models 692,693 and 664 remote controls, compatible with Sentinel exposure devices:

- 11/16" open-end wrench for the control conduit's swage fittings.
- ½" open end wrench for the 5-16 control crank handle bolt.
- Slot screwdriver for the 10-32 remote control crank screws.
- 3/8" wrench for the 10-32 control crank kep-nuts.
- 0.050" Allen wrench for the 4-40 set screw on the odometer knob on the Model 693 and Model 664 remote control units.
- Drive cable run-off prevention (stop) spring removal tool if required.
- Model 550 connector NO GO gauge for wear check of the drive cable connector.
- X7 magnification glass for drive cable inspection if required.
- Micrometer for measurement of control cable diameter.

Materials required for complete maintenance of Models 692, 693 and 664 remote controls:

- Clean solvent: fresh mineral spirits recommended for cleaning and degreasing remote control crank mechanism, drive cable and cleaning the control conduits internally. (Follow manufacturers safety precautions for use, handling, storage and disposal)
- Large pan for cleaning and degreasing the control crank assembly and drive cable.
- Clean lint-free rags and detergent to clean the exterior of the control conduits.
- Mil-spec grease, MIL-G-23827B or MIL-G-23827C (or equivalent radiation resistant grease) for lubricating the drive cable and control crank mechanism.
- Stainless steel, brass or synthetic bristle brush to clean crank parts and the drive cable.
- Compressed air source and hand nozzle to (blow) dry the drive cable internal Teflon liner of the remote control conduits after cleaning.
- 3-M™ yellow polyvinyl tape (or black polyvinyl electrical tape) for repair of cuts in remote control conduits.
- Safety glasses.

III. Inspection and maintenance for source guide tubes: (Every 3 months or sooner based on environmental conditions of use)

Tools required for maintenance of source guide tubes:

- A424-9 XL mock source assembly to perform function tests after cleaning and inspection.
- Length of clean control cable to push the A424-9 XL through a 7 foot (2.1 meter) source guide tube.
- 1”-18 tap and 1”-18 die nut for male and female threads of the source guide tubes if required.

Materials required for maintenance of source guide tubes:

- Solvent: Clean mineral spirits to clean the source guide tubes internally.
- Clean lint-free cloths and detergent to clean the exterior of the source guide tubes.
- Mil-spec grease MIL-G-23827-B or MIL-G-23827C (or equivalent radiation resistant grease) to lubricate the swage fittings on the source guide tubes.
- Compressed air source and hand nozzle to blow dry the internal conduit of the source guide tubes.
- 3-M™ yellow polyvinyl tape (or black polyvinyl electrical tape) for repair of cuts in the source guide tubes.

Remote control maintenance requirements:

1) Disconnect the remote control unit from the exposure device.

2) Straighten out the remote control conduits on a work surface, and then remove the drive cable from the remote control conduits (661 safety connector side) until it stops (a stop spring on the end of the drive cable). Rubber gloves are recommended for this operation. Do not use excessive force during removal of the drive cable. During removal of the drive cable, it should be coiled in loops no less than a 12 inch (30.5cm) diameter and secure.

3) Disconnect the remote control conduit fitting from the control crank using the 11/16"open-end wrench. Remove the stop spring from the end of the drive cable and pass the drive cable through the crank gear to completely disengage. Label the remote control conduits for proper assembly after the servicing.

4) Pull the remaining drive cable through the 661safety connector and secure.

5) Using the 11/16" open-end wrench, remove both remote control conduits from the 661 safety connector and the control crank.

6) Thoroughly clean the drive cable using a brush in a degreaser bath. Use compressed air to blow off residual solvent after the degreasing operation. Be sure to follow the solvent manufacturer's safety recommendations.

7) Perform the following inspections of the drive cable.

   Use the Model 550 NO GO gage to inspect the drive cable connector for wear. Closely inspect the connector for bends or cracks in the neck (shank) area and dented areas on the ball of the connector. Remove the drive cable from service if any cracks or bends in the shank or dents in the ball of the male connector are found during this inspection. The male connector should not be bent at an angle greater than 15 degrees from the axis of the drive cable in the area where it's crimped. Using your hands, attempt to twist or rotate the male connector off the drive cable. If any movement is possible during this test, the drive cable must be removed from service and the male connector must be replaced.

   Carefully inspect the drive cable directly behind the remote cable connector and approximately 12 inches (30.5cm) beyond the male connector looking for the following anomalies:

- Cuts, breaks, nicks or fraying in the spiral windings of the drive cable.
- Kinks or permanent bends.
- Rust (red oxide) on the inner and outer core of the drive cable.
- Uniformity of the spacing between the outer helical windings of the drive cable. Check for flattened areas and excessive wear that reduces the drive cable's outer diameter less than 0.183 inches (4.7mm).

- Perform a flexibility (spring) test of the drive cable by bending the connector end of the drive cable into a “U” shape and then releasing it. A drive cable that is bent/released and does not spring back into an essentially straight shape is indicative of internal corrosion of the cable. The drive cable must be removed from service.
- Carefully examine the drive cable in the area of the control crank gear looking for cuts, breaks, fraying, rust, unusual stiffness and uniformity of the spacing between the outer spiral windings.
- Examine the entire length of drive cable looking for defects described above.

  If a drive cable is deemed as defective during this inspection, remove it from service and attach a “defective” label to prevent inadvertent use.

  The drive cable (Model 550 male) connector must be replaced at intervals not to exceed five (5) years. Maintenance program administrators must maintain traceability records for replacement of all “Safety Class A” designated components.

8) Lightly lubricate the drive cable using MIL-G-23827B or MIL-G-23827C grease or equivalent. Apply additional grease to the first 3 feet (1meter) of drive cable (male connector end).

9) Clean the exterior of the remote control conduits using clean rags and a detergent. Remove all dirt and grease from the yellow polyvinyl conduits and swaged fittings. Carefully inspect the entire length of remote control conduits for cuts and melted areas. Repairs to cut or melted areas can accomplished by sealing the area with 3-M yellow polyvinyl tape (or black polyvinyl electrical tape). The tape will prevent the ingress of water and other liquid that would cause corrosion of the remote control conduit’s inner braids and the remote control drive cable. Look and feel for dents and depressions in the remote control conduits. Minor dents can be rounded out by gently tapping the area with a small hammer. Examine the control conduits where they protrude from the swage fittings, looking for bulges or cracks in the polyvinyl. Remote control conduits with large dented areas or cracks/ bulges near the swage fittings should be sent to the manufacturer for repairs.

   Clean the interior of both remote control conduits by pouring 4-5 ounces (100ml) of clean solvent into one end. Use compressed air to blow the solvent through the entire length of conduits into a clean white cloth attached to the opposite end. Repeat this cleaning process until the solvent blown through the conduit comes out clean. Use the compressed air to thoroughly dry the interior of the conduit. Residual solvent left in the remote control conduit will dilute the lubrication applied to the remote control drive cable diminishing the protective qualities.

   Check the swage fittings to ensure the threads are not stripped and are clean. Using your hands, attempt to twist or rotate the swage fittings off the control conduits. If any movement is possible, the control conduit must be removed from service and new swage fittings must be installed.

   Service the crank mechanism and Model 661 connector assembly according to the applicable manual.

Maintenance records:

Records of all equipment inspected and maintained during the annual maintenance must be recorded (and retained for 3 years in the USA).
Records should indicate:

- The date of the inspection and maintenance.
- Name of the qualified individual performing the required inspections.
- Problems found and maintenance or repairs performed.
- Model number and serial number of the exposure device.
- Associated equipment that was inspected and maintained.
- Part numbers and associated lot numbers or serial numbers of replacement parts installed.

Safety Class Components:

Safety Class A designation items:
Items that comprise the radiographic exposure device and associated equipment that are critical for safe radiological operation are classified as Class A items or components. Class A items could be structures, components and systems whose failure or function could directly result in a condition adversely affecting public health and safety. This would include extreme conditions such as the loss of primary containment with a subsequent release of radioactive material and or a loss of shielding creating a substantial safety hazard. Replacement parts that are sent to you with a safety Class A designation are identified with lot numbers and contain instructions to maintain traceability.

Considerations of Safety Class A items:
Users of the Sentinel exposure devices and associated equipment must recognize their responsibilities of maintaining the integrity of the Type B(U)-85 package and the control of safety Class A items and components by;

- Maintaining traceability of Class A replacement items or components to a specific exposure device or an associated component.
- By the use of manufacturer specified items to maintain the integrity of the exposure device/transport package according to the certifications. Do not use of generic grade items or components that do not meet original design specifications.
- Performance of periodic inspections to verify the Class A items are not excessively worn from long term use or have been damaged as a result of abuse or accidents.
- Use and handling of the system consistent with it's design and intended application.
- Promptly notifying the manufacturer in the event a safety Class A item or component contains a defect or deviates from the original design specifications. This action will cause a formal evaluation of the defect or deviation under the reporting requirements of the USNRC 10CFR21.

Torque Requirements

Torque requirements for 460 and 660 series exposure devices:

1- Models 460, 660, 660E, 660A, 660AE, 660B, 660BE
Lock mechanism retaining screws, s/s socket head cap screws 10-32 X 1¼".
Apply Vibratite or temporary Lock-tite thread sealant to end threads and torque in a cross-pattern. Torque to 30 inch-pounds (3.39 N·m), plus or minus 5 inch-pounds (0.57 N·m) using a calibrated torque wrench.

2- Front and rear plate screws, steel flat head Philips ¼-20 X ¾ on the 660 series devices, s/s ¼-20 X ¾" and ¼-20 X 1" tamperproof Philips-head screws on the 460 device. Do not apply thread sealant.
Torque to 80 inch-pounds (9.04 N·m), plus or minus 10 inch-pounds (1.130 N·m) using a calibrated torque wrench.

Torque requirements for Co-60 series exposure devices:

1- Models 684, 684E, 684A, 684AE, 684B, 684BE, 741, 741E, 741AE, 741B, 741BE, 680, 680E, 680A, 680AE, 680B, 680BE, 676, 676E, 676A, 676AE, 676B, 676BE
Lock mechanism retaining screws, s/s socket head screws 10-31 X 1 3/8".
Apply Vibratite or temporary Lock-tite thread sealant to the end threads and torque in a cross-pattern.
Torque to 30 inch-pounds (3.39 N·m), plus or minus 5 inch-pounds (0.57 N·m) using a calibrated torque wrench.

2- Lock mechanism mounting plate screws, s/s tamper proof-head screws ¼-20 X 5/8"on Posi-Lok versions, s/s ¼-20 hex-head bolts on standard lock versions. Do not apply thread sealant. Torque the screws in a cross-pattern to 70 inch-pounds (7.909 N·m), plus or minus 5 inch-pounds (0.57 N·m) using a calibrated torque wrench.

3- Side frame bolts, steel 7/16-20 X 1 ¼" hex head bolts (7/16-20 X 1" on the 684AE). Do not apply thread sealant. Torque the side frame bolts in a cross-pattern to 30 foot-pounds (40.68 N·m), plus or minus 5 foot-pounds (6.78 N·m) using a calibrated torque wrench.

Selector-ring mechanism Compression Springs

During servicing of the selector-ring locking mechanism, all compression springs located within the selector-ring mechanism must be replaced with new springs. These compression springs must be replaced at 12-month intervals to ensure smooth and consistent operation of the mechanism.

Reference the lock assembly diagram contained in the applicable device manual to obtain specific part numbers for the springs.

Current Sentinel Transport Container Certifications:

Model 460	GB/3686A/B(U)-85
Models 660 and 660E in Model 660-OPL	USA/9283/B(U)-85
Models 660A and 660AE in Model 660-OPL	USA/9283/B(U)-85
Models 660B and 660BE in Model 660-OPL	USA/9283/B(U)-85
Models 684 and 684E	Type A
Models 684A and 684AE	Type A
Models 684B and 684BE	Type A
Models 741 and 741E in Model 741-OP	USA/9027/B(U)-85
Models 741A and 741AE in Model 741-OP	USA/9027/B(U)-85
Models 741B and 741BE in Model 741-OP	USA/9027/B(U)-85
Models 680 and 680E in Model 680-OP	USA/9035/B(U)-85
Models 680A and 680AE in Model 680-OP	USA/9035/B(U)-85
Model 680B and 680BE in Model 680-OP	USA/9035/B(U)-85
Models 676 and 676E	Limited to fixed use
Model 676A and 676AE	Limited to fixed use
Model 676B and 676BE	Limited to fixed use

Please contact a Sentinel - AEA Technology QSA service center if you require copies of the current certifications.