East Building, PHH-23
1200 New Jersey Ave, SE
Washington, D.C. 20590

U.S. Department of Transportation

Pipeline and Hazardous Materials Safety Administration

COMPETENT AUTHORITY CERTIFICATION FOR A TYPE B(U) RADIOACTIVE MATERIALS PACKAGE DESIGN CERTIFICATE USA/9296/B(U), REVISION 14

The Competent Authority of the United States certifies that the radioactive material package design described in this certificate satisfies the regulatory requirements for a Type B(U) package as prescribed in the regulations of the International Atomic Energy Agency[1] and the United States of America[2] The package design is approved for use within the United States for import and export shipments made in accordance with applicable international and domestic transport regulations.

1. Package Identification - QSA Global, Inc., Model No. 880 Series Package.

2. Package Description and Authorized Radioactive Contents - as described in U.S. Nuclear Regulatory Commission Certificate of Compliance No. 9296, Revision 13 (attached).

3. General Conditions -

   a. Each user of this certificate must have in his possession a copy of this certificate and all documents necessary to properly prepare the package for transportation. The user shall prepare the package for shipment in accordance with the documentation and applicable regulations.

   b. Each user of this certificate, other than the original petitioner, shall register his identity in writing to the Office of Engineering and Research, (PHH-23), Pipeline and Hazardous Materials Safety Administration, U.S. Department of Transportation, Washington D.C. 20590-0001.

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[1] "Regulations for the Safe Transport of Radioactive Material, 2018 Edition, No. SSR-6 (Rev. 1)" published by the International Atomic Energy Agency (IAEA), Vienna, Austria.

[2] Title 49, Code of Federal Regulations, Parts 100-199, United States of America.

c. This certificate does not relieve any consignor or carrier from compliance with any requirement of the Government of any country through or into which the package is to be transported.

d. Records of Management System activities required by Paragraph 306 of the IAEA regulations[1] shall be maintained and made available to the authorized officials for at least three years after the last shipment authorized by this certificate. Consignors in the United States exporting shipments under this certificate shall satisfy the applicable requirements of Subpart H of 10 CFR 71.

4. Special Conditions -

a. Aging Management protocols submitted by QSA Global in Service Bulletin SB-23 dated November 2024 shall be followed.

5. Marking and Labeling - The package shall bear the marking USA/9296/B(U) in addition to other required markings and labeling.

6. Expiration Date - This certificate expires on May 31, 2031. Previous editions which have not reached their expiration date may continue to be used.

This certificate is issued in accordance with paragraph(s) 810 of the IAEA Regulations and Section 173.471 of Title 49 of the Code of Federal Regulations, in response to the April 23, 2025 petition by QSA Global, Inc., Burlington, MA, and in consideration of other information on file in this Office.

Certified By:

May 09, 2025

for William Schoonover
Associate Administrator for Hazardous Materials Safety

(DATE)

Revision 14 - Issued to endorse U. S. Nuclear Regulatory Commission Certificate of Compliance No. 9296, Revision 13, to the 2018 Edition of the IAEA Regulations for the Safe Transport of Radioactive Material, SSR-6 (Rev. 1), and to extend the expiration date.

NRC FORM 618
(8-2000)
10 CFR 71

U.S. NUCLEAR REGULATORY COMMISSION

CERTIFICATE OF COMPLIANCE
FOR RADIOACTIVE MATERIAL PACKAGES

1. a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. DOCKET NUMBER	d. PACKAGE IDENTIFICATION NUMBER	PAGE	PAGES
9296	13	71-9296	USA/9296/B(U)-96	1 OF	4

2. PREAMBLE

a. This certificate is issued to certify that the package (packaging and contents) described in Item 5 below meets the applicable safety standards set forth in Title 10, Code of Federal Regulations, Part 71, "Packaging and Transportation of Radioactive Material."

b. This certificate does not relieve the consignor from compliance with any requirement of the regulations of the U.S. Department of Transportation or other applicable regulatory agencies, including the government of any country through or into which the package will be transported.

3. THIS CERTIFICATE IS ISSUED ON THE BASIS OF A SAFETY ANALYSIS REPORT OF THE PACKAGE DESIGN OR APPLICATION

a. ISSUED TO *(Name and Address)*

QSA Global, Inc.
40 North Avenue
Burlington, MA 01803

b. TITLE AND IDENTIFICATION OF REPORT OR APPLICATION

Safety Analysis Report for the Model No. 880 Series Transport Packages, Revision No. 14, dated January 2025.

4. CONDITIONS

This certificate is conditional upon fulfilling the requirements of 10 CFR Part 71, as applicable, and the conditions specified below.

5.

Packaging

(1) Model No. 880 Series Packages

(2) Description

The Model No. 880 series packages are designed for use as radiography exposure devices (or source changers) and as transport packages for Type B quantities of radioactive material in special form. The Model No. 880 series packages have four versions called the 880SC, 880 Delta, 880 Sigma, and the 880 Elite. The 880 Delta and the 880SC have a maximum capacity of 150 Curies of Iridium-192 or 150 Curies of Selenium-75, the 880 Sigma has a maximum capacity of 130 Curies of Iridium-192 or 150 Curies of Selenium-75, and the 880 Elite has a maximum capacity of 50 Curies of Iridium-192 or 150 Curies of Selenium-75. The Delta and Sigma versions are identical and the Elite has a lighter weight depleted uranium shield. The 880SC version is identical to the Delta version except for a different lock plate assembly for the front and rear plates. There are three versions of an optional jacket to facilitate the use of the 880 Delta, Sigma and Elite packages as a radiography device/source changer and transport package. The 880SC can only use the Version 1 jacket.

The 880 Delta, 880 Sigma, and 880 Elite versions of the package, without the jacket, are cylindrical in shape with a diameter of 5 inches (127 mm) and a length of 13 5/16 inches (338 mm). With the Version 1 of the jacket, the shape of the package is an extruded triangle 9 inches (229 mm) high, 7 ½ inches (191 mm) wide, and 13 5/16 (343 mm) inches long. With the Version 2 of the jacket, the package measures 13 ½ inches (343 mm) long by 6 inches (152 mm) wide by 11.33 inches (288 mm) tall. With the Version 3 of the jacket, the package measures approximately 13 ½ inches (343 mm) long by 6 inches (152 mm) wide by 9.7 inches (246 mm) tall.

5.(a) (2) Description (continued)

The 880SC version of the package, without the jacket, is cylindrical in shape with a diameter of 5 inches (127 mm) and a length of 15 ¼ inches (387 mm). With Version 1 of the jacket, the only one that can be used, the shape of the package is an extruded triangle 9 inches (229 mm) high, 7 ½ inches (191 mm) wide, and 15 ¼ inches (387 mm) long.

The weight of the Delta and Sigma versions is 46 pounds (21 kg) without the jacket, 52 pounds (24 kg) with Version 1 of the jacket and 55 pounds (25 kg) with Version 2 or 3 of the jacket. The weight of the Elite version is 37 pounds (17 kg) without the jacket, 42 pounds (19 kg) with Version 1 of the jacket, and 45 pounds (20 kg) with Versions 2 or 3 of the jacket. The weight of the 880SC is 46 lbs (21 kg) without the jacket, and 52 pounds (24 kg) with Version 1 of the jacket.

The major components of the packages consist of a welded stainless steel cylindrical body, a depleted uranium shield, a containment system, and optional jackets. The Delta, Elite, and Sigma versions have a stainless steel rear plate with a locking assembly and a stainless steel front plate with a shielded port. The 880SC version has lock assembly plates and a shipping plug assembly.

The welded cylindrical body consists of a 5 inch (127 mm) diameter, 0.06 inch (1.5 mm) wall tube shell with 0.12 inch (3 mm) end-plates. A U-bracket is welded to each end-plate and is located on the inside cavity of the shell tube. The depleted uranium shield is centrally located within the welded body between the end-plate and is fastened to each U-bracket by a 0.37 inch (9.5 mm) diameter titanium shield pin. A U-shaped copper spacer fills the gap between the shield and the U-bracket. An S-shaped titanium source tube is cast into the center of the shield to provide a cavity for the source wire assembly and shipping plug assembly to travel through during use.

For the Delta, Sigma, and Elite versions, the front and rear plates are attached to the welded body with four tamperproof screws through rivnuts assembled into end-plates. The rear plate assembly consists of a source locking mechanism fastened to the rear plate. The front plate assembly consists of a shielded port mechanism contained within the front plate.

For the 880SC, front and rear locking plate assemblies are attached to the welded body with four tamperproof screws through rivnuts assembled into end-plates.

These locking assemblies, which are interchangeable, are used to secure a source wire assembly on one end of the package and a shipping plug assembly on the opposite end of the package. The locking plate assembly consists of a locking mechanism, consisting of a keyed plunger lock, fastened to the plate. The keyed plunger lock can only be engaged when the source wire and shipping plug assemblies are located in the fully shielded position.

5.(a) (2) Description (continued)

For the 880SC version, a shipping plug assembly is loaded into the other locking plate assembly on the opposite side of the package. During transport and storage, this shipping plug assembly provides additional shielding to the package and it is only removed during radiography operations.

An optional polyurethane jacket covers the package cylinder, provides a handle and a stable base, and is attached to the shell cylinder either by rivets or screws located outside the shield cavity area. Version 1 of the jacket has a handle section that contains a wire molded in for additional reinforcement. Version 2 of the jacket incorporates wheels on the base to facilitate movement during use as a radiography exposure device. Version 3 of the jacket incorporates a PM-Tag assembly used for unit tracking purposes.

(3) Drawings

The packaging is constructed in accordance with the QSA Global, Inc., drawings R88000, Rev. X, sheets 1-6, and R88095, Rev. A, sheets 1-2, R880SC, Rev. E, sheets 1-6.

(b) Contents

(1) Type and form of material

Iridium-192 as a sealed source which meets the requirements of special form radioactive material.

Selenium-75 as a sealed source which meets the requirements of special form radioactive material.

(2) Maximum quantity of material per package

150 Curies (5.55 TBq) (output) Ir-192 for the Model No. 880 Delta and 880SC.
150 Curies (5.55 TBq) Se-75 for the Model No. 880 Delta and 880SC.

130 Curies (4.81 TBq) (output) Ir-192 for the Model No. 880 Sigma.
150 Curies (5.55 TBq) Se-75 for the Model No. 880 Sigma.

50 Curies (1.85 TBq) (output) Ir-192 for the Model No. 880 Elite.
150 Curies (5.55 TBq) Se-75 for the Model No. 880 Elite.

Output curies for Ir-192 are determined by measuring the source output at 1 meter and expressing its activity in curies derived from the following: 0.48 R/(hr-Ci) (Ref: American National Standards Institute N432-1980, “Radiological Safety for the Design and Construction of Apparatus for Gamma Radiography”).

CERTIFICATE OF COMPLIANCE
FOR RADIOACTIVE MATERIAL PACKAGES

1. a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. DOCKET NUMBER	d. PACKAGE IDENTIFICATION NUMBER	PAGE		PAGES
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5.(b) Contents (continued)

(3) Maximum weight: 18 grams.

(4) Maximum decay heat: 3 Watts.

6. In addition to the requirements of Subpart G of 10 CFR Part 71:

(a) The package must meet the Acceptance Tests and Maintenance Program of Chapter 8.0 of the application; and,

(b) The package shall be prepared for shipment and operated in accordance with the Operating Procedures in Chapter 7.0 of the application.

7. The package authorized by this certificate is hereby approved for use under the general license provisions of 10 CFR 71.17.

8. Revision No. 12 of this certificate may be used until March 30, 2026.

9. Expiration date: May 31, 2031.

REFERENCES

QSA Global, Inc., consolidated application, Revision No. 14, dated January 2025.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Signed by Diaz-Sanabria, Yoira
on 04/21/25

Yoira Diaz-Sanabria, Chief
Storage and Transportation Licensing Branch
Division of Fuel Management
Office of Nuclear Material Safety
and Safeguards

Date: April 21, 2025

QSA GLOBAL.

SERVICE BULLETIN.

Purpose

This document provides information applicable to the inspection and maintenance of the Model 880 Series transport packages to comply with IAEA SSR-6 (2018). In addition to ensuring the package is in accordance with the operating instructions supplied with the transport package, per 10 CFR 71.87 and 71.89, specifically Sections 7 & 8 of the Model 880 Series Safety Analysis Report, compliance with this bulletin is required for all packages shipped under a USDOT certificate, or other foreign Type B certification, endorsed to IAEA SSR-6 (2018).

Package Inspection & Maintenance Requirements

The Model 880 Series packages must be maintained regularly by trained and qualified personnel to ensure the package complies with applicable Type B(U) or Type A approval requirements and the package maintains its integrity during transport.

The recommended inspection and maintenance requirements are based on the system's design, application, materials, anticipated work cycles, environmental factors of use under the normal and abnormal conditions of transport. A program of systematic maintenance will prolong the working life of the package in addition to ensuring safety during transport and use. By most national radiographic regulations, routine maintenance of the systems is required at intervals not to exceed 3 months in addition to the daily inspections for obvious defects. The complete annual servicing ensures the integrity of the system.

Maintenance program administrators must recognize the need for maintenance intervals that are less than the required 3-month interval especially in cases where the systems are used in severe environmental conditions. Maintenance program administrators must ensure the systems are completely serviced immediately after certain jobs in severe conditions. Extreme or severe conditions may include, but is not limited to conditions where the equipment was:

- Immersed in water or mud.
- Subjected to high-concentrations of particulate such as fly ash, sand or foundry green-sand.
- Subjected to hot radiography conditions.
- Subjected to salt-water conditions, caustic or acidic materials.
- Subjected to accidental drops or falling objects.
- Whenever subjected to extreme environmental conditions.

The routine maintenance performed every 3 months (see Section 4) requires a more indepth inspection and check of the package. The complete maintenance (performed once a year or after removal from long term storage – see Section 5) involves a complete disassembly, cleaning, inspection, re-lubrication and operational tests of the major assemblies on the package.

Personnel performing the inspections and maintenance in this bulletin must be adequately trained and approved to perform these duties. Personnel approved and qualified under either a USNRC approved QA program or an ISO 9001 QA program to perform Type B container inspection and maintenance would meet the training requirements in this bulletin.

1. General Requirements

a. The Model 880 Series transport packages must be loaded and closed in accordance with procedures that, at a minimum, include the requirements in Sections 7 & 8 of the SAR and this bulletin. Shipment of Type B quantities of radioactive material are authorized for sources specified in Section 2. Maintenance and inspection of these packages is in accordance with the additional requirements specified in Section 3 through 5.

NOTE: Package conformance after storage and prior to use for Type B shipments is ensured by proper inspection and maintenance. The materials used in the Model 880 Series packages are not vulnerable to degradation due to irradiation over time, and there will typically be no chemical/galvanic material interactions between package materials during storage so long that the package is not exposed to hazardous chemicals and is stored under controlled environmental conditions[1].

For packages removed from storage and prior to shipment, the package components are inspected for any degradation due to non-use/storage. Any degradation identified will prevent the package use for shipment until correction by replacement, service and/or repair. (Reference: IAEA SSR-6 §503(e) & 613A).

b. Results of package inspections and maintenance covered in this bulletin must be recorded and include, at a minimum,

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

If any defective/damaged components are identified on the package or source, they must be removed from transport use and identified with a status indicator (tag, label, or tape) to prevent inadvertent shipment or use. Defective or damaged components must be repaired or replaced before continued use of the Model 880 package (or source assembly as applicable) in transport. Contact QSA Global, Inc. if additional guidance or assistance is needed to determine actions needed to deal with defective/damaged equipment.

2. Authorized Package Contents

The Model 880 Series transport packages are designed for use with a special form source capsules as approved under a U.S. Department of Transportation special form certification[2]. The approved isotopes and maximum package activity limits are shown in Table A. Details of encapsulation as well as chemical and physical form of the radioactive material will comply with specifications approved under U.S. Department of Transportation or other Competent Authority special form certifications.

[1] Storage of the Model 880 Series packages must be in a temperature and humidity controlled area away from chemicals or other hazardous substances to prevent degradation of the package integrity while in storage.
[2] Special Form is defined in 10 CFR 71, 49 CFR 173, IAEA TS-R-1 and SSR-6.

Table A: Isotopes Permitted in the Model 880 Series

Model	Nuclide	Maximum Capacity[3]	Maximum DU Weight	Maximum Weight Without Jacket	Maximum Weight With Jacket (Version 1)	Maximum Weight With Jacket (Version 2 or 3)
880 Delta	Ir-192	150 Ci	34.4 lbs (15.6 kg)	46 lbs (21 kg)	52 lbs (24 kg)	55 lbs (25 kg)
	Se-75	150 Ci				
880 Sigma	Ir-192	130 Ci	34.4 lbs (15.6 kg)	46 lbs (21 kg)	52 lbs (24 kg)	55 lbs (25 kg)
	Se-75	150 Ci				
880 Elite	Ir-192	50 Ci	25 lbs (11 kg)	37 lbs (17 kg)	42 lbs (19 kg)	45 lbs (20 kg)
	Se-75	150 Ci				
880SC	Ir-192	150 Ci	34.4 lbs (15.6 kg)	46 lbs (21 kg)	52 lbs (24 kg)	NA[3] [4]
	Se-75	150 Ci				

3. Packaging Maintenance and Inspection Prior to Shipment

a. If the package has been in storage for 1 year or longer, inspection to the requirements in Section 5 must be completed in addition to the maintenance and inspection listed in this section.

b. Ensure all markings are legible and the labels are securely attached to the package. If a source is loaded in the package, inspect the legibility and attachment of the source identification tag that describes the radioactive source contained in the package.

c. Inspect the container for signs of significant degradation. Ensure all welds are intact, the container is free of heavy rust and cracks/damage to the steel housing which breaches the container. If there is any evidence of bent or cracked welds contact QSA Global, Inc. prior to shipping.

d. Inspect the locking mechanism to ensure the protective covers are installed over the source assembly connector. Inspect the plunger lock to ensure the lock will engage when the plunger is depressed, and the key is removed. Grasp the entire locking mechanism with one hand and try to move the lock to determine that the screws have not loosened due to vibration. Unlock the plunger lock and confirm it releases the protective cover. Return the protective cover to the lock assembly and secure it to the package with the plunger lock.

e. Inspect the outlet port for damage and for smooth operation by operating the outlet port cover. Verify that the outlet port cover rotates smoothly and that the mechanism is not clogged with dirt, grease or sludge.

f. Assure all bolts and fasteners (hardware) required for assembly of the package and as specified on the drawings referenced on the Type B transport certificate are fit for use. Without removing the hardware by disassembly from the device, examine the visible external surfaces of the bolts/fasteners for any signs of damage including fatigue cracking.

[3] Maximum Capacity Activity for Ir-192 is defined as output Curies as required in ANSI N432 and 10 CFR 34.20 and in line with TS-R-1/SSR-6 and Rulemaking by the USNRC and the USDOT published in the Federal Register on 26 January 2004.
[4] The Model 880SC uses only the Version 1 optional jacket.

Note: A visual examination of the bolt/fastener thread condition is performed after removal from the exposure device as part of the Annual maintenance inspections required for radiography devices under 10 CFR 34.31 or equivalent Agreement State regulations and as specified in Section 4 of this bulletin.

The bolts/fasteners must be replaced if they are no longer fit for use (e.g., threads stripped, unable to fully thread, signs of cracking, etc.). Ensure the front port is properly secured. Ensure seal wire(s) are properly installed. Ensure any replacement hardware meets all applicable specifications listed on the drawings referenced on the Type B transport certificate.

g. If the container fails any of the inspections in steps 3.a-f, remove the container from use until it can be brought into compliance with the Type B certificate.

4. Packaging Quarterly Maintenance and Inspection

Perform general cleaning of the exterior of the package using water and/or mild detergent only. Record any defects that might affect safe operation or contribute to unsafe transport of the container. If deficiencies are found during this maintenance, the package must be removed from service until repairs are accomplished and the results of subsequent operational tests and inspection are satisfactory. Inspect the package for the following using a 'satisfactory' or 'deficient' criterion:

a. Complete the inspections in Section 3.b through 3.g.

b. Check the welded container stainless steel end plates for any weld failures (e.g. cracks, gaps, etc.). When a jacket is used, ensure the handle, the bottom contact surfaces and the sides comprising the plastic jacket of the exposure device are intact. Check the bottom contact surfaces of the jacket to ensure the contact area is not excessively worn allowing contact of the stainless steel body with the work surface. If any deficiencies are found during this inspection, contact QSA Global, Inc. to determine if repairs can be performed. Significant repairs will need to be performed by QSA Global, Inc. Note: The package may require unloading to return for service since it cannot be transported loaded until repairs have been performed to return the package to a compliant condition.

c. Check the outlet port for proper function by attaching and removing a source guide tube. The operation should be smooth and resistance free. If there is any resistance or 'crunchy' feeling noticed during attachment or removal of the source guide tube or during movement of the outlet port cover, this indicates excessive amounts of sand or dirt may be within the mechanism. The outlet port mechanism must be removed, cleaned and lubricated according to the complete service instructions.

d. If the container fails any of the inspections in steps 4.a-c, remove the container from use until it can be brought into compliance with the Type B certificate

e. Maintain records of this inspection and maintenance.

5. Packaging Annual Maintenance and Inspection

Model 880 Series packages must receive inspection and maintenance at least once a year. The locking mechanism and outlet port mechanism must be removed from the package and disassembled for proper cleaning, inspection and lubrication of components that are critical to safety. These procedures can only be performed on an empty package, which requires transfer of the radioactive source assembly into an approved storage container.

A leak test of a sealed source must be performed every 6 months or prior to its first use after removal from storage. Acceptable results of a radio-assay must indicate removable contamination is less than <185 Bq (0.005 µCi). If the source requires a leak test, perform the test and obtain the results prior to transferring the source from the package into a source changer.

Prior to this inspection, transfer the source from the package following the instructions in the package and source changer operations manuals. The annual inspection and maintenance must be performed by individuals specifically trained, qualified and authorized for this work.

a. After unloading the package, perform a leak test of the package for removable depleted uranium contamination. This test is typically required annually for projection type radiography devices where the source projects out of the device during use. 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 is required to perform a leak test. The wand enables direct contact with the DU where the device's source tube has worn through.

   The analysis performed on the wipe test must be capable of detecting the presence of 0.005 µCi (185 Bq) of radioactive material on the test sample. If the test sample reveals 185 Bq (0.005 µCi) or more of removable DU contamination, the package 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 a QSA Global, Inc. for guidance in the disposition of worn through packages.

b. Complete the inspections in Section 3.b through 3.g.

c. Remove the four 5/16-18 x 1½ in socket button-head screws that retain the locking mechanism plate from the empty Model 880 device using the tamperproof tool bit mounted in a ratchet.

d. Remove the 10-32 socket head screws that retain the selector-ring and plunger lock housings from the mounting plate.

e. Disassemble the locking mechanism assembly. Discard all used locking mechanism springs and replace with new springs[5]. All compression springs located within the selector ring mechanism must be replaced at 12-month intervals to ensure smooth and consistent operation of the mechanism.

[5] Replacement parts compliant for use under the Type B approval can be obtained from QSA Global, Inc. Use of unauthorized replacement parts may invalidate the device and/or Type B approval.

Place the remaining disassembled locking mechanism components into a pan filled with fresh, clean mineral spirits. Clean all parts using a brush to dislodge any dirt or grease. Once cleaned, remove the parts from the solvent bath, dry and place on a clean surface. Inspect all parts for wear. Replace worn parts as necessary.

Remove the lock retainer from the mounting plate by unscrewing the two 10-32 x ½ in socket head screws. Remove the plunger lock from the lock retainer by removing the cap screw. Clean the lock plunger, lock retainer and springs with mineral spirits. Ensure the lock plunger is thoroughly rinsed to remove all dust from the key tumblers. Take the cleaned parts and dry thoroughly, using compressed air to dry the lock tumbler. Inspect all parts for wear. Replace worn parts as necessary.

Lubricate the plunger lock barrel and tumbler using two drops of light viscosity oil. Apply threadlocker[6] to the lock set screw and install. Check the plunger lock for proper function by using the key to engage and unlock. Apply threadlocker to the lock retainer's 10-32 x ½ in screws, then mount the lock retainer to the locking mechanism plate. Hand-tighten the screws.

Apply a light coating of lubrication[7] to the inside surfaces of the selector body and selector ring. Do not lubricate the lock slide and sleeve. Note that some other unapproved types of greases may undergo chemical changes and form tars when exposed to radiation.

f. Perform a visual examination of the bolt/fastener thread condition. The bolts/fasteners must be replaced if they are no longer fit for use (e.g., threads stripped, unable to fully thread, signs of cracking, etc). Ensure any replacement hardware meets all applicable specifications listed on the drawings referenced on approval certifications.

g. Begin assembly of the locking mechanism by lightly coating/lubricating all components. Treat all screw thread ends with threadlocker.

Mount the locking mechanism plate horizontally in a vise or fixture with the plunger lock and retainer at a 12 o'clock position. (Note: Carefully mount the mounting plate in a vise or fixture so hands are free for the assembly procedure and no damage to the mounting plate will occur.)

The narrow end of the lock slide slot must be located at the 3 o'clock position. Locate the lock slide and return spring into the mating slot of the selector body.

Place the selector ring with the word CONNECT at the 12 o'clock position, over the selector body. Push the lock slide inward during placement of the selector ring for clearance. Doing so will allow the selector ring to rest flush on the selector body. Insert the anti-rotation lug springs at the top and bottom of the selector body. Place the anti-rotation lugs over the springs.

Place the tungsten sleeve with the large diameter facing downward, on the center of the lock slide. Place the compression spring over the sleeve.

Install the selector ring retainer into the selector ring. Verify that the three non-threaded holes line up under the word CONNECT located on the selector ring. Depress the selector ring retainer into the selector ring until it is flush with the top of the selector ring. Hold the selector ring retainer firmly against the mounting plate until the 10-32 x 1¼ in screws are installed.

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[6] Unless otherwise noted, references to threadlocker apply to Loctite™ 242.

[7] Unless otherwise noted, references to lubrication (including lightly coated references) in this bulletin apply to the use of MIL-G-23827B (or C), MIL-PRF-23827C, (or equivalent radiation resistant grease authorized in writing by QSA Global, Inc.).

While firmly holding the locking mechanism against the mounting plate, turn the plate over to expose the back side of the mounting plate. Install the four 10-32 x 1¼ in socket head screws to secure the mechanism to the mounting plate. Torque the socket head screws to 30 in/lb (3.39 Nm) ± 5 in/lb (0.57 Nm) using a calibrated torque wrench.

h. Perform functional safety testing of the automatic securing and locking mechanism (see operations and maintenance manual MAN-027 for a more detailed description of performing the functional test.) Verify the securement action of selector mechanism by attempting to both push and pull an inactive source assembly out of the selector mechanism while in the EXPOSE, LOCK and CONNECT positions.

Rotate the selector mechanism back to the OPERATE position and push in the lock slide to ensure smooth operation and positive engagement. Attempt to push the lock slide towards the SECURED position to test for a positive engagement of the sleeve in the lock slide. If a smooth operation is not attained and/or the lock slide can be forced into the secured position by testing for positive engagement, disassemble and thoroughly re-inspect for faulty components.

Thoroughly inspect all components for rough edges, wear points, burrs, etc. which could cause jamming or irregular operation. Replace parts as necessary, re-lubricate and reassemble the selector assembly. Repeat the functional safety testing to verify smooth and safe operation of the selector mechanism. Do not install the serviced back plate (lock mechanism) module to the exposure device at this point.

i. Remove the front plate containing the outlet port mechanism from the empty Model 880 device by removing the four 5/16-18 x 1½ in socket button-head screws using the tamperproof tool bit mounted in a ratchet.

After removing the outlet port mechanism, clean the 'S' tube of the exposure device by pushing cloth swabs wetted with solvent through the 'S' tube until they come out clean. Use a dry cloth swab to remove any residual solvent from the 'S' tube after cleaning.

Clean the exterior of the Model 880 using a mild detergent solution to remove all dirt and grime. Visually inspect the package's stainless steel end plates for weld failures (cracks, etc.) on the locking mechanism and outlet port ends. Ensure the handle, the bottom contact surfaces and sides comprising the plastic jacket are intact. Check the bottom surfaces of the jacket to ensure the contact area is not excessively worn allowing contact of the stainless steel body with a flat work surface. Additionally, if dents to the device's body or flanges due to accidental drops are found during this inspection, contact QSA Global, Inc. to determine if repairs can be made to correct the damage.

If the label needs replacement due to illegibility, remove the old label from the package by using a number 30 drill-bit mounted in a hand drill. Remove the rivet heads used to fasten the label to the stainless steel body by drilling through the rivet head just enough to allow the rivet head to rotate freely. Remove all rivet heads to remove label. Install the replacement label and use a pop-rivet gun to secure the new 1/8 in x 3/16 in stainless steel rivets to secure the label to the package.

Disassemble the front plate (outlet port mechanism) by removing the set screw (or roll pin) from the outlet port cover. Discard the set screw. Unscrew the two socket head cap screws from the pivot disk. Remove and discard the two compression springs from the outlet port mechanism and replace with new springs.

Clean all parts in mineral spirits using a brush to dislodge all dust and dirt. Dry all components thoroughly. Do not lubricate, leave all components completely dry. Inspect for wear and burrs on the brass slider and rotor surfaces. Verify the tungsten port shield is not loose within the rotor. If the port shield is loose, remove the set screw, apply threadlocker (e.g., Vibratite™) and retighten the set screw against the tungsten port shield. If the port shield uses a roll pin, remove the roll pin and replace. Inspect the front plate's outlet port for wear and burrs where the source guide tube bayonet fitting engages.

Install new compression springs and assemble the outlet port mechanism. Apply threadlocker to the socket head cap screws before tightening. Apply threadlocker (e.g, Loctite™ 222), and install a new set screw to the outlet port cover.

After assembly of the front plate, perform the following safety function tests using a bayonet source guide tube fitting. Pull the outlet port cover and rotate clockwise 90 degrees. Movement should be smooth and limited to a clockwise 90 degree turn. Insert a bayonet fitting into the outlet port and rotate 90 degrees in a counter-clockwise direction. Insertion and rotation of the bayonet fitting should be smooth and without snags. Rotate the outlet port cover from a 3 o'clock position to a 5 o'clock position. This operation moves the rotor from the port shield position to a pass-through section of the rotor. Reverse the operation to disengage the bayonet fitting. Repeat the function test multiple times to ensure smooth operation.

j. Re-assemble the Model 880 package by performing the following steps:

1) Apply anti-seize thread lubricant (e.g., Permatex™ 81343) to the first several end threads of the back plate's (locking mechanism) four 5/16-18 x 1½ in socket button-head screws. Align and attach the locking mechanism assembly to the exposure device's end plate by installing the four 5/16-18 x 1½ in screws using a tamperproof tool bit mounted in a calibrated torque wrench. Torque the tamperproof screws to 110 in/lbs (12.43 Nm), ± 5 in/lb (0.57 Nm).

2) Operationally test the function of the entire system using a bayonet-fitting source guide tube, the remote controls and a mock source assembly. Attachment of the bayonet source guide tube to the outlet port must be smooth and without resistance. Rotate the outlet port mechanism to enable exposure of the mock source assembly.

3) Connect the remote controls to the mock source assembly connector and the device locking mechanism. Push the lock slide into the EXPOSE position and crank the control cable into the exposure mode. While cranking the mock source assembly from the package, carefully feel for resistance or snags. During retraction of the mock source assembly back into the package, carefully feel for any resistance or snags during movement. Conclude the test by verifying the lock slide automatically secures the mock source assembly. Action of the lock slide should be smooth with an audible 'snap' during automatic securing. After automatic securing, attempt to expose the mock source assembly from the package to confirm a positive capture. Repeat this testing several times. If resistance, snags or sluggish movement of the lock slide is discovered during this testing, remove the outlet port and locking mechanism plates to determine the cause. Repeat all safety function tests if any additional servicing is required.

4) If the package is operating normally, the mock source assembly can be removed from the package and an active source assembly loaded into the package.

k. Maintain records of this inspection and maintenance.