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DISPOSITION TYPE:	☐ **Design change**	☒ **Configuration change**	
SAFETY CLASSIFICATION:	☒ **SR** Safety Related	☐ **SS** Special Scope	☐ **NSR** Non-Safety Related
Special Scope Category:	☐ Fire Protection	☐ Quality Group D (augmented) systems	
	☐ Non-Category I Seismic and Seismic II/I	☐ Station Blackout	
	☐ ATWS Mitigation System Actuation Circuitry (AMSAC)	☐	
Non Special Scope Category:	☐ Security Systems / Plan	☐ Contains Safe Guards Information	
CORRECTIVE ACTION DISPOSITION CATEGORY:	☒ **Repair**	☐ **Rework**	☐ **Use as is** ☐ **Other** ☐ **N/A**

Prepared by	Bryan Sprock	Date	1-21-14
Reviewed by	Nikki Green Qualification Required for change package review	Date	
Approved	Bruce Huhmann	Date	
DOCUMENT CONTROL RELEASE:		**DATE:**	

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1. ENGINEERING CHANGE SUMMARY

ADCN CAR 201307879 documented a pinhole leak on the plant south manway of EEG01A. This modification will design and install a leak repair device that can be credited in Operability space.

The pinhole leak is located on a ASME Section III Class III 24 inch T-bolt closure designed by Tube Turns and given serial number 8616. The hub and head of the closure is SA516 Grade 70 with a nominal thickness of 0.5 inches and a 0.125 inch corrosion allowance.

The leak repair device will consist of square stock welded between existing hub nut mounts of a T-bolt closure. The square stock will be drilled and tapped to accept a threaded rod or bolt that will push a gasketed steel block over the pinhole leak. All materials will be procured safety-related and the resulting repair credited for maintaining pressure boundary at the pinhole leak location. The gasket will measure 1" x 1" such that it is engaging portions of the closure hub beyond the pinhole leak.

Upon restoration of the degraded condition to a Code-compliant condition, this Modification will be made non-functional and at least partially removed. The hub nut mount to swing nut weld, standoffs and crossmember may remain in place.

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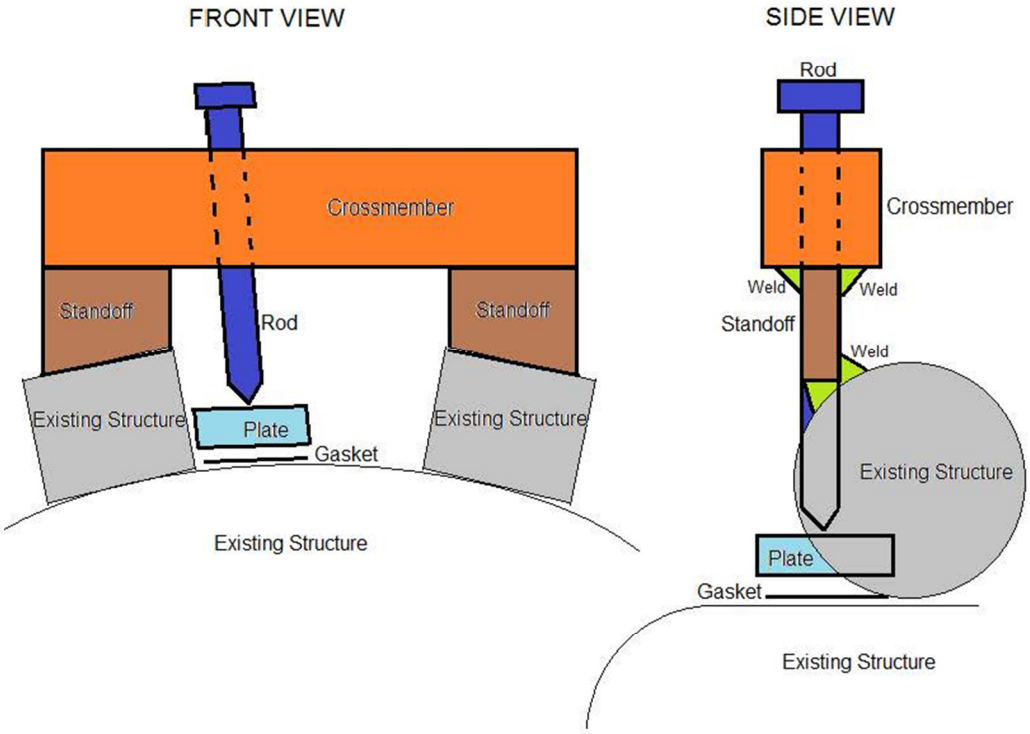

OBJECTIVE

Purpose

Reduce the leakage that must be assumed in assessing Operability of EEG01A with a pinhole leak on the plant south manway.

Scope

The scope of this modification is the pinhole leak identified in ADCN CAR 201307879 on EEG01A.

Initiating Document

RFR CAR 201309376 and ADCN CAR 201307879.

Background

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ADCN CAR 201307879 documented a pinhole leak on the plant south manway of EEG01A. In accordance with the operability guidance of RIS 2005-20 Rev.1, leakage from an ASME Code Class 1, 2, or 3 component must be volumetrically characterized in assessing the operability of the component. An area ½" in diameter cannot be volumetrically examined and was therefore assumed to fail when assessing the postulated leakage due to the through wall leak. This postulated leakage rate has significantly reduced the volume margin in the Ultimate Heat Sink (UHS).

This modification will design and implement a temporary leak mitigation device that can be credited in Operability space. This is a "repair" as defined in ANSI/ANS-3.2-1994 section 2.2 which defines a repair as: "The process of restoring a non-conforming characteristic to a condition such that the capability of an item to function reliably and safely is unimpaired, even though the item still does not conform to the original requirement".

This modification is a Compensatory Measure as defined in RIS 2005-20 Rev. 1 section 7.3 which in part defines a Compensatory Measure as an action that: "Maintain(s) or enhance(s) an operable but degraded or nonconforming SSC's capability to perform its specified safety function, or as the next logical step in support of corrective maintenance or to compensate for the degraded or nonconforming condition."

RIS 2005-20 Rev. 1 section C.11 states that: " The NRC expects that components be restored to ASME Code or Construction code acceptance standards by the end of the next refueling outage." Per RIS 2005-20 Rev. 1 section C.12: "..all such flaws in these components must be repaired in accordance with ASME Code requirements, or relief from ASME Code requirements must be requested of and approval obtained from the NRC."

While the structural integrity of the pinhole leak is determined herein to meet approved Code case N-705 (attached) with or without the repair device in place, the repair implemented via this modification does not meet Construction Code, nor does it comply with an NRC endorsed Code case. Additionally Code case N-705 may only be applied for a maximum of 26 months since discovery of the condition, which was October 14th of 2013 in this case.

2. ENGINEERING DISPOSITION

System Description and Configuration

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The Component Cooling Water (CCW) system transfers heat from numerous safety-related sources to the ESW system. EEG01A is the "A" train Component Cooling Water Heat Exchanger. CCW is circulated through the shell side of EEG01A and the cooler ESW is circulated through the tube side of the heat exchanger. The pinhole leakage is on the tube side of the heat exchanger thus any leakage results in a loss from the Essential Service Water (ESW) system and ultimately volume loss from the UHS.

Alternative Solutions Considered

Performing a temporary or permanent Code repair was considered. Engineering has been directed to prepare a temporary non-code repair option.

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3. DESIGN EVALUATION

Essential Design Inputs (Ref: APA-ZZ-00600)

The following table lists the design inputs identified in APA-ZZ-00600 that must be reviewed and evaluated for applicability to the proposed change.

Item No.	Design Input	Potentially Impacted?
1.	Basic functions of each structure, system and component.	(discussion required)
2.	Performance requirements such as capacity, rating and system output.	(discussion required)
3.	Codes, standards and regulatory requirements including the applicable issue and/or addenda.	(discussion required)
4.	Design and operating conditions such as pressure, temperature, fluid chemistry, and voltage; including normal and abnormal conditions.	(discussion required)
5.	Loads such as seismic, wind, thermal, dynamic, pressure, thermal expansion, thermal transients, anchor and support movement, and reactions of supporting lugs, rings, saddles or other types of supports.	Y
6.	Environmental conditions anticipated during storage, construction and operation (including postulated accident conditions) such as pressure, temperature, humidity, corrosiveness, site elevation, wind direction, nuclear radiation, electromagnetic radiation and duration of exposure.	N
7.	Interface requirements including definition of the functional and physical interfaces of structures, systems and components such as stiffness, electrical requirements (voltage, phase, conduit size), piping connections (size, schedule), etc., physical interfaces involving structures, systems and components, interface loads.	N
8.	Material requirements, including such items as compatibility, electrical insulation properties, protective coating and corrosion resistance.	(discussion required)
9.	Mechanical requirements such as vibration, stress, shock, and reaction forces.	Y
10.	Structural requirements covering such items as equipment foundations and pipe supports.	N
11.	Hydraulic requirements such as pump net positive suction head (NPSH), allowable pressure drop and allowable fluid velocity.	N
12.	Chemistry requirements such as provisions for sampling and limitations on water chemistry.	N
13.	Electrical requirements such as source of power, voltage, raceway requirements, electrical insulation and motor requirements.	N
14.	Layout and arrangement requirements including equipment access within the plant.	N
15.	Operational requirements under various conditions, such as plant startup, normal plant operation, plant shutdown, plant emergency operation, special or infrequent operation and system abnormal or emergency operation.	N
16.	I&C requirements including indicating instruments, controls and alarms required for operation, testing and maintenance. Other requirements such as the type of instrument, installed spares, range of measurement, interlocks, remote local control and location of indication should also be included.	N

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Item No.	Design Input	Potentially Impacted?
17.	Access and administrative control requirements for plant security and safeguards information.	N
18.	Redundancy, diversity and separation requirements of SSCs.	N
19.	Failure effects requirements of SSCs, including a definition of the events and accidents which they must be design to withstand.	Y
20.	Test requirements including in-plant tests and the conditions under which they will be performed. (Also discuss acceptance criteria.)	(discussion required)
21.	Accessibility, maintenance, repair & inservice inspection requirements for the plant including the conditions under which these will be performed.	Y
22.	Personnel requirements and limitations including the qualification and number of personnel available for plant operation, maintenance, testing and inspection and permissible personnel radiation exposures for specified areas and conditions.	N
23.	Transportability requirements such as size, shipping weight, limitations, and Interstate Commerce Commission regulations.	N
24.	Fire Protection or resistance requirements.	N
25.	Handling, storage, and shipping Requirements.	
26.	Other requirements to prevent undue risk to the health and safety of the public.	N
27.	Materials, Processes, Parts and Equipment Suitable for the Application. Discuss references to any design, procurement or fabrication specification.	N
28.	Safety requirements for preventing personnel injury, including such items as radiation hazards, volatile chemicals, restricting the use of dangerous materials, escape provisions from enclosures, grounding of electrical systems and including OSHA requirements.	N
29.	ALARA requirements. (Refer to ZZ-003)	N
30.	Special Installation Requirements (FME, etc.)	N
31.	Special Processes, including welding and painting.	Y
32.	Overpressure protection.	N
33.	Human factors.	N
34.	Reliability requirements.	N
35.	Requirements for criticality control and accountability of nuclear materials.	N
36.	EPRI Report NP-5479 should be consulted for all modifications involving existing or new check valves.	N
37.	Basis for selection of setpoints and setpoint margins. For safety related instruments, address the methodology for accounting for instrument uncertainties.	N
38.	Approval to cut reinforcing steel obtained from Civil Engineering Design prior to designating a required opening as a designed penetration.	N
39.	All non-grouted penetrations through safety related fire barriers given penetration numbers and updated on the M-2X and M-2Y drawings. All penetrations closures around field routed items though seismic block walls installed utilizing flexible materials per Note 4 of M-2Y001.	N
40.	Any attachment to a large motor or generator has been analyzed.	N

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Item No.	Design Input	Potentially Impacted?
41.	All designs which affect Motor Operated Valves (MOV) covered in Generic Letter 89-10 should have as a minimum the following design inputs reviewed: • Configuration changes which may affect DP determinations • Electrical changes which may affect degraded voltage, running current or other electrical or actuator characteristics of the MOV • Actuator changes in configuration which may affect valve loading	N
42.	The above should be done to ensure that original assumptions and design bases for 89-10 valves have not been affected.	N
43.	The ICES Database maintained by INPO should be reviewed for applicable Industry Operating Experience.	(discussion required)
44.	All Engineering Design Changes that may introduce a new failure mode or may affect a design function MUST include documentation of a Failure Modes and Effects Analysis. The level of effort and discussion should be commensurate with the potential impact of the change. For additional guidance on preparation of FMEAs, Refer To: • ZZ-006, Engineering Changes, Failure Modes and Effects Analysis Guidelines • INPO 92-014 Good Practice for Preventive Maintenance Program Enhancement • IEEE Standard 352 - "IEEE Guide for General Principles of Reliability Analysis of Nuclear Power Generating Station Safety Systems" • EDP ZZ 04056, Development and Configuration Management of Digital Plant Systems	(discussion required for design changes)
45.	Consider if the design change introduces or increases the potential for gas accumulation as described in the NRC Generic Letter (GL) 2008-01: "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems" and provide the necessary justification.	N
46.	Ensure compatibility of all petroleum-based products (i.e., hydraulic oil, grease, lubricants, etc.) with any SSC that will contain or interface with them. Review such items as gasket integrity, suitability of the product for the environment they will operate, material interactions, lubrication frequency, etc.	N
47.	EVALUATE impact of the design change on the reactor vessel embrittlement requirements, i.e., charpy upper – shelf energy and pressurized thermal shock screening criteria, and the P-T limit curves, including the effect of lower cold leg temperature or higher fluence.	N

Essential Design Input Discussion

1. Basic Function

EEG01A is a shell and tube heat exchanger that transfers heat from numerous safety and non-safety related loads to the Essential service water and ultimately the Ultimate Heat Sink. Component cooling water is circulated through the shell side of EEG01A and the cooling medium essential service water is circulated through the tube side of EEG01A.

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2. Performance and other requirements

The temporary repair must provide a credited pressure boundary for EEG01A in the vicinity of the pinhole leak. In order to be credited, a seal must be generated outside the area which could not be volumetrically characterized. The repair must allow for continued monitoring of the degraded condition. When the repair device is partially removed for UT, the reduction in postulated leakage due to MP 14-0002 obviously cannot be credited.

The repair device was evaluated in regards to Code case N-705 and it was determined that gasket stress should be limited to ensure margin remains in the N705 evaluation. The N705 analysis attached to this MP limited gasket stress to 1300 psi over the same 1" by 1" square gasket area. Therefore, the force applied at the pinhole leak is limited to 1300 pounds force. Gaskets performing best in this regime will likely be rubber material. EPRI Technical Report 1000922 "Assembling Bolted Connections Using Sheet Gaskets" concluded that assembly stresses for rubber gasket should be in the 400-900 psi range with 750 being a reasonable target. Garlock's current guidance for homogenous rubber is a minimum of 600 psi stress and a maximum of 900 psi for Shore A durometer of less than 70, and a maximum of 1200 psi for durometer 70 or greater. EG-57 determined 224 in-lbs was necessary to generate 2800 psi stress. By ratioing 600, 900 and 1200 pounds to EG-57's 2800 pounds, the torque to generate 600 psi is 48 in-lbs, to generate 900 psi is 72 in-lbs, and for 1200 psi is 96 in-lbs.

3. Codes and Standards

EEG01A is an ASME Section III Class III vessel. This temporary repair is a non-Code repair thus Code requirements are not incorporated into this design. Code case N-705 does not disallow the use of non-Code repairs to reduce leakage.

4. Design and Operating Conditions

The leak being stopped is on the tube side of EEG01A. The design pressure and temperature are 200 psi and 200°F respectively per M-072-00022 Rev. 001. All materials selected herein are acceptable for these service conditions. EEG01A is located in a mild environment thus the design temperature and pressure are adequate parameters for the design of the temporary repair device.

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5. Loads and Reactions

Calculation EG-57 Rev. 000 has calculated very conservative bounding loads and reactions based upon a 4200 pound point load versus the N705 limiting load of 1300 pounds. All materials selected have tensile strength in excess of the calculated loads. Additional load on existing structures was also calculated and found acceptable in EG-57 Rev. 000.

The application of up to 1300 pounds at the pinhole leak location will not create any significant deflection. The closure hub has a bevel on the end to act as a seating surface for the closure O-ring. The direction of the bevel is such that any deflection will immediately start to transfer load to the closure head and thereby the remainder of the closure structure which is very rigid due to the dished head design and short hub length.

The "Code acceptable" structural integrity of the degraded heat exchanger both with and without the temporary leak repair device installed is documented in accordance with Code case N-705 which is attached to this MP. Therefore the N-705 Code case ensures acceptable structural integrity of the degraded component even when the gasketed plate is removed during UT to monitor degradation as well as when the leak repair device is fully installed.

Calculation EG-57 stresses are shown in the table below. The table also shows that selected materials are of adequate strength to resist the loads imposed.

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Loads and Material Strength Table

Item	EG-57 Stress	Size	Material chosen	Material Strength	Comments
Existing hub nut mount to hub welds	-11,969 psi	NA	Existing base materials are SA-106 Gr B and SA-515- GR 70.	Tensile strengths are 60,000 psi and 70,000 psi respectively for base material ensuring weld strength is at least 60,000 psi	Material strength is not exceeded
New hub nut mount to swing nut welds	13,560 psi	1/8" minimum crossection	Hub nut mounts are SA-106 Gr B and the swing nuts are A325 or A193 Gr B7 material	Tensile strength is 60,000 psi for the SA-106 Gr B. Any weld filler selected will exceed the calculated stresses.	Material strength is not exceeded
Standoffs	18,641 psi	½" thick, 1.5" wide and not greater than 1.5" high	SA-36	36,000/ 58,000 psi	Material strength is not exceeded
Crossmember	15,456 psi	1.25" square bar by ~9" overall length	SA-36	36,000/ 58,000 psi	Material strength is not exceeded
Crossmember threads	3105 psi shear	Entire 1.25" thickness of bar is threaded	SA-36	36,000/ 58,000 psi	Material strength is not exceeded
Rod	26,271 psi	½" diameter by 20 threads per inch	A-193 B7	125,000 psi minimum tensile strength	Material strength is not exceeded
Plate	11,683 psi	5/8" thick by 1.25" height and width	SA-36	36,000/ 58,000 psi	Material strength is not exceeded

8. Material Requirements

For optimum sealing a soft gasket should be used due to the slight curvature of the manway hub and roughness in the area of the pinhole leak. In order to meet the low load requirements of N705, rubber is the first choice of materials. Other gasket materials may be used provided they meet temperature and pressure requirements, compatibility, will not compress below the recess in the face of the gasket plate, and will seal with a load not exceeding 1300 pounds. The gasket may be adhered to the gasket plate with a quick drying gasket adhesive (e.g. 3M Super 77 MIN 6371763) to enhance gasket stability. The gasket material, as with all the materials in use for this MP will be procured safety-related.

The threaded rod will be carbon steel or an alloy steel. All other structural components of this temporary closure will be carbon steel per the table above.

9. Mechanical Requirements

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The temporary repair structure has been evaluated to determine the mechanical loads as documented in item 5 above. The temporary repair device has been evaluated for loads in excess of that allowed by the N705 evaluation load of 1300 pounds.

Calculation EG-57 Rev 000 determined that the temporary repair device is seismically rigid with a natural frequency much greater than 33 hertz.

19. Failure Effects

The temporary repair device must meet all the events and accidents for which EEG01A is designed. The forces, including seismic loading, have been calculated in EG-57 and the strength requiremements incorporated into this design.

The potential failures of the temporary repair device include threaded fastener failure, gasket failure, and failure of the welds that hold the device together and attach it to the hub of the closure. The Plant North end cover for this heat exchanger already relies upon threaded fasteners to load a gasket and prevent leakage. Likewise there are numerous existing welds that woud result in leakage should they fail. It is therefore concluded that every one of these failure modes already exist within the current design and the effect of the failure is unchanged when applied to the temporary repair device – a leak.

20. Test Requirements (PCTP) including acceptance criteria

Testing and acceptance criteria are provided in the PCTP. The post change testing consists of an Engineering review of "critical" dimensions that ensure EG-57 Rev 000 is bounding before loading the temporary repair device. The acceptance criteria is given in the PCTP. An In-service Leak Test will be performed post installation.

21. Accessibility

A portion of this temporary modification will have to be removed for periodic inspection of the degraded pinhole location. Accessibility was discussed with those that will be doing the inspection and ample access is available when the rod and gasket plate are removed to facilitate the inspection.

If the nub nut mount to swingnut welds are left in place, the two affected swingnuts will no longer swing out to the way to facilitate quick head removal. The only impact will be the necessity of completely backing out

the hold down bolt rather than just loosening it and swing it out of the way to remove the closure head during maintenance. Should the standoffs and crossmember remain in place there is no impact on accessibility due tho them remaining in place.

31. Special Processes

Welding will be in accordance with applicable Callaway procedures and the ASME Section XI Code.

43. Operating Experience (External and Internal)

CARS system Review over the past 10 years reveals that there have been many pinhole leaks in the ESW system. This pinhole leak developed from a degraded area that had been noted in a prior heat exchanger inspection. Raw water corrosion of carbon steel piping systems is not unexpected.

INPO

An ICES search utilizing "Temporary" and "leak repair" resulted in 236 Operating Experience items. Only #306638 seemed relevant. The incident involved an attempt to use a soft material to stop a small through-wall leak that was unsuccessful and an encapsulation was ultimately installed to stop the leak. The leak was near a weld joint of an elbow and flange. Due to the location of this leak, there is confidence that the temporary repair device will be successful.

Hazards Review

Question # 4 "Seismic" was answered "yes" because a seismic component is being modified. The weight and seismic forces anticipated for this temporary repair is less than 10 pounds and less than 50 pounds static equivalent force. The flooded weight of the heat exchanger is greater than 200,000 pounds. The heat exchanger is therefore not adversely affected. The temporary structure added is rigid per EG-57 Rev 000 and has been designed to meet the bounding conditions of EG-57 Rev. 000.

Question # 10 "ALARA" was answered "yes" because work will take place in the RCA. The work will be on a non-contaminated system and in a low dose area. Normal work and RP planning is sufficient for installation of this MP.

Programs Review

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Questions # 12 & 13 were marked "yes" because a "Maintenance Rule" component is being modified. However neither the Maintenance Rule nor the "Equipment Reliability" program is affected and component reliability is not reduced.

Operational and Design Margin

With the modification in place, design margin is increased over the current degraded condition because the temporary repair can be credited for leak mitigation restoring UHS volume margin. There is no effect on the operation of EEG01A or any other SSC whether the remporary repair is installed or not. Thus it can be concluded that there is no effect on operational margin.

When the temporary repair is partially removed for regular inspection of the pinhole leak location, the plant cannot credit the leak reduction provided by the temporary repair.

Design Basis, ULDBD Review

The CCW Heat Exchanger EEG01A transfers all heat absorbed by the CCW system to the ESW system and is listed as "Mission Critical" in the ULDBD. EEG01A is safety-related and thus seismic category I. The heat exchanger is located in a mild environment. EEG01A serves the following passive functions per Director:

- Transfers heat from Emergency Safety Features systems during LOCA and MSLB
- Provides safety-related cooling for normal operation and during shutdown
- Provides cooling to RCP thermal barriers to preclude seal failure

WCNOC Applicability

Does not apply.

5. FIELD WORK

NOTE: There are numerous "critical" dimensions that must be verified by Engineering to ensure the final installation is within the bounds of calculation EG-57 Rev 000. Engineering should be closely consulted as the repair device is being fabricated and installed to ensure final design is acceptable.

General steps:

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1. Cut a piece of 1-1/4" square stock 5/8" (+1/16", -0/16") thick and machine gasket recess and drill centering pocket per sketch.
2. Drill and tap a length of 1-1/4" square crossmember at a 4° angle per attached sketches to accept ½" by 20 TPI threaded rod. Drill hole should be precisely centered front-to-back in the square crossmember.
3. Machine flat spot at corresponding 4° angle for jam nut fitup.
4. Cut standoffs and machine/fit them up in the field to keep the crossmember and thus the rod centered over the pinhole leak. The longest edge of the standoff should not exceed 1-1/2" to stay within current stress analysis.
5. Cut ½" x 20 TPI threaded rod and machine tip to an inclusive angle 10 degrees less than that of the centering pocket. (This ensure the tip will bottom in the centering pocket even with some misalignment). Slightly radius the tip to fit the bottom of the centering pocket in the plate.
6. Weld ½" x 20 TPI hex nut to opposite end of threaded rod.
7. Weld standoffs to crossmember. Standoffs should be precisely centered on and perpendicular to the face of the square crossmember they are welded to.
8. Weld the hub nut mount to the swing nuts on the two affected hub nut mounts as shown in attached sketches.
9. Remove paint in the area surrounding the pinhole leak where the gasket will contact the closure hub.
10. Weld crossmember and standoffs to the hub nut mounts maintaining the pointed rod tip centered over the pinhole leak. (Final location of rod tip should be within 3/32" of pinhole leak center upon final assembly and rod must be within 3 degrees of perpendicular to the closure hub surface).
11. Thread a jam nut on to the threaded rod and thread rod into crossmember.
12. Cut and attach a piece if 1" wide by 1" long gasket material to fit the recessed side of the gasket plate. Use an approved adhesive to adhere the gasket to the gasket plate.
13. Place gasketed plate over the pinhole leak and hold it from rotating while the threaded rod is torqued. Tighten the rod to an initial torque of 48 in-lbs if using a rubber gasket. If leakage persists, continue to increase the torque in 12 in-lb increments until leakage stops. **DO NOT EXCEED 96 in-lbs**. During torquing, stop if any leakage occurs at the closure head O-ring fit or excessive gasket bulging occurs (rubber gasket material concern only). Record final torque.
14. Lightly tighten the jam nut on the threaded rod.

Planned FCNs

An FCN will revise design documents once this modification is no longer needed to reflect the as-left condition of EEG01A. Additionally, an FCN will be processed if

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the final field fitup of the repair device does not confirm to the conceptual design used formulating EG-57 Rev 000 and requires revision to EG-57.

6. CONFIGURATION CONTROL

Documentation Updates (Drawings, Calculations, Manuals, Procedures)

Drawing M-072-00001 will be revised to reflect installation of the leak repair modification. Once removed, either completely or partially, the same drawing will be revised via FCN.

Design Integration – (review open mods for potential overlap/impact)

No additional mods were identified that are impacted by MP 14-0002

Equipment Database (Director) Updates

None.

Preventative Maintenance (PM) Changes

None.

Procurement/Warehouse Changes (Parts Q List)

None.

7. REFERENCES

Documentation References:

M-072-00001 Rev 018
M-072-00022 Rev 001

Equipment Database Component References:

EEG01A

8. COORDINATION

This design has been coordinated with input from planners, construction supervisors and craft personnel.