

INCOMING INSPECTION REPORT

MS6001FA (GE Frame 6FA) Combustion Liner MNQC — Complete Set

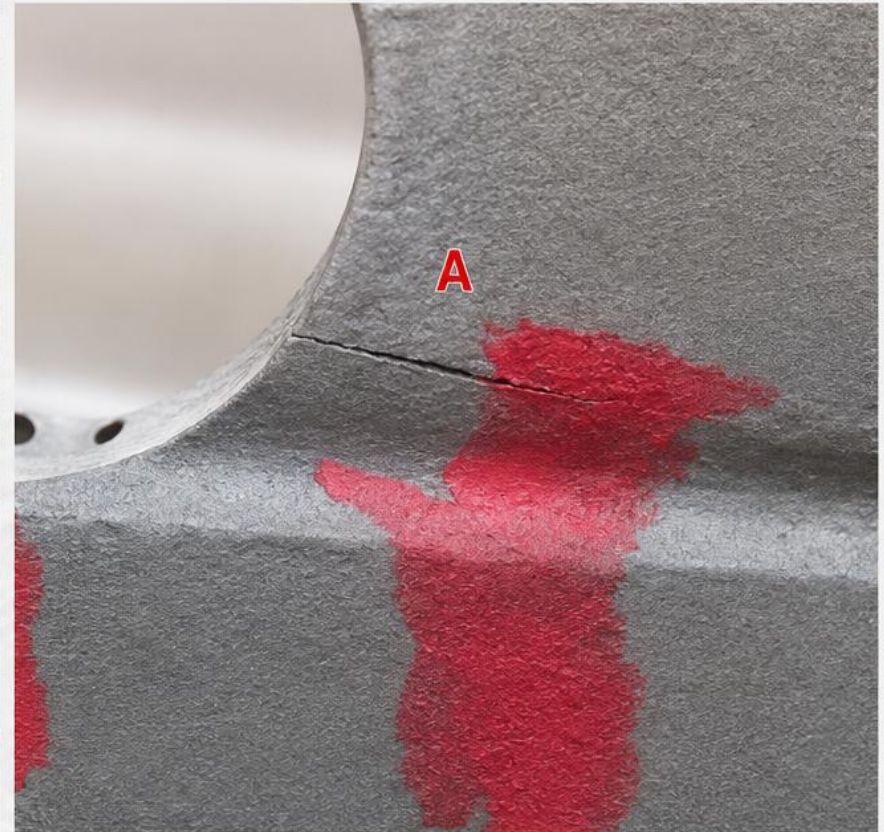
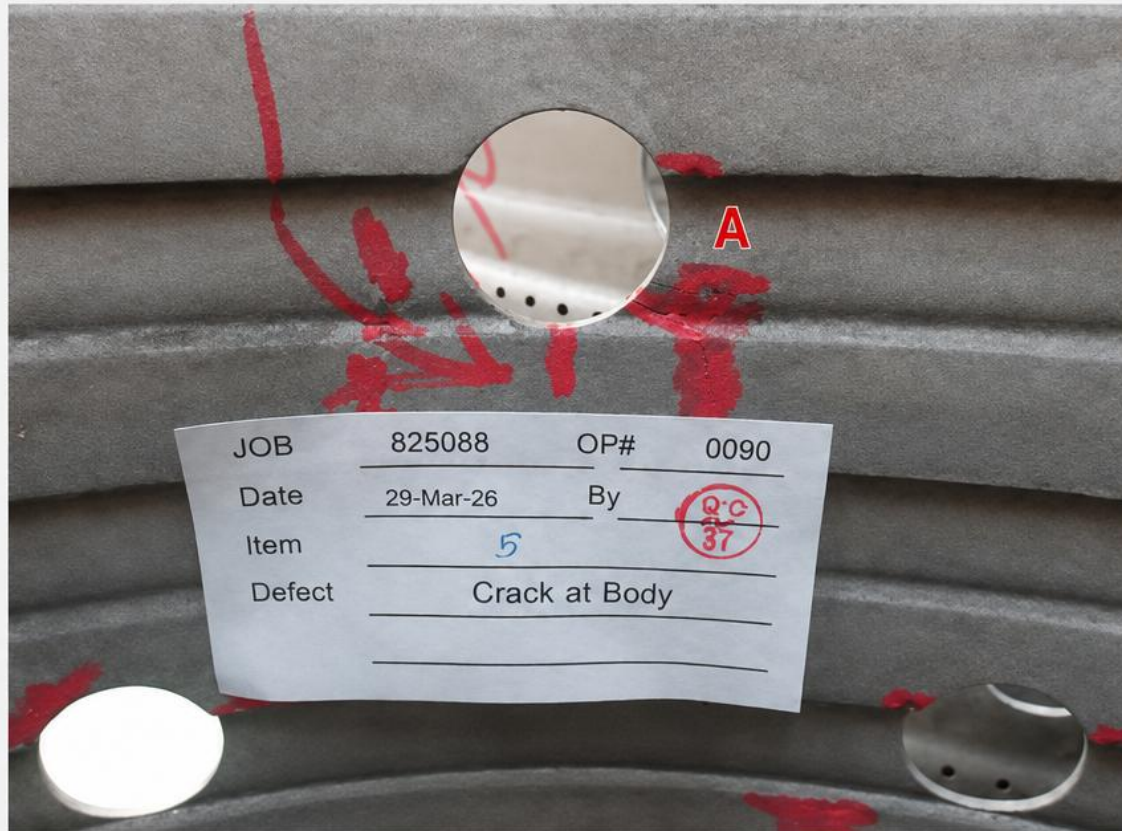
Customer	Nghi Son Refinery & Petrochemical, LLC.	Report Date	27 April 2026
Customer P.O. No.	WO1003946086	UNEW Work Order	825088
Engine Type	MS6001FA (GE Frame 6FA)	Component	Combustion Liner MNQC
Component Part No.	119E9620G001	Qty. Received	6 units (1 complete set)
Primary Material	Hastelloy-X (body, cowl cap, end ring, floating collar, liner stop)	Other Materials	Haynes 188 (crossfire collar); Inconel X-750 (spring seal / hula skirt); SS304 (collar retainer)
As-Received Coating	TBC coating, inside body and inside cowl cap (primary fuel nozzle collar and center bore)	Coating Requirement	Chrome Carbide (hula skirt) + MCrAlY bond coat and Class C TBC (internal surface)
Repair Classification	HEAVY REPAIR	UNEW Repair Severity	Level 9 of 10 (upper boundary of Level 9)
Total Initiated Starts	476	Total Emergency Trips	125
Breaker Trips at Load	127	Incoming Disposition	Repairable under Heavy Repair scope only

Reviewed and approved
UNEW Engineering



Paul McGuire
Engineering Manager

FIG. 11 — LINER BODY CRACK (ITEM 5)



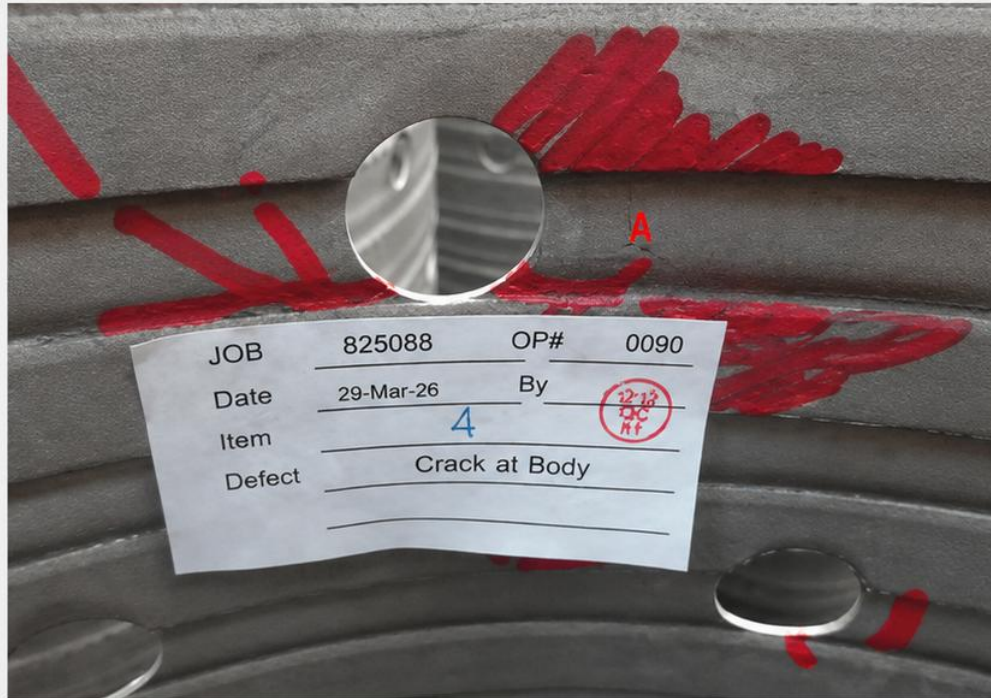
MAGNIFIED VIEW A

DOCUMENTED CRACK SIZE: 2–4 mm

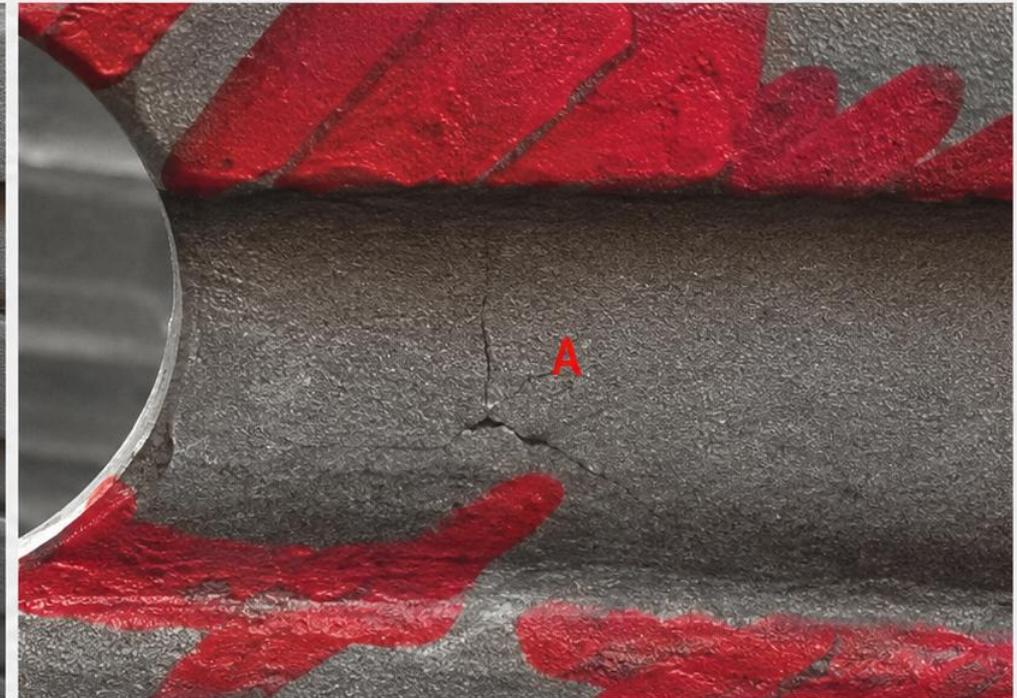
HEAVY REPAIR BASIS

Crack is located in a high-temperature combustion zone and extends beyond surface level.
Complete excavation and GTAW weld reconstruction are required; local blending is not acceptable.
Repair severity is determined by defect location and required restoration scope, not crack length alone.

FIG. 12 — LINER BODY CRACK (ITEM 4)



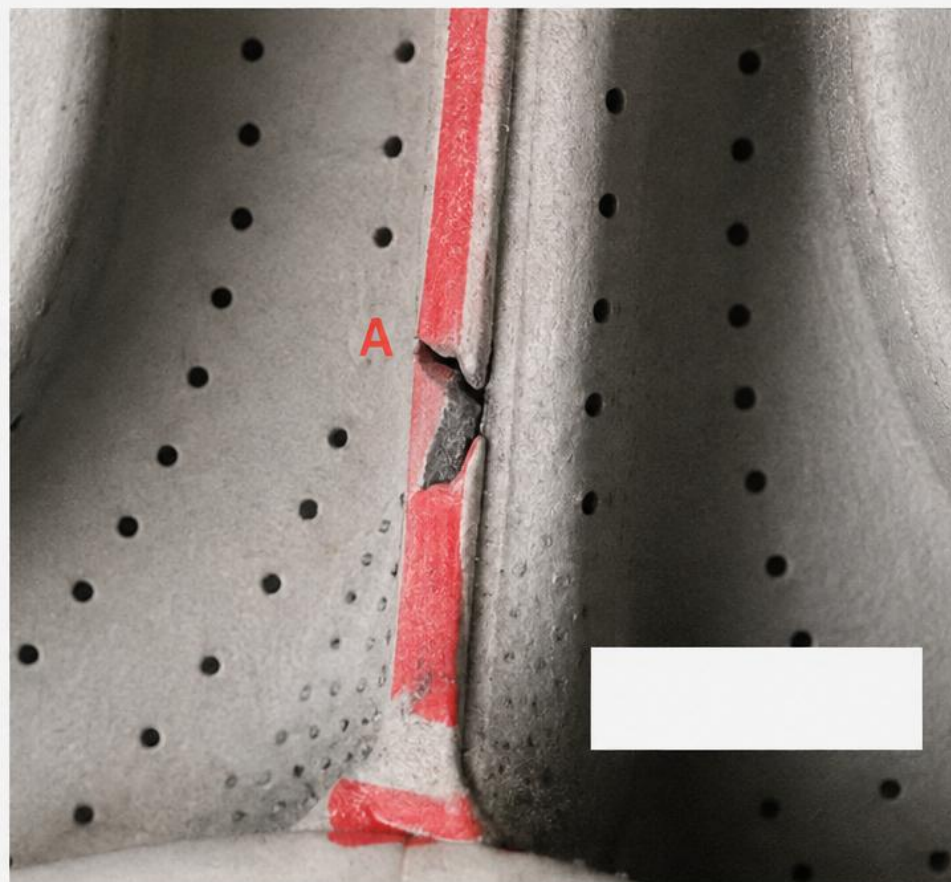
DOCUMENTED CRACK SIZE: 2–4 mm
HEAVY REPAIR BASIS



MAGNIFIED VIEW A

Crack is located in a high-temperature combustion zone and extends beyond surface level. Complete excavation and GTAW weld reconstruction are required; local blending is not acceptable. Repair severity is determined by defect location and required restoration scope, not crack length alone.

FIG. 16 — COWL CAP CRACK (ITEM 5)



MAGNIFIED VIEW A

DOCUMENTED CRACK SIZE: 2 mm

HEAVY REPAIR BASIS

Although limited in length, the crack is located on the cowl cap in the combustion zone.

Complete excavation and GTAW weld reconstruction are required; local blending is not acceptable.

Repair severity is determined by defect location and required restoration scope, not crack length alone.

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1. EXECUTIVE SUMMARY

UNEW received six (6) MS6001FA Combustion Liner MNQC assemblies, P/N 119E9620G001, from Nghi Son Refinery & Petrochemical, LLC. for incoming inspection under Customer P.O. WO1003946086 and UNEW Work Order 825088. The quantity received is one complete combustion liner set.

The incoming inspection recorded body cracking on 6 of 6 liners, body corrosion on 6 of 6 liners, end ring roundness REJECT on 6 of 6 liners, spring seal diameter REJECT on 6 of 6 liners, liner body roundness deviation on 6 of 6 liners, fretting at the sealing and fit-up interfaces across the set, and coating system degradation requiring full strip and recoat on 6 of 6 liners. Each of these findings is recorded as a per-item disposition in Section 7 and as a measured result in Section 6.

The repair classification is HEAVY REPAIR, UNEW Repair Severity Level 9 of 10. The classification is controlled by the recorded pass/fail inspection dispositions and by the restoration scope those dispositions require. It is not based on narrative description, adjectives, or repair preference. Section 2 lists the controlling findings; Section 3 records why the Standard / Medium Repair definition cannot be met by this set; Section 10 records how the findings map onto the ten-level classification.

The set sits at the upper boundary of Level 9. Level 10 is reserved for components at the reparability limit where a non-repairable disposition is under review. No liner in this set reached that limit, and no scrap is recommended at the incoming stage. The set remains repairable, but only under the full Heavy Repair scope defined in Sections 8 and 11.

2. CLASSIFICATION CONTROL SUMMARY

The following recorded findings control the repair classification. They are inspection dispositions taken from the parts as received, recorded in the per-item findings matrix (Section 7) and the dimensional inspection record (Section 6). Where a narrative description and a recorded disposition could be read differently, the recorded disposition governs.

Control Item	Recorded Result	Required Action	Technical Significance
Liner body cracking	6 of 6 liners	Crack excavation and GTAW weld reconstruction	Cracks of 2–4 mm recorded in high-temperature zones extend beyond surface level; removal and weld rebuild is required, not local blending.
Body corrosion and oxidation	6 of 6 liners	Blend and weld build-up as required	Internal combustion surfaces show corrosion and coating-interface degradation requiring controlled removal of affected material and local restoration.

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Control Item	Recorded Result	Required Action	Technical Significance
End ring roundness	REJECT — 6 of 6 liners	Dimensional restoration	Full-set pass/fail rejection on an assembly-fit feature.
Spring seal diameter	REJECT — 6 of 6 liners	Dimensional restoration / hardware replacement	Full-set pass/fail rejection on a sealing and liner-stability feature.
Liner body roundness (F)	Recorded 5.85–6.47 mm, 6 of 6 out of limit	Cold press and reshape	Body geometry must be corrected before fit-up verification and coating.
Fretting at sealing / fit-up interfaces	Recorded across the set (per-item record, Section 7)	Hardware replacement, blend repair of mating surfaces, weld repair where required, fit-up verification	Damage affects sealing, location, fit-up, and combustion stability.
Coating system	6 of 6 liners	Full strip and recoat	Existing TBC / bond coat system requires removal; MCrAlY bond coat, Class C TBC, and Chrome Carbide (hula skirt) must be applied.
Inspection, heat treatment, and release control	Full set	Repeated FPI/NDT, ultrasonic wall-thickness verification, dimensional requalification, post-weld heat treatment	Required as a consequence of full-set weld reconstruction and dimensional restoration.

Any one of the full-set pass/fail rejections above requires restoration beyond routine refurbishment. The classification in this report reflects all of them occurring on the same set at the same time.

3. STANDARD / MEDIUM REPAIR APPLICABILITY REVIEW

The table below places the definition of Standard / Medium Repair (UNEW Levels 4–7) against the recorded condition of this set. Each row is decided by the inspection record, not by description.

Condition required for Standard / Medium Repair	Recorded condition of this set
Localized wear or limited blending only	Body cracking, body corrosion, fretting, geometry deviation, dimensional rejection, and coating degradation are recorded across the set (Section 7).

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Condition required for Standard / Medium Repair	Recorded condition of this set
No full-set pass/fail dimensional rejection on critical fit-up features	End ring roundness and spring seal diameter are recorded REJECT on 6 of 6 liners (Section 6).
No major structural weld reconstruction	Cracks of 2–4 mm require full excavation and GTAW weld reconstruction on the liner body; a cowl cap crack is recorded on Item 5.
Coating removal and recoat without substrate restoration	Coating-interface degradation and corrosion require controlled removal of affected material and local restoration before the coating system can be rebuilt.
Standard inspection and final QA only	The repair route requires repeated FPI/NDT, ultrasonic wall-thickness verification, dimensional requalification, post-weld heat treatment, and final acceptance.

Each condition required for a Standard / Medium classification is contradicted by a recorded finding. Standard / Medium Repair is therefore not technically applicable to this set. The governing disposition is Heavy Repair.

4. COMPONENT AND OPERATING HISTORY

Component	MS6001FA Combustion Liner MNQC
Part Number	119E9620G001
Quantity	6 units (1 complete set)
Body / Cowl Cap / End Ring / Floating Collar / Liner Stop	Hastelloy-X
Crossfire Collar	Haynes 188
Spring Seal / Hula Skirt	Inconel X-750
Collar Retainer	SS304
As-Received Coating	TBC coating inside body and inside cowl cap (primary fuel nozzle collar and center bore)
Total Initiated Starts	476
Manually Initiated Starts	468
Fired Starts	180
Total Emergency Trips	125
Breaker Trips at Load	127

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The operating counters supplied with the set record a high cyclic loading profile: 476 initiated starts against 125 emergency trips and 127 breaker trips at load. This ratio of trips to starts increases the engineering risk applied to fatigue cracking, fretting progression, coating distress, and every acceptance decision in the repair route.

Complete maintenance interval and fuel-condition trend records were not available for this incoming report. The disposition in this report is therefore based on the physical inspection findings, the recorded dimensions, the material evaluation, and the operating counters supplied above.

5. INCOMING INSPECTION FINDINGS

5.1 Structural Cracking — Liner Body and Cowl Cap

Visual inspection and fluorescent penetrant inspection (FPI) recorded body cracking on all six liners. Cracks of 2 to 4 mm are located in high-temperature combustion zones and extend beyond surface level. The recorded disposition is Weld and Blend (WB) on 6 of 6 liners: cracked material must be fully excavated and reconstructed by GTAW weld repair. A 2 mm cowl cap crack is recorded on Item 5, and one floating collar crack is recorded on Item 5. These findings cannot be corrected by local blending.

5.2 Internal Corrosion, Oxidation, and Coating Interface Condition

Corrosion and coating-interface degradation are recorded on the internal combustion surfaces across the set (disposition B/WB on 6 of 6 liners). General wall-thickness readings were recorded as ACCEPTABLE at the incoming stage. These two records are consistent and both stand: the acceptable wall-thickness result means the liners are not classified as scrap; it does not remove the Heavy Repair requirement, because the surface condition, the cracking record, the coating breakdown, and the full-set dimensional rejections control the repair level independently of wall thickness. Localized areas of corrosion-affected material require controlled removal and local weld build-up before coating, with ultrasonic wall-thickness verification repeated after repair.

5.3 Fretting and Fit-up Condition

Fretting and wear are recorded at the sealing and fit-up interfaces. The per-item record (Section 7) shows: spring seal wear on 6 of 6 liners; collar retainer wear on 6 of 6 liners; floating collar wear on 6 of 6 liners (six collars per liner); crossfire collar fretting recorded across the set (two collars per liner); and liner stop wear on 4 of 6 liners (Items 1, 3, 5, 6). These locations are sealing, location, and fit-up features; damage at these features carries a higher severity weight than the same damage at a non-critical area.

The repair route at these interfaces is: replacement of the wear hardware itself with new parts (Section 8), blend repair of the liner-side mating surfaces to the location blend limits, weld repair where blend limits would be exceeded, and dimensional fit-up verification. The Heavy Repair

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classification is not based on fretage alone; fretage is one of the controlling findings recorded in Section 2.

5.4 Geometry and Dimensional Rejection

End ring roundness and spring seal diameter are recorded REJECT on all six liners. Liner body roundness (F) is recorded at 5.85 to 6.47 mm, out of limit on all six liners, requiring cold press correction. These are objective pass/fail results against fixed acceptance limits. They independently require full-set dimensional restoration.

5.5 Coating System Restoration

The internal coating system requires complete removal and reapplication on all six liners. The coating route is: abrasive blast and surface preparation, MCrAlY bond coat by APS, Class C TBC on internal gas path surfaces by APS, and Chrome Carbide hard coating on the hula skirt wear area by APS. Coating is performed only after structural and dimensional repair is complete and accepted.

6. DIMENSIONAL INSPECTION SUMMARY

Key dimensional findings are summarized below. The full measurement record is given in Section 6.1 and the measurement positions are defined on the reference drawing in Section 14.

Inspection Parameter	Result	Status	Repair Meaning
Liner Body Roundness (F-Roundness)	5.85 to 6.47 mm across all 6 liners	OUT OF LIMIT	Body distortion requiring cold press correction.
End Ring Roundness	6 of 6 liners	REJECT: 6/6	Dimensional restoration required before assembly.
Spring Seal Diameter	6 of 6 liners	REJECT: 6/6	Directly affects sealing effectiveness and liner stability.
Crossfire Collar ID	All 12 collars within limits	ACCEPTABLE	Baseline record; collar wear hardware is still replaced per Section 8.
Wall Thickness	General measurements within acceptable limits at incoming stage	ACCEPTABLE	Does not remove the Heavy Repair classification: cracking, surface corrosion, coating breakdown, and the full-set dimensional rejections control the repair level (see 5.2). Re-verified by ultrasonic inspection after repair.

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Inspection Parameter	Result	Status	Repair Meaning
Liner Body Length (Y1, Y2, Y3)	Y1: 47.67–48.11 mm; Y2: 47.65–47.99 mm; Y3: 39.15–39.75 mm	RECORDED	Baseline reference for post-repair dimensional verification.
Outer Diameter (E)	392.50 to 393.60 mm across all 6 liners	RECORDED	Baseline reference for post-repair dimensional verification.

6.1 Detailed Dimensional Measurement Record (unit: mm)

ITEM	A1	A2	A3	A4	A5	A6	G	H	B1	B2
1	64.66	64.68	64.59	64.63	64.47	64.59	127.81	9.85	52.58	52.73
2	64.5	64.57	64.58	64.51	64.51	64.66	127.71	9.85	52.7	52.65
3	64.51	64.72	64.5	64.58	64.61	64.58	127.75	9.99	52.44	52.35
4	64.68	64.75	64.6	64.61	64.55	64.59	128.01	9.89	52.48	53.2
5	64.5	64.63	64.6	64.6	64.55	64.52	127.72	9.98	52.49	52.63
6	64.63	64.57	64.63	64.62	64.5	64.48	128.06	9.86	52.68	52.46

ITEM	C1	C2	D1	D2	D3	Z1	Z2	Z3	F	F-rnd
1	1.61	1.63	8.55	8.61	8.57	41.00	40.73	40.73	383.72	6.24
2	1.57	1.65	8.51	8.59	8.60	41.15	40.72	40.72	381.88	6.47
3	1.55	1.63	8.53	8.58	8.57	41.17	41.04	41.04	382.01	6.17
4	1.60	1.62	8.61	8.61	8.58	41.23	41.24	41.24	382.69	5.98
5	1.60	1.63	8.56	8.56	8.57	41.14	41.46	41.46	381.16	6.21
6	1.51	1.54	8.53	8.55	8.53	41.26	41.17	41.17	381.59	5.85

ITEM	E	Y1	Y2	Y3	Z1	Z2	Z3
1	393.20	47.79	47.82	39.61	41.28	41.47	40.85
2	393.30	48.11	47.90	39.75	41.36	41.25	40.94
3	393.60	47.67	47.65	39.50	41.11	41.21	41.05
4	393.10	47.75	47.99	39.22	41.58	41.33	41.05
5	392.50	47.71	47.68	39.21	41.53	41.20	41.40
6	392.90	47.81	47.80	39.15	41.52	41.49	41.26

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7. PER-ITEM INSPECTION FINDINGS MATRIX

Per-item inspection findings and dispositions are summarized below. This matrix is the single controlling record of per-item dispositions in this report. Disposition codes are defined below the matrix.

Inspection Feature	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6
Body cracking	WB	WB	WB	WB	WB	WB
Body corrosion	B/WB	B/WB	B/WB	B/WB	B/WB	B/WB
Spring seal wear	B	B	B	B	B	B
Liner stop wear	B		B		B	B
Cowl cap cracking					WB	
Collar retainer wear	B	B	B	B	B	B
Floating collar wear (qty 6 per liner)	B	B	B	B	B	B
Floating collar cracking					WB (1)	
End ring roundness	REJ	REJ	REJ	REJ	REJ	REJ
Spring seal diameter	REJ	REJ	REJ	REJ	REJ	REJ
Crossfire collar ID (2 per liner)	ACC	ACC	ACC	ACC	ACC	ACC
Wall thickness	ACC	ACC	ACC	ACC	ACC	ACC

Disposition codes: B = Blend repair in accordance with the location blend limits. WB = Weld and Blend based on the area limits and defects detected. WM = Weld and Machining to restore original dimensions and contours. JK = Jacking / contour correction based on the deformation detected. R = Replace with new. ACC = Acceptable as recorded. REJ = Dimension unacceptable, requiring repair or repairability review. S = Non-repairable / scrap.

Reading the matrix against the repair classification: disposition codes record the local repair method for each inspection feature; they do not set the repair classification of the set. Blend (B) dispositions at the fretage locations apply to the liner-side mating surfaces; the mating wear hardware at those same locations — end rings, spring seals, crossfire collars, liner stops, floating collars, collar retainers, and cowl cap rivets — is replaced new per Section 8. The classification is set by the combined recorded scope: full-set weld reconstruction (WB on 6 of 6), full-set dimensional rejection (REJ on 6 of 6 for two features), full-set geometry correction, full-set hardware replacement, and full-set coating restoration occurring together. No individual code, read alone, represents the repair level of the set.

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8. REPLACEMENT HARDWARE AND REPAIR REQUIREMENTS

Item	Part Description	Required Quantity	Condition	Remark
1	End ring	6/6	Replace	In scope
2	Spring seal (hula skirt)	6/6	Replace	In scope
3	Crossfire collar	12/12	Replace	Additional
4	Liner stop	18/18	Replace	Additional
5	Floating collar	36/36	Replace	Additional
6	Collar retainer	36/36	Replace	Additional
7	Cowl cap rivet	72/72	Replace	Additional

Wear-exposed hardware is replaced new across the complete set. The corresponding liner-side mating surfaces are restored by blend or weld repair to the applicable limits and verified dimensionally at fit-up (Section 7 note).

Repair requirements

DESCRIPTION	QTY	UNIT
Incoming inspections	1	set
Heavy Repair	1	set
Chrome Carbide coating to hula skirt and Class C TBC internal surface	1	set

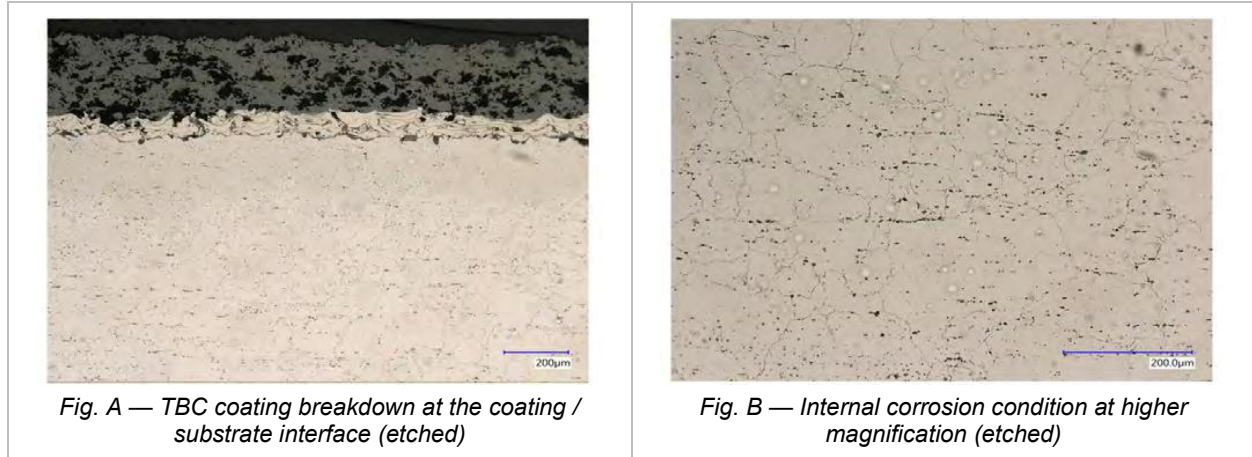
9. MATERIAL EVALUATION AND REPAIRABILITY RECOMMENDATION

Report No.	UNEW-ME-825088-01	Job Order No.	825088
Serial No. (or ID)	Item 2	Cutting Location	Body
Received Status	As-Received	Hardness Test	Not recorded
Grain Size	Not recorded	Coating Type	TBC coating
Nearest Alloy	Hastelloy-X		

Element	Co	Cr	Ni	Mo	Fe	Ti	W	Al
Nominal (%)	-	22.0	49.0	9.0	15.8	-	-	-

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Element	Co	Cr	Ni	Mo	Fe	Ti	W	Al
Result (%)	-	20.0	48.4	9.2	19.6	-	-	-



Specimen UNEW-ME-825088-01 was prepared from material sectioned from the liner body of Item 2, one of the most affected areas in the set, and examined metallographically. The base material was confirmed as Hastelloy-X, with composition consistent with the nominal specification. The examined internal surface shows coating breakdown at the coating and substrate interface (Fig. A) and internal corrosion and oxidation (Fig. B). The base metal microstructure shows a stable gamma matrix with normal carbide distribution.

Material conclusion: the alloy identity and microstructure support weld repair after controlled removal of affected surface material, approved weld procedures, post-weld heat treatment, NDT verification, dimensional acceptance, and coating restoration. The material evaluation therefore supports repair rather than scrap. It does not support a Standard or Medium classification, because the surface condition, the coating-interface damage, the welding scope, and the full-set dimensional rejections recorded in Sections 2, 6, and 7 remain in force regardless of the acceptable base microstructure.

10. REPAIR SEVERITY CLASSIFICATION

UNEW applies a ten-level Repair Severity Classification to all gas turbine capital parts refurbishment: Levels 1–3 Light Repair; Levels 4–7 Standard / Medium Refurbishment; Levels 8–10 Heavy Repair. The level is determined by the actual incoming condition, the location of damage relative to structural, sealing, and fit-up features, and the restoration scope the recorded findings require. Process names alone do not determine the level: cleaning, inspection, FPI, dimensional checks, heat treatment, and coating occur at many levels. Each review category below is assessed against the band its recorded findings require.

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Review Category	Required Band	Controlling Recorded Findings
Welding and Material Build-up	Heavy (Levels 8–10)	Body cracks 2–4 mm on 6 of 6 liners plus cowl cap crack (Item 5): full excavation and multi-pass GTAW weld reconstruction. Corrosion-affected internal surfaces require local weld build-up. This is structural welding across the set, not local repair.
Dimensional Restoration	Heavy (Levels 8–10)	End ring roundness REJECT 6 of 6; spring seal diameter REJECT 6 of 6; liner body F-roundness out of limit 6 of 6, requiring cold press and reshape. These are pass/fail results against fixed acceptance limits, on every unit.
Coating and Base Metal Condition	Heavy (Levels 8–10)	Coating-interface breakdown confirmed by metallurgical examination (Section 9); corrosion and oxidation on internal combustion surfaces 6 of 6. Full coating system removal and reapplication required.
Sealing and Fit-up Function	Heavy (Levels 8–10)	Fretage recorded at spring seals, collar retainers, floating collars, and crossfire collars set-wide, and at liner stops on 4 of 6 liners; spring seal diameter REJECT 6 of 6. Damage at sealing and locating features carries higher severity weight than the same damage at non-critical areas.
Inspection, Heat Treatment, and Engineering Risk	Heavy (Levels 8–10)	Repeated pre-weld and post-weld FPI, post-weld heat treatment, ultrasonic wall-thickness verification, and repeated dimensional acceptance are required by the weld scope. Operating history of 125 emergency trips and 127 breaker trips at load raises the risk weighting on every acceptance decision.

All five review categories independently fall in the Heavy Repair band. Within that band, the level is set by extent and location: the controlling findings are full-set (recorded on 6 of 6 liners) and are located at structural, sealing, and fit-up features. This places the set at Level 9. Level 10 is not assigned, because Level 10 is reserved for components at the repairability limit where a non-repairable disposition is under review, and no component in this set reached that limit. The set sits at the upper boundary of Level 9. Where multiple criteria apply, the more severe recorded condition governs.

Governing classification: **HEAVY REPAIR** — UNEW Repair Severity Level 9 of 10. Any lower classification would not reflect the recorded pass/fail results and the restoration scope documented in this report.

11. REQUIRED HEAVY REPAIR SCOPE

All components shall be processed in the following sequence, applied to all six liners, to maintain structural integrity and coating adhesion:

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Step	Process — Applies to All 6 Liners
1	Receipt inspection, serial number recording and verification on body and cap assembly.
2	Metallurgical evaluation of base material and coating type; report on condition.
3	Dimensional inspection and pre-strip wall-thickness inspection.
4	Abrasive blast to remove TBC and MCrAlY coating and clean all surfaces; assess bond coat condition.
5	Visual inspection and fluorescent penetrant inspection (FPI); record all defects.
6	Post-strip wall-thickness inspection; record all non-conformities to the work order record.
7	Compile incoming inspection report to the work order record.
8	Blend to remove oxidation on combustion liner body.
9	Scallop to remove all defective material from liner body in preparation for weld repair.
10	Scallop to remove defective material from crossfire collar locations in preparation for weld repair.
11	Scallop to remove defective material from ignitor assembly in preparation for weld repair.
12	Scallop to remove defective material from liner stops in preparation for weld repair.
13	GTAW weld repair to liner body: all cracked and missing material areas.
14	GTAW weld repair to crossfire collar locations.
15	GTAW weld repair to liner stops.
16	GTAW weld repair to ignitor assembly.
17	Blend all weld-repaired areas to restore component profile.
18	Cold press to reinstate combustion liner body to original geometry.
19	Abrasive blast all surfaces.
20	Fluorescent penetrant inspection (FPI), post-repair verification.
21	Visual inspection.
22	Dimensional inspection and ultrasonic wall-thickness inspection; record all non-conformities.
23	Heat treatment after welding to restore material properties and relieve residual stresses.
24	Pre-coat fixture check.
25	Apply Chrome Carbide hard coating by APS process to hula skirt.
26	Apply MCrAlY bond coat by APS process to internal gas path surface.
27	Apply Class C Thermal Barrier Coating (TBC) by APS process to liner body.
28	Demask, dress, and perform visual inspection after coating.
29	Final dimensional inspection and final visual inspection.
30	Compile Final Report, pack, and ship with all required documentation per Purchase Order.

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NOTE: All GTAW weld repairs shall use approved filler materials compatible with the Hastelloy-X base alloy. Pre-weld and post-weld FPI is mandatory for all weld-repaired areas. Heat treatment shall be applied after all welding operations are complete. All repair, heat treatment, and coating operations shall be performed in accordance with UNEW approved process specifications and quality procedures.

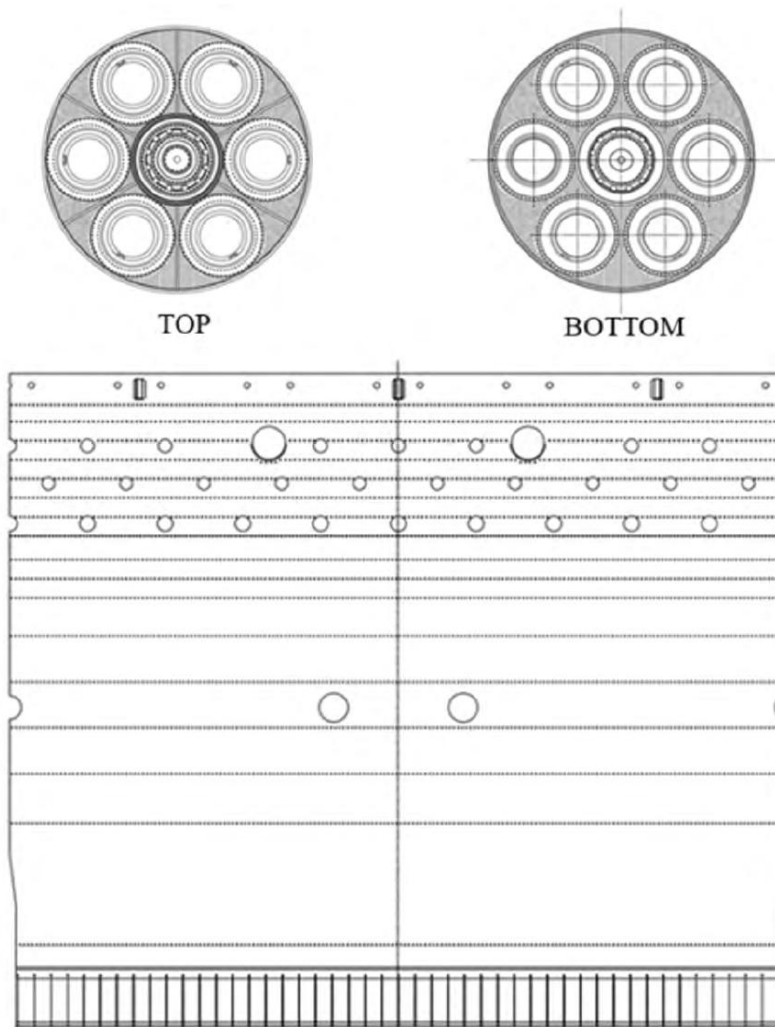
12. FINAL INCOMING DISPOSITION

Repair Classification	HEAVY REPAIR
UNEW Repair Severity	Level 9 of 10 — upper boundary of Level 9, immediately below the Level 10 repairability review threshold
Scrap Recommendation	No scrap recommendation at the incoming stage. The set remains repairable, only under the full Heavy Repair route.
Primary Basis	Full-set body cracking (6/6), full-set body corrosion (6/6), end ring roundness REJECT (6/6), spring seal diameter REJECT (6/6), body roundness out of limit (6/6), fretting at sealing and fit-up interfaces, full-set hardware replacement, geometry correction, coating system restoration, post-weld heat treatment, repeated FPI/NDT, and final dimensional acceptance.
Standard / Medium Repair Applicability	Not technically applicable to this set (Section 3).
Final Release	Subject to completed weld repair, heat treatment, FPI/NDT, ultrasonic wall-thickness verification, dimensional restoration, coating acceptance, and final UNEW Engineering release.

Based on the recorded incoming inspection findings, the complete set of six MS6001FA Combustion Liner MNQC assemblies (UNEW Work Order 825088) requires Heavy Repair. This is the final incoming technical disposition for the repair classification of this set.

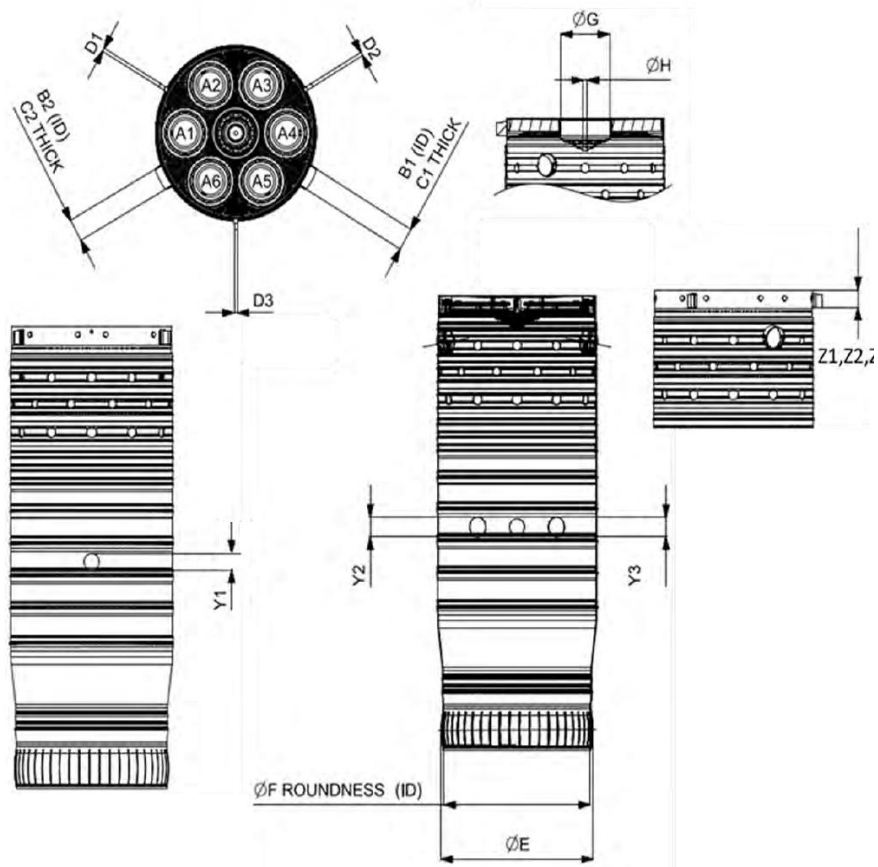
13. COMPONENT INSPECTION ZONES

The following reference drawing shows the combustion liner inspection zones (top view, bottom view, and developed body view) used for defect recording during incoming inspection.



14. DIMENSION INSPECTION REFERENCE

Measurement positions for the dimensional record in Section 6.1 are defined in the reference drawing below. All values are in mm.



APPENDIX A — PHOTOGRAPHIC EVIDENCE RECORD

The following photographs are selected from the incoming inspection record and support the documented findings. Captions describe the visible condition recorded during incoming inspection.



Fig. 1 — As-received liner set condition



Fig. 2 — As-received body and cowl cap condition

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Fig. 3 — Typical liner body condition

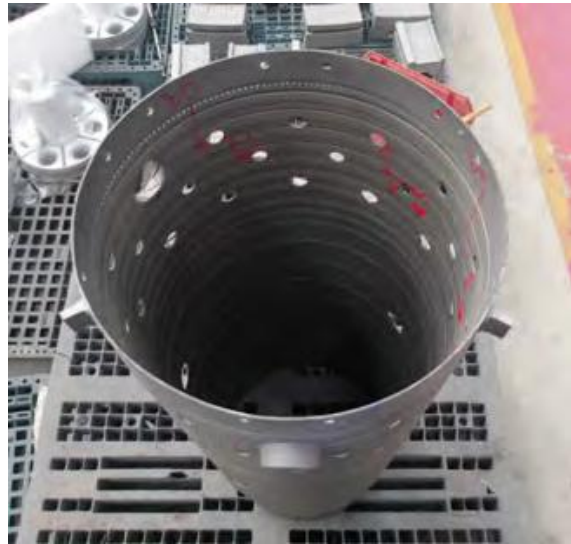


Fig. 4 — Internal body surface condition



Fig. 5 — Degraded cowl cap condition

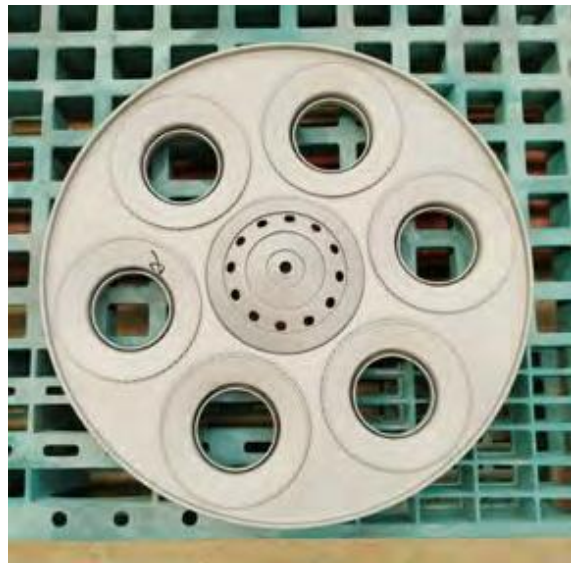


Fig. 6 — Degraded cowl cap condition

INCOMING INSPECTION REPORT



Fig. 7 — Fretting on spring seal



Fig. 8 — Corrosion on internal body



Fig. 9 — Multiple corrosion areas on internal body



Fig. 10 — Corrosion across liner body



Fig. 11 — Crack across liner body



Fig. 12 — Crack across liner body

INCOMING INSPECTION REPORT



Fig. 13 — Fretage at crossfire collar



Fig. 14 — Fretage at liner stop



Fig. 15 — Fretage at liner stop



Fig. 16 — Cowl cap crack (Item 5)

INCOMING INSPECTION REPORT



Fig. 17 — Floating collar fretage



Fig. 18 — Floating collar fretage

INCOMING INSPECTION REPORT

APPENDIX B — REQUIRED REPAIR / COATING PROCESS CONTROL

Work Block	Required Process Control
Inspection	Receipt inspection, serial number record, metallurgical evaluation, dimensional inspection, pre-strip thickness inspection, coating removal, visual inspection, FPI, post-strip thickness inspection, incoming inspection report to the work order record.
Repair	Oxidation removal, scallop / preparation of defective areas, GTAW weld repair to body, crossfire collar locations, liner stops, and ignitor areas; blend of welded areas; cold press geometry correction; post-repair FPI, visual, dimensional, and ultrasonic thickness inspection.
Heat Treatment	Post-weld heat treatment to restore material properties and relieve residual stress.
Coating	Abrasive blast; Chrome Carbide on hula skirt; MCrAlY bond coat on internal gas path; Class C TBC on liner body; demask, dress, and visual inspection.
Final Acceptance	Pre-coat fixture check, final dimensional inspection, final visual inspection, final report, controlled packing, and shipment with required documentation per Purchase Order.

ANNEX A - QUANTIFIED HEAVY REPAIR WORK SCOPE

COMBUSTION LINER

Annex to Incoming Inspection Report Doc. UNEW-NSRP-825088-IIR Rev.02

Customer	Nghi Son Refinery & Petrochemical, LLC.	Report Date	27 April 2026
Customer P.O. No.	WO1003946086	UNEW Work Order	825088
Engine Type	MS6001FA (GE Frame 6FA)	Component	Combustion Liner MNQC
Component Part No.	119E9620G001	Qty. Received	6 units (1 complete set)
Repair Classification	HEAVY REPAIR	UNEW Repair Severity	Level 9 of 10 (upper boundary of Level 9)

A1. PURPOSE AND SCOPE

This Annex records the work quantity of the repair route required by the recorded incoming condition of this set: how many times each process is performed, at which feature, on how many units, and against which recorded finding.

The repair classification of this set is HEAVY REPAIR, UNEW Repair Severity Level 9 of 10 (upper boundary of Level 9), as recorded in the incoming inspection report. All quantities in this Annex are taken from the recorded findings, dimensional results, per item dispositions and part quantities of that report. One controlled operation is one process action applied at one feature location on one liner, or to the complete set where the process is a set level process.

A2. COMPONENT FEATURE COUNT

A process step is one line of the repair route, but it is not one job: it is performed at every affected feature on every liner. The feature counts below establish the multiplier applied throughout this Annex.

Feature	Per liner	Complete set	Source in the incoming inspection report
Liner body	1	6	Section 5.1, cracking recorded 6 of 6
Cowl cap	1	6	Section 7, cracking recorded on Item 5
Ignitor assembly	1	6	Section 11, route steps 11 and 16
Crossfire collar location	2	12	Section 8, item 3, 12 of 12 replaced

ANNEX A - QUANTIFIED HEAVY REPAIR WORK SCOPE

Feature	Per liner	Complete set	Source in the incoming inspection report
Liner stop	3	18	Section 8, item 4, 18 of 18 replaced
Floating collar	6	36	Section 8, item 5, 36 of 36 replaced
Collar retainer	6	36	Section 8, item 6, 36 of 36 replaced
Cowl cap rivet	12	72	Section 8, item 7, 72 of 72 replaced
End ring	1	6	Section 8, item 1, 6 of 6 replaced
Spring seal (hula skirt)	1	6	Section 8, item 2, 6 of 6 replaced

A3. RECORDED FINDINGS AND REQUIRED RESTORATION

Weld location	Recorded finding	Per liner	Set total	Route step
Liner body	Body cracking, cracks 2 to 4 mm in high temperature zones extending beyond surface level, disposition WB	6 of 6 liners	6	13
Cowl cap	Cowl cap cracking, 2 mm, disposition WB	Item 5	1	13
Crossfire collar locations	Fretting recorded across the set at the crossfire collar interfaces	2 per liner	12	14
Liner stops	Liner stop wear recorded on Items 1, 3, 5 and 6; scallop and weld repair applied to all stop locations in the route	3 per liner	18	15
Ignitor assembly	Defective material removal and weld repair required at the ignitor assembly	1 per liner	6	16
Floating collar	Floating collar cracking, disposition WB	Item 5	1	16a
TOTAL WELD ZONES ACROSS THE SET			44	

ANNEX A - QUANTIFIED HEAVY REPAIR WORK SCOPE

Each of the 44 weld zones is excavated to sound metal before welding, inspected by FPI before welding, reconstructed by multi pass GTAW with Hastelloy X compatible filler under controlled heat input and interpass temperature, inspected by FPI after welding, and blended to the component profile. The weld scope of this set is 44 excavations, 44 pre weld inspections, 44 weld reconstructions, 44 post weld inspections and 44 profile blends, and it is the reason post weld heat treatment and ultrasonic wall thickness verification exist in this work order.

A3.1 Material removal

Removal operation	Extent recorded	Ops.	Route step
Full coating system strip, Class C TBC and MCrAlY bond coat, to bare Hastelloy X	100 percent of surfaces, all 6 liners	6	4
Oxidation blend on the liner body	All 6 liner bodies	6	8
Scallop excavation, liner body	1 per liner	6	9
Scallop excavation, crossfire collar locations	2 per liner	12	10
Scallop excavation, ignitor assembly	1 per liner	6	11
Scallop excavation, liner stops	3 per liner	18	12
Controlled removal of corrosion affected material before weld build up	All 6 liner bodies	6	16b
TOTAL MATERIAL REMOVAL OPERATIONS		60	

ANNEX A - QUANTIFIED HEAVY REPAIR WORK SCOPE

A4. DIMENSIONAL REJECTIONS AND GEOMETRY RESTORATION

The features below are recorded as REJECT or out of limit against fixed acceptance criteria. Each requires physical restoration, not measurement.

Feature	Recorded result	Restoration required	Ops.	Route step
Liner body roundness (F)	5.85 to 6.47 mm, out of limit on 6 of 6	Cold press to reinstate original geometry	6	18
End ring roundness	REJECT on 6 of 6	Dimensional restoration before assembly	6	18a
Spring seal diameter	REJECT on 6 of 6	Dimensional restoration and hardware replacement	6	18b
Sealing and fit up interfaces	Fretage recorded set wide at spring seals, collar retainers, floating collars and crossfire collars; liner stop wear on 4 of 6	Blend or weld restoration of the liner side mating surfaces	108	18c
TOTAL GEOMETRY AND INTERFACE RESTORATION OPERATIONS			126	

A5. REPAIR ROUTE WITH WORK QUANTITY

Step	Process, applies to all 6 liners	Work quantity across the set	Ops.
1	Receipt inspection, serial number recording and verification on body and cap assembly	6 liners, body and cap assembly each	6
2	Metallurgical evaluation of base material and coating type; report on condition	1 section and report (UNEW-ME-825088-01, Item 2 body)	1
3	Dimensional inspection and pre-strip wall thickness inspection	6 dimensional campaigns at positions A1 to A6, G, H, B, C, D, Z, F, E, Y1 to Y3, plus 6 wall thickness campaigns	12
4	Abrasive blast to remove TBC and MCrAlY coating and clean all surfaces; assess bond coat condition	6 full coating system strips to bare substrate, plus 6 bond coat condition assessments	12

ANNEX A - QUANTIFIED HEAVY REPAIR WORK SCOPE

Feature	Recorded result	Restoration required	Ops.	Route step
5	Visual inspection and fluorescent penetrant inspection; record all defects	6 visual inspections and 6 full surface FPI events on bare substrate		12
6	Post strip wall thickness inspection; record all non conformities	6 wall thickness campaigns on the stripped condition		6
7	Compile incoming inspection report to the work order record	1 set report		1
8	Blend to remove oxidation on combustion liner body	6 liner bodies		6
9	Scallop to remove all defective material from liner body in preparation for weld repair	6 liner bodies		6
10	Scallop to remove defective material from crossfire collar locations	2 locations per liner, 12 across the set		12
11	Scallop to remove defective material from ignitor assembly	1 assembly per liner, 6 across the set		6
12	Scallop to remove defective material from liner stops	3 stops per liner, 18 across the set		18
12a	Pre weld fluorescent penetrant inspection at every prepared weld area (Section 11 NOTE, mandatory)	44 prepared weld areas		44
13	GTAW weld repair to liner body: all cracked and missing material areas	6 liner bodies (cracking 6 of 6) plus 1 cowl cap (Item 5)		7
14	GTAW weld repair to crossfire collar locations	2 locations per liner, 12 across the set		12
15	GTAW weld repair to liner stops	3 stops per liner, 18 across the set		18
16	GTAW weld repair to ignitor assembly	1 assembly per liner, 6 across the set		6
16a	GTAW weld repair, floating collar crack (Section 7 matrix, Item 5)	1 floating collar		1
16b	Local weld build up of corrosion affected material after controlled removal (Section 5.2)	6 liner bodies		6
16c	Post weld fluorescent penetrant inspection at every weld area (Section 11 NOTE, mandatory)	44 weld areas		44
17	Blend all weld repaired areas to restore component profile	44 weld areas		44

ANNEX A - QUANTIFIED HEAVY REPAIR WORK SCOPE

Feature	Recorded result	Restoration required	Ops.	Route step
18	Cold press to reinstate combustion liner body to original geometry	6 liner bodies, F roundness 5.85 to 6.47 mm out of limit 6 of 6		6
18a	Dimensional restoration of end ring roundness (REJECT 6 of 6)	6 liners		6
18b	Dimensional restoration of spring seal diameter (REJECT 6 of 6)	6 liners		6
18c	Blend or weld restoration of liner side mating surfaces at the sealing and fit up interfaces (Section 5.3, Section 7 note)	18 interfaces per liner, 108 across the set		108
19	Abrasive blast all surfaces	6 liners		6
20	Fluorescent penetrant inspection, post repair verification	6 full surface FPI events		6
21	Visual inspection	6 liners		6
22	Dimensional inspection and ultrasonic wall thickness inspection; record all non conformities	6 dimensional campaigns and 6 ultrasonic campaigns		12
23	Heat treatment after welding to restore material properties and relieve residual stresses	1 full set furnace cycle to qualified procedure with recorded time and temperature chart		1
24	Pre coat fixture check	6 liners		6
25	Apply Chrome Carbide hard coating by APS process to hula skirt	6 applications		6
26	Apply MCrAlY bond coat by APS process to internal gas path surface	6 applications		6
27	Apply Class C Thermal Barrier Coating by APS process to liner body	6 applications		6
28	Demask, dress, and perform visual inspection after coating	6 liners		6
28a	Fit up dimensional verification of every restored interface against new replacement hardware (Section 7 note)	18 interfaces per liner, 108 across the set		108
29	Final dimensional inspection and final visual inspection	6 dimensional campaigns and 6 visual inspections		12
30	Compile Final Report, pack, and ship with all required documentation per Purchase Order	6 liners, 1 set documentation package		6

ANNEX A - QUANTIFIED HEAVY REPAIR WORK SCOPE

Feature	Recorded result	Restoration required	Ops.	Route step
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A6. INSPECTION AND HOLD POINT SCHEDULE

Each event below is a hold point. The set does not advance to the next stage until the event is passed and recorded, and a failure at any gate returns the affected part to the repair loop.

Gate	Inspection event	Route step	Events
1	Dimensional inspection and pre-strip wall thickness inspection	3	12
2	Visual inspection and fluorescent penetrant inspection; record all defects	5	12
3	Post strip wall thickness inspection; record all non conformities	6	6
4	Pre weld fluorescent penetrant inspection at every prepared weld area (Section 11 NOTE, mandatory)	12a	44
5	Post weld fluorescent penetrant inspection at every weld area (Section 11 NOTE, mandatory)	16c	44
6	Fluorescent penetrant inspection, post repair verification	20	6
7	Visual inspection	21	6
8	Dimensional inspection and ultrasonic wall thickness inspection; record all non conformities	22	12
9	Pre coat fixture check	24	6
10	Fit up dimensional verification of every restored interface against new replacement hardware (Section 7 note)	28a	108
11	Final dimensional inspection and final visual inspection	29	12
TOTAL INSPECTION AND VERIFICATION EVENTS			268

ANNEX A - QUANTIFIED HEAVY REPAIR WORK SCOPE

Gate	Inspection event	Route step	Events	
A7. HARDWARE AND RESTORATION CENSUS				
Part	Replaced	Scope	Corresponding mating interface restored	Interfaces
End ring	6 of 6	In scope	1 mating interface per liner	6
Spring seal (hula skirt)	6 of 6	In scope	1 mating interface per liner	6
Crossfire collar	12 of 12	Additional	2 mating interfaces per liner	12
Liner stop	18 of 18	Additional	3 mating interfaces per liner	18
Floating collar	36 of 36	Additional	6 mating interfaces per liner	36
Collar retainer	36 of 36	Additional	6 mating interfaces per liner	36
Cowl cap rivet	72 of 72	Additional	Fastening of the cowl cap assembly	0
TOTAL	186 of 186 (100 percent)			114

A8. WORK VOLUME OF THE REQUIRED REPAIR SCOPE	
Work category	Controlled operations
Cleaning, coating removal and material preparation	60
Structural weld repair, weld build up and profile restoration	94
Geometry restoration, machining and mechanical correction	126
Heat treatment, furnace cycles	1
Inspection, verification and hold point control	268
Coating application and acceptance	30
Receipt, assembly, documentation and release control	14
TOTAL CONTROLLED OPERATIONS	593

The Heavy Repair scope required by this set consists of 593 controlled operations across six liners: 44 structural weld zones each excavated, inspected before and after welding and blended to profile; 60 material removal operations; 126 geometry and interface restoration operations; one full set furnace cycle; and a three material coating system rebuilt on a fully restored substrate.

ANNEX A - QUANTIFIED HEAVY REPAIR WORK SCOPE

A9. HEAVY REPAIR - WORK PERFORMED, AND COMPARISON WITH A MEDIUM REPAIR

This set received a HEAVY REPAIR. We performed 593 controlled operations on 6 MS6001FA combustion liners. Every line below is work we carried out and recorded.

The HEAVY REPAIR work we performed

What we did	Controlled operations	Recorded detail
We stripped the coating and prepared the material	60	All 6 combustion liners, back to bare substrate
We excavated, welded and blended the structural weld zones	94	44 weld zones, FPI before and after every weld
We cut material back to sound metal and restored the geometry	126	60 material removal operations, 114 mating interfaces
We ran a full furnace cycle on the set	1	Complete set, after strip
We inspected and held the set at 11 gates	268	No liner advanced until it passed
We rebuilt the coating system	30	Three material system on a restored substrate
We received, assembled, documented and released	14	186 wear exposed parts fitted new
TOTAL CONTROLLED OPERATIONS	593	On 6 MS6001FA combustion liners

The measurements that required this work: wall thickness non conformities recorded before and after strip, 44 weld areas gated by FPI before and after welding, 108 fit up verifications against new hardware, and 186 of 186 wear exposed parts found unfit to return to service.

Repair work hours for the complete set - the same hours shown on the UNEW invoice

Major task	Standard / Medium repair (hours)	HEAVY REPAIR (hours)	Difference
1. Cleaning, coating strip and surface preparation	30	138	4.6 times (+360%)
2. Welding (GTAW) and material build up	39	322	8.3 times (+726%)
3. Dimensional repair and geometry correction	30	168	5.6 times (+460%)
4. Sealing and fit up restoration (fretage)	52	216	4.2 times (+315%)
5. Hardware replacement and fit up	62	130	2.1 times (+110%)
6. Heat treatment (post weld)	0	93	Not performed at Medium
7. Coating rebuild (three material system)	33	171	5.2 times (+418%)
TOTAL FOR THE SET, 6 UNITS	246	1,238	5.0 times (+403%)

A Standard or Medium repair on this set of 6 MS6001FA combustion liners is 246 working hours. The HEAVY REPAIR we performed is 1,238 working hours. That is 5.0 times more work, 403 percent more. These are the same hours shown on invoice WO-1003946086 / WO-1003986864.

Reviewed and approved
UNEW Engineering

Paul McGuire
Engineering Manager