INCOMING INSPECTION REPORT

Customer	Nghi Son Refinery & Petrochemical, LLC.	**UNEW Work Order No.**	825091
Customer P.O. No.	1003986864	**Report Date**	27 April 2026
Engine Type	MS6001FA (GE Frame 6FA)	**Component**	1st Stage Nozzle
Part Number (Casting)	129E9734 P002	**Part Number (Ring)**	143E5711G02
Material	FSX-414 Cobalt Superalloy	**Qty. Received**	24 Segments (1 Complete Set)
As-Received Coating	HVOF MCrAlY + Full TBC Top Coat	**Repair Classification**	**HEAVY REPAIR**
Total Initiated Starts	476	**Total Emergency Trips**	125

Responsible Product Engineer: _____ Report prepared by: _____

Mr. Komkrit Rattanawong

(Engineer)

Ms. Chamaiporn Butsabong

(Report writer)

Report reviewed and approved by:_____

Mr. Pheerayawat Muadna

(Engineering Manager)

INCOMING INSPECTION REPORT

1. EXECUTIVE SUMMARY:

Twenty-four (24) MS6001FA 1st stage nozzle segments were received and inspected. The inspection identified multiple severe damage mechanisms affecting both airfoil sections and structural components, including extensive cracking, heavy corrosion, wall thinning, deformation, and coating degradation.

Significant cracking is observed in critical regions, particularly along trailing edges and airfoil sections, accompanied by heavy corrosion and material loss . In several areas, the trailing edge exhibits thinning and distortion, indicating loss of structural integrity and reduced load-bearing capability. Widespread corrosion on concave airfoil surfaces and outer shroud walls further confirms material degradation under high temperature service conditions.

Dimensional inspection results show that wall thickness across all segments is below acceptable limits, with multiple locations recorded as reject and requiring restoration . Additional geometric deviations, including bowing and misalignment, are observed and will affect flow path stability, sealing effectiveness, and overall turbine performance if not corrected.

The combined presence of structural cracking, material loss, geometric distortion, and dimensional non-conformance indicates that the components cannot be restored by standard or medium repair methods. Local blending or partial repair will not recover the required geometry, thickness, or structural integrity.

Based on these findings, the nozzle set is classified as heavy repair. Full removal of degraded material, structural weld reconstruction, trailing edge wall thickness restoration (including PSP application), dimensional requalification, and controlled heat treatment are required to restore the components to a stable operating condition.

This heavy level of repair is necessary to recover airfoil geometry, ensure proper cooling effectiveness, maintain flow path stability, and extend component life under high temperature operation.

INCOMING INSPECTION REPORT

2. INTRODUCTION

24 pcs. of MS6001FA 1st stage nozzle have been received and have undergone cleaning, coating removal "where required", incoming inspection and metallurgical analysis. The initial findings and results of the incoming inspection are as follows:

Order Information	
EE Work Order no.	825091
Date of report	27 April 2026
Customer P.O. no.	1003986864
Component Details	
Engine type	MS6001FA
Component type	1st Stage Nozzle
Component part number	Retaining ring P/N :143E5711G02 Casting segment P/N :129E9734 P002
Qty. received	24
Material type	FSX414
As received coating type (s)	HVOF MCrAlY coating and full TBC top coat
Additional items received with main set (if any)	-
Customer supplied component history	
Total Initiated Starts	476
Manually Initiated Starts	468
Fired Starts	180
Total Emergency Trips	125
Breaker Tripped At Load Count :	127
# of previous repairs	(No information supplied)
Hours of operation since last repair interval	(No information supplied)
Operational fuel type	(No information supplied)
Mode of operation (base load / peaking)	(No information supplied)
Maint.intervals combustion	(No information supplied)
Maint.intervals Hot gas path	(No information supplied)
Unloaded condition	
Incoming packing / container condition	Good
Signs of transit damage (if damaged upon receipt photos to be included within report)	-

INCOMING INSPECTION REPORT

3. INSPECTION SUMMARY

The following operational history increases the risk profile and supports the heavy repair classification:

- Total Initiated Starts: 476, Manually Initiated Starts: 468, Fired Starts: 180
- Total Emergency Trips: 125, a notably high count indicative of repeated thermal shock events that accelerate cracking and hot corrosion.
- Breaker Trips at Load: 127, consistent with cyclic thermal loading causing fatigue crack propagation at trailing edges and platform junctions.
- As-received coating: HVOF MCrAlY with full TBC top coat, full coating degradation observed, indicating extended operation since last recoat.

The following damage categories, identified across all 24 nozzle segments, collectively justify the Heavy Repair classification:

Damage Category	Finding (As Inspected)	Disposition
Trailing Edge Cracking	Extensive cracks C5–75 mm at O/D wall; C5–25 mm at I/D wall — all 24 segments (Items 1–24)	**TPR + Weld**
Multi-Cracking — Airfoil Body	C15×40 mm² to C30×120 mm² multi-crack networks on concave/convex surfaces, L/E and T/E — all 24 segments	**TPR Required**
Non-Gas Path Cracking (I/D & O/D Wall)	C8–20 mm cracks I/D wall (non-gas path) all segments; C8–15 mm at O/D wall Items 1, 3, 22, 23	**TPR / Weld**
Heavy Corrosion — Trailing Edge & Concave Airfoil	Heavy oxidation/hot corrosion on T/E and concave airfoil faces across all 24 segments; heavy corrosion on outer shroud wall	**Blend + Braze**
Trailing Edge Wall Thickness Below Minimum	Positions T1 & T2 below 2.03 mm minimum limit on ALL 24 segments; one segment (Item 8) shows missing material at T/E	**PSP Required (48 pcs)**
Trailing Edge Bowing / Distortion	Visible bowing and thin-wall deformation on trailing edges requiring cold straightening/plannishing	**Straighten / PSP**
Missing Material — O/D Wall & T/E	C5×30 mm to C8×50 mm missing material at O/D wall, Items 1, 2, 4, 5, 6, 11, 14, 15, 17; C8×100 mm missing at T/E, Item 8	**Weld Build-up**
Full Coating Degradation (TBC + MCrAlY)	TBC condition requires full strip and recoat; HVOF MCrAlY bond coat also depleted; full gas path recoat required on complete set	**Full Strip + Recoat**

Base Metal Microstructure Degradation	As-received FSX-414 shows grain boundary carbide coarsening and detrimental phase precipitation; hardness 27–31 HRC post-HT	**Recovered via HT**

3.1. DIMENSIONAL INSPECTION SUMMARY

Key dimensional findings from the incoming inspection are summarized below:

Inspection Parameter	Result	Status
Nozzle Set Roundness	0.80 mm (A-A: 1732.70 / B-B: 1733.42 / C-C: 1733.50 / D-D: 1732.95 mm)	**SEVERE/CRITICAL**
Total Nozzle Flow Area	132,124.07 mm² (204.793 in²) | Area Deviation: 0.33%	**SEVERE/CRITICAL**
Retaining Ring Roundness — Upstream	Max-Min: 1.21 mm (range 1715.11–1716.32 mm)	**SEVERE/CRITICAL**
Retaining Ring Roundness — Downstream	Max-Min: 0.92 mm (range 1687.46–1688.38 mm)	**SEVERE/CRITICAL**
Trailing Edge Wall Thickness (T1 & T2)	ALL 24 segments below 2.03 mm minimum PSP required on all 48 T/E positions	**REJECT — 24/24**
Nozzle Alignment (Step between segments)	Multiple segments with 'Rej' status on chord hinge / step dimension to be corrected post-repair	**PARTIAL REJECT**
Harmonic Analysis — Throat Areas	Individual segment areas just small out of acceptable deviation range (max deviation < ±10% on individual throats)	**FORCE ACCEPTABLE**

- Trailing edge (T/E): Extensive cracks ranging C5–75 mm at the O/D wall and C5–25 mm at the I/D wall across all segments (Items 1–24). Photographs (Figs. 11–13) show severe crack networks with associated heavy corrosion at the T/E.
- Airfoil body — multi-cracking: Crack networks C15×40 mm² to C30×120 mm² covering the concave, convex, leading edge, and trailing edge surfaces — all 24 segments. Requires Transient Phase Restoration (TPR).
- Non-gas-path I/D and O/D walls: C8–20 mm cracks (non-gas path) on all segments; C8–15 mm on O/D wall at Items 1, 3, 22, and 23.
- Individual segment anomalies: Item 19 exhibits a C50 mm crack at the concave (c/c) face — a non-typical defect warranting specific weld repair attention.

The extent and distribution of cracking present on every single segment of the set definitively require heavy repair on all structural weld repair (GTAW), Transient Phase Restoration (TPR), and subsequent vacuum solution heat treatment.

3.3. HEAVY HOT CORROSION & OXIDATION

Photographs (Figs. 14–18) and defect map annotations confirm:

- Heavy corrosion on the concave airfoil face and trailing edge, resulting in significant metal loss and surface pitting (Items 1–24).
- Heavy oxidation on the outer shroud (O/D) wall structurally significant as it affects load-bearing and sealing surfaces.
- Light to medium corrosion on the I/D wall and non-gas-path surfaces across all 24 segments requiring blending and restoration.

The severity of corrosive attack, combined with trailing edge thinning, is consistent with Type I or Type II hot corrosion from sulfur-bearing fuel species and elevated operating temperatures, conditions that are only addressable through heavy repair intervention.

3.4. TRAILING EDGE WALL THICKNESS ALL 24 SEGMENTS REJECTED

Post-strip ultrasonic wall thickness inspection at positions T1 and T2 (trailing edge locations) revealed that ALL 24 segments fall below the minimum allowable wall thickness of 2.03 mm. This 100% rejection rate at the trailing edge is a critical finding:

- Trailing edge wall thinning is a direct consequence of combined hot corrosion, oxidation, and bowing consistent with the high emergency trip count.
- Item 8 (S/N A1FC 04955) additionally shows missing material at the T/E (C8×100 mm), indicating through-wall material loss.
- Corrective action: Application of Pressure Side Plate (PSP) for trailing edge wall thickness restoration is required on ALL 48 trailing edges (2 per segment × 24 segments = 48 pieces). This is classified as an Additional (non-standard) work item.

3.5. TRAILING EDGE BOWING & AIRFOIL DISTORTION

Visible bowing and permanent deformation of the trailing edge walls were documented in Fig. 16, with accompanying annotation confirming thin-wall condition requiring PSP. Cold straightening and plannishing will be performed on all affected trailing edge and airfoil sections prior to weld repair.

3.6. MISSING MATERIAL AT O/D WALL AND TRAILING EDGE

- O/D Wall: Missing material patches C5×30 mm to C8×50 mm identified on Items 1, 2, 4, 5, 6, 11, 14, 15, and 17 (9 of 24 segments).
- Trailing Edge, Item 8: C8×100 mm missing material on O/D wall at T/E the largest single missing material defect in the set. Weld build-up and EDM or PSP restoration required.

Missing material in gas-path locations adversely affects aerodynamic performance and thermodynamic efficiency and must be fully restored before return to service.

3.7. FULL THERMAL BARRIER COATING (TBC) & MCRALY DEGRADATION

The as-received TBC condition (HVOF MCrAlY + full TBC) has deteriorated to a level requiring complete chemical strip, abrasive blast, heat tint verification, and full recoat of the gas path surfaces. Metallurgical section L11383, (Fig. 1) confirmed the TBC/substrate interface condition. Full reapplication of HVOF MCrAlY

3.8. BASE METAL CONDITION — FSX-414 (RECOVERABLE)

Metallurgical analysis (Report No. L11383, Item 13 inner Shroud; L11383-1, Item 11; L11383-2, Item 8 Trailing Edge) confirmed:

- Base material: FSX-414 cobalt superalloy composition confirmed (Co 49.8%, Cr 28.1%, Ni 12.0%, W 7.1%, Fe 2.0%).
- As-received microstructure: Coarsened grain boundary carbide and detrimental phase precipitation typical of extended service without intermediate heat treatment.
- Post pre-weld solution heat treatment (HT): Grain boundary carbide and detrimental phases satisfyingly refined. Hardness results: 30.9 HRC (inner shroud) and 27.1 HRC (trailing edge) within acceptable range for weld repair.
- Recommendation: Base material is suitable for repair. All components will undergo full vacuum solution heat treatment as part of the Heavy Repair process.

INCOMING INSPECTION REPORT

3.9. SPARE PART (Repair / Replace):

Item	Part descriptions	Received/ Required	Condition	Quantity	Remark
1	Segment Joint seals (Flat seals), EETH4028-01 to 08	192/192 ea	Replace	192 ea	In scope
2	Inner-Impingement Cover plate	24/24 ea	Replace	24 ea	Additional
3	Outer-Impingement Cover plate	24/24 ea	Replace	24 ea	Additional
4	Leading edge core plugs(inner side)	48/48 ea	Replace	48 ea	In scope
5	Leading edge core plugs(outer side)	48/48 ea	Replace	48 ea	In scope
6	Trailing edge core plugs,	48/48 ea	Replace	48 ea	In scope
7	Internal retaining ring-13/16”	24/24 ea	Replace	24 ea	In scope
8	Heli coil 3/4”-10UNC	4/4 ea	Replace	4 ea	In scope
9	Heli coil 5/8”-11 UNC	18/18 ea	Replace	18 ea	In scope
10	PSP for trailing edge wall thickness restoration	0/48 ea	Replace	48 ea	Additional

4. ENGINEERING RECOMMENDATION:

Following receipt, cleaning, coating removal, incoming solution heat treatment, visual inspection, fluorescent penetrant inspection (FPI), wall thickness measurement, dimensional checks, harmonic analysis, and metallurgical sampling, we have evaluated all 24 segments of the MS6001FA 1st Stage Nozzle set (EE Work Order 825091) received from Nghi Son Refinery & Petrochemical, LLC. (NSRP).

The severity, extent, and combination of damage found across the complete set including through-wall cracking, extensive hot corrosion, universal trailing edge wall thinning below minimum limits, and missing material confirm that this set requires HEAVY REPAIR. No segment in the set is eligible for a lower repair classification.

The following operational factors were noted as contributors to the damage severity:

- 476 Total Initiated Starts with 125 Emergency Trips — high cyclic thermal load causing fatigue cracking at trailing edges and airfoil bodies.
- 127 Breaker Trips at Load — consistent with rapid thermal shock events accelerating hot corrosion and crack propagation.
- No service history, fuel type, or maintenance interval data was provided by the customer — a conservative repair approach has therefore been applied.

4.1. DEFECT FINDINGS AND RECOMMENDED REPAIR ACTIONS

The table below defines the required repair action for each defect category identified during incoming inspection. All repair methods shall be performed in accordance with UNEW approved repair procedures.

INCOMING INSPECTION REPORT

No.	Defect / Condition	Location / Affected Items	Repair Method	Action
1	**Extensive cracking at Trailing Edge (T/E)**	O/D Wall: C5–75 mm cracks, Items 1–24 I/D Wall: C5–25 mm cracks, Items 1–24	**GTAW Weld + Blend**	**REQUIRED**
2	**Multi-cracking at Airfoil Body (concave, convex, L/E, T/E)**	C15×40 mm² to C30×120 mm² — all 24 segments	**Transient Phase Restoration (TPR)**	**REQUIRED**
3	**Non-gas path cracking at I/D and O/D Wall**	I/D Wall: C8–20 mm, Items 1–24 O/D Wall: C8–15 mm, Items 1, 3, 22, 23	**TPR / GTAW Weld**	**REQUIRED**
4	**Single large crack at concave airfoil (c/c)**	C50 mm crack — Item 19 only (non-typical)	**GTAW Weld + Blend**	**REQUIRED**
5	**Heavy hot corrosion at T/E and concave airfoil face**	Gas path surfaces — all 24 segments (Figs. 11–15)	**Blend to Remove**	**REQUIRED**
6	**Heavy corrosion at Outer Shroud (O/D) Wall**	O/D Wall surface — all 24 segments (Figs. 17–18)	**Blend to Remove**	**REQUIRED**
7	**Light to medium corrosion at I/D Wall and non-gas path surfaces**	I/D Wall and non-gas path — all 24 segments	**Blend to Remove**	**REQUIRED**
8	**Trailing Edge wall thickness below minimum limit (T1 & T2)**	ALL 24 segments — T1 & T2 positions below 2.03 mm minimum (Item 8: Missing material at T/E — C8×100 mm)	**Apply PSP (48 pcs)**	**ADDITIONAL ITEM**
9	**Trailing Edge bowing and permanent deformation**	All T/E faces — confirmed across the full set (Fig. 16)	**Cold Straighten / Panish**	**REQUIRED**
10	**Missing material at O/D Wall**	C5×30 mm to C8×50 mm — Items 1, 2, 4, 5, 6, 11, 14, 15, 17 (9 of 24 segments)	**GTAW Weld Build-up**	**REQUIRED**
11	**Full TBC and MCrAlY coating degradation**	All gas path surfaces — complete set	**Full Strip + Recoat**	**REQUIRED**
12	**Base metal microstructure degradation (grain boundary carbide)**	FSX-414 substrate — confirmed via metallurgical analysis (L11383)	**Solution Heat Treatment**	**REQUIRED**

NOTE: All weld repairs (GTAW) will be performed using approved filler materials compatible with FSX-414 base alloy. Pre-weld and post-weld fluorescent penetrant inspection (FPI) is mandatory for all weld and TPR areas.

4.2. RECOMMENDED REPAIR SEQUENCE

All components shall be repaired in the following sequence to ensure structural integrity and coating adhesion:

Step	Process	Applies To
1	Receipt inspection, serial number recording, dimensional and harmonic baseline measurement	All 24 Segments
2	Chemical strip of external gas path coatings + heat tint verification for full removal	All 24 Segments
3	Incoming solution heat treatment in full vacuum environment (pre-weld condition)	All 24 Segments
4	Post-HT FPI + visual inspection; record all defects per defect chart	All 24 Segments
5	Cold straightening / plannishing of trailing edge and airfoil sections	All 24 Segments
6	Blend to remove oxidation, corrosion, and minor surface defects	All 24 Segments
7	Prep and GTAW weld repair — all areas of major structural cracking and missing material	All 24 Segments
8	Local FPI — post-weld verification before heat treatment	All 24 Segments
9	Transient Phase Restoration (TPR) — all areas of multi-cracking	All 24 Segments
10	Solution heat treatment in full vacuum environment (post-repair)	All 24 Segments
11	Post-repair FPI + visual inspection	All 24 Segments
12	Apply PSP for trailing edge wall thickness restoration	All 48 T/E positions
13	EDM to restore cooling holes and seal slots	As required

14	Ultrasonic wall thickness inspection — confirm T/E meets ≥2.03 mm minimum	All 24 Segments
15	Pre-coating dimensional inspection and cooling hole flow check	All 24 Segments
16	Apply HVOF MCrAlY bond coat + full TBC to all gas path surfaces	All 24 Segments
17	Re-install core plugs and cover plates; visual inspect fabrication welds	All 24 Segments
18	Final assembly, dimensional inspection, harmonic and roundness check	Complete Set
19	Weld in place nozzle retaining pins; final visual inspection	Complete Set
20	Compile Final Report, pack and ship with all required documentation per Purchase Order	Complete Set

4.3. **COATING RECOMMENDATION**

The following HVOF MCrAlY bond with full Thermal Barrier Coating top coat scope applies to the complete set:

Coating Process	Surface / Area	Applies To
Chemical strip of existing TBC and MCrAlY	All external gas path surfaces	All 24 Segments
Heat tint verification — confirm full removal	All gas path surfaces	All 24 Segments
Abrasive blast — surface preparation	All gas path surfaces	All 24 Segments
Apply HVOF MCrAlY bond coat	Full gas path surface	All 24 Segments
Apply full Thermal Barrier Coating (TBC) top coat	Full gas path surface	All 24 Segments
Post-coating visual inspection	All coated surfaces	All 24 Segments

4.4. ENGINEERING RECOMMENDATION CONCLUSION

CLASSIFICATION: HEAVY REPAIR All 24 Segments

UNEW Engineering confirms that the complete set of 24 MS6001FA 1st Stage Nozzle segments (UNEW Work Order 825091) is classified as HEAVY REPAIR based on the findings of the incoming inspection process. The damage categories identified pervasive multi-site cracking, heavy hot corrosion, universal trailing edge wall thinning below the 2.03 mm minimum limit, missing material, and full coating degradation are consistent with extended service operation under severe cyclic thermal loading conditions.

All components are within the repairable limits established by UNEW Engineering and will be restored to a serviceable condition in accordance with the Heavy Repair work scope defined in this report. An additional work item PSP application for trailing edge wall thickness restoration (48 pieces) is required and must be formally approved by the NSRP via a letter of acceptance before proceeding.

All repair methods, heat treatment programs, weld procedures, and coating processes will be performed in accordance with UNEW approved process specifications and quality procedures.

INCOMING INSPECTION REPORT

5.0 PACKING LIST FROM CUSTOMER:

NOZZLE KIT, TURB-STG1	2060157737	143E5711G02 129E9734 P002	SNEG642589	SET	6/8	H64 X L220 X W128	700	575

6.0 COMPONENT SERIAL NUMBER CORRELATION:

CORRELATION SHEET			
Retaining ring partnumber		P/N: 143E5711G02	S/N: SNEG 425891
Item	Part Number	Serial Number	Material
1	129E9734 P002	A1FC 04959	FSX414
2	129E9734 P002	A1FC 04965	FSX414
3	129E9734 P002	A1FC 04999	FSX414
4	129E9734 P002	A1FC 04981	FSX414
5	129E9734 P002	A1FC 04978	FSX414
6	129E9734 P002	A1FC 04958	FSX414
7	129E9734 P002	A1FC 04964	FSX414
8	129E9734 P002	A1FC 04955	FSX414
9	129E9734 P002	A1FC 04963	FSX414
10	129E9734 P002	A1FC 05000	FSX414
11	129E9734 P002	A1FC 04957	FSX414
12	129E9734 P002	A1FC 05002	FSX414
13	129E9734 P002	A1FC 04962	FSX414
14	129E9734 P002	A1FC 05007	FSX414
15	129E9734 P002	A1FC 05004	FSX414
16	129E9734 P002	A1FC 04960	FSX414
17	129E9734 P002	A1FC 04956	FSX414
18	129E9734 P002	A1FC 05003	FSX414
19	129E9734 P002	A1FC 04945	FSX414
20	129E9734 P002	A1FC 04998	FSX414
21	129E9734 P002	A1FC 05006	FSX414
22	129E9734 P002	A1FC 05001	FSX414
23	129E9734 P002	A1FC 04996	FSX414
24	129E9734 P002	A1FC 04961	FSX414

7.0 SCOPE OF WORK:

MS6001FA STAGE 1 NOZZLE

Work scope	Inspect	Heavy
Inspect		
Perform receipt inspection and record serial numbers	X	
Mate halves, perform dimension checks and harmonic analysis	X	
Perform metallurgical evaluation of base material and report on condition	X	
Disassemble nozzle segments from carrier ring, bag and tag hardware	X	
Remove cover plates and core plugs, bag and tag hardware with segment serial number	X	
Abrasive blast	X	
Perform chemical strip of external gas path coatings	X	
Perform heat tint operation to ensure full coating removal	X	
Perform incoming solution heat treatment in full vacuum environment	X	
Cooling Hole check	X	
Perform visual inspection on all components and record all defects	X	
Perform fluorescent penetrant inspection on all components and record all defects	X	
Perform post-strip wall thickness inspect, report all non-conformities	X	
Compile and forward Incoming Inspection Report to customer.	X	
Hold points until Customer discussions and agreement on repair scopes have been held/reached.	X	
Repair		
Blend to remove oxidation and corrosion to nozzle segments		X
Cold straighten / Plannish trailing edge and airfoil sections as required.		X
Prep for weld all areas of major structural cracking		X
Perform local fluorescent penetrant inspection		X
Perform weld repairs using GTAW		X

Blending to restore component profile		X
Perform fluorescent penetrant inspection		X
Perform solution heat treatment in full vacuum environment		X
Perform fluorescent penetrant inspection		X
Perform HF and vacuum cleaning in preparation for TPR		X
Perform transient phase restoration of all areas of multi-cracking		X
Electro Discharge Machine (EDM) to restore cooling holes, seal slots		X
Perform ultrasonic wall thickness inspection		X
Perform solution heat treatment in full vacuum environment		X
Perform fluorescent penetrant inspection		X
Perform visual inspection		X
Cooling Hole check		X
Perform dimension inspection		X
Coating		
Apply HVOF MCrAlY & Full TBC to gas path surface		X
Perform visual inspection		X
Re install core plugs and cover plates. Visual inspect fabrication welds		X
Perform final assembly and inspection checks		X
Mate halves, perform final dimension and harmonic inspections, record results		X
Weld in place nozzle retaining pins		X
Perform final visual inspection		X
Compile Final Report, pack and ship components with all required documentation as listed in Purchase Order		X

Required:

- Apply PSP for trailing edge wall thickness restoration ,Q'ty 48ea

9.0 MATERIAL EVALUATION

Report No.	L11383	Job order no.	825091
Serial no.(or ID)	Item# 13	Cutting location	Inner Shroud
Received status	☑ As-Received ☐ Pre-Weld HT ☐ Post-Weld HT ☐ Other		

Analysis Result

Main composition,%										Hardness Test	-
Element	Co	Cr	Ni	Ti	W	Ta	Mo	Fe	Al	Grain size	-
Nominal	52.5	29.0	10.0	-	7.5	-	-	1.0	-	Coating Type	TBC coating
Result	49.8	28.1	12.0	-	7.1	-	-	2.0	-	Nearest Alloy	FSX-414

Microstructure

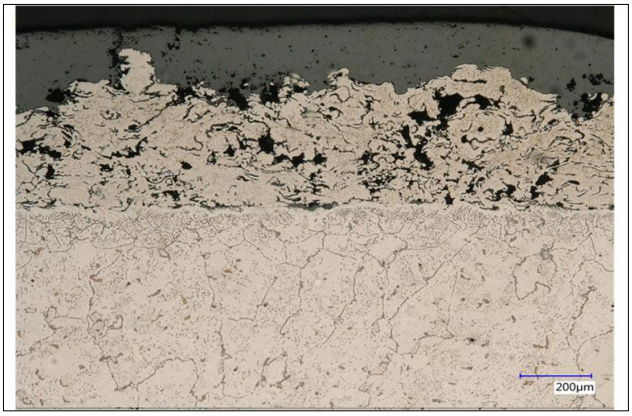


Fig.1 Heavy coating degradation exposing base metal

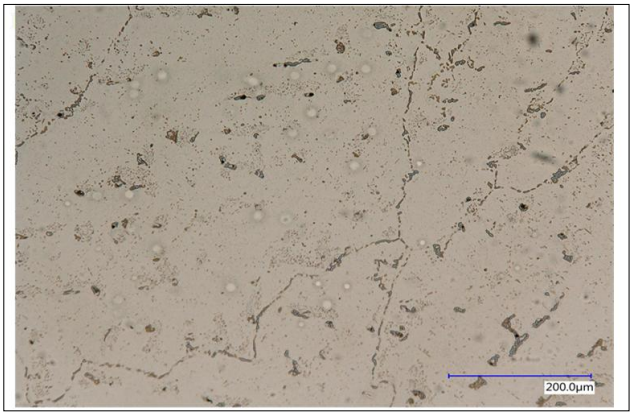


Fig.2 Heavy grain boundary damage at high magnification (Etched)

Specimen L11383 was prepared and examined to assess material condition for repair eligibility. The following was observed. Hot gas path coating (TBC) showed severe degradation with heavy breakdown at the coating-substrate interface, refer to Fig.1. Base material confirmed as FSX-414 alloy, exhibiting heavy grain boundary carbide coarsening, detrimental phase precipitation, and a gamma matrix with advanced primary and secondary carbide deterioration, Fig.2.

Recommendation

Based on the examination above, the base material exhibits severe microstructural degradation consistent with extended high-temperature service under heavy cyclic loading. Heavy grain boundary carbide coarsening and detrimental phase precipitation are confirmed throughout the substrate. The material condition requires mandatory full vacuum solution heat treatment prior to any weld repair to restore microstructural integrity. Subject to successful heat treatment recovery, the base material is considered eligible for Heavy Repair. All repair activities shall be performed strictly in accordance with UNEW approved procedures for FSX-414 alloy.

Report No.	L11383-1	Job order no.	825091
Serial no.(or ID)	Item# 11	Cutting location	Inner Shroud
Received status	☐ As-Received ☑ Pre-Weld HT ☐ Post-Weld HT ☐ Other		

Analysis Result

Main composition,%										Hardness Test	30.9 HRC
Element	Co	Cr	Ni	Ti	W	Ta	Mo	Fe	Al	Grain size	-
Nominal	*(Refer to As-received analysis result)*									Coating Type	*(Refer to As-received analysis result)*
Result	*(Refer to As-received analysis result)*									Nearest Alloy	*(Refer to As-received analysis result)*

Microstructure

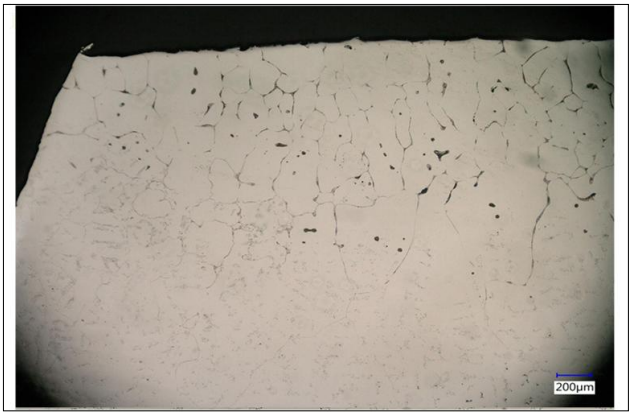


Fig.1 Heavy microstructural damage requiring mandatory heat treatment intervention (Etched)

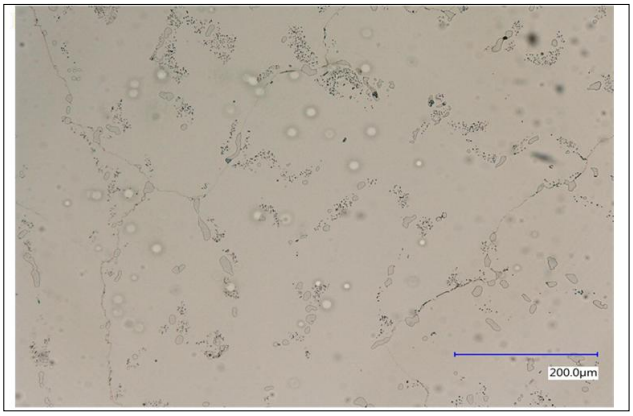


Fig.2 Severe grain boundary attack and carbide deterioration at high magnification (Etched)

Specimen L11383-1 was prepared and examined to evaluate base material microstructure in pre-weld solution heat treated condition. Examination confirmed that the severely degraded microstructure has been recovered through mandatory heat treatment intervention. The heavily coarsened grain boundary carbides and detrimental phases previously identified as critical damage indicators in report L11383 have been successfully refined to an acceptable condition for Heavy Repair welding operations. (Fig.1 and 2)

Recommendation

Based on the examination above, the badly damaged base material has been successfully restored by the pre-weld heat treatment process. The heavy grain boundary damage and harmful phases — which were confirmed as serious damage in the as-received condition — have been reduced to an acceptable level for Heavy Repair welding. Hardness test result is 30.9 HRC, which is acceptable for GTAW weld repair on FSX-414 alloy. The material is now approved to proceed with Heavy Repair welding and all work must follow UNEW approved weld repair procedures for FSX-414 alloy. A full heat treatment process is still required after all welding and TPR work is completed.

Report No.	L11383-2	Job order no.	825091
Serial no.(or ID)	Item# 8	Cutting location	Trailing Edge
Received status	☐ As-Received ☑ Pre-Weld HT ☐ Post-Weld HT ☐ Other		

Analysis Result

Main composition,%										Hardness Test	27.1 HRC
Element	Co	Cr	Ni	Ti	W	Ta	Mo	Fe	Al	Grain size	-
Nominal	*(Refer to As-received analysis result)*									Coating Type	*(Refer to As-received analysis result)*
Result	*(Refer to As-received analysis result)*									Nearest Alloy	*(Refer to As-received analysis result)*

Microstructure

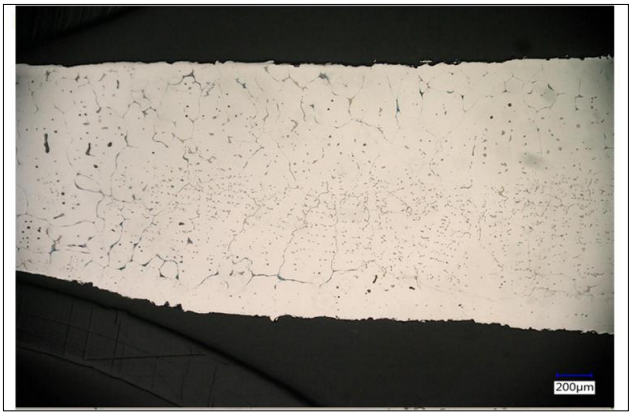


Fig.1 Critical base metal damage condition prior to heat treatment (Etched)

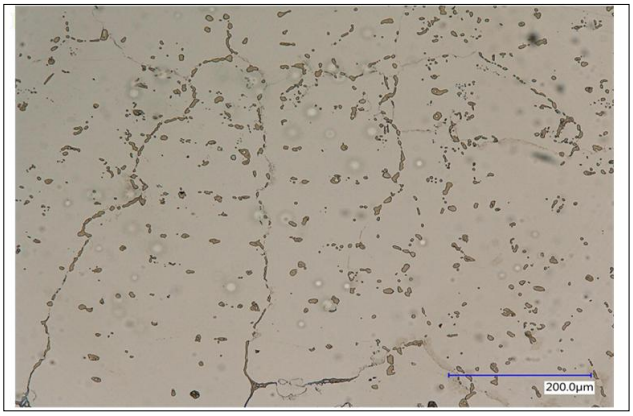


Fig.2 Critical base metal damage confirmed at high magnification (Etched)

Specimen L11383-2 was prepared and examined to evaluate the base metal condition at the Trailing Edge one of the most severely damaged areas in this set. The heavy grain boundary damage and harmful phases confirmed as critical damage in the as-received condition (report L11383) were so severe that mandatory pre-weld heat treatment was required before any repair work could proceed. Following heat treatment, the badly damaged microstructure has been sufficiently restored to allow Heavy Repair welding operations to begin. This confirms that the damage level in this set is beyond normal repair and requires full Heavy Repair intervention. (Fig.1 and 2)

Recommendation

Based on the examination above, the badly damaged base metal at the Trailing Edge has been successfully restored by the pre-weld heat treatment process. The heavy grain boundary damage and harmful phases which were confirmed as critical damage in the as-received condition have been reduced to an acceptable level for Heavy Repair welding. This area required special attention due to the combination of heavy cracking, severe wall thinning below the minimum limit of 2.03 mm, and bowing all confirmed across all 24 segments. Hardness test result is 27.1 HRC, which is acceptable for GTAW weld repair on FSX-414 alloy. The material is now approved to proceed with Heavy Repair welding. All work must follow UNEW approved weld repair procedures for FSX-414 alloy. A full heat treatment process is still required after all welding and TPR work is completed. In addition, all 48 Trailing Edge positions require PSP application to restore wall thickness to the minimum acceptable level before coating can proceed.

INCOMING INSPECTION REPORT

10. PHOTOGRAPHS:

Fig.1 Received as heavy damage condition

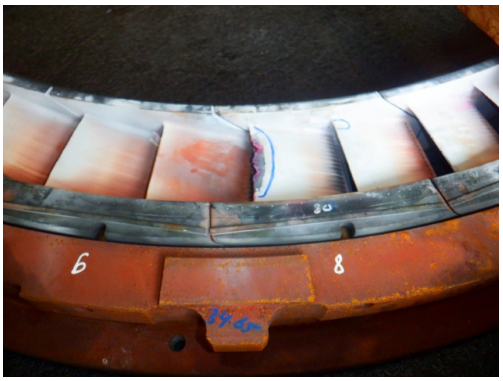


Fig.2 Received as heavy damage condition

Fig.3 .Received as heavy damage condition

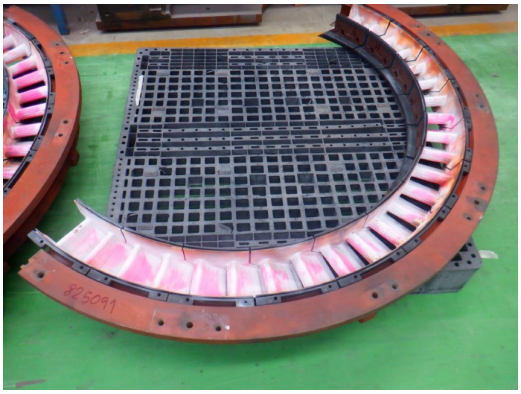


Fig.4 Received as heavy damage condition

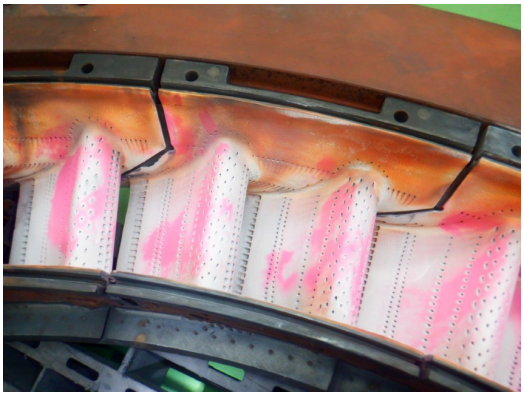


Fig.5 Received as heavy damage condition

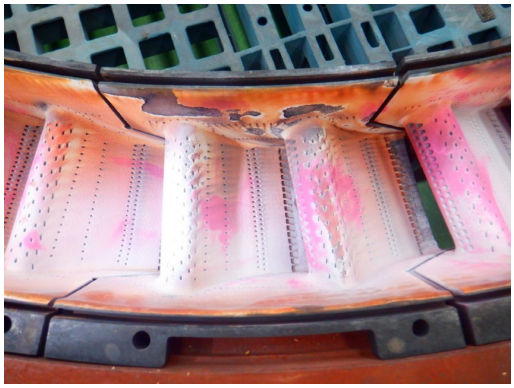


Fig.6 Received as heavy damage condition.

INCOMING INSPECTION REPORT

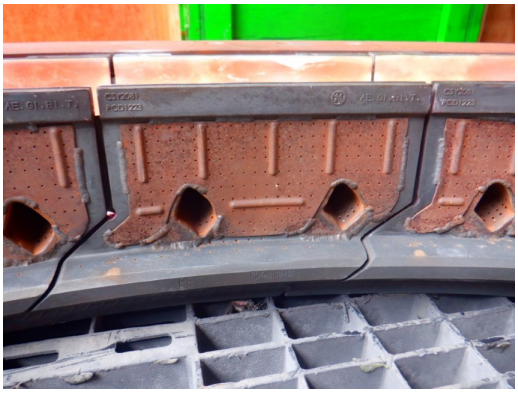


Fig.7 Received as heavy damage condition

Fig.8 Received as heavy damage condition

Fig.9 Received as heavy damage condition

Fig.10 Received as heavy damage condition

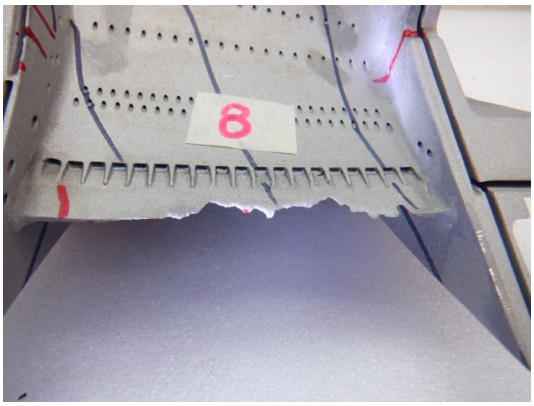


Fig.11 Extensive crack and heavy corrosion on trailing edge.

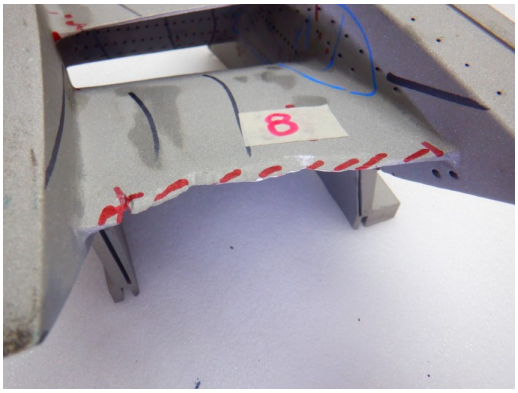


Fig.12 Extensive crack and heavy corrosion on trailing edge.

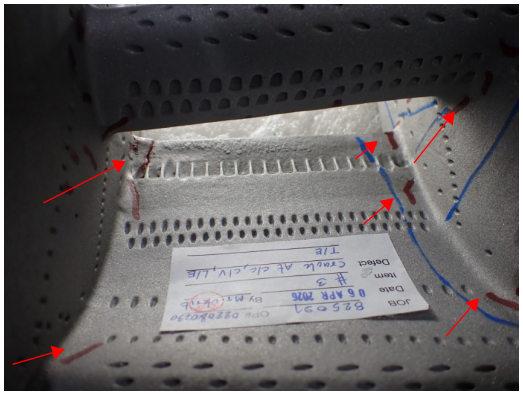


Fig.13 Extensive crack and heavy corrosion on trailing edge.

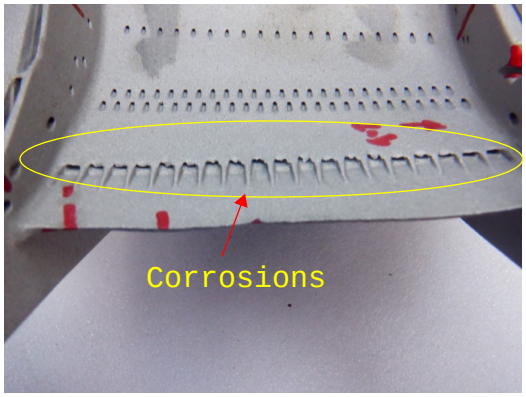


Fig.14 Heavy corrosion on concave airfoil and trailing edge

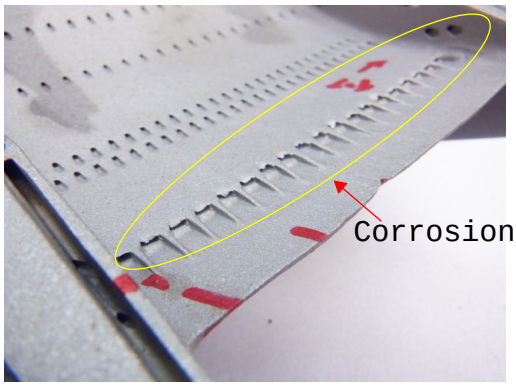


Fig.15 Heavy corrosion on concave airfoil and trailing edge.

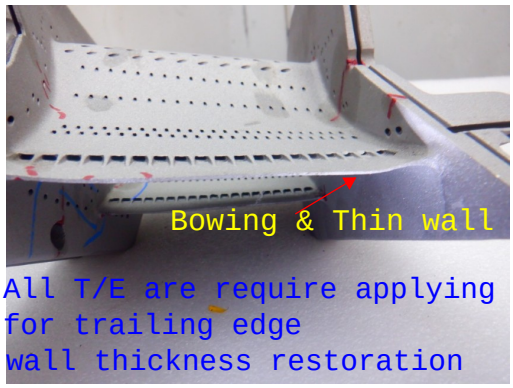


Fig.16 Critial Bowing and thin wall on trailing edge.

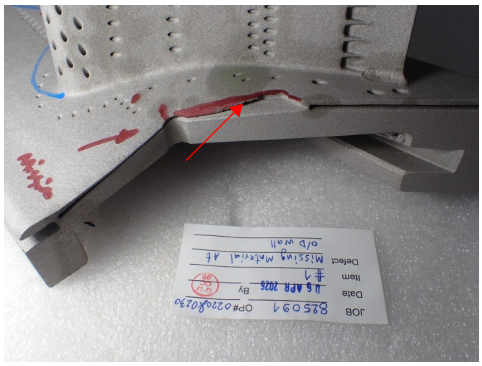


Fig.17 Heavy corrosion on outer shroud wall.

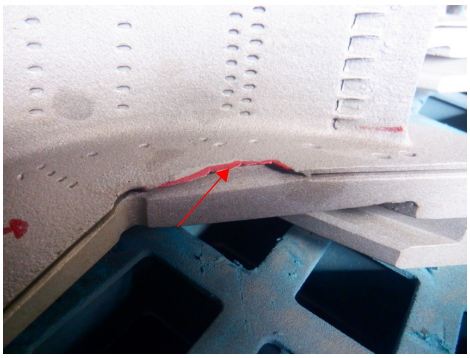


Fig.18 Heavy corrosion on outer shroud wall.

INCOMING INSPECTION REPORT

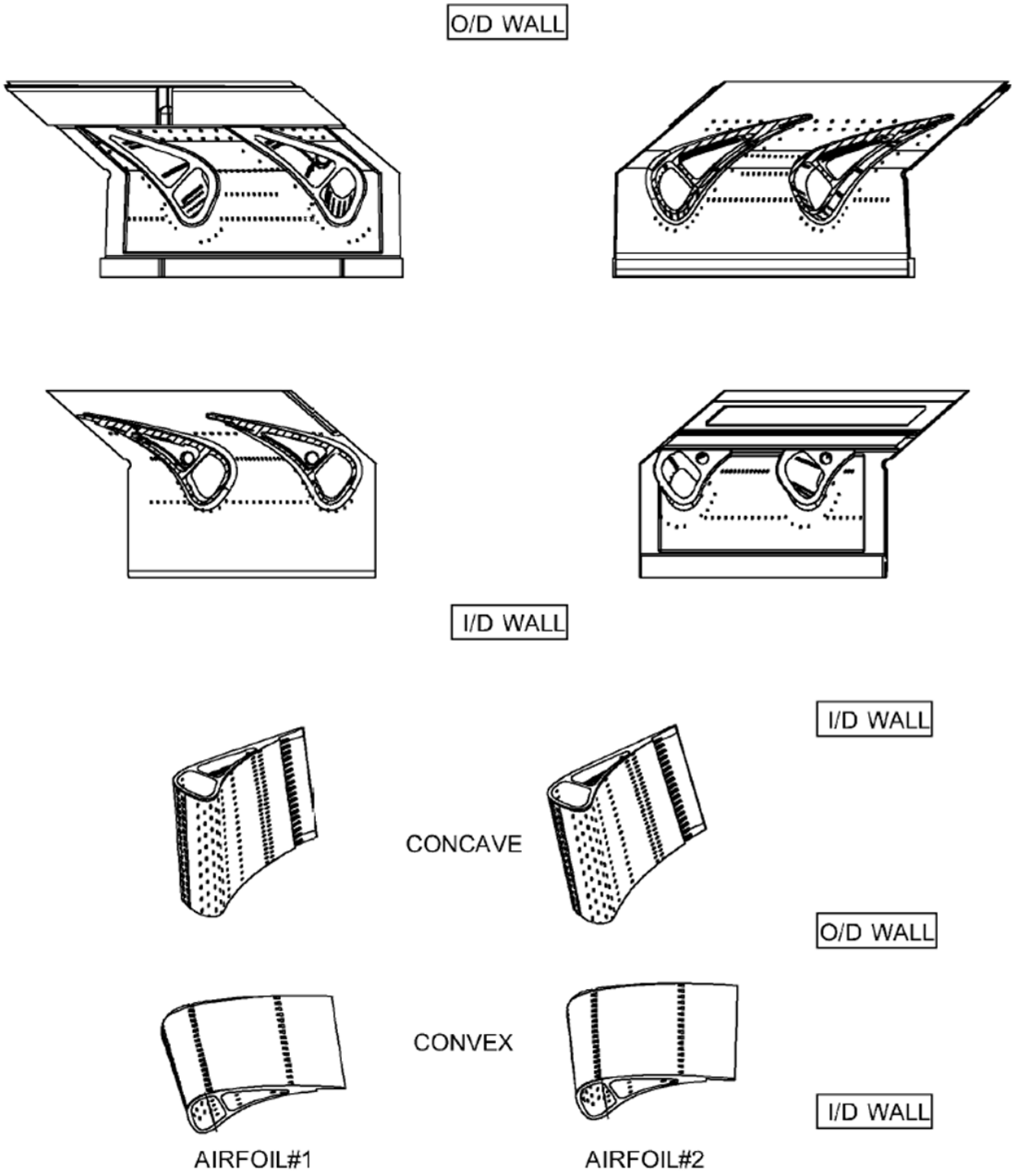
Fig.19 As received condition of Impingement Cover plates .

Fig.20 As received condition of Impingement Cover plates.

Fig.21 As received condition of core plugs

Fig.22 As received condition of core plugs

11. DEFECT LEGEND TABLE:



INCOMING INSPECTION REPORT

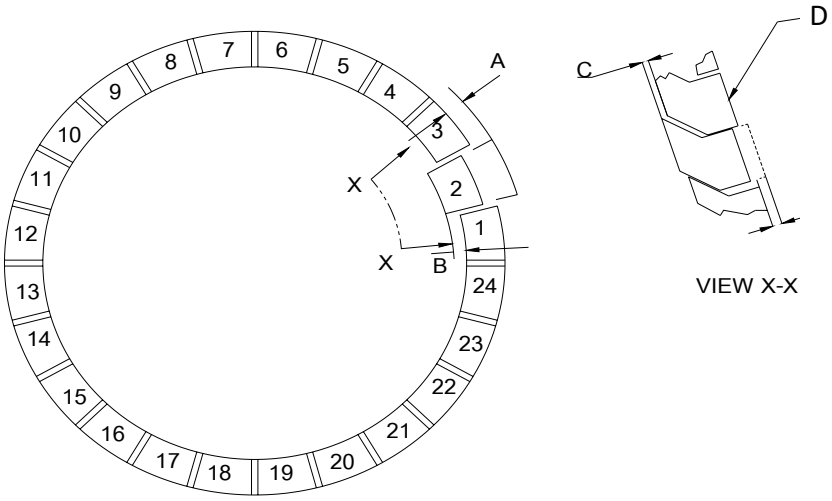
Information		NOZZLE SEGMENT INSPECTION FINDINGS																																														DIMENSIONAL DATA							
		Airfoil #1												Airfoil #2												Gas path Inner & Outer shrouds										Non- Gas path Inner & Outer shrouds										Core Plug Cavity											
Segment No.	S/N	Corrosion/ Erosion		Cracks		FOD		Deform.		Missing material		Bowing Airfoil		Corr/ Erosion		Cracks		FOD		Deform.		Missing material		Bowing Airfoil		Corr / Erosion		Cracks		FOD		Deform.		Missing material		Corr / Erosion		Cracks		FOD		Deform.		Frettage		Cracks		Missing material		Downstream/ Upstream deflection	Chord hinge parallelism	Step between each segment	Roundness	Transition groove seal fit	Gap	Nozzle alignment	Harmonic area
		C.C - A/F	C.V - A/F	C.C - A/F	C.V - A/F	C.C - A/F	C.V - A/F	C.C - A/F	C.V - A/F	C.C - A/F	C.V - A/F	C.C - A/F	C.V - A/F	C.C - A/F	C.V - A/F	C.C - A/F	C.V - A/F	C.C - A/F	C.V - A/F	C.C - A/F	C.V - A/F	C.C - A/F	C.V - A/F	C.C - A/F	C.V - A/F	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	A/F #1	A/F #2	C.C - A/F	C.V - A/F								
1	A1FC 04959			TPR	TPR									B	B	TPR	TPR											TPR	TPR																					ACC	ACC	ACC	ACC	ACC	Rej	ACC	ACC
2	A1FC 04965			TPR	TPR									B	B	TPR	TPR											TPR	TPR																					ACC	ACC	ACC	ACC	ACC	Rej	ACC	ACC
3	A1FC 04999			TPR	TPR									B	B	TPR	TPR											TPR	TPR																					ACC	ACC	ACC	ACC	ACC	Rej	ACC	ACC
4	A1FC 04981			TPR	TPR									B	B	TPR	TPR											TPR	TPR																					ACC	ACC	ACC	ACC	ACC	Rej	ACC	ACC
5	A1FC 04978			TPR	TPR									B	B	TPR	TPR											TPR	TPR																					ACC	ACC	ACC	ACC	ACC	Rej	ACC	Rej
6	A1FC 04958			TPR	TPR									B	B	TPR	TPR											TPR	TPR																					ACC	ACC	ACC	ACC	ACC	Rej	ACC	ACC
7	A1FC 04964			TPR	TPR									B	B	TPR	TPR											TPR	TPR																					ACC	ACC	ACC	ACC	ACC	Rej	ACC	Rej
8	A1FC 04955			TPR	TPR									B	B	TPR	TPR											TPR	TPR																					ACC	ACC	ACC	ACC	ACC	Rej	ACC	ACC
9	A1FC 04963			TPR	TPR									B	B	TPR	TPR											TPR	TPR																					ACC	ACC	ACC	ACC	ACC	Rej	ACC	ACC
10	A1FC 05000			TPR	TPR									B	B	TPR	TPR											TPR	TPR																					ACC	ACC	ACC	ACC	ACC	Rej	ACC	ACC
11	A1FC 04957			TPR	TPR									B	B	TPR	TPR											TPR	TPR																					ACC	ACC	Rej	ACC	ACC	Rej	ACC	ACC
12	A1FC 05002			TPR	TPR									B	B	TPR	TPR											TPR	TPR																					ACC	ACC	ACC	ACC	Rej	Rej	Rej	ACC
13	A1FC 04962			TPR	TPR									B	B	TPR	TPR											TPR	TPR																					ACC	ACC	ACC	ACC	ACC	Rej	ACC	Rej
14	A1FC 05007			TPR	TPR									B	B	TPR	TPR											TPR	TPR																					ACC	ACC	ACC	ACC	ACC	Rej	ACC	ACC
15	A1FC 05004			TPR	TPR									B	B	TPR	TPR											TPR	TPR																					ACC	ACC	ACC	ACC	ACC	Rej	ACC	Rej
16	A1FC 04960			TPR	TPR									B	B	TPR	TPR											TPR	TPR																					ACC	ACC	Rej	ACC	ACC	Rej	ACC	ACC
17	A1FC 04956			TPR	TPR									B	B	TPR	TPR											TPR	TPR																					ACC	ACC	ACC	ACC	ACC	Rej	ACC	Rej
18	A1FC 05003			TPR	TPR									B	B	TPR	TPR											TPR	TPR																					ACC	ACC	ACC	ACC	ACC	Rej	ACC	ACC
19	A1FC 04945			TPR	TPR									B	B	TPR	TPR											TPR	TPR																					ACC	ACC	ACC	ACC	ACC	Rej	ACC	Rej
20	A1FC 04998			TPR	TPR									B	B	TPR	TPR											TPR	TPR																					ACC	ACC	ACC	ACC	ACC	Rej	ACC	ACC
21	A1FC 05006			TPR	TPR									B	B	TPR	TPR											TPR	TPR																					ACC	ACC	ACC	ACC	ACC	Rej	ACC	Rej
22	A1FC 05001			TPR	TPR									B	B	TPR	TPR											TPR	TPR																					ACC	ACC	ACC	ACC	ACC	Rej	ACC	ACC
23	A1FC 04996			TPR	TPR									B	B	TPR	TPR											TPR	TPR																					ACC	ACC	ACC	ACC	ACC	Rej	ACC	ACC
24	A1FC 04961			TPR	TPR									B	B	TPR	TPR											TPR	TPR																					ACC	ACC	ACC	ACC	Rej	Rej	Rej	ACC

B = Blend repair to be performed in accordance with the location blend limits.
JK = jacking and contouring to be performed based on the deformation and distortion detected.
WB = Weld and Blend to be performed based on the area limits and defects detected.
WM = Weld and Machining to be performed to build material dimensions and restore original dimensions and contours.
WE = Welding and Electric discharge machining (EDM) to be performed to build material dimensions and restore original dimensions.
TPR = Transiate Phase Restoration to be performed based on the defects detected.
R = Replace with new.
ACC = Acceptable as is.
Rej = Dimension unacceptable and will require repair or cause of scrap.
S = Non-repairable / Scrap
L = Light repair category
M = Medium repair category
H = Heavy repair category

INCOMING INSPECTION REPORT

12. DIMENTION INSPECTION:

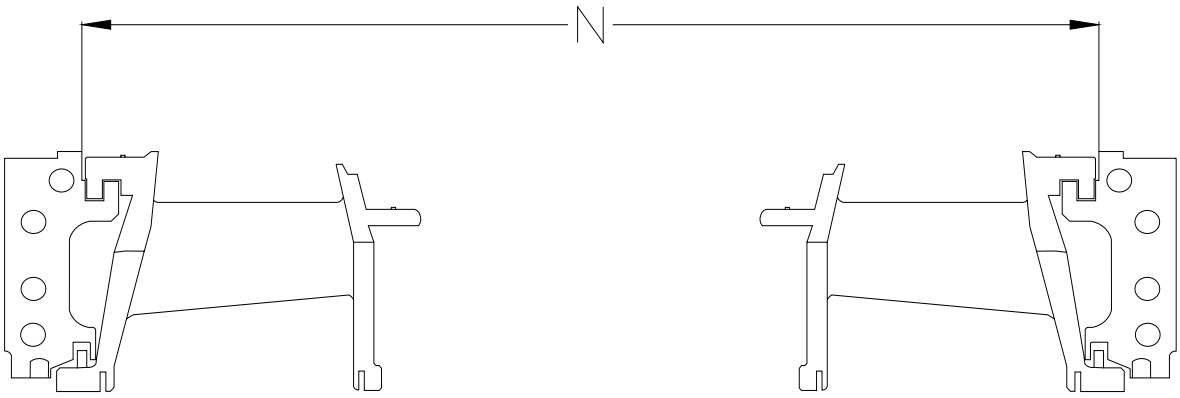
ALIGNMENT CHECK



SEGMENT No.	Horizontal(mm)		Vertical (mm)	
	A	B	C	D
1-2	0.27	0.55	1.04	0.84
2-3	0.17	0.46	0.54	0.98
3-4	0.48	0.17	0.85	0.97
4-5	0.29	0.47	0.80	1.06
5-6	0.48	0.42	1.01	0.75
6-7	0.19	0.33	0.64	1.01
7-8	0.39	0.28	0.92	0.97
8-9	0.29	0.56	0.70	0.79
9-10	0.49	0.33	1.01	1.03
10-11	0.01	0.40	0.70	0.75
11-12	0.22	0.29	0.77	0.67
12-13	0.69	0.78	1.10	1.15
13-14	0.27	0.24	0.91	0.72
14-15	0.34	0.18	0.67	0.70
15-16	0.40	0.11	1.14	0.76
16-17	0.44	0.36	0.93	1.13
17-18	0.45	0.12	0.98	0.93
18-19	0.40	0.36	0.73	1.08
19-20	0.31	0.46	0.85	0.71
20-21	0.20	0.41	1.04	0.93
21-22	0.49	0.28	0.66	0.98
22-23	0.35	0.35	0.93	0.82
23-24	0.39	0.11	0.48	0.64
24-1	0.88	0.71	0.93	0.78

INCOMING INSPECTION REPORT

ROUNDNESS CHECK

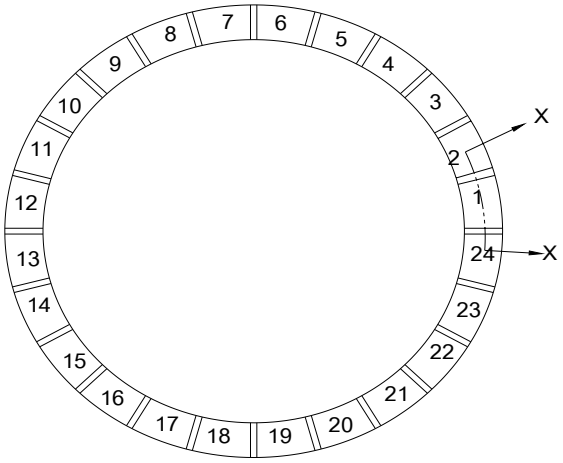


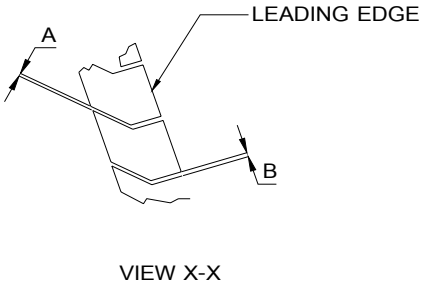
No.	A-A	B-B	C-C	D-D	Roundness	Result
1	1732.70	1733.42	1733.50	1732.95	0.80	ACCEPT

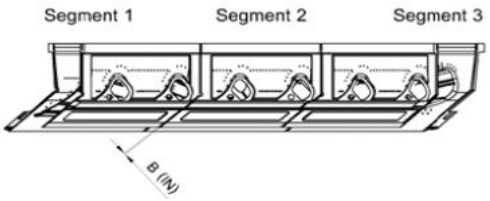
Unit:mm

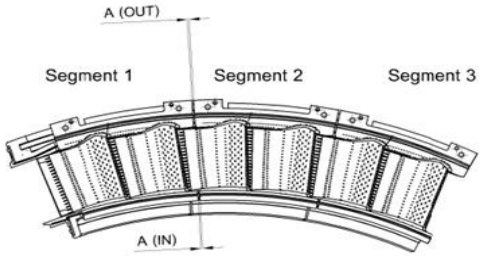
INCOMING INSPECTION REPORT

GAP MEASUREMENT CHECK





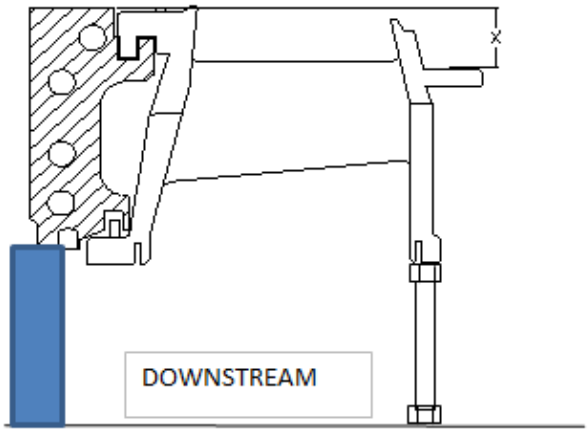


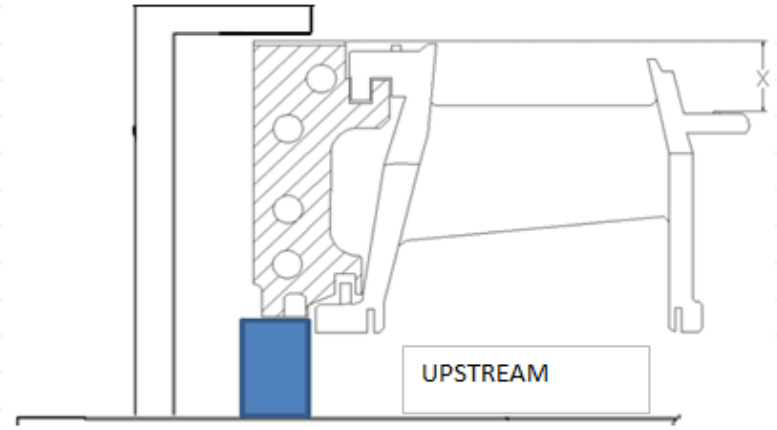


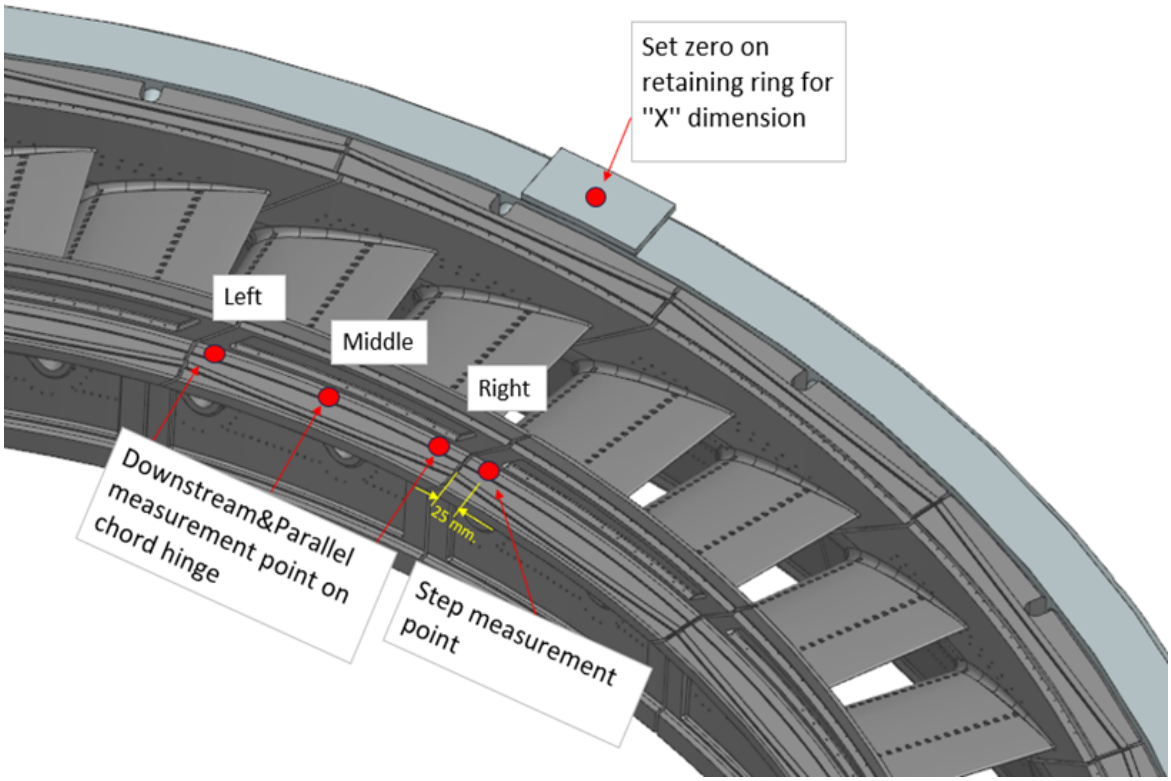
SEGMENT NO.	I/D Wall		O/D Wall	
	A (mm.)	B (mm.)	A (mm.)	B (mm.)
1-2	2.98	4.28	2.83	3.26
2-3	3.53	3.78	3.00	3.73
3-4	3.22	4.08	3.07	5.49
4-5	3.66	4.47	3.48	4.80
5-6	3.38	3.66	2.59	4.43
6-7	3.55	3.76	3.73	5.12
7-8	3.45	3.95	2.63	4.24
8-9	3.14	3.65	2.82	5.91
9-10	3.61	3.55	3.14	3.83
10-11	3.97	4.07	2.47	3.41
11-12	4.08	4.14	2.83	5.95
12-13	4.16	5.22	2.77	6.43
13-14	3.00	3.60	2.47	4.41
14-15	3.87	4.15	3.18	4.45
15-16	2.58	4.10	2.33	5.53
16-17	3.59	4.30	3.24	4.57
17-18	3.01	3.71	2.54	4.10
18-19	3.58	4.58	3.20	4.72
19-20	3.45	4.24	2.61	3.92
20-21	3.63	4.34	3.04	3.07
21-22	3.39	4.04	3.65	3.60
22-23	3.66	3.65	3.52	3.70
23-24	3.28	3.88	2.32	4.64
24-1	3.87	4.13	3.82	5.19

INCOMING INSPECTION REPORT

DROP CHECK





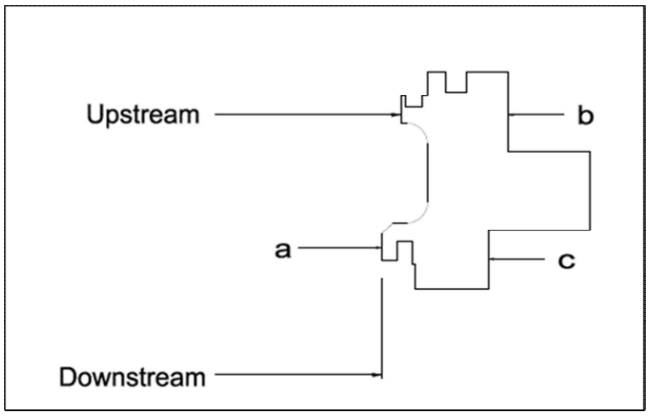


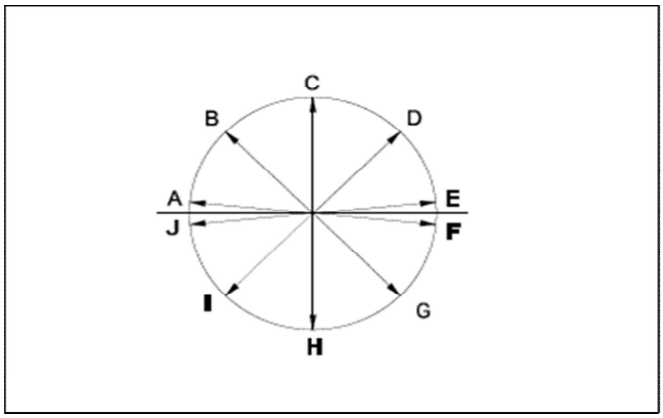
INCOMING INSPECTION REPORT

Downstream Deflection Check (Drop Check)													
SEGMENT	X' Downstream (mm)					X' Upstream (mm)					Flexible 'X' (mm)		
	Left	Middle	Right	Parallel	Step	Left	Middle	Right	Parallel	Step	Left	Middle	Right
1	29.58	29.54	29.47	-0.11	0.19	30.73	30.13	30.46	-0.27	-0.28	1.15	0.59	0.99
2	29.28	29.47	29.23	-0.05	-0.21	30.74	30.67	30.57	-0.17	-0.06	1.46	1.20	1.34
3	29.44	29.42	29.14	-0.30	-0.40	30.63	30.46	30.32	-0.31	-0.58	1.19	1.04	1.18
4	29.54	29.57	28.91	-0.63	-0.94	30.90	30.38	30.80	-0.10	0.02	1.36	0.81	1.89
5	29.85	29.44	29.13	-0.72	-0.13	30.78	31.02	30.88	0.10	0.48	0.93	1.58	1.75
6	29.26	29.23	28.98	-0.28	-0.12	30.40	30.60	30.79	0.39	0.22	1.14	1.37	1.81
7	29.10	29.22	29.22	0.12	-0.21	30.57	30.75	30.72	0.15	-0.01	1.47	1.53	1.50
8	29.43	29.72	29.63	0.20	0.09	30.73	30.85	30.46	-0.27	-0.27	1.30	1.13	0.83
9	29.54	29.26	28.90	-0.64	-0.37	30.73	30.91	30.92	0.19	0.38	1.19	1.65	2.02
10	29.27	29.43	29.41	0.14	0.58	30.54	30.68	30.60	0.06	0.15	1.27	1.25	1.19
11	28.83	28.87	28.42	-0.41	-1.21	30.45	30.53	30.47	0.02	-0.07	1.62	1.66	2.05
12	29.63	29.47	29.12	-0.51	-0.63	30.54	30.62	30.72	0.18	0.16	0.91	1.15	1.60
13	29.75	29.65	29.42	-0.33	0.08	30.56	30.44	30.66	0.10	0.05	0.81	0.79	1.24
14	29.34	29.34	29.19	-0.15	-0.72	30.61	31.24	30.97	0.36	0.13	1.27	1.90	1.78
15	29.91	29.86	29.44	-0.47	0.76	30.84	30.50	31.00	0.16	0.70	0.93	0.64	1.56
16	28.68	28.43	28.44	-0.24	-1.16	30.30	30.24	30.37	0.07	-0.01	1.62	1.81	1.93
17	29.60	29.64	29.52	-0.08	0.45	30.38	30.53	30.38	0.00	-0.40	0.78	0.89	0.86
18	29.07	29.34	29.29	0.22	-0.48	30.78	30.88	30.28	-0.50	-0.28	1.71	1.54	0.99
19	29.77	29.49	29.15	-0.62	-0.45	30.56	30.53	30.45	-0.11	-0.23	0.79	1.04	1.30
20	29.60	29.55	29.35	-0.25	0.04	30.68	30.46	30.37	-0.31	-0.51	1.08	0.91	1.02
21	29.31	29.29	29.08	-0.23	-0.87	30.88	30.70	30.26	-0.62	-0.68	1.57	1.41	1.18
22	29.95	29.76	29.25	-0.70	-0.41	30.94	30.64	30.55	-0.39	0.04	0.99	0.88	1.30
23	29.66	29.88	29.65	-0.01	-0.18	30.51	30.37	30.49	-0.02	-0.09	0.85	0.49	0.84
24	29.83	29.50	29.41	-0.42	-0.17	30.58	30.53	30.43	-0.15	-0.30	0.75	1.03	1.02

INCOMING INSPECTION REPORT

RETAINING RING ROUNDNESS

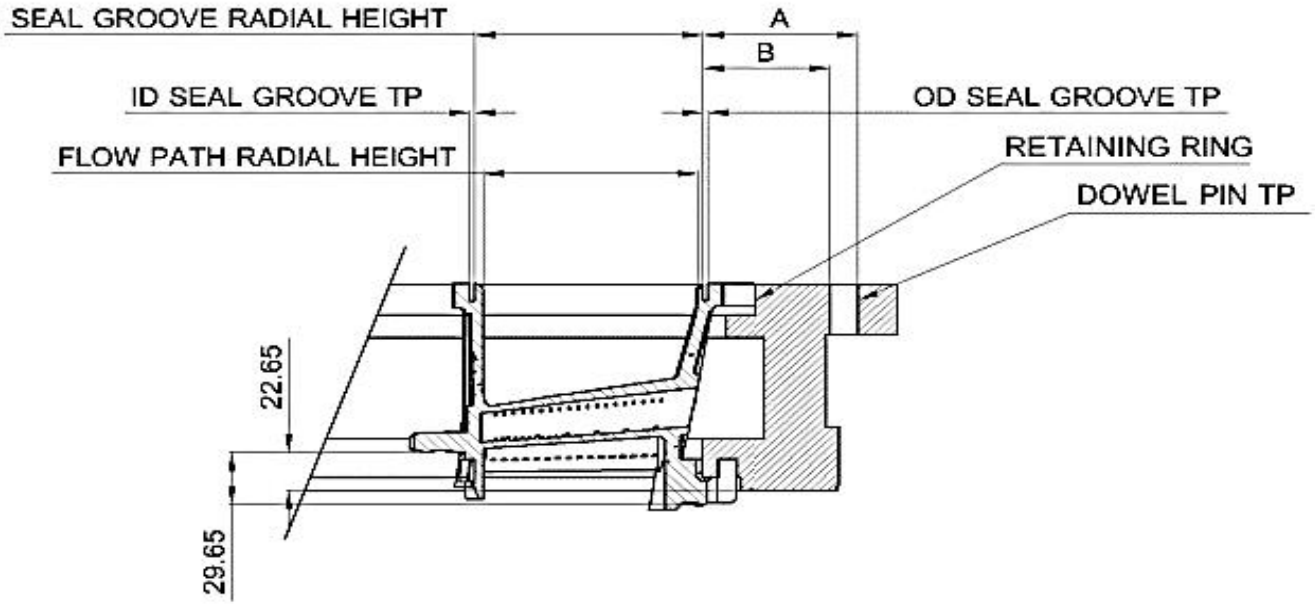




(Unit:mm)	A-F	B-G	C-H	D-I	E-J	Max-min
A-Upstream	1715.19	1716.01	1716.32	1715.36	1715.11	1.21
A-Downstream	1687.50	1688.24	1688.38	1687.79	1687.46	0.92

INCOMING INSPECTION REPORT

RADIAL HEIGHTS

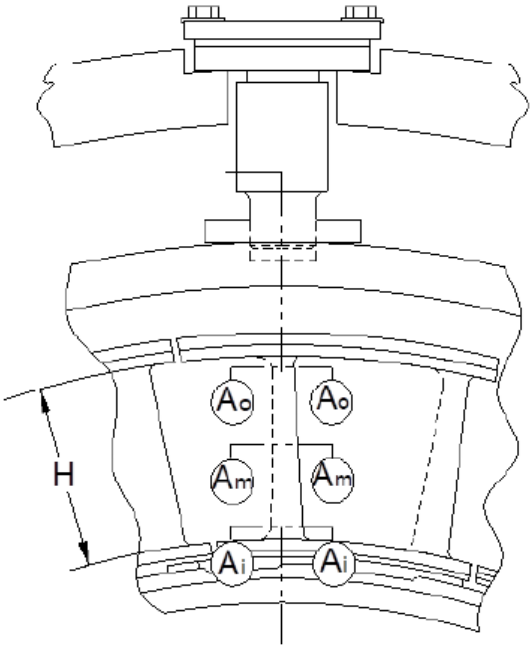


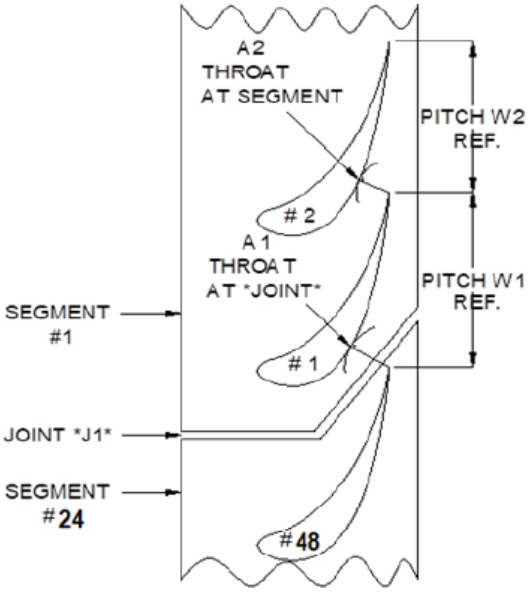
Item	Dowel OD to Outer seal groove	Dowel ID to Outer wall flow path
	A	B
1	86.48	70.58
2	87.78	71.74
3	86.57	70.72
4	87.06	71.56
5	86.60	70.69
6	87.14	71.05
7	86.91	71.17
8	87.04	71.30
9	86.39	70.66
10	87.24	71.59
11	86.76	70.82
12	87.13	71.85

Unit:mm

INCOMING INSPECTION REPORT

HARMONIC





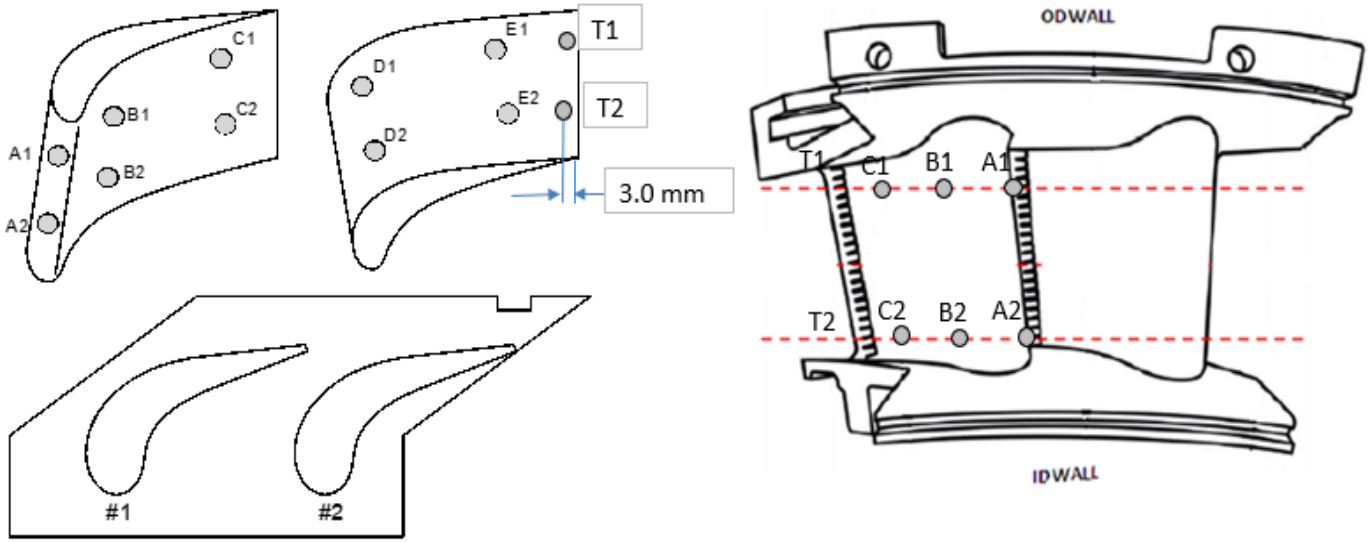
INCOMING INSPECTION REPORT

Seg N^0	Gas Path Number	Throat Dimensions			H at centre	Pitch Dim.		Gas Path Area	Harmonic		Throat Dimensions			H at centre	Pitch Dim.		Gas Path Area	Harmonic	
		AO	AM	AI		WM	WO		Middle	Outer	AO % dev	AM % dev	AI % dev	% dev	WO % dev	WM % dev	% dev	Outer % dev	Middle % dev
1	J 1	29.89	27.45	24.67	106.91	102.08	108.28	2925.59	0.27	0.28	2.68%	6.15%	9.11%	0.17%	1.23%	1.64%	6.00%	0.05	0.01
	S 2	27.91	24.21	22.03	107.21	100.09	105.19	2636.29	0.24	0.27	-3.02%	-5.24%	-1.34%	0.45%	0.01%	-0.49%	-3.33%	-0.05	-0.03
2	J 3	28.78	26.46	23.30	107.39	102.49	107.31	2818.99	0.26	0.27	-1.13%	2.32%	3.05%	0.62%	1.64%	0.73%	2.14%	0.01	-0.02
	S 4	28.36	25.15	21.84	107.59	99.25	105.04	2703.20	0.25	0.27	-1.46%	-1.57%	-2.19%	0.81%	-0.83%	-0.63%	-0.88%	-0.01	-0.01
3	J 5	29.23	26.43	23.04	107.63	101.00	106.84	2828.79	0.26	0.27	0.41%	2.20%	1.90%	0.84%	0.16%	0.29%	2.49%	0.02	0.00
	S 6	28.22	25.25	22.35	107.68	100.72	104.09	2720.80	0.25	0.27	-1.95%	-1.17%	0.09%	0.89%	0.64%	-1.53%	-0.24%	-0.02	0.00
4	J 7	28.65	25.95	22.30	107.69	100.01	105.94	2768.98	0.26	0.27	-1.58%	0.35%	-1.37%	0.90%	-0.82%	-0.55%	0.32%	0.01	-0.01
	S 8	28.86	25.33	22.39	107.41	99.99	104.82	2736.54	0.25	0.28	0.28%	-0.86%	0.27%	0.64%	-0.09%	-0.84%	0.34%	-0.01	0.01
5	J 9	29.87	25.56	23.59	106.78	100.11	108.22	2791.76	0.26	0.28	2.61%	-1.16%	4.33%	0.05%	-0.72%	1.59%	1.15%	0.00	0.01
	S 10	27.65	24.69	21.53	107.07	100.40	104.54	2638.20	0.25	0.26	-3.93%	-3.37%	-3.58%	0.32%	0.32%	-1.11%	-3.26%	-0.04	-0.03
6	J 11	28.67	26.01	22.41	107.53	102.00	105.80	2771.64	0.26	0.27	-1.51%	0.58%	-0.88%	0.75%	1.15%	-0.69%	0.42%	-0.01	-0.01
	S 12	28.33	24.90	21.73	107.20	99.77	104.30	2676.25	0.25	0.27	-1.56%	-2.54%	-2.69%	0.44%	-0.31%	-1.33%	-1.87%	-0.02	0.00
7	J 13	30.03	27.04	22.91	107.22	100.88	106.72	2868.67	0.27	0.28	3.16%	4.56%	1.33%	0.46%	0.04%	0.18%	3.94%	0.05	0.03
	S 14	28.35	25.29	21.96	107.37	99.57	104.46	2708.14	0.25	0.27	-1.49%	-1.02%	-1.66%	0.60%	-0.51%	-1.18%	-0.70%	-0.01	0.00
8	J 15	28.27	25.96	23.00	106.87	100.03	104.50	2756.98	0.26	0.27	-2.89%	0.39%	1.72%	0.13%	-0.80%	-1.90%	-0.11%	0.01	-0.01
	S 16	28.27	25.63	22.58	107.05	98.80	104.41	2732.72	0.26	0.27	-1.77%	0.31%	1.12%	0.30%	-1.28%	-1.23%	0.20%	0.02	-0.01
9	J 17	29.88	27.09	22.98	107.26	103.30	105.89	2870.28	0.26	0.28	2.65%	4.76%	1.64%	0.50%	2.44%	-0.60%	3.99%	0.02	0.03
	S 18	27.49	23.95	22.09	107.04	98.92	104.03	2608.56	0.24	0.26	-4.48%	-6.26%	-1.07%	0.29%	-1.16%	-1.59%	-4.35%	-0.05	-0.03
10	J 19	28.64	24.48	23.14	107.36	100.79	104.92	2703.86	0.24	0.27	-1.61%	-5.34%	2.34%	0.59%	-0.05%	-1.51%	-2.04%	-0.05	0.00
	S 20	28.90	25.39	22.48	108.20	99.19	104.96	2763.43	0.26	0.28	0.42%	-0.63%	0.67%	1.38%	-0.89%	-0.71%	1.33%	0.00	0.01
11	J 21	28.94	25.65	21.69	107.50	101.78	107.44	2739.37	0.25	0.27	-0.58%	-0.81%	-4.07%	0.72%	0.93%	0.85%	-0.75%	-0.02	-0.01
	S 22	27.71	24.97	22.34	107.16	99.37	104.46	2678.73	0.25	0.27	-3.72%	-2.27%	0.04%	0.40%	-0.71%	-1.18%	-1.78%	-0.02	-0.03
12	J 23	28.81	26.22	22.57	106.95	102.39	107.34	2775.89	0.26	0.27	-1.03%	1.39%	-0.18%	0.21%	1.54%	0.76%	0.57%	0.00	-0.02
	S 24	28.88	25.26	22.22	107.75	98.33	104.21	2737.39	0.26	0.28	0.35%	-1.14%	-0.49%	0.96%	-1.75%	-1.42%	0.37%	0.01	0.02
13	J 25	29.72	27.56	23.64	107.23	101.47	108.27	2908.08	0.27	0.27	2.10%	6.57%	4.56%	0.47%	0.62%	1.63%	5.36%	0.06	0.00
	S 26	27.43	24.30	21.68	107.12	99.54	103.49	2616.67	0.24	0.27	-4.69%	-4.89%	-2.91%	0.37%	-0.54%	-2.10%	-4.05%	-0.04	-0.03
14	J 27	28.62	26.16	22.65	107.18	101.09	107.58	2775.69	0.26	0.27	-1.68%	1.16%	0.18%	0.42%	0.25%	0.99%	0.57%	0.01	-0.03
	S 28	28.82	25.25	22.14	107.38	99.32	104.10	2723.69	0.25	0.28	0.14%	-1.17%	-0.85%	0.61%	-0.76%	-1.52%	-0.13%	0.00	0.02
15	J 29	30.02	27.46	23.59	107.25	101.10	106.76	2909.96	0.27	0.28	3.13%	6.19%	4.33%	0.49%	0.26%	0.22%	5.43%	0.06	0.03
	S 30	29.25	25.39	22.25	107.45	99.59	104.57	2747.50	0.25	0.28	1.63%	-0.63%	-0.36%	0.67%	-0.49%	-1.08%	0.74%	0.00	0.03
16	J 31	28.40	25.49	21.79	107.10	101.21	107.41	2708.83	0.25	0.26	-2.44%	-1.43%	-3.63%	0.35%	0.37%	0.83%	-1.86%	-0.02	-0.03
	S 32	28.88	25.57	22.57	107.22	99.44	104.82	2749.92	0.26	0.28	0.35%	0.08%	1.07%	0.46%	-0.64%	-0.84%	0.83%	0.01	0.01
17	J 33	29.91	27.51	24.97	107.07	101.94	107.74	2941.75	0.27	0.28	2.75%	6.38%	10.44%	0.32%	1.09%	1.14%	6.58%	0.05	0.02
	S 34	27.84	24.27	21.28	107.10	99.09	104.31	2614.85	0.24	0.27	-3.27%	-5.01%	-4.70%	0.35%	-0.99%	-1.32%	-4.12%	-0.04	-0.02
18	J 35	27.98	25.24	21.69	107.12	100.49	106.69	2682.02	0.25	0.26	-3.88%	-2.40%	-4.07%	0.37%	-0.35%	0.15%	-2.83%	-0.02	-0.04
	S 36	28.41	25.51	22.11	107.22	99.01	103.97	2721.78	0.26	0.27	-1.29%	-0.16%	-0.99%	0.46%	-1.07%	-1.65%	-0.20%	0.01	0.00
19	J 37	29.86	26.97	23.01	107.03	100.71	107.40	2857.97	0.27	0.28	2.58%	4.29%	1.77%	0.28%	-0.13%	0.82%	3.55%	0.04	0.02
	S 38	27.95	25.01	21.89	107.08	100.03	104.78	2673.25	0.25	0.27	-2.88%	-2.11%	-1.97%	0.33%	-0.05%	-0.88%	-1.98%	-0.02	-0.02
20	J 39	28.94	26.61	23.34	107.13	100.85	107.66	2825.55	0.26	0.27	-0.58%	2.90%	3.23%	0.37%	0.01%	1.06%	2.37%	0.03	-0.02
	S 40	28.35	25.05	22.03	107.54	98.89	104.41	2701.40	0.25	0.27	-1.49%	-1.96%	-1.34%	0.76%	-1.19%	-1.23%	-0.95%	-0.01	0.00
21	J 41	29.37	26.99	23.27	106.95	101.77	108.60	2850.75	0.27	0.27	0.89%	4.37%	2.92%	0.21%	0.92%	1.94%	3.29%	0.03	-0.01
	S 42	27.64	24.49	21.72	107.26	98.66	104.33	2636.99	0.25	0.26	-3.96%	-4.15%	-2.73%	0.50%	-1.42%	-1.31%	-3.31%	-0.03	-0.03
22	J 43	28.43	26.40	23.17	107.13	101.27	106.70	2796.09	0.26	0.27	-2.34%	2.09%	2.48%	0.37%	0.43%	0.16%	1.31%	0.02	-0.02
	S 44	28.73	25.07	22.08	107.34	99.29	104.20	2708.99	0.25	0.28	-0.17%	-1.88%	-1.12%	0.57%	-0.79%	-1.43%	-0.67%	-0.01	0.01
23	J 45	29.07	26.54	23.04	107.33	101.11	107.20	2822.51	0.26	0.27	-0.14%	2.63%	1.90%	0.56%	0.27%	0.63%	2.26%	0.02	-0.01
	S 46	28.69	25.03	22.35	108.14	98.46	104.57	2733.24	0.25	0.27	-0.31%	-2.04%	0.09%	1.32%	-1.62%	-1.08%	0.22%	0.00	0.01
24	J 47	28.88	26.26	22.61	107.03	100.65	106.68	2783.05	0.26	0.27	-0.79%	1.55%	0.00%	0.28%	-0.19%	0.14%	0.83%	0.02	-0.01
	S 48	28.21	24.57	22.36	107.21	100.28	104.18	2672.48	0.25	0.27	-1.98%	-3.84%	0.13%	0.45%	0.20%	-1.45%	-2.01%	-0.04	-0.01

Total Joint Area	67483.04			Total Joint Area IN^2	104.599
Total Segment Area	64641.03	% Area Deviation	*0.33%*	Total Segment Area IN^2	100.194
Total Nozzle Area	132124.07			Total Nozzle Area IN^2	204.793

INCOMING INSPECTION REPORT

WALL THICKNESS CHECK



Segment	Airfoil # 1												Airfoil # 2												Result
No.	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	T1	T2	A1	A2	B1	B2	C1	C2	D1	D2	E1	E2	T1	T2	
1	2.78	2.83	2.49	2.64	2.31	2.27	3.73	3.18	2.95	2.87	1.18	1.21	2.84	2.86	2.44	2.63	2.38	2.49	3.74	3.22	2.85	2.92	1.50	1.22	Rej
2	2.68	2.97	2.52	2.81	2.27	2.22	3.82	3.68	3.60	2.96	1.99	2.05	3.02	3.11	2.98	2.95	2.56	2.64	3.51	3.33	3.40	3.35	1.71	2.06	Rej
3	2.87	2.82	2.69	2.78	2.41	2.30	3.16	2.68	2.79	2.36	1.36	1.68	2.86	3.05	2.58	2.66	2.29	2.28	3.04	3.31	2.77	3.06	2.05	1.81	Rej
4	3.05	3.07	2.55	2.68	2.45	2.92	3.18	3.11	3.44	3.17	1.90	2.26	2.96	2.98	3.08	3.24	2.45	2.88	3.41	3.57	3.43	3.42	1.87	1.93	Rej
5	2.88	3.11	2.71	3.15	2.30	2.48	3.36	3.51	3.51	3.44	1.25	1.26	2.91	3.04	2.60	2.48	2.48	2.76	3.37	3.30	3.11	3.09	1.63	1.60	Rej
6	3.03	3.39	3.16	3.23	3.18	3.45	3.20	3.46	3.69	3.52	1.75	1.90	3.02	3.45	2.91	3.20	3.01	3.11	3.57	3.42	4.15	3.93	1.94	1.93	Rej
7	3.05	3.24	2.46	2.94	2.36	2.70	3.58	2.75	2.95	2.85	1.29	1.53	2.64	3.23	2.50	2.94	2.59	2.97	3.50	2.83	3.14	3.23	1.74	1.68	Rej
8	3.02	3.76	2.62	2.98	2.24	2.46	3.55	3.02	33.90	3.13	1.80	1.96	3.01	3.62	2.36	2.78	2.47	3.12	3.48	3.12	3.76	3.80	Missing	Missing	Rej
9	3.03	3.48	2.60	2.89	2.65	2.94	3.53	3.18	3.54	3.21	1.37	1.38	2.93	3.43	2.57	2.97	2.55	3.14	3.75	3.16	3.32	3.12	1.30	1.43	Rej
10	2.96	3.39	2.48	2.73	2.42	2.47	3.29	3.52	3.45	3.43	1.52	1.60	2.98	3.41	2.81	3.17	2.35	2.60	3.43	3.03	3.44	3.08	1.86	1.88	Rej
11	3.06	3.60	2.78	2.96	2.27	2.46	3.95	3.55	3.03	3.12	1.73	2.10	2.94	3.15	2.63	2.68	2.27	2.51	3.32	3.42	3.55	3.40	1.93	1.79	Rej
12	2.95	3.46	2.38	2.69	2.61	2.42	3.07	3.11	3.47	3.25	1.53	1.64	2.89	3.04	2.64	2.68	2.26	2.56	3.02	3.05	3.57	3.49	1.61	1.59	Rej
13	3.03	3.55	2.28	2.48	2.68	2.54	3.29	2.86	3.70	3.23	1.65	1.61	3.02	3.06	2.44	2.53	2.57	2.63	3.57	2.85	3.52	3.44	1.60	1.36	Rej
14	3.02	3.45	2.57	2.68	2.56	2.30	3.21	3.16	3.35	3.29	1.27	1.50	3.01	3.47	2.68	2.48	2.30	2.50	3.21	3.04	3.42	3.38	1.40	1.18	Rej
15	2.96	2.93	2.53	2.79	2.40	2.48	3.55	3.26	2.80	3.11	1.56	1.73	2.86	2.94	2.51	2.78	2.27	2.39	3.01	2.86	3.07	3.36	1.23	1.35	Rej
16	2.97	3.22	2.42	2.56	2.31	2.48	3.33	2.94	3.45	2.78	1.38	1.56	2.98	3.04	2.47	2.61	2.55	2.64	3.38	3.45	3.05	2.82	1.68	1.70	Rej
17	3.04	3.13	2.56	2.42	2.24	2.35	3.46	3.32	3.44	3.23	1.25	1.26	3.05	3.11	2.24	2.48	2.30	2.55	3.29	2.97	3.54	3.30	1.56	1.68	Rej
18	2.95	3.24	2.32	2.61	2.40	2.82	3.18	2.96	2.95	2.80	1.50	1.60	2.75	3.05	2.65	2.98	2.53	3.18	3.43	3.15	3.34	3.35	1.52	1.41	Rej
19	2.82	3.23	2.45	2.88	2.62	2.89	3.29	3.16	2.95	2.97	1.28	1.45	3.03	3.12	2.60	2.87	2.56	3.00	3.35	3.34	3.31	3.45	1.50	1.56	Rej
20	2.75	3.22	2.53	2.82	2.54	2.78	3.55	3.22	3.44	3.42	1.44	1.53	2.76	3.12	2.75	3.06	2.52	3.04	3.07	2.86	3.31	3.42	1.41	1.52	Rej
21	3.03	3.34	2.62	2.80	2.61	2.77	3.33	2.86	3.55	2.93	1.29	1.62	3.06	3.40	2.72	3.03	2.28	2.43	3.27	2.95	3.22	3.38	1.21	1.12	Rej
22	2.80	3.04	2.66	3.07	2.44	2.55	3.55	3.33	2.98	2.90	1.39	1.45	2.78	3.01	2.73	3.02	2.68	2.92	3.39	3.12	3.32	3.19	1.78	1.75	Rej
23	2.90	2.92	2.46	2.77	2.43	2.66	3.64	3.42	3.32	3.11	1.52	1.58	2.95	3.13	2.63	3.03	2.87	3.02	3.64	3.42	3.41	3.59	1.52	1.41	Rej
24	2.97	3.06	2.41	2.64	2.55	2.88	3.61	3.11	3.32	3.37	1.28	1.25	2.91	3.14	2.74	3.14	2.57	2.70	3.44	3.06	3.10	3.08	1.53	1.38	Rej

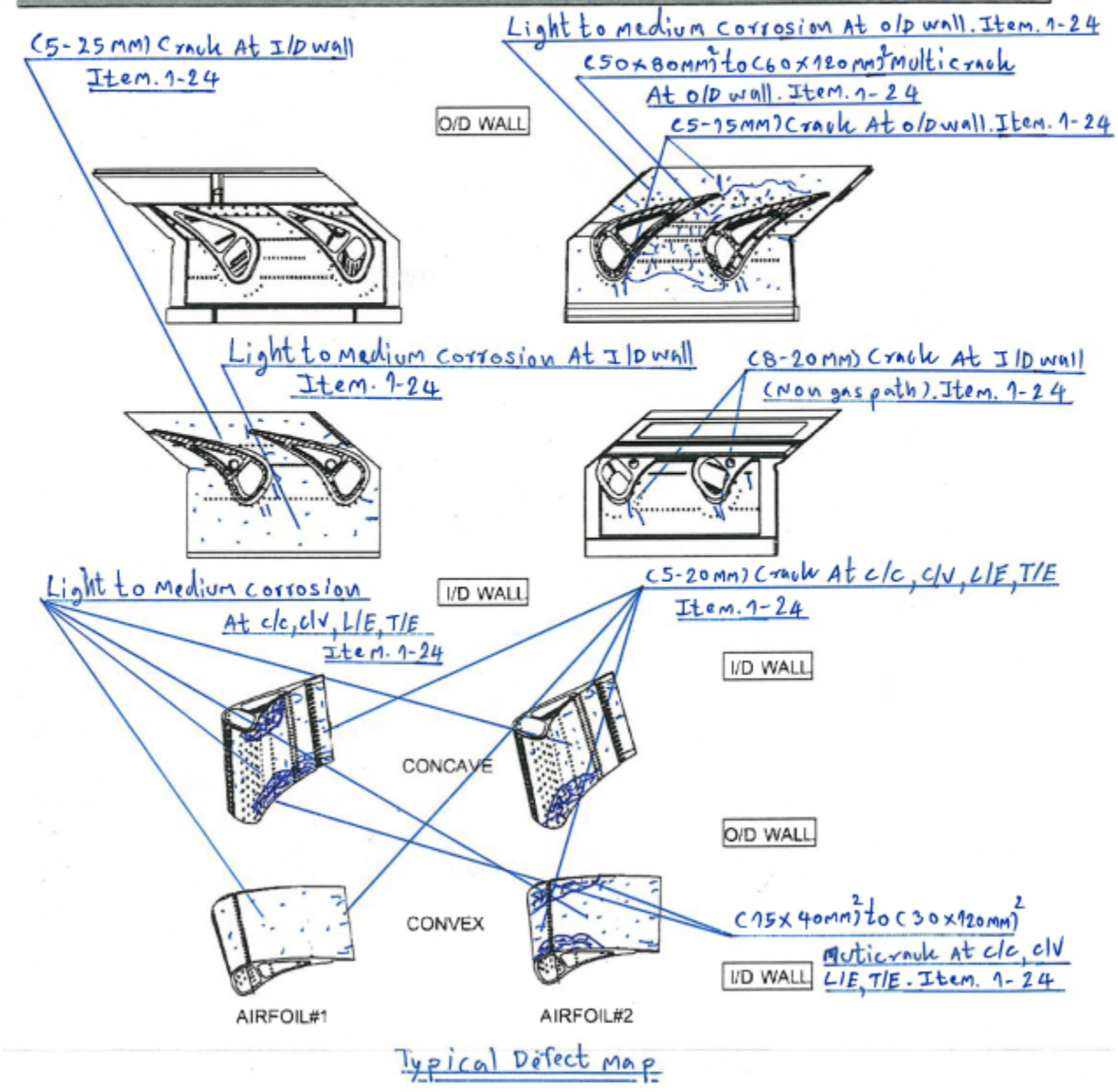
Unit:mm

Note: Based on incoming wall thickness dimensional inspection, Position "T1,T2" are less than limit of 2.03 mm min. that require apply PSP for trailing edge wall thickness restoration.

INCOMING INSPECTION REPORT

13. DEFECT MAP:

INSPECTION AND PROCESS RECORD SHEET	MS6001FA 1st STAGE NOZZLE	IPRS NO.	3062-110
	PART NUMBER : GENZ01M6FA	REV.	03
CUSTOMER :	Nghi Son Refinery &	CUSTOMER PO :	WO02232026-TP-LN-SH
JOB NUMBER :	825091	OP.	0220&0230
INSPECTED BY :	Mr. Ukrit	DATE :	06 APR 2026
DEFECT MAP RECORD SHEET			



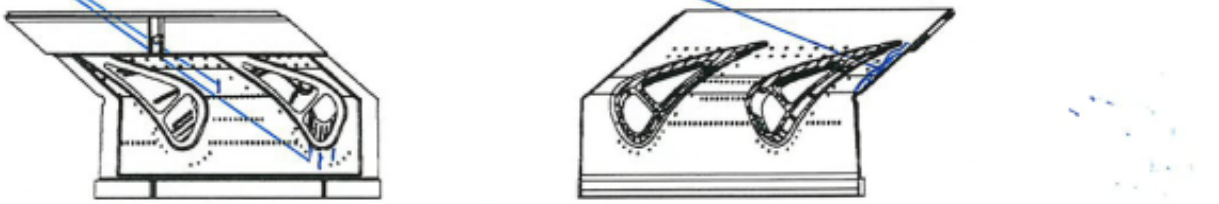
Typical Defect map

INCOMING INSPECTION REPORT

INSPECTION AND PROCESS RECORD SHEET	MS6001FA 1st STAGE NOZZLE	IPRS NO.	3062-110
	PART NUMBER : GENZ01M6FA	REV.	03
CUSTOMER :	Nghi Son Refinery &	CUSTOMER PO :	WO02232026-TP-LN-SH
JOB NUMBER :	825091	OP.	0220&0230
INSPECTED BY :	Mr. Cherit	DATE :	06 APR 2026
DEFECT MAP RECORD SHEET			

(8-15 MM) Crack At o/D wall (Non gas path). Item. 1,22,23,3

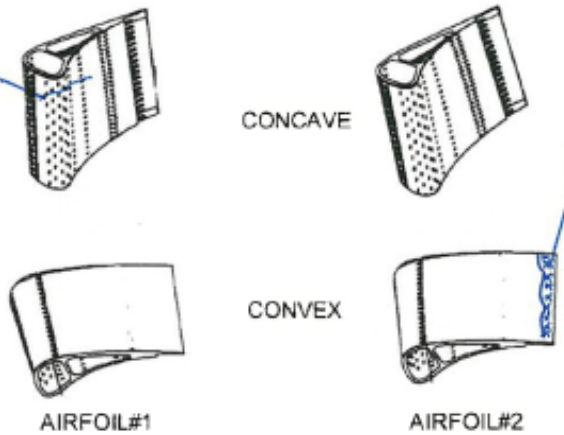
(5x30mm)^2 to (8x50mm)^2 Missing material At o/D wall
Item. 1,2,4,5,6,11,14,15 17



Sample Lab At I/D wall. Item. 11,13

(50MM) Crack At c/c
Item. 19

(8x100MM)^2 Missing material
At T/E. Item. 8



Non-Typical Defect Map

3321 SE Gran Park Way, Stuart, Florida, USA 34997 | Tel: +1-772-408-4600 | www.unew.us.com

Subject: Refurbishment Incoming Inspection Reports and Capital Parts Condition

Dear NSRP Team,

UNEW is submitting the incoming inspection reports for the capital parts received for refurbishment. Our comments and concerns are based not only on the parts covered in the attached reports but also on components recently received by UNEW and parts visually observed during the recent outage. Across all these groups, we have consistently seen a pattern of **severe deterioration, heavy repair requirements, and limited remaining repair life.**

Based on our inspection results and field observations, many capital parts are in poor condition and require heavy repair. We must be transparent that some of these parts have reached a condition where they would normally be recommended for retirement and replacement with new components. However, we fully understand that NSRP may not have sufficient spare parts available in the warehouse for immediate replacement or for the upcoming inspection and outage requirements. For this reason, UNEW has made every effort to evaluate and save these parts where technically possible, so that NSRP has components available to continue operating the units. Some parts may be repairable for **one more service cycle only,** and this should be carefully factored into future outage planning and spare parts strategy.

The deteriorated condition of these parts is caused by several combined factors, including:

1. Operation under severe thermal and mechanical loading conditions, with frequent starts, shutdowns, emergency trips, and load changes. Each unplanned event subjects components to intense thermal cycling that accelerates wear, cracking, and material degradation over time.
2. Long service history with a high number of accumulated operating hours and repeated refurbishment cycles beyond the original design expectation.
3. Previous repairs were carried out with the primary objective of returning the parts to service for the next operating interval only, rather than fully restoring them to their original design condition. While this approach keeps the unit running in the short term, it means that each successive repair cycle starts from a lower baseline, and the useful life of the parts becomes progressively shorter with every overhaul.
4. Many of the original parts are generic OEM components designed for a broad fleet operating range and are not fully optimised for NSRP's specific fuel composition, refinery environment, and operating profile. Over time, this mismatch accelerates coating breakdown, oxidation, frettage, and dimensional distortion.

For the current refurbishment scope, UNEW will continue to repair and save the existing parts to the maximum extent technically possible. At the same time, we respectfully recommend that NSRP consider the following long-term strategy:

5. Maintain sufficient spare parts inventory for outage and emergency readiness, and plan for the retirement of parts that have reached the end of their practical repair life.
6. For new replacement parts, consider components that are better suited to NSRP's actual operating environment, fuel properties, and thermal cycling conditions rather than standard generic OEM variants.
7. Require future refurbishment work to restore parts to the best technically achievable condition and as close as practical to the original design specification, rather than accepting a minimum standard that only supports the next interval.

8. Track the repair history and remaining repair life of each major capital part to reduce unexpected outage risk and support more effective long-term maintenance planning.

UNEW appreciates NSRP's continued trust and remains available to discuss individual part conditions, repair recommendations, and future replacement planning. We believe it is important to share this technical advice now so that NSRP can plan future refurbishment, replacement, and spare parts requirements more effectively. Please review the attached incoming inspection reports at your earliest convenience.